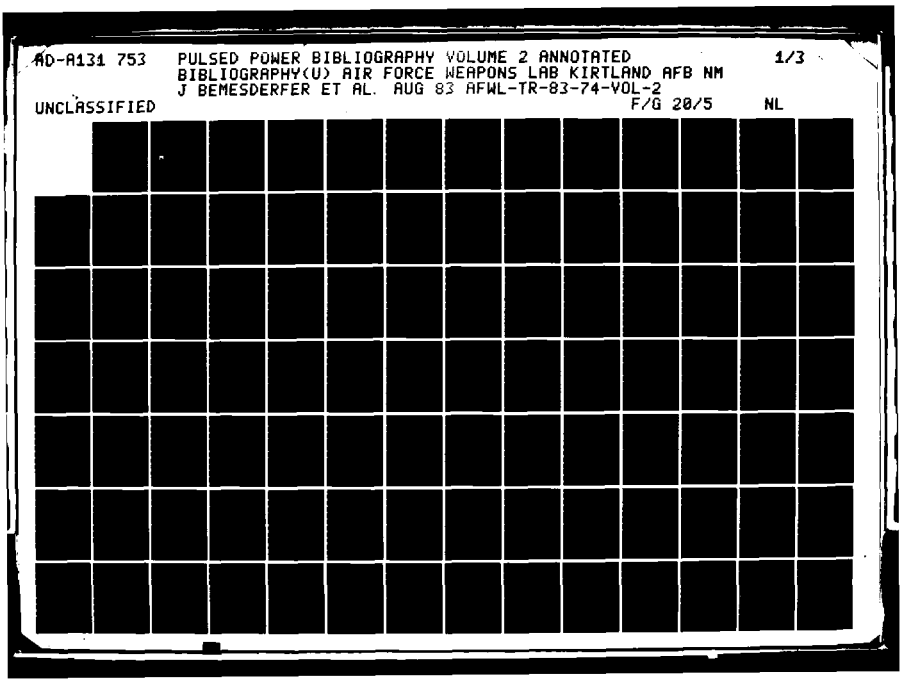
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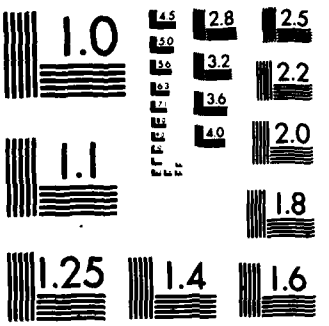

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PULSED POWER BIBLIOGRAPHY

Volume II of II
Annotated Bibliography

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August 1983

Final Report

AIR FORCE WEAPONS LABORATORY
Air Force Systems Command
Kirtland Air Force Base, NM 87117

AFWL-TR-83-74

This final report was prepared by the Air Force Weapons Laboratory, Kirtland Air Force Base, New Mexico, under Job Order 999300CA. Lieutenant Colonel Winston K. Pendleton (CA) was the Laboratory Project Officer-in-Charge.

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This report has been reviewed and is approved for publication.

Winston K. Pendleton

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FOR THE COMMANDER

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Chief Scientist

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Aug 83

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I. Indices
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Pulsed Power	Insulation
Breakdown Studies	Particle Beam Generation
Diagnostics	Power Conditioning
Energy Storage	Switching

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Pulsed power and high-voltage technologies are playing an ever increasing role in weapons' effects simulation, fusion power research, power distribution, materials processing and medical research. It is a rapidly expanding field of applied physics as evidenced by the growth in published literature. Three years ago, the Air Force Weapons Laboratory (AFWL) initiated a project to compile a computerized data base of pulsed power research papers. The data base is stored on our IBM System 2000. This AFWL Technical Report is the first release of the

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20. ABSTRACT (Continued).

bibliography to date. It contains about 2,500 full bibliographic citations, original sources, availability, key words and abstracts. There are three indices: Subject, Personal Author, and Corporate Author. There are 30 main subject headings, from Breakdown Studies to Switching. The indices are contained in Volume I. Volume II contains the citations. In addition to these entries, the data base contains about 7,500 additional titles. As these titles are added to the full bibliography, they will be published.

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ABSTRACT

108
(PARTICLE BEAMS, ION)
(Generation)
GENERATION OF ULTRA-INTENSE HEAVY ION BEAMS FOR INERTIAL CONFINEMENT FUSION

F. Winterberg
University of Nevada System, Reno, NV 89507
Journal Of Plasma Physics, Vol. 21, No. 2, pp 301-315 (04/1979).
A method of producing an intense heavy ion beam using a long drift tube is described. A beam entering the tube is compressed by varying the diode voltage and is contained by an axial magnetic field producing a high density pulse. A drift tube of 100 m can amplify a 10 GW beam to a 100 TW beam using an accelerating voltage of 1 MV and a diode current on the order of 1 KA. Scaling up to even higher beam powers is discussed. 7 Refs.
Primary Keywords: Heavy Ion Beam; Drift Tube; Combining Magnetic Field; Space Charge Neutralized; Axial Beam Compression

102
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
HIGH-VOLTAGE DC POWER CONDITIONER

D.L. Pruitt
RCA Corp, Moorestown, NJ 08057
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1391-1393 (10/1979).
By adopting a variation of the series inverter circuit, liberally infused with artificial line-type pulse modulator technology, an effective, simple, and high performance technique has been devised. Low-frequency (50-400 Hz) transformers are eliminated by direct full-wave rectification of the AC power source. (With appropriate input filter design, power source frequencies from 50 to 400 Hz can be accommodated in one design.) A pair of suitable high-frequency thyristors alternately charge and discharge a pair of capacitors through the primary of a pulse power transformer. Since the effective frequency is high (thousnads of Hz), the transformer and load filter capacitor are small compared to the equivalent normal power frequency components. Operating Q is low (approaches one), minimizing the reactive power. Regulation of the output voltage is achieved by varying the pulse recurrence frequency: from as low as zero to some maximum (e.g. 20 kHz). No-load to full-load regulation < 0.5 percent has been demonstrated. The circuit is not harmed by overload, and has a current fold-back feature. Normal operation resumes automatically when an overload is removed. 0 Refs.
Primary Keywords: DC Power Supply; Light Weight; Compact; High Efficiency; Thyristor Switched

103
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Systems; Explosive Fuses)
INDUCTIVE STORAGE PULSE-TRAIN GENERATOR

R.D. Ford and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1527-1536 (10/1979).
Utilization of inductive storage in production of intense charged particle beams, laser beams, and hot dense plasmas of interest in thermonuclear fusion studies and in other research areas is very attractive because of its inherent compactness associated with energy storage in the form of magnetic fields. A major problem in utilizing inductive energy sources with sufficient output power for such beams and plasmas is the development of an opening switch. In some instances, repetitive pulse output is required, so that switches must open repeatedly at a frequency determined by the needs of the experiment. If only a small number of pulses is needed, then use of one switch per pulse in the train becomes a practical method for generating pulse trains with peak power determined by the performance of individual switches. Formation of pulse trains with peak pulse power in the range of 1E9 to 1E10 W was studied. This study included the investigation of single-switch elements to determine methods for extending the operating power to higher levels. 5 Refs.
Primary Keywords: Explosive Fuse; Rep-rated; Burst Mode; Experiment, Theory

105
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
SHIELDED, HIGH-VOLTAGE PROBES

R.E. Bollinger (1) and D.L. Smith (2)
(1) State University of New York at Buffalo, Buffalo, NY 14226
(2) AFWL, Kirtland AFB, NM 87117
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1553-1555 (10/1979).
A series of high-voltage probes (approximately 300 kV) with a high input impedance (>=10 kohm) and good frequency response (<=100 MHz) have been built. These probes use two concentric cylinders of resistive material; the inner cylinder is the larger resistor of a voltage divider and the outer cylinder shields the innder one from the stray capacitance which would normally degrade the response. These cylinders can be made of almost any resistive material provided that certain theoretical considerations based on nonuniform field penetration and probe impedances are taken into account. The theories discussed are compared to the experimental results of several probes with different resistive materials and relative dimensions. Of primary interest are the probe's response, cost, weight, construction time, energy absorption, and system compatability (loading and shielding). 6 Refs
Primary Keywords: Resistive Voltage Divider; High Input Impedance; Fast Rise Time; Concentric Conducting Cylinders; Stray Capacitance Shielding

109
(PARTICLE BEAMS, ELECTRON)
(Generation)
THE EXPERIMENTAL TEST ACCELERATOR (ETA)

R.E. Hester (1), D.G. Bubp (1), J.C. Clark (1), A.W. Chesterman (1), E.G. Cook (1), W.L. Dexter (1), T.J. Fessenden (1), L.L. Reginato (1), T.T. Yokota (1) and A.A. Faltens (2)
(1) Lawrence Livermore Lab, Livermore, CA 94550
(2) Lawrence Berkeley Lab, Berkeley CA
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 3, pp 4180-4182 (06/1979).
The Lawrence Livermore Laboratory is constructing an induction linac with the following parameters 10A, 50 ns, FWHM pulse width, 5 MeV, and 2.5 MeV injector and its associated pulsed power systems 7 Refs.
Primary Keywords: ETA; LINAC, Design Considerations, Pulsed Power System, Rep rated

114
(PARTICLE BEAMS, ION)
(Generation)
LINEAR INDUCTION ACCELERATORS MADE FROM PULSE-LINE CAVITIES WITH EXTERNAL PULSE INJECTION

Ian Smith
Ian Smith Inc., Alameda, CA 94501
The Review Of Scientific Instruments, Vol. 50, No. 6, pp 714-718 (06/1979).
Two types of linear induction accelerator have been reported previously. In one, unidirectional voltage pulses are generated outside the accelerator and injected into the accelerator cavity modules, which contain ferromagnetic material to reduce energy losses in the form of currents induced, in parallel with the beam, in the cavity structure. In the other type, the accelerator cavity modules are themselves pulse-forming lines with energy storage and switches; parallel current losses are made zero by the use of circuits that generate bidirectional acceleration waveforms with a zero voltage-time integral. In a third type of design described here, the cavities are externally driven, and 100% efficient coupling of energy to the beam is obtained by designing the external pulse generators to produce bidirectional voltage waveforms with zero voltage-time integral. A design for such a pulse generator is described that is itself one hundred percent efficient and which is well suited to existing pulse power techniques. Two accelerator cavity designs are described that can couple the pulse from such a generator to the beam; one of these designs provides voltage doubling. Comparison is made between the accelerating gradients that can be obtained with this and the preceding types of induction accelerator. 10 Refs.
Primary Keywords: Linear Induction Accelerator; 100 Percent Efficient Energy Coupling; Bid rectional Accelerating Pulse; Accelerator Cavity

118
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
MAGNETOOPTICAL CURRENT TRANSFORMER. 1: PRINCIPLES

A. Papp and H Harms
Siemens AG, Munchen, FRG
Applied Optics, Vol. 19, No. 22 pp. 3729-3734 (11/1980).
The authors present a method of measuring current in a high voltage line using a magnetooptical transformer. The use of optical fibers as transmission lines and current sensors, and the birefringence problems that result are discussed. 20 Refs.
Primary Keywords: Magnetooptical Current Transformer; Principles Faraday Effect; Optical Fiber; High Voltage Isolation

119
(PARTICLE BEAMS, ELECTRON)
(Generation)
UPGRADING THE AURORA SIMULATOR

A.G. Stewart
Harry Diamond Labs, Adelphi, MD 20783
Harry Diamond Lab. Report No. HDL-TM-80-28 (10/1980).
Availability: AD A092501
NTIS
The necessary degree of control was acquired over those machine parameters that determine the bremsstrahlung dose output of the simulator, thereby improving the simulator efficiency and extending its range of applications. At a given charge voltage on the Marx generator, average dose output at the center of the test volume (TVC) was increased by approximately 20 percent, the peak dose output exceeded 50 krad (TVC) for the first time, and reproducible low dose (50 rad) at low beam energy (4 MeV) was established. One result of these improvements is that overall machine maintenance time has been reduced. 0 Refs.
Primary Keywords: AURORA; Pulsed Power; High Intensity Bremsstrahlung Production

123
(PULSE GENERATORS; PARTICLE BEAMS, ELECTRON)
(Systems; Generation)
OPERATION OF A 300-KV, 100-HZ, 30-KW AVERAGE POWER PULSER

M.T. Buttram and G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1503-1508 (10/1979).
Applications for efficient and reliable pulse power systems with long lifetimes (>1E8 shots) are forseen for electron-beam generators, ion-beam accelerators, and lasers leading eventually to inertially confined fusion reactors. These systems will have to be capable of continuous operation for sustained periods without requiring major maintenance or repair. High operating efficiency will be required not only to minimize power consumption but also to avoid heat buildup and consequent damage to components. The system described in this paper represents an initial effort to develop an efficient energy-handling high-voltage pulser to study the problems of long-life components. 5 Refs.
Primary Keywords: Pulse Transformer; Pulse Forming Line; Output Switch; Charging Circuit; Rep-rated; Long Lifetime

124
(SWITCHES, CLOSING)
(Ignitrons)
ORIENTATION INDEPENDENT IGNITRON

R.J. Harvey and J.R. Bayless
Hughes Research Labs, Malibu, CA 90265
2nd IEEE International Pulsed Power Conference Proceedings, pp 372-375 (06/1979).
An orientation independent ignitron (OII) has been operated at 30 kV, 15 kA with 10 microsecond wide pulses at frequencies up to 100 hz. The cathode of the OII is a thin mercury film which is held in place by surface tension on a cooled molybdenum substrate. This device has been shown to have a basic voltage withstand of over 60 kV, trigger characteristics comparable to conventional ignitrons, a current rate of rise in excess of 10 kA/microsecond at 30 kV, and a mean stable run time at 8 A average current of 22 s in the burst mode. Reformation of the film occurs during and following the pulse burst with a recycle time on the order of 10 min. 0 Refs.
Primary Keywords: Orientation Independent; Rep-rated; Mercury Film; Surface Tension

127
(PULSE GENERATORS)
(Systems)
POWER SYSTEM FOR A HIGH-POWER BURST MODE PULSED LOAD
T.M. Robinson
GEC Marconi Research Labs, Essex, UK
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1394-1400 (10/1979).
A novel power system, recently completed and commissioned, is described. Operating directly from an 11-kV, 50-Hz public supply, it provides the electrical energy for a burst mode, pulsed load. In each burst, the minimum energy delivered by the power system is 100 kJ at a rate of 330 kW. The pulse modulator operates at a peak charge of 105 kV and is capable of switching 200 MW over a range of pulse lengths and repitition rates. The high-voltage, high-current thyratrons used as the charge, discharge, and PFN energy dump switches were specially developed four-gap CX 1199B thyratrons. Supply voltage stepup transformers were designed to operate over bursts of variable pulse number, length, and rate, with the rectified unfiltered transformer output directly feeding the modulator charging circuit at up to 65 kV. Polarizing effects in the transformer core caused by the use of repitition rates equal to, or harmonically related to, the supply frequency were analyzed and effectively eliminated. Special winding techniques were developed to provide the strength and insulation for withstanding fault transients. 3 Refs.
Primary Keywords: Power Line Operation; High Energy; Rep-rated; Pulse Forming Network; Direct Load Coupling

140
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Marx Generators; Marx)
HIGH DENSITY Z-PINCH PULSE POWER SUPPLY
W.C. Nunnally, C.A. Ekdahl, J.E. Hammel, K.W. Hanks and L.A. Jones
Los Alamos National Labs, Los Alamos, NM 87545
1978 IEEE Thirteenth Modulator Symposium, pp 289-292 (06/1978).
The pulse-power supply for the High Density Z-Pinch (HDZP) experiment at LASL, described in this paper, is required to produce a peak voltage on the order of 1 MV and a peak current of 1 MA in a small, high-pressure gas load. The experimental load is a small diameter (100 micrometer) current filament between two electrodes spaced 10 cm apart with a 20-cm diameter coaxial return conductor. The current filament is to be initiated with an 18-J, 18-ns, Q-switched Nd:glass laser. The HDZP system consists of a 75-nH, 600-kV, 72-kJ marx bank that resonantly charges a water-insulated intermediate storage line. A prototype of 1/12 of the system is also described. The prototype has been tested at its design values. The large system is to become operational in November 1978. 1 Refs.
Primary Keywords: Marx Generator; Pulse Forming Line; High Voltage
Secondary Keywords: Z-pinch

143
(ENERGY STORAGE, MECHANICAL; ENERGY STORAGE, INDUCTIVE)
(Rotating Machines; Systems)
MG ENERGY STORAGE AND SWITCHED PULSE POWER SUPPLY
K.I. Selin
The JET Project, Abingdon, Oxfordshire, UK
1978 IEEE Thirteenth Modulator Symposium, pp 293-296 (06/1978).
For the JET (Joint European Torus) device there are four main pulse power supplies for the following loads: (a) the poloidal field circuit (b) the toroidal field magnetets (c) the plasma positioning (d) the plasma additional heating. The (a) supply will be described in this paper. It is presently in the design stage at GEC Machines Limited, U.K. and is scheduled for operation in 1982. A motor-generator with integrated rotor and flywheel will be used in a pulsed mode. The time between load pulses (9 minutes) is used for acceleration of the flywheel-generator. The generator output AC is rectified in a diode convertor. The nominal energy extracted from the flywheel-generator-converter (FGC) is 2600 MJ at a maximum rate of 400 MW. A magnetic energy storage is included in order to reach a still larger load power. 2 Refs.
Primary Keywords: Homopolar Generator; Power Modulation; Design Considerations; Cost Analysis

144
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Systems; Capacitor Banks)
NEUTRINO BEAM OF THE INSTITUTE OF HIGH-ENERGY PHYSICS. V. PULSED POWER SUPPLY FOR THE NEUTRINO FOCUSING SYSTEM
D.G. Baratov, M.Z. Bikbulatov, V.V. Vasil'ev, E.V. Eremenko, S.A. Knyazev, Yu.A. Lastochkin, V.P. Oshchepkov, V.L. Rykov, A.V. Semoilov, K.Z. Tushabramishvili and A.V. Chernov
Institute Of High-Energy Physics, Protvino, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 1, pp 53-57 (01/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 91-98 (January 1978)
The 350-kJ system that produces unipolar current pulses of 500 kA with length approximately 150 microseconds in the three objective lenses of the neutrino focusing system is described. The system consists of 12 capacitor-bank modules. The modules are connected in parallel with the loads by small ignitrons. The loads are cable transformers whose secondary circuits include the objective lenses of the neutrino focusing system. Schematic diagrams are given for the pulse current generator, the control system, and the monitor system. The basic capabilities of the system are described. 10 Refs.
Primary Keywords: Current Generator; Ignitron; Capacitor Bank; Pulse Transformer; 500 KA Current; 150 Microsecond Pulse Duration

153
(PARTICLE BEAMS, ION)
(Generation)
QUASI-STATIC DRIFT-TUBE ACCELERATING STRUCTURES FOR LOW-SPEED HEAVY IONS
A. Faltens and D. Keefe
Lawrence Berkeley Lab, Berkeley CA
Particle Accelerators, Vol. 8, pp 245-253 (01/1978).
Pulsed drift tubes are discussed as a possible method of accelerating high current bunches at low energies. Several setups for voltage sources and switches which could be used to generate the 1 MV pulses to drive the drift tubes are discussed. Pulse shaping and the drift tube structure are also considered. 9 Refs.
Primary Keywords: Drift-tube; Accelerator; Pulse Shaping; Drift-tube Systems

161
(ENERGY CONVERSION, THERMAL)
(Loads)
LOADS FOR HIGH-POWER TESTING
B.R. Gray
Rome Air Development Center
1978 IEEE Thirteenth Modulator Symposium, pp 70 (06/1978).
The designer or test engineer of high-power systems is often faced with the problem of substituting a load for some portion of the system for the purpose of evaluating some other components in the system, trouble shooting, checkout of the system, calibration, or for system optimization. To be a truly equivalent load it must match the normal load in its reactive and resistive power relationship, its voltage/current ratio as a function of time, power-absorbing ability, polarity, and many other factors. A test load may be required anywhere between the prime power source and the final output. It could mean a load bank on a large AC or DC power line or transformer/rectifier, a pulse-type load in the power conditioner stages of the system, or the energy output of the total system. An example of some substitute loads discussed would be an rf load on the output of an rf amplifier, beam energy absorbers in accelerators, pulsed power load at the video level, and equivalent diode loads for modulators, etc. 0 Refs.
Primary Keywords: Design Considerations
Secondary Keywords: Abstract Only

162
(PULSE GENERATORS)
(Reviews)
PULSED POWER FOR EMP SIMULATORS
I.D. Smith and H. Aslin
Physic International Co, San Leandro, CA 94577
IEEE Transactions On Antennas And Propagation, Vol. AP-26, No. 1, pp 53-59 (01/1978).
Simulation of nuclear weapons effects has been the main motivation for pulse power development in the U.S. in the last decade. EMP simulation has been responsible for a major class of pulse power systems. A general survey of pulse power techniques is given, focusing of those particularly applicable for EMP simulation. This is followed by brief description of several representative simulators. 12 Refs.
Primary Keywords: Marx Generator; L-C Generator; Stacked Line Generator; Insulation; Switching; EMP Simulation

166
(PARTICLE BEAMS, ELECTRON; PULSE GENERATORS)
(Generation; Spiral)
SIMPLE, PULSED, ELECTRON BEAM GUN
C.A. Brau (1), J.L. Raybun (1), J.B. Dodge (2) and F.M. Gilman (2)
(1) Los Alamos National Labs, Los Alamos, NM 87545
(2) Avco Everett Research Lab, Inc, Everett, MA 02149
Review Of Scientific Instruments, Vol. 48, No. 9 pp. 1154-1160 (04/1977).
The construction of a simple, inexpensive electron beam gun is described. The pulsed power supply consists of a homemade spiral generator, constructed with aluminum and vinyl pressure-sensitive tapes, which is switched into the electron beam gun with a spark gap. The electron beam gun itself consists of a vacuum diode with a cold carbon cathode. From an initial charge voltage of 12 kV, the apparatus produces a 10-A beam of 100-keV electrons having a pulse duration of about 7 nsec and diameter of 6 mm. 6 Refs.
Primary Keywords: E-Beam Gun; Spiral Generator; Vacuum Diode

166
(POWER CONDITIONING)
(Pulse Transformers)
THE 10 MILLISECOND 150 KILOAMPERE PULSED POWER SUPPLY FOR THE FERMILAB NEUTRINO FOCUSSING HORN
R.C. Trendler
Fermi National Accelerator Lab, Batavia, IL 60510
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 3, pp 3977-3979 (06/1979).
In order to provide the long spill (one millisecond) necessary for simultaneous operation of the 15-Foot Bubble Chamber Neutrino experiments and counter experiments, the existing short pulse (20 microseconds) Neutrino Focussing Horn power supply was extensively modified. A large high current (200 kiloamp) pulse transformer was procured and installed to modify the circuit impedances. The changing of the electrical characteristics of the system, protection systems, and installation of the transformer will be discussed. 4 Refs.
Primary Keywords: Pulse Transformer; Long Pulse; Sinusoidal Pulse; Capacitor Bank; Ignitron; System Protection

174
(POWER TRANSMISSION)
(Transmission Lines)
SPACE-CHARGE EFFECTS IN LONG COAXIAL VACUUM TRANSMISSION LINES
J.W. Poukey and K.D. Bergeron
Sandia Labs, Albuquerque, NM 87115
Applied Physics Letters, Vol. 32, No. 1, pp 8-10 (01/1973).
A new two-dimensional time-dependent electromagnetic particle code is applied to the high-voltage pulsed power flow problem in a long self-magnetically insulated coaxial line. It is found that the current leakage occurs only near the front of the voltage pulse, that energy transport is very efficient at high voltages, and that the electrons in the insulated region do not get close to the anode. 11 Refs.
Primary Keywords: Transmission Line; Magnetic Insulation; Power Flow Simulation; Numerical Calculation; 2-d Particle Code

178
(DIAGNOSTICS AND INSTRUMENTATION; ENERGY CONVERSION, ELECTRICAL)
(Systems; Power Supplies)
A FACILITY FOR TESTING HIGH POWER DC, AC, OR PULSED DEVICES
R.N. Miller, P.T. Glinski and A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-7 (11/1976).
A fully instrumented facility being developed for the high power testing of pulsed-power and other devices is described. A bank of lead-acid batteries provides the facility with a power source having a maximum discharge capacity of 1.8E9 joules; the batteries can be switched into various series-parallel configurations to realize voltage-current combinations up to 10 kV at 250 A. The battery bank output terminals can be turned on and off at the test bench with a vacuum arc switch if desired. A high vacuum pumping station is built into the test bench for those devices requiring evacuation. An inverter using vacuum arc switches is being developed to convert the power to a sinusoidal AC source having a suitable frequency of up to 10 kHz. The battery bank operation is monitored and controlled either manually or by a microprocessor-based instrumentation system. The instrumentation system automates the battery charging cycle and shuts off the system whenever hazardous conditions develop in the facility during either the charge or the discharge cycle. Among the applications being investigated for the facility are the pulse and duration testing of vacuum arc switches and the development of a high-power inverter. 7 Refs.
Primary Keywords: Pulsed Power Test Facility; Battery; Very High Energy; Medium Voltage; Microprocessor-based Instrumentation

179
(SWITCHES, OPENING)
(Explosive Fuses)
A METHOD FOR ENHANCING EXPLODING ALUMINUM FOIL FUSES FOR INDUCTIVE STORAGE SWITCHING
D. Conte, M. Friedman and M. Ury
Naval Research Lab, Washington, DC 20375
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-7 (11/1976).
The success of inductive storage systems is dependent on the development of fast, low loss opening switches. An approach to this problem is to stage several successively faster switches, such as circuit breakers and fuses, in a manner so as to minimize overall losses while achieving an effective fast opening time. In this paper, we discuss the properties of an aluminum foil fuse immersed in water or hydrogen peroxide for use as one of the final fast acting elements. Although it has been shown that the time to explosion is dependent on the fuse material, peak current amplitude, and rise time, we speculate that the opening characteristics are also influenced by chemical reactions and heat transfer with the surrounding medium. Data is presented showing that the final resistivity can be optimized by proper foil dimensions and further increased by the use of chemically more active surrounding medium such as hydrogen peroxide. 4 Refs.
Primary Keywords: Inductive Energy Storage; Exploding Fuse; Low Loss; Hydrogen Peroxide Medium

180
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)
HIGH VOLTAGE SWITCH PERFORMANCE OF THE EIMAC X-2159 TETRODE
B.R. Gray
RADC, Griffiss AFB, NY 13440
1976 IEEE Pulsed Power Conference Proceedings, Paper IC-4 (11/1976).
High Power Tetrodes designed as RF power amplifiers often times have excellent characteristics that enhance their performance when used as switch tubes. This paper reports on the test and evaluation of one such high power tetrode, the EIMAC X-2159. This tube has a design anode dissipation rating of 1.25 megawatts average power and the cathode grid and screen have very substantial ratings. The objective of the test was to determine the maximum achievable pulsed power with this tube. One main data point of interest was a pulsed current of 1000 amperes-10-20 microseconds and 50 KV hold-off. This point has been achieved. Further testing is planned to fully evolve the limits. Problems encountered included secondary emission causing the load pulse to increase in length as if it were a function of primary emission from grid. Other features of the tube to be discussed will be the ability to interrupt a faulted load current pulse and its overall operating stability. 0 Refs.
Primary Keywords: EIMAC X-2159 Tube, Operational Parameters; Test Results

182
(PULSE GENERATORS)
(Systems)
MAGNETIC FIELD CALCULATIONS FOR HIGH-ENERGY PULSED POWER SUPPLIES
E.B. Becker, M.D. Driga, R.D. Pillsbury, H.G. Rylander, W.F. Weldon and W.H. Wodson
University of Texas at Austin, Austin, TX 78712
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-2 (11/1976).
The accurate calculation of the magnetic fields, steady or rapidly varying, is extremely important in designing pulse power supplies for controlled thermonuclear fusion experiments, lasers, etc., where the traditional simplifying assumptions become unacceptable - especially when ferromagnetic materials in high magnetic fields are used. A finite element method for solution of Maxwell's equations for a moving media in terms of the magnetic vector potential and electrokinetic scalar potential describing the penetration of the magnetic fields in fast pulsing power supplies of electromechanical type is presented. The formulation for the steady-state magnetic fields in nonlinear media results as a particular case of the method. This approach was used for predicting the discharge parameters for the very fast discharging homopolar machine (FDX) designed by the Energy Storage Group at the University of Texas. FDX is in an advanced state of execution. This work was supported by the Electric Power Research Institute (EPRI) and the Energy Research and Development Administration (ERDA). 6 Refs.
Primary Keywords: Magnetic Field Calculation; Steady State; Pulsed; High Fields; Numerical Calculation; Finite Element

184
(ENERGY STORAGE, INDUCTIVE)
(Reviews)
PULSE POWER SYSTEMS EMPLOYING INDUCTIVE ENERGY STORAGE
T.F. Trost, P.E. Garrison and T.R. Burkes
Texas Tech University, Lubbock, TX 79409
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-1 (11/1976).
Basic circuits for utilizing inductive energy storage in high-power pulsers are compared in order to judge overall system performance. The comparisons are made from the standpoint of the power requirements and efficiencies for inductor charging and the switching times and efficiencies for discharging into the load. The response of several circuits are calculated, and the trade-offs in performance are discussed. 5 Refs.
Primary Keywords: Inductive Energy Storage; Performance Comparison; Design Considerations

186
(ENERGY STORAGE, INDUCTIVE)
(Systems)
SUPERCONDUCTIVE INDUCTOR STORAGE AND CONVERTERS FOR PULSED POWER LOADS
N. Mohan (1) and H.A. Peterson (2)
(1) University of Minnesota, Minneapolis, MN
(2) University of Wisconsin, Madison, WI
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-6 (11/1976).
There is a foreseeable need for supplying repetitively pulsed power loads of large magnitudes, with peaks of hundreds of megawatts or more. The nature of such loads can be expected to be as diverse as their application and the pulse durations may range from less than a microsecond to many seconds or minutes. In this paper, loads with pulse durations greater than several milliseconds are considered. The pulsed power demand and corresponding volt-ampere requirement are undesirable from the frequency and voltage fluctuation standpoint, even for the largest utility power systems. For large pulsed energy magnitudes, superconductive inductor storage may be economically employed to reduce the power pulses on the utility system. In this paper, several schemes of interconnecting the pulsed load and the storage inductor are compared in terms of the pulsed power and reactive volt-ampere requirements imposed on the power system. The effects of the storage inductor capacity and the power ratings of the interface converters are explored. A partial or complete elimination of pulsed power and reactive volt-ampere demands on the power system are possible through proper design. 3 Refs.
Primary Keywords: Inductive Energy Storage; Long Pulses; Rep-rated; Inductive Load

187
(ENERGY STORAGE, INDUCTIVE; PULSE GENERATORS)
(Systems; Flux Compression)
TERAWATT PULSE POWER SYSTEMS UTILIZING INDUCTIVE STORAGE
E.C. Cnare, M. Cowan, W.K. Tucker, W.B. Leisher and D.L. Wesenberg
Sandia Labs, Albuquerque, NM 87115
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-4 (11/1976).
This paper describes a system which employs a superconducting magnet, a generator coil, and nondestructive magnetic flux compression to produce pulsed power. Power in the terawatt range is predicted for full-scale systems suitable for both laser and e-beam applications of the future. Small-scale experiments are described which employed radially expanding aluminum tubes or plasma to produce peak powers of 0.5 gigawatt. 7 Refs.
Primary Keywords: Superconducting Magnet; Magnetic Flux Compression; Generator; Nondestructive; Pulsar

188
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, MECHANICAL)
(Systems; Rotating Machines)
THE NRL MULTI-MEGAJOULE INERTIAL-INDUCTIVE ENERGY STORAGE SYSTEM
W.H. Lupton, A.E. Robson and W.L. Warnick
Naval Research Lab, Washington, DC 20375
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-3 (11/1976).
In the NRL multi-megajoule pulse power system, energy is transferred from inertial storage (flywheels) to inductive storage by a self-excited homopolar generator. Reliable operation of the inertial storage at 5 MJ per flywheel is obtained from recent improvements in flywheel mounting, bearing lubrication, cooling and hydraulic power systems. This approach to energy conversion is only possible by use of copper-graphite fiber brushes which can follow rapid variations in wheel radius. Experimental efforts are being devoted to reducing the presently high frictional wear of these brushes. 3 Refs.
Primary Keywords: Inertial Energy Storage; Inductive Energy Storage; Multi-megajoule; Copper and Graphite Fiber Brushes

189
(POWER TRANSMISSION)
(Transmission Lines)
VLIN, AN EFFICIENT ALGORITHM FOR MODELING VARIABLE IMPEDANCE TRANSMISSION LINES
C.H. Jones Jr.
Pulsar Associates Inc, San Diego, CA 92121
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-8 (11/1976).
Transmission lines with a variable impedance are the most practical means for performing impedance transformation in large pulsed power machines. An effective and practical calculation technique is required which can provide adequate modeling of expected machine performance as a part of engineering design analysis. An efficient algorithm has been developed for modeling a transmission line characterized by an impedance which varies as an arbitrary but continuous function over the length of the line. A FORTRAN subroutine incorporating the algorithm is discussed. Comparisons of the algorithm results with the analytic solutions by Schatz and Williams for the special case of the exponential tapered line are shown. The algorithm employs transmission and reflection coefficients that realistically model the response of the line to the high frequencies which are especially of interest in pulsed power work. The traditional approximation of considering such a line to be a series of short segments of constant impedance implicitly ignores the high frequencies and converges more slowly as a result. 1 Refs.
Primary Keywords: Variable Impedance; Impedance Transformation; Modeling; Analysis; Computer Simulation

191
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
APPLYING A HOMOPOLAR POWER SUPPLY TO A TOKAMAK
P. Wildi, S. Hutchins and M. Driga
University of Texas at Austin, Austin, TX 78712
1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-5 (11/1976).
The new Texas Experimental Tokamak will use homopolar generators as a pulsed power source. The high current, low voltage output of such a source calls for unusual solutions to achieve a proper match to toroidal coil system and ohmic heating system. The paper discusses several possible alternatives. The solutions chosen for both the toroidal and the heating coil system are described including some of the salient components such as switches and power electronics. 3 Refs.
Primary Keywords: Homopolar Generator; Application; Impedance Matching
Secondary Keywords: Tokamak Toroidal Field Coil

194
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Capacitor Banks; Capacitor Banks)
MODULAR FAST CAPACITOR BANK FINAL REPORT
P.D'A. Champney
Physic International Co, San Leandro, CA 94577
AFWL Report No. AFWL-TR-74-132 (04/1975).
Availability: AD A010042
NTIS
The report describes the development of a fast capacitor bank module storing 55 kJ at 100 kV DC, capable of operation by itself or as part of a larger system. The module is gasketed and utilizes two triggered gaseous dielectric rail switches operable over the voltage range 15 to 50 kV DC. The module inductance is 8 nH. 10 Refs.
Primary Keywords: Energy Storage, Capacitor Bank; Low Inductance Switches; Rail Gap

196
(PARTICLE BEAMS, ELECTRON)
(Systems)
INITIAL PROTO II PULSED POWER TESTS
D.L. Johnson
Sandia Labs, Albuquerque, NM 87115
1976 IEEE Pulsed Power Conference Proceedings, Paper IE-2 (11/1976).
The Proto II electron beam accelerator is being developed by Sandia Laboratories to study engineering and physics aspects of electron beam pellet fusion. Currently the Marx generator-water capacitor portion of Proto II is undergoing high voltage testing and timing measurements. Eight 112 kJ Marx generators form the primary energy storage system. Each Marx generator pulse charges two parallel 7.5 nF water capacitors to 3 MV. The water capacitors act as intermediate energy storage elements and will transfer their energy to the water insulated pulse-forming lines in 250 ns by means of eight sf/sub 6/ gas insulated, trigatron switches. Test data and design considerations of the trigger systems, Marx generators, water capacitors, and trigatron switches will be presented. 5 Refs.
Primary Keywords: Proto II; E-beam; Marx Generator; Pulse Shaping; Test Data; Design Considerations

198
(PARTICLE BEAMS, ION; INSULATION, MAGNETIC)
(Generation)
MAGNETICALLY INSULATED PULSE POWER DRIVEN LINAC
F. Winterberg
University of Nevada System, Reno, NV 89507
1976 IEEE Pulsed Power Conference Proceedings, Paper IIC-7 (11/1976).
It is shown that a linear accelerator of modest dimensions using magnetically insulated accelerating segments and driven by electric pulsed power sources can accelerate intense beams of heavy ions to multi-GeV energies. The most important application of such an accelerator would be for the ignitron of thermonuclear microexplosions but it could also ideally serve as a research tool for heavy ion induced nuclear reactions. 10 Refs.
Primary Keywords: Linac; Magnetic Insulation; Heavy Ion Beam; Microparticles; Very High Energy
Secondary Keywords: Thermonuclear Microexplosion

199
(SWITCHES, CLOSING)
(Thyristors)
NEW OPTIONS IN PULSE POWER UTILIZING LASS SWITCHES
O. Zucker
Lawrence Livermore Lab, Livermore, CA 9+550
1976 IEEE Pulsed Power Conference Proceedings, Paper IB-6 (11/1976).
Light Activated Silicon Switches are high power, fast rise time, semiconductor devices which open new possibilities in the pulse field. Specifically, the distributed nature of the current path and the sub nanosecond rise time of these devices enables 0 Refs.
Primary Keywords: Light Activatnd Silicon Switches; Fast Rise Time; Rep-rate

201
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
PULSED POWER FROM INERTIAL STORAGE WITH HOMOPOLAR MACHINES FOR CONVERSION
M.M. Woodson, H.G. Rylander and W.F. Weldon
University of Texas at Austin, Austin, TX 78712
1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-1 (11/1976).
Because of its simplicity, an inertial energy storage with a homopolar machine for conversion can provide a relatively inexpensive pulsed-power supply for some important applications. The fundamental principles of operation of homopolar machines are given along with configurations that have been used or proposed and scaling laws for each configuration. Operating characteristics and costs are described as functions of energy level, discharge time and voltage level. The physical limitations on system performance are described to define the ranges of applicability of the concept. 4 Refs.
Primary Keywords: Homopolar Generator; Operating Characteristics; Limitations

204
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
SALVING DIAGNOSTICS IN THE PULSE-POWER ENVIRONMENT
R.A. Fitch
Maxwell Labs Inc, San Diego, CA 92123
1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-5 (11/1976).
Contorted oscillograms and outraged equipment are a commonplace of pulse-power systems. This paper attempts to explain why and what to do about it. 0 Refs.
Primary Keywords: Shielding; Noise Suppression; Short Pulse Operation; Noise Coupling

205
(REVIEWS AND CONFERENCES)
(Reviews)
THE EVOLUTION OF PULSED POWER
G.K. Simcox, J.J. Moriarty and T.J. Griffin
Raytheon Co, Bedford, MA 01730
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-1 (11/1976).
A review of pulse power developments is presented from the viewpoint of low duty-cycle, high power, high voltage generator technology. The effects of increasing duty-cycle upon dielectrics, switching, generator form and engineering problems are briefly discussed. Recognizing the importance of power conditioning and prime power management, the limitations and fundamental importance of pulsed power techniques are explored with reference to the Controlled Thermonuclear Reaction field. 4 Refs.
Primary Keywords: Pulsed Power Development; Nonrep-rated; Pow Conditioning; Rep-rated; Limitations

206
(PULSE GENERATORS)
(Miscellaneous)
THE PLASMA FOCUS AS A PULSED POWER SOURCE FOR DRIVING FU MICROEXPLOSIONS
H.L. Sahlin
Lawrence Livermore Lab, Livermore, CA 94550
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-6 (1
The plasma focus is a very remarkable device. Careful stu focus phenomenon reveals that nature has provided a means of time energy compression superior to most if not all inventions in this field. The focus provides a means of converting relatively slow capacitive energy storage into energy of a rapidly imploding plasma shell and high density inductive stored energy behind this plasma shell. The focus then acts as its own switch by suddenly changing the r-z pinch resistivity by a factor that can exceed 100, and as a result inductive energy is converted into heating of the dense plasma which now acts as a target. The mode of energy concentration of the focus into its own self switching pinch provides a natural mode of burn that may be more effective than the various means that have been proposed for burning a DT microexplosion. We will review the efforts at Livermore to drive fusion microexplosion with the plasma focus utilized as a self-switched pulse power source. The physical phenomenon involved in interrupting the current followed by restrike of the current either as a relativistic electron burst or as short duration ion burst, depending on the operating conditions, will be treated in detail. The relation of our work at LLL to similar efforts in the Soviet Union will be presented, and the similarity to the plasma focus to the current collapse observed in low impedence relativistic electron diodes will be explored. 0 Refs.
Primary Keywords: Dense Plasma Focus; Pulse Compression; Opening Switch
Secondary Keywords: Fusion Driver

208
(PULSE GENERATORS)
(Electrostatic)
VARIABLE CAPACITANCE ELECTROSTATIC ELECTRICAL PULSE GENERATOR
O.P. Breaux
Air Force Avionics Lab, Wright-Paterson Air Force Base, OH 45433
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-8 (11/1976).
Variable capacitance elecrostatic generators are capable of rugged efficient operation and high power output. An exposition is given of a variable capacitance electrostatic energy conversion system, employing self-contained excitation, for electrical pulsed power generation, including mathematical analysis and comment on practical realization. 10 Refs.
Primary Keywords: Electrostatic Pulse Generator; Variable Capacitance; High Efficiency; High Power; Analysis

215
(ENERGY STORAGE, INDUCTIVE)
(Systems)
DESIGN AND CONSTRUCTION OF AN INDUCTIVE STORAGE UNIT FOR LASER PUMPING
I.I. Artemonov, B.A. Barikhin, V.V. Borovkiv and V.I. Keshintsov
Sov. J. Quantum Electron., Vol. 9, No. 1 pp 70-73 (01/1979).
Trans. From: Kvantovaya Elektron. (Moscow) 6,127-133 (January 1979)
Analytic expressions are presented for an exploding wire switched inductive energy storage system. A model is derived for the case of complex impedence loads (inductance and capacitance) and results are compared to an experimont utilizing a flash lamp as a complex impedence load. Power into the load is seen to be increased over that delivered by capacitance energy storage. 9 Refs.
Primary Keywords: Inductive Storage; Exploding Wire; Complex Loads; Theory; Experiment
Secondary Keywords: Laser Pumping; Flash Lamps; Circular Spark Gap

217
(SWITCHES, CLOSING)
(Thyratrons)
HIGH FREQUENCY THYRATRON EVALUATION
G.A. Hill (1) and T.R. Burkes (2)
(1) BDM Corporation
(2) Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 364-367 (06/1979)
The high frequency characteristics of a triple grid thyratron are investigated. The pentode thyratron has three closely spaced grids and operates much like a conventional tetrode thyratron. The first grid has a dual funtion. It functions as a priming grid, preionizing the grid cathode space, as well as a shield grid, isolating the control grid from the cathode plasma during the recovery phase. The second grid is the control grid, with negative control characteristics. The third grid is a shield grid, designed to enhance the control grid aperture deionization. This thyratron is tested in a line-type pulser to determine its high frequency limitations. It proves capable of operating at pulse repetition frequencies of up to 180 kHz. 2 Refs.
Primary Keywords: Pentode Thyratron; Priming Grid; Control Grid; Shield Grid; Rep-rated; Line-type Pulser; Fast Rise

219
(SWITCHES, CLOSING)
(Thyratrons)

HOLLOW-ANODE MULTIGAP THYRATRONS

H. Menown and C.V. Neale
English Electric Valve Co Ltd, Chelmsford, Essex, UK
2nd IEEE International Pulsed Power Conference Proceedings, pp 363 (06/1979).

Subsequent to the introduction of single-gap, hollow-anode tubes in 1978, a new range of multigap hollow-anode tubes is being introduced. There are many applications where high rates of rise of inverse voltage cause premature failure of conventional multigap thyratrons due to arc-back. One solution has been to use double-cathode tubes, which are capable of reverse conduction without deterioration of performance. The hollow-anode tubes offer the similar advantage of tolerating reverse conduction withtout requiring extra high-voltage-isolated supplies. The operation of these tubes in low-inductance circuits is compared with conventional solid-anode tubes. 0 Refs.

Primary Keywords: Arc-back; Comparison With Solid Anode Tube
Secondary Keywords: Abstract Only

221
(ELECTROMAGNETIC LAUNCHERS)
(Reviews)

ELECTROMAGNETIC GUNS, LAUNCHERS AND REACTION ENGINES

H. Kolm, K. Fine, F. Williams and P. Mongeau
Massachusetts Institute of Technology, Cambridge, MA
2nd IEEE International Pulsed Power Conference Proceedings, pp 42-48 (06/1979).

Recent advances in energy storage, switching and magnet technology make electromagnetic acceleration a viable alternative to chemical propulsion for certain tasks, and a means to perform other tasks not previously feasible. Launchers of interest include the DC railgun driven by energy stored inertially in a homopolar generator and transferred through a switching inductor, and the opposite extreme, the synchronous mass driver energized by a high voltage alternator through an oscillating coil-capacitor circuit. A number of hybrid variants between these two extremes are also promising. A novel system described here is the momentum tranasformer which transfers momentum from a massive chemically driven armature to a much lighter, higher velocity projectile by magnetic flux compression. Potential applications include the acceleration of gram-size particles for hypervelocity research and for use as reaction engines in space transport; high velocity artillery; stretcher-size tactical supply and medical evacuation vehicles, the launching of space cargo or nuclear waste in one-ton packets using off-peak electric power. 21 Refs.

Primary Keywords: Electromagnetic Propulsion; Railgun; Synchronous Mass Driver; Flux Compression Generator; Superconducting

223
(SWITCHES, CLOSING)
(Thyratrons)

NEW HYDROGEN THYRATRONS FOR ADVANCED HIGH POWER SWITCHING

D. Turnquist (1), R. Caristi (1), S. Friedman (1), S. Merz (1), R. Plante (1) and N. Reinhardt (2)
(1) EG&G Inc, Salem, MA 01970
(2) Consultant, Lexington, MA
2nd IEEE International Pulsed Power Conference Proceedings, pp 17-24 (05/1979).

Recent advances in high power switching have led to the development of new hydrogen thyratrons operating at high prr and high di/dt with low jitter and long life. Short commutation times, dependent on internal pressure and geometry, and on the method of triggering, combine with inductance less than 1/4 nH/kV to give di/dt on the order of 1E12 amperes per second. Experimental results are in agreement with those predicted by newly derived theoretical models. Operation at peak currents up to 75 kA has been achieved for 10 microsecond pulses, and much higher currents can be achieved at shorter pulse widths. Tests at 1 MW of average power have verified thyratron scaling laws at tens of amperes average and kiloamperes r.m.s. Thyratron operation at average power levels far in excess of 1 MW is possible. 8 Refs.

Primary Keywords: High di/dt; Low Jitter; High Current; Very High Power; Triggering; Pulse Charging

224
(ENERGY CONVERSION, ELECTRICAL: POWER CONDITIONING)
(Charging Circuits; Pulse Transformers)

OFF-RESONANCE TRANSFORMER CHARGING FOR 250-KV WATER BLUMLEIN

E.G. Cook and L.L. Reginato
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1512-1517 (10/1979).

An off-resonance transformer for charging a 250-kV Blumlein system provides a viable alternative to other charging schemes by permitting the use of conventional thyratrons. Such a transformer must have reliability, a reasonable voltage stepup, and a nonreversing primary current. This paper presents the analysis, design, and performance data for such a transformer. The strong interrelationship between transformer design and Blumlein requirements necessitates that Blumlein description and design criterion be briefly presented prior to transformer design such that transformer load requirements be defined. 3 Refs.

Primary Keywords: Off-resonance Transformer; Non-reversing Primary Current; Thyratron Switching; Blumlein Line

228
(PULSE GENERATORS)
(Capacitive)

SIMPLE, FAST RISE TIME, HIGH REPETITION RATE POCKELS CELL DRIVER

B. Plourde, M.E. Mack and E. Verro
Avco Everett Research Lab, Inc, Everett, MA 02149
The Review Of Scientific Instruments, Vol. 51, No. 4, pp 549-550 (04/1980).

A thyratron Pockels cell driver capable of optically switching Pockels cells of up to 2.5 cm aperture in 6 ns at repetition rates of up to 1000 Hz is described. The circuit is based on a modified HY-2 thyratron. 3 Refs.

Primary Keywords: Pulse Generator; Thyratron; 5 kV Operating Voltage, 6 ns Rise Time; Rep-rated; Low Energy
Secondary Keywords: Pockels Cell Driver

231
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas Gaps, Electrical; Gas Gaps, Magnetic Field)

ADVANCES IN THE DEVELOPMENT OF A GAS DISCHARGE SWITCH HAVING A REPETITIVE CURRENT INTERRUPTING CAPABILITY

R.F. Caristi, R.P. Simon and D.V. Turnquist
EG&G Inc, Salem, MA 01970
1978 IEEE Thirteenth Modulator Symposium, pp 227-234 (06/1978)

The practical applications of a repetitively openable and closable high current, high voltage switch have resulted in considerable interest in the phenomenon of current interruption in a conducting gas by the application of a transverse magnetic field to a gas discharge channel. Such a switch is useful as a series-connected protective device, a controllable charging diode, a mechanism for the generation of variable width pulses at high power levels, and as a regulating device for high power, high voltage sources. The physical basis for magnetic current interruption has been shown to be the action of the J × B force on the gaseous conductor. This force serves to drive the gas against a suitably chosen channel sidewall such that the impedance of the discharge rapidly increases as recombination takes place. The geometry of the discharge channel is thus important in the design of a practical magnetic interrupter. 8 Refs.

Primary Keywords: Gas Gaps, Opening Switch, Transverse Magnetic Field; 'Shuted-wall' Discharge Channel, Hydrogen Thyratron

233
(SWITCHES, CLOSING)
(Thyratrons)

DEVELOPMENT OF A FORTY KILOVOLT MEGAWATT AVERAGE POWER THYRATRON (MAPS-40)

J. Hamilton (1), S. Merz (1), R. Plante (1), D. Turnquist (1), N. Reinhardt (2), J. Creedon (3) and J. McGowan (3)
(1) EG&G Inc, Salem, MA 01970
(2) Consultant, Lexington, MA
(3) ECOM, Fort Monmouth, NJ 07703
1978 IEEE Thirteenth Modulator Symposium, pp 135-143 (06/1978).

The thyratron which resulted from the MAPS-40 Megawatt Average Power Switch development effort achieved switching of 40 kV and 40 kA with a pulse width of 10 microseconds and a repetition rate of 125 Hz. Operation was in 10-to-15-second bursts at the 1-megawatt average power level. The MAPS 40 embodies new engineering solutions to the problems encountered in high power thyratrons. In this development, careful attention had to be given to the control of operating dissipations, to the storage and dispersal of heat, to the strength and protection of internal tube structures, and to the special requirements of tube and circuit operation at the megawatt level. In the first phase of the program, eight thyratrons were constructed, five of which were delivered to Fort Monmouth for evaluation. Four of these prototype tubes were tested to the specified objectives in short-burst operation, and were subjected to further tests to explore their nominal design capabilities. Seven more tubes have since been built, all of the same design, all of which have met the specified objectives. 3 Refs.

Primary Keywords: MAPS-40 Thyratron; Ceramic Thyratron; Rep-rated; High Average Power; Design Considerations

235
(SWITCHES, CLOSING)
(Thyratrons)

DOUBLE GAP METAL ENVELOPE THYRATRONS

R.J. Wheldon
English Electric Valve Co Ltd, Chelmsford, Essex, UK
1978 IEEE Thirteenth Modulator Symposium, pp 113-116 (0 /1978).

The metal envelope thyratron has established itself as a versatile switch capable of high power service over a wide range of duties. The compact barium aluminate cathode used in these tubes gives a long life at both high peak and high average currents and the metal envelope provides efficient electrode cooling under these conditions. A compact high content gas reservoir system allows direct switching at high current without gas starvation. A 'boxed in' anode with the high voltage insulator behind the anode prevents material sputtered by ion bombardment in the presence of inverse voltage from degrading the insulation. This range of tubes now includes two new higher voltage versions. The paper describes the CX1525 which is capable of switching 3500 A at 70 kV and the CX1536 10,000 A at 70 kV at 5 and 10 A continuous average current respectively. It describes the grids and gradient grids which enable very short recovery times for tubes of their size (of the order of 25 microseconds), allowing operation at prfs in excess of 10 kHz. An alternative method of tube operation is described, as a single gap triple grid tube, which further improves the recovery time and screens the control from fast rates of change of anode voltage. 2 Refs.

Primary Keywords: Metal Envelope, Electrode Cooling; Boxed In Anode; Multigap; Design Considerations

236
(PARTICLE BEAMS, ELECTRON)
(Generation)

CHARACTERIZATION OF ELECTRON AND ION CURRENT FLOW IN VERY LARGE ASPECT-RATIO TERAWATT DIODES EMPLOYING HEATED AND UNHEATED ANODES

R.D. Genuario and V.L. Bailey
Physic International Co, San Leandro, CA 94577
Applied Physics Letters, Vol. 33, No. 8, pp 694-696 (10/1978).

Electron-beam-focusing experiments using tapered hollow cathodes have been performed at power levels exceeding 1E12 W and with diode aspect ratios (radius/anode-cathode spacing) of 24 and 45 (uncorrected for plasma motion). The spatial distributions of both the electron (using collimated p-i-n diodes) and ion currents (using quartz pressure gauges and Faraday cups) were measured simultaneously. Efficient electron-beam pinches were produced at large R/d (approximately 24) using a diode configuration that employed a small-diameter cathode and heated anode. 5 Refs.

Primary Keywords: E-beam Diode; Tapered Hollow Cathde; Pinching; Cold Anode; Heated Anode; PITHON

237
(SWITCHES, CLOSING)
(Thyratrons)
FLANGE MOUNTING GLASS ENVELOPE HYDROGEN THYRATRONS
L.J. Kettle, C.V. Neale and B.P. Newton
English Electric Valve Co Ltd, Chelmsford, Essex, UK
1978 IEEE Thirteenth Modulator Symposium, pp 102-104 (06/1978).
The stacked grid and anode assembly of conventional ceramic thyratrons does not provide a reservoir of neutral gas near the anode which is as large as that in a glass envelope tube. In consequence, when a trip or kick-out occurs in many pulse modulator applications, the follow through current may cause a ceramic thyratron to quench and conduct in a metallic spark mode, thus causing irreparable damage to itself. The paper describes recently developed hydrogen thyratrons which combine the advantages of the open structured glass envelope tubes, capable of high amp. second ratings for their size, with the conventional low inductance flange mountings normally associated with ceramic envelope tubes. When used in simple low inductance housing, these tubes are capable of handling rates of rise of current in excess of 50 kA/microsecond. 2 Refs.
Primary Keywords: Glass Thyratron; Low Inductance; Fast Rise; Long Pulse
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239
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Reviews; Vacuum Tubes)
HIGH POWER SWITCHING CAPABILITIES
T. Burkes, M. Kristiansen, W. Portnoy and M. Hagler
Texas Tech University, Lubbock, TX 79409
1978 IEEE Thirteenth Modulator Symposium, pp 173-179 (06/1978).
Various high power switches are compared with regard to their capabilities in terms of maximum hold-off voltage, peak current, pulse repetition rate, current rise time, coulomb handling capability and lifetime. The specific switches considered are thyratrons, silicon controlled rectifiers (SCR's), vacuum tubes, ignitrons and spark gaps. Information for this study was obtained from the open literature. Emphasis is placed on a switches capability to handle rated voltage and current simultaneously. 0 Refs.
Primary Keywords: Review; Thyratron; Thyristor; Vacuum Tube; Ignitron; Spark Gap
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240
(SWITCHES, CLOSING; PULSE GENERATORS)
(Thyratrons; Capacitive)
HIGH-POWER, HIGH-REPETITION RATE PULSER FOR PHOTO-IMPULSE IONIZED LASERS
V.E. Merchant, H.J.J. Seguin and J. Dow
University of Alberta, Edmonton, Alberta, Canada
The Review Of Scientific Instruments, Vol. 49, No. 12, pp 1631-1636 (12/1978).
The design and operational parameters of a high-power pulser suitable for a photo-impulse ionized laser are presented. The relatively compact device utilizes a ceramic thyratron in a triggered resonant charging circuit. Efficient operation at repetition rates up to 40 kHz, with pulsed powers in excess of 2 MW and average powers of several kilowats has been achieved. 9 Refs.
Primary Keywords: Thyratron; Coaxial Mount; Low Inductance; Compact Construction; Low Energy; Rep-rated
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244
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Vacuum Gaps, Electrical; Vacuum, Electrical)
ELECTRON CURRENT IN DELAYED TRIGGERING OF HIGH-VOLTAGE, HIGH-VACUUM PULSED DISCHARGES
B.I. Volkov, V.B. Glasko, A.I. Dmitriev, A.B. Korshunov and E.M. Raikhrudel
Moscow State University, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 16, No. 10, pp 1710-1716 (04/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 2159-2166 (October 1971)
A model for the disintegration of metal vapors is used to find the maximum density of the electron beam impinging on the anode in delayed triggering of a pulsed discharge in high vacuum. Computer calculations (using an M-20) show that the maximum stable electron current density in a cold-cathode tube with a trigger electrode is an order of magnitude greater than the electron current density from a thermionic cathode (anode-to-cathode distance d = 3 cm, voltage drop between the electrodes U/sub 0/ = 30 kV). These results are found to agree with experiment. 8 Refs.
Primary Keywords: Vacuum Gap; Metal Vapor; Modeling; Electron Flow; Numerical Calculation; Cold Cathode; Heated Cathode; Space Charge Neutralization
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246
(SWITCHES, CLOSING)
(Thyratrons)
NEW DEVELOPMENTS IN SUPER-FAST, HIGH-POWER, HYDROGEN THYRATRON SWITCHING
R.E. Caristi, S. Friedman, S.S. Merz and D.V. Turnquist
EG&G Inc, Salem, MA 01970
IEEE Transactions On Electron Devices, Vol. ED-26, No 10 pp 1427-1438 (10/1979).
Design criteria for hydrogen thyratrons operating at fast rates of current rise (di/dt), high anode voltages, and high peak currents have been theoretically and experimentally determined. The approach was to divide the investigation into two basic areas. The criteria for achieving high di/dt were first established at relatively low voltages. Then the information necessary to incorporate features promoting high di/dt into a high-voltage structure was determined. The principal factors affecting di/dt are the tube's efective inductance, the nature and rate of the plasma growth, and the manner in which commutation is effected. The inductance depends on the tubes geometry and dimensions. Plasma growth is a function of geometry and gas pressure, and must be controlled in a way such that the tube is triggered and then commutates in the optimum manner for highest di/dt. Rise rates on the order of a few times 1E12 A/s are considered feasible for properly designed tubes operating with anode voltages of 50 kV and peak currents of 10 kA. 8 Refs.
Primary Keywords: High di/dt, High Peak Current; Tube Geometry Considerations; Current Commutation; Rep-rated
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247
(PARTICLE BEAMS, ELECTRON; POWER CONDITIONING; PULSE GENERATORS)
(Generation; Systems; Pulse Forming Lines)
DESIGN STUDY FOR AN AURORA MODIFICATION LEADING TO A 100-TERAWATT NUCLEAR WEAPON RADIATION SIMULATOR
A.G. Stewart and G.A. Huttlin
Harry Diamond Labs, Adelphi, MD 20783
HDL Report No. HDL-TM-79-3 (02/1979).
Availability: AD A071359
NTIS

250
(ENERGY STORAGE, MECHANICAL; PULSE GENERATORS)
(Rotating Machines; Rotating Machines)
DETAILED DESIGN, FABRICATION AND TESTING OF AN ENGINEERING PROTOTYPE COMPENSATED PULSED ALTERNATOR
W.L. Bird and H.H. Woodson
University of Texas at Austin, Austin, TX 78712
LLL Final Report on Contract W-7405-ENG-48 (03/1980).
The design, fabrication, and test results of a prototype compensated pulsed alternator are discussed. The prototype compulsator is a vertical shaft single phase alternator with a rotating armature and salient pole stator. The machine is designed for low rep rate pulsed duty and is sized to drive a modified 10 cm Pota amplifier. The load consists of sixteen 15 mm x 20 mm x 112 cm long xenon flashlamps connected in parallel. The prototype compulsator generates an open circuit voltage of 6 kV, 180 Hertz, at a maximum design speed of 5400 rpm. At maximum speed, the inertial energy stored in the compulsator rotor is 3.4 MJ. 1 Refs.
Primary Keywords: Compulsator; High power; Laminated rotor; Compensating windings; High average flux density; Time varying armature circuit
Secondary Keywords: Pulse shaping; Simulation; Magnetic field mapping, Design notes

251
(SWITCHES, CLOSING)
(Thyratrons)
THYRATRONS FOR SHORT PULSE LASER CIRCUITS
H. Menown and C.V. Neale
English Electric Valve Co Ltd, Chelmsford, Essex, UK
1978 IEEE Thirteenth Modulator Symposium, pp 125-128 (06/1978).
The conventional thyratron is a unidirectional switch; therefore when circuit design demands large current reversals (as in many short pulse laser drivers) arc back, or positive ion sweeping of the anode surface, causes metallic sputtering which soon leads to a degradation of forward voltage hold-off. A new range of tubes is described which is designed to accommodate this circuit requirment by storing plasma during the forward pulse within a hollow annular apertured anode structure. It is shown that by careful design of the grid/anode geometry, a form of bi-directional operation, without loss of forward voltage hold-off, can be obtained. Information is given concerning circuits suitable for operating these thyratrons, principally in order to avoid problems associated with recovery time. 0 Refs.
Primary Keywords: Ceramic Thyratron; Bidirectional Operation; Short Pulse
Secondary Keywords: Gas Laser Pumping
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257
(PULSE GENERATORS)
(Line Type)
A 1200 MEGAWATT VAN-MOUNTED LINE-TYPE MODULATOR
P.A. Corbiere, R.E. Kolibas and J.J. Moriarty
Raytheon Co, Bedford, MA 01730
1978 IEEE Thirteenth Modulator Symposium, pp 260-263 (06/1978).
A line-type modulator is described which operates from a 4160 V AC source and delivers repetitive 12 kJ pulses to a remote load. The module and its controls are self-contained in a 45 foot long environmentally controlled, trailerable van. The pulser is comprised of fourteen thyratron-switched modulators, command-charged from a common source and coupled to the load by means of a single output transformer and cable. Test equipment has been developed which provides system shutdown and fault identification in the event of thyratron malfunction, load fault or charging imbalance. The module has been operated into a resistive load at the following levels: Output Voltage - 165 kV, Energy per Pulse - 12 kJ, Pulse Repetition Rate - Single Shot to 25 pps, Burst Duration - 15 s, Pulse Duration - 10 microseconds and 20 microseconds. 0 Refs.
Primary Keywords: Line-Type Modulator; Portable; Hydrogen Thyratron; High Voltage; System Protection; Command Charge; Modular Construction; Rep-rated
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259
COMPACT MEGAWATT AVERAGE POWER PULSE GENERATOR
J.E. Creedon, J. McGowan, A.J. Buffa and S. Schneider
ECOM, Fort Monmouth, NJ 07703
Research and development technical rept. No. DELET-TR-78-26, 6p (11/1978).
Availability: AD-A065 113/3ST
NTIS
No abstract available.
Primary Keywords: Pulse Generators; Modulators; High Power
Secondary Keywords: Burst Mode; PFN(Pulse Forming Networks); NTISDODXA

263
(SWITCHES, CLOSING)
(Gas Gaps; Electrical)
LOW INDUCTANCE SPARK GAP SWITCH FOR BLUMLEIN-DRIVEN LASERS
J.W. Keto, T.D. Raymond and S.T. Walsh
University of Texas at Austin, Austin, TX 78712
The Review Of Scientific Instruments, Vol. 51, No. 1, pp 42-43 (01/1980).
We report the design of a low inductance spark gap switch for Blumlein-driven lasers which is highly reliable under conditions of high repetition rate and high average power. The reported spark gap has provided reproducible pulse waveforms without maintenance for 1E8 shots in a Blumlein-driven nitrogen laser. When operated with a nitrogen-5%/sub 6/ mixture in the laser tube, this laser provided peak powers in excess of 3 MW at 5-Hz repetition rate and an average power of 0.5 W at 120-Hz repetition rate. 4 Refs.
Primary Keywords: Low Inductance; Copper Electrodes; Nitrogen Gap; Insulator Shield; Rep-rated; Blumlein-line
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267
(SWITCHES, CLOSING)
(Thyratrons)
HIGH RATE OF RISE OF CURRENT PULSE GENERATION USING LOW COST GLASS ENVELOPE THYRATRONS
R.L. Snelling (1), B.P. Newton (1), A. Andrews (2) and I. Littlewood (2)
(1) English Electric Valve Co Ltd, Chelmsford, Essex, UK
(2) Clarendon Lab, Oxford, UK
1976 IEEE Pulsed Power Conference Proceedings, Paper IB-5 (11/1976).
The front edge switching capability of glass thyratrons can be extended many times by special re-entrant mountings and drive circuits. The paper is a practical approach to the problems involved and contains mounting details and circuits for specific tubes, along with some general theory. Detailed results are described of an experiment which compares the switching capabilities of spark gaps and glass thyratrons when used to discharge currents through a lasing medium such as a helium, nitrogen mixture. 0 Refs.
Primary Keywords: Glass Thyratron; Fast Current Rise; Pulse Generator; Tetrode
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296
(PARTICLE BEAMS, ION; PARTICLE BEAMS, ELECTRON)
(Generation; Target Interactions)
DIELECTRIC GUIDE CONTROLLED COLLECTIVE ION ACCELERATION
Spire Corp, Bedford, MA 01730
AFWL Report No. AFWL-TR-77-248 (02/1980).
Availability: AD A084994
NTIS

Experiments performed at Spire and at NRL have demonstrated dielectric guide controlled collective ion acceleration. Control of the phenomenon has been established by varying the electron beam parameters or guide geometry. Specifically, it has been shown that: Total electron current must exceed the space charge limit; a minimum electron current density is required; increasing guide length (assuming the electron beam can propagate to the end) increases ion energy; increasing guide radius at constant electron current decreases ion energy; and, the energy or charge deposited per unit area of wall controls the velocity of propagation of the electron beam front and, therefore, the energy of the ions. NRL VEBA results showed that: Dielectric guide controlled collective ion acceleration is effective at higher electron beam energies; an electron beam with current pinched on axis is more efficient for ion acceleration; and molding the surface of the guide can control the beam front velocity. 18 Refs.
Primary Keywords: Unconventional Accelerators; Collective Effect Acceleration; Dielectric Guide Control

298
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Capacitor Banks; Capacitor Banks)
A 230 KJ PULSED POWER SUPPLY
R. Winje
Fermi National Accelerator Lab, Batavia, IL 60510
IEEE Transactions On Nuclear Science, Vol. NS-22, No. 3, pp 1317-1320 (06/1975).

The Mason Focussing System (Horn), consisting of two single-turn coaxial structures, in which circular magnetic fields of varying intensity are produced, and a 230 kJ pulsed power supply have recently been built and operated at Fermilab. The development and construction of the power supply and its related control system is reported in this paper, while a companion paper published in these proceedings reports on the design and development of the magnetic structure (horns) and the interconnecting transmission line. The capacitor discharge series resonant network was chosen because of the ability to generate the required high current at a relatively modest voltage. Ignitrons are used as the switching elements. A dual set of ignitrons and their controls are connected to the capacitor bank which allows the time-shared operation of the power supply into two loads without the necessity of mechanical, high-current switching. The alternate load for the power supply is a test area where development work on new horn system components is carried out. The power supply is located outside the Neutrino Laboratory Target Hall where the capacitor bank and ignitron switches are safely positioned in an isolated room. The associated support equipment is adjacent to the bank room. 2 Refs.
Primary Keywords: Series Resonant Network; Capacitor Discharge; Ignitron Switch; Crowbar; Modular Construction

299
(PULSE GENERATORS)
(Capacitive)
CONSTANT PULSE ENERGY POWER SUPPLY FOR A HIGH REPETITION RATE LASER SYSTEM
C.C. Lo and B. Fan
Lawrence Berkeley Lab, Berkeley CA
The Review Of Scientific Instruments, Vol. 47, No. 1, pp 63-65 (01/1976).

A pulsed power supply system with constant pulse energy has been developed to drive flashlamps in a 0.5-5 pulses per second Nd:glass laser. By using a stable, absolute reference voltage source to set the trigger level, the energy discharged through the flashlamps is kept constant despite pulsing frequency change, power line fluctuation, and minimum DC power supply regulation. The concept can be expanded or adapted to operate other similar systems. 4 Refs.
Primary Keywords: Capacitor Charging; Excellent Pulse Repeatability; Slow Discharge; Output Pulse; Rep-rated
Secondary Keywords: Nd-glass Laser Pumping

303
(DIAGNOSTICS AND INSTRUMENTATION)
(Component Testing)
EMP SUSCEPTIBILITY OF INTEGRATED CIRCUITS
C.R. Jenkins and D.L. Durgin
BDM Corp, Albuquerque, NM 87106
IEEE Transactions On Nuclear Science, Vol. NS-22, No. 6, pp 2494-2499 (12/1975).

This paper summarizes the results of a major test program which involved the measurement of the pulse power failure thresholds of 41 integrated circuit types, representing seven logic families. The pulse widths used in these tests range from 0.1 microsecond to 10 microseconds. The failure threshold data have been grouped by logic family and test terminal to form failure categories. A simple failure model has been developed which is useful in predicting the failure thresholds of untested devices. 9 Refs.
Primary Keywords: Digital Integrated Circuits; EMP Testing; Failure Modes; Microsecond Pulse Widths; Modeling

308
(PARTICLE BEAMS, ELECTRON)
(Generation)
PULSED MICROSECOND HIGH-ENERGY ELECTRON BEAM ACCELERATOR
T.H. Martin and R.S. Clark
Sandia Labs, Albuquerque, NM 87115
The Review Of Scientific Instruments, Vol. 47, No. 4, pp 460-463 (04/1976).

Electron beams delivering up to 60 kA at 1.5 MV with pulse durations of 0.5-1.5 microseconds were obtained by connecting a low-inductance Marx generator directly across a vacuum diode. Beams with up to 44 kJ and conversion efficiencies up to 51% from Marx energy into electron beam energy were obtained. 11 Refs.
Primary Keywords: Marx Generator; Field Emission Diode; 1.5 Microsecond Pulse Length; No Intermediate Store

311
(PULSE GENERATORS)
(Capacitor Banks)
AN INEXPENSIVE PULSED POWER SUPPLY FOR A SEPTUM MAGNET
W.F. Praeg
Argonne National Lab, Argonne, IL
IEEE Transactions On Nuclear Science, Vol. NS-22, No. 3, pp 1307-1310 (06/1975).

A 16 microhenry, 6 milliohm septum magnet load must be pulsed while extracting beam from the 200 MeV booster of the Zero Gradient Synchrotron (ZGS). A power supply was designed for this purpose that can deliver approximately 2 ms wide, half sine wave pulses with a PRF of 30 pulses per second. The peak current is adjustable from 3 kA to 13 kA and repeatable within +or- 0.05% by means of a novel charging circuit. By providing a transformer between the magnet and the capacitor bank, the overall cost of the system was reduced to less than one half of that of a conventional capacitor discharge system. A high-Q choke shunts the negative half wave of the current around the transformer, thereby extending the life expectancy of the magnet and increasing the circuit efficiency. 3 Refs.
Primary Keywords: Capacitor Bank; Step-down Transformer; Half-sinusoidal Waveform; Inductive Load; Rep-rated

317
(PULSE GENERATORS; POWER CONDITIONING)
(Line Type; Saturable Reactors)
GENERATOR PRODUCING NANOSECOND PULSES WITH AN INCREASED REPETITION FREQUENCY
I.G. Kataev and I.I. Rozhkov
Gork'ii Polytechnic Institute, USSR
Instruments And Experimental Techniques, Vol. 17, No. 4, pp 1037-1038 (08/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 88-89 (July-August 1974)

A generator is described which produces rectangular nanosecond pulses and is designed for operation into an arbitrary load. The principle of contraction of electromagnetic energy and the formation of electromagnetic shock waves in transmission lines with ferrite is used in the generator. The power of the output pulses is 3 kW, and the maximum repetition frequency is 25 kHz. 4 Refs.
Primary Keywords: Rectangular Pulse; Thyratron; Ferrite; Electromagnetic Shock Wave; 3 kW Output Power; Rep-rated

323
(INSULATION, MATERIAL)
(Solid)
THE RESEARCH IN DISCHARGE SUPPRESSION OF HIGH VOLTAGE CROSSLINKED POLYETHYLENE INSULATED POWER CABLE
S. Fujiki, H. Furusawa, T. Kuhara and H. Matsuba
The Furukawa Electric Co. Ltd., Tokyo, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 6, pp 2703-2709 (12/1971).

The main reason why high voltage plastic power cables lead to the dielectric breakdown is considered the insulation deterioration which is brought about by partial discharges within voids and other anomalies. We have taken various measures in order to suppress these partial discharges. Then we got an idea that when some semi-conductive organic material is blended in the insulation material, the surface resistivity of voids in the insulation and between the insulation and semi-conductive layer is reduced. Our study based on this idea produced effectual results. This paper describes the theoretical analysis, fundamental experiments and application experiments to cables and cable joints. 4 Refs.
Primary Keywords: Crosslinked Polyethylene; Partial Discharge; Insulation Deterioration; Semi-conductive Organic Material

327
(PULSE GENERATORS; POWER CONDITIONING)
(Capacitive; Pulse Transformers)
A NOMINAL ONE-MEGAVOLT, PULSED POWER GENERATOR
T.H. Martin
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 3, pp 184-185 (03/1971).

A pulsed voltage generator, called Frizz, has been designed and constructed at Sandia Laboratories and is now being used as a voltage source for breakdown studies of various materials. Frizz generates a nominal 100 ns pulse of variable rise time from 5 to 50 ns across a vacuum chamber in which dielectric test samples are placed. 4 Refs.
Primary Keywords: Variable Rise Time; Series Inductor; Spark Gap; Capacitor Energy Store; Pulse Transformer

333
(BREAKDOWN STUDIES)
(Gas, Optical)
OPTICAL BREAKDOWN OF COMPRESSED GASES BY CO/SUB 2/ LASER RADIATION
N.G. Basov, E.M. Belenov, V.A. Danilychev, O.M. Kerimov and I. B. Kovsh
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics JETP, Vol. 36, No. 6, pp 1061-1063 (06/1973).
Trans. From: Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki 63, 2010-2014 (December 1972)

The breakdown of compressed gases by CO/sub 2/ laser radiation was investigated theoretically and experimentally. The high-pressure breakdown (P>>30 atm) differed considerably from the breakdown in low-pressure gases: the threshold flux density and the energy of the radiation, which were decreasing functions of p at low pressures, increased with p at high pressures. The pressure dependences of the threshold density and energy of the radiation were different for molecular and atomic gases. 10 Refs.
Primary Keywords: Volume Breakdown; Several Gases; 30 atm Pressure Range; Molecular Gas; Atomic Gas; Experiment, Theory

334
(PULSE GENERATORS; POWER CONDITIONING)
(Reviews; Pulse Forming Lines)
PULSED POWER GENERATORS
L.S. Levine and M.G. Ury
Naval Research Lab, Washington, DC 20375
IEEE Transactions On Nuclear Science, Vol. NS-20, No. 1, pp 456-462 (02/1973).
Pulsed power generators are capable of delivering as much as megajoules of energy in pulses of 100 nsec or less. A brief review of the technological approach to this problem is presented as well as the description of three different devices: Gamble II, AURORA, and a small laboratory device designed at NRL. 21 Refs.
Primary Keywords: Reviews; Marx Generator; L-C Generator; Blumlein Line; Pulse Forming Line; Gamble II; AURORA

335
(PARTICLE BEAMS, ELECTRON; PULSE GENERATORS)
(Generation; Reviews)
PULSED POWER TECHNOLOGY FOR CONTROLLED THERMONUCLEAR FUSION
L.S. Levine and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 4, pp 255-264 (04/1971).
Over the past few years, the technology of pulsed power generators has been developed to the level where it is possible to produce powers on the order of 1E12 W for times on the order of 1E-7 sec. Such generators are most commonly utilized to produce intense relativistic electron beams, and this paper briefly surveys the existing state of the art of generators and relativistic beams. As examples, recent work at NRL is considered in some detail. Finally, several potential applications of this technology in controlled fusion research will be discussed. 38 Refs.
Primary Keywords: Relativistic E-beam; Review; Marx Generator; Pulse Forming Line; Field Emission Diode; Drift Tube

336
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Capacitor Banks; Capacitor Banks)
PULSE GENERATOR PRODUCING A HIGH-POWER CURRENT
A.M. Andrianov, V.F. Demichev, G.A. Eliseev, P.A. Levit, A.Yu. Sokolov and A.K. Terent'ev
Instruments And Experimental Techniques, Vol. 14, No. 1, pp 124-126 (02/1971).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 112-114 (January-February 1971)
A capacitor bank made up of 16 low-induction KMK-30-8 capacitors is described. For a comparatively low energy capacity of 58 kJ the bank has an intrinsic oscillatory pulse power of 1.4E11 W and a short-circuit current of 3.5 MA. Low-inductance vacuum spark gaps serve as the current commutators. 5 Refs.
Primary Keywords: Capacitor Bank; 58 kJ Stored Energy; 1E11 W Output; 3.5 MA Short Circuit Current; Vacuum Spark Gap; Low Inductance

339
(SWITCHES, OPENING)
(Plasma Erosion)
PLASMA EROSION SWITCHES WITH IMPLODING PLASMA LOADS ON A MULTITERAWATT PULSED POWER GENERATOR
R. Stringfield, R. Schneider, R.D. Genuario, I. Roth, K. Childers, C. Stallings and D. Dakin
Physic International Co, San Leandro, CA 94577
Journal Of Applied Physics, Vol. 52, No. 3, pp 1278-1284 (03/1981).
Plasma erosion switches have been fielded on the PITHON generator during imploding plasma experiments. Theta pinch plasma guns were used to inject carbon plasmas of densities in the range of 1E12 - 1E14 cu.cm. between the electrodes of the vacuum or feed region, upstream from an imploding plasma load. Current monitors indicated that the erosion switches carried substantial current early in time, diverting it from the load. Late in the pulse the erosion switches opened, transferring the current to an imploding plasma with the effect of sharpening the current rise time at the load. Associated with the sharper rise time was an improvement in the quality of the plasma implosions. The results of varying the density and total number of particles in the plasma of the switches are presented with regard to the effect on the current along the vacuum feed and on the behavior of vacuum flowing electrons. 5 Refs.
Primary Keywords: Plasma Erosion Switch; Opening Switch; PITHON; Fast-rise; Experiment; Theory; Plasma Density Dependance

351
(PULSE GENERATORS)
(Line Type)
HIGH-VOLTAGE PULSE GENERATOR FOR WIRE SPARK CHAMBERS
Y.D. Karpekov, G.P. Makarov, Y.N. Simonov and V.P. Sugonyaev
GKAE Atomic Energy Institute, Moscow, USSR (01/1975).
Availability: IFVE-PEF-75-130
NTIS
A HV pulse generator for power supply of wire spark chambers with pulsed hydrogen thyratron and discharge line in the end cascade is described. The generator forms the pulses of negative polarity with the rise time of 30 nsec, with 170 nsec duration, stabilized pulse-height that may be changed within the limits from 4 up to 6 kV and time delay of about 100 nsec with respect to the triggering signal. (Atomindex citation 09:361077).
Primary Keywords: High-voltage Pulse Generators; Wire Spark Chambers; Delay Circuits; Design; Pulse Rise Time; Pulse Shapers; Tables; Thyratrons; Timing Properties
Secondary Keywords: IN RUSSIAN, ERDA/440104; USSR, NTISINIS
Distribution Restriction: U.S. SALES ONLY.

378
(PARTICLE BEAMS, ELECTRON; BREAKDOWN STUDIES)
(Generation; Vacuum, Electrical)
ELECTRON BEAM GUN SIMULATION
T.E. Springer and W.J. Sarjeant
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. E-DO-740-80 (01/1981).
Availability: E-DC-740-80
LASL
A numerical simulation of a small, hot-cathode electron beam gun is presented. Since the time required for the electric field to propagate into the structure is short compared to the pulse widths of interest (a few nanoseconds compared to 5-200 microsecond pulse widths), electrostatic field and potential calculations are made and space charge is ignored. Calculated E-field and potential plots are shown, along with equipotential and electron trajectory diagrams. Agreement with experiment is good. Suggestions are presented for improving beam uniformity and increasing breakdown potential in similar devices. 2 Refs.
Primary Keywords: Hot Cathode; Long Pulses; Simulation; Fiels Plots; Electron Trajectories; Laplaces Equation
Secondary Keywords: Laser Pumping; Continuous Cathode Voltage

392
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Gas; Gas, Electrical)
A CIRCUIT WHICH PREDICTS AND DIVERTS FLASHOVER FROM A LONG AIR GAP
G. Jarvis-Hunter
Marchwood Engineering Lab, Southampton, UK
The Review Of Scientific Instruments, Vol. 45, No. 3, pp 403-405 (03/1974).
A fast, rugged, electronic circuit is described which predicts an impending switching surge flashover in a long air gap and diverts the discharge energy into a triggered bypass gap. Prediction is based on the amount of charge injected into the gap by the high voltage electrode. A protective gap could be designed which would operate only if the insulation being protected were about to fail. This could significantly improve the techniques of insulation coordination and has important implications for studies of the mechanisms of the long spark. 2 Refs.
Primary Keywords: Air Gap; Self-breakdown; Bypass Gap; Displacement Current; Corona Current; Current Detection; Breakdown Prevention

393
(PULSE GENERATORS)
(Systems)
A GENERATOR FOR STARTING ACOUSTIC CHAMBERS
V.N. Afonas'ev, O.N. Kryzhanovskii, P.I. Lebedev, V.I. Orel'chikov and Yu.F. Tomashchuk
Institute Of Theoretical And Experimental Physics, Moscow, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1427-1429 (10/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 111-114 (September-October 1973)
A generator is described for starting acoustic chambers using a TGI1-1000/25 thyratron as the commutating element. The overall delay of the circuit is approximately equal to 140 nsec; the maximum operating frequency, which is determined by the high-voltage rectifiers, is approximately equal to 50 Hz. 3 Refs.
Primary Keywords: Delay Generation; 5 kV Operating Voltage; Thyratron; Rep-rated
Secondary Keywords: Acoustic Spark Chamber

394
(SWITCHES, CLOSING)
(Thyratrons)
A MULTIGAP, DOUBLE-ENDED, HYDROGEN THYRATRON
H. Menown and B.P. Newton
English Electric Valve Co Ltd, Chelmsford, Essex, UK
IEEE 1973 Eleventh Modulator Symposium pp. 232-235 (09/1973).
This paper discusses the limitations of conventional ceramic thyratrons with regard to inverse voltage and describes a double-ended, multigap thyratron capable of conduction in both directions. This new device behaves as a triggered, bidirectional switch and so improves commutation and simplifies circuit design. Methods of triggering, excitation and protection are described. 0 Refs.
Primary Keywords: Multigap Thyratron; Double-anded Thyratron; Conduction In Both Directions

398
(ENERGY STORAGE)
(Reviews)
CONTEMPORARY CAPACITIVE ENERGY STORAGE SYSTEMS
E.L. Kemp
Los Alamos National Labs, Los Alamos, NM 87545
IEEE Transactions On Nuclear Science, Vol. NS-20, No. 1, pp 446-451 (02/1973).
Capacitive energy storage is one of the oldest forms of energy storage for pulsed power requirements. Most energy storage capacitors are made of Kraft paper and aluminum foil and impregnated with castor oil. A typical capacitor stores approximately 3000 joules at voltage ratings of 5 kV-100 kV. Two types of switches are used for capacitor bank switching, ignitrons and pressurized spark gaps. Ignitrons are commercially available, have a wide voltage operating range and are easy to trigger. However, they are limited to approximately 20 kV for most applications and they will prefire. Spark gaps can be designed for reliable operation at almost any voltage level but they are rarely commercially available. Most spark gaps do not operate satisfactorily below 50% of their design voltage and they require a more complicated trigger system than ignitrons. Low inductance coaxial cable has been developed for capacitor bank transmission systems. It is relatively inexpensive and commercially available. Parallel plate transmission lines can be designed to accumulate large amounts of current and conduct it to a concentrated load but careful attention must be given to the containment of the magnetic forces involved. 9 Refs.
Primary Keywords: Capacitor; Ignitron; Spark Gap; Coaxial Cable; Strip Line

399
(PULSE GENERATORS)
(Reviews)
DESIGN CONSIDERATIONS FOR SUPER POWER PULSE MODULATORS
D.L. Pruitt
RCA Corp, Moorestown, NJ 08057
IEEE 1973 Eleventh Modulator Symposium (09/1973).
Design criteria are discussed which are particularly pertinent to super power artificial line-type modulators. A sample design is illustrated which uses 60 hydrogen thyratron switch tubes in 30 unit modulators to supply 2.5 gigawatts peak power and 10 megawatts average power. A concept physical layout is shown for the sample design. 0 Refs.
Primary Keywords: Line-type Modulator; Design Considerations; Super Power; Thyratron; Spark Gap; End-of-line Clipper; Pulse Transformer; Charging Network

402
(PARTICLE BEAMS, ION)
(Generation)
PULSED ION DIODE EXPERIMENT
D.S. Prono, J.W. Shearer and R.J. Briggs
Lawrence Livermore Lab, Livermore, CA 94550
Physical Review Letters, Vol. 37, No. 1, pp 21-25 (07/1976).
Experiments in ion generation with a reflex-diode are presented. The OWL II generator was used to generate ion beams with total ion current up to 150 kA. Two modes of operation were seen. The first 50 nsec of operation are as a normal diode, then the impedance drops (accompanied by ion flow). An explanation is given for this behavior. 12 Refs.
Primary Keywords: Ion Diode; 300 kV Voltage Range; Reflex-triode; Experiment; Theory; Magnetic Stabilization; Several Anode Foils

403
(PULSE GENERATORS; SWITCHES, CLOSING; POWER CONDITIONING)
(LC; Thyratrons; Pulse Forming Networks)
GENERATION OF HIGH CURRENT, LONG DURATION RECTANGULAR PULSES
P.E. Faugeras, H. Kuhn and J.P. Zenasco
CERN, Prevessin, France
IEEE 1973 Eleventh Modulator Symposium pp. 23-28 (09/1973).
The excitation of the fast pulsed kicker magnets foreseen for the CERN 400 GeV proton synchrotron requires rectangular pulses with a current amplitude of 3000 A to 10000 A, a pulse duration adjustable between 1 and 24 microseconds, and short rise and fall times. These pulses are generated by a LC ladder network discharged with fast switches. Several kinds of switches have been tested: multigap thyratrons of standard design, a composite switch called thyragnitron and made of a normal thyratron by-passed by ignitrons, and finally special thyratrons with a second cathode assembly in place of the usual anode. Experimental pulse shapes and results of life tests for these different switches are presented and discussed. 8 Refs.
Primary Keywords: LC Generator; Multigap Ignitron; Thyratron; Thyragnitron; Life Test; PFN
Secondary Keywords: Proton Synchrotron

413
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
VOLTAGE INDUCED CAPACITANCE FLUCTUATIONS IN A COMPRESSED GAS, HIGH VOLTAGE CAPACITOR
J. Rungis and D.E. Brown
National Measurment Lab, Sydney, Australia
Journal Of Physics E: Scientific Instruments, Vol. 8, pp 16-17 (01/1975).
Capacitance fluctuations of the order of a few parts/million have been observed in a 330 kV capacitor after operating at 300 kV for 30 min. It has been concluded that the capacitance fluctuations are due to convection of the compressed CO/sub 2/ gas, caused by dielectric heating of the insulating walls. 0 Refs.
Primary Keywords: Compressed Gas Capacitor; CO/sub 2/ Dielectric; Guard Electrode; Capacitance Fluctuation; 300 kV Voltage Range

414
(SWITCHES, CLOSING)
(Thyratrons)
THE DISCHARGE CURRENT DISTRIBUTION OVER THE SURFACE OF THE ELECTRODES OF A HYDROGEN THYRATRON DURING A PULSE
A.M. Iskov'skiy, Yu.E. Nesterikhin, L.B. Rukevich, V.I. Sakerin and T.B. Fogel'son
Radio Engineering And Electronic Physics, Vol. 17, No. 6, pp 998-1002 (06/1971).
Experiments were performed in which the current distribution over electrode surfaces in a hydrogen thyratron was examined. Pulses applied to the device lasted 30 microseconds with current varying from 200 to 2400 A. High-speed photography was used to note that the current at the anode formed a filament which rotated around the tube during the pulse. Current at the cathode did not change during the pulse. Hydrogen pressure was also varied during the tests. 8 Refs.
Primary Keywords: Thyratron; High-power; Nonuniform Current Distribution; Grid Distribution; Anode Distribution; Moving Current Filament; Current Variation; Pressure Variation

417
(SWITCHES, CLOSING)
(Thyratrons)
THE USE OF HYDROGEN THYRATRONS AS HIGH SPEED, HIGH VOLTAGE RECTIFIERS
H. Menown and G.J. Scoles
English Electric Valve Co Ltd, Chelmsford, Essex, UK
IEEE 1973 Eleventh Modulator Symposium pp. 236-238 (09/1973).
The necessity for a high forward current, fast reverse recovery diode arose during the design of a thyratron test modulator. This paper describes how such a diode can be obtained by the use of hydrogen thyratrons in a parallel assembly. 0 Refs.
Primary Keywords: High-voltage Rectifier; Hydrogen Thyratron; High Current; Very Fast Switching

418
(PULSE GENERATORS)
(Line Type)
THYRATRON GENERATOR THAT PRODUCES RECTANGULAR PULSES HAVING A SMOOTHLY CONTROLLABLE LENGTH
R.S. Tabachnik
Instruments And Experimental Techniques, Vol. 16, No. 4, pp 1124-1126 (08/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 120-122 (July-August 1973)
The circuit of a powerful generator producing rectangular pulses is described which is implemented using pulsed hydrogen thyratrons with partial discharge of a storage capacitor. The circuit allows rectangular pulses to be obtained having a leading edge duration of approximately 0.1 microsec for output currents of up to tens of amperes and voltages of up to several kilovolts and allows smooth control of the pulse length from several microseconds to several milliseconds. 4 Refs.
Primary Keywords: Rectangular Pulse; Thyratron; Microsecond-millisecond Pulse Duration; Capacitor Bank; Pulse Shaping

419
(PULSE GENERATORS)
(Capacitive)
THYRATRON GENERATOR WHICH PRODUCES HIGH-VOLTAGE LONG PULSES FOR HIGH-OHM LOADS
L.Z. Gogolitzyn and A.V. Senik
Leningrad Electrical Engineering Institute, USSR
Instruments And Experimental Techniques, Vol. 15, No. 5, pp 1397-1398 (10/1972).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 97-98 (September-October 1972)
A thyratron generator which shapes rectangular pulses having an amplitude of up to 20 kV across a high-ohm load of 1E4 to 1E6 ohm is described. The length of the pulse is controlled smoothly in the range from 20 to 2000 microsec. The duration of the leading and trailing edges is 1 microsec. 1 Refs.
Primary Keywords: Capacitor Pulse Generator; Megaohm-load Impedance; 20 kV Output; 20-2000 Microsecond Pulse Duration; Rectangular Pulse

424
(PULSE GENERATORS; SWITCHES, CLOSING)
(Reviews; Thyratrons)
VERY HIGH FREQUENCY PULSE GENERATORS USING HYDROGEN THYRATRONS
B.P. Newton and G.J. Scoles
English Electric Valve Co Ltd, Chelmsford, Essex, UK
IEEE 1973 Eleventh Modulator Symposium pp. 162-166 (09/1973).
Two circuits are described which have been developed to provide high voltage pulses at repetition rates up to 200 kHz. Mention is made of fast recovery hydrogen thyratrons capable of operating in these circuits. 0 Refs.
Primary Keywords: Design Considerations; Thyratron; Very High Rep-rate; Break Modulator; Pulse Transformer

428
(POWER CONDITIONING)
(Pulse Forming Lines)
A FAST HIGH VOLTAGE PULSE GENERATOR
J.W. Jack and T. Smith
University of Aberdeen
Journal Of Physics E: Scientific Instruments, Vol. 6, pp 17-19 (01/1973).
This note describes a fast high voltage pulse generator using a thyratron switch and coaxial pulse forming line. It is capable of producing a pulse with an amplitude of up to 4 kV for a duration of 40 ns and is suitable for continuous operation over periods of several hundred hours at a reptition rate of 50 Hz. 12 Refs.
Primary Keywords: Parallel Coaxial Cables; Low Impedance; Fast Rise Time, 4 kV Output Voltage; Thyratron

429
(PULSE GENERATORS)
(Capacitive)
A HIGH-VOLTAGE PULSE GENERATOR FOR SPARK CHAMBERS IN SPACE
A. Baldwin, T. Lund and R. Madey
Kent State University, Kent, OH 44242
Nuclear Instruments And Methods, Vol. 101, No. 2, pp 363-374 (06/1972).
The design and performance characteristics of a high-voltage pulse generator for use with spark chambers in space are described. In order to minimize power consumption, the pulse generator is designed around a cold-cathode thyratron. The complete pulse generator consists of a thyratron pulser and an avalanche-transistor switching circuit. Included also is a simple means for applying a steady clearing field to the spark chambers. The pulse generator can be triggered at uniform repetition rates up to about 100 per second to produce negative pulses with a peak amplitude of typically 2 kV. The observed rise-time is about 3 ns with only stray capacitance loading. It increases with the capacitance loading introduced by a spark-chamber at the output of the pulser. The total delay-time from the input trigger pulse to the output pulse is about 140 ns. The pulse decays exponentially with a time constant of the order of a microsecond. Pulse amplitudes up to 4 kV are possible with the particular thyratron selected for this application. 6 Refs.
Primary Keywords: Krytron; Capacitor; Low Energy; Keep Alive
Secondary Keywords: Spark Chamber; Space Application

435
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Thyratrons, Materials)
DIELECTRIC INVESTIGATION OF ELECTRIC DISCHARGES IN A MERCURY VAPOUR FILLED THYRATRON
T.K. Bandopadhyaya (1) and V.K. Farkya (2)
(1) G.S. Institute of Technology and Science, Indore, India
(2) Holker Science College, Indore, India
International Journal Of Electronics, Vol. 34, No. 2, pp 253-257 (02/1973).
Experiments are presented in which the effect of frequency and discharge current on the real and imaginary components of the dielectric constant of mercury vapor in a thyratron are studied. Frequencies from 5 kHz to 300 kHz were used with discharge currents up to 8 mA. For low discharge currents an areae of dispersion of the imaginary portion of the dielectric appears at 120 kHz due probably to a relaxation of the dipoles. 7 Refs.
Primary Keywords: Thyratron; Mercury Vapour; Plasma; Dielectric Constant; High Frequency

438
(POWER CONDITIONING; PARTICLE BEAMS, ION)
(Systems; Generation)
FORMATION OF COMPLEX MAGNETIC CYCLES IN A 7-GEV PROTON SYNCHROTRON
I.F. Kleopov and G.I. Kuqushev
Institute Of Theoretical And Experimental Physics, Moscow, USSR
Instruments And Experimental Techniques, Vol. 14, No. 1, pp 12-17 (02/1971).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 19-24 (January-February 1971)
The principles of designing universal systems for controlling ignitron converters are described. Systems are designed for successive formation of main magnetic cycles with one or two smooth transitions from positive values of the field derivative dH/dt = 4 to 9 kOe/sec to any stipulated value dH/dt <=0 (for slow guiding of the beam onto the target), as well as abridged triangular cycles for extraction of a proton beam having an energy of approximately 200 MeV in the interval between the main cycles. The procedure of forming such cycles is demonstrated for operations of the power-supply system of a ring magnet in a mode of 30 cycles/min. 2 Refs.
Primary Keywords: Ignitron; Semiconductor Switch; Voltage Feedback; dV/dt Feedback; Continuous Waveform

444
(PULSE GENERATORS)
(Pulse Forming Lines)
SHORT-CURRENT-PULSE GENERATOR FOR SUPPLYING SEMICONDUCTOR LASERS
A.I. Andrushko
Kazan State University, Kazan, USSR
Instruments And Experimental Techniques, No. 4, pp 1085-1087 (08/1971).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 121-122 (July-August 1971)
The paper describes the circuit of a generator which produces short rectangular current pulses for supplying lasers. The circuit uses the method of shaping powerful current pulses by means of a discharge line. The commutating element of the circuit is a TGI1-10/1 pulse thyratron. The duration of the leading edge of the pulse is 2-3 nsec for a pulse length of approximately 240 nsec. A matching transformer based on cable sections, which allows the voltage to be stepped down and the current to be increased in the load, is used for powerful matching purposes. The current amplitude is equal to 50 A across an equivalent load of 0.2 ohm. 6 Refs.
Primary Keywords: Transmission Line Pulser; Thyratron; Pulse Transformer; Low Voltage; Low Current

445
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Thyratrons)
SOME OBSERVATIONS ON ARC POTENTIALS IN HYDROGEN THYRATRON PULSE DISCHARGES
R.J. Armstrong
Auroral Observatory, Tromo, Norway
Canadian Journal Of Physics, Vol. 50, No. 12, pp 1337-1345 (06/1972).
Experiments are described in which variations in the arc voltage of high power hydrogen thyratrons due to changes in pulse length, probe voltage, and cathode temperature are examined. Light intensity changes in a long pulse were also noted. The arc voltage was found to be higher when the thyratron was pulsed when a DC voltage was applied. Experimental results were found to agree closely with calculations based on the relaxation properties of charged particles in a plasma. 22 Refs.
Primary Keywords: Arc Potential; High Power; Discharge Relaxation; Hydrogen; Deuterium; Post-pulse Period

449
(SWITCHES, CLOSING)
(Ignitrons)
2X II 10-MEGAJOULE IGNITRON CROWBAR
F.B. Headly
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 4, pp 322-330 (04/1971).
A 10-MJ Ignitron Crowbar Array for the 2X II fusion machine has been installed, and is now in operation. It is designed to handle about three times the energy of the previous array used with the 2X machine, which has been supplanted by the 2X II. In addition, this array is expected to be considerably more reliable than previous designs. Furthermore, the floor utilization of the assembly is considerably improved, access to all components is better, and the overall cost per kilojoule is substantially reduced. Two insulated identical main pulse coils are incorporated in the 2XII machine. Similarly, the crowbar array is split into two equal parts, with each connected permanently across its pulse coil. 1 Refs.
Primary Keywords: Ignitron; Crowbar; Design Considerations; Pulse Extension

453
(PULSE GENERATORS)
(Capacitive)
A DOUBLE-TUNED CURRENT GENERATOR WITH ELECTRONIC AMPLITUDE CONTROL
L.A. Kalina, P.A. Novysh and T.B. Pavlova
Instruments And Experimental Techniques, Vol. 17, No. 3, pp 742-744 (06/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 104-106 (May-June 1974)
A pulse-current generator (p.c.g.) producing pulses having a length of 120 microseconds and a half-sinusoid shape in an inductive load at a pulse energy of 30 J is described which contains two controlled thyristor switches: one switch in the charging circuit controls the amplitude, while the other in the discharge circuit controls the phase of the current pulse in the load. Special attention is devoted to the linear and nonlinear elements in the power and control circuits of the thyristor columns; these elements ease the dynamic mode of the thyristors. Experimental data are presented for the p.c.g. 14 Refs.
Primary Keywords: Current-pulse Generator; 1250 A Output Current; Half-sinusoid Output; Thyristor

466
(SWITCHES, CLOSING)
(Ignitrons)
ROLE OF SILICON CARBIDE/MERCURY INTERFACE IN IGNITRONS
M.J. Zarabi and M. Satyam
Indian Institute of Science, Bangalore, India
Journal Of Physics D: Applied Physics, Vol. 3, No. 8, pp 1284-1289 (08/1970).
A new model of ignition in an ignitron, based on the electrical breakdown of the junction between the igniter (semiconductor) and the mercury (metal) is proposed. A method of evaluating some of the ignition characteristics is also developed. The paper gives a critical summary of the various characteristics of the ignition process. The new model is stated and used to explain all the ignition characteristics. The experiments conducted in support of the various aspects of this model are also given. 10 Refs.
Primary Keywords: Breakdown Characteristics; Modeling; Ignition Of Discharge; Junction Breakdown

467
(BREAKDOWN STUDIES; DIAGNOSTICS AND INSTRUMENTATION)
(Gas, Electrical; Miscellaneous)
SPHERICAL PROBE IN A FLOWING PLASMA
J.G. Andrews and D.T. Swift-Hook
Marchwood Engineering Lab, Southampton, UK
Journal Of Physics A: General Physics, Vol. 4, No. 1, pp 142-157 (01/1971).
Ion flow is important in many laboratory discharges, vacuum switches, gas-filled valves, thyratrons and space satellites. A model is presented for subsonic ion flow past a negative spherical probe immersed in a collisionless ionization-free plasma; a stagnation point develops downstream. Although the floating potential given by previous analyses (which all assume spherical symmetry) is substantially correct, there is some dependence on the ion flow velocity (a few % at M = 0.5). Thus the change in floating potential can be used to measure ion flow. In general, only slight modification needs to be made to low pressure probe theories in order to include flow effects. 19 Refs.
Primary Keywords: Subsonic Ion Flow; Spherical Probe; Effect On Flow; Modeling; Potential Measurement

468
(SWITCHES, CLOSING; PULSE GENERATORS)
(Thyratrons; Capacitive)
SQUARE PULSE GENERATOR WITH PULSES OF LARGE AMPLITUDE AND OF VARYING DURATION AND FREQUENCY
D.M. Timush
Institute Of Atomic Physics, Bucharest, Rumania
Instruments And Experimental Techniques, No. 3, pp 811-816 (06/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 156-161 (May-June 1970)
A comparative analysis of series and parallel circuits for connecting thyratrons in pulse generators shows that the parallel circuit has definite advantages. There is a brief description of a generator built on the basis of such a circuit which gives pulses with an amplitude up to 10 kV, a repetition frequency of 5-400 cps, and a duration of 5-300 microseconds. 5 Refs.
Primary Keywords: Thyratron; Series Operation; Parallel Operation; Pulse Shaping

477
(PARTICLE BEAMS)
(Miscellaneous)
ESTIMATES ON THE ACCELERATION OF PELLETS BY GASDYNAMIC AND ELECTROSTATIC MEANS
L.L. Lengyel and W. Riedmuller
Institut fur Plasmaphysik, Garching, FRG
IPP Report No. IPP 4/171 (07/1978).
The authors use mathematical models to estimate the maximum velocity to which a hydrogen pellet could be accelerated. Using gasdynamic drag acceleration the maximum velocity was estimated to be on the order of 100 m/s, while with pneumatic acceleration and electrostatic acceleration velocities on the order of 1000 m/s were estimated to be possible. 29 Refs.
Primary Keywords: Pellet Acceleration; Electrostatic Acceleration; Gasdynamic Acceleration; Pneumatic Acceleration

478
(BREAKDOWN STUDIES)
(Gas, Electrical)
EXCITATION OF HIGH-PRESSURE LASER MEDIA BY A DISCHARGE THROUGH AN INSULATOR
V.N. Ishchenko, V.N. Lisitsyn and A.R. Sorokin
Institute of Semiconductor Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Sov. J. Quant. Electron., Vol. 8, No. 4 pp. 453-457 (04/1978).
Trans. From: Kvantovaya Elektron (Moscow) 5, 788-794 (April 1978).
The authors report a scheme to pump high-pressure laser media by a discharge through an insulator. The suitability of several insulation materials is determined using permittivity and electrical breakdown strength of the insulator, and pyroceramic is found to be best for pulsed discharges. It is found experimentally that the E/p of the discharge can be varied over a wide range, which could previously only be done using an e-beam controlled pump. It was found that both carbon dioxide and atomic transition lasers could be pumped efficiently with this method. 7 Refs.
Primary Keywords: Discharge Through An Insulator; Pyroceramic; Glass; Variation Of E/p; Pulsed Discharge
Secondary Keywords: CO/sub 2/ Laser; Atomic Transition Laser

483
(PULSE GENERATORS; SWITCHES, CLOSING)
(Capacitive; Thyratrons)
A CERAMIC THYRATRON WIRE SPARK CHAMBER PULSER
B. Friend
CERN, Geneva, Switzerland
Nuclear Instruments And Methods, Vol. 65, No. 3, pp 311-313 (11/1968).
A triggered high voltage pulse generator with 1000 A output capability has been developed for use with wire spark chambers. It has short delay and rise times, a high repetition rate and a long lifetime. 5 Refs.
Primary Keywords: Ceramic Thyratron; Tetrode Thyratron; Coaxial Structure; Fast Rise Time; Low Trigger Power

487
(PULSE GENERATORS; ENERGY STORAGE, INDUCTIVE)
(Systems; Systems)
CONVERTERS FOR SUPPLYING PULSED POWER LOADS
N. Mohan (1) and J.T. Broach (2)
(1) University of Minnesota, Minneapolis, MN
(2) U.S. Ameradcom, DRXFB-EA, Fort Belvoir, VA
IEEE Transactions On Industry Applications, Vol. IA-15, No. 1, pp 85-91 (02/1979).
There is a growing need for supplying repetitive pulsed power loads of increasing magnitudes up to several hundred megawatts or more in areas of radar, lasers, high-energy physics experiments and thermonuclear fusion. The nature of such loads can be expected to be as diverse as their applications. The pulsed power demands and corresponding reactive volt-amperes requirements are undesirable from the frequency and voltage fluctuation standpoint, even for the large utility power systems. Techniques for supplying large DC-pulsed loads from a relatively small size AC generator by means of inductive storage and the capacitor commutated converters are presented. A theoretical basis is provided for analyzing the converters which serve to minimize the effects of pulsed power and corresponding reactive volt-amperes. Energy transfer between the storage inductor and the pulsed load is permitted with minimal loss, at a readily controllable rate including the reversibility of power in case of inductive loads. Use of a simple control scheme is shown to provide a precise load voltage regulation which may be a requirement for certain applications. The great use of these circuits would be in supplying loads with pulse durations of a few milliseconds to many seconds or minutes. 9 Refs.
Primary Keywords: Pulse Generator; Inductive Energy Storage; Capacitor Commutator; Analysis; Long Pulse; Rep-rated

489
(INSULATION, MATERIAL)
(Solid)
SOLID INSULATORS IN VACUUM: A REVIEW
R. Hawley
C.A. Parsons & Co Ltd, Newcastle-upon-Tyne, UK
Vacuum, Vol. 18, No. 7, pp 383-390 (07/1968).
The authors bring together the work of several researchers to present a good review of the behavior of solid insulators in vacuum. The effect of surface angle of declination, electrode and insulator material and surface conditions, length dependence, ambient pressure, coatings, and gap conditioning are all considered with qualitative results presented where available. Several suggestions are made for increasing breakdown strength of solid insulators in vacuum. A qualitative review of breakdown along an insulator in vacuum is presented. 26 Refs.
Primary Keywords: Solid Insulator; Vacuum; Breakdown Phenomena; Prebreakdown Phenomena; Variation of Several Parameters; Increased Dielectric Strength

499
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
TWO-MEGAVOLT DIVIDER FOR PULSED HIGH VOLTAGES IN VACUUM
D.G. Pellinen and M.S. Di Capua
Physics International, San Leandro, CA
Review Of Scientific Instruments, Vol. 51, No. 1, pp 70-73 (01/1980).
This paper describes the development of a resistive voltage divider to measure pulsed voltages in excess of 2 MV in vacuo for approximately 100 ns. The monitor can measure either positive or negative polarity by changing the low voltage insulator and reversing the remainder of the insulators and gradient rings. 13 Refs.
Primary Keywords: Megavolt Pulse Divider; Megavolt Vacuum Divider; High Voltage Pulse Divider; Vacuum Insulation; High Frequency Divider

507
(SWITCHES, OPENING)
(Mechanical)
STUDY OF THE EFFECTS OF GAS FLOW ON THE PERFORMANCE OF GAS-BLAST CIRCUIT BREAKERS
H. Kopplin, K. Rolff and K. Zuckler
Siemens AG, Berlin, FRG
Proceedings Of The IEEE, Vol. 59, No. 4, pp 518-524 (04/1971).
Experiments were carried out at a Siemens laboratory with specially designed circuit breakers to investigate the relationship between gas flow and arc behavior for various shapes and arrangements of gas nozzles, as well as for different types of gas and pressure conditions. The current, post-arc current, and voltage measurements were supplemented by the employment of optical methods. By using a high-speed schlieren camera, it was possible to obtain valuable information on the flow characteristics and density of the gas surrounding the arc and to estimate the influence of these quantities on the arc-quenching capacity of a breaker. The interaction of the electric power system and the arc could also be taken into account by using a dynamic arc model. 17 Refs.
Primary Keywords: Gas-blast Breaker; Gas Flow; Arc Behavior; Current Measurement; Post-arc Current Measurement; Voltage Measurement

513
(DIAGNOSTICS AND INSTRUMENTATION)
(Specifications)
HIGH VOLTAGE SPECIFICATIONS AND TESTS (AIRBORNE EQUIPMENT)
W.G. Dunbar
Boeing Aerospace Co, Seattle, WA 98124
AFAPL Report No. AFAPL-TR-79-2024 (04/1979).
Availability: AD AC69473
NTIS
Design engineers rely upon system and component standards and specifications as guides for developing electrical equipment. Specifications and standards are available for most low voltage and commercial high voltage equipment, but not for high voltage/high power airborne equipment with ratings exceeding 20 kV and 20 kW. The test and specification criteria (Engineering Criteria Documents) referred to in this paper pertain to high voltage/high power airborne equipment. 0 Refs.
Primary Keywords: Cables; Cable Assemblies; Capacitors, Connectors, High Power; High Voltage; Transformers; Partial Discharge Test Set
Secondary Keywords: Airborne Equipment; Power Characteristics

515
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)
CHARACTERISTICS OF CO-AXIAL MARX GENERATOR AND ITS APPLICATION TO ELECTRON BEAM FUSION
K. Takagi, Y. Kubota and A. Miyahara
Nagoya University, Nagoya, Japan
Japanese Journal Of Applied Physics, Vol. 18, No. 6, pp 1135-1141 (06/1979).
The design of a 720 kV co-axial Marx generator producing a pulse of 40 ns duration with a rise time of 4 ns is presented. The requirements for electron beam fusion and the role of co-axial Marx generators is discussed. Possible applications of the rectangular output pulse produced are examined. 7 Refs.
Primary Keywords: Coaxial Marx Generator; Short Rise Time; Design Considerations
Secondary Keywords: E-beam Fusion

517
(PARTICLE BEAMS, ELECTRON)
(Generation)
COMPACT ELECTRON ACCELERATOR FOR PUMPING GAS LASERS
C.V. Duncan and L.P. Bradley
Lawrence Livermore Lab, Livermore, CA 94550
1976 IEEE Pulsed Power Conference Proceedings, Paper ID-3 (11/1976).
We describe the design and application of a simple e-beam generator for the repetitive pulse pumping of gas lasers. The circuit uses a low inductance Marx and series tuned pulse forming elements. 5 Refs.
Primary Keywords: E-beam Gun, Rep-rated; Uniform Energy Density; Window Foil Lifetime
Secondary Keywords: Gas Laser Pumping

538
(PARTICLE BEAMS, ION)
(Generation)
MICROSECOND-PULSED ION BEAM FROM A MARX GENERATOR
S. Robertson and M. Wickham
University of California, Irvine, CA 92717
IEEE Transactions Of Plasma Science, Vol. PS-7, No. 1, pp 62-64 (03/1979).
We have maintained Langmuir-Child bipolar flow at a peak voltage of 650 kV in a vacuum diode for 1 microsecond without gap closure or electrical breakdown of the diode insulator. An ion current of >300 A (>7.5 A/sq.cm.) was extracted from the diode in a beam having a large component of divergence <10/sup -2/ rad. 11 Refs.
Primary Keywords: Vacuum Diode; Langmiur-Child Bipolar Flow; Microsecond Time Scale

540
(PARTICLE BEAMS, ELECTRON)
(Generation)
ON THE DEVELOPMENT OF A REPETITIVELY PULSED ELECTRON BEAM SYSTEM
G.A. Tripoli
Ion Physics Corp, Burlington, MA 01803
2nd IEEE International Pulsed Power Conference Proceedings, pp 214-216 (06/1979).
A pulsed electron beam system--PEBS-III--has been developed at Ion Physics Company to generate an electron beam of 200 keV, 4 A/sq.cm., 2.5 cm X 75 cm, 1.3 microsecond, at high repetition rates. The system incorporates a gas-insulated PFN Marx generator in Guillemin C network configuration to drive a cold-cathode electron gun. System performance corresponded to computer simulation of VI waveforms versus generator parameter and impedance-collapse variations. The effort demonstrated the usability of a PFN for energization of long-pulse repetitively pulsed electron guns. 0 Refs.
Primary Keywords: PEBS-II; Marx Generator; Pulse Forming Network; Cold Cathode Diode; Numerical Calculation; Experiment; Long Pulse

541
(PARTICLE BEAMS, NEUTRAL)
(Generation)
PULSED POWER APPLICATIONS TO INTENSE NEUTRON SOURCE DEVELOPMENT
J.J. Ramirez, A.J. Toepfer and M.J. Clauser
Sandia Labs, Albuquerque, NM 87115
Nuclear Instruments And Methods, Vol. 145, No. 1, pp 179-183 (08/1977).
The use of conventional and near term pulsed power technology to generate intense fluxes of neutrons for use in fusion reactor materials studies is duscussed. Two types of neutron production mechanism are considered. For the immediate future, the use of single pulse or high rep rate intense ion beam sources is proposed to provide high fluxes of neutrons from beam-target interactions. Farther along in time, the use of intense ion or electron beams to initiate inertially confined fusion reactions will lead to intense sources of thermonuclear neutrons. 24 Refs.
Primary Keywords: Neutral Beam; Ion Beam; E-beam, Magnetic Insulation

545
(INSULATION, MATERIAL)
(Solid)
VERSATILE THREE-TERMINAL CELL FOR INVESTIGATING THE ELECTRICAL PROPERTIES OF INSULATING MATERIALS OVER A WIDE FREQUENCY AND TEMPERATURE RANGE
F. Sandrolini
Universita di Bologna, Bologna, Italy
Journal Of Physics E: Scientific Instruments, Vol. 13, No. 2, pp 152-154 (02/1980).
A three-terminal cell for the measurement of conductivity and dielectric permittivity of insulating materials (chiefly polymers) over a wide range of frequency (DC to 0.6 MHz) and temperature (140-650 Deg K) in various environments (from vacuum to some pressure of a desired gas) is described. Heat is transferred by conduction from a cooling-heating unit in contact with the high-voltage electrode. The measuring electrode is insulated by a silica glass washer of very high purity and resistivity. Performances are described and discussed. 19 Refs.
Primary Keywords: Insulation Characterization; Conductivity; Permittivity; Wide Frequency Range; Wide Temperature Range; Design Considerations

546
(POWER CONDITIONING)
(Pulse Transformers, Materials)
FERRITES FOR LINEAR APPLICATIONS I-PROPERTIES
E.C. Snelling
Mullard Research Labs
IEEE Spectrum, Vol. 9, No. 1, pp 42-51 (01/1972).
This two part tutorial article describes properties and applications of magnetically soft ferrites. These materials, which are characterized by high permeability and low losses, are used in very large quantities as cores for inductors and transformers. This first installment provides an elementary introduction to the processes of magnetization in ferrites. It also includes a survey of available grades and a summary of the technical properties of typical modern ferrites. Part II, to appear in February, reviews the main applications, describing how the material properties and performance requirements come together in the design of the device. 16 Refs.
Primary Keywords: Magnetization; Soft Ferrite; Ferrite Grades; Basic Theory; Grain Boundary

559
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Marx Generators; Marx)
300-KJ, 200-KA MARX MODULE FOR ANTARES
K.B. Riepe, J. Bickford, J. Jansen and W. Turner
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 254-260 (06/1979).
Antares is a 100-kJ CO/sub 2/ laser driver for inertial confinement fusion experiments. The power amplification stage is pumped by an electron-beam-controlled gas discharge. There are 24 annular discharge regions, each requiring energy input of 250 kJ at 550 kV, in a 2-microsecond pulse. The energy storage module chosen for this system is a single-mesh pulse-forming network. To provide sufficient energy margin each module stores 320 kJ. A prototype 300-kJ, Marx has been built and tested at the Los Alamos Scientific laboratory. This has been used as a test bed for components, triggering, and instrumentation. 4 Refs.
Primary Keywords: Marx Generator; Design Considerations; Reliability; Life Test; Low Inductance

562
(POWER CONDITIONING)
(Pulse Forming Networks)
HIGH-VOLTAGE MICROSECOND PULSE-FORMING NETWORK
K.B. Riepe
Los Alamos National Labs, Los Alamos, NM 87545
The Review Of Scientific Instruments, Vol. 48, No. 8, pp 1028-1030 (08/1977).
A large CO/sub 2/ laser being developed at Los Alamos Scientific Laboratory for fusion research requires a high-voltage, high-power pumping pulse of several microseconds duration. A pulse generator has been developed which provides a flat-topped pulse of 120 kA at 300 kV into a matched impedance load, with a 2.5-microsecond pulse duration. The design is based on a combination of the Guillemin and Marx circuits. Eight of these will be used to pump an eight-beam laser system. There are applications for this circuit in other fields, such as electron beams for plasma heating. Design techniques for the pulse-forming network are discussed, including physical layout and triggering techniques. 9 Refs.
Primary Keywords: Square Pulse; Marx Generator; Guillemin PFN; Modular Construction; 2.5 Microsecond Pulse Duration; 120 kA Current

563
(PARTICLE BEAMS, ELECTRON)
(Generation)
ON THE FORMATION OF PRECISION BEAMS IN MULTISECTION LINEAR ELECTRON ACCELERATORS
V.I. Artemov, I.A. Grishayev, I.M. Gugel', G.K. Dem'yanenko, N. Dovbnya, Y.V. Korniyenko, N.I. Mocheshnikov, F.A. Peyev and V.V. Petrenko
FTD Report No. FTD-ID(RS)T-1919-77 (11/1977).
Trans. From: Ordena Lenina Akademiya Nauk USSR Ordena Lenina Fiziko-Tekhnicheskiy Institut, Khfti 71-31, Khar'kov, 1-30 (1971)
Availability: AD A065859
NTIS
The authors describe a method of obtaining precision beams from a linear electron accelerator based on the use of communication of radial and phase motion. The effect of high-frequency and current instabilities on the parameters of the beam are investigated. A procedure for measurement of the emittance of the beam at the output of the accelerator is presented. Measurements of beam emittance are shown to 2 GeV. Experimental results are compared with theoretical calculations of the beam parameters. 13 Refs.
Primary Keywords: E-beam; Linear Accelerator; Precision Beam; Instabilities; Emittance Measurement; Experiment; Theory

572
(BREAKDOWN STUDIES)
(Reviews)
OPTICAL DISCHARGES
Yu. P. Raizer
Institute For Problems In Mechanics, Moscow, USSR
Journal De Physique, Vol. 7, No. 40 pp. 141-147 (07/1979).
The author discusses the mechanisms involved in discharges initiated by laser radiation. A comparison of optical discharges with discharges of other types is made. The maintenance of equilibrium and non-equilibrium plasma is discussed as is optical discharge propagation. 15 Refs.
Primary Keywords: Optical Discharge; Threshold Field; Non-equilibrium Plasma

573
(ENERGY STORAGE, INDUCTIVE)
(Systems)
PULSED SUPERCONDUCTING INDUCTIVE STORAGE SYSTEM
O.K. Mawardi and H.K. Chung
Case Western Reserve University, Cleveland, OH 44106
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-5 (11/1976).
A novel pulsed inductive storage system is described. This system is the electromagnetic dual of the Marks generator used extensively in high voltage research. In our scheme a number of superconducting inductors are energized in series and subsequently discharged in parallel. The advantage of our scheme is that it spreads the energy stored over several inductors, reducing the current rating of the switches needed to provide the series-parallel interconnection. Furthermore, it improves appreciably the efficiency of energy transfer from the storage inductors to the load as compared to the efficiency of an inductive system using one storage inductor only. The feasibility of this inductive system is demonstrated on a system consisting of three storage inductors. The inductors are energized by means of flux pump of the Wipf design and the switches used are superconducting M-switches (US patent 3,384,762) with a very fast response time. 7 Refs.
Primary Keywords: XPAM; Series Charge; Parallel Discharge; High Efficiency; Flux Pump; M-switch; Inductive Load

574
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
PARAMETER ESTIMATION FOR GENERATOR SIMULATION STUDIES
R.P. Webb (1), C.W. Brice (1), D.T. Tan (2) and C.C. Lee (2)
(1) Georgia Institute of Technology, Atlanta, GA 30332
(2) LSU, Baton Rouge, LA 70803
AFAPL Report No. AFAPL-TR-77-69 (11/1977).
Availability: AD A057006
NTIS
This report presents a detailed study of alternator parameter estimation procedures, including comparison of theoretical results to test data and to simulation results. 36 Refs.
Primary Keywords: Generator Modeling; Sensitivity Analysis; Parameter Identification; Simulation

579
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(LC; LC Generators)
15-KJ LC GENERATOR: LOW INDUCTANCE DEVICE FOR A 100-GW PULSED ELECTRON ACCELERATOR
N.W. Harris (1) and H.I. Milde (2)
(1) Naval Research Lab, Washington, DC 20375
(2) Ion Physics Corp, Burlington, MA 01803
Journal Of Vacuum Science Technology, Vol. 12, No. 6, pp 1188-1190 (12/1975).
In this paper the author describes an L-C generator used to charge a pulse forming line in an e-beam generator . The L-C generator is both more efficient and allows shorter pulses than a Marx driven system. This is due to the fact that the intermediate store is eliminated. Switching inductance and rise time are considered. 3 Refs.
Primary Keywords: L-C Generator; Water Line Pulse Charging; Pulse Forming Line
Secondary Keywords: E-beam Generation

580
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
PROGRAM FOR THE DEVELOPMENT OF A SUPERCONDUCTING GENERATOR
J.L. McCabria
Westinghouse Electric Corp, Lima, OH 45802
AFAPL Report No. AFAPL-TR-79-2012 (02/1979).
Availability: AD A072093
NTIS
This report summarizes work completed in Phase II and Phase III of a program for the development of a superconducting generator. A 5 MW, 400 Hz, 12000 rpm generator was designed and built during Phase II. The oil cooled stator contained a 3-phase, wye connected, 5 kV, floodad winding within a laminated iron shield. The rotor contained a winding of 0.094 cm x 0.14 cm wire with 438 36 micron filaments of Nb-Ti superconducting alloy. A rotating dewar with a cold electro-thermel shield was used. The Phase III work consisted of a warm spin-up of the generator to design speed followed by cool-downs of the rotor. A superconducting state was not obtained in a generator configuration due to high pressure in the vacuum space which resulted in excessive gas conduction into the field winding compartment. A continuous pump-down system was incorporated into the test set-up but the helium leakage rate exceeded the capability of this system. Further work is required to correct this problem. 23 Refs.
Primary Keywords: Superconductors; Cryogenics; Helium; Light Weight; High Power
Secondary Keywords: Generators

589
(PARTICLE BEAMS, ELECTRON)
(Generation)
HARP, A SHORT PULSE, HIGH CURRENT ELECTRON BEAM ACCELERATOR
K.R. Prestwich
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-22, No. 3, pp 975-978 (06/1975)
A 3 MV, 800 kA, 24 ns electron beam accelerator is described and the results of initial switching experiments are discussed. The generator will provide a source for studying the physics of processes leading to electron beam driven, inertially confined fusion. The major components of the accelerator are two diodes with a common anode, twelve oil-dielectric Blumleins with low jitter (<2 ns) multichannel switches, three intermediate storage capacitors, a trigger pulse generator and two Marx generators. 6 Refs.
Primary Keywords: Field Emission Diode; Oil Blumlein Line; Oil Rail Gap; Multichannel Spark Gap

595
(PULSE GENERATORS; PARTICLE BEAMS, ION)
(Systems; Generation)
MAGNETICALLY INSULATED LINAC DRIVEN BY A MULTISTAGE MARX GENERATOR
F. Winterberg
University of Nevada System, Reno, NV 89507
Zeitschrift fur Physik A, Vol. 280, No. 4, pp 359-362 (01/1977).
A method of accelerating intense ion beams so that the ions have an energy of about 5 GeV using a multistage Marx generator to drive a magnetically insulated linear accelerator is presented. This proposed scheme allows the accelerator to be much shorter than conventional setups using microwave driven linacs. With proper scaling of the original plan, beam powers up to 500 TW should be attainable. 11 Refs.
Primary Keywords: Marx Generator; Magnetic Insulation; Heavy Ion Beam; Multi-GeV Energy; Very High Current
Secondary Keywords: E-beam Fusion

597
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)
OVERVOLTAGE AND BREAKDOWN PATTERNS OF FAST MARX GENERATORS
R.W. Morrison and A.M. Smith
Carleton University, Ottawa, Ontario, Canada
IEEE Transactions On Nuclear Science, Vol. NS-19, No. 4, pp 20-31 (08/1972).
Spark gap overvoltages of fast Marx generators in the 100-300 kV range were studied as a function of stray and interstage capacitance for several circuit designs. Overvoltage measurements were made at low voltages by simulating the spark with a silicon-controlled rectifier. Breakdown times were measured to nanoseconds by viewing the light flash from the sparks with a fast photomultiplier. The influence of the ultraviolet irradiation on breakdown time was studied by masking the first gap. Practical conclusions for Marx generator design are presented. 10 Refs.
Primary Keywords: Marx Erection Time; Gap Overvoltage; Stray Capacitance; Interstage Capacitance; Thyristor Simulation; Analysis

602
(SWITCHES, CLOSING)
(Ignitrons)
REVERSE CURRENT AND ARC-BACK IN A SINGLE-GAP MERCURY-ARC VALVE
C.E. Fernando
Central Electricity Generating Board, London, UK
Proceedings Of The IEEE, Vol. 59, No. 4, pp 534-538 (04/1971).
Arc-backs produced by continuously raising the stress on a high-voltage single-gap single-anode mercury-arc valve are preceded by a change in reverse current before failure occurs. On the cycle at which arc-back occurs the reverse current rises rapidly to about 10 A at peak reverse voltage (140 kV maximum). Subsequently, the reverse current decreases and then rises again steadily for several hundred microseconds. Failure occurs during this second rise of current. These changes in reverse current prior to arc-back are reproducible. The peak reverse voltage reached on the cycle at which arc-back sets in is also reproducible (to +or- 10 percent). This type of arc-back is interpreted as a sequential process that is initiated by ignition, at peak voltage, of a stable high-voltage discharge in the valve. The subsequent rise of reverse current which leads to failure is attributed to a rise in gas pressure within the valve due to ion bombardment from the high-voltage discharge. The measured delay of 60 microns from the point of rapid rise in reverse current to the start of the final growth of current suggests that mercury vapor is evolved from the negatively biased main anode to cause a rise in gas pressure. Detection of precursor currents might allow suspect valves to be blocked in time to prevent the occurrence of a full arc-back. 23 Refs.
Primary Keywords: Arc-back Mechanism; Power Frequency; Device Failure Modes

605
(PARTICLE BEAMS, ELECTRON; PULSE GENERATORS)
(Generation; Marx)
A NEW METHOD OF EXCITING UNIFORM DISCHARGES FOR HIGH PRESSURE LASERS
R.W. Morrison and C. Swail
Carleton University, Ottawa, Ontario, Canada
Physics Letters, Vol. 40A, No. 5, pp 375-377 (08/1972).
A Marx generator producing 500 kV pulses lasting 20 ns is used to create a uniform discharge by field emission from a stainless steel wire cathode in a TEA carbon dioxide laser. Variations in peak power, delay time, and pulse width with nominal Marx voltage are given. 5 Refs.
Primary Keywords: Field Emission Large Area Diode; Marx Generator; Townsend Avalanche; Space Charge Limited
Secondary Keywords: Gas Laser Pumping

606
(PULSE GENERATORS; SWITCHES, CLOSING)
(Systems; Gas Gaps, Electrical)
A SIMPLE SYSTEM PRODUCING A 450 KV PULSE WITH 1 NS RISE TIME
K. Eggert
Physikalisches Institut, Technische Hochschule Aachen, Aachen , FRG
Nuclear Instruments And Methods, Vol. 106, No. 3, pp 509-512 (03/1973).
A simple pulse shaping network is described. It consists of a capacitor connected in series with a spark gap. A Marx generator feeds the system. Calculations of the equivalent circuit reproduce the behaviour of the pulseformer, which generates a pulse of 450 kV with 1 ns rise time and 7 ns FWHM on a load of 80-ohm. With such a system streamer chambers can be driven quite conveniently. 1 Refs.
Primary Keywords: Marx Generator; Peaking Gap; Intermediate Storage Capacitor; Rise Time Reduction

611
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)
COMPACT, ULTRA-HIGH DENSITY MARX GENERATOR
D.M. Strickland and W.L. Heatherly
AFWL, Kirtland AFB, NM 87117
IEEE 1973 Eleventh Modulator Symposium pp. 113-120 (09/1973).
This report presents the results of an Air Force Weapons Laboratory program to develop a compact, high-density energy storage system to satisfy various electromagnetic pulse simulation requirements. Such requirements range from small, 1-MV ground-based simulators to elevated or air-supported simulators producing tens of megavolts. Based on studies performed during the High Altitude Simulation program and reported in the EMP-HAS report series, it was concluded that the most versatile and promising pulse generator system for matching this broad range of requirements would utilize a Marx generator and distributed peaking capacitor circuit. 5 Refs.
Primary Keywords: Marx Generator; Ultra-high Density; Peaking Capacitor

613
HIGH-VOLTAGE TECHNOLOGY FOR THE LASL IMPLOSION-HEATING EXPERIMENT
J.E. Hemmel, T. Henins, J. Marshall and A.R. Sherwood
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-731114-38, 4p (01/1973).
Availability: LA-UR-73-1753
NTIS
For abstract, see NSA 29 06, number 14440.
Primary Keywords: Pulse Generators_Specifications; Toroidal Theta Pinch Devices_Plasma Heating; Electronic Equipment; Implosions
Secondary Keywords: AEC

615
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
PRECISE LASER INITIATED CLOSURE OF MULTIMEGAVOLT SPARK GAPS
J.J. Moriarty (1), H.I. Milde (1), J.R. Bettis (2) and A.H. Guenther (2)
(1) Inn Physics Corp, Burlington, MA 01803
(2) AFWL, Kirtland AFB, NM 87117
The Review Of Scientific Instruments, Vol. 42, No. 12, pp 1767-1776 (12/1971)
Single- and double-channel laser triggered switches in high pressure gas have been designed and operated in the voltage range from 1 to more than 3 MV. Jitter times of <1 to 3 nsec were observed in most cases. Gas pressures of 10.5 and 21 kg/sq. cm. were used. The gases were either 100% nitrogen or various mixtures of N/sub 2/, SF/sub 6/, and Ar. Significant accomplishments were (1) the simultaneous firing of four stages of a Marx generator by an optically divided laser beam; (2) up to 40% reduction in the rise time observed in the output pulse from a multimegavolt DC generator when switched into a load through two simultaneously laser triggered channels, and (3) the design operation of a laser triggered, DC charged switch at more than 3 MV. 23 Refs.
Primary Keywords: Laser-triggered Spark Gap; Single Spark Channel; Double Spark Channel; Ruby Laser; Various Gases; High Pressure; Marx Generator

618
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)
(Generation; Transport)
PRODUCTION AND DYNAMICS OF HIGH INTENSITY ELECTRON BEAMS
G. Brautti (1), I. Boscojo (2), R. Coisson (2), M. Leo (2), A. Luches (2) and A. Tapore (2)
(1) Universita Di Bari, Bari, Italy
(2) Universita Di Lecce, Lecce, Italy
IEEE Transactions On Nuclear Science, Vol. NS-20, No. 3, pp 286-288 (06/1973).
High intensity electron beam experiments are in progress at electron energies varying from 100 keV to 2 MeV. The low energy machines are Marx generators, while the high energy one is an electron beam transformer accelerator, home made with some original technical solutions. Its electron energy is 2 MeV, current >10 kA, pulse length 20 ns at a repetition rate of 10 pps. The purpose is injection in the ANEL-type electron ring accelerators; beam dynamics and plasma-beam interaction investigations. Several models of field emission diodes have been investigated by various diagnostic methods and beam pictures on various materials have been taken. 3 Refs.
Primary Keywords: ANEL; Field Emission Diode; Magnetic Field; Bunching

619
(PULSE GENERATORS)
(Marx)
PULSE GENERATORS AND MODULATORS FOR LASER APPLICATIONS
L.N. McClusky, E.L. Roy, W.H. Gurley, C.M. Bowden, A.H. Werkheiser and C. Cason
Army Missile Command, Redstone Arsenal, AL 35809
IEEE 1973 Eleventh Modulator Symposium pp. 121-128 (09/1973).
A high voltage pulse generator has been constructed for laboratory use in powering a high average power pulse laser. The pulse generator has three 500 kVA power transformers, a 3-phase rectifier and four mechanically synchronized 5-stage Marx generators. At 70 kV charge voltage 7350 J are stored. Instabilities in the laser load are observed at approximately 70 kV charge. Very satisfactory 4 second operations of the pulse gererator have been achieved at a PRF of 50 pps which corresponds to an average output power of 280 kW at 300 kV peak. 0 Refs.
Primary Keywords: Marx Generator; High Rep-rate; Design Considerations; Mechanical Synchronized; Variable Pulse Width
Secondary Keywords: Laser Load

620
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)
STREAMER CHAMBER CHARGING REGULATOR SYSTEM
R.E. Fuja and J.W. Dawson
Argonne National Lab, Argonne, IL
Nuclear Instruments And Methods, Vol. 100, No. 2, pp 329-331 (04/1972).
In a streamer chamber system being built at Argonne National Laboratory, the specifications for pulse repeatability impose stringent requirements on the Marx generator charging electronics. A charging regulator using type 284 tetrode modulator tubes was developed to provide the required stability. The system philosophy, design requirements, and circuit configuration are discussed. 2 Refs.
Primary Keywords: Marx Generator; Blumlein Line; 0.1 Percent Repeatability; Series Regulator

621
(PULSE GENERATORS)
(Marx)
THE GENERATION OF LIGHTNING AND SWITCHING IMPULSE VOLTAGES IN THE UHV REGION WITH AN IMPROVED MARX CIRCUIT
A. Rodewald and K. Feser
Haefely Ltd, Basel, Switzerland
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-93, No. 1, pp 414-420 (02/1974)
This paper concerns the trigger performance of Marx circuits and shows the essential features of an improved circuit. It is studied how the introduction of parallel spark gaps PF and firing capacitors C/sub z/ in a multistage impulse generator can improve the trigger performance. Other advantages of the new circuit will also be discussed. 15 Refs.
Primary Keywords: Marx Generator; Trigger Performance; Design Considerations; Principles Of Operation; Sphere-sphere Gap; Improved Circuit; Parallel Spark Gaps

622
(PARTICLE BEAMS, ELECTRON)
(Generation)

THE HYDRA ELECTRON BEAM GENERATOR

T.H. Martin
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-20, No. 3, pp 289-293 (06/1973).

The Hydra electron beam generator was designed to simultaneously produce two 1 MV, 0.5 MA, 80 nanosecond electron beams that could be combined to form a single beam. The machine, undergoing final developmental tests, has generated a 0.5 MA, 1 MV peak electron beam from each line. This accelerator consists of a low-inductance Marx generator, two water-dielectric pulseforming (PF) and impedance-transforming transmission lines and two low-inductance, high-current diodes. A description of the generator is presented along with developmental studies and initial testing data. The Hydra machine is based on accelerator principles described in the literature. The Marx generator is submerged in transformer oil and separated from the transmission line water by a lucite interface. The Marx charges each coaxial PF transmission line which is insulated by deionized water to 3 MV in 0.9 microseconds. At peak voltage a 3 MV SF/sub 6/ spark gap electrically connects the 4 ohm PF line to the impedance transforming (4 ohm to 2 ohm) transmission line. The pulse is transmitted through this line to the single radial insulator diode. A 30 kilojoule, 100 nanosecond duration electron beam is formed by a cold cathode in each diode. 12 Refs.
Primary Keywords: Marx Generator; Pulse Forming Line; Impedence Matching; Field Emission Diode; Design Considerations

624
(SWITCHES, CLOSING)
(Solid Dielectric, Optical)

LASER-TRIGGERED SOLID DIELECTRIC SWITCHING

M. Ury, D. Morse and M. Friedman
Cornell University, Ithica, NY 14850
IEEE Transactions On Nuclear Science, Vol. NS-18, pp 314-321 (01/1971).

A Q-switched ruby laser was used to initiate breakdown in solid dielectric switches with a jitter of less than 3 ns. Polycarbonate in thickness from 40 to 80 mils withstood applied voltage pulses (less than 1 microsecond duration) of up to 400 kV. Laser pulse energy of less than 1 joule was sufficient to initiate breakdown in the solid dielectric. A focusing lens and the switch container were immersed in a grading solution of copper sulfate and water. Command triggering down to 50% of the dielectric's self breakdown voltage was demonstrated. A test system employing a miniature Marx generator, and a high energy system switching 150 kA at 400 kV to form precisely time relativistic electron beams, are described. 5 Refs.
Primary Keywords: Ruby Laser; Polycarbonate Dielectric; Low Energy Laser; Wide Voltage Range; Sphere-plane Gap

625
(BREAKDOWN STUDIES)
(Gas, Optical)

OBSERVATION OF HIGHLY IONISED SPECIES IN PLASMA PRODUCED BY PICOSECOND LASER PULSES

R.J. Dewhurst, C.J. Part and S.A Ramsden
University of Hull, Hull, UK
Optics Communications, Vol. 9, No. 3, pp 287-290 (11/1973).

Results are presented of an experiment to reasure the breakdown of a solid target by laser radiation in a vacuum. The laser used was a mode-locked Nd:glass ring laser. This laser was used to irradiate PTFE, carbon, and aluminum targets. Spectra were taken using a normal incidence spectrometer having a resolution of about 0.5 angstroms, plots are shown of PTFE and aluminum spectra. 11 Refs.
Primary Keywords: Nd-glass Laser; PTFE Target; Aluminum Target; Normal Incedence Spectrometer

626
(PARTICLE BEAMS, ELECTRON)
(Generation)

HERCUS, A 250 KV, 80 KA ELECTRON BEAM GENERATOR

K.R. Prestwich
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 3, pp 493-495 (03/1971).

A 250 - 400 kV, 80 kA, 30 ns electron beam generator has been developed. The machine consists of a 600 kV Marx generator, a water-dielectric transmission line, a diode, and a beam drift chamber. It was necessary to minimize prepulse for stable diode operation. Several cathodes were tested during development and results are reported. Diodes with 26 and 8 nH inductance are described. 4 Refs.
Primary Keywords: Field Emission Diode; Drift Tube; Marx Generator; Water-dielectric Transmission Line; Several Cathode Materials

628
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)

DEVELOPMENT OF AN 18-MEGAVOLT MARX GENERATOR

K.R. Prestwich and D.L. Johnson
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-16, No. 3, pp 64-69 (06/1969).

An 18-megavolt, 1 megajoule Marx generator has been constructed and tested to 11 MV as the primary energy store of the Hermes II flash x-ray machine. A geometrical arrangement for the capacitors that takes advantage of the stray capacities to provide a wide triggering range and fast Marx erection time was developed from model and circuit studies. The design parameters of the Marx were checked by constructing and testing a 4 MV, 100 kJ generator using components proposed for the 18 MV system. Spark gaps were developed specifically for the generator and have operated successfully for over 50,000 gap firings. 6 Refs.
Primary Keywords: 1 MJ Energy; Hermes II; Stray Capacitance; Reliable Triggering; Fast Rise Time; Good Reliability

630
(PARTICLE BEAMS, ELECTRON)
(Generation)

A STUDY OF THE DOUBLE-FOCUSING DIODE

K. Takagi
Nagoya University, Nagoya, Japan
Japanese Journal Of Applied Physics, Vol. 18, No. 12, pp 2255-2262 (12/1979).

Double-focusing diode characteristics are investigated with special emphasis placed on impedance and anode plasma density. A co-axial Marx generator was used to supply a rectangular pulse across a constant load. Two different types of anodes were used on the double-focusing diodes. One was a mesh anode with 75% transperency and the other was a range-thick carbon plate with a 6 mm hole in its center. The double-focusing diodes were found to have a reduced impedance and a denser anode plasma than single diodes. 17 Refs.
Primary Keywords: Double-focusing Diode; Co-axial Marx Generator; Impedance Reduction; Very Low Impedance; Electron Reflexing

632
(PULSE GENERATORS)
(Systems)

DISTRIBUTED PARAMETER MODEL OF THE TRESTLE PULSER

T.H. Lohman, R.L. Hutchins and R. Fisher
BDM Corp, Albuquerque, NM 87106
2nd IEEE International Pulsed Power Conference Proceedings, pp 425-428 (06/1979).

A distributed parameter circuit analog model was developed to evaluate design improvements for the TRESTLE pulser. The approach for specifying the model network and estimating model parameters is given. Model results are shown to compare favorably to available measurements. The model's flexibility and economy allowed ready evaluation of potential modifications. 3 Refs.
Primary Keywords: Marx Generator; Peaking Capacitor; Analysis; Modelling
Secondary Keywords: EMP Generation

635
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)

LOW-IMPEDANCE, COAXIAL-TYPE MARX GENERATOR WITH A QUASI-RECTANGULAR OUTPUT WAVEFORM

M. Obara, Y. Sakato, C.H. Lee, T. Hashimoto and T. Fujioka
Keio University, Kohoku-ku, Yokohama-shi, Japan
2nd IEEE International Pulsed Power Conference Proceedings, pp 165-171 (06/1979).

Theoretical analysis of a low-impedance, coaxial type Marx generator, in terms of the equivalent electrical circuit, can offer the most appropriate parameters for the design of a Marx generator to produce a quasi-rectangular output waveform. The results of this theoretical analysis can be extensively applied to the design of various types of coaxial Marx generator. Based upon theoretical analysis, three Marx generators of 0.6MV, 1.0MV, and 2.6MV have been developed for the e-beam initiation of an HF chemical laser. The results of the analysis were in good agreement with the experimental results. They have a completely coaxial configuration. One advantage of these machines is that they can directly drive a low-impedance electron-beam diode, without a low-impedance PFN, for the efficient production of an intense relativistic electron beam. They are also remarkably compact. 16 Refs.
Primary Keywords: Coaxial Marx Generator; Low-impedance; Quasi-rectangular Output; Theory; Experiment

638
(PULSE GENERATORS)
(Systems)

THE DESIGN APPROACH TO A HIGH-VOLTAGE BURST GENERATOR

D. Cummings and H.G. Hammon III
Physic International Co, San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 172-178 (06/1979).

An increasing number of experimental programs call for a sequence of several closely spaced, high-voltage pulses. This paper presents the various design considerations for such a system. These include the kind of pulse generator, series or parallel configuration, kinds of lines, aspect ratio, choices of dielectric, switch type, triggering considerations, Marx Generator design and isolation, feed problems, pulse formation, and waveform degradation with increasing stages. The design procedure is illustrated by the X-2 pulser built for the PHERMEX Facility at the Los Alamos Scientific Laboratory. This system produces a train of up to three 40 ns pulses, variable from 600 kV to 1.4 MV with pulse separations of 100 ns to 1 ms. Results are given and waveforms presented. 0 Refs.
Primary Keywords: Burst Mode; Design Considerations; PHERMEX; Experiment; Marx Generator; Pulse Line

641
(PULSE GENERATORS)
(Stacked Line)

A COMPACT POWERFUL-PULSE GENERATOR

Y Carmel, S. Eylon and E. Shohet
Government Of Israel Scientific Department, Tel-Aviv, Israel
Journal Of Physics E; Scientific Instruments, Vol. 11, No. 8 pp 748-750 (08/1978).

6 Refs.
Primary Keywords: Stacked Line Transformer; Coaxial Marx Circuit; 25ns, 1000kv Pulses

642
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Marx Generators; Marx)

A LOW INDUCTANCE, COMPACT, 1 MV, 10 KJ MARX GENERATOR

R.D. Stine Jr.
Maxwell Labs Inc, San Diego, CA 92123
1976 IEEE Pulsed Power Conference Proceedings, Paper IIC-2 (11/1976).

The electrical characteristics and design features of a low inductance, compact, 1 MV, 10 kJ Marx generator are discussed. Generators with a wide range of output energies are easily obtained by series/parallel configurations of components. A precision triggered, three-electrode, 100 kV switch and the compact physical arrangement of plastic-cased capacitors results in less than 100 nH inductance per stage in the Marx. Reliable operation over a three to one voltage range is readily achieved by varying the spark-gap gas pressure. 3 Refs.
Primary Keywords: Marx Generator; Low Inductance; Compact Size; Modular Design

643
(POWER CONDITIONING)
(Pulse Transformers)
A REPETITIVE 600 KV STACKED LINE TRANSFORMER PULSE GENERATOR
Y. Carmel and E. Shohet
Israel Scientific Dept, Tel-Aviv, Israel
Journal Of Physics E; Scientific Instruments, Vol. 11, pp 748-751 (08/1978).
A novel approach is described for the design of high-voltage fast pulse generators. It is based on a combination of a stacked line transformer (SLT) and a coaxial Marx circuit, whose principles were successfully applied for the design of a 600 kV, 25 ns repetitively pulsed generator. 1 Refs.
Primary Keywords: Stacked Line Transformer; Coaxial Transmission Line; Marx Generator; Fast Rise Time

649
(PULSE GENERATORS)
(Systems)
HIGH VOLTAGE NANOSECONDS PULSE GENERATOR WITH VERY FAST RISE TIME
Y. Kubota and A. Miyahara
Nagoya University, Nagoya, Japan
Japanese Journal Of Applied Physics, Vol. 17, No. 10, pp 1907-1908 (05/1978).
A description is given of a pulse generator producing a 300 kV, 5 ns pulse into a 5 ohm matching load with a rise time of 5 ns. A 720 kV Marx generator is inductively charged and then discharged through multichannel spark gaps providing the power for the pulse. 2 Refs.
Primary Keywords: Marx Generator; Water Line; Self-break Water Switch; Sub-nanosecond Rise Time
Secondary Keywords: E-beam Fusion

650
(POWER CONDITIONING)
(Voltage Regulation)
HIGH-POWER PULSE GENERATION
R. Arockiasamy and K. Kant
Indian Institute Of Technology, New Delhi-110029, India
Proceedings Of The IEEE, (August 1977), pp 1209-1210 (08/1977).
A thyristor circuit for generating high-power pulses directly from the power frequency supply is described. The circuit has a wide scope of application in industry and research. Typical applications are mentioned. 3 Refs.
Primary Keywords: SCR Power Conditioning; Power Control; Regulation; SCR Power Control; Poly Phase SCR Control; Power Rectifier

653
(BREAKDOWN STUDIES)
(Exploding Wires)
MULTIPLE-WIRE ARRAY LOAD FOR HIGH-POWER PULSED GENERATORS
C. Stallings, K. Mielsen and R. Schneider
Physic International Co, San Leandro, CA 94577
Applied Physics Letters, Vol. 29, No. 7, pp 404-406 (10/1976).
Exploding wire loads have been used for several years to generate a hot dense plasma. For a generator with a rise time of tens of nanoseconds and an impedance of 1 ohm or less, the inductance of the wire load and the tendency of current to flow outside the wire limits the energy that can be transferred to the wire. An array of several wires has now been used to lower the inductance and improve the energy transfer. 8 Refs.
Primary Keywords: Exploding Wires; Multiple-wire Array; 1 MA Current; Current Measurement; Impedance Matching
Secondary Keywords: Plasma Generation

656
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
THE LASER TRIGGERING OF HIGH-VOLTAGE SWITCHES
A.H. Guenther and J.R. Bettis
AFWL, Kirtland AFB, NM 87117
Journal Of Physics D; Applied Physics, Vol. 11, pp 1577-1613 (02/1978).
The laser-triggered switching (LTS) of high-voltage spark gaps is considered. The basic theory is presented which predicts dependencies of the delay to breakdown and switching jitter on such variables as fill gas mixture and pressure, gap spacing, polarity, and geometry. It is shown that electrical arcs of several metres length can be directed by laser action. A complete set of experiments is reported which adequately support the proposed theory. The performance of LTS is considered and results are reported on multiple gap triggering, multiple channel triggering, triggering of voltages in excess of 3 MV, repetitive switching at rates up to 50 pps with subnanosecond jitter, as well as various geometries, pulse forming demonstrations, and output voltage selection on a Marx generator. Solid, liquid, and vacuum insulation mediums are also discussed and experimental results reported. Finally, numerous applications of LTS are presented as well as a list of recommended operating characteristics to obtain optimum switching performance. 126 Refs.
Primary Keywords: Laser-trigered Spark Gap; Switch Delay; Jitter; Variable Pressure; Variable Gas Mixture; Variable Gap Spacing; Discharge Guiding; Experiment; Theory

658
(PULSE GENERATORS)
(Line Type)
WAVE PROCESSES IN HIGH-POWER NANOSECOND PULSE GENERATORS
Yu.P. Kuber'kov
M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 21, No. 4, pp 515-516 (04/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 884-886 (April 1976)
The use of pulse forming lines in the production of electron beams is widespread today. As a result, it is necessary to characterize these lines and their pulse shaping characteristics. The solution proposed here is based on the principle of the superposition of the incident and reflected waves; the system is partitioned into several regions, which are treated as four-poles, whose parameters are governed by the design. Then, for the case in which reflected and incident waves are present, a solution is found in terms of the known reflection and refraction coefficients. To carry out calculations for a system consisting of coaxial lines it is sufficient to determine the amplitudes of the waves propagating in the forward and reverse directions in all regions. The number of these regions depends on the properties of the dielectric medium, the propagation velocity of the electromagnetic waves, the length of the system, and the time step of the calculation. After determining the numerical values for the forward and reverse waves throughout the system for a given time, we can determine the wave incident on the switches and the load. 3 Refs.
Primary Keywords: Pulse Forming Line; Design Considerations; Switching Considerations; Modeling

671
(PULSE GENERATORS; SWITCHES, CLOSING)
(Capacitive, Thyristors)
A FLEXIBLE HIGH POWER PULSE GENERATOR USING THYRISTORS
D.F. Gibbs
H.H. Wills Physics Lab, Royal Fort, UK
Journal Of Physics E; Scientific Instruments, Vol. 4, pp 1065-1066 (12/1971).
A simple pulse generator is described which in conjunction with low voltage triggering equipment is capable of delivering pulses of up to 250 V into open circuit, with a source impedance of less than 1 kohm. Pulse width is variable from about 1 microsec upwards. No difficulty is anticipated in producing higher voltages and currents if required. 0 Refs.
Primary Keywords: Pulse Generator; Variable Pulse Width; Thyristor Switch; 250 V Output

675
(PULSE GENERATORS; POWER CONDITIONING)
(Marx; Pulse Forming Lines)
HIGH-POWER CURRENT PULSE GENERATOR
D.G. Zagorodnov, L.I. Bolotin, I.I. Magda, N.P. Gadetskii, V.I. Belysev and Yu.V. Tkach
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instruments And Experimental Techniques, No. 5, pp 1359-1361 (10/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 100-102 (September--October 1970)
A generator of high-power current pulses, 30 nsec wide, with the electron beam current reaching 12 kA at 400 kV is described. The generator consists of two forming lines with distilled water used as the dielectric and an electron gun with a multipointed cathode. The line is charged from a voltage pulse generator using the Arkad'ev-Marx circuit. Because water is used as the dielectric, the capacitance of the line is approximately 10 nF for relatively small dimensions, which allows approximately 0.5 kJ to be stored and approximately 1E9 W to be discharged into the load. 5 Refs.
Primary Keywords: Marx Generator; Pulse Forming Line; Double Forming Line; Low Impedance; Water Dielectric; 400 kV Operating Voltage

681
(PULSE GENERATORS; SWITCHES, CLOSING)
(Line Type; RBDT)
AN ALL SOLID-STATE MODULATOR FOR THE ARSR-3 TRANSMITTER
E.H. Hooper and S.R. Bird
Westinghouse Electric Corp, Baltimore, MD 21203
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1496-1499 (10/1979)
This paper describes an all solid-state, high-power pulse modulator used in the ARSR-3 system (an FAA air route surveillance radar system). The modulator, the culmination of a number of years of both device and circuit development, uses fast switching Reverse Blocking Diode Thyristors (RBDT's) to directly switch 14-MW, 3 microsecond video pulses at high current without the use of magnetic switching aids. The modulator consists of five identical PFN modules, a trigger amplifier, and a pulse transformer which matches the modulator output to the beam characteristics of a klystron. Each module contains its own PFN, discharge RBDT switch assembly, and associated circuitry. This modulator is the first production equipment to use the new Westinghouse T62R RBDT devices. The devices switch 2200-A pulses with a turn-on rate of rise of up to 300 A/microsecond. 3 Refs.
Primary Keywords: Pulse Forming Network; Reverse Blocking Diode Thyristor; Modular Design; Performance Test

684
(BREAKDOWN STUDIES)
(Lightning)
SURVEY ON ACTUAL KNOWLEDGE AND PHYSICAL PROBLEMS
K. Berger
31 Gstadstrasse, CH 8702, Switzerland
Journal De Physique, Vol. 40 No. 7 pp. 57-62 (07/1979).
An overview of recent lightning research is presented. Also discussed are three physical problems of lightning discharges: the problem of stepped leaders, of the velocity of leaders and return strokes, and of the current rise in the first and subsequent strokes. 0 Refs.
Primary Keywords: Lightning Initiation; Charge Cells; Positive Particle Migration; Upward Leader; Downward Leader

686
(REVIEWS AND CONFERENCES)
(Reviews)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY
W.J. Sarjeant (Ed.)
Los Alamos National Labs, Los Alamos, NM 87545
Collection Of Lectures (10/1980).
Availability:
See Individual Lectures
Thirteen lectures given at the University of New Mexico and Los Alamos Scientific Laboratory concerning pulse power. Topics discussed include energy storage, switching, power conditioning, and particle beam generation. Twelve lectures are referenced individually.
Primary Keywords: Power Conditioning; Power Supplies; Pulse Voltage Circuits; Transmission Lines; Capacitors; Loads; Thyratrons; Ignitrons; Charging; Pulse Transformers; E-beam; Grounding And Shielding

698
NONADIABATIC ENERGY TRANSFER BETWEEN COUPLED L-C RESONATORS AND ITS POSSIBLE APPLICATIONS TO HIGH-POWER RF PULSE GENERATION
I. Sato, K. Minami and K. Ishii
Nagoya University, Nagoya, Japan
No. IPPJ-32, 53p (09/1979).
Availability: N80-14917/2
NTIS
A principle of high-power RF pulse generation available in nuclear fusion research is proposed. The RF energy stored in L-C resonators with variable resonant frequencies is transferred to a load resonator when the frequency crossing occurs. Successive energy transfers from resonators result in a sustained RF oscillation at the load. It is emphasized that the successive triggering is not required in the present method. This simplifies substantially the operation of the RF generators. The principle is analyzed and numerically calculated for practical experimental conditions. An example of the conceptual designs of the variable inductor used in the present method is shown. At the frequency 1 PHz (4 MHZ), the output 110 kW (440 kW) and the pulse width 24 sec (6 micron sec) are expected, if one uses tow toroidal ferrite cores with a major radius 0.5m and a minor radius 0.2m.
Primary Keywords: Energy Transfer; Inductors; Nonadiabatic Conditions; Pulse Generators; Radio Frequencies; Resonators; Heating; Induction Heating; Nuclear Fusion; Radio Frequency Heating
Secondary Keywords: NTISNASAE; NTISFNJA

701
(SWITCHES, OPENING)
(Explosive Fuses)
ELECTRICAL EXPLOSION OF CYLINDRICAL FOILS IN AIR II. HIGH-CURRENT SHUNT PINCH
V.A. Burtsev, V.A. Dubyanskii, N.P. Egorov, M.P. Kasatkina, A.B. Produvnov and I.V. Shestakov
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics Technical Physics, Vol. 23, No. 9, pp 1051-1055 (09/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 48, pp 1845-1852
The properties of the high-current pinch produced in the electrical explosion of a cylindrical alurinum foil in air are studied experimentally. With a thick foil the light pulse emitted from the plasma becomes sharper. Blackbody emission is obtained at wavelingths 270 nm < Lambda < 500 nm. A current reversal arises in part of the plasma which coincides with the space-time position of the secondary shock wave. 9 Refs.
Primary Keywords: Exploding Cylindrical Foils; High-current Shunt Pinch; Cylindrical Aluminum Foil; Plasma Shock Wave; Secondary Shock Wave

704
(SWITCHES, OPENING)
(Explosive Fuses)
ELECTRICAL EXPLOSION OF CYLINDRICAL FOILS IN AIR I. ELECTRICAL CHARACTERISTICS OF THE EXPLOSION
V.A. Burtsev, V.A. Dubyanskii, N.P. Eforov, M.P. Kasatkina, A.B. Produvnov and I.V. Shestakov
D. V. Efremov Scientific-Research Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 7, pp 802-806 (07/1978).
Trans. From: Zhurnal Tekhnecheskoi Fiziki, Vol. 48, pp 1419-1427
The experimental apparatus is described together with the diagnostic methods used to study the electrical explosion of cylindrical foils in air and the properties of the high-current shunt discharge. Experiments on the characteristics of the electrical explosions of cylindrical aluminum foils in air are reported. 23 Refs.
Primary Keywords: Cylindrical Foils; High-current Shunt Discharge; Megaampere Current Switch; Suppressed Edge Effects

707
(POWER CONDITIONING)
(Pulse Transformers)
USE OF TRANSFORMERS IN PRODUCING HIGH POWER OUTPUT FROM HOMOPOLAR GENERATORS
W.H. Lupton, R.D. Ford, D. Conte, H.B. Lindstrom and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
2nd IEEE International Pulsed Power Conference Proceedings, pp 83-86 (06/1979).
Analysis is presented for systems using high current pulse transformers to exploit the high energy storage capability of homrpolar generators or other limited current sources. The stepped-up secondary current can be established either by current interruption when the primary is also used for energy storage or by commutation of current into the primary from a separate storage inductor. For high-power pulse generators the primary insulation and power supply are protected by subsequent crowbarring of the primary. An example is given of a design for matching the NRL homopolar generator with 1.46 mH inductor to a 1-microH, megavolt level inductive pulse generator. 6 Refs.
Primary Keywords: Pulse Transformer; High Current; Crowbar; Inductive Energy Storage

708
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)
VERY FAST, HIGH PEAK POWER PLANAR TRIODE AMPLIFIERS FOR DRIVING OPTICAL GATES
M.M. Howland, S.J. Davis and W.L. Gagnon
Lawrence Livermore Lab, Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 246-249 (06/1979).
Recent extensions of the peak power capabilities of planar triodes have made possible the latter's use as very fast pulse amplifiers, to drive optical gates within high-power Nd:glass laser chains. These pulse amplifiers switch voltages in the 20 kV range with rise times of a few nanoseconds, into crystal optical gates that are essentially capacitive loads. This paper describes a simplified procedure for designing these pulse amplifiers. It further outlines the use of bridged-T constant resistance networks to transform load capacitance into pure resistance, independent of frequency. 4 Refs.
Primary Keywords: Pulse Amplifier; Planar Triode; Miller Effect; Grounded Grid
Secondary Keywords: Pockels Cell

714
(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL)
(Flux Compression; Flux Compression Generators)
EXPLOSIVE MAGNETIC FLUX COMPRESSION PLATE GENERATORS AS FAST HIGH-ENERGY POWER SOURCES
R.S. Caird, D.J. Erickson, W.B. Garn and C.M. Fowler
Los Alamos National Labs, Los Alamos, NM 87545
1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-3 (11/1976).
A type of explosive driven generator, called a plate generator, is described. It is capable of delivering electrical energies in the MJ range at TW power levels. Plane wave detonated explosive systems accelerate two large-area metal plates to high opposing velocities. An initial magnetic field is compressed and the flux transferred to an external load. The characteristics of the plate generator are described and compared with those of other types of generators. Methods of load matching are discussed. The results of several high-power experiments are also given. 5 Refs.
Primary Keywords: Flux Compression Generator; Plate Generator; Performance Comparison; Load Matching

716
(SWITCHES, CLOSING)
(Thyratrons)
HIGH VOLTAGE, LOW INDUCTANCE HYDROGEN THYRATRON STUDY PROGRAM
R.F. Ceristi and D.V. Turnquist
EG&G Inc, Salem, MA 01970
ERADCOM Report No. DELET-TR-2977-F (01/1981).
Availability: AD A095278
NTIS
The second phase of a multi-phase program of research and development to gain the information necessary to fabricate a high voltage, low inductance hydrogen thyratron switch has now been completed. The thyraton is to be capable of switching tens of kiloamperes within tens of nanoseconds at voltage levels as high as 250 kV. To achieve low inductance, the thyratron is operated within a close-fitting coaxial current return. Both the tube and the return are made physically short, and the tube is designed such that the discharge is constrained to flow principally at the outer reaches of the device. A technique has been developed for modelling various types of box grids and then using computer-generated field plots to aid in the specifics of grid design. This model has been used to generate a comprehensive set of theoretical relations that are useful to determine the anode dissipation to be expected. Experimental results are described and discussed. Included are the ceramic test results, hol doff vs. time on charge and gas pressure, stage voltage addition, operation at high pulse repetition rates, current rise time as a function of gas pressure, and the triggering characteristics of multi-stage, box-grid tubes. Finally, the design of an intermediate experimental tube is discussed at length. This tube is expected to have an inductance less than 50nH and to operate at 150kV. 5 Refs.
Primary Keywords: Thyratrtons; Switches; Pulse Generators; Blumleins; Pulse Modulators; Nanosecond Pulsers; High Voltage Components

725
(POWER CONDITIONING)
(Clippers)
SOLID STATE CLIPPER DIODES FOR HIGH POWER MODULATORS
S. Levy and J.E. Creedon
ECOM, Fort Monmouth, NJ 07703
1978 IEEE Thirteenth Modulator Symposium, pp 60-65 (06/1978).
End-of-line solid state clipper diodes are essential to high power pulse modulators. These diodes are chosen to reduce the potentially damaging inverse network and switch voltages which occur when the load is less than the network impedance; especially when non-constant loads are encountered. The choice of the clipper diode stacks for a megawatt (MW) average power pulser resulted from a study of commercially available units. Destructive tests of available units gave a figure of merit of 300:1 for the maximum single shot 10 microsecond current pulse to diode rated average current. A 150 ampere (A) average current diode was chosen for the 20,000 A worst case expected in the MW pulser giving a current safety factor of better than 2:1. For the 40 kilovolt (kV) pulser operation at a 1.5:1 voltage safety factor required 60 of the 1.0 kV diodes in series. A snubber capacitor and resistor across each diode provided equal voltage division and transient turn-on protection. Transient response of the snubber protected diode stacks was modeled at low powers and later confirmed in actual MW pulser operation. 10 Refs.
Primary Keywords: End Of Line Clipper; Low Impedance Load; Non-constant Load; Reflected Voltage; Diode Tests; Snubber

728
(INSULATION, MATERIAL)
(Liquid)
THE COOLING OF OIL-FILLED ELECTRICAL EQUIPMENT, WITH SPECIAL REFERENCE TO HIGH POWER LINE-TYPE PULSE GENERATORS

G. Scoles
English Electric Valve Co Ltd, Chelmsford, Essex, UK
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-4 (11/1976).
Various methods are described for cooling the oil used to insulate the component parts of high voltage, high power line-type pulse generators and their power supplies. Efficiencies of mains transformers, charging inductors, pulse-forming networks, pulse transformers, etc., as well as the actual switching device are such that as much as 15 to 20% of the power consumed is likely to be dissipated as heat. A number of cooling systems are described, ranging from simple air convection to those using chimneys or fan-forced air. Water cooled heat exchanges also include those using convection in the oil as well as systems using pumps or propellers to cause the oil to flow rapidly past the cooled surfaces. The rate of heat extraction with these various systems can vary over a ratio of 1:100, in terms of watts per square foot of cooling surface per degree centigrade above ambient. Empirical results and formulae are given which enable the user to calculate heat extraction to a few percent in the majority of cases. 2 Refs.
Primary Keywords: Oil Filled Equipment; Cooling; Efficiency; Convection; Forced Circulation; Water Cooling
Secondary Keywords: Line Type Pulse Generators

733
(PULSE GENERATORS)
(Flux Compression)
EXPLOSIVE ELECTRICAL GENERATOR

E.I. Azarkevich, A.E. Voitenko, V.P Isakov and Yu.A. Kotov
S. M. Kirov Tomsk Polytechnical Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 21, No. 9, pp 1141-1144 (09/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 46, Pp 1957-1962
An experimental prototype of an explosive electrical generator is described. This device uses the energy of an explosion to produce electrical pulses in a resistive load. It consists of an explosive magnetic-field source, a fast-acting breaker, an explosion chamber, and other elements. A current of 140 ka is produced in a resistive load at a voltage of 120 kV with a pulse length 2.5 usec. 21 Refs.
Primary Keywords: Explosive Generator; Resistive Load; 140 KA Current Pulse

737
(PARTICLE BEAMS, ELECTRON; SWITCHES, OPENING)
(Generation; Explosive Fuses)
HIGH-CURRENT NANOSECOND-PULSE ELECTRON ACCELERATOR WITH INDUCTIVE SHAPING ELEMENT

Yu.A. Kotov, B.M. Koval'chuk, N.G. Kolganov, G.A. Mesyats, V.S. Sedoi and A.L. Ipatov
Soviet Physics-Technical Physics Letters, Vol. 3, No. 9, pp 359-360 (09/1977).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 3, 883-886 (September 1977)
The traditional high-current nanosecond accelerator contains a 'slow' energy storage bank, usually a pulse voltage generator, a 'fast' bank, which is a shaping line with a switching system, and a vacuum diode. Accelerators of this type are reviewed elsewhere. For electron energies above 1E6 V, for currents >50 kA, and for pulse lengths of 50 nsec or more, these accelerators become large, complicated, and expensive. Furthermore, the pulse length in these accelerators is essentially fixed since it is governed by the length of the shaping line. Low-energy pulsed accelerators in which the role of the 'fast' storage bank is played by the inductance of an LC circuit with an exploding-wire current breaker are discussed elsewhere. In the present letter we describe an accelerator which uses the same principle, but a pulse energy of the order of 1E4 J. This accelerator is designed for operation with short pulses (accelerator voltage U up to 2 MV, current I up to 50 kA, and pulse length t up to 100 nsec) and long pulses (U up to 500 kV, I up to 25 kA, and t up to 2.5 microsecond). 4 Refs
Primary Keywords: Stacked Line; Exploding Wire; Inductive Energy Storage; Pulse Transformer; Field-emission Diodes

739
(BREAKDOWN STUDIES)
(Gas, Electrical)
CHARACTERISTICS OF IMPULSE BREAKDOWN OF STANDARD ROD GAPS UNDER CONTROLLED-ATMOSPHERE CONDITIONS

J.E. Matthews and R. Saint-Arnaud
University of Strathclyde, Glasgow, Scotland
Proceedings Of The IEE, Vol. 118, No. 10, pp 1524-1527 (10/1971).
The effect of humidity on the impulse breakdown of rod-rod gaps is considered in this paper, along with the influence of gamma irradiation and polarity effects. It was found that the breakdown voltage increased in all cases except one, where the corona was believed to play a dominating role. A polarity effect was observed in nonirradiated gaps but is probably due to stray capacitance with the grounded vessel. Gamma irradiation of the gap produced strong polarity effects and breakdown voltage was reduced. 20 Refs.
Primary Keywords: Impulse Breakdown; Humidity Effect; Radiation Effect; Gamma Radiation; Polarity Effect; Breakdown Voltage vs Humidity

743
(DIAGNOSTICS AND INSTRUMENTATION)
(Reviews)
NANOSECOND PULSE MEASUREMENTS

C.N. Winningstad
Tektronix Inc., Beaverton, OR
IRE Western Electronic Show And Convention (WESCON) Paper 23/1 (01/1961).
Nanosecond pulse propagation is analyzed utilizing transmission line theory techniques in this paper. TEM transmission lines (coaxial cable, strip lines, etc.) are shown to play a significant role in nanosecond pulse propagation for most applications. These analysis techniques are used to determine pulse delay characteristics, stray capacitance, inductance of signal injection and removal points. Design criteria are presented for voltage and current probes and sources, switches, and trigger circuits. 18 Refs
Primary Keywords: Transmission Line Theory; Current Probe; Voltage Probe; Skin Effect; Signal Source

745
(ENERGY STORAGE, INDUCTIVE)
(Systems)
A PROPOSAL FOR THE CONSTRUCTION AND OPERATION OF AN INDUCTIVE STORE FOR 20 MJ

E.K. Inall
Australian National University, Canberra, Australia
Journal Of Physics E: Scientific Instruments, Vol. 5, pp 679-685 (07/1972).
A proposal for coupling 15 MJ of energy initially stored in the Canberra homopolar generator, to a load in about 1.0 ms is described. 22 MJ is first transferred to a coaxial inductor at a peak current and voltage of 1.5 MA and 190 V respectively. Fast mechanical switches which are being developed would open to produce a potential of 1000 V and a peak power of 15 GW into the load. Information is given on the operation of a small version of the system being used to supply 100000 J to a high power laser amplifier. 6 Refs.
Primary Keywords: Coaxial Inductor; Homopolar Generator; Mechanical Opening Switch; 1 ms Transfer Time; 1000 V Output Voltage

746
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
LASER TRIGGERING THROUGH FIBER OPTICS OF A LOW JITTER SPARK GAP

H.C. Harjes, K.H. Schonbeck, M. Kristiansen, A.H. Guenther and L.L. Hatfield
Texas Tech University, Lubbock, TX 79409
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 170-176 (09/1980).
An optical filter is employed to transport a 15-ns light pulse from a high power ruby laser for precise triggering of a gas filled high voltage spark gap. The maximum power density that can be transmitted by the fiber is limited to 6E12 W/sq.m. above which laser induced damage occurs on the fiber entrance face. The overall throughput efficiency of the optical system was measured as 62 percent. Results are presented for the switching delay time and associated jitter for various mixtures of A and N/sub 2/ gas, and as a function of the voltage across a pulse-charged Blumlein generator gap. Pulse charging of the Blumlein generator was accomplished by a three-stage Marx generator, resulting in output voltages up to 250 kV. It was conclusively demonstrated that an optical fiber will transport a sufficiently intense laser pulse to evince subnanosecond jitter in the triggering of a pressurized gas switch under the conditions studied. 5 Refs.
Primary Keywords: Laser Triggered Spark Gap; Fiber Optic; Ruby Laser; Power Density Limitation; Subnanosecond Jitter

747
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
LONG-LIFE HIGH-REPETITION-RATE TRIGGERED SPARK GAP

M. Watson
AiResearch Co., Torrance, CA 90509
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 154-159 (06/1979).
A forced-air-blown triggered spark gap (TSG) switch system capable of high repetition rates on a continuous basis as well as a TSG comparative study is described. The system consists of two TSG's, each discharging its own 30-ohm pulse cable into a common load. The system was operated at 30 kv, 1 kHz, for 39E6 shots with erosion rates of approximately 60 mg/amp-hour. Each TSG discharged 0.423 joules in 60 nsec (FWHM) per pulse. The switching losses were about 28 percent of the stored cable energy. Calculations indicate this can reduce to 14 percent by optimizing the TSG design and surrounding air channel insulation for a more uniform E-field. Test results indicate a miltielement assembly capable of switching 50 kA or more 40- to 100-nsec pulses at 1 kHz from 50 kV for 500E6 shots without gap adjustment is feasible with this concept. The work was partially supported by the U.S. Energy Research and Development Administration under Contract No. EN-77-C-04-6048. 4 Refs.
Primary Keywords: Re-rated; Life Test; Electrode Erosion; Efficiency; Field Uniformity

749
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Self; Gas Gaps, Recovery)
TESTING OF A 100-KV 100-HZ REP-RATE GAS SWITCH

A. Ramrus and J. Shannon
Maxwell Labs Inc, San Diego, CA 92123
IEEE Transactions On Plasma Science, Vol PS-8, No. 3, pp 160-162 (09/1980).
A two-electrode gas switch with a self-breakdown voltage of 100 kV was operated at a pulse-repetition rate (PRR) of 100 Hz with bursts up to 10 s in duration. The output of a pulse transformer provided the (1-cos omega t) waveform which charged the switch in about one-half ms. The switch discharged with a peak current of about 10 kA and a total charge transfer of about 10 mC into a damped LC circuit. A continuous purge of air through the interelectrode spacing enabled the switch to recover its breakdown voltage between discharges. Flow rates up to 35 standard cubic feet per minute (scfm) were employed. This paper discusses the dependence of switch jitter and waveform reproducibility or airflow rate. 3 Refs.
Primary Keywords: Two Electrode Gas Gap; Air Gap; High Flow Rate; Re-rated; Performance Test

753
(PARTICLE BEAMS, ELECTRON)
(Generation)
ANODE BEHAVIOR IN HIGH INTENSITY FIELD EMISSION DIODES

E. D'Anna, G. Leggieri, A. Luches, V. Nassisi, A. Perrone and M.R. Perrone
Universita di Lecce, Lecce, Italy
Journal Of Vacuum Science And Technology, Vol. 17, No. 4, pp 838-841 (08/1980).
The effects of energy loss in the anode foil of a field emission vacuum diode are considered experimentally and theoretically. The authors calculate the temperature rise in stainless steel foil for several beam energies and currents and 15 ns duration. The temperature rises calculated were not found to be sufficient to induce foil breakdown though experimental observation confirmed that this was, indeed, the case. A theory is presented to explain this discrepancy. 14 Refs.
Primary Keywords: Field Emission Diode; Anode Foil; Beam Energy Deposition; Foil Heating

763
(SWITCHES, CLOSING)
(Gas Gaps, Materials)
EROSION OF SPARK GAP ELECTRODES
R.A. Petr and T.R. Burkes
Texas Tech University, Lubbock, TX 79409
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 149-153 (09/1980).
The erosion characteristics of spark gap electrodes operating with 10- and 20-microsecond square current pulses for various materials is presented. Cathode spot size and criteria for anode spot formation are estimated. Also, the effect of the acoustic properties on electrode erosion is described. 18 Refs.
Primary Keywords: Electrode Erosion; Square Current Pulse; 10-20 Microsecond Current Pulse; Several Electrode Materials; Cathode Spot; Anode Spot
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770
(PARTICLE BEAMS, NEUTRAL)
(Generation)
LARGE AREA NEGATIVE ION SOURCE FOR HIGH VOLTAGE NEUTRAL BEAMS
P. Poulsen and E.B.J. Hooper
Lawrence Berkeley Lab, Berkeley CA
No. CONF-791102-89, 7p (11/1979).
Availability: LBL-10081
NTIS
A source of negative deuterium ions in the multi-ampere range is described that is readily extrapolated to reactor size. 10 amp or more of neutral beam, that is of interest in future experiments and reactors. The negative ion source is based upon the double charge exchange process. A beam of positive ions is created and accelerated to an energy at which the attachment process D + M implies D exp - + M exp + proceeds efficiently. The positive ions are atomically neutralized either in D sub 2 or in the charge exchange medium M. Atomic species make a second charge exchange collision in the charge target to form D exp - . For a sufficiently thick target, the beam reaches an equilibrium fraction of negative ions. For reasons of efficiency, the target is typically alkali metal vapor; this experiment uses sodium. The beam of negative ions can be accelerated to high (>200 keV) energy, the electrons stripped from the ions, and a high energy neutral beam formed. (ERA citation 05:014561)
Primary Keywords: Ion Sources; Neutral Beam Sources; Beam Neutralization; Cations; Charge Exchange; Design; Deuterium Ions; Kev Range 100-1000; Size
Secondary Keywords: ERDA/700205, NTISDE

776
(BREAKDOWN STUDIES)
(Gas, Electrical)
PLASMA CONTRACTION CAUSED BY THE MAGNETIC FIELD OF THE CURRENT IN AN ELECTRON-BEAM-SUSTAINED DISCHARGE
V.V. Vladimirov, V.N. Gorshkov, V.F. Shandkii and A.I. Shchedrin
Academy of Sciences of the Ukrainian SSR, Kiev
Soviet Physics-Technical Physics, Vol. 49, No. 11, pp 1393-1394 (11/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2473-2474 (November 1979)
The externally sustained discharge has found wide-spread use in high-power gas lasers. Theory on the electron-beam-sustained discharge predicts a marked change in the spatial distribution of the beam electron energy loss as a result of the magnetic field produced by the discharge current. In turn, this nonuniform spatial distribution of the energy loss leads to nonuniform pumping of energy into the active medium, so that the optical emission suffers in quality. As we will show in the present paper, for discharge parameters in the 200-400 keV, 2 A/sq.cm. ranges magnetic mirrors can arise which prevent beam electrons from penetrating into the discharge gap, with the consequence that the useful volume of the working chamber is reduced. 4 Refs.
Primary Keywords: E-beam-controlled Discharge; Spatial Discharge Distribution; Discharge Current; Discharge Field; Magnetic Mirror
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778
(BREAKDOWN STUDIES)
(Gas, Electrical)
PULSED BREAKDOWN OF GASEOUS HELIUM AT LOW TEMPERATURES
V.A. Avgustinovich (1) and Yu.G. Yushkov (2)
(1) Scientific-Research Institute Of Nuclear Physics
(2) Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 49, No. 11, pp 1415-1416 (11/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2502-2503 (November 1979)
An effort is currently being made to develop high-voltage devices which operate at low temperatures. In certain situations, in order to transfer the energy stored in a superconducting solenoid or high-Q microwave resonators, switches which are capable of operating in an atmosphere of gaseous helium at low temperatures are required. 7 Refs.
Primary Keywords: Helium; Impulse Breakdown, Point-plane Gap; Low Pressure; 4.2 Deg.K ; 293 Deg.K.; Variable Voltage Rise Time
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780
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas Gaps, E-beam; Gas Gaps, E-beam)
REPETITIVE ELECTRON-BEAM CONTROLLED SWITCHING
R.F. Fernsler (1), D. Conte (2) and I.M. Vitkovitsky (3)
(1) JAYCOR Inc, Alexandria, VA 22304
(2) Research and Development Associates, Arlington, VA 22209
(3) Naval Research Lab, Washington, DC 20375
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 176-180 (09/1980).
Previous investigators have demonstrated the feasibility of using an ionizing electron beam to control the conductivity of a gaseous volume-discharge switch. We consider the possibility of using such switches repetitively at high-power levels (up to 1E10 W), with switch opening and closing times as short as several nanoseconds. An analysis of the relevant gas chemistry indicates that these requirements can best be met by using a nonelectronegative base gas with a high electron mobility, diluted with a small percentage of an electronegative gas. N/sub 2/ and the electronegative gas O/sub 2/, are presented to support the analysis. 10 Refs.
Primary Keywords: Nanosecond Closing Time; Nanosecond Opening Time; Chemistry Simulation; Nitrogen Gaps; Oxygen Gaps; Mixture; Rep-rated; Theory
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782
(PULSE GENERATORS)
(Trigger)
SIMPLE PULSE GENERATOR FOR A POWERFUL MODULATOR
B. Spagnolo
Universita di Palermo, Viale delle Scienze, Italy
The Review Of Scientific Instruments, Vol. 51, No. 8, pp 1134-1136 (08/1980).
A pulse generator circuit with pulse length 2.5 microns, peak voltage 1 kV, pulse repetition frequency 25-300 Hz, is described. This pulser may be used as a trigger for the thyratron of a 'line-type modulator'. 3 Refs.
Primary Keywords: 1 kV Output; Thyristor Pulser; 200 ns Rise Time; Low Impedance; Rep-rated
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798
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
MAGNETIC FIELD SENSITIVITY OF AN OPTICAL FIBER WITH MAGNETOSTRICTIVE JACKET
J. Jarzynski (1), J.H. Cole (1), J.A. Bucaro (1) and C.M. Davis (2)
(1) Naval Research Lab, Washington, DC 20375
(2) Dynamic Systems, Inc., McLean, VA 22102
Applied Optics, Vol. 19, No. 22 pp. 3746-3748 (11/1980).
The authors derive expressions for the magnetically induced strain in an optical fiber with a finite magnetostrictive jacket. The effect of jacket thickness on the magnetic field sensitivity and pressure sensitivity of an optical fiber is calculated. 8 Refs.
Primary Keywords: Magnet Field Measurement, Optical Fiber; Magnetorestrictive Jacket; Phase Shift
Secondary Keywords: Strain Calculation
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801
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A NANOSECOND RISE TIME DIFFERENTIAL PULSE TRANSFORMER
G.E. Alberga
Eindhoven University of Technology, Eindhoven, Netherlands
Journal Of Physics E: Scientific Instruments, Vol. 13, pp 1009-1010 (01/1927).
A differential pulse transformer with a rise time of less than 2 ns and a droop of less than 1% for pulse widths up to 200 ns, is described. The device was primarily designed for the determination of small voltage differences in pulsed experiments on hot electrons in semiconductors. Special attention is paid to the systematic and random errors which may arise at the determination of differences. 4 Refs.
Primary Keywords: Instrumentation Transformer; Transmission Line Transformer
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828
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
A MODEL AIR-SUPPORTED DRUM-TYPE HOMOPOLAR GENERATOR
R.L. Kustom, R.E. Fuja, R.B. Wehrle, R.P. Smith and T.J. Kovarik
Argonne National Lab, Argonne, IL
Argonne Report No. CONF-771132-6 (11/1977).
Availability: CONF-771132-6
NTIS
A single cylinder, drum-type homopolar generator has been designed and built for the purpose of developing a simple air support system for thin cylinder rotors operated at high surface velocities and significant radial drum growth. The model has an aluminum cylinder which is 0.32 cm thick, 25 cm in diameter, and 12.7 cm long. It is designed to operate at a peak current of 2500 A and to store a total of 40 kJ with a surface velocity of 305 m/sec. The drum is mounted over a fiberglass cylinder with its axis vertical. The space between the drum and the fiberglass cylinder form a pressurized air cavity. The drum is bounded between flat surfaces. Air escapes from the cavity between the edges of the cylinder and the flat surfaces. This provides the air lift to support the cylinder. Brushes are located at the edges of the cylinder in four clusters of eight brushes. The brush diameter is 0.36 cm. The peak current density is 781 A/sq.cm.. The brush material is Morganite CMIS. A radial magnetic field is provided by an iron core system using two copper coils. The field strength is 1.05 T. The model is in the initial stages of operation. It has been operated at 3500 rpm with a DC current of 100 A to test the air support system. It has been pulsed with 500 A peak current. Some problems have been encountered in the brush holder system which have required modifications. These modifications are in progress. 4 Refs.
Primary Keywords: Air Bearing; High Surface Velocity; Large Radial Drum Growth; Vertical Axis

831
(SWITCHES, CLOSING; SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Gas Gaps, Materials; Vacuum Gaps, Materials; Electrodes)
ELECTRODES FOR HIGH-CURRENT COMMUTATORS
Yu.S. Pavlov and S.A. Smirnov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instruments And Experimental Techniques, Vol. 14, No. 1, pp 132-134 (02/1971).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 118-120 (January-February 1971)
This article describes two constructions of electrodes which provide for the directional movement of the discharge and its confinement within a specified region. The tests were carried out with current pulses of up to 100 kA in the range of pulse lengths up to 3 msec at atmospheric pressure and in a vacuum. It was established that the electrodes have a comparatively small erosion, while the ignitron devices mounted on them are not covered with molten metal. As a result, the operating resource of arc gaps having such electrodes is increased considerably. 4 Refs.
Primary Keywords: Electrode; Gas Gap; Vacuum Gap; Expanding Arc; Rotating Arc; Erosion Measurement; 100 kA Current
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832
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes, Liquid Gaps, Materials)
DEPENDENCE OF ELECTRODE EROSION UPON FORM OF CURRENT PULSE
A.I. Kruglov and V.N. Fukin
FTD Report No. FTD-TT-64-857/1+2 (01/1965).
Trans. From: Elektroiskrovaya Obrabotka Metallov Izdatel'stvo Akademii Nauk SSSR, 29-37 (1963)
Availability: AD 611075
NTIS
The authors show that the erosion of a copper or brass electrode immersed in kerosene is dependent not only on total charge passed by the electrode, but also on the shape of the current. Two pulse forming lines with pulse widths 1.5-and 20-microseconds, were utilized together to produce a pulse with variable shape. Peak currents were 60 A for the long pulse and 400 A for the short pulse. Evidence is presented that electrode erosion is significantly dependent on pulse shape parameters in a manner not predicted by previous theories. 7 Refs.
Primary Keywords: Electrode Erosion; Pulse Shape; Low Current; Long Pulse; Rectangular Pulse; Significant Dependance

843
(PARTICLE BEAMS, ELECTRON)
(Generation)
DEVELOPMENT AND INVESTIGATION OF RELATIVISTIC ELECTRON BEAMS WITH FINITE ENERGY SPREAD AND IMPROVED EMITTANCE
J. Fink, H.J. Schilling and U. Schumacher
Max-Planck-Institut Fur Plasmaphysik, Garching,FRG
Journal Of Applied Physics, Vol. 51, No. 6, pp 2995-3000 (06/1980).
This paper presents experimental results in the development of low-emittance relativistic electron beams with finite energy spread, which - among other applications - is suitable for suppressing collective instabilities in an electron-ring accelerator. The measurements were performed with a divided cathode in an electron-beam gun one half of which is connected via a resistor with the high voltage terminal. The energy difference can be varied up to 100 keV in proportion to the resistance, with equal subcurrents. The beam parts are well separated, and their radial distance is about equal to the radial difference of the corresponding electron closed orbits, such that electron-ring formation with minimum radial betatron oscillatins should be possible. The beam emittance is as small as about 100 mrad cm and the current is 800 A. 17 Refs.
Primary Keywords: Electron Ring Accelerator; 100 Mrad Cm Emittance; 800 A Current

864
(SWITCHES, CLOSING)
(Gas Gaps, E-beam)
AN ELECTRON-BEAM-TRIGGERED SPARK GAP
K. McDonald (1), M. Newton (1), E.E. Kunhardt (1), M. Kristiansen (1) and A.H. Guenther (2)
(1) Texas Tech University, Lubbock, TX 79409
(2) AFWL, Kirtland AFB, NM 87117
2nd IEEE International Pulsed Power Conference Proceedings, pp 437-441 (06/1979).
Studies on the triggering of a high-voltage, gas-insulated spark gap by an electron beam have been conducted. Rise times of approximately 2.5 ns and subnanosecond jitter have been obtained for 3 cm gaps with gap voltages as low as 50% of the self-breakdown voltage (variable to 1 MV). The switch delay (including the diode) was 50 ns. The working media were N/sub 2/, and mixtures of N/sub 2/ and Ar, and of N/sub 2/ and SF/sub 6/ at pressures of 1-3 atm. Open shutter photographs show that the discharge is broad in cross-section. Voltage, current, and jitter measurements have been made for a wide range of gap conditions and electron-beam parameters. Variations in the character of the discharge have been inferred using streak and open shutter photography. Correlation between electron beam width, beam energy, discharge channel width, current rise time, delay, and jitter are discussed. 7 Refs.
Primary Keywords: E-beam Triggering; High Voltage; Fast Rise; Low Jitter; Wide Trigger Range

869
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
A 3-MV LOW-JITTER TRIGGERED GAS SWITCH
D.B. Cummings and H.G. Hamnon III
Physic International Co. San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 446-449 (06/1979)
Physics International Company has designed, built, and tested a 3 MV, low jitter, triggered gas switch. The switch operates in a 16.5 ohm coaxial pulse line. The system design requires that the pulse line switches perform the difficult task of first holding off a reverse pulse charge, then of holding off the forward pulse charge, then, finally, of triggering on command. The trigger for the switch is generated by a trigger Marx placed within the output pulse line. The remainder of the triggering circuit includes a trigger isolation gap, A Y/N-type trigger electrode is situated within the main gap. To date, the switch has been shown to hold voltage and trigger reliably for pulse charges from 0.9 MV to 2.5 MV. The rms jitter of the switch firing time is less than 6 ns. At an operating voltage of 2.5 MV, the switch transfers a charge of up to 0.1 coulomb per shot, with a peak current of 20 kA. 2 Refs.
Primary Keywords: Electrically Triggering; Very High Voltage; Reverse Voltage Holdoff; Low Jitter

871
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, MECHANICAL)
(Inductors; Rotating Machines)
COMPUTER BASED ELECTRICAL ANALYSIS OF HOMOPOLAR GENERATOR DRIVEN, BITTER PLATE STORAGE INDUCTORS WITH RADIAL CURRENT DIFFUSION
D.J.T. Mayhall, H.G. Rylander, W.F. Weldon and H.H. Woodson
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 330-332 (06/1979).
Maxwell's equations are solved for the operational admittance in the magnetic quasi-static approximation for nonmagnetic cylindrical coils with eximuthal currents and axial magnetic fields. An infinite series, Bessel function solution is obtained and solved for copper coils with given radial dimensions. Coil turns numbers and lengths are design parameters. A multiple branch, shunt network coil model with series resistances and inductances is derived. The UT CEM 5 MJ homopolar generator is modeled with a torque-speed equation including brush and seal drag torques. The brush contact voltage drop is modeled versus surface speed and brush current. Transmission system resistances and inductances are included. Effective depths of current penetration, effective coil resistances and inductances, and peak temperatures are calculated versus time. Coil currents and voltages are obtained, as are system energy storages and dissipations. Peak current times and system discharge times are determined. Slightly underdamped configurations are found. 1 Refs.
Primary Keywords: Homopolar Generator; Analysis; Modelling; Design Parameters

873
(DIAGNOSTICS AND INSTRUMENTATION)
(E-field)
ELECTRIC POTENTIAL MEASUREMENTS IN GASEOUS INSULATING MATERIALS BY CORONA PROBE IN A CONTROLLED ENVIRONMENT
S. Bertini, A. Operto and G. Sciutto
University of Genoa, Genoa, Italy
IEEE Transactions On Instrumentation And Measurement, Vol. IM-29, No. 2, pp 125-130 (06/1980).
The experimental determination of electric potential in gaseous insulating materials is performed using a corona probe. This method can be used to measure point values of electric potential from dc to ac at industrial frequency values. The proposed method, after an initial calibration of the probe, allows the determination of the amplitude of the electric potential at the point in space where the tip of the probe is located. The measurement is performed by adjusting the feeding potential of the probe until a complete corona suppression is obtained. To discriminate the corona effect of the probe from other possible corona sources, a device for probe current detection is proposed. The corona prote method has been verified by measuring electric potential, under both dc and 50-Hz ac conditions, in known field configurations and in natural and controlled environments. Finally, the proposed method has been applied to determine the space distribution of the electric potential around high-voltage insulating structures under dc and 50-Hz voltages in a natural environment. 12 Refs.
Primary Keywords: Dc And 50-Hz, Spatial Distribution; Negative Potentials, Corona Current Measurement

875
(SWITCHES, OPENING)
(Vacuum Gaps, Electical)
EXPERIMENTS ON VACUUM INTERRUPTERS IN HIGH VOLTAGE 72 KV CIRCUITS
R.E. Vorshall, C.W. Kimblin, P.G. Slade and J.G. Gorman
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-99, No. 2, pp 658-666 (03/1980)
Three experimental 23 cm diameter vacuum interrupters have been built and their performance has been evaluated in single-phase high-voltage, high-current circuits. The first of these experimental designs contained 11.7 cm diameter, spiral electrodes and one floating arc shield. It interrupted bus circuits up to 42kV (72kV x 0.58)/15kA. The second and third prototype designs contained three floating arc shields. Prototype number 2, equipped with 14 cm diameter, spiral electrodes, passed single phase bus fault tests at 42 kV/40 kA and 63 kV(72kV x 0.87)/30kA. The third prototype, designed to ensure that a diffuse vacuum arc could be maintained at very high currents, interrupted bus fault currents in the range of 40kA to 60kA in a 63kV circuit. This design also showed potential for series operation at 145kV/55kA for both bus and short line fault situations. Test data are presented in this paper and are discussed with respect to electrode diameter, the contact gap at current zero and the need for maintaining a diffuse vacuum arc. 1 Refs.
Primary Keywords: Vacuum Interrupters; Magnetic Field Interruption Mechanism, Electrode Vapor; Interruption of Over 40kA (rms)

882
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Liquid Gaps, Self; Liquid, Electrical)
INDUCTANCE AND RESISTANCE CHARACTERISTICS OF SINGLE-SITE UNTRIGGERED WATER SWITCHES IN WATER TRANSFER CAPACITOR CIRCUITS
P.W. Spence, Y.G. Chen, G. Frazier and H. Calvin
Physic International Co. San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 359-362 (06/1979)
Inductance and resistance characteristics of single-site untriggered water switch arc-channels have been investigated by measurement of their effects on frequency and voltage gain in a water capacitor transfer circuit. Data are presented for two distinct switch configurations covering a voltage range from 3 to 6 MV, gaps from 7 to 35 cm, and mean switching fields from 150 to 350 kV/cm. A simple lumped circuit model is postulated with switch L and R varying linearly with gap spacing under low voltage conditions. Extrapolation of this zero-order model to higher voltage conditions compares favorably with measured circuit characteristics. Energy loss in the water switch is observed to be approximately a factor of two in excess of maximum losses predicted from previous estimates. 3 Refs.
Primary Keywords: Resistance; Inductance; Variation With Gap Spacing; High Voltage; Efficiency; Rise Time Mensurement

885
(SWITCHES, CLOSING)
(Thyristors)
INSULATED-GATE PLANAR THYRISTORS. I. STRUCTURE AND BASIC OPERATION
J.D. Plummer and B.W. Scharf
Stanford University, Stanford, CA 94305
IEEE Transactions On Electron Devices, Vol. ED-27, No. 2, pp 380-387 (02/1980).
A high-voltage planar triac which is controlled by an insulated-gate terminal is described. Its structure is related to the DMOS transistor on which it is based and its multiple operating modes are discussed in terms of an equivalent circuit composed of MOS and bipolar transistors and resistors. A typical junction isolated device has a 150-V breakdown and a on-resistance less than 10 Ohms for a 400-um wide channel. The on-resistance can easily be scaled to very low values simply by increasing the device width. Extension of the MOS thyristor concept to other devices and higher voltages is described. Quantitative analysis and modeling of these new devices are described in a companion paper. 23 Refs.
Primary Keywords: High Voltage Planer Thyristor; DMOS Transistor; Insulated Gate Control; Metal Gate Technology; Modeling

888
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
LOW JITTER LASER TRIGGERED SPARK GAP USING FIBER OPTIC
L.L. Hatfield, H.C. Harjes, M. Kristiansen, A.H. Guenther and K.H. Schonbach
Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 442-445 (06/1979).
Laser triggering of a pulse charged gas switch is described. The laser triggering results in low jitter switching relative to the timing of the laser pulse. A novel feature is the use of a single element, 1 mm, quartz, optical fiber to transmit the laser beam. The sw tch parameters, such as gas pressure, gas composition, and laser beam focal point location have been optimized to produce nanosecond delay and jitter with as little laser power as possible. The laser optical system has been optimized for best overall efficiency in a configurat on suitable for illumination of many fibers by a single laser. Typical operating parameters for the switch are: 2 cm gap, 2500 Torr pressure, 50% Ar - 50% N/sub 2/ gas mixture, and a charging voltage of 200 kV. Laser power in the gas is typically a few megawatts with an overall efficiency greater than 50% for the optical system. 1 Refs.
Primary Keywords: Laser Triggering; Fiber Optic; Low Laser Power; Low Jitter; Multiple Gaps

889
(SWITCHES, CLOSING)
(Miscellaneous Solid State)
NEW TECHNOLOGIES ADVANCE POWER SEMICONDUCTOR STATE-OF-THE-ART
R. Denning and J. White
RCA Advanced Power Labs, Somerville, NJ
Solid State Technology, (March 1980), pp 98-105 (03/1980).
Improved manufacturability, performance, reliability and adaptability are features of a new series of discrete high voltage power devices. 16 Refs.
Primary Keywords: 1.5 KV Breakdown; 10A Current; Neutron Doping; Ion Implementation; Diffusion Process; Surface Electric Field Control; Sipos/Glass Pasivation System; Metal System; Device Packaging; High Voltage Transistors; High Current Transistors

895
(BREAKDOWN STUDIES)
(Capacitors)
POLARITY EFFECT MEASUREMENTS USING THE KERR ELECTRO-OPTIC EFFECT WITH COAXIAL CYLINDRICAL ELECTRODES
M. Zahn and T.J. McGuire
University of Florida, Gainesville, FL
IEEE Transactions On Electrical Insulation, Vol. EI-15, No. 3, pp 287-293 (06/1980).
Steady state solutions of the electric field and space charge density distributions using a drift dominated unipolar conduction model between coaxial cylindrical electrodes are reviewed and compared to experimental results obtained using the Kerr electro-optic effect. With coaxial cylindrical electrodes, Kerr measurements generally showed weak positive charge injection at the inner cilndrical electrode was so strong that the space charge shielding caused the electric field at the inner cylinder to be minimum, with the field increasing to the outer cylindrical electrode in complete contrast to the usual space chrge free 1/r field dependence. This polarity effect is observed also for a sinusoidal ac high voltage with an essentially space charge free field when the inner cylindrical electrode was instantaneously negative, and a space charge distorted uniform field when the inner cylinder was instantaneously positive. 5 Refs.
Primary Keywords: Space Charge; Charge Injection; Kerr Electro-optic Measurements; Coaxial Electrode Models; Breakdown In Dielectrics

897
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas Gaps, E-beam; Gas Gaps, E-beam)
REPETITIVE ELECTRON BEAM CONTROLLED SWITCHING
R.F. Fernsler, D. Conte and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
2nd IEEE International Pulsed Power Conference Proceedings, pp 368-371 (06/1979).
Previous investigators have demonstrated the feasibility of using an ionizing electron beam to control the conductivity of a gaseous, volume-discharge switch. We have considered the possibility of using such switches repetitively at high power levels (up to 1E10 W), with switch opening and closing times as short as several nanoseconds. An analysis of the relevent gas chemistry has indicated that these requirements can best be met by using a non-electronegative base gas diluted with a small percentage of an electronegative gas. Detailed chemistry simulations, using the non-electronegative gas O/sub 2/, have been performed and will be presented to support this analysis. Also discussed will be the limitations imposed by switch heating and gas breakdown. 6 Refs.
Primary Keywords: Volume Discharge; Electronegative Seed Gas; Numerical Calculation; Chemistry Considerations

906
(PULSE GENERATORS; ENERGY STORAGE, INDUCTIVE)
(Systems, Systems)
TRIDENT-A MEGAVOLT PULSE GENERATOR USING INDUCTIVE ENERGY STORAGE
D. Conte, R.D. Ford, W.H. Lupton and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
2nd IEEE International Pulsed Power Conference Proceedings, pp 276-283 (06/1979).
A megavolt level pulse generator, TRIDENT, has been constructed utilizing an inductive store as the primary pulse forming device. The 2.5 microH coaxial storage inductor can be energized with up to 500 kA obtained from a 500 kJ, 60 kV capacitor bank. Current interruption is accomplished using a three stage opening switch comprised of an explosively actuated switch in parallel with foil and wire fuses. The generator has been operated at the 410 kA charge level (70% energy) to produce 700 kV pulses with rise times of 150 nsec. Energy has been deposited into a 7.5 ohm resistive load at a rate of 5E10 W. Operation with optimized fuse dimensions and at full charge is anticipated to approach megavolt outputs at powers of 1E11 W. Future experiments include utilizing a homopolar generator as the current source. 7 Refs.
Primary Keywords: TRIDENT; Explosive Fuse; Exploding Wire; Design Considerations

907
USA-USSR INVESTIGATION OF 1200 KV TOWER INSULATION
(03/1980).

912
(PULSE GENERATORS)
(Trigger)
A 130 KV LOW IMPEDANCE MULTIPLE OUTPUT TRIGGER GENERATOR
A.H. Bushnell, C.B. Dobbie and A.P. Krickhuhn
Maxwell Labs Inc, San Diego, CA 92123
2nd IEEE International Pulsed Power Conference Proceedings, pp 161-164 (06/1979).
A unique low impedance trigger generator has been developed which can generate 130 kV pulses having 22 ns rise time in four 50 ohm output cables. This generator uses a multichannel rail-gap switch to discharge a group of low inductance capacitors which are charged to 150 kV into the cutput cables. The performance of the circuit was analyzed using a computer and successfully predicted the behavior of the circuit. Time jitter between input triggor and output pulse is less than 2 ns (one standard deviation). The unit is immersed in oil in its own metal housing. 0 Refs.
Primary Keywords: Low Impedance; Four-output; High Voltage; Low Jitter

914
(POWER CONDITIONING)
(Pulse Transformers)
DESIGN OF PULSE TRANSFORMERS FOR PFL CHARGING
C.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 87-90 (06/1979).
Air core pulse transformers powered by low voltage capacitor banks can be simple efficient systems for charging high-voltage (0.5 to 3 MV) pulse forming transmission lines (PFL) such as those used in electron and ion beam accelerators. In these applications pulse transformers must have the combined capability of high voltage endurance and high energy transfer efficiency, particularly in repetitive pulse systems where these features are of primary importance. The design of shielded, high-voltage, spiral, strip transformers which fulfill these requirements is described in this paper. Transformers of this type have been tested in three systems which operate with greater than 90 percent transfer efficiency and have not failed in over 1E7 shots. 6 Refs.
Primary Keywords: Air Core Pulse Transformer; Pulse Forming Line; Charging; Strip Transformer; High Efficiency

916
(SWITCHES, OPENING; SWITCHES, OPENING)
(Mechanical; Gas Gaps, Magnetic Field)
DEVELOPMENT OF DISTRIBUTION AND SUBTRANSMISSION SF/SUB 6/ CIRCUIT BREAKER AND HYBRID TRANSMISSION INTERRUPTER
G.A. Votta, R.K. Smith, M.B. Engels and L.A. Nugent
Gould Inc, Colmar, PA 18915
EPRI Report No. EPRI-EL-810 (06/1978).
Availability: EPRI-EL-810
EPRI
Test models of the arc spinner interrupter were built and tested to determine the component requirements and arrangements necessary for the desired performance. A single-phase laboratory model of this interrupter was successfully tested up through 25 kA at 13.5 kV. Interruption of 40 kA at 13.5 kV was demonstrated; however, satisfactory performance was not obtained at significant current levels during this program when tested at higher voltages. A full-scale model of a three-phase outdoor distribution power circuit breaker rated 18 kA at 15.5 kV was built and successfully tested to standards. 34 Refs.
Primary Keywords: Spinner Interrupter; Hybrid Interrupter; Vacuum Interrupter; Performance Test

917
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH REPETITION RATE MINIATURE TRIGGERED SPARK SWITCH
M.E. Rose and M.T. Glancy
Naval Surface Weapons Center, Dahlgren, VA 22448
2nd IEEE International Pulsed Power Conference Proceedings, pp 295-300 (06/1979).
A miniature triggered spark switch designed to operate at high repetition rates has been constructed. The device, along with associated trigger circuitry, has been incorporated into a simple L-C generator which produces an oscillatory discharge at a frequency of 150 MHz. The switch is operated in the pressure range 760 Torr - 2.6E3 Torr using commericial dry nitrogen as the working gas. Both brass and aluminum electrodes were investigated for repetition frequencies as high as 20 kHz and for gas flow rates as high as 8 cu. cm./sec. The effect of repetition rate on switch jitter and switch breakdown voltage is presented and discussed in terms of gas pressure and flow rate. 4 Refs.
Primary Keywords: Repirated; High Pressure; Quenching Spark Gap; Fast Rise, Low Losses; L-C Oscillator

21

922
(INSULATION, MAGNETIC)
()
INFLUENCE OF NONUNIFORM EXTERNAL MAGNETIC FIELDS AND ANODE-CATHODE SHAPING ON MAGNETIC INSULATION IN COAXIAL TRANSMISSION LINES
M.A. Mostrom
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 475-478 (06/1979).
Coaxial transmission lines, used to transfer the high voltage pulse into the diode region of a relativistic electron beam generator, have been studied using the two-dimensional time-dependent fully relativistic and electromagnetic particle simulation code CCUBE. A simple theory of magnetic insulation that agrees well with simulation results for a straight cylindrical coax in a uniform external magnetic field is used to interpret the effects of anode-cathode shaping and nonuniform external magnetic fields. Loss of magnetic insulation appears to be minimized by satisfying two conditions: (1) the cathode surface should follow a flux surface of the external magnetic field; (2) the anode should then be shaped to insure that the magnetic insulation impedance, including transients, is always greater than the effective load impedance wherever there is an electron flow in the anode-cathode gap. 7 Refs.
Primary Keywords: Numerical Calculation; CCUBE; Simple Theory; External Magnetic Field

923
(POWER TRANSMISSION; INSULATION, MAGNETIC)
(Coaxial Pulse Lines)
STEADY STATE NUMERICAL SOLUTION OF MAGNETICALLY INSULATED CHARGE FLOW IN COAXIAL GEOMETRY
R.J. Barker and R.F. Ottinger
Naval Research Lab, Washington, DC 20375
NRL Report No. NRL 4654 (12/1981).
Availability: AD A109473
NTIS
A vectorized, FORTRAN computer program has been written to calculate steady-state electron and ion fluxes as well as radial profiles of the magnetic and electric fields for specific practical radial diode and magnetically insulated vacuum feed line parameters. The numerical formulation is derived in part from the theoretical treatment of the topic by K.D. Bergeron. However, it differs from the treatment in several important respects, including: a correction in one of the key scaling expressions, a restructuring of the boundary conditions to allow for specific parametric solutions, and a more careful consideration of the regions near the anode and cathode surfaces and near the electron sheath boundary. In deriving these results, analytic approximations for the fields in these 'special' regions were developed. These approximate solutions permitted numerical treatment of the singularities there. Matching the approximations between the regions also provides first-order guesses for the gross steady-state operating characteristics. 25 Refs.
Primary Keywords: Numerical Simulation; Charge Flow; Electron Flux; Ion Flux; Radial Profile; Scaling

924
(BREAKDOWN STUDIES)
(Lightning)
LONG ARC SIMULATED LIGHTNING ATTACHMENT TESTING USING A 150 KV TESLA COIL
R.K. Golke
Wendover AFB, Utah 84083
2nd IEEE International Pulsed Power Conference Proceedings, pp 136-141 (06/1979).
Recent advances in direct lightning strike testing have been in lightning attachment test techniques and generator development using a very large Tesla Coil (51 feet wide). Breakthroughs in simulated lightning attachment to small scale replica aircraft models which can be adapted to full size operational aircraft have been made in the past year. New high voltage long arc generator developments have succeeded in producing voltages in excess of 15 million volts and arc lengths in excess of 40 feet. The shortest path from the discharge arc electrode to the model extremity using the long arc does not govern the attachment points to the test specimen as it does when a short arc is used to conduct simulated lightning testing. The system just described may also have application as an ultra-high mega-volt source for particle beam weaponry. 0 Refs.
Primary Keywords: Lightning Simulation; Pulse Generator; Attachment To Aircraft

925
(INSULATION, MAGNETIC)
()
MAGNETIC INSULATION IN SHORT COAXIAL VACUUM STRUCTURES
M.S. DiCapua and T.S. Sullivan
Physic International Co, San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 483-486 (06/1979)
Magnetically insulated vacuum structures (MIVS) can be used to overcome the limitation on power flow in liquid dielectrics and dielectric vacuum interfaces in pulsed high power accelerators. A short (1 mm), low-impedance (Z/sub o/=5ohm) coaxial MIVS with a gap of 5 mm was studied experimentally. Power flows of 1.5E10 W cm/sup -2/ were observed. The current pulse showed some erosion before the onset of magnetic insulation. The transverse electron current arising from this erosion was observed with Faraday cups imbedded in the wall. Magnetic insulation was lost about 60-70 ns into the pulse. This loss was also observed in the Faraday cups and radiation diagnostics. This loss of magnetic insulation is associated with closure of the gap by cathode plasma. 8 Refs.
Primary Keywords: Vacuum Interface; Insulation Onset; Loss Calculation; Transverse Electron Current; Faraday Cup

927
(INSULATION, MAGNETIC)
()
MITL-A 2-D CODE TO INVESTIGATE ELECTRON FLOW THROUGH NON-UNIFORM FIELD REGION OF MAGNETICALLY INSULATED TRANSMISSION LINES
E.L. Neau and J.P. VanDevender
Sandia Labs, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 479-482 (06/1979).
Self-magnetically insulated, high voltage transmission lines are used in inertial confinement fusion particle accelerators to transmit power from the vacuum insulator to the diode. Injection and output convoluted sections pose special problems in establishing the desired electron flow pattern needed to maintain high overall efficiency. A time dependent, 2-D numerical code for planar or triplate geometries calculates the motion of a test electron through the tapered input or output convolutes. The 1-D parapotential model is assumed to be operative at each position and the magnetic field and potential distribution are calculated in the vicinity of the particle. The electric field is then calculated from Gauss's law, and the electron motion is calculated relativistically. The results show that the electron canonical momentum in the direction of flow changes as the electron passes through a convoluted geometry. As shown by Mendel, these electrons flow between the conductors after the convolute without reintersecting the cathode. We hypothesize that these electrons lead to the losses observed in long self-magnetically insulated lines. Results of calculations are correlated with results of the MITL power flow experiment. 9 Refs.
Primary Keywords: Electron Flow; Convolute Terminations; Numerical Calculation; Loss Calculation

928
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
PARALLEL COMBINATIONS OF PRE-IONIZED LOW JITTER SPARK GAPS
W.A. Fitzsimmons and L.A. Rosocha
National Research Group, Madison, WI 53705
2nd IEEE International Pulsed Power Conference Proceedings, pp 184-186 (06/1979).
The properties of 10 to 30 kV four electrode field emission pre-ionized triggered spark gaps have been studied. A mid-plane off-axis trigger electrode is biased at +V/sub o//2, and a field emission point is located adjacent to and biased at the grounded cathode potential. Simultaneous application of a -V/sub o/ trigger pulse to both the electrodes results in the rapid sequential closing of the anode-trigger and trigger-cathode gaps. The observed jitter is about 1.5 ns. Parallel operation of these gaps (up to 10 so far) connected to a common capacitive load has been studied. A simple theory that predicts the number of gaps that may be expected to operate in parallel is discussed. 0 Refs.
Primary Keywords: Four Electrode Field Emission Spark Gap; Triggering Considerations; Low Jitter; Parallel Operation

932
(SWITCHES, CLOSING)
(Gas Gaps; Materials)
SURFACE AGING IN HIGH REPETITION RATE SPARK SWITCHES WITH ALUMINUM AND BRASS ELECTRODES
M.T. Glancy and M.F. Rose
Naval Surface Weapons Center, Dahlgren, VA 22448
2nd IEEE International Pulsed Power Conference Proceedings, pp 301-307 (06/1979).
The surface aging of the electrodes of miniature spark switches (A/d approximately 50) is explored using commercial dry nitrogen as the working gas. Both brass and aluminum electrodes were investigated for aging characteristics using a constant gas flow rate of 8 cu.cm. sec. The gas pressure was varied from 760 torr-5200 torr. The switches were constructed as an integral part of a miniature L-C oscillator which has a ringing frequency of approximately 150 MHz. The aging process was halted at ervals ranging from one to several thousand discharges and the electrode surface examined with a scanning electron microscope. 9 Refs.
Primary Keywords: Electrode Erosion; L-C Oscillator; Rep-rated; Surface Coatings; Electrode Preparation

936
(SWITCHES, CLOSING)
(Gas Gaps, Materials)
ACOUSTIC PHENOMENA IN EROSION OF SPARK-GAP ELECTRODES
R.A. Pete and T.R. Burkes
Texas Tech Univ, Lubbock, TX
Applied Physics Letters, Vol. 36, No. 7, pp 536-539 (04/1980).
Experiments have been conducted to show that acoustic waves generated in the electrode material may cause an order-of-magnitude increase in the rate of electrode erosion. This increase is due to the arrival of reflected acoustic waves at the electrode surface while arc spots are still molten. 7 Refs.
Primary Keywords: Arc Spots; Reflected Acoustic Waves; Increased Erosion Rate

942
(PULSE GENERATORS; PULSE GENERATORS)
(Marx; Line Type)
A 500 KV REP-RATE MARX GENERATOR
J. Shannon
Maxwell Labs Inc, San Diego, CA 92123
2nd IEEE International Pulsed Power Conference Proceedings, pp 226-231 (06/1979)
An efficient PFN/Marx generator was constructed for generating high average power electron beams. The generator consists of ten 100 kV PFN stages connected in a Marx configuration. The Marx generator employs purged gas switches. The nominal operating parameters are: Voltage-500 kV, Current-10 kA, Pulse Duration-1 microsecond, Rep-Rate-to 100 Hz, Average Power-to 500 kW. This paper discusses the Marx charging power conditioning and the operation of the generator into resistive and electron beam loads. 1 Refs.
Primary Keywords: Pulse Forming Network; Marx Configuration; High Power; Gas Spark Gap; Rep-rated; Charging Considerations

949
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas; Recovery; Gas Gaps, Recovery)
GAS COOLING AND ELECTRIC STRENGTH RECOVERY AFTER A SPARK DISCHARGE
E.P. Belikov
Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 16, No. 8, pp 1321-1323 (02/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 1678-1681 (August 1971)
Recovery of the electric strength of air gaps with a length s = 2-10 mm after the passage of current pulses of 0.6-20 kA and 3-1500 microseconds long is investigated. The cooling of the gas following a spark discharge is investigated qualitatively be means of the shadow method. 4 Refs.
Primary Keywords: Gap Recovery, Air Gap; 20 kA Pulse; 1500 Microsecond Duration; Gas Cooling; Shadowgraph Diagnostic

948
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas; Opt cal; Gas Gaps, Optical)
ELECTRON DENSITIES IN LASER-TRIGGERED SPARK GAP DISCHARGES
R.J. Crumley, P.F. Williams, M.A. Gundersen and A. Watson
Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 119-121 (06/1979).
The results of experiments designed to measure electron densities from measurements of Stark broadened spectral profiles in laser-triggered discharges in hydrogen are reported. Temporally and spatially resolved data have been obtained both during and after the arc for discharges in hydrogen. Evidence of a shockwave is presented, consistent with the observations of other investigators. 3 Refs.
Primary Keywords: Stark Broadening; Laser-triggering; Hydrogen Working Gas; Shock Wave

950
(PARTICLE BEAMS, ION)
(Generation)
HIGH-POWER ION BEAM GENERATION WITH AN INVERSE REFLEX TETRODE
J.A. Pasour, R.A. Mahaffey, J. Golden and C.A. Kapetanakos
Naval Research Lab, Washington, DC 20375
Applied Physics Letters, Vol. 36, No. 8, pp 646-648 (04/1980).
A new reflexing-electron ion source is described. The device produces a unidirectional ion beam with relatively high efficiency even when the applied magnetic field exceeds the self-field. This new source operates at a low, constant impedance during much of the applied voltage pulse and is better matched to available high-power, low-impedance generators than previous reflexing-electron devices. Proton pulses with peak current approximately 500 kA have been produced with the inverse reflex tetrode coupled to the Gamble II generator. 15 Refs.
Primary Keywords: Reflex Triode; Low Impedance; Constant Impedance; Solid Cathode; 500 kA Output Current; Experiment; Theory

951
(PARTICLE BEAMS, ION)
(Generation)
ION BEAM GENERATION THROUGH A MOVING PLASMA BOUNDARY
M. Dembinski and P.K. John
University of Western Ontario, London, Ontario, Canada
2nd IEEE International Pulsed Power Conference Proceedings, pp 72-75 (06/1979).
It is shown that ion currents extracted from a moving plasma can be increased by a factor of approximately plasma velocity/ acoustic speed as compared with a stationary plasma of the same density and temperature. A coninal theta-pinch gun is used to accelerate plasma with density in approximately 1E12 cm/sup -3/ to velocity v approximately 1E7 cm/s. Total currents approximately 100 A of 10-20 keV ions were obtained from an 8 cm diameter extraction system. 7 Refs.
Primary Keywords: Moving Plasma; High Current; Child-Langmuir Law; Experiment

952
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
KRF LASER-TRIGGERED SF/SUB 6/ SPARK GAP FOR LOW-JITTER TIMING
W.R. Rapoport, J. Goldhar, J.R. Murray and M. D'Addario
Lawrence Livermore Lab, Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 236 (06/1979).
An SF/sub 6/ spark gap operated at field stresses of 60-180 kV/cm can be triggered with subnanosecond jitter by volume breakdown in SF/sub 6/ induced by as little as 10 mJ in 15 ns of KrF laser radiation. 0 Refs.
Primary Keywords: Laser Triggering; Very Low Jitter
Secondary Keywords: Abstract Only

954
(BREAKDOWN STUDIES)
(Surface Flashover)
MECHANISM OF PULSED SURFACE FLASHOVER INVOLVING ELECTRON-STIMULATED DESORPTION
R.A. Anderson and J.F. Brainerd
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 51, No. 3, pp 1414-1421 (03/1980).
A simple model is proposed to explain how a prebreakdown avalanche of secondary emission electrons can lead to surface flashover when an insulator in vacuum breaks down a few nanoseconds after high voltage is applied. The case of a plane insulator-vacuum interface perpendicular to parallel electrodes is considered. Positive surface charging is assumed to occur almost immediately upon application of the voltage, and the attendant secondary emission avalanche is assumed to be maintained at saturation throughout the prebreakdown time delay by field emission from the cathode electrode. Bombardment of the insulator by avalanche electrons desorbs a cloud of gas, which is partially ionized as it drifts through the swarm of electrons in the avalanche. The electric field at the cathode end of the insulator becomes enhanced as positive ions accumulate, which in turn increases the field emission and the rates of gas desorption and ionization. This and other regenerative processes rapidly lead to breakdown. Field enhancement at the cathode end of the insulator and increased field emission are individually considered in determining the prebreakdown time delay, with very s m la. results. The proportionality we have observed between the timed delay and the inverse square of the applied voltage is also predicted, as well as a dependence of the time delay on the insulator length. The model may also account for the improved performance of insulators coated with certa n metal oxides. 39 Refs.
Primary Keywords: Pulsed Surface Flashover; Prebreakdown Phenomena; Vacuum-Insulator Interface; Surface Charge, Gas Cloud

958
(PARTICLE BEAMS, ELECTRON)
(Generation)
REPETITIVELY PULSED ELECTRON BEAM DIODE LIFETIME AND STABILITY
M.T. Buttram
Sandia Labs, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 61-64 (06/1979).
Repetitively pulsed vacuum beam diodes will be required for most projected inertially confined fusion systems. Yet data on the operation of diodes under repetitive pulsing is sparse. This paper discusses the operation of a 250 KV, 1.5 kA/sq.cm. diode at repetition rates to 30 Hz for sustained runs. Short term stability is typically 3 percent (standard deviation). Longer term there is a drift toward higher impedance at the start of the pulse. Details on this drift and a comparison of this process for a rather blunt versus a sharp-edged cathode are presented. 1 Refs.
Primary Keywords: Vacuum Diode; Lifetime; Impedance Stability; Repetated

961
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SIMULATION OF INDUCTIVE AND ELECTROMAGNETIC EFFECTS ASSOCIATED WITH SINGLE AND MULTICHANNEL TRIGGERED SPARK GAPS
S. Levinson, E.E. Kunhardt, M. Kristiansen and A.H. Guenther
Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 433-436 (06/1979).
When breakdown of a pressurized spark gap is initiated by a high power laser, a narrow spark channel is quickly established. In this case, the rise time of the current in the external circuit due to the breakdown of the gap is determined in a large measure by the inductive and electromagnetic effects associated with the channel dimensions and the resulting physical discontinuities, experiments have been conducted using spark gaps where the discharge channel is simulated by a very thin wire. Current rise time measurements for various wire sizes (i.e., spark channel radius), wire position (i.e., on or off axis), and number of wires (i.e., multichanneling) have been carried out. The rise time values thus obtained agree quite well with the laser-triggered, single and multichannel, spark gap results. These results can be qualitatively explained using simple inductive circuits which dramatically underline the inductive character of the breakdown. The significance of these results in revealing the mechanism of spark gap breakdown will be discussed. 3 Refs.
Primary Keywords: Spark Channel Study; Simulation; Wires; Switch Inductance

962
(SWITCHES, CLOSING)
(Gas Gaps, Materials)
SPARK GAP EROSION RESULTS
R. Petr, D. Barrett and T.R. Burkes
Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 308-312 (06/1979).
The erosion characteristics of a spark gap with parallel-plane electrodes are determined at atmospheric and vacuum pressures. Erosion as a loss of electrode material is measured in a range from 200 to 1000 amperes. The severity of electrode erosion is found to be related to spot formation, switching rates, melting point of the electrode, pressure, and gap length. Erosion values for a pulsed current are given for aluminum, brass, and carbon. 7 Refs
Primary Keywords: Parallel-plane Electrodes; Low Current; Spot Formation; Switching Rate

968
(SWITCHES, OPENING: BREAKDOWN STUDIES)
(Mechanical; Vacuum, Electrical)
THE EFFECT OF GLASS DEBRIS ON ELECTRON EMISSION AND ELECTRICAL BREAKDOWN OF VACUUM INTERRUPTERS
G.A. Farrall and F.G. Hudda
General Electric Co, Schenectady, NY 12301
IEEE Transactions On Electrical Insulation, Vol. EI-15, No. 2, pp 61-67 (04/1980).
Pre-breakdown electron emission and breakdown voltages have been studied for three experimental vacuum interrupters, two of which contained numerous glass particles the largest of which were typically 50 microns in their longest dimension. The contaminated interrupters differed from the uncontaminated interrupter in the following ways. 1) Continuously recorded Fowler-Nordheim plots had lower slopes and showed several stepwise changes in emission as the applied high voltage was varied. 2) 60 Hz breakdown voltages were lower and occurred randomly for sustained AC voltage at constant peak amplitude. 3) Electron emission current with DC high voltage applied was markedly sensitive to mechanical shock. Changes in emission occurred at statistically varying time intervals which may be several tens of milliseconds from the imposed shock. We conclude that the presence of glass particles within the interrupter strongly alters the emission properties of highly stressed internal surfaces and significantly degrades dielectric capability. 7 Refs.
Primary Keywords: Vacuum Breakdown; Glass Debris; Vacuum Interrupters; 60 Hz Breakdown Voltages; Pre-breakdown Electron Emission; Degraded Dielectric Capability; Mechanical Shock Trials; Performance Degradation

969
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ANALYSIS AND APPLICATION OF A TRANSFORMER CORE THAT ACTS AS AN ARC SNUBBER
J.H. Fink (1), W.R. Baker (2) and H.M. Owren (2)
(1) Brookhaven National Labs, Upton, NY
(2) Lawerence Berkley Labs, Berkley, CA
IEEE Transactions On Plasma Science, Vol. PS-8, No. 1, pp 33-38 (03/1980).
A series of equations is derived from which a transformer-core arc snubber can be designed. The theories used to derive these expressions are elaborations of previous studies of pulse-operated transformer cores. Some comparisons between theoretical and experimental results are given. 6 Refs.
Primary Keywords: Arc Snubber; Transformer Core; Eddy-current Losses; Residual Magnetization

973
(PARTICLE BEAMS, ELECTRON)
(Generation)
A COAXIAL E-BEAM EXCITATION SYSTEM FOR HIGH POWER EXCIMER LASERS
G.L. Oomen and W.J. Witteman
Twente Univ. Technology, Enschede, The Netherlands
Optics Communications, Vol. 32, No. 3 pp. 451-466 (03/1980).
The authors report operation of a medium scale, high current density (250 A/sq cm) co-axial e-beam generator for excimer laser pumping. Construction is described and input and output energies are discussed. The specific input energy is found to be more than triple that of a single-sided transversal system, which is attributed to the absence of a foil support structure, a better concentration of energy, and extra electrons reflected by the potential field. 10 Refs.
Primary Keywords: E-beams; Coaxial generator; Uniform beam; Construction details; Output energy
Secondary Keywords: Excimer laser pumping

987
(POWER TRANSMISSION)
(Transmission Lines)
HIGH POWER PULSE MODELING OF COAXIAL TRANSMISSION LINES
J.P. O'Loughlin
AFWL, Kirtland AFB, NM 87117
2nd IEEE International Pulsed Power Conference Proceedings, pp 96-99 (06/1979).
When coaxial cable is used for high voltage pulse transmission, a voltage transient appears on the outer sheath conductor. Although the magnitude of the transient is in the order of only a few per cent, this amounts to several kilovolts in many cases and must be carefully considered in terms of its effect on instrumentation, control and safety. To a first approximation, theoretically a coaxial cable should not develop any voltage on the outer sheath. A more refined analysis and model shows that the complete cancellation depends upon self inductance of the sheath being exactly equal to the mutual inductance between the sheath and the center conductor. This condition is never exactly satisfied due to current distribution effects, even when the distribution is uniform and radially symmetric. The situation becomes worse when proximity effects are accounted for. The predicted sheath voltage agrees with experimental data within reasonable limits. 2 Refs.
Primary Keywords: Sheath Transient; Sheath Inductance; Proximity Effects

996
(PULSE GENERATORS)
(Trigger)
LIGHT ACTIVATED 10 KV LOW JITTER PULSER
J.D. Gelbraith
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 100-101 (06/1979).
An optically activated 10 kV pulser was designed to provide low jitter, long life, reliable triggering of ignitrons, trigatron, or midplane triggered spark gaps in high voltage electrically noisy environments. For midplane triggered spark gaps, a stepup transformer is also required. The input to a fibre optic cable is a 9.5 watt injection laser diode. The pulser detects and amplifies the fibre optic cable outrut to 10 kV. 0 Refs
Primary Keywords: Low Input Power; Low Jitter; High Reliability
Secondary Keywords: Pulse Transformer

997
(SWITCHES, CLOSING)
(Solid Dielectric, Optical)
LOW JITTER, LOW INDUCTANCE SOLID DIELECTRIC SWITCHES
A.M. Guenther, D.M. Strickland and J.R. Bettis
AFWL, Kirtland AFB, NM 87117
The Review Of Scientific Instruments, Vol. 50, No. 11, pp 1487-1489 (11/1979).
It has been shown that the use of graded solid dielectric sandwiches in laser-triggered spark gaps (LTS) can lead to highly desirable multichannel operations while maintaining the low delay and jitter performance characteristics of LTS. As many as ten separate breakdown channels were observed when small circular or hexagonal aluminum inserts were inserted between two Mylar dielectric sheets stressed at 4.1 kV/mil. A reduction in rise time was noted for these multichannel switching events. 7 Refs.
Primary Keywords: Solid Dielectric Switch; Laser Triggering; Multichannel Operation; Low Jitter, Low Delay

1007
(REVIEWS AND CONFERENCES)
(Pay ews)
PULSED HIGH-CURRENT ELECTRON TECHNOLOGY
G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
2nd IEEE International Pulsed Power Conference Proceedings, pp 9-16 (06/1979).
The use of high-power pulse technology and explosive electron emission enables one to construct new pulsed electron devices. The present report gives the results of an intensive investigation of high-power pulse generation, electron beam geometry and the application of these beams to the production of ultra high frequency, laser and X-ray radiation. This report is based on results obtained at the Institute of High-Current Electronics. 25 Refs.
Primary Keywords: Pulse Generator; Spark Gap; Marx Generator; Module Approach; E-beam Accelerator; Rep-rated; Magnetic Insulation
Secondary Keywords: Gas Lasers

1008
(POWER CONDITIONING)
(Pulse Forming Lines)
PULSE SHARPENING IN FERRITE TRANSMISSION LINES
M. Weiner
ECOM, Fort Monmouth, NJ 07703
2nd IEEE International Pulsed Power Conference Proceedings, pp 91-95 (06/1979).
Pulse sharpening effects in ferrite transmission lines may be used to obtain kV pulses with ns rise time. The exact description of the sharpening effect requires complex shock wave analysis. In this paper an approximate but useful physical model is discussed. The ferrite is treated as a lossy but linear transmission line from which equivalent design results are obtained. In many instances the nonlinear effects present are confined to a region which is small compared to the total transmission length, which makes the linear approximation more plausible. Preliminary experimental results, based on a 130 cm long line, are in accord with the predictions of the model. 4 Refs.
Primary Keywords: Fast Rise Time; Theory; Lossy, Linear Transmission Line; Experiment

1011
(PULSE GENERATORS)
(LC)
HIGH REPETITION RATE LC OSCILLATOR
S.L. Moren
Naval Surface Weapons Center, Dahlgren, VA 22448
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1524-1527 (10/1979).
LC oscillators have been built which can produce multi-kilowatt RF pulses in the megahertz frequency range with repetition rates of tens of kilohertz. The L and C for these oscillators can be determined from the frequency requirement and the high-Q requirements. The high repetition rates are achieved using a high-pressure spark-gap switch together with a DC to AC inverter power supply. Closely spaced antenna elements can be used to increase the number of cycles in the radiated waveforms (radiated Q). 1 Refs.
Primary Keywords: L-C Oscillator; High Q; Design Considerations, Performance Test

1049
(ENERGY STORAGE, INDUCTIVE; PULSE GENERATORS)
(Systems; Systems)
NANOSECOND PULSE GENERATORS WITH INDUCTIVE STORAGE
Yu.A. Kotov, N.G. Kolganov, V.S. Sedoi, B.M. Kovaltchuk and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
1976 IEEE Pulsed Power Conference Proceedings, Paper IA-1 (11/1976).
The exploding wires are used for steepening the power in L-C circuit. The techniques of calculation of circuit with exploding wires is given as well as that of the calculation of the characteristics of inductive energy switching into resistive load. The high-current accelerators of electrons using this principle are also described. 39 Refs.
Primary Keywords: Inductive Energy Storage; Pulse Generator; Exploding Wire; Electron Accelerator

1050
(BREAKDOWN STUDIES)
(Plasma)
PLASMA ACCELERATION IN A COAXIAL INJECTOR WITH NONCYLINDRICAL ELECTRODES DRIVEN BY AN INDUCTIVE STORAGE DEVICE
E.A. Azuzev, I.V. Kizhurov and M.N. Stepanenko
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
Soviet Physics Technical Physics, Vol. 20, No. 9, pp 1160-1164 (09/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 45, pp 1826-1833
In experiments on plasma acceleration in a coaxial-conical injector driven by an inductive energy storage device under various conditions the peak current in the inductive storage device is 360 kA, the maximum injector current is 250 kA, and the initial pressure in the gap is varied over the range 0.1-10 Torr. Interferometer, optical, probe, and electrical measurements show that at pressures 0.1-1 torr a quasisteady contracting MHD plasma flow is established in the injector; this flow arises from a jet with n/sub e/ = 2.10e17 cm/sup -3/, which is focused to a cross section 2 cm in diameter. The velocity is (6-8)x10e6 cm/sec and the exit time is 5-14 usec. The rapid current decay due to the insufficient energy stored in the storage device (30 kJ) and the mismatch between the gas injection and the flow rate in the injector leads to a localization of the discharge near the electrode insulator and to the convection of the discharge into an arc. 7 Refs.
Primary Keywords: Coaxial Injector; Non-cylindrical Electrodes; Inductive Storage; High Energy Transformat on Efficiency; Plasma Jet
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1058
(SWITCHES, OPENING)
(Gas Gaps, E-beam)
CURRENT BREAKER WITH SPACE DISCHARGE CONTROLLED BY ELECTRON BEAM
B.M. Kovaltchuk and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
1976 IEEE Pulsed Power Conference Proceedings, Paper IC-7 (11/1976).
It is suggested that the space gas discharge controlled by the electron beam should be used to break the high current. The break is done by the cessation of electron injection. The break of 150 kA current in CO/sub 2/ laser is made for the time of 200 ns. 5 Refs.
Primary Keywords: E-beam Controlled Opening Switch; Injected Thyratron; Detailed Analysis
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1060
(BREAKDOWN STUDIES)
(Plasma)
ELECTRIC-DISCHARGE SF/SUB 6/-H/SUB 2/ LASER PUMPED BY AN INDUCTIVE STORAGE UNIT
A.F. Zapol'skii and K.P. Yushko
Soviet Journal Of Quantum Electronics, Vol. 9, No. 2, pp 248-249 (02/1979).
Trans. From: Kvantovaya Elektronika, Vol. 6, pp 408-411, (Feb. 1979)
9 Refs.
Primary Keywords: Homogeneous Longitudinal Discharge; Non-preionized; SF sub 6/-H/sub 2/ Plasma; Inductive Energy Storage
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1063
(SWITCHES, OPENING)
(Mechanical)
FAST-ACTING ELECTRODYNAMIC CIRCUIT BREAKER
A.A. Rudenko, F.M. Spevakova, A.M. Stolov and A.D. Frolov
Scientific-Research Institute Of Electro-Physical Apparatus, Leningrad, USSR
Instruments And Experimental Techniques, No. 2, pp 451-454 (04/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 124-127 (March-April 1970)
A device is described which reduces the circuit breaker current to practically zero within a definite time interval, while the opening of the circuit and the restoration of dielectric strength in the breaker take place within a time shorter than that interval. Discussed are the operating principle, the construction, and the test results of a fast-acting circuit breaker which opens a circuit within 100 microseconds with a firing precision of 10 microseconds while a pulse power of 270 MW is dissipated in the resistive load. 1 Refs.
Primary Keywords: Opening Switch, 100 Microsecond Opening Time; Inductive Energy Storage; Capacitor Current Commutator
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1078
(PARTICLE BEAMS, ELECTRON)
(Generation)
A COMPACT PULSED ELECTRON ACCELERATOR WITH AN INDEPENDENT POWER SUPPLY
Yu.V. Afonin, A.G. Ponomarenko, R.I. Soloukhin and Yu.I. Khapov
Institute Of Theoretical And Applied Mechanics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1310-1312 (10/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 20-22 (September-October 1973)
A compact pulsed electron accelerator having an independent power supply from a 12 V storage battery is described. The accelerating voltage of approximately 240 kV is formed by a pulse-voltage generator with a capacitive energy-storage device. The beam current is 4 kA. The length of a pulse is approximately 15 nsec. 8 Refs.
Primary Keywords: E-beam Generation; 15 ns Pulse Width; 240 keV Energy, 4 kA Beam Current, 12 V Primary Voltage Source
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1087
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
A MULTISPARK HIGH-VOLTAGE TRIGATRON
V.G. Emel'yanov, B.M. Koval'chuk, V.A. Lavrinovich, G.A. Mesyats and Yu.F. Potal-tsyn
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 18, No. 4, pp 1114-1116 (08/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 89-92 (July-August 1975)
A trigatron is described having a rated voltage of 400 kV and a nanosecond actuation-time stability over a wide range of working voltages, which allows firing of up to eight spark channels in one discharge gap. For a commutated current of 18 nsec and a double electrical length of the shaping line equal to 130 kA more than half of the energy in the storage device is lost in the commutator in the one-spark operating regime; for operation of eight channels the energy losses in the commutator do not exceed 10% of the energy stored in the storage device. 5 Refs.
Primary Keywords: Trigatron, 400 kV Operating Voltage; Multi-channel Operation, 10% Losses, Multiple Trigger
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1090
(SWITCHES, CLOSING)
(Solid Dielectric, Electrical)
BREAKDOWN OF A SOLID-DIELECTRIC SWITCH
A.B. Andreyev, V.A. Burtsev and A.B. Produnov
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics Technical Physics, Vol. 20, No. 2, pp 187-190 (02/1975)
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 45, pp 294-300
An experimental study is reported of the time characteristics of a two-channel switch over broad ranges of working conditions. The basic dielectric material is polyethylene. A model for controlled breakdown of the basic dielectric is discussed. Qualitative and in certain cases quantitative agreement is found between the calculated and experimental data. The discrepancies are analyzed. 5 Refs.
Primary Keywords: Two Channel Switch; Time Characteristics; Polyethylene; Imax > 10e6 A; Di/dt > 10e12 A/sec
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1095
(PARTICLE BEAMS, ION; PARTICLE BEAMS, ION; PARTICLE BEAMS, ION)
(Generation; Transport; Target Interactions)
THERMONUCLEAR MICRO-EXPLOSIONS WITH INTENSE ION BEAMS
F. Winterberg
University of Nevada System, Reno, NV 89507
Nature, Vol. 251, pp 44-46 (09/1974).
A method of generating intense ion beams using a magnetically insulated diode is presented. Theory predicts a current density of 3 ka/sq cm, and 1 MJ total delivered energy. Low ion velocities permit pulse shortening by time focusing. Two methods producing nuclear micro-explosions are discussed. 5 Refs.
Primary Keywords: Heavy Ion Beam; Vacuum Diode; Magnetic Insulation; Drift Tube; Spherical Symmetry
Secondary Keywords: Ion Beam Fusion
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1096
(SWITCHES, CLOSING; POWER CONDITIONING; PARTICLE BEAMS, ELECTRON)
(Thyratrons; Pulse Transformers; Generation)
CURRENT SWITCHING IN TESLA TRANSFORMERS
A.A. Egorov, V.S. Shirkin and S.M. Panasyuk
Novosibirsk Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, No. 4, pp 786-789 (08/1968).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 26-30 (July-August 1968)
The authors describe the results obtained from studying hydrogen thyratrons working in the current commutator of a Tesla transformer. It is shown that the commutator, which consists of antiparallel thyratrons, makes it possible to decouple the current network in the beat halfperiod. This makes it possible to achieve energy regeneration and increase the efficiency of a direct current accelerator using a Tesla transformer. We also consider the use of inertial (mercury) high current tubes in the energy regeneration circuit for current commutation in a high-frequency circuit, in particular, in a Tesla transformer. 5 Refs
Primary Keywords: Thyratron Switch; Tesla Transformer; High Efficiency; Electron Accelerator
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1098
(BREAKDOWN STUDIES)
(Exploding Wires)
HOLOGRAPHIC INVESTIGATION OF ELECTRICAL EXPLOSIONS OF CONDUCTORS
E.A. Antonov, L.N. Gnatyuk, B.M. Stepanov, Yu.I. Filenko and V.Ya. Tsarfin
High Temperature, Vol. 10, No. 6, pp 1087-1091 (12/1972).
Trans. From: Teplofizika Vysokikh Temperatur 10, 1210-1213 (November-December 1972)
Holography was used to study various stages of the explosions of wires in water and air. Estimates were obtained of the fragment velocity, the shock wave velocity, and the electron density in the resultant plasma. The advantages of the holographic method over photography were identified. 6 Refs.
Primary Keywords: Hologram, Ruby Laser; Low-energy Explosion; Wire Fragmentation; High-energy Explosion; Wire Evaporation, Reconstructed Image
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1099
(PULSE GENERATORS; SWITCHES, CLOSING; PARTICLE BEAMS, ELECTRON)
(Review; Reviews; Generation)
GENERATORS OF POWERFUL SUBNANOSECOND PULSES
B.M. Kovaltchuk, G.A. Mesyats and V.G. Shpak
Academy of Sciences of the USSR, Tomsk, USSR
1976 IEEE Pulsed Power Conference Proceedings, Paper ID-5 (11/1976).
The authors relate the switching times of spark gaps to the amount of overvoltage and rate of voltage rise. They then proceed to show how these parameters can be tailored to switch a pulse generator with subnanosecond duration. A design is then presented for an electron accelerator utilizing this pulse generator that produces subnanosecond e-beam pulses with current densities greater than 1E6 A/cm^2. 10 Refs.
Primary Keywords: Pulse Generator; Subnanosecond Pulses; Static Breakdown; Pulse Breakdown, Very Fast Switching
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1100
(PULSE GENERATORS; SWITCHES, CLOSING)
(Capacitive, Gas Gaps, Self)

HIGH CURRENT SUBNANOSECOND PULSE GENERATOR

B.M. Koval'chuk and G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 5, pp 1362-1365 (10/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 102-105 (September-October 1970)

This paper describes the design and performance of a current pulse generator having a pulse duration of 0.6 nsec at the half-amplitude point. The pulse amplitude is continuously variable from 50 to 1000 A with repetition rates up to 1E4 Hz. The basis of the work is a study of a gas avalanche commutator. 2 Refs.

Primary Keywords: Pulse Generator; 50-1000 A Output Current; 2 kV Charging Voltage; Switch Test; Gas Avalanche Discharger; Rep-rated; 10 kHz Repetition Rate
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1105
(BREAKDOWN STUDIES)
(Creeping Discharge)

HIGH-POWER [illegible] USEC ULTRAVIOLET RADIATION SOURCE FOR PUMPING OF GAS LASERS

A.S. Bashkin, P.G. Grigor'ev, A.N. Oraevskii and A.B. Skvortsov
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Soviet Journal Of Quantum Electronics, Vol. 6, No. 8, pp 994-996 (08/1976).
Trans. From: Kvantovaya Elektronika, Vol. 3, pp 1824-1826

A convenient [illegible] discharge ultraviolet radiation source was built. The length of the emitting region was 93 cm and the stored energy was up to 5 kJ. The initiation was provided by the well-known surface discharge method. The low inductance of the discharge circuit made it possible to achieve a brightness temperature exceeding [illegible] degrees K in the spectral range 240-[illegible] nm when the ultraviolet pulse [illegible] was about [illegible] usec. [illegible] Refs.

Primary Keywords: [illegible] Radiation Pulse; Surface Discharge; Low Inductance Discharge; [illegible] Plasma; 250nm UV Pulse
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1120
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

PLASMA TRIGATRON SPARK GAP

V.V. Baraboshkin
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 20, No. 2, pp 472-474 (04/1977).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 131-132 (March-April 1977)

A trigatron spark gap which works at atmospheric pressure is described. The gap is capable of switching currents of up to 1E4 A over a wide range of voltages. It is shown that for breakdown voltages across the main gap of 10-35 kV, the time interval between the beginning of the trigger pulse and the beginning of the current pulse in the main circuit depends monotonically on the working voltage and may reach 30 microseconds. 5 Refs.

Primary Keywords: Spark Gap; Trigatron Gap; +or- 15 kV Operating Voltage, 10 kA Current; 30 Microsecond Switching Delay
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1133
(REVIEWS AND CONFERENCES; ENERGY STORAGE; PULSE GENERATORS)
(Reviews; Reviews; Reviews)

TECHNOLOGY OF LARGE IMPULSE CURRENTS AND MAGNETIC FIELDS

V.S. Komel'kov
FTD Report No. FTD-MT-24-992-71 (12/1971).
Trans. From: Tekhnika Bol'shikh Impul'snykh Tokov I Magnitnykh Poley, Atomizdat, Moscow, 1-472 (1970)
Availability: AD 736910
NTIS

This book furnishes diagrams, calculation methods, characteristics, and designs of power capacitor batteries and their basic elements: capacitors, various types of spark gaps (vacuum, high pressure, solid dielectric), insulation of junction circuits (busbars, cables), and pulse transformers. Methods of calculating magnetic fields, as well as inductance in solenoids and conductors, are given. The design and behavior of metals in superstrong magnetic fields are examined. Orig. art. has: 205 figures, 34 tables. 268 Refs.

Primary Keywords: Energy Storage; Capacitor; Homopolar Generator; Inductor, Switch, Spark Gap; Insulation; Design Considerations; Power Transmission

1135
(PULSE GENERATORS)
(Line Type)

HIGH-VOLTAGE PULSER DEVELOPMENT

H. Watson
AiResearch Co., Torrance, CA 90509
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1518-1527 (10/1979).

This paper highlights the development of a pulse generator that utilizes a single, midplane, triggered spark gap (TSG) to discharge a pulse-forming network (PFN) into a CS/sub 2/ laser cavity load. The PFN is a four-section line pulser. When charged to 116 kV, it can discharge 300 J in 700 ns, full width half maximum (FWHM). The system operates at 0 to 50 pps. In designing the PFN inductors, the pulse rise time was kept long enough to avoid excessive ringing in the output cables. Such ringing can cause arcing in the cavity or damage to the cables themselves. The PFN capacitors were potted into a coaxial configuration to minimize inductance. As the pulse repetition rate increases or the charge duration decreases, special consideration must be given to design of the midplane TSG voltage grading network to ensure the trigger electrode always stays at some set fraction of the PFN voltage during charge. This paper describes a circuit that makes operation of the grading network independent of frequency and charge duration, within certain limits. Tests were run in synthetic air and in nitrogen to evaluate operating voltage and the amount of jitter and misfire as a function of pressure. 4 Refs.

Primary Keywords: Pulse Forming Network; Spark Gap; Trigger Voltage Grading Network; Rep-rated; Performance Test
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1137
(PARTICLE BEAMS, ELECTRON; PULSE GENERATORS)
(Generation, Blumlein Lines)

'NEPTUNE' HIGH-CURRENT PULSED RELATIVISTIC-ELECTRON ACCELERATOR

S.S. Kingsep, G.P. Maksimov, Yu.L. Sidorov, V.P. Smirnov and A.M. Spektor
Instruments And Experimental Techniques, Vol. 16, No. 2, pp 364-366 (04/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 26-28 (March-April 1973)

A pulsed high-current electron accelerator having a beam current I = 10-30 kA and an electron energy E = 0.5-1 MeV is described. A pulse having a length of approximately 40 nsec was shaped by a Blumlein strip line in which distilled degassed water was used as the dielectric. The charging of the line was achieved by means of two standard GIN-400-0.06/5 pulse generators connected in series. 5 Refs.

Primary Keywords: Blumlein Line; Field Emission Diode; Sliding Discharge; 1 MV Operating Voltage
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1145
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

COMMUTATION OF SPARK GAPS BY MEANS OF A PULSED GAS LASER OPERATING IN THE ULTRAVIOLET RANGE

E.A. Lenberg, Yu.V. Tkach, I.I. Magda, N.P. Gadetskii and V.U. Abramovich
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instruments And Experimental Techniques, Vol. 16, No. 1, pp 165-167 (02/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 16, 140-142 (January-February 1973)

The use of a pulsed ultraviolet laser based on molecular nitrogen, which generates radiation having a wavelength 3371 angstroms and a power of 30 kW, allowed two air spark gaps to be fired at a frequency of 15 to 20 Hz. Synchronization of breakdown within at most =1 nsec was achieved. The dependencies of the operate time of the spark gap on applied voltage are presented for various lengths of the spark gap for laser initiation. 3 Refs.

Primary Keywords: Nitrogen Laser; Multiple-gap Triggering; Field Distortion; Cathode Target Electrode
Secondary Keywords: Water Gaps
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1146
(SWITCHES, CLOSING)
(Thyratrons)

CONTROLLED GAS DISCHARGE SWITCH WITH A COLD CATHODE

G.I. Nosov and S.A. Smirnov
Khar'kov Institute Of Radioelectronics, USSR
Instruments And Experimental Techniques, Vol. 20, No. 4, pp 1147-1149 (08/1977).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 206-208 (July-August 1977)

A sealed-off metal-ceramic controlled gas-discharge low-pressure switch with a cold hollow metal cathode operating at a voltage of 0.4-30 kV is described. The switch is filled with H/sub 2/ at a working pressure of 0.2-0.3 Torr. The device can operate in two modes: in a single mode with a pulsed current of up to 30 kA, and in a frequency mode with a current of 2 kA for a frequency of the construction of the pulses of up to 100 pulses/sec. The device operating delay time is <0.4 microsecond, and the periodic instability of this time is +or- 10 nsec. 6 Refs.

Primary Keywords: Low Pressure Discharge Tube; Hydrogen Gas; 30 kV Operating Voltage; 3 kA Peak Current
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1153
(SWITCHES, CLOSING)
(Gas Gaps, Self)

HIGH VOLTAGE MEGA-AMP ARC GAP WITH DESTRUCTIBLE ELECTRODES

G.S. Villeval'd, V.N. Karasyuk and G.I. Sil'vestrov
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 21, No. 1, pp 76-79 (02/1978).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 75-77 (January-February 1978)

Two low-inductance two-electrode arc-gap constructions of mega-amp rating are described in which one or both electrodes have the form of plates that are destroyed on passage of the current pulse. Efficient removal of electrode erosion products from the working volume of the arc gap is assured and shock loads on the stationary elements of the construction are reduced as a result. The arc gaps are filled with nitrogen to a pressure of 10-15 atm. At a working voltage of 50 kV the inductance of the arc gap does not exceed 8 nH. 3 Refs.

Primary Keywords: Two-electrode Spark Gap; Single Shot Operation; Shot-to-shot Electrode Replacement; 50 kV Operating Voltage; 1 MA Current; 8 nH Inductance
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1157
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

NEW HIGH-POWER NANOSECOND SWITCH

P.A. Vorob'ev, G.A. Mesyats and Yu.F. Potalitsyn
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 11, No. 8, pp 1114-1119 (02/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 1492-1498 (August 1966)

A nanosecond switch has been developed which has a wide range of working voltages, a stable delay between the triggering and operating pulses, and a nanosecond switching time; it can be triggered by a pulse of small amplitude. 7 Refs.

Primary Keywords: Spark Gap; Series-connected; Low Delay; Low Jitter; Low Trigger Voltage
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1160
(PARTICLE BEAMS, ELECTRON)
(Generation)

PRODUCTION OF AN INTENSE ELECTRON BEAM

V. Logunov, A Ponomarenko and L. Fominskii
Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics Technical Physics, Vol. 17, No. 9, pp 1560-1567 (03/1973).
Trans. From: Zurnal Tekhnicheskoi Fiziki, Vol. 42, No. 9, pp 1947-1957
Experimental results are presented on the focusing of an electron beam (300 keV and 3 kA, and pulse length 10e-7 sec), obtained with a field-emission length cathode. The current density is 10e5/cm**2. A method of measuring the beam parameters is described: These include current, electron energy spectrum, the beam configuration in the focusing magnetic field, and the total energy transported by the beam. The effect of the plasma in the accelerating gap on the operation of the vacuum diode and on beam focusing is discussed. 17 Refs.
Primary Keywords: Focused Beam; Beam Parameter Measurements; 300keV, 3kA, 10e-7 Pulse Length

1162
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

THE AVTRON-A CONTROLLED PLASMA-CATHODE GAS-DISCHARGE DEVICE

L.N. Vagin and L.G. Ivleva
Instruments And Experimental Techniques, No. 6, pp 1448-1451 (12/1968).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 157-161 (November-December 1968)
The possibility of constructing a controlled plasma-cathode gas-discharge device, known as the avtron, is demonstrated experimentally. An auxiliary discharge plasma is responsible for conduction between the working electrodes. Freedom from erosive wear of the negative working electrode facilitates the design of high-dense age devices capable of protracted service over a wide range of operating voltages. A metal-ceramic avtron with a maximum operating current of 4 kA was devised. The range of avtron operating voltages runs from 0.2 to 20 kV. The device is filled with hydrogen to a pressure of 0.5 torr. 6 Refs.
Primary Keywords: Avtron; Gas Discharge Switch; Thyratron-like Behavior; Hydrogen Gas; Plasma Cathode

1164
(SWITCHES, CLOSING)
(Gas Gaps, Crossed-field)

THE TRIOTRON-A CONTROLLABLE DEVICE WITH CROSSED FIELDS

A.I. Vishnevskii, L.P. Pavlenko, A.I. Soldatenko and A.I. Shendakov
Kiev Polytechnic Institute, USSR
Instruments And Experimental Techniques, Vol. 14, No. 3, pp 847-848 (06/1971).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 165-166 (May-June 1971)
The possibility of creating a controllable gas-discharge device having a cold cathode and a constant magnetic field was shown experimentally. The ignition of the discharge between the main electrodes was determined by a positive potential applied to the control electrode. The cold cathode allowed powerful devices (10 to 20 kA) to be created which were capable of prolonged operation in the voltage range from 0.4 to 30 kV. The device was filled with H/sub 2/ up to a pressure of 1E-2 Torr. 1 Refs.
Primary Keywords: Triotron; Crossed-field Closing Switch; Electrical Starting; Low Delay

1167
(PARTICLE BEAMS, ELECTRON)
(Generation)

ACCELERATOR MODULE OF 'ANGARA-5'

S.V. Basenkov, O.A. Gusev, Ju.A. Istomin, Ju.V. Koba, G.M. Latmanizova, A.M. Pasechnikov, B.P. Pavchev, O.P. Pecherskii, A.S. Perlin, L.I. Rudakov, V.P. Smirnov, V.I. Chetvertkov and I.R. Jampol'skii
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
2nd IEEE International Pulsed Power Conference Proceedings, pp 25-30 (06/1979).
Features and design principles of the inertial confinement fusion multi-module 'Angara-5' accelerator are considered. The computed output parameters of an individual module are as follows: U=2 MeV; I=0.8 MA, 90 ns; W=102 kJ. The predicted output was compared with the pulseshaping line mock-up measurements. According to these measurements the end on section contributes 21 percent of the total pulse-shaping line capacitor in computations via transmission line sections with appropriate impedance values. The reasonable choice of the pulse-shaping equivalent circuit was confirmed by experimental data and were in good agreement with calculations based on system design features. 9 Refs.
Primary Keywords: E-beam Accelerator; High Voltage; High Power; Low Impedance; Modular Approach

1179
(BREAKDOWN STUDIES)
(Gas, Electric)

CYLINDRICAL CHANNEL IN A HIGH-CURRENT DISCHARGE IN AIR

A. Pavlovskii, G. Kanov, G. Katraev, N. Leonava and E. Smirnov
Affiliation Not Given
Soviet Physics Technical Physics, Vol. 20, No. 2, pp 182-186 (08/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 45, pp 286-293
An experimental study of high-current pulsed cylindrical discharges in air is reported. The discharge is initiated by the electrical explosion of a thin conductor; the current reaches 500 kA and the pulse lengh reaches 150 us. The system of magnetogasdynamic equations with a nonlinear thermal conductivity which describes the expansion of the discharge channel is analyzed. The results of a numerical calculation for a small magnetic Reynolds number are reported. The effects of magnetic pressure and radiation diffusion on the channel expansion velocity are analyzed. It is shown that the motion of the current boundary of the channel can be simulated by the process of heat propagation through a fixed gas. This approach is used to obtain a self-similar solution for the expansion of a high-current discharge channel. 12 Refs.
Primary Keywords: Exploding Wire; 500 Ka Peak; 150us Pulse Length; High Current Discharge Channel; Heat Propagation Model

1186
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

ELECTRICAL BREAKDOWN OF VACUUM GAPS UNDER SUPERHIGH VOLTAGE PULSES

I.I. Kalyatskii, G.M. Kassirov and G.V. Smirnov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Phys cs, Vol. 19, No. 11, pp 1424-1435 (05/1975)
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 2326-2328 (November 1974)
Experimental results are reported for electrical breakdown of centimeter vacuum gaps under superhigh voltage pulses. At distances up to 15 cm the breakdown field across the cathode is virtually constant, and the processes leading to the breakdown occur in short time intervals. In the microsecond time range the breakdown voltage is independent of the pressure and species of the residual gas. 4 Refs.
Primary Keywords: Vacuum Breakdown; Very Large Overvoltage; Low Delay; 15 cm Gap; Residual Gas Effect; Voltage Measurement

1187
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)

ELECTRICAL EXPLOSION OF FOILS. II

V.A. Burtsev, V.N. Litunovskii and V.F. Prokopenko
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 22, No. 8, pp 957-961 (08/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 1653-1661 (August 1977)
Experimental results on electrical explosions of foils in solid, liquid, and friable media are reported. The results are compared with data obtained in a study of explosions of foils in air. Synthetic quartz dust is found to be the most suitable of the media studied for use in microsecond foil current breakers. 7 Refs.
Primary Keywords: Exploding Foil; Solid Environment; Liquid Environment; Synthetic Quartz Dust; Opening Switch

1188
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)

ELECTRICAL EXPLOSION OF FOILS. I

V.A. Burtsev, V.N. Litunovskii and V.F. Prokopenko
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 22, No. 8, pp 950-956 (08/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 1642-1652 (August 1977)
The electrical explosion of plane foils is studied experimentally, and the results are used to formulate a mechanism for the operation of fast high-current foil current breakers. The explosions occur in air, so that optical methods can be used to observe the explosion process and the formation of the high-current shunt discharge. There are edge effects which result in dielectric breakdown of the gap and in the formation of discharge channels before the foil explosion is completed. The electricol measurements are discussed. These measurements confirm the effect of anomalous behavior in the explosion at high energy injection rates. 12 Refs.
Primary Keywords: Exploding Foil; Opening Switch; Air Environment; Optical Diagnostics; Edge Effects; Spark Channel

1197
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)

HIGH PULSED MAGNETIC FIELDS FOR NUCLEAR FUEL ROD SEALING

A.M. Andrianov, V.F. Demichev, G.A. Eliseev and P.A. Levit
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-10 (11/1976).
The technique and technology have been developed at the I.V. Kurchatov Institute of sealing the nuclear fuel rod claddings with high pulsed magnetic fields. The process of bonding the materials by magnetic pulsed sealing technique is of a dynamic character. A metal-to-metal bond is formed when a fuel rod cladding collapses at high impact velocities and impacts upon itself or onto a special plug. In this process the magnetic field serves as an energy source to accelerate the cladding. The sealing process is very short (some microseconds) and the metal does not melt during the process. The main problem in the pulsed magnetic technology is the development of stable coils, which could produce with a good reproduction high pulsed magnetic field intensities of which are much higher than these necessary for cold forming. A frequency must also be rather high because the fuel rod claddings are generally thin-walled and are made of low-conductivity materials (zirconium alloys). Capacitor banks are generally used as current generators for pulsed magnetic machines. To provide the high frequency of a discharge current the machine electrical circuit must be of a low inductance. Thus there are special requirements on pulsed magnetic machine units: capacitors, switches, busworks, and inductors. The shape of a discharge current in such machines is close to that of a damped sine wave. 9 Refs.
Primary Keywords: Magnetic Field; High Field; Stable Coils; High Frequency; Capacitor Bank
Secondary Keywords: Nuclear Fuel Rod Sealing

120?
(SWITCHES, CLOSING)
(Mechanical)

MULTICHANNEL HIGH-CURRENT PULSED COMMUTATOR

R.D. Ziganshin and A.P. Gagarin
Instruments And Experimental Techniques, Vol. 20, No. 2, pp 475-476 (04/1977).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 133-134 (March-April 1977)
The compact commutator described enables one of two pulsed loads to be alternately connected to a capacitor tank. The number of powerful channels of each load is 200 and the amplitude of the current through each channel during discharge is 10 kA. The commutator is convenient to operate and to service. 2 Refs.
Primary Keywords: Closing Switch; Mechanical Switch; 1.5 kJ Capacitor Bank; Two Loads; Load Switching; 1.5 ns Pulse Duration

1223
(POWER CONDITIONING)
(Pulse Forming Lines)
LOW-IMPEDANCE HIGH-VOLTAGE PULSERS FOR TRAVELLING-WAVE EXCITATION OF HIGH-POWER UV GAS LASERS
H.M. Von Bergmann and V. Hesson
Optical Sciences Div. NPRL, CSIR, Pretoria 0001, South Africa
Journal Of Physics E: Scientific Instruments, Vol. 9, pp 982-984 (11/1976).
The authors describe the design of a simple and novel travelling-wave-type pulsing system suitable for transverse discharge excitation of high-power UV gas lasers. The pulsers have been used to excite high-pressure nitrogen lasers at 337.1 nm with effective inversion lifetimes of <5 ns. The beam powers exceed 2 MW. 7 Refs.
Primary Keywords: Strip Line; PC Board; 45 kV Operating Voltage; Travelling Wave Pulser
Secondary Keywords: Gas Laser Pumping

1227
(ENERGY STORAGE, INDUCTIVE)
(Systems)
SUPERCONDUCTING INDUCTIVE ENERGY STORAGE UNIT FOR LASER PUMPING SYSTEMS
B. Vul, V. Karasik, B. Kopylovskii, G. Kurganov, V. Vysotskii, D. Pronkin, Y. Efimov and G. Agapov
Academy of Sciences of the USSR, Moscow, USSR
Soviet Journal Of Quantum Electronics, Vol. 4, No. 9, pp 1099-1101 (03 1975).
Trans. From: Kvantovaye Elektronika, Vol. 1, pp 1983-1987
A description is given of a high voltage pulsed superconducting inductive energy storage unit, intended as a power supply source for laser pumping systems. 6 Refs.
Primary Keywords: Helium Cooled Storage Element; Cryostat; Current Leads; Electrical Power Supply; Current Switching System; Gas Discharge Lamps (20kJ/pulse)

1246
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
MAGNETOOPTICAL CURRENT TRANSFORMER. 2: COMPONENTS
H. Aulich, W. Beck, N. Doukilas, H. Harms, A. Papp and H. Schneider
Siemens AG, Munchen, FRG
Applied Optics, Vol. 19, No. 22 pp. 3735-3740 (11/1980).
A general overview of the requirements for the components of the transformers is given. The optical fiber, the coil former, the light source, and the signal processing circuit are discussed in detail with a view towards actual devices that could be used. 16 Refs.
Primary Keywords: Magnetooptical Current Transformers; Components; Light Source; Signal Processing; Optical Fiber

1247
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
MAGNETOOPTICAL CURRENT TRANSFORMER. 3: MEASUREMENTS
H. Harms and A. Papp
Siemens AG, Munchen, FRG
Applied Optics, Vol. 19, No. 22 pp. 3741-3745 (11/1980).
The authors describe the magnetooptical current transformer they set up. Measurements of currents were taken over a range of 50-1200A at both room temperature and over a range of temperatures from -20 to +45 degrees celsius. At room temperature an accuracy of 0.24% was obtained, while the accuracy was somewhat less over the range of temperatures. 4 Refs.
Primary Keywords: Magnetooptical Current Transformer; Measurements; Very High Accuracy

1248
(BREAKDOWN STUDIES)
(Gas, Electrical)
ANALYSIS OF THE ANODE BOUNDARY LAYER OF HIGH INTENSITY ARCS
H.A. Dinulescu and E. Pfender
University of Minnesota, Minneapolis, MN
Journal Of Applied Physics, Vol. 51, No. 6, pp 3149-3157 (06/1980).
A one-dimensional analysis of the anode boundary layer of an atmospheric pressure, high intensity argon arc reveals substantial deviations from local thermodynamic equilibrium (LTE) in this layer. The temperature of the heavy species approaches the temperature of the anode in the immediate vicinity of the anode surface, whereas the electron temperature remains sufficiently high to ensure the required electrical conductivity. Temperature and density gradients in the anode boundary layer contribute substantially to the electric current flow so that the potential drop across the boundary layer becomes negative. The main voltage drop, which is in the order of 1 V, is essentially confined to the sheath at the bottom of the boundary layer overlying the anode surface. The thickness of this sheath is several orders of magnitude smaller than the anode boundary layer and the potential drop in the sheath is also negative. Therefore, the anode fall becomes negative for the entire parameter range covered in this paper, in contrast to the results of previous theories. This finding affects the anode energy balance as well as the interpretations of indirect (calorimetric) anode fall measurements which is important for the design of arc gas heaters. 17 Refs.
Primary Keywords: Argon Arc; Boundary Layer; Negative Potential Drop

1252
(BREAKDOWN STUDIES)
(Gas, Electrical)
MODELING OF THE ANODE CONTRACTION REGION OF HIGH INTENSITY ARCS
D.M. Chen and E. Pfender
University of Minnesota, Minneapolis, MN
IEEE TRANS PLAS SCI, Vol. PS-8, No. 3 pp. 252-259 (09/1980).
A self-consistent model for the anode contraction region of a high intensity DC arc is based on a wall stabilized axisymmetric arc operated at atmospheric pressure with a plane cooled nonablating anode perpendicular to the arc axis. Arc constrictionin front of the anode gives rise to an entrainment of cold gas from the vicinity of the anode leading to a more or less pronounced anode jet. The conservation equations for the anode region represent a set of highly nonlinear integro-differential equations which describe the temperature and the flow field in the arc. Numerical solutions of these equations are obtained by using an iterative finite-difference method. Results for a nitrogen arc at 250 A indicate that heat transfer close to the anode is dominated by the electron enthalpy transport. The cold gas approaches the arc fringes with velocities in the order of 1 m/s, and reaches velocities of up to 250 m/s in the hot core of the arc, indicating the existence of an anode jet which has been confirmed by experimental investigations. 16 Refs.
Primary Keywords: Anode Contraction Region; Anode Jet; Arc Temperature; Arc Flow Field; Self-magnetic Field
Secondary Keywords: Numerical Results; Boundary Conditions; Potential Profile

1253
(PARTICLE BEAMS, ION)
(Reviews)
NRL LIGHT ION BEAM RESEARCH FOR INERTIAL CONFINEMENT FUSION
G. Cooperstein, S.A. Goldstein, D. Mosher, R.J. Barker, J.R. Boller, D.G. Colombant, A. Drobot, R.A. Meger, W.F. Oliphant, P.F. Ottinger, F.L. Sandel, S.J. Stephanakis and F.C. Young
Naval Research Lab, Washington, DC 20375
NRL Memorandum Report No. 4387 (11/1980).
Availability: AD A092471
NTIS
There is presently great interest in using light ion beams to drive thermonuclear pellets. Terrawatt-level ion beams have been efficiently produced using conventional pulsed power generators at Sandia Laboratory with magnetically-insulated ion diodes and at the Naval Research Laboratory with pinch-reflex ion diodes. Both laboratories have recently focused ion beams to pellet dimensions. This paper reviews recent advances made at NRL in the area of ion production with pinch-reflex diodes, and in the areas of beam focusing and transport. In addition, modular generator and beam requirements for pellet ignition systems are reviewed and compared with the latest experimental results. These results include the following: (1) production of greater than 100 kJ proton and deuteron beams with peak ion powers approaching 2 TW on the PITHON generator in collaboration with Physics International Co., (2) focusing of 0.5 TW deuteron beams produced on the NRL Gamble II generator to current densities of about 300 kA/sq. cm., and (3) efficient transport of 100 kA level ion beams over 1 meter distances using Z-discharge plasma channels. 28 Refs.
Primary Keywords: Intense Light Ion Beams; Ion Beam Focusing; Ion Beam Transport
Secondary Keywords: Inertial Confinement Fusion; Charged Particle Beam Fusion

1255
(PARTICLE BEAMS, ELECTRON)
(Target Interactions)
RADIATION FROM RELATIVISTIC ELECTRONS IN A MAGNETIC WIGGLER
A.N. Didenko, A.V. Kozhevnikov, A.F. Medvedev, M.M. Nikitin and V.Ya. Epp
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics JETP, Vol. 49, No. 6, pp 973-979 (06/1979).
Trans. From: Zh. Eksp. Teor. Fiz. 76, 1919-1932 (June 1979)
The spectral and polarization properties of wiggler radiation of relativistic electrons have been investigated theoretically and experimentaly as a function of angle in the optical region of the spectrum for motion of the electrons in a plane magnetic wiggler installed in the ring of an electron synchrotron. The properties of the first and second harmonics of the radiation are discussed. It is shown that the polarization-angular characteristics of the first harmonic of the wiggler radiation coincide with those of instantaneous synchrotron radiation: the influence of longitudinal oscillations of the electron in the wiggler on the polarization properties of the second harmonic radiation is also shown. The appreciable influence of the angular spread of the electrons in the beam on the spectral-angular distribution of the wiggler radiation is established experimentally. The good agreement of the experimental results with the theory opens up the possibility of further use of wiggler radiation for solution of a wide range of scientific and applied problems. 32 Refs.
Primary Keywords: Relativistic E-beam; Magnetic Wiggler; Spectral Properties, Polarization; Theory; Experiment

1257
(DIAGNOSTICS AND INSTRUMENTATION)
(Data Transmission)
DEMONSTRATION OF FIBER OPTIC LINK APPLICATIONS IN UTILITY PLANT MULTIPLEXED INSTRUMENT AND CONTROL SYSTEMS
W.D. Redus, G.R. Craig and W.J.B. Oldham
E-Systems, Inc., Greenville, TX 75401
EPRI Report No. EPRI NP-1322 (01/1980).
Availability: EPRI NP-1322
EPRI
The application of data transmission via fiber optic cables has been demonstrated for a utility plant instrumentation system at the Bergen Generating Station operated by Public Service Electric and Gas Company (PSE&G) of Newark, N.J. The fiber optic system (FOS) was designed, fabricated, and tested by E-Systems, Inc., Greenville Division, located in Greenville, Texas, using commercially available components. Plastic fiber optic cables were evaluated for short run applications up to 140 feet and glass fiber optic cables were evaluated for long run applications up to 1330 feet. The FOS and fiber optic cables were installed, operated and maintained by PSE&G's technicians under the management of PSE&G with technical input from E-Systems, Inc. The demonstration was conducted over a ten month period.
Primary Keywords: Fiber Optics; Instrumentation; Control; Electromagnetic Interference; Multiplex

1258
(ENERGY CONVERSION, THERMAL)
(Magnetohydrodynamic)
HIGH POWER MAGNETOHYDRODYNAMIC SYSTEM (VOL II)
D.W. Swallom, O.K. Sonju, D.E. Meader and H. Becker
Maxwell Labs Inc, Woburn, MA 01801
AFAPL Report No. AFAPL-TR-78-51 (07/1978).
Availability: AD A064435
NTIS

The technical effort discussed in this report covers Phase B of the High Power Magnetohydrodynamic System program, which is a multi-phase program to develop liquid oxygen/liquid hydrocarbon magnetohydrodynamic generators using cesium seed for high performance, portable power supply applications. During this phase a lightweight, high performance hot gas flow train using liquid oxygen and JP-4 was designed and component modeling completed. The magnetohydrodynamic channel/diffuser performance parameters which were used as the design criteria were an output power of 30 MWe, a specific energy extraction of 1.0 MJ/kg, and a specific power density of 200 MWe/cu.m. To achieve these performance requirements, the required characteristic velocity efficiency of the combustion system was greater than 99%. During this program a limited amount of development testing was completed using a heat sink combustor and a diagnostics channel. These tests measured the combustor characteristic velocity efficiency and the gas electrical conductivity, as well as pressures, vibrations, and temperatures. The results of the development test program, which verified the design assumptions used to achieve the performance requirements, were a characteristic velocity efficiency of nearly 99% and a gas electrical conductivity at the magnetohydrodynamic channel inlet of 15 mhos/m. 53 Refs.

Primary Keywords: Portable Power Supplies; MHD Generators; Fast Start Power Supplies; Compact MHD Generator; Burst Power Supplies; High Performance MHD Generator; Flightweight MHD; Lightweight Megawatt Power Supplies; Cesium Seeding of MHD Gases; JP-4 Fueled MHD

1259
(ENERGY CONVERSION, THERMAL)
(Magnetohydrodynamic)
HIGH POWER MAGNETOHYDRODYNAMIC SYSTEM (VOL I)
D.W. Swallom, O.K. Sonju, D.E. Meader and H. Becker
Maxwell Labs Inc, Woburn, MA 01801
AFAPL Report No. AFAPL-TR-78-51 (07/1978).
Availability: AD A064796
NTIS

The technical effort discussed in this report covers phase B of the High Power Magnetohydrodynamic System program, which is a multi-phase program to develop liquid oxygen/liquid hydrocarbon magnetohydrodynamic generators using cesium seed for high performance, portable power supply applications. During this phase a lightweight, high performance hot gas flow train using liquid oxygen and JP-4 was designed and component modeling completed. The magnetohydrodynamic channel/diffuser performance parameters which were used as the design criteria were an output power of 30 MWe, a specific energy extraction of 1.0 MJ/kg, and a specific power density of 200 MWe/cu. m. To achieve these performance requirements, the required characteristic velocity efficiency of the combustion system was greater than 99%. During this program, a limited amount of development testing was completed using a heat sink combustor and a diagnostics channel. These tests measured the combustor characteristic velocity efficiency and the gas electrical conductivity, as well as pressures, vibrations, and temperatures. The results of the development test program, which verified the design assumptions used to achieve the performance requirements, were a characteristic velocity efficiency of nearly 99% and a gas electrical conductivity at the magnetohydrodynamic channel inlet of 15 mhos/m. 58 Refs.

Primary Keywords: Portable Power Supplies; MHD Generators; Fast Start Power Supplies; Compact MHD Generator; Burst Power Supplies; High Performance MHD Generator; Lightweight Megawatt Power Supplies; Cesium Seeding Of MHD Gases; JP-4 Fueled MHD

1260
(SWITCHES, CLOSING)
(CLASS)
LIGHT-FIRED THYRISTOR DEVELOPMENT
E.S. Schlegel, E.C. Strycula and L.R. Lowry
Westinghouse Electric Corp, Pittsburgh PA
EPRI Report No. EPRI EL-1916 (07/1981).
Availability: EPRI EL-1916
EPRI

A light-fired thyristor switch was demonstrated in one phase of a static volts-amperes-reactive generator and is presently under extended test at Minnesota Power and Light Company. The building of this 13.8-kV, bidirectional, 1200-A rms, solid-state switch required the development of the thyristor element and its special package, a light system consisting of laser diodes and a light distribution harness, and a special monitoring and protecting control circuit to protect the switch against various conditions under which it might not function safely. The switch is entirely self-contained and replaces the electrically gated version with no need for changes in the circuit to which it is connected. The report gives details on the development of each of the novel parts of the systems: on the testing of each part of the system; and on the building, installation, and early evaluation of the switch. 0 Refs.

Primary Keywords: Thyristor; Optical Triggering; Bidirectional; Performance Test

1261
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Liquid; Liquid, Electrical)
HIGH-VOLTAGE OIL GAP TESTS USING PARALLEL-PLANE ELECTRODES
T.K. Sloat, W.J. Carter and H.R. Moore
Westinghouse Electric Corp, Sharon, PA 16146
EPRI Report No. EPRI EL-1301 (12/1979).
Availability: EPRI EL-1301
EPRI

A paraffinic-base insulating oil, PB, and a naphthenic-base insulating oil, NH, were evaluated using two electrode systems. The uniform field electrodes represented a method to easily test relatively large volumes of oil and showed the paraffinic-base oil, PB, had somewhat lower breakdown voltages on both 60-Hz tests and 1.2-X 50-microsecond impulse voltage tests. The rod to plane electrode system represented a more practical configuration that may occur in oil insulated apparatus and showed there was no substantial difference between the oils on the 60-Hz tests. The impulse tests on the rod to plane test showed the paraffinic-base oil had a higher dielectric strength than the naphthenic-base oil. The routine daily dielectric breakdown voltage tests using ASTM D1816 showed the paraffinic-base oil had a higher dielectric strength than the naphthenic-base oil. Since the uniform field tests made with larger volumes of oil indicated a possible weakness in the paraffinic-base insulating oil, it is not acceptable for use in electrical apparatus. 0 Refs.

Primary Keywords: Oil; Paraffinic; Transformers; Naphthenic; Breakdown Strength
Secondary Keywords: Circuit Breakers

1263
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
A 10 KW LIGHTWEIGHT DC CONVERTER (TECHNOLOGY FEASIBILITY STUDY FOR LIGHTWEIGHT MEGAWATT RANGE CONVERTERS)
F.C. Schwarz
Power Electronics Associates, Inc., Lincoln, MA 01773
AFAPL Report No. AFAPL-TR-77-45 (11/1977).
Availability: AD A049937
NTIS

The technology for an ultra-reliable, lightweight, high power DC converter is presented and supported by test data of a small 10 kW feasibility model. Reliability and a high efficiency near 97 percent are derived from a process of natural current commutation of fast switching thyristors in series resonant circuits. Lightweight is the result of an internal frequency near 10 kHz. The feasibility of 150 kW single modules with one set of thyristors is indicated. The salient features of this converter technology are highlighted. 17 Refs.

Primary Keywords: 10kW, 100kW, Submegawatt, Megawatt; High Voltage DC Supply; Natural Current Commutation; Series Resonant Circuit Power Converter; High Power Conditioner; Power Converters; Highly Reliable; Secondary Current Source

1264
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
DEVELOPMENT OF LIGHTWEIGHT TRANSFORMERS FOR AIRBORNE POWER SUPPLIES
J.P. Welsh
Thermal Technology Lab, Inc., Buffalo, NY
AFAPL Report No. AFAPL-TR-79-2049 (06/1979).
Availability: AD A076245
NTIS

Emphasis on this program was on the development of high voltage, high power, high frequency, low specific weight, inverter transformers. A primary intent was on the reduction of specific weight without sacrifice of either electrical performance or reliability. Research was conducted into the characteristics of magnetic and dielectric materials, improved magnetic circuit modeling, and application of advanced heat transfer techniques. Computer-aided design methods were utilized and specialized programs were developed to permit extensive manipulation of multiple design parameters. One goal, to achieve a specific weight of 0.25 lb/KVA, was exceeded. A specific weight of about 0.10 lb/KVA was actually accomplished with a 200 KVA transformer. It is predicted that in larger transformer sizes, specific weights of 0.07 lb/KVA can be realized. The other goals of electrical performance and reliability were also achieved. The inverter transformers developed in this program exhibited unusually low leakage inductance and high efficiency. Higher reliability than conventional transformers should also be realized due to much lower operating temperatures (ie: lower thermal stress) on conductors and insulation. The program has been successfully concluded and two basic transformer/rectifier unit designs (two each at 10 KW and 200 KW) were fabricated, demonstrated and delivered. 10 Refs.

Primary Keywords: Low Specific Weight Transformers; High Energy Density Transformers; Inverter Transformers; High Frequency Transformers
Secondary Keywords: Airborne Transformers; Lightweight Transformers

1265
(BREAKDOWN STUDIES)
(Gas, Optical)
A CW X-RAY PREIONIZER FOR HIGH-REPETITION-RATE GAS LASERS
T. Arai, M. Obara and T. Fujioka
Keio University, Kohoku-ku, Yokohama-shi, Japan
APPL PHYS LETT, Vol. 36, No. 4 pp. 235-237 (02/1980).

Operation of a cw x-ray preionizer for an HF laser is reported. An industrial x-ray tube was used to introduce soft x-rays into a laser chamber. Arcing was seen to be suppressed by the cw x-ray preionizer. The advantages of the cw preionizer over a flash preionizer are discussed, along with the possibe application of a cw preionizer to high repetition rate lasers. 10 Refs.

Primary Keywords: X-ray Preionization; Continuous Wave
Secondary Keywords: KrF Laser; High Rep-rate

1266
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
ELECTRONIC CURRENT TRANSDUCER (ECT) FOR HIGH-VOLTAGE DC LINES
J.M. Houston, P.H. Peters Jr, H.R. Summerhaves Jr, G.J. Carlson and A.M. Itani
General Electric Co, Schenectady, NY 12301
EPRI Report No. EPRI EL-1343 (02/1980).
Availability: EPRI EL-1343
EPRI
This report deals with the development of a bipolar electronic current transducer (ECT) for measuring the current in a high-voltage DC (HVDC) power line at line potential. The design and construction of a free-standing ECT for use on a 400-kV line having a nominal line current of 2000 A (1 pu) is described. Line current is measured by a 0.0001 ohm shunt whose voltage output is sampled by a 16-bit digital data link. The high-voltage interface between line and ground is traversed by optical fibers which carry digital light signals as far as 300 m to a control room where the digital signal is converted back to an analog representation of the shunt voltage. The redundant electronic and optical data links are used in the prototype. Specification goals called for operation over the temperature range -40 to +50 Deg. C to an output accuracy of -+0.6% at 0.1 pu and -+0.3% between 0.3 pu and 1.0 pu. A frequency response greater than 370 Hz and a step response time of less than 2 ms was desired. Initial tests indicate that these goals have been met in the prototype structure. The unit is now installed and being evaluated at the Sylmar converter station of the HVDC Pacific Intertie in California. 0 Refs.
Primary Keywords: HVDC; Electronic Transducer; Current Measurement; Fiber Optic Link
Secondary Keywords: Current Transducer

1267
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Gas Recovery; Mechanical)
FUNDAMENTAL INVESTIGATION OF ARC INTERRUPTION IN GAS FLOWS
D.M. Benenson (1), G. Friend (2), R.E. Kinsinger (2), H.T. Nagamatsu (2), H.O. Noeske (2) and R.S. Sheer Jr (2)
(1) State University of New York at Buffalo, Buffalo, NY 14226
(2) General Electric Co, Schenectady, NY 12301
EPRI Report No. EPRI EL-1455 (07/1980).
Availability: EPRI EL-1455
EPRI
The document reports on continuation of the study of thermal recovery in gas blast interrupters reported earlier in EPRI Report EL-284. The thermal recovery process was investigated with physical and aerodynamic methods, typically using reduced size nozzles and short sinusoidal current pulses. Current-zero dI/dt and gas pressures were representative of full-size interrupters. Aerodynamic characterization of the cold flow fields in several different nozzle types included measurements of the pressure and flow fields, both steady-state and turbulent components, with special attention given to wakes and shock structures. Special schlieren techniques on DC arcs and high-speed photography on arcs in orifice nozzles show that shock heating broadens the arc independent of turbulence effects and producing a poorly recovering downstream arc section. Measured recovery speeds (RRRV) in both orifice and convergent-divergent nozzles agree with predictions of several arc theories assuming turbulent power losses. However, data on post-zero currents and power loss show values much smaller than theoretical predictions. Hydrogen, deuterium, and methane (CH/sub 4/) were measured to have thermal recovery speeds up to one hundred times that of SF/sub 6/ in the same conditions. Mixtures of AF/sub 6/ with CF/sub 4/, C/sub 2/ F/sub 6/, He, or N/sub 2/ can give fast thermal recovery when used at high total pressure but moderate SF/sub 6/ content. 21 Refs.
Primary Keywords: SF/sub 6/; Thermal Recovery
Secondary Keywords: Circuit Breakers; Gas-Blast Interrupters

1269
(DIAGNOSTICS AND INSTRUMENTATION)
(Miscellaneous)
SF/SUB 6/ DIELECTRIC FILL GAS GAUGE
R. Bell, R. Hickstead, J. Vanvliet and M. Bertin
Nucleonic Data Systems Inc, Irvine, CA 92714
EPRI Report No. EPRI EL-747 (04/1978).
Availability: EPRI EL-747
EPRI
The use of SF/sub 6/ gas-insulated equipment in substations is gaining wide acceptance. For reliable operation of this type of equipment, it is important that the gas density be maintained within design limits and that the gas not be contaminated. It is therefore of interest to have a gauge that can be used for continuous monitoring of the gas. Such a gauge should be able to detect leaks in excess of 1-2% per year as well as detect gas contaminants of significant levels. This project has shown that it is feasible to directly measure the density of the SF/sub 6/ gas, as well as measure the gas humidity. The prototype gauge, however, is rather complex and most likely would be more expensive than the conventional pressure gauges. The experimental gauge that has been developed uses the infrared absorption characteristics of the gases. A wavelength is chosen where the monitored gas absorbs strongly, but where interference from other gases is minimal. The photon absorption is approximately proportional to the density of the gas, which is also proportional to the dielectric strength of the gas. 24 Refs.
Primary Keywords: Photo-optic Pressure Gauge For SF/Sub 6/ Gas; Infrared Light Absorption For SF/Sub 6/ Gas; Infrared Light Absorption Of Water Vapor; Infrared Light Absorption Of SF/Sub 6/ Gas Decomposition Products

1271
(BREAKDOWN STUDIES)
(Surface Flashover)
MECHANISM OF FAST SURFACE FLASHOVER IN VACUUM
R.A. Anderson
Sandia Labs, Albuquerque, NM 87115
Applied Physics Letters, Vol. 24, No. 2 pp. 56-56 (08/1973).
Insulator samples of Plexiglas and alumina ceramic in vacuum have been subjected to high-voltage pulses with rise times of a few nanoseconds. Breakdown paths were inclined to the electric field in the presence of a magnetic field normal to the insulator surface, analogous to the Hall effect for bulk conduction. These results, as well as measurements of the flashover propagation velocity, strongly support a model of the flashover mechanism based on secondary electron emission. 9 Refs.
Primary Keywords: Surface Flashover; Vacuum; Plexiglass; Alumina Ceramic; Short Pulse Flashover; Secondary Electron Emission

1272
(PARTICLE BEAMS, ION; PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, NEUTRAL; POWER TRANSMISSION; ENERGY STORAGE, CAPACITIVE)
(Reviews; Reviews, Reviews; Transmission Lines; Marx Generators)
PARTICLE BEAM FUSION PROGRESS REPORT OCTOBER 1977 THROUGH MARCH 1978
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND79-0002 (02/1979).
Availability: SAND79-0002
NTIS
Important data showing the transport of electrical power in the terawatt range over 6.5 meters with a power transport efficiency of 100 percent and an energy transport efficiency of 90 percent were obtained. These results were required for EBFA and demonstrated the feasibility of the vacuum interface, magnetically insulated line, and diode concept. The results exceeded expectations and provided a 2 ns rise from zero to peak of a 0.4 MA current. Magnetically insulated power flow densities exceeding 1E11 W/sq.cm. were achieved over shorter distances. These results indicate that a much smaller beam drift distance to the pellet could be possible. Although about 50 percent of the electron current flows external to the conductor boundary during the 6.5 meter transport, all of the current was recaptured and most was focused to a few mm spot during these experiments. 23 Refs.
Primary Keywords: Pulse Forming Lines; Marx Generator
Secondary Keywords: Trigatron Switch; Intermediate Storage Capacitor; Gas Pressure Transducer

1273
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
APPLICATION OF GENERATOR ANALYSIS METHODS
R. Kuhler
University of Kentucky, Lexington, KY 40506
AFAPL Report No. AFAPL-TR-77-31 (04/1977).
Availability: AD A042071
NTIS
This study provides a theoretical model for simulating a wide variety of transient loading conditions for alternators. The model is represented as an equivalent circuit in a format compatible with the SCEPTRE computer program. SCEPTRE solves the resulting circuit equations for the transient response. Also addressed in this study is the inclusion of an effective saturation property into the SCEPTRE formulation resulting in a more realistic, and accurate nonlinear machine model. 2 Refs.
Primary Keywords: SCEPTRE Simulation; Alternator Modeling; Saturation Effects; Linear Machine Model

1274
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
DEVELOPMENT OF LIGHTWEIGHT TRANSFORMERS FOR AIRBORNE HIGH POWER SUPPLIES
D.L. Lockwood, R.I. McNall Jr. and R.L. Haumesser
Thermal Technology Lab, Inc., Buffalo, NY
AFAPL Report No. AFAPL-TR-76-102 (12/1976).
Availability: AD A041515
NTIS
Several major developments have occurred in this program. As is often the case in research, they did not occur exactly in accordance with the original plan. The total program however is essentially on schedule. New techniques for fabrication of pie wound transformers were developed which yielded superior designs. This development was followed by the development of computer aided design programs for pie wound transformers. Several 10 KW transformers have been fabricated and subjected to a variety of tests. Based on the results of these tests both the 10 KW and 200 KW transformers will be pie rather than layer wound. A 10 KW transformer rectifier system is presently being integrated with a breadboard inverter for final verification. During thefirst half of this program, a numerical method was developed for the solution of the nonlinear lumped parameter transformer model. This model was developed under the previous contract, but no stable solution had been found. The present solution is f or a resistive load and work is continuing to include leakage inductance, shunt capacitance, and an arbitrary load impedance. The materials studies support of the 200 KW transformer task are completed with exception of evaluation of some of the newerflourine based dielectric fluids. Preliminary designs indicate specific weights in the neighborhood of 0.05 lb/KVA for these transformers. 9 Refs.
Primary Keywords: Low Specific Weight Transformers; High Voltage, High Power Transformers; High Energy Density Transformers
Secondary Keywords: Airborne Transfomers; Lightweight Transformers

1275
(ENERGY STORAGE, INDUCTIVE)
(Inductors)
INDUCTOR NETWORK DEVELOPMENT FOR AIRCRAFT HIGH POWER SUPPLIES
J. Teno, R.L. Bryan, S. Ghoshroy, L.M. Lontai and O.K. Sonju
Maxwell Labs Inc, Woburn, MA 01801
AFAPL Report No. AFAPL-TR-77-15 (04/1977).
Availability: AD A052750
NTIS
This report presents the results of a study program undertaken to perform a comparative analysis of several approaches to the generation of high electrical power by storing tens to hundreds of kilojoules of energy in a compact, superconducting inductive system with efficient extraction in short bursts at high repetition rates. The critical factors for the comparison were the weight, volume, dissipation and reliability of the system and components for various operating regimes characterized by pulse power, repetition rate and pulse shape. Research and development work hitherto undertaken in the U.S. and abroad indicate the engineering feasibility of operating inductive storage systems storing ten to perhaps one hundred kilojoules of energy with extraction rates of tens of pulses per second at pulse durations of the order of a few hundred microseconds with state-of-the-art technology. The major effort of this study was directed towards developing analytical tools to predict the performance of superconducting coils at repetition rates of 100 -1000 pps with pulse discharge times of 20 - 40 microseconds and to evaluate the relative merits of different circuit configurations for storage and extraction of energy at high average power (3 - 10 MW). 0 Refs.
Primary Keywords: Inductive Energy Storage; Superconductivity; Pulsed Power
Secondary Keywords: Power Conditioning

1277
(REVIEWS AND CONFERENCES; POWER CONDITIONING; SWITCHES, CLOSING; SWITCHES, OPENING; POWER TRANSMISSION; ENERGY STORAGE, MECHANICAL; ENERGY STORAGE, CAPACITIVE; ENERGY STORAGE, INDUCTIVE; PULSE GENERATORS)
(Reviews; Reviews; Reviews; Reviews; Reviews; Reviews; Reviews; Reviews; Reviews)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 1: INTRODUCTION TO POWER CONDITIONING SYSTEMS

W.J. Sarjeant
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. LA-UR-80-515 (10/1980).
Availability: LA-UR-80-515
LASL

This lecture provides a definition and tutorial overview of power conditioning systems. Many specific examples of energy storage systems are discussed, along with pulse forming techniques. Definitions are given for several pulse parameters with justification for each included. Problems with pulse shaping, ringing, crosstalk, and switch recovery are discussed. Several types of switches are discussed, including ignitrons, thyratrons, and spark gaps, as well as hard tube switches and power conditioning systems. Pulse transformers are also briefly discussed. This lecture is designed as an introduction to the series, with most topics discussed in greater detail in other lectures. 3 Refs.
Primary Keywords: Ignitron; Thyratron; Spark Gap; Pulse Forming Network; Rep Rated; Hard Tube; Pulse Transformer
Secondary Keywords: Charging Curcuit; Overshoot; Peak Power; Loads

1278
(ENERGY CONVERSION, ELECTRICAL; PULSE GENERATORS; INSULATION, MATERIAL)
(Power Supplies; Hard-tube; Reviews)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 2: DC POWER SUPPLIES AND HARD-TUBE POWER CONDITIONING SYSTEMS

W.J. Sarjeant
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. LA-UR-80-515 (10/1980).
Availability: LA-UR-80-515
LASL

This lecture discusses the major characteristics of DC power supplies and hard-tube pulsers. Full-wave bridge rectifier circuits are discussed in detail, with a complete analysis of operation presented. Design criteria pertaining to high voltage diode stacks are presented with a summary of pitfalls inherent to the stacks included. Insulation for these high voltage supplies is discussed. A detailed conceptual discussion of hard-tube pulsers is also presented with a brief mathematical analysis included. 8 Refs.
Primary Keywords: Power Supply; Hard-tube Pulser; Rectifier Circuit; Diode Stack
Secondary Keywords: Insulation; Transformer; Filter; Multi-phase

1279
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS; PULSE GENERATORS; PULSE GENERATORS)
(Marx Generators; Marx; Blumlein Lines; Field Reversal)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 3: PULSE VOLTAGE CIRCUITS

W.L. Willis
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. LA-UR-80-2082 (10/1980).
Availability: LA-UR-80-2082
LASL

The author presents a detailed conceptual discussion of Marx generators, blumleins, and spiral generators with a detailed quantitative discussion of Marx generators included. Several types of Marx generator are discussed, including the Erwin and Martin type generators. Inversion generators, wrapped line generators, and coaxial generators are discussed as sub-topics. Many practical applications are discussed. 8 Refs.
Primary Keywords: Marx Generator; Blumlein; Folded Co-ax Blumlein; Spiral Generator; Design Considerations; Erwin Marx; Martin Marx
Secondary Keywords: Inversion Generator; Wrapped Line Generator; Coaxial Generator; Charging Methods

1280
(POWER CONDITIONING; ENERGY STORAGE, CAPACITIVE)
(Pulse Forming Networks; Capacitors)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 4: TRANSMISSION LINES AND CAPACITORS

R.R. Butcher
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. LA-UR-79-1044 (10/1980).
Availability: LA-UR-79-1044
LASL

Lecture 4 begins with a detailed analysis of transmission lines used as pulse forming networks (PFN's) and proceeds to analyze and discuss lumped PFN's. Extensive quantitative analysis is presented with practical considerations included. Type A, B, C, D, E, and F Guillemin networks are discussed with a quantitative analysis of type C networks presented in depth. Capacitors are mentioned briefly with emphasis on parasitic inductance and its effect. An appendix by W.J. Sarjeant is included which presents a qualitative and quantitative analysis of energy storage capacitors. Basic capacitor parameters are discussed, leading into a discussion of parasitic inductance, environmental considerations, and lifetime. Construction materials are discussedin some detail. 17 Refs.
Primary Keywords: Transmission Line; Guilleman Network; Mathematical Analysis; Waveform; Capacitor
Secondary Keywords: Practical Considerations; Corona; Leakage Inductance; Leakage Capacitance

1281
(SWITCHES, CLOSING; POWER CONDITIONING)
(Applications; Pulse Forming Networks)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 5: DISCHARGE CIRCUITS AND LOADS

W.J. Sarjeant
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. LA-UR-80-2771 (10/1980).
Availability: LA-UR-80-2771
LASL

This lecture discusses, qualitatively and quantitatively, the design and operation of pulse forming networks. Choice of switches to use is discussed, along with the choice of capacitors and other components. A detailed discussion of practical problems, such as load faults, voltage reversal at the end of the discharge, and varying load impedance, is presented. The main characteristics of spark gaps, ignitrons, thyratrons, and thyristors are described and related to application in PFN's. A brief analysis is presented for pulse transformers with design criteria included. Several types of laser loads are described and characterized. Several specific applications are presented. 11 Refs.
Primary Keywords: Pulse Forming Network; Spark Gap; Thyratron; Ignitron; Thyristor; Pulse Transformer; Design Criteria; Practical Considerations
Secondary Keywords: Voltage Reversal; Time Varying Load; Laser Pumping

1282
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Reviews; Gas Gaps, Materials)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 6: SPARK GAPS

W.L. Willis
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. LA-UR-80-634 (10/1980).
Availability: LA-UR-80-634
LASL

This lecture deals in some detail with breakdown of gases and goes on to relate breakdown mechanisms to spark gap performance. Self-break gaps, electronically triggered gaps, and optically triggered gaps are discussed in some detail, with a beam triggered gaps mentioned. Formulas abound for determination of spark gap performance as a function of materials and operating parameters. A field enhancement factor is defined and used to calculate the breakdown voltage of several gap configurations, andthe breakdown voltage is related to the Paschen curve. The merits of various triggering methods are discussed. Liquid and solid dielectric gaps are discussed qualitatively with some quantitative analysis included. 7 Refs.
Primary Keywords: Spark Gap; Gas Breakdown; Self-break; Triggering; Recovery; Erosion; Paschen Curve
Secondary Keywords: Liquid Dielectric; Solid Dielectric

1283
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Thyratrons; Ignitrons)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 7: THYRATRONS AND IGNITRONS

W.J. Sarjeant
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. LA-UR-80-517 (10/1981).
Availability: LA-UR-80-517
LASL

Lecture 7 begins with a conceptual description of thyratrons and ignitrons and proceeds to describe construction and operation of thyratrons and ignitrons in detail. Triggering, charging techniques, and biasing of thyratrons and ignitrons are considered; as are applications and limitations of both devices. Several practical circuits are presented and discussed. The types of thyratrons and ignitrons available are presented and the merits of each are discussed. The state of the art in current thyratron technology is presented, as well as the devices under development for the near future. A compendum of information assembled from manufacturers' data sheets and literature on the theory and application of thyratrons is included as an appendix. 34 Refs.
Primary Keywords: Thyratron, Ignitron; Theory; Application; State-of-the-art; Devices Under Development; Trigger Circuit; Recovery Time
Secondary Keywords: Charging Circuit; Delay; Recovery Mechanism

1284
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 8: CHARGING CIRCUITS

W.C. Nunnally
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. LA-UR-80-2044 (10/1980).
Availability: LA-UR-80-2044
LASL

Lecture 8 of the series compliments Lecture 1 by discussing the AC portion of power supplies. Advantages and disadvantages of multi-phase circuits are discussed with design criteria presented. Voltage ramp, monocyclic constant current, constant power,and saturable reactor charging systems are presented and analyzed, as well as standard charging power supplies. Criteria are presented on choosing a diode stack and the pitfalls of choosing incorrectly. Several snubber circuits are presented and analyzed in detail. Resonant charging systems are discussed. 11 Refs.
Primary Keywords: Power Supply; Voltage Ramp Power Supply, Monocyclic Constant Current Power Supply; Constant Power Power Supply; Saturable Reactor Power Supply; Resonant Charging Power Supply; Choice Of Components; Snubber
Secondary Keywords: Diode Stack

1285
(POWER CONDITIONING)
(Pulse Transformers)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 9: PULSE TRANSFORMERS AND DIELECTRICS

G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND80-0451 (10/1980).
Availability: SAND80-0451
SANDIA

Lecture 9 is a comprehensive review and tutorial on air core pulse transformer design. Helical wound and spiral strip transformers are discussed with design criteria presented. Insulation requirements and voltage grading techniques are analyzed with electrostatic shielding included. The effect of shielding on transformer efficiency and methods of minimizing these effects are analyzed. Dielectric properties and several breakdown models for n-Hexane, Mylar, and various oils are presented and discussed. Results of partial discharges are demonstrated. Voltage stress profiles in two-dielectric insulator configurations are discussed briefly. 32 Refs.
Primary Keywords: Air Core Transformer; Helocal Wire Transformer; Spiral Strip Transformer; FRIZZ; Helical Transformer; Equivalent Circuit; Eddy Current; Electrostatic Shield, Breakdown Model
Secondary Keywords: Pulse Breakdown; Mylar Film; Breakdown Strength; Conductive Liquid Shield

1286
(DIAGNOSTICS AND INSTRUMENTATION)
(Reviews)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY: LECTURE 10: MEASUREMENT TECHNIQUES

W.L. Willis
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. LA-UR-80-2272 (10/1980)
Availability: LA-UR-80-2272
LASL

In Lecture 10, various voltage and current diagnostic techniques are discussed. Spark gaps, capacitive dividers, resistive dividers, and combinations of capacitive and resistive dividers are discussed as voltage diagnostics for high voltage circuits.Electrostatic voltmeters are presented for slowly varying and DC circuits. Kerr cells are discussed as an alternative for very fast measurements. Current measurements are discussed in the form of current viewing resistors, Rogowski loops, current transformers, Hall effect probes, and Townsend rotation probes. Several good references are included. 5 Refs.
Primary Keywords: Voltage Measurement; Current Measurement; Spark Gap; Electrostatic Voltmeter; Capacitive Divider; Resistive Divider; Mixed Divider; Current Viewing Resistor; Rogowski Loop; Current Transformer; Hall Effect Probe
Secondary Keywords: Electro-Optic Effect; Townsend Rotation

1287
(DIAGNOSTICS AND INSTRUMENTATION)
(Reviews)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY: LECTURE 11: PARTICULAR APPLICATIONS

R.P. Butcher
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. LA-UR-80-3506 (12/1980)
Availability: LA-UR-80-3506
LASL

Lecture 11 applies some of the techniques presented in Lecture 10 to determine voltage and current waveforms for a laser load driven by a transmission line pulse forming network (PFN). Lecture 11 then expands upon these measured quantities to derive values for instantaneous power delivered to the load, real power dissipated in the load, total energy delivered to the load, and time varying load impedance. The values are compared to a computer simulation of the circuit and agreement is seen to be good. 2 Refs.
Primary Keywords: Discharge Circuit; Circuit Operation; Voltage Measurement, Current Measurement, Peak Power, varying load impedance
Secondary Keywords: Laser Load

1288
(REVIEWS AND CONFERENCES: ENERGY STORAGE, POWER TRANSMISSION)
(Reviews, Systems, Systems)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY, LECTURE 13 GROUNDING AND SHIELDING TECHNIQUES

T.P. Burkes
Texas Tech University, Lubbock, TX 79409
LASL Report No. LA-UR-80-3330 (10/1980).
Availability: LA-UR-80-3330
LASL

Lecture 13 pertains to grounding and shielding techniques for pulse power applications. The author discusses grounding techniques for personnel safety, power flow, and instrumentation. The merits of series grounding, parallel grounding, and single-point grounding are discussed. The advantages of a ground plane are presented, along with some of the pitfalls of utilyzing a ground plane improperly. Electrostatic shielding of instrumentation cables is presented with a discussion of stray capacitancecoupling included. Magnetic shielding is discussed briefly. 5 Refs.
Primary Keywords: Electrostatic Shield; Magnetic Shield, Grounding Techniques; Safety Ground, Power Ground, Instrumentation Ground
Secondary Keywords: Ground Loop; Humidity Effects; Voltage Gradient, Low Frequency Noise

1289
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Gas, Electrical; Gas)
INVESTIGATION OF HIGH-VOLTAGE PARTICLE-INITIATED BREAKDOWN IN GAS-INSULATED SYSTEMS

R. E. Wootton
Westinghouse Electric Corp, Pittsburgh PA
EPRI Report No. EL-1007 (03/1979)
Availability: EPRI EL-1007
EPRI

This report describes an experimental and theoretical study of the processes involved in electrical breakdown in compressed gases, where the breakdown is initiated by conducting particles. The report contains a great deal of detailed quantitative data relating to particle initiated breakdown in large coaxial and uniform electrode systems at voltages of several hundred kV. One finding of interest involves the demonstration that there is a critical particle-to-electrode spacing at the instant of breakdown in SF/sub 6/ at gas pressures typically used in practical power transmission equipment. The variation of this critical spacing with SF/sub 6/ gas pressure has been determined and the results are reported. The statistical nature of particle initiated breakdown has also been studied and the effects of the presence of multiple particles and of the duration of application voltage reported. Further results given include data for different gases and gas mixtures, particle sizes and materials, corona and wind effects, particle deformation, AC and impulse voltages and other factors. 12 Refs.
Primary Keywords: Gas-Insulated Systems, Gas Insulation, Particle Trap, Particle Initiated Breakdown, SF/sub 6/
Secondary Keywords: Undergrount Transmission

1290
(POWER TRANSMISSION)
(Transmission Lines)
ELECTROSTATIC AND ELECTROMAGNETIC EFFECTS OF ULTRAHIGH-VOLTAGE TRANSMISSION LINES

L.D. Zaffanella and D.W. Deno
General Electric Co. Pittsfield, MA 01201
EPRI Report No. EPRI EL-802 (06/1978).
Availability: EPRI EL-802
EPRI

This report presents the results of research on electric and magnetic field effects of high voltage AC power lines, performed at EPRI's Project UHV from January 1974 to December 1977. Only 'electrical' rather than 'biological' research was performed.This research is applicable to UHV as well as to EHV transmission lines. Calculation methods and measuring techniques have been developed for transmission line fields and their effects. Steady state and spark discharge currents induced in persons and objects have been investigated.With laboratory and full scale tests using a three-phase UHV line. Different methods to reduce the electric field of UHV lines have been investigated, such as grids of grounded wires and lower voltage circuits built underneath the UHV lines. Unusual effects of high electric fields, such as people's reaction to various types of exposures, wood pole burning, and corona on grounded objects, were experienced during the operation of the UHV three-phase test line. These effects have been investigated and design data have been provided. 9 Refs.
Primary Keywords: Electrostatic; Electromagnetic; Electric Field; Transmission Line; Corona
Secondary Keywords: Induction

1291
(INSULATION, MATERIAL)
(Liquid)
CHARACTERISTICS OF INSULATING OIL FOR ELECTRICAL APPLICATION

T.K. Sloat
Westinghouse Electric Corp, Sharon, PA 16146
EPRI Report No. EPRI EL-1300 (12/1979).
Availability: EPRI EL-1300
EPRI

It has been established that the supply of naphthenic type of petroleum crudes historically used for the manufacture of electrical insulating oils is diminishing, and the oil companies have recommended that the more readily available paraffinic typesof crudes should be substituted to produce the insulating oil required by the electrical industry. The purpose of this project was to determine if an insulating oil manufactured from paraffinic-type crudes was interchangeable with the presently accepted insuslating oil and would perform the same function without major changes in designs or limit operating conditions. Paraffinic crude oils are known to contain significant amounts of wax that, if not removed, could provide an insulating oil having a high pour point which could interferr with the low-temperature functioning of most electrical equipment. Because of the wax problem, it was necessary to study the behavior of the paraffinic-base insulating oil in representative production-size equipment to ensure low temperature operability. Other studies, such as material compatability, lubricity of the new oil, arc-formed gas, response to dielectric breakdown levels represented in large power transformers, and accelerated aging in distribution transformers, were important to ensure full acceptance of a replacement oil. This evaluation of experimental oils indicated that paraffinic transformer oils as a class can provide useful supplements or replacements for naphthenic oils. 2 Refs.
Primary Keywords: Oil, Paraffinic, Naphthenic
Secondary Keywords: Transformers; Circuit Breakers

1292
(PARTICLE BEAMS, ION; PARTICLE BEAMS, ION; PARTICLE BEAMS, ION)
(Generation, Transport, Target Interactions)
BEAM REQUIREMENTS FOR LIGHT-ION DRIVEN INERTIAL-CONFINEMENT FUSION

D. Mosher (1), D.G. Colombant (1) and S.A. Goldstein (2)
(1) Naval Research Lab, Washington, DC 20375
(2) SAICOR Inc. Alexandria, VA 22304
NRL Memorandum Report No. 4397 (11/1980).
Availability: AD-A092472
NTIS

Pulsed-power and ion-beam production and handling techniques are available to assemble a break-even ICF experiment. In this report, simple scaling laws for beam focusing, transport, bunching and packing are combined to define an acceptable range of parameters for ion-driven system modules delivering low-atomic-number (<=6) ion beams to a pellet. Techniques for increasing the deliverable beam intensity are then discussed. 18 Refs.
Primary Keywords: Light Ion Beams, Ion Focusing; Ion Transport; Beam Packing; Beam Punching; Pinch Reflex Diode
Secondary Keywords: Inertial-Confinement-Fusion Module; System Requirements

1293
(POWER CONDITIONING)
(Pulse Forming Lines)
DESIGN STUDY FOR AN AURORA MODIFICATION LEADING TO A 100-TERAWATT NUCLEAR WEAPON RADIATION

A. G. Stewart and G. A. Huttlin
Harry Diamond Labs, Adelphi, MD 20783
Report No. HDL-TM 79-3 (02/1979).
Availability: AD-A071339
NTIS

The AURORA machine can be converted to provide beam power outputs near the 1E14 W power level into low impedance loads. The proposed conversion is based on a novel approach to pulse power intensification. The approach can be adapted to AURORA in differing configurations. A device of toroidal geometry utilizes the fast pulse charge capability of the AURORA generator to inject a traveling electromagnetic wave into a toroidal oil filled coaxial line. From the point of injection, electromagnetic waves are propagated along the axis of the torus in opposite directions and at some time will meet each other at the end of the torus diametrically opposite the injection point. As the electromagnetic waves overlap, that portion of their energy stored in the magnetic field will be transformed into electrostatic energy, and the voltage in this region will double. At some optimum preselected time t1, where t1 > t, the toroidal line is then switched circumferentially into an oil-insulated three-electrode parallel-plate transmission line to the diode load. A transmission-line model for the complete system has been developed and analyzed by computer to determine energy transfer efficiencies and power inputs into a matched ohmic load. It has been determined that peak power levels of 90 TW are achievable in a pulse of 30 ns full width at half maximum.
Primary Keywords: High Pulsed Power; High-Intensity Electron Beams; Accelerator Technology

1294
(PARTICLE BEAMS, ION)
(Generation)

HIGH IMPEDANCE ION DIODE EXPERIMENT ON AURORA

R.A. Meger, F.C. Young, A.T. Drobot, G. Cooperstein, S.A. Golstein, D. Graybill, S.E. Mosher, G.A. Huttlin, K.G. Kerris and A.G. Stewart
Naval Research Lab, Washington, DC 20375
NRL Memorandum Report No. 4477 (03/1981).
Availability: AD A096561
NTIS

The ion diode experiments on Aurora described in this paper have produced up to 5E 16 protons with energies of 5 MeV and pulse durations of 150 ns. The corresponding average proton current exceeds 50 kA or 20% of the total current. These numbers give 40-kJ energy in the proton beam. The 20% ion generation efficiency compares favorably with computer simulations. In addition to protons, a carbon-ion component of greater than 3E 14 ions was extracted from CH/sub 2/ anode foil. The energy of these ions was not determined, but their number may be larger depending on their charge-state and hence their energy. 17 Refs.
Primary Keywords: Light Ion Beam, High Impedance Ion Diode; Simulation
Secondary Keywords: Aurora Facility

1295
(SWITCHES, CLOSING)
(Surface Discharge, Electrical)

HIGH-PRESSURE SURFACE-DISCHARGE PLASMA SWITCHES

W.J. Sarjeant
Los Alamos National Labs, Los Alamos, NM 87545
IEEE TRANS PLAS SCI, Vol. PS-8, No. 3 pp. 216-226 (09/1980).

Surface discharge plasma switches operating at high gas pressures with gas discharge laser and resistive loads have been the subject of empirical investigations in recent years. The particular interest has been in the low-inductance uniform multichanneling evident in these switches, in conjunction with the high hold-off voltages that have been observed at multi-atmosphere operating gas pressures. This paper will review the progress to date and present a theoretical model of the surface discharge plasma switch that explains the observed data. 17 Refs.
Primary Keywords: Surface Discharger; Mylar Substrate; Multi-Channel; Very Small Jitter; Variation Of Pressure
Secondary Keywords: High-Pressure, Small Transverse Electric Field; Laser Load

1296
(SWITCHES, CLOSING)
(Thyratrons)

INSTANT START THYRATRON SWITCH

S. Merz and D. Turnquist
EG&G Inc, Salem, MA 01970
ERADCOM Report No. DELET-TR-79-0270-1 (01/1981)
Availability: AD A096579
NTIS

Efforts into the development of a megawatt instant-on hydrogen thyratron are underway. The design work has been divided into three major areas: (1) cathode development, (2) envelope design, and (3) reservoir development. Two experimental thyratrons have been fabricated in order to study the cold emission characteristics of a tungsten matrix cathode material. Design work has been completed on a new, lightweight envelope assembly. Finally, efforts into the development of a reservoir system are described. 1 Refs.
Primary Keywords: Thyratron; Hydrogen Thyratron; Cold Cathode
Secondary Keywords: Gas Filled Device; Switch Tube

1297
(ENERGY STORAGE, MECHANICAL; PULSE GENERATORS; SWITCHES, OPENING)
(Rotating Machines, Systems; Explosive Fuses)

CURRENT INTERRUPTION IN INDUCTIVE STORAGE SYSTEMS WITH INERTIAL CURRENT SOURCE

I.M. Vitkovitsky, D. Conte, R.D. Ford and W.H. Lupton
Naval Research Lab, Washington, DC 20375
NRL Memorandum Report No. 4168 (03/1980).
Availability: AD A083914
NTIS

Utilization of inertial current source inductive storage with high power output requires a switch with short opening time. This switch must operate as a circuit breaker, i.e., be capable of carry the current for a time period characteristic of inertial systems, such as homopolar generators. For reasonable efficiency, its opening time must be fast to minimize the energy dissipated in downstream fuse stages required for any additional pulse compression. A switch that satisfies these criteria, as well as other requirements such as that for high voltage operation associated with high power output, is an explosively driven switch consisting of large number of gaps arranged in series. The performance of this switch in limiting and/or interrupting currents produced by large generators has been studied. Single switch modules were designed and tested for limiting the commutating current output of 1 MW, 60 hz, generator and 500 KJ capacitor banks. Current limiting and commutation were evaluated, using these sources, for currents ranging up to 0.4 MA. The explosive opening of the switch was found to provide an effective first stage for further pulse compression. It opens in tens of microseconds, commutates current at high efficiency (>90%) and recovers very rapidly over a wide range of operating conditions. 29 Refs.
Primary Keywords: Inductive Energy Storage; High Current Pulses; Opening Switches, Terawatt Pulse Generators

1298
(PARTICLE BEAMS, ELECTRON)
(Transport)

EXPERIMENTS ON THE INJECTION OF RELATIVISTIC ELECTRON BEAMS INTO PREFORMED CHANNELS IN THE ATMOSHPERE

M. Raleigh (1), J.D. Sethian (1), R.B. Fiorito (2), L. Allen (1), R.F. Fernsler (3) and J.R. Greig (1)
(1) Naval Research Lab, Washington, DC 20375
(2) Naval Surface Weapons Center, Silver Spring, MD 20910
(3) JAYCOR Inc, Alexandria, VA 22304
NRL Memorandum Report No. 4220 (05/1980).
Availability: AD A086732
NTIS

Reduced-density channels were created by designating a path through the atmosphere by laser-induced, aerosol-initiated air breakdown, and heating the air along the path with a guided electric discharge. A Nd glass laser (60J, 40 nsec), focused with a 5 m f 1. lens, was used and air-breakdown was enhanced by the presence of a light smoke. The electric discharge (40 kV, 17kA peak current, period 3microsec) followed the laser path and damped in 6 microsec. 30 microsec later a hot, reduced density, partially ionized channel had formed. The diameter of the channel was 2.0 cm and channels of length up to 2 m have been produced. Using a field emission diode with a 43 um titanium foil anode, and intense relativistic electron beam (27nsec, 2.4kA, 1.0 MeV) was produced which could be seen propagating in the unperturbed atmosphere for distances 100 cm. The beam was injected into the preformed channel within 3 cm from the anode to 1 to study the beam-channel interaction. Conditions in the channel were varied by controlling the time between creation of the channel and injection of the REB. When injected into a conducting channel with density 6 E5 g/cu cm, and n/sub e 10/cm cu, the beam expanded and was ejected from the channel within 10 cm of travel. But when injected into a channel with much lower conductivity and density 3E14 g/cm the beam propagated in the channel and the effect of the reduced scattering was observed. 19 Refs.
Primary Keywords: Relativistic Electron Beam; Channel; Atmosphere

1299
(BREAKDOWN STUDIES)
(Electrodes)

MODELING AND MEASUREMENT OF THE INITIAL ANODE HEAT FLUXES IN PULSED HIGH-CURRENT ARCS

D. Johnson and E. Pfender
University of Minnesota, Minneapolis, MN
IEEE TRANS PLAS SCI, Vol. PS-7, No. 1 pp. 44-48 (03/1979).

An anode heat flux model has been developed for pulsed high-intensity DC arcs. The model is based on temperature time-history measurements of the rear face of a very thin plane anode and high-speed streak photographs of the arc. The arc heat flux model is derived from a comparison of experimental data with an analytical solution of the one-dimensional heat conduction equation and the arc intensity and timing information obtained from high-speed photographs. A simplified input heat flux model consisting of connected segments of linearly varying heat fluxes with respect to time is used. Duration of the individual segments is determined from the streak photographs and the graphical match of measured rear-face temperature history and the numerical solution. Results using argon gas at atmospheric pressure indicate an initial transient heat flux regime of 100 microsecond duration with a peak heat flux of 2E9 W/sq.m followed by a quasi-steady heat flux regime with a heat flux of 1E8 W/sq.m. 8 Refs.
Primary Keywords: Anode Heat Flux Model; Thin Plate Anode; Transient Study; Anode Temperature Measurement
Secondary Keywords: Finite Difference Calculation

1300
(BREAKDOWN STUDIES)
(Gas, Radiation)

X-RAY PREIONIZED HIGH-PRESSURE KRF LASER

S. Sumida, M. Obara and T. Fujioka
Keio University, Kohoku-ku, Yokohama-shi, Japan
APPL. PHYS. LETT., Vol. 33, No. 11 pp. 913-915 (12/1978).

The authors consider flash x-ray sources as a form of gas laser preionization. The output energy of the laser is seen to increase substantially over that produced by conventional ionization wires, over a much wider pressure range. Spatial uniformity of the output beam is also seen to be greatly improved. 5 Refs.
Primary Keywords: X-ray Preionization, Glow Discharge; High Pressure; Large Volume Ionization
Secondary Keywords: KrF Laser; Uniform Beam

1301
(INSULATION, MATERIAL; INSULATION, MATERIAL)
(Liquid; Solid)

A PROGRAM TO EVALUATE, DEVELOP AND TEST POROPLASTIC MATERIALS AS IMPROVED ELECTRICAL INSULATION FOR HIGH POWER UNDERGROUND CABLES

L.W. Nichols, L. Gilson and A.S. Obermayer
Moleculon Research Corp, Cambridge, MA 02142
EPRI Report No. EPRI EL-312 (04/1977).
Availability: EPRI-EL-312
EPRI

This report presents the results of a project to develop Poroplastic Film, an ultramicroporous material invented by Moleculon Research Corp., as a low loss substitute for the cellulose paper tapes presently used in the manufacture of high pressure oil-filled cable. Structurally, Poroplastic is a stable film consisting of a cellulose triacetate matrix which incorporated a large column of liquid. Pore diameters in the matrix measure several tens of Angstroms and the relative liquid can be controlled to range from as little as 50% to as much as 95%. For use as a cable dielectric, the liquid incorporated in the Poroplastic was a dielectric oil. By virtue of the high oil loading, the material exhibited dielectric properties superior to those of cellulose paper; typically a power factor of 0.07%, a relative dielectric constant of 2.2 and a 60 Hz breakdown stress of 80 kv/mm (2 kv/mil). Mechanically, however, the basic material was inferior to cellulose paper in terms of its tensile, stiffness, frictional and fluid transport characteristics. The high cost of the material which was evolving, coupled with the difficult technical problems yet to be overcome, did not warrant further continuation of this work at this time. 0 Refs.
Primary Keywords: High Pressure Oil-Filled Cable; Synthetic Tapes; Poroplastic
Secondary Keywords: Underground Transmission; Cable Insulation

1302
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

SUPERCONDUCTING ROTOR RESEARCH

B.B. Gamble, T.A. Keim and P.A. Rios
General Electric Co, Schenectady, NY 12301
AFAPL Report No. AFAPL-TR-77-68 (11/1977).
Availability: AD A053612
NTIS

This report summarizes work completed for the Air Force Aero Propulsion Laboratory in Phase I of a program entitled Superconducting Rotor Research. The objective of this program is to incorporate new materials in the design of an airborne, 20 MW, high-speed, superconducting generator. The rotor of the generator will be constructed and its current density demonstrated. The Phase I work consisted of a sizing study to select the machine configuration and dimensions, a survey of superconducting materials, and selection of the superconductor for this application. 13 Refs.

Primary Keywords: Cryogenics; Superconductivity; Synchronous generators

1303
(SWITCHES, CLOSING)
(Thyristors)

LIGHT-TRIGGERED THYRISTORS FOR ELECTRIC POWER SYSTEMS

V.A.K. Temple and A.P. Ferro
General Electric Co, Schenectady, NY [illegible]
EPRI Report No. EPRI [illegible] (11/1978).
Availability: EPRI [illegible]
EPRI

A program to develop a method of triggering a 53mm, 2600-volt, 1,000 amp thyristor with a light source is described. Normally, these devices are electrically triggered, but the need for placing a large number of these units in series for high voltage applications made electrical triggering, with its associated insulation problems, expensive and complex. In this program, a light-sensitive gating method was developed, with associated amplifying layers built integrally into the power thyristor. LEDs and ILs were used as the light source. Fiber optics provided the electrical isolation and transmitted the light [illegible] into the thyristor package. Results were a turn-on capability to handle a voltage rate-of-change of 2000 volts per microsecond, with a light input to the thyristor gate of 30 nanojoules. A problem was encountered and investigated in high rates of current flow at the instant of light trigger. This resulted in excess temperature levels in localized spots where the current flow was initiated. Packaging and light source options are discussed. 13 Refs.

Primary Keywords: Thyristors; Power Electronics; Optical Triggering System

1304
(SWITCHES, CLOSING)
(Thyristors)

LIGHT-TRIGGERED THYRISTORS FOR ELECTRIC POWER SYSTEMS (PHASE 2)

V.A.K. Temple and B. Jackson
General Electric Co, Schenectady, NY 12301
EPRI Report No. EPRI EL-1349 (03/1980)
Availability: EPRI EL-1349
EPRI

This report marks a milestone in the development of thyristors suitable for HVDC applications. Three devices were constructed with 5, 4, and 2 amplifying stages, respectively, with several sub-variations. Of these the 4 amplifying stage GE3 type D device and all variations (A, B, & C) of the two stage GE4 design proved sufficiently reliable for a one for one replacement of the normal, electrically triggered 2.6 kV HVDC cell. Important device characteristics other than a typical 160 A/microsec or better di/dt at 105 deg.C and 1800 volts include the following: (1) typical forward breakdown voltage of 2900 volts, (2) typical reverse breakdown voltage of 3100 volts; (3) dv/dt capability of 2000 V/microsec to 2200 volts; (4) forward drop at 125 deg C, 1000 amperes of 1.3 volts and, finally, (5) a typical photo threshold of 10 to 20 nanojoules of incident photo energy. Surge capability and other device ratings are similar to the original electrically fired device. It is also significant that both the fabrication and packaging of these devices took place in a production facility and that the light triggered thyristor could be fabricated with the same process, apart from the extra sensitivity etch, as the regular electrically triggered device. 8 Refs.

Primary Keywords: Thyristors, Power Electronics, Optical Triggering System

1305
(BREAKDOWN STUDIES)
(Reviews)

THE PREVENTION OF ELECTRICAL BREAKDOWN IN SPACECRAFT

F.W. Paul and D. Burrowbridge
Goddard Space Flight Center, Greenbelt, MD
NASA Report No. NASA SP-208 ([illegible]/1970)
Availability: N70 18[illegible]
NTIS

This paper on high voltage electrical breakdown provides a basic understanding of the phenomena and problems encountered in the use, design, and fabrication of high potential systems for spacecraft. The material was compiled from the literature listed in the bibliography and from conferences with experienced personnel at Goddard Space Flight Center, Jet Propulsion Laboratory, Pasadena, California, and the University of Chicago. 19 Refs.

Primary Keywords: Electrical Breakdown; Design Considerations

1306
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Gas, Electrical; Gas)

PARTICLE-INITIATED BREAKDOWN IN GAS DIELECTRIC CABLE INSULATION EXPANDED SCOPE PROGRAM

C.M. Cooke
Massachusetts Institute of Technology, Cambridge, MA
EPRI Report No. EPRI EL-1264 (11/1979).
Availability: EPRI EL-1264
EPRI

The adverse influence of conducting particle contaminants in gas-insulated power apparatus was investigated in a series of experiments that employed coaxial configurations and DC voltages to 1500 kV. Particle dynamics was shown to be important and related to breakdown initiation in the gas. Both SF/sub 6/ and N/sub 2/ gases at pressures from 1 to 14.6 atm. abs. were used. The particles were intentionally introduced and ranged from 1.6 to 6.4 mm. spheres and wires. Effects in the gas gap as well as along surfaces of solid insulators were studied. Visual observations, photographs and electrical measurements helped in distinguishing various processes. Particles could reduce the insulation performance by factors of 3 to 5 and were especially significant when moved to the center conductor. By coordination of this work with a separate study at the Westinghouse R&D laboratory, a comparison between DC and AC performance was made. Generally the DC breakdown values exhibited wider scatter, though their limit was similar to that found under AC. Overall fundamental forces and processes which involve particle contamination effects were identified and found to be the same for DC and AC voltage stresses. 30 Refs.

Primary Keywords: Gas Insulation, Particle-initiated breakdown, SF/Sub 6/; Gas Dielectrics

Secondary Keywords: Gas-Insulated Cable; Underground Transmission

1307
(INSULATION, MATERIAL; INSULATION, MATERIAL)
(Gas, Liquid)

SF/SUB 6/ OIL DIELECTRIC FOR POWER TRANSFORMERS

E.J. Walsh, J.A. Robinson and R.C. Wendel
Westinghouse Electric Corp, Sharon, PA 16146
EPRI Report No. EPRI EL-1358 (03/1980).
Availability: EPRI EL-1358
EPRI

This project was designed to evaluate the potential for providing a superior gas-oil insulating and cooling system for liquid filled transformers. The potential benefits of using the electronegative gases, sulfur hexafluoride, SF/sub 6/, or hexafluorethane, C/sub 2/ F/sub 6/, of nitrogen gas normally used in gas-oil filled transformers were examined. A test program involving electrical, chemical, and physical properties indicated that the SF/sub 6/-oil combination appeared satisfactory as an insulating medium. No short term reduction in insulating or cooling capacity was determined in SF/sub 6/-oil filled transformers. However, some of the results obtained in the longer term transformer testing using SF/sub 6/ gas and oil indicated that prolonged exposure of currently designed transformers to SF/sub 6/ is to be avoided . It was determined that due to the high degree of solubility of SF/sub 6/ in transformer oil, degassing under thermal or electrical stress could result in extensive bubble formation. It was determined, however, that under our test conditions, SF/sub 6/ gas bubbles did not reduce the insulating capacity of the liquid medium as did nitrogen gas bubbles under the same test conditions. As a result of this study, many previously unknown areas concerning electronegative gas-oil systems have been clarified but the results from these studies have given rise to some new concerns for allowing SF/sub 6/ to enter existing oil filled transformers. 13 Refs.

Primary Keywords: Sulfur Hexafluoride; Transformers; Oils, Dielectric Strength; Hexafluoroethane

Secondary Keywords: Solubility

1308
(BREAKDOWN STUDIES)
(Gas, Electrical)

STUDY OF LIGHTNING CURRENT MAGNITUDE THROUGH DISTRIBUTION ARRESTERS

G.L. Gaibrois, M.S. Mashikian and K. Johnson
The Detroit Edison Co., Detroit, MI 48226
EPRI Report No. EPRI EL-1140 (09/1979).
Availability: EPRI EL-1140
EPRI

This project was undertaken by the Detroit Edison Company on behalf of the Electric Power Research Institute to: 1. Determine the current magnitude of lightning surges discharged through distribution arresters. 2. Determine the frequency of lightning strokes through distribution arresters. In the fulfillment of these objectives, the currents were determined from arrester gap etchings caused by lightning surges. Inspection of the gaps led to the conclusion that two distinct types of etchings had been produced. These were compared to 8-20 microsecond surges and to surges of longer duration produced by tests at the General Electric Laboratory. 5 Refs.

Primary Keywords: Surge Arresters; Lightning Currents; Distribution Surge Protection; Distribution Arresters; Lightning Stroke Characteristics

1309
(REVIEWS AND CONFERENCES: ELECTROMAGNETIC COMPATIBILITY)
(Reviews: Grounding And Shielding)
EMP INTERACTION: PRINCIPLES, TECHNIQUES, AND REFERENCE DATA (A COMPLETE CONCATENATION OF TECHNOLOGY FROM THE EMP INTERACTION NOTES) EMP INTERACTION 2-1
K.S.H. Lee (Ed.)
Dikewood Industries, Inc., Albuquerque, NM 87106
AFWL Report No. TR-80-402 (12/1980).
Availability: AD A100508
NTIS

This work is divided into three parts. The first part, Principles and Techniques, concerns general concepts and calculational procedures from electromagnetic theory relevant to EMP interaction. This contains a discussion of the concept of electromagnetic topology which is used to divide complex systems into somewhat natural smaller parts in an ordered way. This concept is fundamental to the organization and understanding of this work and is expected to lead to further insights and computational techniques. Of course, there are many other concepts and techniques which play important roles and which are discussed in this part. The second part, Formulas and Data, considers the information concerning the pieces of the system. The organization of this part is based on the system topology, specifically the hierarchical topology which divides the system into layers. Each layer is further divided into three ordered parts: coupling, propagation, and penetration. Having considered, first, the general concepts and techniques for EMP interaction and, second, the specific information concerning the pieces, we come to the third part, System Applications. This part attempts to illustrate the use of the previous parts in analyzing the EMP interaction with complex systems. Hypothetical system examples are chosen to illustrate the topological decomposition of the problem for selected signal paths. 10 Refs.
Primary Keywords: Application; Coupling; EMP, Interaction
Secondary Keywords: Aerospace System, Aircraft; Ground Based Systems

1312
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
PHOTOGRAPHIC OBSERVATIONS OF IMPULSE BREAKDOWN IN SHORT VACUUM GAPS
I.D. Chalmers and B.D. Phukan
University of Strathclyde, Glasgow, Scotland
Journal Of Physics D: Applied Physics Vol. 12, No. 8, pp 1285-1292 (08/1979).

An image intensifier and image converter with a maximum sweep speed of 1 ns/mm have been used to observe the development of impulse breakdown in short vacuum gaps of up to 1 mm. Electrodes of stainless steel, copper and aluminum have been used and it has been found that in each case, metal vapour is always produced first at the cathode surface and later at the anode surface. the final arc discharge develops by propagation of the anode vapour. Time delays between voltage application and the appearance of the anode vapour have been measured in the range 10-50 ns and their dependence upon electrode separation and electrode material has been explained using a simple model involving anode heating by the emission current from a vaporised emitting site at the cathode. 16 Refs.
Primary Keywords: Optical Emission; Vacuum Gap, Several Electrode Materials; Cathode Vapor; Anode Vapor; Anode Vapor Gap Closure; Modeling

1314
HIGH VOLTAGE BREAKDOWN IN AN OSO-4 POINTED EXPERIMENT
N.L. Hazen, M.C. Huber and E.M. Reeves
Harvard University Cambridge, MA
No. NASA-CR-109085, 37p (03/1969).
Availability: N70-20748
NTIS

An apparatus for pulsing a high speed transmitter having pulser delay times in the nanosecond range. The combination of solid state and spark gap devices provide protection against high voltage arcs for both transient and power follow-through conditions. (Author)
Primary Keywords: Electrical Faults; Oso-e, Solar Spectrometers, Circuit Protection; Electronic Modules, High Voltages

1315
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
HIGH VOLTAGE BREAKDOWN STUDY
Authors Unknown
Ion Physics Corp, Burlington, MA 01803
ECOM Report No. ECOM-00395 (06/1970).
Availability: AD 711156
NTIS

This is the final report on a series of carefully controlled experiments designed to obtain data on vacuum breakdown in a high voltage vacuum tube environment. A description of the apparatus used and precautions taken to provide adequate controls are included, as are results from many of the preliminary experiments. The controls are presented with the importance and relative effect of each discussed. The breakdown with and without magnetic field (in various configurations) is presented. Since the literature was fragmented and contradictory, factorial design (the effects of parameter changes are studied) was chosen for the experiment. The factors to be varied, along with the parameter ranges of each, are identified and discussed. The statistical methods applied to the data are also presented and the resultant accuracy is discussed. Finally, each individual experiment is presented along with the significant results obtained. 48 Refs.
Primary Keywords: Insulation Strength; Breakdown With Magnetic Field; Yates Algorithm, Spherical Anode
Secondary Keywords: Radar Drivers

1316
(BREAKDOWN STUDIES)
(Electrodes)
HIGH-CURRENT ANODES FOR HIGH POWERED XENON ARC LAMPS
C.S. Fox, M.P. Repne Thomsen and J.A. Schmidtlein
US Army Electronics Command, Fort Belvoir, VA
USAEC Report On Task 1766[illegible]09D4[illegible]6-06 (08/1969)
Availability: AD 696478
NTIS

In-house studies were made on the failure mechanisms of the positive electrodes (anodes) in xenon arc lamps with 20 kW to 40 kW power ratings. New materials, geometrical designs, and fabrication techniques were employed in experimental anodes and tested under operating conditions. Several new designs were tested and discarded because of thermal or mechanical failure. The report concludes that a few promising anode designs are worthy of further development. Also, 20- and 30-kilowatt lamps with various anode designs were bought from six manufacturers for evaluation. 3 Refs.
Primary Keywords: Electrode, Anode, Failure Mechanism, New Designs
Secondary Keywords: Flashlamps

1317
(BREAKDOWN STUDIES, SWITCHES, CLOSING)
(Electrodes, Gas Gaps, Materials)
INVESTIGATION OF ELECTRODE EROSION IN HIGH CURRENT ELECTRIC ARCS
R. Dethlefsen
General Dynamics Corp, San Diego, CA 92112
ARL Report No. ARL 68-0117 (06/1968).
Availability: AD 675185
NTIS

Experiments on electrode erosion due to magnetically driven high current arcs are described together with a review of the literature. The range of parameters is: arc current 2 to 30 kA, pressure in various gases up to 4 atm, magnetic field strength up to 6 kG. The arc travels in a uniform magnetic field between segmented rail electrodes. The self-magnetic field of the current feed rails is reduced to a negligible level. Measurements of the arc velocity are given. Test plates of various metals are placed between the electrode rails. They are traversed by the moving arc so that the plates are exposed to the anode attachment on one side and to the cathode attachment on the other side. Initial parametric studies have shown that the amount of erosion increases with increasing gas pressure. Argon shows the least electrode erosion, hydrogen the strongest, with helium and nitrogen taking intermediate positions. Tungsten, rhenium and clear copper showed the highest erosion resistance of those metals tested with a nitrogen arc. Oxide layers on copper can decrease erosion at the cathode while they increase the tendency for erosion at the anode. Thin coatings of rhenium on copper showed promise for increased erosion resistance. Thermal and electrical properties of various electrode metals have been compiled. High-speed photos have indicated that the moving arc attaches in one or several simultaneous attachment spots at anode and cathode. 58 Refs.
Primary Keywords: Traveling Arc; Magnetic Field; Arc Velocity Measurement; Erosion Track; Triggering

1320
(SWITCHES, OPENING)
(Mechanical)
DEVELOPMENT OF A CURRENT LIMITER USING VACUUM ARC CURRENT COMMUTATION
C.W. Kimblin, J.G. Gorman, F.A. Holmes, P.R. Emtage, J.V.R. Heberlein and R.E. Voshall
Westinghouse Electric Corp, Pittsburgh PA
EPRI Report No. EPRI EL-1221 (10/1979).
Availability: EPRI EL-1221
EPRI

Phase 1 showed the feasibility of developing a current limiter using vacuum arc current commutation. In concept, the electrodes of a vacuum device would be separated during the fault current rise, and the subsequent application of a transverse magnetic field would cause the arc current to commutate into a parallel capacitor and ultimately into a parallel current limiting resistor. The feasibility of commutating at arc current levels to 8.5kA was demonstrated. However, the parallel capacitance was prohibitively large at 300 microfarad. The objective of Phase 2 has been to increase the commutation current of a single 72kV device while also reducing the value of the parallel capacitance. A total of 14 prototype vacuum devices were designed, built and evaluated, and the major parameters varied were device geometry, characteristics of the parallel circuit, electrode actuation speed, waveshape of the applied transverse magnetic field, point on wave of electrode separation, and the use of series connected vacuum interrupters. Progress can be determined by comparing the commutation levels with Phase 1. For the earlier 15kV circuit, the commutation level increased to 14.5kA for a parallel capacitance of 50 microfarad. In particular, commutation levels of 12kA (5 microfarad) were observed in circuits where the transient recovery of 50kV approximated the transient associated with a 72kV circuit. A Phase 3 program is recommended aimed at further improving the device performance. 15 Refs.
Primary Keywords: Fault Current Limiter; Current Limiting Device; Arc Instability, Vacuum Switch
Secondary Keywords: Vacuum Interrupter, Circuit Breaker

1321
(SWITCHES, OPENING)
(Explosive Fuses)
METHOD OF UTILIZING SPARK-GAP FOIL SWITCHES IN DETERMINING DETONATION VELOCITIES OF SOLID EXPLOSIVE MATERIALS
G.W. Carter
Lawrence Livermore Lab, Livermore, CA 94550
(08/1969)
Availability: UCRL-50697
NTIS

Primary Keywords: Detonations Velocity; Instrumentation; Electric Switches
Secondary Keywords: Spark Gap Foil Switches

1323
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
SCIENTIFIC-TECHNICAL CONFERENCE ON HOMOPOLAR GENERATORS
P.L. Alivevk [illegible]
FTD Report No. FTD-HT-23-250-70 (05/1970)
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedeniy 7, 802-804 (1969)
By W. Pearson
Availability: AD 710255
NTIS

At a conference on homopolar generators, 35 reports were heard and discussed. Some of the topics covered were the questions of generator design theory, descriptions of the latest homopolar generator designs and special types, the problem of sliding contacts, merits of these generators and their practical prospects in electrochemical and electrical industries.
Primary Keywords: Homopolar Generator, Design Considerations, Charge Generation, Self excitation; Liquid-metal Contacts

1324
(SWITCHES, CLOSING)
(Gas Gaps, Materials)
SPARK GAP STUDIES
[illegible] Levy
ECOM, Fort Monmouth, NJ 07703
USAELRDL Report No. 2456 (04/1964).
Availability: AD 601[illegible]5
NTIS

Erosion measurements were made using copper-tungsten as an electrode material. The erosion rates for this material were far below the erosion rates for other electrode materials shown in the literature. Tests were performed with and without a saturable reactor in the [illegible] circuit. With the saturable reactor, a reduced electrode erosion was observed. Various triggering schemes were evaluated [illegible] decreased the time jitter from 0.4 microsecond to [illegible]. The same result was achieved by compressed-air [illegible] Refs.
Primary Keywords: [illegible] Copper Tungsten, Low Rates, [illegible]

1325
(PULSE GENERATORS)
(Marx)
HIGH-VOLTAGE PULSE VOLTAGE GENERATOR
I.I. Kolyatskii, V.I. Kurets and V.I. Safronov
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-1972-79, 7p (12/1979).
Availability: AD-A087 884/3
NTIS
No abstract available.
Primary Keywords: Pulse Generators; Spark Gaps; High Voltage; Translations, USSR
Secondary Keywords: Arkad'yev Marx Generators; Marx Generators; NTISDODXA; NTISFNUR

1327
(POWER CONDITIONING)
(Pulse Transformers)
AN IMPROVED PULSE TRANSFORMER FOR HIGH-VOLTAGE APPLICATIONS
T.F. Turner
Stanford University, Stanford, CA 94305
Technical Report M.L. No. 609 (05/1959).
Availability: AD 219114
NTIS
A method of designing high-voltage pulse transformers using less core material than conventional methods is presented. This method creates a constant gradient along the windings. Leakage inductance is reduced, but distributed capacitance is increased. 2 Refs.
Primary Keywords: Pulse Transformer; Conventional Design; Constant Gradient Design; High Efficiency; Core Material Savings

1329
(DIAGNOSTICS AND INSTRUMENTATION; BREAKDOWN STUDIES)
(Voltage; Surface Flashover)
ELECTRO-OPTICAL MEASUREMENTS OF SOLID INSULATOR SURFACE FIELDS AND SURFACE CHARGING IN VACUUM
D.M. Hyslop, J.E. Thompson and T.S. Sudarshan
University of South Carolina, Columbia, SC
GSP Report No. GRC 80-233 (04/1980).
Availability: GSP 80-233
NTIS
Electro-optical measurements of the electric field along insulator surfaces and in the bulk of insulator materials have been made to determine the mechanisms associated with insulator surface flashover. The Pockels effect in KDP has been used in conjuction with a polarization interferometer and a pulsed laser to measure interfacial and bulk fields for KDP/vacuum interfaces. The results show that the solid insulator surface and bulk electric field distributions are spatially non-uniform. The electric field at the cathode is considerably enhanced while the field at the anode is reduced. The time evolution and steady state behavior of the insulator electric field distributions for DC, 60 Hz AC, and pulsed excitations will be presented. 17 Refs.
Primary Keywords: Surface Flashover; Bulk Insulator; KDP Crystal; Vacuum Interface; Non-uniform Electric Field

1331
(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL)
(Flux Compression; Flux Compression Generators)
DESIGN OF EFFICIENT EXPLOSIVELY DRIVEN ELECTROMECHANICAL ENERGY CONVERTERS
S. Frankenthal, O.P. Manley and Y.M. Treve
American Science And Engineering, Inc., Cambridge, MA
Journal Of Applied Physics, Vol. 36, No. 7, pp 2137-2139 (07/1965).
The conversion efficiency of a lumped-parameter, explosively driven electromechanical energy converter is studied. Numerical results of the study, which show the relationship among the device parameters required for unit conversion efficiency, are presented. 5 Refs.
Primary Keywords: Flux Compression Generator; Conversion Efficiency; Parameter Study; Design Suggestions
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1335
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
INVESTIGATION OF OPERATING MODES OF HOMOPOLAR SHOCK GENERATOR WITH REGULATION OF EXCITATION FLOW
V.V. Kharitonov
FTD Report No. FTD-ID(RS)T-0662-80 (05/1980).
Trans. From: Elektrotekhnika (USSR) 12, 43-46 (December 1971) By Robert Potts
Availability: AD A084869
NTIS
The calculation of transient processes in the excitation of a homopolar generator is examined. Several operating modes of the generator are analyzed, with emphasis on the regulation of the excitation. 5 Refs.
Primary Keywords: Homopolar Generator, Analysis; Excitation

1337
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Trigger; Capacitors)
GENERATION OF VOLTAGE PULSES FOR TRANSVERSE DISCHARGES
V.N. Ischenko, V.N. Lisitsyn and V.N. Starinskii
Institute Of Semiconductor Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 20, No. 3, pp 725-727 (05/1977).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 103-105 (May-June 1977)
This paper presents the results of an effort to increase above 10 J the pulse energy of a voltage-pulse generator described earlier. Another voltage-pulse generator is also reported which was assembled using second hand K15-10 condensers to yield 100-J pulses. The voltage-pulse generator is so designed as to provide a rate of rise of current into an ohmic load of 1.3E12 A/sec. 4 Refs.
Primary Keywords: Pulse Generator; Total Output Energy Increase; Capacitor Improvement; Surface Dielectric Maintained
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1338
(BREAKDOWN STUDIES)
(Vacuum, Particle)
MICROPARTICLES IN HIGH-VOLTAGE ACCELERATOR TUBES
G.F. Griffith (1) and D.A. Eastham (2)
(1) Messingum College, New Concord, OH 43762
(2) Culham Lab, Abingdon, Oxfordshire OX14 3DB, UK
Journal Of Physics D: Applied Physics, Vol. 12, No. 9, pp L105-L107 (09/1979).
Microparticles with radii greater than 2 microns have been observed in a high-voltage vacuum accelerator tube. The charge acquired by most of the particles is similar to the contact charging of a conducting sphere on a plate. 5 Refs.
Primary Keywords: Vacuum Breakdown; Microparticle; Charge Measurement, Velocity Measurement
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1340
(PARTICLE BEAMS, ELECTRON)
(Generation)
A PULSED ACCELERATOR BASED ON THE 'ELIT-1' ACCELERATOR
L.P. Fominskii
Novosibirsk Branch, GIAP
Instruments And Experimental Techniques, Vol. 18, No. 6, pp 1674-1675 (11/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 19-21 (November-December 1975)
A pulsed electron accelerator with an explosive-emission cathode is described which has been created on the basis of the 'Elit-1' accelerator and differs from the latter in the use of transformer oil as the dielectric medium (this permits the charging voltage and storage capacitance to be increased). The beam current reaches 20 kA and energy of up to 1.5 MeV and a pulse length of approximately 25 nsec. 8 Refs.
Primary Keywords: E-beam Generation; Explosive Emission Cathode; Elit-1 Accelerator, Oil Insulation; 1.5 Mev Beam Energy; 20 kA Beam Current, 25 ns Pulse Duration
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1342
(DIAGNOSTICS AND INSTRUMENTATION)
(Data Transmission)
FIBER-OPTIC HIGH VOLTAGE ISOLATION OF CAMAC HIGHWAY
S.T. Lee and C.D. Moore
General Atomic Co, San Diego, CA 92121
No. CONF-791102-78, 7p (11/1979).
Availability: GA-A-15659
NTIS
Fault analyses of the Doublet III Machine predict that a worst-case 30 kV might accidentally appear on control and data acquisition wiring connected to CAMAC interface systems. Such an accident could cause damage in CAMAC and computer equipment at distant on the control room, with attendant possibility of personal injury to operators and experimenters. Protection for control room personnel and equipment has been provided in the form of fiber-optic data link systems installed in CAMAC parallel branch and byte serial highways. Both fiber-optic data link systems were designed, documented, and fabricated at General Atomic, using vendor-supplied fiber-optic transmitter and receiver modules. (ERA citation 05:011007.
Primary Keywords: Doublet Reactors, Camac System; Accidents; Control Systems; Data Acquisition Systems; Electric Arcs; Fault Tree Analysis; Hazards; Power Supplies; Safety
Secondary Keywords: ERDA/700209, Fiber Optics; NTISDE

1349
(SWITCHES, CLOSING; SAFETY)
(Gas Gaps, Self)
OVERVOLTAGE PROTECTION BY POINT-PLANE SPARK GAPS
W.R. Scarlett and K.B. Riepe
Los Alamos National Labs, Los Alamos, NM 87545
LA Report No. LA-UR-79-1655 (10/1979).
Availability: LA-UR-79 1655
NTIS
Electron-beam-controlled discharge CO_2 lasers, such as those used in the Antares and Helios laser-fusion drivers at the Los Alamos Scientific Laboratory, need protection against possible damage due to overvoltage. A capacitive point-plane spark gap has been developed and successfully used in the Helios power amplifiers which operate at voltages up to 300 kV. A gap of similar design is planned for use in the Antares power amplifiers which operate at 550 kV. These gaps must reliably hold off the normal discharge voltage, but break down with short delay if overvoltaged, diverting the discharge energy to a resistor. A prototype of the Antares gap has been built and is undergoing tests. Parameters being investigated include voltage polarity, gap spacing, gas composition, and gas pressure. Results of these measurements and the operational experience of the Helios gaps will be presented. 2 Refs.
Primary Keywords: Overvoltage Protection; Point-Plane Spark Gap; High Voltage; Voltage Polarity Variation
Secondary Keywords: Gas Laser

1350
(PULSE GENERATORS)
(Trigger)
SIX CHANNEL DIGITAL DELAY GENERATOR
C.L. Aseltine
Army Armament Research and Development Command, Aberdeen Proving Ground, MD 21005
ARRBL Report ARBRL-TR-02213 (01/1980).
Availability: AD A083575
NTIS
A six channel digital delay generator is described which can provide delays of 1 microseconds to 10,000 microseconds. Delays are digitally generated and are designed to operate in high RFI areas such as those encountered in ballistic measurements. 0 Refs.
Primary Keywords: Delay Generator; Digital Delay Generator
Secondary Keywords: Flash X-ray

1351
(PARTICLE BEAMS. ION)
(Generation)

STUDY OF THE GENERAL PLASMA CHARACTERISTICS OF A HIGH POWER MULTIFILAMENT ION SOURCE

K.F. Schoenberg
Lawrence Berkeley Lab, Berkeley CA
LBL Report No LBL-8940 (09/1979)
Availability: LBL-8940
NTIS

A general assessment of the steady state and time dependent plasma properties which characterize a high power multifilament ion source is presented. Steady state measurements, obtained via a pulsed electrostatic probe data acquisition system, in part include A) The source electron distribution function consists of a bulk component of thermalized electrons comprising 90 to 9? percent of the total electron population, plus a non-thermal high energy tail which is a monotonically decreasing function of energy, and contains a small but experimentally significant electron population at energy values 10 to 15 eV above maximum cathode [illegible]. B) Overall steady state source performance approximately follows low pressure discharge theory assuming spatially uniform ion production. The multifilament source [illegible] presently the heart of the LBL Neutral Beam program, slated to provide neutral beam heating for several major [illegible] fusion experiments. A brief discussion coupling the measured source plasma parameters with overall neutral beam performance is included. [illegible] Refs.
Primary Keywords: Ion Beam, Neutral Beam; Electron Distribution Function; High Energy Tail; Low Pressure Discharge Theory; Electrostatic Probe

1352
(PULSE GENERATORS: POWER CONDITIONING)
(Capacitive, Pulse Transformers)

SURGE GENERATOR IN THE MEGAVOLT RANGE

V.I. Mikhaylov
FTD Report No FTD-ID(RS)T-1149-79 (08/1979).
Availability AD A0?4502
NTIS

A pulse generator designed to investigate the dielectric strength of accelerator tubes is described. This pulse generator is based on a capacitive store that is discharged into a pulse transformer with a subdivided core. An analysis is made of a unit designed to produce pulses of up to 1 MV. 3 Refs.
Primary Keywords: Pulse Generator; Pulse Transformer, Subdivided Core; Calculation; Megavolt Pulses
Secondary Keywords: Accelerator Tube

1353
(PULSE GENERATORS)
(Hand Tube)

A VARIABLE LOW FREQUENCY HIGH VOLTAGE GENERATOR USING VALVES WITH FIBRE OPTIC LIGHT GUIDE CONTROL

R. Miller, I.A. Black and V.N. Gray
Brighton Polytechnic, Moulsecoomb, Brighton, BN2 4GJ, UK
Journal Of Physics E; Scientific Instruments, Vol 8, No. 9, pp 748-750 (09/1975).

This article describes a new method of generating low frequency high alternating voltages by modulating two high voltage DC supplies of opposite polarity. The modulation is accomplished by the use of *triode valves* situated at high voltage whose grids are supplied by control signals, transmitted from the control circuit through fibre optic light guides. The first generator built is capable of driving a 1 nF load at 10 kV peak over the frequency range DC-50 Hz, or a 0-1 uF capacitor at up to 0-1 Hz. In order to increase the voltage and current ratings of the generator, a series parallel arrangement of valves may be used, with the appropriate control signals fed to the grid of each valve. Because the generator is relatively free from any electrical noise, it can be used to energize insulation samples in connection with partial discharge detection investigations. 8 Refs.
Primary Keywords: Bipolar Output, Capacitive Load, 10kV 1000 PPS; Triode Vacuum Tubes

1355
(POWER TRANSMISSION)
(Transmission Lines)

CURRENTS AND CHARGES ON CYLINDERS IN A PARALLEL-PLATE TRANSMISSION LINE

T.T. Wu, M. Krook, R.W.P. King, D.J. Blejer and T.K. Sarkar
Harvard University, Cambridge, MA
Final rept. 30 Jun 76-30 Jun 79 (07/1979).
Availability: AD-A079 597/1
NTIS

The final report summarizes the results of a 3-year model study to evaluate how well a parallel-plate transmission-line structure simulates an electromagnetic pulse with a plane-wave front. The amplitude and phase of the electric field inside the model simulator have been measured at two high frequencies for which transmission-line theory does not apply. An approximate theoretical representation of the field is used to interpret the measured data. Differences between the actual field and the desired traveling plane-wave field are discussed, and possible methods to improve the field in the simulator are offered. (Author)
Primary Keywords: Electromagnetic Pulse Simulators; Electric Fields; Electromagnetic Wave Propagation, Transmission Lines; Metal Plates, Parallel Orientation; Electromagnetic Pulses; High Power; Wavefronts, Plane Waves. Transverse Waves; Waveguides
Secondary Keywords: NTISDODXA, NTISDODAF

1358

ELEMENTS OF HIGH-VOLTAGE NANOSECOND PULSE GENERATORS ON COAXIAL CABLES

P.S. Anan'in, A.G. Sterligov, V.G. Tolmachev and Y.P. Usov
FTD, Wright-Patterson AFB, OH
No FTD-ID(RS)T-0374-79, 11p (03/1979)
Trans From Fiziki Elektroniki i Avtomatiki, No. 2, P 97 (1972) By M.J. Folan
Availability AD-A080 825/3
NTIS

No abstract available
Primary Keywords: Pulse Generators; High Voltage; Coaxial Cables, Transmission Lines, Translations
Secondary Keywords: Nanosecond Pulses, NTISDODXA, NTISFNUP

1359
(INSULATION, MATERIAL: BREAKDOWN STUDIES)
(Solid, Plasma)

EXPERIMENTAL RESULTS ON PLASMA INTERACTIONS WITH LARGE SURFACES AT HIGH VOLTAGES

N.T. Grier
Lewis Research Center, Cleveland, OH
No NASA TM 81423, 12p (03/1979).
Availability N80 ?2??6/7
NTIS

Multikilowatt power levels for future payloads can be more efficiently generated using solar arrays operating in the kilovolt range. This implies that large areas of the array at high operating voltages will be exposed to the space plasma environment. The result of interactions of these high voltage surfaces with space plasma environments can seriously impact the performance of the satellite system. The plasma-surface interaction phenomena were studied in tests performed in two separate vacuum chambers, a 4.6 m diameter by [illegible] chamber and a 20 m diameter by [illegible] m long chamber. The generated plasma density was approximately 1x10 to the [illegible] solar array panels, each with areas of 1400 sq [illegible] were [illegible] tests. Nine of the solar panels were tested as a [illegible] in the form of a 3x3 solar panel matrix. The results [illegible] tests [illegible] small sample tests results: insulators [illegible] the plasma coupling current for high positive [illegible] arcing was found [illegible] at high negative bias.
Primary Keywords: Aerospace Instruments; Plasma-electromagnetic Interactions; Solar Arrays; Surface Reactions; High Voltages; Electrical Insulation; Plasma Density; Plasma Generators; Part 2 Spacecraft; Sp[illegible]
Secondary Keywords: NTISNASA

1360
(BREAKDOWN STUDIES: INSULATION, MATERIAL)
(Surface (Electrical), Liquid)

QUICK DISCHARGES ON INSULATORS IN TRANSFORMER OIL DUE TO VOLTAGE PULSES

W. [illegible]
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-0414-79, 33p (04/1979).
Availability AD A080 775/0
NTIS

No abstract available.
Primary Keywords: Electric Discharges; Transformers; Breakdown(Electronic Threshold); Oils; Pulses; High Voltage. Translations
Secondary Keywords: NTISDODXA, NTISFNGC

1361
(PARTICLE BEAMS, ION)
(Generation)

ACCELERATION OF IONS BY A MODULATED ELECTRON BEAM

V.V. Velikov, A.G. Lymar and N.A. Khizhnyak
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Soviet Technical Physics Letters, Vol. 1, No 7, pp 276-277 (07/1975).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 1, 615-618 (July 1975)

V.I. Veksler's well-known ideas of collective acceleration of charged particles have led to the appearance of a large number of schemes for collective acceleration. In particular, we have proposed to accelerate ions with quasistatic electric fields produced in a straight electron beam of constant diameter propagating a conducting shield whose diameter varies along the system axis. Use is made here of the fact that the potential on the axis of the system increases with increasing ratio of the shield diameter to the electron-beam diameter. If the shield diameter changes periodically, then a sequence of potential wells is produced in the system and the dependence of the longitudinal component of the electric field on z is described by a periodic function. 1 Refs.
Primary Keywords: Collective Acceleration; Shield Diameter; E-beam Diameter, Potential Increase, Shield Diameter Modulation

1363
(SWITCHES, CLOSING)
(LASS)

OPTICALLY ACTIVATED SWITCH

L.R. Lowry
Westinghouse Research and Development Center, Pittsburgh PA
AFAPL Report No. AFAPL-TR-78-17 (04/1978).
Availability AD A 0?0 567
NTIS

There has been a growing need for improved switches for very high energy, pulsed power systems. Conventional switches such as thyratrons, spark gaps, and ignitrons have deficiencies in one or more of the desired parameters. A new solid state device, the Laser Activated Silicon Switch (LASS), appears to have the potential of meeting simultaneously all of the desired parameters including life and reliability of an extremely fast, high power, pulsed power switch. The LASS is a silicon pnpn structure similar to an electrically gated thyristor, but it is triggered by a beam from a Nd:YAG laser. The laser trigger causes the device to turn on orders of magnitude faster than does an electrically gated device. This report describes the development and experimental verification of an analytic model of a high power LASS. Switches were fabricated and tested that achieved di/dt values greater than 40000 A/microsecond to peak currents of 25000 A for a pulse width of 40 microseconds. It is concluded that the LASS indeed has the potential to meet the needs for a pulsed power switch, but considerable research and development work is required. Recommendations are given for future work. 46 Refs.
Primary Keywords: Thyristor; Optical Triggering; High Repetition Rate Switches; Laser Activated Silicon Switch, Nd-YAG Laser; Experiment; Theory

1366
(INSULATION, MATERIAL)
(Solid)
STUDY OF THE EVOLUTION OF ELECTRICAL TREEING BY OBSERVATION OF LUMINOUS PHENOMENA AND DISCHARGE DETECTION

C. Laurent and C. Mayoux
Toulouse Univ. (France). Lab. de Genie Electrique.
No. PUBL-261, 6p (04/1978).
Availability: H80-17374/3
NTIS

Results obtained from the observation of discharge characteristics for different treeing types as well as the time dependent evolution of accompanying light phenomena were studied. The experimental apparatus, consisting of a microscope (400 X) and a camera, are described and the experimental procedure outlined. Results demonstrate the occurance of light emission due to the existence of discharge under the studied voltage conditions. The evolution of the light in the electrode gap was revealed through the use of an image intensifier. The same aging conditions as those reported in the literature for an air filled gap were also observed.
Primary Keywords: Arc Discharges; Circuits; Light Emission; Microchannels; Microphotographs; Amplifiers; Electric Arcs; Imaging Techniques; Insulators; Optics; Microscopes; Spark Gaps
Secondary Keywords: NTIS/NASA6; NTIS/AFR

1366
(DIAGNOSTICS AND INSTRUMENTATION, SYSTEMS)
(Systems)
AUTOMATING THE E-BEAM LASER LABORATORY

P.G. De Biase
Aerospace Corp., El Segundo, CA 90245
Interim rept. No. TR-0080(5945-02)-5, 27p (11/1979).
Availability: AD-A079 579/6
NTIS

Experiments conducted in the E-beam Laser Laboratory require the setting of gas flows, pressures, and voltages in a timed sequence with a variety of sensors monitoring the system. The report describes the use of a CROMEMCO microcomputer and other hardware, and details a BASIC program that senses and displays process variables digitally, reads in process parameters interactively, acquires data during an experiment, and computes and prints out test conditions and results. (Author)
Primary Keywords: Chemical Lasers; Pulsed Lasers; Electron Beams; Trigger Circuits; Experimental Data; Data Acquisition; Computer Applications; Operational Amplifiers; Analog to Digital Converters; Computer Programming; Microcomputers; Mixing; Hydrogen; Fluorine
Secondary Keywords: Marx Generators; Chemical Pumping; Cromemco Computers; BASIC Programming Language; Computer Applications; NTIS/DOEXA; NTIS/DODAF

1371
(POWER CONDITIONING)
(Systems)
HIGH POWER STUDY-POWER CONDITIONING

A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226
AFAPL Report No. AFAPL-TR-76-101 (01/1976).
Availability: AD AD38724
NTIS

This paper summarizes the power conditioning portion of the high power study that was performed for the Air Force Aero-Propulsion Laboratory by the State University of New York at Buffalo. This effort defines the power conditioning system and critical component developments which will be required to interface the airborne 10 MW to 50 MW sources defined under separate study efforts with certain loads. Power conditioning systems are considered for use with magnetohydrodynamic generators and turbine driven alternators; both conventional and superconducting. The critical components required for each of the power conditioning systems are identified and then analyzed. The component analyses include estimations of development efforts necessary and of specific weights and volumes of components. The primary components considered are transformers, switches, capacitors and inductors. Weight algorithms are developed for each of the components. Following the component analyses, subsystems such as inverters and rectifier and filter packages are considered. The data for the various components and subsystems are then utilized for a comparison of the power conditioning techniques to be used with the various power sources. The weights and volumes of power conditioning systems for 5 point designs (8 variations of power, voltage, duty cycle and total run time) are derived. Finally a development program is outlined for the critical components. 12 Refs.
Primary Keywords: Power Conditioning; High Power; Transformers; Solid State Switches; Capacitors; Inductors; Adiabatic Components
Secondary Keywords: Inverter; Converter; Light Weight Components

1372
(DIAGNOSTICS AND INSTRUMENTATION; REVIEWS AND CONFERENCES)
(Systems, Reviews)
HIGH VOLTAGE DESIGN GUIDE FOR AIRBORNE EQUIPMENT

W.G. Dunbar and J.W. Seabrook
Boeing Aerospace Co., Seattle, WA 98124
AFAPL Report No. AFAPL-TR-76-41 (06/1976).
Availability: AD A029168
NTIS

This report supplies the theoretical background and design techniques needed by an engineer who is designing electrical insulation for high-voltage high-power components, equipment, and systems on aircraft. A literature survey and abundant bibliography identify references that provide further data on the subjects of partial discharges, corona, field theory and plotting, voids and processes for applying insulation. Both gaseous and solid insulations are treated. Cryogenic and liquid designations are included. Tests and test equipment for high voltage insulation and equipment are defined. Requirements of test plans and procedures for high-voltage high power equipment are identified and illustrated by examples. Suggestions for high-voltage specifications are provided. Very few of the Military and Government specifications deal with system voltages above 10kv, thus most aircraft high-voltage specifications will have to be derived from the power industry specifications and standards produced by ASTM, IEEE, and NEMA. 12 Refs.
Primary Keywords: Corona; Dielectric Withstanding Voltage; Electrical Insulation; High Voltage, Impulse Voltage, Partial Discharges; Paschen Law; Tracking
Secondary Keywords: Creepage; Field Theory; Utilization Factor; Test

1373
(SWITCHES, OPENING)
(Vacuum Gaps, Magnetic Field)
INVESTIGATION OF FEASIBILITY OF VACUUM-ARC FAULT-CURRENT LIMITING DEVICE

A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226
EPRI Report No. EPRI-EL 538 (12/1977).
Availability: EPRI EL-538
EPRI

The feasibility of a vacuum arc fault current limiter was investigated in this project. This work is an outgrowth of the studies on the interruption of DC vacuum arcs that have been underway at the State University of New York at Buffalo for several years. In those studies a magnetic field has been used to interrupt or control the current flow in a vacuum arc device. The configuration of the device is such that electron current is forced to flow primarily radially outward from the end of a relatively small rod shaped cathode to a ring shaped anode. Control is achieved through the application of an axial magnetic field. Operation at current levels in the 5 to 10 kA range have been demonstrated for periods up to about 8 ms. The voltage of operation that has been demonstrated is less than required because of discharge paths that develop within the device in parallel with the desired path from the cathode to the anode. Significant progress was made in eliminating these discharge paths by using insulating shields between the anode and the cathode support structure. A brief study of fault current limiter commutation voltage requirements showed that the voltage appearing across a commutation device could be limited to a very reasonable value if the commutation current waveform was properly controlled. Another study dealt with an investigation of the phenomena occurring during the ignition of arcs on gold and on copper cathodes. 8 Refs.
Primary Keywords: Vacuum Gap; Current Interruption; Magnetic Field; Waveform Control

1395
(ENERGY STORAGE, ELECTROSTATIC)
(Reviews)
PROGRESS IN RESEARCH ON ELECTROSTATIC GENERATORS

A.W. Bright
University of Southampton, Southampton, UK
Static Electrification, Paper 24, pp 285-296 (05/1971).

The requirements for high voltage generators are determined by the demands of physicists, engineers and industry. In this paper a review of the requirements is given, together with the various techniques for designing electrostatic high voltage power supplies. The basic principles underlying the physics of electrostatic generators are considered, enabling one to envisage which method is more suitable for any particular requirement. An analysis of both the insulating carrier machine and the variable capacitor machine is presented with illustrations indicating the limitations and areas for further research to meet specific power densities. The research associated with liquid insulated generators is reviewed, including both polar and nonpolar fluids. Developments are given for those generators using moving rotors with polar liquids (nitrobenzene) and for the streaming type EHD system with nonpolar liquids (hexane). The areas which require more study are the charge injection, charge collection and the associated bulk motion of the liquid. The latest achievements in these areas are presented. In the last section, a novel electrostatic generator employing dust laden air is described. 20 Refs.
Primary Keywords: Basic Principles; Insulating Carrier Generator; Variable Capacitor Generator; Polar Fluid; Nonpolar Fluid; Dust Laden Air

1402
(BREAKDOWN STUDIES)
(Gas, Electrical)
CONTRIBUTION TO THE THEORY OF IMPULSE BREAKDOWN

F.R. Dickey Jr.
Harvard University, Cambridge, MA
Journal of Applied Physics, Vol. 13, No. 12, pp 1336-1339 (12/1952).

The experiments of R.C. Fletcher on impulse breakdown are discussed and a simple theory for these experiments is developed by assuming that the breakdown consists of ionization and charge separation in a uniform field. The theory accounts reasonably well for the time lags and also explains the shapes of the breakdown voltage transients. It indicates also that measurement of the mean ionizing time for electrons in the gap should be possible. 3 Refs.
Primary Keywords: Gas Breakdown; Impulse Voltage; Theory; Breakdown Delay; Numerical Calculation

1412
(INSULATION, MATERIAL; ENERGY STORAGE, CAPACITIVE)
(Solid; Capacitors)
MODIFIED PLZT HIGH VOLTAGE DIELECTRICS

T.R. Gururaja, S. Kumarakrishnan and E.C. Subbarao
Indian Institute of Technology, Kanpur, India
Ferroelectronics Vol. 27, pp 277-280 (01/1980).

Modified PLZT compositions were tested for the variation of their dielectric constant with respect to temperature and DC bias voltage. Calcium, strontium, and barium were added to replace lead and neodymium in place of lanthanum. Yttrium was also used, but it caused the formation of a cubic zirconia phase. A model based on the nearness of a material to the AFE-FE boundry is discussed. 7 Refs.
Primary Keywords: Multilayer Capacitor Dielectric; Dielectric Constant; Variation With Temperature; Variation With DC Bias; Modeling

1413
(ENERGY CONVERSION, ELECTRICAL; ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Charging Circuits; Systems; Explosive Fuses)
PULSED CHARGING OF CAPACITORS BY MEANS OF EXPLODING WIRES

L. Liebing
Institut fur Plasmaphysik, Garching, FRG
Zeitschrift fur Angewandte Physik, Vol. 26, No. 5, pp 345-350 (04/1969).

Exploding copper wires are used as circuit breakers in a circuit which pulse charges a fast energy storage capacitor from an inductive store. A two stage version of this circuit was constructed and tested with good results. Wire explosions confined in glass capillary tubes with inner diameters up to 2 mm were also studied. The load voltages in these experiments was 40 kV, but a discussion of scaling the circuit up to handle 1 MV is presented. 13 Refs.
Primary Keywords: Pulsed Capacitor Charging; Exploding Wire; Inductive Energy Storage, Two-stage Charging

1415
(PARTICLE BEAMS, ION)
(Transport)
A HIGH VOLTAGE DEFLECTION CONDENSER OPERATED UNDER HIGH VACUUM CONDITIONS
G. Munzenberg (1), W. Faust (1), S. Hofmann (1), H.J. Schott (1) and K. Guttner (2)
(1) Gesellschaft Fur Schwerionenforschung, Darmstadt, FRG
(2) Physik Institut, Universitat Giessen, Giessen, FRG
Nuclear Instruments And Methods 166 (1979), pp 391-395 (12/1979).
Two electrostatic deflection condensers with plane electrodes of 50x60 cm/sup 2/ surface area are operated under high vacuum conditions up to voltages of 620 kV across a gap of 15 cm. The condensers are operated in parallel by common power supplies. They are installed at the velocity filter SHIP at GSI Darmstadt. 10 Refs.
Primary Keywords: Ion Acceleration; Automatic Conditioning; Vacuum; Nuclear Reaction Products; Electrodes

1421
(ENERGY STORAGE, CAPACITIVE; INSULATION, MATERIAL)
(Capacitors; Solid)
HIGH VOLTAGE POWER CAPACITOR DIELECTRICS RECENT DEVELOPMENTS
L. Mandelcorn (1), T.W. Dakin (1), R.L. Miller (1) and G.E. Mercier (2)
(1) Westinghouse Electric Corp, Pittsburgh PA
(2) Westinghouse Electric Corp, Bloomington, IN 47402
IEEE Proceedings Of The 14th Electrical Electronics Insulation Conference, Boston, MA pp 250-255 (10/1979).
This paper discusses recent, new impregnant developments and evaluations for capacitor dielectrics. These dielectric fluids are isopropylbiphenyl, di-2 ethlhexyl phthalate plus trichlorobenzene butylated monochlorodiphenyl oxide phenyl xylyl ethane and benzyl neocaprate. The film-paper dielectrics impregnated with these were extensively tested for thermal stability under voltage, and resistance to overvoltages with partial discharges. Considerable attention is now being devoted to practically significant partial discharge testing, to determine service reliability. Also included here is the evaluation of windings where one foil is narrower and folded at the edges to reduce the voltage stress at the foil edges. 9 Refs.
Primary Keywords: Capacitor Dielectrics; Film-paper Dielectrics; Fluid Properties

1428
(SWITCHES, OPENING)
(Explosive Fuses)
EXPLOSIVELY ACTUATED FAST-OPENING SWITCHES FOR VERY LARGE CURRENTS
R.I. Butler and B.W. Duggin
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND77-1438 (11/1977).
Availability: SAND77-1438
NTIS
In a series of eight experiments the authors investigated the use of high explosives to interrupt electric current by fast-opening switch mechanisms. The conducting link in seven of the experiments was a glass-lined plasma-filled cavity that was closed explosively. In the eighth experiment a foam-metal link was driven into the liquid-vapor phase and expanded into a ceramic cavity. Resistance increases and resultant voltage spikes that correspond in time with the particle velocities of the collapsing walls were obtained. However, unknown high-resistance paths prevented voltage gradients greater than 1E5-1E6 V/m. 0 Refs.
Primary Keywords: Explosive Fuse; Glass Lined Plasma Filled Cavity; Foam Metal Link Ceramic Cavity
Secondary Keywords: Cylindrical Geometry

1429
(POWER CONDITIONING)
(Pulse Forming Networks)
PFN CHARACTERIZATION AND LIFE TEST
C.L. Dailey and C.W. White
TRW Systems Group, Redondo Beach, CA
AFAPL Report No. AFAPL-TR-75-69 (01/1976).
Availability: AD A022958
NTIS
The feasibility of an integral, high temperature, pulse forming network (PFN) operating at a high pulse rate for a short duration burst has been demonstrated. The dielectric construction of the capacitor consisted of Kapton film and paper impregnated with Monsanto Chemical Co. MS 1489 oil. Litz wire coils were wound on a high temperature foam core and the entire assembly was placed in a stainless steel enclosure. A U-shaped aluminum shield was used between the coils and the case to reduce eddy current heating. An overall weight of approximately 20 pounds for an energy storage density of 600 joules (30 joules per pound) was achieved in a design that operated for 1.5E5 shots at a pulse rate of 200 shots per second in 18 second bursts. The burst duration was limited by heating of the stainless steel enclosure due to eddy currents induced by the coil magnetic field. An aluminum case construction would greatly reduce this effect. 2 Refs.
Primary Keywords: PFN; Pulse Forming Network; High Energy Density Capacitors; High Energy Density PFNs; High Pulse Rate PFNs
Secondary Keywords: Integral PFN Design; High Temperature Capacitors

1431
(ENERGY STORAGE, CAPACITIVE; SWITCHES, CLOSING)
(Capacitors; Thyristors)
THE DESIGN OF A REPETITIVELY PULSED MEGAJOULE DENSE-PLASMA FOCUS
D. Zucker, W. Bostick, R. Gullickson, J. Long, J. Luce and M. Sahlin
Lawrence Livermore Lab, Livermore, CA 94550
UCRL Report No. UCRL-51872 (08/1975).
Availability: UCRL-51872
NTIS
This report describes a 1 pulse per second, dense-plasma-focus materials-testing device capable of delivering a minimum of 1E15 neutrons per pulse. Moderate scaling up from existing designs is shown to be sufficient to provide 2E13 neutrons/sq. cm./sec to a suitable target. The average power consumption, which has become a major issue due to the energy crisis, is analyzed with respect to other plasma devices and is shown to be highly favorable. Also discussed is a novel approach to capacitor-bank and switch design with respect to repetitive-pulse operation. 17 Refs.
Primary Keywords: Capacitor Bank; Staggered-foil Capacitor; Silicon Controlled Rectifier
Secondary Keywords: Dense Plasma Focus; Liquid-dielectric Switch

1432
(POWER CONDITIONING)
(Pulse Transformers)
A THREE MEGAVOLT TRANSFORMER FOR PFL PULSE CHARGING
G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 3, pp 4211-4213 (06/1979).
High voltage pulse transformers powered by low voltage capacitor banks have proven to be simple reliable systems for charging pulse forming transmission lines (PFL) up to the one megavolt range. A new transformer has been developed which will operate up to three megavolts in a PFL charging application. This transformer establishes the feasibility of multimegavolt operation and retains the features of compactness and high energy transfer efficiency that has been characteristic of lower voltage systems. This report includes a description of the physical features of the transformer, its electrical characteristics and a discussion of the operational results. 8 Refs.
Primary Keywords: Air Core Pulse Transformer; Megavolt Range; High Efficiency; Spiral Strip Design

1433
(BREAKDOWN STUDIES)
(Solid, Electrical)
CALCULATION OF ELECTRIC FIELD BREAKDOWN IN QUARTZ AS DETERMINED BY DIELECTRIC DISPERSION ANALYSIS
W.T. Lynch
Bell Labs, Murray Hill, NJ 07974
J. Appl. Phys., Vol. 43, No.8, pp 3274-3278 (08/1972).
A breakdown field of 1.0E7 v/cm has been calculated using classical theory of electron energy loss. Dielctric dispersion curves were used to relate longitudinal optical phonon modes to electron energy loss via interaction of these two processes. The dominant mode was seen to be the 0.153eV phonon mode. The breakdown calculation is also in good agreement with breakdown fields in SiO/Sub 2/, which also has optical modes that are strongly localized. 20 Refs.
Primary Keywords: Longitudinal Optical Phonon Modes; Electron Energy Loss; Nonrelativistic Electrons

1442
(BREAKDOWN STUDIES)
(Gas, Electrical)
FORMATION OF NANOSECOND SPARKS IN STATIC BREAKDOWN OF A GAP
G.A. Mesyats and G.S. Korshunov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 13, No. 4, pp 483-487 (10/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 38, 646-654 (April 1968)
An examination is made of the limits of applicability of relations obtained on the basis of the Rompe-Weizel theory of the spark in stetic breakdown of air gaps (0.005 to 3.5 cm) under pressures of 1-6 atm, the time resolution of the recording apparatus being 1E-10 sec. It is demonstrated that the experimental results agree well with this theory for spark processes of duration t <= 1E-8 sec. 0 Refs.
Primary Keywords: Static Breakdown; Nanosecond Resolution; Rompe-Weizel Theory; Experiment; Theory; Variable Gap Spacing; Variable Pressure; Several Electrode Materials; Air Gaps

1445
(PARTICLE BEAMS, ELECTRON)
(Generation)
OPTIMIZATION OF A HIGH ENERGY REB GENERATOR AND CONTRIBUTED STUDY OF THE PULSED REB
C. Pitoizet
CEA Centre d'Etudes de Valduc, Is-sur-Tille, France
(12/1977).
Availability: CEA-R-4894
NTIS
The optimization of a high-power electron generator which has been designed and constructed in the Commissariat a l'Energie Atomique laboratories is described. This device, consists of a Marx generator coupled with a low-impedance coaxial line with liquid dielectric (water), should deliver high power pulses (0.1 TW; 50 ns) in a vacuum diode with a suitable impedance. The report consists of the following parts: the optimization definition and the tests to obtain an optimum for the impedance; the study and realization of a new switch in order to cut off the prepulse; the study of the extracted electron beam and its propagation. The present characteristics are: peak voltage in the diode: 600 kV, peak current in the diode: 273 kA, electron pulse width: 80 ns, beam transported energy: 6.8 kJ (graphite calorimeter), maximum peak power: 0,135 terawatt. (Atomindex citation 09:412075)
Primary Keywords: Electron Guns; Amp Beam Currents; Beam Extraction; Beam Transport; Diode Tubes; Electric Impedance; Electron Spectra; High-voltage Pulse Generators; Performance; Power Generation; Signals; Simulation; Spark Gaps
Secondary Keywords: IN FRENCH; ERDA/440300; France; Pluse Generators; NTISINIS; NTISFNFR
Distribution Restriction: U.S. Sales Only.

1448
(PARTICLE BEAMS, ION)
(Generation)
HIGH-IMPEDANCE ION-DIODE EXPERIMENT ON THE AURORA PULSER
R.A. Meger (1), F.C. Young (1), A.T. Drobot (1), G. Cooperstein (1), S.A. Goldstein (1), D. Mosher (1), S.E. Graybill (2), G.A. Huttlin (2), K.G. Kerris (2) and A.G. Stewart (2)
(1) Naval Research Lab, Washington, DC 20375
(2) Harry Diamond Labs, Adelphi, MD 20783
Journal Of Applied Physics, Vol. 52, No. 10, pp 6084-6093 (10/1981).
Proton beams with currents >50 kA at 5 MeV in a <=160-ns FWHM pulse have been extracted from an ion diode operated on the Aurora pulser. This current corresponds to an efficiency (proton current/total current) of 20%, which compares favorably with numerical simulation. The simulation indicates that the ion current is enhanced over the Child-Langmuir value due to increased electron lifetime in the diode. The proton beam directed onto a LiCl target provides a source of 1.8E12 neutrons/sr/pulse in the forward direction from the /sup 7/Li(p,n)/sup 7/Be reaction. 16 Refs.
Primary Keywords: Proton Beam; 50 kA Current; 5 MeV Energy; Experiment; Theory; Numerical Calculation

1477
(BREAKDOWN STUDIES)
(Gas, Electrical)
IMPULSE BREAKDOWN IN THE 1E-9-SEC. RANGE OF AIR AT ATMOSPHERIC PRESSURE
R.C. Fletcher
Massachusetts Institute of Technology, Cambridge, MA
Physical Review, Vol. 76, No. 10, pp 1501-1511 (11/1949).

The formative lag of spark breakdown has been measured over the range from 0.5 to 50E-9 sec. using transmission line circuits in conjunction with the micro-oscillograph. It is found to be a function only of the applied field (independent of gap width) for the shorter times (high fields), but to increase for decreasing gap-widths for the longer times (low fields). A calculation of the formative lag is presented which is based on the assumption that it consists mainly of the time for a single electron avalanche to build up a space-charge field comparable with the applied field. This predicts the observed formative lags within the experimental accuracy of the measurements over the entire range used. The increasing times for decreasing gap widths for the longer times is interpreted as the transition from a single avalanche to a multiple avalanche mechanism of breakdown. The critical field where this transition takes place for a given gap width is computed and found to predict the observed critical fields within the experimental accuracy. The good agreement between theory and experiment enables a more reliable prediction than has previously been possible for the critical gap-width above which the threshold field is determined by a single avalanche mechanism. A sharp drop in the rate of fall of the breakdown voltage is observed for the shorter times. It is suggested that this may be a change in the mechanism of electron release from the cathode. 13 Refs.

Primary Keywords: Air Gap, Formative Time Lag, High Fields, Gap Spacing Independence, Low Fields, Gap Spacing Dependence

1482
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
LASER-CONTROLLED SWITCHING
J.P. Bradley (1) and T.J. Davies (2)
(1) Sandia Labs, Albuquerque, NM 87115
(2) EG&G Inc., Goleta, CA
IEEE Journal Of Quantum Electronics, Vol. QE-7, No. 9 (09/1971).

A new type of laser switching is discussed. The laser produces volume ionization in the path of a propagating streamer, increasing its velocity. Subnanosecond jitter is thereby obtained with pressurized gas switches. 5 Refs.

Primary Keywords: Laser-enhanced Switching; Volume Ionization; Streamer Propagation; Velocity Increase; Multichannel Operation

1483
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Self)
STATISTICAL STUDY OF NANOSECOND BREAKDOWN DELAY IN NARROW GAS GAPS IN SUPERHIGH ELECTRIC FIELDS
G.A. Mesyats and Yu.I. Bychkov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 12, No. 9, pp 1255-1260 (03/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1712-1719 (September 1967)

This paper studies the delay in breakdown T/sub d/ in narrow air gaps 0.2-0.7 mm long for an electric field strength reaching 1.4E6 V/cm and a rise time of 0.25E-9 sec. A specially developed instrument is used to record automatically a large number of breakdown delay times T/sub d/ (up to 500-600). The distributions of the number of breakdowns are constructed as a function of T/sub d/. It is shown that these distributions have a single maximum when the number of breakdowns is approximately 1E3. The number of maxima in the distribution increases when the number of breakdowns is greater than 1E3. The minimum time T/sub d/ in the distribution is taken to be the time required for discharge to take place and is about 1-2 orders greater than the time required for the avalanche to increase to its critical size T/sub ava/. When the emission current from the cathode is increased, the formation time decreases to about T/sub ava/ because of the ultraviolet light of the spark and scratches on the surface of the cathode. It is shown that even for 6-or 7-fold overvoltages the probability that no electron will appear after breakdown is less than unity. It is also shown that fluctuations in the number of secondary electrons prove to have a considerable effect on the formation of discharge. 10 Refs.

Primary Keywords: Breakdown Delay, Very High Fields, Fast Rise Time, Critical Avalanche Size, Cathode Emission; Air Gap

1485
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
INTERACTION OF CAPACITOR-BANK-PRODUCED MEGAGAUSS MAGNETIC FIELD WITH SMALL SINGLE-TURN COIL
J.W. Shearer
Lawrence Livermore Lab, Livermore, CA 94550
Journal Of Applied Physics, Vol. 40, No. 11, pp 4490-4497 (10/1969).

Experiments on the production of high magnetic fields in single-turn coils by means of high-voltage capacitor banks are described. Fields as high as 3.5 megagauss have been produced. Numerical analysis of the interaction of this field with the metal wall shows that magnetic diffusion and wall compression are the principal interaction phenomena. In addition, experimental and theoretical evidence are presented for the emission of a vapor cloud by the wall into the magnetic-field volume. Finally, a simple approximate method for calculating the early time history of the magnetic field and coil motion is shown to give reasonable agreement with experiment. 16 Refs.

Primary Keywords: 3.5 MG Field; Field-coil Interaction, Field Diffusion; Wall Compression, Vapor Cloud

1499
(BREAKDOWN STUDIES)
(Lightning)
LASER-INDUCED LIGHTNING CONCEPT EXPERIMENT
J.R. Lippert
AFFDL, Wright-Patterson AFB, OH
AFFDL Report No. AFFDL-TR-78-191 (12/1978).
Availability: AD A065897
NTIS

A program was conducted to gain experience and document progress towards development of a concept for a Laser-Induced Lightning Experiment (LILE). The purpose of the program was to develop a method for triggering natural lightning discharges using pulsed lasers and verify theoretical predictions. The technique shows great promise in shortening the acquisition period for obtaining necessary lightning parameter data needed for more realistic Lightning Simulation Tests and more definitive Lightning Transient analyses. To achieve the intended objective within the restrictions of availability, an experimental method was designed, a test locale selected, test parameters were defined, test apparatus designed and test instrumentation selected and/or developed. Although the required climatic conditions did not develop during the experimental period, all other phases of the program were successfully accomplished and will facilitate future experiments. Small scale experiments were also performed to investigate spark gap triggering using [illegible] laser beam effects on electromagnetic fields, and laser power/energy scaling. 11 Refs.

Primary Keywords: Lightning Triggering; Lightning Transient Analyses

1500
(PARTICLE BEAMS, ION)
(Target Interactions)
MATERIAL RESPONSE TO 500 KEV PROTON BEAMS AT INTENSITIES BELOW 1 GW/SQ CM
T.R. Tucker (1), D. Mosher (1) and D. Hinshelwood (2)
(1) Naval Research Lab, Washington, DC 20375
(2) JAYCOR Inc, Alexandria, VA 22304
NRL Memorandum Report No. 4043 (07/1979).
Availability: AD A072416
NTIS

Stress-wave response of several materials to 500 keV, 1 kA/sq. cm proton pulses was monitored by shadowgraphy and interferometric methods. Results indicated the presence of both direct absorption and interaction plasma effects. Incident beam power densities of about 1 GW/sq. cm are necessary for plasma effects to dominate the interaction. 7 Refs.

Primary Keywords: Pulsed Ion Beams, Stress Waves, Interferometry

1501
(PARTICLE BEAMS, ELECTRON; PULSE GENERATORS; SWITCHES, CLOSING; INSULATION, MATERIAL; SYSTEMS)
(Generation; Marx, Gas Gaps, Electrical; Liquid)
SUMMARY OF THE HERMES FLASH X-RAY PROGRAM
T.H. Martin, K.R. Prestwich and D.L. Johnson
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SC-RR-69-421 (10/1969).
Availability: SC-RR-69-421
NTIS

The Hermes program produced significant information in the areas of Marx generator design, flash x-ray tube development, dielectric breakdown, and general flash x-ray machine design. As an outcome of the Hermes program, Hermes II was constructed and is the largest flash x-ray machine presently operating. This report summarizes the results of investigations in the areas mentioned and provides a general knowledge in the operation of megavolt flash x-ray machines which should be useful to the experimenters using these machines. 13 Refs.

Primary Keywords: 18-MV Marx Generator; Blumlein; Postpulse Supression
Secondary Keywords: Flash X-ray Machines; Hermes II

1502
(PARTICLE BEAMS, ELECTRON)
(Generation)
A LONG PULSE, HIGH-CURRENT ELECTRON GUN FOR E-BEAM SUSTAINED EXCIMER LASERS
W.M. Clark and G.J. Dunning
Hughes Research Labs, Malibu, CA 90265
IEEE J. Quant. Electron., Vol. QE-14, No. 2 pp. 126-129 (02/1978).

A new kind of electron gun is described which has produced 5 microsecond beams at 130 keV and 2 A/sq. cm. Scaling estimates are presented which predict that this gun could operate at 400 keV and 10 A/sq. cm., beam parameters suitable for pumping excimer laser systems. For this application the gun has the advantages that the e-beam is nearly monoenergetic and the pulse widths longer than that possible with other presently used e-guns. 9 Refs.

Primary Keywords: Electron Gun, High Energy, Secondary Electrons; Thin-wire Discharge
Secondary Keywords: Multiple Wires

1503
(BREAKDOWN STUDIES)
(Gas, Alpha Particle)
PREIONIZATION OF PULSED GAS LASERS BY RADIOACTIVE SOURCE
I.J. Bigio
Los Alamos National Labs, Los Alamos, NM 87545
IEEE J. Quantum Electronics, Vol. QE 14, No. 2 pp. 75-76 (02/1978)

An alpha-source of americium 241 is used to preionize transverse electrical-discharge gas lasers, enhancing the useful pressure range in a variety of gases. Of particular interest is the enhancement in electron-attaching gases, which corroborates speculations of the role of negative ions in preionization. 11 Refs.

Primary Keywords: Americium 241, Electron Attaching Gases; Negative Ions
Secondary Keywords: Laser Preionization

1505
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
AN INTERNATIONAL COMPARISON OF HIGH VOLTAGE CAPACITOR CALIBRATIONS
W.E. Anderson, R.S. Davis, O. Petersons and W.J.M. Moore
National Bureau of Standards, Washington, DC
Final rept. (01/1978).
Availability: PB-296 114/2ST
NTIS
The suitability of a commercially available, compressed-gas-insulated, high voltage capacitor for precise measurement of ac voltages has been examined by national laboratories in the U.S.A. and Canada. The voltage, temperature, and pressure dependences and the mechanical stability of the capacitor were determined. It was found that, by taking proper precautions, the device is competitive with other methods. As a result of this research, it was also found that high voltage capacitance measurements at the two laboratories involved are in agreement.
Primary Keywords: Capacitors; Calibrating; Comparison; High Voltage; Standards
Secondary Keywords: Reprints; NTISCOMNBS
Distribution Restriction: PUB. IN IEEE (INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS) TRANSACTIONS ON POWER APPARATUS AND SYSTEMS PAS-97, No. 4, P1217-1223, JUL/AUG 78.

1508
(PULSE GENERATORS)
(Pulse Forming)
A MONOLITHIC HIGH VOLTAGE, HIGH CURRENT NANOSECOND PULSE GENERATOR
J. Baird
Cober Electronics Inc, Stamford, CT 06902
1978 IEEE 13th Pulse Modulator Symposium, pp 1-4 (04/1978).
This paper describes the development of a high voltage, high current nanosecond pulse generator of small volume, low weight, and high efficiency. The pulse generator operates either single pulse or 15 kc at a pulse width of 125ns, pulse voltage of 30 kV, 1200 amp pulse is formed by a peaking a Blumlein circuit with a triggered spark gap. A ringing choke cathode converter charges the Blumlein circuit capacitors to 30 kV by transforming the 2% volt input. Presented are factors leading to the design approach, problems encountered, and breadboard test results. 2 Refs.
Primary Keywords: Blumlein Line; Rectifier; Charging Circuit
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1531
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)
COMPUTATIONAL PROCEDURES FOR CHARACTERIZATION OF HIGH VOLTAGE SPARK SOURCES
A. Scheeline, R.J. Kluepfel, D.M. Coleman and J.P. Walters
University of Wisconsin, Madison, WI
Applied Spectroscopy, Vol. 32, No. 2, pp 224-238 (04/1978).
Methods for simulating high voltage spark sources are presented. Complete break patterns are computed given the source parameters, simulation is accomplished by the calculation of capacitor charging current and voltage as they relate to the output of the high-voltage transformer. A relative error of between 1 and 5% is achieved when the computations are compared to the experimental results. 14 Refs.
Primary Keywords: Spark Source; Charging Characterization, Simulation; Numerical Calculation; Capacitor Voltage; Charging Waveform
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1532
(SWITCHES, CLOSING)
(Vacuum Tubes)
A NEW DESIGN FOR A HIGH-VOLTAGE DISCHARGE TUBE
L.C. Van Atta (1), R.J. Van De Graaff (1) and H.A. Barton (2)
(1) Massachusetts Institute of Technology, Cambridge, MA
(2) American Institute Of Physics, New York, NY 10017
Physical Review, Vol. 53, pp 158-159 (02/1933).
A description is given of tests with a high voltage pulse of simple and rugged design. The tube consists esentially of a filter cylinder extending between the electrodes and evacuated to a pressure of 4E-6 mm Hg during operation. A potential of 300000 volts could be maintained on a section of tube 53 cm long. In spite of the fact that the voltage was iniated by discharge there was no case of puncture. A simple clear-cut mechanism for the initiation of discharge in vacuum (independent of field currents) is given together with confirming experimental avidence. On the basis there is proposed a method of screening the electrodes to prevent breakdown and permit the application of extremely high voltages to the tube. 3 Refs.
Primary Keywords: Vacuum Tube; Uniform Field; 300 kV Operating Voltage; Breakdown Mechanism
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1544
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
AC (50 HZ) AND DC ELECTRICAL BREAKDOWN OF VACUUM GAPS AND WITH VARIATION OF AIR PRESSURE IN THE RANGE 1E-9 - 1E-2 TORR USING OFHC COPPER, NICKEL, ALUMINUM, AND NIOBIUM PARALLEL PLANAR ELECTRODES
R. Hackam and L. Altcheh
University of Sheffield, Sheffield, UK
Journal Of Applied Physics, Vol. 46, No. 2, pp 627-636 (02/1975).
Breakdown potentials of vacuum gaps are measured over a wide range of air pressure using both direct and alternating (50 Hz) applied voltage and employing four different electrode materials. The air pressure is varied in the range 2E-9 - 2.5E-2 Torr for DC and 6E-7 - 2.5E-2 Torr for AC applied voltage. OFHC copper, nickel, aluminum, and niobium are used to fabricate the electrodes. It is found that the peak AC breakdown voltage is usually higher than the DC voltage for a fixed electrode separation and a fixed gas pressure. Under certain conditions considerable improvement in the insulating property of the gap can be obtained in semivacuum. The improvement in the breakdown voltage of the gap is considerable and can reach up to 62% in some cases. The higher breakdown voltage is attributed to the increased work function of the metal-gas adsorbate system. 62 Refs.
Primary Keywords: AC Breakdown; DC Breakdown; Vacuum Breakdown; Gas Breakdown; Several Electrode Materials; Variable Gas Pressure; Breakdown Voltage Measurement
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1546
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
CATHODE- AND ANODE-INDUCED ELECTRICAL BREAKDOWN IN VACUUM
T. Utsumi
Cornell University, Ithica, NY 14850
Journal Of Applied Physics, Vol. 38, No. 7, pp 2989-2997 (06/1967).
The problems considered are whether the breakdown that occurs between two parallel-plane electrodes in a vacuum is an anode-induced or cathode-induced breakdown and what conditions determine which type of breakdown is dominant. The critical anode power density for an anode-induced breakdown and the critical cathode current density for a cathode-induced breakdown were measured and the experimental results were compared with predictions from theory of heat conduction. An analysis of these experimental results led to a criterion for determining the type of breakdown that predominates as a function of separation between electrodes and of the thermal and electrical conductivities of the material of the electrodes. It was shown that there were four distinct regions of separation: two anode-induced regions, one cathode-induced region, and one transition region of both types. 8 Refs.
Primary Keywords: Parallel-plane Electrodes; Anode Initiated Breakdown; Cathode Initiated Breakdown; Transition Region; Critical Power Density
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1556
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas Gaps, Materials; Gas Gaps, Materials)
ELECTRODE EROSION BY SPARK DISCHARGES
F.L. Jones
University College of Swansea, Singleton Park, Swansea, Wales
British Journal Of Applied Physics, Vol.1 No. 3 pp. 60-65 (03/1950).
Diffusion and space charge effects are two important factors in determining the size of electrode hot spots. The author presents an estimate of the area of cathode hot spots based on the phenomena and predict that current densities of approximately 1E6 A/sq. cm. are possible in short gaps. Electrode erosion is then estimated using the energy balance of these hot spots with an equilibrium temperature equal to the boiling point of the electrode material. An equation is set up to relate the volume evaporated per spark to the electrode material while neglecting chemical effects. 15 Refs.
Primary Keywords: Electrode Erosion; Very High Current Densities; Lateral Spread; Diffusion; Spare Charge Effects
Secondary Keywords: Diffusion Equation
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1557
(SWITCHES, CLOSING)
(Gas Gaps, Materials)
ELECTRODE EROSION IN PULSED HIGH-CURRENT DISCHARGES
G.S. Belkin and V.Y. Kiselev
Order Of Lenin Power Institute, Moscow
Soviet Physics-Technical Physics, Vol. 11, No. 2 pp. 280-283 (08/1966).
Experimental and theoretical results are presented relating electrode erosion to total energy passed through the gap. The authors obtain a formula for the amount of material melted at the electrode by assuming a plane heat source at the electrode surface and calculating T(x,t), an emperically obtained constant is then used to relate the amount of material eroded to that melted. Comparison with experiment shows agreement to be good above a threshold current defined by the authors. 5 Refs.
Primary Keywords: Electrode Erosion; Molten Metal; Threshold Current; High Current
Secondary Keywords: Capacitor Bank Discharge
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1558
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas Gaps, Materials; Gas Gaps, Materials)
ELECTRODE VAPOUR JETS IN SPARK DISCHARGES
C.M. Cundall and J.D. Craggs
University of Liverpool, Liverpool, UK
Spectrochimica Acta, Vol. 7 pp. 149-164 (12/1954).
The characteristics of electrode vapor jets are reported. Velocities of propagation, luminosity, and total material removed from the electrode are measured using a framing camera, spectrometer, and microbalance. The anode and cathode jets were analyzed for several voltages, currents, and electrode materials. 14 Refs.
Primary Keywords: Electrode Erosion; Luminosity; Metal Vapor Jets; Geometrical Considerations
Secondary Keywords: Framing Photography; Spectroscopy
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1559
(BREAKDOWN STUDIES)
(Gas, Electrical)
EXCITATION OF THE SPECTRUM IN A SPARK DISCHARGE
S. Mandelstam
P.N. Lebedev Physics Institute, The Academy of Sciences of the USSR, Moscow
Spectrochimica Acta, Vol. 15 pp. 255-271 (01/1959).
This paper reports a hydrodynamic theory of the excitation of spectra in a spark channel. The channel is produced in air and is completely ionized, consisting mainly of doubly ionized nitrogen. Gas density is approximately 3.8 torr. Ion and electron temperatures are approximately equal at 40,000-50,000 degrees centigrade. 27 Refs.
Primary Keywords: Excitation Spectrum; Shock Wave; Discharge-Arc Transition Region
Secondary Keywords: Spectroscopy
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1560
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Surface Flashover; Solid)
NEW DATA ON THE CREEP DISCHARGE AT THE SURFACE OF A DIELECTRIC
J.S. Brzosko, A. Konarzewski, A. Wojewodzka, E. Zukowski and J. Grudzinski
Bialystok Div. Warsaw University, Bialystok, Poland
J. Phys. D, Vol. 8, No. 14 pp L175-L178 (07/1975).
Dielelctric samples immersed in an intense electric field exhibit a creep discharge in the gas near the dielectric surface. The authors present measurements of the energy spectra of varying fields with peak values on the order of 1.0E3 V/mm and a frequency of 50 Hz. Organic glass and seignette salt were used as samples. High energy discharges were found to occur. 10 Refs.
Primary Keywords: Creep Discharge; High Energy Discharge; Lichtenberg Figure; Organic Glass; Seignette Salt
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1561
(BREAKDOWN STUDIES)
(Solid, Electrical)
ON THE THEORY OF ELECTRON MULTIPLICATION IN CRYSTALS
Seitz F.
Carnegie Mellon University, Pittsburgh PA 15213
Physical Review, Vol. 76, No. 9 pp.1376-1393 (11/1949).
The authors investigate electron multiplication in strong electro-static fields by import investigation. Statistical velocity fluctuations and few-electron interactions with non-polar lattice vibrations are seen to be important in electron multiplications. The non-polar interaction appear to make differences between von Hippel and Frohlich breakdown criteria less important than thought previously. 27 Refs.
Primary Keywords: Electron Multiplication; Non-polar Coupling; Statistical Velocity Fluctuations; Import Ionization
Secondary Keywords: Laue Scattering; Polar Crystals; Non-Polar Crystals
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1562
(PARTICLE BEAMS, ION)
(Reviews)
OVERVIEW OF HEAVY ION FUSION PROGRAM IN U.S.A.
D. Keefe
Lawrence Berkeley Lab, Berkeley CA
LBL Report No. LBL-7519 (02/1978).
Available typ: LBL-7519
NTIS
This report provides an overview of the Heavy Ion Fusion Program in the U.S. The author begins with a short summary of funding for Heavy Ion Fusion and proceeds to discuss briefly the state-of-the-art in heavy ion drivers. Advantages are discussed for fusion applications. A qualitative description is given of ion accelerator technology. 9 Refs.
Primary Keywords: Heavy Ion; Accelerator Systems Future Plans

1563
(BREAKDOWN STUDIES)
(Lightning)
RECOMMENDED PRACTICE FOR LIGHTNING SIMULATION AND TESTING TECHNIQUES FOR AIRCRAFT
J. Phillpott
Culham Lab, Abingdon, Oxfordshire, UK
UKAEA Report No. CLM - R 163 (05/1977).
Availability: CLM-R163
Culham Laboratory, Abingdon Oxfordshire, H.M. Stationery Office
This paper is designed as a guide to simulating lightning effects on aircraft. The probable characteristics of lightning are presented, along with parameter ranges for duration of stroke, and total energy. Waveforms are given for simulating the effects of lightning stroke on aircraft components and systems with the most devastating waveforms indicated. 9 Refs.
Primary Keywords: Lightning Simulation; Current Ranges, Duration; Simulation Waveforms
Secondary Keywords: Aircraft Damage
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1564
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
SHUNTS AND INDUCTORS FOR SURGE-CURRENT MEASUREMENTS
Park, J.H.
Journal Of Research Of The National Bureau Of Standards, Vol. 39, pp 191-212 (09/1947).
The special requirements that must be fulfilled by a shunt intended to be used in surge-current measurements are explained. A tubular shunt with coaxial potential leads that meets these requirements is described, and factors affecting its design are discussed. A theoretical derivation of the 'skin effect' in this type of shunt at high frequencies is given in one of the appendices. The advantages of using a mutual inductor for obtaining oscillograms of the rate of change of current during a surge are outlined, and several types of mutual inductors developed especially for this purpose are described. Theoretical derivations, given in the appendices, indicate that the concentric-tube mutual inductors described in this paper can be used to measure the high-frequency components of a current surge up to 70 megacycles with less than 10 percent error. Several shunts and mutual inductors of the designs described in this paper were constructed for use in the high voltage laboratory at the National Bureau of Standards. Their complete description and oscillograms showing results obtained with them are included. 7 Refs.
Primary Keywords: Pulse Current; Shunt; Current Transformer; Low Inductance; Coaxial Shunt; Mechanical Force, Di/Dt Measurement

1565
(BREAKDOWN STUDIES)
(Lightning)
SIMULATION OF LIGHTNING STRIKES TO AIRCRAFT
T.E. James and J. Phillpott
Culham Lab. Abingdon.,Oxfordshire, UK
UKAEA Report No. CLM - R111 (05/1971).
Availability: CLM-R111
Culham Laboratory, Abingdon Berkshire, H.M. Stationery Office
The authors report on a feasibility study of lightning testing of aircraft. A detailed description of the probable characteristics of lightning is presented, along with probable effects on aircraft. The design of a pulse generator required to successfully simulate a lightning stroke is considered in some detail, with attention given to the waveshape of the initial current pulse, voltage gradients, swept strokes, and constant current intermediate strikes. 62 Refs.
Primary Keywords: Lightning Simulation; Lightning Waveforms; High Voltage Waveform Generator
Secondary Keywords: Aircraft Damage; Test Regulations
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1566
(PULSE GENERATORS; PULSE GENERATORS; POWER CONDITIONING)
(Marx; LC, Pulse Forming Networks)
THE POWER BEHIND THE PULSE
N.T. Olson
Maxwell Labs Inc, San Diego, CA 92123
Optical Spectra, Vol. 10, No. 12 pp. 42-46 (12/1976).
This paper is a tutorial on the design and operation of Marx generators, L-C generators, and pulse forming networks (PFN) for pumping pulsed gas lasers. Many basic design parameters important to all applications are discussed, along with particular problem areas. The author stresses that the application engineer should interface closely with the designer to avoid potential problems with these systems. 0 Refs.
Primary Keywords: Marx Generator; Blumlein; L-C Generator; Pulse Forming Network; Design Considerations; Pulse Transformer
Secondary Keywords: Laser Loads
COPYRIGHT: 1976 OPTICAL PUBLISHING COMPANY

1568
(DIAGNOSTICS AND INSTRUMENTATION)
(Miscellaneous)
DIGITAL TIMING UNIT FOR IMPULSE GENERATOR CONTROL
R. Minchin (1) and [illegible] Parnell (2)
(1) Southern Electric Authority of Queensland, Brisbane, Queensland, Australia
(2) University of Queensland, St. Lucia, Queensland, Australia
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-97, No. 3, pp 925-929 (05/1978).
This paper describes the design and construction of an impulse generator control unit which uses the counting of predetermined numbers of 10 MHz pulses to fix precise time delays for the control of a high voltage impulse generator and its associated recording equipment. Facilities for point on wave firing control are also provided. Particular attention is paid to problems arising from the high noise levels likely to occur in the high voltage laboratory environment. 2 Refs.
Primary Keywords: 10MHz Clock; 300 V Output Pulse; TTL Components; 10ms Interval; High Noise Environment
COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

1576
(PULSE GENERATORS)
(Blumlein Lines)
HIGH AVERAGE POWER PULSER DESIGN FOR COPPER HALIDE LASER SYSTEMS
J.L. Peck, C.S. Liu, D.W. Feldman and L.A. Weaver
Westinghouse Research and Development Center, Pittsburgh PA
The Review Of Scientific Instruments, Vol. 48, No. 8, pp 1047-1049 (08/1977).
A circuit using two thyratrons is described which provides alternating polarity, high-current pulses at pulse repetition rates up to 20 kHz, suitable for operating copper halide lasers. The circuit is a modification of a Blumlein configuration in which two networks are charged in parallel and discharged in series, providing a voltage quadrupling effect when used with resonant charging. By triggering the thyratrons sequentially the current is reversed on alternate pulses, which greatly reduces axial cataphoretic effects and extends the laser tube operating lifetime. The circuit can deliver up to 5 kW average power at 15 kHz. 16 Refs.
Primary Keywords: Bipolar Pulse Generator; Blumlein Line; Resonant Charging; Thyratron, Rep-rated
COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1593
(ENERGY STORAGE, CAPACITIVE; ENERGY STORAGE, CAPACITIVE; PARTICLE BEAMS, ELECTRON)
(Capacitors, Systems; Generation)
MAGNETICALLY INSULATED AND INDUCTIVELY CHARGED CAPACITOR FOR THE ATTAINMENT OF GIGAVOLT POTENTIALS
F. Winterberg
University of Nevada System, Reno, NV 89507
Nuovo Cimento, Vol. 20B, No. 1, pp 173-195 (03/1974).
The author describes a coaxial capacitor which could be charged to a gigavolt. The device employs magnetic insulation, but no superconductors are needed. It can be charged inductively and when discharged produces an intense electron beam. Scaling laws are considered with a view towards a machine several meters in size. The design problems encountered in choosing a power supply are also discussed. 12 Refs.
Primary Keywords: Toroidal Capacitor; Very High Voltage; Very High Energy; Magnetic Insulation; Inductive Charging
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1596
(ENERGY CONVERSION, ELECTRICAL; INSULATION, MAGNETIC)
(Transformers)
MAGNETICALLY INSULATED TRANSFORMER FOR ATTAINING ULTRAHIGH VOLTAGES
F. Winterberg
University of Nevada System, Las Vegas, NV 89109
The Review Of Scientific Instruments, Vol. 41, No. 12, pp 1756-1763 (12/1970).
A high voltage transformer in which a high magnetic field inside a hard vacuum insulates against breakdown is proposed. The magnetic field is generated by electric currents in high field superconductors. Voltages up to 1E9 V may be attainable with such a system. A rectifier using high magnetic fields can transform the end voltage from AC to DC. The energy output at the terminal of the secondary coil can be extracted in the form of either an electron or an ion beam through the use of the field emission process. Potential applications include (1) high energy particle accelerators with beam intensities many orders of magnitude larger than in conventional accelerators or meson factories, (2) use in controlled thermonuclear fusion devices, and (3) continuous pumping of powerful lasers. The feasibility of the system will depend upon depressing the breakdown perpendicular to the direction of the high magnetic field. 5 Refs.
Primary Keywords: High Voltage Transformer; Magnetic Insulation; 1E9 V Output; E-beam Generation; Ion Beam Generation
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1608
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN AT VERY LOW GAS PRESSURES
J.W. Leech
Queen Mary College, London, UK
British Journal Of Applied Physics, Vol. 6, pp 107-109 (03/1955).
Gas discharge phenomena at the pressures used in particle accelerators differ, in general, from those encountered in the normal discharge, since they occur at the pressures for which the mean free paths of the gas particles are comparable with the dimensions of the apparatus. It is the purpose of this note to examine, in terms of atomic collision data, two problems arising in connection with such low pressure discharges. The first problem concerns the validity of a proposed interpretation of an observed breakdown anomaly, the second is to estimate at what pressure breakdown would occur if it were due solely to ionizing collisions in the body of the gas. 6 Refs.
Primary Keywords: Low Pressure; Long Mean Free Path; Electron Scattering; Paschen Curve Departure

1622
(PARTICLE BEAMS, ELECTRON)
(Generation)
PULSE ELECTRON ACCELERATOR TO EXCITE LARGE GAS VOLUMES
B.M. Koval'chuk, V.A. Lavrinovich, V.I. Manylov, G.A. Mesyats and A.M. Rybalov
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 19, No. 6, pp 1731-1733 (12/1976).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 125-127 (November-December 1976)
The description and characteristics of an electron accelerator to produce preionization in the active volume of a CO/sub 2/ laser are presented. The exit window of the accelerator is 30 x 300 cm, the density of the derived electron beam is 2 A/sq cm, for a 2E-6-sec pulse duration and 300-kev electron energy. 3 Refs.
Primary Keywords: E-beam Generation; Field Emission Diode; Low Current Density; Large Area Emitter; Pulse Generator

1629
IMPULSE GENERATOR SPECTRUM AMPLITUDE MEASUREMENT TECHNIQUES
J.R. Andrews
National Bureau of Standards, Washington, DC
Final rept. (01/1976).
Availability: PB-264 328/6ST NTIS
Various techniques that have been used to calibrate impulse generators and to measure spectrum amplitude are surveyed. A summary of experiments comparing the various techniques is included. The NBS measurement service for calibrating impulse generators is described.
Primary Keywords: Pulse Generators; Spectrum Analyzers; Calibrating; Radiometers; Oscilloscopes; Electromagnetic Interference; Fourier Transformation; Measurement
Secondary Keywords: Reprints; Spectrum Amplitude; Fast Fourier Transform; NTISCOMNBS
Distribution Restriction: PUB. IN IEEE TRANS. INSTRUM. MEAS. IM-25, N4 P380-384 DEC 76.

1645
(PULSE GENERATORS)
(Blumlein Lines)
HIGH-VOLTAGE PULSE GENERATOR FOR THE TWO-METER STREAMER CHAMBER OF THE JINR
N.S. Glagoleva, V.D. Volodin, Yu. Lukstin'sh, M.I. Kozlov, Yu.A. Karzhavin, P.S. Kuznetsov, A.T. Matyushin, V.T. Matyushin, V.S. Pak, N.S. Rudenko, V.I. Smetanin, V.I. Tsvetkov, A.A. Shatanov, E.A. Shevchenko and A.F. Yudin
Joint Institute Of Nuclear Research, Dubna, USSR
Instruments And Experimental Techniques, Vol. 18, No. 5, pp 1439-1440 (10/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 99-100 (September-October 1975)
A Blumlein generator with a pulse length which is controllable by changing the middle cylinder of the shaping line is described. The matching load of the generator is 35 ohm; the amplitude instability of the output pulse is <= 1-1.5%. The generator is tested jointly with a working streamer chamber which has two gaps of 30 cm each for an output pulse length of 30.0 and 15.5 nsec. Experimental results obtained during the course of development and testing were presented. 5 Refs.
Primary Keywords: Pulse Generators; Blumlein Line; Variable Pulse Duration; 35 Ohm Impedance; Performance Test

1652
PRESENT CAPABILITIES OF THE NBS AUTOMATIC PULSE MEASUREMENT SYSTEM
W.L. Gans
National Bureau of Standards, Washington, DC
Final rept. (01/1976).
Availability: PB-264 331/0ST NTIS
In 1972, NBS began development of an Automatic Pulse Measurement System (APMS) consisting essentially of a minicomputer-controlled wide-band sampling oscilloscope. The objective of the work was to produce a fast general purpose pulse waveform acquisition and processing instrument with spectral capability in the frequency range dc-18 GHz. The purpose of this paper is to report the highlights of work done on the APMS from early 1975 to present. The measurement applications of the APMS now consist of both publicly offered calibration services and in-house experimental measurements. In the first category, calibration services are available for the following physical parameters: (a) Impulse generator spectrum amplitude; (b) Wide-band coaxial attenuation/gain; (c) Pulse generator transition time. Still in the experimental stage are measurements involving reflection coefficient and impedance, group delay, pulse distortion, and wide-band antenna characteristics.
Primary Keywords: Pulse Analyzers; Automation, Oscilloscopes; Pulse Generators; Measurement
Secondary Keywords: Reprints; Spectrum Amplitude; NTISCOMNBS
Distribution Restriction: PUB. IN IEEE TRANS. INSTRUM. MEAS. IM-25, N4 P384-388 DEC 76.

1663
(PULSE GENERATORS)
(Systems)
TWO TANDEM PULSE GENERATORS PROVIDE WAVEFORM FLEXIBILITY
S. Jacobson
Caber Electronics Inc, Stamford, CT 06902
Electronics, Vol. 49, No. 11, pp 118-119 (05/1976).
The author proposes methods for producing complicated waveforms using two pulse generators connected in series, parallel or tandem. Problems and possibilities for each set up are discussed. 0 Refs.
Primary Keywords: Bipolar Pulse; Simple Arrangement; Tandem Connection; Series Connection; Parallel Connection

1669
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN BETWEEN METAL ELECTRODES IN HIGH VACUUM. I. THEORY
F.M. Charbonnier, C.J. Bennette and L.W. Swanson
Field Emission Corp, McMinnville, OR 97128
Journal Of Applied Physics, Vol. 38, No. 2, pp 627-633 (02/1967).
A theoretical description of electrical breakdown across narrow gaps in high vacuum is presented under conditions for which surface cleanliness, work functions, gap geometry, and cathode surface roughness are well defined. Two basic initiating mechanisms are considered: (1) thermal processes initiated at both the anode and the cathode by the prebreakdown field-emitted electron current, and (2) mechanical processes resulting from yield of one of the electrode surfaces under the action of electrostatic stress produced by the electric field in the gap. In the case of thermal breakdown initiation, there exists a boundary between an anode and a cathode-initiated arc which can be expressed in terms of the factor gamma by which the gross field in the gap is enhanced at the tip of microscopic cathode protrusions. Solution of the heat conduction equation is given for the general case of DC or pulse gap voltages. This leads to a distinction between three ranges of pulse duration, and for each region, a simple analyt cal expression is given for the boundary value gamma/sub 0/ which separates cathode- and anode-initiated breakdown. Based on the considerations presented here, some practical limitations of several electrode materials are given. 21 Refs.
Primary Keywords: Narrow Gap; Several Electrode Materials; Several Geometries; Variable Surface Roughness; Field Emission; Thermal Processes; Electrostatic Stress; Electrode Deformation; Theory

1677
(INSULATION, MAGNETIC)
()
MAGNETIC INSULATION AND MICROWAVE GENERATION
E. Ott and R.V. Lovelace
Cornell University, Ithaca, NY
Applied Physics Letters, Vol. 27, No. 7, pp 378-380 (10/1975).
A relativistic self-consistent equilibrium is found for the magnetic insulation of a diode for conditions where the voltage rise time is long compared to the cyclotron period. Instability of the magnetic insulation equilibrium may allow high-power pulsed microwave generation in magnetronlike configurations. 10 Refs.
Primary Keywords: High Voltage Diode; Magnetic Insulation Instabilities; Pulsed Microwave Generation; Magnetron-like Configurations

1683
(PARTICLE BEAMS, ION)
(Generation)
PROGRESS IN INTENSE PULSED ION SOURCES
S. Humphries Jr.
Cornell University, Ithica, NY 14850
Journal Of Vacuum Science And Technology, Vol. 12, No. 6, pp 1204-1207 (12/1975).
The authors consider the reflex triode as a source of ion beams. The possibility of magnetic insulation, foil anodes, and virtual cathodes are discussed, along with the effect on production efficiency. Several experiments performed at Cornell on ion beam production are reported. 23 Refs.
Primary Keywords: Reflex Triode; Foil Anode; Virtual Cathode; Magnetic Insulation; High Efficiency

1686
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN BETWEEN METAL ELECTRODES IN HIGH VACUUM. I: EXPERIMENTAL
C.J. Bennette, L.W. Swanson and F.M. Charbonnier
Field Emission Corp, McMinnville, OR 97128
Journal Of Applied Physics, Vol. 38, No. 2, pp 634-640 (02/1967).
Experiments were performed in order to test the validity of the theory outlined in I. Significant theoretical parameters varied experimentally included electrode material, electrode geometry, and applied voltage pulse length. Electrode materials chosen included W, Mo, Cu, and Al. Gap spacings varied from a few tenths to a few thousandths of a centimeter at gap voltages up to 30 kV applied either continuously or in single pulses of 1 to 100 microsecond duration. For all electrode materials except Al, thermal processes are the primary initiation mechanism, and experimental observations agree with the theoretical predictions of I. With electrode materials of low tensile strength such as Al, the primary cause of electrical breakdown is due to the electrostatic stress produced by the high electric field. 4 Refs.
Primary Keywords: Several Electrode Materials; Several Electrode Geometries; Impulse Voltage; Variable Pulse Length

1692
(SWITCHES, OPENING)
(Electrostatic Confinement)
A SIMPLE HIGH-VOLTAGE OPENING SWITCH USING SPOILED ELECTROSTATIC CONFINEMENT
I. Alexeff and F. Dyer
University of Tennessee, Knoxville, TN 37916
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 163 (09/1980).
We have initiated and sustained a plasma discharge at pressures well below the Paschen minimum by trapping electrons in orbits around a positively charged wire. Spoiling the traping process terminates the discharge and opens the circuit in spite of high voltage applied. 5 Refs.
Primary Keywords: Opening Switch; Below Paschen Minimum; Charged Wire; Electron Confinement Ground Wire; Discharged Wire; Electron Diffusion

1693
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN UNDER VACUUM CAUSED BY EVAPORATION AT THE ANODE
I.N. Slivkov
Soviet Physics-Technical Physics, Vol. 13, No. 8, pp 1131-1132 (02/1969).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 38, 1385-1387 (August 1968)
Vacuum insulation works with strong electric fields E, so such discharges have very high E/n, where n is vapor density. Under these conditions, the electron energy is determined mainly by the potential difference through which the electron has passed, not by E/n. The number of ionizing collisions increases with n, and the electron energy soon reaches a value such that the ionization cross-section sigma/sub n/ falls as the energy increases further. The gas discharge is therefore most likely to arise in a comparatively small volume d rectly at the anode, where n is large. In this paper, this process is compared with other secondary processes previously considered by other workers. 3 Refs.
Primary Keywords: Parallel-plane Electrodes; High E/n; High Electron Energy; Small Discharge Volume; Theory

1699
(INSULATION, VACUUM)
()
PREVENTION OF ELECTRICAL BREAKDOWN IN SPACECRAFT
F.W. Paul and D.R. Burrowbridge
Goddard Space Flight Center, Greenbelt, MD
IEEE Transactions On Electrical Insulation, Vol. EI-6, No. 3, pp 114-123 (09/1971).
The methods for preventing electrical breakdown problems in space flight are discussed. The techniques that have been evolved by several successful users of high-voltage systems in space are given in considerable detail. The fundamental elements are the avoidance of high electric fields and the avoidance of critical gas pressures. Selection of materials, scrupulous cleanness, good mechanical design, solid potting or complete venting, and frequent testing are the major steps to success. 1 Refs.
Primary Keywords: Vacuum Insulation; Cleanliness; Mechanical Design; Geometrical Considerations; Varying Gas Pressure

1715
(INSULATION, MAGNETIC; ENERGY STORAGE, CAPACITIVE)
(; Capacitors)
ATTAINMENT OF GIGAVOLT POTENTIALS BY MAGNETIC INSULATION
F. Winterberg
University of Nevada System, Reno, NV 89507
Nature, Vol. 246, No. 5431, pp 299-300 (11/1973).
The author presents a design for a toroidal machine which can be charged inductively up to one gigavolt. Magnetic insulation keeps the inner conductor separated from the outer conductor. Application of the machine to controlled fusion and collective ion acceleration is discussed. 6 Refs.
Primary Keywords: Magnetic Insulation; Toroidal Capacitor; Very High Voltage; E-beam

1726
(SWITCHES, OPENING)
(Explosive Fuses)
NETWORK FOR FAST COMMUTATION OF LARGE CURRENTS IN AN INDUCTIVE STORAGE DEVICE
V.G. Artyukh, L.G. Lisenko and S.A. Smirnov
Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instruments And Experimental Techniques, Vol. 15, No. 1, pp 130-131 (02/1972).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 119-120 (January-February 1972)
A network for commutating a current of up to 25 kA by means of an exploding wire is described. The instant of commutation is established with an accuracy of up to tenths of a microsecond and is independent of the wire cross section and of the magnitude of the compensated current. 4 Refs.
Primary Keywords: Exploding Wire; Inductive Energy Storage; Switch System; Triggered Opening Switch

1727
(SWITCHES, OPENING)
(Thyratrons, Electrical)
MECHANISM FOR NANOSECOND GRID CUTOFF OF HIGH-CURRENT DISCHARGES
I.I. Bakaleinik
Soviet Journal Of Plasma Physics, Vol. 6, No. 1, pp 119-121 (02/1980).
Trans. From: Fiz. Plazmy 6, 206-210 (January-February 1980)
Discharge currents of hundreds of amperes can be cut off in a few nanoseconds by a grid in a thyratron with a cutoff device (at average current densities up to approximately 1000 A/sq.cm through the grid). The density of the hydrogen plasma near the grid just before cutoff is estimated to reach 1E15 cm/sup -3/. The negative potential applied to the grid by the cutoff device is 1-2 kV during the cutoff. The effective range, even at these high grid potentials, is much smaller than the grid cell in a plasma of this density, so that the cutoff cannot be attributed to the effect of the grid potential on the discharge. 9 Refs.
Primary Keywords: Thyratron; Grid Structure, Current Cutoff; Discharge Contraction; Nanosecond Time Scale

1728
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
MECHANISM OF DC ELECTRICAL BREAKDOWN BETWEEN EXTENDED ELECTRODES IN VACUUM
D.K. Davies and M.A. Biondi
Westinghouse Research and Development Center, Pittsburgh PA
Journal Of Applied Physics, Vol. 42, No. 8, pp 3089-3107 (07/1971).
A description is given of vacuum breakdown between extended copper electrodes in DC electric fields in terms of the relevant atomic-collision processes. The theory is based on a model involving avalanche amplification of current in electrode vapor generated by the evaporation of an anode macroparticle during its transit to the cathode. Calculations are presented of the dynamics, heating, and evaporation of the macroparticle leading to the production of the vapor medium in the interelectrode gap. The inferred copper vapor density distribution accounts quantitatively for the absorption of resonance radiation measured just prior to current amplification in the gap. Calculations of electron avalanche multiplication in the vapor lead to predictions of breakdown conditions in agreement with our observations. The predicted size of the anode macroparticle which initiates breakdown is, on the average, of the order of 1 micron in diameter. 55 Refs.
Primary Keywords: Copper Electrodes; Extended Electrodes; DC Breakdown; Atomic-collision Process; Theory

1729
(INSULATION, MAGNETIC)
()
ON THE CONCEPT OF MAGNETIC INSULATION
F. Winterburg
University of Nevada System, Las Vegas, NV 89109
The Review Of Scientific Instruments, Vol. 43, No. 5, pp 814-815 (05/1972).
In a reply to a recent Note by Hirsch [Rev. Sci. Instrum. 42, 1371 (1971)], the several conditions for the feasibility of magnetic field insulation are presented. These conditions are quite similar to those to be satisfied for the magnetic confinement of an electron cloud. 5 Refs.
Primary Keywords: Feasibility; Simple Geometry; Dust Particles

1736
(SWITCHES, OPENING)
(Explosive Fuses)
COMMENTS ON THE LIQUID-METAL MODEL FOR THE CALCULATED ELECTRICAL RESISTIVITY OF AN EXPLODING COPPER WIRE
A.J. Greenfield and N. Wiser
Bar-Ilan University, Ramat-Gan, Israel
Physical Review B, Vol. 1, No. 10, pp 4186-4187 (05/1970).
An argument is presented against the use of a liquid-metal model in computing the resistivity of an exploding wire, calculations done by the authors show as much as an order of magnitude difference between liquid-metal model predictions and experimental data. 6 Refs.
Primary Keywords: Exploding Wire; Liquid-metal; Pseudopotential; Charge Distribution; Calculation

1741
(BREAKDOWN STUDIES)
(Exploding Wires)
EXPLODING WIRE PARTICLE SIZE BY LIGHT SCATTERING MEASUREMENT
F.N. Weber and D.D. Shear
Army Armament Research and Development Command, Aberdeen Proving Ground, MD 21005
No. BRL-R-1403, 26p (06/1968).
Availability: AD-673 710
NTIS
The reddish color seen in photographs of exploding copper wires was assumed to be due in part to the scattering of the blue and green wavelengths of the BH6 mercury lamp used. Accordingly, this scattered light was used to measure particle size by the dissymmetry method. The average value of the predominant particle dimension was found to be time dependent with a value of 1200 A occurring .6 usec before the voltage peak. (Author)
Primary Keywords: Exploding Wires_Vaporization; Rayleigh Scattering_Particle Size; Mathematical Analysis; High-speed Photography; Voltage; Optical Instruments

1743
(BREAKDOWN STUDIES)
(Exploding Wires)
EXPLOSION OF BARE AND INSULATED COPPER WIRES
B.K. Bhat and I.B. Jordan
Laval University, Quebec, Canada
Journal Of Applied Physics, Vol. 42, No. 2, pp 809-814 (02/1971).
8 Refs.
Primary Keywords: Bare And Insulated; Condenser Bank Discharge; Insulation Effects; Restrike Current; Restrike Delay; Explosion Zones In Voltage Length Plane

1745
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
LIQUID-COPPER RESISTIVITY
N. Ben-Yosef and A.G. Rubin
AFCRL, Bedford, MA 01730
Physical Review Letters, Vol. 23, No. 6, pp 289-290 (08/1969).
The authors present experiments done measuring liquid copper resistivity and calculations done using both a classical plasma approach and Ziman's theory of resistivity of liquid metal. The classical approach failed to adequately explain the experimental results, while close agreement was found using Ziman's theory with a structure factor based on the hard-sphere model. 7 Refs.
Primary Keywords: Liquid Copper; Resistivity; Degenerate Electron Gas; Ziman's Theory

1750
(BREAKDOWN STUDIES)
(Exploding Wires)
TEMPERATURE OF THE RESTRIKE CHANNELS OF EXPLODING WIRES
S. Lundquist and A.E. Vlastos
Institutet For Hogspanningsforskning, Uppsala, Sweden
Journal Of Applied Physics, Vol. 41, No. 12, pp 4830-4835 (11/1970).
13 Refs.
Primary Keywords: Restrike Channel; Plasma Temperature; Thermal Conductivity; Electron Density; Fully Ionized; Uniform Current Distribution

1753
(SWITCHES, CLOSING)
(Reviews)
SOVIET RESEARCH AND DEVELOPMENT OF HIGH-POWER GAP SWITCHES
S. Kassel and C. D. Hendricks
RAND Corp. Santa Monica, CA 90406
ARPA Report No. R-1333-ARPA (01/1974).
Availability: AD A004599
NTIS
The Tomsk Polytechnical Institute and the Institute of Atmospheric Optics of the Siberian Department of the Academy of Sciences, USSR, have been engaged in the comprehensive research and development of high-pressure gap switches for high-current electron accelerators. The work involves the establishment of broad theoretical foundations for the understanding of the physical phenomena associated with the structure and operation of gap switches, specification of the optimum operating characteristics, such as current rise time of a fraction of a nanosecond, and construction of prototypes. The theory based on the avalanche-breakdown principle specifies alternate modes of discharge behavior depending on the quantity of initiating electrons, applied field, gap width, and gap pressure. Triggered gap structures incorporating BaTiO/sub 3/ ceramics were built; these are capable of delivering pulses ranging in length down to 0.6 nanosecond and of maintaining pulse repetition frequencies of the order of kHz for peak currents in the kA range. Multielectrode air-spark gaps for accelerator power sources have also been developed for 100-kA currents with a jitter of less than 5 nanoseconds and without the necessity to adjust gap length. 11 Refs.
Primary Keywords: Gas Gap Switch; Parallel Switch; Multichannel Switch; Fast Switch
Secondary Keywords: Relativistic-Charged-Particle Beams

1767
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Reviews; Reviews)
INDUCTIVE STORAGE-PROSPECTS FOR HIGH POWER GENERATION
J.K. Burton, D. Conte, R.D. Ford, W.H. Lupton, V.E. Scherrer and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
2nd IEEE International Pulsed Power Conference Proceedings, pp 284-286 (06/1979).
Recent progress in the development of key elements of high power inductive storage systems makes it possible to generate high power pulses using energy storage systems (other than explosive generators) that include single-pulse inductive systems, hybrids (inductor/pulse line and inductive devices for steepening of the capacitor output) as well as inductive systems for generation of high power pulse trains. Prospects for further development of opening switches and storage systems suggest potential near-term payoff. Improvements based on such developments can be expected to impact system efficiency, compactness and operational convenience. 15 Refs.
Primary Keywords: Opening Switches; Pulse Compression; Rep-rated; Switch Performance Comparison

1768
(ELECTROMAGNETIC COMPATIBILITY)
(Hardness)
INTERNAL SGEMP AND ANALYTIC REPRESENTATIONS FOR THE SKYNET STRUCTURAL MODEL
R. Stettner and R.N. Marks
Mission Research Corporation, Santa Barbara, CA 93102
IEEE Transactions On Nuclear Science, Vol. NS-26, No 6, pp 4970-4976 (12/1979).
Internal excitation data from the Skynet exploding wire experiments have been compared with finite difference code particle pushing calculations. Comparison between data and calculations was, for the most part, within the expected uncertainty except for two sensors located in the same section of the satellite. For those two sensors a modeling descrepancy in this satellite section may be the source of disagreement. A simple modal circuit model is shown to have very nearly the same electromagnetic charater as the finite difference code model (and presumably the Skynet Structural model) for a realistic external excitation. Driver models for internal p-dot drivers are suggested. When these models are coupled with the circuit model they agree quite well with the corresponding p-dot driver or the finite difference code SSM mode. 7 Refs.
Primary Keywords: Exploding Wire Radiator Response Data; Finite Difference Code Model; Space Charge Limiting; Modal Circuit Model

1770
(SWITCHES, CLOSING)
(Liquid Gaps, Self)
LOW PREPULSE, HIGH POWER DENSITY WATER DIELECTRIC SWITCHING
D.L. Johnson, J.P. VanDevender and T.H. Martin
Sandia Lebs, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 191-194 (06/1979).
Prepulse voltage suppression has proven difficult in high power, high voltage accelerators employing self-breakdown water dielectric switches. A novel and cost effective water switch has been developed at Sandia Laboratories which reduces prepulse voltage by reducing the capacity across the switch. This prepulse suppression switch causes energy formerly stored in the switch capacity and dissipated in the arc to be useful output energy. The switching technique also allows the pulse forming lines to be stacked in parallel and electrically isolated from the load after the line has been discharged. The switch consists of a ground plane, with several holes, inserted between the switch electrodes. The output line switch electrodes extend through the holes and face electrodes on the pulse forming line (PFL). The capacity between the PFL and the output transmission line is reduced by about 80 percent. The gap spacing between the output line electrode and the hole in the ground plane is adjusted so that breakdown occurs after the main pulse and provides a crow bar between the load and the source. Performance data from the Proto II, Mite and Ripple test facilities will be presented. 5 Refs.
Primary Keywords: Low Prepulse, Reduced Switch Capacitance, Ground Plane Electrode; Crowbar

1771
(PARTICLE BEAMS, ELECTRON; BREAKDOWN STUDIES)
(Generation; Gas, Electrical)
LOW PRESSURE, HIGH VOLTAGE DISCHARGES FOR THE PRODUCTION OF ENERGETIC ELECTRON BEAMS
J.T. Verdeyen
University of Illinois, Urbana IL
ARO Report No. 12528.1-P (09/1979).
Availability: AD A076556
NTIS
The fundamental theories of gas discharges offer widely varying predictions for the relative power input to the negative glow. Calorimetric measurements have been made in a planar helium discharge of the power input to the negative glow relative to the total input power. These measurements show that the limiting efficiency of devices working in this region (e.g. hollow cathode lasers) is approximately 30-40%. To aid in the interpretation of the experimental results a simplified theoretical model was derived. 9 Refs.
Primary Keywords: Gas Discharge Theory; Energetic Electron Beams; Negative Glow
Secondary Keywords: Hollow Cathode Lasers

1774
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
NEW DERIVATION OF THE VACUUM BREAKDOWN EQUATION RELATING BREAKDOWN VOLTAGE AND ELECTRODE SEPARATION
A. Maitland
University of Manchester, Manchester, UK
Journal Of Applied Physics, Vol. 32, No. 11, pp 2399-2407 (11/1961).
An analysis of the published measurements of breakdown voltage for various gap lengths for uniform and approximately uniform fields shows that the results may be represented by the breakdown equation V = Cx/sup alpha/ and that the values of alpha lie in the range 0.1 to 1.1 with a mode of 0.7. A theory is developed which leads both to a breakdown equation of the same form and to a general expression to account for the range of values of alpha. This expression is confirmed for gaps up to 0.375 cm by direct experiment. The development is based on the postulate that an electron beam is emitted from the cathode, diverges, and bombards the anode to cause breakdown when a critical power flux is reached. The factor C is shown to include the critical power flux and to be related to both field and electrode separation. In support of the theory, the radii of craters produced on the anode are measured and shown to be related to the radius of an electron beam at the anode. Calculation shows the current carried by the beam to be of the order of 1E-4 amp. Values of the critical power flux obtained from the equation V = Cx/sup alpha/ and from anode crater data, respectively, agree within a factor of 1.5 and are of the order of 1E8 W cm/sup -2/. To explain the observed phenomena, a multiple electron beam system is proposed. 36 Refs.
Primary Keywords: Vacuum Breakdown; Uniform Field; Voltage vs Gap Spacing; Experiment; Theory; 0.75 mm Gap Spacing; Field Emission; Anode Melting

1776
(REVIEWS AND CONFERENCES; POWER CONDITIONING; PARTICLE BEAMS, ELECTRON)
(Reviews; Pulse Transformers; Generation)
RECENT DEVELOPMENTS IN HIGH AVERAGE POWER DRIVER TECHNOLOGY
K.R. Prestwich, M.T. Buttram and G.J Rohwein
Sandia Lebs, Albuquerque, NM 87115
No. CONF-790723-6, 10p (11/1961).
Availability: SAND-79-0778C
NTIS
Inertial confinement fusion (ICF) reactors will require driver systems operating with tens to hundreds of megawatts of average power. The pulse power technology that will be required to build such drivers is in a primitive state of development. Recent developments in repetitive pulse power are discussed. A high-voltage transformer has been developed and operated at 3 MV in a single pulse experiment and is being tested at 1.5 MV, 5 kj and 10 pps. A low-loss, 1 MV, 10 kj, 10 pps Marx generator is being tested. Test results from gas-dynamic spark gaps that operate both in the 100 kV and 700 kV range are reported. A 250 kV, 1.5 kA/cm exp 2, 30 ns electron beam diode has operated stably for 1.6 x 10 exp 5 pulses. (ERA citation 04:049198)
Primary Keywords: Inertial Confinement; Power Supplies; Diode Tubes; Performance, Power Transmission; Spark Gaps; Transformers
Secondary Keywords: ERDA/700203; ERDA/700208; NTISDE

1777
(PARTICLE BEAMS, ELECTRON)
(Generation)
RIG FOR TESTING COLD CATHODES
E.N. Demi'ttsev and V.I. Pershin
GKAE Atomic Energy Institute, Moscow, USSR
Availability: IIEF-57(1978)
NTIS
A rig is described for testing various types of cold cathodes with 1 cm exp 2 area at 600 A total current, intended for use in the linear induction accelerator LIU-5/5000, which is an injector of facility for investigation of the collective acceleration method. The rig consists of an electron gun, nanosecond pulse generator, pumping system and beam monitors. Voltage pulses with a 100-120 kV amplitude and 35 ns duration were generated by adouble shaping line (DSL), made of 9 cables connected in parallel. The pulses from the DSL were fed in the gun vacuum diode through the transformer-inductor section, increasing the voltage. It is shown that rig is reliable in operation and that the quick replacement is possible in case of cable failure. (Atomindex citation 10:452579)
Primary Keywords: Ion Sources; Beam Monitors; Cathodes; Collective Accelerators; Electron Guns; Flowsheets; High voltage Pulse Generators, Performance Testing; Pulse Shapers; Spark Gaps
Secondary Keywords: IN RUSSIAN; ERDA/635501; USSR, NTISINIS; NTISFNUR
Distribution Restriction: U.S. Sales Only

1781
(ELECTROMAGNETIC COMPATIBILITY)
(Hardness)
THE EFFECT OF ELECTRON PRECHARGING ON SGEMP RESPONSE OF INSULATORS
V.A.J. Van Lint (1), B.C. Passenheim (1), R. Stettner (1) and D.A. Fromme (2)
(1) Mission Research Corp, La Jolla, CA
(2) Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 6, pp 5024-5029 (12/1979).
7 Refs.
Primary Keywords: Exploding Wire Radiator; 5 To 30 keV Electron Precharging, Dielectric; SKYNET Satellite, Enhanced SGEMP Response

1785
(PARTICLE BEAMS, ION; PARTICLE BEAMS, ELECTRON)
(Generation; Transport)
INTENSE RELATIVISTIC ELECTRON BEAM INVESTIGATIONS
W.D. Doggett
North Carolina State University, Raleigh, NC 27607
AFOSR Report No. AFOSR-TR-79-1310 (09/1979).
Availability: AD A078515
NTIS
During this period research was performed at North Carolina State on collective ion acceleration in a vacuum diode geometry and in collaboration with a group from the Naval Research Lab on collective ion acceleration within an evacuated dielectric tube. Diode voltage and current wave forms along with transmitted beam energy and current were measured for a series of linear diameters and lengths. Beam energy loss was linear at the rate of approx 12 J/cm. For the 8.3 and 15.9 cm length tubes the Alfen limiting current was exceeded, indicating the creation of enough plasma for some current neutralization. Below the Alfen limit the current propagates in a pinched beam. The beam velocity was 1.4 cm/nsec. Equipment for experimental work on electron beam propagation in evacuated magnetized pipes has been assembled and a theoretical study was made of intense electron beam equilibrium in magnetized pipes using a relativistic cold fluid model. 12 Refs.
Primary Keywords: Collective Ion Acceleration; E-beam Transport; Machine Calibration; E-beam Diagnostics

1795
(BREAKDOWN STUDIES)
(Exploding Wires)
EFFECT OF STRUCTURAL INHOMOGENEITIES IN EXPLODING WIRES
V.L. Budovich, O.A. Zakstel'skaya, I.S. Kotova and I.P. Kuzhekin
Moscow Energetics Institute, Moscow, USSR
Soviet Physics Technical Physics, Vol. 21, No. 6, pp 681-684 (06/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 48, pp 1219-1223, (June 1978)
12 Refs.
Primary Keywords: Longitudinal Inhomogenity; Early Melting; MHD Sausage Instability; High Temperature Annealing; Local Melting; Initial Perturbations In Melted Conductor
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1797
(ELECTROMAGNETIC COMPATIBILITY)
(Hardness)
EXPLODING-WIRE PHOTON TESTING OF SKYNET SATELLITE
D.A. Fromme (1), V.A.J. Van Lint (1), R. Stettner (2), R.W. Macgurn (2) and B.M. Goldstein (2)
(1) Mission Research Corp, La Jolla, CA
(2) Mission Research Corp, Santa Barbara, CA
IEEE Transactions On Nuclear Science, Vol. NS-25, No. 6, pp 1349-1357 (12/1978).
14 Refs.
Primary Keywords: Electrical Testing; Photon Testing; Exploding Wire; SKYNET; High Flux; Electromagnetic Response
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1806
(SWITCHES, OPENING)
(Explosive Fuses)
OPTICAL FLASHES FROM DOUBLE WIRE EXPLOSION
C.Y. Kang, M.H. Lee and S.S. Lee
Korea Advanced Institute Of Science, Chongyangni, Seoul, Korea
Canadian Journal Of Physics, Vol. 57, No. 9, pp 1439-1443 (09/1979).
Two optical flashes are obtained when two wires of different diameters connected in series are exploded. Calculations were done predicting the time between flashes and agreed closely with the experimental results. The flash separation time was found to be controllable depending only on the diameter and composition of the wires exploded. 9 Refs.
Primary Keywords: Double Wire Explosion; Time Dependent Resistence; Simulation; Numerical Calculation, Optical Flash
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1809
(INSULATION, MAGNETIC)
()
PROPAGATION OF A MAGNETIC-INSULATION WAVE IN A COAXIAL LINE
A.V. Gordeev
Soviet Physics Technical Physics, Vol. 23, No. 4, pp 463-465 (04/1978
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 48, No. 4, pp 784-788
7 Refs.
Primary Keywords: Nonlinear; Vacuum Coaxial Line; Time-dependent, Two-dimentional
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1816
(ELECTROMAGNETIC COMPATIBILITY)
(Hardness)
SPONTANEOUS DISCHARGES AND THE EFFECT OF ELECTRON CHARGING ON SKYNET SGEMP RESPONSE
V.A.J. Van Lint (1), D.A. Fromme (1) and J.A. Rutherford (2)
(1) Mission Research Corp, La Jolla, CA
(2) IRT Corporation, San Diego, Calif.
IEEE Transactions On Nuclear Science, Vol. NS-25, No. 6, pp 1293 1298 (12/1978)
11 Refs
Primary Keywords: Electron Implantation; Spontaneous Electric Discharge; E-beam; SGEMP Response; Exploding Wire Radiator; Electric Potential Profile
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1819
(BREAKDOWN STUDIES)
(Exploding Wires)
THE PHOTOEMISSION SPECTRUM FOR AN EXPLODING WIRE RADIATOR SOURCE INCIDENT ON AL AND AU
D.J. Strickland and D.L. Lin
Science Applications Inc., Vienna, Virginia
IEEE Transactions On Nuclear Science, Vol. NS-25, No. 6, pp 1571-1576 (12/1978).
Rigorous solutions to photoemission for an Al and Au are presented for the first time. The solutions were obtained by solving a Boltzmann transport equation. The results are compared with magnetic spectrometer data by Bernstein and results deduced by Fromme, et al. from backbiased diode data. Except for the spectrometer data for Al, the measured results do not agree well with our calculations. Good agreement, however, is achieved between our results and published data for both photemission using line sources and for electron backscatter. 16 Refs.
Primary Keywords: Boltzmann Transport Equation; Soft X-ray Spectrum
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1823
(PULSE GENERATORS)
(Control Systems)
A DIGITAL CONTROL SYSTEM FOR HV IMPULSE GENERATORS
J.E. Matthews and C.Y. Kong
University of Strathclyde, Glasgow, Scotland
Journal Of Physics E; Scientific Instruments, Vol. 11, pp 256-258 (03/1978).
A digital control system using TTL logic elements is described for use with a 1.6 MV impulse generator. The unit is fully programmable and records on magnetic tape the data obtained from breakdown studies of long spark gaps in a form suitable for on-line computer processing. The precautions necessary for operating solid state components in the hostile environment of a high-voltage laboratory include the use of optical links and battery-operated power supplies. 4 Refs.
Primary Keywords: Pulse Generator Control Syster; TTL Logic Control; Noise Reduction; Circuit Monitoring System
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1833
(PARTICLE BEAM, ION)
(Generation)
HIGH-CURRENT-PULSED LINEAR ION ACCELERATORS
S. Humphries Jr.
Cornell University, Ithica, NY 14850
Journal Of Applied Physics, Vol. 49, No. 2, pp 501-512 (02/1978).
Possible methods are described for constructing ion linear accelerators in the 100-MeV range which have pulsed current outputs 10e5 times higher than currently available. A drift-tube design with insulating magnetic fields between the tubes is presented. The fields not only prevent electron flow, but also are essential for beam neutralization by low-energy electrons and transverse beam focusing. Preliminary discussions are given on accelerator design and construction, transverse focusing and beam neutralization, and control of the beam in longitudinal phase space. 36 Refs.
Primary Keywords: 100meV Range; High Pulsed Current Output (10kA); Insulating Magnetic Field Drift Tube; High Efficiency (20%)
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1834
(BREAKDOWN STUDIES)
(Gas, Optical)
HIGH-POWER PHOTOPREIONIZATION-STABILIZED CARBON DIOXIDE WAVEGUIDE LASERS OPERATING AT GAS PRESSURES OF UP TO 13 ATM
D.J. Brink and V. Hasson
National Physical Research Lab, Pretoria, South Africa
Journal Of Applied Physics, Vol. 49, No. 4, pp 2250-2253 (04/1978).
A simple photopreionization-stabilized waveguide laser is energized effectively by fast Blumlein-type pulsers and operates at pressures of up to 13 atm. The laser has an active plasma volume of 0.2 cm-sup 3/ and provides 20 ns gain-switched pulses with beam energies of 10 mJ. The maximum pressures and beam energies are more than an order of magnitude higher than those published previously; the peak power is enhanced by two orders of magnitude. 13 Refs.
Primary Keywords: Blumlein Pulsers; High Pressure (13atm); 20ns Pulses; 10ms Beam Energy
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1862
(PARTICLE BEAMS, ELECTRON)
(Generation)
ELECTRON GUN FOR GENERATION OF SUBNANOSECOND ELECTRON PACKETS AT VERY HIGH REPETITION RATE
M. Weinfeld and A. Bouchoule
Ecole Polytechnique, Palaiseau, France
Review Of Scientific Instruments, Vol. 47, No. 4, pp 412-417 (04/1976).
In order to create and study trapped particle modes in a plasma column, we have designed an electron gun which delivers packets with a duration shorter than 1 nsec at energies of about 100 eV, and with a repetition frequency of several hundred megahertz. This gun is made with parts of a classical disk-sealed microwave triode. This paper describes the gun itself and the pulse generator used to modulate it. Some results concerning trapped particle modes are shown in conclusion. 10 Refs.
Primary Keywords: Trapped Particle Modes; Magneticelly Confined Plasma; Electron Plasma Potential Wells; Disk Sealed Microwave Triodes
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1868
(SWITCHES, OPENING)
(Explosive Fuses)
EXPLOSIVELY ACTUATED 100 KA OPENING SWITCH FOR HIGH VOLTAGE APPLICATIONS
R.D. Ford and I. M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
NRL Memorandum Report No. 3561 (07/1977).
Availability: AD A046798
NTIS

The role of opening switches for high power energy sources such as those required in particle beam research is becoming more important as the prospects for use of inductive storage techniques widens. The technology associated with these switches is also applicable to protection of electric power transmission equipment where continually increasing voltage levels are being sought. A single shot modular opening switch capable of carrying currents up to 100 kA indefinitely and opening in a time of approximately 20 microseconds has been developed. Very low trigger jitter characteristics as well as its simplicity allow the switch to be used both in series and in parallel operation. This switch operates on the principle of an explosively generated pressure which radially drives paraffin to produce multiple ruptures in a cylindrical conductor. Current probes and fast frame photography were used to determine its mechanical performance characteristics such as the reproducibility of the opening time and the simultaneity of the rupturing of the conductor. Current and voltage probes have shown, for example, that a 16-segment switch develops 8 kV in 10 to 20 microseconds in the process of interrupting 100 kA current when used as a safety device, or 110 kV at 40 kA when used with an integral exploding wire fuse. 15 Refs.

Primary Keywords: High Speed Opening Switch; Inductive Storage
Secondary Keywords: Current Interrupter; Power Line Protection

1875
(REVIEWS AND CONFERENCES)
(Reviews)
PULSED POWER FOR FUSION
T.H. Martin
Sandia Labs, Albuquerque, NM 87115
1976 IEEE Pulsed Power Conference Proceedings, Paper ID-1 (11/1976).

A review which traces the development of high power pulsed accelerators from the original inception at the Atomic Weapons Research Establishment, Aldermaston, England, for Bremsstrahlung output, through the low impedance accelerators, to the double-sided accelreators for fusion will be given. Proto II is presently being assembled at Sandia and preliminary testing on the Marx has been completed. Examples of various techniques will be shown from Sandia accelerators. Requirements for accelerators capable of achieving fusion levels wiwll be developed and problem areas outlined. The diode insulator flashover problem presently limits the maximum current available from the accelerators. 14 Refs.

Primary Keywords: Particle Accelerator; Proto II; Low Impedance; Fast Pulse
Secondary Keywords: Nuclear Fusion
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1876
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines, Materials)
PULSED HIGH POWER BRUSH RESEARCH
I.R. McNab
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Components, Hybrids, And Manufacturing Technology, Vol. CHMT-1, No. 1, pp 30-35 (03/1978).

The successful utilization of homopolar machines for pulsed power applications requires the development of solid brushes capable of operating at very high current densities and slip ring speeds. Relevant data on the major current collection parameters are reviewed and, where possible, functional variations are suggested. Measured data on voltage drops, friction coefficients and wear rates at current densities up to 27.9 MA/m/sup 2/ (18 kA/sq.in.) and slip ring speeds up to 360 m/s in air, hydrogen and carbon dioxide are discussed. 30 Refs.

Primary Keywords: Homopolar Generator; Solid Brush; Voltage Drop Measurement; Friction Coefficient Measurement; Wear Measurement; Several Atmospheres
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1881
(INSULATION, MAGNETIC)
()
MAGNETIC INSULATION
I.D. Smith, P. D'A. Champney and J.M. Creedon
Physic International Co, San Leandro, CA 94577
1976 IEEE Pulsed Power Conference Proceedings, Paper IIC8-1 (11/1976).

Magnetic insulation of short pulses in vacuum transmission line configurations has been studied analytically since it was successfully used in the AURORA generator. Criteria for its effectiveness have been derived for cases that are steady state and where the load current provides the magnetic field. Experiments are reported here in the 2 to 3.5 MV range. Criteria for insulation have been investigated, insulation has been demonstrated at applied fields of over 6 MV/cm, and preliminary results obtained for a coaxial line whose double transit time is longer than the pulse duration. 6 Refs.

Primary Keywords: Magnetic Insulation, Vacuum Transmission Line, Analysis; Experimental Results
Secondary Keywords: Pellet Fusion
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1898
(BREAKDOWN STUDIES)
(Exploding Wires)
PURE ROTATIONAL HF LASER OSCILLATIONS FROM EXPLODING-WIRE LASER
W.W. Rice and R.C. Oldenborg
Los Alamos National Labs, Los Alamos, NM
IEEE Journal Of Quantum Electronics (March 1977), pp 86-88 (03/1977).

We report 19 pure rotational HF laser transitions, 5 of which are new, from exploding-wire, metal atom oxidation lasers. The laser operates at F/sub 2/ pressures as high as 500 Torr and a gain length of only 0.24 m. The laser pulses are 1-4 us duration and deliver 10E-4 J/pulse. 13 Refs.

Primary Keywords: HF Exploding Wire Laser; 19 Rotational HF Laser Transitions (5 New); F/sub 2/ Pressures Up To 500 Torr; 1-4 Us Laser Pulse Length; 10E-4 J/pulse
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1907
(BREAKDOWN STUDIES)
(Exploding Wires)
SKIN EFFECT IN EXPLODING-WIRE PHYSICS
P.V. Phung and D.D. Miles
Lockheed Palo Alto Research Laboratory, Palo Alto, CA 94304
Journal Of Applied Physics, Vol. 46, No. 10, pp 4487-4492 (10/1975).

This paper describes a method for calculating the current density in a cylindrical conductor under fast-pulse high-current conditions commonly encountered in exploding-wire studies. Due to extensive Joule heating, the transport property (resistivity-to-permeability ratio) of the conductor must be considered as a varying parameter. Basic mathematical representation of the electrodynamical process is recast into a standard nonlinear diffusion problem. An approximate analytical expression is derived for the penetration depth as a function of time. A numerical solution for the early stages of explosion is also presented for the case of a gold wire in which the permeability is temperature independent and the transport parameter varies only with the resistivity. The effect of magnetic pinch on the solid-liquid transition is not included in this illustrative computation. 11 Refs.

Primary Keywords: Skin Depth As Function Of Time; Numerical Solution for Gold (constant Permeability)
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1926
(PULSE GENERATORS)
(Capacitive)
HIGH VOLTAGE PULSED CIRCUIT FOR DICHROIC STUDIES
H.A. Glick
Univ of California, Riverside, CA
Review Of Scientific Instruments, Vol. 47, No. 1, pp 150-152 (01/1976).

A high voltage pulse generator using stacks of silicon-controlled rectifiers (SCR's) is described. Pulses of 2 kV are easily produced and applied to solutions for dichroic studies. The system is easily adapted for higher voltage pulses. 3 Refs.

Primary Keywords: Solid State; SCR Pulse Generator; SCR Switch, Series SCR Switch
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1927
(PULSE GENERATORS; SWITCHES, CLOSING)
(Trigger; Krytrons)
HIGH-VOLTAGE PULSE GENERATOR OFFERS VARIABLE DELAY AND ONLY 3-NS JITTER
R.H. Vandre and G.M. Molen
Aerospace Corp, Los Angeles, CA 90009
Electronic Design, Vol. 24, No. 9, pp 86 (04/1976).

The large amount of jitter normally associated with thyratrons is reduced to 3 ns through the use of a cold-cathode tube. The circuit to do this along with some delay circuitry is presented. The generator can produce 4 kV pulses into 50 ohms with a rise time of 10 ns which can be triggered with delays from 0 to 10 microseconds. 0 Refs.

Primary Keywords: Trigger Generator; Multichannel Delay Generator; Kytron Switch; Delay Logic; Low Jitter; Fast Rise; Low Impedance
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1937
(BREAKDOWN STUDIES)
(Electrodes)
STABILITY OF FIELD EMISSION AND MIGRATION PROCESSES PRECEDING DEVELOPMENT OF A VACUUM ARC
G.N. Fursei and G.K. Kartsev
Leningrad State University, USSR
Soviet Physics-Technical Physics, Vol. 15, No. 2, pp 225-232 (08/1970).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 40, 310-319 (February 1970)

This paper gives the results of an experimental investigation of the migration processes leading to a change in the geometry of the cathode surface and preparing the way for vacuum breakdown. Field emission microscopes - Muller guns with tungsten single crystals - were used for the investigation. The changes in the surface of the tungsten cathode with time in relation to the temperature, residual gas pressure, electric field, and power dissipated by the emitted electron beam on the anode have been investigated. The residual gas pressure was varied from 10 to 5E5 mm Hg, and the temperature from room temperature to 2000 Deg.K. There is a significant relationship between the rate of formation of migrational irregularities on the cathode and the residual gas pressure, cleanness of surface, and electron beam power in the prebreakdown stage. When the surface remained clean, the processes leading to breakdown are the same in a wide range of pulse lengths (1E-3 - 10 sec). There is a considerable reduction in electric strength of the vacuum gap when the surface is contaminated. The rate of development of breakdown in the stage of transition to a highly conducting vacuum gap is several orders greater than the rate of development of the process in the preliminary stage. 12 Refs.

Primary Keywords: Field Emission; Migration Process; Cathode Geometry Change; Tungsten Cathode; Variable Temperature; Variable Gas Pressure; Variable E-field; Variable Power Dissipation
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1946
(PULSE GENERATORS)
(Marx)
BOOTSTRAP CIRCUIT GENERATES HIGH-VOLTAGE PULSE TRAIN
L.H. Bannister
Massachusetts Institute of Technology, Cambridge, MA
Electronics, Vol. 48, No. 14, pp 95-97 (07/1975).

A 1 kV, 400 Hz pulse generator with a 100 ns rise time is built from 20 low voltage stages. The circuit was to be used in a spaceborne instrument and needs only a low voltage power supply. 0 Refs.

Primary Keywords: Transistorized Marx; High Voltage; Fast Rise
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1961
(PULSE GENERATOR)
(Miscellaneous)
PICOSECOND-PULSE SEQUENTIAL WAVEFORM GENERATION
H.M. Cronson
Sperry Research Center, Sudbury, MA 01776
IEEE Transactions On Microwave Theory And Techniques, (December 1975), pp 1048-1049 (12/1975).

This short paper describes a novel method of generating a pulse sequence using step-recovery diodes (SRD's) shunting a transmission line. Individual pulses in the train may have rise times less than 60 ps with amplitudes greater than 10 V. The many potential applications of the device include a short RF pulse generator, and FM generator, and a high-speed word generator. 2 Refs.

Primary Keywords: Step-recovery Diodes (SRD's); Shunted Transmission Line; 60ps Risetimes; 10V Amplitudes; N-section

1963
(PULSE GENERATORS)
(Trigger)
PULSE AMPLIFIER CAN DELIVER OVER 500 V WITH FREQUENCIES TO 100 KHZ
D. Limuti
Stanford Research Institute, Menlo Park, CA 94025
Electronic Design, Vol. 20, pp 102 (09/1975).

The pulse amplifier presented takes a TTL input and outputs up to 500 volts. The circuit can handle frequencies up to 100 kHz and can drive capacitive loads. 1 Ref.

Primary Keywords: Opto-coupler; TTL Level Input; Simple Design

1973
(PULSE GENERATORS; SWITCHES, CLOSING; SWITCHES, OPENING)
(Sensitive: Tacitrons; Tacitrons)
TACITRON GENERATOR OF LONG HIGH-VOLTAGE PULSES
N.T. Gagin, V.F. Gnido, V.A. Krestov and ..A. Nikolaev
Instruments And Experimental Techniques, Vol. 17, No. 6, pp 1568-1669 (12/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 102-104 (November-December 1974)

A generator of long high-voltage pulses is described which uses a tacitron in a self-sustaining-discharge mode. An output pulse amplitude of up to 5 kV is achieved. Two time-shifted pulses are used to effect continuous variation of the pulse duration in the range from 2 to 100 microsec. 2 Refs.

Primary Keywords: Tacitron Switch; Self-sustaining Discharge; Long Duration Pulse; Two-pulse Control

1977
(SWITCHES, OPENING; BREAKDOWN STUDIES)
(Vacuum Gaps, Magnetic Field; Vacuum, Electrical)
STABILITY OF AC VACUUM ARCS IN TRANSVERSE PULSED MAGNETIC FIELD
B.L. Rao, S. Linke and R.N. Sudan
Cornell University, Ithica, NY 14850
IEEE Trans Plasma Sci, Vol. PS-4, No. 2 pp. 148-152 (06/1976).

The preliminary results of an experimental study of the effect of an external transverse pulsed magnetic field on the stability of AC vacuum arcs are reported. An air-core coil that will produce magnetic fields of up to 4,000 gauss in the arcing region was designed, built, and tested. The magnetic field is initiated a few hundred microseconds prior to current zero. The magnetic field is found to help in the interruption process of the arc and a qualitative explanation is offered for the observed phenomena. 10 Refs.

Primary Keywords: Vacuum Arcs; Transverse Pulsed Magnetic Field, Arc Interruption
Secondary Keywords: Electrode Erosion

1978
(PARTICLE BEAMS, ELECTRON)
(Reviews)
CIVILIAN APPLICATIONS OF PARTICLE-BEAM-INITIATED INERTIAL CONFINEMENT FUSION TECHNOLOGY
S.G. Varnado, J.L. Mitchiner and G. Yonas
Sandia Labs, Albuquerque, NM 87115
Sandia Report No SAND77-0516 (05/1977)
Availability: SAND77-0516
NTIS

Electrical power generation by controlled fusion may provide a partial solution to the world's long-term energy supply problem. Achievement of a fusion reaction requires the confinement of an extremely hot plasma for a time long enough to allow fuel burn-up. Inertial confinement of the plasma may be possible through the use of tightly focused, relativistic electron or ion beams to compress a fuel pellet. The Sandia Particle Beam Fusion program is developing the particle-beam accelerators necessary to achieve fuel ignition. In this report we review the status of the particle-beam fusion technology development program and identify several potential civilian applications for this technology. We describe program objectives, discuss the specific accelerators presently under development, and briefly review the results of beam-focusing and target-irradiation experiments. Then we identify and discuss applications for the beam technology and for the fusion neutrons. The applications are grouped into near-term, intermediate-term, and long-term categories. Near-term applications for the beam technology include electron-beam (e-beam) pumping of gas lasers and several commercial applications. Intermediate-term applications (pellet gain < 50) include hybrid reactors for electrical power production, and medical therapy using ion accelerators. In the long term, complex, high-gain pellets may be used in pure fusion reactors. 66 Refs.

Primary Keywords: Relativistic E-Beam; Light Ion Beam; Beam Focusing, Water-Dielectric
Secondary Keywords: Inertial Confinement Fusion; Gas Laser Excitation; ICF Targets

1982
DESIGN OF A HIGH-VOLTAGE GENERATOR FOR THE LASL IMPLOSION-HEATING EXPERIMENT
J.E. Hammel, I. Henins, J. Marshall and A.R. Sherwood
Los Alamos National Labs, Los Alamos, NM 87545
No CONF-731114-37, 4c (01/1973)
Availability: LA-UR-73-1752
NTIS

For abstract, see NSA 29 06, number 14439.

Primary Keywords: Toroidal Theta Pinch Devices Plasma Heating, Pulse Generators_Specifications; Compression, Implosions
Secondary Keywords: AEC

1990
(REVIEWS AND CONFERENCES; ENERGY STORAGE; PULSE GENERATORS; SWITCHES)
(Reviews; Reviews; Reviews; Reviews)
GENERATION OF ULTRA-HIGH POWER ELECTRICAL PULSES
L. Birenbaum and E. Levi
Polytechnic Institute of New York, Brooklyn, NY 11201
RADC Report No. RADC-TR-74-119 (05/1974).
Availability: AD 781114
NTIS

This report is a comprehensive assessment of the state-of-the-art of various energy conversion techniques involving high power electrical pulse generation. The subjects treated include rotating machines, explosive devices, superconductivity, switching, and plasma techniques, including the supercritical temperature and pressure regions. 131 Refs.

Primary Keywords: Supercondcting Compounds; Electromagnetic Radiation; Electrical Machinery; Electrical Power Conversion Device; Pulse Generator; Energy Storage; Switch; Flux Compression; Capacitor; Inductor
Secondary Keywords: Microwave Generation; RF Transmitter; Nuclear Power Source

1991
(PULSE GENERATORS)
(Marx)
GENERATORS PRODUCING VOLTAGE FOR A TRANSVERSE DISCHARGE
V.M. Ishchenko, V.N. Lisitsyn and V.N. Starinskii
Institute Of Semiconductor Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 17, No. 3, pp 747-749 (06/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 108-110 (May-June 1974)

A series of pulsed voltage generators has been developed operating at voltages of 10 to 70 kV and an energy of 1 to 10 J which are based on low-inductance KIS-10 capacitors and gas-filled spark gaps. The construction of the pulsed voltage generators ensures a rate of current growth in a low-resistance load amounting to approximately 1E13 A/sec and a repetition frequency of up to approximately 1E2 Hz. 5 Refs.

Primary Keywords: Pulse Generator; Modular Construction; Marx Generator; Spark Gap; Rep-rated; Low Energy

2002
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
STARTING HIGH-VOLTAGE GENERATORS AT A VOLTAGE OF UP TO 1 MV BY MEANS OF PULSED X RADIATION
V.A. Davidenko, B.A. Dolgoshein, A.N. Lebedev, S.V. Somov and V.N. Starosel'tsev
Moscow Engineering-Physics Institute, Moscow, USSR
Instruments And Experimental Techniques, No. 3 pp 753-755 (05/1974).
Trans. From: Pribory I Technika Eksperimenta 3, 113-115 (May-June 1974)

The possibility was investigated of firing a high-voltage spark gap by means of x radiation. It was shown that such firing may be accomplished at voltages of up to 500 kV. The dependence of the efficiency of x-ray firing on the interelctrode distance of the spark gap and a rise time of the voltage across it was studied. A circuit was proposed for using such a spark gap in voltage generators rated up to 1 MV. 7 Refs.

Primary Keywords: Spark Gap; X-ray Triggering; Parameter Study; Interelectrode Distance; Voltage Rise Time

2003
(PULSE GENERATORS)
(Miscellaneous)
SUBNANOSECOND RISE TIME PULSES FROM INJECTION LASERS
J. Vanderwall, W. Hattery and Z. Sztankay
Harry Diamond Labs, Washington, DC 20438
IEEE Journal Of Quantum Electronics, (July 1974), pp 570-572 (07/1974).

The hybrid integration of an injection laser with a simple avalanche transistor modulator is shown to produce optical peak powers of several tens of watts magnitude and pulse rise times appreciably shorter than 1 ns. In certain circumstances the pulse leading edge assumes the form of a spike having a displayed rise time of 120 ps. 11 Refs.

Primary Keywords: Avalanche Transistor Modulator; Motorola 2N3507 Transistor Chip

2007
(BREAKDOWN STUDIES)
(Gas, Electrical)
TUBULAR PULSE-DISCHARGE LAMPS AS CIRCUIT ELEMENTS
Y. Anan'ev, E. Bordachev, V. Irtuganov, V. Kalinin and V. Sergeev
Affiliation Not Given
Soviet Journal Of Quantum Electronics, Vol. 4, No. 5, pp 656-657 (11/1974).
Trans. From: Kvantovaya Elektronika, Vol. 1, pp 1195-1200

The results are given of an experimental investigation of the load characteristics of pulse-discharge xenon lamps with a luminous channel of 16 mm diameter. A description is given of the method of calculationg the operating conditions of such lamps in a CLR series curcuit. 9 Refs.

Primary Keywords: Tubular Xenon Flashlamps, 16mm Diameter; CLR Series Circuit, 240mm Discharge Length; Reflection Effects On Resistance

2008
(PULSE GENERATORS)
(Line Type)
300 KV RECTANGULAR PULSE GENERATOR WITH NANOSECOND RISETIME
R.D. Genuario and J.C. Blackburn
Harry Diamond Labs, Washington, DC 20438
Review Of Scientific Instruments, Vol. 45, No. 12, pp 1546-1549 (12/1974)

A system is described for producing rectangular pulses up to 300 kV in amplitude with rise times of about 1 nsec and pulse widths adjustable between 5 and 20 nsec. A coaxial line is pulse charged from a Martin-type autotransformer and then discharged by a fast-rise high pressure switch into a matched CuSO/sub 4/ load resistor. A low inductance, capacitive voltage divider allows monitoring of the pulse. The pulse reproducibility is excellent and the low jitter (250 psec) in the discharge switch allows synchronization with other events. The system has been in use for two years with satisfactory results. 7 Refs.

Primary Keywords: 300 Kv Rectangular Pulse; 1ns Risetime (98 Ohm Load); 5ns To 20ns Pulse Width; Coaxial Charge Line; Pulse Charged; Martin typo Autotransformer

2013
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN IN A COLD CATHODE VACUUM DIODE

O. Milton
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Electrical Insulation, Vol. EI-9, No. 2, pp 68-80 (06/1974).
A 50-ns pulse generator is used to obtain time-correlated current-voltage relationships in the prebreakdown region for a long vacuum gap with cold planar electrodes. Analysis of data indicates several sequential stages occur. These stages include an initial quiet stage of voltage increase without interelectrode current, a microdischarge stage, a field emission stage, a space-charge controlled stage, and a final low-impedance stage where the current becomes sustaining. Electrical breakdown of the gap is considered in terms of a positive ion front moving from the anode. 37 Refs.
Primary Keywords: Various Breakdown Stages; Microdischarges; Monotonic Current-field Emission; Sustaining Current; Electrical Breakdown

2018
(PULSE GENERATORS)
(Trigger)
GENERATOR PRODUCING TRAINS OF HIGH-VOLTAGE PULSES IN THE NANOSECOND RANGE

I.Ya. Timoshin (1) and E.I. Kolobanov (1)
(1) Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR, USSR
Instruments And Experimental Techniques, Vol. 17, No. 1, pp 107-109 (02/1974).
Trans. from: Pribory i Tekhnika Eksperimenta 1, 101-103 (January-February 1974)
A generator is described which produces rectangular pulses having a length of approximately 10 nsec and an amplitude of up to 4 kV across a 75-ohm load, a repetition frequency of approximately 10 MHz within the pulse train, and a length of the pulse train approximately 200 microsec with a train repetition frequency of 1 to 5 Hz. 3 Refs.
Primary Keywords: Pulse Generator; 4 kV Output; Repetrant; Burst Mode; 10 MHz Repetition Rate; 100 Microsecond Burst; Ferrite Peaking Line; Thyratron

2021
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
THE FIELD EMISSION INITIATED VACUUM ARC. I. EXPERIMENTS ON ARC INITIATION

W.P. Dyke, J.K. Trolan, E.E. Martin and J.P. Barbour
Linfield College, McMinnville, OR
Physical Review, Vol. 91, No. 5, pp 1043-1054 (09/1953).
It is known that electrical breakdown between metal electrodes can be initiated by field emission. The present work concerns a further study of that initiation process under conditions of excellent vacuum and a clean cathode surface. As the field current density from the single crystal tungsten emitter is continuously increased, the normal emission is terminated by an explosive vacuum arc. Since this breakdown occurs in less than a microsecond, the experimental observations were obtained by use of pulse electronic techniques. The magnitude of the electric field, current density, and work function at the cathode were simultaneously determined prior to breakdown. From this investigation it has been established that: (1) the vacuum arc was initiated at a critical value of the field current density of the order of 1E5 amperes/cu.cm.; (2) breakdown was predictable and not random, in fact easily recognizable conditions preceding arc formation have been established; at current densities just below the critical value, an electron emission process was observed, which apparently involved both high electric fields and high temperatures; (3) arc formation did not require cathode bombardment by material from the anode or from residual gases; (4) breakdown was independent of the applied microsecond voltage in the range 5<V<60 kV, provided the critical current density was not exceeded; (5) the current during arc exceeding the initiating field current by a factor of at least 100. 39 Refs.
Primary Keywords: Field Emission; Tungsten Cathode; Critical Current Density; High E-field, High Temperature; Voltage vs Pulse Duration

2026
(BREAKDOWN STUDIES: SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Optical)
MEASUREMENT OF THE ACTUATION TIME OF SPARK GAPS IN A CASCADE PULSE-VOLTAGE GENERATOR

I.R. Petrov
Kharkhov Polytechnic Institute
Instruments And Experimental Techniques, No. 1 pp 128-131 (01/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 117-120 (January-February 1974)
The methods and results are described of measuring the actuation time of the spark gaps in a seven-stage high-voltage pulse generator. The results were obtained by photography using an SFR streak camera. The integral probability curves which were obtained provide a quantitative estimate of the effect of the mutual illumination between spark gaps on the actuation time. 5 Refs.
Primary Keywords: Spark Gap; Breakdown Time; Ultraviolet Radiation; Gap Communication; Relation To Overvoltage

2030
(PULSE GENERATORS)
(Capacitive)
PULSE GENERATOR FOR A THIN-ECHO NUCLEAR MAGNETIC RESONANCE RELAXOMETER

V.M. Zagainov, A.M. Zharkov, V.S. Matochkin and M.I. Emel'yanov
Instruments And Experimental Techniques, Vol. 16, No. 6, pp 1842-1844 (12/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 192-194 (November-December 1973)
The circuit of a rectangular pulse generator designed for modulation of the spin-echo transmitter of a nuclear magnetic resonance (NMR) relaxometer in measurements of the relaxation times in the laboratory and rotating coordinate systems is described. The use of the generator considerably shortens the process of resetting the equipment for measurements performed in different coordinate systems. 6 Refs.
Primary Keywords: Pulse Generator, Delay Line; Pulse Shaper; Several Outputs

2036
(PULSE GENERATORS)
(Miscellaneous)
SIMPLE INSTRUMENTATION FOR RISE AND DECAY TIME MEASUREMENT OF CATHODOLUMINESCENCE IN AN ELECTRON MICROPROBE

J. Lebiedzik, E. White and R Bhalla
Pennsylvania State University, University Park, PA
The Review Of Scientific Instruments, Vol. 45, No. 3, pp 451-452 (03/1974)
A pulser voltage generator has been built for an electron microprobe for measuring rise and decay characteristics of cathodoluminescence from micron size sample areas. The pulsed voltage operation has an advantage in that excessive heating of the sample can be avoided by keeping the electron beam on the sample surface only for the duration necessary to get the full trace. Both the pulsing frequency and the pulse duration are variable continuously over wide ranges. 6 Refs.
Primary Keywords: Electron Microprobe; Cathodoluminescence; Varable Pulse Frequency, Variable Pulse Duration

2041
(PULSE GENERATORS)
(Miscellaneous)
TUNNEL DIODE NARROW PULSE GENERATOR

Z. Tan
University of Auckland, Auckland, New Zealand
Proceedings Of The IEEE, (November 1973), pp 1659-1660 (11/1973).
A simple tunnel diode circuit is described which can generate narrow current pulses from low-amplitude voltage pulses at instances in time corresponding to either the leading or the trailing edge of the driving pulses. The pulse generator is capable of producing pulses at a rate of about 330 Mhz. 2 Refs.
Primary Keywords: Displaced Nonlinear Load Line; Tunnel Diode

2042
(DIAGNOSTICS AND INSTRUMENTATION)
(Review)
ULTRASHORT PULSE MEASUREMENTS

D. Bradley and G. New
Imperial College, University of London, London, UK
Proceedings Of The IEEE, Vol. 62, No. 3, pp 313-345 (03/1974).
267 Refs.
Primary Keywords: Ultrashort Light Pulse Measurements; Electron-optical Streak Camera; Two-photon Fluorescence Method; Direct Measurements Of I(t); photodiodes; chirping; pulse compression; dynamic spectroscopy

2050
(BREAKDOWN STUDIES)
(Gas, Electrical)
FORMATIVE TIME OF PENNING DISCHARGE

S.I. Ivanov
Sofia University, Bulgaria
International Journal Of Electronics, Vol. 34, No. 6, pp 769-775 (06/1973).
This paper describes an investigation done into the formative time of a Penning discharge and into the effect of variations in anode voltage, pressure, and magnetic field upon this time. The formative time was found to be on the order of hundreds of microseconds and decreased if any of the three varying parameters was increased. This long formative time (as compared to the formative time of a glow discharge) can be explained in terms of the decrease in the cross-field mobility of the electrons. 5 Refs.
Primary Keywords: Penning Discharge; Control Grid; Quench Pulse; Formative Time, Experiment; Theory

2051
(BREAKDOWN STUDIES)
(Gas, Optical)
GAS BREAKDOWN BY A SHORT LASER PULSE

C.F.M. Ireland and C.G. Morgan
University College of Swansea, Singleton Park, Swansea, Wales
Journal Of Physics D, Applied Physics, Vol. 6, No. 6, pp 720-729 (04/1973).
The breakdown of gases by short (typically sub-nanosecond) laser pulses when the two dominant mechanisms governing the plasma growth are multiphoton and cascade ionization is treated theoretically. It is shown that two important pressure regimes result: a low pressure regime where the breakdown is governed solely by the multiphoton ionization process, and a high-pressure regime where the expression for threshold breakdown intensity involves both ionization processes as well as the effect of impurities in the gas. The predictions of the theory are compared with published experimental data for ruby and Nd:glass laser pulses. Good agreement is obtained in the case of ruby radiation, and a possible explanation of deviation from the experimental data obtained using a Nd:sup 3+: laser is offered. 17 Refs.
Primary Keywords: Sub-nanosecond Laser Pulse; Multiphoton Plasma Growth; Cascade Ionization; Low Pressure; High Pressure; Nd:+ Laser; Ruby Laser

2075
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
SINGLE TIME MEASUREMENT DETERMINES CAPACITOR R AND L

C. Ward
Massachusetts Institute of Technology, Cambridge, MA
Electronics, Vol. 45, No. 21, pp 119-120 (10/1972).
The resistance and inductance of a capacitor is easily measured using a pulse generator and an oscilloscope. The DC offset of the capacitor voltage response is used to calculate the resistance while the overshoot transient is used to calculate the inductance. 0 Refs.
Primary Keywords: Capacitor Characterization, Dissipation Factor; Inductance Measurement

2082
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Electrodes; Vacuum, Electrical)
THE NATURE OF FIELD EMISSION SITES

B.M. Cox
Marchwood Engineering Lab, Southampton, UK
Journal Of Physics D. Applied Physics, Vol. 8, No. 17, pp 2065-2073 (12/1975).
A probe-hole technique for measuring and mapping electron emission from metal surfaces (e.g. contacts from used vacuum switches) has been developed for use in situ in a scanning electron microscope. A single emitting region can be selected and its voltage/current characteristic measured. The specific site of the emission source can be predicted, to an accuracy of better than +or- 10 microns, using an electron beam tracking technique; then this site can be examined with the microscope. Visual evidence is shown of 'conditioning' an electrode by voltage breakdown. The link between the source of pre-breakdown current and the site of a spark is confirmed in an experiment which demonstrates the accuracy of predicting the position of emission sites. The ambiguity of the Fowler-Nordheim method of analysing voltage/current characteristics is shown by the failure to correlate size predictions with visual observation of certain types of emitter. 20 Refs.
Primary Keywords: Field Emission; Scanning Electron Microscope; Emission Site Location; Emission Site Prediction; Electrode Conditioning
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2085
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines, Materials)
THE TESTING OF SLIDING ELECTRICAL CONTACTS FOR HOMOPOLAR GENERATORS
M. Brennan, Z. Eliezer, W.F. Weldon, H.G. Rylander and H.H. Woodson
University of Texas at Austin, Austin, TX 78712
IEEE Transactions On Components, Hybrids, And Manufacturing Technology, Vol. CHMT-2, No. 1, pp 111-115 (03/1979).
Due to the recent interest in homopolar generators as pulsed power supplies, the need has arisen for pulsed brush data on slip rings at high current levels and high surface velocities. Tests were conducted to examine the effect of varying the apparent area of contact on the coefficient of friction, voltage drop, and wear rate. Brush areas from 0.806-3.23 sq.cm. were individually tested at current levels from 0.0-2800 A per brush. Experimental data are presented for a high copper grade of commercially available sintered copper graphite material. The data corroborate the 'thermal mounding' phenomenon described by R.A. Marshall. 8 Refs.
Primary Keywords: Brush Testing, Pulsed High Current; Variable Brush Area; Voltage Drop Measurement; Wear Rate Measurement
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2090
(PULSE GENERATORS)
(Capacitive)
HIGH-VOLTAGE PULSE GENERATOR
L.Z. Barabash, O.I. Kryzhanovskii and P.I. Lebedev
Institute Of Theoretical And Experimental Physics, Moscow, USSR
Instruments And Experimental Techniques, No. 1, pp 133-134 (02/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 121-123 (January-February 1970)
A generator of high-voltage pulses for feeding the inflector of an input system injecting an ion beam into the chamber of the ITEP proton synchrotron is described. The generator forms symmetrical different polarity pulses the amplitude of which is adjusted from +or- 5 to +or- 25 kV; the time of establishing the voltage on the inflector is 150 microseconds, and the interruption time is <0.1 microsecond. 3 Refs.
Primary Keywords: Pulse Generator; Thyristor, Capacitive Load; 25 kV Output; Bipolar Pulse; Symmetric Pulse
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2094
(PULSE GENERATORS)
(Capacitive)
NANOSECOND-PULSE GENERATOR USING THYRISTORS
I.I. Rozhkov
Gork'ii Polytechnic Institute, USSR
Instruments And Experimental Techniques, Vol. 14, No. 4, pp 1083-1084 (08/1971).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 119-120 (July-August 1971)
The paper describes a thyristor circuit for matching the channel in a nanosecond-pulse generator for waves reflected from an unmatched load. The shaping of the pulses of the generator is based on using electromagnetic shock waves in transmission lines containing ferrite. Experimental samples of a nanosecond-pulse generator having a rated power of 3E3 W with a repetition frequency of up to 10 kHz were created. 4 Refs.
Primary Keywords: Pulse Generator; Electromagnetic Shock Wave; Ferrite Loaded Peaking Line; Unmatched Storage Capacitor; No Reflections; Thyratron, Thyristor
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2100
(PULSE GENERATORS; PULSE GENERATORS)
(Systems, Capacitive)
PULSED SUPPLY OF PHOTOMULTIPLIERS
I.V. Sanin, N.G. Ivchenko, G.N. Markov and S.V. Samylov
Instruments And Experimental Techniques, No. 1, pp 185-187 (02/1970).
Trans. from: Pribory i Tekhnika Eksperimenta 1, 163-164 (January-February 1970)
The operation of an FEU-30 photomultiplier on feeding with a pulsed voltage of up to 10 kV with a pulse length of 5 microsec was studied. The leading edge of a single-electron pulse was shortened to 1.5 nsec. The circuit of the pulse generator and effects accompanying the pulsed feeding of the photomultiplier are considered. 6 Refs.
Primary Keywords: Pulse Generator, Thyratron, 10 kV Output, 10^-4 Output, 5 Microsecond Pulse Width
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2107
(PULSE GENERATORS; PULSE GENERATORS)
(Systems, Capacitive)
SPARK-CHAMBER POWER-SUPPLY CIRCUIT WITH SEMICONDUCTOR TRIGGER
A.F. Ivudin, A.V. Kurochkin, E.M. Shermanzon and Yu.T. Yurkin
Moscow Engineering Physics Institute, Moscow, USSR
Instruments And Experimental Techniques, No. 4, pp 1058-1059 (08/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 90-91 (July-August 1970)
The circuit of a spark-chamber power supply which utilizes transistors operating in the avalanche mode, dynistors, and a vacuum spark relay is presented. The operational threshold is less than 100 mV. The delay of the high voltage pulse with respect to the input pulse is approximately 80 nsec. 4 Refs.
Primary Keywords: Pulse Generator; Transistor Driver Circuit; Vacuum Spark Gap; Low Delay; Low Jitter; Low Trigger Voltage
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2109
(PULSE GENERATORS; SWITCHES, CLOSING)
(Trigger, Thyristors)
THYRISTOR HIGH-VOLTAGE PULSE GENERATORS
V.A. Artem'ev, N.S. Voroneva and V.M. Knyazev
Instruments And Experimental Techniques, No. 3, pp 817-818 (06/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 162-163 (May-June 1970)
Thyristor high-voltage pulse generators for triggering spark chambers are described. The generators use KU201L thyristors and produce isolated pulses having for the respective generators the following parameters: pulse voltage, 4 and 5 kV; pulse current, 100 and 50 A; rise time 100 nsec; delay from moment of application of triggering pulse, 80 and 400 nsec. 3 Refs.
Primary Keywords: Trigger Pulse Generator; Thyristor; Pulse Transformer; Cascade Generator
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2110
(PULSE GENERATORS; BREAKDOWN STUDIES)
(Capacitive; Exploding Wires)
THYRISTOR PULSE CIRCUIT FOR CONTROLLING THE EXPLOSION OF A THIN WIRE
Ya.S. Broyman and F.I. Slezinger
Transcaucasian Branch, ENIMS, Erevan
Instruments And Experimental Techniques, No. 1, pp 139-140 (02/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 126-127 (January-February 1970)
A circuit for control of wire explosion in a magnetic field is described. The wire itself closes the circuit, being driven by a current pulse shaped by an LC circuit containing the wire. 2 Refs.
Primary Keywords: Pulse Generator; Low Voltage; Low Current; Thyristor; Exploding Wire; Self-switching; Wire Displacement; I x B Force
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2111
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
TIME CHARACTERISTICS OF ELECTRICAL BREAKDOWN IN VACUUM
N.F. Olendskaya and M.A. Sal'man
Soviet Physics-Technical Physics, Vol. 15, No. 2, pp 242-247 (08/1970).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 40, 333-339 (February 1970)
Volt-second characteristics of breakdown in vacuum up to 550 kV have been determined with interelectrode gaps in the range of 5-15 mm with unconditioned electrodes. The breakdown delay time is calculated from the volt-second characteristics with ramp voltage pulses. It was found that with unconditioned electrodes the pulse factor (surge factor) and delay time increase when the interelectrode gap is increased. 7 Refs.
Primary Keywords: Temporal Resolution; Unconditioned Electrode; 5-15 mm Gap; Delay Measurement
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2133
(DIAGNOSTICS AND INSTRUMENTATION)
(Particle Beams, Neutral)
SPECTRALLY RESOLVED OPTICAL DIAGNOSTICS FOR HIGH-POWER NEUTRAL BEAMS
J.F. Boinal, G. Bracco, C. Breton, C. DeMichelis, J. Druaux, M. Mattioli, R. Oberson and J. Rinnette
EURATOM-CEA, Centre d'Etudes Nucleaires, France 92260
Physics Letters, Vol. 75A, No. 1,2, pp 65-68 (12/1979).
An optical method of diagnosing a high-power neutral beam is proposed. Spectral profiles for some of the neutral particle emissions are obtained and then used to calculate the proportions of the different populations. An aposteriori check of the results is also done. 7 Refs.
Primary Keywords: Neutral Beam; Target Interactions; Emitted Light; Forward Emission, Beam Energy; Particle Flux
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2139
(POWER CONDITIONING)
(Pulse Transformers)
DESIGN OF TESLA TRANSFORMERS USED IN DIRECT-VOLTAGE ACCELERATORS
D.Kh. Dinev
University of Sophia, Bulgaria
Soviet Atomic Energy, Vol 46, No. 3, pp 208-209 (03/1979).
Trans. From: Atomnaya Energiya 46, 179-180 (March 1979)
Direct-voltage charged-particle accelerators, employing the Tesla transformer as a high-voltage generator, have come into wide use in recent years. In such accelerators the load to the secondary transformer circuit is the accelerating tube which accelerates beams with pulse currents ranging from tens to several thousands amperes. The present paper considers theoretically the effect of this load on the processes in the Tesla transformer and on its parameters. 2 Refs.
Primary Keywords: Tesla Transformer; Analysis; Coupling Coefficient; Load Considerations
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2147
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Gaps, Electrical; Vacuum Gaps, Magnetic Field)
MAGNETICALLY CONTROLLED VACUUM-ARC ON-OFF SWITCH
R. Dethlefsen and J. Mylius
Gould Inc, Colmar, PA 18915
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1491-1496 (10/1979).
A vacuum spark gap is demonstrated which attains high-power switch-off capability by a magnetic control field applied to the anode in a Penning-type discharge geometry. Applying the magnetic field raises the arc voltage and excites oscillations. Circuit interruption results if the arc current is reduced to the current chopping level of the cathode material. Shunt capacitance raises the interruption ability. Currents up to 9 kA were interrupted. Transient recovery voltages ranged up to 20 kV. 10 Refs.
Primary Keywords: Vacuum Arc; Pulsed Magnetic Field; Cathode Current Chopping Level; Penning Discharge

2156
(POWER CONDITIONING)
(Pulse Forming Networks)
PULSE-FORMING NETWORKS WITH TIME-VARYING OR NONLINEAR RESISTIVE LOADS
R.M. Roark, M.E. Parten, L.B. Masten and T.R. Burkes
Texas Tech University, Lubbock, TX 79409
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1541-1544 (10/1979)
High-power pulse-forming networks (PFN) have been in use for some time. The networks are usually designed using techniques that assume a desired pulse shape and a constant resistive load. High-power gaseous discharge devices have created a need for high-power pulse generation operating into time-varying resistive loads or nonlinear resistive loads. Although some work has been done in designing a PFN with a time-varying load, little has been done for the nonlinear loads in general. In this paper a study of the effects of a time-varying or nonlinear load on a PFN is presented using simulation techniques. The resultant output pulse is compared to the desired pulse using different error functions, such as mean-square error and absolute error. The sensitivity of the error function with respect to the parameters of the PFN is determined. A criterion is developed for the adjustment of the parameters of a PFN to improve the pulse delivered to a time-varying or nonlinear resistive load. The form of the desired pulse, the error function, and the type of resistive load can be varied to obtain a specific adjustment criterion. In one case, applying the technique to a given PFN resulted in a 46.4-percent improvement in mean-square error. 5 Refs.
Primary Keywords: Nonlinear Load; Numerical Calculation; Design Considerations; Comparison With Experiment

2161
(ENERGY STORAGE, INDUCTIVE; PARTICLE BEAMS, ELECTRON)
(Systems; Generation)
ANALYSIS OF AN INDUCTIVE ENERGY HIGH-PERVEANCE ELECTRON-BEAM GENERATOR
M. Weiner
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1531-1536 (10/1979).
Recently, Slivkov and Dolgachev proposed an interesting type of electron-beam generator, consisting of a high-voltage triode in series with a storage inductor. During the storage time, the triode operates with a depressed collector voltage. A high-energy current pulse is obtained when the triode is switched from a high-perveance state to a low-perveance one. In this paper, the circuit model for the beam generator was expanded to take into account grid capacitance and beam loss. Computer results based on the new circuit model predict a train of sinusoidal-like pulses in the triode output when the grid is suddenly connected to a portion of the storage inductor. An electron-beam generator, capable of producing a train of megavolt pulses at high currents, is predicted. 4 Refs.
Primary Keywords: Storage Inductor; High Voltage Triode; Low Perveance; Modelling; Numerical Calculation

2164
(POWER CONDITIONING)
(Pulse Forming Networks)
A MODULAR PFN WITH PULSEWIDTH AGILITY
M.J. Blinchikoff and R.A. Gardenghi
Westinghouse Electric Corp, Baltimore, MD 21203
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1537-1540 (10/1979)
This paper describes the design, analysis, and realization of a lightweight, low-impedance pulse-forming network (PFN) in which identical inductor-capacitor modules can be added or removed to change pulsewidth while maintaining high pulse quality without introducing excessive pulse-to-pulse perturbations. The PFN evolved contains an input module that is optimized for a pulse-plateau ripple of less 0.5 percent. The ripple remains within this limit as modules are added or removed from the PFN to change the pulsewidth in 2-microsecond steps. The optimized parameters are presented in normalized form allowing the optimum response to be achieved for arbitrary pulsewidths and network impedances. This low-ripple response is achieved without incorporating mutual inductance into the design, therefore, easing the module turning and assembly. Mutual inductance has been considered indispensible in PFN's, but it is a roadblock for modular construction. Its elimination as a design parameter is the key to realizing the modular PFN. A breadboard was built and tested under high power. Included are measured responses that verify that the modular concept and optimum response can be realized in practice. 2 Refs.
Primary Keywords: Variable Pulse Width; High Pulse Quality; Low Impedance; Modular Design

2165
(ENERGY CONVERSION, ELECTRICAL; ENERGY CONVERSION, ELECTRICAL)
(Power Supplies; Charging Circuits)
A NEW RESONANCE TRANSFORMER
J.L. Harrison
Maxwell Labs Inc, San Diego, CA 92123
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1545-1549 (10/1979).
Resonance systems have been used to provide transformer-like voltage stepup from a low voltage to a high voltage. However, all early systems have the disadvantage that the voltage gain is limited to the Q of the total circuit (including the load). This imposes a severe gain limit and leads to high line voltage regulation under changing load conditions when the gain is moderate. The circuit described here is a new curcuit which overcomes most of these early problems. It provides a gain which is relatively insensitive to the load circuit and is mainly limited to the product of the Q of the resonant loops (i.e., the regulation of the circuit is similar to that of an iron-core transformer). Furthermore, several stages can be stop or series connected to provide an unlimited potential gain. The circuit is thus a competitor of the iron-core transformer, and will be particularly attractive in very-high-voltage or high-frequency circuits where adequate insulation or hysteresis loss becomes a problem. 1 Refs.
Primary Keywords: Resonance Transformer; Good Voltage Regulation; Resonant Q; High Gain; Series-parallel Connection

2169
(POWER CONDITIONING)
(Pulse Transformers)
DESIGN OF COAXIAL-CABLE PULSE TRANSFORMERS
R.E. Dollinger (1), D.A. Moll (1) and D.L. Smith (2)
(1) State University of New York at Buffalo, Buffalo, NY 14226
(2) AFWL, Kirtland AFB, NM 87117
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1549-1551 (10/1979).
Coaxial-cable pulse transformers with good high-frequency response (30-ns rise time) and excellent high-voltage interwinding insulation (>=300 kV primary to secondary) were designed, built, and tested. They have the advantage that the open-circuit transformation ratio is unaffected by the thickness of the interwinding insulation, and good coupling is maintained with step-up designs. An equivalent circuit was developed, involving two coupling coefficients, which predicted the measured results with reasonable accuracy. Values of primary, secondary, and leakage inductances were 1.4, 2.2, and 0.8 microHenry, respectively. 9 Refs.
Primary Keywords: Coaxial-cable Pulse Transformer; Fast Rise Time; High-voltage Capability; Very Good Coupling; Voltage Stepup

2172
(SWITCHES, CLOSING)
(Thyratrons)
DOUBLE-ENDED HYDROGEN THYRATRONS FOR CROWBAR PROTECTION OF HIGH-POWER TWT SYSTEMS
N.S. Nicholls (1), M. Menown (2) and R.J. Wheldon (2)
(1) Royal Radar Establishment, Malvern, Worcestershire, UK
(2) English Electric Valve Co Ltd, Chelmsford, Essex, UK
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1456-1461 (10/1979).
The paper describes a new range of compact double-ended thyratrons specifically designed for crowbar use up to 100 kV with an auxiliary power consumption of only 75 W. A dynamic test arrangement is described which demonstrates the tube's capability of discharging 0.25 microfarad charged to 60 kV, the current rising to 500 A at a rate of 50 kA/microsecond, with an anode delay time of 200 ns. The test equipment simulates either grounded cathode or floating deck operation under conditions where a flash arc fault occurs. The efficiency of the protection is evaluated by monitoring the 'let-through current', charge, and energy. Coincidence counters register faulty operations. A compact auxiliary supply module makes these tubes especially attractive to aerospace systems engineers. 4 Refs.
Primary Keywords: Ceramic Thyratron; Multigap; Crowbar; 'Thyratron' Mode, H.T. Transient Analysis; Fault Simulation

2175
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH REPETITION RATE BURST-MODE SPARK GAP
A. Faltens, C.L. Pagnato, R. Hester, A. Chesterman, E.G. Cook, T. Yokota and W. Dexter
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp. 1411-1413 (10/1979).
Results are presented on the design and testing of a pressurized gas silicon spark-gap switch capable of high repetition rates in a burst mode of operation. The switch parameters which have been achieved are as follows: 220 kV, 42 kA, a five-pulse burst at 1 kHz, 10-ns rise time, 2-ns jitter at a pulsewidth of 50 ns. 1 Refs.
Primary Keywords: Gas Blown Spark Gap; Burst-Mode; High Reliability
Secondary Keywords: Blumlein

2176
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ION)
(Generation, Generation)
HIGH-POWER ELECTRON AND ION BEAM GENERATION
J.A. Nation
Cornell University, Ithica, NY 14850
Particle Accelerators, Vol. 10, pp 1-30 (01/1979).
The author presents a review of high-power electron and ion beam generation. A general overview is given for Marx generators, pulse forming networks, insulators (including a presentation of some unpublished data on dielectric strengths and breakdown times), and beam diodes. The mechanisms involved in the generation of electron and ion berms are examined. Also presented are discussions of inductive accelerators and collective ion acceleration. 154 Refs.
Primary Keywords: Review; Beam Description; Machine Description; Basic Physics Of Generation; Marx Generator

2178
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
MULTICHANNEL SURFACE SPARK GAPS
W.J. Sarjeant, R.S. Taylor, A.J. Alcock and K.E. Leopold
National Research Council, Ottawa, Ontario, Canada
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1414-1417 (10/1979).
A study has been undertaken on high-pressure surface discharge switches potentially capable of moderate repetition rate operation. The parametric experiments reported were carried out utilizing the gaps as transfer switches, under pulse charging conditions, between several types of low-impedance transmission lines and a high-pressure rare-gas halide laser discharge, acting as the load. The effects of spark gap internal geometry, gas composition, and controlled changes in the laser load, upon gap multichanneling, closure simultaneity, and peak holdoff capability are discussed. These surface gaps, of length 66 cm, reliably close 19 channels per side (29 per meter) with a holdoff voltage greater than 120 kV and a closure simultaneity of approximately 2 ns for the first 500 shots, increasing to about 5 ns and remaining there for 10000 shots, the test limit to date. Preliminary results at higher charging voltages have yielded intense multichanneling with holdoff voltages in excess of 210 kV. 8 Refs.
Primary Keywords: Surface Discharge; Rep-rated; Geometric Effects; Intense Multichanneling

2180
(SWITCHES, CLOSING)
(Gas Gaps, Crossed-field)
OPERATING CHARACTERISTICS OF THE CROSSED-FIELD CLOSING SWITCH
R.J. Harvey
Hughes Research Labs, Malibu, CA 90265
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1472-1482 (10/1979).
The function of the crossed-field closing switch (CFCS) has been studied over a wide range of variables. Three different modes of conduction have been observed: the conventional crossed-field discharge, a hybrid hollow-cathode discharge, and the vacuum arc. Depending on the amplitude and duration of the current, conduction may typically pass through these modes in the above sequence. The CFCS may be triggered magnetically or by grid control into a number of states with varying levels of voltage drop. Conduction may be allowed in the reverse direction or prevented. The present design is limited in response speed and repetition rate by the inductance of the grid and anode leads, the lack of efficient pressure control, and the need for a pulsed magnetic field. Criteria are presented which show the directions in which extrapolations in design may lead. It is concluded that the CFCS is potentially capable of performing some functions more reliably or effectively than conventional switching devices, and variants of the device may eventually be capable of performing functions not presently achievable by any other means. 13 Refs.
Primary Keywords: Closing Switch; Three Conduction Modes; Magnetic Trigger; Grid Trigger; Helium Filled; Rep-rated

2186
(SWITCHES, CLOSING)
(Gas Gaps, Self)
TIME-RESOLVED RESISTANCE DURING SPARK GAP BREAKDOWN
W.K. Cary Jr. and J.A. Mazzie
Naval Surface Weapons Center, Dahlgren, VA 22448
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1422-1427 (10/1979).
The breakdown voltage and the time derivative of the current through a spark gap terminating a transmission line were measured as a function of 4 gas species, 3 gap pressures, and 2 gap spacings. From these measurements, the time-varying channel resistance, the power, and the energy dissipated in the discharge can be determined for the first 1500 ps of breakdown. Data were obtained with a 74-cm-long transmission line, open at the charging end, and terminated by a spark gap at the other end. The line was pulse charged with a 2-microsecond rise time pulse having a maximum voltage of 3 kV. The breakdown voltage was determined by monitoring the charge voltage waveform while a di/dt probe close to the spark gap provided a sampling oscilloscope with the other desired signal. The latter waveform was then digitized and the data were reconstructed using Fourier techniques on a computer to account for the frequency response of the required signal delay line. 4 Refs.
Primary Keywords: Breakdown Voltage, di/dt Measurement; Derived Resistance; Pulse Forming Line

2188
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
DEVELOPMENT OF A 100-KV MULTIMEGAWATT REPETITION RATE GAS SWITCH
A. Ramrus
Maxwell Laboritories Inc., San Diego, CA 92123
IEEE Transactions On Electronic Devices, Vol. ED-26, No. 10, pp 1417-1421 (10/1979).
A 100 kV gas switch has been developed and tested which is capable of controlling 5 MW average power when operated up to 250 pps repetition rate. Recovery of the switch voltage holdoff capability after each discharge was accomplished by providing both a 1 ms grace period during which no voltage is reapplied and by continuously purging the switch with 40 psig pressurized air at flow rates up to 60 SCFM. The switch was tested using a simulation technique in which the switch was subjected to the same repetitive peak voltage and current as it would in controlling several megawatts of average power. Limits of switch performance as a function of air flow rate and peak voltage have been established. 0 Refs.
Primary Keywords: Controls 5 MW Average Power, 250 Pps Repetition Rate, Pressurized Air Flow; Simulation Testing; Matched Load PFN

2189
(BREAKDOWN STUDIES)
(Gas, Electrical)
ELECTRICAL BREAKDOWN OF GASES: IONIZATION GROWTH IN AIR AT HIGH PRESSURES
J. Dutton, F.L. Jones and R.W. Palmer
University College of Swansea, Singleton Park, Swansea, Wales
Proc. Phys. Soc., Vol.78, No.4 pp. 569-583 (02/1961).
This paper describes experiments used to measure the ionization coefficients in air extending the range of pd(pressure x distance) values examined up to 2300 Torr cm for which the sparking potential is about 80 kv. The value of E/p for the experiments was varied from 35 to 40 v/cm Torr. The growth of pre-breakdown ionization currents is analyzed using (I/Io,d) graphs, where Io is the small initial current from the cathode. Initial results showed that the cathode surface had an effect on the value of the secondary ionization coefficient. Once these effects were negated by using a silver cathode it was found that the secondary ionization coefficient was dependent only on E/p, while the primary ionization coefficient showed a decrease as pressure was increased at a constant E/p. The results found agree fairly closely with previously published results even though the accuracy of the measurement of the ionization current had improved. 20 Refs.
Primary Keywords: Townsend's Second Ionization Coefficient; E/p Variation; Dry Air

2190
(BREAKDOWN STUDIES)
(Gas, Electrical)
VARIATION OF TOWNSEND'S SECOND COEFFICIENT IN ELECTRODELESS DISCHARGE
Sen S.N. and Ghosh A.K.
Jadavpur University, Calcutta, India
Proc. Phys. Soc., Vol. 79 pp. 180-189 (06/1962).
The authors report the variation of Townsend's second coefficient in an electrodeless discharge. Results for several lengths and pressures in dry air are presented, along with the variation with E/P. A mathematical expression is presented for the variation of Townsend's second coefficient with E/P, which agrees well with experimental results. 8 Refs.
Primary Keywords: Townsend's Second Coefficient; Electrodeless Discharge; Pressure Variation; E/P Variation

2191
(POWER CONDITIONING)
(Pulse Transformers)
PULSE TRANSFORMERS
H.W. Lord
General Electric Co, Schenectady, NY 12301
IEEE Transactions On Magnetics, Vol. MAG-7, No. 1, pp 17-28 (03/1971).
Pulse transformers capable of transmitting substantially rectangular voltage pulses, with durations of less than one microsecond, were developed for radar applications during World War II. Their primary functions were to match the impedances of high-power microwave radio-frequency electron-tube generators to electronic pulse generators and coaxial transmission cables, and to provide polarity reversal and impedance matching functions within pulse generator circuitry. The principle contributor to the development of satisfactory pulse transformers was the development of cores of thin-guage magnetic materials having 1 microsecond pulse permeabilities in the range of 500 to 3500 for flux-density changes of 10000 G. The development of void free dry-type insulation systems made it possible to produce dry-type pulse transformers for operation at pulse voltages below 12 kV. The pulse transformer development work was paralleled by analytical work which enabled pulse transformer designers to make designs to meet the requirements of the radar circuit designers. The analysis relates the three principle pulse transformer parameters, which are magnetizing inductance, leakage inductance, and effective distributed capacitance, in combination with the circuit parameters which are source resistance, effective load resistance, and load shunt capacitance, to the rise time, top ripple and droop, and fall time of the output pulse. 19 Refs.
Primary Keywords: Impedance Matching; Core Construction; History; Design Considerations

2211
(SWITCHES, OPENING)
(Gas Gaps, Crossed-field)
A HIGH SPEED HVDC CIRCUIT BREAKER WITH CROSSED-FIELD INTERRUPTERS
G.A. Hofmann, G.L. LaBarbera, N.E. Reed and L.A. Shillong
Hughes Research Labs, Malibu, CA 90265
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-95, No. 4, pp 1182-1193 (08/1976).
A novel HVDC circuit breaker is described which utilizes crossed-field interrupters in a sequential switching mode. The breaker and its components were tested in an inductive energy storage facility at levels of 1000 A, 100 kV and performed satisfactorily. 22 Refs.
Primary Keywords: 1000 A, 100 kV HVDC Circuit Breaker; Crossed-field Interrupters; Opening Switch

2217
(SWITCHES, CLOSING)
(Avalanche Transistors, Electrical)
METHOD OF APPLYING AN AVALANCHE TRANSISTOR GENERATED 70 NS GATING IMPULSE TO A FOCUSED PHOTOMULTIPLIER
B.L. Elphick
Atomic Weapons Research Establishment, Aldermaston, Berkshire, UK
Journal Of Physics E: Scientific Intruments, Vol. 2, Series 2, pp 953-955 (03/1976).
7 Refs.
Primary Keywords: Transformer Coupled; 70 Nanosecond Pulse Width; 10 Nanosecond Switching Time; Photomultiplier Driver

2244
(PULSE GENERATORS; POWER CONDITIONING)
(Systems, Pulse Transformers)
500 KV NANOSECOND SQUARE WAVE PULSE GENERATOR
G.A. Mesyats, , V.V. Khmyrov and V.P. Osipov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 2, pp 379-381 (04/1969).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 102-104 (March-April 1969).
This paper describes a pulse generator with the following output characteristics: pulse amplitude, 50-500 kV; pulse duration, 10-40 nsec; pulse frequency, from single pulses to 50 Hz; pulse front duration, 3 nsec. The generator is designed to feed an electron tube. 6 Refs.
Primary Keywords: Marx Generator, Tesla Charging Transformer; Pulse Forming Line; Oil Core Pulse Transformer

2266
(PARTICLE BEAMS, ELECTRON)
(Transport)
BEAM CHOPPER FOR SUBNANOSECOND PULSES IN SCANNING ELECTRON MICROSCOPY
H.P. Feuerbaum and J. Otto
Siemens AG, Munchen, FRG
J. Phys. E. Sci. Instrum., Vol. 11 pp. 529-532 (07/1977).
A method for deflecting the beam of primary electrons in a scanning electron microscope is described. Two trough-type travelling-wave structures are driven by two pulse generators of opposite polarity, thus creating the electrostatic field which deflects the beam. Primarily electron beam pulses of 350 ps are realized. 11 Refs.
Primary Keywords: E-beam Chopper; Travelling Wave Structure; Fast Rise; Fast Fall
Secondary Keywords: Scanning Electron Microscopy

2277
(PULSE GENERATORS)
(Trigger)
A HIGH VOLTAGE PULSE GENERATOR FOR ACOUSTOELECTRIC STUDIES
B. Griffing
Purdue University, West Lafayette, IN 47907
The Review Of Scientific Instruments, Vol. 45, No. 7, pp 964-965 (07/1974).
A simple high voltage pulse generator, suitable for acoustoelectric studies, is described. Pulse outputs of variable width and amplitudes up to 1 kV are achieved. A technique to increase the maximum output to 3 kV is mentioned. 2 Refs.
Primary Keywords: Capacitor Energy Store; Thyristor; Rectangular Pulse; 1 kV Operating Voltage

2281
(BREAKDOWN STUDIES)
(Exploding Wires)
A METHOD FOR DETERMINING DENSITY-RADIUS RELATIONS DURING WIRE EXPLOSIONS
T. Korneff (1) and W. Chace (2)
(1) Temple University, Philadelphia, PA 19122
(2) Chace Assoc, Punta Gora, FL 33950
The Review Of Scientific Instruments, Vol. 42, No. 8, pp 1184-1186 (08/1971).
A twin tube flash x-ray unit is used to probe the density of expanding metal vapor produced in exploding wire experiments. Using an axial orientation for one of the tubes, details not seen in usual perpendicular pictures can be brought out. The developed x-ray film is scanned by a microphotometer and the trace compared with a standard wedge exposed on the same film. The tracings are then reduced to obtain density as a function of radius. Typical results as applied to copper wire are included. 4 Refs.
Primary Keywords: Metal Vapor Density; X-ray Diagnostic; Axially Directed Radiation; Copper Wire

2283
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Gaps, Electrical; Vacuum Gaps, Self)
RELAXATION PULSING WITH A VACUUM ARC DEVICE
A.S. Gilmour Jr., R. Dollinger, C.H. Manikopoulos, P. Schwartz and M. Rosenfeld
State University of New York at Buffalo, Buffalo, NY 14226
1978 IEEE Thirteenth Modulator Symposium, pp 217-221 (06/1978).
In some configurations of a vacuum arc device with a cylindrical anode and an axially positioned cathode, high-repetition-rate relaxation pulsing occurs. Narrow, repetitive voltage spikes occur with amplitudes well in excess of several kilovolts. Each voltage pulse is accompanied by a rapid 'chop' in the current through the arc from a level as high as 10 kA to zero. The repetition rate for this phenomenon is approximately 30 kHz. Such a repetitive opening switch could be very useful if its pulse characteristics could be controlled. An intensive, experimental and diagnostic effort to understand this phenomenon has been in progress for some time now. This paper will present the results that have been obtained to date concerning the spiking phenomenon. 7 Refs.
Primary Keywords: Switch Spiking, Self Relaxation; Self-magnetic Field; Plasma Burst

2284
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Vacuum Gaps, Electrical; Vacuum, Electrical)
BREAKDOWN MECHANISMS AND ELECTRICAL PROPERTIES OF TRIGGERED VACUUM GAPS
G.R. Govinda Raju and F.A. Benson
University of Sheffield, Sheffield, UK
Journal Of Applied Physics, Vol. 47, No. 4 pp.1310-1317 (05/1975).
Some electrical characteristics of a triggered vacuum gap (TVG) having three different dielectric materials have been studied. Silicon carbide which possesses very high resistance (500 M ohms), steatite ceramic of medium resistance (20 M ohms), and boron nitride of very low resistance (50 ohms) have been used. The resistance of the dielectric is found to decrease with increasing trigger current and this is attributed to the deposition of metal vapor on the surface. The minimum trigger voltage and trigger current necessary for a successful operation of the TVG are measured. Deconditioning (reduction) in the minimum trigger voltage, after repeated firings, has been found and is attributed also to the deposition of metal vapor on the dielectric surface. The minimum trigger current for successful firing of the main gap decreases with increasing trigger voltage. The probability of successful firing of the TVG is found to rise rapidly with increasing trigger voltage. The delay time between the application of the trigger pulse to the breakdown of the main gap decreases with increasing trigger current and trigger voltage. A mechanism is suggested for the operation of the TVG. 11 Refs.
Primary Keywords: Triggered Vacuum Gap; Insulation Effects; Electrode Effects; Resistance Variation; Gap Statistics

2303
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A RELIABLE MULTIMEGAVOLT VOLTAGE DIVIDER
D.G. Pellinen and I. Smith
Physic International Co. San Leandro, CA 94577
The Review Of Scientific Instruments, Vol. 43, No. 2, pp 299-301 (02/1972).
A two stage, DC coupled, linear resistive voltage divider having a rise time of 1.5 nsec has been used to measure voltage pulses up to 1.8 MV on a pulsed electron accelerator. The monitor has proved to be stable, reliable, and has required little maintenance. 5 Refs.
Primary Keywords: Resistive Divider; Two Stage Divider; Copper Sulphate Resistor; 50 Ohm Output

2321
(SWITCHES, OPENING; REVIEWS AND CONFERENCES)
(Mechanical; Conferences)
CURRENT INTERRUPTION IN HIGH-VOLTAGE NETWORKS
K. Ragaller Ed.
Brown, Boveri & Co Ltd, Baden, Switzerland
Publisher: Plenum Press, New York And London (01/1978).
This conference record is primarily concerned with gas blast interrupters. The interaction of these breakers with the interruption of a power line fault is reported extensively. Two main interruption schemes: the thermal interruption mode, and the dielectric interruption mode are studied both theoretically and experimentally. DC current interruption is not considered. 270 Refs.
Primary Keywords: Opening Switch; Gas Blast Interrupter; AC Current Interruption; Thermal Interruption Mode; Dielectric Interruption Mode; Experiment; Theory

2350
(INSULATION, MATERIAL: POWER TRANSMISSION)
(Solid: Cables)
CORRELATION OF ELECTROCHEMICAL TREEING IN POWER CABLES REMOVED FROM SERVICE AND IN CABLES TESTED IN THE LABORATORY
M.A. Martin Jr. and R.A. Hartlein
Georgia Power Co., Atlanta, GA
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-99, No. 4, pp 1597-1605 (08/1980).
Laboratory tests were performed to develop a relationship between treeing in extruded dielectric crosslinked polyethylene power cables removed from field service and cables tested in the Georgia Power Company Research Laboratory. New and used cables were subjected to various tests including accelerated treeing, thermal aging and chemical analyses. Cable integrity was examined by physical and optical examination, dissipation factor measurements, partial discharge measurements and AC high voltage breakdown testing. The information gathered during the project aided in the development of accelerated treeing tests to better evaluate the relative resistance of cables to electrochemical treeing and to determine effective cable life. 11 Refs.
Primary Keywords: Cable Insulation, Crosslinked Polyethylene; Insulation Treeing; Cable Life

2360
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
DESIGN AND STRUCTURE OF AN EXTENDED LIFE HIGH CURRENT SPARKGAP
Affinito, D., E. Bar-Avraham and A. Fisher
Univ of California, Irvine, CA
IEEE Transactions On Plasma Science, Vol. PS-7, No. 3, pp 162-163 (05/1979).
The failure modes of a high-current 100-kA 0.6-C sparkgap were studied. The results of the study were used to design and build a high reliability, high-current sparkgap(130-kA 0.7-C). The structure of the sparkgap and the results of the testing are described. 7 Refs.
Primary Keywords: Failure Modes; Repetitive Pulse Applications; Electrode Erosion; Field Enhancement; Insulator Tracking; Design

2382
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A TECHNIQUE FOR MEASURING NONSQUARE PULSED HIGH VOLTAGES TO +OR- 0.25% ACCURACY
J.W. Holm-Kennedy and T.P.C. Ku
University of California, Los Angeles, CA 90024
The Review Of Scientific Instruments, Vol. 43, No. 1, pp 31-37 (01/1972).
An accurate technique (<= +or- 1/4% error) for measuring a wide range of pulsed voltages and currents of large magnitude (kilovolts and amperes) and short duration at either low or high repetition rates is described. The technique is accurate for both square and nonsquare pulses. The technique is particularly useful for measuring the J-E characteristics (current density-electric field) of semiconductors at high electric fields. The unknown voltages are matched on a CRO to voltage-divided Zener diode limited pulses which are accurately known. The sample circuit and reference pulse circuits are given. The accuracy of the technique is demonstrated over a wide voltage and current range. Operating and construction precautions are listed for the convenience of the reader. 0 Refs.
Primary Keywords: Less Than 1% Error; Various Waveshapes; Comparison To Standard; Repetated; J-E Characteristic

2384
(PARTICLE BEAMS, ION)
(Generation)
PRODUCTION OF INTENSE FOCUSED ION BEAMS IN A SPHERICAL MAGNETICALLY INSULATED DIODE
M.A. Greenspan, D.A. Hammer and R.N. Sudan
Cornell University, Ithica, NY 14850
Journal Of Applied Physics, Vol. 50, No. 5, pp 3031-3038 (05/1979).

A magnetically insulated ion diode has been constructed with a spherically focusing geometry. The diode has been operated at voltages of approximately 250 and approximately 500 kV, with impedances adjusted to 2-3 and 7-10 ohm, respectively. The pulse length was approximately 85 ns. Total ion currents were >=30% of the diode current. In the high-voltage case, a focal current density of 2100 A/sq.cm. was obtained; this is >=90 times the anode ion current density. Auxilliary magnetic fields were used to steer the beam, with the beam deflection as calculated for a single proton. The diode design and diagnostic techniques are described, as well as possibilities for improvements suggested by our data. 20 Refs.

Primary Keywords: Ion Diode; Magnetic Insulation; 250 kV Operating Voltage; Diode Diagnostics
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2396
(SWITCHES, OPENING)
(Mechanical)
EFFECT OF MECHANICAL CONTACT FORCE ON WITHSTAND VOLTAGE OF COPPER-BISMUTH AND CLR VACUUM INTERRUPTERS
O. Lloyd (1) and R. Hackam (2)
(1) Marchwood Engineering Lab, Southampton, UK
(2) University of Sheffield, Sheffield, UK
Proceedings Of The IEE, Vol. 22, No. 11 pp 1275-1278 (11/1975).

Experiments are described in which the effect of axial compression of the contacts of two commercial vacuum interrupters is examined. The results show that the first few compressions decondition the contacts, but after that the effect is minimal. Spark conditioning of the electrodes with an alternating voltage results in the breakdown voltage of the vacuum gap to be the same in both AC and DC case. 9 Refs.

Primary Keywords: *Vacuum Interrupter; Dielectric Strength; Surface Condition; DC Voltage; AC Voltage*
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2397
(PARTICLE BEAMS, ION)
(Generation)
HIGH VOLTAGE PROTECTION OF HIGH POWER ION SOURCES BY FAST VACUUM TUBE SWITCHES
W. Welkus
Institut fur Plasmaphysik, Garching, FRG
Symposium Proceedings Fusion Technology, 9th Symposium pp 821-826 (06/1976).

A method is presented for preventing damage to the high voltage accelerating grids of ion sources using vacuum power switches between the power supply and the injector. These switches can also condition the grids against breakdown, automatically recover from a sparkover, and provide pulses of variable duration. Further application as a voltage regulator or current modulator is explored.

Primary Keywords: Ion Source Arc Protection; High Voltage; Vacuum Tube *Protecting Switch*
Secondary Keywords: Neutral Beam Injection
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2398
(PARTICLE BEAMS, ION)
(Target Interactions)
ION BEAM EROSION OF ROUGH GLASS SURFACES
M. Tarasevich
Kollsman Instrument Corp, Syosset, NY 11791
Applied Optics, Vol. 9, No. 1 pp. 173-176 (06/1970).

Glass, in the final stage of grinding prior to optical polishing, is irradiated with an argon ion beam at a high angle of incidence. A striated surface is produced as individual surface features are sputtered away at different rates depending on the local angle of incidence. The removal of an isolated asperity and the production of a smooth surface through the use of an ion beam are also discussed. 1 Refs.

Primary Keywords: Ion Beam Erosion; Argon Ion Beam; Sputtering
Secondary Keywords: Surface Polishing, Striated Surface
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2399
(BREAKDOWN STUDIES)
(Gas, Electrical)
TIME LAGS ASSOCIATED WITH ULTRA-HIGH FREQUENCY GAS BREAKDOWN
W. A. Prowse, J.R. Rowbotham and P. G. Monk
University of Durham, Durham, UK
Proc Phys. Soc., Vol. 77 pp. 158-170 (02/1961).

This paper deals with the time to breakdown of a gas in a parallel plate gap at 183 MHz. *Gap widths ranged from 0.2 cm to 0.5 cm* for hydrogen, while the pressure was varied between 1 and 20 torr. Air was tested under approximately the same conditions. Gap widths of 0.2 cm to 0.8 cm were used for neon with pressures up to 161 torr. The time lags measured were broken down into a formative lag and a statistical lag. There were no lags observed in hydrogen, and in air there was no formative lag, but 400 microsecond statistical lags were found. The formative lag in neon was effected when the gap was irradiated with neon light, but not when the gap was varied, meaning perhaps that metastable atoms affected ionization. Both lags had the same magnitude in neon. 12 Refs.

Primary Keywords: Gas Breakdown, AC Breakdown; Ultra-high Frequency; Time Lag, Hydrogen
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2417
(PULSE GENERATORS)
(Flux Compression)
EXPLOSIVE-DRIVEN ENERGY GENERATORS WITH TRANSFORMER COUPLING
F. Herlach
Katholieke Universiteit Leuven, Leuven, Belgium
Journal Of Physics E, Scientific Instruments, Vol. 12, No. 5, pp 421-429 (05/1979)

The adaptation of inductive-resistive loads to explosive-driven generators by means of pulse tranformers is discussed in practical terms. An analytical procedure for optimising the energy transfer is derived, and conditions are stated under which this is valid. Representative examples of generators, transmission lines and pulse transformers are given, including some experimental results on the performance of a helical/bellows generator capable of delivering 1 MA into 100 nH. 30 Refs.

Primary Keywords: Pulse Transformers, Energy Transfer Optimization, Inductive resistive Loads, Transformer Coupling; Load Matching
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2419
(BREAKDOWN STUDIES)
(Gas, Electrical)
INFLUENCE OF HUMIDITY ON THE SPARKOVER OF ROD-ROD GAPS OF SEVERAL GEOMETRICAL FORMS SUBJECTED TO POSITIVE IMPULSE VOLTAGES OF VARYING WAVESHAPES
T. E. Allibone and N.L. Allen
Leeds University, Leeds, UK
Proceedings Of IEE, Vol. 126, No. 5, pp 462-466 (05/1979).

The authors report on an experiment designed to expand standard BS 923:1972 concerning humidity correction. Experiments were performed in which the geometrical shape and spacings of the electrodes and the waveshape of the applied voltage were varied. Self breakdown was observed and found to be at wide variance with the standard in several cases. 12 Refs.

Primary Keywords: Rod-rod Gap; Atmospheric Air; Lightning, Long Pulse; Horizontally Mounted Gap, Corona Inception
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2433
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
THE SOURCE OF HIGH-BETA ELECTRON EMISSION SITES ON BROAD-AREA HIGH-VOLTAGE ALLOY ELECTRODES
N.K. Allen (1), R.V. Latham (1) and B.M. Cox (2)
(1) University of Aston, Birmingham, Birmingham B4 7ET, UK
(2) Central Electricity Research Labs, Leatherhead, Surrey, UK
Journal of Physics D: Applied Physics, Vol. 12, pp 969-977 (02/1979).

Two recently developed techniques have been used sequentially in an attempt to define the nature of high-beta field emission sites on a commercial-alloy, broad-area, electrode surface. The techniques involved were: (1) an in-situ electron optical method for locating and examining the emission site; and (2) a high resolution spectrometer for determining the energy spectra of the electrons field emitted from this site. Furthermore, following these measurements, the elemental composition of the emission area was determined by electron microprobe x-ray analysis. Observations, which cast further doubt upon the traditional concept of field-enhancing microprojections, indicate that the sites are non-metallic and probably consist of impurities located at cracks or grain boundaries in the surface. Tentative hypotheses are proposed for the emission mechanism and include provision for an unstable situation caused by the effects of adsorbed gas atoms. 12 Refs.

Primary Keywords: Electron Emission; Energy Spectra; Composition Of Emission Area; No Microprojections; Grain Boundary
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2436
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Surface Flashover)
ANALYSIS OF FLASHES ACCOMPANYING DISCHARGES IN AIR AT DIELECTRIC SURFACES
J. S. Brzosko, A. Konarzewski, A. Wojewodzka, E. Zukowski and J. Grudzinski
Bialystok Div, Warsaw University, Bialystok, Poland
J. Phys. D. Appl. Phys., Vol. 9 pp.2369-2377 (04/1976).

Experiments were done in which the flashes accompanying discharges at the surface of a dielectric were examined using a linear photomultiplier. The dielectric constant was shown to have an effect on the flash-energy spectra *when analyzed with respect to time and* the applied electric field. Two different types of discharges were observed: high energy, low intensity sparks, and low-energy, high-intensity sparks. 19 Refs.

Primary Keywords: Discharge; Dielectric Surface; Air Discharge; Flash Energy Spectra
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2437
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Gas Gaps, Electrical; Gas, Electrical)
ARC VOLTAGE OF PULSED HIGH CURRENT SPARK GAPS
T.E. James and J.L. Browning
Culham Lab, Abingdon, Oxfordshire, UK
International Conference On Gas Discharges, London, U.K. pp 318-322 (09/1970).

Experiments are described in which arc voltage measurements are made in a triggered three-electrode spark gap as a capacitor is discharged into an inductive load. The peak current, the pressure and the pulse length are varied, and their effects on the arc voltage are observed. Measurements were taken in both argon and air. A general expression for pulsed arc voltage is derived. 6 Refs.

Primary Keywords: Spark Gaps, High Current; Arc Voltage Measurement; Pressure Variation; Pulse Length Variation
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2438
(PARTICLE BEAMS, ION, PARTICLE BEAMS, ELECTRON)
(Generation; Target Interactions)
COLLECTIVE ACCELERATION WITH INTENSE ELECTRON BEAMS
C.L. Olson
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-22, No. 3 pp. 962-969 (06/1975).

Collective acceleration methods that employ an intense relativistic electron beam (IREB) are discussed. A brief history and a classification of collective acceleration methods are given. Methods examined include IREB injection into neutral gas; IREB injection into vacuum, plasma-filled IREB diodes; and vacuum filled IREB diodes. Accelerating fields of order 1E6 V/cm have been observed experimentally. The collective acceleration processes for IREB injection into neutral gas and vacuum are discussed. It is noted that the collective acceleration processes for IREB diodes have not been elucidated yet. A summary of present collective ion acceleration research areas that involve IREB's is given. 143 Refs.

Primary Keywords: Electron Acceleration, Ion Acceleration; Collective Acceleration; Intense-Relativistic Electron-Beam
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2439
(PARTICLE BEAMS, ELECTRON)
(Reviews)
COMPACT HIGH VOLTAGE ACCELERATORS OF CHARGED PARTICLES IN SPACE EXPERIMENTS
A.G. Ponomarenko and R.I. Soloukhin
Institute For Pure & Applied Mechanics, Novosibirsk, USSR
Acta Astronautica, Vol. 1 pp. 1385-1398 (03/1974)

The authors address the problem of the generation of pulse electric fields in the megavolt range using the limited power sources available to a spacecraft. The electron beams produced could then be used to study the earth's radiation belts and magnetic field. Possible methods of developing the IEB [illegible] necessary are discussed. [illegible] lasers are also discussed. 14 Refs.

Primary Keywords: Particle Beam Generation, Ion Beam Propulsion, Heavy [illegible] Neutral Particle Generation
Secondary Keywords: [illegible] Earth's Magnetic Field
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2440
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Systems; Mechanical)
DEVELOPMENT OF A PULSED HIGH-ENERGY INDUCTIVE ENERGY STORAGE SYSTEM
J. Teno, O.K. Sonju and J.M. Lonta
Avco Everett Research Lab., Inc., Everett, MA 02149
AFAPL Report No. AFAPL-TR-73-49 (08/1973).
Availability: AD-766518
NTIS
This work was concerned with the complete investigation and feasibility demonstration of superconducting inductive energy storage systems capable of producing high power pulses in the 200 microsecond range on a repetitive bases. The system studied was a 100 kJ system. A 15 kJ model system was successfully tested. Also, as part of this program, a complete investigation of switches appropriate for short pulse inductive energy storage systems was made. This investigation led to the preliminary development of a multiple contact high speed switch which was successfully tested in model size. 4 Refs.
Primary Keywords: Superconducting; Energy Storage; Switching; Inductive Energy Storage Coils; Multiple Contact Switches; High Speed Switches; Pulse-forming Networks; High Power Pulses
Secondary Keywords: Rapidly Changing Currents In A Superconductor; Superconducting Coil Delay Lines

2441
(ENERGY STORAGE, INDUCTIVE)
(Systems)
DYNAMIC CONSTRAINTS ON INDUCTIVE ENERGY STORAGE
K.H. Schmitter
Institut fur Plasmaphysik, Garching, FRG
IEEE Sixth Symposium On Engineering Problems Of Fusion Research pp 296-297 (11/1975).
Relations between energy density and discharge rate in inductive energy storage units are considered. The dynamic constraints imposed on the unit size are estimated for the Brooks coil geometry. 0 Refs.
Primary Keywords: Storage Inductor; Spurious Capacitance; Inductive Load; Brooks Coil
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2442
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Vacuum Gaps, Self; Vacuum, Electrical)
EFFECTS OF VOLTAGE POLARITY, ELECTRIC CURRENT, EXTERNAL RESISTANCE, NUMBER OF SPARKINGS, SUPPLY FREQUENCY, AND ADDITION OF HYDROGEN AND AIR ON ELECTRICAL BREAKDOWN IN VACUUM
R. Heckam
University of Sheffield, Sheffield, UK
Journal Of Applied Physics, Vol. 46, No. 9 pp. 3789-3799 (01/1975).
The breakdown potential of a vacuum gap is measured using parallel planar electrodes made of sterling silver as a function of gap separations, number of sparkings, external resistance, and variation of hydrogen and air pressures using DC and AC (50 Hz) applied voltages. It is found that the DC and AC vacuum breakdown voltages become equal after full conditioning by repeated sparkings of both electrodes either with AC or with both polarities of the DC applied voltage. The vacuum breakdown voltage is found to be independent of supply frequency up to 250 Hz. The vacuum breakdown voltage decreases with decreasing the external circuit resistance in series with the gap in the range below 1000 ohms. This decrease in the breakdown potential is attributed to the very short discharge time of the stray capacitive energy of the connecting leads into the gap compared to the time necessary for the current growth leading to breakdown. The minimum energy necessary to decondition (degrade) a vacuum gap is measured and the degree of deconditioning is determined as a function of energy discharged into the gap. The DC dielectric strength of the vacuum gap always recovers to its original value after a few sparkings. 50 Refs.
Primary Keywords: Vacuum Gaps; Breakdown Potential; Planar Electrode; Rep Rate; Gap Recovery; Gap Conditioning
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2443
(PARTICLE BEAMS, ELECTRON)
(Target Interactions)
INTENSE RELATIVISTIC ELECTRON BEAM INTERACTION WITH A COOL THETA PINCH PLASMA
D.A. Hammer, K.A. Gerber, W.F. Dove, G.C. Goldenbaum, B.G. Logan, K. Papadopoulos and A.W. Ali
Naval Research Lab, Washington, DC 20375
NRL Memorandum Report No. 3439 (01/1977).
Availability: AD A036308
NTIS
Experimental results are presented for the heating of a 4 m long plasma confined by a uniform magnetic field of 4-5 kg by an intense relativistic electron beam. The initial plasma density ranged from approximately 5E13/cu. cm. to approximately 1E15/cu. cm., the lower density cases being partially ionized and the higher density cases highly ionized. In all cases, the energy coupled from the beam to the plasma is greater than can be explained by binary collisions between beam electrons and the plasmaa particles. Over most of the density range tested, 5E13/cu. cm. to 1.5E15/cu. cm., the plasma heating cannot be explained quantitatively by the use of a full nonlinear treatment of the electron-electron two stream instability in the kinetic regime. A review of beam plasma interaction theory and previous experiments is presented to facilitate comparison with the present results. 6 Refs.
Primary Keywords: Intense Electron Beams; Ionization By Electron Beams
Secondary Keywords: Beam-Plasma Heating

2444
(BREAKDOWN STUDIES)
(Reviews)
IONIZATION IN THE FIELD OF A STRONG ELECTROMAGNETIC WAVE
Lebedev, P. N.
Physics Institute, Academy of Sciences of the USSR, Leningrad, USSR
Soviet Physics JETP Vol. 20, No. 5 pp 1307-1314 (05/1965).
Trans. From: J. Exptl. Theoret. Phys. (USSR) 47, 1945-1957 (November 1964)
Expressions are obtained for the probability of ionization of atoms and solid bodies in the field of a strong electromagnetic wave whose frequency is lower than the ionization potential. In the limiting case of low frequencies these expressions change into the well known formulas for the probability of tunnel auto-ionization; at high frequencies they describe processes in which several photons are absorbed simultaneously. The ionization probability has a number of resonance maxima due to intermediate transition of the atom to an excited state. In the vicinity of such a maximum the ionization cross section increases by several orders of magnitude. The positions and widths of the resonances depend on the field strength in the wave. It is shown that for optical frequencies the mechanism under consideration of direct ionization by the wave field, may be significant in the case of electric breakdown in gases, and especially in condensed media. 8 Refs.
Primary Keywords: Ionization; Multi-photon Absorption; Solids; Gases; Theory; Resonance Effect
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2446
(PARTICLE BEAMS, ELECTRON)
(Target Interactions)
MAGNETIC-FIELD-INDUCED ENHANCEMENT OF RELATIVISTIC-ELECTRON-BEAM ENERGY DEPOSITION
D. Mosher and I.B. Bernstein
Naval Research Lab, Washington, DC 20375
NRL Memorandum Report No. 3441 (02/1977).
Availability: AD A037693
NTIS
The collisional transport of relativistic electron beams in dense, magnetized, high-Z plasmas is characterized by a perturbation solution of the relativistic Boltzmann equation with a Fokker-Plank collision term in the limit of small beam-electron mean-free-path or gyroradius. The general formulation allows for arbitrary magnetic-field, electric-field, and plasma geometries. Analytic solutions in 1-D yield energy-deposition profiles for a magnetized plasma slab. 10 Refs.
Primary Keywords: Relativistic Electron Beams; Energy-deposition Profiles; B-field Enhancement

2448
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ION)
(Transport; Transport)
RADIANCE AND RADIANT ENERGY DENSITY IN LIGHT OPTICS AND ELECTRON OPTICS ANALOGIES, DIFFERENCES, AND PRACTICAL CONSEQUENCES
B.W. Schumacher
Westinghouse Electric Corp, Pittsburgh PA
Optik, Vol 45, No. 4 pp. 355-380 (01/1976).
The geometrical-optical description of light is compared to that of corpuscular beams. The differences and similarities in the concepts of radience, energy flux, spatial energy density, spatial radiation density, and power of a beam as they apply to light optics and electron optics are examined. The analogy showing the refractive index of a medium for a light beam is similar to the beam voltage for an electron beam us used as a basis for the comparison. Spacial emphasis is placed on the energy carrying and concentration properties of the two types of beams. 14 Refs.
Primary Keywords: Particle Beam Optics; Comparison With Light; Radiance
Secondary Keywords: Optical Ray Tracing
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2449
(DIAGNOSTICS AND INSTRUMENTATION)
(Reviews)
SENSORS FOR ELECTROMAGNETIC PULSE MEASUREMENTS BOTH INSIDE AND AWAY FROM NUCLEAR SOURCE REGIONS
C. E. Baum (1), E.L. Breen (1), J.C. Giles (2), J. O'Neill (1) and G. D. Sower (2)
(1) AFWL, Kirtland AFB, NM 87117
(2) EG&G, Inc., Albuquerque, NM 87114
IEEE Transactions On Antennas And Propagation, Vol. AP-26, No. 1 pp. 22-35 (01/1978).
For measuring transient electromagnetic fields and related quantities, one needs accurate broadband sensors with simple transfer functions. The various sensor designs developed to achieve this in an optimal manner are summarized. Such sensors are designed for use either in a free space environment (such as in an EMP simulator or on a system under test in such a simulator) or in a nuclear source region that includes local source current and perhaps conductivity. There are now numerous designs which have been iterated for improvements over the last decade. 85 Refs.
Primary Keywords: Sensor, Electromagnetic Pulse; Electromagnetic Field Measurement, Antenna; D-Dot Sensor
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2450
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Reviews; Reviews)
SOME SWITCHING PROBLEMS IN THERMONUCLEAR RESEARCH
D L. Smart
Atomic Energy Research Establishment, Harwell, Berkshire, UK
IEE Paper No. 2932, pp 107-116 (04/1959).
The problems of switching a large amount of energy from a storage device to an inductive load is examined. Several combinations of spark gap, vacuum arc, and mechanical switches that are possible are discussed along with their limitations. Inductive energy storage requires the use of circuit-breakers with a large breaking capacity; several possible arrangements are looked at. 11 Refs.
Primary Keywords: Spark Gap; Loads; Switching System; Ignitron; Circuit Breaker
Secondary Keywords: Thermonuclear Research
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2451
(BREAKDOWN STUDIES)
(Reviews)
THE EXCITATION AND IONIZATION OF ATOMS IN A STRONG RADIATION FIELD
F.V. Bunkin and A.M. Prokhorov
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Leningrad, USSR
Soviet Physics JETP, Vol. 19, No. 3 pp.739-743 (09/1964).
Trans. From: J. Exptl. Theoret. Phys. (USSR) 46, 1090-1097 (March 1964)
Some general results are obtained regarding the behavior of atomic systems in a strong radiation field. By the latter is understood a radiation field with such a density that the energy of interaction between it and the atomic electrons approaches that between the electrons and nucleus. It is shown, in particular, that if the interaction time between the atom and field is sufficiently large, atomic ionization will be more probable than its excitation in the bound state, even though the field quantum may be much smaller than the ionization potential. Some estimates of the photoionization potential are presented. 7 Refs.
Primary Keywords: Ionization; String Radiation Field; Multi-photon Absorption; Effective Ionizing Field

2455
(PARTICLE BEAMS, ION)
(Generation)
A COMPACT 250-KV INJECTOR SYSTEM FOR PIGMI
R.W. Hamm, R.R. Stevens Jr., D.W. Mueller, J.N. Leavitt and H.M. Lederer
Los Alamos National Labs, Los Alamos, NM 87545
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 1, pp 1493-1495 (02/1979).
A 250-kV proton injector to be used in the development of a linac suitable for medical applications has been constructed. This injector utilized a spherical Pierce geometry to produce a converging beam. A gas-insulated accelerating column is cantilevered on a grounded vacuum system, with a separate high voltage equipment dome connected to a 300-kV Cockcroft-Walton power supply. The injector can be operated locally or remotely, with the remote control accomplished by a microprocessor system linked to a central control minicomputer. This injector has been designed as a low-cost compact system. The design details and the data obtained during initial operation are presented. 5 Refs.
Primary Keywords: LINAC; Low Current; Medium Energy; Proton Beam
Secondary Keywords: Medical Application

2503
(PARTICLE BEAMS, ELECTRON; ENERGY CONVERSION, ELECTRICAL)
(Generation; Power Supplies)
PROTECTING A HIGH-VOLTAGE ELECTRON GUN POWER SUPPLY FROM BREAKDOWNS
A.G. Klyuikov and V.M. Lebedev
Soviet Journal Of Optical Technology, Vol. 45, No. 5, pp 312-314 (05/1978).
Trans. From: Optiko-mekhanicheskaya Promyshelnnost 45, 49-51 (May 1978)
Systems for protecting an electron gun from short-term shorts across it's high-voltage power supply are examined. Protection systems are discussed for low and high power devices as well as low voltage sputtering devices. Magnetic regulators, limiting resistors, self-excited oscillators, and ageing the electrodes are considered. 0 Refs.
Primary Keywords: Interelectrode Breakdown; Magnetic Regulator; High-frequency Power Supply; Resistive Current *Limiting*

2521
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
AN OPTIMIZED CHARGE SIMULATION METHOD FOR THE CALCULATION OF HIGH VOLTAGE FIELDS
A. Yializis, E. Kuffel and P.H. Alexander
University of Windsor, Windsor, Ontario, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-97, No. 6, pp 2436-2443 (11/1977).
A new approach for the computation of electric fields is described, based on the application of optimization techniques to the charge simulation method. The charge simulation technique is briefly considered and the optimized version is formulated. The potential distribution of the rod-plane configuration is solved as a sample problem for comparative purposes, and consideration is given to the solution of field distributions with non-axial symmetry. The new optimized approach proves to be more efficient, minimizing the time required to set up and implement a solution of this kind. 15 Refs.
Primary Keywords: Electrical Field Calculation; Charge Simulation; Optimization Techniques; No Axial Symmetry

2525
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
A MULTI-MEGAWATT, VACUUM ARC SWITCHED INVERTER FOR AIRBORNE APPLICATIONS
R.H. Miller, D.C. Hopkins, C.J. King, A. Pedano, R. Dollinger and A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226
1978 IEEE Thirteenth Modulator Symposium, pp 204-207 (06/1978).
In previous papers the single-cycle tests of the operation of a vacuum arc switched inverter have been reported. Now, the High Power Test Facility at the State University of New York at Buffalo has reached a sufficient state of completion to permit more advanced testing of the inverter than has previously been reported. Several of these tests have been completed in which many cycles having peak voltage amplitudes up to 1.6 kV and peak current amplitudes up to 1.8 kA were produced. The switches used in this advanced inverter embody several new refinements in the evolution of electrically controlled vacuum arc switches. The inverter employing these new switches is also refined, with special care being taken to reduce internal power losses in the circuit elements and leads. These tests and refinements emphasize the usefulness of vacuum arc switches in high power inverter applications. 6 Refs.
Primary Keywords: Inverter, High Power; High Frequency; Low Loss

2529
(BREAKDOWN STUDIES)
(Electrodes)
ANODE CURRENT DENSITY IN HIGH-CURRENT PULSED ARCS
K.T. Shih
General Dynamics Corp, San Diego, CA 92112
Journal Of Applied Physics, Vol. 43, No. 12, pp 5002-5005 (12/1972).
A method has been developed using a split anode to measure the anode current density distribution in high-current pulsed arcs. Rogowski coils were used to detect the current to each half of the split anode as a function of arc position relative to the splitting plane. Transformation equations were derived to obtain local values of current density from the measured lateral distributions. The data were taken using a copper anode in air at one atmosphere with arc current from 750 to 2250 A. The peak anode current densities were found to be between 3.4E5 and 5.5E5 A/sq. cm. 9 Refs.
Primary Keywords: Anode Current Density; Split Anode; Copper Anode; Arc Position; Transformation Equation

2532
(BREAKDOWN STUDIES)
(Gas, Optical)
CO/SUB 2/ LASER-INDUCED GAS BREAKDOWN IN HYDROGEN
J. Offenberger and N.H. Burnett
University of Alberta, Edmonton, Alberta, Canada
Journal Of Applied Physics, Vol. 43, No. 12, pp 4977-4980 (12/1972).
A single-mode CO/sub 2/ laser pulse of approximately 10 MW peak power has been used to induce breakdown at pressures from 50 to 700 Torr in hydrogen. Measurements of the reflected and transmitted laser intensity were obtained and the properties of the resulting spark were studied by means of image converter camera and spectroscopic techniques. At pressures in excess of 100 Torr the spark was observed to grow preferentially towards the focusing lens, while at lower pressures a symmetric expansion was observed. The observed motion was consistent with the existance of a breakdown wave during the rising portion of the laser pulse followed by a laser-supported detonation. At pressures greater than 100 Torr, significant reflection (> 2%) was observed during the detonation phase. 11 Refs.
Primary Keywords: CO/sub 2/ Laser; Hydrogen Gas; Low Pressure; Spectroscopic Spark Diagnostic; Transmitted Radiation; Reflected Radiation

2537
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
CURRENTS PRECEDING ELECTRICAL BREAKDOWN IN VACUUM
I.N. Slivkov
Soviet Physics-Technical Physics, Vol. 12, No. 11, pp 1482-1486 (05/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 2015-2020 (November 1967)
The present-day hypotheses about the mechanism of electrical breakdown in vacuum give different degrees of importance to the role played in the initiation of breakdown by currents flowing between the electrodes before breakdown. Thus, when the breakdown is initiated by field emission from projections on the cathode, or by microdischarges (by current pulses of a duration 1E-5 - 1E-3 sec), this current is an immediate cause of breakdown. However, no such straight-forward relationship between breakdown and the current flowing before it may exist when the breakdown is initiated by microparticle impact. For this reason, an oscillographic investigation of the prebreakdown current is of particular importance in the case of a slightly nonuniform field between the electrodes when the breakdown mechanism is not entirely clear. This is the subject of this article. 7 Refs.
Primary Keywords: Prebreakdown Current; Microparticle Impact; Nonuniform Field Molybdenum Electrodes; Hemisphere-plane Gap

2539
(DIAGNOSTICS AND INSTRUMENTATION)
(Data Transmission)
FAIL-SAFE FIBER-OPTICS DATA BUS USING ACTIVE MULTIMODE MIRROR TERMINALS
W.B. Spillman Jr., R.L. Gravel and R.A. Soref
Sperry Research Center, Sudbury, MA 01776
Applied Optics, Vol. 17, No. 23, pp 3822-3826 (12/1978).
Low-loss active switching devices are used to construct a fail safe optical data bus. The system uses only one optical source, and show a low optical loss in the fail-safe mode. The LED sources, P-I-N photodiode detectors, and the step-under multimode monofibers used are all commercially available, and by using a pulse transformer technique the electrooptic modulation voltages needed can be generated from a 5-V supply which makes the system TTL compatable. 10 Refs.
Primary Keywords: Fiber-optic Data Bus; Electrooptic Mirror Terminal; Low Loss; Single-supply Operation

2541
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Gaps, Electrical; Vacuum Gaps, Self)
HIGH REPETITION-RATE, HIGH POWER PULSE TESTS OF VACUUM ARC SWITCHES
R.H. Miller, R. Dollinger and A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226
1978 IEEE Thirteenth Modulator Symposium, pp 200-203 (06/1978).
Research has been proceeding at the State University of New York at Buffalo on developing vacuum arc switches that can be operated in a pulsed mode. These switches have been demonstrated to have turn-on and turn-off times in the order of microseconds, and recent tests now show that the vacuum arc switch exhibits significant potential for high frequency pulsing applications. These new tests, which have been conducted on vacuum arc switches employed in a series inverter circuit, show that the switches can be reliably turned on by kilovolt-level triggers having a rise time on the order of one microsecond. They also show that the switches can be reliably self commutated to a turned-off mode by the operation of a series resonant circuit placed in series with the load. Combining these two techniques provides reliable pulsing of the vacuum arc switches if the resonant frequency of the resonant circuit is higher than the pulsing rate of the switches. Using this procedure, repetition rates in the five to eight kilohertz range have been reached. 5 Refs.
Primary Keywords: Self-commutation; Series Resonant Circuit; Pen rated, Cathode Igniter

2547
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
DELAY CHARACTERISTICS OF VACUUM DISC SWITCHES
G.N. Aretov, V.I. Vasil'ev, M.I. Pergament and S.S. Tsaregitinov
Soviet Physics-Technical Physics, Vol. 12, No. 1, pp 90-96 (07/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 131-138 (January 1967)
In a previous article an examination was made of problems regarding the electric strength of vacuum disc spark gaps. In the present article the results of a study of the controllability of such spark gaps are reported, the investigation being confined to vacuum switches with base pressures of 1E-1 to 1E-3 mm Hg in the interelectrode region. 17 Refs.
Primary Keywords: Vacuum Spark Gap; Delay Measurement; Jitter Measurement; Aquadag; Trigger Circuit

2550
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
LIGHTWEIGHT POWER CONDITIONING MAGNETICS
J.P. Welsh, R.L. Haumesser and D.L. Lockwood
Thermal Technology Lab, Inc., Buffalo, NY
1978 IEEE Thirteenth Modulator Symposium, pp 71-74 (06/1978).
Recent requirements for lightweight high power magnetics which have led to increased research and development in this and related areas are explained. Transformers with specific weights in the range of 0.1 to 0.25 lbs/KVA have been developed through the utilization of improved materials, improved magnetic circuit modeling, and the application of advanced heat transfer techniques. These thermal aspects are particularly important to the size and weight reduction of magnetics. If each conductor in a magnetic device can be adequately cooled throughout most of its length, then the current density can be increased and the conductor cross sectional area significantly reduced. This, in turn, results in a smaller core window and consequently, a smaller core. 2 Refs.
Primary Keywords: Transformer; Small Size; Light Weight; Better Modelling, Thermal Considerations

2553
(DIAGNOSTICS AND INSTRUMENTATION)
(Particle Beams, Neutral)
OPTICAL DIAGNOSTICS ON HIGH-POWER NEUTRAL BEAMS
J.F. Bonnal, C. Breton, C. DeMichelis, J. Druaux, M. Mattioli, R. Oberson and J. Ramette
EURATOM-CEA, Centre d'Etudes Nucleaires, France 92260
Physics Letters, Vol. 69A, No. 2, pp 116-118 (11/1978).
A method for measuring the optical emission of a high-energy neutral hydrogen beam is presented. The optical profile thus obtained is found to compare well with the profile obtained by conventional electrical methods. 3 Refs.
Primary Keywords: Spectroscopy; No Doppler Shift

2560
(BREAKDOWN STUDIES)
(Gas, Electrical)
ELECTRICAL FIELD BREAKDOWN IN SULPHUR HEXAFLUORIDE
D.W. George and P.H. Richards
Marchwood Engineering Lab, Southampton, UK
British Journal Of Applied Physics (Journal Of Physics D), Ser. 2, Vol. 2, pp 1473-1471 (01/1969).
The breakdown strength of SF/sub 6/ for uniform electric fields has been measured over a wide range of nd from 1E20 to 2E23 m/sup -2/ (pd values at 0 Deg.C. from 3 to 6000 Torr mm) and compared with the dielectric strength of air under the same conditions. 6 Refs.
Primary Keywords: SF/sub 6/; Uniform Field; Large pd Range; Comparison With Air

2567
(DIAGNOSTICS AND INSTRUMENTATION)
(Particle Beams, Neutral)
A NEUTRAL-PARTICLE ANALYSER FOR PLASMA DIAGNOSTICS
DDR Summers, R.D. Gill and P.E. Stott
Culham Lab, Abingdon, Oxfordshire, UK
Journal Of Physics E: Scientific Instruments, Vol. 11, No. 12, pp 1283-1290 (12/1978).
We describe an instrument which can be used to measure the neutral-particle flux from a plasma over the energy range 200 eV to 30 keV. This wide range makes the device especially useful for plasmas where neutral injection heating may be employed. It has been used for measuring both the ion temperature and the high-energy spectrum due to the injection of high-power neutral beams into the DITE (Divertor Injection Tokamak Experiment) Tokamak. 12 Refs.
Primary Keywords: Neutral-particle Flux; 200eV To 30keV; Neutral Injection Heating; Ion Temprature; Energy Spectrum; Tokamak

2598
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
ELECTRICAL STRENGTH OF VACUUM DISC SWITCHES
G.N. Aretov, V.I. Vasil'ev, M.I. Pergament and S.S. Tsaregitinov
Soviet Physics-Technical Physics, Vol. 11, No. 11, pp 1548-1555 (05/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 2080-2093 (November 1966)
A study is made of the electrical strength, response time, inductance, and other characteristics of multiple action vacuum disc spark gaps (having an initial pressure of 1E-3 to 1E-1 mm Hg), designed for switching heavy electric currents (up to 2E6 A) at voltages of up to 30 to 50 kv. A description is given of the results of an investigation of the dependence of the electrical strength of the spark gaps on the nature and initial pressure of the gas in the region between the electrodes, on the size of the interelectrode gap, and on the number, position, and construction of the metal partitions. Data are presented on the durability of spark gaps of a number of types. 19 Refs.
Primary Keywords: Vacuum Spark Gap; Hold Off Voltage; Delay Measurement; Switch Inductance; Gas Pressure Variation; Reliability Test

2621
(INSULATION, MATERIAL; SWITCHES, CLOSING)
(Composite; Molecular Seive)
A GAS-PHASE HIGH-VOLTAGE ELECTRICAL ISOLATOR WITH CONTROLLED BREAKDOWN
J.W. Pye
Royal Aircraft Establishment, Farnborough, UK
Journal Of Physics E: Scientific Instruments, Vol. 11, pp 825-829 (08/1978).
A simple electrical isolation device is described, which incorporates an insulating *porous* core to assist in electron-ion recombination. Designed for isolating an ion thruster from its mercury propellant feed system, it has resulted in stand-off voltages in excess of 7 kV at normal operating mercury vapour pressures. Breakdown investigations, leading to the final design, have been included and these show that operation as a controlled high-voltage switch is possible. Some of the life-limiting operating factors have been identified. 25 Refs.
Primary Keywords: Insulator; Vapor Pockets; Mercury Vapor; Insulating Balls; Porous Insulator

2635
(SWITCHES, CLOSING)
(Vacuum Gaps, Materials)
ELECTRODE EROSION IN VACUUM GAP BREAKDOWN BY NANOSECOND PULSES
G.A. Mesyats and V.I. Eshkenazi
Soviet Physics Journal, Vol. 11, No. 2, pp 79-82 (02/1968).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii. Fizika 11, 123-125 (1968)
In studies of high-vacuum electrical breakdown much attention has been allotted to electrode erosion. However, only the instant of initiation or the complete breakdown stage have been considered. We studied the erosion on electrodes under pulsed breakdown of a 0.35 mm gap at 35 kV for various pulse lengths. 6 Refs.
Primary Keywords: Electrode Erosion; 35 kV Operating Voltage; Variable Pulse Duration

2670
(BREAKDOWN STUDIES)
(Exploding Wires)
ORIGIN OF STRIATIONS DUE TO MECHANICAL EFFECTS IN FAST WIRE EXPLOSIONS
S.H. Smith
Stevens Institute of Technology, Hoboken, NJ 07030
Journal Of Applied Physics, Vol. 41, No. 10, pp 3918-3921 (09/1970).
The suggestion that mechanical oscillations in the solid wire are in part responsible for the production of striations observed in a class of wire explosions is investigated using the dispersion relation for elastic waves in isotropic solid cylinders. It is proposed that these oscillations arise due to the transient nature of the electrical energy deposition and that axial waves originate at points of discontinuities such as impurities and grain boundaries. Numerical solutions are obtained using the first shear- and dilatational-mode cutoff frequencies, and the wave numbers of these and standing waves are presented as a function of Poisson's ratio. Experimental data on the average distance between striations and new data are found to lie within the range predicted by the theoretical analysis. 11 Refs.
Primary Keywords: Exploding Wire; Striation; Mechanical Oscillation; Dispersion Relation; Elastic Wave; Theory; Numerical Calculation

2692
(BREAKDOWN STUDIES)
(Gas, Electrical)
PROCESSES INVOLVED IN THE TRIGGERING OF VACUUM BREAKDOWN BY LOW-VELOCITY MICROPARTICLES
P.A. Chatterton, M.M. Menon and K.D. Srivastava
University of Waterloo, Waterloo, Ontario, Canada
Journal Of Applied Physics, Vol. 43, No. 11, pp 4536-4542 (11/1972).
The role of low-velocity microparticles (diameters < 100 micron; velocites approximately 10-50 m/sec) in inducing breakdown in a high vacuum gap is investigated. On the basis of a simple model, it is shown that as an anode initiated microparticle approaches the cathode, fields sufficient to cause appreciable field emission (> 1E9 V/m) are possible at the cathode surface. The emission current not only causes partial neutralization of the initial charge on the microparticle, but also raises the temperature (> 2000 K) of the particle surface. As a consequence, a significant increase in gas pressure (approximately 100 Torr) in the microvolume between the cathode and the particle is possible, resulting in a discharge between the two. Such a discharge could act as a trigger for the breakdown of the main gap. Other possible processes that could arise due to the onset of melting or boiling of the bombarded surface, and which may lead to breakdown of the entire gap, are also discussed. 29 Refs.
Primary Keywords: Microparticle; 10-50 m/sec Velocity; 100 Micron Diameter; Vacuum Gap; Gas Liberation

2717
(BREAKDOWN STUDIES)
(Gas, Electrical)
PULSED BREAKDOWN OF AIR IN A HOMOGENEOUS FIELD AT LARGE OVERVOLTAGES
V.V. Vorob'ev and A.M. Iskol'dskii
Soviet Physics-Technical Physics, Vol. 11, No. 11, pp 1560-1562 (05/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 2095-2098 (November 1966)
We have carried out an investigation of the mechanism of electron breakdown in atmospheric air at pressures p=45 to 760 mm Hg with electrode separations d=2 to 5 mm using electron-optical and oscilloscopic methods. Breakdown was initiated in a spark gap located either at the end of or at an interruption in a coaxial line with a characteristic impedance of ρ=75 ohm. The gap was fed with rectangular voltage pulses of duration T/sub p/=30 nsec (the rise time t/sub f/ of the leading edge was approximately 1 nsec) and amplitude U/sub 0/=20 to 50 kV; the pulses were formed by a high voltage line generator. 6 Refs.
Primary Keywords: Uniform Field; Impulse Breakdown; High Overvoltage; Air Gap; Variable Pressure; Variable Gap Spacing

2718
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
CIRCUIT AND MAGNETIC ANALYSIS FOR A SYSTEM OF FARADAY ROTATOR COILS DRIVEN BY A TWO-SPOOL, FOUR-ROTOR HOMOPOLAR GENERATOR
D.J. Mayhall (1), W.F. Weldon (1), H.H. Woodson (1), K.M. Tolk (2) and H.G. Rylander (2)
(1) University Of Texas At Austin, Austin, TX 78712
(2) Department Of Energy
(01/1977).
Availability: CONF-771029-119
NTIS
As part of a cost optimization study, a computer based circuit analysis is performed to determine the energy storage requirements a homopolar generator must meet to drive an inductive load of Faraday rotator coils, which is an option considered for the Lawrence Livermore Laboratory (LLL) Shiva laser system upgrade. The reference load consists of five parallel sets of three different size solenoidal coils in series. Each coil is modelled as a series inductance and resistance. The homopolar is modelled as a capacitance in series with a resistance and an inductance. The transmission lines connecting the homopolar and the coils are modelled as series inductances and resistances. The initial homopolar voltages and energies to create the required coil magnetic fields are obtained versus the small coil turns, homopolar capacitance, and line length, as are the times to current maximum, peak homopolar currents, and peak coil currents. For 50 ft lines, the minimum initial homopolar voltage varies from 20 to 17 MJ. The axial magnetic field variation in the rotator glass is <1.0%. The stored energy for the thickest coils is 2.4 times that of the thinnest coils. (ERA citation 03:025500)
Primary Keywords: Electric Generators; Tokamak Type Reactors; Cost; Electronic Circuits; Energy Storage; Optimization; Specifications
Secondary Keywords: ERDA/700203; DC Generators; Computer Applications; Cost Engineering, NTISDE

2724
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
DEVELOPMENT OF THE SWITCHING COMPONENTS FOR ZT-40
J.G. Melton, R.S. Dike, K.W. Hanks and W.C. Nunnally
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-771029-23, 4p (01/1977).
Availability: LA-UR-77-2440
NTIS
Switching of the main capacitor banks for ZT-40 will be accomplished by spark gap switches. Initially, there will be 576 start switches and 288 crowbar switches. A development program is under way to develop three switches; (1) a versatile start switch, which can be used for both the I/sub z/ and the I/sub theta/ capacitor banks, with a wide operating voltage range, (2) a crowbar switch which is capable of crowbarring the circuit without the power crowbar bank, and (3) a power crowbar switch, which can handle 50 to 100 coulombs, so that a large number of crowbar switches will not be required when the power crowbar circuit is added. The problems with the start switches and the first crowbar switch have been solved, or alleviated. The development of a power crowbar switch has just begun. (ERA citation 03:016258)
Primary Keywords: Power Supplies; Switches; Zt-40 Device; Capacitors; Design; Energy Transfer; Spark Gaps
Secondary Keywords: ERDA/700203; NTISDE

2725
(SWITCHES, CLOSING)
(Gas Gaps, Materials)
RECOIL MOMENTUM AND EJECTION OF METAL PARTICLES UNDER THE ACTION OF A GIANT LASER PULSE
A.M. Bonch-Bruevich and Ya.A. Imas
Soviet Physics-Technical Physics, Vol. 12, No. 10, pp 1407-1409 (04/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1917-1920 (October 1967)
The effect of laser radiation with a density exceeding the critical one on a metal target is a rapid heating of a certain metal layer and ejection of metal particles in the form of vapors and drops, the entire target acquiring a certain recoil momentum. The magnitude of this recoil momentum for a number of metals is given for light flux densities q approximately < 1E8 W/sq.cm. (continuous wave laser), and for q approximately < 1E10 - 1E11 W/sq.cm., on which basis some conclusions can be drawn on the damage mechanism. 4 Refs.
Primary Keywords: Laser-metal Interaction; Mass Ejection; Neodymium Laser; Threshold Intensity; Surface Micrograph

2737
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
MULTICHANNEL, HIGH-ENERGY RAILGAP SWITCH
G.R. Neil and R.S. Post
University of Wisconsin, Madison, WI
The Review Of Scientific Instruments, Vol. 49, No. 3, pp 401-403 (03/1978).
A low inductance, multichannel railgap switch has been developed which is capable of switching 20 kJ at 500 kA. The switch has low jitter, a wide operating voltage range and low electrode erosion rate. 1 Refs.
Primary Keywords: Railgap Switch; Multichannel Operation; Low Inductance; Low Jitter; Low Electrode Erosion Rate

2745
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines, Materials)
TEST DATA ON ELECTRICAL CONTACTS AT HIGH SURFACE VELOCITIES AND HIGH CURRENT DENSITIES FOR HOMOPOLAR GENERATORS
M. Brennan (1), W.F. Weldon (1), H.H. Woodson (1), H.G. Rylander (2) and K.M. Tolk (2)
(1) University Of Texas At Austin, Austin, TX 78712
(2) Department Of Energy
(01/1977).
Availability: CONF-771029-121
NTIS
Test data is presented for one grade of copper graphite brush material, Morganite CM15, over a wide range of surface velocities, atmospheres, and current densities that are expected for fast discharge (<100 ms) homopolar generators. The brushes were run on a copper coated 7075-T6 aluminum disk at surface speeds up to 277 m/sec. One electroplated copper and three flame sprayed copper coatings were used during the tests. Significant differences in contact voltage drops and surface mechanical properties of the copper coatings were observed. (ERA citation 03:025502)
Primary Keywords: Electric Generators; Reference Theta Pinch Reactor; Coatings; Copper; Electric Contacts; Graphite; Mechanical Properties; Performance Testing; Power Supplies
Secondary Keywords: ERDA/700203; DC Generators; NTISDE

2754
(BREAKDOWN STUDIES)
(Gas, Electrical)
A NEW APPROACH TO COMPUTE UNIFORM FIELD BREAKDOWN OF GASES
G. Oliv er, Y. Gervais and D. Mukhedkar
Ecole Polytechnique De Montreal, Montreal, Quebec, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-97, No. 3, pp 969-976 (06/1978).
This paper presents a direct method for computing the uniform field breakdown of gases. An equation is derived for calculating the breakdown voltage of a uniform field gap as a function of gas density and gap length. The equation has been verified for several common gases for a wide range of voltage and pressure. 1 Refs.
Primary Keywords: Uniform Field; DC Voltage; AC Voltage; Breakdown Voltage Determination; Several Gases

2755
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
A VERSATILE HIGH-VOLTAGE BIAS SUPPLY FOR EXTENDED RANGE MIS C(V) AND G(V) MEASUREMENTS
P. Yuczer, H.C. Hook and A.M. Goodman
RCA Labs, Princeton NJ 08540
NBS Report No. NBS SP 400-41 (12/1977).
Availability: PB 274 939
NTIS
Recently developed technology has enabled the measurement of MIS C(V) and G(V) at bias-voltage magnitudes as large as 25 kV. This report describes a versatile high-voltage power supply intended for use as a bias source in carrying out such measurements. The design allows the user a wide variety of options in the selection of the sweep function (waveform), sweep time, initial bias voltage, and the amplitude of the bias sweep. There are six possible sweep functions: (i) increasing ramp, (ii) decreasing ramp, (iii) positive polarity half-wave sawtooth increasing ramp followed by decreasing ramp), (iv) negative polarity half-wave sawtooth (decreasing ramp followed by increasing ramp), (v) full-wave sawtooth starting with increasing ramp, and (vi) full-wave sawtooth starting with decreasing ramp. Either single or repetitive sweeps may be selected. The sweep time from the initial value to the end of the first ramp segment may be varied from 1 to 2000 s. Operator convenience is enhanced by certain features of the design; among these are light-emitting diodes which display the state of the sweep and automatic pen control if the sweep is used with an x-y recorder. 5 Refs.
Primary Keywords: Bias Supply; 25 kV Voltage Range; High-voltage Sweep; Single Sweep; Repetitive Sweep; High-voltage C(V) And G(V) Measurement

2779
(BREAKDOWN STUDIES: SWITCHES, CLOSING)
(Gas, Optical, Gas Gaps, Optical)
PRESSURE DEPENDENCE OF THE RISE TIME OF LASER-TRIGGERED SPARK GAPS
J.C. Scott and A.W. Palmer
City University, St. John Street, London
Journal Of Physics E: Scientific Instruments, Vol. 11, pp 495-496 (12/1977).
The laser-triggered spark gap (LTSG) has found uses in many applications where ultra-fast voltage transitions are required, primarily because of its reliability of operation, simplicity of construction and speed of response. The LTSG can be incorporated into most coaxial systems with minimum change of impedance, a necessary condition to achieve fast electrical switching. In this communication we report on our practical measurements of the rise times generated by the LTSG which show that, for a certain gap setting, there is a minimum rise time that may be achieved and that the parameters, voltage and pressure, which are determined theoretically to give this minimum rise time are in reasonable agreement with the practically measured values. 6 Refs.
Primary Keywords: Laser-triggered Spark Gap; Deviation From Paschen's Law; Experiment; Comparison With Theory

2794
(BREAKDOWN STUDIES)
(Surface Flashover)
SPARK DISCHARGE OVER THE SURFACE OF FILMS OF DIFFERENT COMPOSITION
M.P. Vanyukov and E.V. Daniel
Soviet Physics-Technical Physics, Vol. 12, No. 10, pp 1416-1418 (04/1968)
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1927-1929 (October 1967)
Investigations of space and time scans of the channel of a surface discharge and of the charged particle density in the plasma of the channel of a surface discharge have shown that the luminous channel becomes flat and pressed against the surface over which the discharge occurs, whereas the charged-particle density in the discharge channel is distributed nonuniformly and increases with approach to the surface. In view of this result it was of interest to determine the effect of the surface on the formation and development of a surface discharge. We investigated discharges over the surface of films deposited on different substrates. 3 Refs.
Primary Keywords: Surface Discharge; Current Pressing; TiO/sub 2/ Film; Several Substrates; Spatial Resolution; Temporal Resolution

2798
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
MEASUREMENT OF NANOSECOND HV TRANSIENTS WITH KERR EFFECT
E.E. Bergmann and G.P. Kolleogy
Lehigh University, Bethlehem, PA
Review Of Scientific Instruments, Vol. 48, No. 12, pp 1641-1644 (12/1977).
A technique for measuring the high-voltage transients associated with low inductance, pulsed gas discharges is described. Measurements are made directly at the 10-k V level with a transmission line Kerr cell and narrow-width, pulsed dye laser, synchronized with the test discharge. The data indicates a temporal resolution of 2 ns. 9 Refs.
Primary Keywords: Kerr Effect; Laser Synchronizing Pulse

2813
(POWER CONDITIONING)
(Pulse Transformers)
THE PREDICTION OF PULSE PERMEABILITY AND LOSS OF NI/FE ALLOYS IN TOROIDAL CORE PULSE CURRENT TRANSFORMERS
P.C. Hooke and A.R. Piercy
Brighton Polytechnic, Moulsecoomb, Brighton, BN2 4GJ, UK
Journal of Physics D: Applied Physics, Vol. 11, pp 937-944 (11/1977).
Measurements of pulse permeability and loss of Ni/Fe toroidal cores in the unidirectional pulse current transformer mode are reported. These are discussed in comparison with the classical eddy current theory and an improved empirical model developed. 4 Refs.
Primary Keywords: Unidirectional Pulse Transformer; Eddy Current Theory; Empirical Model; Experiment; Theory

2814
(SWITCHES, CLOSING; POWER CONDITIONING)
(Gas Gaps; Self; Transient Suppressors)
AN ELECTRICAL SURGE ARRESTOR (ESA) MODEL FOR ELECTROMAGNETIC PULSE ANALYSIS
C.T. Kleiner, E.D. Johnson, L.R. McMurray and F.T. Suzuki
Rockwell International Electronics Operations, Anaheim, CA 92803
IEEE Transactions On Nuclear Science, Vol. NS-24, No. 6, pp 2352-2356 (12/1977).
Electrical Surge Arrestors (ESA's) have been used extensively for lightning and EMP protection. These components are characterized by (a) presenting an open circuit (high impedance) below the gap breakdown potential, (b) becoming a virtual short-circuit above the gap breakdown and (c) displaying a significantly higher level of apparent gap breakdown for very fast input voltage rise-times (dv/dt). This paper describes a mathematical model for a spark gap surge arrestor which has been used successfully to characterize ESA response to the following stimulus: 1. Below DC Gap Breakdown 2. At or above Gap Breakdown 3. At high apparent Gap Breakdown voltage as a function of increased rise-time 4. Damped Sinewave Input (below and at Gap Breakdown) 5. Exposed to prompt gamma radiation using a Flash X-Ray source and an electrical input. 5 Refs.
Primary Keywords: Surge Arrester; Spark Gap; Modeling; Analysis; Prompt Gamma Radiation

2827
(SWITCHES, CLOSING)
(Miscellaneous Solid State)
SUBNANOSECOND SWITCH FOR USE IN SHOCK WAVE EXPERIMENTS
T.T. Cole and J.W. Lyle
Lawrence Livermore Lab, Livermore, CA 94550
The Review Of Scientific Instruments, Vol. 42, No. 8, pp 1258-1259 (08/1971).
A subnanosecond selenium switch has been developed for use in shock wave experiments. Bulk selenium makes a transition to the metallic state at a pressure of 138 kilobars, with a resistivity decreasing by a factor of about 1E11 from the value at atmospheric pressure. A shock wave traversing the selenium film in a direction normal to the film induces the transition. 2 Refs.
Primary Keywords: Selenium Switch; Metallic State; Pressure Transition; 1E11 Resistivity Decrease; Shock Wave Induced Resistance Change

2835
(SWITCHES, OPENING; REVIEWS AND CONFERENCES)
(Conferences; Conferences)
SYMPOSIUM PROCEEDINGS NEW CONCEPTS IN FAULT CURRENT LIMITERS AND POWER CIRCUIT BREAKERS
G. Bates Ed. (1), R. Kennon Ed. (1) and A.S. Gilmour Ed. (2)
(1) Electric Power Research Institute, Palo Alto, CA 94306
(2) State University of New York at Buffalo, Buffalo, NY 14226
EPRI Report No. EPRI EL-276-SP (09/1976)
Availability: EPRI EL-276-SR
EPRI
Serious industry attention is being directed toward developing fault current limiters and improving power circuit breaker interrupters through R&D programs at EPRI, ERDA, and other research organizations. Many of these projects have begun to provide important findings so this symposium was held on September 28, 29, and 30, 1976, at the State University of New York at Buffalo (SUNYAB). The symposium was equally divided between papers and open discussions among the participating researchers, designers, application engineers, and utility operations personnel. Participants expressed their views and opinions openly. The subject of power circuit breakers was covered from the fundamental aspects of arc physics to design and development of actual interrupters. Development of gas, vacuum and combination interrupters was discussed. Both switched resistor and turned fault current limiters were presented. Considerable general discussion centered around potential application and need for fault current limiters. Two electric utility papers were presented on the subject of applications. 126 Refs.
Primary Keywords: Fault Current Limiter; Arc Voltage; Fault Sensing; Arc Interruption; Power Circuit Breaker; Arc Modeling

2864
(BREAKDOWN STUDIES)
(Surface Flashover)
PROPAGATION VELOCITY OF CATHODE-INITIATED SURFACE FLASHOVER
R.A. Anderson
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 48, No. 10, pp 4210-4214 (10/1977).
A polymethyl methacrylate insulator rod in vacuum is stressed by high-voltage pulses having 3-ns rise times, with the result that 40-mm-long incomplete discharges occur at the cathode end of the rod. Time-resolved measurements of electron emission from different areas on the insulator surface indicate that a discharge propagates toward the anode at approximately 2E7 m/s during a pulse. A velocity of this order is expected if surface flashover results from an avalanche of electrons due to secondary emission at the insulator surface. Dependence of the velocity on the angle of the electric field relative to the insulator surface is predicted. 14 Refs.
Primary Keywords: Pulsed Surface Flashover; Vacuum-Insulator Interface; Cathode-Initiated; Secondary Emission

2872
(ENERGY STORAGE)
(Reviews)
ENERGY STORAGE OPTIONS FOR SHIVA UPGRADE
B. Carder and B. Gagnon
Lawrence Livermore Lab, Livermore, CA 94550
1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-9 (11/1976).
The Shiva Glass Laser at LLL will use 20-25 MJ of Capacitive energy storage. An improved laser system is proposed that will increase this energy requirement by a factor of ten: 25 MJ for Faraday rotators, and 150 MJ for flashlamps. This paper discusses alternative options to capacitors for driving both kinds of loads. Included are homopolar generators that discharge in approximately 0.1 seconds that will drive Faraday rotators directly. Similar generators can be used to drive inductive stores for flashlamp power. The features of the flashlamp system include a wide distribution of 10 kJ load elements, and a half-millisecond discharge time requirement. The possibilities of providing open-switching for inductive storage and of driving many flashlamps in parallel are discussed. 5 Refs.
Primary Keywords: High Energy Storage Requirements; Capacitive Energy Storage; Homopolar Generator; Inductive Energy Storage
Secondary Keywords: Shiva Glass Laser

2881
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
CONTROLLABLE HOMOPOLAR MOTOR-GENERATOR ENERGY STORAGE FOR APPLICATION IN A FUSION POWER REACTOR
W.Y. Chen, W.E. Toffolo and J.R. Purcell
General Atomic Co, San Diego, CA 92121
1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-3 (11/1976).
Homopolar motor-generators are considered as likely candidates for the energy storage devices to be used in conjunction with rapidly pulsed coils in future fusion reactors. In a Tokamak fusion reactor, the induction coil will be pulsed, and it is likely to be superconducting. Then an HMG will be the most economical and efficient energy storage device. However, it is highly desirable to control the HMG effective capacitance in order to shape the induction coil current waveform and utilize the full volt-second capability of the coil. Then it is important to minimize the stored energy in the HMG excitation coils in order to reduce the power required for controlling the HMG. Investigations have been made to optimize the design of a controllable HMG. The excitation coil stored energy and the machine cost are minimized in the process. The study has been concentrated on drum type HMGs. It was found that for an HMG assembly with a total capacity of 1500 MJ, the excitation coil stored energy can be as low as 100 MJ. Thus, the scheme for controlling the effective capacitance of the HMG appears to be feasible. 4 Refs.
Primary Keywords: Homopolar Generator; Motor-generator; Output Pulse Shaping; Controllable Excitation Coil

2887
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
PRELIMINARY ENGINEERING DESIGN OF A PULSED HOMOPOLAR GENERATOR POWER SUPPLY
W.L. Bird, W.G. Dean, G.B. Grant, H.G. Rylander, K.M. Tolk, W.F. Weldon and H.H. Woodson
University of Texas at Austin, Austin, TX 78712
1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-4 (11/1976).
A 250 megajoule 500 volt homopolar generator system is proposed as the inertial storage-conversion device for the Texas Experimental Tokamak. The result of engineering design of a 50 megajoule 125 volt homopolar generator module is presented and major components: excited coil, rotor/shaft/bearings, brushes and armature conductors are described in detail. The support for this work was provided by the Energy Research and Development Administration and the Texas Atomic Energy Research Foundation. 0 Refs.
Primary Keywords: Homopolar Generator; Engineering Design; Component Design
Secondary Keywords: Tokamak Toroidal Field Coil

2888
(SWITCHES, OPENING)
(Vacuum Gaps; Electrical)
RECENT RESULTS OF VACUUM-ARC SWITCHED MULTI-MEGAWATT INVERTER TESTS
A.S. Gilmour and D.A. Hopkins
State University of New York at Buffalo, Buffalo, NY 14226
1976 IEEE Pulsed Power Conference Proceedings, Paper IB-7 (11/1976).
Previous studies have shown the possibility of using a vacuum arc switch in high power force commutated or series commutated inverter circuits. One such application, discussed in this paper, is in the development of a 10,000 volt, multi-megawatt series capacitor inverter circuit. Initial testing has been performed on a 10 kHz half sine resonant L-C circuit using a VAS. Single pulse tests at 3000 A peak and 5000 V have been very successful. Extensive energy loss studies of the various circuit components result in predicted inverter efficiencies in excess of 95 percent. The tests show that these high efficiencies will be achievable if high quality circuit components are used. The inductors must be fabricated from Litz wire low loss materials must be used for the capacitors and distributed connections must be made to capacitor elements. The configuration and composition of the electrodes in the VAS must be such as to minimize the switch voltage drop. 4 Refs.
Primary Keywords: Vacuum Arc Switched Inverter; Vacuum Gap; Ignitor; Performance

2899
(DIAGNOSTICS AND INSTRUMENTATION)
(Data Transmission)
SYSTEM FOR DATA ACQUISITION FROM HIGH VOLTAGE TERMINALS
G.W. York, J.T. Park, J.J. Mishkinis, D.M. Crandall and V. Pol
University of Missouri-Rolla, Rolla, MI 65401
The Review Of Scientific Instruments, Vol. 43, No. 2, pp 230-232 (02/1972).
An inexpensive data acquisition system has been designed to provide high voltage isolation for data acquisition to analog, digital, and pulse modes. The telemetry system uses GaAs light sources, fiber optics, and phototransistors to accomplish the data transmission. Prewired logic boards have been adapted to accomplish the timing and logic functions. Seven decades of digital data are transmitted error free, pulse data can be transmitted at rates up to 1 MHz, and analog data are transmitted with 0.05% full scale accuracy. 6 Refs.
Primary Keywords: Fiber Optic; Electrical Isolation; GaAs Diode; Phototransistor; 1 Mhz Bandwidth

2957
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE ROLE OF THE CATHODE ZONE IN THE TRANSITION CORONA EFFECT ARC
P. Bertault, J. Dupuy and A. Gibert
Institut Universitaire de Recherche Scientifique, Chemin Philippon, Pau, France
Journal of Physics D: Applied Physics, Vol. 10, No. 16, pp L219-L222 (11/1977).
The transition corona effect arc, in atmospheric air, for inter-electrode distances less than a few centimetres in point-to-plane geometry (the high DC positive voltage being applied to the point with the plane at earth potential) is dependent on the existence of a cathode zone and a 'cathode canal'. A sufficient reserve of energy (internal capacity in parallel with the spark gap) permits the 'cathode canal' to develop into a transient arc which is extinguished when the capacity has discharged itself. However, the increasing duration of the cathode zone, with increasing total current, leads to a continuous luminous discharge (named a 'silent' arc) which then evolves into an arc for high currents. 4 Refs.
Primary Keywords: Atmospheric Air; Cathode Zone; Point-to-plane Geometry; Cathode Canal

2958
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE USE OF A PHOTOMULTIPLIER IN THE DETERMINATION OF IONIZATION COEFFICIENTS IN GASES STRESSED WITH HIGH VOLTAGE
M.M. Benford and D.J. Tedford
University of Strathclyde, Glasgow, Scotland
Journal Of Physics D: Applied Physics, Vol. 10, No. 16, pp 2177-2180 (11/1976).
Experiments using a photomultiplier in the determination of the effective ionization coefficient of ambient room air stressed at very high voltages are described, and the results compared with data previously obtained by conventional current measurement techniques. Good agreement has been achieved, and the advantages of the photomultiplier method are discussed. 8 Refs.
Primary Keywords: Ionization Coefficient; Air; Photomultiplier; Current Measurement; Uniform-field Gap; Alpha-particle Irradiation

2976
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes, Gas Gaps, Recovery)
THE INFLUENCE OF ELECTRODE HEAT TRANSPORT IN SPARK RECOVERY
F.L. Curzon and M.S. Gautam
University of British Columbia, Vancouver, British Columbia, Canada
British Journal Of Applied Physics, Vol. 18, pp 79-87 (01/1967).
A one-dimensional model of heat flow in a recovering spark channel is presented, taking into account the effect of electrode heat transport. The theory indicated that the ratio of the times taken for spark channels equipped with different electrodes to achieve the same recovery voltage is constant over a wide range of voltages. The value of the constant depends on the thermal constants of the spark channel and electrode materials. Recovery measurements have been carried out on spark gaps operated in air between tungsten, copper and stainless-steel electrodes. The copper and stainless-steel electrodes were capped by thin tungsten layers to keep the surface properties fixed. The experimental results agree well with the theory provided the recovery voltage lies between 35% and 75% of the final breakdown potential of the spark channel. The results also show that for tungsten electrodes electrode heating has a minor, but significant, effect on the recovery characteristics. 8 Refs.
Primary Keywords: Spark Recovery; Heat Flow; Modeling; 1-d Simulation; Several Electrode Materials

2993
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Surface Flashover; Gas Gaps, Materials)
AVOIDING FLASHOVERS IN LOW INDUCTANCE HIGH VOLTAGE SPARK GAPS AT ATMOSPHERIC PRESSURE
M. De Pretis
Centre d'Etudes Nucleaires, Boite Postale N 6, 92 Fontenay-aux-Roses, France
The Review Of Scientific Instruments, Vol. 41, No. 6, pp 889-891 (06/1970).
The major problem when designing a high voltage spark gap is represented by flashovers occurring on the inner surface of the main insulator, and which strongly depend on the insulating materials used as well as on their surface state and shape. For voltages up to 20 or 30 kV, the breakdown distance for flashovers on Teflon is practically linear and almost three times larger than in a r.f. For higher voltages it increases more rapidly and we observed flashes over more than 40 cm occurring within 100 nsec after a potential difference of approximately 100 kV was applied. 2 Refs.
Primary Keywords: Insulator Flashover; Teflon; Coaxial Spark Gap; Low Inductance; Air Gap

3006
(SWITCHES, CLOSING)
(Gas Gaps, Crossed-field)
HIGH AVERAGE POWER TESTS OF A CROSSED-FIELD CLOSING SWITCH
R.J. Harvey (1), R.W. Holly (1) and J.E. Creedon (2)
(1) Hughes Research Labs, Malibu, CA 90265
(2) ECOM, Fort Monmouth, NJ 07703
1976 IEEE Pulsed Power Conference Proceedings, Paper IB-2 (11/1976).
A triode version of the crossed-field closing switch has been successfully tested at average powers of up to 800 kW for burst durations of 32 s. Unlike most convertional spark gaps, the arc is initiated from a crossed-field glow discharge and occurs at random locations on a shot-to-shot basis. This uniformly disperses the heat loading and erosion over a relatively large electrode surface area which may then be cooled. 4 Refs.
Primary Keywords: Crossed-field Closing Switch; Triode; Glow Discharge; Performance

3014
(BREAKDOWN STUDIES)
(Gas, Electrical)
IMPULSE FLASHOVER CHARACTERISTICS OF LONG AIR GAPS AND ATMOSPHERIC CORRECTION
Y. Aihara (1), Harada T. (1), Y. Ito (1) and Y. Aoshima (2)
(1) Central Research Institute Of Electric Power Industry, Tokyo, Japan
(2) Meidensha Electric Mfg. Co., Ltd., Numazu, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-97, No. 2, pp 342-348 (03/1978).
The flashover voltages of long air gaps such as rod-rod and rod-plane gaps vary with impulse waveform, polarity, gap spacing and atomospheric conditions. This paper deals with the results of analysis of the flashover characteristics for various impulse waveforms of positive and negative polarities, measured in many laboratories including CRIEPI. New and general relations were found between flashover voltages and the factors mentioned above, thereby enabling determination of flashover voltages under various test conditions. 5 Refs.
Primary Keywords: Rod-plane Gaps; Rod-rod Gaps; Impulse Flashover; Atmospheric Consisideration

3024
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Surface Flashover; Solid)
BREAKDOWN OF INSULATING MATERIALS BY SURFACE DISCHARGE
Y. Toriyama (1), H. Okamoto (2) and M. Kanazashi (3)
(1) Musashi Institute of Technology, Tokyo, Japan
(2) Central Research Institute of The Electric Power Industry, Tokyo, Japan
(3) Electrotechnical Lab, Tokyo, Japan
IEEE Transactions On Electrical Insulation, Vol. EI-6, No. 3, pp 124-129 (09/1971).
'Round-robin' experiments for partial discharge degradation of polyethylene have been made by means of a parallel-plate electrode system. Following this, a second round-robin was run using direct electrodes with the object of surveying some simple testing methods corresponding to actual phenomena such as local perforation by corona. Corona lifetimes of several insulating materials were measured by using two kinds of electrode systems, i.e., a hemisphere-plane configuration and a cylinder plane as recommended by the International Electrotechnical Commission (IEC). Precise differences between different materials cannot be defined because of the fluctuation of corona lifetime of the same material, but there may be some significance in the order of six kinds of materials. Several possible causes of the variability were examined with regard to the differences of test dates, humidities, airflows, and specimens' thickness and some information concerning relations between variability and experimental conditions was obtained. These results and considerations should be helpful relative to the adoption of the most reasonable electrode and the performance of test procedure. 9 Refs.
Primary Keywords: Partial Discharge; Local Perforation; Corona; Insulation Lifetime; Test Procedure

3039
(DIAGNOSTICS AND INSTRUMENTATION; DIAGNOSTICS AND INSTRUMENTATION)
(Component Testing; Current)
MEASUREMENT PROCEDURES FOR CHARACTERIZATION OF HIGH VOLTAGE SPARK SOURCES
A. Scheeline, D.M. Coleman and J.P. Walters
University of Wisconsin, Madison, WI
Applied Spectroscopy, Vol. 32, No. 2, pp 215-223 (04/1978).
The authors outline methods that can be used to calibrate capacitor discharge spark sources. Procedures and devices needed in the measurement of both individual components and systems used in capacitor charging, and in the control and monitoring of the discharge current are discussed. Characterization methods and their applications to source development is examined. 16 Refs.
Primary Keywords: Capacitive Discharge Spark Source; Pulse Shape Programming; Spectroscopic Measurement

3045
(BREAKDOWN STUDIES)
(Gas, Electrical)
CALCULATION OF SPARK BREAKDOWN OR CORONA STARTING VOLTAGES IN NONUNIFORM FIELDS
A. Pedersen
Technical University of Denmark, Lyngby, Denmark
IEEE Transactions On Power Apparatus And Systems, Vol PAS-86, No. 2, pp 200-206 (02/1967).
The processes leading to a spark breakdown or corona discharge are discussed very briefly. A quantitative breakdown criterion for use in high-voltage design is derived by which spark breakdown or corona starting voltages in nonuniform fields can be calculated. The criterion is applied to the sphere gap, and it is shown how it can give a very detailed and accurate description of known breakdown characteristics. 26 Refs.
Primary Keywords: Gas Breakdown; Spark; Corona; Breakdown Threshold; Nonuniform Field; Theory; Townsend Ionization; Sphere-sphere Gap; Insulation Design Criteria

3069
(BREAKDOWN STUDIES)
(Gas, Optical)
BACKGROUND GAS PRESSURE DEPENDENCE AND SPATIAL VARIATION OF SPONTANEOUSLY GENERATED MAGNETIC FIELDS IN LASER-PRODUCED PLASMAS
R.S. Case Jr. (1) and F. Schwirzke (2)
(1) AFWL, Kirtland AFB, NM 87117
(2) Naval Postgraduate School, Monterey, CA 93940
Journal Of Applied Physics, Vol. 46, No. 4, pp 1483-1498 (04/1975).
A spontaneous eximuthal magnetic field generated by electron currents which flow during the interval that a high-brightness 4-nsec full width at half-maximum intensity ruby laser was incident on a metallic target has been detected, its spatial characteristics evaluated, and its dependency upon background gas pressure investigated both experimentally and theoretically. The propagation velocity of the early component of this magnetic field is greater than 1E8 cm/sec, more than an order of magnitude larger than the plasma convective velocity, and indicates that the electron currents responsible for this fast field must flow through the background photoionized gas. The early component is first detected at a pressure of 5E-6 Torr, and for a fixed spatial location, reaches a peak intensity at a pressure of 2E-3 Torr. Its intensity is typically on the order of 1-10 G, a factor 10-100 times smaller than the spontaneously generated magnetic fields which are driven by pressure gradient effects in the expanding laser plasma. The pressure dependence of the pressure gradient magnetic field has also been evaluated and compared with previous experimental results, obtained at laser pulse lengths of greater than 20 nsec. 14 Refs.
Primary Keywords: Gas Breakdown; Laser Breakdown; Metal Target; Ruby Laser; Variable Gas Pressure

3089
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, MECHANICAL)
(Systems; Rotating Machines)
AN INDUCTIVE ENERGY STORAGE SYSTEM BASED ON A SELF-EXCITED HOMOPOLAR GENERATOR
A.E. Robson, R.E. Lanham, W.H. Lupton, T.J. O'Connell, P.J. Turchi and W.L. Warnick
Naval Research Lab, Washington, DC 20375
IEEE Sixth Symposium On Engineering Problems Of Fusion Research pp. 298-302 (11/1975).
A 10 MJ inductive energy storage system is described in which the storage coil is also the excitation coil of a homopolar generator. Energy is stored initially in two counter-rotating rotors, and transferred to the coil when the generator is connected in a self-excited mode. The circuit is interrupted by a large sulfurhexaflouride circuit breaker working in conjunction with a fuse, and delivers energy to a resistive load in approximately 1 ms. The system contains a number of novel features, including very high-speed rotors and carbon fiber brushes. It is intended as a prototype module for large energy storage systems. 19 Refs.
Primary Keywords: Homopolar Generator; High Speed Rotor; Circuit Breaker; Sulfurhexaflouride; High Energy

3105
(PULSE GENERATORS)
(Trigger)
AVALANCHING TRANSISTORS SPEED UP HIGH-VOLTAGE PULSES
E.A. Jung
Argonne National Lab, Argonne, IL
Electronics, Vol. 44, No. 2, pp 73 (01/1971).
A circuit producing variable pulses of 200-400 volts with rise and fall times of 30 ns is designed using a vacuum tube and a transistor. A 2 kHz repetition rate at a 1% duty cycle is possible. 0 Refs.
Primary Keywords: Avalanche Transistor; Vacuum Tube; Fast Rise; Hundreds Of Volts Output

3131
(PULSE GENERATORS)
(Marx)
STABILIZATION OF THE TIME CHARACTERISTICS OF AN ARKAD'EV-MARX GENERATOR
I.Yu. Antipov, Yu.V. Kuznetsov, E.V. Lazutin, I.M. Piskarev, V.A. Khrushchev and A.V. Shumakov
Scientific-Research Institute Of Nuclear Physics, Moscow State University, Moscow, USSR
Instruments And Experimental Techniques, Vol. 19, No. 2, pp 429-431 (04/1976).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 99-100 (March-April 1976)
A method is proposed for stabilizing the actuation time delay and the fluctuations of this time delay in an Arkad'ev-Marx generator. The method allows the output voltage of the generator to be varied within limits of approximately 35% without controlling the spark gaps and makes it possible to avoid purging the spark gaps during operation. 1 Refs.
Primary Keywords: Arkad'ev-Marx Generator; Jitter Stabilization; Large Operating Voltage Range; Trigger Optimization

3150
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)
EXPLOSIVELY PRODUCED MEGAGAUSS FIELDS AND APPLICATIONS
C.M. Fowler, R.S. Caird, W.B. Garn and D.J. Erickson
Los Alamos National Labs, Los Alamos, NM 87545
IEEE Transactions On Magnetics, Vol. MAG-12, No. 6, pp 1018-1023 (11/1976).
We describe various explosive magnetic flux compression devices that produce pulsed megagauss fields, and a number of applications in which they have been used. Among the systems described are relatively simple ones that generate fields up to 250 T in large fixed volumes, and cylindrical implosion systems that produce fields in excess of 1000 T. Small fixed volume systems are described that may be used in the laboratory. They require only small amounts of explosive and can produce 100 T fields in coils 25 mm long and 10 mm diameter. We discuss measurements made on various materials in megagauss fields, often at cryogenic temperatures, including magnetoresistance, magnetic susceptibility, optical absorption, Faraday rotation, and Zeeman splittings. We also discuss experiments in which large magnetic pressures have been used to compress solid deuterium isentropically. In flux compression devices part of the energy of the explosives is converted to electromagnetic energy. This has led to their use as compact single-shot high power energy sources. At times it is necessary to transformer couple loads to the device outputs. We describe successful operation to transformers in 165 T fields, and suggest that they can operate in much higher fields. 22 Refs.
Primary Keywords: Magnetic Field Generation; Flux Compression; Explosive Driver; Laboratory size Generator; Application

3151
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Mechanical; Gas Gaps, Self)
GENERATOR PRODUCING SINGLE NANOSECOND PULSES WITH CONTROLLABLE AMPLITUDE AND DURATION
A.I. Aleksandrin and I.S. Samodelov
Instruments And Experimental Techniques, Vol. 19, No. 4, pp 1092-1095 (08/1976)
Trans. From: Pribory i Tekhnika Eksperimenta 4, 142-144 (July-August 1976)
A generator is described which produces single nanosecond pulses having a rectangular shape with a mechanically commutated spark gap in hydrogen under a pressure of 50 gauge atmospheres; the amplitude of the pulses is 10-5000 V, and the duration of the leading edge is <0.1 nsec. 7 Refs.
Primary Keywords: Mercury-wetted Delay; Peaking Spark Gap; Subnanosecond Risetime; 5 kV Operating Voltage, 50 Atmosphere Pressure

3154
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)
CASCADE IONIZATION OF A GAS BY A LIGHT PULSE
Ya.B. Zel'dovich and Yu.P. Raizer
Soviet Physics JETP, Vol. 20, No. 3, pp 772-780 (03/1965).
Trans. From: Zhurnal Eksperimental'noi I Teoreticheskoi Fiziki 47, 1150-1161 (September 1964)
The mechanism of ionization of a gas under the action of a light pulse is considered. The case is investigated when the pulse power and electric field strengths in the light wave are not very large and the light-induced emission of electrons is not of decisive importance. Under these conditions ionization is of a cascade nature, the electrons absorb light quanta in collisions with neutral atoms and accumulate energy sufficient for ionization. Approximate calculations of the kinetics of development of the cascade are carried out by taking into account the most important processes. Results of calculation of the breakdown fields are compared with published experimental data. 9 Refs.
Primary Keywords: Laser Ionization; Volume Ionization; Cascade Ionization; Low Laser Power; Helium Gas; Argon Gas; Ruby Laser; Theory

3175
(BREAKDOWN STUDIES)
(Gas, Electrical)
DIELECTRIC BREAKDOWN OF SULPHUR HEXAFLUORIDE IN NEARLY UNIFORM FIELDS
Y. Kawaguchi, K. Sakata and S. Menju
Tokyo Shibaura Electric Co. Ltd., Yokohama, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 3, pp 1072-1078 (06/1971).
This paper describes the breakdown potential gradient of sulphur hexafluoride (SF_6) at pressures up to 4 kg/sq.cm. absolute against power frequency, switching impulse and standard impulse voltages in nearly uniform fields such as plane-plane, sphere-sphere, and coaxial cylinder electrode configurations. Electrode material, smoothness and polarity effect are also investigated for coaxial cylinders. Test results indicate that potential gradient is the most influential factor in the dielectric breakdown of SF_6. Switching impulse and standard impulse breakdown at positive polarity occur at the potential gradients close to a limiting value of E/P = 86.1 (kV/cm/kg/sq.cm.) measured by Geballe and Reeves. Breakdown potential gradient at negative polarity is below the limiting value of E/P at pressures above 1 kg/sq.cm. The negative breakdown seems to be more dependent on electrode area and duration of applied voltages. 9 Refs.
Primary Keywords: Uniform Field; Several Electrode Materials; Surface Condition; Polarity Effect; Power Frequency Voltage; Impulse Voltage; High Pressure

3185
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
CAPACITIVE MEASUREMENTS OF SLOW FLUCTUATIONS IN HIGH-VOLTAGE SUPPLIES FOR ELECTRON MICROSCOPES
H-P. Rust, K. Weiss and P. Zilske
Institut Fur Elektronenmikroskopie Am Fritz-Haber-Institut Der Max-Planck-Gesellschaft, Berlin,GDR
Journal Of Physics E: Scientific Instruments, Vol. 10, No. 1, pp 71-72 (01/1977)
(Refs
Primary Keywords: Capacitive Measurement; Low Frequency; Capacitor Leakage Current; Leakage Current Drift; Leakage Current Error

3188
ELECTRICAL BREAKDOWN AND TRACKING CHARACTERISTICS OF PULSED HIGH VOLTAGES IN CRYOGENIC HELIUM AND NITROGEN
R.A. Haarman and K.D.J. Williamson
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-750716-7, 16p (01/1975).
Availability: LA-UR-75-1032
NTIS
The proposed Scyllac Fusion Test Reactor (SFTR) at the Los Alamos Scientific Laboratory (LASL) anticipates using superconducting coils as the main energy storage device and will store a total energy of 470 MJ. The SFTR will operate in a pulsed mode with the superconducting energy storage system--METS (Magnetic Energy Transfer System)--experiencing a 60 kV pulsed voltage during each pulsed operation. This paper presents experimental data for use by engineers in the design of cryogenic apparatus that will be subject to the SFTR 60 kV pulsed waveform. Various electrode configurations were used in order to provide the designer with the most commonly used geometries over the widest practical range of helium and nitrogen temperatures from liquid to room temperature at pressures of 0.9 and 1.6 atm. Data are also presented on voltage tracking characteristics of Mylar, phenolic, polyethlene, nylon, teflon, and permali, which are commonly used structural dielectric materials.
Primary Keywords: Scyllac Devices_Specifications; Dielectric Materials_Breakdown; Cryogenics; Electric Potential; Electrical Insulation; Helium; Nitrogen; Superconducting Magnets
Secondary Keywords: NTISERDA

3191
(PULSE GENERATORS; POWER CONDITIONING)
(LC; Pulse Transformers)
CIRCUIT FOR SHAPING SHORT HIGH-VOLTAGE PULSES
N.I. Elagin, V.V. Starykh and S.D. Fanchenko
Institute Of Atomic Energy, Moscow, USSR
Instruments And Experimental Techniques, No. 2, pp 438-439 (04/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 114-115 (March-April 1970).
The paper describes a generator which produces single pulses and solves the problem of producing short high-voltage pulses at a power level of 1E2 to 1E3 MW across the circuit of a plasma turn. The pulses are produced in the secondary winding of a coreless transformer. Two high voltage spark gaps and a nonlinear vilite resistor are used as the commutating elements. Single pulses having a length of 0.3 microsecond and an amplitude of up to 40 kV are obtained. 2 Refs.
Primary Keywords: Pulse Transformer; Air Core Transformer; Spark Gap; 10 ns Pulse Length
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3198
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
NOVEL SHORT RECOVERY TIME HIGH-VOLTAGE SWITCH
M. Dufour, H. Egger and K. Seelig
Institute Of Applied Physics, Univ. Berne, Switzerland
Rev. Sci. Instrum. Vol. 47, No. 12 pp 1552-1553 (06/1976).
A novel, sea-egroff low-pressure quench ng discharge gap capable of switch ng voltages up to 25 kv has been built. A recovery time of a few microseconds was measured, allowing switching rates in the 100 kHz range. 2 Refs.
Primary Keywords: Very Low Pressure Gaps; Short Recovery Time; Porous Silica; High Resistance
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3199
(PULSE GENERATORS)
(Trigger)
OPTICALLY ISOLATED HIGH-VOLTAGE TRIGGER SYSTEM
I. Henins and M.S. Kelly
Los Alamos National Labs, Los Alamos, NM 87545
The Review Of Scientific Instruments, Vol. 48, No. 2, pp 168-170 (02/1977).
An optically isolated high-voltage trigger system has been built to eliminate ground loop and electromagnetic interference problems in the triggering of a pulsed high-voltage plasma experiment. In this system fast-rising light pulses are generated at the trigger source and transmitted through 20 m long glass fiber optics cables to detectors, which trigger 7-kV pulsers used to drive high-voltage spark gap switches. The 7-kV pulsers are battery powered and may be floated to the potentials existing on the spark gaps. 9 Refs.
Primary Keywords: Optical Isolation; Battery Operation; Long Battery Life; 7 kV Output; 8 ns Rise Time; 5 ns Jitter
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3228
(CIRCUIT CALCULATIONS)
(Capacitance)
CAPACITANCE CALCULATIONS FOR SOME BASIC HIGH VOLTAGE ELECTRODE CONFIGURATIONS
P. Maruvada and N. Hylton-cavallius
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Power Apperatus And Systems, Vol. PAS-94, No. 5, pp 1708-1713 (09/1975).
Calculation of the capacitance to ground, as well as of the capacitance between objects of various shapes is a problem occurring frequently in high voltage engineering. Simple methods do not exist, however, for such calculations even in the case of some basic electrode configurations. Although general purpose computer programs may have been developed for most of the comfigurations, their availability is rather limited, and the data preparation often cumbersome. Accurate computer calculations of the capacitance to ground have been made for a large number of electrode configurations. The results are presented graphically in a normalized form, and should permit a rapid and precise detemination of capacitances for most practical electrode arrangements. Furthermore, some simple equations have been developed which permit an approximate, but often sufficiently accurate, evaluation of the capacitances by hand calculations. It is believed that both the accurate graphs and the simple equations would be of great practical value, especially to high voltage engineers. 9 Refs.
Primary Keywords: Sphere; Circular Disc; horiz. and vertical rectangular plates; normalized curves; charge distribution determination
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3242
(PULSE GENERATORS)
(Hard-tube)
HIGH POWER MODULATOR/REGULATORS FOR NEUTRAL BEAM SOURCES
J.Q. Lawson and A. Deitz
Princeton University, Princeton, NJ
Availability: CONF-751125-131
NTIS
PPPL has recently completed two new Modulator/Regulators for neutral injection sources used on the ATC machine and is constructing four new ones for use with sources on the PLT machine. The ATC modulator uses the well proven 4CW35,000C tetrode as the main switch tube, while the PLT modulators will be using the new but significantly higher powered Y-2170 tetrodes. Some interesting circuit and manufacturing techniques are discussed.
Primary Keywords: Atc Devices_Neutral Atom Beam Injection, Neutral Atom Beam Injection_Power Supplies; Ion Sources; Modulators; Switches
Secondary Keywords: NTISERDA

3251
(BREAKDOWN STUDIES; INSULATION, VACUUM)
(Surface Flashover)
INSULATOR FLASHOVER MECHANISM IN VACUUM INSULATED CRYOCABLES
P. Grenoble and D.B. Montgomery
Massachusetts Institute of Technology, Cambridge, MA
Journal Of Vacuum Science And Technology, Vol. 13, No. 5, pp 1081-1087 (10/1976).
The authors present evidence that surface flashover in vacuum is largely due to gases absorbed at the insulation surface. Cryogenic underground power cables are considered in experiments in the conditioning effect in vacuum insulation, insulation damage experiments, and flashover mechanism investigations. It is shown that the early stages of surface flashover are the results of discharges in the unwetted gases. 11 Refs.
Primary Keywords: Vacuum Insulation, Surface Flashover; Conditioning; Insulator Damage; Lichtenberg Discharge
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3253
(BREAKDOWN STUDIES)
(Electrodes)
IONIZATION, ELECTRODE SURFACES AND DISCHARGES IN SF/SUB 6/ AT EXTRA-HIGH-VOLTAGES
C. Cooke
Massachusetts Institute of Technology, Cambridge, MA
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-94, No. 5, pp 1518-1523 (09/1975).
The influence on DC electrical performance of SF6 gas from small protrusions on electrode surfaces has been investigated experimentally in a system of moderate size over the pressure range from 1/2 to 15 atm abs. The protrusions used were steel or aluminum spheres with 0.039cm radius on a rod 12 times higher than its tip radius of 0.039cm. Over the complete voltage range, 100 kV to 1500 kV, good agreement was found between measured values and those calculated using a simple ionization development model for discharge initiation. This simple model was applied to calculate the effect of other protrusion shapes. In each case when the product of gas pressure times protrusion height above a flat electrode exceeded 80 atm-microns their presence decreased the breakdown stress. Scanning microscope views of the sphere tips after sparking showed microscopic protrusions which account for the deterioration found after the first spark. 15 Refs.
Primary Keywords: Effects Of Small Protrusions On Electrode Surface, 1/2 To 15 Atm Abs; Spherical Protrusions; 100 Kv To 1500 Kv; Pressure-protrusion Height Product; Scanning Microscope Data; SF6 Insulated Equipment
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3258
(BREAKDOWN STUDIES)
(Gas, Electrical)
NANOSECOND VOLUME DISCHARGE IN AIR AT ATMOSPHERIC PRESSURE
S. Andreev and G. Novikova
Affiliation Not Given
Soviet Physics Technical Physics, Vol. 20, No. 8, pp 2078-2084 (08/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 45, pp 1692-1703
In the breakdown of short gaps in air at atmospheric pressure at high overvoltages in electron density reaches 10e16cm**-3, and the glow region has clearly defined boundaries in the region of pronounced ionization, which emits a continuum. The line emission forms a jacket which gives the glow region a diffuse shape in white light. A model of the nonequilibrium plasma is analyzed; it can be used to calculate the electron temperature and drift velocity. The quasisteady nature of the current and voltage is attributed to the inertial lag in the gas heating, due to the heat capacity of the gas. Ionization processes are inhomogneous over the length of the gap. A region with an elevated charged-particle density develops from the cathode toward the anode while there is a quasisteady voltage between the electrodes. The contraction process, which completes the volume-discharge stage, turns out to be due to an avalanche increase in the electron density as the conditions for equilibrium thermal ionization are approached. 31 Refs.
Primary Keywords: Short Voltage Pulse; Volume Glow; Avalanche Increase In Electron Density; Hemispherical Electrodes; Pointed Electrodes
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3275
(PARTICLE BEAMS, ELECTRON; ENERGY STORAGE, INDUCTIVE)
(Generation; Systems)
ACCELERATING AND SWITCHING OPTOELECTRONIC SYSTEM OF A HIGH-POWERED ACCELERATOR WITH AN INDUCTIVE STORAGE ELEMENT
I.N. Silvkov and G.I. Dolgachev
Instruments And Experimental Techniques, Vol. 18, No. 3, pp 688-691 (06/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 27-30 (May-June 1975)
The characteristics and design of an optoelectronic system are considered, which in a high-powered pulsed electron accelerator with an inductive energy storage element, provides current switching and generation of a beam of accelerated electrons. The circuit of an accelerator with this optoelectronic system is described. 5 Refs.
Primary Keywords: E-beam Generation; Inductive Energy Storage; Optoelectronic System; Variable Perveance
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3286
(PARTICLE BEAMS, ELECTRON)
(Generation)
COLD CATHODE ELECTRON GUNS IN THE LASL HIGH POWER SHORT-PULSE CO/SUB 2/ LASER PROGRAM
S. Singer, J.S. Ladish and M.J. Nutter
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-751108-14, 24p (01/1975).
Availability: LA-UR-75-2155
NTIS
The design, operation, and performance of the 200 x 35 cm exp 2 two s red cold cathode electron gun used in the 2.5 kJ laser system and to be used in the 10 kJ laser are described.
Primary Keywords: Carbon Dioxide Lasers_Electron Beams; Electron Sources_Design; Control Systems; Operation; Performance
Secondary Keywords: Cold Cathodes; Electron Guns; NTISERDA

3287
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
CONTROLLED VACUUM SPARK GAPS RATED AT A VOLTAGE OF 50 KV FOR MULTIPLE COMMUTATION OF MEGA-AMPERE CURRENTS

P.N. Dashuk and G.S. Kichaeva
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments and Experimental Techniques, Vol. 18, No. 2, pp 463-465 (04/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 113-115 (March-April 1975)

The construction and the results of an experimental study of vacuum spark gaps suitable for multiple commutation (>5000 'makes') of current pulses having an amplitude of 1.4 to 1.2E6 A and a length of approximately 1E-3 to 1E-5 sec in capacitive storage devices having an energy of approximately 50 kJ are presented. The time delay of spark gap operation at a pressure of 0.266 Pa and at voltages of 35 to 50 kV is equal to approximately 0.2 microseconds; the mean square deviation does not exceed 20 nsec. The distribution of the time delay corresponds to a normal law. The dielectric strength of the interelectrode insulation of the spark gaps after multiple commutation of currents having various shapes amounts to 60 and 65 kV. The inductance of the spark gap is 6 nH. 3 Refs.

Primary Keywords: Vacuum Spark Gap; 50 kV Operating Voltage; 1.2 MA Current; 6 nH Inductance; Delay Measurement; Jitter Measurement; Life Test
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3288
(VOLTAGE GENERATORS)
(Capacitive Machines)
FUNDAMENTAL LIMITATIONS AND TOPOLOGICAL CONSIDERATIONS FOR FAST DISCHARGE HOMOPOLAR MACHINES

M.D. Driga, S.A. Maas, H.G. Rylander, W.F. Weldon and H.H. Woodson
University of Texas At Austin, Austin, TX
IEEE Transactions On Plasma Science, Vol. PS-3, No. 4, pp 209-215 (12/1975).
9 Refs.

Primary Keywords: Homopolar Machines; Fast Discharge (5-30ms)
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3306
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
HIGH VOLTAGE STATIC BREAKDOWN IN VACUUM

A. Watson
University of Western Ontario, London, Ontario, Canada
Canadian Journal Of Physics, Vol. 54, No. 2, pp 142-157 (01/1976).

A model of the vacuum breakdown mechanism, where a semiconducting layer on a cathode protrusion produces the prebreakdown current, is presented. An analysis is given of the creation of a virtual cathode and the accompanying electron reservoir, and of the growth of the space charge bubble at the anode. The interaction of the two regions, ion interaction with the electron reservoir, and instabilities in the model are also discussed. The calculated breakdown voltage for copper electrodes is found to agree well with the obtained experimental value. 15 Refs.

Primary Keywords: Uniform Field Breakdown; Electron Reservoir; Virtual Cathode; Anode Evaporation; Impact Ionization
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3320
(BREAKDOWN STUDIES, INSULATION, VACUUM)
(Vacuum, Particle)
IN-SITU OBSERVATION OF MICROPARTICLES IN A VACUUM-INSULATED GAP USING A SCANNING ELECTRON MICROSCOPE

G.D. Theophilus, K.D. Srivastava and R.G. Van Heeswijk
University of Waterloo, Waterloo, Ontario, Canada
Journal of Applied Physics, Vol. 47, No. 3, pp 897-898 (03/1976).

Results are presented of an investigation into microparticle activity in a vacuum-insulated 1-mm electrode gap. The experiments were conducted in situ in the specimen state of a scanning electron microscope (SEM) and confirm microparticle activity at voltages well below breakdown. The most common size of the microparticles observed was 3 micrometers and very few particles above 10 micrometers were detected. 6 Refs.

Primary Keywords: Small-sized Microparticle; Medium Sized Microparticle; Large Microparticle; Microparticle Activity; Insulator Charging
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3322
(SWITCHES, CLOSING)
(Vacuum Gaps, Optical)
LASER-TRIGGERED VACUUM SWITCH

V.S. Bulygin, V.B. Lebedev, G.A. Pryanikova, V.V. Ryukkert, S.S. Sultoiashvili and V.A. Yakovlev
Soviet Physics-Technical Physics, Vol. 20, No. 4, pp 561-563 (04/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 892-897 (April 1975)

The conductivity of a two electrode vacuum gap is increased by the plasma produced by focusing laser light on the surface of one of the electrodes. The switching properties of a vacuum discharge initiated by the laser beam are determined. These studies are conducted over a wide range of gap voltages and for differing polarities of the target electrode. 3 Refs.

Primary Keywords: Vacuum Spark Gap; Electrode Laser Illumination; Surface Triggering; Delay Measurement; Jitter Measurement
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3338
(PARTICLE BEAMS, ION)
(Generation)
PLASMA-SURFACE SOURCE OF NEGATIVE IONS

Yu.I. Belchenko, G.I. Dimov and V.G. Dudnikov
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics Technical Physics, Vol. 20, No. 1, pp 43-47 (07/1975)
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 68-73 (January 1975)

A high-power pulsed source of negative ions that uses a plasmotron discharge is described. A H beam with a current density up to 1.7 A/sq cm in the emission slit has been obtained from the discharge chamber as a result of the intense generation of negative ions from the cathode surface, which is bombarded by fast protons from the discharge. The intensity of the extracted ion beam is roughly proportional to the area of the emission slit. A negative ion beam with a current of 0.88 A has been obtained from a source with an emission slit 0.5 x 10 mm in size. The electron current is less than 1.1 A. 5 Refs.

Primary Keywords: Hydrogen Ion; Plasmotron Discharge; 1 A Ion Current; Cathode Bombardment By Electrons
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3340
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
PREBREAKDOWN PHENOMENA IN VACUUM WITH DIRECT AND ALTERNATING VOLTAGES AT ROOM AND CRYOGENIC TEMPERATURES

R.N. Allan and P.K. Rondolo
University of Manchester, Manchester, UK
Journal Of Physics D: Applied Physics, Vol. 8, No. 15, pp 2170-2180 (12/1975)

These investigations were conducted to measure the prebreakdown current and breakdown voltage between stainless steel electrodes using 50 Hz alternating and direct voltages. The measurements were made at room temperature and liquid nitrogen temperature using uniform field electrodes. The range of electrode spacings for the current measurements was 0.1-2.1 mm and for the breakdown voltages was 0.1-0.8 mm. The variation of the prebreakdown current and breakdown voltage with temperature and electrode spacing was very similar with both types of voltage applied. Also with both types of voltage, the prebreakdown current obeyed a cold-cathode emission law, analytically similar to the Fowler-Nordheim relation. In both cases an ambient pressure greater than about 1E-6 Torr caused the current to be suppressed, though this was found to be a reversible effect. 18 Refs.

Primary Keywords: Prebreakdown Current; Breakdown Voltage; Power Line Frequency; DC Voltage; Room Temperature; Liquid Nitrogen Temperature
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3352
(BREAKDOWN STUDIES)
(Gas, Electrical)
ELECTRICAL BREAKDOWN OF LONG GAPS IN SULFUR HEXAFLUORIDE

T. Nitta and Y. Shibuya
Mitsubishi Electric Corp, Amagasaki, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 3, pp 1045-1051 (06/1971)

The electrical discharge characteristics of SF/sub 6/ are discussed theoretically in relation to the field dependence of the ionization coefficient, alpha and the electron attachment coefficient, eta. The results are compared with the characteristics of air. A simple theoretical formulation of breakdown or corona inception voltages of gaps in SF/sub 6/ is derived. The formulation has been examined by experiments on several electrode configurations. At low pressures of less than 4 atm, the agreement of the theoretical and the experimental results is fairly good. The breakdown voltage decreases from the theoretical estimation at higher pressure. 12 Refs.

Primary Keywords: SF/sub 6/; Theory; Breakdown; Corona; Analytical Solution; Ionization Coefficient; Attachment Coefficient; High Pressure; Comparison With Air
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3362
(SWITCHES, CLOSING)
(Liquid Gaps, Self)
WATER SPARK GAP FOR A NITROGEN LASER

S. Saikan and F. Shimizu
University of Tokyo, Bunkyo-ku, Tokyo, Japan
Review Of Scientific Instruments, Vol. 46, No. 12, pp. 1700-1701 (12/1975)

Satisfactory operation of the Blumlein type nitrogen laser was obtained by using a water-filled spark gap. The water-filled spark gap uses flowing water, and the Blumlein circuit is charged by a Marx-bank driver. 4 Refs.

Primary Keywords: Water Spark Gap; Blumlein Line; Fast Rise Time; Comparison With Air Gap; General Electrode Material
Secondary Keywords: Gas Laser Pumping
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3374
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
FAST AIR GAP CROWBAR SWITCH DECOUPLED BY A LOW PRESSURE GAP

S. Kitagawa and K.I. Hiruno
Nagoya University, Nagoya, Japan
No. IPPJ-T-20, 26p (04/1976).
Availability: N76-35158/8GI
NTIS

A fast pressurized crowbar gap switch, in which a low pressure gap is used as a nonlinear decoupler, is investigated. The switch is composed of a simple two electrode high pressure gap and a low pressure gap of trigatron type. A special trigger circuit is designed in order that a single pulse breaks down the high- and low-pressure gaps successively. The jitter of breakdown time is less than 20 nsec for the wide range of the operating conditions: Working voltage and pressures in both gaps. The switch is designed for 40 kV operation and its inductance is 22 nH. Seventy switches of this type are installed in a 40 kV, 210 kJ fast capacitor bank. Up to now they have been running successfully for 8000 shots with little maintenance. (Author)

Primary Keywords: Gaps; High Voltages; Switches; Trigger Circuits; Capacitors, Electric Switches; Plasma Pinch; Trigatrons
Secondary Keywords: NTISNASA

3383
(BREAKDOWN STUDIES: BREAKDOWN STUDIES)
(Electrodes. Gas. Electrical)
INVESTIGATION OF ELECTRODE EROSION AND OF THE CONDITIONS OF SPECTRUM EXCITATION WITH AN IMPULSIVE DISCHARGE IN A MAGNETIC FIELD
A.V. Kolesn[illegible], L.A. Strelkov and A.A. Yankovskii
Journal Of Applied Spectroscopy, Vol. 19, No. 2, pp 969-973 (08/1973).
Trans. From: Zhurnal Prikladnoi Spektroskopii 19, 195-201 (August 1973)
Previous research investigated the entrance of electrode material into the cloud of a low-voltage impulsive discharge and established the time variation of the entrance of both the vapor and liquid phases of the erosion products. In the initial stage of the discharge, independently of the electrode's polarity, there was a predominant entrance of material in the most finely divided phase. The duration of this discharge stage was increased by mechanical displacement of a substitute electrode along tnte flat surface of the specimen. This permitted an enhancement of effictiveness in the use of material for obtaining a spectrum. In the present research, instead of mechanical displacement of a substitute electrode, the base of the discharge's current-conducting channel was displaced under the action of a magnetic field. The coil that created the magnetic field had an inductance of 20 microHenry and was connected into the discharge circuit in series with the interelectrode gap. Time scanning of the total discharge-cloud luminescence showed that brightly-shining spots adjacent to an electrode are formed on the surface of the specimen during the discharge. In the initial stage of the discharge, the shifting of the spots is smooth and continuous, with increase of current the spots shift in a jerky manner. The number of anode spots is larger than that of the cathode spots. 2 Refs.
Primary Keywords: Gas Breakdown; Low Pressure Breakdown; Electrode Erosion; Magnetic Field; Electrode Spot Movement; Anode Spot; Cathode Spot

3385
LASER TRIGGERED SWITCHING OF A PULSED, CHARGED, OIL FILLED SPARK GAP
A.H. Guenther, G.L. Zigler, J.R. Bettis and R.P. Copeland
AFWL, Kirtland AFB, NM 87117
Review Of Scientific Instruments, Vol.46, No. 7 pp 914-920 (07/1975).
A focused, Q-spoiled laser, aligned along the interelectrode axis of a [illegible] charged switch assembly, was used to initiate the [illegible] of an overvolted transformer oil filled gap. Laser power [illegible] between [illegible] and 2[illegible] MW and the voltage pulse exhibited a rise time of [illegible] nsec to a voltage of [illegible] kV. A parametric study of the factors affecting the delay between the laser pulse arrival at the gap and conduction of the gap was accomplished, in which the effects of the focal point location, laser power, switch polarity, and voltage on the gap at laser arrival were determined. Delay times as short as 12 nsec were recorded with jitter, a measure of reproducibility, in the low nanosecond region. 13 Refs.
Primary Keywords: Laser Switching; Pulse Charged Dielectrics; Oil Dielectrics; Laser Triggered Marx Generator; Oil-filled Capacitor; Laser Induced Breakdown; Arc Discharge, Nanosecond Switching

3390
(BREAKDOWN STUDIES)
(Gas, Electrical)
ON THE THEORY OF THE SPARK PLASMA IN NANOSECOND LIGHT SOURCES AND FAST SPARK-GAP SWITCHES
H. Hess
Akademie der Wissenschaften der DDR, Zentralinstitut Fur Elektronenphysik, Berlin, DDR
Journal Of Physics D: Applied Physics, Vol. 8, No. 6, pp 685-689 (04/1975).
In papers on nanosecond gas discharge light sources there has been no theoretical approach capable of describing the dependence of the half-width and the maximum power of the optical pulse on the many parameters which can be varied. On the basis of the theory of Weizel and Rompe (1947) extended to thermal plasmas, the author predicts at least the electric behaviour of the spark discharge in low-inductance circuits normally used for the generation of nanosecond light pulses. 13 Refs.
Primary Keywords: Spark Discharge; Theory; Thermal Plasma; Power Dissipated
Secondary Keywords: Optical Source

3404
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
APPLICATIONS OF A LASER-TRIGGERED SPARK GAP (LTSG)
T. Noguchi (1), M. Yano (2), T. Takagi (2) and K. Horii (2)
(1) Electrotechnical Lab, Tokyo, Japan
(2) Nagoya University, Nagoya, Japan
Electrical Engineering In Japan, Vol. 94, No. 2, pp 13-19 (03/1974).
Trans. From: Denki Gakkai Ronbunshi 94, 121-128 (March 1974)
20 Refs.
Primary Keywords: Applications; Several Triggering Modes; Crowbar Switch; Master Trigger Gap

3418
(PARTICLE BEAMS, ELECTRON, PARTICLE BEAMS, ELECTRON)
(Transport, Target Interactions)
ELECTRON BEAM FOCUSING AND APPLICATION TO PULSED FUSION
G. Yonas, J.W. Poukey, K.R. Prestwich, J.R. Freeman, A.J. Toepfer and M.J. Clauser
Sandia Labs, Albuquerque, NM 87115
Nuclear Fusion, Vol. 14, No. 5, pp 73[illegible], 74[illegible] ([illegible]/1974)
Recent works on the focusing of high-current relativistic electron beams are reviewed and the physics of these beams is examined both empirically and through computer simulation. The application of the electron beams in fusion research is discussed along with the interaction of the beam with the target and the beam requirements for break-even. 49 Refs.
Primary Keywords: Relativistic Electron Beam, Beam Focusing, Vacuum Diode, Plasma Transport
Secondary Keywords: Inertial Confinement Fusion

3423
(POWER CONDITIONING)
(Pulse Transformers)
FOCUS ON PULSE TRANSFORMERS
Unknown
Electronic Design, Vol. 23, No. 13, pp 78-83 (06/1975).
A discussion of pulse transformers and their key parameters is given. Problems and tradeoffs in designing systems with pulse transformers are examined with a special emphasis given to reading specification sheets. 0 Refs.
Primary Keywords: Characterization; Reading Specifications, Application Data; Design Considerations; Bibliography Of Supplies

3426
(BREAKDOWN STUDIES)
(Plasma)
GAS LASER DISCHARGES IN CONTINUOUS METAL TUBES
A.L.S. Smith and M. Brooks
University of St. Andrews, St. Andrews, Fife, KY16 9SS, UK
Journal Of Physics D: Applied Physics, Vol. 7, No. 18, pp 2455-2463 (12/1974).
4 Refs.
Primary Keywords: Current Distribution; Multi Segment Construction; Glow Discharge; Single Continous Discharge; 10 Torr CO/sub 2/ Laser

3429
(PULSE GENERATORS)
(Trigger)
HIGH-SPEED SWITCH HANDLES +OR- 400-V PEAK AND IS CONTROLLED BY LOGIC LEVELS
S.D. Anderson
Minneapolis, MN 55417
Electronic Design, Vol. 23, No. 2, pp 74 (01/1975).
A circuit is presented that can switch 400 V at 100 kHz. Output voltage waveforms are given for switching rates of 1 kHz and 100 kHz (310 V into a 10 K ohm load). 0 Refs.
Primary Keywords: 400 V Voltage Range, Very High Rep-rate; Fast Rise, Isolated Switch

3452
(BREAKDOWN STUDIES)
(Electrodes)
INFLUENCE OF ELECTRODE COATINGS ON THE BREAKDOWN STRENGTH OF TRANSFORMER OIL
A.A. Zaky, M.E. Zein Eldine and R. Hawley
C.A. Parsons & Co Ltd, Newcastle-upon-Tyne, UK
Nature, Vol. 202, pp 687-688 (05/1964).
The influence of coating one or both of the electrodes on the breakdown of transformer oil is studied. It is found that coating the electrodes with 'Penton' increases the initial breakdown voltage substantially. Coating either electrode is found to be as effective as coating both electrodes. 4 Refs.
Primary Keywords: Transformer Oil Breakdown; Electrode Coating; 'Penton'; One Electrode Coated; Both Electrodes Coated

3462
(MAGNETIC INSULATION)
()
COAXIAL HIGH-VOLTAGE DIODE WITH MAGNETIC INSULATION
V.S. Voronin and A.N. Lebedev
Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Technical Physics, Vol. 18, No. 12, pp 162 -1631 (06/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 43, pp 2591-2598
A theory is derived for magnetic insulation in a relativistic coaxial diode. This theory is self-consistent in terms of the magnetic field (beam diamagnetism) and the electrostatic field (space-charge limitation. The magnitude of the insulating magnetic field is found as a function of the diode parameters. The self-consistent equilibrium of a charged hollow beam in an external magnetic field is analyzed in the transport section. The conditions corresponding to maximum current are determined. 5 Refs.
Primary Keywords: Relativistic Coaxial Diode; Diamagnetism, Space-charge Limitation

3483
(INSULATION, VACUUM)
()
HIGH-VOLTAGE VACUUM INSULATION WITH EPOXY-COATED CATHODES
L. Jedynak (1) and S.Y. Towliati (2)
(1) University of Wisconsin, Madison, WI
(2) University of Tehran, Iran
Journal Of Vacuum Science And Technology, Vol. 11, No. 1, pp 472-473 (02/1974)
The breakdown voltages for two electrode coating materials (C-26 epoxy and MgF/sub 2/) and uncoated electrodes in vacuum are compared for several gap spacings, ranging from 1-4 mm. The authors conclude that the breakdown voltage is dependent only on field strength and that the coatings have a significant effect on breakdown voltage and prebreakdown currents. 5 Refs.
Primary Keywords: Vacuum Insulation, Epoxy Coating, Breakdown Voltage; Prebreakdown Current; Variable Gap Spacing

3502
(PARTICLE BEAMS, ELECTRON)
(Generation)
PLASMA-INDUCED FIELD EMISSION AND THE CHARACTERISTICS OF HIGH-CURRENT RELATIVISTIC ELECTRON FLOW
R.K. Parker, R.E. Anderson and C.V. Duncan
AFWL, Kirtland AFB, NM 87117
Journal Of Applied Physics, Vol. 45, No. 6, pp 2463-2479 (06/1974).

The results of a comprehensive diode study conducted using a pulsed high current electron accelerator are reported. Time-dependent analysis of [illegible] cylindrical graphite cathodes has shown evidence of the field emission character of the cold-cathode diode. The effects of cathode whiskers or microprojections on the diode response have been observed. Within a few nanoseconds after the voltage is applied to the diode, the whiskers explode to form cathode flares. The observed diode perveance throughout the remainder of the pulse can be explained in terms of the expansion of the plasma cathode formed by the merger of many cathode flares. Cathode plasma velocities ranged from approximately 2 to 3 cm/microsecond. The observed diode behavior was consistent with that predicted by previous studies of high-voltage vacuum breakdown. 43 Refs.

Primary Keywords: Field Emission Diode; Graphite Cathode; E-beam Generation; Cathode Flare; Plasma Cathode; Diode Perveance
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3513
(BREAKDOWN STUDIES)
(Gas, Electrical)
INHERENT LIMITATIONS IN UNIFORM FIELD DISCHARGE DATA FOR SF/SUB 6/
P.W. Karlsson and A. Pedersen
The Technical University, Lyngby, Denmark
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 4, p 1597-1601 (08/1972).

So-called uniform field discharge data for SF/sub 6/ may be subject to errors caused by the effect of the inherent nonuniformity of the test gap. It is shown that uniform field prebreakdown measurements of ionization and attachment coefficients in SF/sub 6/ require pd values below a few hundred mmHg cm, and that pd must be less than a few thousand mmHg cm to obtain proper uniform field breakdown voltages. 11 Refs.

Primary Keywords: Gas Breakdown; Uniform Field; SF/sub 6/; Field Nonuniformities, Prebreakdown Current; Ionization Coefficient, Attachment Coefficient; Theory
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3524
(BREAKDOWN STUDIES)
(Gas, Corona)
ANTICIPATION OF ELECTRICAL BREAKDOWN OF LONG AIR GAPS
C. Jarvis Hunter and B.A. Tozer
Marchwood Engineering Lab. Southampton, UK
Journal Of Physics D: Applied Physics, Vol. 7, No. 2, pp 383-388 (01/1974).
4 Refs.
Primary Keywords: Point To Plane Gap; Critical Charge Criterion
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3528
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid; Solid, Radiation)
IONIZATION RADIATION EFFECTS IN INSULATORS AND INSULATING PARTS
V.A.J. Van Lint and J.W. Harrity
Gulf Energy And Environmental Systems, Inc., San Diego, CA
IEEE Transactions On Electrical Insulation, Vol. EI-6, No. 3, pp 111-113 (09/1971).

The effects of ionizing radiation on insulator parts are discussed as being the results of four associated phenomena: conduction, charge transfer, space charge buildup, and air ionization. Techniques for estimating these effects under some circumstances of interest are described. 1 Refs.

Primary Keywords: Ionizing Radiation; Conduction; Charge Transfer; Space Charge; Numerical Calculation
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3529
(BREAKDOWN STUDIES)
(Gas, Electrical)
EFFECT OF HUMIDITY ON SPARKOVER OF AIRGAPS UNDER IMPULSE VOLTAGES
T.E. Allibone and D. Dring
Leeds University, Leeds, UK
Proceedings Of The IEE, Vol. 121, No. 3, pp 221-222 (03/1974).

Rod-rod and rod-plane gaps are utilized to study the effects of varying the humidity in a 40 cm gap in this paper. Impulse voltages were used with humidity ranging from 7-27 g/cu m. An approximately linear relation was found between humidity and breakdown voltage. 4 Refs.

Primary Keywords: Air Gap; Rod-rod Gap; Rod-plane Gap; Impulse Voltage, 7-27 g/cu.m. Humidity, Linear Relationship
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3537
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas, Optical; Gas Gaps, Optical)
FORMATION AND GUIDING OF HIGH VELOCITY ELECTRICAL STREAMERS BY LASER INDUCED IONIZATION
D.W. Koopman and K.A. Saum
Versar Inc. Springfield, VA 22151
Journal Of Applied Physics, Vol. 44, No. 12, pp 5328-5336 (12/1973).

The electrical breakdown characteristics of long spark gaps have been modified by laser-induced ionization. The mean velocity of ~500-kV streamers is increased by an order of magnitude, to approximately 1E8 cm/sec, and discharge columns are guided over a straight path in air and other atmospheres, by a 1.06 micron optical beam focused to approximately 1E11 W/sq.cm. Time-resolved studies of the experimental phenomena, together with theoretical models for the evolution of laser induced ionization, indicate that a continuous low-level ionization, rather than the occasional optical breakdown beads along the beam path, is responsible for the observed effects. Analysis of the discharge data and direct measurement of the ionization generated by laser radiation focused to subbreakdown intensities both confirm that positive and negative ion pair densities in the range 1E10-1E11 cm/sup -3/ are responsible for directing and increasing the streamer velocities. Photodetachment of electrons by the luminous streamer tip enhances the streamer propagation. Our model can also be used to interpret previously reported optical influence on electrical breakdown. 31 Refs.

Primary Keywords: Nd glass Laser; Streamer [illegible]; Various Gases, Temporally Resolved, Experiment, Theory, Continuous Low-level Ionization
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3544
(ENERGY CONVERSION, THERMAL)
(Loads)
LOW INDUCTANCE, LOW IMPEDANCE MEGAWATT AVERAGE POWER LOAD
W.J. Wright
ECOM, Fort Monmouth, NJ 07703
Technical rept. No. DELET-TR-78-27, 5p (11/1978).
Availability: AD-A064 824/6ST
NTIS

A compact, low inductance, one-half ohm, one megawatt average power resistive load has been developed to facilitate testing of the MAPS-40 thyratron. The flowing liquid electrolyte system uses the large thermal mass of a storage tank of electrolyte to store the energy which is dissipated through a heat exchanger after the high power run. The electrolyte starting temperature, flow rate, and allowable temperature rise determine the maximum average power into the load; the external and internal spacings and flow uniformity determine the maximum peak power; and flow rate and storage volume determine maximum running time. The load assembly consists of two parallel glass pipes 10.2 centimeters(cm) in diameter and 15.25 cm long. The active volume in each pipe is 6.35 cm long and is contained between electrodes 8.9 cm in diameter. The two sections of the load are electrically in parallel and flowing in series, putting both flow connections at ground potential. The major problem was getting the internal flow pattern uniform to eliminate local boiling and arcing across the bubbles while keeping the pressure drop low and flow high. The calculated inductance of the load assembly is 11 nanohenry(nH), and the structure lends itself to coaxial connections which reduce the overall inductance still further. Material compatibility with the electrolyte will be discussed. (Author) discussed (Author)

Primary Keywords: Dummy Loads(Electricity); Electrical Loads, Pulse Generators, Electrolytes; Bubbles; Electric Arcs; Boiling; Electrical Resistance, High Energy; High Power, Thyratrons
Secondary Keywords: Liquid Resistors; Burst Mode; NTISDODXA

3553
(BREAKDOWN STUDIES)
(Gas, Optical)
OPTICAL FREQUENCY ELECTRICAL DISCHARGES IN GASES
R.W. Minck
Ford Motor Co. Dearborn, MI
Journal Of Applied Physics, Vol. 31, No. 1, pp 252-254 (01/1960).

By focusing the output beam of a giant-pulse laser, electrical discharge phenomena have been observed in air. The purpose of this communication is to present data on breakdown for various gases and to show that the behavior can be predicted by an extension of microwave frequency discharge theory. As with other sparks, a brilliant flash is seen and a sharp sound is heard. The spark is presumably initiated at the focus but quickly grows to a volume several mm in length and 1 mm in diameter. 3 Refs.

Primary Keywords: Ruby Laser; Several Gases; High Pressure; Volume Discharge; Focal Volume; Threshold Power
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3555
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
THE MEASUREMENT OF SHORT-DURATION IMPULSE VOLTAGES
F.C. Creed and M.M.C. Collins
National Research Council, Ottawa, *Ontario, Canada*
IEEE Transactions On Communication And Electronics, Vol. 82, No. 69, pp 621-630 (11/1963).

A description is given of a very-small-impulse voltage divider which is insulated by compressed gas. The divider was designed for the measurement of steep-front impulse waves, and its errors have been evaluated by the step-response method, using a pressurized sphere-gap. It was then used for measuring the volt-time curve of a sphere gap, and *the results have been compared* with those obtained by others. 9 Refs.

Primary Keywords: Shielded Resistance Voltage Divider; Design Considerations, Analysis, Step Response
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3574
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Corona; Electrodes)
CONTROL OF CORONA AND SPARKOVER OF COAXIAL SYSTEMS BY IRRADIATION
R.T. Waters and W.B. Stark
University of Wales Institute Of Science And Technology, Cathays Park, Cardiff
Proceedings Of The IEE, Vol. 120, No. 4, pp 519-522 (04/1973).

The subject of this paper is the breakdown of coaxial systems with small inner conductors (0.315 - 4 cm). The paper begins with a study of the corona and breakdown voltages with variation in the diameters of the inner conductor for DC and AC applied voltages up to 220 kV DC and 130 kV AC. The observation of the breakdown voltage and pre-breakdown corona is presented with probable causes for specific behavior given. The gap between conductors is then irradiated with beta particles to improve the glow discharge characteristics for larger inner conductor diameters. It is found that the breakdown voltage is indeed improved for larger diameter inner conductors due to the onset of glow discharge, which was not observed for large diameters without irradiation. 14 Refs.

Primary Keywords: Corona, Breakdown; Coaxial Line; DC Voltage; AC Voltage, Beta Particles; Improved Breakdown Voltage
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3584
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
INFLUENCE OF ADSORBED GASES ON PREBREAKDOWN CURRENTS IN VACUUM
[illegible]
Fysisch Laboratorium Rijksuniversiteit Utrecht, The Netherlands
Journal Of Physics D: Applied Physics, Vol. 6, No. 12, pp 1455-1465 (08/1973).

It is demonstrated that ions released from adsorbed layers on the anode by field emission electrons change the emitting properties of a well-conditioned cathode, if the current density at the anode is small. If the field emission current density at the anode is greater than 10 A/sq m., as is the case for plane parallel electrodes with the anode as high-voltage electrode, no change could be measured. For point-hemisphere electrodes (for which the field emission current density at the anode is much less than 10 A/sq m.) it is suggested that surface migration as a result of ion bombardment is responsible for the alterations in the emitting properties of the cathode. 10 Refs.

Primary Keywords: Anode Effect, Adsorbed Gases; Cathode Effect, Prebreakdown Current, Plane parallel Gap, Point-hemisphere Gap
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3587
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Optical)
INFLUENCE OF RADIATION ON THE SPARKOVER OF SPHERE GAPS AND CROSSED-CYLINDER GAPS STRESSED WITH IMPULSE VOLTAGES
T. E. Allibone and D. Dring
Leeds University, Leeds, UK
Proceedings Of IEE, Vol. 120, No. 7, pp 815-821 (07/1973).
The authors consider the effects of illumination of sphere-sphere gaps on breakdown characteristics. The effect of voltage polarity, pulse duration, sphere diameter, and gap spacing are studied with and without incident UV and gamma radiation to determine its effect. The main thrust of the experiment is to determine the desirability of irradiating spark gaps to be used as voltage monitors. There are, however, several aspects of the experiment that would be useful to performance of spark gaps as switches. 15 Refs.
Primary Keywords: Sphere-sphere Gap; UV Irradiation, Gamma Irradiation, Variable Diameter; Variable Spacing; Variable Polarity; Breakdown Characteristics
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3588
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Electrodes, Vacuum, Electrical)
LICHTENBERG FIGURES PRODUCED BY HIGH-VOLTAGE DISCHARGES IN VACUUM
P. Graneau
Massachusetts Institute of Technology, Cambridge, MA
IEEE Transactions On Electrical Insulation, Vol. EI-8, No. 3, pp 87-91 (09/1973).
The formation of Lichtenberg figures on aluminum and titanium electrodes covered by oxide and nitride layers while being exposed to high vacuum and 100-kV (rms) 60-Hz voltage is recorded. The observations were made in the course of research on high-voltage vacuum insulation for cryocables. The Lichtenberg figures have several technological implications. They provide evidence for the occurrence of 1) focused ion beams, and 2) tangential discharges in the adsorbed layer of gas on the vacuum side of dielectric coverings on metal conductors. As Lichtenberg figures can only be produced by fast high-voltage pulses, they prove that the discharge duration was short compared with the period of the 60-Hz voltage wave. 7 Refs.
Primary Keywords: Lichtenberg Figure; Aluminum Electrode; Titanium Electrode, High Voltage Pulse, Fast Pulse
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3596
(BREAKDOWN STUDIES)
(Vacuum, Materials)
NOVEL DESIGN FOR ACCURATE ALIGNMENT OF HIGH VOLTAGE ELECTRODES ASSEMBLY
R. Hackam and S.K. Salman
University of Sheffield, Sheffield, UK
Vacuum, Vol. 23, No. 1, pp 9-10 (01/1973).
A design is described which enables the accurate alignment of high voltage plane parallel electrodes used in an ultra-high vacuum assembly. The main features of this design are that it effectively overcomes the eccentricities which are present in both the glass-to-metal graded seal used in the housing envelope and in the linear motion drives employed to vary the gap separation between the electrodes, as well as being relatively simple to fabricate. The present design has been successfully tested in two large chambers at applied voltages of up to 100 kV and at a background pressure of better than 1E-9 Torr. 0 Refs.
Primary Keywords: Electrode Alignment; Parallel-plane Electrodes; E-field Prediction, Breakdown Chamber Design
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3604
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)
TRIGGERING MECHANISM OF A LASER-TRIGGERED SPARK GAP
T. Noguchi (1), M. Yano (1), T. Shimomura (1) and K. Horii (2)
(1) Electrotechnical Lab, Tokyo, Japan
(2) Nagoya University, Nagoya, Japan
Electrical Engineering In Japan, Vol. 92-A, No. 5, pp 27-34 (10/1972).
Trans. From: Denki Gakkai Ronbunshi 92A, 449-456 (October 1972)
There has been an urgent need to develop impulse voltage and large current generators with fast rise time for use in the field of nuclear fusion, and which facilitates the development of high-speed switches. We have investigated the triggering mechanism of the laser-triggered spark gap (LTSG) for use as a high-speed switch. The LTSG is a switch which initiates the breakdown of the gap by generating a laser spark in the gap with an applied voltage lower than the self-breakdown voltage. 18 Refs.
Primary Keywords: Breakdown Mechanism, High Energy Concentration; Detonation Wave, Double Current Pulse; Delay Measurement

3607
(POWER TRANSMISSION)
(Cables)
ADVANCED APPLICATION REPORT HIGH VOLTAGE XLPE INSULATED POWER CABLE WITH SEMI-CONDUCTING ORGANIC LIQUID
T. Shibata, H. Matsuba, K. Nakano and T. Tanabe
The Furukawa Electric Co. Ltd., Tokyo, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 5, pp 1931-1940 (10/1972).
In our previous paper we reported our fundamental study and, to some extent, application to cables of the semiconductive organic liquid which, when mixed in cross-linked polyethylene insulation for cable, deposits on the surfaces of voids in the insulation or between the insulation and the semiconductive layer with the lapse of time and brings about a remarkable reduction in surface resistivity there, thus weakening the electric field within voids and eliminating partial discharges. Furthermore, the voltage-time characteristic curve of the cable with such insulation is more horizontal as compared with that of conventional crosslinked polyethylene insulated cable. We have since continued our study on such semiconductive organic liquid in the process of its application to cable insulation and therefore is stable with very little deviation. The cable insulation containing the semiconductive organic liquid has a higher impulse breakdown voltage and is free from breakdown at low voltages. We also found that its AC voltage breakdown is due not to treeing but to thermal breakdown caused by sharp increase in tan (sigma) near the breakdown voltage. 3 Refs.
Primary Keywords: Cable Insulation; Semi-conducting Organic Liquid; Voids; E-field Reduction; Partial Discharge Reduction
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3609
(BREAKDOWN STUDIES)
(Gas, Electrical)
BREAKDOWN CHARACTERISTICS OF HIGHLY NON-UNIFORM LONG GAPS IN COMPRESSED AIR
T. Takuma, T. Watanabe and K. Kita
Central Research Institute of The Electric Power Industry, Tokyo, Japan
Proceedings Of The IEE, Vol. 119, No. 12, pp 1767-1768 (12/1972).
The authors present data on the breakdown voltage of long (50 cm) compressed air gaps. A rod-plane geometry is used with a square rod utilized. Both polarities are considered with a range of pressures and gap spacings used. Both breakdown voltage and delay data are presented. 0 Refs.
Primary Keywords: Compressed Air Gap; 50 cm Gap, Rod-plane Gap, Square Rod; Corona, Breakdown Path
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3615
(PULSE GENERATORS)
(Trigger)
DOUBLING BREAKDOWN VOLTAGE WITH CASCODED TRANSISTORS
P. T. Uhler
Tinker Air Force Base, Midwest City, OK
Electronics, Vol. 46, No. 1, pp 102 (01/1973).
A method of protecting bipolar transistors when placed in series in power-circuit applications is discussed. The breakdown voltage of the transistors is doubled without the use of costly high-voltage zener diodes by taking a cascode switch approach. 0 Refs.
Primary Keywords: Saturating Cascode Switch; Transistor Saturation, Charge-storage Transient Suppression
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3617
(BREAKDOWN STUDIES)
(Gas, Electrical)
ELECTRICAL BREAKDOWN AND THE SIMILARITY LAW IN SF/SUB 6/ AT EXTRA-HIGH-VOLTAGES
I.M. Bortnik (1) and C.M. Cook (2)
(1) All-Union Institute, Moscow, USSR
(2) Massachusetts Institute of Technology, Cambridge, MA
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 5, pp 2196-2203 (10/1972).
The DC electrical breakdown of SF/sub 6/ gas at extra-high-voltages was studied experimentally in coaxial systems of moderate size. The results were compared to a similarity relationship of electric stress for breakdown based on ionization of the gas. For laboratory-clean systems, theory and experiment agree when the macroscopic gradient does not exceed 150 to 200 kV/cm. If the active area of the stressed electrode is small the law remains accurate for higher gradients. Departures from the law are qualitatively explained by including the electrode surface microstructure in its application. 20 Refs.
Primary Keywords: SF/sub 6/; DC Breakdown In Sulfurhexafluoride, Coaxial System, Similarity Law; Experiment; Theory, Electrode Surface Structure
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3623
(INSULATION, VACUUM)
()
HIGH-VOLTAGE CONDITIONING AT LARGE GAPS IN INDUSTRIAL VACUUM
G.F. Steib (1) and E. Moll (2)
(1) CEA Centre d'Etudes Nucleaires, Saclay, France 92260
(2) Institut Max von Laue-Paul Langevin, France
Journal Of Physics D: Applied Physics, Vol. 6, No. 2, pp 243-255 (01/1973).
The improvement of high-voltage insulation in vacuum by ageing the electrodes is well known. This so-called conditioning effect becomes very important if ultra-high-vacuum techniques cannot be employed in systems with large dimensions. For unbaked surfaces this effect allows one to increase the initial field strength by a factor of about 10. In the present paper, the electrode gaps were variable between 15 and 30 cm. For such gaps, the conditioning and also the deconditioning process which occurs when the high voltage is removed have been studied. An attempt has been made to describe these processes mathematically, and to understand the mechanism involved. The results are compatible with the hypothesis that these effects are due to a change in the adsorbed gas layer; that is, a change in the work function of the electrode material. 26 Refs.
Primary Keywords: Vacuum Insulation; Conditioning; Breakdown Voltage Increase; Deconditioning; Experiment; Theory; Modeling
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3626
(BREAKDOWN STUDIES)
(Gas, Electrical)
IMPULSE BREAKDOWN OF LARGE SPHERE-PLANE GAPS
J. K. Harworth, P. C. Klewe and B. A. Tozer
Marchwood Engineering Lab, Southampton, UK
Proceedings Of The IEE, Vol. 119, No. 12, pp 1751-1753 (12/1972).
The authors present a comparison of sphere-plane and rod-plane, long air gaps. Sphere diameters of 25-75 cm, a 12.5 mm square cut rod, and gap distances of 75 to 100 cm place these gaps in the region between the uniform field gaps and highly divergent field gaps usually studied. Plots of current vs time are presented for several gap parameters. 5 Refs.
Primary Keywords: Long Air Gap, Sphere-plane Gap, Rod-plane Gap; Air Gas; Temporal Current Resolution
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3631
(BREAKDOWN STUDIES)
(Gas, Electrical)
MEASUREMENT OF THE ENERGY RELEASED IN NANOSECOND ELECTRIC SPARKS
L. Johnsson, K. Strid and S.R. Johansson
Swedish Match Co, Jonkoping, Sweden
Combustion Science And Technology, Vol. 5, pp 1-6 (01/1972).
The energy released in a spark is studied by the authors. A pulse traveling down a transmission line is used to initiate a spark. The energy reflected back down the transmission line is analyzed to infer the energy dissipated in the spark. A method of calculating the energy dissipated without resorting to calculating instantaneous power is presented. 4 Refs.
Primary Keywords: Spark Breakdown, Energy Dissipated, Transmission Line; Reflected Energy; Analytical Calculation
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3633
(INSULATION, MATERIAL)
(Solid)
MECHANISM OF SURFACE CHARGING OF HIGH-VOLTAGE INSULATORS IN VACUUM
C.M. De Tourreil and K.D. Srivastava
University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-8, No. 1, pp 17-21 (03/1973).
In vacuum, the surface of insulators becomes electrically charged when subjected to high-voltage stresses. The charging mechanism is described. A model simulating the charging shows that the surface charge densities are proportional to the applied voltage and depend on the secondary electron emission of the dielectric surface. It is also time dependent. Surface charges are shown to explain many results obtained in studies of insulator surface breakdown. 10 Refs.
Primary Keywords: Insulator Charging; Secondary Emission; Incidence Angle; Simulation; Numerical Calculation

3634
(BREAKDOWN STUDIES)
(Gas, Electrical)
NANOSECOND BREAKDOWN IN HEXANE
J.A. Bell, R.R. Rogers and A.H. Guenther
AFWL, Kirtland AFB, NM 87117
IEEE Transactions On Electrical Insulation, Vol. EI-7, No. 2, pp 78-83 (06/1972).
The electrical breakdown of hexane was investigated using nanosecond duration high-voltage pulses. An attempt was made to experimentally isolate the formative time lag contributions of the two major breakdown mechanisms: electron avalanche and streamer processes. The electrode area was kept constant at 2.85 sq.cm. throughout the study, and time resolution was on the order of 0.5 ns. The gap spacing and the applied field were varied in a highly controlled manner. A series of breakdown events were studied for gap spacing ranging from 0.07 to 0.41 cm with selected constant field strengths from 0.8 to 1.6 MV/cm. The results obtained indicate that the streamer mechanism is the dominant process in the breakdown of hexane and the average velocity of propagation is on the order of 1E7 cm/s for the fields and gap spacings used in this study. 20 Refs.
Primary Keywords: Formative Time Lag; Avalanche, Streamer; Very High Field Strength

3636
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
OPTICAL KERR CONSTANT MEASUREMENT IN SOME LIQUIDS AND GLASSES
B. Lacour and J.P. Pocholle
Centre de Recherches, Compagnie Generale d'Electricite, Marcoussis, France
IEEE Journal Of Quantum Electronics, Vol. QE-8, No. 5, pp 456-457 (05/1972).
We have measured the optical Kerr constant of two glasses and two liquids, namely phosphoryl chloride and toluene. We find that the nonlinear indices n/sub 2/ are of same order of magnitude in glass and phosphoryl chloride. 7 Refs.
Primary Keywords: Kerr Constant; Phosphoryl Chloride; Toluene; Two Glasses; Glass Laser; 45 Deg. Incident Polarization

3638
(BREAKDOWN STUDIES)
(Liquid, Electrical)
PREBREAKDOWN PROCESSES IN ELECTRICALLY STRESSED INSULATING LIQUIDS
B. Singh, W.G. Chadband, C.W. Smith and J.H. Calderwood
University of Salford, Salford, UK
Journal Of Physics D: Applied Physics, Vol. 5, No. 8, pp 1457-1464 (08/1972).
It has previously been reported that a spray originates from high-voltage point electrodes in n-hexane. This paper is concerned with more detailed investigation of that spray. Although it is more readily observed if the point electrode is negative, it can also be seen when the point is positive provided that the gap length is adequate. The distribution of spray in the gap of a point-plane system is approximately conical. The apex of the cone is about 60 Deg. for a negative point and 120 deg. for a positive point. The spray appears to consist of bubbles which cross the gap with a velocity of the order of metres per second, and which have grown to become about 15 microns in diameter by the time they reach the plane electrode. Their size at the point electrode is not directly measurable but has been found to be an order of magnitude less by light-scattering measurements. The onset of the spray coincides with the appearance of corona at the tip of the point electrode, and the spray onset voltage is a function of the radius of the electrode tip. An account is given of some of the complex processes which seem to govern breakdown processes in insulating liquids. 23 Refs.
Primary Keywords: Prebreakdown Current; N-hexane; Point Electrode; N-hexane Spray; Cathode, Corona

3639
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
PRECISION CAPACITIVE VOLTAGE DIVIDER FOR IMPULSE VOLTAGE MEASUREMENTS
A.J. Schwebb and J.H.W. Pagel
University of Karlsruhe, Karlsruhe, FRG
IEEE Transactions On Power Apparatus And Systems, Vol. 91, No. 6, pp 2376-2382 (12/1972).
This paper describes a precision capacitive voltage divider for impulse voltage measurements. The main feature of the new divider is a compressed-gas capacitor in the high-voltage arm. The divider is insensitive to environmental influences, possesses outstanding high-frequency properties, and causes little loading of the high-voltage circuit. Its excellent linearity and stable ratio permit meaningful high-voltage pulse measurements in the megavolt range. 14 Refs.
Primary Keywords: Capacitive Voltage Divider; Compressed Gas Capacitor; Good Linearity; Megavolt Voltages

3641
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
RECENT REFINEMENTS AND DEVELOPMENTS IN KERR SYSTEM ELECTRICAL MEASUREMENT TECHNIQUES
E.C. Cassidy (1), W.E. Anderson (1) and S.R. Booker (2)
(1) National Bureau of Standards, Washington, DC 20234
(2) Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Instrumentation And Measurement, Vol. IM-21, No. 4, pp 504-510 (11/1972).
Kerr system electrical measurement techniques are improved by progress in two important areas: 1) in the development of methods for visualizing and measuring pulsed (microsecond) electric fields and high voltages from time-varying electrooptical fringe patterns recorded using high-speed photographic techniques, and 2) in the development of convenient experimental methods for evaluating and correcting path-dependent errors in Kerr system response. Results demonstrate use of fringe-pattern measurements in achieving accurate pulse voltage measurements and in correction of errors resulting from sizeable end-field variations in existing 300-kV Kerr cells. 4 Refs.
Primary Keywords: Kerr Effect; Electric Field Measurement, Error Analysis; Error Correction; Streak Camera

3644
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Electrical; Gas Gaps, Self)
SPARK GAPS CAN SWITCH AS WELL AS PROTECT
M. Distefano
General Instrument Corp, Neptune, NJ
Electronics, Vol. 45, No. 15, pp 94-95 (07/1972).
Possible applications of the spark gap as a high-energy, voltage-sensitive switch are discussed. Considered are load protection circuits, flash tube triggering circuits, crowbar protection circuits, and high voltage Marx generators. Important parameters and characteristics of the spark gap are examined. 0 Refs.
Primary Keywords: Low Voltage; Arc Mode; Short Duty; Triggered Spark Gap; Self-breaking Spark Gap

3646
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SPECIAL SPARK-GAP SWITCHES FOR USE IN SYNTHETIC TEST CIRCUITS
N.S. Ellis, W.T. Lugton, C.W. Powell and H.M. Ryan
A. Reyrolle & Co. Ltd., Hebburn, County Durham, UK
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 5, pp 2020-2025 (10/1972).
In technology concerned with proving the performance of modern high-power circuit-breakers, special spark-gap switches have been developed to meet the specific requirements of 'break' and 'make-break' synthetic circuits, the former operating up to equivalent three-phase test levels of 30 G.V.A. This paper describes the design, performance characteristics and operating experiences for two types of specialized triggered switches incorporated in the Synthetic test circuits of the Reyrolle Short-Circuit Testing Station. 6 Refs.
Primary Keywords: Plasma-jet Trigger; Spinner Electrode Switch; Large Voltage Range; High Reliability; Air Blast Gaps

3647
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
SUBNANOSECOND HIGH VOLTAGE ATTENUATOR
H.D. Sutphin
Los Alamos National Labs, Los Alamos, NM 87545
Review Of Scientific Instruments, Vol. 43, No. 10, pp 1535-1536 (10/1972).
A high voltage attenuator has been developed and tested that is capable of maintaining pulse rise times of less than 300 psec. Pulse amplitudes to 5 kV may be attenuated by a factor of 16, allowing the use of high speed, lower voltage commercial attenuators for reduction of the pulses to oscilloscope levels. The mechanical and electrical design maintains an impedance of 50 ohm. 2 Refs.
Primary Keywords: Resistive Voltage; Coaxial Configuration; Compensated; Subnanosecond Rise Time

3648
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
SWITCHING JITTER IN SPARK GAP TRIGGERED BY A TEM/SUB 00/-MODE MODE-LOCKED RUBY LASER
D. Milam, C.C. Gallagher, R.A. Bradbury and E.S. Bliss
AFCRL, Bedford, MA 01730
The Review Of Scientific Instruments, Vol. 43, No. 10, pp 1482-1484 (10/1972).
The first study of jitter in a laser triggered spark gap switched by pulse trains from a mode-locked ruby laser is described. The spark gap was fired by producing gas breakdown in a high pressure argon nitrogen mixture between the pole pieces. Jitter was measured as a function of the position of the lens used to focus the laser beam and as a function of the ratio of the applied voltage to the self-breakdown voltage of the gap. Jitter values of less than 2 nsec were obtained under optimum conditions provided that the gap was fired by the early part of the pulse train. 10 Refs.
Primary Keywords: Ruby Laser; Argon-nitrogen Gap; Focal Plane Position Variation; Applied Voltage Variation; Jitter Measurement

3649
(INSULATION, MATERIAL)
()
SYNTHETIC PAPER FOR EXTRA HIGH VOLTAGE CABLE
T. Yamamoto, S Isshiki and S. Nakayama
The Fujikura Cable Works, Ltd.
IEEE Transactions On Power Appartus And Systems, Vol. PAS-91, No. 6, pp 2415-2426 (12/1971).
Extra high OF cables insulated by synthetic paper exclusively made of synthetic polymer were developed. It has been proved that the synthetic paper, given a structure similar to conventional paper, showed more favorable electric and physical characteristics and oil resistance, thus solving problems of extra high OF cables using films for insulation. This improvement is due to a structure having minute pores. This report develops considerations on this point. Trial OF cables with the synthetic paper for insulation were produced and tested on their characteristics; the measured results were satisfactory. Heating tests by loading power were conducted on its model samples. The test results showed that the synthetic paper is superior over the kraft paper as the insulator because of better heat resistance of its component polymers. 9 Refs.
Primary Keywords: Synthetic Kraft Paper; Artificial Fiber; Polymer Material

3656
(POWER CONDITIONING)
(Pulse Forming Lines)
A TRANSMISSION LINE CIRCUIT FOR RELIAPLE SPARK GAP OPERATION
C L M. Ireland
University College of Swansea, Singleton Park, Swansea, Wales
The Review Of Scientific Instruments, Vol. 43, No. 9, pp 1378-1379 (09/1972).
The common transmission line circuits employed to enable a fast laser triggered spark gap to switch an optical cell are discussed. A modification is suggested that leads to a more reliable operation of the gap. 5 Refs.
Primary Keywords: Laser Triggered Spark Gap; Two Circuits; Pulse Shaping
Secondary Keywords: Laser Light Pulse Shaping

3676
(BREAKDOWN STUDIES)
(Gas, Electrical)
INFLUENCE OF CORONA DISCHARGES ON THE BREAKDOWN VOLTAGE OF AIRGAPS
K. Feser
Haefely Ltd, Basel, Switzerland
Proceedings Of The IEE, Vol. 118, No. 9, pp 1309-1313 (09/1971).
The authors consider the role of corona in the variation of breakdown voltage in rod-rod and rod-plane air gaps. The breakdown characteristics for several gap spacings are observed, along with the predischarge corona in each case. An attempt is made to separate the contribution of corona to breakdown for several waveshapes of both polarities. 20 Refs.
Primary Keywords: Breakdown Voltage; Rod-rod Gap; Rod-plane Gap; Pre-breakdown Corona; Effect On Breakdown

3686
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
PULSED LASER KERR SYSTEM POLARIMETER FOR ELECTRO-OPTICAL FRINGE PATTERN MEASUREMENT OF TRANSIENT ELECTRICAL PARAMETERS
E.C. Cassidy
National Bureau of Standards, Washington, DC 20234
The Review Of Scientific Instruments, Vol. 43, No. 6, pp 886-893 (06/1972).
Novel electro-optical fringe pattern methods are developed for measurement of transient high voltages and electric fields. Several techniques employing the Kerr effect, a pulsed laser source, and high speed photographic recording equipment are described. Typical fringe pattern results are compared with conventional resistive divider measurements. 13 Refs.
Primary Keywords: Impulse Voltage Measurement, Kerr Effect; Crossed Polarizers

3688
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Vacuum, Magnetic Field)
REDUCTION OF SPARKING VOLTAGES DUE TO A MAGNETIC FIELD PARALLEL TO THE AXIS OF ROD ELECTRODES
M J. Rofoid and M.V. Cleva
Boeing Aerospace Co, Seattle, WA 98124
Journal Of Applied Physics, Vol. 42, No. 13 pp. 5392-5394 (12/1971)
Round-rod electrodes with flat ends were aligned with the axis of a glass vacuum chamber. They were completely insulated by close-fitting glass except for the 1.0-cm-diam ends which faced each other to form a 2.5-cm-long spark gap. Sparkover voltage tests were made at 5 and/or 40 micron in Ar, Ne, He, N/sub 2/, and air. An unexpected dramatic and sudden decrease in sparkover voltage occurred in all gases when a modest steady uniform magnetic field was applied parallel to the axis of the electrodes. 4 Refs.
Primary Keywords: Breakdown Voltage Reduction; Parallel Magnetic Field

3689
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
RESISTOR DIVIDER WITH DIVIDING ELEMENT ON HIGH VOLTAGE SIDE FOR IMPULSE VOLTAGE MEASUREMENTS
T. Harada (1), Y. Aoshima (1) and T. Itami (2)
(1) Central Research Institute of The Electric Power Industry, Tokyo, Japan
(2) Shikoku Electric Power Co., Takamatsu, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 3, pp 1407-1414 (06/1971)
The response characteristics of a resistor divider with dividing element on high voltage side were investigated theoretically and experimentaly. As the results, it was revealed that it could be realized a divider having an excellent response characteristic by this method. 3 Refs.
Primary Keywords: Resistive Divider; Floating Ground; Stray Capacitance; Experiment; Theory

3691
(BREAKDOWN STUDIES; DIAGNOSTICS AND INSTRUMENTATION)
(Gas, Electrical; Miscellaneous)
SPECTROSCOPIC INVESTIGATION OF THE SPARK CHANNEL
M.M. Kekez, M.R. Barrault and J.D. Craggs
University of Liverpool, Liverpool, UK
Journal Of Applied Physics, Vol. 5, pp 253-265 (07/1971).
The different processes involved during the formation of spark discharges in hydrogen have been studied by the use of a spectrophotographic method. The voltage collapse across the gap during what is described as the second glow phase has been computed for a simple model, and good agreement between this and experimental results was found over a wide range of the experimental conditions. 19 Refs.
Primary Keywords: Spark Channel; Voltage Fall; Formative Time Lag; Experiment; Theory

3698
(SWITCHES, CLOSING)
(Gas Gaps, Materials)
ENERGY DISSIPATION AND ELECTRODE EROSION IN ARCS
H.G. Heard
Levinthal Electronic Products, Inc., Palo Alto, CA
Interim Report Prepared Under AFCRC Contract No. AF 19(604)-1856 (10/1956).
Availability: AD 117031
NTIS
A survey is made of the mechanisms of energy dissipation and electrode erosion in the DC and in the transient arc discharge at atmospheric pressure and in high vacuum. Loss of electrode material is shown to be due to electrochemical and electrokinetic processes. The scope of the report is confined to electrochemical and electrokinetic processes. It is concluded that erosion from the anode is due to evaporation whereas erosion from the cathode may be due to direct sublimation as well as evaporation. It is proposed that the onset of electrode erosion is governed by the thermodynamics of the evaporation process. This model predicts that electrode erosion is a threshold phenomenon. Appreciable erosion is expected only when the mechanism of the electric arc produces a net energy in excess of the heat of vaporization of the material. If the net energy released at the electrode is less than this value, the model predicts negligible erosion. Recommendations are included which are expected to reduce the rate of erosion in a spark gap. If the erosion rate cannot be reduced, the useful life of the spark gap may be extended by methods outlined herein. 98 Refs.
Primary Keywords: Electrode Erosion; DC Arc; Impulse Arc; Electrochemical Process; Electrokinetic Process; Evaporation; Sublimation; Electrode Life Extension

3699
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Vacuum Gaps, Self; Vacuum, Electrical)
AC (50 HZ) AND DC ELECTRICAL BREAKDOWN OF VACUUM GAPS AND WITH VARIATION OF AIR PRESSURE IN THE RANGE 1E-9-1E-2 TORR USING OFHC COPPER, NICKEL, ALUMINUM, AND NIOBIUM PARALLEL PLANAR ELECTRODES
R. Hackam and L Altcheh
University of Sheffield, Sheffield, UK
Journal Of Applied Physics, Vol. 46, No. 2 (05/1974).
Breakdown potentials of vacuum gaps are measured over a wide range of air pressure using both direct and alternating applied voltage and employing four different electrode materials. The air pressure is varied in the range 2E-9 - 2.5E-2 Torr for DC and 6E-7 - 2.5E-2 Torr for AC applied voltage. OFHC copper, nickel, aluminum, and niobium are used to fabricate the electrodes. It is found that the peak AC breakdown voltage is usually higher than the DC voltage for a fixed electrode separation and a fixed gas pressure. Under certain conditions considerable improvement in the insulating property of the gap can be obtained in semivacuum. The improvement in the breakdown voltage of the gap is considerable and can reach up to 62% in some cases. The higher breakdown voltage is attributed to the increased work function of the metal-gas adsorbate system. 62 Refs.
Primary Keywords: Vacuum Gap; Breakdown; DC Breakdown; AC Breakdown; Several Electrode Materials; Variable Electrode Separation

3700
(BREAKDOWN STUDIES)
(Lightning)
ARTIFICIAL INTIIATION OF LIGHTNING DISCHARGES
M. Brook (1), G. Armstrong (2), R.P.H. Winder (3), B. Vonnegut (4) and C B. Moore (4)
(1) New Mexico Institute of Mining and Technology, Socorro, NM
(2) Museum Of Science, Boston, MA
(3) Office of Naval Research, Boston, MA
(4) Arthur D. Little, Inc., Cambridge, MA
Journal Of Geophysical Research, Vol. 66, No. 11 pp. 3967-3969 (11/1961)
It was found that small currents of several milliamperes flow through a wire suspended beneath a storm creating an electric field that shields it from the lightning. Experiments were then performed in which a rapidly introduced wire caused a discharge from a Van de Graaf generator. The authors then theorized that a wire introduced rapidly beneath a storm might artificially cause a discharge. 2 Refs.
Primary Keywords: Lightning Initiation; Space Charge Neutralization; Piano Wire
Secondary Keywords: Rockets

3701
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid, Vacuum; Electrical)
AUTOMATED PARTIAL-DISCHARGE TESTING OF TRAVELING-WAVE TUBES
K.W. Perchen and F. Hai
Aerospace Corp, El Segundo, CA 90245
AFSC Report No. SD-TR-81-38 (05/1981).
Availability: AD A099379
NTIS
A test system is described that is used in the Materials Sciences Laboratory to evaluate the quality of high-voltage insulation in traveling-wave tubes. Evaluation is performed by quantitatively recording the occurrence of partial discharges during temperature cycling in vacuum for extended periods. 0 Refs.
Primary Keywords: Corona; High-Voltage Test; Partial Discharge
Secondary Keywords: Automation; Traveling-Wave Tubes

3702
(PULSE GENERATORS; ENERGY STORAGE)
(Systems; Systems)
CONCEPTS STUDY FOR NANOSECOND RISETIME MULTI-MEGAJOULE IMPULSE POWER SYSTEMS

D. Holder
Army Missile Command, Redstone Arsenal, AL 35809
Technical Report No. RG-75-52 (06/1975).
Availability: AD A014985
NTIS

This report considers the concepts, techniques, and limitations of means for controlling the flow of extremely high electric currents and the production of very rapid rates of change of current through a load. Circuit-opening, and circuit-closing switches as well as a combination of the two for switching a source into a load are considered. 14 Refs.
Primary Keywords: Closing Switches; Opening Switches; Exploding Wire; Restrike; Spark Gap; Resistive Phase; Capacitive Energy Storage; Inductive Energy Storage
Secondary Keywords: Crossed-field Switch

3703
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
CONCEPTUAL ENGINEERING DESIGN OF A ONE-GJ FAST DISCHARGING HOMOPOLAR MACHINE FOR THE REFERENCE THETA-PINCH FUSION REACTOR

K.I. Thomassen
Los Alamos National Labs, Los Alamos, NM 87545
EPRI Report No. EPRI ER-246 (08/1976).
Availability: EPRI ER-246
EPRI

The design of a fast discharging homopolar machine (30 ms) storing 1.3 GJ of energy is described. Electrical, mechanical, and thermal considerations are included. The machine is designed to operate reversibly into an inductive load, with a 95% cycle efficiency. Other fusion applications of this type of machine are also described. 43 Refs.
Primary Keywords: Design Considerations; High Efficiency; Applications

3704
(POWER CONDITIONING)
(Pulse Transformers)
DEVELOPMENT OF A 3 MV PULSE TRANSFORMER

G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND79-0813 (05/1979).
Availability: SAND79-0813
NTIS

This report describes a 3 MV transformer designed for charging high voltage pulse forming transmission lines. The transformer is an air core spiral strip design which incorporates ring cage shielding to control edge breakdown in the secondary winding. The physical features of the transformer are described along with its electrical characteristics and the operational results. 8 Refs.
Primary Keywords: Pulse Transformer; Pulse Forming Network; Small Size; Multimegavolt
Secondary Keywords: Capacitor Bank; Spark Gap

3705
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Vacuum Gaps, Self; Vacuum, Electrical)
EFFECTS OF ELECTRODE CURVATURE, DISTANCE FROM GLASS INSULATOR, AND ADDITION OF HYDROGEN ON FIELD-EMISSION CURRENTS AND BREAKDOWN VOLTAGE IN VACUUM

R. Hackam and S.K. Salman
University of Sheffield, Sheffield, UK
Journal Of Applied Physics, Vol. 45, No. 10 pp 4384-4392 (10/1974).
Measurements of the prebreakdown currents have been made for highly polished stainless-steel electrodes in an ultrahigh vacuum at 1E-9 Torr as a function of electrode separation in the range 0.5-3.81 mm. Three sets of electrodes are employed to investigate the dependence of the prebreakdown current on the radius of curvature of the electrodes and the electrodes-insulator distance. The breakdown potentials is measured in UHV gaps over the gap length range 0.25-4.57 mm and in hydrogen, in the pressure range 1 x 1E-9-1.5 x 1E-2 Torr, over the gap length range 0.35-2.16 mm. It has been found that the breakdown voltage, the electric field enhancement factor, and the prebreakdown current are independent of electrode-glass-insulator distance in the range 1-12.65 mm for a fixed gap length and a fixed radius of curvature of the electrodes. On the other hand, increasing the radius of curvature of the edge of the flat electrodes, at a fixed gap length, results in (i) large increases in the prebreakdown currents, (ii) increase in the electric field enhancement factor, the cathode, and (iii) a decrease in the breakdown voltage. The addition of hydrogen causes an increase in both the prebreakdown currents and the field enhancement factor, at a fixed gap distance. 67 Refs.
Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Electrode Geometry; Ultrahigh Vacuum
Secondary Keywords: Stainless Steel; Electrons

3706
(SWITCHES, CLOSING; SWITCHES, OPENING; BREAKDOWN STUDIES)
(Gas Gaps, Materials; Gas Gaps, Materials, Electrodes)
ELECTRODE PHENOMENA IN A HIGH CURRENT, DC-NANOSECOND SPARK

H. Fischer and C.C. Gallagher
AFCRL, Bedford, MA 01730
Applied Optics, Vol. 6, No. 12 pp 2176-2178 (12/1967).
Directed flares from the anode of a 0.85 mm gap in 1 atm of air appear to be a type of explosive erosion, appearing after current cutoff. A kerr cell is used to observe the initial electrode processes. The development of the spark channel and the related afterglow are also discussed. 11 Refs.
Primary Keywords: Electrode Erosion; Metal Vapor Jets; Optical Phenomena; Twenty Nanosecond Duration

3707
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Vacuum Gaps, Electrical; Vacuum Gaps, Materials)
FIRING CHARACTERISTICS OF A TRIGGERED VACUUM GAP EMPLOYING DIELECTRIC COATED WITH A SEMICONDUCTING LAYER

G.R. Govinda Raju, R. Hackam and F.A. Benson
University of Sheffield, Sheffield, UK
Journal Of Applied Physics, Vol. 48, No. 3 pp 1101-1105 (05/1976).
Some electrical properties of a triggered vacuum gap incorporating five different dielectric materials coated with a semiconducting layer to produce a low surface resistance are studied. The dielectric materials used are high-alumina ceramic, steatite ceramic, barium titanate, silicon carbide, and boron nitride. It has been found that the probability of firing and the time delay to firing generally decreases with an increase of both the trigger energy and the trigger voltage until saturation is reached. The minimum trigger voltage for successful firing is about 300 V for all substrates except for barium titanate which is higher at 700 V. The higher trigger voltage in the case of barium titanate is attributed to the difficulty of coating this material evenly with the particular semiconducting layer used of colloidal solution of aquadag carbon. A new method is described to rejuvenate a TVG which ceased to operate by applying a keep-alive direct current superimposed on the trigger pulse voltage. A mechanism responsible for this phenomena is also discussed. 10 Refs.
Primary Keywords: Triggered Vacuum Gap, Multiple Dielectrics; Semiconductor Coating; Aquadag Copper Electrodes
Secondary Keywords: Reliability

3708
(PARTICLE BEAMS, ELECTRON)
(Reviews)
HIGH POWER RELATIVISTIC ELECTRON BEAMS IN PLASMA AND IN VACUUM

B.N. Breizman and D.D. Ryutov
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Sandia Report No. SAND-74-6022 (01/1975).
Trans. From: Preprint 179-74 By P. Newman
Availability: SAND-74-6022
NTIS

In this review the authors discuss the possibilities of using high power relativistic electron beams for plasma heating in open systems. We shall consider the following three groups of questions: 1. Beam transport in a vacuum in a strong magnetic field, equilibrium, stability, and critical beam currents in vacuum. 2. Beam transport in plasma: charge and current neutralization of the beam; plasma heating by a reverse current, macroscopic beam instabilities in plasma. 3. Theory of collective beam relaxation in plasma, including quasi-linear and nonlinear relaxation models; the role of plasma instability; macroscopic effects during beam relaxation. The review encompasses results published up to September 1973. 71 Refs.
Primary Keywords: Relativistic Electron Beam; Beam-Plasma Interaction; Vacuum Transport; Critical Beam Current
Secondary Keywords: Instabilities; Relaxation

3709
(INSULATION, MATERIAL)
(Liquid)
INFLUENCE OF SPECIMEN SIZE ON THE DIELECTRIC STRENGTH OF TRANSFORMER OIL

W.R. Bell
University of Newcastle Upon Tyne, Newcastle Upon Tyne, UK
IEEE Transactions On Electrical Insulation, Vol. EI-12 No. 4 pp 281-292 (08/1977).
The results of some specimen size effect experiments on technical grade transformer oil are reported. Four electrode areas (1.77, 8.19, 37.9 and 177 sq.cm.) and four gap spacings (0.215, 0.464, 1.0 and 2.15 mm) were investigated using a fast ramp 5 x 1E12 V. cm/sup -1/ sec/sup -1/) and an AC ramp (12 kV.cm/sup -1/ sec/sup -1/). Whilst the results are in general agreement with weak link theories, it is suggested that physical specimen size factors play a significant part. Examples of physical size factors are spark conditioning, electrode profile, and liquid motion. 18 Refs.
Primary Keywords: Dielectric Strength; Transformer Oil; Specimen Size Influence; Uniform Field, Plane Electrodes; Parallel Electrodes; Electrode Effects

3710
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas Gaps, Materials; Gas Gaps, Materials)
INVESTIGATION OF THE EROSION PHENOMENA IN HIGH CURRENT, HIGH PRESSURE GAS DISCHARGES

J.E. Gruber and R. Suess
Inst fur Plasmaphysik, Garching, FRG
IPP Report No. IPP 4/72 (12/1969).
Erosion, resulting from discharges whose total current is between 1 and 20 coulombs, is measured for electrode gaps of 1.5 mm and 13 mm and for pressures from 1 to 5 atm at a gap separation of 1.5 mm. Pressure was found to have no effect on the electrode erosion whereas the gap distance did. Experiments were done for Aluminum, Brass, Stainless Steel, Molybdenum, Tungsten and Tungsten-Copper electrodes. 0 Refs.
Primary Keywords: Electrode Erosion; Parallel Electrodes; Small Charge Conductors; Variable Gap Width; Several Electrode Materials

3711
(PULSE GENERATORS)
(Hard-tube)

AEGIS AN/SPY-1 CFA CONSTANT-CURRENT HARD-TUBE MODULATOR

K.M. Smalley
Raytheon Co., Wayland, MA 01778
IEEE 1973 Eleventh Modulator Symposium pp.68-74 (09/1973).

This paper describes a modulator employing four switch tubes each supplying a crossed-field amplifier tube operating at 13 KV and 22 amperes peak. Separate modified 4CX5000R tetrode switch tubes for each CFA, operating in the constant-current mode, allow a 25:1 reduction in the size of the filter capacitor bank required to limit droop and ripple. Constant-current operation also permits an individual CFA to arc without affecting operation of the other three CFA's. Continued arcing of a CFA causes a circuit to close a vacuum relay, shorting out the malfunctioning CFA until it can be replaced, still without shutting down the modulator. Only one switch tube driver employing paralleled 4CPX250K tetrodes is required, as a tapped zener string allows individual setting of switch tube grid drive voltages. No floating power supplies are required, as the zener string and the switch tube driver screen and grid-bias voltages are obtained from the bleeder for the switch tube bias supply. Other features of this compact modulator are a shunt clamp regulator with switch tube screen voltage compensation, automatic switch tube driver current reduction after pulse rise times, pulse-width limiting, and remote location of HVPS filter banks. 0 Refs.

Primary Keywords: Hard-tube Modulator; Crossed-Field Amplifier; Low Ripple; High Reliability; Constant Current

3712
(BREAKDOWN STUDIES)
(Liquid, Optical)

MULTIPHOTON FRAGMENTATION AND IONIZATION

M.B. Robin
Bell Labs, Murray Hill, NJ 07974
Applied Optics, Vol 19, No. 23 pp 3941-3947 (12/1980).

The paper presents a study of the multiphoton fragmentation and ionization of acetaldehyde. A model of the kinetics of this ionization and fragmentation is discussed, as is the effects of postresonant processes on the polarization ratio and the power laws of ionic fragments. 13 Refs.

Primary Keywords: Multiphoton Ionization; Multiphoton Fragmentation; Power Laws; Polarization Ratio

3713
(SWITCHES, CLOSING)
(Thyristors)

NANOSECOND SWITCHING OF HIGH POWER LASER ACTIVATED SILICON SWITCHES

O.S. Zucker (1), J.R. Long (1), V.L. Smith (1), D.J. Page (2) and J.S. Roberts (2)
(1) Lawrence Livermore Lab, Livermore, CA 94550
(2) Westinghouse Electric Corp, Pittsburgh PA
LLL Report No. UCRL-77449 (11/1975)
Availability: UCRL-77449
NTIS

Light activated multilayered silicon semiconductor devices have been used to switch at Megawatt power levels with nanosecond turnon time. Current rate of rise of 700 kA/ns at 10 kA, with 1 kV across the load have been achieved. 3 Refs.

Primary Keywords: Thyristor, Switch Characterization; Light Activated Silicon Switch, Switching Speed

3714
(PULSE GENERATORS)
(Systems)

SHIVA ELECTROMAGNETIC IMPLOSION X-RAY SOURCE

J.H. Degnan, W.L. Baker, M.C. Clark, J.F. Kiuttu, C.R. McClenahan and R.E. Reinosvky
AFWL, Kirtland AFB, NM 87117
AFWL Report No. AFWL-TR-77-252 (05/1978).
Availability: AD A061884
NTIS

The generation of pulsed high energy density plasmas by electromagnetic implosion of cylindrical foils has been investigated experimentally and theoretically at the Air Force Weapons Laboratory. The experimental studies involve discharging a 1.3 microsecond, 1.1 megajoule capacitor bank through 5 cm radius, 2 cm tall, 3 to 30 mg cylindrical foil liners. Typical discharge parameters are 7 to 10 MA peak current and 1-1.5 microsecond current rise time. Current and voltage waveforms indicate strong coupling of the load to the capacitor bank, and analysis of the waveforms indicates good implosion of the current sheath. Optical and magnetic probe measurements are consistent with [illegible] to 2 cm thickness of the imploding plasma shell and with final implosion velocities of approximately 15 to 20 cm/microsecond. Radiation diagnostic measurements indicate ultrasoft x-ray yields of approximately [illegible] to [illegible] with the FWHM of the photon pulse being approximately 60 to 170 ns. The radiation data are consistent with a [illegible] black body spectrum containing most of the energy, with additional higher temperature and optically thin spectral components. The [illegible] and [illegible] line and recombination radiation is frequently observed. Comparison of electrical, magnetic, and radiation data with one dimensional magnetohydrodynamic and two dimensional magnetohydrodynamic calculations is presented. The prospects for improving the present energy source and scaling to larger sources are discussed. 23 Refs.

Primary Keywords: Electromagnetic Implosion; Imploding Liner; Cylindrical [illegible]; [illegible] Magnetic Probe; [illegible]

Secondary Keywords: [illegible]

3715
(BREAKDOWN STUDIES)
(Electrodes)

SPACE-CHARGE INJECTION: A NEW TECHNIQUE FOR STUDYING NONUNIFORM FIELD BREAKDOWN [illegible]

R.C. Kleve, M.B.C. Quigley and [illegible]
Marchwood Engineering [illegible]
Applied Physics Letters, Vol. 15, No. 6, pp 155-156 (09/1969).

The pulse of a Q [illegible] laser operated below the threshold for spark formation and [illegible] gap can profoundly affect the development [illegible] effect can be strongly [illegible] by the application of a [illegible] V/mm) DC field across the gap. W[illegible] and a negative DC field, a change of [illegible] in the delay time between charge injection and [illegible] of the voltage [illegible] can change the probability of gap [illegible] from [illegible] to greater than 90%. 8 Refs.

Primary Keywords: [illegible] Spark Formation; Threshold [illegible]

3716
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

SPECIAL SHIELDED RESISTOR FOR HIGH-VOLTAGE D-C MEASUREMENTS

J.H. Park
Journal Of Research, National Bureau Of Standards--C. Engineering And Instrumentation, Vol. 66C, No. 1 pp. 19-24 (03/1962).

A new design for an accurate high-voltage d-c standard resistor has been devised. It is made up of a large number of individually shielded one-megohm wire-wound resistors connected in series and arranged to form a vertical helix between a ground plate and a high-voltage electrode. The individual shields completely enclose each one-megohm resistor and prevent formation of corona at the surface of the resistance coil no matter how high the potential of the shield is above ground. The vertical helical configuration with a large hat, or high-voltage electrode, on top serves to prevent concentration of electric field and corona formation at the high-potential end of the resistor. A 200-megohm unit, constructed during 1955 and tried out up to 100 kv in 1956, indicated the design to be free of corona errors but, for the particular one-megohm resistors used, the variation with temperature was quite large. A 100 megohm unit using low-temperature coefficient resistors has been recently constructed and tested up to 100 kv. 0 Refs.

Primary Keywords: DC Voltage Diodes; Shielded Resistor; Corona Suppression, Very High Accuracy, Very High Resistance; Very Low Drift

3717
(PARTICLE BEAMS, ELECTRON)
(Transport)

STUDY OF ELECTRON BEAM PROPAGATION EFFICIENCIES IN NEUTRAL GAS AS A FUNCTION OF NU/GAMMA

G. Cooperstein
Ion Physics Corp, Burlington, MA 01803
DNA Report No. DNA 3017F (06/1972).
Availability: AD 785253
NTIS

The propagation efficiency of pulsed relativistic electron beams of approximately 225 keV mean electron kinetic energy with currents ranging from 30 to 88 kiloamps has been studied as a function of drift tube length (5 to 300 centimeters) and drift tube pressure (100 to 2000 mTorr). All the data were taken with air as the transport medium and with no preionization and no externally applied magnetic fields. Simultaneous measurements were made of the diode voltage and current, the net beam currents at both the entrance and exit of the drift tube, and the total beam energy and primary beam current at the exit of the drift tube. A complete description of all the experimental apparatus is given. A partial data analysis has been performed and the results show that the optimum drift tube pressure is approximately 750 torr. The measured e-folding distances for the transport efficiencies were 6.0, 4.5 and 3.0 meters at nu/gamma's (defined as peak diode current/beta*gamma where beta = v/c and gamma = SQRT(1-beta squared)) of 1.7, 3.0 and 5.0 respectively. The net value of nu/gamma is always less than one indicating, as expected that current neutralization plays an essential role in beam transport. 11 Refs.

Primary Keywords: Electron Beams; High Nu/gamma; Propagation Of Electrons In Neutral Gas; Drifted Beams; Cool Beams

3718
(BREAKDOWN STUDIES)
(Lightning)

THE LASER LIGHTNING ROD SYSTEM, A FEASIBILITY STUDY

C.W. Schubert
AFIT, Wright-Patterson AFB, OH
AFIT Report In Support Of In-house Work Unit 43630146 (12/1977).
Availability: AD A055755/46A
NTIS

The feasibility of triggering lightning with a laser-induced ionized pathway is considered. The author begins with a description of the known lightning processes and proceeds to consider triggering of lightning. Conventional lightning rods are discussed as well as rockets. The main thrust of the paper is, however, concerned with laser triggering of lightning which is discussed in some detail. 0 Refs.

Primary Keywords: Laser Triggered Lightning; Laser Induced Ionization; Atmospheric Laser Attenuation; Aerosol Breakdown

3719
(SWITCHES, CLOSING)
(Gas Gaps, Materials)

IR ABSORPTION OF HIGHLY EXCITED SF/SUB 6/

[illegible] and J. Hartmann
Institut für Plasmaphysik, Garching, FRG
Springer Series In Chemical Physics, Volume 6: Laser-Induced Processes [illegible] pp 128-130 (09/1978).

A TEA carbon dioxide laser was used to pump the sulfurhexafluoride up to an average energy of 10,000/cm without collisions and up to 20,000/cm with some collisional relaxation. A tunable laser is used as a probe, and graphs of the absorption spectra over several pump laser energies for both long and short pulses are presented and discussed. 4 Refs.

Primary Keywords: Sulfurhexafiouride Dielectric, Absorption; Excited Gas; Absorption Spectra

3720
(BREAKDOWN STUDIES)
(Gas, Optical)

AIR BREAKDOWN BY PULSED-LASER RADIATION IN THE 2.7-AND 3.8-MICRON REGION

[illegible] Folleau
Naval Weapons Center, China Lake, CA 93555
Applied Physics Letters, Vol. 35, No. 4 pp 309-311 (08/1979).

The breakdown thresholds of unfiltered laboratory air were measured in the 3.8- and 2.7-micron regions. The breakdown threshold at 10.6 microns was also measured under identical experimental conditions in order to provide a correlation with previous work. Measurements at different focal-spot radii were used to establish an empirical scaling law for the focal-spot radius dependence of the breakdown thresholds. This scaling law was then used to reduce all the data to a common focal-spot radius. The results indicate that the air breakdown threshold has an inverse square wavelength dependence in the 2.7-10.6-micron range. 7 Refs.

Primary Keywords: Breakdown Threshold; Focal Spot Dimensions; 2.7 Micron Radiation, 3.8 Micron Radiation, Scaling Laws

3721
(BREAKDOWN STUDIES)
(Gas, Optical)
BREAKDOWN OF AIR NEAR TRANSPARENT DIELECTRICS
A.M. Bonch-Bruevich, V.I. Zinchenko and L.N. Kaporskii
Soviet Physics-Technical Physics, Vol. 22, No. 5 pp. 629-631 (06/1976).
Trans. From: Zh. Tekh. Fiz. 47, 1055-1058 (May 1977)
An experimental study is made of the breakdown of air near the surface of a transparent target irradiated by a series of giant pulses. The observed decrease in the breakdown threshold is not due to processes occurring at the focus of the lens focusing the radiation. The breakdown of air is initiated in the immediate vicinity of the dielectric surface and is not affected by the distance from the focus to the surface. The breakdown of air near the surface of a dielectric is not due to evaporation of the dielectric material. It is suggested that the breakdown is initiated by microscopic inhomogeneities which result from the contact of the surface with the surrounding medium. 7 Refs.
Primary Keywords: Air Discharges; Dielectrics; Laser-initiated Breakdown

3722
(SWITCHES, CLOSING: BREAKDOWN STUDIES)
(Gas Gaps, Self; Gas, Electrical)
COMPUTATION OF IONISATION GROWTH AT HIGH CURRENT DENSITIES
A.J. Davies, C.J. Evans and P.M. Woodison
University College of Swansea, Singleton Park, Swansea, Wales
Proc. IEE, Vol. 122, No. 7 pp 765-768 (12/1974).
The paper gives a numerical method for integrating the differential equations describing the ionization of gases in the discharge gap between electrodes. The method improves upon previous work in that it allows the discharge to be traced through the later stages up to currents of 20-100A. The computed data is found to agree closely with previous experimental values of light output and total current. 8 Refs.
Primary Keywords: 1-dimensional Ionization; Plane Electrodes; Parallel Electrodes; Small Gap; Theory; Experiment

3723
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH POWER SPARK GAP SWITCH DEVELOPMENT
W. Clark
Maxwell Labs Inc, San Diego, CA 92123
AFAPL Report No. AFAPL-TR-75-41 (05/1975).
Availability: AD-A015 072
NTIS
A pressurized spark gap switch is described which is capable of high repetition rates in the multi-megawatt average power range. This switch used airflow to remove the hot gas generated by the conduction current. A two electrode pair version of this switch has been operated at repetition rates up to 500 pps and simulated average power levels up to 5.6 megawatts in bursts of several seconds with an air flow on the order of 150 CFM per electrode pair. The switch was tested using a simulation technique which duplicates the high power electrical waveforms experienced by the switch but requires less operating power than is transferred to the load under actual operating conditions. Using this testing scheme, a broad base of statistical experimental data was generated on spark gap switch operation at high average power levels. The data from these tests indicates that the switch performance is strongly influenced by the gas flow velocity in the gap region. This velocity is determined by the electrode shape, the gas flow geometry, the gas flow rate, the gas pressure, and the gap length. Other important variables involved were found to be the switch voltage, the electrical charge transferred per shot, the recharging voltage rise time, the pulse repetition frequency, and the grace period or zero voltage time. 47 Refs.
Primary Keywords: High Power Spark Gap Switches; High Repetition Rate Switches; Switches For High Power Pulse Modulators; Spark Gap Switches

3724
(BREAKDOWN STUDIES)
(Gas, Optical)
MEASUREMENT OF THE WAVELENGTH DEPENDENCE OF THE THRESHOLD OF LASER-INDUCED GAS BREAKDOWN
K.C. Byron and G.J. Pert
University of Hull, Hull, UK
J. Phys. D: Appl. Phys., Vol 12 pp 481-488 (07/1979)
Experiments are described which study the wavelength scaling of cascade breakdown. A tunable dye laser with a peak output power of 60 MW in a 18 ns pulse, is used over a wavelength range of 720-840 nm to measure the threshold breakdown intensity in the rare gases helium, argon, and krypton, and in the molecular gases hydrogen and sulphur hexafluoride all at 760 Torr. The data obtained for the rare gases agreed well with the cascade breakdown theory while the molecular gases varied greatly from the theory possibly due to the effects of molecular vibrational levels. 12 Refs.
Primary Keywords: Gas Discharges; Laser-induced Breakdown; Wavelength Dependence; Focal-spot Dependencies; Breakdown Threshold

3725
(PARTICLE BEAMS, ION)
(Generation)
MICROSECOND OPERATION OF A GENERAL PURPOSE PULSED PROTON GUN
S. Humphries and G.W. Kuswa
Sandia Labs, Albuquerque, NM 87115
Applied Physics Letters, Vol. 35, No. 1 pp 13-16 (07/1979).
A magnetically insulated pulsed proton gun is described that provides an extracted parallel beam of annular cross section for microsecond pulse lengths. In initial tests, time-averaged currents of 5 kA and current densities of 50 A/sq. cm were achieved with a 200 kV voltage. The behavior of the gun appears to be determined by instabilities of the cathode electron cloud growing over time scales of the order of 0.5 microseconds to give ion current-density enhancements greater than a factor of 50 above the Child-Langmuir limit. 5 Refs.
Primary Keywords: Magnetic Insulation; Annular Cross Section; Microsecond Pulse Length; Cathode Instability

3726
(BREAKDOWN STUDIES)
(Gas, Optical)
MODELING OF THE BREAKDOWN OF A DENSE MOLECULAR GAS BY LASER RADIATION CLOSE TO A METALLIC SURFACE
V.I. Mazhukin, A.A. Uglov and B.N. Chetverushkin
M.V. Keldysh Institute Of Applied Mathematics, Academy of Sciences of the USSR
Soviet Physics Doklady, Vol. 24, No. 6, pp 443-446 (06/1979).
Trans. From: Doklady Akademii Nauk SSSR 246, 1338-1342 (June 1979)
The authors use methods of numerical simulation to investigate the phenomenon of optical breakdown of molecular nitrogen by laser radiation with wavelength 1.06 microns under conditions when the high pressure essentially suppresses the processes of vaporization of the target substance, and when the thermal emission of electrons from the surface of a molybdenum disk exerts a direct effect on the breakdown mechanism, which, as is known, is an avalanche-ionization process in the region of P >= 1 atm. 5 Refs.
Primary Keywords: Molecular Gas Breakdown; Neodymium Laser; Metallic Surface; Numerical Calculation

3727
(ENERGY CONVERSION, ELECTRICAL; PULSE GENERATORS)
(Power Supplies, Reviews)
ANALYSIS OF PHASED ARRAY RADAR POWER SUPPLY SYSTEMS OPERATING UNDER VARIABLE PULSE LOADING CONDITIONS
C.J. Eichenauer
General Electric Co, Syracuse, NY 13201
IEEE 1973 Eleventh Modulator Symposium pp. 138-149 (09/1973).
Detailed quantitative analyses of phased array power systems are often required as a result of the radar system's variable pulse templet operating conditions. A matrix format, with system capability factors forming columns and system operating modes forming rows, is presented as a useful type of display for the quantitative results of a power supply system analysis. Four alternate forms of system analysis are then examined, use of steady state techniques, use of analog computer techniques, development and use of special purpose digital computer programs, and use of one of the general purpose user oriented circuit analysis programs. Examples of a power supply system analog computer analysis and a *CIRCUS 2 digital analysis are* presented. Advantages and disadvantages of each method of analysis are discussed. 0 Refs
Primary Keywords: Power Supply; Analysis Techniques; Analog Computer; Digital Computer

3728
(SWITCHES, CLOSING)
(Gas Gaps, Materials)
NONLINEAR SURFACE PHOTOELECTRIC EFFECT IN METALS SUBJECTED TO INTENSE LIGHT
I.I. Kantorovich
V.I. Lenin Belorussian State University, Minsk
Soviet Physics-Technical Physics, Vol. 22, No. 3 pp 397-399 (03/1977).
Trans. From: Zh. Tekh. Fiz. 47, 660-664 (March 1977)
Recently there has been renewed interest in the surface photoelectric effect of metals. When a metal is irradiated by a laser the photoelectric effect is nonlinear. In the present note we derive a general equation for the electron emission current. 5 Refs.
Primary Keywords: Surface Photoelectric Effect; Laser Light; K-photon
Secondary Keywords: Fermi Energy

3729
(INSULATION, MATERIAL; INSULATION, VACUUM; SWITCHES, CLOSING; SWITCHES, OPENING; REVIEWS AND CONFERENCES)
(Reviews, Reviews; Reviews; Reviews; Reviews)
REVIEW OF DIELECTRICS AND SWITCHING
A. S. Denholm
Energy Sciences Inc., Bedford, MA 01730
AFWL Report No. AFWL-TR-72-88 (02/1973).
Availability: AD 907739
NTIS
Systems to generate high power levels frequently operate at high voltage, and their design requires special knowledge of dielectric and switching technology. The treatment of these technologies in this report starts with a discussion of electric field analysis then covers insulation and switching in the four dielectric media; namely gas, liquid, solid and vacuum. An extensive search of the literature produced a listing of relevant books, reports and papers and the establishment of a punched card classification and retrieval system specially designed for the subject area. 6 Refs.
Primary Keywords: Electric Field Profile; Dielectric Properties; Breakdown; Tracking; Solid State Switches; Circuit Breakers; Spark Gaps

3730
(BREAKDOWN STUDIES)
(Gas, Electrical)
AFTERGLOW TAILS AND STABILITY OF HIGH-DENSITY NANOSECOND ARC CHANNELS
H. Fischer and W. Ruppel
AFCRL, Bedford, MA 01730
Applied Optics, Vol. 3 pp. 769-772 (08/1963).
Experiments are presented which study the afterglow tail of a 10 ns arc channel in air at 760 Torr. The photodetector was protected from saturation by a gated Kerr cell which reduced some intensities by a factor of four. Multishots are used to get integrated arc images with delays up to 500 ns. 3 Refs.
Primary Keywords: Afterglow Tails; Arc Channels; Spectral Intensity; Temporally Resolved
Secondary Keywords: Kerr Cell

3731
(BREAKDOWN STUDIES)
(Gas, Electrical)
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF PULSED DISCHARGES IN GASES
V. Yu Baranov, Yu. V. Petrushevich, Yu. B. Smakovskii, A. N. Starostin and A P Strel'sov
Soviet J. Quantum Electronics, Vol. 9, No. 12 pp. 1509-1515 (12/1979).
Trans. From: Kvantovaya Elektron. (Moscow) 6, 2552-2561 (December 1979)
A numerical investigation was made of the properties of pulsed self-sustained discharges in gases, and of the ways in which their development was affected by nonmonotonic dependencies on the electron drift velocity on the ratio of the field to the density and on other parameters. The procedure used made it possible to perform calculations for discharges having large discharge gaps and, at the same time, to study the detailed distributions of the electric field and of the ion and electron densities in the discharge gap. The calculations were in good agreement with the results of an experimental investigation of a large-volume nonself-sustained discharge. 34 Refs.
Primary Keywords: Pulsed Discharges; Theoretical Investigation; Experimental Investigation; Self-Sustained; Nonself-sustained

3732
(PARTICLE BEAMS, ELECTRON)
(Generation)
TRANSFORMER-TYPE HIGH-CURRENT ACCELERATOR
Ye. A. Abramyan and V.A. Gaponov
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
USSR Academy Of Sciences Monograph (03/1970)
Trans. From: Monograph Silnotochnyi Uskoritelnoi Osnove Transform Atora, Novosibirsk (1966)
Availability: JPRS 50119
NTIS
This article contains a description of the operating principle of a direct-action accelerator designed to accelerate electrons to an energy of 1.5 megaelectron volts with an average beam power of tens of kilowatts and an efficiency of about 96 percent. The accelerator is a transformer with a core made up of insulated sections with a built-in accelerating tube operating on a 50 hertz network in a compressed gas environment. Constant electron energy is insured by voltage stabilization in the tube by means of current regulation. The pulse length of the electron current is regulated from zero to five milliseconds, and the repetition rate to 50 times per second. The mean current can reach 1/6 of the maximum current in the pulse. Magnetic lenses are installed in the tube to bring an electron current up to 100 milliamps through the accelerating tube in a beam with a diameter of several millimeters. Heavy metal shields near the tube axis protect the gas gaps and other electrically stressed sections of the accelerator from radiation. There is a structural description of a device in which an electron beam is obtained with an energy of 1.5 megaelectron volts and an average power of 25 kilowatts. 6 Refs.
Primary Keywords: Transformers, Accelerating Tube, Electron Beam, Hot-Cathode Diode

3733
(PARTICLE BEAMS, ELECTRON)
(Target Interactions)
TWO DIMENSIONAL FLUID SIMULATION OF RELATIVISTIC ELECTRON BEAM-HIGH Z TARGET INTERACTIONS
D G. Colombant and D. Mosher
Naval Research Lab, Washington, DC 20375
NRL Memorandum Report No. 3496 (05/1977).
Availability: AD690090
NTIS
A two-dimensional r-z fluid code has been developed to study the interaction between a relativistic electron beam and an anode plasma. A self-consistent treatment of the electromagnetic fields has been included. Radial pinching of the beam is observed when its self field resistively diffuses into the plasma. 8 Refs.
Primary Keywords: Relativistic E-beam; Two-dimensional Fluid Simulation; Diode Flow; Pinch Formation

3734
(SWITCHES, OPENING)
(Explosive Fuses)
WHYRAC, A NEW MODULAR ONE-DIMENSIONAL EXPLODING WIRE CODE
D G. Colombant (1), M. Lampe (1) and H W. Bloomberg (2)
(1) Naval Research Lab, Washington, DC 20375
(2) Science Applications, Mclean, VA 22209
NRL Memorandum Report No. 3726 (02/1978).
Availability: AD A053847
NTIS
A new one-dimensional code, WHYRAC, intended to provide a comprehensive treatment of exploding wires and wire arrays, is described. The circuit equations treat the wire plasma in an exact way, rather than using a lumped circuit model. Great care has been taken in the Eulerian MHD treatment of plasma motion, resulting in an unusual combination of rapid running capability to handle density ranges spanning at least four orders of magnitude, and very accurate energy conservation in the overall circuit. The code is written in a modular and fluxible way, to permit continual upgrading, and extension to different elements of the atomic physics and radiation transport packages. At present, a fairly simple, rapid-running model is used to provide transport at each time step. A much more extensive, state of the art, atomic radiation code is used to generate output radiation data as they are required, and to benchmark the energy transport package. The report gives special attention to the treatment of numerical problems in WHYRAC. 11 Refs.
Primary Keywords: Z pinch; Wire Produced Plasma; Numerical MHD

3735
(BREAKDOWN STUDIES)
(Gas, Electrical)
SIMULATION OF THE GROWTH OF AXIALLY SYMMETRIC DISCHARGES BETWEEN PLANE PARALLEL ELECTRODES
A J. Davies, C. J. Evans and P M. Woodison
University College of Swansea, Singleton Park, Swansea, Wales
Computer Physics Communications Vol. 14 pp. 283-297 (12/1977)
A program is presented that uses a two dimensional numerical method to simulate the complete radial and axial development of an axially symmetric discharge. The processes of primary ionization, excitation of gas atoms, attachment, detachment, and secondary emission from the cathode due to the avalanche of photons and positive ions all are taken into account. A test run for a discharge in air is included. 4 Refs.
Primary Keywords: Discharges, Numerical Calculation, Plane Electrodes, Parallel Electrodes, Axially Symmetric

3736
(PULSE GENERATORS)
(Pulse Forming Lines)
NANOSECOND PULSES OF VERY LOW IMPEDANCE
H. Fischer
AFCRL, Bedford, MA 01730
AFCRL Report No. AFCRL-65-219 (04/1965).
Availability: AD 614900
NTIS
Nanosecond pulses exceeding 2000 A are obtained by discharging a plated-capacitor transmission line of very low impedance through an air gap. High repetition rates exceeding 20 kHz are possible. Also triggered single shots with a time jitter of less than a nanosecond. A compact model of the pulser for operating a laser diode is described. Lower pulses covering a wide current range conveniently are produced by the same geometry, using a mercury wetted contact switch. 7 Refs.
Primary Keywords: Transmission Line Pulser; Rep-rated; Low Jitter

3737
(SWITCHES, CLOSING)
(Miscellaneous)
APPLICATION OF THE RSR SWITCH
R A. Hill and R.A. Smith
Westinghouse Electric Corp, Baltimore, MD 21203
IEEE 1973 Eleventh Modulator Symposium pp. 95-106 (09/1973).
The Reverse Switching Rectifier, a four layer-two terminal solid state switch, has been successfully applied in several pulse modulator designs. The modulators have demonstrated high reliability and have achieved a substantial reduction in size and weight compared to conventional designs. Thorough testing has been performed including extensive operation under load fault conditions. The RSR modulator design techniques are now being applied in a number of new programs. 5 Refs.
Primary Keywords: Reverse Switching Rectifier Switch; Solid State Switch; High Reliability; Light Weight

3738
(PULSE GENERATORS)
(Hard-tube)
A CONSTANT CURRENT HARD TUBE MODULATOR
R. Alsmeyer
Raytheo Co., Wayland, MA 01778
IEEE 1973 Eleventh Modulator Symposium pp. 75-78 (09/1973).
Modern air defense radars require reliable stable high-power transmitters. This paper describes the modulator for the final amplifier stage for such a transmitter. It is completely solid state except for the high-power switch tube and the crowbar spark gap. The modulator drives a crossed field amplifier tube. 2 Refs.
Primary Keywords: Constant Current; Solid State; Crossed-field Amplifier

3739
(SWITCHES, CLOSING)
(Miscellaneous)
A NEW SOLID-STATE SWITCH FOR POWER PULSE MODULATOR APPLICATIONS, THE REVERSE SWITCHING RECTIFIER
J B. Brewster and P F. Pittman
Westinghouse Electric Corp, Pittsburgh PA
IEEE 1973 Eleventh Modulator Symposium pp. 6-9 (09/1973).
The Reverse Switching Rectifier is a new solid state switching device with performance optimized for short, high rate of rise pulse current switching. It is a two terminal device which switches from blocking to conduction upon application of a fast rising pulse of voltage. Devices with peak pulse current ratings of 1200 A and di/dt ratings of 2000 A/microseconds are available with blocking voltage ratings of 1000 V at 125 C. A typical value of turn off time is 50 microseconds at 25 C. Many practical pulse modulator circuits have been built using series and parallel combinations of RSR's to demonstrate the use of this device in power pulse modulator service. 4 Refs.
Primary Keywords: Reverse Switching Rectifier, First Rise Time, Two Terminal Device, High-Voltage

3740
(POWER CONDITIONING)
(Pulse Forming Networks)
A POST CHARGE REGULATOR
R M. Smalley
Raytheon Co., Wayland, MA 01778
IEEE 1973 Eleventh Modulator Symposium pp. 186-188 (09/1973)
This paper describes a novel regulator for a line type modulator to reduce pulse-to-pulse load voltage ripple due to variations in PFN charging voltage. Control of the PFN voltage is accomplished by dividing the conventional PFN into two series-connected networks, and dissipating the excess charge on one of the networks. In many cases, the extra network can be a simple capacitor. Regulation is accomplished by use of a closed-loop regulator which senses the intermediate voltage of the series connection of PFN's and controls a solid state dissipative element to reduce the total voltage to the desired value. The dissipating element need only have a voltage rating somewhat greater than the peak to peak ripple variations in charge voltage exist ing without the regulator. The regulator is all solid state and circuitry is all ground based. There is no necessity for a fault current diverter across the dissipative element, as a short to ground at any point in the circuit will not damage the regulator. In applications involving staggered repetition rates, linear regulation of pulse to pulse resonant charge voltage may be obtained that with regulators that maintain the D.C. HVPS with a constant. 8 Refs.
Primary Keywords: Regulator; Pulse to pulse Voltage Ripple; Dielectric Absorption

3741
(SWITCHES, CLOSING; SWITCHES, OPENING)
(EBS; EBS)

CHARACTERISTICS AND CAPABILITIES OF THE MODULAR EBS

R.I. Knight and D.J. Bates
Watkins-Johnson Co., Palo Alto, CA
IEEE 1973 Eleventh Modulator Symposium pp. 17-22 (09/1973).
EBS devices have been designed, tested and are now available for use in a wide range of power modulation applications. Current multiplication due to electron beam illumination of a semiconductor diode results in rise times and delay times of a few nanoseconds, on-off ratios of 1E5 or more and the ability to provide multiple or coded output pulses. EBS devices have been tested which can provide up to 400 V output pulses with less than a 3 ns rise time and an EBS device designed for high current operation has been used to produce pulses of 250 A with a 1 ns rise time. EBS devices available at the present time can be used for CRT modulation, for the modulation of injection lasers and as TWT grid modulators. 0 Refs.
Primary Keywords: EBS Devices; WJ-3650 Device; Current Amplification; Low Voltage
Secondary Keywords: CRT Modulator; TWT Grid Modulator

3742
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)

CHARGING AND STABILISING SYSTEM FOR A PULSED CROSSED-FIELD AMPLIFIER USING AN SCR-SWITCHED ULTRASONIC INVERTER

T.P. Crowfoot (1) and G.W. Whalley (2)
(1) Admiralty Surface Weapons Establishment, Portsmouth, Hampshire, UK
(2) GEC Marconi Research Labs, Essex, UK
IEEE 1973 Eleventh Modulator Symposium pp. 176-183 (09/1973).
The system described is used to provide a very stable 10 kV d.c. power supply for an RF switched CFA. The stability is provided by a novel quantum stabilisation method using a controllable high frequency inverter to charge an EHT reservoir capacitor to an accurately determined level. The use of a high inverter frequency greatly reduces the bulk of the power supply by eliminating all mains frequency transformers and filters. Similar techniques have also been successfully used for high stability pulse forming network charging systems. 3 Refs.
Primary Keywords: Ultrasonic Invertor; Very High Stability; Crossed-field Amplifier; Thyristor

3743
(PULSE GENERATORS)
(Hard-tube)

DESIGN AND PERFORMANCE OF THE LAMPF 1-1/4 MW KLYSTRON MODULATOR

P.J. Tallerico, R.L. Cady and J.D. Doss
Los Alamos National Labs, Los Alamos, NM 87545
IEEE 1973 Eleventh Modulator Symposium pp. 56-60 (09/1973).
A design for a very reliable single-triode modulator for a 1-1/4 MW modulating-anode klystron is presented. The operating voltage is 86 kV and the variable pulse length ranges from 200 microseconds to 1.2 msec. The basic modulator circuit, which uses a novel Zener diode bias circuit, and several of the individual components are *described* in detail. Over 140,000 high-voltage hours have been accumulated on these modulators. The principal failure mechanism is grid emission from the triode. The failures can be anticipated and repaired during a normal maintenance period. The triode is then reprocessed and reused. Tube life data and a summary of the failures modes are presented. 0 Refs.
Primary Keywords: LAMPF Modulator; High Power; Zener Diode Bias Circuit; Failure Mechanisms; Life Test
Secondary Keywords: Klystron Modulator

3744
(POWER CONDITIONING)
(Pulse Forming Networks)

DESIGN CHARTS FOR DROOP-COMPENSATION NETWORKS

T.A. Weil
Raytheon Co., Wayland, MA 01778
IEEE 1973 Eleventh Modulator Symposium pp. 156-161 (09/1973).
The principles of pulse droop compensation with passive RLC networks are well known, but the practical application of these principles has been hindered by the complexity of analyzing even the simplest cases quantitatively. This paper presents the results of a computer analysis of droop-compensation methods. The tradeoffs are described, and the results are presented in charts that show directly the loss in efficiency versus the amount of droop before and after compensation. The charts also provide the data necessary to determine the component values to provide the selected droop-compensation performance. 1 Refs.
Primary Keywords: Droop-compensation Network, Analysis; Design Considerations

3745
(SWITCHES, OPENING)
(Fuses)

EVALUATION OF HVDC FUSES AS TWT PROTECTIVE DEVICES

J.V. Stover
Hughes Aircraft Co, Fullerton, CA
IEEE 1973 Eleventh Modulator Symposium pp. [illegible] (09/1973).
This paper concerns itself with the evaluation of series-parallel assemblies of Bendix 5 kV, 1A rms fuses to obtain 50 kV, 4A rms operation; the evaluation of Bendix 50 kV, 4A rms fuses; and the evaluation of Hughes 50 kV, 4A rms experimental fuses. The purpose of this evaluation was to determine the adequacy of the protection provided to a high power, grid pulse modulated traveling wave tube in an unattended, multiple transmitter system. Such a system may have several TWTs operating from a single power supply, and it becomes highly undesirable to shut down or crowbar the entire supply should only one tube experience a fault. 1 Refs.
Primary Keywords: Development, Analysis, Evaluation
Secondary Keywords: Travelling Wave Tube

3746

EVALUATION OF STATE-OF-THE-ART HYDROGEN THYRATRONS AT EXTENDED RATINGS

B.R. Gray
RADC, Griffiss AFB, NY 13440
IEEE 1973 Eleventh Modulator Symposium pp. 227-231 (09/1973).
Paper describes the background behind a comprehensive test on a group of selected off-the-shelf thyratrons. Specific objectives of the test were (1) determine the maximum operating anode voltage as a function of average current, (2) determine the maximum average current as a function of anode voltage, (3) determine short time on stability and (4) determine the above parameters with the tube operating in a vibration test stand. While the data is in the form of a preliminary report certain trends are evident. These are (1) the peak voltage which can be achieved is considerably above the rated value if average current is kept lower than rated value. (2) at rated voltage the average current is equal to or close to the rated value, and (3) average current can be raised above the rated value if anode voltage is lowered. 1 Refs.

3747
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

A CO/SUB 2/-LASER-TRIGGERED SPARK GAP

A.V. Nurmikko
University of California, Berkeley CA
IEEE Journal Of Quantum Electronics, Vol. QE-7, No. 9, pp 470-471 (09/1971).
A coaxial spark gap triggered by a high-pressure CO/sub 2/ laser has been constructed. High-voltage pulses with subnanosecond rise time and very low jitter have been obtained. The observed low laser energy threshold required to initiate switching suggests an application of the spark gap in controlling and manipulating higher intensity infrared radiation by electrooptic shutters. 3 Refs.
Primary Keywords: CO/sub 2/ Laser; Coaxial Spark Gap; Tungsten Electrode; Nitrogen Gas; High Pressure; Low Jitter; Subnanosecond Rise Time

3748
(PULSE GENERATORS)
(Systems)

HIGH POWER SOLID STATE MODULATOR FOR COHERENT AGILE MICROWAVE AMPLIFIER

G. Scorch
Selenia SPA, Rome, Italy
IEEE 1973 Eleventh Modulator Symposium pp. 84-88 (09/1973).
The present paper describes a high power broadband microwave amplifier realized for a pulse compression, M.T.I. or frequency agile radar system. After a short description of the amplifier global network, the most important solutions are pointed out, i.e., H.V. microsecond protections, grid modulator circuit, H.V.-ground level interface, amplifier processor. The overall performances obtained are also given. 10 Refs.
Primary Keywords: Solid State Switches; Crowbar; Protection Circuit
Secondary Keywords: TWT Modulator

3749
(SWITCHES, OPENING)
(Fuses)

HIGH VOLTAGE FUSES FOR PHASED ARRAY RADAR TRANSMITTERS

S. Schneider, A. Buffa and J. Carter
ECOM, Fort Monmouth, NJ 07703
IEEE 1973 Eleventh Modulator Symposium pp. 189-196 (09/1973).
In large phased array radar systems utilizing microwave amplifier arrays connected to a common power supply, it is necessary to provide isolation between a faulted amplifier and the other amplifiers in the array. A series interrupter in the form of a high voltage fuse has been evaluated for this application. The high voltage fuse is attractive due to its low voltage drop, low cost, size and weight. A 50 kV fuse with a current rating of 4 A RMS and a current interruption time of less than 20 microseconds has been developed. This type of fuse has been found satisfactory for the majority of phased array transmitter applications. 0 Refs.
Primary Keywords: High Voltage Fuse; Series Interrupter; Series Operation

3750
(PULSE GENERATORS)
(Reviews)

HIGH VOLTAGE PULSE GENERATORS FOR KICKER MAGNET EXCITATION

DC Fiander, D. Grier, K.D. Metzmacher and P. Pearce
CERN, Geneva, Switzerland
IEEE 1973 Eleventh Modulator Symposium pp. 129-137 (09/1973).
The fast ejection facilities at the CERN 28 GeV proton synchrotron are being continually expanded to meet the increasing demand for fast ejected beams. The paper describes three new pulse generator systems for the excitation of the kicker magnets of these facilities. Firstly a pulse generator for the fast ejection from the CPS of any desired number of the twenty circulating proton bunches is treated. This equipment can perform up to six ejections per machine cycle with a minimum interval of 25 milliseconds. Extensive life testing of the principal elements such as thyratron switches, cable pulse forming networks and pulsed resonant power supplies is reported on. 7 Refs.
Primary Keywords: Full Aperture Kicker; Pulse Forming Network; Thyratron; Staircase Pulse Generator

3751
(SWITCHES, CLOSING)
(Systems)

IMPROVED MULTIGAP ELECTRONIC CROWBAR

W.W. Schrader
Raytheon Co., Wayland, MA 01778
IEEE 1973 Eleventh Modulator Symposium pp. 204-206 (09/1973).
The open-air multigap crowbar has the following characteristics: (a) rapid firing after application of the trigger pulse, (b) low voltage drop after firing, (c) low energy triggering capability, (d) large range of operating voltage. Under transient conditions immediately following a load arc, however, there is a danger zone of operating voltages in which the crowbar [illegible]tially self-fires, thus loading the trigger voltage so that [illegible] triggering does not occur. [illegible] describes a simple m[illegible]ication to the multigap crowbar [illegible] under transient conditions (1) makes it reliably self-fire at all voltages above 20 percent of its voltage rating, (2) increases the speed of self-firing at voltages near the rated [illegible] that the device can be triggered when the operating voltage is too low to provide self-firing. 6 Refs.
Primary Keywords: Multigap Crowbar; Open-air Gap; Wide Voltage Range; Shunt Capacitor

3752
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)
LONG PULSE SWITCH AND POWER AMPLIFIER TUBES FOR PHASED ARRAY RADAR
R.E. Byram and J.T. Mark
RCA Corp., Lancaster, PA 19104
IEEE 1973 Eleventh Modulator Symposium pp. 29-34 (09/1973).
Three new tetrode tubes are now in development in 50 kW, 100 kW, and 500 kW sizes for use as long pulse radar switch tubes, and with 10 kW, 20 kW, and 40 kW levels in long pulse UHF and L-Band rf power amplifiers. All three tubes use newly developed tungsten matrix cathodes and are currently being tested for pulse lengths from 1 to 8 milliseconds and with capability for greater pulse lengths. These new cathodes are specially developed for high current long pulses, arc resistance, and long life. Aspects of the tube design and operation in typical service life test are discussed. 7 Refs.
Primary Keywords: Tetrode Tube; Long Pulse; Tungsten-Matrix Cathode; Pulsed Emission
Secondary Keywords: Phased Array Radar

3753
(SWITCHES, CLOSING)
(Systems)
MULTIGAP CROWBAR TRIGGERING STUDY
T.A. Weil
Raytheon Co., Wayland, MA 01778
IEEE 1973 Eleventh Modulator Symposium pp. 207-216 (09/1973).
This paper reports the results of a study on triggering problems in the use of multigap crowbars. The validity of various crowbar test methods was studied, and recommendations will be presented. The study also determined which stray inductances and capacitances in the crowbar and its triggering circuit have a significant effect on triggering performance. Bottom triggering was studied as an alternative triggering method that provides firing under all conditions and requires no HVDC blocking capacitor. A multigap crowbar using the results of this study will be described. The crowbar includes improvements in creepage paths and in the electrode capacitor design. The crowbar is corona-free at 180 kV and is reliably self-firing above 50 kV. 8 Refs.
Primary Keywords: Multigap Crowbar; Triggering Problems; Peaking Gap; Bottom Triggering

3754
(PULSE GENERATORS)
(Line Type)
PULSE GROUP OPERATION OF HIGH POWER LINE TYPE MODULATORS
R.M. Rowe
Stanford University, Stanford, CA 94305
IEEE 1973 Eleventh Modulator Symposium pp. 162-171 (09/1973).
The development of a high power double pulse line type modulator is described. The design goal output of this modulator was two 185 kilovolt 2.5 microsecond pulses with an interpulse separation of 23 microseconds. In order to produce two closely spaced pulses the network of a SLAC standard 65 megawatt single pulse modulator was split electrically, but not physically. An additional hold off diode, thyratron and end of line clipper were installed thus enabling the two networks to function independently while sharing a common charging inductor and power supply. The interaction problems, i.e., sympathetic firing, etc., encountered and the methods used to solve them are discussed. 0 Refs.
Primary Keywords: Line Type Modulator; Double Pulsed Operation; End-of-line Clipper; Pulse Transformer; Thyratron

3755
(PULSE GENERATORS)
(Hard-tube)
QUENCH MODULATOR FOR COLD-CATHODE CROSSED-FIELD AMPLIFIER
W.I. Smith
RCA Corp., Moorestown, NJ 08057
IEEE 1973 Eleventh Modulator Symposium pp. 153-155 (09/1973).
A radar transmitter designed by the Missile and Surface Radar Division of RCA has achieved versatile performance through use of a type SFD-257 crossed-field amplifier. This CFA features a cold cathode whose emission is initiated by RF drive and terminated by a *hard-tube modulator-driven* electrode. The performance and design features of the transmitter are described, with emphasis on the specialized pulse shaping and hard-tube modulator required by the quench electrode. 0 Refs.
Primary Keywords: Hard-tube Pulse Generator; Quench Modulator; Crossed-Field Amplifier; Variable Power; Variable Rep-rate

3756
(SWITCHES, CLOSING)
(Systems)
RAPID RECYCLE CROWBAR CIRCUITS
G.R. Lyuta and T.A. Weil
Raytheon Co., Wayland, MA 01778
IEEE 1973 Eleventh Modulator Symposium pp. 217-226 (09/1973).
Crowbar circuits are used across high voltage energy storage capacitors employed in the output stages of high power radar transmitters. Conventional high voltage power supply and crowbar systems require OFF-ON recycle times in the order of seconds. Circuits were studied which will allow the radar transmitter to be brought back to operation within a few hundred microseconds after a tube fault condition. Two basic circuits were tested. In the first kind of circuit, the capacitor bank energy is dissipated, as in conventional crowbar circuits, and the bank is then quickly recharged from another capacitor. In the second kind of circuit, the energy in the *capacitor bank is temporarily stored* in reversed polarity on the same capacitor, and then returned to normal polarity to restore operation. The tests showed that both kinds of circuits worked, with a preference for the second kind described above. Further work is needed on switching devices for this application, and it remains to be determined how fast voltage may actually be reapplied to an RF tube after an arc without causing it to arc again. 7 Refs.
Primary Keywords: Crowbar Circuit; Rapid recycling; Triggered Vacuum Gap; Triggered Gas Gap; Short Recovery Time

3757
(PULSE GENERATORS; SWITCHES, CLOSING)
(Line Type; Thyristors)
SOLID-STATE MODULATOR TECHNIQUES TO PROMOTE FAST PULSE FALL TIMES
V.N. Martin
Raytheon Co, Waltham, MA
IEEE 1973 Eleventh Modulator Symposium pp. 89-94 (09/1973).
This paper describes solid-state tail-biter switching circuitry for grid drive tail-biters in hard-tube modulators and tail-biters employed in high pulse repetition rate line-type modulators used in short range search and mapping radars. Tail-biter circuits are most advantageous in producing fast fall times in the video pulses used to *drive high power rf amplifiers. This paper describes the use of SCRs* in tail-biter circuits that overcome dv/dt limitations which formerly precluded their use in such applications. Results of laboratory experimentation and actual circuit implementation in production systems are described. 3 Refs.
Primary Keywords: Tail-biter Circuit; Thyristors; Transistors; Fast Fall Time
Secondary Keywords: Hard-tube Pulser; Line Type Modulator

3758
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas Gaps, Crossed-field; Gas Gaps, Crossed-field)
THE CROSSED FIELD SWITCH TUBE AND ITS APPLICATION TO HIGH POWER MODULATORS
M.A. Lutz
Hughes Research Labs, Malibu, CA 90265
IEEE 1973 Eleventh Modulator Symposium pp. 40-46 (09/1973).
This paper describes the principles and recent development of a crossed field switch tube capable of closing and opening an HVDC circuit. The tube operates as a Penning discharge which can be controlled by an externally applied magnetic field. Several of the physical phenomena associated with this tube are described, including ignition jitter, the glow to arc transition, sputtering, gas clean-up and life. One particular tube has reliably interrupted 2.5 kA against 60 kV with a voltage recovery rate of 15 kV/microsecond. Several applications for this tube are described besides those relating to power utility service. These include component protection, HVDC interruption for current-fed line-type modulators and substitution for hard vacuum tubes for higher power hard tube modulators. 12 Refs.
Primary Keywords: Crossed Field Switch Tube; HVDC Circuit; Penning Discharge; Jitter; Glow-to-Arc Transition; Life Test
Secondary Keywords: Hard Tube Modulator

3759
(SWITCHES, CLOSING)
(Thyratrons)
THE DEVELOPMENT OF DEUTERIUM THYRATRONS FOR OPERATION AT HIGH *DUTY-RATIOS AND HIGH AVERAGE CURRENTS*
R.J. Wheldon (1) and N.S. Nicholls (2)
(1) MO Valve Co. London, UK
(2) Royal Radar Establishment, Malvern, Worcestershire, UK
IEEE 1973 Eleventh Modulator Symposium pp. 239-241 (09/1973).
A circuit is described in which thyratrons have been operated at 50% duty-ratio with unusually high average current. Two valve types *are described which have been developed* to give long lives in this class of service. Good inverse-voltage performance and instant-start capability at full power were also necessary. 4 Refs.
Primary Keywords: Deuterium Thyratrons; High Average Current; High Speed

3760
THE GENERATION OF HIGH FREQUENCY SINUSOIDAL AND PULSE WAVEFORMS USING HYDROGEN THYRATRONS
L.J. Kettle and B.P. Newton
English Electric Valve Co Ltd, Chelmsford, Essex, UK
IEEE 1973 *Eleventh Modulator Symposium pp.* 150-152 (09/1973).
The circuit of a high efficiency, high frequency sinewave generator using a hydrogen thyratron switch is described and some of its uses are mentioned. Further, a combination of this circuit with a standard pulse modulator circuit enables a high frequency pulse generator to be built which allows a longer than normal recovery period for the thyratron. 0 Refs.
Primary Keywords: Pulse Generator; Waveform Generator; Hydrogen Thyratron; Long Recovery Period

3761
(SWITCHES, CLOSING)
(Thyristors)
THYRISTORS FOR PULSE MODULATION AT HIGH PEAK AND AVERAGE POWERS
D.E. Crow (1), N.S. Nicholls (2) and F. Wood (2)
(1) Hirst Research Labs, Wembley, UK
(2) Royal Radar Establishment, Malvern, Worcestershire, UK
IEEE 1973 Eleventh Modulator Symposium pp. 12-16 (09/1973).
The design problems of a large pulse modulator thyristor for 2 KV 1 KA operation at 30 microsecond pulse length are discussed, and experimental devices are described. The performance obtained is compared with that of possible alternative devices, both solid-state and gas-discharge. 1 Refs.
Primary Keywords: Thyristor Modulator; Experimental Device; Design Problems; High Current; High Speed

3762
(PULSE GENERATORS)
(Hard-tube)
TRADEX S-BAND TRANSMITTER MODULATOR
R.N. Cassiere
RCA Corp., Moorestown, NJ 08057
IEEE 1973 Eleventh Modulator Symposium pp. 61-67 (09/1973).
The TRADEX S-Band transmitter modulator is a direct series-coupled floating-deck modulator employing three L5097 Beam Switch Tubes in a parallel connection as the main switch device. The modulator normally operates at a full peak-power level of 15 megawatts and a duty of 0.03 and delivers a -120 kV, 125-ampere pulse to a VKS8250 klystron load. The modulator can generate a wide range of single-pulse or burst-mode waveforms at various PRFs and allows for continuous changing of waveform during a mission without interruption of data. The constant current characteristic of the BST provides flat-top pulses, inherent regulation features and fault current limiting. 0 Refs.
Primary Keywords: Beam Switch Tube; Paralleled Switch Tubes; Variable Pulse Width
Secondary Keywords: Klystron Modulator

3763
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)
TRIGGERED CHARGING TECHNIQUES FOR PULSE GENERATING CIRCUITS
G.J. Scoles
English Electric Valve Co Ltd, Chelmsford, Essex, UK
IEEE 1973 Eleventh Modulator Symposium pp. 172-174 (09/1973).
This paper describes several different circuits which can be used to obtain reliable triggered charging. For hydrogen thyratron modulators with duty cycles in excess of 0.001 it is usually necessary to delay the recharging of the pulse forming network to allow time for switch tube recovery. 0 Refs.
Primary Keywords: Charging Circuit; Command Charging; High Duty Factor

3764
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)
4CW 100,000 TETRODE PULSE TESTS AT RADC
P. Bryan and H. Beard
RADC, Griffiss AFB, NY 13440
IEEE 1973 Eleventh Modulator Symposium pp. 35-39 (09/1973).
This investigation showed that this tube can provide very stable pul t performance at a wide variety of conditions well above its 4 megawatt and 40 KV ratings. In an effort to obtain data beyond the published ratings on Tetrode Switch Tubes, the RADC High Power Laboratory conducted an investigation on three versions of the EIMAC 4CW100,000 Tetrodes. These tubes are manufactured for high power short-wave broadcast service. 0 Refs.
Primary Keywords: 4CW100,000 Tetrode; Rise Time Determination; Voltage Drop; Anode Dissipation; High Voltage; High Power

3765
(PULSE GENERATORS)
(Hard-tube)
600 KW PEAK HIGH REPETITION RATE HARD TUBE MODULATOR
R.A. Ecken and L Genova
Stanford University, Stanford, CA 94305
IEEE 1973 Eleventh Modulator Symposium pp. 47-55 (09/1973).
This paper describes the design, fabrication and test results of a modulator for the 220 kW S-Band klystrons which are part of the proposed beam recirculating system at the Stanford Linear Accelerator Center. 0 Refs.
Primary Keywords: Hard-Tube Pulser; Series Modulator; High Rep-Rate
Secondary Keywords: Klystron Driver

3767
(BREAKDOWN STUDIES)
(Gas, Electrical)
EXPERIMENTAL INVESTIGATION OF THE STABILITY CONDITIONS OF A DISCHARGE IN A GAS STREAM
G.A. Galechyan and S.I. Petrosyan
Institute Of Physics Research, Academy of Sciences of the Armenian SSR, Ashtarak
Sov. J. Quantum Electron., Vol. 7, No. 5 pp. 649-650 (05/1977).
Trans. From: Kvantovaya Elektron 4, 1143-1144 (January 1977)
It is shown that the flow of a gas through a discharge region gives rise to fluctuation of the current and the amplitude of these fluctuations depend on the gas pressure and flow rate. The conditions for stability of a discharge in a flowing gas are determined. 2 Refs.
Primary Keywords: Electrical Discharge; Flowing Gas; Discharge Stability; Variation With Pressure
Secondary Keywords: Laser Pumping

3768
(REVIEWS AND CONFERENCES)
(Reviews)
GENERAL CONSIDERATION OF ENERGY COMPRESSION
D.S. Zucker
Lawrence Livermore Lab, Livermore, CA 94550
LLL Report No. UCRL-80047 (10/1977).
Availability: UCRL-80047
NTIS
This general treatment of energy compression deals with some of the fundamental considerations involved in such a process. The authors discuss, 1) the need for complementary energy modes such as magnetic electric or kinetic energy modes among which to transfer the energy from one to another; 2) the difference between longitudinal and transverse compression where the former shortens the pulse length and the latter the pulse width; 3) the adiabatic vs. the nonadiabatic process and the need for coherence; 4) the maximum efficiency path and optimum number of stages to achieve a given compression; 5) the generalized action equation of compression. A variety of compression circuits will be discussed utilizing some of the above mentioned principles. 0 Refs.
Primary Keywords: Energy Compression; Impedance Conversion; Plasma State

3769
(SWITCHES, CLOSING)
(Miscelleneous)
LIGHT ACTIVATED SEMICONDUCTOR SWITCHES
D.S. Zucker
Lawrence Livermore Lab, Livermore, CA 94550
LLL Report No. UCRL-80046 (10/1977).
Availability: UCRL-80046
NTIS
Semiconductor junctions are capable of switching large power densities. As far back as the early 60's, silicon thyristors conducted 10 kA/sq. cm. in the surge mode. Electric fields approaching 100 kV/cm are quite common. The single obstacle in the utilization of these devices in high power applications is the slow current rate of rise, and high power operation was attained in millisecond type applications only. The slow turn-on is due to the slow diffusion of carriers in the absence of an electric field limiting these devices to the microsecond rise time regime. Light activation which involves flooding the depletion region with laser light provides for instantaneous conduction by creating the electron hole pairs necessary for conduction in situ. This paper will discuss the potentialities--theoretical and practical--for the utilization of these devices in high-power applications. In addition, open circuiting potentialities and some techniques to improve the performance and new materials. 0 Refs
Primary Keywords: Light Activated Semiconductor Switches; Resonance Effects

3771
(BREAKDOWN STUDIES)
(Gas, Electrical)
PULSED NANOSECOND ELECTRIC DISCHARGES IN GASES
G.A. Mesyats, Y.I. Bychkov and V.V. Kremnev
Academy of Sciences of the USSR, Tomsk, USSR
Sov. Phys. Usp. Vol. 15, No. 3 pp. 282-297 (12/1972).
Trans. From: Usp. Fiz. Nauk 107, 201-228 (June 1972)
We analyze the physical phenomena occurring during the breakdown of gas gaps within times on the order of several nanoseconds or less. It is noted that the streamer mechanism has low probability if the times of formation of the discharge and the fall-off of the voltage across the gap are commensurate with the emission times of the excited molecules. The development of a Townsend discharge is made difficult by the strong influence of the space charge of the avalanche. The discharge mechanisms in single-electron and multi-electron initiation are described and the features of their development are outlined. Oscillographic and electron-optical measurement procedures are described and the main experimental results are reported. Theories explaining the main regularities are presented together with the mechanism for initiation and development of a discharge in ult . strong electric fields. It is noted that x-radiation is produced in the discharge. Results are reported on a discharge at a voltage below the static breakdown value, initiated by fast electrons and by intense ultraviolet radiation. 66 Refs.
Primary Keywords: Nanosecond Breakdown; Single-electron Initiation; Multi-electron Initiation; Townsend Discharge; Very Strong Electric Fields

3772
(SWITCHES, OPENING)
(Gas Gaps, E-beam)
RAPID CUTOFF OF A HIGH CURRENT IN AN ELECTRON-BEAM-EXCITED DISCHARGE
B.M. Koval'chuk and G.A. Mesyats
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Technical Physics Letters, Vol. 2, No. 7, pp 252-25 (07/1976).
Trans. From: Pisma V Zhurnal Tekhnicheskoy Fizike 2, 644-648 (1976)
The problem of cutting off a high current like 1E5-1E6 A in a time interval of the order of 1E7 sec is a central problem in the development of high-power nanosecond pulse systems with inductive energy storage. Apparently the only known current breaker capable of handling high-power, nanosecond pulses in inductive energy storage systems is a device which exploits the explosion of a large number of micron-size conductors. These breakers are single-shot devices, so that their application is limited. We believe that devices with externally sustained volume gas discharges, controlled by electron beams, are promising for use in high-current current breakers. In such a device, which we call an 'injection thyratron', the current is cut off by terminating the injection of electrons into the gas. 5 Refs.
Primary Keywords: E-beam Controlled Opening Switch; Injection Thyratron; Analysis; Theory

3774
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Optical; Lightning)
A PRELIMINARY STUDY OF AEROSOL INITIATED CO/SUB 2/ LASER PRODUCED AIR SPARKS AND THEIR ABILITY TO GUIDE ELECTRICAL DISCHARGES
J.R. Greig, R.E. Pechacek, R.F. Fernsler, I.M. Vitkovitsky, A.W. DeSilva and D.W. Koopman
Naval Research Lab, Washington, DC 20375
NRL Memorandum Report No. 3647 (11/1977).
Availability: AD A050097
NTIS
The time development of air sparks initiated on aerosols near the focal region (f=3m) of a 1 kJ CO/sub 2/ laser beam has been studied. The spark at each aerosol produced a shock wave that expanded spherically at approximately 2E5 cm/sec during the 1.5 microsecond tail of the laser pulse. In time these spherical waves coalesced forming a turbulent cylindrical column from which a cylindrical blast wave separated. The turbulent cylindrical region was nearly stationary (> 100 microsecond time scale) and was able to conduct electrical streamers at greatly enhanced velocities at times as long as one millisecond after the laser pulse. 19 Refs.
Primary Keywords: High Power; Aerosol; Air Breakdown; Electrical Discharge Guiding
Secondary Keywords: Gas Laser

3778
(BREAKDOWN STUDIES)
(Gas, Electrical)
CRITERIA FOR SPARK BREAKDOWN IN SULFUR HEXAFLUORIDE
A. Pedersen
The Technical University, Lyngby, Denmark
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-89, No. 8, pp 2043-2048 (12/1970).
Possible mechanisms of spark breakdown in SF/sub 6/ and other electronegative gases are discussed, and quantitative criteria are derived for the Townsend type and the streamer type of breakdown in nonu form fields. The Townsend criterion is of considerable physical inte t but difficult to apply to engineering problems, whereas the semi-empirical streamer criterion, which holds for impulse breakdown, can be applied to any gap geometry of known field distribution. 23 Refs.
Primary Keywords: SF/sub 6/; Breakdown Mechanism; Townsend Discharge; Streamer Mechanism; Field Distribution

3789
(SWITCHES, CLOSING)
(Solid Dielectric, Electrical)
HIGH-PRECISION FAST-ACTING DISCHARGER WITH A SOLID DIELECTRIC
A.B. Gerasimov, L.V. Dubovoi and G.R. Zablotskaya
Scientific-Research Institute Of Electro-Physical Apparatus, Leningrad, USSR
Instruments And Experimental Techniques, No. 2, pp 446-448 (04/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 120-122 (March-April 1970)
A discharger with polyethylene insulation for the spark gap is described. The discharger inductance is less than 1 cm, it operates in the 30-50 kV voltage range, and the firing time is about 3E-7 sec. 7 Refs.
Primary Keywords: Solid Dielectric Switch; Polyethylene Dielectric; 30-50 kV Operating Voltage; Low Inductance

3806
(POWER CONDITIONING; POWER CONDITIONING)
(Peaking Gaps; Saturable Reactors)
PEAKING THE TRAILING EDGE OF A HIGH-VOLTAGE NANOSECOND PULSE IN AN UNMATCHED LOAD
O.G. Il'in and A.M. Shenderovich
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Kharkhov, USSR
Instruments And Experimental Techniques, No. 2, pp 440-442 (04/1970). Trans. From: Pribory i Tekhnika Eksperimenta ? 116-118 (March-April 1970)
Methods of peaking the trailing edge of high-voltage pulses by means of spark gaps and nonlinear inductances are described. Oscillograms of the pulses are given. From the results obtained it follows, in particular, that the methods suggested can be used to obtain durations of 1 to 2 nsec for both the leading and trailing edges of a pulse in an unmatched load. 5 Refs.
Primary Keywords: Pulse Trailing Edge; Edge Sharpening; Trigatron Spark Gap; Nonlinear Inductance; Unmatched Load

3812
(PULSE GENERATORS)
(Reviews)
BE KIND TO YOUR PULSE GENERATOR
M. Marshall
E-H Research Labs, Oakland, CA 94607
Electronic Design, Vol. 1, pp 34-88 (01/1975).
Problems frequently encountered by pulse generator users, such as improper termination and missing pulses, are examined as are their solutions. Selecting the right generator for different applications and the trade-offs to watch out for are discussed. 0 Refs.
Primary Keywords: Proper Pulse Generator Application; Reading Specifications; Care With Cabling

3822
(DIAGNOSTICS AND INSTRUMENTATION)
(B-field)
ALTERNATING MAGNETIC-FIELD INDUCTION METER UTILIZING THE HALL EFFECT
I.L. Vinnikov and V.I. Katamadze
Institute Of Electronics, Automation, And Remote Control, Academy of Sciences of the Georgian SSR, Tbilisi, USSR
Instruments And Experimental Techniques, No. 5, pp 1221-1224 (10/1969). Trans. From: Pribory i Tekhnika Eksperimenta 5, 116-119 (September-October 1969)
An instrument is described for measuring average values of the alternating component of magnetic field induction in air gaps of 1 mm or more at frequencies from 20 Hz up to 10 kHz, within the range from 0.001 to 1.0 T, with an accuracy better than +or- 2.5%. The response of the induction pickup (an indium arsenide-phosphide Hall generator) is linearized over each measuring range. The variations of the induction curve can be observed on an electronic oscilloscope for which connections are provided. The induction meter has been calibrated with known values of constant magnetic-field induction. 4 Refs.
Primary Keywords: Hall Effect Sensor; 0.001-1.0 T Field Range; 20 Hz-10 kHz Frequency Range; Error Analysis

3838
(PULSE GENERATORS)
(Trigger)
FOUR-CHANNEL UNIT FOR FIRING SPARK GAPS SYNCHRONOUSLY
V.N. Rybin, V.N. Cherepanov, N.I. Zinchenko and V.A. Stepnov
Sukhumi Physiotechnical Institute, Sukhumi, USSR
Instruments And Experimental Techniques, No. 5, pp 1187-1188 (10/1969). Trans. From: Pribory i Tekhnika Eksperimenta 5, 86-87 (September-October 1969)
A simple circuit is described for a four-channel synchronous spark-gap firing unit with an independent power supply based on a pulsed rectifier. The device was tested on a modulator at a working voltage of 50 kV. The dispersion in the firing was no more than 50 nsec. 4 Refs.
Primary Keywords: Trigger Generator, Thyratron; Capacitor Energy Storage; 45 kV Output Voltage; 50 ns Jitter; Pulse Transformer

3840
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH-VOLTAGE GAS-FILLED SPARK GAP
V.M. Ishchenko and V.N. Starinskii
Institute Of Semiconductor Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, No. 5, pp 1185-1186 (10/1969). Trans. From: Pribory i Tekhnika Eksperimenta 5, 85-86 (September-October 1969)
A gas-filled spark gap and the results of its electrical tests are described. The spark gap is designed to switch coaxial cables that are charged up to voltages between 10 and 40 kV. 1 Refs.
Primary Keywords: Spark Gap; Field Distortion Gap; Nitrogen Gap; 40 kV Operating Voltage; Breakdown Voltage Measurement; Switching Line Measurement; Repr-rated; 1 Hz Repetition Rate

3843
(POWER CONDITIONING)
(Pulse Transformers)
INCREASING THE MAXIMUM GRADIENTS IN THE WINDINGS OF THE PULSE TRANSFORMERS OF ACCELERATOR FOREINJECTORS
A.I. Babalin, G.R. Zabinskaya, I.M. Rotfu and S.P. Yakovlev
Instruments And Experimental Techniques, No. 4, pp 911-915 (07/1969). Trans. From: Pribory i Tekhnika Eksperimenta 4, 94-98 (July-August 1969)
The present article describes the results of an investigation of the maximum electric field gradients in the winding insulation of the pulse transformers used for the high-voltage supply of accelerator tubes in high-power accelerators. An increase in the capacitive load leads to an increase in the maximum gradients. 1 Refs.
Primary Keywords: Pulse Transformer; Voltage Distribution, Low Current, Capacitive Load, Performance Test

3855
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Gas, Optical)
PROPAGATION OF HIGH-VOLTAGE STREAMERS ALONG LASER-INDUCED IONIZATION TRAILS
J.R. Veill, D.A. Tidman, T.D. Wilkerson and D.W. Koopman
Versar Inc, Alexandria, VA 22314
Applied Physics Letters, Vol. 17, No. 1, pp 20-22 (07/1970).
The channeling and guidance of an electrical breakdown streamer via a laser-induced ionization trail is discussed, and preliminary experiments demonstrating this phenomenon are reported. 15 Refs.
Primary Keywords: Breakdown Channeling; Laser Channeling; Theory; Geometry Considerations

3861
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SUBNANOSECOND-JITTER LASER-TRIGGERED SWITCHING AT MODERATE REPETITION RATES
J.R. Bettis and A.H. Guenther
AFWL, Kirtland AFB, NM 87117
IEEE Journal Of Quantum Electronics, Vol. QE-6, No. 8, pp 483-491 (08/1970).
A 50-kV laser-triggered spark gap operated at repetition rates to 50 pps is described. Jitter of delay time as low as +or-0.1 ns was demonstrated. Dependence of delay and jitter was investigated as a function of gas mixture, pressure, laser power, and electrode material. Subnanosecond jitter was obtained with as little as 0.17 mJ in a 6-ns giant pulse from a Nd/sup +3/ in a YAG laser. The dielectric gases used included a high proportion of Ar mixed with N/sub 2/ or SF/sub 6/. 16 Refs.
Primary Keywords: Nd-YAG Laser; Argon Gaps; Various Electrode Materials; Subnanosecond Jitter; Rep-rated; Life Test

3888
(DIAGNOSTICS AND INSTRUMENTATION; DIAGNOSTICS AND INSTRUMENTATION)
(Current; Voltage)
HIGH-IMPULSE CURRENT AND VOLTAGE MEASUREMENT
R.J. Thomas
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Instruments And Measurement, Vol. IM-19, No. 2, pp 102-117 (05/1970).
This paper is a survey of methods of high-impulse current and voltage measurements. Typically, such measurement techniques must now include capabilities for measuring high-energy impulses having peak powers as high as many megawatts, currents as high as many mega-amperes, or voltages as high as several megavolts, with rise times as short as a fraction of a microsecond (even as short as the subnanosecond range for moderately high-energy impulses). These capabilities had to be attained in recent years to meet the needs of various areas of scientific research employing such high-energy impulses. This represents a significant extension in the state of the art of such measurement techniques beyond their more traditional role in development and testing of high-voltage bulk power system equipment. The three most commonly used methods of high-impulse current measurement are the magnetic probe, current transformer, and 'pure' resistive shunt methods. These methods are treated in considerable detail. High-voltage capacitive dividers, resistive dividers, and reflection-type attenuators are covered as the principal methods of high-impulse voltage measurement, with some added discussion of the means of insulating such devices. 41 Refs.
Primary Keywords: Review; Magnetic Probe; Shunt; Capacitive Divider; Resistive Divider; Reflection-type Attenuator

3907
(INSULATION, MATERIAL)
(Reviews)
SELECTION OF MATERIALS FOR USE AS ELECTRICAL INSULATION-A PHILOSOPHICAL AND SYSTEMATIC APPROACH
J.R. Perkins
DuPont Co. Wilmington, DE 19898
IEEE Transactions On Electrical Insulation, Vol. EI-6, No. 3, pp 106-110 (09/1971).
The selection of a material for use can be simplified by listing the use-requirements/material-properties systematically so that a workable combination of properties can be found. The requirements are organized under the headings of mechanical, thermal, environmental, electrical, and economic. These are generally in decreasing order of importance except where economic factors override. 0 Refs.
Primary Keywords: Insulation; Selection Criteria; Mechanical; Thermal; Environmental; Electrical; Economic

3920
(SWITCHES, CLOSING)
(Gas Gaps; Optical)
TRIGGERING OF SPARK GAPS BY LASER-INDUCED ION EMISSION
K. Ujihara and M. Kamiyama
University of Tokyo, Bunkyo-ku, Tokyo, Japan
IEEE Journal Of Quantum Electronics, Vol. QE-6, No. 4, pp 239-241 (04/1970).
A mechanism of laser triggering of spark gaps in which laser-produced ions play the dominant role is investigated for several electrode materials. Spark channels due mainly to laser-produced electrons and channels due mainly to laser-produced ions are clearly distinguished by high-speed shadowgraph techniques. 10 Refs.
Primary Keywords: Laser-produced Ions; Several Electrode Materials; Long Delay Times; Anode Irradiation; Ruby Laser

3937
(BREAKDOWN STUDIES)
(Gas; Particle)
STUDY OF THE EFFECT OF DUST PARTICLES ON BREAKDOWN VOLTAGES IN AIR
K.H.H. Martinusson and G.R. Bozzoli
The Transactions Of The South African Institute Of Electrical Engineers, Vol. 55, Part 4, pp 133-141 (04/1964).
The results of a study of the influence of carbon and silica dust in a sphere-sphere air gap is presented in this paper. It was found that the dust deposited on the cathode was the major contributor to the reduction of breakdown voltage and that dust concentration in the gaps has negligible effect. The Fowler-Nordheim equation is used to show that this is, indeed, the case from a theoretical approach. 9 Refs.
Primary Keywords: Air Breakdown; Sphere-sphere Gaps; Dust Particles; Carbon; Silica; Cathode Effects

3954
(POWER CONDITIONING)
(Pulse Transformers)
ENERGY TRANSFER FROM A LOW-VOLTAGE CAPACITOR BANK TO A HIGH INDUCTANCE WITH THE AID OF AN AIR PULSE TRANSFORMER
E. Bar-Avraham (1) and A. Ginzburg (2)
(1) Soreq Nuclear Research Center, Yavneh, Israel
(2) Hebrew University, Jerusalem, Israel
J. Phys. E, Vol. 11, No. 4 pp. 320-322 (04/1978).
A method for transferring energy from a capacitor bank to a high inductance load using an air pulse transformer is described. A transformer with a coupling constant of 97, which allows an energy transfer efficiency of better than 55%, is shown to be simple to construct. 4 Refs.
Primary Keywords: Pulse Transformers; High Energy; Tesla Transformer; High Efficiency

3982
BREAKDOWN MECHANISM OF LASER-TRIGGERED SPARK GAP IN NONUNIFORM FIELD 1. TRIGGER EFFECT AND TIME-LAG CHARACTERISTICS

3987
(SWITCHES, CLOSING)
(Gas Gaps, Thermal)
THE HOT-WIRE TRIGGERED SPARK GAP AT VERY HIGH VOLTAGES
T.E. Broadbent and A.H.A. Shlash
University of Manchester, Manchester, UK
British Journal Of Applied Physics, Vol. 13, pp 596-597 (01/1962).
The performance of the hot-wire triggered spark gap at voltages up to 1 MV and gap spacings up to 80 cm is described. It is shown that the effect of the hot wire is to lower the breakdown voltage of the gap by as much as half. Optical phenomena which occur in the gap when positive voltage is applied are discussed. 4 Refs.
Primary Keywords: Spark Gap; Hot-wire Trigger; 1 MV Operating Voltage; Breakdown Voltage vs Wire Temperature

3997
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Pulse Forming Lines)
INTENSE PULSED NEUTRON SOURCE (IPNS-I) ACCELERATOR 500 MEV FAST KICKERS
D.E. Suddeth and G.J. Volk
Argonne National Lab, Argonne, IL
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 3, pp 3024-3025 (06/1979).
Two ferrite loaded picture frame magnets with a kick of up to 15 mrad each are used to extract 500 MeV protons from the IPNS-I accelerator to the neutron source target at the Argonne National Laboratory. The magnet aperture is 10 cm wide by 5 cm high and the length is 60 cm. The single bunch extraction requires a magnetic field rise time (0 to 100%) of 90 ns and a flattop of 100 ns. The magnets receive the 3600 A maximum current via an array of 50 ohm coaxial cables connected in a shunt arrangement. The two legs of each magnet are energized with separate lines to keep the potential to ground to less than 40 kV. The system is designed to run at 30 pulses per second repetition rate. The complete system of control electronics, power supply, deuterium thyratron switch, magnet and resistive load is described along with some of the problems of stray inductances and the techniques used to reduce them. 0 Refs.
Primary Keywords: Picture Frame Magnet; 90 ns Rise Time; 3600 A Current; Thyratron; Pulse Forming Line; Rep-rated

4010
(BREAKDOWN STUDIES; DIAGNOSTICS AND INSTRUMENTATION)
(Vacuum, Electrical; Current)
PREBREAKDOWN CURRENT MEASUREMENTS IN VACUUM GAPS STRESSED BY ALTERNATING VOLTAGES
K.A. Narayanankutty and G.R. Nagabhushana
Indian Institute of Science, Bangalore, India
Proceedings Of The IEE, Vol. 123, No. 5, pp 475 (05/1976).
A method of measuring prebreakdown currents in a vacuum gap is described in this paper. A precision transformer is used to sample imput voltage, which can then be used to compensate for displacement current in the gap. Currents as low as 0.1 microamp have been measured. A sample Fowler-Nordheim Plot is included. 2 Refs.
Primary Keywords: Prebreakdown Current; Vacuum Gap; Compensating Transformer; Fowler-Nordheim Plot

4013
(SWITCHES, CLOSING)
(Gas Gaps, Self)
RISE TIME AND TIME DEPENDENT SPARK-GAP RESISTANCE IN NITROGEN AND HELIUM
T.P. Sorensen and V.M. Ristic
University of Toronto, Toronto, Canada
Journal Of Applied Physics, Vol. 48, No. 1, pp 114-117 (01/1977).
The rise time and time-dependent spark-gap resistance in nitrogen and helium were measured using a novel microwave method. Emperical formulas for spark-gap resistance and rise time are proposed, with a maximum error, as compared to experimental results, of for- 8%. 9 Refs.
Primary Keywords: Self-break Spark Gap; Resistance Measurement; Temporal Resolution; Nitrogen Gap; Helium Gap; Current Rise Time; Microwave Diagnostic

4016
(PARTICLE BEAMS, ION)
(Generation)
[illegible] IN THE EFFICIENT GENERATION OF INTENSE PULSED PROTON BEAMS
[illegible] J.J. Lee and P.N. Sudan
[illegible]ersity, Ithica, NY 14850
[illegible] Applied Physics, Vol. 46, No. 1, pp 187-192 (01/1975).
[illegible]ated as or the space-charge-limited reflex vacuum triode [illegible] accelerator show a marked improvement in the output [illegible] and efficiency of the device. In the current machine, a [illegible] of 130 keV protons of 6000 A is produced at a current [illegible] cm. Energies up to 300 keV have been [illegible] diode efficiency, defined as proton energy output [illegible] has been raised from 10 to 42% by the [illegible] fields that prevent anomalous electron loss in [illegible] the edges of the electrodes. Time-of-flight [illegible] energies. The beam was measured to [illegible] and. The results obtained [illegible] scaled to the ranges of [illegible] pulsed electron accelerators. R

[illegible]
[illegible] Improved Efficiency
[illegible] PHYSICS, REPRINTED WITH

4033
(BREAKDOWN STUDIES)
(Vacuum, Particle)
EFFECTS OF PARTICLES ON HIGH-VOLTAGE VACUUM BREAKDOWN AND INTERELECTRODE CURRENT
J.J. Maley
RCA Corp, Lancaster, PA 19104
Journal Of Vacuum Science And Technology, Vol. 11, No. 5, pp 892-895 (10/1974).
The effect of both dielectric and conducting microparticles on vacuum tube breakdown voltage are considered. It is found that insulating particles can reduce breakdown voltage by 30% while conducting particles typically reduce the breakdown voltage by 45%. It is also shown that it is fairly simple to condition stainless steel electrodes contaminated by dielectric particles. Conducting particles, on the other hand, cause extensive arcing and are very difficult to remove. 10 Refs.
Primary Keywords: Microparticle; Dielectric; Conducting; Effect On Breakdown; Voltage; Conditioning; Stainless Steel Electrode

4043
(BREAKDOWN STUDIES)
(Solid, Electrical)
INVESTIGATION OF BREAKDOWN AND RESISTIVITY STRIATIONS IN HIGH-VOLTAGE SILICON DIODES
A. Muhlbauer, F. Sedlak and P. Voss
Siemens AG, Munchen, FRG
Journal Of The Electrochemical Society; Solid-state Science And Technology, Vol. 122, No. 8, pp 1113-1116 (08/1975).
The paper presents experiments in which the relationship between microscopic resistivity variations and the breakdown behavior of high-voltage diodes made from silicon wafers cut parallel to the rod axis is studied. The breakdown pattern was found to be striated. Where there were regular fluctuations in the resitivity, breakdowns occurred at microscopic resistivity minima. Otherwide the distance between breakdown striations was more than twice the minimum distance between resistivity minima. 4 Refs.
Primary Keywords: Silicon Diode; High-voltage Diode; Breakdown; Absolute Resistivity; Variation In Resistivity

4045
(BREAKDOWN STUDIES)
(Gas, Electrical)
ANALYSIS OF SPARK BREAKDOWN CHARACTERISTICS FOR SPHERE GAPS
A. Pedersen, J. Lebeda and S. Vibholm
The Technical University, Lundtofte, Lyngby, Denmark
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-86, No. 8, pp 975-978 (08/1967).
The application of a semi-empirical spark breakdown criterion is illustrated, and it is shown that it can give a very detailed analysis of known spark breakdown characteristics for the sphere gap. Measurements are reported on scattering in impulse voltage for a 25-cm sphere gap. The results give new evidence for the existence of the Toepler discontinuity. 13 Refs.
Primary Keywords: Spark Breakdown; Air Gap; Atmospheric Pressure; Sphere Gap; Toepler Discontinuity; Breakdown Voltage Scatter

4049
(BREAKDOWN STUDIES)
(Gas, Electrical)
ASYMPTOTIC PLASMA AND SHEATH REPRESENTATIONS FOR LOW-PRESSURE DISCHARGES
S.A. Self
Stanford University, Stanford, CA 94305
Journal Of Applied Physics, Vol. 36, No. 2, pp 456-459 (02/1965).
The collisionless plasma-sheath equation is discussed in the limit that the ratio of Debye length to discharge dimension is vanishingly small, for the cases of planar, cylindrical, and spherical symmetric discharges. Separate representations for the plasma and sheath regions are found and numerical results given for the potential profiles, ion currents, energy distributions, and floating wall potentials for two different assumptions regarding the ion generation function in each case. 10 Refs.
Primary Keywords: Low-pressure Discharge; Collisionless Plasma-sheath Equation; Floating Wall Potential; Ion Generation; Electron Distribution Function

4051
(PARTICLE BEAMS, ELECTRON)
(Generation)
BEHAVIOR OF LOW-IMPEDANCE RELATIVISTIC ELECTRON DIODES IN CONVERGING MAGNETIC GRADIENTS
D.A. Phelps, J.R. Oldenettel, P. Korn and J. Shannon
Maxwell Labs Inc, San Diego, CA 92123
Applied Physics Letters, Vol. 29, No. 6, pp 335-338 (09/1976).
The behavior of a large-area field emission diode located in a 4:1 converging magnetic gradient is described. Evidence is presented that this technique significantly reduces the early-time L/R decay into the nominal 3/4 ohm space-charge-limited impedance characteristic. The elimination of late-time plasma closure in the diode gap is also demonstrated. Due to these characteristics, a significant reduction in the time-averaged diode impedance and an improvement in the pulse-line-diode energy transfer efficiency has been obtained-thereby permitting first observations of efficient matching to a sub-ohm pulsed electron accelerator.
Primary Keywords: E-beam Generation; Field Emission Diode; Magnetic Field, Converging Gradient; Diode Impedance Reduction

4057
(BREAKDOWN STUDIES)
(Gas, Electrical)
STATIC AND DYNAMIC PROPERTIES OF ARCS NEAR PLANE SURFACES
E.J. Los (1) and DC Jolly (2)
(1) General Electric Co, Pittsfield, MA 01201
(2) Massachusetts Institute of Technology, Cambridge, MA
Z. Physik, Vol. 20, pp 3-11 (01/1975).
The static and transient behavior of arcs near plane surfaces are analyzed theoretically, and the models obtained are compared with empirical data. The linearization technique of Maecker was used to predict the static properties of the arcs and showed fair agreement with test results when the surface was dry, but was off when the surface was wet. Phillip's model was used to analyze the dynamic behavior of the arcs, and as before the dry surface results agreed with theory, but wet surface results did not. 22 Refs.
Primary Keywords: Dielectric Surface; Dry Surface; Wet Surface; Experiment; Theory; Maecker's Method; Phillips' Method.

4067
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
A 100 KV, FAST, HIGH ENERGY, NONUNIFORM FIELD DISTORTION SWITCH
R.S. Post and Y.G. Chen
Columbia University, New York, NY 10027
The Review Of Scientific Instruments, Vol. 43, No. 4, pp 622-624 (04/1972).
A fast closing, high voltage, high energy, nonuniform field distortion switch has been developed. This switch, filled with free-flowing one atmospheric sulfur-hexafluoride gas, operates in the cascade mode, and is able to handle 36 kJ at 85 kV. These switches have been tested and put into operation with the Columbia high voltage capacitor bank. The over-all jitter between the six switches used is less than 10 nsec at 85 kV. 4 Refs.
Primary Keywords: Field Distortion Gap; SF/sub 6/ Gap; Atmospheric Pressure; Flowing Gas; 85 kV Operating Voltage; 10 ns Jitter

4068
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
CERAMIC HIGH-VOLTAGE CAPACITORS K-15U-1, K-15U-2, AND K-15U-3
N.V. Stavitskaya (Ed.) and S.Y. Baban (Ed.)
FSTC Report No. FSTC-HT-23-762-68 (05/1969).
Trans. From: Handbook Published By The Standards Publishing House, USSR (1967)
Availability: AD 687317
NTIS
This report is a translation of a Soviet standard concerning ceramic capacitor fabrication. The present standard applies to capacitors of fixed capacitance having a ceramic dielectric, designed for operation in direct current circuits with a voltage up to 30 kV, in high frequency alternating current circuits with a voltage up to 25 kV rms and in pulse modes. 0 Refs.
Primary Keywords: Ceramic Capacitor; High Voltage; Standard Of Fabrication; Application Data

4069
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
CROWBARRING TECHNIQUE FOR HIGH-VOLTAGE CAPACITOR BANKS
W.K. Tucker
Sandia Labs, Albuquerque, NM 87115
(04/1971).
Availability: SC-DR-710154
NTIS
For abstract, see NSA 25 17, number 41665.
Primary Keywords: Electric Capacitors

4070
(PULSE GENERATORS)
(Capacitor Banks)
CURRENT SHAPING TECHNIQUES FOR HIGH-VOLTAGE CAPACITOR BANKS
W.K. Tucker
Sandia Labs, Albuquerque, NM 87115
(08/1971).
Availability: SC-DR-710463
NTIS
For abstract, see NSA 25 23, number 57268.
Primary Keywords: Electric Capacitors

4071
(ENERGY STORAGE, CAPACITIVE)
(Capacitor Banks)
DESIGN AND CONSTRUCTION OF FAST HIGH ENERGY, HIGH VOLTAGE CAPACITOR BANKS
W. Hess
Lawrence Livermore Lab, Livermore, CA 94550
(06/1969).
Availability: UCID-16166
NTIS
For abstract, see NSA 27 11, number 26591.
Primary Keywords: Electric Capacitors
Secondary Keywords: AEC

4073
(POWER CONDITIONING)
(Pulse Forming Networks)
DIGITAL SIMULATION AND PARAMETER ESTIMATION TECHNIQUES FOR THE E-LINE PULSE-FORMING NETWORK
L.W. Vannoy
AFIT, Wright-Patterson AFB, OH
AFIT Report No. AFIT/GE/EE/79-2 (03/1979).
Availability: AD A069199
NTIS
A line-type, voltage-fed, pulse-forming network, called the 'E-line', is studied. The energy to be delivered to the load is stored in a source capacitor at the front of the network. Storing all the energy in the source capacitor leads to a more reliable and lightweight system than is achievalbe by a conventional network where all the capacitors store energy. The network is to deliver 100-200 rectangular pulses per second to the load where each pulse is 20-30 microseconds in duration and has a pulse height of 30,000 volts. A computer program is developed which models the discharge of the network and is used to analyze the output pulse shape for different inductor and capacitor values within the network. Another computer program is developed which estimates the inductor and capacitor values needed for the network to give a close approximation to the desired rectangular pulse. 8 Refs.
Primary Keywords: 'E-line' Pulse Forming Line; Simulation; State-variable Model; Design Considerations; Numerical Calculation

4074
(PARTICLE BEAMS, ELECTRON)
(Generation)
CURRENT FLOW IN A HIGH-VOLTAGE DIODE SUBJECTED TO A CROSSED MAGNETIC FIELD
T.J. Orzechowski and G. Bekefi
Massachusetts Institute of Technology, Cambridge, MA
The Physics Of Fluids, Vol. 19, No. 1, pp 43-51 (01/1976).
The space-charge limited electron current (approximately 50 kA) flowing in a pulsed, high voltage (approximately 200 kV) vacuum diode is studied as a function of magnetic field applied at right angles to the diode electric field. The observations compare favorably with predictions from self-consistent theory which takes account of space-charge and allows for the presence of the magnetic field. Time-resolved measurements of the diode current and voltage lead to a determination of the expansion velocity of the cathode and anode plasmas. It is shown that a magnetic field of approximately 5 kG suffices to stop plasma motion, in agreement with magnetohydrodynamic computations. Thus, diode closure is inhibited, at least over the 40 nsec time span of the voltage pulse. 39 Refs.
Primary Keywords: E-beam Generation; Field Emission Diode; Transverse Magnetic Field; Electron Current Flow; Cylindrical Diode; Graphite Cathode

4075
(REVIEWS AND CONFERENCES; PULSE GENERATORS)
(Reviews; Reviews)
FORMATION OF NANOSECOND PULSES OF HIGH VOLTAGE
G.A. Mesyats, A.S. Nasibor and V.V. Kremnev
FTD Report No. FTD-HC-385-71 (11/1971).
Trans. From: Formirovaniye Nanosekundnykh Impul'sov Vysokogo Napryazheniya 1970, pp 1-153
Availability: AD 733130
NTIS
The book is devoted to the design and construction of devices producing pulses lasting from one to hundreds of nanoseconds of voltage ranging up to 1000 kV. A survey is given of the existing methods for producing short high-voltage pulses. Various types of circuitry for generators of high-voltage nanosecond pulses are discussed. An analysis is given of transient processes within the framework of equivalent circuits. Engineering calculations are included for the formative elements of various types of generators. Consideration is given to circuits correcting pulse waveforms, and also to circuits used to measure pulse parameters. This book is intended for experimental physicists, specialists in the area of electrical and radio engineering, and for students majoring in engineering. 176 Refs.
Primary Keywords: Nanosecond Pulse; Pulse Signal; Circuit; Design; Pulse Generators
Secondary Keywords: Pulse Laser

4076
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
HIGH ENERGY DENSITY CAPACITORS FOR VACUUM OPERATION WITH A PULSED PLASMA LOAD
W.J. Guman
Fairchild Industries Inc, Farmingdale, NY 11735
Final Report, No. NASA-CR-149813, 59p (03/1976).
Availability: N77-19166/6ST
NTIS
Results of the effort of designing, fabricating, and testing of a 40 joules/lb (88.2 joules/kg) high voltage energy storage capacitor suitable for operating a pulsed plasma thruster in a vacuum environment for millions of pulses are presented. Using vacuum brazing and heli-arc welding techniques followed by vacuum and high pressure helium leak tests it was possible to produce a hermetically sealed relatively light weight enclosure for the dielectric system. An energy density of 40 joules/lb was realized with a KF-polyvinylidene fluoride dielectric system. One capacitor was D.C. life tested at 4 KV (107.8 joules/lb) for 2,000 hours before it failed. Another exceeded 2,679 hours without failure at 38.3 joules/lb. Pulse life testing in a vacuum exceeded 300,000 discharges with testing still in progress. The D.C. life test data shows a small decrease in capacitance and an increase in dissipation factor with time. Heat transfer from the load to the capacitor must also be considered besides the self-heat generated by the capacitor.
Primary Keywords: Capacitors; Energy Storage; Plasma Engines; High Voltages; Vacuum; Accelerated Life Tests; Dielectrics; Failure; Heat Transfer; Plasma Jets
Secondary Keywords: NTISNASA

4077
HIGH VOLTAGE DOUBLE PULSE SYSTEM FOR THE STUDY OF THRESHOLD SWITCHING MATERIALS
C.H. Culp
Ames Lab, IA
(05/1975).
Availability: IS-3459
NTIS
No abstract available
Primary Keywords: Semiconductor Switches_Performance Testing; Capacitors; Electric Potential; Electronic Circuits; Mechanics; Pulse Circuits; Pulse Rise Time; Pulses; Transistors
Secondary Keywords: ERDA/4.0800; NTISERDA

4079
(PULSE GENERATORS; POWER CONDITIONING)
(Line Type, Pulse Forming Networks)
HIGH VOLTAGE NANOSECOND PULSE GENERATORS
C. Zavales
Cober Electronics Inc, Stamford, CT 06902
Eradcom Report No. DELET-TR-77-2641-5 (05/1980).
Availability: AD A087291
NTIS

A parallel Blumlein curcuit, combined with a spark gap switch, was designed for operation at 24 kV, 5 kA peak. Tests were conducted with a single Blumlein with a 10 ohm load. Because of problems with breakdown in the triggered spark gap, a slightly larger spark gap was substituted. An acceptable pulse was delivered from the pulse forming network after adjustment of the inductive elements in the network. 0 Refs.

Primary Keywords: Pulse Generator; Blumlein; Spark Gap Switch; Avalanche Transistor

4080
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
HIGH VOLTAGE PULSE CAPACITORS
G.S. Kuchinskii
FTD, Wright-Patterson AFB, OH
No. FTD-HC-23-2678-74, 197p (04/1975).
Availability: AD-A017 190/0ST
NTIS

High voltage pulse power capacitors are considered in this book. The characteristics of the basic insulation materials are presented. The physical processes arising in pulse capacitors under various operating conditions are considered. A technique is given for calculating the basic dimensions of capacitors, inductance, energy losses, thermal calculations, and evaluation of service life and reliability. The main contemporary types of domestic and foreign pulse capacitors are described.

Primary Keywords: Capacitors; Pulses; High Voltage; Electrical Insulation; Translations; USSR
Secondary Keywords: NTISDODAF

4081
HIGH VOLTAGE PULSE GENERATOR
D.L. Pippen
National Aeronautics and Space Administration, Washington, DC
Patent No. PAT-APPL-845 365, (09/1970).
Availability: PATENT-3 530 336
NTIS

A capacitive discharge circuit is employed to produce a controlled, high voltage, fixed energy spark. A fixed voltage for the spark discharge is provided by a storage capacitor connected in parallel with a Zener diode. Discharge of the capacitor through the primary of an output transformer is controlled by a separately powered control circuit which employs a silicon controlled rectifier (SCR) as a switching device. A Zener diode employed in the control circuit is subject to the storage capacitor voltage and when the desired capacitor voltage is reached, is driven into conduction to fire a second SCR in the control circuit which in turn activates a relay to energize a ready lamp indicating that the circuit is prepared to deliver a fixed energy spark. The charge circuit is manually fired by closing a switch or is automatically fired each time the circuit is prepared to deliver the fixed energy spark by linking the switching mechanism to the relay. After each discharge, the first SCR is automatically commutated by the back EMF of the output transformer and the second SCR is commutated by the AC input to the control circuit.

Primary Keywords: Patents; High; Voltage; Pulse; Generator
Secondary Keywords: PAT-CL-315-241; NTISGPNASA
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

4082
(SWITCHES, CLOSING)
(Thyratrons)
HIGH VOLTAGE PULSE SUPPLY FOR WIRE SPARK CHAMBER BY MEANS OF THYRATRON
K.S.T Watanabe
Tokyo University, Tanashi (Japan). Inst. for Nuclear Study
(01/1976).
Availability: INS-TH-104
NTIS

The wire spark chamber is being operated conveniently as one of the important track measuring devices in photon-nucleus interaction experiments with the 1.3 BeV synchrotron in the Institute for Nuclear Study, the University of Tokyo. In order to get the stable operation of the chamber at high efficiency during long experimental period, the pulse supply employing a deuteron gas filled thyratron was produced for the high voltage circuits. The thyratron used was CX-1154 (EE and V Co., Ltd.), a high performance tube of reduced time jitter, prolonged life, small internal impedance and short transit time. The pulse supply was produced by adopting modular parts, not paying special care to the power supply and its stabilization, but mainly considering long term stability and easy maintenance. Thus it was divided into a main module, a bias supply and a condenser bank. As a result, the total transition time in the high voltage [illegible] was 140 ns, while the rise time of output pulses was 60 ns. It has operated stably for over 3 months [illegible] during the continuous operation at [illegible] (Atomindex citation 08:313479)

Primary Keywords: High voltage pulse [illegible] chambers. [illegible] Performance; Power [illegible] Thyratrons
Secondary Keywords: IN JAPANESE; ERDA [illegible] NTISINIS
Distribution Restriction: U. S. SALES ONLY

4084
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
HIGH-VOLTAGE SUPPLY SYSTEM FOR ELECTROSTATIC DEFLECTOR
V.A. Akkuratov, A.A. Glazov, V.V. Kudryashov, M.M. Semenov and N.G. Shakun
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
(01/1978).
Availability: JINR-R-9-11344
NTIS

To increase the efficiency of output of accelerated particles a system of high-voltage supply to the electrostatic deflector of the U-120 M cyclotron was developed. The peculiarity of the system is a possibility of a deep and smooth (90%) regulation of rectified voltage with its stability being preserved. To power the multiplying column assembled using a single-cycle circuit on the 2 Ts 106 G small-dimensional rectifying posts and K15-4 condensers, a transistor converter and a step-up transformer of an original design on a disconnected ferrite core are used. To raise the transformation coefficient and to obtain voltage of a sinusoidal shape the frequency of the converter has been chosen to be equal to the frequency of successive resonance of the transformer scattering induction with the input capacity of the column. The stabilization system consisting of two rings of feedback permitted the combination of deep smooth regulation of rectified voltage and its stabilization with a high accuracy. (Atomindex citation 10:441637)

Primary Keywords: Cyclotrons; Beam Extraction; Capacitors; Efficiency; Electronic Circuits; Electrostatic Septa; Ferrites; Flowsheets; Performance Testing; Power Supplies; Voltage Regulators
Secondary Keywords: IN RUSSIAN; Foreign Technology; ERDA/430302; NTISINIS; NTISFNUR
Distribution Restriction: U.S. SALES ONLY.

4086
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
IMPROVED SYSTEM FOR THE MEASUREMENT OF HIGH-VOLTAGE PULSES
W.A. Stephenson
Sandia Labs, Albuquerque, NM 87115
(05/1976).
Availability: SAND-75-0470
NTIS

A small 71.8 mm x 127 mm (2.83'' x 5'') capacitive voltage divider is described that is used for measuring waveforms in the 200 kilovolt range with durations of tens of microseconds. The device, immersed in a dielectric fluid, works over the temperature range of 219 to 347 exp 0 K (-65 to +165 exp 0 F). The divider works into an electronic impedance matching line driver which has selectable division ratios of 10,000, 20,000, 30,000, and works into a 50-ohm load. Total deviation in division ratio for the system is in the order of +1.5 percent to -1.05 percent. (ERA citation 01:018808)

Primary Keywords: Capacitors; Electric Measuring Instruments; Neutron Sources; Electric Potential; Electronic Circuits; Pulsed Neutron Techniques; Pulses; Wave Forms
Secondary Keywords: ERDA/070200; ERDA/440300; NTISERDA

4088
(PULSE GENERATORS; SWITCHES, CLOSING)
(Systems; Systems)
PULSER FOR EMP SIMULATION
W H. Wright Jr.
ECOM, Fort Monmouth, NJ 07703
ECOM Report No. ECOM-4198 (02/1974).
Availability: ECOM-4198
NTIS

This development project was undertaken to provide a pulser capable of driving a low-impedance array of antennas with a high-peak-power, short rise-time pulse to simulate the electrical interferance effects of an electromagnetic pulse (EMP). The final pulser produced a 100 kilovolt (kV), 72 kiloamperes (kA) output pulse with a 6 nanosecond (ns) voltage rise time and 42 ns current rise time through a single output switch. Additional experiments showed how multiple output switches could reduce the current rise time to 14 ns with a 9 ns jitter. The output switch was a water-or air-filled spark gap, and operation in both modes is described. The report also includes design information on a simple and reliable 100 kV DC switch, a low-impedance high power dummy load, and voltage and current measuring devices for viewing fast transients. 10 Refs.

Primary Keywords: Capacitor Discharge; Strip Line Pulser; Spark Gap; Water Switch; Dummy Load

4089
(ENERGY STORAGE, CAPACITIVE)
(Capacitor Banks)
REGULATOR FOR HIGH VOLTAGE CAPACITOR BANK
A.M. Kozodaev and N.V. Lazarev
GKAE Atomic Energy Institute, Moscow, USSR
(01/1970).
Availability: ITEF 761
NTIS

For abstract, see NSA 25 12, number 28108.

Primary Keywords: Electron Tubes; Linear Accelerators
Distribution Restriction: U. S. SALES ONLY

4090
(BREAKDOWN STUDIES)
[illegible]
TANTALUM CAPACITOR BEHAVIOR UNDER FAST TRANSIENT OVERVOLTAGES
[illegible] and W. D. Castle
[illegible] Space Center, Houston, TX 77058
NASA Report No. NASA TM X-58152 (12/1974).
Availability: N75-14030
NTIS

Tantalum capacitors were tested to determine failure time when subjected to short duration, high-voltage surges caused by lightning strikes. Lightning is of concern to NASA because of possible damage to [illegible] spacecraft circuits. The test was designed to determine the minimum time for tantalum capacitor failure and the amount of overvoltage a capacitor could survive, without permanent damage, in [illegible] microseconds. All capacitors tested exhibited good recovery from [illegible] one-shot pulses with no failure at any voltage, forward or reverse, in less than 25 microseconds. 0 Refs.

Primary Keywords: Capacitor Breakdown; Circuit Protection; High Voltage; Failure Analysis; Lightning; Leakage
Secondary Keywords: Electric Filters

4093
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Marx Generators; Marx)
THE MOLECULE, A COMPACT, HIGH-DENSITY, HIGH-PRECISION MARX GENERATOR
D.M. Strickland and W.L. Weatherly
AFWL, Kirtland AFB, NM 87117
AFWL Report No. AFWL-TR-73-196 (11/1973).
Availability: AD 915353
NTIS
A Marx generator with the highest energy density ever achieved (39 J/pound) is described. The unit, which operates at 2 MV in atmospheric SF/sub 6/, is 2 m long, stores 18 kj, and weighs 460 pounds. The design incorporates several novel features: the stage capacitors are 100-kV plastic-cased units with a density of 100 joules per pound; grading is achieved by split grading rings, and a conductive elastomer charges and triggers the resistors. Its compactness, light weight, and atmospheric gas insulation ideally suit this Marx design for a variety of applications such as bounded-wave and radiating EMP simulators, plasma devices, laser systems, and electron-beam devices. The modular nature allows the design voltage to be increased or decreased as necessary. The unit has a demonstrated erection jitter of less than 10 nsec over a 7:1 voltage range and consequently can be precisely time-tied to test sequences or to other hardware. 8 Refs.
Primary Keywords: High Energy Density, Very High Voltage; Grading Rings; Modular Design; EMP Simulation

4100
(SWITCHES, OPENING)
(Superconductive)
INVESTIGATIONS ON FAST SWITCHING SUPERCONDUCTIVE/NORMALCONDUCTIVE CURRENT BREAKERS (CRYOTRONS)
M. Pillsticker
Institut fur Plasmaphysik, Garching, FRG
Proceedings Of The 6th Symposium On Engineering Problems Of Fusion Research, pp 453-457 (11/1976).
Operating physical experiments often requires switching equipments for the fast commutation of high currents from the current-breaker-branch of a network into an ohmic or capacitive load branch. Considering circuits with superconductive windings breakers working as cryotrons (SC/NC switching) are researched. Requirements for extremely fast current breaking at a minimum trigger energy are defined. Possible are triggering by current pulse and magnetic field pulse. Advantages and disadvantages of the trigger methods are explained. Concepts of breaker units are presented being very small and suitable for single operation as well as in parallel and/or serial arrangement. Breaker-units are switched carrying currents of nearly 800 A at the superconductive state before triggering. Current commutation times less than 0.5 microseconds were measured. The maximum switching voltage across a breaker must be less than 5 kV. 4 Refs.
Primary Keywords: Cryotron; Superconductive Switch; Magnetic Field Triggering; Current Pulse Triggering; Zero Resistance; Finite Resistance; Resistive Load

4103
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
NOVEL CAPACITOR-DIVIDER VOLTAGE SENSORS FOR HIGH-VOLTAGE TRANSMISSION SYSTEMS
A. Stalewski (1) and G.C. Weller (2)
(1) CEGB, Burymead House, Guildford GU2 5BN, UK
(2) GEC Measurement Ltd, Stafford, UK
Proceedings Of The IEE, Vol. 126, No. 11, pp 1186-1195 (11/1979).
A design is presented for a new capacitive divider and amplifier system for the protection of high voltage power lines. The effect of trapped charge (charge trapped in the divider after the breaker opens) is considered and a solution is proposed. Parasitic inductance effects and problems with discharges caused by polution are discussed. 10 Refs.
Primary Keywords: Capacitive Voltage Divider; Performance Test; AC Voltage; Impulse Voltage; Charge Trapping; DC Offset
Secondary Keywords: Power Line Protection

4105
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)
PRECISION REGULATED, 20 KW, MODULATOR PFN CHARGING SYSTEM
C.A. Corson
Westinghouse Electric Corp, Baltimore, MD 21203
1978 IEEE Thirteenth Modulator Symposium, pp 34-37 (06/1978).
This paper describes a new, high efficiency, regulated modulator charging system that accurately charges the pulse forming networks (PFN's) in a 14 megawatt modulator to over 5 kV without the use of a conventional high voltage power supply, or dissipative regulator. It is impervious to load open and short circuits and regulates PFN voltage precisely. The circuit stores a measured amount of energy in a transformer as 1/2 LI/sup 2/ and then transfers it to a PFN capacitor as 1/2 CV/sup 2/. This technique uses considerably less parts than previous methods and therefore produces impressive size, weight and cost reductions as well as design simplification. It also charges and regulates PFN's more efficiently than previous methods because of using less parts in the main power path and now using a dissipative regulator. 3 Refs.
Primary Keywords: High Energy; Precise Energy Stored In Transformer; Design Simplification; No Dissipative Regulator

4111
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
CONTROLLED AVALANCHE RECTIFIER CHAINS FOR ACCELERATING VOLTAGE SUPPLIES
N.N. Hanna
Egyptian Atomic Energy Establishment, Cairo, Egypt
International Journal Of Electronics, Vol. 34, No. 1, pp 121-126 (11/1971).
Controlled avalanche rectifier chains are proposed as an alternative to conventional silicon rectifier chains since voltage sharing capacitors are not needed. Voltage and current distribution is analyzed as are the rectifier current and power ratings. A design example is given. 4 Refs.
Primary Keywords: Controlled Avalanche Rectifier; Series Connection; Voltage Sharing; No Capacitors

4118
PULSE FORMING NETWORKS FOR FAST PUMPING OF HIGH POWER ELECTRON-BEAM-CONTROLLED CO/SUB 2/ LASERS
K.B. Riepe
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-751102-1, 10p (01/1975).
Availability: LA-UR-75-1832
NTIS
The transverse electric discharge is a widely used technique for pumping CO sub 2 lasers at high pressures for the generation, simply and efficiently, of very high power laser pulses. The development of the electron-beam-controlled discharge has allowed the application of the transverse discharge to large aperture, very high energy systems. LASL is now in the process of assembly and checkout of a CO sub 2 laser which is designed to generate a one nanosecond pulse containing 10 kilojoules, for use in laser fusion experiments. The front end of this laser consists of a set of preamplifiers and a mode locked oscillator with electro-optic single pulse switchout. The final amplifier stage consists of four parallel modules, each one consisting of a two-sided electron gun, and two 35 x 35 x 200 cm gas pumping regions operating at a pressure of 1500 torr with a 3/ exp 1 / sub 4 /1 (He/N sub 2 /CO sub 2) laser mix.
Primary Keywords: Carbon Dioxide Lasers_Pumping; Electric Discharges; Electron Beams; Pulse Generators
Secondary Keywords: Optical Pumping, NTISERDA

4119
(PULSE GENERATORS)
(Trigger)
SCR TURN-OFF PROBLEM ELIMINATED IN RAPID-FIRE STROBOSCOPE TRIGGER
D. Zinder
Motorola Semi-conductor Products Inc, Phoenix, AZ 85008
Electronic Design, Vol. 22, pp 116 (10/1973).
In the circuit presented a low-voltage rectifier and a high-voltage transistor allow the SCR to turn off when the capacitor charging current is greater than the SCR holding current. Pulse rates of greater than 1 kHz can be achieved. 0 Refs.
Primary Keywords: Trigger Generator; SCR Switches; Rep-rated; Charging Circuit

4123
(PARTICLE BEAMS, ELECTRON)
(Generation)
EXPERIMENTAL INVESTIGATION OF HIGH-CURRENT RELATIVISTIC ELECTRON FLOW IN DIODES
M. Di Capua, J. Creedon and R. Huff
Physic International Co, San Leandro, CA 94577
Journal Of Applied Physics, Vol. 47, No. 5, pp 1887-1896 (05/1976).
Various aspects of the magnetically self-pinched electron flow patterns in megavolt megampere diodes have been investigated. The onset of pinching has been correlated with a transition from Child-Langmuir to parapotential voltage-current characteristics. The average velocity at which the pinch sweeps towards the axis has been measured and is found to be approximately mm/nsec. The invariance of the current under geometrical scaling is demonstrated, and the connection between this invariance and plasma motion is discussed. Measurements of total diode current are compared with existing theories and agreement is found with the parapotential model. 31 Refs.
Primary Keywords: E-beam Generation; Field Emission Diode; Electron Flow; Magnetic Self Pinching; Parapotential Voltage-current Characteristic

4129
(INSULATION, MAGNETIC)
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MAGNETIC INSULATION OF HIGH VOLTAGES IN VACUUM: COMPARISON OF EXPERIMENT WITH SIMULATIONS
K.D. Bergeron (1), J.W. Poukey (1), M.S. Di Capua (2) and D.G. Pellinen (2)
(1) Sandia Labs, Albuquerque, NM 87115
(2) Physic International Co, San Leandro, CA 94577
Sandia Report No. SAND-78-1145C (09/1978).
Availability: SAND-78-1145C
NTIS
Experiments on long magnetically insulated vacuum transmission lines at the 700 kV/cm level have been analyzed by comparing with computer simulations. The particle-in-cell code used is 2-D, time-dependent and, like the experiments, coaxial cylindrical. Comparison could be made with current monitors at three intermediate longitudinal positions at both the outer electrode (for total current) and the inner electrode (for boundary current). The overall agreement was quite good, though the measured boundary current was consistently about 22% lower than the simulation values. In addition, a detailed comparison of the radial variation of several time-averaged quantities from the simulation was made with the predictions of the parapotential theory. It was found that the electric potential was very similar in the two cases, but the charge and current densities were not. 12 Refs
Primary Keywords: Long Transmission Line, Experiment; Theory; Current Measurement; Particle-in-cell Computer Code; Good Agreement

4136
(PARTICLE BEAMS, ELECTRON)
(Transport)
TRANSPORT OF A RELATIVISTIC ELECTRON BEAM TO A FUSION TARGET
Yu.I. Rudakov
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
Soviet Journal Of Plasma Physics, Vol. 4, No. 1, pp 40-43 (01/1978).
Trans. From: Fiziki Plazmy, Vol. 4, pp 72-77, (Jan-Feb 1978)
9 Refs
Primary Keywords: Vacuum Line; Magnetic Insulation; 5 Meter Distance; 10e14 Watt Beam; Turbulent Heating In High Current Diode

4143
(INSULATION, MATERIAL)
(Systems)
A GAS-SUPPLY LINE WHICH PERMITS A HIGH VOLTAGE TO BE MAINTAINED ACROSS ITS ENDS
G.C. King, M. Tronc and R.C. Bradford
University of Manchester, Manchester, UK
Journal Of Physics E: Scientific Instruments, Vol. 9, pp 1049-1050 (12/1976).
A simple gas-supply line is described which allows a high voltage to be maintained across its ends at gas pressures in the gas line at which electrical breakdown would normally occur. It consists of a series of insulated electrically conducting tubes across which resistors are connected in a similar manner to the dynode resistor chain of a photomultiplier. In the present application a voltage of 2.5 kV is maintained across the ends of the gas line, but this may readily be increased. 1 Refs.
Primary Keywords: Gas-supply Line; Enhanced Insulation Properties; Increased Breakdown Voltage; Grading Resistor

4147
(BREAKDOWN STUDIES)
(Gas, Electrical)
OPERATION OF SLIDING-SPARK ARRAYS FOR LASER PRE-IONIZATION
B. Norris and A.L.S. Smith
University of St. Andrews, St. Andrews, Fife KY16 9SS, UK
Journal Of Physics E: Scientific Instruments, Vol. 10, No. 5, pp 551-554 (05/1977).
The electrical conditions necessary for reliable operation of sliding-spark arrays have been determined. The emission from an array can be considerably enhanced by critically damping the spark discharge circuit. When used to pre-ionize a CO/sub 2/ laser there must be a delay between the array and main discharge pulses, but this delay may be as small as 100 ns and less than the array discharge pulse width. 10 Refs.
Primary Keywords: 'Sliding Spark'; Series Breakdown; Multiple Gaps; Minimum Charging Voltage
Secondary Keywords: Gas Laser Pumping

4149
(REVIEWS AND CONFERENCES)
(Conferences)
IEEE 1973 MODULATOR SYMPOSIUM
(09/1973).
This conference record includes 38 papers relating to the generation of medium to high power pulses with very carefully controlled parameters. Papers on switching, pulse generation, and energy storage are included. Thirty seven papers are referenced separately.
Primary Keywords: Modulators; Hard-tube Pulse Generators; Thyratrons; Thyristors

4157
(BREAKDOWN STUDIES)
(Gas, Electrical)
FOUR-METER SPARKS IN AIR
M.A. Uman (1), R.E. Orville (1), A.M. Sletten (1) and E.P. Krider (2)
(1) Westinghouse Research and Development Center, Pittsburgh PA
(2) University of Arizona, Tucson, AZ 85721
Journal Of Applied Physics, Vol. 39, No. 11, pp 5162-5168 (10/1968).
Sparks of 4-m length in atmospheric air were studied, using high-speed image-converter photography, current and voltage measurements, absolute measurements of radiated light intensity, and high-speed image-converter spectroscopy. Correlated results of the various measurements are presented. The energy balance of the spark is discussed. 12 Refs.
Primary Keywords: Long Spark; Rod-plane Gap; Both Polarities; Photographic Observation; Voltage Measurement; Current Measurement; Comparison With Lightning

4186
(INSULATION, MATERIAL)
(Liquid)
THE ASSIGNMENT OF APPROPRIATE DIELECTRIC STRESSES IN LIQUIDS
G.K.H. Simcox
Megapulse, Inc., Bedford, MA
5th International Conference On Conduction And Breakdown In Dielectric Liquids pp. 179-182 (07/1975).
Liquid dielectrics are in common use in the electrical equipment industry and are often used, in perhaps greater variety, for the insulating media of high voltage pulse generators. The requirements for these two areas are distinct and different. For the former, long term reliability and economic upkeep are mandatory and, for the latter, the emphasis is on peak performance at low duty cycle. On the one hand the dielectric is stressed continuously by AC-DC voltages and, on the other, the stresses are of microsecond duration or less, with seconds between stresses. This alone would indicate the use of different stress levels but, for liquids, there are added complications due to contaminants. These seriously reduce the electrical performance of liquids for prolonged AC-DC stress applications but have little influence upon the short, microsecond, pulse performance. Because of these differing requirements and characteristics there are interesting contrasts of style and content in the publications of research workers in these respective fields. 7 Refs.
Primary Keywords: Liquid Dielectric; Dielectric Stress; AC Fields; DC Fields; Impulse Fields; Streamer Velocity

4187
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Vacuum Gaps, Materials)
EROSION CRATERS AND ARC CATHODE SPOTS IN VACUUM
B. Juttner
German Academy Of Sciences, East Berlin, DDR
Beitr. Plasma Physics, Vol. 19, No. 1 pp. 25-48 (01/1979).
The author describes experiments which examine erosion craters on clean, smooth cathodes. The discharges have durations on the order of nanoseconds with a current ranging from 10 to 200 amps. It is proposed that the craters are the result of discharge pressure on molten metal in a spot, and that the spots move in a random manner one crater radius at a time because of the micropoints that are formed at the edge of the crater. The dependence of crater size, erosion rate and velocity of spot displacement on current is also measured. 34 Refs.
Primary Keywords: Erosion Crater; Discharge Pressure; Molten Metal; Spot Movement

4188
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Vacuum Gaps, Materials)
EROSION STRUCTURES ON CATHODES ARCED IN VACUUM
J.E. Daalder
Eindhoven University of Technology, Eindhoven, Netherlands
J. Phys. D, Appl. Phys., Vol. 12 pp 1769-1779 (01/1979).
The author presents a discussion of the erosion craters that form on the cathode during a discharge in a vacuum using total currents up to a few hundred amps. The cathode materials studied are cadium, copper, molybdenum, and tungsten. Cathode spots can move either randomly, or along a path determined by the magnetic field, but the spot movement can also be greatly affected by surface contamination. A three-dimensional analysis of a crater is presented. Crater formation is analyzed in terms of ion flow incident on the cathode surface. 14 Refs.
Primary Keywords: Cathode Erosion Structure; Vacuum Arc; Low Current; High Purity Electrode; Cathode Spot Movement

4191
(SWITCHES, CLOSING)
(Surface Discharge, Electrical)
A TEST OF A VACUUM/DIELECTRIC SURFACE FLASHOVER SWITCH
I.D. Smith
Lawrence Livermore Lab, Livermore, CA 94550
Report No. UCID-18553 (02/1980).
Availability: UCID-18553
NTIS
A vacuum surface flashover switch is being considered for >10 kHz operation in a 250 kV, 10 ohm, 40 ns coaxial water Blumlein. Various possible switch designs are compared, and two promising ones selected for tests in the switch test facility at LLL. The initial test configurations are described. 0 Refs.
Primary Keywords: Vacuum Surface Flashover Switch; High Rep-rate; Low Jitter

4192
(SWITCHES, CLOSING)
(Gas Gaps, Crossed-field)
CROSSED-FIELD CLOSING SWITCH DEVELOPMENT
R.J. Harvey
Hughes Research Labs, Malibu, CA 90265
ECOM Report No. ECOM-76-1313-F (01/1977).
Availability: AD A035609
NTIS
A triode version of the crossed-field closing switch has been successfully tested at average powers of up to 800 kW for burst durations of 30 sec. Unlike most conventional spark gaps, the arc is initiated from a crossed-field glow discharge and occurs at random locations on a shot-to-shot basis. This uniformly disperses the heat loading and erosion over a relatively large electrode surface area which may then be cooled. 10 Refs.
Primary Keywords: Closing Switch; Arc Discharge; Crossed Field

4196
(INSULATION, VACUUM)
(Reviews)
HIGH VOLTAGE BREAKDOWN STUDY: HANDBOOK OF VACUUM INSULATION
M.J. Mulcahy and P.C. Bolin
Ion Physics Corp, Burlington, MA 01803
ECOM Report No. ECOM-00394-20 (02/1971).
Availability: AD 723107
NTIS
The 'Handbook on Vacuum Insulation' discusses the factors influencing breakdown in high voltage vacuum devices. The data on the factors, interactions and theories on vacuum breakdown are interpreted and presented in a manner so as to be useful in the design of microwave and modulator tubes that must operate at voltages greater than 100 kV. It is produced as part of a 5-year program, which was carried out at Ion Physics Corporation, to investigate, under controlled conditions and using factorial design and analytical techniques, vacuum breakdown up to 300 kV for conditions pertinent to high power vacuum tubes. The handbook is intended both as an introduction to, and realistic appraisal of, the use of vacuum as the insulating medium for high voltage and high power tubes. As such, it contains general discussions and recommendations pertaining to factors, levels, combinations and interactions of same, preparation, conditioning and operating procedures, etc. The handbook first describes briefly the experimental program. This is followed by an introduction to the basic phenomena of vacuum insulation and a short review of the major theories of vacuum breakdown. The factors of practical import which influence insulation of metal electrodes in vacuum are then discussed in some detail. A final section briefly discusses the role of solid dielectrics in vacuum insulation. 8 Refs.
Primary Keywords: Electrical Breakdown In Vacuum; Prebreakdown Phenomena In Vacuum; Criteria For Vacuum Breakdown; Optical And X-Radiation; Electric Field Enhancement And Etching; Conditioning Procedures; Electrode Materials And Surface Properties
Secondary Keywords: Factors Influencing Vacuum Breakdown; Partial Pressure And Gap Current; Breakdown Voltage And Voltage Collapse

4200
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH POWER SWITCH DEVELOPMENT
E. Kunhardt and M. Kristiansen
Texas Tech University, Lubbock, TX 79409
AFOSR Report No. AFOSR-TR-80-0171 (11/1979).
Availability: AD A081870
NTIS
Studies on the triggering of a high-voltage, gas-insulated spark gap by an electron beam have been conducted. Measurements of the gap voltage, current, and jitter have been made for a wide range of gap conditions and electron-beam cross-sectional areas. The character of the breakdown, for each condition, has been inferred using photographic techniques. Current rise times of approximately 2 ns with subnanosecond jitter have been obtained for 3 cm gaps with gap voltages as low as 50% of the self-breakdown voltage. The observational time lag, i.e. the interval of time between the application of a voltage pulse to the electron gun and the beginning of the current rise in the gap circuit, was 50 ns. The gases used in this series of experiments were: N/sub 2/ and Ar, and mixture of N/sub 2/ and SF/sub 6/ at pressures of 1-3 atm. Open shutter photographs show that the discharge is broad in crossection. A number of papers reporting the results obtained in this program have been given at international conferences and two master thesis were completed. 5 Refs.
Primary Keywords: Electron Beam Triggered Switch; Electron Gun; Spark Gap Switch Model

4201
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas Gaps, E-beam; Gas Gaps, E-beam)
HIGH VOLTAGE SWITCH USING EXTERNALLY IONIZED PLASMAS
J.W. Dzimianski and L.E. Kline
Westinghouse Electric Corp, Baltimore, MD 21203
AFWAL Report No. AFWAL-TR-80-2041 (04/1980).
Availability: AD A086761
NTIS
A physical model was developed and the performance parameters were studied for high-voltage high-current on/off switches which use the low energy secondary electrons in an electron beam sustained discharge as the conducting medium. The model equations are presented and described along with the underlying physical assumptions. Electron transport data and static breakdown voltages were calculated for N/sub 2/, Ar, a N/sub 2/: Ar=1:9 mixture and CH/sub 4/ by numerically solving the Boltzman equation to find the energy distribution. Study of steady state performance for N/sub 2/, Ar, N/sub 2/: Ar=1:9 and CH/sub 4/ indicated that the N/sub 2/ : Ar=1:9 and CH/sub 4/ were both good candidate gases; hence transient switch performance were studied for these two gases. The performance of the e-beam plasma switches were mapped in a regime where the power delivered to the load is much greater than the e-beam power. Study of e-beam sources pointed to the thin-film field emission cathode as offering a means of controlling e-beam plasma switches with very high control power gain. A switch geometry was suggested using such an e-beam source. 52 Refs.
Primary Keywords: E-Beam; Plasma; High Voltage; High Current; Thin-film Field Emission; Electron Transport Data
Secondary Keywords: Switch

4202
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
INVESTIGATION OF THE RESISTIVE PHASE IN HIGH POWER GAS SWITCHING
R.C. O'Rourke
Science Applications, La Jolla, CA 92037
LLL Report No. UCRL-13776 (01/1977).
Availability: UCRL-13776
NTIS
The authors derive an emperical formula for the time dependent resistance of a gas spark gap using experimental values of the voltage fall time across a gap. A model is chosen and assumptions are made to reduce the problem to a tractable form. The values obtained experimentally for the fall times of the voltage are inserted to give a formula for the time dependent resistance of the gap. The authors then proceed to consider the problems associated with designing a rep-rated system using spark gaps. 12 Refs.
Primary Keywords: Gas Gaps; Resistive Phase; Emperical Formula; Spark Gap Model

4204
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
LASER CONTROL OF SPARK GAPS
E.A. Lemberg
Joint Pulications Research Service, Arlington, VA
JPRS Report No. JPRS-59677 (08/1973).
Availability: JPRS-59677
NTIS
The report contains discussions on the use of pulsed ultraviolet waveband gas lasers to switch spark gaps and the time characteristics of spark gaps activated by laser pulse. 4 Refs.
Primary Keywords: Spark Gap Triggering; Nitrogen Laser; Delay Measurement; Jitter Measurement; Synchronization Of Gaps

4205
(PARTICLE BEAMS, ION)
(Generation)
GENERATION OF INTENSE ION BEAMS IN PULSED DIODES
R.N. Sudan and R.V. Lovelace
Cornell University, Ithica, NY 14850
Physical Review Letters, Vol. 31, No. 19, pp 1174-1177 (11/1973).
The generation of high-current (approximately 1E5 A) pulsed ion beams with ion energy in the range 0.5-10 MeV appears to be possible by modifications of present electron-beam technology. 8 Refs.
Primary Keywords: Ion Beam Generation; Ion Emission; Electron Current Suppression; Transverse Magnetic Field

4208
(PARTICLE BEAMS, ELECTRON)
(Generation)
OWL II DIODE STUDY
K. Childers and C. Stallings
Physic International Co, San Leandro, CA 94577
DNA Report No. DNA 4432F (12/1977).
Availability: AD A052578
NTIS
An experimental program performed on the OWL II pulsed electron beam accelerator with mean electron energy of 950 keV and electron beam energy of 80 kJ has been accomplished. The reliability of the accelerator was shown to be greater than 90 percent at the 90 percent confidence level. The repeatability of the accelerator can be characterized by +or- 4 percent MSD of beam energy in the diode, +or- 2 percent MSD of mean electron energy in the diode, and +or- 8 percent MSD of average fluence at target location. Electron beams with areas in excess of 400 sq. cm., depths of penetration in excess of 0.6 gm/sq. cm. and peak doses ranging from 25 to 100 cal/gm were characterized for future thermal structural response testing. 0 Refs.
Primary Keywords: Electron Beams; Thermal Structural Response Testing

4209
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Electrical)
PARAMETERS AFFECTING FIRING TIME OF SIMULTANEOUSLY TRIGGERED TRIGATRON SPARK GAP SWITCHES
M.D. Williams
Langley Research Center, Hampton, VA
NASA Report No. NASA TN D-5077 (03/1969).
Availability: N69-20888
NTIS
This report describes a technique and apparatus for spark gap research and presents the results of an investigation performed with that apparatus. The investigation was conducted primarily to determine how the variation of each of several spark gap parameters affects the firing-time differences (switch jitter) of simultaneously triggered trigatron spark gap switches. These parameters were switch voltage (15 to 20 kV), peak trigger voltage (14 to 20 kV), and the curvature of the edge of the trigger electrode hole. The firing times were measured using the light emitted from the switches. 5 Refs.
Primary Keywords: Trigatron Switch; Gap Voltage Variation; Trigger Voltage Variation; Curvature Of Trigger Hole; Experiment; Theory; High Switch Voltage

4210
(ENERGY STORAGE, INDUCTIVE)
(Systems)
PULSE POWER SYSTEMS EMPLOYING MAGNETIC ENERGY STORAGE
T.F. Trost
Texas Tech University, Lubbock, TX 79409
NSKC Final Report On Contract No. N60921-76-C-0092 (05/1977).
Availability: AD A039 897
NTIS
Several basic aspects of pulsed power systems supplying repetitive pulses and using inductive energy storage are investigated. These include the method of inductor charging, the efficiency of discharging with a resistive opening switch, the limitations of thermally driven resistors as opening switches, the design of pulse forming networks for time-varying resistive loads and the relative merits of voltage-fed versus current-fed networks, and some limitations on inductors. 22 Refs.
Primary Keywords: Inductive Energy Storage; Pulsed Power Systems

4212
(SWITCHES, CLOSING; SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Gas Gaps, Optical; Systems; Gas, Optical)
SYMPATHETIC BREAKDOWN IN AIR
J.P. Brainard and L.A. Andrews
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND77-1203 (08/1977).
Availability: SAND77-1203
NTIS
The breakdown of a spark gap by UV radiation from another spark gap is presented in this report. In this experiment, two air gaps were placed various distances apart. The behavior of the gaps under observation is studied with relation to a gap that is triggered by other means. The mechanism of breakdown in the gap under observation is found to be ultraviolet radiation from the control gap. 3 Refs.
Primary Keywords: Sympathetic Breakdown; UV Radiation; Medium Voltage
Secondary Keywords: Lightning Arrestor

4214
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE STATISTICAL DISTRIBUTION OF VALUES OF BREAKDOWN VOLTAGE FOR AN AIR GAP
W.P. Baker
Electricity Council Research Centre, Capenhurst, UK
Electricity Council Research Report No. ECRC/M-1283 (09/1979).
Availability: ECRC M1283
NTIS
An analysis of 30,000 measurements of breakdown voltage on a spark gap removed from a surge diverter shows there to be a linear relation between normal probability and the logarithm of the excess of the applied voltage over a critical voltage. This linearity extended over more than six standard deviations. A statistical model is derived which agrees well with the experimental findings and which is investigated further to show that the physical parameter of the breakdown process in air which controls the scatter of test results is the rate of change of the first Townsend coefficient with field. 0 Refs.
Primary Keywords: Spark Gaps; Dielectric Breakdown; Foreign Technology; Percent Overvoltage; First Townsend Coefficient

4216
(INSULATION, MATERIAL)
(Gas)
BEHAVIOR OF AIR INSULATING GAPS OF DC SYSTEMS UNDER IMPULSE, DC AND COMPOSITE VOLTAGES
C. Menemenlis and G. Harbec
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-98, No. 6, pp 2065-2075 (12/1979).
This paper deals with the behavior of air insulating gaps of direct current (DC) transmission systems in the voltage range of +or- 600 kV to +or- 200 kV. The gaps studied were simulating either a bipolar DC tower or a bipolar rigid bus system. The influence of the terminations of the two ends of the insulator supporting the bus was investigated by using a single bus supported at one end. The breakdown voltage of the gaps was determined for a pure impulse, pure DC voltage or composite voltage formed by a DC on which an impulse was superimposed. The proximity effect of one pole on the pole-to-ground breakdown voltage of the other was also investigated. 7 Refs.
Primary Keywords: Air Insulating Gaps; +or- 600 kV To +or- 1200 kV voltage Range; Impulse, DC, And Composite Test Voltages; Bipolar Buses; Rod-plane Breakdown Voltage; Terminating Electrodes

4236
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
MODEL FOR A LOW PRESSURE SPARK GAP
E.P. Lee
Lawrence Livermore Lab, Livermore, CA 94550
LLL Report No. UCID 18059 (02/1979).
Availability: UCID 18059
NTIS
The space and time-dependent generation of plasma in a low pressure spark gap is modeled with a two-dimensional Boltzmann equation. 0 Refs.
Primary Keywords: Low Pressure Spark Gaps; 2-D Boltzmann Equation; Numerical Calculation; Approximate Solution

4237
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH POWER SPARK GAP SWITCH PROGRAM
J. Heckl (1), W. Clark (2) and J. Driscoll (3)
(1) Naval Surface Weapons Center
(2) Maxwell Labs Inc, San Diego, CA 92123
(3) University of Michigan, Ann Arbor, MI
1976 IEEE Pulsed Power Conference Proceedings, Paper IB-1 (11/1976).
We will highlight a program presently underway into the investigation and final development of a spark gap switch capable of operating at repetition rates of 50 to 250 pulses/sec at voltages of several hundred kilovolts and 5 megawatts average power. Results of an Aero Propulsion Laboratory program on High Power Spark Gap Switch Development will be given; it will be shown how these results have led to the present study. The present investigation, a coordinated effort between the Gas Dynamics Laboratories of The University of Michigan, Naval Surface Weapons Center and Maxwell Laboratories, Inc., will be described. Theoretical investigations into the nature of dynamic nonstationary arcs under transverse gas flow conditions between electrodes will be discussed. Future plans for experimental studies of arc properties include time resolved temperature measurements using a unique optical scanning system at The University Of Michigan. An optimized high power spark gap switch will be designed and fabricated by Maxwell Laboratories and tested at their switch test facility. 8 Refs.
Primary Keywords: Spark Gap; High Rep-rate; Nonstationary Arcs

4248
(REVIEWS AND CONFERENCES; BREAKDOWN STUDIES)
(Reviews; Reviews)
BASIC PROCESSES OF GASEOUS ELECTRONICS
L.B. Loeb
University of California, Berkeley CA
Publisher; Univ. Of California Press, Berkeley And Los Angeles, California (02/1955).
The thrust of this book is consideration of the basic phenomena associated with gaseous electronics. Mobilities, ionization, and recombination, are all considered as are energy distributions of particles and electron attachment. Each chapter includes a short historical background of the discoveries leading to the state-of-the-art. The relevant experiments used to collect the pertinent data are presented along with the data and the theory behind it. 464 Refs.
Primary Keywords: Gaseous Electronics; Ion Mobility; Electron Mobility; Energy Distribution; Negative Ion; Recombination; Ionization

4263
(PARTICLE BEAMS, ELECTRON)
(Generation)
HIGH-CURRENT PULSED ELECTRON ACCELERATOR WITH AN ANNULAR BEAM
M.I. Avramenko, V.A. Glukhikh, O.A. Gusev, E.G. Komar, O.L. Komarov, V.S. Kuznetsov, A.S. Perlin and M.P. Svin'in
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 3, pp 368-370 (09/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 591-595 (March 1974)
Certain questions related to the design and construction of a high-current pulsed accelerator with a pulse length of 1E-4 sec, a beam current of 2E4 A, and an electron energy of 1 MeV are discussed. The pulsed accelerating voltage is produced by an electrical solenoid in which energy from an auxiliary power supply is stored with a high-speed current switch. It is shown that an annular thermionic cathode should be used to produce a beam having the specified parameters. The focusing and maintenance of the annular structure of the beam are achieved by means of the inhomogeneous magnetic field of the solenoid. 5 Refs.
Primary Keywords: Electron Accelerator; Annular Beam; 100 Microsecond Pulse; 20 kA Beam Current; Thermionic Cathode

4276
(SWITCHES, CLOSING)
(Surface Discharge, Electrical)
LOW-INDUCTANCE MEGAAMPERE-CURRENT COMMUTATOR BASED ON SLIDING DISCHARGE
A.V. Grigor'ev, P.N. Dushuk, S.N. Markov, V.L. Shutov and M.D. Yurysheva
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 19, No. 4, pp 1104-1106 (08/1976).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 151-153 (July-August 1976)
An air spark gap is described in which current commutation is realized by a multichannel discharge along the surface of the solid dielectric, which is created during the development of a sliding discharge. The spark gap repeatedly commutated currents of 500 kA. The self-inductance of the spark gap amounted to L/sub sg/ = 5 nH under these conditions, while its resistance was r/sub sg/ = 7E-3 ohm. 4 Refs.
Primary Keywords: Surface Discharge Switch; Multichannel Discharge; Sliding Discharge; 500 kA Current; 5 nH Gap Inductance

4291
(SWITCHES, CLOSING)
(Vacuum Gaps, Optical)
LASER-TRIGGERED-SWITCH STUDY (PROJECT LASWITCH)
R.J. Clark
Cornell Aeronautical Lab Inc, Buffalo, NY 14221
RADC Report No. RADC-TR-68-355 (12/1968).
Availability: AD 846056
NTIS
Interaction between the emission from a pulsed laser and a metallic surface in vacuum has been investigated as a means of initiating a plasma discharge between isolated electrodes. Experimental studies of the triggering and arc development processes were carried out at applied potentials of several kilovolts and discharge currents up to the kiloampere level. Electrode and optical energy density effects were examined and compared in discharge service. A prototype switch designed for operation at 20 kilovolts, 10 megawatts was tested with a pulsed gas laser trigger and shows promise of reasonable life. Switching experiments were also performed at potentials in excess of 200 kilovolts. A parallel study of magnetic arc quenching phenomena led to the development of an electrically triggered low impedance switch that could pulse modulate the output of a hard energy storage system, supplying peak powers of several hundred kilowatts. 0 Refs.
Primary Keywords: Laser Triggering; Arc Development; Pulsed Gas Laser; Electrode Effects

4298
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
FIBRE-OPTICAL CURRENT MEASUREMENT
A.J. Rogers
Central Electricity Generating Board, London, UK
No. TDB-280, 4p (03/1977).
Availability: N78-28428/8ST
NTIS
A simple, cheap, and reliable arrangement for fiber optic current measurement, consisting of fiber, a light emitting diode, two polarizers, a photodetector, and an output signal amplifier, is described. Successful laboratory tests were carried out. The use of monomode fiber looks more promising than that of multimode fibers.
Primary Keywords: Electric Current; Fiber Optics; Measuring Instruments; Fibers; Equipment Specifications; High Voltages; Polarizers
Secondary Keywords: Great Britain; NTISNASAE

4302
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
LOW-VOLTAGE AND HIGH-CURRENT DELAY CHARACTERISTICS OF A SIMPLE TRIGGERED VACUUM GAP
S. Kamakshaiah and R.S.N. Rau
Indian Institute of Science, Bangalore, India
Journal Of Physics D; Applied Physics, Vol. 10, No. 7, pp 1017-1022 (06/1977).
Low-voltage and high-current switching delay characteristics of a simple triggered vacuum gap (TVG) are described using lead zirconate titanate as the dielectric material in the auxiliary gap. This TVG has superior performance at high currents (up to 14 kA was studied) with regard to delay, reliable firing and extended life as compared to the one using either Supramica (Mycalex Corporation of America) or silicon carbide. The latter materials were used in our earlier work which was confined to low currents up to 2.5 kA. The total delay consists of three intervals: to break down the auxiliary gap, to propagate the trigger plasma and to break down the main gap. The data on the influence of the various parameters like the trigger voltage, current, energy and the main circuit energy are given. It has been found that the delay due to the first two intervals is small compared to the third. 10 Refs.
Primary Keywords: Low Voltage; 14 kA Current; Trigger Gap; Variable Trigger Voltage; Variable Current; Variable Energy; Delay Measurement

4305
(PULSE GENERATORS)
(Trigger)
PICOSECOND TRIGGER SYSTEM USEFUL IN MODE-LOCKED LASER PULSE MEASUREMENTS
B. Cunin, J.A. Miehe, B. Sipp and J. Thebault
CEA Centre d'Etudes Nucleaires, Sarclay, France 92260
Availability: CRN-CNPA-76-21
NTIS
A highly sensitive tunnel diode trigger useful in temporal intensity build-up measurements of mode-locked lasers has been developed; the device reduces notably the time walk due to the lack of repeatability in intensity of the laser output. The performance of the trigger have been established by means of a GHz wideband-0.1V/cm sensitive real-time oscilloscope and of an image converter camera having a picosecond resolution: the experimental results show that a variation of the amplitude of the laser pulse train of a factor 5 leads to a time jitter of less than 30 ps. (Atomindex citation 08:301981)
Primary Keywords: Lasers; Tunnel Diodes; Mode Locking; Performance; Pulses; Timing Properties; Trigger Circuits; Ultrahigh-speed Photography
Secondary Keywords: EPDA/420300; France; Mode Locked Lasers; NTISINIS
Distribution Restriction: U.S. Sales Only.

4336
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
HIGH-VOLTAGE PROBE SYSTEM WITH SUBNANOSECOND RISE TIME
W.J. Sergeant and A.J. Alcock
National Research Council, Ottawa, Ontario, Canada
The Review Of Scientific Instruments, Vol. 47, No. 10, pp 1283-1287 (10/1976).
A high-voltage probe measuring system with an overall rise time of less than 50 psec and a peak voltage capability of 20 kV has been developed. Probe perturbations at the 50 ohm impedance level are minimized by maintaining a moderately high input impedance, in conjunction with the absorption of internal reflection waves by means of a lossy distributed transmission line. System long term stability and constructional reproducibility have been investigated. 17 Refs.
Primary Keywords: Voltage Attenuator; 20 kV Voltage Capability; 50 Psec Rise Time; 3000 Ohm Input Impedance; Ferrite Loaded Transmission Line

12

4342
(BREAKDOWN STUDIES)
(Lightning)
LABORATORY SIMULATION OF THE STEPPED LEADER IN LIGHTNING
M.M. Kekez and P. Savic
National Research Council, Ottawa, Ontario, Canada
Canadian Journal Of Physics, Vol. 54, pp 2216-2224 (07/1976).
The stepped leader in lightining is shown to be a relaxation oscillation phenomenon. The stepped leader was simulated by adding a parallel RC combination to the external circuit of a discharge gap. Experiments were also done in a well-preionized gas where there was no displacement current. 15 Refs.
Primary Keywords: Stepped Leader; Nonlinear Glow; Relaxation Oscillation; Simulation

4347
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Liquid Gaps, Optical; Liquid, Electrical)
ON THE USE OF PERFLUOROPOLYETHER FLUIDS IN HV SPARK-GAPS
A. Luches and L. Provenzano
Universita di Lecce, Lecce, Italy
Journal Of Physics D; Applied Physics, Vol. 10, No. 3, pp 339-341 (02/1977).
Tests were performed to examine the dielectric properties of perfluoropolyether fluids (Fomblin Y) and their transparence to ultraviolet radiation. The purpose was to evaluate the advantage of their use in high-power spark-gaps, triggered by pulsed N/sub 2/ lasers (3371 angstroms). Our results show that the perfluoropolyether fluids exhibit many advantages over the commonly used transformer oils. 3 Refs.
Primary Keywords: Perfluoropolyether Fluid; Nitrogen Laser Triggering; Self Healing; Fluid 'Aging'; Resistivity Measurement

4348
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Vacuum, Magnetic Field)
PERTURBATION OF THE STATIC VOLTAGE BREAKDOWN MECHANISM IN VACUUM BY A WEAK MAGNETIC FIELD
A. Watson
University of Western Ontario, London, Ontario, Canada
Canadian Journal Of Physics, Vol. 54, pp 2403-2417 (01/1976).
An analysis is presented of the effect of a weak magnetic field on the breakdown mechanism concentrating on the magneto-transport phenomena in a semiconducting field emitter. The geometry of a cathode protrusion is also considered. A new model of the breakdown mechanism is developed by altering the Fowler-Nordheim equation. A close agreement is found between predictions by this model and experimental results. 11 Refs.
Primary Keywords: Magnetic Field; Perturbation Of Breakdown Voltage; Field Emission; Poor Vacuum; Low Magnetic Field; Transverse Field; Copper Electrode

4358
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A QUICK RESPONSE HIGH VOLTAGE DIVIDER
Y. Kubota, H. Kobayashi and A. Miyahara
Nagoya University, Nagoya, Japan
Japanese Journal Of Applied Physics, Vol. 15, No. 10, pp 2037-2038 (10/1976).
The authors describe a resistive voltage divider for use in a noisy pulsed power environment. The divider is constructed of a plexiglass tube filled with a copper sulphate solution. The divider employs a copper sulphate guard resistor for noise reduction. 2 Refs.
Primary Keywords: Resistive Voltage Divider; Guard Resistor; Copper Sulphate Solution; 2 MV Voltage Range

4369
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Gas, Electrical; Gas Gaps, Materials)
HIGH VOLTAGE RESEARCH (BREAKDOWN STRENGTHS OF GASEOUS AND LIQUID INSULATORS) AND ENVIRONMENTAL EFFECTS OF DIELECTRIC GASES
L.G. Christophorou, D.R. James, R.Y. Pai, R.A. Mathis, I. Sauers, L. Frees, M.O. Pace, D.W. Bouldin and C.C. Chan
Oak Ridge National Lab, Oak Ridge, TN 37830
ORNL Report No. ORNL/TM-7173 (01/1980).
Availability: ORNL/TM-7173
NTIS
A number of gas mixtures are suggested for industrial-scale testing. Electron attachment rates were measured and unfolded to give attachment cross section functions for several gases each in N/sub 2/, and for CCl/sub 3/F in Ar. The results of this study led to conclusions relating these parameters to molecular structure. Electron attachment rates were measured also for n-C/sub 6/F/sub 14/ in both Ar and N/sub 2/. A study was made of the potential role for electron detachment in breakdown. The roles of several modes of detachment was assessed, especially for SF/sub 6/ and O/sub 2/. The role of dipolar scattering of electrons in inhibiting breakdown was investigated. The importance of large electron scattering cross sections at subexcitation energies was demonstrated, and means of realizing this with dipolar scattering were studied. The impulse measurements concentrated on c-C/sub 4/F/sub 8/-SF/sub 6/ mixtures, which were found to be especially interesting under impulse conditions. Lightning and switching surges were used with a large point-plane gap as well as a sphere-sphere gap. In the practical conditions of cylindrical geometry with and without surface roughness, many multicomponent mixtures of the gases SF/sub 6/, c-C/sub 4/F/sub 8/, N/sub 2/, and 1,1,1-CH/sub 3/CF/sub 3/ were tested, at both 1 and 4.4 atmospheres. 40 Refs.
Primary Keywords: Attachment Rate; Attachment Cross Section; Several Gasses; Plane Electrodes; Parallel Electrodes; Sphere-sphere Electrodes; Sensitivity To Field Nonuniformity

4374
(SWITCHES, CLOSING)
(Liquid Gaps, Electrical)
TIME-LAG CHARACTERISTICS OF A LIQUID TRIGATRON
J.L. Maksiejewski and J.H. Calderwood
University of Salford, Salford, UK
Journal Of Physics D; Applied Physics, Vol. 9, No. 17, pp L195-L198 (12/1976).
A study was made of the time-lag characteristics of a trigatron spark gap in n-hexane. The influence of the polarity of the triggering pulses and of the gap length was investigated. The significance of the results obtained is discussed. 1 Refs.
Primary Keywords: Trigatron; N-hexane; Polarity Effects; Variable Gap Spacing; Delay Measurement

4377
(INSULATION, MATERIAL)
(Solid)
COMMENTS ON MANY-BODY DIELECTRIC RELAXATION IN SOLIDS
A.K. Jonscher, L.A. Dissado and R.M. Hill
Chelsea College, University of London, London, UK
Phys. Status Solidi B, Vol. 102, No. 1 pp. 351-356 (11/1980).
This paper breaks with previously held views on dielectric relaxation based on non-interacting dipoles or charges and instead develops a model in terms of many-body phenomena. Disorder, occurring at three levels, is presented as a major feature of orientational polarization and thus is an important consideration in the model. The difference between large and small transitions is discussed along with what happens to the energy stored in a solid when the polarization is changed. 9 Refs.
Primary Keywords: Dielectric Relaxation; Many Body Interaction; Polarization; Dipolar Transitions

4379
(REVIEWS AND CONFERENCES; PARTICLE BEAMS, ELECTRON)
(Reviews; Reviews)
ELECTRON-BEAM-FUSION PROGRESS REPORT JANUARY-JUNE 1976
Authors Unknown
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND76-0410 (10/1976).
Availability: SAND76-0410
NTIS
This report presents an overview of the electron beam fusion program at Sandia Laboratories for 1976. Included are brief discussions of progress made in 1976 in switching, water insulated accelerators, Marx generators, water switches, vacuum interfaces, inductive energy storage systems, and magnetically insulated diodes and transmission lines. 90 Refs.
Primary Keywords: Switch Development; Particle Accelerator; Magnetic Insulation; Marx Generator; Inductive Energy Storage
Secondary Keywords: E-beam Fusion; Target Design; Plasma Diagnostics

4380
(REVIEWS AND CONFERENCES; PARTICLE BEAMS)
(Reviews; Reviews)
ELECTRON-BEAM-FUSION PROGRESS REPORT JULY THROUGH SEPTEMBER 1976
Authors Unknown
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND76-0711 (05/1977).
Availability: SAND76-0711
NTIS
This report presents an overview of the electron beam fusion program at Sandia Laboratories for 1976. Included are brief discussions of progress made in 1976 in switching, water insulated accelerators, Marx generators, water switches, vacuum interfaces, inductive energy storage systems, and magnetically insulated diodes and transmission lines. 44 Refs.
Primary Keywords: Marx Generator; Marx Trigger System; Water Capacitor; Transmission Line; Trigatron Gas Switch; Cold Cathode Diode

4381
(PULSE GENERATORS)
(Blumlein Lines)
A BLUMLEIN MODULATOR FOR A TIME-VARYING LOAD
S. Schneider, W.H.J. Wright and A.J. Buffa
ECOM, Fort Monmouth, NJ 07703
Technical rept. No. ECOM-4447, 14p (10/1976).
Availability: AD-A035 102/3ST
NTIS
A modulator has been built to drive a time-varying-impedance load. A Blumlein circuit, with two identical pulse forming networks, was used to produce an effective voltage of twice the charging voltage. A dissipative clamper circuit was included to simulate a well-behaved load. The switch is a 10 section iterative cavity-grid thyratron designed for 250 kilovolts (kV) and 20 kiloamperes (kA) peak current. The modulator has been operated at 210 kV at a repetition rate of a few hertz (Hz). (Author)
Primary Keywords: Modulators; Electronic Switches; Thyratrons; High Voltage; Electron Beams; Switching Circuits; Waveform Generators; Chemical Lasers; Deuterium; Pulse Generators
Secondary Keywords: Blumlein Circuits; High Energy Lasers; NTISDODXA

4382
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Electrical; Gas Gaps, Self)
FERRITE DECOUPLED CROWBAR SPARKGAP
R.C. Kunze, E.V. Mark, H. Wedler and G. Klement
Institut fur Plasmaphysik, Garching, FRG
IPP Report No. IPP 4/32 (06/1966).
Three crowbar sparkgaps are presented each with a different triggering mechanism. The first switch, tested for 8000 discharges on a 2.6 MJ bank, is triggered when the pulse voltage is 1.5 to 2 times the static breakdown voltage which can only occur when the electrodes are decoupled. The second, which also uses ferrite decoupling, is triggered without much jitter by a trigger pulse sent to a middle electrode which is at half potential. The third switch is also triggered by a middle electrode, but does not use ferrite decoupling. The trigger pulse applied to the middle electrode is sharpened allowing the gap to break down to both electrodes at the same time. 0 Refs.
Primary Keywords: Crowbar Gap; Ferrite Decoupling; Three Triggering Methods

4384
(PARTICLE BEAMS, ELECTRON)
(Reviews)
ISSUES IN UNCLASSIFIED PARTICLE BEAM RESEARCH (PROCEEDINGS OF THE 1980 PARTICLE BEAM-RESEARCH WORKSHOP)
B.D. Guenther (1), R. Lontz (1), J.L. May (2) and C.M. Stickley (3)
(1) US Army Research Office
(2) AFOSR, Bolling AFB, Washington, DC 20332
(3) BDM Corp, McLean, VA
Availability: AD A0 85158
NTIS
This workshop is designed to define the important parameters relating to particle beam weapons that require further research. Important parameters in the aspect of pulsed power, charged particle sources, accelerators, propagation, and target interactions are presented, along with necessary research in each area. 0 Refs.
Primary Keywords: Particle Beam; Electron Beam; Ion Beam

4385
(REVIEWS AND CONFERENCES; PARTICLE BEAMS, ELECTRON)
(Reviews; Reviews)
LASER-FUSION AND ELECTRON-BEAM-FUSION RESEARCH PROGRESS REPORT JANUARY-JUNE 1974
E.N. Beckner, J.B. Gerardo and G. Yonas
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND74-0439 (C '1975).
Availability: SAND74-0439
NTIS
This report presents an overview of the laser and electron beam fusion efforts at Sandia Laboratories for the period January-June 1974. Progress on multichannel and dielectric switching, inductive energy stores, self breaking water switching, Marx Generators, gas gap switching, and e-beam diodes are presented. 48 Refs.
Primary Keywords: Switching; Marx Generator; Liquid Dielectric Switch; Gas Gap; Trigatron; Particle Beam Generation
Secondary Keywords: E-beam Fusion; Laser Fusion; Plasma Diagnostics

4386
(PARTICLE BEAMS; POWER CONDITIONING; SWITCHES, CLOSING)
(Reviews; Pulse Forming Lines; Gas Gaps, Optical)
PARTICLE BEAM FUSION PROGRESS REPORT APRIL 1978 THROUGH DECEMBER 1978
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND79-1011 (12/1979).
Availability: SAND79-1011
NTIS
This report provides an overview of the particle beam fusion effort at Sandia Laboratories for the period of April-December 1978. Sections on vacuum diodes, analysis of magnetically insulated transmission lines, Marx generator development, laser and X-ray triggering of spark gaps, and power flow studies are included, as well as sections on plasma diagnostics and fusion target design and analysis. Rep-rated systems are briefly presented. 191 Refs.
Primary Keywords: EBFA; Proto; E-beam; Marx Generator; Magnetic Insulation; Spark Gap; Power Flow; Resonant Transformer; Rep-rated
Secondary Keywords: Particle Beam Fusion; Fusion Target; Plasma Diagnostics

4387
(PARTICLE BEAMS, ELECTRON)
(Reviews)
PARTICLE BEAM WEAPONS-A TECHNICAL ASSESSMENT
G. Bekefi, B.T. Feld, J. Parmentola and K. Tsipis
Massachusetts Institute of Technology, Cambridge, MA
Nature Vol. 284 pp. 219-225 (03/1980).
The authors consider the use of a high energy particle beam as a weapon. The technical problems of generation, propagation, and interaction with a target are addressed. Several examples are given of possible missions that the particle beam could be used for, and the practical aspects of weapons targeting and control are discussed. Both endoatmospheric and exoatmospheric applications are examined. 34 Refs.
Primary Keywords: Particle Beam Weapons; Generation; Propagation; Target Interaction; Beam Requirements
Secondary Keywords: Orbiting Weapons

4388
(REVIEWS AND CONFERENCES)
(Reviews)
PULSED-POWER RESEARCH AND DEVELOPMENT IN THE USSR
S. Kassel
The Rand Corp, Santa Monica, CA 90406
ARPA Report No. R-2212-ARPA (05/1978).
Availability: AD A056635
The pulsed power work conducted in the Soviet Union from 1960 to 1978 is reviewed in this report. The organizational aspects, as well as the technical side of the open Soviet research is discussed in the areas of electromagnetic compression of liners, flux compression generators, inductive energy storage, homopolar generators, multipolar generators, and opening and closing switches. The principal groups associated with each effort are identified with important results presented. 161 Refs.
Primary Keywords: Flux Compression Generator; Inductive Energy Storage; Superconductivity; Homopolar Generator; Multipolar Generator; MHD Generator; Switching

4389
(PULSE GENERATORS)
(Capacitive)
AN IMPROVED METHOD OF TRIGGERING FLASHLAMPS POWERED FROM AN ENERGY STORAGE INDUCTOR
E.K. Inall
Australian National University, Canberra, Australia
Journal Of Physics E: Scientific Instruments, Vol. 9, No. 5, pp 213-215 (05/1976).
2 Refs
Primary Keywords: Pre-ionize Lamps; Series/parallel Lamps

4404
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Gas, Electrical; Gas)
SPARKING POTENTIALS AND IONISATION COEFFICIENTS IN SF/SUB 6/
V.N. Maller and M.S. Naidu
Indian Institute of Science, Bangalore, India
Proceedings Of The IEE, Vol. 123, No. 1, pp 107-108 (01/1976).
The authors present results of an experiment to determine the ionization coefficients of SF/sub 6/. A deviation from the Paschen Curve is pointed out at pd=1. Comparisons are made with the work of several other researchers. 12 Refs.
Primary Keywords: SF/sub 6/ Gas; Townsend's Primary Coefficient; Townsend's Secondary Coefficient; Electron-attachment Coefficient

4409
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)
USE OF A 'LASER SPARK' TO INITIATE A HIGH-POWER HIGH-PRESSURE GAS DISCHARGE
R.V. Mitin, V.I. Petrenko and Yu.L. Evetskii
Institute Of Engineering Physics, Academy of Sciences of the USSR, Khar'kov
High Temperature, Vol. 11, No. 6, pp 1026-1028 (12/1973).
Trans. From: Teplofizika Vysokikh Temperatur 11, 1147-1149 (November-December 1973)
An investigation is made of the initiation of high-pressure discharges in argon using a 'laser spark.' An experimental determination has been made of the threshold breakdown electric field required for laser initiation of high-power gas discharges in argon at pressures up to 100 atm. 7 Refs.
Primary Keywords: Argon Gap; 100 Atmosphere Pressure Range; Ruby Laser

4410
(PARTICLE BEAMS, ELECTRON; ENERGY STORAGE, INDUCTIVE)
(Generation; Systems)
HIGH-CURRENT, HIGH PULSE RATE ELECTRON ACCELERATOR WITH INDUCTIVE ENERGY STORAGE
V.I. Mikhailov and I.N. Slivkov
Soviet Physics-Technical Physics, Vol. 22, No. 6 pp. 703-705 (10/1975).
The characteristics of a high-current, high-voltage electron accelerator with inductive energy storage and the associated electron-optical system used for electron acceleration and current switching in a storage device are discussed. Accelerators of this kind can be efficient and relatively simple and provide pulse repetition frequencies above 100-200 Hz and at an average power of tens or hundreds of kilowatts. 6 Refs.
Primary Keywords: Electron Accelerator; Inductive Energy Storage; Electron-Optical Switch

4411
FLOATING DECK GRID MODULATOR
D.V. Savage
Hughes Aircraft Co, Fullerton, CA
Final technical rept. Mar 77-May 78 (10/1978).
Availability: AD-A061 502/1ST
NTIS
The all solid state Floating Deck Grid Modulator has been completed and successfully tested. The design goals of pulse width, pulse amplitude, duty cycle, operation in a 50 KV gradient and circuit survival during multiple crowbars of the 50 KV power supply have been met. The rises and fall times are less than 700 nsec. (Author)
Primary Keywords: Traveling Wave Tubes; Pulse Generators; Microwave Tubes; Tube Grids; Radar Transmitters; Pulse Duration Modulation; Pulse Amplitude Modulation; Pulse Transformers
Secondary Keywords: Modulators; NTISDODXA

4415
(SWITCHES, CLOSING)
(Thyratrons)
PLASMA CATHODE THYRATRON
D. Fleischer and D. Turnquist
EG&G Inc, Salem, MA 01970
ERADCOM Report No. DELET-TR-77-2704-1 (09/1978).
Availability: AD A065048
NTIS
The objective of this work is to provide a thyratron type device which is capable of cold-start operation; thus eliminating the need for standby power. A replica of a cold-cathode triode, described by Vagin in the Russian literature, was built and tested. The results do not support Vagin's description of its operation. A triode of our own design operates satisfactorily without filament power. A keep-alive or ignitor electrode is proposed as a solution to the high grid breakdown voltage and anode jitter found during the start-up period. 0 Refs.
Primary Keywords: Gas Filled Tube; Switch Tube; Cold Cathode; Instant Start

4419
(PULSE GENERATORS)
(Line Type)
GENERATOR OF HIGH VOLTAGE NANOSECOND PULSES WITH PRECISE LENGTH
P.S. Anan'in, A.G. Sterligov, V.G. Tolmacheva and Yu.P. Usov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 4, pp 1115-1117 (08/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 137-139 (July-August 1970)
A method is described to decrease the amplitude of repeated pulses in a coaxial generator with a spark gap operating into a mismatched load. The length of the pulse on the load is set by a short-circuited section of coaxial cable, where the accuracy with which its length is measured determines the accuracy with which the length of the pulse on the load is set. The generator provides even control of the pulse amplitude from 5 to 15 kV, 0.5 nsec length of the front and trailing edge of the pulse on a matched load, and pulse length to 20 nsec when the amplitude of the repeated pulses is no greater than 5% of the amplitude of the basic pulse. The generator is designed to supply the electron optic shutter in an optic quantum generator. 5 Refs.
Primary Keywords: Pulse Generator; Coaxial Line Energy Storage; Variable Pulse Length; Small Trailing Pulses

4427
(PARTICLE BEAMS, ELECTRON)
(Generation)
ANALYSIS OF COUPLING REGION IN TRANSMISSION-LINE ACCELERATORS
J.K. Temperley
Army Amament Research and Development Command, Aberdeen Proving Ground MD 21005
ARBRL Report No. ARBRL-TR-02120 (11/1978).
Availability: AD A063463
NTIS
A Laplace-transform analysis is presented of an equivalent circuit which represents a pair of asymmetric transmission lines coupled through a reentrant discontinuity. This cavity configuration is applicable for transmission-line accelerator designs. General expressions for the time-dependent open-circuit output voltage are derived. Some numerical examples for specific line geometries are presented. 7 Refs.
Primary Keywords: Electron Accelerator, Transmission-line; Asymmetric Transmission-line Pairs, Reentrant Transmission-line Discontinuities; Laplace Transform

4428
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
AN ELECTRO-OPTIC, HIGH-VOLTAGE, TRANSIENT PROBE
S.J. Posta and C.J. Michels
Lewis Research Center, Cleveland, OH
NASA Technical Memorandom Report No. 79019 (10/1978).
Availability: N79-12414
NTIS
A differential electro-optic voltage probe is described to measure transient differential high volgates in the range of 10 to 20 kV and 10 to 50 ns. This probe was designed to measure the voltage applied to a laser and an electro-optical device was chosen to reduce noise and to minimize problems associated with ground loops in the circuit. Common mode rejection techniques were applied to the probe to reduce common mode noise. The probe consists of a LED with with an input resistor which allows a current to flow in the LED that is proportional to the input voltage. The output of the LED is routed, via fiber optic to a remote photomultiplier and associated measuring equipment. A small bias is applied to the LED through a balanced network (to provide common mode rejection) to allow small reverse voltages to be measured. The probe was calibrated using a 2 kV pulser with a 1:10 step-up transformer for amplitude measurements and the same 2 kV pulser with a fast rise amplifier for the rise time measurements. The probe was found to be less noisy with better common mode rejection than the electrical probe used previously. 5 Refs.
Primary Keywords: Electro-optic Probe, Fast Rise, High Niose Rejection; High Common Mode Rejection; Simple Design

4429
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Solid, Electrical; Solid)
A PROGRAMMABLE D-C HIGH-VOLTAGE RAMPED TEST SYSTEM FOR ELECTRICAL INSULATION
U. Milano
Bureau Of Reclamation, Denver, CO 80225
Bureau Of Reclamation Report No. REC ERC-78-7 (10/1978).
Availability: PB 290495
NTIS
A technique is presented that uses a programmable DC high-voltage test set to automatically ramp the high voltage at a preselected rate while continuously recording the resultant rotating machinery stator insulation current. The principal advantage of the ramp testing technique over the conventional stepped method is the greatly improved sensitivity and accuracy of the test results. In addition, the ramp test requires only one person to run the test and provides that person with better control and sufficient lead time when a failure point is approached to avoid damaging the insulation. A full description of the test technique, interpretation of test results, and test set operation are included. 5 Refs
Primary Keywords: Insulation Breakdown Strength; Ramp Test, Rotating Machine; Non-destructive Test

4431
(DIAGNOSTICS AND INSTRUMENTATION)
(Systems)
ONLINE DATA ACQUISITION SYSTEM FOR REPETITIVE PULSER DEVELOPMENT
M.T. Buttram
Sandia Labs, Albuquerque, NM 87115
(09/1978).
Availability: SAND 78 1751
NTIS
The computer system currently online to the RIF-I, a one hundred pulse per second (pps), 700-kV pulser, is described. This system partially analyzes data as received to provide real-time, online diagnostic information about the performance of RIF-I. The system is based on CAMAC, a set of conventions for the transferral of data between a computer and experimental modules. The computer for this facility is a PDP 11-34. The interface between computer and experimental modules is itself a microcomputer. A variety of experimental modules is used. The computer stores all incoming data on tape for subsequent complete analysis, if desired, performs a real time partial analysis, and provides displays as requested. The interface controls the transfer of data between experimental modules and the PDP-11 computer. The input modules were chosen to acquire a few digital words per pulse which, when collected into statistical ensembles, characterize RIF-I operation. Time digitizers and analog-to-digital converters are currently being used. The system has the capability of providing active computer control should that become desirable. 14 figures, 6 tables. (ERA citation 04:016975)
Primary Keywords: Beam Pulsers; Electrostatic Accelerators; High voltage Pulse Generators; Linac System, Data Acquisition Systems, Electrons, Fortran, On line Measurement Systems, Pdp Computers
Secondary Keywords: ERDA/450300, NTIS/DE

4434
TRIGGERING OF A HIGH VOLTAGE PULSE SHAPER FOR IMPROVING TIME STABILITY AND AMPLITUDE STABILITY
K. Deiters, G. Peter, A.F. Sviridov, R. Trautzschler and Y.V. Grishkevich
Deutsche Akademie der Wissenschaften zu Berlin, Zeuthen, GDR
(01/1976).
Availability: PHF 76-15
NTIS
Triggering of a transformer powered Blumlein line with a N sub 2 -laser and a trigger pin (Trigatron) is described. Stability of the amplitudes of delta U/U 1% and time jitter < 5 ns are available. Advantages and disadvantages of both methods are discussed. (Atominder citation 09:596568)
Primary Keywords: High voltage Pulse Generator; Streamer Spark Chambers; Amplitude [illegible] Rise Time; Pulse Shapers; Stability; Trigger Circuits
Secondary Keywords: [illegible]
Distribution Restrictions: [illegible]

4440
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
A MULTICHANNEL LASER TRIGGERED SPARK GAP WITH SUBNANOSECOND RISETIME FOR ELECTRO OPTIC SWITCHING
C.L.M. Ireland
Atomic Weapons Research Establishment, Aldermaston, Berkshire, UK
Journal Of Physics E, Vol. 8, pp 1007-1010 (07/1975).
The construction and some of the operating characteristics of a multichannel, laser triggered spark gap (LTSG) are described. Simultaneous subnanosecond switching in five channels of up to 10 kV is possible, making the LTSG an ideal master switch for pulsing Pockel cells to control the pulse shape and isolation necessary in a large laser oscillator amplifier system. Operated under N/sub 2/ at a pressure of approximately 10 kNm/m the LTSG had a rise time <300 ps and used in conjunction with a fast Pockel cell switch could shutter reliably optical pulses of <500 ps duration from the output of a Q-switched laser. The results indicate that at higher pressure the rise time of the LTSG should be further reduced allowing switching in approximately 100 pps to be achieved. 11 Refs.
Primary Keywords: Coaxial Spark Gap, Nitrogen Gap; Variable Pressure; Multichannel Operation; Five Channels; 300 Picosecond Rise Time; High Pressure Gap
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4444
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
A THREE GAP SPARK-DISCHARGE DEVICE FOR SUPPLYING SPARK CHAMBERS
G.D. Alekseev and D.M. Khazins
Joint Institute Of Nuclear Research, Dubna, USSR
Instruments And Experimental Techniques, Vol. 18, No. 5, pp 1447-1449 (10/1975).
Trans. From: Pribory i Tekhnike Eksperimenta 5, 105-106 (September-October 1975)
A three-gap air spark-discharge device was investigated. The device is efficient over a wide range of supply voltages, it has an actuation delay of 30 to 60 nsec, depending on the supply voltage; the scatter of the delay is 7-15 nsec; the duration of the leading edge of the output pulse is approximately 10 nsec. The spark-discharge device is reliable in operation, has a long service life, and is simple to fabricate. 5 Refs
Primary Keywords: Spark Gap; Air Gap; Self-crowbaring; 7-15 ns Jitter; Long Life; Low Current
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4456
(INSULATION, MATERIAL)
(Solid)
DISTRIBUTION OF SURFACE CHARGES ON PERSPEX DUE TO PARTIAL DISCHARGES
S. Indrayel and V. Prabhashankar
Indian Institute of Science, Bangalore, India
Journal Of Physics D: Applied Physics, Vol. 9, No. 6, pp 987-997 (04/1976)
11 Refs
Primary Keywords: Perspex air Insulation; Partial Discharge; Corona Inception; Surface Tracking; Puncture
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4460
(BREAKDOWN STUDIES)
(Electrodes)
EROSION OF METAL CATHODES BY ARCS AND BREAKDOWNS IN VACUUM
E. Hantzsche (1), R. Juttner (1), V.F. Puchkarov (2), W. Rohrbeck (1) and H. Wolff (1)
(1) Akademie Der Wissenschaften Der DDR, Zentralinstitut Fur Elektronenphysik, Berlin, DDR
(2) Siberian Department Of The Academy of Science of the USSR, Tomsk, USSR
Journal Of Physics D, Applied Physics, Vol. 9, No. 12, pp 1771-1781 (08/1976)
19 Refs.
Primary Keywords: Metal Cathodes; Erosion Structure; Nanosecond Breakdowns; Quasi stationary Arcs; Crater formation Types, Micropoint Explosions, Cathode Spots; Field emission; Ion Pressure
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4474
(BREAKDOWN STUDIES)
(Gas, Electrical)
INFLUENCE OF RAIN ON SWITCHING IMPULSE SPARKOVER VOLTAGE OF LARGE-ELECTRODE AIR GAPS
J.A.M. Rizk
Hydro Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS 95, No. 4, pp 1394-1402 (08/1976)
The paper deals with a laboratory investigation into the influence of rain on the switching impulse sparkover characteristics of large sphere and toroid plane air gaps. Tests were also carried out on rone terminated rod plane gaps for reference purposes. The factors investigated include the high voltage electrode geometry, nature of the surface, rain intensity as well as the impulse form and polarity. Attention is also paid to the influence of rain on the statistical dispersion of the sparkover voltage and on the nature of the cumulative probability curve. A general correlation, valid for a wide variety of electrodes, has been established between the mean sparkover voltage gradient for positive switching impulses under dry conditions, and the corresponding influence of rain on the breakdown voltage. 19 Refs.
Primary Keywords: Humidity Influence; Air Gap, Sphere sphere Gap, Toroid plane Gap; Geometry Effects
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4481
(BREAKDOWN STUDIES)
(Surface Flashover)
ON THE CONDITIONING PHENOMENA OF SURFACE FLASHOVER OF EPOXY RESINS IN A VACUUM
Y. Ohki and K. Yahagi
Waseda University, Tokyo, Japan
Japanese Journal Of Applied Physics, Vol. 15, No. 1, pp 177-178 (01/1976)
Experiments were done which studied the flashover of epoxy resins in a vacuum. Conditioning effects were noted with the epoxy resin (electric and without it. Seven types of resin were used so that the effect of the benzene ring on breakdown voltage could be examined. 2 Refs.
Primary Keywords: Surface Flashover; Conditioning; Electrode Effect; Several Samples; Similar Behavior
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4489
(PULSE GENERATORS; POWER CONDITIONING; PARTICLE BEAMS, ELECTRON)
(Systems; Pulse Transformers; Generation)
RELATIVISTIC ELECTRON BEAM SOURCE WITH AN AIR-CORE STEP-UP TRANSFORMER
A. Mohri, K. Ikuta, M. Masuzaki, T. Tsuzuki, S. Fujiwaka, K. Ukegawa and T. Kato
Nagoya University, Nagoya, Japan
Japanese Journal Of Applied Physics, Vol. 14, No. 11, pp 1777-1781 (11/1975).
A design for a high current relativistic electron beam source using an *air-core step-up transformer* is presented. The step-up ratio was greater than 10 and the energy transfer effeciency from the capacitor bank to the pulse forming line was 43%. The machine proved to be reliable as it required little maintenance during the 5000 times it was operated without major trouble. 13 Refs.
Primary Keywords: Vacuum Diode; Marx Generator; Pulse Transformer; Pulse Forming Line; Impedance Conversion

4492
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
STARTING CHARACTERISTICS OF A 180-KV TRIGATRON FILLED WITH SF/SUB 6/
A.I. Gersimov, G.D. Kuleshov, A.I. Pavlovskii, S.Ya. Slyusarenko and A.S. Fedotkin
Instruments And Experimental Techniques, Vol. 18, No. 5, pp 1435-1437 (10/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 111-113 (September-October 1975)
An experimental investigation was made of the delay and scatter of the time required to turn on a trigatron as a function of the polarity of the high-voltage electrode and of the control-voltage pulse, on the amplitude of the pulse, and on the SF/sub 6/ pressure. The distance between the main trigatron electrodes is 7 mm; the diameter of the control electrode is 2 mm; the annular gap between the control electrode and the main electrode which encompasses it is 2.5 mm. It is shown that for a negative potential of the high-voltage electrode and a positive starting pulse, the scatter of the actuation time delay does not exceed 10 nsec in the range of pressure variations from the value corresponding to uncontrollable breakdown at 100 kV up to a pressure five times as great (15 atm). 1 Refs.
Primary Keywords: Trigatron; SF/sub 6/ Gap; Switching Delay; Both Polarities; Variable Gas Pressure; Variable Trigger Voltage; 100 kV Operating Voltage

4501
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
UV LASER TRIGGERING OF SPARK GAPS BY TWO-QUANTUM PHOTOELECTRIC EFFECT
K. Hersch, H. Selzmann and H. Strohweld
University of Stuttgart, Stuttgart, FRG
Physics Letters, Vol. 55A, No. 3 pp 153-154 (12/1975).
A nitrogen laser is utilized to irradiate an aluminum cathode in an attempt to isolate the ionization mechanism of UV laser triggering of spark gaps. The two mechanisms considered are Richardson emission and photoelectric emission. The gap was evacuated during the study to prevent breakdown, enabling study of the electron emission from the cathode in detail. The authors present evidence for two photon photoelectric emission of electrons from the cathode as the primary triggering mechanism. 8 Refs.
Primary Keywords: Nitrogen Laser; Aluminum Cathode; Richardson Effect; Photoelectric Emission; Two-photon Effect; Spark Gap; Vacuum Gap

4530
(POWER CONDITIONING)
(Pulse Forming Networks)
SCEPTRE MODELS OF A PULSE FORMING SYSTEM
R.J. Kuhler and V.J. Watson
University of Kentucky, Lexington, KY 40506
RADC Report No. RADC-TR-75-69 (03/1975).
Availability: AD A009175
NTIS
Work performed in the generation and testing of the pulse forming network SCEPTRE model is discussed with emphasis upon attempts to determine the pulse forming network element stressing factors under conditions of specific fault occurrences: pulse transformer failure via secondary short or load short; secondary open; and pulse forming network capacitance short. When the generator model is available, the composite system can be simulated to determine the result of transient and fault conditions on the overall network operation 0 Refs.
Primary Keywords: Pulse Forming Network; SCEPTRE Computer Code; Fault Modeling; Electromagnetic Compatibility

4537
THE VEBA RELATIVISTIC ELECTRON ACCELERATOR
R.K. Parker and M. Ury
Naval Research Lab, Washington, DC 20375
Interim rept. No. NRL-MR-3056, 19p (05/1975).
Availability: AD-A013 188/8ST
NTIS
The VEBA high-current, relativistic electron accelerator has been designed and constructed at NRL for application in the study of high power microwave sources. To meet the requirements of this study, the accelerator was designed for operation in either a short (60 nsec) or long (2.2 microsec) pulse mode. The pulse-forming network in the short-pulse mode is an unbalanced water Blumlein with an output impedance of 9.1 ohms. The Blumlein is pulse-charged by a 1.9 MV Marx generator which has a series capacitance of 26 nF. By transmission along a tapered coaxial line, the output pulse is transformed to 20 ohms and the voltage developed across the diode increased to 2 MV. The Blumlein and transformer sections are removed to convert to the long pulse mode, and the diode is attached directly to the oversized Marx tank. The direct coupling between the Marx and the Blumlein is then replaced by two, nested, water capacitors which are shunted by spiral inductors. This unit with the Marx forms a three-section, voltage-fed, Guillemin (type A), pulse-forming network with a characteristic impedance of 40 ohms and an output voltage of 1 MV.
Primary Keywords: Electron Accelerators; Microwaves; Pulse Generators; Diodes; Sources
Secondary Keywords: NTISDODNRL

4540
(ENERGY CONVERSION, ELECTRICAL; INSULATION, MATERIAL)
(Power Supplies; Liquid)
A HIGH VOLTAGE SOURCE WITH DIGITAL CONTROL FOR DIELECTRIC MEASUREMENTS
A.R. Reichert, G.M. Rhodes and J.E. Brignell
City University, London, EC1, UK
Journal Of Physics E: Scientific Instruments, Vol. 5, pp 587-590 (06/1972).
An improvement in the rigorous control of high voltages for dielectric measurements is achieved by employing digital techniques in the development of a low-voltage controller for a generator of either the oscillator or electrostatic type. Principal advantages over a method previously described are the provision of a highly stable hold mode and the capability for very slow rates of voltage application. Comprehensive logic controls, incorporating essential safety features, allow fully automatic experiments to be performed, and a flexible design permits a simple addition to the equipment to increase the resolution if desired. 7 Refs.
Primary Keywords: Insulation Tester; Ramp Voltage Generator; Digital Control; High Voltage Accuracy

4547
(SWITCHES, CLOSING)
(Liquid Gaps, Optical)
A HIGH-VOLTAGE WATER SPARK GAP WITH LASER FIRING
B.A. Demidov, M.V. Ivkin, V.A. Petrov and S.D. Fanchenko
Instruments And Experimental Techniques, Vol. 17, pp 131-133 (02/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 120-122 (January-February 1974)
The possibility is investigated of initiating high-voltage breakdown of distilled water in a spark gap by means of a spark from a neodymium laser having a power of up to 500 MW. It is shown that for focusing of laser radiation onto the positively charged electrode the scatter of the actuation time of the spark gap amounts to several nanoseconds. A spark gap construction was proposed which ensures reliable firing of the discharge for any polarity of the voltage across the electrodes. 6 Refs.
Primary Keywords: Nd Laser; Polarity Effects; Several Nanosecond Jitter

4552
(PULSE GENERATORS; BREAKDOWN STUDIES)
(Marx; Vacuum, Electrical)
A 2-MV PULSED ELECTROVACUUM INSTALLATION
I.I. Kalyatskii, G.M. Kassirov and G.V. Smirnov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 17, No. 4, pp 1032-1034 (08/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 84-86 (July-August 1974)
An experimental installation is described for investigating electrical breakdown in a vacuum of up to 1E-5 Torr at pulse voltages of up to 2 MV. The length of the vacuum gap reaches 16 cm. 4 Refs.
Primary Keywords: Vacuum Breakdown Study; Apparatus Description; Experimental Results; Aluminum Electrodes; Sphere-plane Gap

4565
(PARTICLE BEAMS, MACRO; BREAKDOWN STUDIES)
(Generation; Vacuum, Particle)
MICROPARTICLE ENERGY ENHANCEMENT FOLLOWING A BOUNCING IMPACT IN A HIGH-VOLTAGE GAP
A.S. Brah and R.V. Latham
University of Aston, Birmingham, Birmingham B4 7ET, UK
Journal Of Physics D; Applied Physics, Vol. 8, No. 8, pp L109-L11' (06/1975).
A low-velocity microparticle gun has been developed for a controlled study of the momentum and charge reversal associated with particle bouncing in a high-voltage vacuum gap for impact velocities of 5-200 m/s. It has been demonstrated that there are a range of experimental conditions for which this mechanism can lead to an enhancement in the kinetic energy of a microparticle. This observation is used in support of a multi-transit model for the initiation of electrical breakdown by the impact of microparticles having velocities in excess of 1500 m/s. 12 Refs.
Primary Keywords: Microparticle; Acceleration; Momentum Transfer; Charge Reversal; Vacuum Breakdown; Multi-transit Model

4570
(PARTICLE BEAMS, ELECTRON; POWER CONDITIONING; PULSE GENERATORS)
(Generation; Pulse Transformers, Systems)
RESONANT TRANSFORMER ELECTRON BEAM PULSER
J.J. Moriarty
Energy Sciences Inc., Burlington, MA 01803
AFWL Report No. AFWL-TR-74-122 (11/1974).
Availability: AD A001828
NTIS
A resonant air-core transformer has been evaluated theoretically and experimentally as a pulser for an electron beam gun. The analysis has resulted in a set of design parameters which has been used to design a lightweight (approximately 100 kg) pulser for the generation of 150 kV, 40-A pulses of 30 microsecond duration at 250 pps in 10-sec bursts. An experimental model has generated 150-kV, 2 to 5-A pulses of 10 to 14 microsecond duration at 20 pps in operation limited by the available power supply. Experimental results have been in sufficient agreement with the theory to provide a high level of confidence in the full scale design. The efficiency predicted in the simplified case of decoupled losses varies from 42 percent with resistive charging to 56 percent by reactive charging methods. In general, the DC-to-beam efficiency improves as the loading is increased and may approach 60 percent in view of the coupling which realistically exists between loss elements. 7 Refs.
Primary Keywords: Resonant Air-core Pulse Transformer; E-beam Generation; Light Weight; Rep-rated; Experiment; Theory; Design Considerations

4572
(PARTICLE BEAMS, ELECTRON; ENERGY STORAGE, INDUCTIVE)
(Generation; Systems)
SHAPING OF VOLTAGE PULSES BY DISCHARGING AN INDUCTIVE STORAGE BANK WITH A CHARGED-PARTICLE BEAM
D.A. Gusev, E.G. Komar, V.B. Markov and E.M. Mallekh
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 5, pp 662-663 (11/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 1051-1054 (May 1974)
Calculations and experimental data are reported on the conditions for the formation of a rectangular accelerating-voltage pulse in a direct-action charged-particle accelerator in which energy is supplied from an inductive bank. 2 Refs.
Primary Keywords: E-beam Generation; Inductive Energy Store; Matching Condition; Current Regulation; Impedance Calculation

4581
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Materials)
THE RECOVERY OF HIGH CURRENT LONG GAPS IN HYDROGEN AND ARGON
R. Simmons and A.B. Parker
University of Liverpool, Liverpool, UK
International Journal Of Electronics, Vol. 37, No. 6, pp 825-832 (C1/1974).
Dielectric recovery voltages of high current long gaps (8 cm) in hydrogen and argon are investigated. Temperature profile of the gap is given along with values of temperature versus time. Recovery curves calculated from measurements were found to differ greatly from derived recovery curves. Explanations for the differences are discussed. 11 Refs.
Primary Keywords: Spark Channel Recovery; Argon; Hydrogen; Temporal Variation Of Temperature; Radial Variation Of Temperature

4590
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
A DYE LASER TRIGGERED SPARK GAP
K. Schildbach and D. Basting
Max-Planck-Institut fur Biophysikalische Chemie, Gottingen, BDR, Germany
The Review Of Scientific Instruments, Vol. 45, No. 8, pp 1015-1016 (08/1974).
Performance of a dye laser triggered spark gap is described with a triggering threshold of only 2 kW peak power and 5 microjoules pulse energy. This spark gap is used as a switching element in a nitrogen laser resulting in a delay between dye laser and nitrogen laser emission of only 20 nsec and a subnanosecond jitter. 5 Refs.
Primary Keywords: Dye Laser; Low Power; Very Low Energy; Tungsten Electrode; Subnanosecond Jitter

4592
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A PICOSECOND RISETIME HIGH VOLTAGE DIVIDER
D.G. Pellinen (1), Q. Johnson (2) and A. Mitchell (2)
(1) Physic International Co, San Leandro, CA 94577
(2) Lawrence Livermore Lab, Livermore, CA 94550
The Review Of Scientific Instruments, Vol. 45, No. 7, pp 944-946 (07/1974).
A two-stage voltage divider having a voltage measuring capability on the order of 100 kV and a rise time of 250 psec has been used to measure submicrosecond pulses on a pulsed electron accelerator. The divider uses a copper sulphate solution high-voltage divider, and a secondary divider made of carbon composition resistors. Measurements have been made indicating the solution divider is useful with fields of 30 kV/cm and with subnanosecond rise times. 4 Refs.
Primary Keywords: Two-stage Voltage Divider; Resistive Divider; Copper Sulphate Resistor; Carbon Resistor; 100 kV Voltage Range; 250 ps Rise Time

4593
(SWITCHES, CLOSING)
(Vacuum Gaps; Optical)
A VACUUM SPARK GAP WITH LASER FIRING
A.A. Malkarevich and V.A. Rodichkin
Scientific-Research Institute Of Electro-Physical Equipment, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 16, No. 6, pp 1716-1717 (12/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 90-91 (November-December 1973)
A Vacuum (p approximately 1E6-1E13 Torr) spark gap operating at a voltage of up to 50 kV is described which is fired by a Q switched ruby laser. The time delay of spark-gap breakdown was measured at various computed voltages, various pressures, and different polarities of the target electrode. The possibility of using the spark gap in circuits for shaping nanosecond pulses is evaluated 3 Refs.
Primary Keywords: Ruby Laser; 50 kV Voltage Range; Time Delay Measurement; Plane Electrodes; Nanosecond Jitter

4626
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
MEASUREMENT OF A HIGH VOLTAGE BY A ROTOR VOLTMETER USING AN INSULATED ELECTRODE
M.T. Novikov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1591-1592 (10/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 247-248 (September-October 1973)
The possibility and singularities of the measurement of a high voltage by a rotor voltmeter when the electric field from the high-voltage electrode is brought out to the voltmeter by means of an insulated measurement electrode are demonstrated experimentally. The measurements were carried out at voltages of 0 to 50 kV. 2 Refs.
Primary Keywords: Rotor Voltmeter; DC Voltage Measurement, 50 kV Operating Voltage; High Reliability

4640
(PARTICLE BEAMS, ELECTRON)
(Generation)
ION-INDUCED PINCH AND THE ENHANCEMENT OF ION CURRENT BY PINCHED ELECTRON FLOW IN RELATIVISTIC DIODES
S.A. Goldstein (1) and R. Lee (2)
(1) University of Maryland, College Park, MD 20742
(2) Naval Research Lab, Washington, DC 20375
Physical Review Letters, Vol. 35, No. 16, pp 1079-1082 (10/1975).
A new model for time-dependent and steady-state ion and electron flow in large-aspect-ratio diodes is constructed. The electron trajectories are computed with use of the self-consistent fields calculated during the initial ion motion. The dynamic formation of a tightly pinched electron flow is qualitatively explained. Very large ion currents, nearly equal to the electron current, are predicted for flat solid cathodes, when steady-state flow is achieved. 8 Refs.
Primary Keywords: E-beam Generation; Large Aspect Ratio Diode; Flat Solid Cathode; Ion Current; Electron Current; Pinched Electron Flow

4641
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
ROTARY SPARK GAP SWITCHING FOR HIGH POWER DYE LASERS
C.M. Ferrer
United Aircraft Research Labs, East Hartford, CT 06108
Applied Optics, Vol. 13, No. 9, pp 1998-1999 (09/1974).
A rotary spark gap is used in series with a flashlamp to provide the necessary voltage holdoff between pulses. The gap was tested up to 150 pps with the flashlamp pumped dye laser reaching a maximum output of 39W at 110 pps. Possible gap improvements are discussed. 5 Refs.
Primary Keywords: Rotary Spark Gap; Rep-rated; Short Recovery Time; High Gap Inductance
Secondary Keywords: Dye Laser Pumping

4644
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SIMPLE SPARK GAP FOR A HIGH REPETITION RATE NITROGEN LASER
L. Pallaro, R. Polloni and F. Zarage
Lab di Fisica del Plasma ed Elettronica Quantistica del CNR, Milan, Italy
Optics And Laser Technology, Vol. 6, No. 4, pp 1 (08/1974).
A simple and inexpensive 30 kV spark gap capable of repetition rates up to 100 Hz is presented. It uses, among other things, the terminal external part of a spark plug of a car as the trigger electrode. 3 Refs.
Primary Keywords: Spark Gap; Simple Design; Medium Voltage; High Reliability; Rep-rated

4660
(BREAKDOWN STUDIES)
(Gas, Electrical)
VARIATION OF ION DENSITY IN A HIGH-VOLTAGE LABORATORY DURING IMPULSE-VOLTAGE TESTING
T.E. Allibone and D. Dring
Leeds University, Leeds, UK
Proceedings Of The IEE, Vol. 121, No. 5, pp 401-402 (05/1974).
The measurement of ions in the vicinity of a gas breakdown gap with and without stabilizing radiation is described. The time of decay to background level is reported, as well as effects of nearby high-voltage equipment 5 Refs.
Primary Keywords: Ambient Ionization Level; Radiation; DC Voltage; Impulse Voltage; Decay Time

4679
(REVIEWS AND CONFERENCES)
(Conferences)
1976 IEEE PULSED POWER CONFERENCE PROCEEDINGS
Conference Record (11/1976).
This conference record contains 97 papers (9 are included as abstracts only), all of which are referenced individually in the bibliography. Topics include energy storage, pulse generation, pulse shaping, switching, particle beam generation and transport, applications, and reviews of the state-of-the-art. 0 Refs.
Primary Keywords: Energy Storage; Pulse Generation; Pulse Shaping; Switching; Particle Beam Generation And Transport; Applications

4680
(PULSE GENERATORS; ENERGY CONVERSION, ELECTRICAL)
(Line Type; Charging Circuits)
AN AMENDED LINE-TYPE PULSE GENERATOR CIRCUIT
G. Scoles
English Electric Valve Co Ltd, Chelmsford, Essex, UK
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB-6 (11/1976).
Over the years line-type pulse generators have tended to become standardised and in the majority of modern circuits a pulse-forming network is charged cosinusoidally to twice the supply voltage and then discharged into a substantially matched load to generate an output pulse. The variant described in this paper is similar, except that instead of connecting one terminal of the load to the common negative busbar, it is connected to the high tension terminal of the capacitor forming the reservoir of the power supply. This halves the voltage to which the PFN is charged and several advantages accrue from the change. These are, in a few cases, offset by the use of a floating load, although a correctly designed pulse transformer largely obviates this. The advantages and disadvantages of the circuit are discussed, showing that in many applications its use results in lower capital cost and more certain recovery of the switching device. 0 Refs.
Primary Keywords: Line Type Pulse Generator; PFN Charging Method

4681
(ENERGY STORAGE, MECHANICAL; PULSE GENERATORS)
(Rotating Machines; Rotating Machines)
AN ELECTROMECHANICAL PULSE GENERATOR
J.P. Craig and R. Seeks
Texas Tech University, Lubbock, TX 79409
1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-7 (11/1976).
A prime pole generator has been conceived and designed and a low power model has been built and tested. The machine produces one large positive pulse per revolution and a number of small, equal magnitude negative pulses per revolution depending upon the number of poles. Any prime number of poles can be used, with one zero-strength pole and an equal number of equal strength north and south poles. The pole pattern can be determined from a Legendre Sequence. 0 Refs.
Primary Keywords: Prime Pole Generator; Rep-rate; Legendre Sequence

4682
(ENERGY STORAGE, CAPACITIVE)
(Systems)
A DESIGN APPROACH TO A REPETITIVELY PULSED SUPER FAST CAPACITOR BANK
D. Zucker (1), J. Long (1) and W. Bostick (2)
(1) Lawrence Livermore Lab, Livermore, CA 94550
(2) Stevens Institute of Technology, Hoboken, NJ 07030
1976 IEEE Pulsed Power Conference Proceedings, Paper IIC-4 (11/1976).
Repetitively pulsed super fast banks suffer from the following problem: On the one hand, long life necessitates low fields. On the other hand, high fields are necessary to shrink down the volume of the total system and thus, the inductance. Here we are describing an approach that tries to optimize as much as possible, these two conflicting requirements in a design for a megajoule capacitor bank capable of pulsing ten million shots or above, at a minimum of one pulse a second. Problems such as current crowding in the capacitor bank, switching, heat removal, poyntig vector flow surface to volume considerations, energy recycling and foil design will all be discussed. Specific design parameters and final dimensions will be presented.
Primary Keywords: Super Fast Capacitor Banks; Long Life; Low Inductance

4683
(POWER CONDITIONING)
(Pulse Forming Networks)
A HALF MEGAWATT PULSE FORMING NETWORK
J.E. Creadon (1) and R.A. Fitch (2)
(1) ECOM, Fort Monmouth, NJ 07703
(2) Maxwell Labs Inc, San Diego, CA 92123
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB-1 (11/1976).
A lightweight half megawatt average power pulse forming network designed to store 4 kilojoules at 40 kilovolts has been developed. The energy storage system produces a 10 microsecond pulse at a repetition rate of 125 hertz and has a one ohm impedance. It is designed to operate adiabatically for durations of 60 seconds. A lifetime capability of over 4E5 pulses has been demonstrated. 0 Refs.
Primary Keywords: Pulse Forming Network; Rep-rate; Burst Mode; High Average Power; Adiabatic Operation

4684
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
A HIGH VOLTAGE D-C REGULATOR SYSTEM PERFORMANCE PREDICTION TECHNIQUE
C.J. Eichenauer Jr.
General Electric Co, Syracuse, NY 13201
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-6 (11/1976).
The DC beam accelerating voltage applied between the cathode and the slow wave structure of a traveling wave amplifier tube must often be held to within a few hundreths of one percent of its specified value if acceptable R-F phase stability is to be obtained from the amplifier. In high power pulsed radar applications this d-c voltage may be on the order of 40 kilovolts, hence the requirement for a precisely controlled high voltage regulated power supply with excellent transient response typically results. Since the construction of a breadboard model of such a system is usually impractical from both schedule and cost points of view, a reliable means of analytical performance prediction is of considerable importance. The CIRCUS 2 computer aided design program was used for this analysis. The techniques described are equally applicable to many current requirements, for example, neutral beam pulse regulator systems. 0 Refs.
Primary Keywords: Excellent Voltage Regulation; Good Transient Response; Analysis; Design Considerations
Secondary Keywords: Travelling Wave Tube

4685
(POWER CONDITIONING)
(Saturable Reactors)
A PULSE COMPRESSION NETWORK
D. Zucker
Lawrence Livermore Lab, Livermore, CA 94550
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB-8 (11/1976).
Classic pulse compression networks are typically of the Melville line type. These types of compression networks are characterized by resonant transfer of energy between identical capacitors through successively smaller inductors. These stages are isolated by switches which in the case of the Melville line are integrated into the inductor by the use of saturable magnetic cores. The reduced inductance reduces the ringing frequency and the impedance. In this paper we discuss a novel compression circuit which utilizes both saturable capacitors and saturable inductors with the resulting improvement in both compression per stage and impedance control. Some basic calculations and practical limitations of the compressor will be discussed. 0 Refs.
Primary Keywords: Pulse Compression Technique; Saturable Inductor
Secondary Keywords: Abstract Only

4686
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Systems; LC)
A 3 MA, 600 KV FAST CAPACITOR BANK FOR A SHOCK-HEATED TORUS
D. Markins (1), Y.G. Chen (2), C. Chin-Fatt (2) and A. DeSilva (2)
(1) Maxwell Labs Inc, San Diego, CA 92123
(2) University of Maryland, College Park, MD 20742
1976 IEEE Pulsed Power Conference Proceedings, Paper IIC-3 (11/1976).
A high-beta, toroidal discharge is shock-heated by a hexagonal array of low-inductance, synchronized pulser modules. The toroidal load is immersed in a water-filled tank to grade the high electrical stresses. Strip-line connections between the pulser outputs and segments of the toroidal coil are made through diaphragms installed in the abutting faces of the pulser tanks and flexible seals in the load vessel. 100 kJ, LC generators in each of the oil-immersed pulser module tanks produce a peak open circuit voltage of 580 kV. Complete voltage erection occurs in a time of 14 microseconds; at this time, parallel output switches connect each erected LC generator to a toroid segment via parallel plate strip lines and an interface diaphragm. A total peak current of 3 MA with dI/dt approximately 6E12 A/sec is delivered to the toroidal load coil from the six pulser modules. At current peak, parllel crowbar switches are closed in each pulser to produce an e-fold load current decay time of about 20 microseconds. Synchronous command triggering of both start and crowbar switches is achieved by three master trigger generators, each delivering six high level trigger pulses. 3 Refs.
Primary Keywords: LC Inversion Pulse Generator Module; Triggering Considerations; Series Switching
Secondary Keywords: Shock-heated Torus

4687
(POWER CONDITIONING)
(Pulse Forming Networks)
CONSTANT CURRENT PFN
L. Masten and T.R. Burkes
Texas Tech University, Lubbock, TX 79409
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB-3 (11/1976).
This paper describes a procedure for designing current fed networks to produce constant current pulses into time varying loads. The procedure is an extension of Guillemin's method for PFN design for constant loads. Examples of the procedure and computer derived responses are given. Problems associated with the design of voltage fed networks which produce constant-current pulses into time varying loads are discussed. The primary problem is one of prescribing the appropriate initial conditions for analysis, so that a realizable network may be derived to produce the desired pulse with only an initial voltage on the energy storage capacitors. 0 Refs.
Primary Keywords: Pulse Forming Network; Constant Current; Guillemin's Method; Analysis; Synthesis

4688
(PULSE GENERATORS)
(Systems)
DISCHARGE CIRCUITRY FOR HIGH REPETITION RATE METAL VAPOR LASERS
L.W. Springer, T.W. Karras, R.S. Anderson and B.C. Bricks
General Electric Co, King of Prussia, PA
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-1 (11/1976).
The evolution of discharge circuitry for high repetition rate metal vapor lasers is described. The circuitry needed for operation of a discharge-heated copper vapor laser at up to 12 watts average power at 6 kHz rates is given. Switch characteristics and component [illegible] are also discussed. 5 Refs.
Primary Keywords: Rep-rated; Solid-state Trigger; Thyratron
Secondary Keywords: Copper Vapor Laser Pumping

4689
(SWITCHES, CLOSING)
(Gas Gaps, E-beam)
ELECTRON BEAM CONTROLLED SWITCHING
R.O. Hunter
Maxwell Labs Inc, San Diego, CA 92123
1976 IEEE Pulsed Power Conference Proceedings, Paper IC-8 (11/1976).
A fast switching technique has been demonstrated which relies on the control of the impedance level of a gas discharge by an electron beam. Uncommutated di/dt's in excess of 1E11 Amperes/second were obtained for a 50 kV blocking voltage switch with a forward drop of approximately 1 kV utilizing atmospheric pressure gas in a 10 liter volume as the working medium. The scaling of recombination and attachment controlled switches is discussed in terms of molecular and discharge parameters. It is shown that gases with high drift velocities at low electrical fields are desirable for high efficiency in the switching process. Such switches appear to be scalable to the megampere level and perhaps to recovery times on the order of 1E-8 seconds. 9 Refs.
Primary Keywords: E-beam Controlled Switch; Fast Turn-on; Fast Recovery; Design Considerations; Performance Test

4690
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps; Electrical; Reviews)
GASEOUS SWITCHES: THE PAST AND PRESENT STATE OF THE ART
H. Menown
English Electric Valve Co Ltd, Chelmsford, Essex, UK
1976 IEEE Pulsed Power Conference Proceedings, Paper IA-2 (11/1976).
Triggered discharge devices which use a gaseous medium to carry the current are discussed in a general manner. Devices operating at pressures above and below atmospheric and in vapours as well as true gases are considered. Normal and quenched spark gaps are described, along with mercury pool and hot cathode devices. A number of cold cathode switches are also briefly mentioned, including flashlamps and trigger tubes. Most emphasis is given to hydrogen thyratrons and ignitrons as these are felt to be of the greatest value in pulsed power generation. Crowbars are discussed as well as modulator applications. In each case the uses of the various devices are indicated along with the advantages and shortcomings where relevant. 0 Refs.
Primary Keywords: Gas Gap; State-of-the-art; Quenched Spark Gap; Thyratron; Ignitron, Crowbar
Secondary Keywords: Modulator; Applications

4691
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
INERTIAL ENERGY STORAGE RESEARCH AT THE UNIVERSITY OF TEXAS AT AUSTIN
K M Tolk, M D Driga, E B Becker, W F Weldon, W L Bird, H G Rylander and H H Woodson
University of Texas at Austin, Austin, TX 78712
1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-6 (11/1976).

During the past few years the Energy Storage Group at the University of Texas has been doing research on the design, theory, and application of homopolar machines. Two machines have been built and a third machine is now under construction. This third machine is intended to study the fundamental limitations in fast discharging homopolar machines. Studies have been conducted on other homopolar systems with energy storage of up to 63 GJ. Experimental research areas discussed include brush testing, electromagnetic bearings, and welding. Theoretical areas include pulse compression and magnetic field mapping. Other applications of homopolar machines including research, military, and industrial uses have been investigated and are discussed. Funding for this program has been provided by the Texas Atomic Energy Research Foundation, the Energy Research and Development Administration and the Electric Power Research Institute. 12 Refs.

Primary Keywords: Inertial Energy Storage, Review, Very High Energy, Component Testing, Application

4692
(PULSE GENERATORS)
(Line Type)
INVERSE VOLTAGE CONTROL IN LINE TYPE PULSE GENERATING CIRCUITS
G Scoles and B P. Newton
English Electric Valve Co Ltd, Chelmsford, Essex, UK
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC 7 (11/1976).

Firstly, various circuits are described which have been used in line type modulators either to afford rapid inverse voltage removal or protection against cumulative voltage build up following a load failure. The advantages and disadvantages of each are discussed briefly. In addition, two new circuits are described. The first combines a rapid removal of inverse voltage with precise determination of the voltage zero immediately prior to the recharging of the pfn. Although requiring extra components, this new arrangement offers advantages over circuits hitherto employed. The second new circuit is a diode switched charge-sharing capacitor circuit designed to remove or reduce in amplitude the short duration inverse spikes which can occur in line type modulators. Should a thyratron be employed as the switching means, this inverse spike can lead to undesirable heating of the grid due to plasma clean up. The circuit described largely eliminates this heating and the two circuits are complementary and may be used together. 6 Refs.

Primary Keywords: Inverse Voltage; Load Failure, Voltage Zero

4693
(REVIEWS AND CONFERENCES)
(Reviews)
LIGHTWEIGHT MULTIMEGAWATT POWER TECHNOLOGY A SURVEY
R L Verga (1), J P Heckl (2) and L I Amstutz (3)
(1) USAF Aero Propulsion Lab
(2) Naval Surface Weapons Center
(3) US Army Mobility Equipment Research and Development Command
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB 5 (11/1976)

A discussion is presented of the various power source and conditioning technologies and hardware suitable for lightweight multimegawatt applications. Tradeoffs are shown on the basis of critical operating parameters among various power system components. Included are the applicable power sources: turbines (chemically fueled and airbreathing), flywheels, rotating generators (conventional and superconducting), electrochemical devices (batteries and fuel cells) and magnetohydrodynamic generators. Also discussed is the appropriate power conditioning: energy storage (capacitive, inductive), switching (closing, opening) and power conversion (transformers, inverters). An assessment of the current state-of-the art in each of these technologies is given. Anticipated advancements are discussed and projections are given of potential lightweight low volume electrical power generation and conditioning capabilities through the 1980-85 time period. 0 Refs.

Primary Keywords: High Power Technology, Operating Parameters, Turbine, Flywheel, Magnetohydrodynamic
Secondary Keywords: Abstract Only

4694
(POWER CONDITIONING)
(Current Limiters)
LIQUID NITROGEN COOLED WIRES AS SWITCHABLE HIGH POWER DIRECT CURRENT LIMITING ELEMENTS
A S Gilmour and J D Marshall
State University of New York at Buffalo, Buffalo, NY 14226
1976 IEEE Pulsed Power Conference Proceedings, Paper IC 3 (11/1976)

While designing a high power current limiting device which utilizes the large change of resistivity with temperature of certain metals, it was discovered that some metals, when immersed in liquid nitrogen may form a jacket of gaseous nitrogen around them and can be heated electrically to any temperature up to their melting point without oxidation. Due to this effect, herein called the vapor lock effect, the resistivity of the metal has been observed to increase by a factor of 91 and power dissipations of up to 550 watts/sq cm have been attained. Using these properties along with a series/parallel switching arrangement for several metal elements may aid in the development of reliable and compact high power current limiting devices. 3 Refs.

Primary Keywords: Current Limiter, Nonlinear Resistor, Liquid Nitrogen Cooled, Vapor Lock Effect

4695
(PARTICLE BEAMS, ELECTRON)
(Transport)
METAL FOILS FOR USE IN PULSED LASER APPLICATIONS
C G Hoffman
Los Alamos National Labs, Los Alamos, NM 87545
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC 2 (11/1976)

Testing of foils used for electron gun windows for laser pumping is the subject of this paper. Several foils of different composition are tested and results are presented concerning the number and size of inclusions, grain size, and second and third phases. The effects of brazing are considered, as are the effects of electron irradiation. 0 Refs.

Primary Keywords: Metal Foil Windows, E beam Windows, Specifications, Test Results

4696
(PARTICLE BEAMS, ELECTRON)
(Generation)
MICROWAVE EMISSION FROM MAGNETICALLY INSULATED RELATIVISTIC ELECTRON BEAM DIODES
G Bekefi and T J Orzechowski
Massachusetts Institute of Technology, Cambridge, MA
1976 IEEE Pulsed Power Conference Proceedings, Paper IIC6 1 (11/1976)

Experiments will be described concerning the behavior of cylindrical field emission diodes immersed in externally applied magnetic fields < 20 kG. Sizeable current flows are observed even in forbidden regions of magnetic field in which the diode is presumably insulated magnetically. This current flow is accompanied by copious microwave radiation. In the case of smooth anodes, the emission is fairly broadband in frequency, and does not exceed several kilowatts in power. When the anode supports a periodic structure, narrow band emission in the gigawatt range of powers is observed. In the latter case, approximately 35% of the beam kinetic energy is converted into radiation. 28 Refs.

Primary Keywords: Microwave Emission, Field Emission Diode, Magnetic Insulation, Smooth Anode, Periodic Structure

4697
(POWER CONDITIONING)
(Pulse Forming Networks)
NETWORKS FOR DRIVING TEA LASERS
A Bostwell
Texas Tech University, Lubbock, TX 79409
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB 4 (11/1976).

A new type of pulse forming network is described. The PFN produces a train of pulses for simultaneously driving a CO/sub 2/ TEA laser and sustaining the discharge in the TEA laser without arc formation. The PFN offers the advantage of not requiring active circuits, such as hard tube modulators. 3 Refs.

Primary Keywords: Pulse Forming Network, Burst Mode; Pulse Train, Pulse Shaping
Secondary Keywords: Gas Laser Pumping

4698
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
ONE MILLISECOND DISCHARGE TIME HOMOPOLAR MACHINE
J H Gully, M D Driga, B Grant, H G Rylander, K M Tolk, W F Weldon and H H Woodson
University of Texas at Austin, Austin, TX 78712
1976 IEEE Pulsed Power Conference Proceedings, Paper IIB 2 (11/1976)

All information now available concerning fast discharge homopolar machines is only theoretical. No such machine has ever been built and existing electrical machines do not approach the extremely severe conditions required for a fast discharge machine. The Energy Storage Group at the University of Texas at Austin has designed and is in an advanced stage of building a very fast discharge experimental homopolar machine which will explore fundamental mechanical and electromagnetic limitations to discharge times. The FDX is a fully compensated, pulsed field homopolar generator with two counterrotating rotors. It will discharge in 1.05 milliseconds when short circuited. The applied field averages 4 Tesla and the equivalent capacitance is 36.5 F. When discharged from full speed into a load having 0.275 microhenry inductance and 60 microohm resistance, the discharge time will increase to 3.075 milliseconds and the efficiency of the discharge will approach 80 percent. This research has been funded by the Electric Power Research Institute, Texas Atomic Energy Research Foundation and the US Energy Research and Development Administration. 2 Refs.

Primary Keywords: Homopolar Generator, Fast Discharge, Pulsed Field, High Efficiency

4699
(POWER CONDITIONING)
(Pulse Forming Networks)
PFN DESIGN INTERFACE WITH E BEAM SUSTAINED GAS DISCHARGE
J P O'Loughlin
AFWL, Kirtland AFB, NM 87117
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC 5 (11/1976)

The non linear time varying conductivity characteristics of electron beam sustained gas discharges require special consideration in the design interface with the pulse forming network in line type modulators. Equations and tables are used to analyze effects of varying E/N, a non uniform electron beam, and the interaction with the PFN. Experimental data is compared to calculations and found to be in reasonable agreement. 2 Refs.

Primary Keywords: PFN, E beam Interaction, Time Varying Impedance, Line Type Modulator, Computer Calculation

4700
(BREAKDOWN STUDIES)
(Gas, Optical)
DEVELOPMENT AND PERFORMANCE CHARACTERISTICS OF A UV PREIONIZED, HIGH POWER TEA PULSED CO/SUB 2/ LASER
C Ohandano and T Sekiguchi
University of Tokyo, Hongo, Bunkyo, Tokyo
Japanese Journal Of Applied Physics, Vol 19, No 8, pp 1493-1504 (08/1980)

A high power TEA CO2/sub 2/ laser was developed and tested. The laser used UV preionization and produced a total output energy of 300 joules with the first spike lasting 50 ns. The preionization characteristics, the effect of the preionization on the main discharge, the effect of gas composition on the small signal gain and laser oscillation characteristics are also discussed. 12 Refs.

Primary Keywords: UV Preionizer, Energy Deposition, Discharge Characterization
Secondary Keywords: Gas Laser Pumping

AD-A131 753 PULSED POWER BIBLIOGRAPHY VOLUME 2 ANNOTATED BIBLIOGRAPHY(U) AIR FORCE WEAPONS LAB KIRTLAND AFB NM J BEMESDERFER ET AL. AUG 83 AFWL-TR-83-74-VOL-2 2/3

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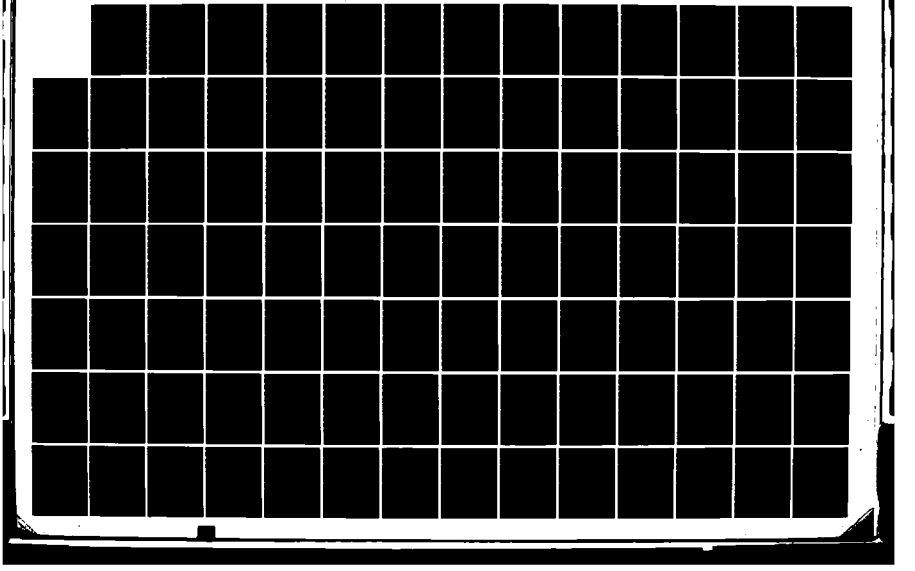

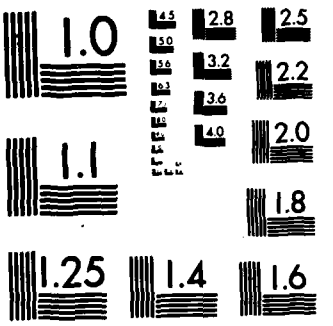

4701
(ENERGY STORAGE, CAPACITIVE)
(Systems)
PRINCIPAL CONSIDERATIONS IN LARGE ENERGY-STORAGE CAPACITOR BANKS
E.L. Kemp
Los Alamos National Labs, Los Alamos, NM 87545
1976 IEEE Pulsed Power Conference Proceedings, Paper IIC-1 (11/1976).
Capacitor banks storing onn or more megajoules and costing more then one million dollars have unique problems not often found in smaller systems. Two large banks, Scyllac at Los Alamos and Shiva at Livermore, are used as models of large, complex systems. Scyllac is a 10-MJ, 60-kV theta pinch system while Shiva is a 20-MJ, 20-kV energy system for lasher flash lamps. A number of design principles are emphasized for expediting the design and construction of large banks. The sensitive features of the charge system, the storage system layout, the switching system, the transmission system, and the design of the principal bank components are presented. Project management and planning must involve a PERT chart with certain common features for all the activities. The importance of the budget is emphasized. 3 Refs.
Primary Keywords: High Energy Capacitor Bank; Scyllac Bank; Shiva Bank; Design Considerations; Construction Schedule

4702
(ENERGY STORAGE, CAPACITIVE; PARTICLE BEAMS, ELECTRON; SYSTEMS)
(Marx Generators; Generation)
PULSED POWER SYSTEMS FOR THE LASL HIGH ENERGY GAS LASER FACILITY
K. Riepe and H. Jansen
Los Alamos National Labs, Los Alamos, NM 87545
1976 IEEE Pulsed Power Conference Proceedings, Paper IIC5-1 (11/1976).
The laser division at Los Alamos Scientific Laboratory is designing a CO/sub 2/ laser fusion experiment with the goal of delivering 100 kJ to the target in a one nanosecond pulse. The laser will be pumped by an electron-beam-controlled discharge. The pumping power supply will be a number of parallel Marx generators, with an output voltage of 500 kV, and a total energy storage of about 5 MJ. The elecctron gun is a cold cathode triode, also operating at abut 500 kV. Preliminary design considerations for the pulsed power systems are presented. Some pulse forming network designs are discused with calculated waveforms shown. 1 Refs.
Primary Keywords: Marx Generator; Cold Cathode Triode; Reliability
Secondary Keywords: Gas Laser Pumping

4704
(SYSTEMS)
()
PULSE POWER REQUIREMENTS FOR LASER ISOTOPE SEPARATION SYSTEMS
P. Mace, E.A. O'Hair and M. Piltch
Los Alamos National Labs, Los Alamos, NM 87545
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-3 (11/1976).
The uranium enrichment process currently under investigation at the Los Alamos Scientific Laboratory will require pulsed lasers with unique characteristics. The requirements are such that great demands will be made on the state-of-the-art in terms of pulsed power components and techniques. This paper is devoted to a discussion of the pulsed laser output characteristics and their relationship to available electrical devices. Further research areas will be designated as they are seen to affect the system requirements. 0 Refs.
Primary Keywords: Laser Isotope Separation; Rep-rated; Switching Requirements
Secondary Keywords: IR Laser; UV Laser

4706
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)
RECENT DEVELOPMENTS IN HIGH POWER SWITCH TUBES FOR HIGH POWER RADAR AND FUSION RESEARCH
Mark, J.T. and J.A. Eshleman
RCA Corp, Lancaster, PA 19104
1976 IEEE Pulsed Power Conference Proceedings, Paper IC-5 (11/1976).
This paper describes two tubes now in development. The first is a 425 kW, 20 kV switch tube with a long life, tungsten matrix cathode and conduction cooled, copper alloy grids. The second is a 24 megawatt, 200 kV switch tube with thoriated tungsten cathodes and water cooled electrodes. 1 Refs.
Primary Keywords: RCA A2960B Switch Tube; Tungsten Matrix Cathode; Copper Alloy Grid; Thoriated Tungsten Cathode; Long Life

4707
(SWITCHES, CLOSING)
(Thyristors)
SOLID STATE HIGH POWER PULSE SWITCHING
P.F. Pittman and D.J. Page
Westinghouse Electric Corp, Pittsburgh PA
1976 IEEE Pulsed Power Conference Proceedings, Paper IA-3 (11/1976).
In this paper, the structural features and the methods of turning on high power thyristors, reverse blocking diode thyristors and light activated silicon switches are reviewed. The advantages and limitations of these devices are described together with a description of the performance achieved to date by the various devices. Finally, the operation of these devices in series strings to form high power switching modules is described. 2 Refs.
Primary Keywords: High Power Thyristor; Reverse Blocking Diode Thyristor; Light Activatd Silicon Switch; Performance; Series Strings

4708
(SWITCHES, CLOSING)
(Liquid Metal)
THE LIQUID METAL PLASMA VALVE CLOSING SWITCH
J.R. Bayless (1) and J.P. Meckl (2)
(1) Hughes Research Labs, Malibu, CA 90265
(2) Naval Surface Weapons Center, Silver Spring, MD 20910
1976 IEEE Pulsed Power Conference Proceedings, Paper IB-3 (11/1976).
The liquid metal plasma valve is a high average power mercury vacuum-arc switching device. It has been extensively developed over the past ten years as a converter valve for the use by the electric utilities industry at nominal average power levels of 90 MW. This paper will describe an LMPV closing switch now under development for operation in conjunction with a PFN to deliver 1 MW average power to a load in 20 to 50 microsecond pulses at up to 100 kV. The objective of this development is to obtain information for the design of switches capable of operating at much higher power levels. 1 Refs.
Primary Keywords: Liquid Metal Plasma Valve; High Average Power; Vacuum Arc; Ignitor
Secondary Keywords: Pulse Forming Network

4709
(SWITCHES, OPENING)
(Vacuum Gaps, Plasma Erosion)
THE PLASMA EROSION SWITCH
C.W. Mendel, S.A. Goldstein and P.A. Miller
Sandia Labs, Albuquerque, NM 87115
1976 IEEE Pulsed Power Conference Proceedings, Paper IC-2 (11/1976).
The plasma erosion switch is a device capable of initially carrying high currents, and then of opening in nanoseconds to stand off high voltages. It depends upon the erosion of a plasma which initially fills the switch. The sheath between the plasma and the cathode behaves as a diode with a rapidly increasing A-K gap. Preliminary tests of the switch on the Proto I accelerator at Sandia will be described. In these tests, the switch consisted of a cylinder of highly ionized plasma four inches in diameter and one-inch thick surrounding a one-inch cathode. The switch shorted out prepulse voltages and allowed energy to be stored in the diode inductance outside the switch until the accelerator current reached 75 kA. The switch impedance then rose rapidly to approximately 100 ohms in 5 nanoseconds, whereupon the accelerator current transferred to the cathode. Current rise rates of 3E13 A/sec were limited by cathode turnon. Voltage rise rates of 1E15 V/sec were achieved. The elimination of prepulse and machine turn-on transients allowed A-K gaps of 2 mm to be used with 2.5 MV pulses, yielding average E fields of 12 MV/cm. 0 Refs.
Primary Keywords: Plasma Erosion Switch; Diode; Fast Opening Time; Plasma Depletion

4710
(SWITCHES, OPENING)
(Vacuum Gaps, Magnetic Field)
THE PRESENT STATUS AND PROJECTED CAPABILITIES OF VACUUM ARC OPENING SWITCHES
A.S. Gilmour
State University of New York at Buffalo, Buffalo, NY 14226
1976 IEEE Pulsed Power Conference Proceedings, Paper IC-1 (11/1976).
Vacuum arc opening switches are under development at the State University of New York at Buffalo. The configuration of these devices is such that electron current is forced to flow, primarily, radially outward from the end of a relatively small rod shaped cathode to a ring shaped anode. The source of current is a vacuum arc that is initiated on the surface of the cathode by a pulse to an ignitar electrode. This vacuum arc also generates a metallic plasma in the cathode to anode region resulting in a low switch drop during conduction. Current control is achieved through the application of an axial magnetic field. Operating characteristics that have been achieved are circuit interruption at DC voltages up to 25 kV, control of currents up to 10 kA and operation at repetition frequencies up to 1 kHz. The turn-on and turn-off times are, respectively, as short as one and two microseconds. The pulse width is continuously variable. Applications being considered at the present time include high-power inverters, fault-current limiters and high-power modulators. The status of the device development is described and then projected capabilities are given. 10 Refs.
Primary Keywords: Vacuum Arc Opening Switch; Low Dissipation; Magnetic Field Interruption Mechanism

4711
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)
TIME SELECTIVE RECHARGING OF AN AUXILIARY PULSER
E.H. Hooper and R.A. Gardenghi
Westinghouse Electric Corp, Baltimore, MD 21203
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB-7 (11/1976).
This paper describes a technique for maximizing the utilization of a prime power source when the principle load is a line type pulser. A resonantly charged line-type pulser draws energy from the prime source in a periodic manner resulting in dead spots or load valleys between cycles. Time limited resonant charging may be used to draw energy from the prime source during these load valleys to provide power for auxiliary equipment. This increases power available from the source without increasing peak power demand. Basic circuits and waveforms are presented. 2 Refs.
Primary Keywords: Charging Circuit; Line Type Pulser; Maximum Utilization Of Power

4712
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
U.S. AIR FORCE SUPERCONDUCTING GENERATOR DEVELOPMENT
M.L. Southall
AFAPL, Wright-Patterson AFB, OH
1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-8 (11/1976).
A review of Air Force-sponsored development of a 12,000 RPM superconducting generator is presented. Results are given for recent critical component tests including stator coils and four coil rotor assembly. A brief discussion of potential future work in high power superconducting generators is given. Superconducting generators with specific weights of less than 0.1 lb/kva in the multimegawatt class can be anticipated. 7 Refs.
Primary Keywords: Superconducting Generator; Lightweight Generator; Airborne Power Supply

4713
(POWER CONDITIONING)
(Pulse Transformers)
ANALYSIS OF POWER TRANSFORMERS UNDER TRANSIENT CONDITIONS
D.L. Lockwood, R.I. McNall Jr. and R.F. Whitbeck
Thermal Technology Lab, Inc., Buffalo, NY
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-1 (11/1976).
Low specific weight transformers may be designed to operate under impulse conditions well above the steady state limit. This usually results in nonlinear current and voltage transformation. A procedure is outlined in this paper for the analysis of lumped parameter transformer models with nonlinear self-inductance. An algorithm for modeling inductance is developed which is accurate for square loop cores as well as ordinary soft magnetic materials. A simple routine which can be implemented with modest computing power is used to determine the dynamic response of transformers driven by a variety of sources. The model permits independent assignment of initial conditions for the magnetic state of the core and the phase of the driving source. This permits a computation of inrush currents and output waveforms under the entire range of possible initial conditions. This work was sponsored by the United States Air Force Aero Propulsion Laboratory, Wright Patterson Air Force Base, Ohio. 2 Refs.
Primary Keywords: Lightweight Power Transformer; Pulse Application; Modelling

4714
(PULSE GENERATORS)
(Trigger)
AN AIR-POWERED FIBER-OPTIC COUPLED PULSER SYSTEM FOR CTR EXPERIMENTS
M.C. Hunnally and A.T. Brousseau
Los Alamos National Labs, Los Alamos, NM 87545
1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-6 (11/1976).
The design, construction, and operation of an air-powered fiber-optic coupled pulser system for initiating various high-voltage systems in Controlled Thermonuclear Research Experiments are discussed. The pulser system provides complete electrical isolation of the experimental high-voltage circuits from the timing and control circuits. It also prevents crosstalk between individual pulser output channels and eliminates trigger system ground loops. The electronic design and reliability of the pulser system, including the fiber-optic electrical interface considerations, are discussed. A description of the air-driven power supply and a brief cost analysis of this system compared to conventional pulser systems are presented. 8 Refs.
Primary Keywords: Pulser; Fiber Optic Coupling; Electrical Isolation; Air-driven Power Supply

4715
(POWER CONDITIONING)
(Pulse Transformers)
AN ANALYSIS OF CO-AXIAL PULSE TRANSFORMERS
R. Dollinger and D.L. Smith
Texas Tech University, Lubbock, TX 79409
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-4 (11/1976).
The basic idea of using a co-axial cable as an isolation pulse transformer for triggering spark gaps is not new. However, there are several distinct advantages of driving the braid as the primary as opposed to driving the inner conductor. The fundamental advantage is that the ratio of the output voltage to the input voltage is unaffected by the thickness of insulation between the inner conductor(s) and the braid. Thus, the transformer with the braid as the primary works well for isolating high secondary to primary voltages. This and other advantages are demonstrated. 6 Refs.
Primary Keywords: Co-axial Pulse Transformer; Outer Conductor Primary; Strong Coupling; High Voltage

4716
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
AN INEXPENSIVE HIGH VOLTAGE PROBE
R. Dollinger and D.L. Smith
Texas Tech University, Lubbock, TX 79409
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-8 (11/1976).
A simple, easily constructed, high voltage probe (<= 300 kV) with a good frequency response (<= 100 MHz) and high input impedance (>= 10 kohm) is desirable in many applications. Such a probe, constructed of two concentric cylinders of Velostat is reported. 2 Refs.
Primary Keywords: High Voltage Probe; Simple Design; Simple Construction; High Frequency Response

4717
(ENERGY CONVERSION, THERMAL)
(Loads)
A COMPACT LOW INDUCTANCE LOAD FOR PULSE TESTS
R.D. Gourley
Hughes Aircraft Co, Culver City, CA 90230
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-6 (11/1976).
The development of a low inductance resistive load for high energy pulse tests is described. The performance requirements and design alternatives for a specific application are discussed. The selected design is an air cooled bank of silicon carbide resistors in parallel coaxial mounts. This design has an inductance less than 25nH, a continuous power dissipation exceeding 50kW and a peak pulse voltage rating of 22kV. The load will operate 40kV off ground. The grounded enclosure is a 3-foot cube that permits stacking for higher power requirements. 3 Refs
Primary Keywords: Resistive Load; Low Inductance; High Power; Medium Voltage

4718
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Systems; Systems)
A HIGH CURRENT, HIGH FREQUENCY CAPACITIVE ENERGY STORAGE SYSTEM USED TO PRODUCE INTENSE MAGNETIC FIELDS
D. Markins, J. Bandas and H.T. Olson
Maxwell Labs Inc, San Diego, CA 92123
1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-2 (11/1976).
Recent component design and fabrication concepts have evolved a versatile high current, low inductance capacitive energy storage system in which a modular approach allows for expansion to larger systems. The design utilizes low inductance, high voltage reversal capacitors with a low profile bushing. The capacitors are connected in parallel in a mylar insulated parallel plate transmission line. An important feature of the design is the gas, multichannel, rail spark gap switching system which provides low inductance combined with high current, high Coulomb capabilities. A system incorporating these design features is currently in operation to produce intense pulsed magnetic fields. The machine is a 50 kV, 60 kJ, 9 nH design which is capable of currents in excess of 1 MA and di/dt's of 5E12 amp/sec. In the present application, the load is a single turn inductor and the peak current is 1.2 MA. Pulsed magnetic fields of 500,000 Gauss have been produced at frequencies of 160 kHz. Fields of these frequencies and intensities are being used to impact-bond metals, illustrating one of many potential applications of such a system. 1 Refs.
Primary Keywords: Capacitor Bank; High Current; Low Impedance; Rail Gap; Pulsed Magnetic Field

4719
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Systems; Systems)
A MODULAR POWER-CROWBAR BANK FOR THE GENERATION OF A 50 MA, 50 MICROSECOND CURRENT PULSE FOR THE TOROIDAL PLASMA EXPERIMENT HBS II AT GARCHING
E. Breit, J.E. Gruber, M. Munich, G. Schramm, U. Seidel and R. Sub
Max-Planck-Institut FUr Plasmaphysic, Garching, Euratom Assoc.
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-7 (11/1976).
The 50 m long, single-turn stellarator coil for the toroidal HBS II experiment at Garching will be fed from a low inductance modular power-crowbar bank. A start bank 2 x 48 kV, 768 kJ consisting of 96 modules generates a submicrosecond current rise, while the power-crowbar bank 3 kV, 3.3 MJ extends the pulse for 50 microseconds. The plug-in modules with newly developed capacitors and double-gap switches are described as well as the channel diagnostics by means of fibre-optics. 1 Refs.
Primary Keywords: Capacitor Bank; High Energy; Low Voltage; Low Inductance; Modular Construction; Double-gap Spark Gap
Secondary Keywords: Stellarator

4721
(ENERGY STORAGE, INDUCTIVE)
(Reviews)
DEVELOPMENT OF INDUCTIVE STORAGE FOR GENERATION OF HIGH VOLTAGE PULSES
I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-2 (11/1976).
Traditionally, the generation of very high power electromagnetic pulses, applied to the production of intense relativistic beams, dense hot plasmas and other transient phenomena has depended on the capacitive energy storage. Growing needs for increased energy capability of the generators has led to studies and proposals to demonstrate the feasibility of using magnetic storage systems with high voltage, power-multiplying stages as a means of satisfying these needs. Most recent progress in the development of the elements for such high power systems is presented. Examples demonstrating the integration of inductive storage and high voltage technologies, to achieve high power output are considered. 12 Refs.
Primary Keywords: Inductive Energy Storage; Basic Concepts; Circuit Breaker; Explosive Interrupter

4722
(PULSE GENERATORS)
(Systems)
HIGH-VOLTAGE PULSE GENERATORS OF THE BASE OF THE SHOCK TRANSFORMER
E.A. Abramyan
Academy of Sciences of the USSR, Moscow, USSR
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-3 (11/1976).
A review of the accelerators comprising a resonance transformer with shock excitation as a power supply sourse is given. Operating voltage is approximately 1 MV, pulse length 1E-7 - 1ES sec, repetition rate - up to 100 Hz and above. 12 Refs.
Primary Keywords: Pulse Generator; Shock Transformer; Rep-rated
Secondary Keywords: E-beam Generation

4723
(SWITCHES, CLOSING)
(Vacuum Gaps, RF)
CONTROLLED DISCHARGE IN A VACUUM GAP SWITCHED BY 1 MC CURRENT PULSES OF UP TO 150 KA
P.N. Dashuk, G.S. Kichaeva and M.D. Yarysheva
Soviet Physics Journal, Vol. 11, No. 1, pp 1-7 (01/1968).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika II, 11-16 (1968)
The firing delay time, the rise time of the current up to its maximum, and the primary current amplitude of a controlled discharge in a vacuum gap are considered, for a voltage range of 10-80 kV, with a rosidual gas pressure in the chamber of 1E-4 - 1E-5 mm of mercury. The gap is switched by a damped oscillatory current pulse with a frequency of 1.25 MHz and a maximum amplitude of about 150 kA. The discharge is started by either one or three triggering devices. 5 Refs.
Primary Keywords: 1.25 MHz Current Pulse Frequency; 10-80 kV Voltage Range; Damped Oscillatory Current Pulse; 150 kA Maximum Amplitude; Controlled Discharges

4724
(PARTICLE BEAMS, ELECTRON)
(Generation)
LILI, A 0.5-1.5 MICROSECOND, 600 KV ELECTRON BEAM ACCELERATOR
R.S. Clark and K.R. Prestwich
Sandia Labs, Albuquerque, NM 87115
1976 IEEE Pulsed Power Conference Proceedings, Paper IE-1 (11/1976).
A 600 kV, 5-14 kJ, 0.5-1.5 microsecond electron beam accelerator has been developed for gas laser excitation studies. The 1.2 MV Marx generator charges a 2 nF, solid dielectric peaking capacitor to 2.3 MV in 0.6 microsecond. The pulse duration is controlled by a crowbar switch. Cathode geometries were varied to generate a uniform current density beam and maximize the beam energy density that could be passed through thin foils. A 7.6 cm diameter cylindrical beam is guided through the laser chamber by a 1-3 kG axial magnetic field. The design and development of the accelerator, including experimental results of diode studies, are discussed. 15 Refs.
Primary Keywords: E-beam; Field Emission Vacuum Diode; Marx Generator; Low Inductance
Secondary Keywords: Gas Laser

4725
(PARTICLE BEAMS, ELECTRON; PULSE GENERATORS)
(Generation; Blumlein Lines)
MODULATOR-REPETITIVELY PULSED FIELD EMISSION ELECTRON BEAM GUN INTERFACE
G.J. Dezenberg (1), W. Wright (2) and S. Schneider (2)
(1) Army Missile Command, Redstone Arsenal, AL 35809
(2) ECOM, Fort Monmouth, NJ 07703
1976 IEEE Pulsed Power Conference Proceedings, Paper ID-2 (11/1976).
A field emission electron beam gun is repetitively pulsed with a modulator in a Blumlein arrangement. The modulator is operated in an unmatched condition with the output connected directly to the gun. The gun is a time varying monotonically decreasing impedance load while the modulator impedance is constant. The modulator-gun configuration produces an initial voltage peak which approaches twice the value of the charge voltage to promote gun emission. After the initial peak the load voltage plateaus at a value determined by the gun impedance. Peak voltages in excess of 350 kV and peak currents up to 8 kA have been delivered in 5 microsecond pulses by the modulator to the gun. The modulator routinely operates at 50 Hz repetition rate, 135 kV recharge voltage and about 3 amps of average current. 5 Refs.
Primary Keywords: E-Beam Gun; Rep-rated; Blumlein; Cold Cathode; Pulse Forming Network

4726
(PULSE GENERATORS; REVIEWS AND CONFERENCES)
(Reviews; Reviews)
NANOSECOND PULSE GENERATORS FOR MAGNETRON OPERATION
R.E. Nyswander and G.J. Auger
Naval Weapons Center, China Lake, CA 93555
1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-4 (11/1976).
To operate with pulse durations of under 15 ns, most magnetrons require a special type of modulation signal. This paper describes the design and operation of practical short pulse modulator circuits providing magnetron outputs of as short as 7 ns. The resulting transmitters provide an economical approach to high resolution radar systems. The short pulse techniques have also been used to enhance the coherent operation of magnetrons which are being pumped with an RF reference signal. 4 Refs.
Primary Keywords: Short Pulse Generator; Modulator; Pedistal Generator
Secondary Keywords: Magnetron; Radar

4727
(ENERGY STORAGE, CAPACITIVE)
(Reviews)
PULSED ENERGY AND SWITCHING REQUIREMENTS FOR TOKAMAK OHMIC HEATING
H.F. Vogel (1), K.I. Thomassen (1), W. Bird (2) and F.M. Heck (3)
(1) Los Alamos National Labs, Los Alamos, NM 87545
(2) University of Texas at Austin, Austin, TX 78712
(3) Westinghouse Electric Corp, Fusion Power Systems Dept.
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-9 (11/1976).
The electrical circuit requirements are presented which result from a study of the ohmic-heating system of a Tokamak Experimental Power Reactor (EPR). A computer model for plasma startup was developed as part of an electrical network analysis program. The results of a parametric study are presented in which the pulsed energy and voltsecond-requirements were optimized, electrical machinery was selected, and the switching requirements were defined. 4 Refs.
Primary Keywords: Pulsed Power Requirements; Numerical Calculation; Modeling
Secondary Keywords: Tokamak; Ohmic Heating

4728
(PARTICLE BEAMS, ELECTRON)
(Systems)
REBLE, A RADIALLY CONVERGING ELECTRON BEAM ACCELERATOR
J.J. Ramirez and K.R. Prestwich
Sandia Labs, Albuquerque, NM 87115
1976 IEEE Pulsed Power Conference Proceedings, Paper IE-3 (11/1976).
The Reble accelerator at Sandia Laboratories is described. This accelerator was developed to provide an experimental source for studying the relevant diode physics, beam propagation, beam energy deposition in a gas using a radially converging e-beam. The nominal parameters for Reble are 1 MV, 200 kA, 20 ns e-beam pulse. The anode and cathode are concentric cylinders with the anode as the inner cylinder. The radial beam can be propagated through the thin foil anode into the laser gas volume. The design and performance of the various components of the accelerator are presented. 11 Refs.
Primary Keywords: Reble; Field Emission; Vacuum Diode; Transport; Energy Deposition
Secondary Keywords: Gas Laser

4729
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)
(Generation; Transport)
RECTANGULAR BEAM SCALING LAWS
J. Shannon
Maxwell Labs Inc, San Diego, CA 92123
1976 IEEE Pulsed Power Conference Proceedings, Paper ID-6 (11/1976).
Scaling laws for rectangular electron beams in the time regime <0.1 microseconds are presented. The data covers the parameter ranges 0.5 - 2 MV, 1-4 cm gap spacing, up to 100 cm lengths and 7.5-30 ohms impedance. The temporal behavior of the impedance relations is also discussed. 8 Refs.
Primary Keywords: E-beam; Rectangular Beam; Child-Langmuir Law; Variable Impedance

4730
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
CALIBRATION OF A KERR CELL SYSTEM FOR HIGH-VOLTAGE PULSE MEASUREMENTS
E.C. Cassidy (1), H. N. Cones (1), DC Wunsch (2) and S.R. Booker (2)
(1) National Bureau of Standards, Washington, DC 20234
(2) Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Instrumentation And Measurement, Vol. IM-17, No. 4, pp 313-320 (12/1968).
Several techniques for calibration of an electrooptical (Kerr cell) high-voltage pulse measuring system are described. Independent calibrations, without reference to pulse divider measurements, are achieved by application of a direct bias voltage to the kV demonstrator resonable agreement (to within 1 percent) between simultaneous Kerr cell and calibrated pulse divider measurements. 6 Refs.
Primary Keywords: Kerr Cell; Calibration Technique; Several Calibration Methods; 1 Percent Measurement Accuracy
Secondary Keywords: 1968 IEEE, Reprinted With Permission

4731
(BREAKDOWN STUDIES)
(Liquid, Electrical)
SHORT PULSE ELECTRICAL BREAKDOWN STRENGTH OF H/SUB 2/ O
J.P. VanDevender
Sandia Labs, Albuquerque, NM 87115
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-3 (11/1976).
The electrical breakdown strength E/sub BD/ of a water dielectric transmission line has been measured for 7E-9 <= t <= 3E-8 sec, 4E5 volts <= V <= 1.1E6 volts, and 6E7 V/m <= E/sub Bd/ <= 1.1E8 V/m. The stressed area was approximately 0.1 m/sup 2/, and a Weibull analysis was used to determine the area scaling. Values of E/sub Bd/ obtained were as much as 80 percent higher than that given by extrapolation of the long pulse formulas to t = 2E-8 sec. 3 Refs.
Primary Keywords: Breakdown Strength; Medium Area; Short Pulse; Comparison To Long Pulse

4732
(PARTICLE BEAMS, ELECTRON)
(Generation)
SPACE-CHARGE FLOW IN A NON-CYLINDRICALLY SYMMETRIC DIODE
J.P. Quintenz and J.W. Poukey
Sandia Labs, Albuquerque, NM 87115
1976 IEEE Pulsed Power Conference Proceedings, Paper IE-4 (11/1976).
The one-dimensional cylindrical space-charge-limited emission and flow results of Langmuir and Blodgett are extended to the two-dimensional (r-theta) non-symmetric case by solving a fluid model numerically. It is found that particle beams thus generated can be controlled by suitable adjustment of the applied potentials and cylinder radii. A particle code has been modified to treat razor blade cathodes by including a simplified model for the blade emission. Numerical results are compared with experimental data. These results indicate that beams produced by razor blades pinch less tightly than those from block cathodes, but in some cases may still pinch enough to be interesting. 17 Refs.
Primary Keywords: E-beam; Space Charge; Numerical Calculation; 2-d Fluid Model; Optimization

4733
(PULSE GENERATORS)
(Miscellaneous)
THE BOUNCING CONDUCTOR GENERATOR
E. Kunhardt, J. Tardiff and B-R Cheo
Polytechnic Institute of New York, Farmington, NY 11735
1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-7 (11/1976).
A generator has been built which uses a conducting body to transfer charge between two electrodes. The generator, know as the BCG, produces baseband pulses with peak voltages of 7 kilovolts and approximately .5 nsec. rise time at a repetition rate of 70-100 pulses/sec. The peak power into a 50 ohm line is .98 MW. 2 Refs.
Primary Keywords: Bouncing Conductor Generator; Short Rise Time; Mechanical Charge Transfer

4734
(ENERGY STORAGE, INDUCTIVE)
(Inductors)
THE MEGAGAUSS MAGNETIC FIELD LABORATORY IN GRENOBLE
M. Guillot (1), J. Besancon (2) and R. Signoret (3)
(1) Lab de Magnetisme, Grenoble Cedex, France
(2) Centre d'Etudes de Vaujours, Sevran, France
(3) CEA Centre d'Etudes Nucleaires, Sarclay, France 92260
1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-1 (11/1976).
Two process of high transient magnetic field production are analyzed. With the first one, fields up to 130 T are performed by capacitor bank discharge through single turn-coil; the stability of the coil under thermal and mechanical action is discussed, tantalum appears to be the best choice as coil material. The second one is based on magnetic flux compression using explosive driven implosion of a liner. A simple cylindrical charge and its initiation generator are described. Field up to 300 T (3 MG) are obtained using moderate capacitor bank energy (43 kJ). 11 Refs.
Primary Keywords: Very High Magnetic Fields; Capacitor Discharge; Flux Compression; Liner Implosion

4735
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
WEIGHT ALGORITHMS FOR ADIABATIC TRANSFORMERS FOR PULSED HIGH POWER SYSTEMS
R.P. McNall (1), D.L. Lockwood (1) and A.S. Gilmour Jr. (2)
(1) Thermal Technology Lab, Inc.
(2) State University of New York at Buffalo, Buffalo, NY 14226
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-5 (11/1976).
A transformer design computer program developed by Thermal Technology Laboratory, Inc. has been used in a mode whereby it automatically minimized the weight of a transformer with any given set of operating parameters. Four classes of adiabatic transformers (wherein heat capacity is used to absorb heat generated) for use in pulsed power systems have been investigated in detail. Two of these were at power levels in the 10 to 50 MW range and the other two were in the 1 to 5 MW range. In each power range, three-phase square wave transformers were analyzed in detail. The three phase transformers would be used in conjunction with alternators. The single phase units would be used in inverters. This paper gives a brief description of the transformer design program and then summarizes the results of weight studies on over 120 optimized transformers designed for operatin at various powers, voltages, frequencies and pulse durations. Algorithms, developed for calculating transformer specific weight as functions of these peremeters are given. 1 Refs.
Primary Keywords: Transformer Design; Computer Aided Design; Adiabatic Mode; Light Weight

4736
(PARTICLE BEAMS, ELECTRON)
(Generation)
100 GW ELECTRON BEAM GENERATOR
H.I. Milde (1) and M.W. Harris (2)
(1) Ion Physics Corp, Burlington, MA 01803
(2) Naval Research Lab, Washington, DC 20375
1976 IEEE Pulsed Power Conference Proceedings, Paper ID-4 (11/1976).
A 100 GW electron beam generator consisting of an LC generator, a coaxial water line, and 8-channel output switch, and a field emission diode are described. This generator, directed toward the support of research activities, is capable of producing up to 6 kJ of beam energy with particle energies in the range of 100 to 500 keV. 8 Refs.
Primary Keywords: E-beam Generator; LC Pulse Generator; Field-Emission Diode; Ion Beam Conversion; Neptune; High Power

4737
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
PULSE DISCHARGE CAPACITOR WEIGHT MINIMIZATION BY PEAK FOIL EDGE FIELDS
R.D. Parker
Hughes Aircraft Co. Culver City, CA 90230
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB-2 (11/1976).
Corona failure at foil edges is the principle failure mechanism in well designed and manufactured high energy density pulse discharge capacitors. by forming the foil edge with laser cutting or spark discharge machining, a 25 percent increase in corona inception voltage over untreated edges is obtained. Folded foil produces a larger increase. Weight minimization using peak edge field as the limiting factor suggests a configuration where the foil and dielectric are of equal thickness produces the lightest capacitor. Typical designs are presented. 4 Refs.
Primary Keywords: Pulse Discharge Capacitor; Weight Minimization; Foil Edge Fields; Failure Modes

4741
(SWITCHES, CLOSING)
(Mechanical)
A SIMPLE CIRCUIT FOR THE PRODUCTION OF A HIGH VOLTAGE STEP
G. Clarke and A. Roberts
Huddersfield Polytechnic, Huddersfield
Journal Of Physics E; Scientific Instruments, Vol. 5, pp 848-849 (09/1972).
This note describes the development of a circuit and switch capable of producing a highly stable step voltage of up to 30 kV, with a switching time of 1 ms. The design allows absorption current measurements to be made which are not possible at low voltages on certain dielectric materials. 2 Refs.
Primary Keywords: High Voltage DC Power Supply; Mechanical Switch; Magnetically Driven Plunger (solenoid); 1 ms Rise Time; Deshpot; Little Contact Bounce

4743
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
A TRIGGERED SPARK GAP WITH ROTATING ELECTRODES
M.W. Fulbright
University of Rochester, River Campus Station, Rochester, NY 14627
Nuclear Instruments And Methods 104, Pp 71-72 (05/1972).
A spark gap used for triggering a spark counter is described, featuring rotating Sparkonite electrodes. It operates for more than 1E6 firings without apparent deterioration of characteristics. 0 Refs.
Primary Keywords: Electrically Triggered Spark Gap; Rotating Electrodes; High Reliability; Low Brush Wear

4744
(SWITCHES, CLOSING; INSULATION, MATERIAL; SYSTEMS)
(Gas Gaps, Electrical; Solid)
A VERSATILE 60 KV SWITCHING SYSTEM FOR PULSED EXCITATION OF LASERS
L.R. Lidholt
Research Institute of National Defense, Stockholm, Sweden
The Review Of Scientific Instruments, Vol. 43, No. 12, pp 1765-1768 (12/1972).
A fast switching high voltage system capable of handling 60 kV is described. The system utilizes a sealed-off pressurized hydrogen spark gap as a switching device. A versatile silicone rubber coupling module makes different high voltage components easily interchangeable without the need of draining off any insulation liquid. The system was used to build a laser, which emits radiation pulses of a few nanoseconds duration at a wavelength ranging from 337 nm in the ultraviolet region of the spectrum to 9.0 microns in the infrared. The uv pulses contain enough energy to permit pumping of a tunable rhodamine 6 G dye laser. 20 Refs.
Primary Keywords: Hydrogen Spark Gap; Atmosphere Pressure; Insulation Technique; Silicone Rubber Boot
Secondary Keywords: Dye Laser Pumping

4745
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
AN OPTICAL TECHNIQUE FOR HIGH VOLTAGE MEASUREMENTS
Unknown
Optical Spectra, Vol. 6, No. 9, pp 19-20 (09/1972).
A method of measuring pulsed high-voltages using optical fringe patterns is presented. The fringe pattern is produced in a calibrated Kerr cell which is illuminated with an expanded-beam pulsed laser so that high-speed photographic equipment can record the optical fringe. 0 Refs.
Primary Keywords: Kerr Effect; High Isolation; Nitrobenzene; Argon Laser; No Space Charge

4749
(SWITCHES, CLOSING)
(Vacuum Gaps, E-beam)
BREAKDOWN OF A VACUUM SPARK GAP TRIGGERED BY AN ELECTRON BEAM
N.V. Belan, V.F. Gaidukov, G.I. Kostyuk, E.K. Ostrovskii and I.V. Strelkov
Khar'kov Aeronautical Institute, USSR
Soviet Physics-Technical Physics, Vol. 17, No. 2, pp 303-305 (08/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 42, 382-384 (February 1972)
Breakdown of a vacuum spark gap by an electron beam is studied. The breakdown criterion is related to the critical pressure of metal vapor in the evaporation zone at which an experimentally observable avalanche buildup of current takes place. The dependence of the discharge time lag on the electron beam parameters is examined. 4 Refs.
Primary Keywords: Metal Evaporation; Evaporation Zone; Critical Pressure; E-beam Parameter Variation; Delay Measurement

4760
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
EFFECTS OF SPARK GAP GEOMETRY AND LASER COMPONENTS ON THE LASER-TRIGGERED ELECTRIC BREAKDOWN
M. Pillaticker
Institut fur Plasmaphysik, Garching, FRG
IEE 2nd International Conference On Gas Discharge, pp 7-9 (01/1972).
Triggering spark gaps with laser light is superior to the conventional method of electrical triggering in many fields of application. Investigations hitherto have provided only inadequate information on the influence of laser components and the spark gap geometry on the breakdown process. In order to complete the available knowledge on the subject and facilitate application of laser-triggered gaps, these parameters had to be optimized. Triggering can then be achieved with minimum laser power, thus ensuring economy of the triggering method, which is largely governed by the laser power. 11 Refs.
Primary Keywords: Geometry Considerations; Optimization; Axial Beam Propagation; Small Gap; Effect Of Gap Medium

4761
(DIAGNOSTICS AND INSTRUMENTATION; POWER TRANSMISSION)
(E-field; Cables)
ELECTRIC-FIELD DISTRIBUTION AROUND AN ISOLATED STRANDED CONDUCTOR
J.G. Andrews and A.J. Shrapnel
Central Electricity Generating Board, London, UK
Proceedings Of The IEE, Vol. 119, No. 8, pp 162-166 (08/1972).
The authors present a method for calculation of the voltage and E-fields of a stranded cable. Laplace's equation is solved analytically with the assumption that the r and theta components of the variation of potential are seperable. The boundary conditions are then inserted numerically to give n equations in n unknowns. Example solutions are given, and the effect of stranding on corona is discussed. 10 Refs.
Primary Keywords: Stranded Wire; Field Calculation; Potential Calculation; Laplace's Equation; Analytical Solution; Numerical Boundary Solution

4767
(PULSE GENERATORS)
(Blumlein Lines)
GENERATOR WITH AMPLITUDE AND LENGTH STABILIZATION OF THE PULSE FOR SUPPLYING A STREAMER CHAMBER
N.S. Rudenko and V.I. Tsvetkov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 15, No. 2, pp 489-411 (04/1972).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 94-96 (March-April 1972)
A generator producing pulses having an amplitude of 200 kV and a length of 14 nsec is described. The pulse length of such a generator is stable and is determined by the transit time of the leading edge of the wave in the shaping line. The amplitude of the pulses is stabilized by means of a three-electrode spark gap which allows operation on the flat portion of the charging pulse of an Arkad'ev-Marx generator. The results of tests performed on the generator showed that within the limits of the measurement error no scatter of the pulse amplitude or of the width of cosmic-particle tracks is observed. 5 Refs.
Primary Keywords: Blumlein Line; Spark Gap; Stable Pulse Length; Stable Pulse Amplitude; Marx Generator
Secondary Keywords: Streamer Chamber

4768
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
GROUNDED MONITOR FOR HIGH VOLTAGE ACCELERATORS
C.G. Crockett
Edwards High Vacuum International, Manor Royal, Crawley, Sussex, UK
Journal Of Physics E; Scientific Instruments, Vol. 5, pp 753-754 (08/1972).
A simple apparatus is described which is used to monitor equipment in the high voltage terminal of a particle accelerator, and display the reading on a meter at ground potential. A servo mechanism is used to rotate an insulating rod coupled to a grounded potentiometer. The system, while being relatively inexpensive, provides an accuracy better then 1%. 1 Refs.
Primary Keywords: Voltage Monitor; Servo Mechanism; Insulated Mechanical Link; Low Frequency
Secondary Keywords: Particle Accelerator

4773
(POWER CONDITIONING)
(Pulse Forming Lines)
HIGH-VOLTAGE GENERATOR PRODUCING SINGLE NANOSECOND PULSES ACROSS A VARIABLE LOAD

V.I. Manylov
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 15, No. 2, pp 486-488 (04/1972).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 91-93 (March-April 1972)

The construction of a generator which forms single pulses having an amplitude of 5 to 50 kV, a trailing-edge duration of 2 nsec and a length of from 3 nsec up is described. Due to the charging of the core of the shaping line the insulation conditions are considerably improved. The construction of a simple and reliable commutator with preliminary open-circuiting of the charging circuit of the shaping line is presented. 4 Refs.
Primary Keywords: Pulse Forming Line; Variable Pulse Length; Rectangular Pulse; Unmatched Load

4778
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
MODULATION OF THE TRANSMISSION FACTOR OF RESISTIVE DIVIDERS IN MEASURING A HIGH DC VOLTAGE

K.L. Grudev
Institute Of Electrical Welding, Academy Of Sciences Ukrainian SSR, Kiev
Instruments And Experimental Techniques, Vol. 15, No. 2, pp 465-467 (04/1972).
Trans. From: Pribory I Tekhnika Eksperimenta 2, 138-140 (March-April 1972)

A method is described for measuring high-voltage electrical signals, which is based on modulating the transmission factor of a resistive DC voltage divider. The achievable accuracy of measuring the resistance and of performing the scale conversion of the dividers according to the method proposed is in the range from 0.001 to 0.1% for resistors of approximately 0.1 to 10 Gigaohm which convert voltages ranging from approximately 0.05 to 1 MV. 3 Refs.
Primary Keywords: Resistive Divider; Transmission Factor Modulation; DC Voltage; 0.001 percent Accuracy

4780
(PULSE GENERATORS; SWITCHES, CLOSING)
(Systems; Gas Gaps, Electrical)
MULTI-STAGE SYNTHETIC CIRCUIT FOR EXTRA-HIGH-VOLTAGE CIRCUIT-BREAKER TESTING

V. Zajic and G. St-Jean
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 3, pp 782-790 (06/1972).

A new synthetic testing circuit, intended mainly for E.H.V. circuit breaker tests is being described. Based on the well known idea of parallel current injection method, the circuit is created in the form of several, integrated stages. The adjustment of the circuit test voltage to the rated voltage of the tested breaker is made by connecting the stages in series, in parallel or in a series-parallel combination. This arrangement creates a special type of a combined current and voltage impulse generator. After describing the new circuit diagram and its operation, the authors give the results of the work accomplished to date. This includes an analysis of possible disturbances caused by improper triggering of the spark gaps, results of development of the spark gaps triggered, via a light beam, by plasma guns, a short description of an experimental 3 stage circuit which is now prepared for tests and an outline of the final testing circuit for voltages up to 1500 kV and equivalent 3 phase symetric interrupting capacity of 60,000 MVA at T.R.V. frequencies as low as 600 Hz. 5 Refs.
Primary Keywords: Multistage Pulse Generator; Series-parallel Operation; Modular Construction; Trigatron Gap; Optical Trigger Isolation

4786
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
RANGE OF COMMUTATABLE VOLTAGES OF VACUUM SPARK GAPS

V.K. Bocharov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instruments And Experimental Techniques, Vol. 14, No. 5, pp 1418-1419 (10/1971).
Trans. From: Pribory i Tekhnika Eksperimenta 14, 134-135 (September-October 1971)

The minimal commutatable voltages and currents of vacuum spark gaps with evaporating walls are determined as a function of the parameters of the discharge tank circuit and the inside diameter of the insulator which separates the high-voltage electrodes of the device. The results allow the working range of commutatable voltages of spark gaps to be chosen, and the inside diameter of the main insulators of the spark gaps to be determined for a stipulated density and magnitude of the commutated current; they also allow certain spark-gap insulators to be cleaned without disrupting the vacuum-tightness or cleaning the device mechanically. 6 Refs.
Primary Keywords: Vacuum Gap; Evaporating Walls; Stable Operation; Inductive Load; Capacitive Energy Store

4791
(BREAKDOWN STUDIES)
(Gas, Electrical)
STUDIES OF SPARK FORMATION AT HIGH SWITCHING VOLTAGES OF POSITIVE POLARITY

B.E. Ganger and E.G. Maier
Brown, Boveri & Co Ltd, Baden, Switzerland
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 6, pp 2427-2436 (12/1972).

Studies of the development of pre-discharges with large air gaps and positive switching voltages of 1.5 and 2.0 MV are reported. Measurements of the charge flowing into the gap and recordings obtained with a high-resolution image converter have shown that the origin of the filamentary brush-like discharges moves forward at an almost constant rate of a few cm/microsecond, and that variations in luminosity are accompanied by similar fluctuations in the transfer of charge. The space behind the streamers remains without light except when a leader is formed for a short time in the event of a charge step. The discussion is illustrated by numerous photographs and oscillograms. 10 Refs.
Primary Keywords: Prebreakdown Development; Nonuniform Field Gap; Charge Transfer; Rod-plane Gap

4803
(BREAKDOWN STUDIES)
(Solid, Electrical)
UNIT FOR INVESTIGATING THE OPTICAL AND ELECTRICAL CHARACTERISTICS OF NANOSECOND BREAKDOWN OF CONDENSED MEDIA

V.V. Lopatin and V.Ya. Ushakov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 15, No. 1, pp 165-167 (02/1972).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 144-146 (January-February 1972)

A unit is described containing a nanosecond generator producing pulses having an amplitude of 400 kV and a controllable length, a network for recording the pulse prebreakdown current having an amplitude >=5 mA, an electron-optic shutter, and a light amplifier. The length of the voltage pulse can be controlled by a controllable clipping spark gap in which a discharge in a liquid along the surface of a solid dielectric is used. The recordings of the prebreakdown current with compensation of the capacitive component is achieved using a bridge circuit based on Rogowski transformers. 9 Refs.
Primary Keywords: Insulation Breakdown; Solid Breakdown; Pulse Generator; Voltage Monitor; Current Monitor; Displacement Current Compensation; Optical Monitor

4805
(POWER CONDITIONING)
(Systems)
POWER CONDITIONING SYSTEMS FOR HIGH-POWER, AIRBORNE, PULSED APPLICATIONS

A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226
IEEE Trans. Aerospace And Electron. Sys., Vol. AES-13, No. 6 pp 668-678 (11/1977).

The power conditioning portion of the high-power study that was performed for the Air Force Aeropropulsion Laboratory by the State University of New York at Buffalo is summarized. This effort defines the power conditioning system and critical component developments which will be required to interface the airborne 10-MW to 50-MW sources defined under separate study efforts with certain loads. Power conditioning systems are considered for use with magnetohydrodynamic generators and turbine driven alternators, both conventional and superconducting. The critical components required for each of the power conditioning systems are identified and then analyzed. The component analyses include estimations of development efforts necessary and of specific weights and volumes for components. The primary components considered are transformers (for alternator as well as for inverter use), switches, capacitors, and inductors. Weight algorithms are developed for each of the components. Following the component analyses, subsystems such as inverters and rectifier and filter packages are considered. The data for the various components and subsystems are then utilized for a comparison of the power conditioning techniques to be used with the various power sources. The weights and volumes of power conditioining systems for 8-point designs (8 variations of power, voltage, duty cycle, and total run time) are derived. 23 Refs.
Primary Keywords: Transformer; Switch; Capacitor; Inductor; Light Weight; Subsystem

4806
(ENERGY STORAGE, INDUCTIVE)
(Systems)
0.54-MJ SUPERCONDUCTING MAGNETIC ENERGY TRANSFER AND STORAGE

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(1) Los Alamos National Labs, Los Alamos, NM 87545
(2) Westinghouse Electric Corp, Pittsburgh PA
LASL Report No. LA-UR-77-1312 (08/1977).
Availability: LA-UR-77-1312
NTIS

A superconducting energy storage coil designed to store 300 kJ of energy was operated with stored energy up to 0.54 MJ. The energy was transferred from the coil in periods from 1 to 2.4 ms. Hysteresis loss and losses from all effects during pulsed energy transfer were observed. The coil is described and the test results are presented. Also included is a description of a METS (magnetic energy transfer and storage) driven adiabatic plasma compression system for a large toroidal theta-pinch reactor test and of a 300-kJ, monolithic conductor, superconducting pulsed energy storage coil. 27 Refs.
Primary Keywords: Superconducting Coil; Hysteresis Loss; Monolithic Conductor
Secondary Keywords: Theta-pinch

4819
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)
CURRENT DENSITY IN ELECTRODE SPOTS OF ARC WITH METAL ELECTRODES

P.V. Sergeev and G.A. Shepel'
Journal Of Engineering Physics, Vol. 17, No. 6 pp 1589-1514 (12/1969).
Trans. From: Inzhenerno-Fizicheskii Zhurnal 17, 1041-1049 (December 1969)

The dependence of the total current density in the spots on its different components and the current is examined by considering the energy balance of the electrode sheaths. The factors affecting electrode erosion are determined. Results of measurements of the current density on spots on iron electrodes in arcs with different currents are given. 3 Refs.
Primary Keywords: DC Arc; Current Density; Graphitized Refractory Electrode; Metal Electrode; Electrode Sheath; Power Balance

4831
(BREAKDOWN STUDIES)
(Gas, Electrical)
MEASUREMENT OF THE ELECTRON TEMPERATURE OF THE PLASMA OF A QUASI-STABLL PULSED GLOW DISCHARGE IN SPARK GAPS WITH HIGH OVERVOLTAGES

V.V. Osipov, R.B Baksht, Yu.I. Bychkov and A.G. Filonov
Optics And Spectroscopy, Vol. 33, No. 5, pp 459-461 (05/1972).

A quasi-stable glow discharge in helium at 30 and 100 Torr is studied. The discharges for several electrode separations are analyzed spectroscopically and the results obtained are used to calculate the electron temperature of the plasma. Measurements taken of gap voltage and current allow the electron concentration to be calculated. 9 Refs.
Primary Keywords: Glow Discharge; Pulsed Discharge; Helium; Plane Electrodes; Parallel Electrodes

4870
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
STUDY OF A 40 KV MULTISTAGE SPARK GAP OPERATED IN AIR AT ATMOSPHERIC PRESSURE

A. Anvari and O. Steinvall
Institute Of Physics, University of Uppsala, Uppsala, Sweden
Journal Of Physics E: Scientific Instruments, Vol. 6, No. 11, pp 1113-1115 (07/1973).
The electrical properties of a multistage spark gap have been studied and a compact 40 kV four-stage switch is described. The switch can be operated in atmospheric air with a 50 ns delay time and a +-5 ns jitter, when triggered at breakdown voltage. Both these values are shorter, by a factor of 3, than those of a similar two-electrode spark gap. The discharge gaps, besides the electrical connection, have been coupled to each other, optically, by means of an axial hole through the switch. This coupling, which gives rise to a simultaneous ignition in the gaps, is mainly responsible for reduction of the jitter and the delay time. The simultaneity of the gap ignitions has been shown by investigating the short light pulses (about 2 ns halfwidth) emitted from the spark of each gap. The switch is also capable to work with high repetition rate. More than 1200 Hz with a 4 kA peak current has been obtained, when operating the switch in air at atmospheric pressure. 6 Refs.
Primary Keywords: Multistage Spark Gap; Four-stage Spark Gap; 5 NS Jitter; Optical Coupling; Rep-rated

4875
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
THE EFFECT OF IONIZATION AND FLOW VELOCITY UPON SPARK GAP RECOVERY

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(1) University of Victoria, Victoria, British Columbia, Canada
(2) University of Alberta, Edmonton, Alberta, Canada
Journal Of Physics D: Applied Physics, Vol. 6, No. 10, pp 1253-1265 (06/1973).
Breakdown measurements for a small cylindrical cathode in an atmospheric-pressure flowing plasma of variable ionization (between 1E15 and 1E18 m/sup -3/) are reported for both DC voltages and fast-rise pulses (rise time 0.16 microsecond) applied to the cathode. For these measurements the breakdown voltages are found to be reduced to as little as 1/6 of the breakdown voltage with no ionization. The measurements agree reasonably well with a theoretical model in which the anode is not the positive electrode in the plasma, but rather the edge of the coaxial sheath which surrounds the cathode, with breakdown voltages being given by the well-known breakdown relation for coaxial gaps. (For cylindrical geometry and a thick sheath, the ion space charge in the sheath is shown not to change materially the electric field from its value calculated for a conventional coaxial gap of the same dimensions.) In this experiment the impedance of the plasma between the sheath edge and the actual positive electrode is low enough for breakdown not to occur over this region. It is expected that this model will be used to predict reignition voltages at short recovery times in circuit breakers. 15 Refs.
Primary Keywords: Breakdown Measurement; Flowing Plasma; Variable Ionization; DC Voltage; Impulse Voltage

4880
(PULSE GENERATORS)
(Blumlein Lines)
THREE-ELECTRODE BLUMLEIN LINE FOR SUPPLYING A STREAMER CHAMBER

V.S. Chirochkin and S.B. Shaulov
Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Instruments And Experimental Techniques, Vol. 15, No. 5, pp 1328-1330 (10/1972).
Trans. from: Pribory I Tekhnika Eksperimenta 5, 38-40 (September-October 1972)
The construction of a Blumlein line and a shaping spark gap is described which produces pulses having an amplitude of 260 kV and a length of 13 nsec. 3 Refs.
Primary Keywords: Design Considerations; 25 Ohm Line Impedance; 50 Ohm Load Impedance; Marx Generator

4887
(PULSE GENERATORS)
(Blumlein Lines)
A COMPACT HIGH SPEED LOW IMPEDANCE BLUMLEIN LINE FOR HIGH VOLTAGE PULSE SHAPING

J.H. Crouch and W.S. Risk
University of Maryland, College Park, MD 20742
The Review Of Scientific Instruments, Vol. 43, No. 4, pp 632-637 (04/1972).
Design, construction, and operation of a low impedance Blumlein line are presented. Glycerol was used as a dielectric to obtain a 14.5 ohm line which in conjunction with a Marx generator driver could produce 5 nsec long 240 kV pulses. The line, which is small enough to be housed in a Lucite box 30 cm wide x 30 cm long x 13 cm thick, was used to drive a bank of four 2.2 m long x 30 cm wide x 7.62 cm gap streamer chambers. Properties of the Blumlein line with water as the dielectric are also given and limitations on further shortening of the pulse are discussed. 16 Refs.
Primary Keywords: Blumlein Line; Low Impedance; Glycerol Dielectric; Water Dielectric; Small Size

4889
(BREAKDOWN STUDIES)
(Gas, Electrical)
A COMPUTER SIMULATED MODEL FOR DIFFUSION AND DRIFT OF ELECTRONS IN FLASH TUBES

F.W. Holroyd and J.M. Breere
University of Durham, Durham, UK
Nuclear Instruruments And Methods, Vol. 100, No. 2, pp 277-280 (04/1972).
A Monte Carlo method is used to solve the equation of diffusion and drift of electrons in a flash tube, taking into account the formative distance of the discharge. Hence the efficiency as a function of delay between the passage of an ionising particle and the application of the high voltage pulse is found, for different electron drift velocities. Comparison of experimental efficiencies with these results enables an estimate to be made of the electric fields built up in flash tubes when they are operated at high repetition rates. 8 Refs.
Primary Keywords: Flash Tube; Numerical Calculation; Monte Carlo Calculation; Electron Diffusion; Electron Drift; Rep-rated; E-field Buildup

4890
(DIAGNOSTICS AND INSTRUMENTATION)
(E-field)
A CYLINDRICAL ELECTROSTATIC FLUXMETER FOR CORONA STUDIES

R.T. Waters
UWIST, Cardiff, UK
Journal Of Physics E: Scientific Instruments, Vol. 5, pp 475-478 (05/1972).
The electric field at a high voltage electrode is modified by corona discharge in the space surrounding the electrode. A knowledge of the resultant magnitude of the electric field is of value in the theoretical analysis of the corona. Systems of cylindrical geometry are of particular importance because of applications in electrostatic precipitators and in power loss from overhead transmission lines. The earlier methods of field measurement in corona discharges have not been suitable for measurement of the field strength at the electrode surface, especially in the case of power-frequency corona. The paper describes a new technique employing a cylindrical rotating electrostatic fluxmeter. The device is capable of differentiating between conduction and displacement current when used as part of an active corona electrode. 11 Refs.
Primary Keywords: E-field Measurement; Corona; Cylindrical Geometry; Rotating Fluxmeter; Power Frequencies

4897
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
ALTERNATE POLARITY MULTIPLE SPARK GAP FOR HIGH EFFICIENCY SHOWER DETECTORS

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(1) Universita di Bari, Bari, Italy
(2) Brown University, Providence, RI
(3) Massachusetts Institute of Technology, Cambridge, MA
Nuclear Instruments And Methods, Vol. 97, No. 3, pp 539-545 (12/1971).
The developments in the HV pulsing system which have been made in order to reduce the rise time and the delay of the HV pulse at the plates of a large spark chamber system are reported. Higher efficiency has been achieved feeding each chamber through an alternate polarity multiple spark gap. 0 Refs.
Primary Keywords: Low Inductance; Stainless Electrode; Spark Plug Trigger; Alternate Polarity
Secondary Keywords: Spark Chamber

4910
(SWITCHES, OPENING)
(Mechanical)
DIELECTRIC RECOVERY AND SHIELD-CURRENTS IN VACUUM-ARC INTERRUPTERS

C.W. Kimblin
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 3, pp 1261-1270 (06/1971).
Dielectric recovery data is presented following forced current interruption of 930 A DC copper vapor arcs in a vacuum interrupter. At given free recovery periods during the first 6 to 25 microsec. following interruption, the instantaneous dielectric strength is determined by the application of high voltage step function pulses. This instantaneous dielectric strength is defined as the maximum voltage which can be consistently reapplied without causing reignition. The influence of electrode spacing (0.6 or 1.3 cm), shield potential and polarity of the reapplied voltage on the recovery of dielectric strength have been determined. The more rapid rate of recovery initially observed at long spacings is attributed to the lower mean inter-electrode vapor density immediately following interruption. Recovery is also more rapid for 'reverse' rather than 'same' polarity reapplication indicating surface effects, in particular the roughening of the cathode surface during arcing. Post arc currents lead to an initial reduction of dielectric strength for 'reverse' reapplication with the vapor shield tied to the 'arcing-anode'. The mechanism of these post arc currents has been investigated by observations of the high ion currents which flow to a negatively biased shield during and immediately following arcing. 16 Refs.
Primary Keywords: Vacuum Arc; Copper Electrode; Dielectric Strength; Temporal Resolution; Variable Electrode Spacing; Variable Shield Potential

4914
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
EPOXY RESIN CHAMBER FOR HIGH VOLTAGE BREAKDOWN STUDIES IN HIGH VACUUM

B.R. Prabhakar and M.R. Nandagopal
Indian Institute of Science, Bangalore, India
Vacuum, Vol. 22, No. 2, pp 47-50 (02/1972).
As the study of electrical breakdown phenomena in vacuum systems gains more importance, a thorough understanding of the breakdown mechanism at high voltages necessitates a chamber for experimental studies. An epoxy-resin chamber has been constructed by casting ring sections which were joined together. The advantages of such a chamber over the conventional metal or glass chamber are given especially as regards the electric field configuration, high voltage lead-in, and the ease of construction. Special facilities can be incorporated while construcing the chamber which makes it more versatile; for example, in pre-breakdown current measurements, electron beam focusing studies, etc. 5 Refs.
Primary Keywords: Vacuum Breakdown; Breakdown Chamber; Epoxy Resin Construction; Field Configuration

4917
(PULSE GENERATORS)
(Marx)
FIRING AND VOLTAGE SHAPE OF MULTISTAGE IMPULSE GENERATORS

F.W. Heilbronner
Hochspannungsinstitut, Technical University, Munich, Germany
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 5, pp 2233-2238 (10/1971).
The calculation of electromagnetic transients is applied to an impulse generator circuit of n stages with the overvoltage behaviour of the spark-gaps taken into account. Measurements of the impulse voltage by a damped-capacitive divider and of the subsequent firing of the sphere gaps by streak photography with an image converter camera illustrate good agreement between equivalent model and actual circuit. 14 Refs.
Primary Keywords: Marx Generator; Experiment; Theory; Modeling; Analytical Calculation; Performance Prediction; Pulse Shape Prediction

4919
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Surface Flashover; Solid)
FLASHOVER TESTS ON DUST-CONTAMINATED INSULATORS
F.A.M. Risk and A.A. Assaad
Electricity Corp, UAR
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 1, pp 328-335 (02/1972).
This paper describes a high voltage laboratory testing program of artificially dust-contaminated cap and pin insulators. Several factors are found to influence the flashover characteristics including: the method of voltage application, the rate of wetting of the contaminated insulators, and the duration of the high voltage test. The 50% flashover voltage is found to be proportional to the number of insulater units per string while the relative dispersion decreases considerably for longer strings, within the range investigated. Flashover characteristics of artificially and naturally contaminated insulators are compared. Due consideration is given to the statistical nature of the problem which determines the volume of the tests involved. Flashover values are shown to belong to a population characterized by a Gaussian distribution and a procedure for optimizing the number of necessary tests is developed. 16 Refs.
Primary Keywords: Surface Flashover; Surface Contamination; Cap Insulation; Pin Insulation; Artificial Contamination; Natural Contamination

4931
(SWITCHES, CLOSING)
(Gas Gaps, E-beam)
INITIATION OF A DISCHARGE IN A MEGAVOLT GAS SPARK GAP BY AN ELECTRON BEAM
E.A. Abramyan, V.V. Borob'ev, A.A. Egorov, V.A. Elkin and A.G. Ponomarenko
Nuclear Physics Institute, Academy of Sciences of the USSR, Novosibirsk
Instruments And Experimental Techniques, Vol. 14, No. 1, pp 130-131 (02/1971).
Trans. From: Pribory i Tekhnika EKsperimenta 14, 117-118 (January-February 1971)
The preliminary results of experiments on the excitation of a discharge in a gas spark gap under a high pressure by means of external injection of an electron beam are presented. The study of nanosecond commutation of megavolt gaps is designed for plasma research, work in the field of accelerators, and work in nanosecond engineering. 5 Refs.
Primary Keywords: E-beam Triggered Spark Gap; Delay Measurement; Nitrogen Gap; Low Current Beam

4932
(BREAKDOWN STUDIES)
(Gas, Electrical)
IONIZING POTENTIAL WAVES AND HIGH-VOLTAGE BREAKDOWN STREAMERS
M.W. Albright and D.A. Tidman
University of Maryland, College Park, MD 20742
The Physics Of Fluids, Vol. 15, No. 1, pp 86-90 (01/1972).
The structure of ionizing potential waves driven by a strong electric field in a dense gas is discussed. Negative breakdown waves are found to propagate with a velocity proportional to the electric field normal to the wavefront. This causes a curved ionizing potential wavefront to focus down into a filamentary structure, and may provide the reason why breakdown in dense gases propagates in the form of a narrow leader streamer instead of a broad wavefront. 10 Refs.
Primary Keywords: Potential Wave; Negative Breakdown Wave; Filamentary Structure; Theory

4933
(PULSE GENERATORS; SWITCHES, CLOSING)
(Trigger; Avalanche Transistors, Optical)
LASER-TRIGGERED AVALANCHE-TRANSISTOR VOLTAGE GENERATOR FOR A PICOSECOND STREAK CAMERA
S.W. Thomas and L.W Coleman
Lawrence Livermore Lab, Livermore, CA 94550
Applied Physics Letters, Vol. 20, No. 2, pp 83-84 (01/1972).
Direct optical triggering of an avalanche transistor with a short laser pulse has been demonstrated. In some applications this system provides a compact low-jitter replacement for a laser triggered spark gap. The technique has been applied to generating the gating and sweep voltages in a picosecond streak camera for laser pulse diagnostics where it eliminates the need for multiple beam splitters and long delays. The 'trigger' avalanche transistor was placed as one of a series string of avalanche transistors. A portion of the switch-out laser pulse to be diagnosed was focused onto the trigger transistor chip. Nanosecond-rise kilovolt waveforms are thus generated with time jitter of the entire system being less than 100 psec. 4 Refs.
Primary Keywords: Avalanche-transistor; Series String; Laser Trigger; Subnanosecond Jitter; Nanojoule Trigger Energy

4935
(PARTICLE BEAMS, ION)
(Generation)
PRODUCTION OF INTENSE DEUTERON BEAMS
J. Golden and C.A. Kapetanakos
Naval Research Lab, Washington, DC 20375
Applied Physics Letters, Vol. 20, No. 1, pp 3-4 (01/1972).
Results are reported on the production of 400-keV 50-nsec-duration 1.3-kA deuteron beams using a reflex triode. 11 Refs.
Primary Keywords: Ion Beam Generation; Reflex Triode; 1.3 kA Current; Field-reversing Ion Layer; Ion Ring

4941
(PULSE GENERATORS)
(Blumlein Lines)
OPERATIONAL EXPERIENCE WITH A PROTOTYPE FAST KICKER MODULATOR
M. Fruitman
Brookhaven National Lab, Upton, NY
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 3, pp 962-963 (03/1971).
The modulator built to test components for the proposed AGS fast kicker operated at 800 MW peak output for 1700 hours. Its unique circuit is described and the operating conditions are listed. The results of the testing of various high power components are discussed. 2 Refs.
Primary Keywords: Blumlein Line; Design Considerations; Performance Test; Component Selection; Dummy Load Design

4944
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Electrodes)
PERFORMANCE OF SPHERE AND ROD-ROD GAPS UNDER HIGH DIRECT VOLTAGES
A. Colombo and W. Mosca
CESI-Centro Elettrotecnico Sperimentale Italiano, Milan, Italy
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 2, pp 501-510 (04/1972).
Up to now there is no detailed study dealing with the problems concerning the measurements of the highest DC voltages. The sphere gap is the only device recognized and normally used, but there are many doubts on its behaviour especially as far as the accuracy is concerned. Additional causes of uncertainty are related to correction factors for atmospheric conditions and to the exact knowledge of the characteristics of very high ohmic voltage dividers, for which a precise and therefore difficult calibration must be required. This paper reports the results of a research on the behaviour of the sphere-gaps. The performance of the rod-rod gap is also examined with a view to the possibility of using it as a measuring device. Finally the problem of defining a withstand test voltage is briefly discussed. 12 Refs.
Primary Keywords: DC Voltage; Sphere-sphere Gap; Rod-rod Gap; Voltage Measurement; Self-breakdown; Voltage Scatter; Variable Gap Spacing

4945
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
PICOSECOND TRIGGERING OF A LASER-TRIGGERED SPARK GAP
R.J. Dewhurst, G.J. Pert and S.A. Ramsden
University of Hull, Hull, UK
Journal Of Physics D:Applied Physics, Vol. 5, pp 97-103 (01/1972).
The characteristics of laser-triggered spark gaps, initiated by a switched-out pulse of about 7 ps from a mode-locked Nd:glass laser system, are investigated. The formation time delay of breakdown across the gap can be of the order of 1 ns and is found to increase as the gap voltage is reduced. Comparison with spark gaps triggered by Q-spoiled nanosecond laser pulses is made. Finally, a comparison of the agreement between the experimental results and theory suggests that the initiation of gap breakdown is due to the production of only a few free electrons from the electrode surface on which the laser beam is focused. 15 Refs.
Primary Keywords: Nd-glass Laser; Mode Locked Laser; Single Triggering Pulse; Formative Time Lag; Experiment; Theory

4948
(BREAKDOWN STUDIES)
(Gas, Electrical)
PREBREAKDOWN PHENOMENA IN STANDARD ROD GAPS SUBJECTED TO IMPULSE VOLTAGES
J.E. Matthews and R. Saint-Arnaud
University of Strathclyde, Glasgow, Scotland
Proceedings Of The IEE, Vol. 118, No. 10, pp 1528-1534 (10/1971).
The authors consider the prebreakdown corona and leader formation for impulse voltages in this paper. The gap was a rod-rod gap with up to 30 cm spacing and applied voltage of 400 kV. The times to corona onset, leader formation, and main stroke were measured, along with the number of current pulses (to be correlated with leader steps). From this, the average voltage at corona onset, propagation speeds of corona and leaders, and average leader step length were derived. 28 Refs.
Primary Keywords: Corona; Leader Step Corona Voltage; Impulse Voltage; Rod-rod Gap

4950
(PARTICLE BEAMS, ELECTRON)
(Generation)
RELATIVISTIC BRILLOUIN FLOW IN THE HIGH NU/GAMMA DIODE
J.M. Creedon
Physic International Co, San Leandro, CA 94577
Journal Of Applied Physics, Vol. 46, No. 7, pp 2946-2955 (07/1975).
Relativistic Brillouin solutions have been derived for electron flow in crossed electric and magnetic fields. The application of these solutions to the high nu/gamma diode is discussed and an approximate analytical expression for the anode current is derived. Measurements of diode current are compared to the theoretical and empirical expressions for diode current which have been developed. 39 Refs.
Primary Keywords: Field Emission Diode; Electron Flow; Brillouin Flow; Magnetic Field; Experiment; Theory

4960
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE FORMATION AND GROWTH OF A STABILIZED SPARK DISCHARGE
J.P. Walters
University of Wisconsin, Madison, WI
Applied Spectroscopy, Vol. 26, No. 3, pp 323-334 (06/1972).
Experiments are described in which stabilized spark discharges in nitrogen and argon at atmospheric pressure are studied. The discharges were generated by a quarter wave, current injection spark source at rates up to 300/sec. Optical spectrometers, photoelectric detection systems, and forming cameras were used to examine the formation of the plasma, the growth of the current flow, and the radiance of the spark. An analysis of discharge formation mechanisms involving metastable argon is presented. Electrode erosion is also discussed. 39 Refs.
Primary Keywords: Atmospheric Pressure Discharge; Nanosecond Time Scale; Space Charge; Electrode Erosion; Spectral Output; Metastable Argon

4963
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

THE LASER TRIGGERED SPARK GAP

S.N. Khan and D. Phil
University of Oxford, Oxford, UK
The Radio And Electronic Engineer, Vol. 41, No. 10, pp 475-480 (10/1971).

There is considerable interest in switching high voltages in the range of 10-1000 kV, with the minimum of delay and jitter. Delays of a few nanoseconds with assured, reasonable freedom from jitter are of considerable importance in work requiring synchronization, such as the pulsed line acceleration of electron rings. The general requirements of a spark-gap switch are two-fold: (a) it must be able to take the full voltage applied to it; and (b) it must be able to conduct on demand. For this it is necessary that enough primary electrons be present to initiate the discharge and the gap voltage must be sufficiently high. The primary electrons are generally provided by ultra-violet or other irradiation of the gap, while a third or fourth trigger electrode is used to supply a voltage pulse that would distrub an existing voltage distribution and provide sufficient gap voltage. Such methods work quite well up to 70-80 kV, beyond which the problems posed by proper insulation and voltage division are quite enormous. The laser offers an alternative triggering device which is basically sa'er and simpler to use as it is isolated electrically from the spark gap. Moreover, a two-electrode configuration has obvious advantages from the engineering design point of view. 22 Refs.

Primary Keywords: Air Gap; Variable Gap Spacing; Experiment; Theory

4978
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)

500-KV IMPULSING GENERATOR

A.I. Pavlovskii, V.S. Bosamykin, A.I. Gerasimov and A.P. Klement'ev
Instruments And Experimental Techniques, Vol. 14, No. 4, pp 1075-1077 (08/1971).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 112-114 (July-August 1971)

A 10-stage Arkad'ev-Marx generator is described having a coaxial discharge impulsing circuit with a maximum voltage of 500 kV; the generator serves as the power supply for a high-current electron gun. The inductance of the generator is 1.2 microHenry. The spark gap of the first stage is gas-filled (N/sub 2/ approximately 5 atm), while the subsequent spark gaps are air gaps; five trigatrons with automatic firing from the operation of the preceding stage, and four two-electrode spark gaps. The duration of the flat top of the output pulse is controlled by a cutoff spark gap. The time distribution of the breakdown of the spark gaps is given, as well as the dependence of the generator operating time on the number of trigatron spark gaps. 4 Refs.

Primary Keywords: Marx Generator; 500 kV Output Voltage; Rectangular Pulse; Spark Gap; 10 ns Rise Time

4977
(PARTICLE BEAMS, ELECTRON)
(Generation)

A NEW DIODE FOR THE PRODUCTION OF HIGH POWER RELATIVISTIC ELECTRON BEAMS

M. Friedman
Cornell University, Ithica, NY 14850
The Review Of Scientific Instruments, Vol. 42, No. 8, pp 1255-1256 (08/1971).

A new type of low impedance diode has been developed to produce pulsed relativistic electron beams. Using a multicathode system, the diode impedance was lowered to approximately 4 ohm. Currents of approximately 60 kA and voltages of approximately 250 kV have been obtained. 7 Refs.

Primary Keywords: Low Impedance Diode; Multicathode System; Foilless Diode

4983
(DIAGNOSTICS AND INSTRUMENTATION)
(Systems)

A SPARK GAP MONITOR

D. Brown
Los Alamos National Labs, Los Alamos, NM 87545
The Review Of Scientific Instruments, Vol. 42, No. 9, pp 1287-1291 (09/1971).

A relatively simple method for determining the delay of many electrical signals with respect to a common trigger (e.g., in capacitor banks) is described. Using the well known principle of time-to-pulse-height conversion, a low leakage polystyrene capacitor is charged to a voltage proportional to the delay. A reed relay is used to disconnect the capacitor from the charging circuit, which permits the charge to be maintained on the capacitor for many seconds. Another reed relay is employed to connect each capacitor to an ADC when it is desired to digitize the charge on the capacitor. A change in delay of less than 1 nsec (with a full scale of 200 nsec) is reliably detected for many hundreds of signals at a parts cost of less than 61¢ per signal. 0 Refs.

Primary Keywords: Signal Delay Measurement; Capacitor Charging; Time-to-pulse-height Conversion

4990
(INSULATION, MATERIAL)
(Solid)

COMPARISON OF TRACKING TEST METHODS

M. Kurtz
Ontario Hydro Research , Toronto, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol EI-6, No. 2, pp 76-81 (06/1971).

A selection of epoxy specimens has been subjected to a number of different tests for track resistance. The degree of agreement between testing agencies using the same method, and between the different test methods is described. Generally speaking, those methods, which impose alternate wet-dry cycles, or otherwise simulate the 'dry-banding' effects that occur in service, appear to classify materials in the 'correct' order, that is, in best agreement with each other, and with actual outdoor performance. The superior track resistance of cycloaliphatic systems, and the further improvement consequent upon the use of hydrated alumina filler are confirmed. Details of the Tracking Endurance Wheel Test method are given in the Appendix. 4 Refs.

Primary Keywords: Insulation Tracking; Epoxy Resin, Several Specimens; Dry Banding; Cycloaliphatic Material, Outdoor Operation; Power Line Frequency

4998
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

EFFECT OF CATHODE MATERIAL IN A LASER TRIGGERED SPARK GAP

S.M. Khan and D. Walsh
University of Oxford, Oxford, UK
Journal Of Physics D: Applied Physics, Vol. 4, pp 344-347 (10/1970).

The use of a refractory material like tungsten for the target electrode causes faster switching of a laser triggered spark gap. This is believed to be due to the faster local heating to a higher temperature which causes a greater injection of plasma into the gap. Reliable switching with a formative time of less than 10 ns has been achieved. 4 Refs.

Primary Keywords: Refractory Electrode Material; Faster Local Heating; More Plasma; Faster Switching

4999
(ENERGY STORAGE, MECHANICAL; PULSE GENERATORS; SWITCHES, OPENING)
(Rotating Machines; Systems; Mechanical)

FAST CIRCUIT BREAKER FOR THE DISCHARGE OF A STORAGE INDUCTOR

E.K. Inall
Australian National University, Canberra, Australia
Nature Physical Science, Vol. 231, No. 22, pp 111-112 (05/1971).

The authors report a scheme to transfer energy from a homopolar generator to a resistive load. The homopolar generator is discharged into an inductor to be discharged into a load. The heart of the apparatus is a switch/fuse combination that allows a power multiplication of over 200 when opened. 2 Refs.

Primary Keywords: Homopolar Generator; Toroidal Inductor; Mechanical Circuit Breaker; Fuse; Resistive Load; Power Multiplication

5027
(POWER CONDITIONING)
(Pulse Transformers, Materials)

REVIEW OF MAGNETIC PROPERTIES OF FE-NI ALLOYS

G.Y. Chin
Bell Labs, Murray Hill, NJ 07974
IEEE Transactions On Magnetics, Vol. Mag-7, No. 1, pp 102-113 (03/1971).

During the past two decades, improved understanding of the fundamental magnetic behavior of Fe-Ni alloys has made them one of the most versatile class of soft magnetic materials. No longer is the concern limited to high permeability and low coercive force at room temperature. Alloys have now been custom-crafted to meet high permeability requirements at cryogenic temperatures, exhibit a skewed hysteresis loop for pulse transformer use, or a square hysteresis loop combined with stress insensitivity and controlled coercive force for memory applications. These examples are discussed in terms of the relationship of magnetic properties to structure and composition in Fe Ni alloys. 90 Refs.

Primary Keywords: Fe-Ni Alloy; Room Temperature; Cryogenic Temperature; Skewed Hysterisis Loop; Pulsed Transformer

5033
(PULSE GENERATORS)
(Trigger)

SPARK GAP TRIGGER AMPLIFIER WITH 1-MSEC RECOVERY TIME

C.C. Lo
Lawrence Berkeley Lab, Berkeley CA
Nuclear Instruments And Methods, Vol. 92, No. 2, pp 299-308 (03/1971).

A spark-gap trigger amplifier with 1-msec recovery time has been developed for experiments using spark chambers with fast recovery time. The system utilizes a spark gap operating under the ambient pressure as the high-current fast switching element, and is entirely self-contained. The system is capable of operating at 1 kHz for 1 sec burst, or 400 Hz continuously. 2 Refs.

Primary Keywords: Trigger Amplifier; 8 kV Output Pulse; Leakage Current; Field Distortion Spark Gap; Corona Lamp

5045
(SWITCHES, CLOSING)
(Gas Gaps, Recovery)

THE INFLUENCE OF FORMATIVE TIME LAGS ON SPARK-GAP RECOVERY MEASUREMENTS

F.L. Curzon and M.S. Gautam
University of British Columbia, Vancouver, British Columbia, Canada
Journal Of Physics D: Applied Physics, Vol. 4, No. 2, pp 341-343 (02/1971).

This note shows that the observed lack of density variations for formative time lags of sparks can be explained by the known pressure and electric field dependences of the first Townsend ionization coefficient and the electron drift velocity. It is demonstrated that the time lag varied linearly with gap length and inversely as the fractional over-voltage across the spark gap (in agreement with the measurements of Blair and Farish). Finally, it is demonstrated that the accuracy of the error in the measured 'restriking' voltage for a recovering spark channel is constant for the complete recovery period. 11 Refs.

Primary Keywords: Formative Time Lag; First Townsend Coefficient; E-field Dependence; Pressure Dependence; Recovery Time; Restrike Voltage

5047
(INSULATION, MATERIAL)
(Solid)

THERMAL EROSION OF ELECTRICAL INSULATING MATERIALS

M.J. Billings (1), L. Warren (2) and R. Wilkins (3)
(1) British Oxygen Co., Crawley, Sussex, UK
(2) University of Manchester, Manchester, UK
(3) University of Ankara, Ankara, Turkey
IEEE Transactions On Electrical Insulation, Vol. EI-6, No. 2, pp 82-90 (06/1971).

The erosion of synthetic insulating materials by surface discharges constitutes an important problem in the application of these materials for high-voltage outdoor applications. A method of erosion testing is described that simulates the heat flux from surface discharges by radiant energy from a thermal imaging source. This permits accurate measurement of erosion. A theory of erosion is developed that is found to agree well with experiments performed on several cycloaliphatic epoxy resin systems. 4 Refs.

Primary Keywords: Cycloaliphatic Epoxy Resin; Surface Tracking; Thermal Erosion, Thermal Imaging Device; Experiment; Theory

5048
(BREAKDOWN STUDIES; PARTICLE BEAMS, ELECTRON)
(Solid, Electrical; Generation)
TRANSIENTS IN LARGE TANDEM ACCELERATORS
P.N. Rose (1) and H. Milde (2)
(1) High Voltage Engineering Corp, Burlington, MA
(2) Ion Physics Corp, Burlington, MA 01803
IEEE Transactions On Nuclear Science, Vol. 18, No. 3, pp 63-67 (03/1971).
The stored energy in DC accelerators capable of reaching terminal potentials of 30 or 40 MV is more than an order of magnitude greater than in existing machines. To analyze the concentration of electrical fields under surge conditions the accelerator has been modeled by lumped constant networks. The analysis shows that in structures similar to the present ones the voltage distribution during a surge is very uneven and micro-discharges in the tube can initiate complete accelerator collapse. 10 Refs.
Primary Keywords: Accelerator; Modeling; Stored Energy; Fault Analysis; Circuit Approach

5053
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
A SIMPLE LASER-TRIGGERED SPARK GAP WITH SUBNANOSECOND RISETIME
A.J. Alcock, M.C. Richardson and K. Leopold
National Research Council, Ottawa, Ontario, Canada
The Review Of Scientific Instruments, Vol. 41, No. 7, pp 1028-1029 (07/1970).
The construction and operating characteristics of a pressurized laser-triggered spark gap capable of switching voltages exceeding 10 kV with a rise time of less than 300 psec are described. Other desirable features are its low delay and jitter times (approximately 1 nsec), the ability to deliver rectangular pulses with less than 10% ripple during and after the pulse, and its simplicity of construction. The gap has been investigated using the output of either a single mode ruby laser or a mode-locked neodymium-glass laser as a trigger. 7 Refs.
Primary Keywords: Ruby Laser; Nd-glass Laser; Low Delay; Low Jitter; High Pressure Gap; Nitrogen Gas

5064
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH-CURRENT 60 KV MULTIPLE-ARC SPARK GAP SWITCH OF 1.7 NH INDUCTANCE
T.E. James
Culham Lab, Abingdon, Oxfordshire, UK
Proceedings Of The IEE, Vol. 117, No. 7 pp 1648-1652 (07/1970).
A multichannel spark gap is described. Multiple trigger pins are utilized to produce a switch with 1.7 nH effective inductance at 60 kV operating voltage. Very low jitter is a valuable side affect of the multiple trigger arrangement. Two trigger arrangements are described: a single circuit supplying all trigger pins, and an arrangement with one trigger circuit for each trigger pin. Both arrangements are shown to have advantages and disadvantages for certain applications. The effects of the variation of several circuit parameters (trigger voltage, gap voltage, load impedance, etc.) are described. 8 Refs.
Primary Keywords: Multichannel Spark Gap; Field Distortion Gap; Experiment; Theory; Low Inductance; Low Jitter; Performance Test

5081
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
KERR COEFFICIENTS OF POLYCHLORINATED BIPHENYLS AND CHLORINATED NAPHTHALENE
M. Misakian and R.E. Hebner Jr
National Bureau of Standards, Washington, DC 20234
Journal Of Applied Physics, Vol.47, No. 9, pp 4052-4055 (09/1976).
The electro-optic Kerr coefficients of two polychlorinated biphenyls and chlorinated naphthalene have been measured to an accuracy of +or- 7% using a comparative technique. Physical properties of the fluids relevant to application in electro-optic devices are discussed. 22 Refs.
Primary Keywords: Kerr Coefficient Measurement; Polychlorinated Biphenyls Kerr Coefficient; Naphthalene Kerr Coefficient; General Measurements; Dielectric Strength Measurements

5082
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
ELECTRICAL ENGINEERING (SELECTED ARTICLES)
E.G. Korolev, L.A. Sukhanov and G.A. Karmanov
FTD Report No. FTD-ID(RS)T-0663-80 (05/1980).
Trans. From: Elektrotekhnika 10, 45-48 (October 1969) By R. Potts
Availability: FTD-ID(RS)T-0663-80
NTIS
This document contains two articles translated from Russian concerning the design, construction, and application of homopolar generators. The first reports the analysis of an acceleration transducer. The acceleration transducer, which is essentially a homopolar generator working in a mode close to short circuit, is analyzed in detail. The second article reports on the design and construction of a homopolar generator. Special attention is devoted to the use of sodium-potassium as the contact medium and to the design and construction of the stator rings. 6 Refs.
Primary Keywords: Homopolar Generator; Acceleration Transducer; Liquid Metal Contacts. Analysis; Construction

5093
(BREAKDOWN STUDIES)
(Gas, Electrical)
ELECTRICAL AND PHOTOGRAPHIC MEASUREMENTS OF HIGH-POWER ARCS
G.R. Jordan, B. Bowman and D. Wakelam
British Steel Corp, Moorgate, Rotherham, Yorkshire, UK
Journal Of Physics D; Applied Physics, Vol. 3, No. 7, pp 1089-1099 (07/1970).
The nature and behaviour of free-burning arcs between a graphite electrode and a molten steel pool at current levels up to 10 kA, rms, and associated powers of 1 MW, has been determined from electrical measurements and high-speed photographs. The dimensions, mobility and electrical properties of these arcs are reported for the half-cycles when the graphite electrode is cathode. Similar measurements were not possible for the alternate half-cycles because of the complex arc forms present. Some information of the velocities, electrical conductivity and energy-loss processes of these arcs was obtained by considering the steady-state characteristics in the electrode cathode half-cycles. It was concluded that the electrical conductivity was influenced, to a large extent, by the low ionization potential vapours evolved from the steel and graphite surfaces and that the main net energy loss from these arcs was by convection associated with the plasma jet streaming towards the steel surface, radiation playing a smaller but still significant role. Surprisingly, thermal conduction appears to be almost negligible as a mode of energy loss. 16 Refs.
Primary Keywords: High-current Arc; Graphite Cathode; Molten Steel Pool Anode; Half-cycle; Power Line Frequency; Conductivity Measurement; Thermal Conduction

5098
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Surface Flashover)
INFLUENCE OF AIR DENSITY ON FLASHOVER VOLTAGES OF AIR GAPS AND INSULATORS
T. Harada (1), Y. Aoshima (1), Y. Ishida (2), Y. Ichihara (2), K. Anjo (3) and N. Nimura (3)
(1) Central Research Institute of The Electric Power Industry, Tokyo, Japan
(2) Tokyo Electric Power Co., Inc., Tokyo, Japan
(3) Chubu Electric Power Co., Inc., Nagoya, Japan
IEEE Transactions Of Power Apparatus And Systems, Vol. PAS-89, No. 6, pp 1192-1202 (08/1970).
Flashover tests were conducted with the cooperation of the Central Research Institute of Electric Power Industry, the Tokyo Electric Power Company, Inc., and the Chubu Electric Power Company, Inc., at the top of Mount Myougase, 1850 meters above sea level and the Takayama Laboratory, nearly at sea level, to obtain comparative data to evaluate the influence of air density n the flashover voltages of air gaps and insulators. From these tests results, the following relation between flashover voltage and air density was derived. The 50-percent flashover voltage at relative air density d/sub 1/ and absolute humidity h/sub 1/ on an air gap of spacing d is equal to that at relative air density d/sub 2/ and absolute humidity (d/sub 2/d/sub 1/) h/sub 1/ on the gap of spacing (d/sub 1/d sub 2/)d. From the relation between the 50-percent flashover voltage and the gap spacing at relative air density 1.0, the 50-percent flashover voltage at any relative air density can be determined by using the relation set forth above. 12 Refs.
Primary Keywords: Long Air Gaps; Variation Of Breakdown; Voltage With Altitude; Emperical Formula; Humidity Dependence

5102
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
LOW-JITTER MULTIGAP LASER-TRIGGERED SWITCHING AT 50 PPS
A.H. Guenther, J.R. Bettis, R.E. Anderson and Wick. R.V.
AFWL, Kirtland AFB, NM 87117
IEEE Journal Of Quantum Electronics, Vol. QE-6, No. 8, pp 492-495 (08/1970).
Results on the simultaneous initiation of four high-voltage spark gaps by a single moderate power laser system are presented. A Q-spoiled YAG laser irradiated each of four 50-kV spark gaps with 10-20 mJ energy in a 7-ns pulse full-width at half maximum (FWHM) by use of simple beam-splitting techniques. Synchronization of approximately 0.1 ns at repetition rates as high as 50 pps was demonstrated both on electrically well-isolated switches as well as on switches connected in parallel with less than 1-ns time isolation. A unique synchronization indicator is described for use as a performance diagnostic. 20 Refs.
Primary Keywords: YAG Laser; Triggering Of Several Gaps; Tens Of mJ Energy; Tenth Nanosecond Synchronization; Transit-time Isolation; Rep Rated

5103
(PARTICLE BEAMS, ION)
(Generation)
THEORY OF INTENSE ION BEAM ACCELERATION
T.M. Antonsen Jr. and E. Ott
Cornell University, Ithica, NY 14850
The Physics Of Fluids, Vol. 19, No. 1, pp 52-59 (01/1976).
The application of high voltage pulse power techniques to the production of intense ion beams is of great interest for plasma confinement, plasma heating, and pellet implosion. The main problem is that application of a high voltage to a simple anode-cathode gap will draw both an electron current from the cathode and an ion current from the anode, and the electrons will receive most of the input energy due to their smaller mass. Two methods of efficient intense ion beam production are considered: (1) the magnetically insulated diode and (2) the 'reflex-triode.' The relativistic equilibria, the ion current dependence on accelerating voltage, its dependence on applied magnetic field (in the first method), and its variation due to a velocity distribution of the electrons (in the second method) are determined. For both methods the ion current can be substantially enhanced with respect to the Langmuir-Child current due to the presence of the negative electron space charge. In the case of magnetic insulation this enhancement increases as the magnetic field is lowered and diverges as it approaches the critical value past which electrons can traverse the gap. For the reflex triode the enhancement is increased by relativistic electron effects and by a population of electrons with energies less than the full voltage across the gap. 18 Refs
Primary Keywords: Ion Beam Generation; Magnetically Insulated Diode; Reflex Triode; Ion Current; Electron Current

5104
(POWER CONDITIONING)
(Peaking Gaps)

LOW-VOLTAGE SPARK PEAKER

O.S. Kolotov and V.A. Pogozhev
Moscow State University, Moscow, USSR
Instruments And Experimental Techniques, No. 3, pp 677-679 (05/1969).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 130-133 (May-June 1969)

A spark peaker for shaping pulses of approximately 1 kV is described and the results of a test of its performance are considered. The spark peaker operates periodically and shapes pulses with a rise time of 0.5 +or- 0.1 nsec and a triggering-time instability of 0.15-0.2 nsec. 7 Refs.

Primary Keywords: Spark Gap; Peaking Gap; 1 kV Voltage; Subnanosecond Rise Time; Air Gap

5106
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)

MULTICHANNEL VACUUM SPARK GAP

A.I. Babaritskii, B.A. Demidov, S.D. Fanchenko and V.V. Frolov
Institute Of Atomic Physics, Moscow, USSR
Instruments And Experimental Techniques, No. 3, pp 718-720 (05/1969).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 167-169 (May-June 1969)

A two-electrode vacuum spark gap having the configuration of a slot in a dielectric with three firings distributed along the electrodes is studied with a high-speed electron-optical camera. It is shown that over the wide voltage range of 10-90 kV all three current channels develop simultaneously, which reduces inductance to a minimum. 6 Refs.

Primary Keywords: Three Channel Operation; Plasma Gun; Three Guns; Low Jitter; Holdoff Voltage Reproducibility

5119
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

A NEW HIGH-VOLTAGE TRIGGERED SPARK GAP

T.E. Broadbent
University of Manchester, Manchester, UK
British Journal Of Applied Physics, Vol. 15, pp 97-99 (01/1964).

The trigatron type of spark gap and the hot-wire gap are combined into a single device in which a trigger spark is produced near a heated filament at the sparking surface of one main electrode. The breakdown voltage of the gap, when triggered, is considerably lower than the corresponding breakdown voltage for the two constituent gaps *separately, provided the applied voltage is negative. By adjusting* the wire temperature the range of voltage over which satisfactory triggering occurs can be controlled, without the need to adjust the gap spacing. 4 Refs.

Primary Keywords: Trigatron Gap; Hot-wire Trigger; Combination; Polarity Effects; Wide Voltage Range

5120
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)

SURVEY OF EFFECT OF SURFACE PROPERTIES ON ANODE EROSION

N.S. Reser
Aerospace Research Labs, Wright-Patterson AFB, OH
No. ARL-68-0069, 29pp (04/1968).
Availability: AD-671 503
NTIS

Anode erosion is a serious problem in high power electric arcs and appears to be due primarily to intense local heating. Three means are considered for amelioration: improved heat transfer from the anode spot, broadening of the anode spot (decreased power density), and reduction of total anode power dissipation. Low work function 'patches' may create preferred arc attachment points. Surface composition, structure, and preparation can have major influence, and means are discussed for tailoring anode surface properties. (Author)

Primary Keywords: Gas Discharges_Anodes(Electron Tubes); Anodes(Electron Tubes)_Erosion; Electric Arcs; Heat Transfer; Surface Properties; Work Functions; Adsorption

5143
(DIAGNOSTICS AND INSTRUMENTATION)
(E-field)

AN AUTOMATIC ELECTRIC FIELD MEASURING EQUIPMENT OF VERY HIGH RESOLUTION AND ITS APPLICATION FOR THE STUDY OF ACOUSTOELECTRIC PHENOMENA

T. Zold
McGill University, Montreal, Canada
The Review Of Scientific Instruments, Vol. 44, No. 4, pp 408-414 (04/1973).

An electric field measuring equipment with a capacitive probe of 40 micron resolution was constructed using only ordinary materials and techniques. The operation of this equipment was completely automatic and the electric field profiles were recorded continuously by an x-y recorder. The duration of one measurement, consisting typically of the recording of about 50 profiles and of the sample current vs time diagram, in 4 mm long samples, was approximately 50 min. The usefulness of this equipment has been proven through its use for the observation of a large number of new electric field domain formations in photoconducting CdS samples. The detailed description of these observations will be reported elsewhere. 16 Refs.

Primary Keywords: Capacitive Probe; 40 Micron Resolution; Design Considerations; Operation Considerations

5154
(ENERGY STORAGE, INDUCTIVE: ELECTROMAGNETIC FIELD GENERATION; SWITCHES, OPENING)
(Systems: Magnetic; Superconductive)

HIGH MAGNETIC FIELD PRODUCTION BY ELECTROMAGNETIC ENERGY STORAGE IN A *SUPERCONDUCTING COIL*

A. Hairie (1), A. Fortini (1), M. Huissier (2) and M. Sauzade (2)
(1) Universite de Caen, Caen, France
(2) Faculte Des Sciences D'Orsay, Orsay, France
Review Of Scientific Instruments, Vol. 45, No. 10, pp 1464-1467 (10/1973).

A new method to produce high pulsed magnetic fields has been developed. Capacitors generally used for the storage of energy have been replaced by a superconducting coil which requires less space and lower operating cost. The choice for the different elements of the setup is discussed. A low energy model has produced a field of 20 teslas with a time constant of 15 msec.

Primary Keywords: Magnetic Field Generation; Inductive Energy Store; Superconducting Coil; Superconducting/normal Opening Switch; Design Considerations; Low Energy Prototype

5156
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

TRIGGERING OF A PRESSURIZED SPARK GAP BY A LASER BEAM

F. Deutsch
CERN, Geneva, Switzerland
Journal Of Physics D; British Journal Of Applied Physics, Vol. 1, pp 1711-1719 (03/1968).

A delay line was discharged into a terminating resistor by a spark gap of coaxial design. The spark gap was triggered by a focussed laser beam, introduced along the axis; a Q-switched ruby laser giving pulses of 20 ns duration and up to 50 MW power was used. The range of operation of the gap, formative time of the breakdown and jitter were investigated for different gases at pressures above atmospheric, gap widths of 4-10 mm and voltages of up to 120 kv. Mixtures of argon and nitrogen were found to have certain advantages, such as a low threshold for ionization by the laser beam, sufficient dielectric strength, low values of the formative-time jitter and chemical inertness. Formative times of down to about 1 ns and jitters below 1 ns were found. The laser power can be relatively low (0.5-5 MW). An explanation for the breakdown mechanism is proposed. 5 Refs.

Primary Keywords: Ruby Laser; Coaxial Spark Gap; Jitter Measurement; Delay Measurement; High Gap Pressure; Breakdown Mechanism

5158
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

A PRECISION MEGOHM RATIO UNIT FOR HIGH VOLTAGE MEASUREMENTS

J.N. Harris
California Institute of Technology, Pasadena, CA
Review Of Scientific Instruments, Vol. 23, No. 8 pp 409-413 (08/1952).

A precision megohm ratio unit consisting of 100 resistance units wound of manganin wire is described. Stability of the order of a few parts per million is achieved through careful construction. Variations due to temperature changes are reduced by operating the resistor in a circulating oil bath maintained at a temperature of 33 deg.C, where the temperature coefficient of the resistor is essentially zero. The resistor is capable of continuous operation at a potential of 5 kV and intermittent operation to 25 kV. A general method is also reviewed for setting up accurate resistance ratios by comparing two groups of resistors in appropriate series and parallel arrangements. Employing this method and using the units of the described megohm ratio unit, high ratios, consistently accurate to one part per million, have been set up. 6 Refs.

Primary Keywords: DC Voltage Measurement; Modular Construction; High Precision; Medium Voltage

5161
(PARTICLE BEAMS, ELECTRON)
(Generation)

ANALYSIS OF TRANSMISSION-LINE ACCELERATOR CONCEPTS

J.K. Temperley and D. Eccleshall
Army Amament Research and Development Command, Aberdeen Proving Ground, MD 21005
Final rept. Nov 76-Sep 77 No. ARBRL-TR-02067, 58p (05/1978).
Availability: AD-A056 364/3ST
NTIS

An analysis is presented of charged transmission-line configurations for use in high-current accelerators. Basic drawbacks of the symmetric radial-pulse-line design are identified. The concept of using asymmetric pairs of transmission lines of various geometries is introduced. Conditions for maximum efficiency and maximum energy transfer to the beam load are derived for ideal constant-impedance lines. It is shown that, in the lossless-line approximation, asymmetric line-pair configurations exist with which both a high accelerating voltage per stage and nominal unit efficiency can be achieved. A recirculating accelerator is described, in which advantage is taken of a repetitive voltage waveform present in the transmission-line cavities to repeatedly accelerate a current pulse which is recirculated through the accelerator. Expressions for the open-circuit output voltage, accelerating voltage per stage, and efficiency of energy transfer to the beam are derived for this case also. It is shown that, with proper choice of parameters, this type of design again affords the possibility of nominal unit efficiency for energy transfer to the beam. (Author)

Primary Keywords: Electron Accelerators; Transmission Lines; Electron Beams; Pulses; Energy Transfer; High Power; Voltage; Efficiency; Recirculation; Physics Laboratories; Army Research Laboratories
Secondary Keywords: Aurora Facility; NTISDODXA

5162
(PULSE GENERATORS)
(Capacitive)

BIG OPTICAL SPARK CHAMBERS AND PULSE GENERATORS FOR THEIR SUPPLING

A.F. Grushin, A.I. Egorov, L.K. Lytkin, A.F. Pisarev and V.F. Pisarev
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1976).
Availability: JINR-R-13-9745
NTIS

The construction is described and main operating characteristics are presented for big optical spark chambers with the gap of 2 cm, used in particle beams from accelerators. The working substance on the path of particles in the chambers is small and the chambers are of high shower efficiency. The characteristics of high-voltage pulse generators, feeding these chambers, are presented. (Atomindex citation 09:358364)

Primary Keywords: High-voltage Pulse Generators; Spark Chambers; Aluminium; Design; Diagrams; Efficiency; Electrodes; Fabrication, Foils; Spark Gaps; Specifications
Secondary Keywords: ERDA/440104; NTISINIS Microfiche Only
Distribution Restriction: U.S. SALES ONLY.

5164
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
CALIBRATION OF HIGH-VOLTAGE PULSE MEASUREMENT SYSTEMS BASED ON THE KERR EFFECT
R.E.J.M.M Hebner
Sandia Labs, Albuquerque, NM 87115
Final rept. Jul 75-Oct 77 No. NBSIR-77-1317, 39p (09/1977).
Availability: PB-274 333/4ST
NTIS
High voltage pulse measurements have been performed using systems based on the electrooptic Kerr effect for a number of years. These systems permit state-of-the-art measurements (uncertainties approximately equal to + or - 1%). Because the precision of the measurement can be significantly better than the accuracy, an investigation of techniques to improve the calibration of the system was undertaken. The investigation focused on two areas. One was the experimental determination of correction factors which would account for differences in environmental factors between the calibration of the system and its use. These measurements yielded accurate corrections for variations in temperature and quantitative evidence of the magnitude of the wavelength dependence of a Kerr system's response. The second was further study into the feasibility of calibrating the Kerr system at a number of discrete frequencies and using this calibration for pulse measurement.
Primary Keywords: Kerr Cells; Electrical Measurement; Pulsation; High Voltage; Calibrating; Kerr Electrooptical Effect; Nitrobenzenes; Space Charge
Secondary Keywords: NTISCOMNBS

5167
(BREAKDOWN STUDIES)
(Exploding Wires)
POSTULATION OF THE ARC RESTRIKE MECHANISMS FOR EXPLODING WIRES AND TUBES
D.Y. Chen, W.J. Loubsky and V.E. Fousekis
University of Santa Clara, Santa Clara, CA 95053
The Physics Of Fluids, Vol. 14, No. 11, pp 2328-2336 (11/1971).
The many facets of exploding wire restrikes are studied. They are related to the cylindrical shock wave which pumps down the density of the center region of a line energy source or around the surface of the heated wire continuously to a lower density. When the density of any region is pumped down to lower than Paschen's electric breakdown criteria, restrike occurs. The cylindrical shocks occurring in exploding wires are, in general divided into two types. In the first type the shock is generated by wire explosion and in the second type the shock is generated by the heat conduction of the wire to the surrounding gas. Application of this mechanism to exploding tubes will enable us to create arc channels in arbitrary gaseous atmospheres with controllable plasma density with the contamination excluded. Neutral density shielded plasma experiments, therefore, can be conducted in a controllable environment. 14 Refs.
Primary Keywords: Exploding Wire; Exploding Tube; Arc Restrike; Cylindrical Shock Wave
Secondary Keywords: Vapor Density Calculation; Thermal Conduction

5170
(PARTICLE BEAMS, ION; PARTICLE BEAMS, NEUTRAL)
(Generation; Generation)
DESIGN PHILOSOPHY AND USE OF HIGH VOLTAGE POWER SYSTEMS FOR MULTI-MEGAWATT ION BEAM ACCELERATORS
G.C. Barber, A.Y. Broverman, R.E. Hill, C.M. Loring and N.S. Ponte
Oak Ridge National Lab, Oak Ridge, TN 37830
Availability: CONF-771829-68
NTIS
The requirements for a neutral beam high voltage power system are derived from the characteristics of the ion source. High voltage system component characteristic requirements and choices are described. (ERA citation 03:016270)
Primary Keywords: Neutral Beam Sources; Power Supplies; Beam Injection Heating; Design; Ion Sources; Plasma Heating; Recommendations; Specifications
Secondary Keywords: ERDA/700205; NTISDE

5177
HIGH-VOLTAGE TEST STAND AT LIVERMORE
M.E. Smith
Lawrence Livermore Lab, Livermore, CA 94550
No. CONF-771029-78, 7p (10/1977).
Availability: UCRL-79614
NTIS
This paper describes the present design and future capability of the high-voltage test stand for neutral-beam sources at Lawrence Livermore Laboratory. The stand's immediate use will be for testing the full-scale sources (120 kV, 65 A) for the Tokamak Fusion Test Reactor. It will then be used to test parts of the sustaining source system (80 kV, 85 A) being designed for the Magnetic Fusion Test Facility. Following that will be an intensive effort to develop beams of up to 200 kV at 20 A by accelerating negative ions. The design of the test stand features a 5-MVA power supply feeding a vacuum tetrode that is used as a switch and regulator. The 500-kW arc supply and the 100-kW filament supply for the neutral-beam source are battery powered, thus eliminating one or two costly isolation transformers. (ERA citation 03:016277)
Primary Keywords: Neutral Beam Sources; Test Facilities; Design; Electronic Circuits; Performance; Power Supplies; Tfttr Device
Secondary Keywords: ERDA/700205; NTISDE

5179
(PARTICLE BEAMS, ELECTRON)
(Generation)
INVESTIGATION OF A HIGH VOLTAGE HOLLOW CATHODE ELECTRON BEAM SOURCE
J. Hansen
Risoe National Lab., Roskilde (Denmark).
(04/1977).
Availability: RISO-359
NTIS
An investigation is presented of the possibility of developing an electron accelerator comprising several radiation units with a relatively low power per unit, and without the many elements such as accelerator tube, focusing and scanning systems. A study was desired of an electron gun operated at 200 kV vased on the cold, hollow-cathode principle, where problems concentrated on the design of an electrode configuration that could withstand the high voltage at a pressure where a plasma could be generated too. Studies concentrated on the high voltage breakdown criterion in the pressure range 10 exp -3 to 10 exp -2 torr and on the plasma formation in a low pressure gas discharge. Controlled beams with energies up to 130 keV were generated in nitrogen at a pressure of 2 x 10 exp -3 torr with a beam current of about 1 mA in a continuous operation. The high voltage was limited by the existing power supply in the laboratory; however, a decision was taken not to purchase a power supply that could have delivered the required voltage. (Atomindex citation 08:343720)
Primary Keywords: Electron Sources; Breakdown; Cold Cathode Tubes; Electric Potential; Electron Beams; Electron Guns; Feasibility Studies; Glow Discharges; Hollow Cathodes; Kev Range 10-100; Medium Vacuum; Paschen Law; Plasma Instability
Secondary Keywords: ERDA/430100; Denmark; NTISINIS
Distribution Restriction: AVAILABLE IN MICROFICHE ONLY. U.S. SALES ONLY.

5180
(BREAKDOWN STUDIES)
(Liquid, Electrical)
INVESTIGATIONS ON BREAKDOWN EVENTS IN LIQUID NITROGEN AT HIGH VOLTAGES
D. Peier
Technische Univ. Brunswick (West Germany)). Fakultaet fuer Maschine und Elektrotechnik.
(06/1975).
Availability: NP-22472
NTIS
The breakdown of liquid nitrogen was investigated using dc, a impulse voltages up to 200 kV. The electrode arrangement varied point-to-plane electrodes with point radii of 40 mu m to electrodes with nearly homogeneous fields. Electrode material and surface roughness were taken into account. The prebreakdown events were studied by the charge of the electrode, the breakdown itself by measuring the voltage and the current. Some types of instable predischarges were detected, but no stable ones. The immediately following breakdown occurred within 20 ns. The breakdown field strength depends on the gap distance s and the electrode radius There is a minimum field strength due to the ratio of s/r = 5 to At a gap distance of 1 mm breakdown voltages of 50 kV were measured at ac and dc under atmospheric pressure (homogeneous field). This value is influenced by the surface roughness and the heat flux into LN sub 2 . Electrode material is only of little influence. Based on these measurements some aspects of a breakdown mechanism are pointed out: electrons, generated by field emission, may cause microbubbling in front of microtips on the surface. The microbubbles may be the starting point for ionization processes and avalanches, leading to a breakdown channel. The channel build up is similar to the streamer and leader mechanism, observed in long air gaps. (ERA citation 03:008313)
Primary Keywords: Cryogenic Cables; Nitrogen; Breakdown; Cryogenic Fluids; Data; Dielectric Materials; Ehv Ac Systems; Ehv Dc Systems; Performance Testing
Secondary Keywords: ERDA/200303; ERDA/420201; West Germany; Dielectric Breakdown; Liquid Nitrogen; High Voltage; NTISDEE
Distribution Restriction: U.S. Sales Only.

5181
(PULSE GENERATORS)
(Trigger)
LIMITING CONDITIONS IN A FERRORESONANT TRIGGER CIRCUIT
J.G. SKALNIK
Yale Univ New Haven Conn Dunham Lab
(10/1955).
Availability: AD-079 851/2ST
NTIS
No abstract available.
Primary Keywords: Trigger Circuits; Circuits; Mathematical Analysis
Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

5184
OPTICALLY COUPLED HIGH VOLTAGE ISOLATION AMPLIFIER
J.W. Pearce
Oak Ridge National Lab, Oak Ridge, TN 37830
(02/1978).
Availability: ORNL/TM-6207
NTIS
A common and persistent problem in modern instrumentation is the observation and recording of small signal waveforms that are removed from ground by very high voltages. Examples of this are the instrumentation of neutral particle injectors used in controlled thermonuclear research and the construction of safety breaks for air core toroidal devices. To overcome this problem a very high voltage isolation amplifier was designed. It employs analog-to-digital conversion with serial data transmission on a fiber optic cable. (ERA citation 03.032477)
Primary Keywords: Measuring Instruments; Neutral Beam Sources; Amplifiers; Analog-to-digital Converters; Construction; Design; Neutral Atom Beam Injection; Thermonuclear Reactors
Secondary Keywords: ERDA/700209; ERDA/700205; Isolation; High Voltage; Fiber Optics Transmission Lines; NTISDE

5185
(POWER CONDITIONING)
(Saturable Reactors)
POSSIBILITY OF USING MAGNETIC PULSE GENERATORS IN LINEAR INDUCTION ACCELERATORS
R.V. Khar'yuzov and V.A. Shvets
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1976).
Availability: JINR-9-9523
NTIS

Results of an experimental study of pulse magnetic generators for the LIU-30 pulsed linear accelerator are given. The pulse magnetic generator is essentially a forming line including capacitors and iron-core chokes. Two types of generators are described: generators of the first type are energized from an ac source and have no controlled switches, while those of the second type are energized from a dc source and contain controlled switches. Advantages of generators of the second type are shown. Circuits of generators of the second type for 18 and 24 kW are given. Experiments aimed at producing a nanosecond front in generator pulses indicate that in the case of high-quality permalloy or permendur being used as the material of the choke cores, a pulse with a front of 50 to 60 ns at an amplitude of up to 100 A can be obtained. To provide the front of less than 10 exp - exp 8 s, in the last two stages use should be made of low-inductance capacitors with an intrinsic inductance of no more than a few nH. The results of the study show that pulse magnetic generators operate stably with a load of 500 to 1,000 Ohm. At this load the current front is 5 to 6 ns. (Atomindex citation 09:363273)
Primary Keywords: Accelerators; High-voltage Pulse Generators; Capacitors; Diagrams; Electric Coils; Frequency Dependence; Induction; Performance; Permalloy; Pulse Rise Time; Pulse Shapers; Reliability; Specifications; Thyristors
Secondary Keywords: ERDA/430300; USSR; NTISINIS
Distribution Restriction: AVAILABLE IN MICROFICHE ONLY. U.S. SALES ONLY.

5186
(PARTICLE BEAMS, NEUTRAL)
(Generation)
PRESENT AND FUTURE TECHNOLOGY OF HIGH VOLTAGE SYSTEMS FOR NEUTRAL BEAM INJECTIONS
W.R. Baker and D.B. Hopkins
Lawrence Berkeley Lab, Berkeley CA
No. CONF-771213-8, 36p (01/1978).
Availability: LBL-7261
NTIS

This paper presents: (1) A brief review of existing neutral beam (NB) power supply technology for operating up to approximately 200 kV, 65 A; (2) Possibilities for using existing systems for next-generation NB sources, and associated problems; (3) A summary of the features of present systems which contribute to a high degree of complexity and/or cost; (4) A plea and proposal for minimizing cost and complexity of future systems operating up to approximately 300 kV; (5) A few comments pertaining to special problems associated with operating in the 300 to 1000-kV range; and (6) A listing of some specific task areas which we believe should receive early R and D effort. (ERA citation 03:032415)
Primary Keywords: Neutral Beam Sources; Power Supplies; Cost; Research Programs; Reviews; Thermonuclear Reactors
Secondary Keywords: ERDA/700203; ERDA/700205; Neutral Atomic Beam Injection; NTISDE

5189
(ENERGY CONVERSION, MECHANICAL)
(Charging Circuits)
PULSE CHARGING OF NANOFARAD CAPACITORS TO TENS OF KILOVOLTS FROM THE SHOCK DEPOLING OF PZT FERROELECTRIC CERAMICS
W.J.H.W.H. Mock
Naval Surface Weapons Center, Dahlgren, VA 22448
Final rept. No. NSWC/DL-TR-3804, 74p (04/1978).
Availability: AD-A058 607/3ST
NTIS

Gas gun impact techniques have been used to pulse charge nanofarad capacitors from the shock depoling of PZT 56/44 and PZT 95/5 ferroelectric ceramics. The PZT materials were depoled in the normal mode. Pulse powers of hundreds of kilowatts were produced in a few microseconds. The PZT 56/44 material was impacted in the stress range from 4.4 to 11.8 GPa. A maximum load voltage of 55 kV was produced at 7.9 GPa. Shock-induced electrical breakdown in the PZT material occurred at 11.8 GPa. The PZT 95/5 material was impacted at 1.4 and 2.9 GPa stress levels. A maximum load voltage of 81 kV was produced at the higher stress. (Author)
Primary Keywords: Pulse Generators; Shock Waves; Ferroelectric Crystals; Breakdown(Electronic Threshold); Dielectric Properties; High Energy; High Voltage; Electrical Loads; Zirconates; Titanates
Secondary Keywords: Capacitor Chargers; NTISDODXA

5190
(PULSE GENERATORS)
(Capacitor Banks)
PULSE MODULATOR FOR AN EXPERIMENTAL ELECTRON GUN
P.S. Antsupov, I.M. Matora and V.A. Shvets
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1975).
Availability: JINR-13-9277
NTIS

The construction features are described and the main diagram is presented for a pulse modulator with an output power up to 150 mW, potential of 60 kV, and pulse current of 2500 A. A capacitative energy accumulator with particle discharge and output pulse transformer are used in the modulator. An advantage of the modulator is the absence of high-energy forming lines. The modulator consists of three main units: a thyristor startup device, thyratron sub-modulator, and modulator with stable tubes. There is also a series of charging devices, a water-cooling system, and a system of locking, control, and signal units. The main feature of the modulator is the absence of a constant potential on the screening grids of the modulator tubes; the modulator tubes are started up simultaneously through two grids---the control and the screen. The tubes are cooled by water forced from the water-distillation unit with 4.5 atm pressure. The modulator has operated dependably for 4 years and has shown highly constant parameters for the output pulse and reliability in operation. (Atomindex citation 09:360709)
Primary Keywords: Electron Guns; Control Systems; Cooling; Diagrams; Medium Pressure; Modulation; Pulse Shapers; Pulses; Thyratrons; Thyristors; Transformers; Trigger Circuits
Secondary Keywords: ERDA/430200; USSR; NTISINIS
Distribution Restriction: U.S. SALES ONLY

5191
(POWER CONDITIONING)
(Pulse Transformers)
PULSE TRANSFORMER DESIGN STUDY
H Aslin
Physic International Co, San Leandro, CA 94577
Final rept. Dec 75-Mar 77 No. PIFR-897, 79p (11/1977).
Availability: AD-A047 499/9ST
NTIS

This final report describes the design, development of fabrication techniques, fabrication, and testing of two uniform field, air core pulse transformers. The described transformer design minimizes the volume of dielectric material, which provides turn-to-turn insulation, reduces stray series inductance, and thus improves the transformer high frequency response in comparison to conventional pulse transformers. The described pulse transformers are intended for repetitive pulse operation with output voltages of about 200 kV into matched resistive loads. Output pulse width and risetimes are about 10 microsec and 1 microsec (10 to 90 percent) respectively. (Author)
Primary Keywords: Pulse Transformers; Solenoids; Electric Coils; Fabrication; Inductance; Frequency Response; Dielectrics; Pulse Trains; Electric Fields; Insulation; Lightweight
Secondary Keywords: Air Cores; Dielectric Constant; NTISDODXA

5192
(PARTICLE BEAMS, ELECTRON)
(Generation)
REB FOCUSING IN A HIGH-VOLTAGE DIODE
I.P. Afonin, M.V. Babykin and B.V. Baev
GKAE Atomic Energy Institute, Moscow, USSR
(02/1978).
Availability: SAND-78-6005
NTIS

Experimental data on the focusing of an intense relativistic electron beam on the ''Angara-1'' and ''Kalmar-1'' accelerators are reported. The use of these accelerators to simulate conditions in a controlled thermonuclear reactor with inertial plasma confinement is discussed. (ERA citation 03:033593)
Primary Keywords: Accelerators; Thermonuclear Reactors; Electron Beams; Focusing; Foils; Heating; Plasma Confinement; Relativistic Range
Secondary Keywords: ERDA/430200; ERDA/700208; Translations; USSR; NTISDET
Distribution Restriction: TRANSLATION BY P. NEWMAN OF ISSLEDOVANIE FOKUSIROVKI REP V VYSOKOVOL'TNOM DIODE.

5193
REPETITIVE SERIES INTERRUPTER II
R.F. Caristi, R.P. Simon and D.V. Turnquist
EG&G Inc, Salem, MA 01970
Interim rept. no. 7, 1 Oct 77-31 Jan 78 (06/1978).
Availability: AD-A055 999/7ST
NTIS

The interruption characteristics have been established for six developmental 'plasma chute' interrupters, five rated at 15 kV and one rated at 30 kV. Six-hundred ampere interruptions at 20 kV have been achieved with a magnetic field energy of less than 8 joules. The most efficient interaction channel geometry has been found to be one which contains both a 'chuted' surface against which the discharge is magnetically driven, and an unchuted (smooth) surface located behind the driven discharge, the presence of which latter surface minimizes the availability of plasma to sustain the discharge. Typical interaction column drops have been found to be 300 to 400 volts per section (20 to 26 volts/cm) at reasonable tube pressures with no more than three (and possibly two) sections being adequate for the operation of tubes rated at 50 kV. Holdoff-section voltage drops of about 120 volts have been observed for holdoff sections capable of withstanding 30 kV. A total tube drop of 830 volts has been observed at the 25 kV, 18.5 A level. Linear extrapolation of existing data to the 50 kV, 1000 A level shows that reliable interruption should be achievable with a magnetic field energy of the order of 10 joules for an interrupter having a total tube drop of about 1200 volts, or 2.4% of the system's operating voltage. (Author)
Primary Keywords: Interrupters; Thyratrons; Switching Circuits; Plasma(Physics); Magnetic Fields; Gas Discharges; Trigger Circuits; Electric Discharges; Protective Equipment; Energy; Pulse Generators
Secondary Keywords: Hydrogen Thyratrons; NTISDODXA

5195
(BREAKDOWN STUDIES)
(Gas, E-beam)
SMALL SCALE DISCHARGE STUDIES
M. Rokni, J.H. Jacob and J.A. Mangano
Avco Everett Research Lab, Inc, Everett, MA 02149
Semi-annual rept. 1 Sep 76-28 Feb 77 (02/1977).
Availability: AD-A047 221/7ST
NTIS

The dominant formation and quenching processes in e-beam pumped ArF* and KrF* lasers are discussed. The exciplexes are produced by irradiating Ar/F2 and Ar/Kr/F2 mixtures with a 5 A/cm2, 150 keV e-beam. A steady state analysis is valid since the reaction times are short compared to the 300 nsec beam pulse length. The quenching of ArF* by F2 and Ar has been measured by analyzing the ArF* fluorescence as a function of the F2 and Ar partial pressures. We have also measured the displacement of the Ar in ArF* by Kr to form KrF*. The dominant quenching processes of KrF* were identified and the rate constants were measured. The ArF* and KrF* are formed from the ionic states with high efficiency. Interception of the precursers can be made negligible by choosing the experimental conditions properly. The quenching of KrF* by Ar and Kr is mainly a three body process resulting in the formation of Kr2F*. The emission from Kr2F* was observed in a broad band centered at 410 nm. We have verified that the Kr2F* is produced subsequent to the KrF* formation by performing a laser saturation experiment.
Primary Keywords: Ultraviolet Lasers; Gas Lasers; Rare Gases; Fluorides; Argon Lasers; Electron Beams; Krypton; Gas Discharges; High Voltage; Fluorescence; Quenching
Secondary Keywords: Krypton Fluoride Lasers; Argon Fluoride Lasers; Electrical Lasers; Reaction Kinetics; NTISDODXA

5196
(SWITCHES, CLOSING)
(Gas Gaps, Materials)
SPARK GAP OVERPRESSURES IN THE TRANSFER CAPACITOR DEVICE
L.C. Burkhardt and R.S. Dike
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-771029-29, 4p (01/1977).
Availability: LA-UR-77-2417
NTIS
A designer of spark gaps is often faced with two gas pressure problems, one static and one dynamic. The former is easy to obtain data on which to base intelligent design specifications; about the latter, less is known. It is the total internal pressure environment we have attempted to measure, in an un-time-resolved way, in order to give the designer some rationale in designing gaps of this category. We measure overpressures of approximately 400 PSI in a 13 cubic inch gap passing currents of approximately 200 kA. (ERA citation 03:020701)
Primary Keywords: Power Supplies; Spark Gaps; Breakdown; Capacitors; Electrodes; Failures; Medium Pressure; Switches; Thermonuclear Devices
Secondary Keywords: ERDA/700203; NTISDE

5197
(POWER CONDITIONING; PULSE GENERATORS)
(Pulse Transformers; Blumlein Lines)
STREAMER CHAMBER POWER SUPPLY ON THE BASE OF A 500KV PULSE TRANSFORMER
Y.V. Grishkevich, D. Poze, K. Ryuger, K. Tryuchler and G. Peter
Joint Inst. for Nuclear Research, Dubna (USSR).
Availability: JINR-R-13-9306
NTIS
Theory and constructional layout of a pulse transformer is given by which it is possible to drive a large Blumlein-line as a high-voltage pulse generator for a streamer chamber. The transformer is capable of generating voltage pulses with an amplitude of 500 kV at a load of 1000 pF. The rise time of the pulse is 300 nsec. The stability of the pulse amplitude in the streamer chamber is +-1.5% and the jitter of the pulse delay time is +- 10 nsec. (Atomindex citation 08:318990)
Primary Keywords: High-voltage Pulse Generators; Streamer Spark Chambers; Diagrams; Pressure Dependence; Pulse Shapers; Specifications; Surges; Transformers
Secondary Keywords: ERDA/440104; USSR; NTISINIS
Distribution Restriction: Available in microfiche only. U.S. Sales Only.

5198
SUPER POWER GENERATORS
T.H. Martin, D.L. Johnson and D.H. McDaniel
Sandia Labs, Albuquerque, NM 87115
No. CONF-771035-5, 24p (01/1977).
Availability: SAND-77-1324c
NTIS
PROTO II, a super power generator, is presently undergoing testing at Sandia Laboratories. It has operated with an 80 ns, 50 ns, 35 ns, and 20 ns positive output pulse high voltage mode and achieved total current rates of rise of 4 x 10 exp 14 A/s. The two sided disk accelerator concept using two diodes has achieved voltages of 1.5 MV and currents of 4.5 MA providing a power exceeding 6 TW in the electron beam and 8 TW in the transmission lines. A new test bed named MITE (Magnetically Insulated Transmission Experiment) was designed and is now being tested. The pulse forming lines are back to back short pulse Blumleins which use untriggered water switching. Output data showing a ten ns half width power pulse peaking above one terrawatt were obtained. MITE is a module being investigated for use in the Electron Beam Fusion Accelerator and will be used to test the effects of short pulses propagating down vacuum transmission lines. (ERA citation 03:008968)
Primary Keywords: Accelerators; Power Transmission Lines; Design; Electron Beams; High-voltage Pulse Generators; Magnetic Shielding; Mega Amp Beam Currents; Operation; Performance Testing; Thermonuclear Reactors
Secondary Keywords: ERDA/430300; ERDA/700208; NTISDE

5200
(POWER CONDITIONING)
(Pulse Transformers)
THE THEORY OF THE OPTIMUM TRANSMISSION-LINE PULSE-TRANSFORMER
F.J. YOUNG
Carnegie Mellon University, Pittsburgh PA 15213
(10/1956).
Availability: AD-114 090/4ST
NTIS
No abstract available.
Primary Keywords: Transmission Lines; Transients; Determination; Theory
Secondary Keywords: Pulse Transformers; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

5201
(PULSE GENERATORS)
(Systems)
TRIGGER AND CONTROL CIRCUITS FOR HIGH-VOLTAGE GENERATORS
K. Ondre ka and L.K. Lytkin
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
(01/1977).
Availability: JINR-R-13-10432
NTIS
Fast trigger and control circuits have been designed for a system of high-voltage generators used for spark chamber supply. The trigger circuit has been constructed on the basis of the tube GI-30 and semiconductor transistors KT603B operating in a shower regime. The control circuit has been constructed of integral circuits of TTL type. For a long time the scheme was tested on the magnet spark spectrometer of the JINR and was found to be highly reliable. (Atomindex citation 08:335382)
Primary Keywords: High-voltage Pulse Generators; Spark Chambers; Control Systems; Diagrams; Integrated Circuits; Logic Circuits; Transistor Trigger Circuits
Secondary Keywords: ERDA/440104; USSR; NTISINIS
Distribution Restriction: AVAILABLE IN MICROFICHE ONLY. U.S. SALES ONLY

5203
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
USE OF A CORONA IN THE NEEDLE-PLANE SYSTEM AS A HIGH-VOLTAGE DIVIDER ELEMENT
L.V. Smirnov, V.D. Mikhailov and R.S. Chechikov
GKAE Atomic Energy Institute, Moscow, USSR
(01/1975).
Availability: NIIEFA-D-0246
NTIS
Some characteristics are investigated of a corona discharge in a needle-surface system with a view to utilizing corona-displaying gaps as elements of a high-voltage divider. Results are cited for preliminary trials of a ''corona divider'' model. A comparative assessment is also given with regard to divider efficiency. (Atomindex citation 05:340870)
Primary Keywords: Electrostatic Accelerators; Breakdown; Comparative Evaluations; Corona Discharges; Efficiency; Electric Potential; Medium Pressure; Nitrogen; Pressure Dependence
Secondary Keywords: ERDA/430200; USSR; NTISINIS
Distribution Restriction: AVAILABLE IN MICROFICHE ONLY. U.S. SALES ONLY.

5204
(PARTICLE BEAMS, ELECTRON; SWITCHES, CLOSING; ENERGY STORAGE, CAPACITIVE)
(Reviews; Reviews; Marx Generators)
LASER-FUSION AND ELECTRON-BEAM-FUSION PROGRESS REPORT JULY-DECEMBER 1974
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND75-0262 (06/1975).
Availability: SAND75-0262
NTIS
This report provides an overview of the research conducted at Sandia Laboratories in July-December 1974. The laser fusion program is discussed with most attention placed on lasing action in the lasing medium and target interaction. The report on electron beam fusion is characterized by sections on energy storage, switching, transmission lines, and diode construction. Theoretical work on target design and plans for the future are included. 8 Refs.
Primary Keywords: E-beam; Water Switch; Oil Switch; Gas Gap; Blumlein; Magnetic Insulation; Water Insulated Transmission Line
Secondary Keywords: HF Laser; KrO Laser; Laser-target Interaction

5205
(SWITCHES, OPENING; DIAGNOSTICS AND INSTRUMENTATION)
(Explosive Fuses; Miscellaneous)
MICROWAVE DOPPLER MEASUREMENTS OF THE IONIZATION FRONT IN CYLINDRICAL SHOCK WAVES FROM EXPLODING WIRES
D.L. Jones and M. Gellet
National Bureau of Standards, Boulder, CO 80302
Exploding Wires, Vol. 2 pp. 127-144 (01/1962).
Strong cylindrical shock waves from exploding wires have been measured by microwave Doppler techniques. The results obtained simultaneously on two or three independent frequencies are in very good agreement and show that the ionization front is well defined. The Taylor-Lin similarity blast wave theory for the shock wave propagation is well verified over distances up to 6 or 7 cm under the present conditions. Systematic results for the determination of shock wave energy and the efficiency for shock production in air over a range of pressures, wire diameters, and stored electrical energy are presented. Relative to optical methods used in the same problem the present technique is more sensitive and perhaps more precise. It is remarkable that very good reflections are still consistently obtained when the shock Mach number falls below 3 in air. From the calculated temperature and ionization in the shock front, the expected electron density should then be negligible. This effect is probably a result of the pre-excitation of the gas ahead of the shock front, caused by ultraviolet radiation from the wire explosion or from the advancing shock front itself. There is also a relatively weak precursor, for which recent microwave absorption measurements have indicated electron densities of the order of 1E11/cu. cm. several cm. ahead of the front. The good reflection at low Mach numbers permits one to show that the similarity theory is still valid until Mach number 4 or below. 9 Refs.
Primary Keywords: Exploding Wire; Shock Wave; Low Mach Numbers; Comparison With Optical Technique; Pre-excitation; Precursor Ionization

5206
(SWITCHES, OPENING)
(Explosive Fuses)
PRECURSOR ELECTRONS AHEAD OF CYLINDRICAL SHOCK WAVES
D.L. Jones
National Bureau of Standards, Boulder, CO 80302
The Physics Of Fluids, Vol.5, No. 9 pp 1121-1122 (09/1962).
Microwave absorption techniques are used to study the ionization ahead of cylindrical shock waves produced by exploding wires. Before the front of the shock waves reaches the microwave beam, significant ionization occurs in the area. Possible explanations are discussed. The tests were done using a copper wire in air, argon, nitrogen, and helium. 8 Refs.
Primary Keywords: Exploding Wires; Plasma Radiation; Cylindrical Shock Wave; Gas Pressure

5207
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
LASER TRIGGERED SPARK GAP USING FIBER OPTIC TRANSMISSION
H.C. Harjes
Texas Tech University, Lubbock, TX 79409
LLL Report No. UCRL 15202 (12/1979).
Availability: UCRL 15202
NTIS
The use of an optical fiber in a laser triggering system is described. The fiber transmits a high power ruby laser pulse which triggers a high voltage spark gap. The spark gap is a gas switch on a water dielectric Blumlein generator which is pulse charged by a three stage Marx bank. Typical operating parameters for the spark gap are: 2 cm gap, 2700 Torr pressure, Ar-N/sub 2/ gas mixture, and a charging voltage of 200 kV. The single strand, 1 mm, quartz, optical fiber is selected specifically for high power transmission capability. Laser pulses of 4 MW are coupled into and transmitted by the fiber with no observed damage. The overall optical system transmission efficiency is 62%. The triggering performance of the system is excellent in that switching delays of less than 10 ns and subnanosecond jitters are measured. 11 Refs.
Primary Keywords: Laser Triggering; Fiber Optic; Ruby Laser; Low Jitter

5248
(PARTICLE BEAMS)
(Reviews)
DEVELOPMENTS IN SANDIA LABORATORIES PARTICLE BEAM FUSION PROGRAM
G. Yonas and The Sandia Laboratories Particle Beam Fusion Group
Sandia Labs, Albuquerque, NM 87115
Seventh International Conference On Plasma Physics And Controlled Nuclear Fusion Research (08/1978).
An overview of work being done by the Sandia Labs particle beam fusion group is presented. Developments in the areas of light ion drivers and targets specifically tailored for that type of beam are described. Overall requirments for the reactor itself are examined. 21 Refs.
Primary Keywords: High Energy; High Current; High Power
Secondary Keywords: Fusion Reactor; Fusion Targets
COPYRIGHT: ???????????

5233
(BREAKDOWN STUDIES)
(Partial Discharges)
AN INFORMATIVE METHOD FOR RECORDING PARTIAL DISCHARGES IN INSULATING MATERIALS
R.G. Johnson and S.J. Tibbetts
Honeywell Corporate Research Center, Bloomington, MN 55420
The Review Of Scientific Instruments, Vol. 44, No. 4, pp 519-520 (04/1973).
A method of recording large numbers of partial discharge pulses graphically as a function of specimen voltage on a linear time base is described. The conventional method, using a Lissajous figure synchronized with the specimen voltage, does not show a graphic relation between the pulse occurrence and specimen voltage, and is limited by the repetitive nature of the Lissajous figure. Examples of the discharge pulse patterns obtained with the new method are given to illustrate the versatility of the technique. The method provides useful information in the study of partial discharge characteristics and causes. 1 Refs.
Primary Keywords: Partial Discharge; Several Discharges; Automated System; Specimen Voltage Recording
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5236
(INSULATION, MATERIAL)
(Gas)
COMPRESSED GAS INSULATION IN THE MILLION-VOLT RANGE: A COMPARISON OF SF/SUB 6/ WITH N/SUB 2/ AND CO/SUB 2/
S.F. Philp
Massachusetts Institute of Technology, Cambridge, MA
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-82, No. 3, pp 356-359 (06/1963).
Maximum voltage which can be insulated between a sphere and a plane has been measured as a function of gas pressure and gap. It is found to be approximately three times higher in SF/sub 6/ than in N/sub 2/ + CO/sub 2/, up to pressures of roughly 9 atm. For higher pressures the relative superiority of SF/sub 6/ over N/sub 2/ + CO/sub 2/ diminishes. Gradients of more than 100 MV/m were insulated on a 19-mm-diameter electrode in 20 atm of SF/sub 6/. 26 Refs.
Primary Keywords: Sphere-plane Gap; Several Gases; Variable Gas Pressure; Variable Gap Spacing
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5249
(INSULATION, MATERIAL)
(Gas)
FLUOROCARBON GASES
J.T. Milek
Hughes Aircraft Co, Culver City, CA 90230
Data sheets No. ds-142, 2p (11/1964).
Availability: AD-608 897
NTIS
A compilation of the electrical properties of various halocarbon or halogenated hydrocarbons known as Freons, Genetrons, Arctons, etc., is presented. A master iden tification chart relating the tradenames and numbers to the chemical name is included for easy reference. Detailed electrical properties include Corona effects, dielectric constant, dielectric strength and dissipation factor. Each property is compiled over the widest possible range of pressure, temperature, electrode geometry effects and types of electrodes from references obtained in a thorough literature search. Physical and chemical property data are also included as well as electrical and electronic applications. (Author)
Primary Keywords: HALOGENATED HYDROCARBONS_ELECTRICAL PROPERTIES; FLUORINE COMPOUNDS_ELECTRICAL PROPERTIES; ELECTRICAL PROPERTIES_HALOGENATED HYDROCARBONS; GASES; DIELECTRICS; FLUOROCHLORIDES; BROMINE COMPOUNDS; FLUORIDES; ALIPHATIC COMPOUNDS; ELECTRICAL CORONA. DATA
Secondary Keywords: FLUOROCARBONS

5255
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
INVESTIGATION OF A LASER TRIGGERED SPARK GAP
W.K. Pendleton (1) and A.H. Guenther (2)
(1) AFIT, Wright-Patterson AFB, OH
(2) AFWL, Kirtland AFB, NM 87117
The Review Of Scientific Instruments, Vol 36, No. 11, pp 1546-1550 (11/1965).
The influence of parameters affecting the laser triggering of a high voltage electrical sphere-sphere gap has been experimentally investigated. Of primary interest was the delay time between arrival of the laser pulse and current flow across the gap. This delay was studied as a function of total laser beam power (0-80 MW); dielectric gas (SF/sub 6/, N/sub 2/, air); gas pressure (100-1400 Torr); electrode spacing (0.4-1.5 cm); gap electric field (10-100 kV/cm); and focus point location between two 5 cm diam. stainless steel spheres. Delay times less than 10 nsec were observed in SF/sub 6/ at atmospheric pressure with corresponding low jitter. For the cases studied delay times varied inversely with the electric field, gas pressure, and focus point distance from the anode surface. Above a certain laser beam power the delay time was not a significant function of laser power for the range studied. Applications of laser triggering are discussed with a description of current and future research areas. 12 Refs
Primary Keywords: Delay Measurement; Sphere-sphere Gap; Several Gases, Variable Pressure; Variable Spacing; Variable Voltage
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5260
NANOSECOND SWITCH DEVELOPMENT
J.M. Proud and P. Felsenthal
Space Sciences Inc, Waltham, MA
Technical rept. 1 Jun 64-1 Apr 65 No. SSI-229-FR, 156p (11/1965).
Availability: AD-474 653/3ST
NTIS
A program to develop a switch or switch technique suitable for use in a stripline voltage multiplication circuit is reported. Switch requirements include rise time and jitter of less than 5 nsec, inductance in the low nanohenry range, as well as simplicity, reliability and ease of maintenance. Two major tasks were the design and development of a high pressure gas switch aimed at meeting the above requirements and the obtaining of sufficient fundamental breakdown data in liquid and solid dielectrics to show their feasibility as a nanosecond switching medium. A comprehensive switch literature search and the bibliography included here show that no existing switches meet program requirements. (Author)
Primary Keywords: Pressure Switches_Electric Switches; Dielectric Films; Dielectrics; Solids; Liquids; Pulse Generators; Gas Discharges; Electric Discharges; Reliability(Electronics); Abstracts; Halogenated Hydrocarbons; Halocarbon Plastics; Hydrocarbons
Secondary Keywords: Nanosecond Switch; Stripline Circuits; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

5277
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Electrical; Liquid Gaps, Electrical)
THE ADVANCED DEVELOPMENT OF WATER TRIGATRON AND THREE-ELECTRODE SULFUR HEXAFLUORIDE SWITCHES
T. Fleischman and I. Smith
Physic International Co, San Leandro, CA 94577
Physics International Report No. PIFR-114 (01/1970).
Availability: AD 707407
NTIS
In this report, the performances of a water trigatron and a field distortion gas gap are compared. Voltage of interest ranged from 300 kV to 1 MV with jitters of 1 ns or less desirable. The gas switch is an SF/sub 6/ filled spark gap with both a knife edge and fine wire used as a trigger. Since the switch was designed to operate in a water filled line, the water trigatron was at first thought to provide the most promise, but subsequent tests proved that the gas switch had much less delay and jitter. The design philosophy is analyzed for each switch with several design tips presented. 0 Refs.
Primary Keywords: Water Trigatron; SF/sub 6/ Field Distortion Gap; Performance Tests; Design Considerations; Transmission Line

5294
(BREAKDOWN STUDIES)
(Gas, Optical)
IONIZATION EFFECTS IN A HYDRODYNAMIC MODEL OF RADIATION-DRIVEN BREAKDOWN WAVE PROPAGATION
M.H. Key
Queen's University of Belfast
Journal Of Physics B :Atom. Molec. Phys., Ser. 2, Vol. 2, pp 544-550 (05/1969).
An extension of the hydrodynamic theory of radiation-driven breakdown wave propagation is described in which ionization is treated explicitly in the conservation equations. A cubic equation relating the instanteneous velocity to the absorbed laser flux density is obtained. This reduces to the result obtained by Ramsden and Savic in 1964 and Raizer in 1965 if ionization energies are neglected. Calculated results from the present theory are compared with those obtained by neglecting ionization. For the regime of interest in laser-induced breakdown of gases, the effects of ionization are seen to be significant. 10 Refs.
Primary Keywords: Laser Driven Breakdown; Breakdown Wave; Theory; Hydrodynamic Theory; Conservation Equation; Breakdown Wave vs Laser Flux Relationship
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5295
(PULSE GENERATORS; SWITCHES, CLOSING)
(Line Type: Gas Gaps, Electrical)
MULTIMEGAVOLT MODULATOR STUDY
J.J. Moriarty, H.I. Milde and J.E. Nipple
Ion Physics Corp, Burlington, MA 01803
Final technical rept. 6 Mar 69-4 Mar 70 (08/1970).
Availability: AD-873 259/6ST
NTIS
Energy storage and switching systems related to modulator operation at voltages in excess of one million volts are discussed. Two basic switch-closure schemes are treated in detail: the trigatron and the laser-triggered switch. Experimental determinations of multimegavolt switching range and spark gap erosion are described. Test results are presented for a high voltage pulse generator which can be controlled from ground potential by means of optical telemetry. A 1-MV prototype of a high average power, high voltage power supply developed at the High Voltage Engineering Corporation is described. (Author)
Primary Keywords: Modulators_Pulse Generators; Electronic Switches; Trigger Circuits; Lasers; Radar Equipment; Voltage; Power Supplies
Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

5297
(BREAKDOWN STUDIES)
(Gas, Electrical)
PHOTOGRAPHIC AND OSCILLOGRAPHIC INVESTIGATIONS OF SPARK DISCHARGES IN HYDROGEN
A.A. Doran and J. Meyer
University of New England, Armidale, NSW, Australia
British Journal Of Applied Physics, Vol. 18, pp 793-799 (06/1967).
The development of spark discharges in near-uniform fields under low over-voltage has been studied with nanosecond resolution using image converter and intensifier techniques. The results indicate three main phases in the development of the discharge from the time of initiation by the Townsend mechanism up to the stage where complete voltage collapse across the gap is achieved. First, a quasi-stable glow-like discharge is built up, then a thin filament progresses from the anode to the cathode-fall region. Finally, a luminous region moves quickly from cathode to anode, leaving behind the highly conducting spark channel. 5 Refs.
Primary Keywords: Hydrogen Breakdown; Near-uniform Field; Small Overvoltage; Three Breakdown Phases; Glow Region; Filament; Spark Channel
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5318
PICOSECOND RISETIME SWITCH STUDY
J.M. Proud and H.J. Huber
Ikor Inc, Burlington, MA
Final rept. (08/1967).
Availability: AD-820 141/8ST
NTIS
This effort is part of a program aimed at utilizing nanosecond pulses to provide superior range resolution in long range radar. The generation of nanosecond pulses requires switches with picosecond risetime and jitter capabilities. The objective of this program was to develop the necessary switching techniques in the picosecond time domain. Apparatus and a measurement technique have been developed and applied to high voltage spark gap switching times in the 10 to the minus 11th power sec time domain. The investigation has included study of electrode material and surface condition leading to ultra-fast closure times in highly over-volted gaps brought about by enhanced high field electron emission. Closure times of 50 psec or less have been achieved. Ultraviolet triggering of overvolted gaps has been observed with jitter as low as 25 psec.
Primary Keywords: Electronic Switches_Sparks; Pulse Generators_Electronic Switches; Radar Pulses_Pulse Generators; Gas Discharges; Ultraviolet Radiation; Electrodes
Secondary Keywords: Nanosecond Pulses; Picosecond Rise Time Switches; Rise Time; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

5324
(ENERGY STORAGE, INDUCTIVE)
(Systems)
THEORETICAL AND EXPERIMENTAL STUDY OF SUPERCONDUCTING INDUCTIVE STORAGE SYSTEMS
O.K. Mawardi, D. Hazony, H.K. Chung and L.D. Holland
Case Western Reserve University, Cleveland, OH 44106
AFOSR Report No. AFOSR-76-2886 (10/1978).
Availability: AD A062078
NTIS
This report covers a two year effort to develop efficient pulse inductive storage sources. Two schemes have been considered in detail. One scheme is based on the electromagnetic duel of the classic Marx generator. In the other scheme a pulse shaping circuit has been used to improve the energy transfer from the storage to the load. In the process of these investigations two types of flux pumps have been investigated. These superconducting devices are ideal to provide the charging current to the inductors. Fast acting pumps were designed and built. Their response is several orders of magnitude better than is currently available. 28 Refs.
Primary Keywords: Inductive Storage; Pulsed; Flux Pump; Shaping Circuit

5325
(PARTICLE BEAMS, ELECTRON)
(Target Interactions)
CHARGING DIELECTRICS WITH A BEAM OF CHARGED PARTICLES
A.A. Vorob'yev, O.B. Yevdokimov and V.N. Gusel'nikov
FTD Reprot No. FTD-ID(RS)T-1448-77 (08/1977).
Trans. From: Radiatsionnaya Fizika Nemetallicheskikh Kristallov 3, 131-138 (1971) By M.C. Reynolds
Availability: FTD-ID(RS)T-1448-77
NTIS
This paper discusses the possibility of charging dielectrics with an electron or radiation beam. The authors consider theoretically the two basic aspects of charge deposition in dielectrics: 1) transport, moderation and thermalization of electrons with the creation of volume charge, and 2) drift, capture, and neutralization of thermal electrons. The authors go on to analyze the most likely conditions for charge buildup and show that this buildup is heavily dependent on beam current. The characteristics of the discharge after completion of the charging process is also considered. 5 Refs.
Primary Keywords: Fast Electron Beam; Gamma Ray Beam; Theory; Dependence On Beam Current; Spallation

5326
(BREAKDOWN STUDIES; PARTICLE BEAMS, NEUTRAL)
(Gas, Electrical; Generation)
CROSS SECTIONS FOR CHARGE TRANSFER COLLISIONS INVOLVING HYDROGEN ATOMS
Y. Kaneko, T. Arikawa, Y. Itikawa, T. Iwai and T. Kato
Nagoya University, Nagoya, Japan
No. IPPJ-AM-15, 186p (10/1980).
Availability: N81-14847/0
NTIS
Experimental data on the cross section for H + X sup qt yields H(+) + X sup (q-1)+ are compiled for any element X and charge state q. The result is shown in graphs as a function of collision energy. A scaling law for the cross section is derived theoretically to provide quantitative information for highly-stripped ions for which no data are available. Cross sections for some related processes are also shown.
Primary Keywords: Charge Exchange; Collision Parameters; Hydrogen Atoms; Plasmas (Physics); Scattering Cross Sections; Excitation; Graphs (Charts); Ion Density (Concentration); Ion Temperature; Nuclear Fusion; Scaling Laws
Secondary Keywords: Foreign Technology; NTISNASAE; NTISFNJA

5328
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)
ELECTRODE MATERIAL RELEASE DURING HIGH VOLTAGE BREAKDOWN
R.T. Schneider, T.B. McCall III and M.G. Lohnert
University of Florida, Gainesville, FL
NASA Report No. NASA CR-107880 (01/1969).
Availability: N70-17442
NTIS
This report begins with a comprehensive survey of the available literature in the areas of vacuum breakdown and electrode erosion. After pointing out some of the deficiencies and strong points of the existing work, the authors proceed to describe an experiment to measure the eroded electrode mass per shot and to ascertain what happens to this eroded mass. The diagnostics used were neutron activation and gamma ray spectromentry. Several erosion patterns are exhibited, along with pictures of typical breakdowns. An analysis is also given for the fate of the material ejected from the electrodes. 99 Refs.
Primary Keywords: Vacuum Breakdown; Prebreakdown; Polarity Effects; Material Release; Aluminum Electrode; Copper Electrode

5329
(PARTICLE BEAMS; POWER CONDITIONING; SWITCHES, CLOSING; SWITCHES, OPENING)
(Reviews; Pulse Forming Lines; Gas Gaps; Optical; Explosive Fuses)
PARTICLE BEAM FUSION PROGRESS REPORT JANUARY 1980 THROUGH JUNE 1980
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND80-2500 (05/1981).
Availability: SAND80-2500
NTIS
This report provides an overview of the particle beam fusion effort at Sandia Laboratories for the period of January-June 1980. Sections on vacuum ion diodes, analysis of magnetically insulated convolutes, Marx generator development, laser and X-ray triggering of spark gaps, opening switches, and power flow studies are included, as well as sections on plasma diagnostics and fusion target design and analysis. Rep-rated systems are briefly presented. 189 Refs.
Primary Keywords: PBFA; Proto; Ion Beam; Marx Generator; Magnetic Insulation; Spark Gap; Intrepid Opening Switch; Power Flow; Resonant Transformer; Rep-rated
Secondary Keywords: Particle Beam Fusion; Fusion Target; Plasma Diagnostics

5331
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
CAPACITORS FOR AIRCRAFT HIGH POWER (FINAL REPORT)
R.D. Parker
Hughes Aircraft Co, Culver City, CA 90230
AFWAL Report No. AFWAL-TR-80-2037 (04/1980).
Availability: AD A087427
NTIS
This report describes an experimental exploratory development program conducted by Hughes Aircraft Company to develop reliable light-weight pulse discharge capacitors for airborne application. The specific duty was a 1 min. burst every 2 hrs., and both low (50 pps) and high (300 pps) repetition rate service was to be considered. The energy density goals were 400 to 1100 J/kg with a 20 microsec. capacitor pulse width. A five layer polysulfone/kraft paper dielectric was selected for high rate service, while polyvinylidene flouride/kraft paper was chosen for the low rate service. Both mineral oil and dioctylphtalate fluids were used. A highly-instrumented test bay accurately simulated a PFN envirement and allowed detailed and accurate testing.Three types of complete capacitors were built, all for high rate service. 0 Refs.
Primary Keywords: Capacitors; Pulse Discharge; Pulsed Capacitors; Pulse Power
Secondary Keywords: Pulse Forming Networks; Energy Storage; Dielectric Systems

5332
(ENERGY STORAGE, CHEMICAL; PULSE GENERATORS)
(Flux Compression Generators; Flux Compression)
AN INTRODUCTION TO EXPLOSIVE MAGNETIC FLUX COMPRESSION GENERATORS
C.M. Fowler, R.S. Caird and W.B. Garn
Los Alamos National Labs, Los Alamos, NM 87545
LASL Report No. LA 5890-MS (02/1975).
Availability: LA-5890-MS
LASL
Various types of explosive flux compression generators are illustrated and their relative advantages are compared. Experiments are described in which energy was supplied by these generators. The experiments were selected to show both versatility and limitations of the devices. Generator principles are derived from lumped parameter circuit theory. 15 Refs.

5333
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Surface Flashover; Solid)
CONTAMINATION EFFECTS ON HVDC INSULATOR FLASHOVER
T. C. Cheng
University of Southern California, Los Angeles, CA 90007
EPRI Report No. EPRI EL-1203 (11/1979).
Availability: EPRI EL-1203
EPRI
An integrated field and laboratory study was conducted to investigate the mechanism of flashover of contaminated insulators under HVDC conditions. The field testing rack, construction at the Sylmar Converter Station, is directly energized by the Pacific HVDC Intertie. Salient factors identified in the field studies were reproduced under simulated conditions in the laboratory for in-depth studies. Effects of each factor were studied one at a time using a highly controllable laboratory testing procedure. Newly discovered phenomena which occur during the flashover process such as formation of clean zones and the deleterious effect of nitrates on insulating materials, were observed. Theories were formulated to explain the mechanisms involved in these phenomena. Electrochemical properties of contaminants and their effects on flashover process were examined. The relationship between single-component salts and multi-component salts was investigated. Experiments on corona intiation on a contaminated insulator were performed. 5 Refs.
Primary Keywords: Insulators; Contamination; HVDC Flashover
Secondary Keywords: HVDC Transmission

5334
(PARTICLE BEAMS, NEUTRAL; PARTICLE BEAMS, NEUTRAL; PARTICLE BEAMS, NEUTRAL)
(Generation; Transport; Target Interactions)
FIELD-REVERSED MIRROR PILOT REACTOR
Authors Unknown (1), Authors Unknown (2) and Authors Unknown (3)
(1) Lawrence Livermore Lab, Livermore, CA 94550
(2) General Atomic Co, San Diego, CA 92121
(3) Pacific Gas And Electric Co., San Francisco, CA 94105
ERPI Report No. EPRI AP-1544 (09/1980).
Availability: EPRI AP-1544
EPRI
This report concludes a two-year effort to design a near-term small-scale fusion power plant which, through its construction and operation, would be a direct and important step toward the commercialization of fusion energy. The fusion reactor pilot plant was designed under the ground rules that it must produce net power, be compact, have minimum total cost, and use near-term (late 1980's) engineering technology. The neutral beam driven, field-reversed mirror (FRM) was selected as the fusion plasma confinement concept around which the pilot plant was designed. Although the physics data base for this design is not yet well in hand, it is being pursued within the magnetic field-reversal framework of the U.S. Mirror Fusion Program. Depending onthe plasma size, the pilot plant would gross up to 19.8 MW(e) and would produce up to 10.7 MW(e) net, with the recirculated power used principally for the neutral beam injectors and refrigeration for the superconducting magnets. 106 Refs.
Primary Keywords: Deuterium Beam; 11 A, 0.2 MeV Beam; Parallel Beamlines; Penning Source; Minimum-B Magnetic Well; Ioffe Bars; Superconducting Magnet
Secondary Keywords: Reactor Design; Tritium Handling; Cryogenic System

5335
(BREAKDOWN STUDIES)
(Gas, Electrical)
STUDY OF ARC BY-PRODUCTS IN GAS-INSULATED EQUIPMENT
Authors Unknown
Gould Inc, Greensburg, PA 15601
EPRI Report No. EPRI EL-1646 (12/1980).
Availability: EPRI EL-1646
EPRI
The project objective was to develop a chemical data base for sulfurhexaflouride, SF/sub 6/ decomposition products as generated by electrical discharges within gas-insulated equipment to serve as a basis for unified handling procedures of faulted SF/sub 6/ equipment and disposal of the arc products. An analysis capability was to be developed that could be used by utilities for incipient and actual fault analysis on SF/sub 6/ insulated power equipment. Arced SF/sub 6/ gas and solid samples were generated in test devices which simulate SF/sub 6/ circuit breakers or SF/sub 6/ insulated bus. Actual production hardware and procedures were used for assembly of the test devices. Fault arc currents ranged between 15 kA and 50 kA. Arced SF/sub 6/ samples were obtained and shipped in stainless steel cylinders. Gaseous arc products were analyzed with a combination of gas chromatography-mass spectrometry. The attained sensitivity is 100 ppm. The major SF/sub 6/ arc products are SOF/sub 2/ and CF/sub 4/. The amount increases with arc energy. SFO/sub 2/ can effectively be removed by absorber-scrubbers containing soda-lime, activated alumina and molecular sieves. 8 Refs.
Primary Keywords: Sulfurhexaflouride Gas; Gas-Insulated Equipment; Arcing In Sulfurhexaflouride; Arc By-Products; Faults In Gas-Insulated Equipment

5336
(PULSE GENERATORS)
(Capacitive)
A PULSED CURRENT SOURCE WITH ENERGY RECUPERATION
G.I. Kugushev and M.D. Sukhachev
Instruments And Experimental Techniques, Vol. 17, No. 3, pp 740-741 (06/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 102-103 (May-June 1974)
A pulsed power supply of a magnetic lens having recuperation of energy of the magnetic field of the lens into the storage capacitor is described. Stabilization of the charge of the storage capacitor is achieved by cutting off the charging current. The described principle of designing the source ensures a high rate of charging the storage capacitor for high voltage stability of at worst 0.01%; this allows an amplitude stability of the current in the load to be obtained which does not exceed 0.03% at a cycling frequency down to 2 Hz. 3 Refs.
Primary Keywords: Energy Recuperation; Thyristor; Inductive Load; Conservation Of Energy; Charging Circuit; Rep-rated; Low Voltage; Low Current
Secondary Keywords: Magnetic Lens

5337
(POWER CONDITIONING)
(Pulse Transformers)
AIRCORE PULSE TRANSFORMERS FOR HIGHPOWER LASERS
G.J. Rohwein
Sandia Labs, *Albuquerque*, NM 87115
Laser Focus pp. 70-74 (01/1980).
Aircore pulse transformers are proposed as alternative to Marx Generators as power sources for highpower lasers. The advantages and disadvantages in using the aircore transformers are discussed. A comparison of two types of aircore transformers, the helical-wound type and the spiral-strip version, is made. 4 Refs.
Primary Keywords: Aircore Pulse Transformer; Reduced Weight; Reduced Complexity; Flux Linkage; Spiral-strip Transformer
Secondary Keywords: Laser

5338
(DIAGNOSTICS AND INSTRUMENTATION)
(Particle Beams, Electron)
THERMAL SENSITIVE PAPER AS A DIAGNOSTIC FOR INTENSE RELATIVISTIC ELECTRON BEAM DYNAMICS
R.M. Gilgenbach, D.B. McDermott and T.C. Marshall
Columbia University, New York, NY 10027
Review Of Scientific Instruments, Vol. 49, No. 8 pp 1098-1099 (08/1978).
Thermal sensitive paper has been used as a diagnostic for an intense relativistic electron beam propagating in a rippled magnetic field. The E x B rotation of the beam has been measured from the exposed pattern on the thermal paper and used to calculate the electrostatic field of the beam and the corresponding values of electron density and beam current. Exposed strips of thermal paper show longitudinal modulation of the radial electron velocity with a period corresponding to that of a rippled magnetic field; modulation of the radial electron velocity ot the cyclotron frequency has also been observed. 3 Refs.
Primary Keywords: E-beam Diagnostic; Rippled Magnetic Field; Velocity Modulation; E X B Rotation

5339
(PULSE GENERATORS; SWITCHES, CLOSING)
(LC; Thyristors)
A POWERFUL THYRISTOR MODULATOR
N.M. Gavrilov, B.M. Kozuev and A.V. Stupin
Moscow Engineering-Physics Institute, Moscow, USSR
Instruments And Experimental Techniques, Vol. 17, No 5, pp 1340-1341 (10/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 84-85 (September-October 1974)
A powerful thyristor modulator is described having the following parameters: pulse power 5 MW; length of the shaped pulse 50 to 300 microseconds; amplitude of the output voltage 120 kV; pulse repetition frequency 1 Hz. The basis of modulator operation is the principle of complete discharge of the shaping line made up of L-C sections through a matched load. The commutator is a controlled thyristor spark gap shunted by avalanche diodes. Devices of this type may be used in accelerator engineering. 4 Refs.
Primary Keywords: Thyristor; L-C Pulse Generator; Pulse Transformer, 500 A Output Current

5340
(ENERGY CONVERSION, THERMAL)
(Loads)
HIGH PULSE POWER FAILURE OF DISCRETE RESISTORS
M. Domingos (1) and DC Munsch (2)
(1) Clarkson College Of Technology, Potsdam, NY 13675
(2) AFWL, Kirtland AFB, NM 87117
IEEE Transactions On Parts, Hybrids, And Packaging, Vol. PHP-11, No. 3, pp 225-229 (09/1975).
Theoretical and experimental studies have been conducted on discrete resistors to determine the power required to cause failure as a function of pulse width over the range 1 microsecond to 10 ms. Single pulses of increasing amplitude were applied until voltage breakdown occurred, the resistor shattered, or until a resistance change of 5% or more took place. Carbon composition (both slug and film type), wire-wound (both precision and power type) and film resistors were tested. Computer calculations, temperature cycling tests, and field plots were utilized to interpret the results. 2 Refs.
Primary Keywords: Carbon Resistor; Wire-wound Resistor; Film Resistor; 1 Microsecond-10 Millisecond Pulse Width; Component Destruction

5343
(PULSE GENERATORS)
(Systems)
MULTIPLE-CIRCUIT PULSE GENERATOR FOR HIGH REPETITION RATE RARE GAS HALIDE LASERS
C.P. Wang
The Ivan A. Getting Labs, El Segundo, CA 90245
The Review Of Scientific Instruments, Vol. 49, No. 10, pp 1399-1400 (10/1978).
A multiple-circuit high pulse repetition frequency (PRF) pulse generator for the pumping of rare gas halide lasers is reported. With this multiple-circuit design, high PRF can be achieved by the use of existing low PRF thyratron switches and capacitors. A two-circuit pulse generator was constructed, and its performance is described. By means of this pulse generator and a blowdown-type fast transverse-flow system, high PRF laser action in XeF was obtained, typically, 6 mJ/pulse at 1 kHz or 6 W average power. High PRF laser action in N/sub 2/ was also observed. 12 Refs.
Primary Keywords: Modular Pulse Generator; Low Rep-rate Modules; High Rep-rate System; Capacitive Discharge Circuit

5344
(PULSE GENERATORS)
(Line Type)
COMPACT MEGAWATT AVERAGE POWER BURST PULSE GENERATOR
J.E. Creedon, J. McGowan, A.J. Buffa and S. Schneider
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1500-1502 (10/1979).
A compact, lightweight, burst mode pulse generator has been designed and evaluated at a megawatt of average power. The modulator occupies a volume of 0.81 cu m and weighs 225 kg. The recently developed MAP5-40 thyratron and two high-energy density pulse-forming networks (PFN) are used as the switch and energy store. A solid-state end-of-line clipper circuit is included and was found to be essential at high average power loadings. The modulator has been evaluated using a copper sulphate load at 40-kV peak voltage, 40-ka peak current, 10-microsacond pulse width, 40-kA/microsecond current rise, and 50 A of average curent at a repetition rate of 125 Hz. Repeated burst on times of 5 s in a 35-s time period have been demonstrated. 4 Refs.
Primary Keywords: High Average Power; Modular Design; Rep-rated; Hydrogen Thyratron; Design Considerations; Small Size

5345
(PULSE GENERATORS)
(Hard-tube)
A BROADBAND PULSE POWER AMPLIFIER
V.D. Dvornikov, S.T. Latushkin and L.I. Yudin
Atomic Energy Institute, Moscow, USSR
Instruments And Experimental Techniques, No. 2, pp 373-375 (04/1969).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 97-99 (March-April 1969)
A circuit is given for a pulse amplifier-shaper that guarantees amplification from 3-5 V to 3 kV with an output current of approximately 20 A in a pulse having a duration of approximately 1 msec. The edges of the output pulse have a duration of 15 to 20 nsec. The amplifier is designed using secondary-emission tubes. The 'GI-30' output tubes guarantee a pulse power of more than 50 kW. 2 Refs.
Primary Keywords: Pulse Amplifier; 5 V Input; 3 kV Output; Fired Pulse Shape; Secondary Emission Tube; Carrier Pulses

5346
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas Gaps, Electrical; Gas Gaps, Magnetic Field)
A REPETITIVELY OPERABLE, HIGH-CURRENT INTERRUPTER
R.F. Ceristi and D.V. Turnquist
EG&G Inc, Salem, MA 01970
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1482-1490 (10/1981).
A series of fast-acting and repetitively operable bimodal gas discharge switches capable of both the initiation and the interruption of high pulse currents at high-voltage levels has been designed, built, and tested. Based on hydrogen thyratron technology, these switches retain most of the characteristics of thyratrons when switching from the open to the closed state. In addition, the interruption of high currents against high source voltages is achieved when an externally generated, pulsed magnetic field is transversely applied to the current by means of a plasma-field interaction region built into the device. The interruption process is rapid (typically requiring less than 10 microseconds), complete (current reduced to zero), and permanent (the current in the device does not restrike even when the field pulse terminates). In general, operation at lower voltages allows the interruption of higher currents for a given magnetic field energy. Typical data are the interruption of 1000 A against 15 kV with a field energy of 8 J, and 100 A against 50 kV with a field energy of 33 J. The theory, design, and construction of such switches are described, and the results of various parametric studies are discussed. 22 Refs.
Primary Keywords: Thyratron-like Operation; Bimodal Gas Discharge; Pulsed Magnetic Field; Design Considerations

5350
(SWITCHES, CLOSING)
(Thyratrons)
DOUBLE-ENDED THYRATRONS IN HIGH-POWER BURST MODE PULSE MODULATOR APPLICATIONS

R.B. Molyneux-Berry
GEC Marconi Research Lags, Essex, UK
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1451-1455 (10/1979).

The use of four-gap double-ended thyratrons in a 30- to 100-microsecond pulse modulator is described. The PFN-type modulator operates at 105 kV peak, charged from the 11 kV public supply, and powers an ill-matched and potentially unreliable load directly at 30 to 70 kV without a pulse transformer. The maximum repitition rate is 200 pps. The completed modulator has been delivered to the customer and successfully recommissioned. Satisfactory operation is reported with 200-MW, 6-kJ pulses in bursts of average power up to 400 kW; this is well in excess of the published ratings of the tubes employed. The methods used to obtain this performance are discussed and the main details are given of pulse discharge, energy dump, and switched charge circuits appropriate to the thyratrons used. The possibility of uprating the modulator is mentioned, and certain recent developments in large thyratrons are discussed. These include a new pentode-type electrode system which should give improved performance with simpler deck circuitry. For extended bursts at long pulse lengths the realistic maximum capability of single tubes in current production seems to be about 1-GW peak at 2-MW average power. 5 Refs.
Primary Keywords: Multigap Thyratron; Pulse Forming Network; Thyratron Systems; Reverse Current Circuit

5355
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A NON-DESTRUCTIVE ACOUSTIC ELECTRIC FIELD PROBE

A. Migliori and J.D. Thompson
Los Alamos National Labs, Los Alamos, NM 87545
Journal Of Applied Physics, Vol. 51, No. 1 pp 479-485 (01/1980).

A new method is described for the non-destructive measurement of electric field and space charge distributions inside solid or liquid insulators by using a non-structured acoustic pulse. The integral equation is derived for the response of the dielectric during propagation of an acoustic pulse and some acoustic measurements of electric fields and space charge inside transformer oil and polymethylmethacrylate plastic are described. 7 Refs.
Primary Keywords: Electric Field Measurement; Space Charge Measurement; Bulk Dielectric; Acoustic Wave

5357
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Vacuum Gaps, Self; Vacuum, Electrical)
CURRENT GROWTH IN PULSE BREAKDOWN OF A SHORT VACUUM GAP

G.A. Mesyats and D.I. Proskurovskii
Soviet Physics Journal, Vol. 11, No. 1, pp 49-51 (01/1968).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii. Fizika 11, 81-85 (1968)

The rise time of the current in breakdown of short (up to 1 mm) vacuum gaps is related to the voltage and gap length; this has been examined by initiation involving heating the anode by field-emission current from the cathode. However, optical studies show that the cathode plays the leading part in initiation and current growth. Bright spots appear at the cathode at the start of the monotonic increase in current, and expand toward the anode at about 2E6 cm/sec. The current and the light intensity increase as the spots spread toward the anode, the current reaching a maximum at the anode. 8 Refs.
Primary Keywords: Vacuum Gap; Millimeter Gap; Delay Measurement; Rise Time Measurement; Optical Measurement; Variable Voltage; Variable Gap Spacing

5359
(DIAGNOSTICS AND INSTRUMENTATION)
(Component Testing)
THE DAMAGE SUSCEPTIBILITY OF INTEGRATED CIRCUITS TO A SIMULATED IEMP TRANSIENT

W.L. Vault
Harry Diamond Labs, Washington, DC 20438
IEEE Transactions On Nuclear Science, Vol. NS-20, No. 6, pp 40-47 (12/1973).

Recent investigations have been directed toward gaining insight into the effect of electrical pulse overstressing in integrated circuits, especially simple gates and bipolar LSI arrays. In order to determine the effect of ionizing radiation on the pulse-power failure susceptibility levels of small scale, monolithic, junction-isolated integrated circuits (simple gates), an experimental study was undertaken such that device failures could be induced in a simulated EMP or IEMP environment. The device types investigated included low and high power, quadruple, dual-input, positive NAND TTL gates. Permanent damage levels for these devices were determined for both positive and negative polarity sub-microsecond pulses, introduced into the input, output and bias terminals of active devices, some of which were simultaneously irradiated by gamma radiation. The failure susceptibility level of a device was found to depend uniquely upon the ionizing radiation, the device terminal subjected to the electrical stress pulse, and the polarity of the pulse. The data for device failures in the simulated EMP environment agree with the existing thermal-failure models characterized by P = At/sup m/, where P is the power required to induce failure and t is the time to failure. In a radiation environment it was observed that initial ionization tends to reduce the magnitude of the constant A and shifts the time to failure t from the constant-energy regime (m = -1) to another. 13 Refs.
Primary Keywords: Digital Integrated Circuits; Bipolar Logic; Ionizing Radiation; Comparison With Thermal-failure Model

5360
(SWITCHES, CLOSING)
(Thyratrons)
THE MAPS-40 BURST-MODE 40-KV MEGAWATT AVERAGE POWER HYDROGEN THYRATRON

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(1) EG&G Inc, Salem, MA 01970
(2) ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1438-1443 (10/1979).

A hydrogen thyratron capable of switching 40 kV and 40 kA in repetitive bursts at the 1-MW average power level is described. Major design problems were obtaining the necessary forward and inverse holdoff capability and controlling the thermal and mechanical effects of the several kilowatts of operating dissipation encountered at this power level. A conventional external anode, planar-electrode, ceramic-metal tube design was chosen to meet the design requirements, which include reliable, kickout-free operation following long periods of standby. Emission was provided by a large cathode specifically designed to handle ohmic heating due to the 1500 A of rms-equivalent pulse current, as well as the heat developed in the surrounding plasma. Massive auxiliary, control, and gradient grids were incorporated into a tightly baffled box-type grid structure of sufficient total aperture area to prevent quenching below 70-80 kA. Molybdenum wall shielding was employed to improve holdoff capability and prevent arc damage. Design and operating considerations are discussed and representative test results for the first 16 tubes are given, together with the results of special tests for high peak current, high average current, and high-voltage holdoff. 13 Refs.
Primary Keywords: MAPS-40 Thyratron; Ceramic Thyratron; High Average Power; Rep-rated; Design Considerations

5362
(SWITCHES, CLOSING)
(Thyratrons)
THE PLASMA-HEATED THYRATRON

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(1) EG&G Inc, Salem, MA 01970
(2) 10 Eliot Rd., Lexington, Ma 02173
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1444-1450 (10/1979).

An instant-starting hydrogen thyratron is described which incorporates a cathode requiring no warmup time, no standby power, and no separate heater power supply. Starting cold, time jitter is less than 1 ns; anode delay time is less than 200 ns; and the 0-30 s anode delay time drift is less than 100 ns. The cathode is a self-heating design made of impregnated tungsten. Even when cold, it provides sufficient emission capability to trigger readily and to prevent arcing. During operation, it attains full operating temperature via plasma-heating effects and its own resistive dissipation; after shutdown, it remains active, in readiness for the next cold start, a cycle which can be repeated as often as desired. Thyratrons made with the new cathode display operating behavior and life compatible to conventional hydrogen thyratrons of equivalent size. 4 Refs.
Primary Keywords: Instant-start Thyratron; Tungsten Cathode; Plasma Heating; Cathode Dissipation Heating; Long Life

5380
(SWITCHES, CLOSING)
(Thyratrons)
100-KV HYDROGEN THYRATRON WITHOUT GRADIENT GRIDS

L. Mancebo
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Electron Devices, Vol. ED-18, No. 10, pp 920-924 (10/1971).

A high-power hydrogen thyratron grid-anode structre has been developed using a 5949 thyratron cathode assembly. One such device was operated for 10 h at 2000 A, 32 kV, at 1400 pps with a pulse width of 0.3 microseconds. Another was operated for periods up to 220 h at 1000 A, 100 kV, at a duty cycle of 0.00004. The duty cycle is presently limited by our test modulator circuit. Trigger requirements are 2 kV at 50 ohm with a 2.5-microsecond duration. The jitter was nil when measured with a Tektronix 517 oscilloscope using a sweep speed of 50 ns/cm. The anode delay time is in the range of 1/4 to 1/2 microns. The grid-anode geometry is designed for a minimum anode-grid capacity, thus providing a tube with a higher repetition rate capability. The field emission limit up to 100 kV is not evident in the normal sense in this geometry. 8 Refs.
Primary Keywords: Grid-anode Structure; Nanosecond Jitter; Rep-rated; Paschen's Curve

5395
(PULSE GENERATORS)
(Line Type)
HIGH-VOLTAGE NANOSECOND PULSE GENERATOR WITH COMPENSATION USING NONLINEAR COMPONENTS

V.G. Bagramov, D.V. Iremashvili, A.I. Kolesnikov and N.I. Leont'ev
Sukhumi Physiotechnical Institute, Sukhumi, USSR
Instruments And Experimental Techniques, No. 5 pp 1179-1182 (09/1969).
Trans. From: Pribory i Takhnika Eksperimenta 5, 80-82 (September-October 1969)

A generator is described which generates pulses by means of a two-stage uniform line. The steepness of the leading and trailing edges of the pulse is increased by connecting a compensating LC network with nonlinear inductance to the anode of a thyratron. Voltage pulses of 30-kV amplitude are generated with a load consisting of load resistance 50 ohm and load capacitance 150 pF. The widths of the leading edge, the top, and the trailing edge of the pulse are, respectively, 35, 70, and 40 ns. The pulse repetition frequency is 25 Hz. 4 Refs.
Primary Keywords: Pulse Generator; Pulse Shaping; Nonlinear Inductor; LC Network

5402
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)
STABILIZATION OF CHARGING VOLTAGE OF CAPACITIVE ENERGY STORAGE ELEMENTS OF HIGH-POWER PULSED DEVICES
A.M. Leonov and M.M. Ofitserov
Radiophysical Scientific Research Institute, Gorki State University, USSR
Instruments And Experimental Techniques, No. 1, pp 132-134 (02/1969).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 123-125 (January-February 1969)
A simple method of charging-voltage stabilization is described whose accuracy is not worse than +or- 0.5% for line voltage variations of +or- 10%; the method is based on the control of thyratron rectifiers. 3 Refs.
Primary Keywords: Thyratron Regulator; Larionon's Circuit; Feedback Circuit

5408
(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL)
(Flux Compression; Flux Compression Generators)
A COMPRESSED MAGNETIC FIELD GENERATOR SYSTEMS MODEL
J.E. Gover
Sandia Labs, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 402-405 (06/1979).
A model relating the volume of a compressed magnetic field generator pulsed power system to its electrical energy output is developed. This systems model includes energy density and/or power density models of the electronic components and a CMF generator model which has been confirmed experimentally for system output energies up to 5000 joules. For a given output energy there exists an optimum selection of the pulsed power components to give an overall minimum system volume. Under optimum conditions the volume of the CMF generator is equal to one-half of the overall system volume and the overall system volume increases with the one-half power of the systems output energy. In an all electronic system there is a linear relationship between volume and output energy. 6 Refs.
Primary Keywords: Flux Compression Generator; Analysis; Scaling Laws

5412
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Electrical; Gas Gaps, Materials)
CHARACTERIZATION OF HIGH POWER GAS SWITCH FAILURE MECHANISMS
E.E. Nolting
Naval Surface Weapons Center, Silver Spring, MD 20910
2nd IEEE International Pulsed Power Conference Proceedings, pp 450-453 (06/1979).
A multistage, 4 MV, low jitter, command triggered gas switch is being developed for use on large pulse power devices. Experiments to date have shown that the performance and operational life of the switch are severely limited by mechanical and electrical failure of the insulating housing. Estimates of the internal overpressure produced during switch closure have been made which indicate the severity of the blast containment problem; this information has led to the development of a mechanically stronger switch design. Surface analyses performed on both switch electrode and insulator surfaces were used to investigate observed electrical failure of the insulators. A layer of closely spaced metal particles were found imbedded in the insulator walls. 8 Refs.
Primary Keywords: Switch Failure; Very High Voltage; Insulator Failure; Surface Analysis; Metal Implantation

5413
(PULSE GENERATORS)
(Reviews)
DEVELOPMENT OF HIGH REPETITION-RATE PULSED POWER GENERATORS
R.J. Sojka and G.K. Simcox
Physic International Co, San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, Pp 217-220 (06/1979).
The design and development of high repetition-rate, (>1 kHz) pulsed power generators are discussed and a set of chosen design approaches presented. The ensuing technical approaches for the pulse forming network, PFN switching, and PFN charging modulators are described. Key elements of the system are the deionized-water, fast-energy store, and a flowing air spark gap switch, both capable of operation at higher than a 1 kHz repetition frequency. Based on this design and development effort, the technical issues of high repetition rate pulsed power systems are discussed, and recommendations are offered for further study and development of dielectrics, spark gap switches, and high power modulators. 4 Refs
Primary Keywords: Pulse Generator; Rep-rated; Design Considerations; Pulse Forming Network; Switch

5414
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Systems; Systems)
HIGH-DENSITY Z-PINCH PULSE-POWER SUPPLY SYSTEM
W.C. Nunnally, L.A. Jones and S. Singer
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 142-147 (06/1979).
The design and operation of the high-density Z-pinch experiment pulse-power supply is discussed. A 600-kV, 1-MA, 75-nH Marx bank is designed to charge a 1-ohm, 90-ns, water-insulated transmission l ne to approximately 0.6-1.0 MV. The water line is then discharged through a small laser-initiated current channel in 1-5 atm of hydrogen. The components of the Marx bank, the trigger system, the water line, and the gas load as well as the control system that uses fiber optics and air links for monitor and control are discussed. 1 Refs.
Primary Keywords: Marx Generator; Pulse Forming Line; Low Inductance, Control System; Optical Trigger
Secondary Keywords: Z-pinch

5416
(REVIEWS AND CONFERENCES)
(Reviews)
OVERVIEW OF INERTIAL CONFINEMENT FUSION
G.H. Canavan
US Dept. Of Energy, Germantown, MD 20767
2nd IEEE International Pulsed Power Conference Proceedings, pp 1 (06/1979).
Progress and plans for the U.S. program in inertial confinement fusion are reviewed with emphasis on the pulsed power aspects of pellet driver technology. The program has grown in five years from early experiments at the sub-terawatt level to construction of large facilities capable of peak power on target of about 100 TW. Driver technology options have broadened from glass and CO/sub 2/ lasers to short wavelength lasers, electron and light ion beams, and high energy heavy ion accelerators. Except for the heavy ion drivers, near term emphasis has been placed on single-shot systems to establish scientific feasibility at greatly reduced cost compared to rep-rate facilities. However, as the program develops attention must be given to components and subsystems necessary for reliable rep-rated operation. 0 Refs.
Primary Keywords: Fusion; E-beam; Ion Beam; Rep-rated
Secondary Keywords: Carbon Diozide Laser; Glass Laser; Abstract Only

5417
(PULSE GENERATORS)
(Spiral)
HIGH-VOLTAGE SPIRAL GENERATORS
A. Ramrus (1) and F. Rose (2)
(1) Maxwell Labs Inc, San Diego, CA 92123
(2) Naval Surface Weapons Center, Dahlgren, VA 22448
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-9 (11/1976).
The performance of Spiral Generators operating at high output voltage is described. Generators employing castor oil impregnation are compared to those with air insulation. Tests on oil-insulated generators with output capacitance of about 1 nF indicate their high voltage capability is up to 1 MV. Generator failure at high output voltage appears to be caused, in part, by the initial DC charge voltage, thereby limiting the allowable stored energy. Recent preliminary data suggests this limitation may be overcome by including resistive paper in the generator winding. Also discussed are switching techniques applicable to Spiral Generators or other sources requiring a low-inductance input switch. Solid-dielectric multichannel switches are found particularly suitable for Spiral Generators. 1 Refs.
Primary Keywords: Spiral Generator; High Voltage; Insulation Considerations; Triggering

5418
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
REBUILDING THE FIVE MEGAJOULE HOMOPOLAR MACHINE AT THE UNIVERSITY OF TEXAS
J.H. Gully, K.M. Tolk, R.C. Zowarka, M. Brennan, W.L. Bird, W.F. Weldon, H.G. Rylander and H.M. Woodson
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 325-329 (06/1979).
The role of the 5 MJ homopolar machine at the Center for *Electromechanics* has changed from that of a pulsed power supply experiment to that of a power supply for various experiments. Because of this change in duty, it was necessary to modify the machine to allow more efficient operation and easier connection of the machine to the load. The experimental bearings which were on the machine were replaced with bearings of a more conventional design. These bearings exhibit a high stiffness and lower loss than the original bearings, making the machine more reliable and reducing motoring time. The surface of the poles were faced to make the applied field more uniform over the face of the rotor. This reduced the magnetic moment on the rotor and reduced the side forces on the rotor during discharge. The busbars were built to lower the resistance of the output circuit and to allow quicker change of experiments. The latching mechanism of the closing switch was rebuilt for better reliability and a damper was added to lower the mechanical shock on the switch during operation. 2 Refs.
Primary Keywords: Homopolar Generator; Power Supply; High Reliability; Bearing Design

5419
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Systems, Systems)
STATUS OF THE UPGRADED VERSION OF THE NRL GAMBLE II PULSE POWER GENERATOR
J.R. Boller, J.K. Burton and J.D. Shipman Jr.
Naval Research Lab, Washington, DC 20375
2nd IEEE International Pulsed Power Conference Proceedings, pp 205-208 (06/1979).
The GAMBLE II water dielectric pulse power generator, in 1978, was the forerunner of the high energy (>50 kJ) class of water dielectric generators. It has been redesigned internally to make maximum use of its original outer conductor shell and to optimize it for the positive ion beam experimentation. The new design also initiates the use of an oil dielectric multi-channel switch at the output of the pulse forming line. This switch, because of it low capacitance, eliminates the need for an extra prepulse switch. The upgraded version has been tested up to power and energy levels which are nearly twice the original. 0 Refs.
Primary Keywords: GAMBLE II; Water Dielectric; Positive Polarity; Oil Switch; Prepulse Suppression
Secondary Keywords: Ion Beam Generation

5425
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Reviews; Reviews)
A REVIEW OF HIGH-POWER SWITCH TECHNOLOGY
T.R. Burkes, J.P. Craig, M.O. Hegler, M. Kristiansen and W.M. Portnoy
Texas Tech University, Lubbock, TX 79409
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1401-1411 (10/1979).
The basic operation and some of the performance parameters and limitations of various high-power switches with potential for rep-rated operation are summarized. The specific switches included are: thyratrons, ignitrons, liquid metal plasma valve, crossed field tube, vacuum tube, spark gaps (gas, liquid, vacuum, and solid), thyristors, transistors, mechanical switches, vacuum arc opening switch, e-beam switches, dielectric surface discharge switches, thermally driven opening switches, and superconducting switches. 55 Refs.
Primary Keywords: Basic Operation; Thyratron; Ignitron; Liquid Metal Plasma Valve; Crossed-field Switch; Vacuum Tube; Vacuum Gap; Spark Gap; Solid State Switch; Surface Discharge Switch; Mechanical Switch; Superconducting Switch

5431
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH POWER SPARK GAP OPTIMIZATION
Authors Unknown
Maxwell Labs Inc, San Diego, CA 92123
MLR Report No. MLR-670 (06/1977).
Availability: MLR-670
NTIS
Maxwell Laboratories presents this final report in completion of the High Power Spark Gap Optimization program. This program was, in effect, a continuation of one started under a contract with Wright-Patterson AFB. In that program, data was obtained in the power range of 1-5 MW to investigate switch performance at rep-rates up to 500 pps and at voltages up to 60 kV. For the maximum power experiments, two switches were connected in parallel to reduce the power delivered per switch to about 2.7 MW to maintain minimum pre-fire probability and to demonstrate the feasibility of parallel switches. In the current program, the main experimental objectives were to demonstrate spark gap power above 5 MW per switch and raise operating voltage into the 100 kV range. 3 Refs.
Primary Keywords: Spark Gap; High Power; Medium Voltage; Rep-rated; Theory; Experiment

5432
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)
STUDIES OF TRANSIENT DISCHARGES
P.F. Williams and M.A. Gunderson
Texas Tech University, Lubbock, TX 79409
AFOSR Report No. AFOSR-TR-79-1304 (10/1979).
Availability: AD A078894
NTIS
Progress during the time period June 15, 1978 through June 14, 1979 in this program to study the basic physical processes responsible for laser-induced breakdown of spark gaps is reported. Major accomplishments during the period include (1) the measurement of temporally and spatially resolved electron densities during and after the arc phase, (2) the study of the initial buildup of charge and current in these gaps, and (3) improvements in the data acquisition equipment used in the work. Evidence of a shock front seen in the electron density data was obtained. 19 Refs.
Primary Keywords: Spark Gap; Laser Triggering; Breakdown Modelling; Comparison With Experiment

5433
(BREAKDOWN STUDIES)
(Lightning)
ARTIFICIAL TRIGGERING OF LIGHTNING ABOVE GROUND
Fieux R. (1), C. Gary (1) and P. Hubert (2)
(1) Electricite De France
(2) CEA, France
1975 Conference On Lightning And Static Electricity, Abingdon, Berks, U.K. (04/1975).
The results of an attempt to trigger lightning using wire-carrying rockets are presented. The purpose of the experiment is to study the potential rise of the upper portions of high-voltage transmission towers. The rocket was launched from the top of the tower under test and pulled the wire to a height of 700 m in approximately 5 sec. Twenty out of 36 shots proved successful in triggering lightning strokes. Analyses of the triggered strokes are presented briefly, with more complete analyses referred to in the references. 16 Refs.
Primary Keywords: Lightning Triggering; Wire-carrying Rocket; Flash Counter; 'Field Mill'; Radioactive Probe
Secondary Keywords: Electric Transmission Tower

5434
(BREAKDOWN STUDIES)
(Lightning)
INDUCED VOLTAGES, MEASUREMENT TECHNIQUES AND TYPICAL VALUES
B.J.C. Burrows
Culham Lab, Abingdon, Oxfordshire, UK
1975 Conference On Lightning And Static Electricity, Abingdon, Berks, U.K. (04/1975).
This paper analyzes the voltages induced on internal electronic components and systems produced by lightning strikes on the airframe of an aircraft. The induced voltages are classified as either (1) Airframe return circuits or (2) Two-wire circuits. The effects of voltages produced by current flowing in the resistive airframe and effects of voltages induced by magnetic coupling to apertures in the airframe are considered. Detailed theoretical analyses of the interiors of both the fuselage and wing geometries are included. 7 Refs.
Primary Keywords: Lightning Induced Currents; Aircraft; Theoretical Analyses; Geometry Considerations

5435
(BREAKDOWN STUDIES)
(Lightning)
A SWEPTSTROKE EXPERIMENT WITH A ROCKET SLED
J.A. Dobbing and A.W. Hanson
Culham Lab, Abingdon, Oxfordshire, UK
1978 IEEE Electromagnetic Compatibility Symposium pp 390-395 (06/1978).
A new method of simulating the sweeping of a lightning stroke has been developed using a moving test vehicle and stationary arcs. Realistic aircraft landing and approach speeds were obtained by using the rocket driven sled installation at the Royal Aircraft Establishment, Farnborough. The sled was used to carry a simulated 'wing' at speeds up to 160 mph. A simple arrangement was used to vary the boundary layer. A unidirectional current pulse with an amplitude and duration in the continuing current range was used. This was generated from a lead acid battery and inductive storage system, which was capable of producing arcs more than 5 meters long carrying 600 A. 9 Refs.
Primary Keywords: Lightning Simulation; Swept Stroke; Rocket Sled; Inductive Energy Storage; Damage Levels

5436
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Lightning; Electrodes)
ARCS ON METAL SHEETS IN SIMULATED LIGHTNING DISCHARGES
P.F. Little, A.W. Hanson and J.A. Dobbing
Culham Lab, Abingdon, Oxfordshire, UK
1977 IEEE Electromagnetic Compatibility Symposium pp 375-380 (08/1977).
This paper presents a simplified physical model of an arc attachment point, and experimental tests of the validity of this model. The extent of melting in a metal sheet due to a constant-current pulse is measured and compared with theory. Using longer pulses or higher currents, a comparison is made of the observed time required to puncture the sheet with the calculated value. From this work major parameters controlling the time to puncture any metal sheet can be identified. The model offers theoretical guidance in determining the minimum metal thickness required for lightning protection and the experimental techniques used here are applicable to simulated lightning tests. 7 Refs.
Primary Keywords: Lightning Simulation; Metal Sheet; Damage Threshold; Puncture Threshold; Experiment; Theory

5437
(BREAKDOWN STUDIES)
(Lightning)
INDUCED VOLTAGES IN FULL SIZE AIRCRAFT AT 10/SUP 11/ A/S
B.J.C. Burrows, C. Luther and P. Pownall
Culham Lab, Abingdon, Oxfordshire, UK
1977 IEEE Electromagnetic Compatibility Symposium pp 207-214 (08/1977).
The principal results are given of the preliminary work on induced voltages in idealized wing and fuselage models in which quantitative theoretical predictions were confirmed experimentally. A test rig for subjecting a Hawker Hunter fuselage to current pulses with very high di/dt (100 kA/microsecond) is described and measurements of the fuselage current distribution and induced voltages on some selected loops are given. A maximum voltage (excluding the high frequency components) of about 2.5 kV was predicted and measured in the cockpit. The h.f. components in the observed induced voltages were investigated by consideration of the current pulse into the fuselage and it was found to contain many discrete frequencies. The amplitude of the initial h.f. components varied in a complex manner with bank voltage and gap pressure, and so scaling of these transients is totally unreliable. Resonances in the aircraft and return conductor structure are discussed. Suggestions are given for standardized test systems to simulate both the high current effects on the aircraft and the effects of streamering current excitation. 7 Refs.
Primary Keywords: Lightning Simulation; Capacitor Discharge; Theory; Experiment; Resonances; Streamering Excitation

5438
(BREAKDOWN STUDIES)
(Lightning)
LIGHTNING STRIKE POINT LOCATION STUDIES ON SCALE MODELS
J. Phillpott (1), P. Little (1), E.L. White (2), H.M. Ryan (3), C. Powell (3), S.J. Dale (4), A. Akad (4), D.J. Tedford (5) and R.T. Waters (5)
(1) Culham Lab, Abingdon, Oxfordshire, UK
(2) Electrical Research Association, Leatherhead, Surrey, UK
(3) A. Reyrolle & Co. Ltd., Hebburn, County Durham, UK
(4) University of Strathclyde, UK
(5) UWIST, Cardiff, UK
1975 Conference On Lightning And Static Electricity, Abingdon, Berks, U.K. (04/1975).
With the multitude of variables involved, the electric fields around an aircraft and, hence, the probability of lightning strike at a given point on the surface of an aircraft is very difficult to calculate. As a result, the authors use the simplified model of a conducting disk with an attached hemispherical vertical post to allow comparison between experiment and theory. An experiment was conducted by placing the simplified model in a point-plane gap and observing the breakdown produced by a pulse generator of variable amplitude, waveshape, and polarity. The size of the model and position in the gap were also varied to provide complete data. The electric fields around the model were calculated and an attempt was made to identify breakdown mechanisms. Results are also presented for detailed models of several aircraft. 8 Refs.
Primary Keywords: Lightning Simulation; Simplified Model; Experiment; Theory; Scale Aircraft Model

5439
(BREAKDOWN STUDIES)
(Lightning)
RECENT DEVELOPMENTS IN HIGH CURRENT TESTING TECHNIQUES FOR LIGHTNING SIMULATION
A.W. Hanson
Culham Lab, Abingdon, Oxfordshire, UK
1977 IEEE Electromagnetic Compatibility Symposium pp 385-389 (08/1977).
This paper reviews the developments that have taken place in testing techniques employed at Culham since 1975. Generation of high current pulse waveforms, waveshaping, arc testing, swept stroke experiments, testing of entrie aircraft, and future plans are discussed. 6 Refs.
Primary Keywords: Lightning Simulation; Pulse Generator; Waveshape; Swept Stroke; Whole Aircraft Test

5441
(ENERGY STORAGE, CAPACITIVE; POWER TRANSMISSION)
(Capacitor Banks; Transmission Lines)
DESIGN AND CONSTRUCTION OF FAST ENERGY, HIGH VOLTAGE CAPACITOR BANKS
W. Hess
Lawrence Livermore Lab, Livermore, CA 94550
LLL Report No. UCID-16166 (06/1969).
Availability: UCID-16166
NTIS

This report begins with the identification of the basic parts of a capacitor bank and proceeds to describe each component. Switches and charging circuits are described briefly with more detail given to power trnansmission and to capacitor selection and failure detection. A short discourse on strip lines and insulator strength is included.

Primary Keywords: Capacitor Bank; Capacitor Selection; Capacitor Failure Detection; Charging Circuit; Switch; Transmission Line; Breakdown Data

5443
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Solid, Radiation; Vacuum, Radiation)
QUICKE2: A ONE-DIMENSIONAL CODE FOR CALCULATING BULK AND VACUUM EMITTED PHOTO-COMPTON CURRENTS
T.A. Dellin (1) and C.J. MacCallum (2)
(1) Lawrence Livermore Lab, Livermore, CA 94550
(2) Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SLL-74-0218 (04/1974).
Availability: SLL-74-0218
NTIS

The theory and operational features of the one-dimensional code QUICKE2 are described. The code calculates the bulk and vacuum-emitted photo-Compton current of electrons generated in a material exposed to photons with energies from 1 keV to 10 MeV and arbitrary angle of incidence. The rapid and easy-to-use calculational technique is based on analytical solutions to the transport equation modeling electron multiple scattering and slowing down. 14 Refs.

Primary Keywords: Photo-Compton Current, Bulk Current; Emission Current; Vacuum Emission; Quantum Efficiency; Energy Distribution; Numerical Calculation

5456
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)
(Generation; Transport)
ADVANCED SIMULATION RESEARCH: VOLUME II-VACUUM ENERGY STORAGE
W. Clark, A. Mondalli, P. Korn and M. Rostoker
Maxwell Labs Inc, San Diego, CA 92123
DNA Report No. DNA 4297F-2 (09/1975).
Availability: AD A048158
NTIS

The STP experiment has been placed in operation during this contract period. A number of electon injectors have been explored with the injected charge shown to scale linearly with the injector bias voltage. Injected charge levels of approximately 100 microcoulombs, which corresponds to potential well depths of about 300 kV, have been measured as will be described in this report. Vertical magnetic field coils have been installed on the experiment, and preparations for high-energy electron injection have been completed. 8 Refs.

Primary Keywords: Magnetic Field; Diverter Loop; Azimuthal Drift; Vacuum Energy Storage

5637
(PARTICLE BEAMS, ELECTRON)
(Generation)
AURORA ELECTRON BEAM MODIFICATION
S.E. Graybill
Harry Diamond Labs, Adelphi, MD 20783
HDL Report No. HDL-TR-1862 (07/1978).
Availability: AD A062931
NTIS

The AURORA pulser, which normally operates as a pulsed bremsstrahlung machine, has been modified to inject the electron beam from one of the four lines into a drift chamber. The beam obtained from a hemispheric cathode and a machine charging voltage of 90 kV has been studied in detail. This beam of 8 MeV, 240 kA, 200 ns, 300 kJ has produced energy fluences of 10 to 500 cal/sq. cm. The energy deposition profile in three materials has been measured and calculated with reasonable agreement. The beam has been successfully used for structures testing, fluidics curcuit irradiation, high intensity bremsstrahlung production, and collective ion acceleration. 12 Refs.

Primary Keywords: Intense Relativistic Electron Beams; Pinched Beams; Hemispherical Cathode; Energy Deposition Profile

5458
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
COMPRESSION OF A MAGNETIC FIELD BY A SHELL WITH CONSTANT CONDUCTIVITY
A.Y. Kulago
FTD Report No. FTD-ID(RS)T-0236-78 (03/1978).
Trans. From: Vestnik Moskovskogo Universiteta 5, 88-91 (1971) By C.S Mack
Availability: AD A067028
NTIS

The authors derive an analytical solution to the problem of an axial magnetic field compressed by an imploding cylindrical conducting shell. Displacement currents are ignored but the finite conductivity of, and field diffusion into, the conductor are included. The limit of infinite conductivity is also taken to show that it reduces to the correct form. The limits of the analysis are demonstrated with a comparison given between the finite and infinite conductivity cases. 10 Refs.

Primary Keywords: Magnetic Field Compression; Theory; Analytical Solution, Finite Conductivity

5459
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
CURRENT-MEASURING DEVICES USED WITH THE SUPER-FAST PINCH ASSEMBLY
S.J. Leonard
Space Technology Labs Inc, Redondo Beach, CA
BMD Report No. TR-59-0000-00571 (01/1959).
Availability: AD 609387
NTIS

It was early recognized that the magnitude of the discharge current in the Super-Fast Pinch Assembly was an important parameter. As a result, several current-measuring devices were built and utilized. In addition, methods were developed for checking the calibration of these current-measuring devices in the required range of 20-100 kA at 17 MHz. For current measurement, solenoidal and toroidal coils were used, and they were calibrated against either a two-turn coil or a shunt. Good agreement was obtained among the current values indicated by the various current-measuring coils and by the two calibrating devices. In the report which follows, the various coils and the shunt are described and a summary of the results is given. 0 Refs.

Primary Keywords: Current Transformer; Solenoidal Coil; Toroidal Coil; Shunt; High Current; Medium Frequency

5460
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)
(Transport; Target Interactions)
DEVELOPMENT OF AN INTENSE ELECTRON BEAM ENVIRONMENT FOR MATERAIAL CHARACTERIZATION
D. Dakin
Physic International Co, San Leandro, CA 94577
DNA Report No. PIFR-21-979 (10/1978).
Availability: AD A069155
NTIS

An intense relativistic electron beam environment has been developed for material characterization. Experimental results on the magnetic compression and expansion of intense beams are presented and compared with theoretical models; emphasis is given to transport efficiency, electron angular distributions, and beam uniformity. Diode energies of 75 kJ are achieved (DNA OWL II generator) with greater than 80 percent transport efficiency using a magnetic compression ratio of three. Experimental results have been analyzed in terms of the physics of diode impedance lifetime. Several diagnostics essential for characterizing these intense beams have been successfully demonstrated. 15 Refs.

Primary Keywords: E-beam; Intense Beam; Magnetic Beam Compression; Materials Response; Beam Diagnostics
Secondary Keywords: Beam Angles; Material Characterization

5463
(SWITCHES, CLOSING)
(Thyratrons)
ADIABATIC MODE OPERATION OF THYRATRONS FOR MEGAWATT AVERAGE POWER APPLICATIONS
J.E. Creedon, A.J. Buffa and J. McGowan
ECOM, Fort Monmouth, NJ 07703
ECOM Report No ECOM 4470 (02/1977).
Availability: AD A038687
NTIS

Significant impact on the size, weight, and cost of high energy pulse systems having short on times can be obtained by designing components to operate in the adiabatic mode. Several thyratron design concepts for short term, high peak and average power switching applications have been studied. They include cavity grid designs for high voltage reliability, grid baffling designs to improve anode take over times, and plasma cathode designs to eliminate standby filament power. Using these concepts, several thyratron designs have been fabricated and evaluated at average powers approaching one megawatt. Evaluation of an off the shelf HY-5 operating in the adiabatic mode, was also conducted. It was found that by modifying the cathode structure the device was capable of being operated reliably at 22.5 amperes of average current at a peak voltage of 15 kilovolts. 1 Refs.

Primary Keywords: High Power Operation; Cavity Grid Thyratron; Grid Baffling; Plasma Cathode; Performance Test

5465
(SAFETY)
()
BACKGROUND INFORMATION ON HIGH-VOLTAGE FIELDS
D.E.J. Janes
New York University, N.Y. Task Force for Research Planning in Environmental Health Sciences (2nd).; ; Office of Radiation Programs, Silver Spring, Md.; National Inst. of Environmental Health Sciences, Research Triangle Park, N.C.
Final rept. 1970-76 (02/1977).
Availability: PB-273 265/9ST
NTIS

To conserve fuel and to provide service as economically as possible, the electric utilities have been increasing the operating voltages of overhead transmission lines. Transmission at 345kV began in the mid-1950s. By 1980, it is estimated that 15% of the transmission capability will be on 765 kV lines and a prototype 1,100 kV line was to be completed in 1976. Although the bulk of the research evidence suggests that there are no prompt or acute adverse effects on biological systems and the environment from electric and magnetic fields associated with such transmissions, few studies have been designed to detect the effects of long-term exposures. Research needs on this subject include studies using existing electric field environments, studies in controlled simulated environments, studies on medical devices, and dosimetry studies. Included as appendices to the paper are several recently published references on biological effects of transmission lines.

Primary Keywords: High Voltage; Power Transmission Lines; Electric Fields; Magnetic Fields; Exposure; Dosimetry; Electric Coronas; Health; Biology; Research; Requirements; Recommendations
Secondary Keywords: Environmental Health; Environmental Effects; NTISNIHEMS

5466
(INSULATION, MAGNETIC)
()
BREAKDOWN OF MAGNETIC INSULATION DUE TO DIAMAGNETISM
I. Hebenzahl
Cornell University, Ithica, NY 14850
Topical research rept. No. LPS-76, 23p (07/1971).
Availability: AD-750 658
NTIS
A magnetic field can act as an insulator by inhibiting the electrons from transversing a gap between two metallic plates. It is here shown that, if electrons are produced at a high enough rate on the surface of the negative plate, breakdown will occur. The 'critical' current density is given by an equation; or, if the current is space-charge limited, by another equation. The calculation here reported is non-relativistic, i.e. (H/sub 0/) >> (E/sub 0/) is assumed.
Primary Keywords: Electron Beams_Particle Trajectories; Electron Density; Equations Of Motion; Magnetic Fields; Space Charges; Electrostatics
Secondary Keywords: Diamagnetism; Electron Gas

5468
(BREAKDOWN STUDIES)
(Exploding Wires)
CHEMICAL AND PHYSICAL CHARACTERISTICS OF EXPLODING WIRE PRODUCTS
I.J. Russell and J.R. Driscoll
Boston College, Chestnut Hill, MA
(06/1971).
Availability: NYO-3756-6
NTIS
For abstract, see NSA 25 19, number 45830.
Primary Keywords: Antimony; Barium; Cerium; Exploding Wire Phenomena; Indium; Iron; Lanthanum; Molybdenum; Neodymium; Ruthenium; Selenium; Strontium; Tellurium; Tin; Yttrium; Zirconium

5470
TIME-RESOLVED INTENSITY PATTERNS OF THE RADIATION FROM VARIOUS REGIONS OF A VACUUM SPARK DISCHARGE

5472
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Solid, Electrical; Solid)
ELECTRICAL CONDUCTION AND ELECTRICAL BREAKDOWN OF ORGANIC INSULATORS AND SEMICONDUCTORS
H. Ahne, B. Andressa, K. Nissen and P. Roehl
Siemens AG Research Lab, Erlangen, FRG
Final Report. No. BMFT-FB-T-76-56, 141p (12/1976).
Availability: M77-29613/5ST
NTIS
The results of electrical measurements performed on characterized polyethylenes allow formulation of a simplified picture of the conduction mechanism. The conduction current results from electrode-injected electrons and leads to the build-up of a long-lived space charge. Initially the electronic contribution is superposed by a dipolar polarization current, the latter also giving rise to the discharge currents observed. The space charge built up, especially in the presence of impurities and defects, may well influence the electrical breakdown while the material's breakdown strength, of about 800 kV/mm, is relatively unaffected by external parameters.
Primary Keywords: Electrical Faults; Electrical Insulation; Electrical Resistivity; Organic Semiconductors; Polyethylenes; Charge Transfer; Electrical Measurement; High Voltages; Organic Materials; Power Lines; Space Charge
Secondary Keywords: West Germany; Dielectric Breakdown; Breakdown(Electronic Threshold); NTISNASAE
Distribution Restriction: In German; English Summary.

5475
(BREAKDOWN STUDIES)
(Exploding Wires)
EXPLODING WIRE FACILITY
A. DiGiacomo
Aerospace Corp, El Segundo, CA 90245
Technical documentary rept. No. TDR-669(6250-30)-1, 22p (10/1965).
Availability: AD-674 478/5ST
NTIS
The installation and calibration of the Material Sciences Laboratory's exploding wire facility are described. The facility provides blast pressure pulses used, for example, in determining the vulnerability of the char layer on ablative materials to impulses representative of shock-on-shock loading. In the original configuration the facility was limited to a maximum over-pressure of 10 psi with a duration in the order of 1.5 msec. Modifications, such as the introduction of a straight tube section and the addition of two capacitors, are presently in progress to obtain higher peak over-pressures. (Author)
Primary Keywords: Exploding Wires_Test Facilities; Calibration; Instrumentation; Shock Tubes; Ablation; Shock Waves; Subsonic Flow; Transducers; Measurement; Stagnation Point; Circuits; Rectifiers; Capacitors; Resistors; Wiring Diagrams; Piezoelectric Gages; Pressure
Secondary Keywords: NTISDODXD
Distribution Restriction: Distribution limitation now removed.

5476
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Exploding Wires)
EXPLODING WIRE INITIATION AND ELECTRICAL OPERATION OF A 40-KV SYSTEM FOR ARC-HEATED DRIVERS UP TO 10 FEET LONG
R.E. Dannenberg and A.F. Silva
Ames Research Center, Moffett Field, CA
NASA Report No. NASA TM D-5126 (04/1969).
This report describes an energy storage and electric-arc driver system for shock-driven facilities. Energy for the arc is supplied from a capacitor bank rated at 1 MJ at an operating voltage of 40 kV. Results are presented for arc discharge lengths of 54 and 116 inches with peak currents of 600 kA. The entire arc strike sequence of exploding wire initiation, dwell period, and subsequent bank discharge is discussed. The composition of the driver gas is shown to be a factor that limits the discharge of stored energy from the capacitor bank. 17 Refs.
Primary Keywords: Exploding Wire; Long Arc; High Energy Density; Wire Variation
Secondary Keywords: Shock Driver

5478
(BREAKDOWN STUDIES)
(Exploding Wires)
EXPLODING WIRE RESEARCH 1774-1963
J.R. McGrath
Naval Research Lab, Washington, DC 20375
Memo. rept. No. NRL-MR-1698, 2p (05/1966).
Availability: AD-633 623
NTIS
A review of Exploding Wire Phenomena (EWP) research is presented. This review covers the work performed from 1774 to the most current publication. Representative and significant studies are cited to indicate the difficulties associated with EWP research and the recent progress made in overcoming them. (Author)
Primary Keywords: Exploding Wires_Reviews; Naval Research; Bibliographies; Vaporization; Electric Currents; Explosions; Electrical Properties; Vapors; Spectroscopy; Metals; Light; Sources; Shock Waves; High Temperature Research; Ignition; Aerosol Generators; Theory

5483
FAIL-SAFE ISOLATION DEVICE PROVIDES MAXIMUM ENERGY TRANSFER FROM EXPLODING WIRE EXPERIMENTS
D.S.F. Zucker
Lawrence Livermore Lab, Livermore, CA 94550
(08/1967).
Availability: UCID-16968
NTIS
For abstract, see NSA 31 03, number 08119.
Primary Keywords: Electronic Circuits_Design; Detonators; Efficiency; Electric Fuses; Energy Transfer; Exploding Wires; Fabrication; Failures; Signals
Secondary Keywords: NTISAEC

5486
(ENERGY CONVERSION, MECHANICAL)
(Rotating Machines)
HIGH POWER STUDY SUPERCONDUCTING GENERATORS
A.E. King, C.C. Kouba, J.L. McCabria and L.D. Smith
Westinghouse Electric Corp Lima Ohio Aerospace Electrical Div
Final rept. 2 Jun 75-1 Mar 76 (03/1976).
Availability: AD-A031 620/8ST
NTIS
This report summarizes the results of a design study of light weight, high power electrical generators in the 10 to 50 Megawatt range with output voltages up to 200 kV dc (after rectification). Superconducting machines representing the latest technology were the focus of the study; non-superconducting machines utilizing the most advanced conventional design technologies were also studied to develop comparable performance data. Turbine requirements and integration features were studied to assure compatibility. A separate analysis of MHD electrical generator designs was also carried out to highlight comparable performance data for that type of power source. (Author)
Primary Keywords: Generators; Superconductivity; High Power; Lightweight; Magnetohydrodynamic Generators; Turbogenerators; High Voltage; Pulses; Stators; Rotors; Cooling
Secondary Keywords: Superconducting Generators; NTISDODXA

5487
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Miscellaneous Solid State; Miscellaneous Solid State)
HIGH VOLTAGE, HIGH POWER TRANSISTORS: CHARACTERISTICS OF DEVELOPMENTAL UNITS
W.M.J Lawson
Naval Research Lab, Washington, DC 20375
Interim rept. no. & No. NRL-MR-1132, 17p (01/1961).
Availability: AD-A045 478/5ST
NTIS
The Radio Corporation of America, under the auspices of Office of Naval Research contract number NOBsr-81322, has continued development work on silicon power transistors. Eight state-of-the-art samples of this transistor, designated TA-1891, have been tested by the U.S. Naval Research Laboratory for voltage breakdown, output characteristics and saturation voltage. The breakdown voltage of these units is in the range between 400 and 500 volts, and the characteristic is stable, with no negative resistance region up to 500 volts. Output characteristics, although satisfactory, should be improved, particularly at low collector voltages. Gain and saturation voltage for these ten ampere units are excellent. A fifty percent improvement in the gain would result in a 20 to 25 ampere unit. Thermal resistance could probably be improved, but is, on the average, adequate at this time for 300 watts dissipation. Two transistors are capable of 450 watts dissipation at 25 C case temperature, even in the interim case provided.
Primary Keywords: Transistors; Acoustic Detection; Test And *Evaluation; High Power; High Voltage;* Silicon; Electrical Properties; Curves(Geometry); Plotters; Breakdown(Electronic Threshold); Test Fixtures
Secondary Keywords: MOST-Project-4; NTISDODXA

5488
(PARTICLE BEAMS, ION)
(Generation)
IMPROVED BEAM CURRENT DENSITIES AT HIGH VOLTAGES
J.H. Fink
Lawrence Livermore Lab, Livermore, CA 94550
(08/1976).
Availability: UCID-17235
NTIS
The performance of ion extractors is analyzed with crude approximations that show improved performance to be possible with the certain modifications. However, additional studies are required to evaluate the beam optics in the presence of the deformed grids. (ERA citation 02:018820)
Primary Keywords: Ion Sources; Beam Currents; Beam Extraction; Electrodes; Ion Beams; Plasma
Secondary Keywords: ERDA/700103, NTISERDA

5489
(BREAKDOWN STUDIES)
(Gas, Recovery)
INVESTIGATION OF HIGH POWER GASEOUS ELECTRONICS
H.S. Maddix and J.J. Pergola
Microwave Associates Inc, Burlington, MA
Quarterly rept. no. 3, 1 Aug-31 Oct 66 (02/1967).
Availability: AD-808 279/4ST
NTIS

An investigation of the role of electron attaching gases in the performance of TR tubes has continued. Attempts at verifying recovery time theory in bromine and chlorine discharges at higher peak powers than previously, met with no success because of gas contamination attributed to discharge induced wall outgassing. An investigation of the bromine recovery characteristic over a 25 C to 330 C ambient temperature range showed no significant variations. This result indicates that the attachment rate is insensitive to electron energies in the thermal range. The TR attenuation theory has been extended to apply to the discharge period as well as to the recovery period. This extended theory correlates leakage as well as recovery time to the parameters of an attachment controlled gas discharge. A skin depth theory has been applied to determine electron density and discharge thickness. (Author)

Primary Keywords: Transmit Receive Tubes_Dissociation; Ions_Recombination Reactions; Bromine; Chlorine; Electron Density; Reaction Kinetics; Electric Arcs; Pressure; Attenuation; Gas Discharges
Secondary Keywords: Recovery Time; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

5490
(BREAKDOWN STUDIES)
(Exploding Wires)
INVESTIGATIONS OF THE EXPLODING WIRE PROCESS AS A SOURCE FOR HIGH TEMPERATURE STUDIES
E.C. Cassidy and S.B.C.W. Abramowitz
National Bureau of Standards Washington D C
Interim rept. No. NBS-Monograph-109, 59p (11/1968).
Availability: AD-681 912
NTIS

Numerous experiments with electrically exploded wires are described. The results include time-resolved measurements of electrical energy, power, voltage, and current during the discharge; periodic still and high-speed photographs of the entire explosion process; integrated and time-resolved measurements of the intensity and spectral distribution of the radiation emitted; and time-resolved absorption spectra from the products of the discharge, with emphasis on observations of the spectrum of the AlO molecule. The apparatus, instrumentation, and fast-measurement techniques developed in order to permit these direct experimental observations and measurements, under the extreme and transient conditions of the explosive discharge, are also described. Results from calculations of the composition, entropy, enthalpy, and density of the explosion mixture are given. (Author)

Primary Keywords: Exploding Wires_High-temperature Research; Aluminum_Exploding Wires; Standardization; Reviews; Design; High-speed Photography; Electric Discharges; Oxygen; Alumina; Entropy; Enthalpy; Spectra(Visible + Ultraviolet); Spectroscopy
Secondary Keywords: Time Resolved Spectroscopy
Distribution Restriction: Availability: Paper copy available from Superintendent of Documents GPO, Washington, D. C. 20402, $0.55.

5491
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Gas, Electrical; Reviews)
ELECTRICAL BREAKDOWN OF GASES: THE PREBREAKDOWN STAGE
E.E. Kunhardt
Texas Tech University, Lubbock, TX 79409
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 130-138 (09/1980).

In this paper, a review of the theories and experiments devoted to the understanding of the development of the electrical breakdown of a gas insulated gap, i.e., the switching delay, is presented. The presentation is chronological. The classical Townsend and streamer models for breakdown are discussed; followed by a brief account of the continuous acceleration and avalanche-chain models. These last two models have been proposed primarily to describe breakdown at large electric fields. Then, the two-group model for breakdown at voltages above approximately 20-percent self-breakdown is presented. Finally, a brief analysis is given of the present state of the field and the direction it is taking. 61 Refs.

Primary Keywords: Prebreakdown Current; Gas Breakdown; Townsend Ionization; Streamer Theory; Continuous Acceleration; Avalanche-chain

5492
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
MEASUREMENT OF FAST RISETIME MEGAMPERE CURRENTS BY QUARTZ GAUGE
R.R. Williams, D.M. McDaniel and R.W. Stinnett
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND 80-0460C (08/1980).
Availability: SAND 80-0460C
NTIS

Quartz guages have been used on the Sandia National Laboratories Proto II accelerator to measure current in the magnetically insulated transmission lines at the 11 TW power level. The accelerator delivers 3.5 MA at 2E14 A/s in a 40 ns pulse to a 0.0127 m diameter aluminum liner to produce a high density plasma. At this radius and dI/dt levels, the B-dot monitors no longer function for the measurement of load current because the monitor suffers electrical breakdown. Quartz pressure gauges mounted at a radius of 0.0086 m have successfully measured the magnetic pressure due to the load current with nanosecond temporal resolution. 2 Refs.

Primary Keywords: Quartz Pressure Gauge; Magnetic Pressure; Fast Rise Time; Very High Current; No Field Perturbation

5494
(INSULATION, MATERIAL)
(Solid)
PHOTOCONDUCTIVITY OF HIGH VOLTAGE SPACE INSULATING MATERIALS: MEASUREMENTS WITH METAL ELECTRODES
H.T. Coffey and J.E. Manevicz
Stanford Research Institute, Menlo Park, CA 94025
Interim Technical Report, 1 Jul. 1974 - 1 Apr. 1975. No. NASA-CR-152839, 31p (04/1975).
Availability: N77-23365/8ST
NTIS

The electrical conductivities of high voltage insulating materials were measured in the dark and under various intensities of illumination. The materials investigated included FEP Teflon, Kapton-H, fused quartz, and parylene. Conductivities were determined as functions of temperature between 22 and 100 C and light intensity between 0 and 2.5 kW/m2. The thickness dependence of the conductivity was determined for Teflon and Kapton, and the influence of spectral wavelengths on the conductivity was determined in several cases. All measurements were made in a vacuum to simulate a space environment, and all samples had metallic electrodes. The conductivity of Kapton was permanently increased by exposure to light; changes as great as five orders of magnitude were observed after six hours of illumination.

Primary Keywords: Electrical Resistivity; Kapton (Trademark); Photoconductivity; Teflon (Trademark); Electrical Insulation; Light (Visible Radiation); Solar Arrays; Temperature
Secondary Keywords: NTISNASA

5495
(SWITCHES, CLOSING)
(Vacuum Gaps, Plasma-injection)
PLASMA-INJECTION VACUUM ENERGY DIVERTER (CROWBAR)
H.S. Dunkerley
General Electric Co, Schenectady, NY 12301
Rept. no. 4 (Final), 1 Jul 64-30 Jun 65 (02/1966).
Availability: AD-478 494/8ST
NTIS

The purpose of this program was to conduct a theoretical and experimental study toward establishing design concepts for high-voltage energy diverters. The approach utilized the relatively new principle of plasmoid injection for triggering the breakdown of a high-vacuum multiple-section gap. After the metallic arc conduction period the gap returns to a high-vacuum state and voltage hold-off capability, ready for a subsequent controlled operation by the plasmoid trigger. Studies were made on the effects of electrode material, geometry, sputtering, vacuum conditions, external geometry, methods of generating the plasmoid, electron and ion densities and their rate of propagation through vacuum, the trigger geometrical arrangement and location with respect to the hold-off electrodes, use of multiple triggering elements, factors influencing operating range, use of variable spacing and triggering speed, power-handling capabilities and recovery characteristics. The principles studied were used to construct a model of a high-power triggered vacuum gap with an operation objective of 350,000 volts DC. The limited tests results on the model are presented and recommendations for further work. (Author)

Primary Keywords: Plasmas(Physics)_Energy Management; Electric Discharges_Trigger Circuits; Electric Arcs; Switching Circuits; Electric Insulators; Plasma Jets; Electrodes; Erosion; Electron Tubes; Ions; Performance(Engineering); Injection
Secondary Keywords: Crowbar; Energy Diverters; NTISDODXD
Distribution Restriction: Distribution limitation now removed.

5498
A 20 KV, NANOSECOND-RISE-TIME PULSE GENERATOR USING KRYTRONS

5499
(BREAKDOWN STUDIES)
(Exploding Wires)
RADIATION GENERATION FROM EXPLODING WIRE
M.G. Bhattacharya, J.P. Craig and T.F. Trost
Texas Tech Univ Lubbock Dept of Electrical Engineering
Final rept. (08/1976).
Availability: AD-A031 007/8ST
NTIS

A theoretical investigation has been performed on the dual nature of the experimentally observed x-ray spectra emitted by high power exploded wire plasmas. The observed spectra consist of a steeply decreasing region for photon energies below about 8KeV followed by a nearly constant region above this value. The region of steep decrease is the result of Bremsstrahlung from plasma electrons having a Maxwellian distribution. The constant region was considered as being caused by non-thermal high energy electrons. The constant region was investigated in more detail. They calculated first the Bremsstrahlung spectrum that would result from mono-energetic electrons of 5, 10, 20, 50 and 100 KeV incident on tungsten targets. All the spectra were found to have the same flat shape. The case of non-Maxwellian distribution of electrons was examined by using a distribution function appropriate to a homogeneous plasma in a strong electric field. After integration it was found that the spectrum changed from steep to flat as a function of time. It was concluded that a flat spectrum may arise through a distortion of the electron distribution function in a strong electric field. (Author)

Primary Keywords: Exploding Wires; Electromagnetic Radiation; Bremsstrahlung; X Rays; Plasmas(Physics); High Voltage; Photons; Mathematical Analysis; Statistical Distributions; Pulses
Secondary Keywords: NTISDODXA

5501
(BREAKDOWN STUDIES)
(Exploding Wires)
RECORDING SHOCK WAVES AND EXPLODING WIRE ELECTRICAL CHARACTERISTICS
Y.A. Kotov and M.A. Malnikov
FTD, Wright-Patterson AFB, OH
No. FTD-MT-24-184-68, 15p (07/1968).
Availability: AD-685 489
NTIS

A system for the recording of shock-wave velocities and the current and voltage in an exploding wire is described. The purpose of the present work is to create a source of shock waves with controllable (variable) parameters. The solution of the problem consists in the strict synchronization of the basic elements of the system. The circuitry and its operation are described and its components discussed. (Author)

Primary Keywords: Exploding Wires_Electrical Properties; Shock Waves_Recording Systems; Measurement; Measuring Devices(Electrical + Electronic); Optical Equipment; Synchronization(Electronics); USSR
Secondary Keywords: Translations

5504
(INSULATION, MAGNETIC)
()
SIMULATION OF POWER FLOW IN MAGNETICALLY INSULATED CONVOLUTES FOR PULSED MODULAR ACCELERATORS
D.B. Seidel, B.C. Coplan and J.F. VanDevender
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND 80-1241C (07/1968).
Availability: SAND 80-1241C
NTIS
Recent advances in the technology of magnetic insulation have led to the design of a new class of high power modular accelerators such as PBFA 1 which is nearing completion at Sandia National Laboratory. In this accelerator, power is fed inward along 36 radially converging, magnetically insulated transmission line (MITL) modules. In many applications, these 36 modules must be recombined into a central magnetically insulated convolute. This recombination can have a significant effect upon magnetic insulation, primarily due to the inevitable lack of simultaneity between power pulses in the 36 MITL modules. In this paper, two distinct simulation approaches for magnetic insulation are developed which can be used to address the question of nonsimultaneity. First, a two-dimensional model for a two-module system is simulated using a fully electromagnetic, two-dimensional, time-dependent particle code. Next, a nonlinear equivalent circuit approach is used to compare with the direct simulation for the two module case. The latter approach is then extended to a more interesting three-dimensional geometry with several MITL modules. 16 Refs.
Primary Keywords: Combinations Of Power From Several Modules; Pulse Simultaneity; Simulation; Numerical Calculation; Particle Code; Nonlinear Equivalent Circuit
Secondary Keywords: Particle Beam Fusion

5508
(BREAKDOWN STUDIES)
(Exploding Wires)
TERMINATED EXPLODING WIRE ENERGY SOURCE
L.A. Rosenthal
Naval Ordnance Test Station, Pasadena, CA
No. NOLTR-65-12, 2p (04/1965).
Availability: AD-618 478
NTIS
By placing a discharge or 'dump' tube across an exploding bridgewire load, it is possible to by-pass the electrical energy and terminate the explosion of the wire. The dump tube is triggered by a signal derived from the energy removed from the storage capacitor. (Author)
Primary Keywords: Exploding Wires_Explosive Initiators; Explosive Initiators_Exploding Wires; Capacitors; Circuits
Secondary Keywords: Exploding Bridge Wires

5509
(BREAKDOWN STUDIES)
(Exploding Wires)
THE APPLICATION OF P.W. BRIDGMAN'S 'NEW EMF' TO EXPLODING WIRE PHENOMENA
K.G. Moses and T Korneff
Temple University, Philadelphia, PA 19122
Availability: AD-602 913
NTIS
P.W. Bridgman propounded the possible existence of a 'New emf' generated in a conductor carrying a current due to a time varying temperature. This emf was not detected by any researchers due to the fact that the magnitude of this generated voltage is very small under normal conditions. However, under the conditions of an exploding wire the magnitude of the emf can become increasingly important. It is shown that this effect can possibly account for the excess energy required to melt and vaporize a wire under the extreme conditions of a rapid discharge. (Author)
Primary Keywords: EXPLODING WIRES_ELECTRICAL PROPERTIES; VOLTAGE; THERMODYNAMICS; WIRE; MELTING; VAPORIZATION; ENERGY; HALL EFFECT; CAPACITORS
Secondary Keywords: BRIDGMAN EFFECT

5513
(DIAGNOSTICS AND INSTRUMENTATION; DIAGNOSTICS AND INSTRUMENTATION; PARTICLE BEAMS, ELECTRON)
(Current; Voltage; Generation)
VOLTAGE AND CURRENT MEASUREMENTS IN HIFX DIODES
J.D. Silverstein
Harry Diamond Labs, Adelphi, MD 20783
Technical memo. No. HDL-TM-77-6, 116p (08/1977).
Availability: AD-A043 971/1ST
NTIS
Capacitive-voltage (V) monitors and shunt-resistor (I) monitors have been fabricated for the Harry Diamond Laboratories High-Intensity Flash X Ray Facility. Sensitivities of these monitors have been measured to an accuracy of 10 percent or better by improved pulse techniques. The monitors were used to measure V and I pulses a. charge voltages between 2.8 and 5.0 MV for both high- and low-impedance (z) diodes. For the high-z diode, consisting of a hemispherical cathode and a planar anode, Z increases from 70 to 120 ohms as the cathode-anode gap is increased from 1.5 to 3.8 cm. For the low-Z diode, whose cathode and anode are both planar, Z increases from 7 to 33 ohms as the cathod-anode gap is increased from 0.4 to 1.4 cm. Electron energy spectra calculated from the V and I pulses are in reasonable agreement with those measured previously by means of a magnetic spectrometer. There is also general agreement between the time variation of gamma dose rate calculated from the V and I pulses and that measured with a scintillator-photodiode. However, the doses obtained by integrating the calculated dose rates are, on the average, 70 percent lower than those measured with CaF2:Mn thermoluminescent dosimeters. (Author)
Primary Keywords: Pulses; Measuring Instruments; Monitors; Diodes(Electron Tubes); Voltage; Electric Current; Field Emission Tubes; Flash Radiography; X Ray Apparatus; Electrical Impedance; High Voltage; Capacitance; Shunts; Resistors; Electron Energy
Secondary Keywords: NTISDODXA

5516
(SWITCHES, OPENING)
(Explosive Fuses)
CHARACTERISTICS OF A MAGNETIC ENERGY STORAGE SYSTEM USING EXPLODING FOILS
J.N. DiMarco and L.C. Burkhardt
Los Alamos National Labs, Los Alamos, NM 87545
Journal Of Applied Physics, Vol. 41, No. 9, pp 3894-3899 (08/1970).
A capacitor bank operating at 15 kJ is used to energize an inductive system of 40 nH. Interrupting the current of approximately 800 kA, by means of an exploding copper foil fuse, produces voltages across the fuse of the order of 80 kV. The opening time of the fuse, as well as the characteristics of the voltage developed across the fuse are examined as a function of the fuse dimensions. If transfer of the current into a matching inductive load is to take place at the time of peak voltage, energy transfer efficiency is of the order of 8% with I-dot's of the order of 2E12 A/sec. 9 Refs.
Primary Keywords: Copper Foil Fuse; 15 kV Charging Voltage; 80 kV Output Voltage; Multilayer Fuse
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5517
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
HIGH VOLTAGE PROBE FOR LIQUID IMMERSION
N.W. Harris
Naval Research Lab, Washington, DC 20375
The Review Of Scientific Instruments, Vol. 45, No. 7, pp 961-962 (07/1974).
A capacitive voltage divider for the measurement of very high voltage transients in liquid-filled transmission lines has been developed. The probe is suitable for pulse lengths in the range 10 nsec to 1 microsecond, and peak voltages between 50 kV and 10 MV. The divider automatically compensates for changes in dielectric constant and loss. 0 Refs.
Primary Keywords: Capacitive Voltage Divider; Liquid Filled; Transmission Line; 10 MV Voltage Range; Compensation
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5518
(SWITCHES, OPENING)
(Explosive Fuses)
HIGH-POWER PULSE STEEPENING BY MEANS OF EXPLODING WIRES
G.S. Janes and H. Koritz
Arco-Everett Research Lab, Everett 49, MA
The Review Of Scientific Instruments, Vol. 30, No. 11, pp 1032-1037 (11/1959).
A circuit technique is described which reduces the rise times of high power pulses by means of exploding wires. This circuit is a nonlinear lumped parameter transmission line. The magnetic energy is stored in the interstage lead inductances and rapidly transferred into (or more correctly, shared with) succeeding stages by the vaporization of exploding wire resistive fuse elements connected in shunt between the leads. In our case, each of three resistive fuse elements consisted of 20 to 50 parallel 0.001-in diam copper wires held in place across a 2-in. gap with pressure sensitive tape. An empirically determined arrangement is described wherein we have increased the maximum rate of current rise from 300000 amp/microsecond to 800000 amp/microsecond. Using this technique, a magnetic field of 10000 gauss is built up in 0.15 microsecond throughout a volume 4 cm in length and 10 cm in diameter. It will be shown that the best results are obtained with high conductivity fuse materials such as copper or aluminum. Similarity theorems are presented for the design of pulse steepening elements for use with circuits having similar pulse shapes but different energies and characteristic impedances. 0 Refs.
Primary Keywords: Pulse Sharpening; Nonlinear Lumped Parameter Line; Multiple Stages; Copper Wire; Aluminum Wire; Dimensional Analysis
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5519
(PARTICLE BEAMS, ELECTRON)
(Generation)
MICROSECOND DURATION INTENSE RELATIVISTIC ELECTRON BEAMS
M. Friedman and M. Ury
Naval Research Lab, Washington, DC 20375
The Review Of Scientific Instruments, Vol. 43, No. 11, pp 1659-1661 (11/1972).
A preliminary study was performed to ascertain the feasibility of delivering large quantities of electrical energy in relativistic electron beams of long pulse duration. An electron beam of 8 kA peak current and 250 kV peak voltage was produced with a duration of =>1 microsecond. The electron beam was transported through a 1 m long drift tube with little energy loss. 9 Refs.
Primary Keywords: Long Duration E-beam; Foilless Diode; Drift Tube; Guiding Magnetic Field
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5520
(BREAKDOWN STUDIES)
(Exploding Wires)
EXPLODING WIRES IN STRONG AXIAL MAGNETIC FIELDS
E.M. Honig, M. Kristiansen and M.O. Hagler
Texas Tech University, Lubbock, TX 79409
Journal Of Applied Physics, Vol. 44, No. 14, pp 1923 (04/1973).
Thin copper wires, typically No. 27 and No. 33, were exploded in magnetic fields up to 72 kG. The ambient gas was atmospheric pressure air. The wire lengths were 0.5-1.35 cm, the applied voltage 3-7 kV, the peak currents 3.5-39 kA, and the ringing frequency 300 kHz. The effect of the magnetic field was generally to increase the pause length and to increase damping of discharge. 1 Refs.
Primary Keywords: Exploding Wire; Copper Wire; Magnetic Field; 72 kG Field; Air; Increased Current Pause
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5521
(SWITCHES, OPENING)
(Explosive Fuses)
RAPID TRANSFER OF MAGNETIC ENERGY BY MEANS OF EXPLODING FOILS
C. Maisonnier, J.G. Linhart and C. Gourlan
Lab Gas Ionizzati, Euratom-CHEM, Frascati, Italy
The Review Of Scientific Instruments, Vol. 37, No. 10, pp 1380-1384 (10/1966).
Rapid transfer of magnetic energy to an inductive load is usually done by discharging a condenser bank, but it can, in principle, also be done by using inductive storage. The problem then is how to open quickly a switch carrying a large current. Using a thin (10 micron) cylindrical foil of aluminum as a switch, energies of the order of 1E6 J have been transferred into an inductance of about 1E-8 H in a few times 1E-7 sec. An elementary theory of the explosion of the foil is presented, and it is shown to agree well with experimental results. Technical problems associated with the construction of such a fast switch can be considered solved up to an energy level of at least 100 kJ. 5 Refs.
Primary Keywords: Cylindrical Aluminum Foil; Experiment; Theory; Conductivity; Temperature Considerations

5527
(BREAKDOWN STUDIES)
(Gas, Electrical)
COMPUTATION OF AXIAL AND RADIAL DEVELOPMENT OF DISCHARGES BETWEEN PLANE PARALLEL ELECTRODES
A.J. Davies, C.J. Evans, P. Townsend and P.M. Woodison
University College of Swansea, Singleton Park, Swansea, Wales
Proceedings Of The IEE, Vol. 124, No. 2 pp 179-182 (02/1977).
A two-dimensional numerical calculation for the simulation of axially symmetric discharges is presented. Calculations simulating experiments done in nitrogen were made. The simulated shutter and streak photographs were found to agree well with those obtained in the experiments. As the cathode streamer neared the cathode, the calculation failed due to instabilities that developed. 10 Refs.
Primary Keywords: 2-D Ionization Growth; Plane Electrodes; Parallel Electrodes; Calculated Field Distribution; Photon Flux

5531
DIELECTRICS STUDY: FINAL REPORT
DNA Report No. DNA2823F (06/1972).
0 Refs.

5532
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps; Materials)
EXPLOSIVE ANODE EROSION IN HIGH CURRENT SPARKS
K. Schonbach and H. Fischer
Angewandte Physik, Technische Hochschule Darmstadt, Darmstadt , FRG
Applied Optics, Vol. 9, No. 7 pp 1695-1697 (07/1970).
Anode jets believed to be formed by an explosion of material at the anode of a spark gap are studied. The authors discuss the relationship of the jet with current rise, electrode electrical conductivity, thermal conductivity, and boiling point for lead, copper, tungsten, and aluminum. The temporal development of the spark channel and anode jet are presented. It is concluded that the anode jet is formed by local heating of electrons incident on the anode. 4 Refs.
Primary Keywords: Anode Jet; Turbulence; Anode Drop; Dependence On Cathode Material; Thermalization

5533
(BREAKDOWN STUDIES; REVIEWS AND CONFERENCES)
(Reviews; Reviews)
INVESTIGATIONS INTO ELECTRICAL DISCHARGES IN GASES
B.N. Klyarfel'd Ed.
All-Union Institute, Moscow, USSR
Publisher; The Macmillan Co., NY (01/1964).
Trans. From: The Collected Papers Edited By B.N. Klyarfel'd By D. Cossutta
This book is a collection of 12 papers by Russian authors concerning discharges in gases and mercury vapor. The first two papers concern the initial phases of self-sustaining discharges in several gases with pd combinations that fall to the left of the minimum of the Paschen curve. Two more papers follow on the plasma spreading of the early part of a discharge and on cathode effects. A good paper follows on postdischarge recovery in several gases. The last seven papers concern processes that occur in mercury vapor arcs (including cathode effects) that include cathode spot observations, temporal histories of mercury vapor densities in discharges, and anode effects. 128 Refs.
Primary Keywords: Self-sustaining Breakdown; Polyatomic Gas; Nonuniform Field; Plasma Spread; Postbreakdown Recovery; Mercury Arc; Cathode Effects, Anode Effects, Plasma Density

5534
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Surface Flashover)
SWITCHING SURGE AND IMPULSE SPARKOVER CHARACTERISTICS OF LARGE GAP SPACINGS AND LONG INSULATOR STRINGS
T. Udo
Central Research Institute of The Electric Power Industry, Tokyo, Japan
IEEE Transactions On Power Apparatus And Systems, Vol PAS-84, No 4, pp 304-309 (04/1965).
This paper describes the results of sparkover tests made with impulse voltages and switching surges for large gap spacings and long insulator strings under both dry and wet conditions. The tests were conducted at the Shiobara Outdoor Laboratory; a 10,000-kV 750-kJ surge generator was used. 6 Refs.
Primary Keywords: Impulse Voltage; Wet Conditions; Dry Conditions; 10 Meter Gap; Air Gap; Cylinder-cylinder Gap

5535
(BREAKDOWN STUDIES)
(Lightning)
TECHNIQUES OF STRIKE TESTS ON STRUCTURES, COMPONENTS AND MATERIALS
A.W. Hanson
Culham Lab, Abingdon, Oxfordshire, UK
1975 Conference Of Lightning And Static Electricity, pp 1-12 (01/1975).
The lightning simulation facilities at Culham Laboratory are described. The design philosophy behind the pulse generators utilized are discussed, with a comparison with the known characteristics of natural lightning presented briefly. A swept stroke experiment is briefly described. The testing philosophy and various materials responses (heat damage, magnetic forces, etc.) to simulations are discussed in some detail. 0 Refs.
Primary Keywords: Lightning Simulation; Pulse Generator; Swept Stroke; Heat Damage; Induced Effects; Test Philosophy; Diagnostics

5536
(PARTICLE BEAMS, ELECTRON)
()
THE GAMBLE I PULSED ELECTRON BEAM GENERATOR
G. Cooperstein, J.J. Condon and J.R. Boller
Naval Research Lab, Washington, DC 20375
Journal Of Vacuum Science And Technology, Vol. 10, No. 6, pp 981-984 (12/1973).
Several modifications, including lengthening of the pulse forming line, lowering the output pulse amplitude, and sharply reducing the prepulse amplitude have been made to the Gamble I electron beam generator. The generator, which consists of a Marx generator charging a water-insulated intermediate storage capacitor feeding a water-insulated pulse forming line, now produces a beam of 750 keV electrons. The major component changes include substitution of triggered gas switches for the previously used water switches and construction of a new diode insulator. 12 Refs.
Primary Keywords: Gas Switch; Diode Insulator; Impedance Transforming Line; Prepulse Reduction

5537
(PARTICLE BEAMS, ELECTRON; INSULATION, MAGNETIC)
(Generation)
TWO SPECIES FLOW IN RELATIVISTIC DIODES NEAR THE CRITICAL FIELD FOR MAGNETIC INSULATION
K.D. Bergeron
Sandia Labs, Albuquerque, NM 87115
Applied Physics Letters, Vol. 28, No. 6, pp 306-308 (03/1976).
An analysis of space-charge-limited counterstreaming flow of ions and electrons in a high-voltage planar diode in the presence of a strong transverse magnetic field is presented. A two-component one-dimensional cold-fluid model is used which includes most self-consistent effects. A substantial enhancement of ion current by a factor of 3-6 is found at fields slightly larger than the critical magnetic insulation field. 14 Refs.
Primary Keywords: Counterstreaming Flow; Space-charge-limited; Planar Diode; Ion Current Enhancement; Magnetic Insulation; Critical Field

5538
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
SURGE MEASUREMENT ERRORS INTRODUCED BY COAXIAL CABLES
J.H. Park
National Bureau of Standards, Washington, DC 20234
Communication And Electronics, Vol. 77, Pt. 1, No. 37 pp 343-347 (07/1958).
The author considers measurement of pulsed voltages and, in particular, the errors introduced by the coaxial cables used to transmit diagnostic data between sensor and recording medium. Attenuation of the signal due to losses in the conductors and dielectric of the cable are considered, as well as errors introduced by variation in the cable impedance with frequency. Cable termination is also discussed. Suggestions are included for minimization of error and correcting for inherent errors. 4 Refs.
Primary Keywords: Coaxial Cable; Measurement Error; Attenuation; Impedance Variation With Frequency; Termination

5539
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE MECHANISM OF THE LONG SPARK FORMATION
I. Gallimberti
Padova University, Padova, Italy
Journal Of Physics, Vol. 40, No. 7, pp C7-193-C7-250 (07/1979).
Trans. From: Journal De Physique 40, C7-193-C7-250 (Juillet 1979)
The authors present several theoretical and experimental results on the physics of long sparks. The mechanism of breakdown is followed through initiation of ionization through conductive arc channel. The air gap considered is a rod-plane type with a positive pulse applied to the rod. The effects of incident radiation is also considered. Diagnostics are discussed. 134 Refs.
Primary Keywords: Long Spark; Rod-plane Gap; Early Phases; Pulse Voltage; Experiment; Theory; Modeling; Diagnostics

5543
(BREAKDOWN STUDIES)
(Gas, Electrical)
COMPUTER SIMULATION OF RAPIDLY DEVELOPING GASEOUS DISCHARGES
A.J. Davies, C.S. Davies and C.J. Evans
University College of Swansea, Singleton Park, Swansea, Wales
Proceedings Of The IEE, Vol. 118, No. 6, pp 816-823 (06/1971).
A detailed description is presented of the numerical simulation of a high-growth-rate gaseous discharge. The main feature of this simulation are Townsend ionization and field distortion due to the presence of space charge. The simulation proceeds from an initially uniform field with a small core of electrons emitted from the cathode to full breakdown. Cathode and anode streamers are predicted successfully. Agreement with the experimental results of Wagner in nitrogen are seen to be good. 7 Refs.
Primary Keywords: Townsend Breakdown; Space Charge; Electric Field Distortion; Anode Streamer; Cathode Streamer; Numerical Simulation

5545
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
COUPLING BETWEEN OPEN AND SHIELDED WIRE LINES OVER A GROUND PLANE
R.J. Mohr
Cutler-Hammer Inc, Deer Park, NY
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-9, No. 2, pp 34-45 (09/1967).
Convenient expressions are derived which permit accurate determination of induced interference in open unshielded wire and shielded wire or coaxial lines due to AC and transient currents. Curves and tables are presented for obtaining key parameters in the calculation of interference. The limitations of the derived expressions are set forth and an example interference problem is solved. Experimental verification of the analysis is presented. 7 Refs.
Primary Keywords: Analytical Expressions; Coupling Coefficient; Several Geometries; Attenuation Effectiveness; Experiment; Theory

5547
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
ELECTROMAGNETIC-INTERFERENCE CONTROL
E.F. Vance
Stanford Research Institute, Menlo Park, CA 94025
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-22, No. 4, pp 319-328 (11/1980).
The use of shield topology concepts to design interference control is described. Starting with the postulate that electromagnetic environments can be separated by closed shield surfaces, the proper design of essential compromises such as insulated power and signal conductors, and openings for access and ventilation are deduced. The role of grounding is described and the relation of grounding conductors to shield surfaces is deduced. Some guidelines are given for determining how effective the shield needs to be. It is concluded that the effectiveness of a shield is usually limited most by interference propagating on insulated conductors passing through the shield, followed by leakage through apertures and diffusion through the shield walls. 8 Refs.
Primary Keywords: Shield Topology; Grounding; Design Considerations; Effectiveness Analysis

5549
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
GEOMETRICAL EFFECTS ON SHIELDING EFFECTIVENESS AT LOW FREQUENCIES
D.A. Miller and J.E. Bridges
Illinois Intitute of Technology, Chicago, IL
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-8, No. 4, pp 174-186 (12/1966).
A frequent approach to computing the magnetic shielding effectiveness of enclosures is to consider the effect of a plane wave impinging on a sheet of infinite extent. This permits an analysis based on a transmission-line characterization. However, when the wave-length is large compared to the dimensions of the enclosure, other analytical approaches provide better results. It has been shown that the current distribution on a box-like object scattering in the Rayleigh region tends to concentrate at the edges and corners of the box. This leads to concentrations of the magnetic field in the vicinity of edges and corners both inside and outside the enclosure. Since the effects of the current concentrations are localized, the magnetic shielding problem can be simplified by assuming a uniform current distribution on the exterior of the enclosure. Under this assumption the so-called 'circuit approach' can be applied. 10 Refs.
Primary Keywords: Low Frequency; Corner Effects; Shorted Transformer; Mutual Impedance; Leakage Impedance; Circuit Approach; Scattering Theory; Comparison

5550
(REVIEWS AND CONFERENCES; ELECTROMAGNETIC COMPATIBILITY)
(Reviews; Grounding And Shielding)
GROUNDING AND SHIELDING TECHNIQUES IN INSTRUMENTATION
R. Morrison
Dynamics Instrumentation Co.
Publisher; John Wiley And Sons, Inc. New York, London, Sydney (01/1967).
Though proper grounding and shielding techniques are an important consideration in any pulsed power system, these are often not dealt with until they become a difficult problem. The author of this book shows, beginning with basic field theory, how to incorporate proper grounding and shielding systems into a pulsed power environment. Consideration is given to choosing an earth ground for the system and to dealing with the power system grounds. Both electrostatic and magnetic shielding techniques are presented.
Primary Keywords: Grounding; Shielding; Instrumentation; Field Theory; Power Supply Isolation; Isolation Transformer

5551
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
LOW-FREQUENCY SHIELDING EFFECTIVENESS OF A DOUBLE CYLINDER ENCLOSURE
F.A.M. Rizk
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Electromagnetic Compatability, Vol. EMC-19, No. 1, pp 14-21 (02/1977).
The low-frequency shielding effectiveness of a long double cylinder shield is determined through a solution of Maxwell's field equations. The shielding expression obtained is then compared with the results obtained by both the circuit approach and the transmission line analogy. The findings of the present paper are also compared with the analysis by previous authors of the multishield problem. A digital computer program for numerical evaluation of the effectiveness of a double cylinder shield is developed and used to study the influence of the shield dimensions and material constants. 16 Refs.
Primary Keywords: Low-frequency Shielding; Double Cylinder; Maxwell's Equations; Analytical Solution, Planar Shielding Approach; Circuit Approach; Transmission Line Analogy

5552
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
MAGNETIC SHIELDED ENCLOSURE DESIGN IN THE DC AND VLF REGION
A.K. Thomas
TRW Systems Group, Redondo Beach, CA
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-10, No. 1, pp 142-152 (03/1968).
A review of magnetic shielding concepts and equations as applied to ideal shield configurations has provided a basis for the analysis of the shielding effectiveness of practical shielded enclosures to DC and VLF magnetic fields. The permeability of the shield material is considered as a function of the induction, and a significantly improved method of estimating the induction and permeability of the shield is presented. The effects of multiple shell geometry are given by the equations of this analysis, which are indeterminable with a transmission line analysis. The degrading effects of other departures from ideal shield materials and configurations are analyzed qualitatively; equations for estimating the magnitude of those effects are developed where possible. 13 Refs.
Primary Keywords: Magnetic Shielding; Shielding Concepts; Design Criteria; Induction Estimation; Multiple Shields

5554
(REVIEWS AND CONFERENCES; ELECTROMAGNETIC COMPATIBILITY)
(Reviews; Grounding And Shielding)
NOISE REDUCTION TECHNIQUES IN ELECTRONIC SYSTEMS
H.W. Ott
Bell Labs, Whippany, NJ
Publisher; John Wiley & Sons New York, London, Sydney, Toronto (01/1976).
This book presents a comprehensive study of electrical noise and it's elimination. The basic mechanisms of noise generation are presented with methods included for the reduction of each type. Grounding and shielding techniques for the elimination of coupling between circuits are discussed in detail with quantitative comparisons given of various configurations. Protection circuits for mechanical switch contacts are included. Inherent noise sources (thermal noise, shot noise, etc.) are discussed with reduction techniques included. Though this book is designed to be utilized with electronic circuits, almost all of the techniques presented can be used in a pulsed power environment. 108 Refs.
Primary Keywords: Grouning; Shielding; Electrostatic; Magnetic; Capacitive Coupling; Inductive Coupling; Radiative Coupling; Thermal Noise; Shot Noise; Filtering; Coding
Secondary Keywords: Mechanical Switch

5557
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE CATHODE FALL OF AN ARC
R.C. Mason
Research Labs, Westinghouse Elec. And MFG. Co., East Pittsburgh PA
Physical Review, Vol. 38, pp 427-440 (08/1931).
Schottky and classical theory are used to derive the energy distribution of electrons in the cathode fall of an arc. Both thermionic and field emission at the cathode are considered with the main thrust of the paper centering around a theoretical study and experimental test of Langmuir's theory of required high field for field emission of electrons. Conclusions are presented that either Langmuir's theory is incorrect or a very complicated ionization process occurs to produce the required positive ions. 26 Refs.
Primary Keywords: Cathode Fall; Thermionic Emission; Field Emission; Space Charge; Langmuir's Theory

5558
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE FALL OF POTENTIAL IN THE INITIAL STAGES OF ELECTRICAL DISCHARGES
J.C. Street and J.W. Beams
University of Virginia, VA
Physical Review, Vol. 38, pp 416-426 (08/1931).
Data are presented concerning the voltage history of the early stages of gas discharges in this paper. The fall of the discharge voltage in air, nitrogen, hydrogen, and CO/sub 2/ are investigated for the pressure range 50-140 cm of Hg and seem to be in good agreement with Toepler's discharge law. Possible methods are discussed for increasing the rate of voltage fall for discharges in these gases. 13 Refs.
Primary Keywords: Voltage Fall; Time History; Several Gases; Wide Pressure Range; Impulse Voltage

5559
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE MECHANISM OF THE ELECTRICAL BREAKDOWN OF AIR IN UNIFORM FIELDS AT VOLTAGES UP TO 400 KV
J. Dutton and W.T. Morris
University College of Swanson
British Journal Of Applied Physics, Vol. 18, pp 1115-1120 (03/1967).
This paper presents the results of the measurement of pre-breakdown currents at a gap of over 12000. Voltages of 16 to 400 KV constrained the fields to the less than 60 kV/cm, which reduced field emission to a negligible level. The secondary ionization coefficient was measured and found to be highly dependent on the condition of the cathode surface. Experimentally observed values of ionization growth agreed well with the generalized Townsend equation in all cases. 13 Refs.
Primary Keywords: Pre-breakdown Current; Uniform Field; Secondary Ionization Coefficient, Townsend Discharge; Modified Fowler-Nordheim Equation

5560
(BREAKDOWN STUDIES)
(Gas, Electrical)
TRANSITION FROM THE PRIMARY STREAMER TO THE ARC IN POSITIVE POINT-TO-PLANE CORONA
T. Suzuki
University of California, Berkeley CA
Journal Of Applied Physics, Vol. 42, No. 10, pp 3766-3777 (09/1971).
This paper reports for the first time measurements with multiple techniques delineating the complete sequence of events from the primary streamer to the thermalization of a highly ionized channel to the arc phase in the common spark transition for relatively small point-to-plane gaps. The observations cover a range of point diameters from 0.1 to 2 mm, for gaps in room air from 1 to 4 cm long, covering the whole range of potentials from streamer onset to in excess of 30% above the standard sparking threshold. It is shown that starting with the primary streamer, which occasionally at its start creates photoionization up to the midgap and at the cathode, there is produced a succession of ionizing waves of potential starting in many cases on the arrival of its tip at the cathode. These waves, observed by photomultipliers as well as by current pulses over a period of some microseconds, create what has been called a 'secondary streamer' by Hudson and Loeb. Unless overvoltage exceeds 30%, the electron density and temperature in the resulting channel are not adequate to thermalize to an arc. Above this value, thermalization occurs in several hundred nanoseconds. At lower overvoltages, there is a dark phase lasting at low values for hundreds of microseconds. 26 Refs.
Primary Keywords: Streamer; Arc Channel; Spark Transition; Photoionization; Cathode Effects; Thermalization

5562
(BREAKDOWN STUDIES)
(Gas, Microwave)
EXPERIMENTAL INVESTIGATION OF THE TRANSIENT FORMATION OF A MICROWAVE-GENERATED IONIZED SHEATH IN AIR
S.E. El-Khamy and R.E. Mcintosh
University of Massachusetts, Amherst, MA 01002
Journal Of Applied Physics, Vol. 44, No. 1, pp 100-105 (01/1973).
Microwave and photometric techniques are used to study the temporal and spatial behavior of a transient microwave-generated air plasma sheath in a coaxial transmission line. In particular, breakdown times, stabilization times, and thickness of the ionized sheath are investigated at different pressures and generating signal amplitudes. 22 Refs.
Primary Keywords: Microwave Ionization; Coaxial Transmission Line; Breakdown Time, Diagnostics

5564
(BREAKDOWN STUDIES)
(Solid, Electrical)
SOME ASPECTS OF DIELECTRIC BREAKDOWN OF SOLIDS
D.B. Watson, W. Hayes, K.C. Kao and J.H. Calderwood
Royal College Of Advanced Technology, Salford, UK
IEEE Transactions On Electrical Insulation, Vol. EI-1, No. 3, pp 30-37 (11/1965).
The electric strengths of sodium chloride, polythene, and polymethyl methacrylate were measured using direct and impulse voltages at room temperature. The effects of specimen thickness, electrode radius, and rate of rise of applied field are different in degree from material to material indicating the importance of prebreakdown conditions. It is suggested that the final breakdown mechanism is of the avalanche type, heating by prebreakdown current and the formation of space charges being factors affecting its occurrence. 21 Refs.
Primary Keywords: Dielectric Strength; Several Materials; Impulse Voltage; Several Geometries; Analysis Of Mechanisms

5566
(BREAKDOWN STUDIES)
(Surface Flashover)
THE EFFECT OF CUPROUS OXIDE COATINGS ON SURFACE FLASHOVER OF DIELECTRIC SPACERS IN VACUUM
J.D. Cross and T.S. Sudarshan
University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-9, No. 4, pp 146-150 (12/1974).
An experimental investigation of the effect of a cuprous oxide coating upon the surface flashover of high-density alumina in vacuum is reported. It is shown that such coatings improve the impulse strength of the system and eliminate the conditioning effect observed in the case of uncoated specimens at DC and 60-Hz voltages. An explanation of the observed behavior is given in terms of a surface charging model. It is postulated that the improvement in the insulation by the coatings is due to a reduction in the secondary electron emission yield. 8 Refs.
Primary Keywords: Coating; Increased Breakdown Strength; No Conditioning Effect; Low Frequency Field; Modeling; Surface Charge

5567
ELECTRODYNAMIC PULSE GENERATOR
A.I. Bertinov and D.A. But
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-2092-77, 10p (12/1977).
Availability: AD-A065 843/5ST
NTIS
No abstract available.
Primary Keywords: Pulse Generators; Translations; USSR
Secondary Keywords: Patents; NTISDODXA; NTISFNUR

5569
(SWITCHES, CLOSING)
(RBDT)
COMPLETE CHARACTERIZATION STUDIES PROVIDE VERIFICATION OF RBDT (RSR) RELIABILITY
J.B. Brewster (1) and G.F. Sherbondy (2)
(1) Westinghouse Electric Corp, Pittsburgh PA
(2) Westinghouse Electric Corp, Youngwood, PA
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1462-1468 (10/1979).
This paper presents the latest characterization information available for a two-terminal, high-speed, solid-state switch previously called the RSR (Reverse Switching Rectifier) but presently referred to as the RBDT (Reverse Blocking Diode Thyristor). Studies of the RBDT have been continuing, leading to broader pulse loss characterization than had previously been available. Loss characterization and trigger studies were made concurrently, and the results show that with proper triggering, the RBDT will function reliably and with minimum loss. New test equipment, which tests to customer specified load conditions is described. The paper concludes with a summary of field origirated life data, which supports the conclusion that the RBDT may be effectively and reliably applied for short-pulse, high-current, high rate-of-rise duty. 3 Refs.
Primary Keywords: Reverse Blocking Diode Thyristor; Reverse Switching Rectifier; Characterization; Losses; Triggering

5572
(ENERGY CONVERSION, THERMAL)
(Loads)
LOW-INDUCTANCE, LOW-IMPEDANCE MEGAWATT AVERAGE POWER LOAD
W. Wright Jr.
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1556-1559 (10/1979).
A compact, low-inductance, 0.5-ohm, 1-MW average power resistive load has been developed to facilitate testing of the MAPS-40 thyratron. The flowing liquid electrolyte system uses the large thermal mass of a storage tank of electrolyte to store the energy which is dissipated through a heat exchanger after the high-power run. The electrolyte starting temperature, flow rate, and allowable temperature rise determine the maximum average power into the load; the external and internal spacings and flow uniformity determine the maximum peak power; the flow rate and storate volume determine maximum running time. The load assembly consists of two parallel glass pipes 10.2 cm in diameter and 15.25 cm long. The active volume in each pipe is 6.35 cm long and is contained between electrodes 8.9 cm in diameter. The two sections of the load are electrically in parallel and flowing in series, putting both flow connections at ground potential. The major problem was getting the internal flow pattern uniform to eliminate local boiling and arcing across the bubbles while keeping the pressure drop low and flow high. THe calculated inductance of the load assembly is 11 nH, and the structure lends itself to coaxial connections which reduce the overall inductance still further. Material compatibility with the electrolyte will be discussed. 3 Refs.
Primary Keywords: Dummy Load; High Average Power; Low Inductance; Low Resistance; MAPS-40 Thyratron; Design Considerations

5573
(PULSE GENERATORS)
(Systems)
MODULATOR CHARGING SYSTEM UPGRADE FOR A 5-MEV ELECTRON ACCELERATION
D. Rogers Jr., W. Dexter, L.L. Reginato and A. Zimmerman
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1509-1511 (10/1979).
The Lawrence Livermore Laboratory is currently constructing a new linear induction accelerator with a higher beam current than the Astron accelerator. The new accelerator, called the Experimental Test Accelerator (ETA) will be a 5-MeV, 10-kA accelerator with a pulsewidth of 50 ns. Like the Astron, the principle of magnetic induction is used to obtain a linear accelerator. The modular accelerating cavities form essentially a 1:1 transformer and the change in flux in the ferrite core induces an axial electric field for the acceleration of electrons. Since the total energy storage for the ETA is much greater than the requirement for Astron, the power system, the capacitor bank, and the modulator charging system all had to be modified to provide an overall regulation of 0.1 percent. This strict regulation of the charging voltage is necessary for pulse-to-pulse repeatability. 2 Refs.
Primary Keywords: Electron Linear Accelerator; Hard Tube Modulator; Charging Circuit; Power Supply; High Average Power; Very Good Voltage Regulation

5574
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
IMPULSE-VOLTAGE BREAKDOWN CHARACTERISTICS OF LARGE GAPS AT LOW PRESSURES
M.R. Nandagopal and H.V. Gopalakrishna
Indian Institute of Science, Bangalore, India
Journal Of Applied Physics, Vol. 42, No. 13, pp 5874-5876 (12/1971).
A study of the gap breakdown voltage characteristic at a low pressure of 1E-5 Torr with a standard (1/50)-microsecond impulse-voltage wave reveals an agreement with the criterion V/sub 5/ = Cd/sub 0.5/ suggested by Cranberg. Voltage-time-to-breakdown characteristics have also been determined. From these studies, it is concluded that impulse breakdown in vacuum is initiated by an electron current heating an anode spot and thereby liberating a clump which causes breakdown. 3 Refs.
Primary Keywords: Breakdown; 1E-4 Torr Pressure; Impulse Voltage; Cranberg Criterion; Delay Measurement; Anode Heating

5575
(SWITCHES, CLOSING)
(LASS)
OPTICAL DRIVE REQUIREMENTS FOR LASER-ACTIVATED SEMICONDUCTOR SWITCHES
P.G. McMullin and L.R. Loury
Westinghouse Electric Corp, Pittsburgh PA
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1469-1472 (10/1979).
Laser-activated semiconductor switch (LASS) devices of the thyristor type exhibit three regimes of operation. At low optical drive, optical triggering is obtained with delay time before conduction and relatively low current rise rates. At intermediate drive levels, fast switching is obtained with no appreciable delay time and fast current rise rates (greater than 1E9 A/s) but with substantial power lost in the switch element. At higher optical drives, saturated switching is observed with the rise rate and power loss relatively independent of the optical drive level. LASS thyristors of 1- and 4-kV operating voltage ratings have been characterized in the lossy fast switching regime. For pulses of 100-ns duration, the devices act as resistive elements. The magnitude of the resistance varies inversely with the optical drive, and can be understood as conductivity modulation of the conduction path by the photo-generated carriers. Such characterization allows switch system design tradeoff between the required optical drive level and the tolerable power loss in the switch elements. 4 Refs.
Primary Keywords: Thyristor; Optical Triggering; Variation With Trigger Level; Small Delay; Fast Rise; Performance Test

5576
GENERATOR OF POWERFUL CURRENT PULSES
F.M. Spevakova and A.M. Stolov
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-0050-78, 9p (01/1978).
Availability: AD-A066 671/9ST
NTIS
No abstract available.
Primary Keywords: Electric Generators; Magnetic Fields; Electric Current; Current Regulators; Translations; USSR
Secondary Keywords: Pulse Generators; NTISDODXA; NTISFNUR

5577
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Surface Flashover; Solid)
COLLOQUIUM ON ELECTRICAL BREAKDOWN ON INSULATING SURFACES
T.A.J Kitchens
Office of Naval Research, London, UK
Conference rept. No. ONRL-C-1-76, 8p (01/1976).
Availability: AD-A021 853/7ST
NTIS
A one-day colloquium on electrical breakdown on insulating surfaces was held by the Institution of Electrical Engineers in London on 6 November 1975. Three introductory talks and a half a dozen contributed papers were given summarizing the state of the knowledge of electrical breakdown in practical systems and some recent research on various aspects of the subject. (Author)
Primary Keywords: Electric Discharges; Insulation; High Voltage; Electrical Insulation; Electrical Properties; Surfaces; Vacuum; Decomposition
Secondary Keywords: Electrical Breakdown; Hydrofluoric Acid; Insulating Materials; NTISDODXA; NTISDODN

5578
(PARTICLE BEAMS, ION)
(Generation)
DEPENDENCE OF THE ION CURRENT ON VOLTAGE IN A REFLEX TRIODE
C.A. Kapetanakos, J. Golden and W.M. Black
Naval Research Lab, Washington, DC 20375
Physical Review Letters, Vol. 37, No. 18, pp 1236-1239 (11/1976).
Results are reported on the dependence of the current of a pulsed ion beam produced in a reflex triode upon the applied resistive voltage in the range 0.6 to 1.3 MV. The measured peak ion current at the maximum voltage tested is 20 kA, corresponding to a current density of 200 A/cu.cm.. 14 Refs.
Primary Keywords: Ion Beam Generation; Reflex Triode; 0.6-3 MV Voltage Range; 20 kA Current

5580
(SWITCHES, CLOSING)
(LASS)
DEVELOPMENT AND APPLICATION OF LIGHT ACTIVATED SILICON SWITCHES
J.S. Roberts, D.R. Muss and R.A. Hill
Westinghouse Research and Development Center, Pittsburgh PA
Final rept. May 68-May 70 No. 69-9F6-DESAN-R2, 130p (05/1970).
Availability: AD-870 913
NTIS
Light activated silicon switches (LASS) were fabricated and devices tested in a flexible test modulator built specifically for LASS testing. Various types of light triggering were investigated including radiation from GaAs laser diode, xenon flash lamp, incandescent lamp and Q-switched neodymium (Nd3+) laser. Devices were fired singly and in series at pulse currents of 500 amperes and dI/dt's of 1000 amps/microseconds using GaAs laser diodes as light trigger. Using the Q-switched Nd3+ laser resulted in extremely high speed device turn-on with forward voltage transient over in 20 nanoseconds. A redesign of the early prototype encapsulation was necessary to achieve large pulse current capability. (Author)
Primary Keywords: Electronic Switches_Excitation; Excitation_Light Pulses, Modulators; Xenon Lamps; Diodes(Semiconductor); Gallium Arsenides; Lasers; Encapsulation; Trigger Circuits
Secondary Keywords: Silicon Switches; Light Activated Devices

5581
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
DEVELOPMENT OF SOLID AND/OR LIQUID-METAL COLLECTORS FOR ACYCLIC MACHINES
R.L. Rhodenizer
General Electric Co, Schenectady, NY 12301
GE Report No. GE S-71-1110 (09/1971).
Availability: AD 888334
NTIS
The development of a high-performance liquid-metal collector configuration for operation in high-intensity ambient magnetic fields is discussed. The influence of various design alternatives on collector performance is considered and a collector configuration is specified for further study in an experimental program. The results of a test program confirming the performance characteristics predicted in the theoretical studies is described. The development of liquid-metal collector systems for use in superconductive acyclic machines having multiple-disk rotor arrangements is presented. The characteristics of multiple-disk acyclic machines are reviewed and design factors for high-power-capacity machinery are developed. The results of tests on a 150-kilowatt generator are presented. The experiments correlated well with theoretical predictions, and the results of this program will permit the development of large superconductive direct-current machines with efficiencies of over 96 percent. 3 Refs.
Primary Keywords: Liquid Contact; High Intensity Magnetic Field; Performance Test; Experiment; Theory

5582
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
ELECTRICAL MEASUREMENT OF HIGH VOLTAGE PULSES IN DIAGNOSTIC X-RAY UNITS
R.E. Hebner Jr.
National Bureau of Standards, Washington, DC
Interim rept. Mar 74-Sep 75 No. NBSIR-75-775, 62p (11/1975).
Availability: PB-248 684/3ST
NTIS
The report describes a method of calibrating dividers used to measure high voltage pulses in diagnostic x-ray units. The experimental development emphasized four areas. These were the divider ratio under direct voltage, the frequency dependence of the ratio, the voltage dependence of the ratio and the effect of self-heating on the device. The results of measurements on approximately fifteen different dividers are summarized. In addition, this report contains two appendices. The first discusses conventional and electro-optical methods of measuring the high voltage pulses, while the second presents a more detailed analysis of the feasibility of electro-optical measurement of these pulses.
Primary Keywords: X Ray Apparatus; Electrical Measurement; High Voltage; Diagnosis; Medical Equipment; Electrooptics; Kerr Electrooptical Effect; Pulsation
Secondary Keywords: Diagnostic Equipment; NTISCOMNBS; NTISFDABRH

5583
(SWITCHES, OPENING)
(Superconductive)
EXPERIMENTAL RESULTS WITH SC/NC BREAKERS
W. Amende, M. Pillsticker and M. Soel
Institut fur Plasmaphysik, Garching, FRG
No. IPP-4/128, 51p (01/1975).
Availability: N76-22465/8ST
NTIS
The switching-off effect of a superconductive/normal conductive (SC/NC)-breaker (cryotron) is based on the increase of the resistance from 0 to a determined value, if the transition from the superconductive to the normal conductive state is triggered. The fast commutation of a current from one branch of a network to another can be started by the switching-off effect of a SC/NC-breaker. Results of several tests with SC/NC-breakers suitable for high currents up to 800 A are reported. The relation between the switching time or the commutation time and the rise time of the trigger current pulse, the energy of the pulse, the direct current of the breaker before triggering and a few other electrical parameters are determined experimentally. The demonstration that during commutation an intrusion of electrical energy from the trigger-pulse-circuit into the main circuit never can be compensated completely is an important result of the measurements. (Author)
Primary Keywords: Circuit Breakers; Superconductors; Switching Circuits; Electrical Resistance; Network Analysis; Niobium; Titanium; Trigger Circuits; Wire
Secondary Keywords: West Germany; NTISNASAE

5585
(SWITCHES, CLOSING)
(Systems)
HERTZIAN ARRAY SWITCH INVESTIGATION
J.M. Proud, D.H. Baird and W.H. McNeill
GTE Labs Inc., Waltham, MA 02154
RADC Report No. RADC-TR-76-301 (10/1976).
Availability: RADC-TR-76-301
NTIS
An investigation of fast, high power switching with jitter in the subnanosecond time domain is reported. Methods involving field distortion triggering in high pressure gases, photoconduction triggering in aprotic liquids and opto-electronic triggered in solid semiconductors have been identified. The most promising avenue for further research is identified in the latter area where extremely small jitter and rapid turn-on capabilities are well matched to the timing requirements in Hertzian arrays. 20 Refs.
Primary Keywords: Hertzian Array; Spark Gap; Field Distortion Triggering; Photoconduction Triggering; Subnanosecond Jitter; Gas Gap; Aprotic Liquid Gap

5588
(POWER TRANSMISSION)
(Cables)
HIGH VOLTAGE CABLE SPLICING AND CABLE TERMINATION TECHNIQUES
D.E. Weems
Naval Civil Engineering Lab, Port Hueneme, CA
Final rept. Jul 74-Dec 75 No. CEL-TN-1452, 22p (08/1976).
Availability: AD-A030 872/6ST
NTIS

The splicing and termination of underground electrical distribution cable requires that the integrity of cable conductor and insulation be maintained throughout its length. A large number of commercial cable splice and termination kits are available which are claimed to fulfill these requirements. The Civil Engineering Laboratory (CEL) was requested to investigate the suitability of these kits for use at Naval shore facilities. Of special interest were the slip-on cable splice and cable termination for solid dielectric insulated cable. These slip-on devices proved to be the easiest and fastest to install with good reproducibility, and the electrical characteristics were as good as, or better than, the other types of cable splice and cable termination kits tested. (Author)
Primary Keywords: Electric Cables; Splices; Electric Terminals; Underwater Equipment; Underground; Coaxial Cables; Couplings; Electric Power Distribution; High Voltage; Electric Power; Commercial Equipment; Kits; Dielectric Properties; Electrical Insulation
Secondary Keywords: NTISDODXA

5590
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
MECHANICAL TANGENT STRESSES IN THE ROTOR DISC OF THE SHOCK-EXCITED HOMOPOLAR GENERATOR AT ITS BRAKING
Y.V. Spirchenko
Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR).
Availability: NP-20375
NTIS

Formules for determining the mechanical tangential stresses in the rotor disc of the homopolar generator with a liquid-metal circular contact at braking in shock-excited conditions are obtained. The particular cases are considered: a constant thickness disc and a conical one.
Primary Keywords: Electric Generators_Rotors; Rotors_Stresses; Brakes; Liquid Metals; Stress Analysis
Secondary Keywords: ERDA/420200; NTISERDA
Distribution Restriction: U.S. Sales Only.

5591
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
MULTICHANNEL SPARK-GAP TECHNOLOGY FOR STAGED THETA-PINCH MACHINES
W.H. Borkenhagen, R.F. Gribble, L.D. Hansborough, R.K. Linford and J.G. Melton
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-751125-48, 5p (08/1976).
Availability: LA-UR-75-2152
NTIS

Triggered multichannel switches operating at voltages up to 180 kV with inductances of 10 to 15 nH have been developed for the staged theta-pinch machines at LASL. These multichannel devices, depending upon their design, can switch up to 30 kJ per switch with peak currents up to 1 MA. The designs of the various spark-gap configurations are discussed from a mechanical and an electrical viewpoint. The switching modes including crowbar, high-voltage start, and high-voltage holdoff low-voltage start, as well as the experimentally determined triggering characteristics, are also discussed.
Primary Keywords: Linear Theta Pinch Devices_Switches; Power Supplies_Spark Gaps; Design
Secondary Keywords: NTISERDA

5592
N/SUB 2/-SF/SUB 6/ GAS MIXTURE AS INSULATION MATERIAL FOR HIGH VOLTAG_ TECHNOLOGY
M. Ermel
(01/1975).
Availability: ORNL-tr-4182
NTIS

Breakdown strength in the uniform and nonuniform field, vapor pressure curves and chemical stability under spark discharges are examined. Moreover, considerations are made to the theory of breakdown in gas mixtures. The investigation of breakdown characteristics leads to a general statement about the electric strength of the N sub 2 -SF sub 6 -mixture. Even an important reduction of SF sub 6 -content causes only low loss of strength compared to SF sub 6 , at the same time preventing SF sub 6 -condensation in a wider range. Altogether the mixture shows some advantages compared to SF sub 6 . As a result of the theoretical considerations modified ionization coefficients for gas mixtures are introduced and explained for the N sub 2 -SF sub 6 -mixture. (ERA citation 01:025717)
Primary Keywords: HVAC Systems; Nitrogen; Sulfur Fluorides; Breakdown; Dielectric Properties; Electrical Insulation; Gas-insulated Cables; Gases; Mixtures
Secondary Keywords: ERDA/200301; Translations; West Germany; Dielectric Breakdown; NTISERDAT
Distribution Restriction: TRANSLATED BY E.G. SILVER FROM INSULATION MATERIAL FOR HIGH VOLTAGE TECHNOLOGY, ELEKTROTECH. Z., A 96 N5 P231-235 1975

5593
(PARTICLE BEAMS, ELECTRON)
(Transport)
ON THE PROPAGATION OF HIGH INTENSITY, HIGH VOLTAGE ELECTRON BEAMS AND THE MAXIMUM CURRENT WHICH SUCH BEAMS MAY POSSESS
T.G. Roberts
Army Missile Command, Redstone Arsenal, AL 35809
Technical rept. No. RR-TR-69-7, 27p (06/1969).
Availability: AD-857 607/6ST
NTIS

The existing theories for the propagation of intense electron beams at relativistic energies and the experimental results so far obtained are reviewed. A phenomenological description of beam propagation is given and an expression for the maximum current that a beam may possess is derived. This expression is somewhat different from the Alfven limit but reduces to this limit in the case of a fully neutralized beam. (Author)
Primary Keywords: Electron Beams_Propagation; Relativity Theory; Electric Currents; Drift; Focusing; Cosmic Rays
Secondary Keywords: NTISDODXD
Distribution Restriction: Distribution limitation now removed.

5594
(SWITCHES, CLOSING)
(Reviews)
R AND D RECOMMENDATIONS FOR FUTURE ERDA SWITCH REQUIREMENTS
O.S. Zucker
Lawrence Livermore Lab, Livermore, CA 94550
No. CONF-760334-2, 8p (04/1976).
Availability: UCRL-78112
NTIS

The following switches are briefly discussed: (1) high pressure and vacuum spark gaps, (2) liquid dielectric gaps, (3) solid dielectrics, (4) nonlinear ferromagnetic materials, (5) semiconductors, superconductors, (6) ferroelectric switches, (7) exploding wires, and (8) plasma instabilities. (ERA citation 01:018359)
Primary Keywords: Switches; Dielectric Materials; Planning; Power Supplies; Research Programs; Spark Gaps; Thermonuclear Reactors
Secondary Keywords: ERDA/700209; NTISERDA

5597
(ELECTROMAGNETIC COMPATIBILITY)
(Transient Suppressors)
TEST PROCEDURES FOR EVALUATING TERMINAL PROTECTION DEVICES USED IN EMP APPLICATIONS
R.L.J Williams
Harry Diamond Labs, Washington, DC 20438
Technical rept. No. HDL-TR-1709, 84p (06/1975).
Availability: AD-A019 098/3ST
NTIS

Certain commercially available components were tested to establish test procedures for characterizing terminal protection devices used in electromagnetic-pulse (EMP) applications. The devices tested include spark gaps, filters, avalanche diodes, and various other nonlinear components. Square pulses of 50- and 500-nsec duration and up to 11 kV in amplitude, with rise times of 2 to 4 nsec, were applied to the devices. Response time and energy leakage were recorded for each test. Insertion loss and approximate failure level were measured for each device. Results are presented in tabular form. The devices that appear suitable for terminal protection include spark gaps, some filters, and some semiconductor devices with breakdown voltage less than about 50.
Primary Keywords: Suppressors; Electromagnetic Pulses; Surges; Transients; Spark Gaps; Electromagnetic Wave Filters; Semiconductor Devices; Test Methods; Electronic Equipment; Protection
Secondary Keywords: Terminal Protection Devices; NTISDODA

5601
(PARTICLE BEAM, ION)
(Generation)
BEAM OPTICS FOR ION EXTRACTION WITH A HIGH-VOLTAGE-RATIO ACCELERATION-DECELERATION SYSTEM
T.S. Green
Culham Lab, Abingdon, Oxfordshire, UK
Journal Of Physics D; Applied Physics, Vol. 9, No. 7, pp 1165-1171 (05/1976).
7 Refs.
Primary Keywords: Ion Beam Perveance; Two Stage Extraction; Beam Optics; Multiple-lens Model; Zero Divergence Beam; Beam Magnification

5602
(ENERGY STORAGE, MECHANICAL; ENERGY STORAGE, INDUCTIVE)
(Rotating Machines; Systems)
ANALYSIS OF HOMOPOLAR GENERATORS AND SUPERCONDUCTING INDUCTIVE ENERGY STORAGE SYSTEMS AS POWER SUPPLIES FOR HIGH-ENERGY, SPACE-BASED LASERS
J.S. Gilbert and E.A. Kern
Los Alamos National Labs, Los Alamos, NM 87545
(02/1975).
Availability: LA-5837-MS
NTIS

For abstract, see ERA 75 02, number 00231.
Primary Keywords: Energy Storage_Electric Generators; Flywheels; Induction; Lasers; Power Supplies; Superconducting Magnets
Secondary Keywords: ERDA/250100; NTISERDA

5603
(BREAKDOWN STUDIES)
(Gas, Electrical)
BREAKDOWN AND PLASMA FORMATION IN A ROTATING PLASMA DEVICE
B. Bonnevier and A.H. Sillesen
Royal Institute of Technology, Stockholm, Sweden
No. TRITA-EPP-74-06, 17p (03/1974).
Availability: N74-26196/7
NTIS

Breakdown and formation of a plasma with high ion temperature were studied in the Puffatron at Riso. The conditions for plasma formation are along the same lines as breakdown in an ordinary crossed field discharge such as Penning, PIG, or magnetron discharge, where ions are not magnetically confined, as in the present experiment. The growth of ionization occurs much faster than expected from ionization by thermal electrons. This has been seen in some earlier rotating plasma experiments. It is suggested that work along the present lines can result in a time independent arc discharge, where ions have thermonuclear energies. (Author)
Primary Keywords: Arc Discharges; Critical Velocity; Crossed Fields; Plasma Heating; Thermonuclear Power Generation; Direct Power Generators; Energy Conversion; Energy Transfer; High Voltages; Ion Motion; Ionization; Magnetically Trapped Particles; Plasma Control
Secondary Keywords: NTISNASA

5604
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)
CASTING COPPER TO TUNGSTEN FOR HIGH POWER ARC LAMP CATHODES
H.A. Will
Lewis Research Center, Cleveland, OH
No. NASA-TM-X-2865, 11p (08/1973).
Availability: N73-27451/6
NTIS

A method for making 400-kW arc lamp cathodes is described. The cathodes are made by casting a 1.75-in. diameter copper body onto a thoriated tungsten insert. The addition of 0.5-percent nickel to the copper prevents voids from forming at the copper-tungsten interface. Cathodes made by this process have withstood more than 110 hours of operation in a 400-kW arc lamp. (Author)

Primary Keywords: Arc Lamps; Cathodes; Copper Alloys; Refractory Metal Alloys; Tungsten Alloys; Equipment Specifications; Manufacturing; Product Development; Service Life
Secondary Keywords: NASA

5605
(ELECTROMAGNETIC COMPATIBILITY)
(Transient Suppressors)
CHARACTERIZATION OF EMP PROTECTION DEVICES
G.G. Davidson and E.T. Hunter
ECOM, Fort Monmouth, NJ 07703
Technical rept. No. ECOM-4128, 53p (07/1973).
Availability: AD-763 886
NTIS

Since late 1969, a technique based on time domain reflectometry (TDR) to measure the fast switching and shunting capability of EMP protective devices has been used. This technique allows the devices to be characterized in their actual working condition--inserted in the cable line--without the perturbing influence of voltage and current probes. The report starts with the basic line theory and develops an understanding of the effect of shunt devices and the measurement of such effects using TDR. This section is fairly lengthy; however, a good background is essential for the understanding of measurements made with this technique. In addition to the measurement technique itself, a special pulse generator was developed to provide the necessary pulse into 50 ohm lines. This pulse source is described along with the basic measurement procedure. Specific techniques and data are shown for a variety of shunt protective devices. (Author)

Primary Keywords: Suppressors_Electromagnetic Pulses; Switching Circuits; Nuclear Explosions; Avalanche Diodes; Silicon Controlled Rectifiers; Electric Discharges; Neon; Measurement
Secondary Keywords: Bypasses; Spark Gaps; A

5609
(ENERGY STORAGE, CAPACITIVE; SWITCHES, CLOSING)
(Capacitor Banks; Gas Gaps, Electrical)
CONTROL OF HIGH ENERGY CAPACITOR BANKS
M. Sugiura, M. Ikeda, M. Iguchi and S. Takeda
Electrotechnical Lab, Tokyo, Japan
No. RR-713, 116p (01/1971).
Availability: N72-13200
NTIS

Primary Keywords: Capacitors; Electric Equipment; Electrical Properties; Trigger Circuits; Electric Equipment Tests; Equipment Specifications; *Spark Gaps*

5611
DESIGN AND CONSTRUCTION OF A SPARK GAP ASSEMBLY AND ASSOCIATED CIRCUITS
L. Hubbeling
CERN, Geneva, Switzerland
(04/1972).
Availability: CERN-72-6
NTIS
For abstract, see NSA 26 18, number 43103.
Primary Keywords: Pulse Generators ELECTRONICS; Radiation Detectors/ Spark Chamber
Distribution Restriction: U. S. SALES ONLY

5612
(INSULATION, MATERIAL)
()
EFFECTS OF COATING AND CLEANING ON CORONA AND HIGH-VOLTAGE BREAKDOWN IN ELECTRONIC ASSEMBLIES
E.R. Brown
Bendix Corp, Kansas City, MO
(02/1975).
Availability: BDX-613-1181(Rev.)
NTIS
For abstract, see NSA 31 10, number 28928.
Primary Keywords: Dielectric Materials_Protective Coatings; Corona Discharges_Protective Coatings; Cleaning; Failures; Surface Contamination
Secondary Keywords: NTISERDA

5614
(BREAKDOWN STUDIES)
(Gas, Electrical)
ELECTRICAL AND PHOTOGRAPHIC CHARACTERIZATION OF LOW-INTENSITY CAPACITOR SPARK DISCHARGES
C.R. Westgate, M.S. Kirshenbaum and B.D. Pollock
Picatinny Arsenal, Dover, NJ
Technical rept. No. PA-TR-4737, 36p (02/1975).
Availability: AD-A008 356/8ST
NTIS

Some properties of the gaseous discharges normally used in electrostatic initiation of primary explosives are determined from electrical and photographic studies. It is shown that the magnitude of the postbreakdown current can determine the form of the discharge. For currents larger than about 0.3 amp, the discharge is essentially an arc characterized by a low (15-30 v) voltage drop across the gap. For currents less than 0.1 amp, the discharge is essentially a spark or glow discharge characterized by a voltage drop of approximately 300 volts across the gap. In both cases, the voltages and the transition current are only slightly affected by variations in the gap length.

Primary Keywords: Explosives; Electric Ignition; Spark Ignition; Electrostatic Charge; Electric Igniters; Spark Gaps, Glow Discharges; Photographic Analysis
Secondary Keywords: NTISDODA

5616
(ELECTROMAGNETIC COMPATIBILITY)
(Lightning)
FAA LIGHTNING PROTECTION STUDY: LIGHTNING PROTECTION DEVICES
C Chen
RADC, Griffiss AFB, NY 13440
Final rept. Nov 72-31 Jan 74 (04/1974).
Availability: AD-781 319/9
NTIS

The purpose of the Lightning Protection Study is to determine the degree of susceptibility of the Federal Aviation Administration electronic systems to induced electromagnetic pulse effects due to lightning, and to propose protective devices adequate for low voltage electronic systems. This report covers one phase of the study; the lightning protective devices. The other study phases are reported in separate reports, namely lightning simulation tests of communication cables, analytical study of cable coupling, cable terminal equipment susceptibility levels. The report consists of five chapters on introductory remarks and definition of terms, gas discharge transient protectors, semiconductor breakdown diodes, metal-oxide varistors, and deployment and retrofit of protective devices. (Author)

Primary Keywords: Lightning Arresters; Communication Equipment; Electronic Equipment; Air Traffic Control Systems; Protective Equipment; Gas Discharges; Avalanche Diodes; Semiconductor Devices; Transients; Suppression
Secondary Keywords: NTISDODT; Varistors; Spark Gaps; NTISDODFAA

5619
(PARTICLE BEAMS, ION)
(Generation)
HIGH POWER ELECTROSTATIC ION ACCELERATORS
S.J. Humphries
Cornell University, Ithica, NY 14850
(10/1973).
Availability: LPS-136
NTIS
For abstract, see NSA 29 05, number 10806.
Primary Keywords: Electrostatic Accelerators_Operation; Field Emission; Ion Beams; Ion Sources; Kev Range 100-1000; Kilo Amp Beam Currents; Mev Range 01-10; Planning, Plasma
Secondary Keywords: AEC

5620
(PULSE GENERATORS; SWITCHES, CLOSING)
(Line Type: Thyristors)
HIGH POWER MODULATOR TECHNIQUES (SCR)
R.A. Smith
Westinghouse Electric Corp, Baltimore, MD Surface Div.
Final rept. 28 Nov 67-30 Jul 68 (11/1968).
Availability: AD-845 111
NTIS

Development and test of a 65KV Silicon Controlled Rectifier demonstrates the application of solid state devices and their inherent reliability in high power pulse modulator techniques. The design exploits the high voltage and high current capabilities of the SCR. Eighty devices in series yield a minimum holdoff voltage of 65KV; the test modulator switches pulse currents of 375 amperes although the SCRs have a 1000 ampere minimum peak pulse current capability. The 65KV SCR switch assembly employs a building block concept utilizing ten, 6.5KV SCR switch assemblies. (Author)

Primary Keywords: Modulators_Silicon Controlled Rectifiers; *Controlled Rectifiers_Electronic Switches*; Trigger Circuits; Flash Lamps; Xenon; Saturable Reactors; Control Panels

5622
(SWITCHES, OPENING)
(Vacuum Gaps, Electrical)
HIGH-VOLTAGE ARC INTERRUPTION STUDY
A.S.L.D L. Gilmour
Senders Associates Inc, Nashua, NH
Final rept. Dec 70-Dec 71 (04/1972).
Availability: AD 744 836
NTIS

In 1968 it was observed by the authors that an axial magnetic field applied to a vacuum-arc discharge in a coaxial diode was capable of extinguishing the discharge. A continuing effort to develop a high-voltage dc arc interrupter has resulted in a device capable of interrupting 300 amperes at 15 kilovolts. This device has been operated at repetition frequencies of several pulses per second. Over 300 pulses per second have been achieved at low power levels. The turn-on and turn-off times are, respectively, one and two microseconds. The pulse width is variable from about two to several hundred microseconds. Operation at voltages above 15 kilovolts has been prevented, primarily, by anode spots. With improved materials and vacuum techniques and modified geometries, operating voltages far above 15 kv should be possible. One of the uses for the interrupter is expected to be in high-power modulators. (Author)

Primary Keywords: Electric Switches_Electric Arcs; Electric Arcs_Reduction; Vacuum Apparatus; Magnetic Fields; Plasma Generators
Secondary Keywords: Interrupters

5623
(BREAKDOWN STUDIES)
(Corona)
INVESTIGATION OF CORONA DISCHARGE DEVICES AS ELECTRICAL LOADS FOR EXPERIMENTAL HIGH-VOLTAGE GENERATORS
K.K. Joshi and T.H. Maloney
Systems Research Labs Inc, Dayton, OH
(06/1971).
Availability: AD-748 535
NTIS

The use of the corona discharge mechanism as a means of providing an electrical load for experimental high-voltage low-current dc generators is investigated. The current-voltage characteristics of several corona discharge configurations, such as point-to-plane, coaxial cylindrical, and wire-to-plane, were experimentally obtained and compared with theoretically predicted values. Of all the configurations tested, the wire-to-plane configuration is found to be capable of dissipating the maximum electrical power (nearly 3 KW/m length of wire) and exhibits a wide range of current-voltage characteristics of various pressures, depending largely upon the wire-to-plane spacing. (Author)

Primary Keywords: Generators_Electrical Corona; Direct Current
Secondary Keywords: loading(Electrical)
Distribution Restriction: Availability: Pub. in IEEE Transactions on Electron Devices, vED18 n12 p1163-1166 Dec 71.

5624
(PULSE GENERATORS)
(Trigger)
INVESTIGATIONS ON HIGH VOLTAGE PULSERS AND AMPLIFIERS FOR THE EXACT TIMING OF THE IGNITION OF SPARK DISCHARGERS
M. Pillsticker
Technische Universiteet, Brunswick (West Germany). Institut Fur Hochspannungstechnik.
(12/1971).
Availability: BMBW-FBK-71-22
NTIS
For abstract, see NSA 26 10, number 24548.
Primary Keywords: Electric Arcs

5625
(BREAKDOWN STUDIES)
(Gas, Recovery)
INVESTIGATIONS ON THE INTERACTION BETWEEN ARCS AND GAS FLOW
K. Zueckler, H. Teppiin, H. Naecke, R. Patzelt and K.P. Rolff
Siemens-Werke, Berlin, FRG
No. BMFT-FB-T-73-89, 75p (07/1973).
Availability: N74-11552/8
NTIS
Model circuit breaker experiments were carried out to investigate the relationship between gas flow and arc behavior in the current zero-region. Synthetic circuits were used for the electrical tests. The optical investigations were carried out by the aid of a schlieren-apparatus with a high speed camera. The existence of plasma jets, which carry metal particles in the region between the contacts, was demonstrated. The behavior of the insulation material in the proximity of the arc was investigated and a suitable test method was worked out. It was possible to improve the mathematical description of the dynamic arc-behavior by a completion of the equation of Mayr. (Author)
Primary Keywords: Circuit Breakers; Electric Arcs; Gas Cooling; High Speed Cameras; Schlieren Photography; Extinguishing; Gas Flow; High Voltages; Metal Particles; Plasma Jets; Quenching (Cooling)
Secondary Keywords: NASA

5626
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
MECHANISM WHICH LEADS TO THE FORMATION OF AN ELECTRIC SPARK AT VERY HIGH VOLTAGE AND UNDER ULTRA-VACUUM FOR THE MEASUREMENT OF THE DELAY TIME OF THE DISRUPTION
F. Rohrbach
CERN, Geneva, Switzerland
(10/1971).
Availability: CERN-71-28
NTIS
For abstract, see NSA 26 09, number 22469.
Primary Keywords: Electric Arcs

5631
(PARTICLE BEAMS, ION)
(Generation)
THE USE OF FINITE J/SUB THETA/ FOR INCREASING THE ION EFFICIENCY OF HIGH IMPEDANCE DIODES
R.J. Barker and S.A. Goldstein
Naval Research Lab, Washington, DC 20375
NRL Memorandum Report No. 4773, 45p (04/1982).
Availability:
NTIS
Numerical simulations predict that the ratio of the effective ion current to total diode current can be significantly increased by introducing a small but finite azimuthal current into the tip of the cathode shank of a high impedance (4 ohm) axial pinch-reflex diode. Such a current generates large tangential magnetic fields along the electron-emitting cathode surfaces. These fields, in turn, impart a finite angular momentum to the electrons as they are injected into the anode-cathode gap. The resultant particle self-fields alter electron trajectories in such a way as to boost electron space charge near certain portions of the ion-emitting anode surface. The net consequence is a modification of the radial profile of ion emission which enhances the net ion current transmitted through the interior of the hollow cathode shank. 31 Refs.
Primary Keywords: Ion Beam Generation; Magnetic Insulation; Pinch-reflex Diode; Theory; Numerical Simulation

5634
PHOTOCONDUCTIVITY OF HIGH-VOLTAGE SPACE INSULATING MATERIALS
H.T. Coffey, J.E. Nanevicz and R.C. Adamo
Stanford Research Institute, Menlo Park, CA 94025
Final Report, 1 Jul. 1974 - 1 Oct. 1975. No. NASA-CR-134995, 67p (01/1975).
Availability: N76-19233/5ST
NTIS
The dark and photoconductivities of four high voltage spacecraft insulators, Kapton-H, FEP Teflon, Parylene, and fused quartz, were studied under a variety of conditions intended to simulate a space environment. All measurements were made in a vacuum of less than .00001 torr while the temperature was varied from 22 C to 100 C. Some of the samples used employed conventional deposited metal electrodes--others employed electrodes composed either of an electron beam or a plasma formed by ionization of the residual gas in the test chamber. Test results show: (1) Kapton had unusual conduction properties; it conductivity decreased by more than an order of magnitude when heated at 100 C in a vacuum, but ultimately attained a stable and reproducible value. (2) Both Teflon and fused quartz had high dark resistivities but low photoresistivities when exposed to UV. Optical-density measurements revealed that both materials transmitted UV with little attenuation. (3) Parylene was found to have a low but relatively stable resistivity--comparatively minor changes occurred upon heating or illuminating the sample. Optical-density measurements showed that Parylene was absorbent in the UV and would prevent photoemission from the metal electrode on the back surface. (Author)
Primary Keywords: Electrical Insulation; Materials Tests; Photoconductivity; Spacecraft; High Voltages; Environment Simulation; Quartz; Teflon (Trademark)
Secondary Keywords: Polyimide Resins; Kapton; Tetrafluoroethylene Resins; Parylene Polymers; Poly(methylene-phenylene-methylene); NTISNASA

5635
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
PORTABLE KERR SYSTEM FOR THE MEASUREMENT OF HIGH VOLTAGE PULSES
R.E.J. Hebner and S.R. Booker
Sandia Labs, Albuquerque, NM 87115
No. CONF-750405-1, 3p (01/1975).
Availability: SAND-75-5132
NTIS
For abstract, see NSA 31 12, number 35721.
Primary Keywords: Pulses_Measuring Methods; Optical Systems_Kerr Effect; Laser Radiation; Mirrors; Oscillographs; Photodetectors; Polarization; Pulse Rise Time
Secondary Keywords: NTISERDA

5636
(POWER CONDITIONING)
(Pulse Transformers)
POWER PULSE TRANSFORMER
O.S. Bogdanov, Y.P. Vakhrushin, V.G. Zhitenev, N.I. Kolesov and A.V. Orlov
Scientific-Research Institute Of Electro-Physical Apparatus, Leningrad, USSR.
Availability: NP-19092
NTIS
For abstract, see NSA 26 05, number 10678.
Primary Keywords: Electron Sources; Linear Accelerators; Transformers

5638
(BREAKDOWN STUDIES)
(Gas, Electrical)
QUANTITATIVE MEASUREMENTS OF THE EMISSION FROM HIGH DENSITY NANOSECOND SPARK CHANNELS
H.S.W. Fischer
Angewandte Physik, Technische Hochschule Darmstadt, Darmstadt , FRG
Interim scientific rept. no. 2, 1 Feb 70-31 Jan 71 (12/1971).
Availability: AD-739 253
NTIS
Quantitative values of the luminance and radiance at 4550 Angstrom were measured for Nanolite spark channels in the nanosecond range. The comparison standard was a crater of a low current carbon arc. Data of the Nanolite were: Capacitance, 1.35 nanofarads; Inductance, 2.1 microHenrys; Breakdown Voltage, 3.2 kilovolts; Gap, 0.65 mm; Pressure, 1 atmosphere. The maximum luminance was 20.0 watts per centimeter squared steradian Angstrom plus or minus 20 percent. The maximum radiance (at 4950 Angstrom) was 12.6 times ten to the sixth candlepower per centimeter squared, plus or minus 20 percent. Earlier observations demonstrated that the opacity in 1 atmosphere air during the current maximum is greater than 0.8. This opacity value is used to calculate the radiation temperature which was 31000 degrees Kelvin. Scaling laws are being derived for comparison with earlier observations in literature. These results compare rather well in spite of considerable simplifications used in the calculations. (Author)
Primary Keywords: Electric Discharges_Light Pulses; Luminescence; Gas Discharges; Electric Arcs; Spectra(Visible + Ultraviolet)
Secondary Keywords: Spark Gaps

5640
(SWITCHES, OPENING)
(Superconductive)
SUPERCONDUCTING SWITCH WITH IMPULSE CURRENT TRIGGERING
H. Koefler
Institut fur Experimentelle Kernphysik, Karlsruhe, FRG
No. KFK-2123, 24p (08/1975).
Availability: N76-25667/6ST
NTIS
Supplying reactive power by superconducting storage systems may have considerable advantages. The behavior and parameters of the switching device, and opening and closing the storage circuit were studied. Approximate mathematical solutions were checked against measured results. The influence of the impulse capacitor was studied and hints to design the triggering circuits are given. (Author)
Primary Keywords: Actuators; Superconductors; Switches; Capacitors; Energy Storage; Trigger Circuits
Secondary Keywords: West Germany; NTISNASAE
Distribution Restriction: In German; English Summary.

5642
(PULSE GENERATORS)
(LC)
DRIVING CIRCUITS FOR COPPER HALIDE LASERS - A PARAMETRIC STUDY
A.J. Andrews, R.C. Tobin and C.E. Webb
Clarendon Lab, Oxford, UK
Journal Of Physics D: Applied Physics, Vol 13, No. 6, pp 1017-1027 (06/1980).
13 Refs.
Primary Keywords: Double Spark Gap; Thyratron Burst Mode Drivers; Circuit Inductance; Current Rise-time; Laser Performance

5644
(BREAKDOWN STUDIES)
(Gas, Electrical)
INFLUENCE OF STATISTICAL TIME LAGS UPON ELECTRIC BREAKDOWN IN ELECTRONEGATIVE GASES

R.W. Crowe
Franklin GNO Corp, West Palm Beach, FL
Journal Of Applied Physics, Vol. 37, No. 4, pp 1515-1527 (03/1966).
Measurement of the electric strength of SF/sub 6/ and a number of other electronegative gases has provided direct evidence that an unusually long statistical time lag is associated with the breakdown process in such gases under certain experimental conditions. For example, time lags in excess of one minute have been reported for the breakdown of SF/sub 6/. The reason for the difference in breakdown behavior of such gases, when compared with the behavior of the more common gases, is not well understood. The paper represents an attempt to provide an explanation of the role that these statistical time lags can often play in yielding misleading experimental values of the electric breakdown voltage, when measured under certain standard test conditions. A number of cases are discussed and evaluated by combining accurate experimental data with theories involving the occurance of random events. It is concluded that the 'apparent' value of the electric breakdown voltage in electronegative gases ought to be strongly dependent upon the mean statistical time lag, the nature of voltage application, and the electrode configuration. The experimentally observed appearance of field emission from the cathode surface at voltages considerably in excess of the threshold value, can be used to derive theoretical relationships which indicate that rather significant 'apparent' deviations from Paschen's law are to be expected under certain experimental conditions. 9 Refs.
Primary Keywords: Statistical Time Lag; Electronegative Gas; Several Gases; Breakdown Voltage Error; Paschen's Law Deviation; Experiment; Theory

5646
(PULSE GENERATORS)
(Marx)
TRANSIENT PHENOMENA IN THE MARX-TYPE MULTIPLIER CIRCUIT AFTER FIRING THE FIRST SWITCHING SPARK GAP

A. Rodewald
National Research Council, Ottawa, Ontario, Canada
No. NRC-TT-1516, 28p (01/1972).
Availability: N72-18236
NTIS
The transient processes after the firing of the first switching spark gap in the Marx-type multiplier circuit are investigated experimentally. The test results are described in terms of a simple equivalent diagram. The equivalent diagram comprises a series of resistances with longitudinal and transverse capacitance. The series of resistances is formed by the resistances inserted between the individual generator stages. The so-called discharge resistances here play the principal part. The longitudinal and transverse capacitances in the circuit are provided by the stray capacitances between the neighbouring generator stages and the stray capacitances of the generator stages relative to earth. The generally capacitive loading of the generator in the case of the observed rapid transient processes acts as a short circuit at the output of the series. The longitudinal voltages in the individual stages of the series appear as overvoltages at the corresponding switching spark gaps. The firing of a switching spark gap as the result of such an over voltage is oscillographed. (Author)
Primary Keywords: Multiplexing; Spark Gaps; Transient Response; Circuit Diagrams; Electric Potential; Fire Control Circuits

5647
(BREAKDOWN STUDIES)
(Equipment)
TRANSPORT PROPERTIES IN HIGH POWER ARCS

H.H. Maecker
Technische Universitaet Munich (West Germany) Elektrophysikalisches Institut
Final rept. 1 Feb 67-31 Jan 71 (05/1972).
Availability: AD-744 518
NTIS
In order to investigate transport and radiation properties of various plasmas the cascade arc chamber was improved with respect to new electrodes, to pressure proof, and to air-cooled plates for low power input and was made fit for viscosity measurements by providing a honeycomb flow rectifier and pressure taps along the cascade. The temperature distribution across the H2 - arc has been re-examined by all methods available with high precision. The splitting of the heat flux potential curves vs. temperature at low currents in the H2 arc could be removed by reducing the electron temperature to the gas temperature taking into account inelastic collisions between electrons and H2 - molecules. In the Ar-arc radiation plays a dominant role and changes rapidly with elevated pressures. Therefore extended measurements of all quantities of interest have been carried out at temperatures up to 25.000K and in the pressure range from 1 to 10 atms.
Primary Keywords: Gas Discharges_Transport Properties; Gas Ionization; Laminar Flow; Hydrogen; Oxygen; Nitrogen; Electrical Conductance; Thermal Conductivity; West Germany
Secondary Keywords: Plasma Diagnostics; Electron Energy; Hydrogen Plasma; Nitrogen Plasma; Argon Plasma

5648
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)
TUBE FAILURE MECHANISMS

K.G. Bauchard and L.W.P Lesensky
Raytheon Co. Waltham, MA
Final rept. 1 May 68-30 Sep 69 No. PT-2517, 98p (03/1970).
Availability: AD-869 174
NTIS
The investigation focused attention on (1) high voltage breakdown in vacuum as it occurs across vacuum gaps and along insulating surfaces and (2) surface studies of metal-oxide composite cathodes, as exemplified by the tungsten-thoria (W-ThO2) cermet cathode, pertaining to the chemical and topographical changes resulting from heat and electron bombardment. (Author)
Primary Keywords: Electron Tubes_Failure(Electronics); Cathodes(Electron Tubes); Cermets; Copper; Surface Properties; Electric Discharges; Diffusion; Platinum; Tungsten; Titanium Alloys
Secondary Keywords: High Voltage Breakdown

5649
(PULSE GENERATORS)
(Blumlein Lines)
ELECTRICAL AND OPTICAL CHARACTERISTICS OF A MULTICHANNEL N/SUB 2/-LASER

M. Hugenschmidt and J. Wey
Deutsch-Franzosisches Forschungsinsitut, Saint Louis, France
Optics Communications, Vol. 29, No. 2, pp 191-196 (05/1979).
The influence of electrical parameters on the optical properties of atmospheric pressure transversely excited N/sub 2/ -lasers of the Blumlein-type is investigated. Experiments are performed using a multichannel laser system providing high repetition rate trains of nanosecond pulses (50 to 100 MHz). Both the high voltage rise and decay times of the order of several kV/ns are determined electro-optically and correlated with the intensity and time lag of the optical pulses. Using an injection technique the intensity and beam divergence could be markedly improved. 16 Refs.
Primary Keywords: Blumlein Type Multichannel N/sub 2/ Laser; Electrical Properites; Optical Properties; Transverse Excitation

5651
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
CALIBRATION OF A FAR ULTRAVIOLET SPECTROGRAPH AND A STUDY OF VACUUM SPARK BREAKDOWN

T.M. Carpenter
Oklahoma State University, Stillwater, OK
No. NASA-CR-102643, 120p (05/1970).
Availability: N70-26046
NTIS

Primary Keywords: Aluminum; Far Ultraviolet Radiation; Spark Gaps; Spectrometers; Emission Spectra; Plasma Temperature; Ruby Lasers; Spectrum Analysis

5652
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
CALIBRATION OF A KERR CELL SYSTEM FOR HIGH VOLTAGE PULSE MEASUREMENTS

E.C. Cassidy and H.N. Cones
Sandia Labs, Albuquerque, NM 87115
Final rept. No. SC-CR-68-3730, 53p (08/1968).
Availability: PB-180 864
NTIS
The report summarizes progress made on the Kerr cell pulse measurements project. The following are included: (1) Systems for purification and testing of the nitrobenzene used in our Kerr cells were developed. (2) Methods for calibration of a Kerr system by reference to calibrated pulse divider measurements. These calibrations are believed to be accurate to better than 1%. (3) Methods for independent (without reference to pulse divider measurements), under both uniform and nonuniform field conditions, were developed and evaluated. (4) Pulse voltages as high as 100 kV were measured (simultaneously) by use of a calibrated pulse divider and a Kerr system. Several different Kerr cells were used. With further refinements, it is anticipated that such calibrations, accurate to within plus or minus 0.5% will be feasible for systems capable of time-resolved measurements of pulses as high as 300 kV.
Primary Keywords: Shutters(Optics)_Kerr Cells; Kerr Cells_Calibration; Electrostatic Fields; Birefringence; Polarization; Nitrobenzenes; Optical Equipment; Design; Pulse Systems; Lasers

5653
(ENERGY STORAGE, CAPACITIVE)
(Capacitor Banks)
CAPACITOR BANKS FOR A TURBULENCE HEATING EXPERIMENT

G. Herppich, A. Knobloch and G. Mueller
Institut fur Plasmaphysik, Garching, FRG
No. IPP-4/50, 44p (06/1968).
Availability: N68-32301
NTIS

Primary Keywords: Capacitors; Electric Energy Storage; Turbulent Heat Transfer; Electric Potential; Ignition; Inductors; Ionization; Spark Gaps; Suppressors; Theta Pinch

5655
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Systems; Gas Gaps, Electrical)
CROWBAR SYSTEM IN ISAR 1

E. Van Mark and H. Wedler
Institut fur Plasmaphysik, Garching, FRG
No. IPP-4/59, 29p (06/1968).
Availability: N68-32534
NTIS

Primary Keywords: Capacitors; Plasma Generators; Spark Gaps; Arc Generators; Electric Discharges; Magnetic Fields; Short Circuits; Systems Engineering; Trigatrons

5656
(POWER CONDITIONING)
(Cable Terminations)
DAMPING OF VOLTAGE REFLECTIONS AT OPEN CIRCUIT ENDS OF CHARGED CABLES

H.-. Schneider-muntau
European Space Research Inst, Frascati, Italy
(01/1969).
Availability: N69-35146
NTIS

Primary Keywords: Capacitance; Electric Pulses; High Voltages; Transmission Lines; Damping; Electrical Resistance; Numerical Analysis; Reflected Waves

5657
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
DESIGN AND ANALYSIS OF A STATISTICAL EXPERIMENT ON HIGH VOLTAGE BREAKDOWN IN VACUUM
M.M. Chrenta, M.H. Zinn and G.W. Taylor
ECOM, Fort Monmouth, NJ 07703
Technical rept. No. ECOM-2939, 19p (02/1968).
Availability: AD-668 241
NTIS

The results of an experiment designed as a quarter replicate of a 2 to the 7th power plan on factors affecting high-voltage breakdown in vacuum are given. The significance of each of the seven factors is analyzed, showing the effect of electrode materials, electrode geometry, electrode finishes, and the bakeout process. A good degree of confidence was obtained showing that the anode material and anode geometry are important in the cause for breakdown. The results of these statistically designed experiments and other experiments performed investigating the activity in high-voltage gaps lead to the conclusion that anode effects play a major role in the breakdown process. Upon completion of the full line of designed experiments, the information gained from this work will be compiled in charts and graphs as a design monograph for the high-voltage high vacuum component design engineer. (Author)

Primary Keywords: Failure(Electronics)_Vacuum; Voltage; Statistical Analysis; Radar Equipment; Design; Ion Accelerators; Space Propulsion; Particle Accelerators; Test Methods; Electrodes; Geometry; Materials; Anodes; Cathodes
Secondary Keywords: Graphs(Charts)

5658
(BREAKDOWN STUDIES)
(Gas, Electrical)
EFFECT OF ATMOSPHERIC HUMIDITY ON BREAKDOWN VOLTAGE OF VARIOUS SPARKOVER LENGTHS AT VARIOUS VOLTAGE FORMS
M.S. Guindehi
Eidgenossische Technische Hochschule, Zurich, Switzerland
Einfluss Der Luftfeuchtigkeit Auf Die Durchbruchspannung Verschiedener Funkenstrecken Bei Verschiedenen Spannungsformen No. DISS-4347, 140p (02/1968).
Availability: N70-38345
NTIS

Primary Keywords: Atmospheric Moisture; Electrical Faults; Spark Gaps; Electric Potential; Flashover

5659
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Electrodes)
ELECTRICAL BREAKDOWN BETWEEN ERBIUM OXIDE, ERBIUM DEUTERIDE, AND MOLYBDENUM ELECTRODES IN A VACUUM
M.H. Davies, W.D. Owen and W.D. Powell
Atomic Weapons Research Establishment, Aldermaston, Berkshire, UK
No. AWRE-O-1/69, 32p (02/1969).
Availability: N69-34178
NTIS

Primary Keywords: Electrical Faults; Electrodes; Erbium Compounds; Molybdenum; Vacuum; Deuterides; Oxides; Spark Gaps

5661
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
FIRING CHARACTERISTICS OF MULTIPLE-ELECTRODE TRIGGERED VACUUM GAPS
S.B.A.J. Schneider and J.E. Creedon
ECOM, Fort Monmouth, NJ 07703
Research and development technical rept. No. ECOM-3025, 15p (10/1968).
Availability: AD-677 381
NTIS

The design of a multiple-electrode triggered vacuum gap for 350-kilovolt operation as an energy diverter was described at the Ninth Modulator Symposium. This program was continued. In the design of the new tubes, the primary design objective was to achieve minimum firing times without sacrifice of voltage hold-off reliability. The arc length was considerably shortened and the ceramic sidewalls have been shielded from the arc. Three different designs were constructed. They are a six-gap tube, a three-gap tube, and a modified version of the three-gap tube with a hydrogen reservoir added. The firing characteristics of these tubes were studied from 1 kilovolt to 280 kilovolts. The influence of a low pressure of hydrogen on firing and hold-off was evaluated. (Author)

Primary Keywords: Discharge Tubes_Trigger Circuits; Electrodes; Design; Electric Arcs; Plasma Medium; Energy Management

5662
(BREAKDOWN STUDIES)
(Equipment)
FURTHER DEVELOPMENT OF THE CASCADE HIGH POWER ARC CHAMBER
H. Maecker and S. Steinberger
Culham Translations Office, UK
No. CTO-477, 12p (02/1968).
Trans. From: Z. Angew. Phys. No. 6, pp 456-458 (1967)
Availability: N68-30378
NTIS

Primary Keywords: Arc Chambers; Plasma Cylinders; Copper; Electrical Insulation; Electrodes; Electromagnetic Fields; Heat Transfer; High Voltages; Silicon; Thermal Insulation

5663
(PULSE GENERATORS)
(Capacitor Banks)
GENERATION OF RAPID RISE CURRENT PULSES IN THE MSEC RANGE FOR FAST COMPRESSION EXPERIMENTS
G. Herppich and A. Knobloch
Institut fur Plasmaphysik, Garching, FRG
No. IPP-4/57, 48p (06/1968).
Availability: N68-32280
NTIS

Primary Keywords: Analysis (mathematics); Electric Energy Storage; Inductance; Pulse Generators; Shock Heating; Capacitors; Conferences; Costs; Electric Current; Electric Discharges; Magnetic Diffusion; Magnetohydrodynamic Generators; Plasma Generators

5666
(SWITCHES, CLOSING)
(Gas Gaps, Self)
INHOMOGENOUS AIR SPARK GAPS AT DIFFERING VOLTAGE LOAD
K. Feser
Technische Hochschule Munchen (West Germany). Fakultaet Fur Maschinenwesen Und Elektrotechnik.
Inhomogene Luftfunkenstrecken Bei Verschiedener Spannungsbeanspruchung (06/1968).
Availability: N70-33687
NTIS

Primary Keywords: Circuit Protection; Electric Potential; Overvoltage; Spark Gaps; Alternating Current; Direct Current; Electric Power Transmission; Surges; Volt-ampere Characteristics

5667
(INSULATION, MATERIAL)
(Solid)
INSULATION STUDIES FOR HIGH POWER TUBES
H.C. McGowan, E.J. Smoke and D.L. Frey
New Jersey Ceramic Research Station, New Brunswick, NJ
Final rept. 27 Jan-26 Sep 69 (03/1970).
Availability: AD-707 946
NTIS

A feasibility study of insulation materials for application in high power electron tubes was made. Pertinent properties included: low dielectric constant (< 3.0), low dielectric loss (LD.0001), high thermal conductivity (0.5 cal/cm, sec. C). After an extensive literature search, a theoretical study was carried out on the fundamental factors affecting a material's property values. This was extended to include those materials, currently available, which most closely approximate the target values. The approaches to determine the feasibility of developing the desired new material centered around three areas: (1) observation of property value ranges for material classes, (2) analysis of property value trends for families of compounds based on the position of their elements in the Periodic Table, (3) a similar analysis based on the more promising crystal structures as predicted by radius ratios. No new material was found which better approximated the ideal than do BeO and BN. The trends in the data do not give much hope of finding a more ideal new compound. This study concludes that the most feasible approach to a close approximation of the target values would be the growth and utilization of BN in whisker form. (Author)

Primary Keywords: Electron Tubes_Electric Insulation; Beryllium Oxides; Boron Compounds; Nitrides; Dielectric Properties; Thermal Conductivity; Feasibility Studies
Secondary Keywords: Boron Nitrides

5668
(SWITCHES, CLOSING)
(Miscellaneous Solid State)
INVESTIGATION OF DESIGN OF HIGH VOLTAGE, HIGH CURRENT SOLID STATE SWITCHING DEVICES (FINAL TECHNICAL REPORT)
E.R. Graf
Auburn University, AL
No. NASA-CR-98075, 109p (06/1968).
Availability: N69-10271
NTIS

Primary Keywords: Rectifiers; Semiconductor Devices; Switching Circuits; Semiconductor Junctions; Surges; Trigger Circuits

5669
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
INVESTIGATIONS ON LOW-INDUCTIVE SPARK GAPS FOR HIGH VOLTAGES IN AIR
M. Pillsticker
Technische Universitaet, Brunswick (West Germany). Institut Fur Hochspannungstechnik.
(10/1970).
Availability: BMBW-FBK-70-17
NTIS
For abstract, see NSA 25 04, number 07375.
Primary Keywords: Electric Fields

5670
(PULSE GENERATORS)
(Trigger)
MODEL-10 PRECISION DELAY TRIGGER GENERATOR
A.T. Brousseau
Los Alamos National Labs, Los Alamos, NM 87545
(08/1968).
Availability: LA-3964-MS
NTIS

Primary Keywords: Trigger Circuits_Delay Circuits; Plasma Physics

5671
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
MULTIPLE-ELECTRODE TRIGGERED VACUUM GAPS
S. Schneider, A.J. Buffa and J.E. Creedon
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-16, No. 3, pp 293-296 (03/1969).

Since the design criteria for reliable operation of a single gap at 300 kV are not well know, multiple-electrode triggered vacuum gaps were constructed. A six-gap structure was initially studied. It had excessive time delay in the initiation of the arc. Subsequently, a three-gap structure was built. Time delays in initiation of the arc were satisfactory, but the rate of rise of current was slow. In addition, voltage hold-off capability was marginal. To improve these characteristics, a low pressure of hydrogen, 7 to 25 mTorr, was added. Considerably improved firing characteristics and reliable voltage hold-off at 320 kV were obtained. 8 Refs.

Primary Keywords: 300 kV Operating Voltage; Six-gap Switch; Delay Measurement, Three-gap Switch Short Delay, Slow Current Rise; Gas Fill

5672
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
PRESSURIZED SWITCHING UNIT DESIGNED TO START AND TO CROWBAR A TURBULENCE HEATING EXPERIMENT
G. Klement and G. Mueller
Institut fur Plasmaphysik, Garching, FRG
No. IPP-4/52, 37p (06/1968).
Availability: N68-32431
NTIS

Primary Keywords: Spark Gaps; Switching Circuits; Trigger Circuits; Aluminum; Bibliographies; Electrodes; Epoxy Resins; Ferrites; Oscillographs; Pressure Chambers; Trigatrons

5676
(ENERGY STORAGE, CAPACITIVE; SAFETY)
(Capacitor Banks)
SAFETY PROBLEMS IN THE JULIETTA CAPACITOR BANK
F.J. Friedrich and A. Liedtke
Institut fur Plasmaphysik, Garching, FRG
No. JUL-540-PP, 18p (06/1968).
Availability: N69-18694
NTIS

Primary Keywords: Capacitors; Circuit Protection; High Current; Safety Devices; Capacitance Switches; Electric Energy Storage; Failure; Reactor Safety; Trigatrons

5677
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SWITCHES FOR HIGH CURRENT DEVICES
R. Wilhelm
Institut fur Plasmaphysik, Garching, FRG
Schaltelemente Fuer Stossstromanlagen No. IPP-1/85, 33p (08/1968).
Availability: N69-18790
NTIS

Primary Keywords: Electric Switches; High Current; Plasma Physics; Spark Gaps; Electric Pulses; Ferrites; Foils (materials); Theta Pinch; Vacuum Apparatus

5678
(POWER CONDITIONING)
(Reviews)
TECHNIQUES OF SHAPING HIGH-VOLTAGE NANOSECOND PULSES
G.A. Vorobev and G.A. Mesyats
FTD, Wright-Patterson AFB, OH
No. FTD-MC-23-643-70, 168p (03/1971).
Availability: AD-726 793
NTIS

The monograph is the first attempt at a systematic presentation of material on the technique of shaping high-voltage nanosecond pulses. A considerable portion of the book is made up of the authors' works started at the high-voltage laboratory of Tomsk Polytechnic Institute in 1957 on the initiative of the Doctor of Physicomathematical Sciences Professor A. A. Vovab'yov. Description of devices for obtaining and converting the high-voltage nanosecond pulses is preceded by an analysis of the basic processes taking place in a spark with account taken of Weizel and Rompe theories and of the theory of streamer discharge and transient processes in a discharge circuit. (Author)
Primary Keywords: Pulse Generators_Configuration; Gas Discharges; Voltage; Measurement; USSR
Secondary Keywords: Translations; Nanosecond Pulses

5679
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE DEVELOPMENT OF A LONG SPARK AND LIGHTNING
I.S. Stekolnikov and A.V. Shkilev
FTD, Wright-Patterson AFB, OH
No. FTD-MT-24-46-68, 29p (03/1968).
Trans. From: Energeticheskii Institut, Moscow Trudy, pp 97-100 (1966)
Availability: AD-675 456
NTIS

To increase the understanding of the growth process of long sparks, laboratory studies were conducted. In these image-converter tube graphs were constructed using an electron-converter tube with light amplification. To record the discharge current and voltage in the gap, a high speed electronic oscillograph was used. High optical sensitivity permitted a sharp focusing of the weak light fluxes of the initial spark stages. These spark studies were conducted with three different gap arrangements. (Author)
Primary Keywords: Electric Discharges_Production; Growth; Sparks; Lightning; Amplifiers; Light; Electron Tubes; Photographic Equipment; Image Converters; Electric Currents; Voltage; Oscillographs; Optical Scanning; Test Facilities; USSR
Secondary Keywords: Translations; Coronas; Spark Gaps

5680
(BREAKDOWN STUDIES)
(Liquid, Electrical)
THE IMPULSE BREAKDOWN IN INSULATING OIL
M.G. Kratzenstein
Technische Hochschule Munchen (West Germany). Fakultaet Fur Maschinenwesen Und Elektrotechnik.
Der Stossdurchschlag in Isolieroel (03/1968).
Availability: N69-40758
NTIS

Primary Keywords: Electric Discharges; Electrical Faults; Electrical Insulation; High Voltages; Mineral Oils; Electric Field Strength; Electrodes; Voltage Generators

5683
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
USE OF THE HOMOPOLAR GENERATOR TO POWER XENON DISCHARGE TUBES AND SOME ASSOCIATED SWITCHING PROBLEMS
E.K. Inall
Australian National University, Canberra, Australia
No. EP-RR-23, 30p (03/1969).
Availability: N71-11368
NTIS

Primary Keywords: Electric Equipment; Electric Generators; Electrical Faults; Electric Switches; Equipment Specifications; Failure Analysis; High Voltages

5684
(BREAKDOWN STUDIES)
(Gas, Electrical)
A HIGH-POWER ELECTRIC SPARK IN AIR AT ATMOSPHERIC PRESSURE
I.S. Abramson and I.S. Marshak
American Meteorological Society, Boston, MA
No. T-R-414, 2p (12/1963).
Availability: AD-602 128
NTIS

Investigation of a spark, energized by a voltage source capable of supplying currents of several hundred amperes for a period of the order of 10 to the minus 8th power sec, showed that the voltage drop on the spark for such currents is considerably greater than the potential difference in a normal arc. By the end of the voltage dip, the diameter of the channel, determined by the Kerr cell, is independent of the current, at least in first approximation. There is a certain critical current density in the spark channel for the given potential difference between the electrodes. The quantity of energy liberated in the spark gap can be very large, owing to saturation. A discharge in metal-wire vapor is akin to a discharge with high current density in the last stage of the spark. (Author)
Primary Keywords: ELECTRICAL DISCHARGES_ENERGY; SPARKS_ELECTRICAL PROPERTIES; ELECTRIC ARCS; VOLTAGE; ELECTRIC CURRENTS; ELECTRODES; GAS IONIZATION; PLASMA PHYSICS; USSR

5685
(PULSE GENERATORS; POWER CONDITIONING)
(Trigger; Saturable Reactors)
A MAGNETO-DYNAMIC TRIGGER
B.V. Bolotov and V.F. Kalyuzhnyi
FTD, Wright-Patterson AFB, OH
(08/1964).
Availability: AD-605 463
NTIS

A new trigger is proposed containing a magnetic core with three magnetic contours of a material having hysteresis loops in a nearly rectangular position, and characterized by the fact that for the purpose of expanding the limits of the signal switch connection with power output, a 'Khalla' pick-up is placed in the first magnetic contour and, in the magnetic circuit of the other two, are placed toroidal cores on which is wound a commutating winding. (Author)
Primary Keywords: MAGNETIC CORES_TRIGGER CIRCUITS; TRIGGER CIRCUITS_MAGNETIC CORES; SWITCHING CIRCUITS; MAGNETIC COILS; DESIGN; HYSTERESIS; PATENTS; USSR

5686
(PULSE GENERATORS)
(Trigger)
A 15 KV TRIGGER-GENERATOR WITH SPARK GAP
R.C. Kunze and E.V. Mark
Institut fur Plasmaphysik, Garching, FRG
15 Kv Triggergerat Mit Funkenstrecke No. IPP-4/43, 13p (06/1967).
Availability: N67-36499
NTIS

Primary Keywords: Kerr Cell; Pulsed Generator; Spark Gap; Cell; Discharge; Fast; Gap; Generator; High Voltage; Jitter; Lifespan; Low; Power; Pulse; Rise; Spark; Transient; Trigger
Secondary Keywords: IN GERMAN; English Summary

5689
(PULSE GENERATORS)
(Trigger)
DEVICE FOR TRIGGERING DISCHARGE TUBES IN A HIGH-VOLTAGE PULSE GENERATOR
Y.F. Usov
FTD, Wright-Patterson AFB, OH
No. FTD-MT-66-723, 7p (02/1967).
Trans. From: Russian Patent No. 175 085
Availability: AD-655 036
NTIS

The patent describes a device for triggering discharge tubes in a high-voltage pulse generator containing a generator of triggering pulses, electrodes of an ignition discharge tube, and a section of coaxial cable. For the purpose of preventing the shunting of the resistance of the load of the generator by the ignition circuit and the protection of the generator of the triggering generator from the action of high tension, a section of the coaxial cable over which the triggering pulse is passed to the ignition discharge tube is wound on a core of ferromagnetic material, and the sheath of the cable is grounded from the side of generator of the triggering pulses.
Primary Keywords: Pulse Generators_Trigger Circuits; Trigger Circuits_Discharge Tubes; Electrodes; Coaxial Cables; USSR; Patents

5695
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; INSULATION, MATERIAL; INSULATION, VACUUM)
(Vacuum, Electrical; Liquid, Electrical; Liquid)
HIGH-VOLTAGE BREAKDOWN IN VACUUM AND IN OIL
L.H. Bettenhausen
Battelle Memorial Institute, Columbus, OH
BMI Report No. BMI-197-12-1 (10/1962).
Availability: AD 294022
NTIS

A summary is given of the state of knowledge and current research into high-voltage breakdown in vacuum and in oil. It is directed toward engineers who will use vacuum and oil as electrical-insulation media. The nature of the breakdown phenomena in vacuum is discussed. Current research into vacuum breakdown is then considered. A description of the breakdown phenomena in liquid dielectrics is the next topic, with emphasis on the behavior of insulating oils. The amount of source literature available on the topic of liquid dielectrics is staggering. Three reviews of this subject have been published within the past year alone; the reader will be referred to these for a more detailed treatment. While recent reviews of vacuum-breakdown phenomena have appeared, considerable new information has become available and is included herein for additional assessment. 169 Refs.

Primary Keywords: Vacuum Breakdown; Qualitative Overview; Electrode Effects; Modeling; Surface Flashover; Oil Breakdown; Modeling

5697
INDUCTANCE EFFECTS IN ENERGY DIVERTER DISCHARGE CIRCUITS
G.W. Taylor and S Schneider
ECOM, Fort Monmouth, NJ 07703
No. ECOM-2529, 2p (11/1964).
Availability: AD-611 276
NTIS

The effectiveness of energy-diverter protection can be reduced by the presence of inductance between the energy diverter and the 'protected system'. Two primary effects caused by inductance have been noted. The first effect occurs when the fault-sensing circuit triggers the energy-diverter during a high-impedance fault. In this case a large voltage oscillation about the zero reference level appears at the 'protected system'. If the inductance is large, the oscillation will be maintained for a long period and will prevent quick removal of voltage. The second effect occurs when the faultsensing circuit triggers the energy diverter during a low-impedance arc. In this case the large inductance retards arc quenching. As the arc attempts to quench, the voltage oscillation reappears because of the energy stored in the inductor, and arc quenching is prevented. Observations on a system and an analysis of the circuit are discussed. (Author)

Primary Keywords: ELECTRONIC SWITCHES_ELECTRIC DISCHARGES; SWITCHING CIRCUITS_ELECTRONIC SWITCHES; INDUCTANCE; TRIGGER CIRCUITS; VOLTAGE; OSCILLATION; ELECTRONICS; ELECTRICAL IMPEDANCE; ENERGY; DELAY CIRCUITS

5698
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Electrodes)
INFLUENCE OF ELECTRODE MATERIAL ON HIGH-VOLTAGE VACUUM BREAKDOWN
M.H. Zinn, G.W. Taylor and M.M. Chrepta
ECOM, Fort Monmouth, NJ 07703
Research and Development Technical rept. No. ECOM-2901, 16p (01/1968).
Availability: AD-664 145
NTIS

The question of which electrode in a two-electrode system, the anode or the cathode, contributes most to the primary voltage breakdown mechanism, and the reasons for this contribution have been the subject of wide debate among workers in the field. Theories of breakdown that involve the anode or the cathode or both to varying extent have been proposed by Cranberg, Alpert, et al, Slivkov, Utsumi and Dalman, and others. Recent data collected by Watson, Mulcahy, and Ball and by Krenjec and Ruby, when subjected to analysis, indicate a role of the anode material in the breakdown process sufficiently clear to be applied in high-voltage vacuum tube construction. Both the analysis and data collected by Taylor and Chrepta indicate that heating of the anode owing to the flow of field emission is a primary cause of breakdown at spacings of interest in vacuum tube technology. (Author)

Primary Keywords: Electric Discharges_Vacuum; Electrodes; Materials; Voltage; Theory; Regression Analysis; Field Emission

Secondary Keywords: Breakdown(Electrical)

5699
(ELECTROMAGNETIC LAUNCHERS)
(Railguns)
INVESTIGATION OF AN ARC GUN
T. Fujii, E.P. Palmer and R.W. Grow
University of Utah, Salt Lake City, UT
No. uu-6, 2p (08/1960).
Availability: AD-604 499
NTIS

To satisfy needs for a superior hypervelocity gun, a study was made of the possibility of converting the electrical energy in a capacitor bank to kinetic energy of a projectile through the use of an electric arc discharge in a gun chamber. An arc gun was developed consisting of a chamber with a pair of electrodes and an accelerating barrel. To operate the gun, the chamber is packed with lithium hydride and the barrel is fitted with a nylon pellet. The capacitor bank is discharged into the chamber, causing conversion of the lithium hydride into a low-molecular gas. The expansion of the light gas accelerates the pellet. With a 30 microfarad capacitor bank charged to 17 kilovolts, a 3.7 milligram nylon projectile was accelerated to 5.0 kilometers per second. The efficiency of the energy conversion from the capacitor to the arc was 58.2 per cent, and the efficiency of the energy conversion from the arc to the projectile was 1.82 per cent. The total efficiency of the energy conversion from the capacitor to the projectile was 1.1 per cent. (Author)

Primary Keywords: ELECTRIC GUNS_LIGHT GAS GUNS; HYPERVELOCITY GUNS_LIGHT GAS GUNS; LIGHT GAS GUNS_ELECTRIC ARCS; FIRING MECHANISMS (WEAPON); GUN COMPONENTS; LITHIUM COMPOUNDS; HYDRIDES; NYLON; PELLETS; PROJECTILES; PROPELLANTS; TRIGGER CIRCUITS; ENERGY CONVERSION

Secondary Keywords: ARC GUNS

5701
(BREAKDOWN STUDIES)
(Gas, Electrical)
METHODS FOR DETERMINATION OF TRANSPORT COEFFICIENTS FROM HIGH POWER ARCS
H Maecker
Technische Hochschule Munich (West Germany) Elektrophysikalisches Institut
Final scientific rept. 1 Oct 62-31 Jan 67 (10/1967).
Availability: AD-661 995
NTIS

Analytical methods and instruments were developed to aid in the study of transport coefficients in nitrogen, hydrogen, and argon arcs at temperatures above 15,000K. The transport properties considered were electrical conductivity, heat flux potential, thermal conductivity, and specific radiation.

Primary Keywords: Electric Arcs_Transport Properties; Plasma Medium_Transport Properties; Gas Discharges_Transport Properties; Gas Ionization; Laboratory Equipment; Argon; Line Spectrum; Intensity; Hydrogen; Nitrogen; Electrical Conductance; Thermal Conductivity

5703
(BREAKDOWN STUDIES)
(Gas, Optical)
GAS BREAKDOWN BY SINGLE 20PS, 1.06UM AND 0.53UM LASER PULSES
C.L.M. Ireland and C.G. Morgan
University College of Swansea, Singleton Park, Swansea, Wales
Journal Of Physics D; Applied Physics, Vol 7, No. 8, pp L87-L90 (05/1974).

The pressure dependence of the intensity for optical frequency breakdown of nitrogen and argon has been studied using single 20 ps, Nd/sup 3+/ laser pulses at the fundamental and second harmonic frequencies. The gases were studied over a pressure range of 10/sup -1/-10/sup 5/ Torr at 1.06 um and 10/sup 4/-10/sup 5/ Torr at 0.53 um. The results lend support to the view that breakdown at both frequencies proceeds via cascade collisional ionization rather than by multiphoton ionization. 15 Refs.

Primary Keywords: Pressure Dependence; Nitrogen And Argon; Cascade Collisional Breakdown; Multiphoton Ionization

5706
(INSULATION, MATERIAL)
(Solid)
SILICONE RUBBER GRADED CONSTRUCTION FOR HIGH VOLTAGE INSULATION
S.J. Nizinski
Dow Corning Corp, Midland, MI
(01/1961).
Availability: AD-656 174
NTIS

The results obtained show that the electric strength of silicone rubber insulated cable can be increased by using a graded construction, when one layer has a high dielectric constant and the other a low dielectric constant. Silicone rubber is easily adapted to this method because the dielectric constant can be varied from 3 to 7.5 by varying the amount of titanium dioxide added to the silicone rubber base. By making use of silicone rubber's versatility the breakdown voltage was increased by 50%. The amount of increase in breakdown voltage obtained depends upon the variables mentioned in the discussion of the calculated breakdown voltages. The capacitance also increases along with the breakdown voltage. This variation may or may not be important depending upon the application. Two possible applications of graded constructions are ignition cable and gas-tube-sign cable. (Author)

Primary Keywords: Electric Insulation_Silicone Plastics; Voltage; Dielectric Properties; Electric Cables; Manufacturing Methods

5709
(BREAKDOWN STUDIES)
(Exploding Wires)
INSTABILITIES OF ELECTRICALLY EXPLODED WIRES
A.E. Vlastos
The Royal Institute of Technology, Sweden
Journal Of Applied Physics, Vol. 44, No. 4, pp 1616-1621 (04/1973).

The experimental results summarized in this paper, which have been obtained with thin tungsten, copper, and constantan wires, give further evidence that electromagnetic macroinstabilities may develop near the melting point of thin wires which are heated by the sudden release of electrical energy and lead to their disintegration. At low-energy-input rates, screw-type instabilities develop in all the wire materials used. On the other hand, at high-energy-input rates, the copper and constantan wires show striations after the explosion, while tungsten wires are not striated but are split into tiny fibers which emerge along the whole wire. At the beginning the restrike channel of copper and constantan wires has an helicoidal form. Annealed wires show the same results. Helical channels were not observed in tungsten wires. By twisting the copper and constantan wires in the opposite direction to the channel helix, it was possible to change the direction of the helix. Thus, the helical shape of the channel may be an effect produced by the twisting of the wire in mounting it between the electrodes. The possibility that the helicoidal shape of the channel is due to some other effect is also discussed. 17 Refs.

Primary Keywords: Exploding Wire; Tungsten Wire; Copper Wire; Constantan Wire; Macroinstability; Screw-type Instability

5710
(INSULATION, MATERIAL)
(Solid)
THE INTERRELATIONSHIP BETWEEN DENSITY AND DIELECTRIC STRENGTH OF HIGH PRESSURE POLYETHYLENE FOR HIGH VOLTAGE APPLICATIONS IN INSULATED WIRES
A.S. Silver
Royal Electric Corp, Pawtucket, RI
(12/1957).
Availability: AD-656 418
NTIS

Data is presented which shows that branched P. E. manufactured by the high pressure system must be insulated properly in order to maintain a high density and crystallinity to give maximum dielectric strength in cable. (Author)

Primary Keywords: Polyethylene Plastics_Electric Insulation; Electric Wire; Density; Dielectric Properties; Crystallization; Data; Electric Cables

5711
(DIAGNOSTICS AND INSTRUMENTATION)
(Impedance)
THE MEASUREMENT OF IMPEDANCE AT HIGH POWER
R.E. Ford and C.W. Stoops
Naval Research Lab, Orlando, FL
(10/1967).
Availability: AD-661 230
NTIS
A method and the electronic equipment for applying it was developed to enable the impedance of a transducer or other device, linear or nonlinear, to be calculated from measurements made while the device is operating at high power, pulsed or c-w. The method involves the use of a null-balance technique by which the current and voltage of a c-w reference signal are compared with samples of the 'unknown' signal and nulled against the unknown on an oscilloscope. The relative phase also is measured. Toroidal transformers provide the means of extracting samples from the high driving voltage and current. The electronic components are of solid-state circuitry throughout. (Author)
Primary Keywords: Electrical Impedance Measurement; Transducers; Test Methods; Power; Underwater Sound Equipment; Calibration; Phase Measurement; Electric Currents; Voltage; Test Equipment(Electronics)

5714
(SWITCHES, CLOSING)
(Thyristors)
THE SCR AS A HIGH POWER MODULATOR SWITCH
A.S. Cardello
RADC, Griffiss AFB, NY 13440
RADC Report No. RADC TR 67-625 (12/1967).
Availability: AD 664331
NTIS
This report is a survey of the current state-of-the-art in the use of silicon controlled rectifiers in high power modulator switch series. A brief description of the device and device characteristics is included. The report describes several contractual efforts which proved the feasibility of applying the devices to high power equipments and in detail describes the device, development of circuitry, triggering techniques and device improvements. The applications discussed in the report show that the silicon controlled rectifier has been used in a 5 megawatt modulator and is capable of operation at power levels of 25 megawatts and beyond. Continued efforts in this area will prove the high power capability of the device in practical applications. 8 Refs.
Primary Keywords: Silicon Controlled Rectifier; Modulator; Characterization; Performance Test; Triggering Considerations

5715
(PARTICLE BEAM, ION)
(Generation)
ION ACCELERATION IN A MAGNETICALLY INSULATED DIODE
Y.L. Bakshaev, P.I. Blinov, G.I. Dolgavchev and V.A. Skoryupin
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
Soviet Journal Of Plasma Physics, Vol. 5, No. 5, pp 583-584 (09/1979).
Trans. From: Fiziki Plazmy, Vol. 5, pp 1041-1043
Experiments have been carried out to determine the mechanism for the formation of the anode plasma and to study the ion acceleration in a magnetically insulated coaxial diode. The anode plasma forms as a result of electron bombardment of the polyethylene anode. In a magnetic field H=(3-8)H/sub cr/, the ion current density reaches 60 A/cm/sup 2/, while the insulation lasts 1 usec. 4 Refs.
Primary Keywords: Magnetic Insulation; Anode Plasma; Electron Bombardment; Electric Discharge
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5733
HIGH-VOLTAGE PULSE MONITOR SYSTEM FOR NEUTRINO ELECTRON ELASTIC SCATTERING
C. Dalton
Los Alamos National Labs, Los Alamos, NM 87545
(08/1980).
Availability: LA-8505-MS
NTIS
The Neutrino Electron Elastic Scattering Experiment will use 40 high-voltage pulsers and 40 flash-chamber detector modules. This report describes the proposed microprocessor controlled monitor system to ensure the safe and efficient operation of the high-voltage pulsers and flash chambers. (ERA citation 05:037095)
Primary Keywords: Data Acquisition Systems; High-voltage Pulse Generators; Target Chambers; Lampf Linac; Microprocessors; Neutrino-electron Interactions; On-line Control Systems
Secondary Keywords: ERDA/430303; NTISDE

5782
(BREAKDOWN STUDIES)
(Gas, Electrical)
PARTICLE-INITIATED BREAKDOWN IN GAS DIELECTRIC CABLE INSULATION EXPANDED SCOPE PROGRAM (FINAL REPORT)
C.M. Cooke
Massachusetts Institute of Technology, Cambridge, MA
(11/1979).
Availability: EPRI-EL-1264
NTIS
The adverse influence of conducting particle contaminants in gas-insulated power apparatus was investigated in a series of experiments that employed coaxial configurations and dc voltages to 1500 kV. Particle dynamics was shown to be important and related to breakdown initiation in the gas. Both SF sub 6 and N sub 2 gases at pressures from 1 to 14.6 atm absolute were used. The particles were intentionally introduced and ranged from 1.6 to 6.4 mm spheres and wires. Effects in the gas gap as well as along surfaces of solid insulators were studied. Visual observations, photographs, and electrical measurements helped in distinguishing various processes. Particles could reduce the insulation performance by factors of 3 to 5 and were especially significant when moved to the center conductor. By coordination of this work with a separate study at the Westinghouse R and D laboratory, a comparison between dc and ac performance was made. Generally the dc breakdown values exhibited wider scatter, though their lower limit was similar to that found under ac. Overall fundamental forces and processes which involve particle contamination effects were identified and found to be the same for dc and ac voltage stresses. (ERA citation 05:015703)
Primary Keywords: Gas-insulated Cables; Uhv Dc Systems; Aluminium; Breakdown; Coaxial Cables; Comparative Evaluations; Dielectric Materials; Electrical Insulation; Experimental Data; Graphs; Nitrogen; Particles; Power Transmission Lines; Pressure Dependence
Secondary Keywords: ERDA/280302; NTISDE

5798
(PULSE GENERATORS)
(Marx)
A SOLID STATE NANOSECOND PULSER USING MARX BANK TECHNIQUES
E.A. Jung and R.N. Lewis
Argonne National Lab, Argonne, IL
Nuclear Instruments And Methods, Vol. 44, No. 2, pp 224-228 (10/1966).
This pulser generates a 5 kV pulse into 50 ohm, 17 nsec after receiving a .33 V input signal. The voltage is derived from capacitors which are charged in parallel and discharged in series. Avalanche transistors are used as the switching elements from the 0 to 1 kV level, while Elkonite spark gaps are used from the 1 to 5 kV level. Pulse repetition rates in excess of 100 pps at readily obtainable and output pulse jitter is less than 1 nsec. 4 Refs.
Primary Keywords: Solid State Pulser; Marx Generator; Avalanche Transistor; 5 kV Output Voltage; Rep-rated
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5801
(ENERGY CONVERSION, ELECTRICAL; PULSE GENERATORS)
(Charging Circuits; Marx)
CHARGING TIME OF A HIGH-VOLTAGE IMPULSE GENERATOR
G.W. Swift
University of Manitoba, Winnipeg, Manitoba, Canada
Electronics Letters, Vol. 5, No. 21, pp 534 (10/1969).
The charging characteristics of Marx generators are considered. A time constant is defined by taking the product of the total parallel capacitance and total series resistance. This time constant will give the time required to charge a bank of several sections to 93% of its final value. 0 Refs.
Primary Keywords: Marx Generator Charging; Waveform Prediction; Time Constant Definition; Theoretical Justification
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5802
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
ENERGY STORAGE AND TRANSFER WITH HOMOPOLAR MACHINE FOR A LINEAR THETA-PINCH HYBRID REACTOR
H.F. Vogel (1), M. Brennan (2), W.G. Dase (2), K.M. Tolk (2) and W.F. Weldon (2)
(1) Los Alamos National Labs, Los Alamos, NM 87545
(2) University of Texas at Austin, Austin, TX 78712
Los Alamos Report No. LA-6174 (12/1975).
Availability: LA-6174
NTIS
This report describes the energy storage and transfer system for the compression coil system of a linear theta-pinch hybrid reactor (LTPHR). High efficiency and low cost are the principal requirements for the energy storage and transfer of 25 MJ/m or 25 GJ for a 1-km LTPHR. The circuit efficiency must be approximately 90%, and the cost for the circuit 5-6 cents/J. Scaling laws and simple relationships between circuit efficiency and cost per unit energy as a function of the half cycle time are presented. An important consideration concerns the pulse repetition rate of 2.25 pulses per second, 70E6 shots/yr, or 1.7E9 shots over the 25-yr plant life. Current interruption to initiate energy transfer is not feasible at this rate. We consider, therefore, a simple ringing circuit with contactors to make and break at the periodically occurring zero-current instances. Even this simple operation will require considerable development effort for an inexpensive and reliable contactor that may be replaced during annual plant maintenance. We consider capacitors and homopolar machines as energy storage elements with both functioning basically as capacitors. The advantage of the homopolar machine in this application is its relatively low cost, whereas that of capacitors is better efficiency. 12 Refs.
Primary Keywords: Homopolar Generator; Energy Transfer; High Efficiency; Rep-rated; High Reliability

5824
INVESTIGATION OF THE EROSION PHENOMENON IN HIGH CURRENT, HIGH PRESSURE GAS DISCHARGES
J.E. Gruber and R. Suess
Institut fur Plasmaphysik, Garching, FRG
(12/1969).
Availability: IPP-4/72
NTIS
For abstract, see NSA 25 04, number 07379.
Primary Keywords: Plasma Medium; Gas Discharges

5827
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)
MARX--AND MARX-LIKE--HIGH-VOLTAGE GENERATORS
R.A. Fitch
Maxwell Labs Inc, San Diego, CA 92123
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 4, pp 190-198 (04/1971).
Major developments have taken place in the art of Marx generating in recent years. The rationales, modi operandi and relative merits of these developments are discussed in an attempt at exegesis and classification. 7 Refs.
Primary Keywords: Marx Generator; Principles Of Operation; History; Design Considerations; Folded Marx; Back-coupled Marx
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5839
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)
ELECTRICAL DISCHARGE THROUGH LASER-INDUCED SPARK
V.I. Vladimirov, G.M. Malyshev, G.T. Razdobarin and V.V. Semenov
A.F. Ioffe Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Leningrad
Soviet Physics-Technical Physics, Vol. 12, No. 9, pp 1277-1279 (03/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1742-1745 (September 1967)
An electrical discharge occurs in a region produced by a laser-induced spark in air at potentials two-to-three orders of magnitude lower than the breakdown potential of air. The initiation of the breakdown is associated with the arrival of a region of reduced density at the electrode. For electrode potentials from 30 V to 3 kV the peak current ranges from 50 A to 11 kA and the resistance varies from 0.5-0.07 ohm. The duration of current flow is about 40 microseconds. 6 Refs.
Primary Keywords: Reduced Density Region; Electrode Effects; Low Resistance; Blast Wave
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5840
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)
INVESTIGATION OF AN ELECTRIC DISCHARGE ACROSS A LASER SPARK
V.I. Vladimirov, G.M. Malyshev, G.T. Razdobarin and V.V. Semenov
A.F. Ioffe Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Leningrad
Soviet Physics-Technical Physics, Vol. 14, No. 5, pp 677-680 (11/1969).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 906-910 (May 1969)
Behind the front of the shock wave a laser spark produces a hot region which creates conditions for the initiation of an electric discharge. The shock-wave front separates from the boundaries of the hot region at a velocity of 3E5 cm/sec 100 nsec after the start of the laser spark. The onset of the discharge depends on the position of the electrodes relative to the center of the hot region. The developed discharge is self-sustaining. 4 Refs.
Primary Keywords: Tungsten Electrode; Variable Focal Plane Position; Low Voltage; Gap Resistance Measurement
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5841
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, Optical; Vacuum Gaps, Optical)
LASER-INITIATED VACUUM DISCHARGE
V.P. Kovalenko, A.A. Makarevich, V.A. Rodichkin and A.M. Timonin
Soviet Physics Technical Physics, Vol. 19, No. 11, pp 1429-1431 (05/1975).
Trans. From: Zh. Tekh. Fiz. 44, 2317-2321 (November 1974)
The amplitude and time characteristics of a vacuum discharge (initial pressure p=2E-6 Torr) are studied in a two-electrode gap. The discharge is driven by the light pulse from a 15 MW ruby laser, which is focused on one of the electrodes. As the laser-produced plasma expands across the gap, a current flows due to the emission of charged particles from the plasma and changes caused in the strength and configuration of the electric field in the gap by the laser plasma. The maximum current across the gap and the time required for the current to reach its maximum value are functions of the gap voltage (U/sub o/=5-50 kV) and the capacitance (C/sub o/= 1100-4400 pF). 3 Refs.
Primary Keywords: Laser Initiated Breakdown; Variable Polarity; X-ray Burst; Intensity Dependence; Very Short Delay Time
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5844
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
PHYSICS OF A SPARK VACUUM DISCHARGE AND QUANTITATIVE MASS-SPECTROMETRIC ANALYSIS. QUALITATIVE MODEL OF A WEAK CURRENT VACUUM DISCHARGE
G.I. Ramendik and V.I. Derzhiev
V. I. Vernadskii Institute Of Geochemistry And Analytical Chemistry, Academy of Sciences of the USSR, Moscow, USSR, Moscow, USSR
Journal Of Analytical Chemistry Of The USSR, Vol. 32, No. 8 pp 1197-1203 (08/1977).
Trans. From: Zhurnal Analiticheskoi Khimii 32, 1508-1515 (August 1977)
The authors present evidence for a model of the physics of vacuum breakdown. Three distinct stages are proposed and defined: breakdown-initiation, spark, and arc. Each stage is described in detail with theories presented for the mechanism of each stage. The passage of electrode material into the vacuum gap is discussed, as is the effect of electrode vaporization on the speed of breakdown. Particle density in the plasma channel formed is investigated. Recovery processes are also briefly discussed. 37 Refs.
Primary Keywords: Vacuum Breakdown; Three Stages; Breakdown-initiation; Spark; Arc; Plasma Formation; Recovery After Current
Secondary Keywords: Ion-source Mass Spectrometry
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5848
(PARTICLE BEAMS, ION)
(Generation)
ACCELERATION OF CHARGED PARTICLES BY INTENSE ELECTRON BEAMS
G. Yonas
Sandia Labs, Albuquerque, NM 87115
Particle Accelerators, Vol. 5, pp 81-91 (01/1973).
Ion acceleration by electron beams propogating in a plasma or neutral gas has resulted in the generation of ion beams with energies much greater than the accelerating e-beams. The ion acceleration occurs as the e-beam pinches in all cases. The author experimentally and theoretically investigates collective acceleration in a plasma filled diode. Results are presented to indicate that accelerating fields of over 1 MV/cm are present in the diode. 35 Refs.
Primary Keywords: Collective Acceleration; Plasma Filled Diode; 1 MV/cm Accelerating Field; Experiment; Theory
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5851
(BREAKDOWN STUDIES)
(Lightning)
DETECTION OF LIGHTNING SUPERBOLTS
B.N. Turman
Patrick AFB, Florida 32925
Journal Of Geophysical Research, Vol. 81, No. 18, pp 2566-2568 (06/1977).
Lightning superbolts are the subject of this paper. The authors briefly describe the criteria that qualify a superbolt and proceed to describe the statistics of lightning superbolts. The primary criteria used are optical radiance and duration. Satellite based sensors are utilized as detection devices. 12 Refs.
Primary Keywords: Lightning Detection; Superbolt Detection; Superbolt Statistics; Optical Radiance
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5854
(BREAKDOWN STUDIES)
(Surface Flashover)
ELECTRICAL BREAKDOWN OVER INSULATORS IN HIGH VACUUM
P.H. Gleichauf
Westinghouse Research and Development Center, Pittsburgh PA
Journal Of Applied Physics, Volume 22, No. 5, pp 535-541 (05/1951).
In the investigated range of 5E-5 to 1E-7 mm Hg, the breakdown voltage over insulators in high vacuum is independent of pressure. Currents of 1E-11 to 1E-8 ampere were observed in the region below breakdown voltage by detecting x-ray quanta with a Geiger-Mueller counter. Pinhole camera x-ray pictures revealed that practically all radiations originate from an area on the anode a distance from the insulator; with a weaker radiation coming from a ring immediately adjacent to the insulator. Current-voltage relationships as usually observed in these experiments indicate a roughness factor and an emitting area on the cathode similar to previous findings in vacuum gaps. Oscilloscopic observations revealed that sometimes at breakdown over insulators the voltage on the test sample drops to 2.5 kV; in other cases it falls to less than 100 volts. The low voltage arc-like discharge extinguishes at a current of about one ampere for copper electrodes in contact with Pyrex glass. As in a vacuum gap, the breakdown voltage over an insulator is increased by successive breakdowns. Part of this 'conditioning' is permanent. The non-permanent part is dependent on the state of the test sample prior to conditioning. 10 Refs.
Primary Keywords: Surface Flashover; Pyrex Insulator; Copper Electrodes; High Vacuum; X-ray Diagnostic; Voltage Measurement; Cutoff Current; Conditioning Effects
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5855
(PARTICLE BEAMS, ELECTRON)
(Generation)
ELECTRON BEAM FOCUSING USING CURRENT-CARRYING PLASMAS IN HIGH-NU/GAMMA DIODES
G. Yonas, K.R. Prestwich, J.W. Poukey and J.R. Freeman
Sandia Labs, Albuquerque, NM 87115
Physical Review Letters, Vol. 30, No. 5, pp 164-167 (01/1973).
A technique has been demonstrated for concentrating electron beams to 5E3 A/sq.cm. plasmas on the axis of diodes. A two-dimensional particle code has been used to illustrate the importance of both the E x B motion in vacuum and the self-pinch of the beam within the plasma. 5 Refs.
Primary Keywords: Electron Beam Focusing; Diode Axis; High Nu/gamma Diodes; Self-pinched Diode; Current-carrying Plasmas; Theory; 2-d Particle Code
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5860
(SWITCHES, CLOSING)
(Liquid Gaps, Self)
HIGH POWER DENSITY WATER DIELECTRIC SWITCHING
D.L. Johnson, J.P. Vandevender and T.H. Martin
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 204-209 (09/1980).
Pulse forming networks for high current particle beam fusion accelerators must produce fast rise time, low jitter, low prepulse, and high voltage power pulses. Conventional water dielectric switching can provide the required rise time and jitter, but has limitations on prepulse and output voltage. A high power density, low prepulse, pulse forming line (PFL) configuration with self-breakdown water dielectric switches is presented. The design parameters and the results of switching experiments are described. 7 Refs.
Primary Keywords: Self-break Water Switch; Prepulse Suppression; Ground Plane; Pulse Forming Line
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5865
(BREAKDOWN STUDIES)
(Lightning)
LIGHTNING DETECTION FROM SPACE
B.N. Turman
U.S. Air Force Academy, CO 80840
American Scientist, Vol. 67, No. 3, pp 321-329 (06/1979).
The author presents data on satellite lightning detection in this paper. Reasons are presented for using optical sensors for detecting lightning from space. The energy distribution of lightning is discussed and the presence of superbolts is hypothesized and confirmed. The waveshapes of lightning are studied, as is the probability that the bolt will have a given total energy and charge transfer. The possibility of implementing a satellite based severe storm early warning system is discussed. 23 Refs.
Primary Keywords: Lightning; Normal Bolt; Superbolt; Positive Giant; Optical Lightning Detection; Storm Monitoring
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5867
(INSULATION, MAGNETIC)
()
MAGNETIC INHIBITION OF SURFACE FLASHOVER OF INSULATORS IN VACUUM
K.D. Bergeron and D.H. McDaniel
Sandia Labs, Albuquerque, NM 87115
Applied Physics Letters, Vol. 19, No. 9, pp 534-536 (11/1976).
The possibility of preventing high-voltage surface flashover of insulators in vacuum by means of a strong magnetic field perpendicular to the electric field and parallel to the insulator surface is investigated theoretically. A simple model predicts that with the right choice of insulating material one can design diodes and transmission lines so that the magnetic field from the line current inhibits the secondary-electron-emission avalanche which is believed to play an important role in the flashover process. 13 Refs.
Primary Keywords: Surface Flashover; Modeling; Diode; Transmission Line; Theory; Secondary-electron-emission Avalanche
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5870
(DIAGNOSTICS AND INSTRUMENTATION)
(Particle Beams)
MEASUREMENTS OF HIGH-CURRENT RELATIVISTIC ELECTRON DIODE PLASMA PROPERTIES WITH HOLOGRAPHIC INTERFEROMETRY
J.G. Kelly and L.P. Mix
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 46, No. 3, pp 1084-1090 (03/1975).
Double-exposure interference holography has been used to measure the temporal and spatial dependence of plasma densities and velocities in relativistic electron beam diodes. In this paper some of the physics revealed by a detailed analysis of holograms from one such diode is presented. Abel inversion of holograms taken on the Reba accelerator (100 kA, 1.5 MV) incorporating a 0.6-cm-diam glass rod cathode show the axial and radial structure of the diode plasmas. Fringe-shift analysis has yielded densities of 5E17 - 5E19 electrons/cu.cm., and magnetohydrodynamic pressure balance implies a plasma temperature of about 0.3 keV. In addition, exposure variation of the fringe pattern and motion of plasmas between pictures taken at different times during the pulse have indicated plasma velocities vs spatial position that vary from 1E6 to 1E7 cm/sec. 12 Refs.
Primary Keywords: E-beam Generation; Field Emission Diode; Diode Plasma; Holographic Interferometer; REBA Accelerator

5872
(PARTICLE BEAMS, ION; PARTICLE BEAMS, NEUTRAL)
(Generation; Generation)
NEUTRON PRODUCTION AND COLLECTIVE ION ACCELERATION IN A HIGH-CURRENT DIODE
L.P. Bradley and G.W. Kuswa
Sandia Labs, Albuquerque, NM 87115
Physical Review Letters, Vol. 29, No. 21, pp 1441-1445 (11/1972).
New measurements demonstrate that neutrons produced in a high-current pulsed diode with deuterium-bearing electrodes are of beam-target origin. During a brief portion of a 70-nsec, 2-MV, 50-kA pulse, positive ions from the anode and cathode plasmas were observed to be accelerated toward the anode rather than the cathode as dictated by the externally applied field. Energetic deuterons were observed, behind a small aperture in the anode, which were the source of neutrons produced with Li or C anodes. 12 Refs.
Primary Keywords: Collective Acceleration; Neutron Production; High Beam Energy; High Beam Current; Positive Ion; Anode Plasma; Cathode Plasma; Lithium Anode; Carbon Anode

5881
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Optical)
PREIONIZATION CONTROL OF STREAMER PROPAGATION
L.P. Bradley
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 43, No. 3, pp 886-890 (03/1972).
Streamer velocity is experimentally shown to vary with preionization in N/sub 2/ and SF/sub 6/. The velocity has been controlled over orders of magnitude by introducing pulsed preionization ahead of an already propagated streamer. The preionization is produced by pulsed UV irradiation. The pulsed electric field is uniform in the gap. Avalanche-streamer conversion times were observed which agree well with prediction. 13 Refs.
Primary Keywords: Streamer Velocity Control; Quasistatic Preionization; Pulsed Preionization; Wide Range Of Control

5882
PRELIMINARY DESIGN OF A 100 HZ, 350 KV SHORT PULSE GENERATOR
G.J. Rohwein and M.T. Buttram
Sandia Labs, Albuquerque, NM 87115
(06/1977)
Availability: SAND-77-0174
NTIS
This report describes a 350 kV pulser designed to generate 100 ns square pulses with 300 joules total energy at a pulse repetition frequency of 100 per second. This design incorporates a transformer charged helical coaxial pulse forming line. The considerations leading to this design are presented together with results from prototype experiments. The pulser which is presently in the construction and testing phase is described in detail. The pulser will be used for electron beam acceleration. (ERA citation 02:055490)
Primary Keywords: Electron Sources; Pulse Generators; Design; Electron Beams; Performance Testing; Power Supplies; Transformers
Secondary Keywords: ERDA/700203; ERDA/700208; NTISERDA

5893
(PARTICLE BEAMS, ELECTRON)
(Generation)
Z/SUB E/ < 1 OHM PINCHED ELECTRON DIODES
J.W. Poukey
Sandia Labs, Albuquerque, NM 87115
No. CONF-751108-2, 9p (06/1977).
Availability: SAND-75-5747
NTIS
High current pinched electron flow in diodes is shown to be self-limiting, in the sense that for given diode voltage the electron current approaches a limiting value as R/d (cathode radius/gap) implies infinity. The consequence is that in order to achieve electron impedances Z/sub e/ less than 1 omega , one may have to inject high-atomic-weight plasma into the diode.
Primary Keywords: Electron Sources, Design; Electron Beams; Pinch Effect; Plasma
Secondary Keywords: NTISERDA

5894
(BREAKDOWN STUDIES)
(Gas, Electrical)
CENTERING A HIGH-CURRENT ARC IN A COAXIAL ARC CHAMBER
E.K. Inall
Australian National University, Canberra, Australia
J. Phys. D, Applied Physics, Ser. 2, Vol. 1 pp 1584-1586 (07/1968).
When an electric arc carrying 100 kA or more occurs a few mm off the axis of a coaxial chamber, it experiences a force of several kg/cm of arc length, driving it further off the axis. This can be overcome and the arc maintained on the axis by dividing one electrode and the outer conductor into sectors. With such an arrangement arcs of more than 100 kA have burnt on the axis for the duration of runs lasting 0.5 s. 1 Refs.
Primary Keywords: Coaxial Arc; High-current; Segmented Electrode; Long Duration Arc; Force Analysis

5895
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
CORRELATED ELECTRICAL AND OPTICAL MEASUREMENTS OF EXPLODING WIRES
F.D. Bennett, H.S. Burden and D.D. Shear
Army Aviation Research and Development Command, Aberdeen Proving Ground, MD 21005
The Physics Of Fluids, Vol. 5, No. 1, pp 102-113 (01/1962).
Description is given of a high-resolution streak camera and of an experimental method whereby streak-camera records and electrical measurements of exploding wires may be accurately correlated in time. Composite data together with derived values of resistance, power, and energy are given for 4 and 5 mil Cu wires at several voltages. These data are compared with the experimental and theoretical results of other workers. The transfer of energy from electrical to fluid-mechanical form is discussed as are problems having to do with formation of the shock waves. 30 Refs.
Primary Keywords: Current Measurement; Voltage Measurement; Streak Photograph; Back Lighting; Peripheral Arc

5896
(SWITCHES, OPENING; DIAGNOSTICS AND INSTRUMENTATION)
(Explosive Fuses; Current)
CURRENT MEASUREMENT AND TRANSIENT SKIN EFFECTS IN EXPLODING WIRE CIRCUITS
F.D. Bennett and J.W. Marvin
Army Aviation Research and Development Command, Aberdeen Proving Ground, MD 21005
The Review Of Scientific Instruments, Vol. 33, No. 11, pp 1218-1226 (11/1962).
The transient response of the coaxial, current-measuring shunt commonly used in high current, high frequency applications (up to 1 mHz) is analyzed by Laplace transform methods. The exact solution is obtained as is an approximate solution which allows estimates to be made of the errors expected. The current shunt measuring a damped oscillation will always report an initial current slope of zero, and the maximum current slope is sensed shortly after switch-on. It is several percent low in typical cases. At the true current maximum, the shunt reading is a few tenths percent low and lags the impressed current by a small fraction of a cycle. A second problem concerning the transient resistance of an idealized plate condenser is analyzed using the asymptotic solution for current. A numerical calculation indicates no alteration of initial conditions on the damped oscillation to arise from this source so long as the characteristic damping time of the transient skin effect is small compared with the ringing time. 14 Refs.
Primary Keywords: Current Measurement; Coaxial Current Shunt; Laplace Analysis; Error Estimate

5897
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
HIGH-ENERGY DENSITIES BEFORE DWELL IN ELECTRICALLY EXPLODED WIRES
F.M. Webb Jr., H.M. Bingham and A.V. Tollestrup
Electro-Optical Systems, Inc., Pasadena, CA
The Physics Of Fluids, Vol. 3, No. 2, pp 318-319 (04/1960).
High-energy densities above 10 eV/atom have been placed in electrically exploded wires before current dwell. Power input and electrical conduction above the critical point are inferred. Lochte-Holtgreven has discussed the possible occurrence of this type of overheating; Funfer et al, also have reported achieving temperatures above 50000 K in exploding wires. Our results confirm theirs under different conditions. Our experiments took place in much shorter time intervals (1E-8 sec) where the energy losses due to radiation and any air-breakdown across the gap are negligible during the initial conduction phase. The voltage and current were measured simultaneously using a resistive shunt and voltage divider and two traveling wave oscilloscopes. A series of single-frame photographs were also taken. The overheating has been achieved in fine wires of good conducting materials in circuits where the initial current rise is extremely rapid, and the reactance is slightly larger than the circuit resistance initially. The essential feature is to establish a large current density in the wire before the resistance increases sufficiently to throttle further current flow. 4 Refs.
Primary Keywords: Exploding Wire; Initial Stages; Energy Density Before Current Pause; Critical Point; Aluminum Wire

5905
(SWITCHES, OPENING; BREAKDOWN STUDIES)
(Explosive Fuses; Exploding Wires)
INITIAL PHASE OF THE EXPLODING WIRE PHENOMENON
C.P. Nash and C.W. Olsen
University of California, Davis, CA
The Physics Of Fluids, Vol. 7, No. 2, pp 209-213 (02/1964).
As an approximation to the behavior of a circuit containing an exploding wire, the differential equation for the discharge of a condenser through a resistive load which increases linearly with time has been solved analytically. The calculations indicate that inductive effects govern the energy consumption in the first pulse for small-diameter wires, while thermodynamic effects are important for large-diameter wires. The importance of the heat of vaporization per unit volume, the resistivity, and the temperature coefficient of resistivity is stressed. Owing to their similarities in these properties, it is predicted, and confirmed experimentally, that gold wires and aluminum wires should display nearly identical first-pulse characteristics. 13 Refs.
Primary Keywords: Exploding Wire, Analytical Calculation; Time Varying Resistor; Inductive Effects; Thermodynamic Effects; Gold Wire; Aluminum Wire

5899
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
ON THE MECHANISM OF EXPLODING WIRES
C.P. Nash (1) and W.G. McMillan (2)
(1) University of California, Davis, CA
(2) University of California, Los Angeles, CA 90024
The Physics Of Fluids, Vol. 4, No. 7, pp 911-917 (07/1961).
Experimental measurements are given for the energy input and shock wave arrival times for 10-cm No. 40 Cu wires exploded in air at an initial voltage of 9.25 kV. Two shocks in air are observed, one for each pulse before and after the dark pause. Pause duration measurements are also reported for wire explosions in gaseous He, K/sub 2/, O/sub 2/, Ar and CCIF/sub 3/ at 1 atm. Semiquantitive theoretical explanations are proposed for the increase in wire resistance which terminates the first current surge, and for the elapsed time (pause duration) before the vapor density of the expanding wire material declines sufficiently for reignition of the discharge. 17 Refs.
Primary Keywords: Exploding Wire; Copper Wire; Shock Wave; Double Shock; Energy Input; Pause Duration; Several Environments
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5900
(SWITCHES, OPENING; BREAKDOWN STUDIES)
(Explosive Fuses; Exploding Wires)
SHOCK-PRODUCING MECHANISMS FOR EXPLODING WIRES
F.D. Bennett
Army Amament Research and Development Command, Aberdeen Proving Ground, MD 21005
The Physics Of Fluids, Vol. 5, No. 8, pp 891-898 (08/1962).
Single-fringe interferograms are presented of 4-mil Cu wires exploded at 20 kV into argon at ambient pressures of 1/8, 1/16, and 1/32 atm. Features discernible include a compressive-head shock wave, arc plasma, a weak plasma wave and the expanding metal wire. On the basis of certain plausible assumptions it is seen that the arc plasma has atemperature of about 2.5 eV; but its leading edge, a region not in thermal equilibrium, has electron temperatures approximately 1E5 eV and is the boundary of an electron-driven shock wave. 11 Refs.
Primary Keywords: Exploding Wire; Copper Wire; Comprehensive-Head Shock Wave; Electron-driven Shock Wave; Plasma Wave
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5901
(DIAGNOSTICS AND INSTRUMENTATION)
(Power)
A DEVICE FOR MEASURING PULSE POWER
K.A. Yakovlev, D.K. Penkrushina and Yu.G. Basin
Instruments And Experimental Techniques, No. 4 pp 711-713 (07/1961).
Trans. From: Pribory i Tekhnika 4, 89-91 (July-August 1961)
A design for a device to measure the instantaneous power of a pulse is presented. The device can handle currents of 50 to 2100 A at voltages up to 15 kV over a frequency range of 0.8 to 8 MHz. Pulses can have a repetition frequency to 1 kHz, and the pulse duration can be 50 microseconds to 10 ms. 0 Refs.
Primary Keywords: Pulse Power Meter; True Power Reading; 1-15 kV Voltage Range; 50-2100 A Current Range; 0.8-8 MHz Frequency Range
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5902
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
RADIO-FREQUENCY SHIELDING PROVIDED BY BOLTED SEAMS CONNECTING ARMORED-PLYWOOD PANELS
H.A. Lasitter
Naval Civil Engineering Lab, Port Hueneme, CA
Naval Facilities Engineering Command Report No. R-535 (06/1967).
Availability: AD 816496
NTIS
Rooms shielded against radio-frequency (RF) signals are essential to the Navy's research and development and operational use of equipment sensitive to RF interference. A series of shielding-effectiveness measurements of armor-clad plywood sections representative of those used in the construction of radio-frequency shielded rooms has been conducted. Five sections and their bolted seams were subjected to wet cycles of 70 Deg.F, 100% RH, and to dry cycles of 200 Deg.F, 10% RH. The percent moisture content, thickness variability, DC resistance, and surface currents at 12.8 kHz were observed during the wet-dry cycles. DC surface resistance of the seams increased monotonically throughout the test period. Standard deviation of the surface current measurements reached a peak at approximately 12 days. Another series of tests indicated that seams caulked with silver-loaded compounds had distribution of surface currents similar to those of solid armored sheets. 10 Refs.
Primary Keywords: Faraday Cage; Armored Plywood; Shielding Effectiveness; Variation With Temperature; Variation With Humidity; Quality Of Electrical Bond

5914
(PARTICLE BEAMS, ELECTRON)
(Target Interactions)
DEEP CRATERS PRODUCED BY SHOCK FOCUSING IN RELATIVISTIC ELECTRON-BEAM DIODES
J.G. Kelly and M.M. Widner
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 46, No. 10, pp 4515-4518 (10/1975)
Narrow craters have been produced in aluminum-rod targets mounted in the anode of the Nereus electron-beam accelerator (150 kV, 50 kA, 40 ns). These craters (approximately 0.025 cm in diameter), which are characteristically deeper than their diameter and which extend into the electrode materials significantly beyond the classical range of the primary electrons in a relativistic electron-beam diode, were generated by a converging shock wave that melted and fractured the material in the region of shock focus. It is suggested that similar craters seen by other experimenters were also produced by the same mechanism. 13 Refs.
Primary Keywords: E-beam Focusing; Converging Shock Wave; Deep Craters; Hydrodynamic Code Calculations; Shock Focusing; 100 J Total Beam Energy; 15u eV Electron Beam; Nereus Electron-beam Accelerator
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5921
(PARTICLE BEAMS, ELECTRON)
(Generation)
ELECTRON BEAM GENERATION IN PLASMA-FILLED DIODES
P.A. Miller, J.W. Poukey and T.P. Wright
Sandia Labs, Albuquerque, NM 87115
Physical Review Letters, Vol. 35, No. 14, pp 940-943 (10/1975).
A study has been made of the response of low-density (approximately 1E13 cu.cm.) plasmas when subjected to the very high electric fields of relativistic-electron-beam-accelerator diodes. An anomalous resistive behavior has not been seen. Instead, sheath formation at the cathode and electron-beam generation across the sheath has been found. This has important applications to the design of diodes for future electron-beam machines. 12 Refs.
Primary Keywords: Low Density Plasma; Field Emission Diode; Cathode Sheath Formation; Electron-beam Generation; High Electric Fields; Anode Plasma
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5928
(PARTICLE BEAMS, ELECTRON)
(Generation)
HIGH POWER ELECTRON BEAM ACCELERATORS FOR GAS LASER EXCITATION
J.G. Kelly, T.H. Martin and J.A. Halbleib
Sandia Labs, Albuquerque, NM 87115
(06/1976).
Availability: SAND-75-5682
NTIS
A preliminary parameter investigation has been used to determine a possible design of a high-power, relativistic electron beam, transversely excited laser. Based on considerations of present and developing pulsed power technology, broad area diode physics and projected laser requirements, an exciter is proposed consisting of a Marx generator, pulse shaping transmission lines, radially converging ring diodes and a laser chamber. The accelerator should be able to deliver approximately 20 kJ of electron energy at 1 MeV to the 10 exp 4 cm exp 2 cylindrical surface of a laser chamber 1 m long and 0.3 m in diameter in 24 ns with very small azimuthal asymmetry and uniform radial deposition. (ERA citation 02:001384)
Primary Keywords: Electrostatic Accelerators; Gas Lasers; Electron Beams; Electron Sources; Excitation; Kilo Amp Beam Currents; Mev Range 01-10; Planning
Secondary Keywords: ERDA/430100; ERDA/420300; NTISERDA

5933
(PARTICLE BEAMS)
(Generation)
ION SHEATH MOTION IN PLASMA-FILLED DIODES
M.M. Widner and J.W. Poukey
Sandia Labs, Albuquerque, NM 87115
The Physics Of Fluids, Vol. 19, No. 11, pp 1838-1840 (11/1976).
The time development of the ion space charge sheath in a plasma-filled planar diode is considered in reference to the behavior of relativistic diodes used for electron and/or ion beam production. 6 Refs.
Primary Keywords: E-beam Generation; Ion Beam Generation; Plasma Filled Diode; Planar Diode; Diode Closure
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5954
(BREAKDOWN STUDIES)
(Exploding Foils)
SELF-SIMILAR POWER-DRIVEN EXPANSION INTO VACUUM
K.E. Lonngren
University of Iowa, Iowa City, IA 52240
The Physics Of Fluids, Vol. 22, No. 5, pp 859-865 (05/1979).
Planar, power-driven expansion into a vacuum is found to be self-similar for a power-law driving source for the two ideal cases of a thick slab and a thin foil. For the thick slab expansion, an asymptotic solution for the far-blowoff region is obtained and a numerical solution is present for the rest of the expansion wave. For the thin foil expansion, an analytical solution is obtained. In both cases, the solutions exhibit an unbounded flow field with velocities tending to infinity as a consequence of the continuum assumption, a finite temperature limit for the far-blowoff material, and density profiles that decrease as a Gaussian in the far expanded material. 15 Refs.
Primary Keywords: Exploding Foil; Expasion Into Vacuum; Thin Foil; Thick Slab; Power-law Driving Source; Self Similarity
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5970
(SWITCHES, CLOSING)
(Liquid Gaps, Self)
UNTRIGGERED WATER SWITCHING
J.P. VanDevender and T.H. Martin
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-22, No. 3, pp 979-982 (06/1975).
Recent experiments indicate that synchronous untriggered multichannel switching in water will permit the development of relatively simple, ultra-low impedance, short pulse, relativistic electron (REB) accelerators. These experiments resulted in the delivery of a 1.5 MV, 0.75 MA, 15 ns pulse into a 2 ohm line with a current risetime of 2E14 A/sec. The apparatus consisted of a 3 MV Marx generator and a series of three 112 cm wide strip water lines separated by 2 edge-plane water-gap switches. The Marx generator charged the first line in <400 ns. The first switch then formed 5 or more channels. The second line was charged in 60 ns and broke down with 10 to 25 channels at a mean field of 1.6 MV/cm. The closure time of each spark channel along both switches was measured with a streak camera and showed low jitter. The resulting fast pulse line construction is simpler and should provide considerable cost savings from previous designs. Multiples of these low impedance lines in parallel can be employed to obtain power levels in the 1E14 W range for REB fusion studies. 6 Refs.
Primary Keywords: Water Switch; Self-breakdown Operation; Multichannel Operation; Experiment; Theory
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5974
(BREAKDOWN STUDIES)
(Liquid, Electrical)
NANOSECOND BREAKDOWN IN LIQUID DIELECTRICS
P. Felsenthal
Arthur D. Little, Inc., Cambridge, MA
Journal Of Applied Physics, Vol. 37, No. 10, pp 3713-3715 (09/1966).
Measurements of nanosecond formative times in various liquids are summarized. The experiments utilized applied fields of up to 3.3E6 V/cm while equipment time resolution was on the order of 0.3 nsec. Detailed results are given for n-hexane including aging time histories and formative times with and without an applied bias field. The data obtained in this study are compared with earlier work. Using a simplified breakdown model the mobility of charge carriers at 2E6 V/cm is calculated to be 8.7E-2 sq.cm.V.sec. The nanosecond high-voltage insulating qualities of various liquids are discussed. 6 Refs.
Primary Keywords: Formative Time Lag; Liquid Breakdown; Several Liquids; High E-field; Short Pulse Insulation

6024
DESIGN STUDIES FOR ULTRA-FAST, LOW-IMPEDANCE HIGH-PEAK-POWER PULSED SYSTEMS
J.L. Brewster , F.M. Charbonnier , L.F. Garrett , K.W. Riegelmann and J.K. Trolan
Field Emission Corp, McMinnville, OR 97128
Technical rept. Apr 62-Aug 65 (11/1965).
Availability: AD-475 369/5ST
NTIS
Ultrafast pulsed power systems have proved to be effective energy sources for transducers to produce intense X rays, dense electron beams, and very high temperature plasmas. The principal function of a single shot or low repetition rate pulsed power system is to accept energy at low power levels and subsequently to deliver such energy at extremely high power levels, with maximum efficiency, to a suitable transducer. This objective can best be met by use of either distributed or lumped-constant pulse forming networks where optimum performance is realized by maintaining the proper impedance match between the power source and transducer throughout the energy delivery process. Attainment of the proper impedance match can impose stringent and sometimes contra-indicating requirements upon the dielectric storage media, the switching mechanism, and the transducer chamber. The most promising approach to such power sources appears to be a pulse-charged two-stage coaxial Blumlein system. Such a system can deliver 25 kiloamperes at 2 megavolts in a pulse width of 40 nanoseconds to a suitably matched flash X-ray tube to produce relatively high dose rates with long tube life and minimal maintenance. The performance of a Blumlein exploding wire system, with respect to the rate of energy transfer, is primarily limited by the uncancelled transducer chamber impedance to the extent required to give di/dt values close to 10 to the 14th power amp/sec for wires a few mils in diameter. Attainment
Primary Keywords: Pulse Generators_Transducers; X Rays; Electron Beams; Plasma Medium; Impedance Matching; Electrical Impedance; Dielectric Properties; X Ray Tubes; Voltage; Switching Circuits; Power Transformers; Gas Discharges; Transmission Lines
Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

6026
(PULSE GENERATORS)
(Trigger)
GENERATOR PRODUCING RECTANGULAR VOLTAGE PULSES HAVING AN AMPLITUDE OF 50 KV
S.S. Kingsep and V.P. Smirnov
Atomic Energy Institute, Moscow, USSR
Instruments And Experimental Techniques, Vol. 16, No. 2, pp 456-457 (04/1973).
Trans. From: Pribori i Tekhnika Eksperimenta 2, 109-110 (March-April 1973)
A high-voltage pulse generator is described which is implemented using long lines (RK-5-9-12 coaxial cable). A trigatron with external oil insulation is used as the commutator. The generator allows a voltage pulse having an amplitude of up to 50 kV and a length of 40 nsec with a leading-edge duration of approximately 1 nsec to be obtained across a matched 50-ohm load. Results are presented of investigations of generator operation in various modes. The generator was used in circuits for synchronizing high-voltage devices. 2 Refs.
Primary Keywords: High-voltage Pulse Generator; 50 kV Voltage Pulse Amplitude; Blumlein Line; Trigatron Switch; Rectangular Pulse Output; Nanosecond Rise Time

6027
HIGH ENERGY HIGH DUTY PULSER
Authors Unknown
RCA Corp, Moorestown, NJ 08057
Final technical rept. Feb 73-Feb 74. (03/1974).
Availability: AD-780 031/1
NTIS
The report presents the results of a one year in-depth study on achieving a high peak energy and high average power pulser. Design objectives are for a 2.5 gigawatt peak power/10 megawatt average power pulser supplying 20 microsecond pulses at 200 pulses per second. An artificial line type modulator with hydrogen thyratron switch tubes was chosen for the pulser design. Emphasis was placed on selection of the type of switching device (hydrogen thyratrons versus spark gaps versus solid state versus mercury pool switches, etc.), and on selection of a particular device of the chosen type. Hydrogen thyratrons were chosen over competing types of switches because suitable types are available "off the shelf", whereas all of the competing types require some development work to meet the requirements. A sample pulser design, using the KU-275 hydrogen thyratron, is given. (Author)
Primary Keywords: Pulse Generators; Thyratrons; Hydrogen; High Power; Short Pulses; Switches; Modulators; Safety
Secondary Keywords: Design; Pulsers; NTISAF

6028
(SWITCHES, CLOSING)
(Systems)
LOW-INDUCTANCE SWITCHING USING PARALLEL SPARK-GAPS
R.A. Fitch and N.R. McCormick
Atomic Weapons Research Establishment, Aldermeston, Berkshire, UK
Proceedings Of The IEE, Vol. 106, Part A Supplement No. 2, pp 117-130 (11/1959).
The parallel operation of triggered gas spark gaps is considered in this paper. The authors analyze the triggering and breakdown of trigatrons, cascade overvolted gaps, and swinging cascade gaps when switched in parallel with transit time isolation. An extensive analysis is made of the effects of trigger voltage, trigger scatter, trigger cable impedance, load impedance, and type of gap used. Fault analysis is included. Experimental results are included for a bank at AWRE (nicknamed Maggi). This bank utilized 200 trigatron switches to give a current rise of over 1E13 A/sec. 21 Refs.
Primary Keywords: Parallel Spark Gaps; Three Spark Gap Types; Performance Test; Analysis; Trigatron; Cascade Overvolted Gap; Field Distortion Gap

6034
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SELF-CROWBARRING, LOAD-ISOLATING TRIGGERED SPARK GAP
J.W. Robinson
Pennsylvania State University, University Park, PA
The Review Of Scientific Instruments, Vol. 51, No. 11, pp 1532-1534 (11/1980).
Crowbarring is achieved when a magnetically driven arc contacts an electrode in the crowbar circuit. No auxiliary timing circuitry is required and, at the time of crowbarring, the arc divides into two parts such that the load is isolated from the source. A discharge which peaks at 200 kA in 4 microseconds is crowbarred and displays a 50-microsecond e-folding time with a ripple current of less than 5%. Main switching and crowbarring are combined in a single 3-electrode spark gap which is triggered by a pin between two of the electrodes. Crowbar timing is insensitive to gap dimensions and to current magnitude. Pin placement is critical but little energy is dissipated in the neighborhood of the trigger pin. 7 Refs.
Primary Keywords: Triggered Spark Gap; Self-crowbarring Gap; 200 kA Peak Current; Three-electrode System; 95 nH Total Switching System Inductance

6035
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, Reviews; Vacuum Gaps, Reviews)
VACUUM ARCS AND SWITCHING
G.A. Farrall
General Electric Co, Schenectady, NY 12301
Proceedings Of The IEEE, Vol. 61, No. 8, pp 1113-1136 (08/1973).
This paper is a review of vacuum-arc phenomena which are related to switching devices. Despite the device overtones, the approach adopted for this paper is fundamental. Topics discussed include the drawn arc, the triggered arc, the power input to the cathode spot, cathode-spot division, arc stability, substructure of the cathode spot, dielectric recovery processes, and breakdown between electrodes subjected to repeated arcing. Frequent reference to the recent literature is made. Due to the somewhat specialized nature of certain parts of the discussion, introductory and appended sections of the paper present supplementary remarks on the concept of plasma and electrical conduction in gases, electron emission processes, and electrical contact phenomena. 134 Refs.
Primary Keywords: Vacuum Breakdown; Vacuum Switching; Drawn Arc; Triggered Arc; Cathode Spot; Recovery; Electrode Conditioning; Field Emission

6036
(SWITCHES, CLOSING)
(Reviews)
A CRITICAL ANALYSIS AND ASSESSMENT OF HIGH POWER SWITCHES
T.R. Burkes, M.O. Hagler, M. Kristiansen, J.P. Craig, W.M. Portnoy and E.E. Kunhardt
Texas Tech University, Lubbock, TX 79409
Naval Surface Weapons Center Final Report On Subcontract SCEEE-SIP/77-29 (08/1978).
This work represents an evaluation and summary of the current state-of-the-art in pulsed power switching. Specifically, tube type switches (thyratrons, ignitrons, etc.), thyristors, transistors, spark gaps, mechanical switches and various other switches are described. The emphasis is on single element devices and switch performance achieved by series-parallel combinations of small devices is not included. A comparison of the capabilities of commercially available switches is made. Switch characterization and evaluation of those parameters responsible for switching performance, including standoff voltage, peak current, di/dt, pulse width, and pulse repetition rate, are presented. 345 Refs.
Primary Keywords: State-of-the-art; Thyratron; Ignitron; Thyristor; Transistor; Spark Gap; Mechanical Switch; Parameter Characterization

6038
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
A LASER-TRIGGERED 50 PPS HIGH-VOLTAGE SWITCH WITH NANOSECOND JITTER
A.H. Guenther and P.H. McKnight
AFWL, Kirtland AFB, NM 87117
Proceedings Of The IEEE, Vol. 55, No. 8, pp 1504 (08/1967).
A Q-spoiled YAG laser system was used to switch a high-voltage spark gap at rates up to 50 pps with jitter of approximately 1 ns. 6 Refs.
Primary Keywords: Laser-triggered Spark Gap; YAG Laser; Electrode Triggering; 11-100 mJ Laser Output; Megavolt Operating Voltage; Pep-rated

6054
(PULSE GENERATORS; POWER CONDITIONING; SWITCHES, CLOSING; SWITCHES, CLOSING)
(Capacitive; Pulse Transformers; Gas Gaps, Electrical; Avalanche Transistors, Electrical)

SPARK CHAMBER PULSING SYSTEM

L. Lavoie, S. Parker, C. Rey and D.M. Schwartz
University of Chicago, Chicago, IL
The Review Of Scientific Instruments, Vol. 35, No. 11, pp 1567-1571 (11/1964).

A spark chamber pulser is described in which several avalanche transistors and a step-up transformer drive directly an air spark gap whose trigger electrode is surrounded by barium titanate dielectric. Output pulses of from 1 to 25 kV with a risetime of 1 nsec and an output impedance of less than 1 ohm can be obtained. The total delay from the 1-V input pulse to the high voltage output pulse ranges from 17 to 65 nsec dependent on the desired voltage and the mode of operation of the spark gap. Jitter times are less than 3 nsec. When Elkonite-tipped electrodes are used, the gap life is in excess of 5000000 pulses. Methods are given for reducing the delay to less than 25 nsec at 20 kV and the recovery time to less than 200 microseconds at 10 kV. 12 Refs.

Primary Keywords: Spark Chamber Pulser; 1 To 25 kV Output Pulses; <1 Ohm Output Impedance; >5 Million Pulses Gap Life; Spark Gap; Avalanche Circuit; Low Delay; Nanosecond Jitter; Elkonite Electrodes

6055
(ENERGY STORAGE, CAPACITIVE; SWITCHES, CLOSING)
(Capacitor Banks; Gas Gaps, Electrical)

SPARK-GAP SWITCHING OF A 384-KJ LOW INDUCTANCE CAPACITOR BANK

L.M. Goldman, H.C. Pollock, J.A. Reynolds and W.F. Westendorp
General Electric Co, Schenectady, NY 12301
The Review Of Scientific Instruments, Vol. 33, No. 10, pp 1041-1044 (10/1962).

A three-electrode spark gap which can handle high energy (96 kJ) has been designed and used with a 384 kJ capacitor bank having an operating range from 30 to 60 kV. The gap jitter time has been reduced to less than 25 nsec. During theta-pinch experiments involving 3000 discharges of the bank, there has been no significant deterioration of the gaps or variation of the electrical characteristics of the system. 10 Refs.

Primary Keywords: Spark Gap; 384 kJ Capacitor Bank; <25 nsec Gap Jitter; Low Inductance Bank; Life Test
Secondary Keywords: Theta-pinch

6057
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

TRIGGERING MECHANISM OF LOW-PRESSURE SPARK GAPS

R. Hancon
Culham Lab, Abingdon, Oxfordshire, UK
The Review Of Scientific Instruments, Vol. 33, No. 11, pp 1239-1244 (11/1962).

The triggering delay in two low-pressure spark-gap switches, operating in the pressure range 1E-3 to 3E-2 mm Hg, has been measured under a wide range of conditions. When the trigger pin is in the negative electrode, the delay is found to consist of two components. The first part depends on the construction of the trigger pin, the trigger voltage, and the impedance of the trigger circuit, while the second part depends on the nature and pressure of the gas in the gap, and the voltage and impedance of the circuit being switched. If the trigger pin is in the positive electrode a further delay is added which is approximately equal to the transit time of an ion across the gap. A mechanism for the breakdown is proposed which is consistent with the measurements and with previously reported results. 3 Refs.

Primary Keywords: Spark Gap; Triggering Mechanism; Low-pressure Spark-gap; 1E-3 To 3E-2 mmHg Pressure Range; Triggering Delay Measurement; Critical Pressure; Breakdown Modeling

6060
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Electrodes)

A MEANS OF RAISING THE THRESHOLD CURRENT FOR ANODE SPOT FORMATION IN METAL-VAPOR ARCS

J.A. Rich
General Electric Co, Schenectady, NY 12301
Proceedings Of The IEEE, Vol. 59, No. 4, pp 539-545 (04/1971).

Of the various processes occurring in an arc at high currents one of the most important with regard to application is the formation of an anode spot and the consequent melting associated with it. Vacuum arc devices depend for their operation on the formation of a high current transient metal-vapor arc. The limiting current in a particular design may be set by destructive melting at the anode. It is shown that it is possible to raise the threshold current for anode spot formation in a metal-vapor arc by suitably changing the electrode geometry. From a study of a few simple electrode geometries a set of guidelines has been evolved governing the choice of electrode geometry. As an illustration of the efficacy of these guidelines and the means of implementing them in practice it is shown how it is possible, with successive modifications of a coaxial-cylindrical electrode structure, to attain a peak current of 72 kA for a damped 60-Hz current wave without electrode melting. 5 Refs.

Primary Keywords: Vacuum Breakdown; High-current Arc; Anode Spot; Anode Melting; Operation Limitation; Electrode Geometry Selection; Design Considerations

6064
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Electrodes, Vacuum, Electrical)

ANODE PHENOMENA IN METAL-VAPOR ARCS AT HIGH CURRENTS

J.A. Rich, L.E. Prescott and J.D. Cobine
General Electric Co, Schenectady, NY 12301
Journal Of Applied Physics, Vol. 42, No. 2, pp 587-601 (02/1971).

The present investigation is concerned with the conditions associated with the development of an anode spot for metal-vapor (vacuum) arcs. Chief among the aims of the investigation is the determination of the threshold current density for anode-spot formation for a variety of electrode materials spanning a wide range of thermal and electrical properties. Electrodes of Sn, Al, Ag, Cu, Mo, and W were chosen for study in a plane-parallel electrode geometry. Arcing was over one-half cycle of a 60-Hz current wave. The onset of anode-spot formation was determined from high-speed streak photographs of the discharge. An oscillographic record of the arc voltage was obtained simultaneously with the streak picture. From the data obtained particular interest attaches to the threshold current for anode-spot formation, the threshold current density derived from it, and the arc voltage current characteristic. In general, high-current metal-vapor arcs have positive volt-ampere characteristics and exhibit an hysteresis effect. Rapid changes in arc voltage, noise voltage, and in the magnitude of the hysteresis effect are associated with the formation of an anode spot. The noise voltage and arc drop decrease as the spot develops. 13 Refs.

Primary Keywords: Vacuum Breakdown; Anode Spot; Spot Formation; Threshold Current; Several Anode Materials; Parallel-plane Electrodes; Voltage Variations

6067
(SWITCHES, CLOSING)
(Ignitrons)

BEHAVIOR OF THE RESISTANCE IGNITOR IN MERCURY

W.W. Rigrod
Westinghouse Electric Corp, Bloomfield, NJ
Journal Of Applied Physics, Vol. 22, No. 6, pp 787-796 (06/1951).

An empiric expression has been derived for the probability of arc striking per unit time, per unit length of contact perimeter, for a resistance ignitor in a mercury-pool tube: p'=k(E-E/sub 0/)/s 3/ rho/sup 2/, where k and E/sub 0/ are constants, E is the 'useful' electric field strength near the mercury surface, and rho the resistivity of ignitor material at the junction with the mercury. From the foregoing, a formula has been established for the probability of ignition per unit time, for the entire ignitor, in terms of the applied voltage V and ignitor 'firing resistance' R. With this formula, whose two arbitrary constants can be determined by two sets of measurements, the firing voltage of any ignitor can be predicted under a wide variety of circuit conditions, provided R remains unchanged under these conditions. The probability formula was found to be consistent with a modification of a theory advanced by L. Tonks, whereby mercury surface distortion and rupture permit field emission at field strengths less than those effective for smooth surfaces. The modification attributes the reduction in ignitor firing voltage by ignitor current to its extremely localized ohmic heating of the mercury. This heating reduces the surface tension and roughens the mercury surface, thereby accelerating the process of surface rupture by the electric field. 12 Refs.

Primary Keywords: Ignition Switch; Ignition Characteristics; Resistance Ignition; Ignition Probability; Geometry Consideration; Emperical Formula

6068
(BREAKDOWN STUDIES)
(Electrodes)

CATHODE DARK SPACE AND NEGATIVE GLOW OF A MERCURY ARC

C.G. Smith
Raytheon Manufacturing Co, Newton, MA
Physical Review, Vol. 69, No. 3-4, pp 96-100 (02/1946).

Means were evolved to observe the cathode dark space of the mercury arc, the object being to measure the thickness and evaluate therefrom the voltage gradient at the cathode to distinguish between field and emission theories of electron liberation. A magnetic field transverse to the arc drives it in the opposite direction to the force involved. This wrong way motion made it possible to race the arc spot over smooth mercury while ions, electrons, and vapor were blown rearward. Photomicrographs showed a negative glow, its image in the mercury, and a space between; evidently twice the dark space. A one-ampere arc had a dark space of 0.001 cm; a hundred times too large for the field theory, and causing excessive space charge limitation of current unless compensating ionization occurs throughout said space. Phenomena in the negative glow must cause the needed ionization and also intensive electronic bombardment of the cathode. This is assumed to cause cumulative excitation of the liquid resulting in emission of electrons and light. A continuous spectrum originates within the limits of measurement at the liquid. 12 Refs.

Primary Keywords: Mercury Arc Cathode Spot; Spot Motion; Negative Glow; 0.001 cm Cathode Dark Space; 10000 V/cm Gradient; Transverse Magnetic Field; Field Emission

6070
(INSULATION, MATERIAL)
(Liquid)

DETERMINATION OF HIGHLY STRESSED VOLUMES IN OIL DIELECTRICS

P.V. Birke, J. Lackey and S. Palmer
Westinghouse Canada Ltd., Hamilton, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-7, No. 3, pp 139-144 (09/1972).

The volume of oil under the highest stress has been shown to correlate well with the measured breakdown voltages of transformer oil in different electrode systems. The determination of the volume of oil that is most highly stressed in a given electrode system is not however an easy matter. It involves the location of equistress or equigradient surfaces followed by computation of the oil volume contained within the surfaces. This paper describes a differential probe and amplifier system, which has been developed to allow the direct plotting of equigradient lines on a conducting paper analog of any two-dimensional electrostatic field. 18 Refs.

Primary Keywords: Oil Insulation; Electrical Stress Calculation; Volume Effect; Several Geometries; Equigradient Surface

6071
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Electrodes)
ELECTRON EMISSION IN INTENSE ELECTRIC FIELDS
R.H. Fowler and L. Nordheim
Proceedings Of The Royal Society Of London, Vol. A119, pp 173-181 (01/1928).
In this paper, Fowler and Nordheim build upon the accomplishments of others in an attempt to improve the theoretical exposition and the correlation with experiments in relation to the process of extracting electrons from cold metals by intense electric fields. They have included the effect of an external field and have established a formula for currents which is independent of T at low temperature and concurs with experiment. In addition, the emission coefficients for electrons of given energy in a uniform external field are calculated. It is shown for the most commonly used metals that emission should occur for fields >1E7 volts/cm. 12 Refs.
Primary Keywords: Field Emission; Thermionic Emission; Intense Electric Fields; Electron Emission; Emission Coefficients; Potential Energy Step; Theory

6076
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid; Surface Flashover)
HIGH VOLTAGE INSULATORS FOR PARTICLE ACCELERATORS
K.D. Srivastava
University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Nuclear Science, Vol. NS-16, No. 3, pp 111-112 (06/1969).
In modern high energy particle accelerators there are many component parts and devices which operate at high voltages in vacuum, e.g., injectors, inflectors, beam choppers and velocity separators. Since the surface voltage stress attainable across insulators is generally lower than across plane gaps, the physical size of the apparatus is governed by the high voltage performance of the support insulators in vacuum. In this paper the author discusses the various factors affecting the insulator performance, in the light of his experience with NIMROD, the 7 BeV proton synchrotron and the design of a DC injector for an intense neutron generator machine which was under study at Chalk River, Canada. 4 Refs.
Primary Keywords: High Voltage Insulators; Insulator Flashover; Particle Accelerator; Field Emission; Insulator Charging; Gas Evolution; Breakdown Factors

6080
(BREAKDOWN STUDIES)
(Electrodes)
MOTION AND SPECTRUM OF ARC CATHODE SPOT IN A MAGNETIC FIELD
R.M. St. John and J.G. Winans
University of Wisconsin, Madison, WI
Physical Review, Vol. 98, No. 6, pp 1664-1671 (06/1955).
The velocity of the cathode spot of a mercury arc at the junction between liquid and metal in a transverse magnetic field has been measured for magnetic field strengths between 0 and 20700 oersteds. The approximate doubling of retrograde velocity at about 11000 to 15000 oersteds was followed by an additional rapid rise of velocity at about 15000 oersteds. Spectra of the arc showed Hg II and Hg III lines at the stronger magnetic fields. Radiation from the cathode spot showed mercury lines and a continuous spectrum which is *especially intense at the lines*. Some Hg lines are broadened symmetrically and others asymmetrically. If the broadening is due to a Stark effect, the electric field strength in the cathode spot region is greater than 6E6 volts/cm. The arc mechanism previously proposed is extended to explain the rapid velocity rises with increasing magnetic field strength by associating them with the effect of Hg/sup ++/ and Hg/sup +++/ ions. 12 Refs.
Primary Keywords: Cathode Spot Motion; Transverse Magnetic Field; >6E6 Volts/cm Electric Field Strength; Cathode Spot; Rapid Velocity Rises; Spectroscopic Diagnostic; Mercury Cathode

6085
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Liquid, Electrical; Ignitrons)
ON ANCHORING THE MERCURY POOL CATHODE SPOT
L. Tonks
General Electric Co, Schenectady, NY 12301
Physics, Vol. 6, No. 9, pp 234-305 (09/1935).
This paper presents results of an experiment designed to observe the anchoring of the spot in a mercury cathode by several metals projecting through the surface of the mercury pool. Fe, Pd, Zr, Pt, Cr, Cb, Ir, Mo, Ta, and W are all tried with varying results. The current in the spot is seen to *have a marked effect on behavior*. The spot is seen to become a fine line around the meniscus of the projection. 7 Refs.
Primary Keywords: Cathode Spot Anchoring; Cathode Line; Mercury Pool; Limited Cathode Line Length; Several Anchoring Materials

6091
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Gas, Recovery)
THE APPLICATION OF PASCHEN'S LAW TO THE RE-IGNITION OF AN ARC
J.D. Cobine and R.B. Power
Harvard University, Cambridge, MA
Journal Of Applied Physics, Vol. 8, No. 4, pp 287-290 (04/1937).
An AC arc, in order to restrike after passing through current zero, requires a potential considerably higher than the normal burning potential. This re-ignition potential is investigated for short gaps in nitrogen, using pure graphite electrodes with spacings up to two mm and pressures up to 500 cm Hg. The re-ignition potential is found to have two characteristics. One of these characteristics is followed for the arcs in which the cathode spot is maintained by field emission, and the other is followed for the 'thermionic' arc. Relations are obtained between this re-ignition potential and both the gas pressure and the gap spacing, with the arc current as a parameter. These relations may then be combined into a single relation between the reignition potential and the product of the pressure and spacing. This gives a function that is of the same form as the Paschen law for the initial sparking potential of a gap. 10 Refs.
Primary Keywords: Paschen's Law; Arc Reignition; Extreme Electrode Materials; Reignition Potential, Gap Separation; Gas Pressure

6097
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical, Ignitrons)
THE PRODUCTION OF HIGH VELOCITY MERCURY VAPOR JETS BY SPARK DISCHARGE
J.R. Haynes
Bell Labs, Murray Hill, NJ 07974
Physical Review, Vol. 73, No. 8, pp 891-903 (04/1948).
Photographs of sparks of microsecond duration in hydrogen to a mercury electrode show high velocity jets from the mercury surface regardless of polarity. Spectroscopic examination shows that these jets are largely composed of mercury atoms which sweep away the hydrogen. Measurements of jet velocity demonstrate that it is independent of current and gas pressure over a wide range. While it decreases with distance from the source, the original velocity of the cathode jet is 1.9E5 cm/sec., and that of the anode jet is 1.5E5 cm/sec. The energy of the anode jet can be accounted for by positive mercury ions crossing the anode drop. It appears that the energy of the cathode jet cannot be accounted for unless it is assumed that, in addition to positive ions striking the cathode and rebounding as neutral atoms, many mercury atoms leave the cathode as negative ions. 20 Refs.
Primary Keywords: Hydrogen Breakdown; Mercury Electrode; Mercury Vapor Jet; Jet Velocity; Microsecond Time Scale; Spectroscopic Diagnostic

6103
(SWITCHES, CLOSING)
(Thyratrons)
CATHODE-CURRENT DEPENDENCE ON PULSE WIDTH FOR HYDROGEN THYRATRONS
J.E. Crozden
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Communications And Electronics, Vol. 83, No. 74, pp 582-585 (09/1964).
It is well known that the oxide-coated cathode in a well-activated hydrogen thyratron is capable of sustaining a current density in excess of 20 A/sq.cm. for pulse durations of 1 microsecond or less. It is also known that, as the pulse length increases, the emission density at which arcing occurs decreases. The current capabilities of oxide-coated cathodes in hydrogen thyratrons were experimentally evaluated at pulse lengths of 5, 30, 110, and 1,000 microseconds, and a number of different tube sizes were used. At a constant pulse width, it was found that the current density at which arcing occurred was related to the cathode-coating resistance and that the limiting factor was a maximum power-dissipation density; the power density at which arcing occurred was related to the pulse length. The use of this dependence to determine the cathode current capability at any pulse width is discussed. 1 Refs.
Primary Keywords: Cathode Effects; Long Pulse Lengths; Breakdown Voltage vs Pulse Length; Several Thyratron Sizes

6106
(SWITCHES, CLOSING)
(Thyratrons)
DEVELOPMENT OF A HYDROGEN THYRATRON HAVING A LONG PULSE CAPABILITY
D. Dolbear (1), D. Fleischer (1), S. Merz (1), R. Plante (1), D. Turnquist (1) and N. Reinhardt (2)
(1) EG&G Inc, Salem, MA 01970
(2) Consultant, Lexington, MA
1978 IEEE Thirteenth Modulator Symposium, pp 117-124 (06/1978).
A hydrogen thyratron is being developed which is capable of switching 80 amperes at 100 kilovolts with the additional and unusual requirement that the pulse width be as long as 30 seconds with a 10 percent duty cycle. Thyratron operation under these relatively long pulse conditions at moderate current levels represents a unique class of thyratron service, requiring significant departures from standard thyratron design practices. Radical departures from standard cathode design are necessary to ensure effective utilization of the cathode at the required cathode current on the long time scales involved. In addition, energy losses which occur both in the cathode plasma and at the grid structure integrate over the duration of the current pulse, and the resulting high transient heating must be considered and controlled. The need for a conservative 100-kilovolt anode holdoff capability necessitates the use of a multiple-section high voltage holdoff structure, and this need is complicated by an additional requirement that high voltage recovery be achieved within 100 microseconds. The various aspects of the overall tube design are reviewed and the design approach is discussed. Experimental results are presented and consideration is given to the external circuitry associated with the tube in its intended environment, a neutral beam power supply for a magnetic plasma confinement fusion application. 4 Refs.
Primary Keywords: Ceramic Thyratron, Long Pulse; New Cathode Design

6109
METAL-OXIDE DEVICES FOR RAPID HIGH CURRENT SWITCHING
G. Gaule, P. LaPlante, S. Levy and S. Schneider
ECOM, Fort Monmouth, NJ 07703
(01/1976).
Availability: AD-A055 136/6ST
NTIS
No abstract available.
Primary Keywords: Switching Circuits; Suppressors; Pulse Generators; High Voltage; Reprints
Secondary Keywords: Niobium Dioxide, NTISDODXR
Distribution Restriction: AVAILABILITY PUB. IN IEDM TECHNICAL DIGEST, P273 282 1976

6110
(SWITCHES, CLOSING)
(Thyratrons)
MULTI-GIGAWATT HYDROGEN THYRATRONS WITH NANO-SECOND RISE TIMES
S. Friedman, F. Goldberg, J. Hamilton, S. Merz, R. Plante and D. Turnquist
EG&G Inc, Salem, MA 01970
1978 IEEE Thirteenth Modulator Symposium, pp 129-134 (06/1978).
A new and advanced class of high-power hydrogen thyratrons is being developed which is capable of switching very short and ultra fast rising multigigawatt pulses. The effort underway is to extend the operating range of thyratrons in values of di/dt and current rise time an order of magnitude faster than heretofore achieved, and to do so at high voltages, peak currents, and repetition rates. Immediate goals are di/dt = 1E12 A/s with a 5 ±0 ns rise time, peak currents of up to 75 kA, pulse repetition rates of 1 kHz, and forward voltage holdoffs of 50 kV for a single section tube and up to 250 kV for a grandient grid tube. Retention of the usual advantages of thyratron switches (stable operation, fast recovery time, and long life), is required in addition to meeting various other requirements imposed on these tubes in new applications. This paper describes some of the problems encountered and the progress we have made in this [illegible] investigated regime of thyratron operation. 3 Refs.
Primary Keywords: Ceramic Thyratron, Fast Rise; Short Pulse, High Power; Recirculator, Analysis Of Discharge Formation

6154
(BREAKDOWN STUDIES)
(Gas, Electrical)
MONTE CARLO SIMULATION OF THE LOW-VOLTAGE ARC MODE IN PLASMA DIODES
S.N. Salingar and J.E. Rowe
University of Michigan, Ann Arbor, MI
Journal Of Applied Physics, Vol. 39, No. 8, pp 3933 (07/1968).
A statistical simulation of the low-voltage arc mode of plasma diodes is carried out on a large-scale digital computer to ascertain the importance of various thermalization and transport mechanisms. The computer experiment is two-dimensional and utilizes Monte Carlo techniques to study the low-voltage arc in neon at p=2 Torr, current=6 A, and diode spacing=2.37 cm. Results on the potential distribution, electron-density distribution, and electron-energy density function are presented and discussed. The theoretical results are correlated with experimental results. 6 Refs.
Primary Keywords: Plasma Diode; Low Voltage Arc; Theory; Numerical Calculation; 2-d Monte Carlo Simulation

6158
(BREAKDOWN STUDIES)
(Gas, Electrical)
PLASMA PROPERTIES OF KILOAMPERE DISCHARGES
J.E. Creedon
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-15, No. 6, pp 396-402 (06/1968).
Plasma properties and characteristics that are of interest to high-current switching devices have been investigated. Peak pulse currents up to 80000 amperes have been used to generate dense plasmas in linear glass-metal diodes. Two tube diameters, 3 and 7.5 inches, have been studied. In the case of the 3-inch-diameter diode, the electrode separation was varied from 10.6 to 25.1 cm. Hydrogen gas was studied in the pressure range from 0.5 to 40 Torr. Electron densities and temperatures have been determined using spectroscopic techniques. Densities were found to be in the 1E16 to 1E17 per cu.cm. range. Plasma resistivities have been determined from a knowledge of the density and temperature. The observed dependence of resistivity on current and pressure is discussed and the results are compared with resistivities obtained from tube-drop measurements. The effects of impurities and instabilities are also discussed. 8 Refs.
Primary Keywords: Hydrogen Breakdown; 80 kA Current Level; Glass-metal Diode; 5-40 Torr Pressure Range; Plasma Density; Plasma Resistivity; Impurity Effects

6174
(PARTICLE BEAMS, ELECTRON)
(Generation)
NANOSECOND PULSED ELECTRON ACCELERATOR
T. Yamamoto, J. Ohkuma and M. Kawanishi
Osaka University, Suita, Osaka, Japan
The Review Of Scientific Instruments, Vol. 42, No. 9, pp 1366-1367 (09/1971).
An electron accelerator that can deliver a pulsed electron beam of the shortest duration and highest energy and current possible is desirable in many fields of research, especially in studying the fast transient phenomena in radiation physics and chemistry. In general, pulsation of the electron beam is usually performed by supplying a pulsed gating-voltage from a coaxial line-type pulser, hard tube pulser, or pulse sharpener to the grid of the gun. A unique electron accelerator which satisfies the above mentioned conditions has been developed and the characteristic features of the device are reported in the present note. 3 Refs.
Primary Keywords: Electron Gun; Mercury Relay; Short Pulse; Low Current

6211
ELECTROMECHANICAL PULSE GENERATORS
E. Levi
Polytechnic Institute of New York, Brooklyn, NY 11201
Research rept. No. R-751-59, 40p (07/1959).
Availability: AD-220 852/8ST
NTIS
No abstract available.
Primary Keywords: Electromechanical Converters; Pulse Generators; Design; Radar, Thermonuclear Reactions
Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE

6288
(PULSE GENERATORS; PULSE GENERATORS; PULSE GENERATORS)
(LC; Spiral; Stacked Line)
NOVEL PRINCIPLE OF TRANSIENT HIGH-VOLTAGE GENERATION
R.A. Fitch (1) and V.T.S. Howell (2)
(1) United Kingdom Atomic Energy Authority
(2) Boner, Long Electronics Ltd.
Proceedings Of The IEE, Vol. 111, No. 4, pp 849-855 (04/1964).
The authors discuss a class of pulse generator in which several sections are charged to opposite polarity to produce a net voltage of zero. The sections are then discharged in series such that the inherent delays effect a voltage reversal in one-half of sections to provide voltage multiplication. This method of multiplication is termed voltage inversion by the authors. Stacked-line, LC, and spiral generators are discussed as members of this class of generator. 13 Refs.
Primary Keywords: Voltage Inversion Pulse Generator; Voltage Multiplication; Stacked-line Pulse Generator; LC Pulse Generator; Spiral Pulse Generator

6297
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Liquid, Electrical; Liquid)
THE INFLUENCE OF DISSOLVED GASES ON THE ELECTRIC STRENGTH OF N-HEXANE
A.M. Sletten and T.J. Lewis
Queen Mary College, London, UK
British Journal Of Applied Physics, Vol. 14, pp 883-888 (12/1963).
The electric strength of n-hexane for steady fields (direct strength) is found to increase from 0.7 MV/cm. and to become insensitive to electrode material as the amount of dissolved oxygen is increased to an equilibrium partial pressure of 100 mmHg in the vapour phase above the liquid. Greater amounts to not increase the strength. Nitrogen, hydrogen and carbon dioxide have no effect even when large amounts are dissolved, except that repeated discharges when carbon dioxide is present cause the strength to rise, probably because of the release of oxygen. Unless the liquid has been pre-stressed with direct voltage of opposite polarity, the strength with 1.5 microsecond pulses is not affected by dissolved gas. Immediately after pre-stressing, however, the strength with pulses may be as great as 2.5 MV/cm. Dust particles of the order of 1 micron in size are always observed in the liquid and under direct stress pass to and fro between the electrodes. This activity is reduced by the addition of oxygen. With high oxygen concentrations the visible particles are sometimes observed to be expelled from the gap and strengths up to 2 MV/cm. are then recorded. Oxygen, being electronegative, is likely to cause the formation of negative ions. It is suggested that these ions can inhibit the breakdown and lead to higher strengths with direct voltage and also with pulses if the liquid has been previously stressed with direct voltage of opposite polarity. 19 Refs.
Primary Keywords: N-hexane; Dissolved Gas; Oxygen Gas; Increased Dielectric Strength; Several Gases; No Effect; Dust Particles

6319
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE STEP VOLTAGE DROP ACROSS A SPARK WITH A PULSE DISCHARGE IN THE NANOSECOND RANGE
L.G. Bychkova, Yu.I. Bychkov and G.A. Mesyats
Soviet Physics Journal, Vol. 10, No. 12, pp 75 (12/1967).
Trans. From: Izvestiya VUZ. Fizika 10, 116-117 (1967)
The step voltage drop across a spark when there is a static breakdown was first observed by Rogowski and his colleagues. A survey of the work on the voltage steps of sparks in gases with a static breakdown for values of E/P < 100 V/cm Torr is given. The cause of this phenomenon has not been definitely established, so that interest in its study continues. Most authors connect the presence of steps with a transition from a Townsend type of discharge to a streamer type. 5 Refs.
Primary Keywords: Townsend Discharge; Streamer Breakdown; Discontinuous Voltage Drop; UV Radiation

6322
(ENERGY STORAGE)
(System Protection)
ENERGY CONTROL FOR MICROWAVE AMPLIFIER ARRAYS
G.W. Taylor and S. Schneider
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Aerospace And Electronic Systems, Vol. AES-4, No. 5, pp 659-664 (09/1968).
In large systems using microwave amplifier arrays, the size, weight, and cost of individual energy sources require consideration of the use of a common power supply and energy storage bank. Complex energy control techniques may be necessary to protect the RF amplifier and to provide isolation of the faulted amplifier from the common energy source. Four approaches are discussed. Three of these are dependant on either the development of reliable arc-free microwave amplifiers or special isolator tubes, gas or vacuum types. A practical circuit using available components is suggested. Its advantages and limitations are discussed. Calculations are presented showing this approach can result in increased system efficiency, improved regulation, and large decreases in the size of the secondary capacitance bank for each microwave amplifier. 3 Refs.
Primary Keywords: Amplifier Array; Common Power Supply; Fault Protection; Efficiency Considerations; Voltage Regulation

6336
(BREAKDOWN STUDIES)
(Vacuum; Electrical)
INFLUENCE OF HYDROGEN ON MULTIPLE-ELECTRODE (VACUUM) GAP CHARACTERISTICS
S. Schneider, A.J. Buffa and J.E. Creedon
ECOM, Fort Monmouth, NJ 07703
Journal Of Applied Physics, Vol. 40, No. 1, pp 424-425 (01/1969).
The influence of a low pressure of hydrogen on the voltage hold off and breakdown characteristics of a multiple-electrode triggered vacuum gap has been investigated. The tube is designed for 300 kV operation. The tube characteristics were studied under vacuum and at several hydrogen fill pressures at voltages from 10-300 kV. 1 Ref.
Primary Keywords: Vacuum Breakdown; Effect Of Hydrogen Gas; Current Measurement; Voltage Measure; Variable Hydrogen Pressure

6342
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A NANOSECOND RISETIME MEGAVOLT VOLTAGE DIVIDER
D.G. Pellinen and S. Haurlin
Physic International Co, San Leandro, CA 94577
The Review Of Scientific Instruments, Vol. 42, No. 6, pp 824-891 (06/1971).
A small linear resistive voltage divider has been used in vacuo for measuring pulsed voltages exceeding 1 MV on electron accelerators. The monitor appears to be linear until breakdown and has a bandwidth greater than 60 Hz-150 MHz. A method of correcting for nonconservative induced potentials is described as well as several independent calibration methods. 4 Refs.
Primary Keywords: Resitive Voltage Divider; Vacuum Environment; 150 MHz Bandwidth; Calibration Consideration; Nonconservative Induced Potential

6353
(POWER CONDITIONING; SWITCHES, CLOSING; SWITCHES, OPENING)
(Metal Oxide Switches; Miscellaneous Solid State; Miscellaneous Solid State)
PULSE SHARPENING WITH METAL-OXIDE BULK SWITCHING DEVICES
G.K. Gaule, P.R. LaPlante, S. Levy and S. Schneider
ECOM, Fort Monmouth, NJ 07703
1976 IEEE Pulsed Power Conference Proceedings, Paper IC-6 (11/1976).
Certain niobium oxide (NbO/sub x/, x approximately 2) materials are near insulating at room temperature but undergo an 'insulator-to-metal' transition near 800 Deg.C. A similar transition can be initiated at room temperature by applying an electric field exceeding the 'threshold' value, which depends on the oxygen concentration (x) of the NbO/sub x/. Metal-oxide threshold switch (MOTS) prototypes are obtained by applying appropriate contacts and packaging. Threshold voltages range from 100 V to several kV. A typical MOTS has a surge current capability exceeding 100 A, an off-state capacitance of only a few pF, and a switch delay of less than 0.5 ns. The latter two characteristics make the MOTS potentially superior to conventional devices for a number of high-speed, high-current switching functions. In particular, insertion of a MOTS into the output circuit of a conventional pulse generator can 'sharpen' the leading edge of the pulse to yield a ns or even sub-ns rise time. 6 Refs.
Primary Keywords: Metal-oxide Bulk Switching Device; Pulse Sharpening; Fast Closing; Low Current; Switching Threshold

6368
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
TRIGGERED VACUUM GAPS
J.M. Lafferty
General Electric Co, Schenectady, NY 12301
Proceedings Of The IEEE, Vol. 54, No. 1, pp 23-32 (01/1966).
Characteristics of a sealed vacuum gap are described and the difficulties encountered in applying this gap as an overvoltage protection device are discussed. It is shown how these difficulties can be ameliorated by the use of gas-free electrode materials and by triggering the gap when breakdown is required. Several methods of triggering are discussed and some practical triggering devices are described that inject minute quantities of ionized hydrogen into the gap. The hydrogen is eventually recovered by the use of a titanium hydride getter. It is shown that breakdown of the gap can be accomplished in less than one-tenth microsecond by first producing a glow discharge that is rapidly transformed into a metal-vapor arc. Properties of the metal-vapor arc are described which have an effect on the characteristics of the vacuum gap. A number of practical sealed-off triggered vacuum gaps are illustrated. These are used to carry microsecond capacitor discharge currents and 60-cycle power line currents for 1/2 cycle. The operating voltage range is from a few hundred volts to 100 kV. The advantages of vacuum gaps over gas-filled gaps are given and a number of overvoltage protection and switching applications are listed. 29 Refs.
Primary Keywords: Overvoltage Protection; Electrode Effects; Several Triggering Methods; Plasma Gun Trigger; Practical Consideration

6376
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
A SIMPLE SWITCHING SYSTEM FOR REPEATABLE PULSED DISCHARGES
F.L. Curzon (1) and K. Dimoff (2)
(1) University of British Columbia, Vancouver, British Columbia, Canada
(2) University of Alberta, Edmonton, Alberta, Canada
Journal Of Physics E: Scientific Instruments, Vol. 3, pp 153-154 (02/1970).
A switching system has been designed to operate with an overall jitter of 0.2 microsec in current breakdown for a 5.7 kJ pulsed discharge. Reproducibility can be sustained for up to 70 consecutive firings. Consisting of two inexpensive open air spark gaps built from readily available materials, the system functions reliably with a minimum of maintenance. 2 Refs.
Primary Keywords: Trigatron Gap; Good Reproducibility; Brass Electrodes; Atmospheric Air Gap

6432
(PARTICLE BEAMS, ELECTRON)
(Generation)
INTENSE ELECTRON-BEAM PINCH FORMATION AND PROPAGATION IN ROD PINCH DIODES
R.A. Mahaffey, J. Golden, S.A. Goldstein and G. Cooperstein
Naval Research Lab, Washington, DC 20375
Applied Physics Letters, Vol. 33, No. 9, pp 795-797 (11/1978).
Intense electron-beam pinches are formed and propagated at moderate impedence (5-25 ohm) using rod pinch diodes. Pinch propagation of up to 20 cm with 45% efficiency and ion-generation efficiency >=15% has been observed. 16 Refs.
Primary Keywords: Intense Electron-beam Pinches; 5-25 Ohm Impedances; Rod Pinch Diodes; 20 cm Pinch Propagation; 20 cm/s Pinch Velocity, Diode Damage Ion Formation

6433
(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL)
(Flux Compression; Flux Compression Generators)
LIMITING CAPABILITIES OF A PLANAR EXPLOSIVE MAGNETIC GENERATOR AS A PULSED ENERGY SOURCE
L.S. Gerasimov and V.I. Ikryannikov
Soviet Physics-Technical Physics, Vol. 24, No. 7, pp 841-844 (07/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 1513-1519 (July 1979)
The limiting capabilities of a planar explosive magnetic generato are studied. the voltage, the power, and the energy for operation with inductive and resistive loads. The possibility of constructing module and cascade explosive systems with energies up to 100 MJ is studied. A corresponding calculation method is proposed. The theory is compared with experiment. 10 Refs.
Primary Keywords: Flux Compression Generator; Resistive Load; Inductive Load; Modular Approach; 100 MJ Output; Analysis

6436
(BREAKDOWN STUDIES)
(Surface Flashover)
SURFACE BREAKDOWN OF A SOLID DIELECTRIC IN VACUUM. III. QUANTITATIVE MODEL
A.A. Avdienko and M.D. Malev
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 5, pp 581-587 (05/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 987-998 (May 1979)
A method is described for the analysis of surface breakdowns. This method is based on a desorption model proposed earlier. The dielectric strength calculated as a function of the length of the insulator and the angle between its surface and the field direction agree with experimental data reported by various workers. The role played by surface charge is evaluated. Methods are discused for increasing the dielectric strength of insulators in vaccum. It is shown that a surface form of thermal breakdown can occur in a dielectric with a relatively high conductivity (pV less than or approximately equal to 1E11 ohm-cm). The characteristics of this breakdown are described. 25 Refs.
Primary Keywords: Surface Flashover; Desorption Model; Dielectric Strength vs Insulator Length; Surface Charge; Thermal Breakdown

6438
(PULSE GENERATORS)
(Systems)
A GENERATOR OF POWERFUL PULSES OF COMPLEX SHAPE
A.A. Egorov, V.S. Panasyuk, L.I. Yudin and G.N. Ostreiko
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, No. 5, pp 1183-1186 (10/1966).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 156-159 (September-October 1966)
A multicell thyretron generator of electric pulses of complex shape is described. Each section of the pulse can be independently controlled both in shape and amplitude. The design principle of such a generator is related to the task of obtaining millisecond pulses with a current amplitude of hundreds and thousands of amperes. The generator can be most profitably used for the production of large-amplitude current pulses of prescribed shape in various types of coils. In the majority of practical cases the generator makes it possible to reproduce a prescribed law of current variation. 2 Refs.
Primary Keywords: Pulse Generation System; Variable Pulse Shape; Several Independent Sections; Millisecond Pulse Width; 100 kA Pulse Amplitude

6441
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Liquid, Electrical; Liquid)
AN INVESTIGATION OF THE ELECTRIC STRENGTH OF SOME LIQUID DIELECTRICS SUBJECT TO NANOSECOND VOLTAGE PULSES
N.S. Rudenko and V.I. Tsvetkov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 10, No. 10, pp 1417-1419 (10/1965).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1840-1843 (October 1965)
Experimental tests of the electric strength of transformer oil, doubly-distilled water, and process water subject to nanosecond voltage pulses are described for sample thickness of 50, 100, 200, and 500 microns. The function E/sub b/ = f(t/sub d/) E/sub b/ is the electric field strength at breakdown, and t/sub d/ is the discharge time) can be explained under the assumption that the discharge is electronic. The results of the experiments yield the significant conclusion that water can be used as an insulator in high-voltage nanosecond devices; it is at least as good as transformer oil. 4 Refs.
Primary Keywords: Liquid Insulation; Transformer Oil; Water; Thin Specimen Thickness; Breakdown Voltage Measurement; Comparison Of Results

6443
(PARTICLE BEAMS, ELECTRON)
(Generation)
CERTAIN CHARACTERISTICS OF COLD CATHODES
I.Z. Gleizer and B.V. Okulov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 16, No. 4, pp 1214-1215 (08/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 196-197 (July-August 1973)
The procedure is described and results are presented for an investigation of the emission capacity and stability of the current from various cold cathodes. The service life of a multiemitter cathode with 2000 points and a working-surface diameter of 9 mm is determined. For a diode voltage of 130 kV and a pulse length of 15 nsec the average current in the cathode was 430 A for a relative mean-square scatter of 4%. After 1F6 pulses the cathode characteristics did not change. 4 Refs.
Primary Keywords: Field Emission Diode; Multiemitter Cathode; Life Test; 130 kV Operating Voltage; 430 A Current

6447
(PARTICLE BEAMS, ION)
(Generation)
COLLECTIVE ACCELERATION OF IONS IN RELATIVISTIC ELECTRON BEAMS
V.M. Bystritskii, V.I. Podkatov, A.G. Sterligov, G.E. Remnev and Yu.P. Usov
Soviet Physics-Technical Physics, Vol. 2, No. 1, pp 30-32 (01/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 2, 80-84 (January 1976)
The model advanced of a two-dimensional stationary well formed behind the anode of a nanosecond accelerator, as well as the results of recent investigations on ion acceleration in a relativistic electron beam, (REB), indicate a threshold injection current I/sub thr/ below which ion acceleration is not observed. To obtain additional data on the processes connected with acceleration of ions in REB, we have undertaken the investigations reported below. In the first group of experiments we estab the threshold values of the injection current for several diame of the drift tubes (70 and 90 mm). As a rule, the ion pulses with amp itude above the electromagnetic-noise level (~= 10 V) appear at values of the injection current larger than (1.3-1.4) I/sub lim/. In the second group of experiments we investigate the efficiency of ion acceleration as a function of the pressure of the gas filling the dr ft tube. 9 Refs.
Primary Keywords: Collective Acceleration; Relativistic Electron Beam; Wide Incedent Current Range; Threshold Current; Ion Beam Generation Efficiency

6448
(PARTICLE BEAMS, ION)
(Generation)
COLLECTIVE ION ACCELERATION BY A HIGH-CURRENT RELATIVISTIC ELECTRON BEAM
V.I. Kucherov
Gork'ii Polytechnic Institute, USSR
Soviet Physics-Technical Physics, Vol. 20, No. 6, pp 817-819 (12/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 1307-1310 (June 1975)

Two-dimensional ion acceleration by the quasistatic field of a high-current relativistic beam moving with respect to the ion in a strong external magnetic field is studied analytically and numerically. The accelerating and focusing fields are found as functions of the beam current. The maximum energy and density of the accelerated ions are evaluated. 15 Refs.

Primary Keywords: Collective Acceleration; External Magnetic Field; Beam Focusing; Theory; Analytical Calculation; Numerical Calculation; Energy Density Calculation

6449
(PARTICLE BEAMS, ELECTRON)
(Generation)
COMPUTATION OF THE ELECTRIC FIELD AT MULTIPOINT CATHODES
S.Ya. Belomytsev, S.F. Bugaev, V.P. Il'in, E.A. Litvinov and G.A. Mesyats
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Journal, Vol. 18, No. 11, pp 1622-1623 (11/1975).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii 18, 142-143 (November 1975)

Ribbon electron beams with cross-sectional areas of 1E2-1E4 sq.cm. are now used in powerful electron ionization gas lasers. Such beams are produced using multipoint cold cathodes with explosive emission of electrons. The explosion of the tips of the points does not take place simultaneously with application of the voltage, but after some time called the delay time t/sub d/. To obtain a rectangular current pulse it is necessary that the t/sub d/ for most of the peaks should be comparable to the risetime of the voltage front (t/sub d/ <= t/sub r/). 3 Refs.

Primary Keywords: E-beam Generation; Multipoint Cathode; Rectangular Beam Pulse; Theory; Numerical Calculation; E-field Calculation; Analytical Formula

6451
(PULSE GENERATORS)
(Current)
CURRENT PULSE GENERATOR
B.F. Bayanov, A.V. Il'in, V.N. Pakin, A.P. Panov and G.I. Sil'vestrov
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, No. 5, pp 1113-1117 (10/1968).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 96-100 (September-October 1968)

A generator producing on an inductive load of approximately 1E-7 H current pulses with a flat peak with an amplitude to 200 kA at a pulse duration of 130 microseconds is described. Problems of commutation, design of pulse transformers, method of effective shaping of a flat peak, and stabilization of pulsed current within approximately +-0.1% at a pulse repetition frequency of up to 5 Hz are examined. Experimental data are given on the use of TGI1-2500/35 pulsed thyratrons in nonstandard regimes of switching current pulses with a duration of 100-300 microseconds. 4 Refs.

Primary Keywords: Constant-current Pulse; Inductive Load; 130 Microsecond Duration; Pulse Transformer; Good Repeatability; Rep-rated

6454
(PULSE GENERATORS; SWITCHES, CLOSING)
(Capacitive; Gas Gaps, Optical)
DRIVEN HIGH-VOLTAGE NANOSECOND PULSE GENERATOR TRIGGERED BY LASER RADIATION
V.Yu. Petrun'kin, L.N. Pakhomov and P.A. Andreev
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 15, No. 2, pp 515-517 (06/1972).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 178-180 (March-April 1972)

A high-voltage pulse generator (amplitude 30 kV) is described which is triggered by laser radiation. The generator is distinguished by a high sensitivity to the magnitude of the triggering light energy (not exceeding 1E-3 J), a short operate delay (approximately 40 nsec), and a pulse leading-edge duration <1.5 nsec. A generator construction is presented which allows the shaping of several synchronous high-voltage pulses obtained in various channels. 6 Refs.

Primary Keywords: Nd-glass Laser; Steel Electrodes; Strip Line Configuration; Nanosecond Rise Time; Four-pulse Output

6436
(PARTICLE BEAMS, ELECTRON)
(Generation)
ELECTRON ENERGY SPECTRUM IN HIGH-ENERGY NANOSECOND ACCELERATORS
V.V. Kremnev, G.A. Mesyats and V.P. Reznikov
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 10, pp 1342-1344 (04/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 2168-2173 (October 1974)

The effects of matching the storage line to the diode, the switching time, and circuit inductance on the electron energy spectrum of an accelerator beam are considered. The spectrum is analyzed for a linear load, a diode with a field emission cathode, a diode with a thermionic cathode (three-halves law) and a diode with explosive electron emission. Relationships are obtained for the spectrum amplitude and half-width and for the maximum electron energy in the beam. Equations are derived for estimating the effects on the energy spectrum of the electron beam of movement of the plasma front in a diode with explosive emission and of retardation in a foil at the diode output. 4 Refs.

Primary Keywords: E-beam Generation; Thermionic Emission Diode; Field Emission Diode; Storage Line; Impedance Matching; Switching Time; Inductance; Effect On Beam; Explosive Emission

6457
(PARTICLE BEAMS, ELECTRON)
(Generation)
EMISSION OF ELECTRONS FROM THE PLASMA OF AN UNCOMPLETED DISCHARGE ALONG A DIELECTRIC IN A VACUUM
S.P. Bugaev and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Doklady, Vol. 16, No. 1, pp 41-43 (07/1971).
Trans. From: Doklady Akademii Nauk SSSR 196, 324-326 (January 1971)

The discharge current in an uncompleted discharge along a dielectric in a vacuum increases with increasing epsilon/sub D/ of the dielectric other conditions remaining equal. Therefore, we investigated the emission of electrons from the plasma of the discharge along a surface of barium titanate (BaTiO/sub 3/) having epsilon/sub D/=1500. A disk made of BaTiO/sub 3/ and having a thickness 0=2 mm was mounted in a vacuum chamber. A layer of silver was brazed onto one side of the disk, while a needle made of tungsten having a point radius approximately 25 micron was pressed against the other side. The removal of electrons from the plasma was carried out by means of an extractor. Voltage pulses ranging from 0.4 to 4 kV having a leading edge t/sub 1/=1 nsec and length t/sub p/ 2, 4, 8, 20, 50 nsec were applied between the electrodes. 8 Refs.

Primary Keywords: E-beam Generation, Dielectric Surface Flashover; Effect Of Insulator Dielectric Constant, Threshold Voltage

6458
(PARTICLE BEAMS, ION)
(Generation)
EXPERIMENTS ON ACCELERATION OF DEUTERONS AND PROTONS IN AN ELECTRON BEAM PASSING THROUGH A GAS
A.A. Kolomenskii, V.M. Likhachev, I.V. Sinil'shchikova, O.A. Smit and V.N. Ivanov
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics JETP, Vol. 41, No. 1, pp 26-27 (01/1975).
Trans. From: Zhurnal Eksperimental'noi I Teoreticheskoi Fiziki 68, 51-54 (January 1975)

We have carried out experiments on acceleration of deuterons and protons on passage of a high-current electron beam through a low pressure gas at nu/gamma=0.37. For an electron energy of 700 keV the maximum energy of the accelerated deuterons and protons exceeds 2 MeV. The total number of accelerated particles in a pulse reaches approximately 1E12. 10 Refs.

Primary Keywords: Collective Acceleration; High Beam Energy; Low Beam Current; Several Diagnostics Techniques

6461
(PARTICLE BEAMS, ELECTRON)
(Generation)
HIGH-CURRENT CAVITY ELECTRON ACCELERATOR
D.V. Iremashvili, N.I. Leont'ev and A.A. Plyutto
Sukhumi Physicotechnical Institute, Sukhumi, USSR
Instruments And Experimental Techniques, No. 2, pp 261-266 (04/1967).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 35-40 (March-April 1967)

The operating principle of a pulsed high-current electron accelerator with the following parameters is described: accelerating potential 1-1.3 MV, electron current up to 1E3 A in a pulse with a duration of approximately 70 nsec. The frequency of the operating cycles is 1-5 Hz. The designs of the cavity resonator and spark source are given, along with their basic characteristics. 5 Refs.

Primary Keywords: Resonant Cavity Accelerator; Design Considerations; 1 MV Accelerating Potential; 1 kA Current; Spark Source; Rep-rated

6465
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
INVESTIGATION OF THE TIME CHARACTERISTICS OF THE TRANSITION OF FIELD EMISSION TO A VACUUM ARC
G.K. Kartsev, G.A. Mesyats, D.I. Proskurovskii, V.P. Rotshtein and G.N. Furse)
A.A. Zhdanov Lenningrad State University, Lenningrad, USSR
Soviet Physics-Doklady, Vol. 15, No. 4, pp 475-477 (11/1970).
Trans. From: Doklady Akademii Nauk SSSR 192, 309-312 (May 1970)

It was of interest to investigate the explosion of emitters at much higher field current densities than previously done and to investigate thoroughly the change in current from the start of explosion to complete occupation of the gap by plasma. An increase in current density leads to a reduction of the time before explosion and, hence, to obtain maximum current densities (>1E9 A/sq.cm.) we used voltage pulses with a rise time T/sub r/ approximately 1E-9 sec and a length T/sub p/ of 5 nsec to 4 microseconds. The circuit of the pulse generator was described previously. The current flowing through the vacuum gap was measured at different stages with a resolution of not more than 1E-9 sec. The sensitivity of current measurement was 7E-2 A. 15 Refs.

Primary Keywords: Vacuum Breakdown; Arc Transition; Single Crystal Tungsten Cathode; Cathode Explosion; Comparison With Exploding Wires

6467
(PARTICLE BEAMS, ELECTRON)
(Generation)
MULTIELEMENT ACCELERATORS BASED ON RADIAL LINES
A.I. Pavlovskii, V.S. Bosamykin, G.D. Kuleshov, A.I. Gerasimov, V.A. Tararakin and A.P. Klement'ev
Soviet Physics Doklady, Vol. 20, No. 6, pp 441-443 (06/1975).
Trans. From: Doklady Akademii Nauk SSSR 222, 817-820 (June 1975)

For several years the authors have been carrying out investigations on high-current pulsed electron accelerators based on radial lines, which allow the realization of cylindrical accumulation of electromagnetic energy. The maximum energy flux density is determined by the limiting values of the electric and magnetic fields which are attained in such devices. In many important practical cases the pulse length and the magnitude of the working voltage are stipulated. With allowance for the dielectric strength of the dielectrics which are used, these conditions uniquely determine the upper limit of the energy-source power. One of the methods for achieving a further increase in the power of high-current accelerators and other installations in which a high density of the electromagnetic energy flux is required involves the use of a large number of radial lines, which are connected in series, in parallel, or in a mixed manner, depending on the required amplitudes of the current and the voltage. 5 Refs.

Primary Keywords: Radial Line Accelerator; Insulation Considerations; Lines

6469
(BREAKDOWN STUDIES)
(Gas, E-beam)
NONINDEPENDENT PULSED ATMOSPHERIC PRESSURE DISCHARGE SUSTAINED BY A HIGH-ENERGY ELECTRON BEAM LASTING 100 MICROSECONDS
Yu.I. Vychkov, S.A. Genkin, Yu.D. Korolev, G.A. Mesyats, V.G. Rabotkin and A.G. Filonov
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Journal, Vol. 18, No. 11, pp 1618-1619 (11/1975).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedanii, Fizika 18, 139-140 (November 1975)
The use of a high-energy electron beam for ionizing a gas is an effective method of exciting high-pressure space discharges. The use of comparatively weak beams substantially increases the duration of such discharges and allows us to obtain stationary combustion conditions for weak electric fields that obviously insure that the discharge will be nonindependent. However, in this case the selection of conditions for maximal energy influx into the space discharge involves theoretical questions. The problem of how to increase the input energy while maintaining the stability of the discharge will be considered in the present work. An instrument similar to that described previously was used to excite an atmospheric pressure discharge in CO/sub 2/:N/sub 2/ mixtures. The duration of the beam current was 1E-6 sec. Electrons were injected through the gas discharge gap cathode over an area of 6x6 cm. Interelectron distance d was 6 cm. The energy scattered in the gas was determined from oscillograms as well as from readings of an electrostatic kilovolt meter, which was connected in parallel to the gap and a cell-charged capacitance. The capacitance was selected as sufficiently high in order to insure that the electric field would be constant during the pulse. 7 Refs.
Primary Keywords: Atmospheric Pressure Discharge; High-energy Electron Beam; E-beam Excited Discharge; 1E-4 sec Beam Current Duration; Nonindependent Discharge; Discharge Stability; Nonuniform Ionization

6476
(POWER TRANSMISSION)
(Contacts)
REMOTELY CONTROLLED CONTACTS CARRYING MEGAAMPERE CURRENTS
G.S. Villeval'd, V.N. Karasyuk and G.I. Sil'vestrov
Nuclear Physics Institute, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 21, No. 4, pp 980-982 (08/1978).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 128-130 (July-August 1978)
The construction and the manufacturing technology is described of annular hydraulic contact clamps. Results are presented of lifetime tests at a current of approximately 1 MA made on clamps with diameters of 80-170 mm. 3 Refs.
Primary Keywords: High Current Contact; Hydraulic Closing; 1 MA Current Capability; High Reliability

6477
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
REPRODUCIBILITY OF DELAY TIME FOR BREAKDOWN OF HIGH-PRESSURE TRIGGERED SPARK GAPS
G.S. Korshunov, N.S. Rudenko and V.I. Tsvetkov
Soviet Physics-Technical Physics, Vol. 14, No. 8, pp 1074-1078 (02/1970)
Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 1430-1436 (August 1969)
Results are given of studies of breakdown delay time of high-pressure (p=1 to 15 atm) triggered spark gaps in the nanosecond range with positive and negative pulses, both with and without irradiation of the spark gap. The tests were made with pulse amplitudes of 100 to 600 kV with 2 nsec front. Two variants of irradiation were used. Prior irradiation did not improve stability. High stability is obtained by irradiating the gap at the time the trigger pulse is applied (t/sub tr/=7 +or- 0.5 nsec, t/sub tr/=29 +or- 3 nsec). It is shown that cathode irradiation plays the major part, mainly by causing electron emission from the cathode. Photoionization of gas in the discharge gap is not important. Recommendations are given concerning the construction of high-stability trigger gaps operating at hundreds of kilovolts in the nanosecond time range. 11 Refs.
Primary Keywords: Spark Gap; Delay Measurement; 1-15 atm Pressure Range; Bipolar Trigger Pulses; Gap Irradiation; Cathode Effects

6479
(PARTICLE BEAMS, ELECTRON)
(Generation)
SELF-ACCELERATION OF AN ELECTRON BEAM IN A GYROTROPIC MEDIUM
N.N. Nasonov and A.M. Shenderovich
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Soviet Physics-Technical Physics, Vol. 20, No. 7, pp 932-935 (07/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 1476-1481 (July 1975)
In a theoretical study of the excitation of electromagnetic fields by an electron beam passing through a longitudinally magnetized ferrite, calculations are carried out for two cases: that of an infinite gyrotropic medium and that of a waveguide partially filled with a ferrite. After the front of the beam pulse passes, a longitudinal electric field arises as a result of the precession of the magnetic moment of the ferrite. This electric field accelerates part of the beam. 4 Refs.
Primary Keywords: E-beam Acceleration; Gyrotropic Medium; Ferrite-filled Waveguide; Magnetic Moment Precession

6480
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SPARK CURRENT AND VOLTAGE IN NANOSECOND BREAKDOWN OF A GAS GAP
G.A. Mesyats, V.V. Kremnev, G.S. Korshunov and Yu.B. Yankelevich
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 14, No. 1, pp 49-53 (07/1969).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 75-81 (January 1969)
Current and voltage across a spark gap in a pulsed breakdown in air were calculated as time-dependent variables, with the resistance of the discharge circuit and the capacitance of the spark gap taken into account. The current in the spark gap was assumed to be controlled by avalanche electrons. Excellent agreement between theoretical and experimental curves was obtained at spark gap overvoltage levels. A simple equation is proposed for calculating the maximum slope of voltage decay across the spark gap, ignoring gap capacitance. The conditions under which this equation is valid are specified. The effect of increased rate of gap voltage decay with increased interelectrode capacitance is demonstrated. 11 Refs.
Primary Keywords: Gas Spark Gap; Air Gap; Current Measurement; Voltage Measurement; Experiment; Theory, Good Agreement; Analytical Formula

6485
(PARTICLE BEAMS, ELECTRON)
(Generation)
THE EMISSION OF OXIDE CATHODES IN A STRONG LONGITUDINAL MAGNETIC FIELD
S. Rutshteyn
Radio Engineering And Electronics Physics, Vol. 16, No. 4, pp 710-712 (04/1971).
Trans. From: Radiotekhnika i Elektronika 16, 648-650 (April 1971)
The authors theorize that the discrepancy between experimental and theoretical values of the electron emission of an oxide cathode is due to the porosity of the oxide coating. This porosity of the coating allows electrons to be emitted from the base of oxide particles which increases the total emitting surface. To test this theory, the emission of an oxide cathode is measured with and without a longitudinal magnetic field. Emission is found to be reduced significantly for large currents, which supports the hypothesis that oxide porosity effects are important. 5 Refs.
Primary Keywords: E-beam Generation; Thermionic Cathode; Oxide Cathode; Longitudinal Magnetic Field; Reduced Emission; Area Effects

6489
(PULSE GENERATORS)
(Pulse Forming Lines)
IMPROVEMENTS ON TRANSMISSION-LINE PULSERS
R.E. Dollinger, C.P. Scheffler and D.A. Moll
State University of New York at Buffalo, Buffalo, NY 14226
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1551-1553 (10/1979).
A series of pulsers operating up to 100 kW with efficiencies up to 80 percent have been built. The voltage levels, rise times, durations, and repetition rates have been investigated for pulsers operating into different loads. The difficulties of mechanical and solid-state switching (e.g., contact erosion, sticking, and bouncing contacts), have been elimated by using a stream of mercury droplets to bridge the gap between two switch electrodes in order to discharge a transmission line into a load or by discharging charged mercury droplets into the load. 9 Refs.
Primary Keywords: Pulse Generator; Fast Rise; Low Impedance; Pep-rated

6491
(PULSE GENERATORS)
(Trigger)
A PROGRAMMING GENERATOR PRODUCING POWERFUL NANOSECOND PULSES
V.P. Krylov, A.N. Meshkov, V.N. Smirnov and V.I. Shishko
Gork'ii Polytechnic Institute, USSR
Instruments And Experimental Techniques, Vol. 18, No. 6, pp 1788-1789 (12/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 186-187 (November-December 1975)
A controlled paired-pulse generator is described which uses the shaping of electromagnetic shock waves in a transmission line containing ferrite. The external program stipulates the time interval between the pulse edges (10, 50, or 250 nsec) which determines the duration of the electron beam in a high-current linear electron accelerator to which the generator pulses having an amplitude of 4 kV are supplied. The generator ensures a rise and decay time of the electron concentration in the beam amounting to 2 nsec, and a time instability of the beam relative to the starting pulse which does not exceed 1 nsec. 2 Refs.
Primary Keywords: Pulse Generator; Paired-pulse Generator; Ferrite Loaded Line; Electromagnetic Shock Wave; 2 ns Rise And Fall; 40-ohm Impedance

6493
(SWITCHES, OPENING)
(Hall Effect)
APPLICATION OF THE HALL EFFECT TO THE SWITCHING OF INDUCTIVE CIRCUITS
E.K. Inall, A.E. Robson and P.J. Turchi
Naval Research Lab, Washington, DC 20375
The Review Of Scientific Instruments, Vol. 48, No. 4, pp 462-463 (04/1977).
Experiments are described in which the application of a pulsed magnetic field to a Corbino disk of indium antimonide causes an increase in resistance of about 2 orders of magnitude in a time of 5 microseconds. The use of this element as a switch for the transfer of energy from an inductive energy store is discussed. 9 Refs.
Primary Keywords: Hall Effect Switch; Pulsed Magnetic Field; Indium Antimonide; Corbino Disk; 100-fold Increase In Resistance; 5 Microsecond Rise Time

6494
(BREAKDOWN STUDIES; PARTICLE BEAMS, ELECTRON)
(Vacuum, Electrical; Generation)
ARRANGEMENT FOR STUDYING FIELD EMISSION IN THE NANOSECOND AND SUBNANOSECOND RANGES
B.A. Koval, D.I. Proskurovskii and V.P. Rotshtein
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 22, No. 4, pp 1146-1151 (08/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 243-247 (July-August 1979)
An experimental arrangement is described for studying field emission in the pre-explosion mode with a pulse duration of up to 0.7 nsec. The Fower-Nordheim characteristics are given along with oscillograms of the transition of field emission to the explosion emission mode. 5 Refs.
Primary Keywords: Field Emission; High Current Density; Emitter Melting; Vacuum Breakdown; Peak Current vs Pulse Width
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6496
(BREAKDOWN STUDIES)
(Gas, Electrical)
BREAKDOWN MECHANISM OF A NARROW AIR GAP. II
S.I. Andreev and B.M. Sokolov
Soviet Physics-Technical Physics, Vol. 11, No. 2, pp 254-256 (08/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 349-352 (February 1966)
The current, impedance, and dissipated energy are measured for diffusion glow formation when the discharge gap is broken down by nanosecond pulses. The conditions for formation of a cathode spot and of a spark channel in a discharge in air at pd=45 Torr cm are investigated. 8 Refs.
Primary Keywords: Air Breakdown; Current Measurement; Energy Dissipated; Glow Discharge; Nanosecond Pulse; Cathode Spot; Spark Channel
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6503
(PARTICLE BEAMS, ELECTRON)
(Generation)
ELECTRON ACCELERATION IN A TWO-CONDUCTOR STRUCTURE
E.G. Bessonov and A.V. Serov
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Soviet Technical Physics Letters, Vol. 4, No. 4, pp 188-189 (04/1978).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 4, 467-470 (April 26, 1978)
Picosecond beams can be produced by shock acceleration-a method in which the particles are accelerated in reflection from a moving potential barrier. There are several ways to produce a moving potential barrier. Fermi drew attention to one possible shock acceleration mechanism in space. Veksler suggested a collective shock acceleration method. This method is now usually associated with the acceleration of positive ions in the *potential well of an electron* ring which is accelerated as it collides with a 'heavier' electron ring that moves with a relativistic velocity. With the shock acceleration method, a heavy electron ring can also be used to accelerate a beam of negative ions. It is already possible to produce an electron ring which is capable of reflecting electrons and negative ions which are at rest with an energy increment approximately 100 MeV/m. A proposed accelerating structure reflects particles from a moving elect-omagnetic wave with a longitudinal electric field component. In the present letter we report an experimental study of electron acceleration in a structure of this kind. 9 Refs.
Primary Keywords: Picosecond E-beam Generation; Shock Acceleration; Electron Ring
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6506
(BREAKDOWN STUDIES; PARTICLE BEAMS, ION)
(Vacuum, Electrical; Generation)
EMISSION PPOPERTIES OF THE PLASMA OF VACUUM SPARKS. I. ION BEAMS
K V. Suladze and A.A. Plyutto
Soviet Physics-Technical Physics, Vol. 10, No. 7, pp 1006-1013 (01/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1298-1307 (July 1965)
The emission properties of the plasma of vacuum sparks in producing heavy-current beams of H/sup +/ and D/sup +/ with a spark source were studied. With large emitting surface (5 to 7 sq.cm.) ion-current densities of 5 to 15 A/sq.cm. and total ion currents of 50 to 100 A in a 1t-6 sec pulse are achieved. The ion current to the Faraday cylinder is 40% of the total current. Compensation of the beam by secondary electrons has been observed. Mass-spectroscopic investigations show that the H/sup +/ and D/sup +/ ions amount to 80% of the total beam current on the average. 29 Refs.
Primary Keywords: Ion Beam Generation; Vacuum Breakdown; 100 A Ion Beam; Hydrogen Ion Beam; Deuterium Ion Beam
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6509
(ENERGY STORAGE, CHEMICAL; PULSE GENERATORS)
(Flux Compression Generators; Flux Compression)
EXPERIMENTS WITH AN EXPLOSIVE-MAGNETIC GENERATOR IN LABORATORY CONDITIONS
E.I. Bichenkov, A.E. Voitenko, A.F. Demchuk, A.A. Deribas, B.I. Kulikov, Yu.E. Nesterikhin and O.P. Soholev
Soviet Physics-Doklady, Vol. 13, No. 12, pp 1256-1257 (06/1969).
Trans. From: Doklady Akademii Nauk SSSR 183, 1289-1291 (November-December 1968)
Explosive-magnetic generators are a very promising means of conducting experimental work, particularly in the field of high temperature plasmas and short-duration iron-free accelerators with mega-gauss fields. The main advantages of using explosives in powerful current sources, as compared, for example, with banks of capacitors, are found in the large output of electrical power and the great energy. The investigations of large explosive-magnetic generators have been conducted on outdoor proving grounds, because of the shock wave and the explosion product fragments produced during the test. The distinctive feature of the present paper is the conduct of experiments with explosive-magnetic generators under laboratory conditions, which enlarges the possibilities of their use. 5 Refs.
Primary Keywords: Flux Compression Generator; Laboratory Testing; 14 MA Current; Plane Configuration
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6510
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Electrical; Thyratrons)
FAST HIGH-VOLTAGE HIGH-CURRENT SWITCH: THYRATRON-SPARK GAP HYBRID
R.B. Gibson
Massachusetts Institute of Technology, Cambridge, MA
The Review Of Scientific Instruments, Vol. 50, No. 11, pp 1489-1490 (11/1979).
A high-voltage high-current switch using a hydrogen thyratron in series with a two-element spark gap is described. The hybrid switch triggers like a thyratron, turns off like a spark gap, and holds off *twice the potential* of either element alone. 9 Refs.
Primary Keywords: Thyratron; Self-trigger Spark Gap; Series Combination; Thyratron Triggering; Spark Gap Recovery
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6518
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
INITIATION OF ELECTRICAL BREAKDOWN IN VACUUM BY FIELD EMISSION
I.N. Slivkov
Soviet Physics-Technical Physics, Vol. 11, No. 2, pp 249-253 (08/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 342-348 (February 1966)
Approximate values of currents are determined by analyzing the conditions at the electrodes and within the interelectrode gap leading to vacuum breakdown because of partial melting at the anode and at the cathode and because of space charge resulting from ionization of the anode material vapors. The relative effectiveness of the above processes as initiators of breakdown between flat electrodes at various voltages and for various cathode microstructures are then compared. 14 Refs.
Primary Keywords: Field Emission; Prebreakdown Current; Anode Melting; Cathode Melting; Cathode Microstructure; Theory
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6528
NANOSECOND PULSERS FOR MM WAVE TUBES
J. Stover, N. Komatsu and A. Miata
ECOM, Fort Monmouth, NJ 07703
Interim rept. no. 2, Feb-May 79 No. HAC-FR-79-14-353, 18p (02/1980).
Availability: AD-A080 990/5 NTIS
The AVG avalanche transistor has been selected as the switching element for the nanosecond pulsers. Still open for consideration is a high voltage (400V) VMOS FET that will be available shortly for evaluation of that device operating in avalanche mode.
Primary Keywords: Pulse Generators; Electronic Switches; Metal Oxide Semiconductors; Field Effect Transistors; Switching Circuits; Bipolar Transistors; Millimeter Waves; Junction Transistors; Power Supplies; Avalanche Effect(Electronics); Electron Tubes; Electric Wire
Secondary Keywords: Avalanche Transistors; NTISDODXA; NTISDODA

6532
(PARTICLE BEAMS, ELECTRON)
(Generation)
PULSED DESORPTION SLOT CATHODE
E.N. Danil'tsev and V.I. Pershin
Instruments And Experimental Techniques, Vol. 22, No. 4, pp 918-922 (08/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 36-39 (July-August 1979)
This paper describes a pulsed desorption slot cathode consisting of an assembly projecting above a metal surface and comprising dielectric walls, the sides of which are directed along the applied electric field while the ends lie parallel with the plane of the anode. A cathode with an area of approximately 1 sq.cm. subjected to a pulse voltage of 65 kV with duration 35 nsec can provide a current of 370 A. The authors estimate the emission capacity of such a cathode. The stability of operation of the cathode is shown by experiment to be high at a current density of 370 A/sq.cm. 8 Refs.
Primary Keywords: Pulsed Desorption Slot Cathode; E-beam Generation; Dielectric Structure; Metal Substrate; Adsorbed Gas
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6535
(PARTICLE BEAMS, ELECTRON)
(Generation)
SELF-ACCELERATION OF A CHOPPED ELECTRON BEAM IN A FERRITE-FILLED WAVEGUIDE
N.N. Nasonov and A.M. Shenderovich
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Soviet Physics-Technical Physics, Vol. 21, No. 9, pp 1090-1093 (09/1976).
Trans From: Zhurnal Tekhnicheskoi Fiziki 46, 1873-1878 (September 1976)
The shock excitation of the precession of the magnetic moment of a ferrite by the trailing edge of an intense electron beam that moves along the axis of a waveguide filled with ferrite rings, magnetized to saturation, is analyzed. Solution of Maxwell's equations and the Landau-Lifshitz equation for the remagnetization of the ferrite yields an electric field which accelerates the particles at the trailing edge of the beam. Axially magnetized and azimuthally magnetized ferrites are considered. 5 Refs.
Primary Keywords: E-beam Generation; Self-acceleration; Ferrite Ring; Saturated Magnetization; Remagnetization; E-field Generation
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6542
(SWITCHES, OPENING)
(Gas Gaps, Crossed-field)
THE GAMITRON-A HIGH POWER CROSSED-FIELD SWITCH TUBE FOR HVDC INTERRUPTION
M.A. Lutz and G.A. Hofmann
Hughes Research Labs, Malibu, CA 90265
IEEE Transactions On Plasma Science, Vol. PS-2, No. 1, pp 11-18 (03/1974).
A high power crossed-field discharge device has been developed for use as a high voltage direct current interrupter. This device operates at low pressure (0.05 Torr), conducting current at a fixed voltage (approximately 500 V) only in the presence of a weak magnetic field (approximately 100 G) which is substantially perpendicular to the electric field between the electrodes. When the magnetic field is removed, ionization ceases and current interruption results. Physical phenomena occuring in this device have been investigated, including the glow-to-arc transition, gas cleanup, and high voltage breakdown. Based on the results of these investigations, switch tubes have been developed and successfully tested at the 2 kA, 100 kV level, with recovery rates in excess of 2 kV/microseconds. The availability of such devices will make possible many applications including HVDC circuit breakers, AC current limiters, and practical inductive energy storage. 30 Refs.
Primary Keywords: Crossed-field Switch; Gamitron; Opening Switch; External Magnetic Field; Field Removal Opening; Glow-to-arc Transition; Gas Cleanup; 2 kV/microsecond Opening Rate

6543
(PARTICLE BEAMS, ELECTRON)
(Generation)
THE GROWTH RATE OF THE POWER IN A PULSED HIGH-CURRENT BEAM OF ACCELERATED ELECTRONS
I.N. Slivkov
All-Union Institute, Moscow, USSR
Instruments And Experimental Techniques, Vol. 18, No. 2, pp 352-354 (05/1975)
Trans. From: Pribory i Tekhnika Eksperimenta 2, 28-29 (March-April 1975)
It is shown that the growth rate of the power of a beam of electrons obtained in pulsed high-current accelerators is limited by the wave impedance of the circuit sections and primarily by the wave impedance of the diode. The indicated limitation may be overcome by means of a stepwise increase in voltage. A method for effecting such an increase is proposed. 4 Refs.
Primary Keywords: E-beam Generation; Power Rise; Circuit Impedance; Diode Impedance; Voltage Pulse Shaping

6566
(POWER CONDITIONING)
(Saturable Reactors)
THE USE OF FERRITES FOR THE GENERATION OF POWERFUL HIGH-VOLTAGE PULSES OF NANOSECOND DURATION
S.I. Vanyukov, M.P. Andreev and V.A. Serebryakov
State Optical Institute, USSR
Instruments And Experimental Techniques, No. 3, pp 502-505 (06/1962).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 89-92 (May-June 1962)
When a conductor loaded with ferrite toroids is connected into the circuit of a high-current spark discharge it is observed that high-voltage nanosecond impulses arise across the loaded segment with powers of the order of 1E6 W. Data are presented concerning the influence of the discharge parameters on the amplitude, duration and repetition frequency of these impulses. 4 Refs.
Primary Keywords: Pulse Sharpening; Ferrite Loaded Transmission Line; Switch Parameters; Effect On Pulse Shape

6548
(PARTICLE BEAMS, ELECTRON)
(Generation)
TRANSFORMER TYPE ACCELERATORS FOR INTENSE ELECTRON BEAMS
E.A. Abramyan
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 3, pp 447-455 (06/1971).
The principles and designs of transformer accelerators (TA) generating intense beams of charged particles over energy ranges 0.5-5 MeV are described. Pulse electron accelerators with pulse lengths of 1E-8 to 1E-5 sec are investigated (some of them have a repetition rate of several hundreds pps) as well as one-phase and three-phase 50-cps transformers. The most models' power efficiency is in the range of 60-95%, the averaged beam power comes up to or exceeds 10 kW and is in excess of 150 kW for one of the last models. The design of a 5 MeV single-pulse TA with peak current of 30 kA at pulse length of 40 nsec and of 1.2 MeV proton TA with average beam power of 10 kW are described. The features of main components of high voltage transformers and of intense current acceleration tubes are discussed. 18 Refs.
Primary Keywords: Transformer Accelerator; High Efficiency; 5 MeV Beam Energy; 30 KA Current; Design Considerations

6569
(POWER CONDITIONING)
(Pulse Transformers)
USING A CABLE PULSE TRANSFORMER IN THE POWER SYSTEM OF A GAS LASER
A.S. Nasibov, A.A. Isaev, V.M. Kaslin and G.G. Petrash
Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Instruments And Experimental Techniques, No. 4, pp 934-935 (08/1967).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 232-233 (July-August 1967)
Pulsed gas lasers have recently gained wide use and are being intensively studied. Certain characteristics, for example, the possibility of generation in the widest spectral interval from ultraviolet to far infrared make them very promising for a number of practical problems. Up to the present time, generation in the ultraviolet region has been obtained only with gas lasers in the pulsed mode. The power attained with generators of this type reaches 200 kW. The discharge of a capacitor through a spark gap or a thyratron is usually used to excite pulsed gas lasers. Since the working voltages reach 50 kV, and in some cases higher voltage is desired, serious power difficulties arise. A power supply for a pulsed gas laser that allows the required characteristics to be obtained by comparatively simple means is described below. 5 Refs.
Primary Keywords: Coaxial Cable Pulse Transformer; High Power; Low Pulse Distortion; High Efficiency
Secondary Keywords: Gas Laser Pumping

6552
(PARTICLE BEAMS, ELECTRON; ENERGY STORAGE, INDUCTIVE)
(Generation; Systems)
A MULTIELECTRODE ELECTRON-OPTIC SYSTEM WITH AN INDUCTIVE STORAGE DEVICE FOR A HIGH-CURRENT ACCELERATOR
A.A. Kozlov, A.E. Maslov, G.I. Prokhova and I.N. Slivkov
Prokhova, And I.N. Slivkov Scientific-Research Institute Of Opticophysical Measurements, Moscow, USSR
Instruments And Experimental Techniques, Vol. 18, No. 3, pp 685-687 (06/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 25-27 (May-June 1975)
The circuit of an accelerator with an inductive energy-storage device and a multielectrode electron-optic system is described. The results of studying the characteristics of such a system with models are presented. The possibility of creating an electron-optic system having the properties required for an accelerator is demonstrated. 2 Refs.
Primary Keywords: E-beam Generation; Inductive Energy Store; Electron-optic System; Design Considerations; Performance Test

6562
(SWITCHES, CLOSING)
(Liquid Metal)
PULSE MODULATOR BEHAVIOR OF THE LIQUID METAL PLASMA VALVE (LMPV)
W. Wright Jr (1) and J.R. Bayless (2)
(1) ECOM, Fort Monmouth, NJ 07703
(2) Hughes Research Labs, Malibu, CA 90265
1978 IEEE Thirteenth Modulator Symposium, pp 83-87 (06/1978).
The LMPV is a mercury-cathode, triggered, closing switch which employs a small area mercury pool and a cooled (-30 Deg.C.) condensing surface to maintain the conditions for vacuum arc operation. These conditions result in high-voltage capability, fast recovery and high current operation with negligible cathode wear. Therefore, the LMPV was considered to have potential as a high average power closing switch for modulator applications. An LMPV closing switch (LMPVCS) was built at Hughes Research Laboratories and evaluated at ERADCOM at voltages up to 150 kV, currents up to 8 kA peak and 7.5 A average, pulse lengths up to 50 microsecond, and repetition rates up to 250 Hz. The device failed as a result of excessive anode dissipation caused by a long anode fall time on the order of 5 microsecond. Subsequent experimentation has indicated that the fall time is reduced at increased mercury vapor pressures, however, experiments are required to define the relation between the fall time and voltage hold-off capability. 3 Refs.
Primary Keywords: Closing Switch; Vacuum Gap; High Voltage; Fast Recovery; Rep-rated

6571
CONSTANT CURRENT CHARGING CIRCUITS FOR HIGH ENERGY MODULATORS
J.L. Carter
Department of the Army, Washington, DC
Patent No. PAT-APPL-759 684, 8p (06/1978).
Availability: AD-D005 499/9ST
NTIS
A means is described for achieving square wave charging of pulse forming networks in line type pulsers which include parallel pulse forming networks with charging inductors connected between the PFNs. The cumulative value of the distributed inductance of the charging inductors is chosen so that when combined with the total capacitance of the PFNs, the charging network pulsewidth equals the interpulse period. (Author)
Primary Keywords: Patents; Circuits; Pulse Modulation; Pulse Generators; Square Waves; Inductors; Capacitors; High Energy
Secondary Keywords: PAT-CL-328-65; NTISGPA
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6582
(BREAKDOWN STUDIES; DIAGNOSTICS AND INSTRUMENTATION)
(Gas, Electrical; Miscellaneous)
SPECTROGRAPHIC ERRORS IN PULSED DISCHARGES
W.H. Wright Jr.
ECOM, Fort Monmouth, NJ 07703
The Review Of Scientific Instruments, Vol. 41, No. 2, pp 265-269 (02/1970).
The method of electronically processing the detector signal can be critical when making spectrographic measurements on a pulsed discharge. The output of the commonly used synchronous detector is dependent on both signal amplitude and signal pulse shape, and, when the shape of the radiated light pulse varies with wavelength, serious errors can be introduced. Two disparate spectrograms are shown that were taken from the same light source, differing only in signal processing, and the reasons for the discrepancies are explained. When taking spectrograms of pulsed light sources where afterglow effects may result in a variable pulse shape, it is recommended that the synchronous detector not be used; if the resultant spectrogram is to be power vs wavelength, then some form of signal sampling should be used instead. A measurement technique using a sampling oscilloscope for signal processing is described. A curve is included that predicts the magnitude of error introduced when using the synchronous detector to process a rectangular pulse-exponential decay signal. The error discussed does not exist when studying a mechanically chopped continuous light source since the pulse shape then depends only on the chopper and is invariant. 6 Refs.
Primary Keywords: Pulsed Breakdown; Spectrographic Diagnostic; Synchronous Detector; Effect Of Waveshape

6583
(SWITCHES, CLOSING; SWITCHES, CLOSING; ENERGY STORAGE)
(Gas Gaps, Self; Gas Gaps, Systems; System Protection)
THE 'HOURGLASS' ENERGY DIVERTER
S. Schneider and A.J. Buffa
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-14, No. 8, pp 433-438 (08/1967).
A new design for a series spark-gap array for energy diverter usage has been developed. The electrical circuit of this array differs from previously reported energy diverter designs in two respects. First, the capacitors from each electrode to ground are eliminated, and second, the interelectrode capacitances of the gaps are not all equal. By varying the interelectrode capacitances of each gap in accordance with predetermined requirements, it was possible to study several triggering modes. In particular, two triggering modes were investigated: a 'constant overvoltage' mode and an 'increasing overvoltage' mode. 7 Refs.
Primary Keywords: Spark Gap Array; Series Operation; Non-constant Interelectrode Capacitance; Several Triggering Modes

6584
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
RECTANGULAR BEAM FARADAY CUP
J. Shannon
Maxwell Labs Inc, San Diego, CA 92123
1976 IEEE Pulsed Power Conference Proceedings, Paper IE-5 (11/1976).
A Faraday Cup was developed for calibrating current sensors in generators producing rectangular electron beams. The current is measured with 24 re-entrant cavities of known area arranged to average the beam current. Design criteria are discussed, including the error due to spatial variations of the beam, the high frequency response, and late time effects due to resistive losses in the walls of the cavity. A criteria for optimizing the low frequency response of the cavity using the finite time constant of the passive integrator is given. 0 Refs.
Primary Keywords: Faraday Cup; E-beam; Current Sensor; Design Considerations

6585
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
INTERIM REPORT ON DEVELOPMENT OF HIGH POWER, SHORT DUTY TRANSFORMER/RECTIFIER UNITS
R.I. McNall Jr. and R.L. Haumesser
Thermal Technology Lab, Inc., Buffalo, NY
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-2 (11/1976).
This report describes the development of transformer/rectifier (T/R) units capable of delivering high power for relatively short periods of time. The primary objective of the program was to develop lightweight and compact T/R-units to minimize the size and weight of the final system consistent with other specified requirements. A specific weight of 0.25-0.3 lbs./kva. was achieved for the final 6 MW T/R-system, including all associated external cooling apparatus. The results of parametric optimization and engineering design studies leading to the selection and final development of two (2) forced oil cooled 3 MW T/R-units are presented. Included in the results is a discussion of the advantages and disadvantages of different cooling techniques including vaporization, adiabatic, and forced liquid cooling and a detailed thermal analysis of the final T/R-system design. The development and use of computer aided transformer design optimization procedures is also discussed. 0 Refs.
Primary Keywords: Power Supply; Burst Mode; High Power; Light Weight

6587
(BREAKDOWN STUDIES)
(Liquid, Electrical)
BROADENING OF A HIGH-INTENSITY SPARK CHANNEL IN A LIQUID
V.S. Komel'kov and Yu.V. Skvortsov
Soviet Physics Doklady, Vol. 4, No. 6, pp 1313-1316 (06/1960).
Trans. From: Doklady Akademii Nauk SSSR 129, 1273-1276 (November-December 1959)
In the present paper, the results of an investigation on the initial stages of the broadening of a spark channel in a liquid (the first period of current flow) are described. A discharge originated in water along the axis of a cylindrical transparent container (chamber) with a diameter of 40-70 mm, a height of 50 mm, between brass needle-shaped electrodes placed at an interval of 12-15 mm. A current loop with a capacitance of 2.7-260 microFarad and a potential U/sub 0/ = 20-40 kV, was discharged through a circuit with an inductance L = 7E-6 henries. The loop was closed with the burning away of air or detonation-type dischargers, which received a synchronized pulse from a photorecorder. 5 Refs.
Primary Keywords: Water Breakdown; Initial Current; Voltage Measurement; Current Measurement; Photographic Measurement; 12 kA Current; Thermal Considerations

6590
(INSULATION, MATERIAL)
(Liquid)
DIELECTRIC STRENGTH OF PAPER-OIL INSULATION ACTED ON BY DC VOLTAGE
V.G. Butkevich, A.K. Lokhanin and V.M. Ponomarenko
Soviet Electrical Engineering, Vol. 49, No. 4, pp 47-52 (04/1978).
Trans. From: Elektrotekhnika 49, 28-32 (1978)
The authors study the resistivity and dielectric strength of oil-impregnated paper sheet and tape insulation in this paper. Field strength, temperature, and moisture content were all varied in a controlled experiment to determine their effect on the properties of the insulation in question. 8 Refs.
Primary Keywords: Oil-impregnated Paper Insulation; Resistivity Measurement; Dielectric Strength Measurement; DC Field; Field Strength Variation; Moisture Variation; Temperature Variation

6595
(PARTICLE BEAMS)
(Generation)
FORMATION OF INTENSE CHARGED PARTICLE BEAMS IN A CURRENT-CARRYING PLASMA
K.V. Suladze
Sukhumi Physiotechnical Institute, Sukhumi, USSR
JETP Letters, Vol. 15, No. 11, pp 459-462 (06/1972).
Trans. From: ZhETF Pis'ma V Redaktsiyu 15, 648-652 (June 1972)
This paper reports an investigation of intense charged-particle beams occurring in a current-carrying plasma as a result of formation of a 'break' on which the entire potential difference is concentrated. A strong electric field inside a plasma accelerates the charged particles and the entire discharge current is carried by the beams of electrons and ions. The limiting accelerated-particle current Jlenv is determined by the plasma concentration and can reach large values. 10 Refs.
Primary Keywords: Particle Beam Generation; Plasma Dynamics; Potential Break; Turbulent Plasma Layer; E-beam; Ion Beam

6598
(PARTICLE BEAMS, ELECTRON)
(Generation)
HIGH-CURRENT PULSED ELECTRON ACCELERATOR
E.A. Abramyan and S.B Vasserman
Soviet Atomic Energy, Vol. 23, No. 1, pp 709-711 (07/1967).
Trans. From: Atomnaya Energiya 23, 44-45 (July 1967)
The acceleration of electron beams with intensities of hundreds of amperes of energies of several MeV with pulses lasting 1E-9 - 1E-5 sec can be carried out very effectively with apparatuses in which a Tesla transformer is used as the high-voltage source. 0 Refs.
Primary Keywords: Electron Accelerator; 1E-9 - 1E-5 Sec Pulse Length; Tesla Transformer; High Pulse Powers; High Average Beam Powers; High Efficiencies; Several Hundred Amp Beam Current

6599
(PULSE GENERATORS; POWER CONDITIONING)
(Systems; Saturable Reactors)
HIGH-VOLTAGE GENERATORS OF NANOSECOND PULSES
M.Yu. Gel'tsel, A.D. Panfilov, V.S. Panasyuk, S.S. Sobolev and L.I. Yudin
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, No. 3, pp 613-618 (06/1966).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 101-107 (May-June 1966)
Pulse generators are described providing voltage pulses of a duration from 5 to 30 nsec, 1 to 5 nsec rise times, and amplitudes up to 50 kV. The stability of delay between the trigger and output pulse is of the order of 1 nsec. Hydrogen thyratrons are used as switching elements. The leading edge of the pulse is shaped by a nonlinear ferrite line, and its termination by a short-circuited cable section. 7 Refs.
Primary Keywords: Pulse Generators; 5-30 nsec Voltage Pulse Duration; Hydrogen Thyratron; 50 kV Amplitude; Nonlinear Ferrite Line; Pulse Shaping Circuit; 1-5 nsec Rise Times

6603
(POWER CONDITIONING)
(Pulse Transformers)
NEW PULSED X-RAY MACHINES, TYPE IRA-1 AND TYPE IRA-1D
N.I. Komyak and E.A. Pel'ks
Special Constructor Dept. Of X-ray Apparatus
The Soviet Journal Of Non-destructive Testing, No. 5, pp 420-424 (10/1967).
Trans. From: Defektoskopiya 5, 91-96 (September-October 1967)
Pulsed x-ray machines having a transformer source for high voltage are described. It is demonstrated that the weight and size of x-ray machines are significantly reduced when a pulse transformer is used instead of a condenser bank to obtain the high voltage pulses. This permits the apparatus to be used both for studies of rapidly proceeding processes and for defectoscopy under field conditions. 6 Refs.
Primary Keywords: Pulse Transformer; Pulse Generator; Weight And Size Reduced; Rapidly Proceeding Process Studies; Defectoscopy; Pulse Radiography; Short, High Intensity Pulses

6605
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
PULSED MAGNETIC FIELD OF MASSIVE SOLENOID WITH MOVING CONDUCTING SHELL
V.M. Mikhailov and E.I. Pis'mennyi
Power Engineering, Vol. 16, No. 5, pp 63-68 (10/1978).
Trans. From: Izvestiya Akademii Nauk SSSR. Energetika i Transport 16, 73-78 (1978)
The authors study the expansion or compression of a conducting shell in a solenoid with a conducting core or die. The field distribution is calculated using a 1-dimensional formulation. 12 Refs.
Primary Keywords: Pulsed Magnetic Field; Massive Solenoid; Conducting Die; Shell Displacement; Invariant Field Strength; Integrodifferential Equations; Theory

6607
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic, Flux Compression)
SOME CHARACTERISTIC FEATURES OF DIFFUSION OF A MAGNETIC FIELD INTO A MOVING CONDUCTOR
F.I. Bichenkov
Journal Of Applied Mechanics And Technical Physics, Vol. 8, No. 1, pp 90-91 (02/1966).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 8, 132-133 (1967)
The study of the diffusion of a magnetic field into a moving conductor is of interest in connection with the production of high-strength magnetic fields by rapid compression of conducting shells. It is shown that when a magnetic field in a plane slit is compressed at constant velocity, the entire flux enters the conductor; in the present paper we formulate a general result concerning the conservation of the sum current in the cavity and conductor for arbitrary motion of the latter. We also consider a special case of conductor motion when the flux in the cavity remains constant despite the finite conductivity of the material bounding the magnetic field. 6 Refs.
Primary Keywords: Magnetic Field; Diffusion Into A Conductor; Flux Compression; Constant Velocity Conductor Movement

6608
(PARTICLE BEAMS, ELECTRON)
(Generation)
SPARK SOURCE IN A HIGH-CURRENT ELECTRON INJECTOR
K.V. Suladze, A.A. Plyutto and D.V. Iremashvili
Institute Of Physics And Technology, Academy Of Sciences, Geor. SSR, Sikhumi, USSR
Instruments And Experimental Techniques, No. 3, pp 509-510 (06/1965).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 46-47 (May-June 1965)
The present article provides some of the results obtained in testing a spark source in an electron injector capable of producing a focused pulse electron beam with a current of 10 A for trapping voltage pulses with a duration of 5E-8 sec and an amplitude of up to 1E6 V. 5 Refs.
Primary Keywords: Spark Source; High-current Electron Injector; Focused Electron Beam; 1E6 V Amplitude; 10 A Current Field Emission Diode
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6609
(DIAGNOSTICS AND INSTRUMENTATION)
(Systems)
SPECIAL MEANS FOR MEASUREMENT OF THE ELECTRICAL PARAMETERS OF ELECTROPHYSICAL INSTALLATIONS
M.P. Vasil'ev, V.P. Gerasimov, O.A. Gusev, V.P. Zhibura, V.G. Kunstman, I.V. Mozin, S.S. Repin and V.A. Skosarev
Power Engineering, Vol. 16, No. 3, pp 57-60 (01/1978).
Trans. From: Izvestiya Akademii Nauk SSSR. Energetika I Transport 16, 65-69 (1978)
Pulsed current and voltage measurements are vital to any installation that utilizes pulsed power. The authors describe design principles for equipment to measure voltages in the range of 50 kV 5 MV and currents of over 1 MA. Data transmission in a pulsed power environment is also considered. 0 Refs.
Primary Keywords: Electrical Diagnostics; Electrophysical Installations; Pulse Signals; High Accuracy; Ultra High Voltage Reduction; Measurement Converters; Direct-current Transformers; Date Transmission
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6610
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
STUDY OF OPERATION OF CONTROLLED SPARK GAPS IN AIR
P.I. Shkuropat
Soviet Physics-Technical Physics, Vol. 5, No. 8, pp 895-902 (02/1961).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 30, 954-963 (August 1960)
A study was made of the relation between the breakdown time lag of controlled spark gaps in air at atmospheric pressure and various trigger conditions. On the basis of the experimental data obtained a mechanism for the development of the discharge in triggered spark gaps is proposed. A recommended design for a controlled spark gap with a short time lag is given. 6 Refs.
Primary Keywords: Spark Gap Breakdown; Trigger Variation; Breakdown Time; Breakdown Mechanism; Sphere-sphere Gap; Aluminum Electrodes; Steel Insert
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6612
(PULSE GENERATORS; POWER CONDITIONING)
(Systems; Pulse Transformers)
TRANSFORMERS FOR HEAVY-CURRENT NANOSECOND IMPULSES
B.M. Koval'chuk, V.V. Kremnev and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, No. 3, pp 672-676 (06/1969).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 125-129 (May-June 1969)
A procedure has been developed for calculating transformers for nanosecond current impulses based on segments of long lines using ferrites as decoupling elements. Results of an experimental check of the proposed method are given. Transformer constructions are described that can deliver current impulses of up to 1E3 A of 1E-7 to 1E-8 sec duration, with a front length of 1E-9 sec on a load of 0.2 to 2 ohm. 6 Refs.
Primary Keywords: Nanosecond Current Impulses; Pulse Transformers; 1E3 A Current Impulses; 1E-9 sec Pulse Front; Low Output Impedance
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6613
(POWER TRANSMISSION)
(Transient Effects)
TRANSIENT ELECTROMAGNETIC PROCESSES IN DEVICES WITH HEAVY CURRENT LEADS
V.M. Mikhailov
Power Engineering, Vol. 16, No. 4, pp 41-48 (08/1978).
Trans. From: Izvestiya Akademii Nauk SSSR. Energetika i Transport 16, 48-55 (1978)
The authors present an analysis of transients in the environment surrounding cables carrying high current pulses. The fields surrounding the cables are calculated numerically for a rectangular cross-section bus and the crosstalk to another rectangular bus is also calculated. 13 Refs.
Primary Keywords: Field Calculation; Numerical Formulations; Plane Pulse Electromagnetic Field; Heavy Current Leads; Transient Regimes; High Current Energy Transport
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6617
(POWER CONDITIONING)
(Saturable Reactors)
A CIRCUIT USING FERRITES TO OBTAIN HIGH-VOLTAGE NANOSECOND PULSES
R.B. Baksht and G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 3, pp 598-600 (06/1964).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 108-110 (May-June 1964)
The authors describe a circuit for generating short pulses with amplitudes of up to 20 kV by means of a nonlinear element with ferrite toruses in a cable propagating a voltage pulse. They give data about the influence of parameters of propagating pulses on the shape and amplitude of the output signal. 3 Refs.
Primary Keywords: Pulse Sharpening; Nanosecond Pulses; 20 kV Amplitudes; Ferrite Toruses
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6618
(PULSE GENERATORS)
(Pulse Forming Lines)
A SUPPLY GENERATOR FOR A STREAMER CHAMBER WITH A LARGE INTERELECTRODE GAP
G.A. Vorob'ev, N.S. Rudenko, V.I. Tsvetkov and M.I. Kozlov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 1, pp 65-68 (02/1967).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 68-71 (January-February 1967)
Spark chambers that operate in the streamer (track) mode permit the isotropy of the recording of particle tracks to be increased considerably. The development of electron avalanches and streamers in neon is defined in times of 1E-8 to 1E-9 sec at field strengths of 7-15 kV/cm. When the chamber gap d=10-20 cm, a pulse with an amplitude on the order of hundreds of kV, a controllable duration on the order of tens of nsec, and a duration stability of not worse than 1E-9 sec is required. The proposed generator for chamber supply was developed on the basis of the generator proposed previously, which produced pulses with an amplitude of 500 kV and higher and a rise time of 1-2E-9 sec. In order to limit the pulse duration with acceptable accuracy, the main attention was given to the development of spark gaps and methods of connecting them. 3 Refs.
Primary Keywords: Pulse Generator; Streamer Chamber; 500 kV Amplitude Pulses; 1-2E-9 sec Rise Time
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6619
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
A TRIGATRON FOR LARGE CURRENTS IN HIGH-VOLTAGE APPARATUS
S.A. Smirnov, L.A. Mikhnenko and A.M. Shendrovich
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instruments And Experimental Techniques, No. 3, pp 503-506 (06/1961).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 89-93 (May-June 1961)
A trigatron is described which can handle currents up to 2.5 kA at voltages from 20 to 60 kV, for a pulse duration of 2.7 microseconds and a repetition frequency of 50 cycles. 7 Refs.
Primary Keywords: Trigatron Spark Gap, 2.5 kA Current Capacity; 60 kV Operating Voltage; Reprrated; Life Test
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6620
(PULSE GENERATORS; PULSE GENERATORS)
(Marx; Pulse Forming Lines)
A 500-KV NANOSECOND PULSE GENERATOR
G.A. Vorob'ev and N.S. Rudenko
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 1, pp 106-108 (01/1965).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 109-111 (January 1965)
A 500-kV generator of pulses with a front of 1.5 nsec is described. The generator consists of a storage capacitor, in which glycerine is used as the dielectric, a pressurized discharge chamber, and a transmission line. The storage capacitor is charged from a single-stage pulse generator. Owing to the coaxial design of the storage capacitor-transmission line system, the dimensions of the discharge circuit could be reduced and a steep pulse front could be obtained. 8 Refs.
Primary Keywords: 500 kV Pulse Generator; 1.5 nsec Pulse Front; Storage Capacitor, Pressurized Discharge Chamber; Transmission Line
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6621
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)
AN APPROXIMATE THEORY OF MAGNETIC PILE-UP
N.N. Kalitkin and L.S. Tsareva
Magnetohydrodynamics, Vol. 5, No. 3, pp 5-9 (09/1969).
Trans. From: Magnitnaya Gidrodinamika 5, 8-14 (1969)
The compression of the magnetic field of a moving shell is considered when the shell exhibits finite conductivity and becomes heated in the process of compression. The envelope material is taken to be an incompressible fluid (which is justifiable for fields of up to 3-4 million Oe), and the magnetic field diffusion in the envelope is taken into account by the skin-layer method. With these assumptions the mathematical problem reduces to the solutions of a system of three ordinary differential equations, which may be solved exactly in a number of cases. The mechanical calculations which were carried out are in good agreement with experiment. 14 Refs.
Primary Keywords: Magnetic Field Compression; Magnetic Field Diffusion, Magnetic Pile-up; Magnetohydrodynamic Equations; Theory
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6622
(ENERGY STORAGE, CAPACITIVE; ELECTROMAGNETIC FIELD GENERATION)
(Capacitor Banks; Magnetic)
APPARATUS FOR GENERATING INTENSE MAGNETIC FIELDS OF SHORT DURATION
E.I. Kondorskii and E.V. Susov
Instruments And Experimental Techniques, No. 1, pp 118-123 (02/1963).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 125-130 (January-February 1963)
Apparatus for producing intense short-duration magnetic fields of up to 0.9E6 Oe is described. The magnetic field pulse is produced by discharging a capacitor bank of nominal energy 13.5 kJ. Construction of solenoids and switches is described. 8 Refs.
Primary Keywords: Magnetic Field Generation; Intense, Short-duration Fields; 13.5 kJ Nominal Energy Capacitor Bank; 3000 Microfarad Total Capacitance; Copper Wound Solenoids
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6623
(BREAKDOWN STUDIES)
(Exploding Wires)
CALCULATION OF THE VOLTAGE IMPULSE IN ELECTRIC EXPLOSION OF CONDUCTORS
V.L. Budovich and I.P. Kuzhekin
Moscow Energetics Institute, Moscow, USSR
Electric Technology USSR, Vol. 95, No. 1, pp 24-32 (01/1975).
Trans. From: Elektrichestvo 95, 22-26 (1975)
The voltage pulse associated with the electrical explosion of a wire is studied theoretically in this paper. The voltage peak is calculated analytically using a serial arc model. Comparison with experiment shows good agreement. 16 Refs
Primary Keywords: Slow Electric Explosion; Voltage Impulse Parameters; Conductor Dimensions; Serial-arc Theory
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6624
(POWER CONDITIONING)
(Saturable Reactors)
CONTROLLED DELAY OF HIGH-POWER NANOSECOND PULSES WITH THE USE OF THE MAGNETIZATION REVERSAL TIME OF FERRITES
R.B. Baksht, A.S. El'chaninov and G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 4, pp 893-895 (08/1968).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 124-126 (July-August 1968)
A controlled delay system for high-power nanosecond pulses that is assembled from ferrite elements is described. The system ensures smooth variation of the delay in an interval of 0 to 50 nsec for a pulse of 5 to 15 kV amplitude and a leading edge of 3 nsec. The delay stability is not worse than +or- 1% of the maximum delay. 6 Refs.
Primary Keywords: Nonlinear Inductor; Magnetization Reversal Time; Controlled Delay System; High-power Nanosecond Pulses; Self-inductive Ferrite Element

6628
(BREAKDOWN STUDIES)
(Liquid, Electrical)
EXPANSION OF A SPARK CHANNEL IN A LIQUID
Yu.V. Skvortsov, V.S. Komel'kov and M.M. Kuznetsov
Soviet Physics-Technical Physics, Vol. 5, No. 10, pp 1100-1112 (04/1961).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 30, 1165-1177 (October 1960)
An investigation has been made of the initial stages of expansion of the channel of an intense spark in water for currents up to 7.5E5 amp in the discharge circuit and a rate-of-rise of 2E11 amp/sec. The rate of expansion of the channel boundaries, the velocity of the shock wave, the voltage in the spark channel, and the discharge time have been measured. Estimates are given of the conductivity and current density in the discharge channel. A hydrodynamic calculation of the pressure field and the velocity behind the shock-wave front is presented. 10 Refs.
Primary Keywords: Spark Channel Expansion; 7.5E5 Amp Currents; 2E11 Amp/sec Rate-of-rise; Hydrodynamic Pressure Field Calculation; Plasma Conductivity; Current Density

6632
(SWITCHES, CLOSING)
(Gas Gaps, Systems)
INDUCTANCE OF MULTICHANNEL HIGH-VOLTAGE DISCHARGERS
A.P. Komarov and I.N. Romanenko
Soviet Electrical Engineering, Vol. 50, No. 7, pp 55-59 (07/1979).
Trans. From: Elektrotekhnika 50, 27-29 (1979)
Low-inductance, multichannel gas switching is the subject of this paper. Several types of multichannel operation are considered quantitatively. Several configurations from parallel operation of conventional spark gaps to creeping surface discharge switches are considered. 5 Refs.
Primary Keywords: Parallel Spark Gap Operation; Multichannel High-voltage Dischargers; Small Power Demand; 1-2 nH Minimum Inductance; Fast Rise Time; Low Erosion; Creeping Discharge Switch

6635
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)
INVESTIGATION OF RECTIFIER UNITS FOR PERIODIC CHARGING OF STORAGE CAPACITORS
A.E. Krasnopol'skii, L.F. Lebedev and V.B. Sokolov
Soviet Electrical Engineering, Vol. 50, No. 10, pp 58-63 (10/1979).
Trans. From: Elektrotekhnika 50, 25-28 (1979)
Capacitor charging circuits are described which use inductive and combination capacitive-inductive current limiting in the secondary circuit. Efficiencies as high as 85% are reported with almost total power factor compensation possible. A split-phase arrangement is used. 3 Refs.
Primary Keywords: Capacitor Charging Circuit; Split-phase Circuit; Inductive Limiting; Capacitive-inductive Limiting; High Efficiency; Experiment; Theory

6637
(BREAKDOWN STUDIES)
(Suspensions, Electrical)
MECHANISM OF SURGE BREAKDOWN IN SUSPENSIONS
A.A. Vorob'ev, M.P. Tonkonogov and F.D. Fominykh
Soviet Physics Journal, Vol. 11, No. 7, pp 69-70 (07/1968).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii. Fiziki 11, 103-105 (1968)
Data are presented of the breakdown of suspensions of several solid materials in liquid dielectrics. Both dielectric and conducting particles are used in several dielectric liquids. Graphs are presented for several combinations of liquid and solid. 7 Refs.
Primary Keywords: Liquid Breakdown; Suspension Breakdown; Pulsed Dielectric Strength; Solid-phase Concentration

6638
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
METHOD OF MEASURING THE DISPERSION OF THE DELAY TIMES OF BREAKDOWN OF CONTROLLED SPARK GAPS
I.I. Aksenov, V.K. Bocharov, V.L. Golosnyak, A.L. Zhdanov, V.I. Slatin and S.A. Smirnov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Kharkov, USSR
Instruments And Experimental Techniques, No. 3, pp 753-756 (06/1968).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 232 (May-June 1968)
The most complete information on the stability of operation of spark gaps (distribution of the delay time, mathematical expectation of this quantity, variance, etc.) can be obtained by the method described in a previous paper. However, measurement by this method, based on statistical analysis of numerous oscillograms obtained by photographing each pulse on a separate frame, is a quite laborious process. The shortcoming of the method is especially felt when many measurements must be made. Expenditures of time and labor are greatly lessened by using the below-described method based on automatic photographing of the oscillograms with subsequent processing of the photographs by a computer. The investigated signals are photographed from the screen of a pulse oscillograph by an ordinary narrow-film camera, the reverse winding handle of which is connected to the film-torquing mechanism. As such a mechanism we can use the magnetic drive of a selector. The winding of the drive is supplied from the control unit, to the input of which are sent synchronizing pulses from the firing unit of the investigated spark gap. Each time after operation of the spark gap the drive moves the film 1.5-2 mm. When the film is completely rewound the protection device of the control unit de-energizes the supply circuit of the magnetic drive and switches on the signalling system. 3 Refs.
Primary Keywords: Controlled Spark Gaps, Delay Time Distribution; Oscillograms; Computer Processing; Jitter Measurement; Automatic Data Recording

6640
(PULSE GENERATORS)
(Pulse Forming Lines)
OBTAINING HIGH-VOLTAGE SQUARE PULSES
A.I. Pavlovskii and G.V. Sklizkov
Instruments And Experimental Techniques, No. 2, pp 320-322 (04/1962).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 98-100 (March-April 1962)
The paper describes a new method for obtaining square pulses whose amplitude exceeds the charging voltage applied to the transmission line which forms the pulses by a factor of several times. The circit and construction are cited for an oscillator which produces a square pulse with an amplitude of 160 kV and a current of 600 amp when it operates into a matched load of 250 ohm, and a pulse amplitude of up to 300 kV when it operates into a load of 200 kohm. 0 Refs.
Primary Keywords: 160 kV Square Pulse Amplitude; 600 Amp Current; Long Coaxial Cables; .25 Microsecond Duration; 250 Ohm Impedance

6641
(SWITCHES, CLOSING)
(Gas Gaps, Electrical
ON THE USE OF GAS-DISCHARGE MICROGAPS IN HIGH-VOLTAGE NANOSECOND PULSE DEVICES
G.A. Mesyats, P.A. Vorob'yev and Yu.I. Bychkov
Radio Engineering And Electronic Physics, Vol. 10, No. 4, pp 668-670 (04/1965).
Trans. From: Radiotekhnika I Elektronika 10, 780-782 (1965)
The authors discuss the use of spark gaps as switches and pulse sharpening devices in this paper. The variaton of switching time with field intensity is found emperically for single gaps and a formula is given for cascaded gaps. Experimental tests are performed. 6 Refs.
Primary Keywords: Gas-discharge Microgaps; Spark Gas-discharge Switches; Strobotrons; Jitter Measurement, Emperical Delay Formula; Spark Gap System

6644
(POWER CONDITIONING)
(Saturable Reactors)
SHORTENING THE FRONTS OF HIGH-VOLTAGE PULSES WITH THE AID OF A NONLINEAR INDUCTANCE
O.G. Il'in and A.M. Shenderovich
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Kharkov, USSR
Instruments And Experimental Techniques, No. 1, pp 109-110 (02/1965).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 112-113 (January-February 1965)
A method of shortening pulse fronts with the aid of a nonlinear inductance (for example, a coil with a ferrite core) connected in series with a load is described. The parameters of the inductance are such that during a time equal to the duration of the front of a pulse from the shaper its value will be high. Therefore, the current rise during the time of the front will occur very slowly. Up until the end of the front, the core is saturated, the inductance is considerably reduced, and a fast current rise occurs. Oscillograms illustrating shortening of the front by the described method of from 30 to 7 nsec are given. 4 Refs.
Primary Keywords: Pulse Front Sharpening; Nonlinear Inductance; High Voltage Pulses; Core Saturation; Several Configurations

6646
(PARTICLE BEAMS, ELECTRON)
(Generation)
SUPPLY AND CONTROL OF AN ACCELERATOR ACTING ON THE PRINCIPLE OF A TESLA TRANSFORMER
A.A. Egorov, V.S. Panasyuk and V.M. Radchenko
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, No. 2, pp 261-265 (04/1968).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 18-23 (March-April 1968)
Described are charging units which were developed in conformity with the construction of a Tesla transformer, used as an element of a direct action accelerator. The units can also be used in other cases. A circuit, operationally controlled by an electron beam current set below the accelerating potential, is described. 4 Refs.
Primary Keywords: E-beam Generation; Tesla Transformer, Direct Action Accelerator, Hydrogen Thyratrons; Supply Network; Grid Voltage

6648
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic Flux Compression)
THE ELECTROMAGNETIC FIELD IN A CAVITY UNDERGOING COMPRESSION
I.M. Rutkevich
Moscow, USSR
Journal Of Applied Mathematics And Mechanics, Vol. 31, No. 3, pp 578-585 (06/1967).
Trans. From: Prikladnaya Matematika I Mekhanika 31, 552-559 (1967)
A theory of magnetic flux compression is presented. The authors consider flux compression by a perfectly conducting boundary in plane and axisymmetrical geometries. The method of integral transformations is used to obtain an analytical solution to the compression problem. 9 Refs.
Primary Keywords: Magnetic Flux Compression; Extra-strong Magnetic Fields; Compressing Conducting Shells; 1E4 T Field Intensities; Homogeneous Magnetic Field; Integral Representations

6652
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
A COMPENSATED SHUNT FOR MEASUREMENT OF POWERFUL NONSTATIONARY CURRENTS
A.P. Baikov, L.S. Gerasimov and A.M. Iskol'dskii
Institute Of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 16, No. 6, pp 1744-1745 (12/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 112-113 (November-December 1973)
The construction of a compensated shunt for measurement of mega-ampere currents having a rise time of 1E-8 sec is described. Oscillograms of the currents recorded by means of the proposed shunt are presented. 2 Refs.
Primary Keywords: Compensated Shunt; 10 MA Current Range; 10 ns Rise Time; RL Circuit
Secondary Keywords: Exploding Wires

6654
(PARTICLE BEAMS, ION)
(Generation)
ACCELERATION OF IONS BY A RELATIVISTIC ELECTRON BEAM
A.A. Plyutto, K.V. Suladze, S.M. Temchin, G.P. Mkheidze, E.D Korop, B.A. Tskhadaya and I.V. Golovin
Soviet Physics-Technical Physics, Vol. 18, No. 8, pp 1026-1028 (02/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 1627-1631 (August 1973)
The acceleration of ions by a relativistic electron beam is investigated. Protons are accelerated to 6-7 MeV by a beam of approximately 1 MeV electrons. The compositions of the beam and their energy distribution are studied. It is shown that the energies of protons accelerated by electrons increase more rapidly than linearly with increase in the accelerating voltage in the range 0.3-1 MeV. 11 Refs.
Primary Keywords: Collective Acceleration; 7 MeV Ion Beam Energy; Beam Diagnostics; Beam Profile Measurement

6655
(PARTICLE BEAMS, ELECTRON)
(Generation)
ACCELERATION OF IONS IN AN ELECTRON BEAM
A.A. Plyutto, K.V. Suladze, S.M. Temchin and E.D. Korop
Soviet Atomic Energy, Vol. 27, pp 1197-1202 (11/1969).
Trans. From: Atomnaya Energiya 27, 418-423 (November 1969)
In the production of ion beams derived from vacuum spark plasma, particles have been observed with energy in excess of the accelerating potential. Further investigation has led to the observation of an effective process of acceleration of ions up to energies approximately 1-10 MeV, produced during formation of electron beams from a plasma. The present article gives an account of some results of investigating the process of acceleration of ions in electron beams during emission from the plasma produced by vacuum sparks. 9 Refs.
Primary Keywords: Collective Acceleration; Vacuum Spark Plasma; E-beam Generation; Ion Beam Generation

6657
(PULSE GENERATORS)
(Flux Compression)
CALCULATING SCHEME AND SWITCHING-ON OF THE LOAD OF PLANE EXPLOSIVE-DRIVEN MAGNETIC GENERATORS
E.I. Bichenkov, A.E. Voltenko, V.A. Lobanov and E.P. Matochkin
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 14, No. 2, pp 176-180 (04/1973).
Trans. From: Zhurnal Prikladnoi Mekhanika i Tekhnicheskoi Fiziki 2, 37-41 (March-April 1973)
A scheme is described for calculating explosive-driven magnetic generators, and analytical and numerical calculations are made of the problems of switching a generator onto a constant ohmic and induction load, to a load whose resistance rises linearly with the temperature, and to a plasma load with equilibrium radiation. In the latter case, a calculation is made of a variant involving switching on the load through a matched transformer. 9 Refs.
Primary Keywords: Flux Compression Generator; Analysis; Numerical Calculation; Output Switch Analysis; Several Load Types

6660
(PARTICLE BEAMS, ELECTRON; ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Generation; Systems; Explosive Fuses)
DIRECT-ACTION ACCELERATORS WITH INDUCTIVE ENERGY STORAGE AND EXPLODING CONDUCTORS
Yu.D. Bakulin, V.S. Divenkov, V.P. Kovalev, A.I. Kormilitsyn, B.N. Lavrent'ev, A.V. Luchinskii and V.I. Martynov
Instruments And Experimental Techniques, Vol. 22, No. 2, pp 323-326 (04/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 34-37 (March-April 1979)
Two generators of pulsed bremsstrahlung and electron beams are described, the IGUR-I and IGUR-II instruments, in which inductive storage devices with exploding conductors are used. At a voltage of 2.8 MV on the accelerator tube and a current of 44 kA through the tube the IGUR-I provides a bremsstrahlung dose of 110 R at a distance of 1 m from the anode, while the IGUR-II at a voltage of 3.7 MV on the tube and a current of 70 kA provides a dose of 700 R. On both instruments the half-width of the bremsstrahlung pulse is regulated in the range of 0.1-0.5 microsecond. Electron beams with an energy density of 300 J/sq.cm. are extracted from the accelerator tubes. 1 Refs.
Primary Keywords: E-beam Generation; Inductive Energy Storage; Opening Switch; 2.8 MV Operating Voltage

6661
(BREAKDOWN STUDIES)
(Gas, RF)
DYNAMICS OF THE DEVELOPMENT OF HIGH-CURRENT INDUCTION DISCHARGE
P.N. Baronets, V.I. Myshenkov and M.I. Yakushin
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 20, No. 3, pp 305-311 (06/1979).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 3, 58-67 (May-June 1979)
Pulsed high-current discharges in the range of relatively low pressures were investigated mostly in connection with the problem of controlled thermonuclear fusion. The need for investigating such discharges at elevated pressures was dictated to a considerable extent by the requirement for high-power light sources. Significant advances in investigating the structure and dynamics of the development of high-current discharges have now been achieved. However, there also remain unsolved problems. In particular, with regard to pulsed induction discharges, complete understanding of the mechanism of development of such discharges is still lacking. Our purpose is to investigate high-current induction discharges in argon under gas pressures in the range from 5 to 50 mm Hg. A physical interpretation of individual stages in the development of high-current discharges is given on the basis of an analysis of the experimental results, and the stages of discharge development, the mechanism of which is not yet fully understood, are discussed. The discharge is investigated for relatively low energy inputs, when it is possible to separate in time the various stages of discharge development, which occur virtually simultaneously at high energy inputs. 8 Refs.
Primary Keywords: Induction Breakdown; 20 kHz Frequency; 70 V/cm Field Strength; Azimuthal E-field; Experiment; Theory

6663
(ENERGY STORAGE, INDUCTIVE; ELECTROMAGNETIC LAUNCHERS)
(Systems; Plasma)
EFFECT OF INTERRUPTION TIME ON PLASMOID ACCELERATION IN AN INDUCTIVE ENERGY-STORAGE ACCELERATOR
N.V. Belan, N.A. Mashtylev and B.I. Panachevnyi
Soviet Physics-Technical Physics, Vol. 16, No. 3, pp 433-435 (09/1971).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 559-562 (March 1971)
Plasmoid acceleration is discussed for an accelerator with inductive energy storage; it is assumed that a self-sustained arc is produced in the switching system. The plasmoid acceleration process is characterized by two stages: in the first the acceleration is due to power from the source; in the second the acceleration is due to the stored energy. A faster interruption time yields higher efficiency in acceleration in injectors of this kind. 5 Refs.
Primary Keywords: Plasmoid Arceleration; Inductive Energy Storage; Interruption Time; Charging Circuit; High Efficiency; Switching System; Self-sustained Arc

6664
(BREAKDOWN STUDIES)
(Exploding Wires)
ELECTRIC EXPLOSION OF SPIRAL WIRES IN VACUUM
I.F. Kvartskhava, V.V. Bondarenko, P.D. Meladze and K.V. Suladze
Soviet Physics JETP, Vol. 35 (8), No. 4, pp 636-638 (04/1959).
Trans. From: Zhurnal Eksperimental'noi I Teoreticheskoi Fiziki 35, 911-916 (October 1958)
When a bent wire is exploded in vacuo, the motion of the explosion products through the magnetic field of the current produces current tubes and also certain glow effects, due to the interaction of the streams of explosion products with each other. By scanning the explosion with a mirror, the stream fronts were found to have a speed of 1E6 cm/sec. A possibility of thermally insulating the plasma by means of the strong magnetic field that exists during a very short time of explosion is demonstrated. A qualitative explanation is proposed for the observed effect. 8 Refs.
Primary Keywords: Exploding Wire; Spiral Wire; Magnetic Field; Current Tubes; 1E6 cm/sec Stream Front Speed

6666
(BREAKDOWN STUDIES)
(Exploding Wires)
ELECTRICAL EXPLOSION OF WIRES IN VACUUM
I.F. Kvartskhava, V.V. Bondarenko, R.D. Meladze and K.V. Suladze
Soviet Physics JETP, Vol. 4, No. 5, pp 637-644 (06/1957).
Trans. From: Zhurnal Eksperimental'noi I Teoreticheskoi Fiziki 31, 737-744 (November 1956)

Results of an investigation of electric explosions of wires in vacuum are described. It is shown that regardless of the initial shape of the wire the explosion products propagate as in an ordinary explosion, in a direction normal to the surface of the wire. If the voltage across the capacitor of the explosion circuit is relatively low, the vapor streams, as in the case of an explosion in air, from layers that range themselves perpendicular to the wire. It has been established that at high capacitor voltages the motion of the vapor streams affects the distribution of the discharge current in the space around the wire. A qualitative explanation is given for the observed effects. 7 Refs.

Primary Keywords: Vacuum; Discharge Current; Current Channel; Electrode Streamers; Exploding Wire; Geometry Inconcongance

6668
(BREAKDOWN STUDIES, PARTICLE BEAMS, ELECTRON)
(Vacuum, Electrical; Generation)
ELECTRON EMISSION PROPERTIES OF A VACUUM SPARK. II. ELECTRON BEAMS
K.V. Suladze and A.A. Plyutte
Soviet Physics-Technical Physics, Vol. 12, No. 1, pp 48-52 (07/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 72-78 (January 1967)

Details are given of the emission properties of the plasma of a vacuum spark that arises in the production of a high-current electron beam. An emitting surface of 5-7 sq.cm. can produce current densities of 100-250 A/sq.cm. in a pulse of duration 1E-6 sec. Certain features of the high-current beams have been studied by extraction of electrons from the plasma; this occurs in two stages. In the first stage the extracted current is independent of the voltage and is proportional to the plasma density. The anomalous resistance of the plasma is due to deceleration of the electrons by the waves excited at the onset of instability. The second stage shows a sudden increase in the current. 29 Refs.

Primary Keywords: Vacuum Breakdown; E-beam Generation; Plasma Emission; Anomalous Plasma Resistivity; Two Beam Generation Stages

6671
(PARTICLE BEAMS, ELECTRON; SWITCHES, OPENING)
(Generation, Explosive Fuses)
EXPLODING FOILS FOR ACCELERATOR APPLICATIONS
A.B. Andrezen, V.A. Burtsev, V.M. Vodovozov and A.A. Drozdov
Soviet Technical Physics Letters, Vol. 5, No. 2, pp 68-69 (02/1979).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 5, 172-175 (February 1979)

The traditional design of high-current nanosecond electron accelerators uses shaping lines and Marx generators. Another approach makes use of exploding wires to generate the high-voltage pulses. This approach is attractive because it is simpler than in the traditional approach and because inductive energy storage holds promise. 5 Refs.

Primary Keywords: E-beam Generation; High-voltage Pulses; Exploding Foil; Inductive Energy Storage; 10 kA Peak Beam Current; Capacitive Inductor Charging

6672
(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL)
(Flux Compression; Flux Compression Generators)
EXPLOSIVE GENERATORS
E.I. Bichenkov
Institute Of Hydrodynamics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics-Doklady, Vol. 12, No. 6, pp 567-569 (12/1967).
Trans. From: Doklady Akademii Nauk SSSR 174, 779-782 (June 1967)

In this paper, the results are discussed of experiments carried out in the Institute of Hydrodynamics, Siberian Branch of the Academy of Sciences of the USSR on the construction of explosive devices which convert explosive energy into magnetic field energy. Such devices have been called explosive generators. 8 Refs.

Primary Keywords: Flux Compression Generator; Explosive Driver; Design Considerations; Performance; etc.

6673
(PULSE GENERATORS)
(Flux Compression)
FLUX DIFFUSION DURING MAGNETIC ACCUMULATION IN NARROW CAVITIES
E.I. Bichenkov and E.P. Matochkin
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 15, No. 4, pp 555-559 (08/1974)
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 4, 148-152 (July-August 1974)

An equation is obtained for the flux diffusion during the compression of a uniform magnetic field in a flat gap. Calculations are made for fast and slow pumping of the cavity by the initial current and for a constant linear increase and an increase proportional to the square root of t of the initial current. It is shown that the flux losses are considerable even for large magnetic Reynolds numbers, the flux losses depend essentially on the pumping time and depend little on the shape of the pumping current pulse. 7 Refs.

Primary Keywords: Flux Compression; Flat Gap; Field Diffusion; Magnetic Reynolds Number; Current Pump; Pumping Speed

6674
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)
FLUX DIFFUSION UPON THE COMPRESSION OF A MAGNETIC FIELD BY FLAT STRIPS OF VARIABLE WIDTH
E.I. Bichenkov and E.P. Matochkin
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 15, No. 6, pp 865-868 (12/1974).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 6, 159-162 (November-December 1974)

An equation is obtained describing the flux diffusion in flat profiled generators having magnetic cumulation (MC). The critical modes of operation of such generators on active and inductive loads are calculated. 4 Refs.

Primary Keywords: Magnetic Flux Compression; Flux Diffusion; Magnetic Cumulation; Powerful Pulsed Currents; Superstrong Magnetic Fields; Magnetic Flux; Flux Losses; Strip Conductance Constant; Load Resistance Constant

6675
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)
FLUX LOSSES DURING COMPRESSION OF A MAGNETIC FIELD BY FLAT STRIPS
E.I. Bichenkov and V.A. Lobanov
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 16, No. 2, pp 276-279 (04/1975).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 2, 154-158 (March-April 1975)

The compression of a magnetic field by a moving conductor-magnetic cumulation is used to obtain powerful magnetic fields and large pulsed currents. The potentialities of magnetic cumulation are determined mainly by the flux losses due to diffusion of the magnetic field into the conductor surfaces. Experiments on the compression of a magnetic field by flat strips of copper and Dural are described in the report, and a comparison is made with the calculation of diffusional flux losses. The possible role of a gutter instability of the copper conductors is evaluated for the explanation of the increase in flux losses when a critical linear current density, whose value in the experiments presented was 180-210 kA/cm, is exceeded in the strips. 4 Refs.

Primary Keywords: Magnetic Field Compression; Magnetic Cumulation; Powerful Magnetic Fields; Large Pulsed Currents; Flux Losses; Flat Strips

6676
(POWER CONDITIONING)
(Pulse Transformers)
HIGH-VOLTAGE MEGA-AMPERE CABLE TRANSFORMER
G.S. Volkevich, V.N. Krasyuk and G.I. Silivestrov
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 20, No. 4, pp 1105-1106 (08/1977)
Trans. From: Pribory i Tekhnika Eksperimenta 4, 166-168 (July-August 1977)

A cable transformer, without iron, with a voltage transformation factor of n=2 or n=4 in the primary 50 kV or ton- 50 kV loop, respectively, and 25 kV in the load loop is described. The cable RK-50-17-12 is used in the transformer, and the number of parallel branches is 12. The scattering inductance, referred to the load loop is L/sub S/ = 5 nH for n=2 (L/sub S/ = 6 nH for n=4). Diagrams of working versions of generators using the transformer are presented. 3 Refs.

Primary Keywords: Cable Transformer; 25 kV Output Voltage; 50 kV Input Voltage; Low-Inductance Load; Scattering Inductance; 2 MA Current; 100-200 kHz Discharge Frequency

6677
(ENERGY STORAGE, INDUCTIVE; PARTICLE BEAMS, ELECTRON)
(Systems, Generation)
INCREASING ELECTRON BEAM POWER BY INDUCTIVE ACCUMULATOR
P.I. Blinov, G.I. Dolgachev and D.N. Lin
Instruments And Experimental Techniques, Vol. 20, No. 2, pp 368-370 (04/1977)
Trans. From: Pribory i Tekhnika Eksperimenta 2, 35-37 (March-April 1977)

A device consisting of a diode electron accelerator and an inductive accumulator in a beam collector circuit is described. When the anode-cathode gap is shorted by the plasma or as a result of breakdown across the insulator, a potential difference is generated in the collector-anode gap which can be used to accelerate the electrons emitted by the collector. It is shown experimentally that with a voltage of 240 kV between the anode and cathode, the collector-anode voltage is 600 kV. The power of the beam is then doubled. 6 Refs.

Primary Keywords: Field Emission Diode; Plasma Diode Closure; Inductive Energy Store Switch; Beam Collector; Explosive Electron Emission

6682
(PULSE GENERATORS)
(Flux Compression)
LIMITING CURRENTS IN THE COMPRESSION OF MAGNETIC FLUX BETWEEN FLAT AND COAXIAL CONDUCTORS
E.I. Bichenkov and V.A. Lobanov
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 16, No. 5, pp 770-773 (10/1975).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 5, 116-120 (September-October 1975)

Experiments are described on magnetic flux compression by flat and coaxial conductors. As the initial current I/sub 0/ is increased the final current I/sub 1/ obtained as a result of flux compression at first increases proportional to I/sub 0/ and then reaches a maximum and remains constant for further increases in I/sub 0/. Analysis of the experiments shows that in coaxial structures when a small explosive charge accelerates the conductors the limiting current is determined by the maximum work which a conductor can perform in compressing the magnetic field. In experiments with flat busbars and large explosive charges the limiting currents appear to be determined by the flux losses in short-circuited voids formed in the linking of irregular surfaces of the busbars. This assumption is shown to be in qualitative agreement with experiment. 8 Refs.

Primary Keywords: Flux Compression Generator; Flat Conductors; Coaxial Conductors; Limiting Current; Maximum Field Compression

6681
(PULSE GENERATORS)
(Flux Compression)
MAGNETIC FIELD IN A CYLINDRICAL CONDUCTOR MOVING WITH A VELOCITY PROPORTIONAL TO R/SUP -1/
E.I. Bichenkov and E.P. Matochkin
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 14, No. 5, pp 617-623 (10/1973).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 5, 18-25 (September-October 1973)

Nonstationary magnetic field problems in a moving conductor are of interest in connection with obtaining pulsed magnetic fields by magnetic cumulation. The field penetrates into the conductor as a result of the growth of the skin layer and is carried along with the conductor. The first mechanism of the interaction of a field with a conductor is called the diffusion of the field, and the second convection. Five self-similar solutions of magnetic field problems in a conductor which has a velocity v=a pi r and a conductivity sigma const are discussed and a numerical solution of the problem of the compression of a field in a cylindrical cavity when the conductor moves toward the axis is presented. One of the self-similar solutions is compared with the numerical solution. 7 Refs.

Primary Keywords: Flux Compression; Field-conductor Interaction; Field Diffusion; Field Convection; Theory; Analytical Solution; Numerical Calculation

6683
(PULSE GENERATORS)
(Flux Compression)
METHOD OF DESIGNING EXPLOSIVE-DRIVEN MAGNETIC FIELD GENERATORS
V.A. Lobanov
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 17, No. 1, pp 97-102 (02/1976).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1, 120-127 (January-February 1976)

A method of designing explosive-driven magnetic field generators that allows us to establish a dependence between the parameters of the generator circuit, in which the greatest energy release occurs under a time-invariant resistive load, is described. The problem of switching two-dimensional generators to a load whose resistance linearly increases with temperature is analytically solved as an example. The theoretical possibility of designing a generator in which the power released under the resistive load R(t) varies in a specified way with time is demonstrated. Types of current pulse, power, and energy released in the load are studied in the case of different generator circuit parameters. 8 Refs.

Primary Keywords: Flux Compression Generator; Resistive Load; Time-invariant Load; Load Switching; Pulse Shaping; Circuit Parameter Variation

6685
(ENERGY STORAGE, INDUCTIVE; POWER CONDITIONING)
(Systems; Nonlinear Resistors)
PRECISION PEAKING DISCHARGER WITH A NONLINEAR ELEMENT IN AN INDUCTIVE STORAGE CIRCUIT WITH FOIL BREAKER
A.V. Grigor'ev, A.G. Novikov, V.V. Titkov and G.A. Shneerson
Instruments And Experimental Techniques, Vol. 23, No. 5, pp 1193-1194 (10/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 129-130 (September-October 1980)

A solid-state peaking discharger for an inductive-capacitive energy store is described, in which the switch-on element is based on Tervit-2, which is a material with a nonlinear volt-ampere characteristic. The discharger has repeatedly switched currents with an amplitude of 360 kA and a duration of 80 microseconds. The self-inductance L/sub p/ of the discharger is 2.5 nH and its resistance r/sub p/ is 2.8 m ohm. 4 Refs.

Primary Keywords: Nonlinear Resistor; Peaking Discharger; Inductive Energy Store; 2.5 nH Self-inductance; 260 kA Amplitude; Rep-rated; 2 Microsecond Rise Time

6687
(PARTICLE BEAMS, ION)
(Generation)
PULSED ION BEAMS FROM A HIGH-CURRENT PLASMA DIODE
B.A. Tskhadaya, A.A. Plyutto and K.V. Suladze
Soviet Physics-Technical Physics, Vol. 19, No. 8, pp 1108-1109 (02/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 1779-1783 (August 1974)

In a study of pulsed ion beams in a high-current plasma diode it has been found that an ion beam of 6E2 A is produced when a critical diode current is reached and a discontinuity appears in the plasma. The ion beam has a large energy spread, but the average energy is approximately equal to the initial voltage, U/sub 0/ = 30-50 kV. The linear functional dependence of the ion-beam current on the critical diode current implies that ion beams with currents of 2E4 A can be achieved at diode currents of 136 A. 8 Refs.

Primary Keywords: Ion Beam Generation; Plasma-filled Diode; 30-50 kV Diode Voltage; 30-50 keV Ion Beam Energy; Threshold Current

6688
(BREAKDOWN STUDIES)
(Exploding Wires)
RESTORATION OF THE DIELECTRIC STRENGTH FOLLOWING EXPLOSION OF A WIRE
R.K. Borisov, V.L. Budovich and I.F. Kuznetsov
Moscow Energetics Institute, Moscow, USSR
Soviet Technical Physics Letters, Vol. 3, No. 12, pp 516-517 (12/1977).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 3, 1250-1253 (December 1977)

After an electrical explosion and the current cutoff, the insulating properties of the gap are known to be restored. An understanding of the process by which the dielectric strength is restored after an explosion can help in describing the state of the explosion products and the destruction mechanism of the wire. The rate at which the dielectric strength is restored is a characteristic which must be known in order to design switches, fast-acting fuses, etc. Although there are many papers on electrical explosions in the literature, no information is available on the restoration of dielectric strength after the explosion of a wire. Furthermore, there is no information on the restoration of the dielectric strength after the explosion of wires in air and quartz sand. 5 Refs.

Primary Keywords: Exploding Wires; Recovery; Gap Restoration; Air Environment; Sand Environment; Copper Wire

6689
(PARTICLE BEAMS, ELECTRON)
(Generation)
SCREENING EFFECT IN HIGH-CURRENT DIODES
S.Ya. Belomyttsev, S.D. Korovin and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics Letters, Vol. 6, No. 9, pp 466-467 (09/1980).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 6, 1089-1092 (September 1980)

Secondary processes which occur in high-current diodes with explosive electron emission lead to the appearance of new emission centers through propagation of the cathode plasma. We have found that there is an opposite effect, which opposes the spontaneous appearance of new centers of explosive electron emission. We have shown that a screening effect is responsible for this situation. The occurrence of explosive electron emission leads to a pronounced increase in the electron current. The space charge of these electrons reduces the electric field at the cathode near the primary emission center. The time at which explosive emission occurs, t, is proportional to 1/sup -2/, where j is the field-emission current, which is an exponential function of the electric field. Consequently, even a slight decrease in the electric field of the cathode prevents the spontaneous appearance of new emission centers. This effect leads to an inhomogeneity of the electron beam in an explosive-emission diode, and in several cases, e.g., that of the low-energy beams used for surface processing, it becomes difficult or even impossible to use these beams. 3 Refs.

Primary Keywords: E-beam Generation; Field Emission Diode; Explosive Emission; Multitip Cathode; Screening Effect; Beam Inhomogeneities

6690
(BREAKDOWN STUDIES)
(Exploding Wires)
SELF-SIMILAR ELECTRICAL SKIN EXPLOSION OF A CONDUCTOR
E.I. Bichenkov and A.E. Voitenko
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 10, No. 3, pp 350-355 (05/1969).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 10, 21-26 (May-June 1969)

We examine the problem of the electrical explosion of a conductor with flat boundary in a strong magnetic field. We estimate the role of heat conduction in order to determine the critical electrical fields in which fusion and vaporization of the metal take place. The characteristic features of the explosion of a layered medium are examined. 6 Refs.

Primary Keywords: Flat Wire; Wire Skin Explosion; Magnetic Field; Thermal Conduction; Layered Wire

6691
(BREAKDOWN STUDIES)
(Gas, E-beam)
SEMISELF-MAINTAINED DISCHARGE DEVICE WITH IONIZING BEAM REGENERATION
L.P. Fominskii
Novomoskovsk: Branch Of State Nitrogen Industry Institute, USSR
Instruments And Experimental Techniques, Vol. 20, No. 1, pp 213-215 (02/1977).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 186-188 (January-February 1977)

A device for generating a semiself-maintained discharge in a gas, initiated by an electron beam from an accelerator, in which the electron beam is regenerated is described. With this device it is possible to achieve an electrical field strength in the base of >=100 kV/cm without a transition into a spark discharge. 6 Refs.

Primary Keywords: Semiself-maintained Discharge; E-beam Sustained Discharge; Retarded E-beam; Very High Field Strength; No Spark Transition

6692
(BREAKDOWN STUDIES)
(Liquid, Electrical)
THE DEVELOPMENT OF ELECTRICAL DISCHARGE IN WATER
A.P. Alkhimov, V.V. Vorob'ev, V.F. Klimkin, A.G. Ponomarenko and R.I. Soloukhin
The Institute Of Nuclear Physics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics Doklady, Vol. 15, No. 10, pp 959-961 (04/1971).
Trans. From: Doklady Akademii Nauk SSSR 194, 1052-1054 (October 1970)

Distilled water is used in high-voltage impulse energy storage and conversion devices and it is, therefore, necessary to make a thorough study of the physical features of the development of electrical discharge in water at field strengths of 100 to 500 kV/cm. In addition to clarifying certain fundamental problems of the physics of breakdown of water under these conditions it is of particular interest to obtain quantitative characteristics of the process, such as the delay time t/sub d/, the streamer velocity v/sub s/ and its dependence on the field strength E/sub 0/, the resistivity rho, pressure p, etc. 2 Refs.

Primary Keywords: Water Breakdown; Distilled Water; Insulation; Switch; Shadography; Voltage Measurement; Delay Measurement; Streamer Velocity Measurement

6693
(ENERGY STORAGE, INDUCTIVE)
(Systems)
TRANSIENTS IN INDUCTIVE ENERGY-STORAGE DEVICES FOR PLASMA INJECTORS
N.V. Belan, N.A. Mashtylev and B.I. Panachevnyi
Khar'kov Aviation Institute, USSR
Soviet Physics-Technical Physics, Vol. 18, No. 1, pp 51-53 (07/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 83-86 (January 1973)

The present work considers charging and discharging processes in an inductive energy-storage device for a pulsed plasma injector. A system of equations is given which describe the transient that arises in an inductive storage device when the charging circuit is switched by the moving plasma. The system is solvied analytically for one particular case. An experiment involving transients in an inductive energy-storage device is described. The results of the experiments are in satisfactory agreement with the analytic solution of the system of equations. 6 Refs.

Primary Keywords: Charging Process; Discharge Process; Plasma Switch; Experiment; Theory; Analytical Solution

Secondary Keywords: Plasma Injector

6694
(BREAKDOWN STUDIES)
(Gas, E-beam)
TRANSITION FROM A NON-SELF-SUSTAINED VOLUME DISCHARGE MAINTAINED BY A BEAM OF FAST ELECTRONS TO A SPARK DISCHARGE
Yu.I. Bychkov, S.A. Genkin, Yu.D. Korolev, G.A. Mesyats, V.G. Rabotkin and A.G. Filonov
Institute Of High Current Electronics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Journal, Vol. 21, No. 10, pp 1375-1377 (10/1978).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 21, 146-148 (October 1978)
Non-self-sustained current regimes are an efficient way of obtaining volume discharges with considerably wider ranges of gas pressure and burn duration. By applying lower voltages than the breakdown voltage to the discharge gap, it is possible to obtain a stable volume discharge maintained by a beam of fast electrons and lasting approximately 1E-4 sec or longer. However, in this regime the amount of energy which can be fed to the discharge is also limited by formation of a spark channel. In this paper we report observations of the dynamics of the formation of a spark channel in a volume discharge excited by an electron beam. The discharge was in nitrogen at atmospheric pressure. The interelectrode gap was 6 cm long and was formed by a 8.5-cm-diameter Duraluminum anode and a convex steel mesh with a grid size of 2 x 2 mm. Electrons were injected from the cathode and through a 4 x 4 cm window. An accelerator with a plasma electron source similar to that described previously was used. The electron current pulse was triangular with a fast rise time (T/sub R/ = 5 microseconds) and a slow decay (the half maximum duration of the current was 150 microseconds). The peak current density of the beam at the entrance to the gas discharge gap was j/sub B/ = 0.3 mA/sq cm, and the accelerating voltage was 200-230 kV. 9 Refs.
Primary Keywords: Non-self-sustained Discharge; Volume Discharge; E-beam Sustained Discharge; Arc Transition; Nitrogen Gas; Triangular Current Pulse
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6695
(PULSE GENERATORS; POWER CONDITIONING)
(Flux Compression; Pulse Transformers)
USE OF AN EXPLOSIVE MAGNETIC GENERATOR TO SUPPLY A GAS DISCHARGE
A.E. Voitenko, E.P. Matochkin and B.A. Yablochnikov
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 16, No. 3, pp 866-867 (06/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 177-178 (May-June 1973)
A device is described which consists of an explosive magnetic generator acting as a current source, a matching transformer, and a resistive load. A gas discharge was used as the load. The experiments were carried out under laboratory conditions. 9 Refs.
Primary Keywords: Explosive Magnetic Generator; Matching Transformer; Gas Discharge; 50 Microsecond Generator Operating Time; Pulsed Electrical Light Sources
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6698
(SWITCHES, CLOSING)
(Gas Gaps, Materials)
A THEORY OF THE PRODUCTION OF ELECTRODE VAPOR JETS BY SPARKS AND ARCS
W. Finkelnburg
Engineer Research and Development Lab, Fort Belvoir, VA
Physical Review, Vol. 74, No. 10, pp 1475-1477 (11/1948).
Ionization of the surfaces of mercury and carbon electrodes and the subsequent production of vapor jets are discussed. The theory presented is found to agree closely with the experimental values for the vapor jet velocity. Further theoretical predictions are made for vapor jet production based on the atomic properties of the electrode material. 6 Refs.
Primary Keywords: Vapor Jet; Anode Jet; Cathode Jet; Mercury Arc; Thermal Considerations
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6701
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
AN EXPLOSIVE-DRIVEN HIGH-FIELD SYSTEM FOR PHYSICS APPLICATIONS
P.S. Caird, W.B. Garn, D.B. Thomson and C.M. Fowler
Los Alamos National Labs, Los Alamos, NM 87545
Journal Of Applied Physics, Vol. 39, No. 1, pp 781-782 (01/1968).
A simple explosive driven flux compression system is described for producing magnetic fields in the MG range. The flux-trapping device is a seamless hollow stainless steel cylinder driven by a ring of explosive. The initial field is introduced by a coil pair supplied by a 90-kJ capacitor bank. The assembly is mechanically mounted. During implosion, the experimental volume is free of objectionable debris and asymmetries. Peak fields of 1.2 and 4 MG are achieved in working diameters of 8.9 and 3.2 mm, respectively. The usable length is about 15 mm at these fields. Several possible applications are mentioned. 2 Refs.
Primary Keywords: Magnetic Field Generation; Flux Compression; Explosive Driver; Stainless Steel Cylinder; 4 MG Field
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6704
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
ANALYSIS OF FLUX COMPRESSION EXPERIMENTS III
T. Erber (1), H.G. Latal (2), J.E. Kennedy (2), and S.M. Prestein (3)
(1) Institut Fur Theoretische Physik, Universitat Graz
(2) Illinois Institute of Technology, Chicago, IL
(3) Argonne National Lab, Argonne, IL
Acta Physica Austriaca Vol. 34, No. 4, pp 316-353 (01/1972).
This is the third of a series of three papers on magnetic simulation. The authors present a complete analysis of their flux compression experiments from the theory behind flux compression to analysis of data. Several specific devices are presented. 24 Refs.
Primary Keywords: Flux Compression; Toroid; "Top Hat"; Stages Of Flux Compression; Experimental Theory
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6718
ENERGY AND TECHNOLOGY REVIEW
Lawrence Livermore Lab, Livermore, CA 94550
(05/1981)
Availability: UCRL-52000-81-5
NTIS
Research programs at LLNL are reviewed. This issue discusses validation of the pulsed-power design for FXR, the NOVA plasma shutter, thermal control of the MFTF superconducting magnet, a low-energy x-ray spectrometer for pulsed-source diagnostics, micromachining, the electronics engineer's design station, and brazing with a laser microtorch. (ERA citation 06:024019)
Primary Keywords: Lawrence Livermore Laboratory; Cooling Systems; Electrical Engineering; High-voltage Pulse Generators; Machining; Optical Systems; Research Programs; Shutters; Superconducting Magnets; X-ray Spectrometers
Secondary Keywords: ERDA/420300; ERDA/420800; ERDA/420201; NTISDE

6726
(DIAGNOSTICS AND INSTRUMENTATION; SWITCHES, CLOSING)
(Systems, Gas Gaps, Systems)
ARGUS-A SIMPLE DEVICE FOR SIMULTANEOUS MEASUREMENT OF BREAKDOWN TIMES OF MANY SPARK GAPS
G. Postegni
Padova University, Padova, Italy
The Review Of Scientific Instruments, Vol. 37, No. 1, pp 65-68 (01/1966).
A simple device, which enables one to observe on a single oscilloscope trace the individual breakdown times of many spark gaps in parallel, is described. It employs signals from magnetic probes placed near each spark gap. For illustration the signals of typical breakdown conditions are shown and briefly discussed on the basis of some qualitative remarks on the behavior of a fast discharge capacitor bank. 6 Refs.
Primary Keywords: Magnetic Probe; Addition Of Several Signals; Spark Gap Monitoring; Parallel Spark Gap Operation
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6733
(PULSE GENERATORS; POWER CONDITIONING)
(Capacitor Banks; Pulse Transformers)
HIGH VOLTAGE IMPULSE SYSTEM
D. Finkelstein, P. Goldburg and J. Shuchatowitz
Yeshiva University of New York, NY 10033
The Review Of Scientific Instruments, Vol. 37, No. 2, pp 159-162 (02/1966).
An alternative to the Marx circuit for the production of high voltage, high current pulses is developed. It employs a water-immersed spiral-wound stepup transformer to go from a capacitor bank charged to 100 kV to an output of 1 MV. A method for using such a transformer to pulse charge a second capacitor bank efficiently without very tight coupling is derived. It is shown that for total transfer of energy (except for dissipation) the two resonant frequencies of the primary and secondary LC circuits (each measured with the other circuit open) should be equal, while the two normal mode frequencies of the coupled circuit should be in the ratio of 2.1, implying a coupling coefficient of 3/5. The design and operation of such a system is described. 3 Refs.
Primary Keywords: Pulse Generator; Capacitor Bank; Spiral Wound Transformer; Resonant Pulse Charging; 2-1 Transformer Ratio
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6741
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
MAGNETIC FLUX COMPRESSION BY MAGNETICALLY IMPLODED METALLIC FOILS
E.C. Cnare
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 37, No. 10, pp 3812-3816 (09/1966).
A 136-kJ capacitor-bank energy source was used to implode metallic foils in a 'theta' pinch. Aluminum foils accelerated by this scheme attained a velocity of 2.3 mm/microsecond and a capacitive-to-kinetic energy conversion efficiency of 23%. An upper limit for the foil velocity depended upon the foil thickness and density, together with a parameter which accounted for electrical heating of the foil. This parameter was determined in exploding wire studies. Experiments with and without auxiliary injection of magnetic flux are described. Thick, imploding foils have been found to be capable of compressing enclosed magnetic flux to more than 2 MG. 9 Refs.
Primary Keywords: Imploded Metallic Foils; 136 kJ Capacitor-bank Energy Source; 2.3 mm/microsecond Aluminum Foil Velocity; Megagauss Magnetic Fields; Theta-pinch Arrangement; 2 MG Magnetic Flux Compression; Semiempirical Mathematical Model
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6747
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
MEGAGAUSS PHYSICS
C.M. Fowler
Los Alamos National Labs, Los Alamos, NM 87545
Science, Vol. 180, pp 261-267 (04/1973).
The generation and application of megagauss magnetic fields is the subject of this paper. Field generation by capacitor discharge and flux compression are considered briefly with the main thrust concentrated on applications. Several experiments are described briefly, which require the use of high magnetic fields. 51 Refs.
Primary Keywords: Magnetic Field Generation; Solenoid; Flux Compression; Application, High Pressure Physics; Particle Physics
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6750
(PULSE GENERATORS; SWITCHES, CLOSING; SWITCHES, OPENING)
(Switches, Solid Dielectric, Electrical; Explosive Fuses)
METHOD OF PRODUCING A FAST CURRENT RISE FROM ENERGY STORAGE CAPACITORS
H.G. Early and E.J. Martin
University of Michigan, Ann Arbor, MI
The Review Of Scientific Instruments, Vol. 36, No. 7, pp 1000-1002 (07/1965).
A rate of current rise of the order of 1E12 A/sec can be produced by inexpensive capacitors used in conjunction with a special, low inductance fuse and spark gap. The capacitors are discharged through the fuse until the current reaches a near maximum value at which time the current is transferred from the fuse into a load inductance of [illegible] The spark gap isolates the load until the moment of [illegible] 3 Refs.
[illegible] Capacitor Bank; Solid Dielectric Switch; Melting [illegible] Fuse; Approximately Inductance Independent
[illegible] 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6759
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
PRODUCTION OF VERY HIGH MAGNETIC FIELDS BY IMPLOSION
C.M. Fowler, W.B. Garn and R.S. Caird
Los Alamos National Labs, Los Alamos, NM 87545
Journal Of Applied Physics, Vol. 31, No. 3, pp 588-594 (03/1960).
Magnetic fields are produced in the 10-15 megagauss range by use of high explosives which compress the flux obtained from initial fields of approximately a hundred thousand gauss. The fields described here occupy a cylindrical volume and are essentially axial. A typical field might have these general characteristics: Peak field 14 megagauss; 2 microsecond duration from 10-14 megagauss; field volume around peak, 6 mm diameter, 50 mm estimated length. 4 Refs.
Primary Keywords: Magnetic Field Generation; Flux Compression; Explosive Driver; 1E MG Field; 100 kG Pump Field
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6772
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Liquid; Liquid, Electrical)
COMPARISON OF THE DIELECTRIC PROPERTIES OF NORMAL AND HEAVY WATER, ABSORBED ON ZEOLITES
B.A. Glazun, M.M. Dubinin and I.V. Zhilenkov
Voronezh Agricultural Institute And Institute Of Physical Chemistry, Academy of Sciences of the USSR
Buletin Of The Academy Of Sciences, USSR. Division Of Chemical Science, No. 5, pp 956-959 (05/1967).
Trans. From: Izvestiya Akademii Nauk SSSR, Seriya Khimicheskaya 5, 987-990 (May 1967)
A study of the dielectric properties indicated that the relaxation times of heavy water and heavy ice are greater than those of normal water and ice. We have found that in hydrated NaA zeolite there are two relaxation processes (which we denoted at I and II), caused by the presence of water. A study by the dielectric method revealed that the relaxation times of the adsorbed water are intermediate between the relaxation times of liquid water and ice. It is therefore natural to expect that the relaxation maximum caused by adsorbed water will be displaced toward lower frequencies, if normal water is replaced by heavy water. 19 Refs.
Primary Keywords: Water; Heavy Water; Hydrated Zeolite; Conductivity Measurement; Relaxation
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6789
(PULSE GENERATORS)
(Line Type)
A GENERATOR OF CURRENT PULSES OF ADJUSTABLE SHAPE AND DURATION FOR SUPPLYING GAS-DISCHARGE TUBES
S.A. Vitsinskii, V.I. Kulakov and V.M. Opre
Instruments And Experimental Techniques, Vol. 23, No 1, pp 121-123 (02/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 123-124 (January-February 1980)
A generator of current pulses of adjustable shape and duration, built on the basis of an artificial long line with ignition dischargers in sections of the line, is described. The generator allows one to obtain current pulses of different shapes and an amplitude of up to 10 kA in a gas-discharge load. Discrete regulation of the duration of the current pulse from 300 to 600 microseconds with an interval of 100 microseconds is possible. 5 Refs.
Primary Keywords: Pulse Generator; Artificial Long Line; Variable Pulse Shape; 10 kA Output Current; 300-600 Microsecond Pulse Duration
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6790
(POWER CONDITIONING)
(Pulse Transformers)
A HIGH-VOLTAGE CABLE TRANSFORMER FOR PRODUCING STRONG PULSED CURRENTS
V.G. Gaaze and G.A. Shneerson
Instruments And Experimental Techniques, No. 6, pp 1413-1418 (12/1965).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 105-110 (November-December 1965)
The basic calculation principles are discussed and designs described for step-down cable transformers with a primary voltage of up to 150 kV for producing current pulses of up to 3 MA. 5 Refs.
Primary Keywords: Step-down Cable Transformers; 150 kV Primary Voltage; 3 MA Current Pulses; High-voltage Coaxial Cable; Leakage Inductance Reduced, Insulation Problem Solved
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6793
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
ACYCLIC GENERATORS WITHOUT A FERROMAGNETIC MAGNETIC CIRCUIT FOR SUPPLYING ELECTROPHYSICAL APPARATUS USED IN MHD RESEARCH
B.L. Alievskii, A.I. Bertinov and A.G. Sherstyuk
Magnetohydrodynamics, Vol. 3, No. 1, pp 87-91 (12/1967).
Trans. From: Magnitnaya Gidrodinamika 3, 135-142 (1967)
The authors discuss a method of calculating generator electromagnetic characteristics that utilizes the idea of the mutual inductance of annular field coils of finite cross section and a cylindrical or disk armature. 11 Refs.
Primary Keywords: Acyclic Generators; Generator Electromagnetic Characteristic Calculation; Annular Field Coils; Liquid-metal Current Collection; Strong Magnetic Fields; Equivalent Loop Method
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6799
(ENERGY STORAGE, CAPACITIVE)
(Capacitor Banks)
CAPACITOR BATTERY FOR ONE MEGAJOULE HAVING A SMALL TIME CONSTANT
V.A. Burtsev, V.N. Litunovskii, V.F. Prokopenko and G.M. Makeev
Instruments And Experimental Techniques, Vol. 22, No. 4, pp 1056-1059 (08/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 167-170 (July-August 1979)
A capacitor battery for one megajoule is described which is made up with type IM-50/3 capacitors in a modular arrangement. The battery parameters are: Capacity 854 microfarad, self-inductance 4 nh, natural period 12 microseconds, and short-circuit current 24 MA. 6 Refs.
Primary Keywords: Capacitor Bank; 1.1 MJ Energy Stoage, 24 MA Output Current; 4 nH Inductance; Modular Construction; Solid Dielectric Switch
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6800
(ENERGY STORAGE, INDUCTIVE; PULSE GENERATORS)
(Systems; Flux Compression)
CHARGING OF AN INDUCTIVE ACCUMULATOR FROM AN EXPLOSIVE-TYPE MAGNETIC GENERATOR THROUGH AN ELECTRICAL EXPLOSIVE-TYPE CURRENT BREAKER
L.S. Gerasimov, V.I. Ikryannikov and A.I. Pinchuk
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 15, No. 5, pp 693-697 (10/1974).
Trans. From: Zhurnal Prikladnoi Tekhnicheskoi Fiziki 15, 132-137 (September-October 1974)
Analytical investigations were made of electromagnetic processes with the work of an explosive-type magnetic generator, in a series-connected inductive-type accumulator and a current breaker based on an exploding wire. A solution is obtained in dimensionless form for a model of a current breaker based on an ohmic resistance, whose value rises linearly with the temperature. The conditions are determined under which an inductive load can be connected in parallel to the current breaker; under these circumstances, the current of the load branch remains small during the whole charging stage. 6 Refs.
Primary Keywords: Inductive Accumulator; Explosive-type Magnetic Generator; Electromagnetic Processes; Current Breaker; Ohmic Resistance
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6815
(BREAKDOWN STUDIES)
(Exploding Foils)
ELECTRICAL CONDUCTIVITY OF AN ALUMINUM FOIL IN AN ELECTRICAL EXPLOSION
A.P. Baikov, L.S. Gerasimov and A.M. Iskol'dskii
Institute Of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 20, No. 1, pp 29-32 (07/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 49-55 (January 1975)
In a study of the electrical conductivity of aluminum foil as energy is rapidly supplied to it during an electrical explosion, it has been established that the function dependence of the foil resistance on the specific energy changes with the energy supply rates. This behavior had been observed in an earlier study of exploding wires. The present experimental results are at odds with the model of surface evaporation waves. A possible physical mechanism for the electrical explosion of foil is offered. 10 Refs.
Primary Keywords: Electrical Conductivity; Foil Resistance; Electrical Explosion Of Foils; Surface Evaporation Wave Model
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6817
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Systems; Explosive Fuses)
ENERGY TRANSFER FROM AN INDUCTIVE STORAGE BY MEANS OF AN EXPLOSIVE CURRENT DISCONNECT
L.S. Gerasimov, A.M. Iskol'dskii, Yu.E. Nesterikhin and V.K. Pinus
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 16, No. 1, Pp 47-51 (02/1975).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1, 60-65 (January-February 1975)
Energy transfer from an inductive storage is considered for two types of systems: a disconnect with an intrinsic parasitic inductance for an inductive load and a purely resistive disconnect for a resistive load. Solutions are obtained for the voltage, power, and energy transferred to the load. The dependence of the efficiency of the device on its parameters is established. 4 Refs.
Primary Keywords: Inductive Storage; Explosive Current Disconnect; Energy Transfer; Efficiency Dependence On Parameters; Parasitic Inductance; Theory
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6819
(BREAKDOWN STUDIES)
(Exploding Wires)
EXPLODING WIRES WITH HIGH ENERGY INPUT
A.P. Baikov, A.M. Iskol'dskii and Yu.E. Nesterikhin
Institute Of Automation And Electrical Measurements, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 18, No. 1, pp 87-89 (07/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 136-140 (January 1973)
The explosion of tungsten wires has been observed with an oscilloscope and by synchronous photography at energy input rates of dw/dt approximately 1E10 - 1E11 J/g sec. When dw/dt > 1E10 J/g sec, the electrical explosion (for a diameter of 1E-3 cm) occurs without magnetohydrodynamic instabilities. It is found that the resistance near the melting point is reduced when the energy input rate is increased. A criterion is derived for this effect. 5 Refs.
Primary Keywords: Electrically Exploded Tungsten Wires; 1E10 - 1E11 W/g Energy Input Rates; Magnetohydrodynamic Instabilities; Phase-transition Point Resistance Reduced; Theory
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6826
(PARTICLE BEAMS, ELECTRON)
(Generation)
HIGH-CURRENT ELECTRON ACCELERATOR FOR OPTICAL PUMPING OF GASES
G.R. Bekalyants, V.A. Mamikonyan, G.T. Nersisyan and V.O. Papanyan
Institute Of Physical Studies, Academy of Sciences of the Armenian SSR, Ashtarak, USSR
Soviet Technical Physics Letters, Vol. 4, No. 11, pp 543-544 (11/1978).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 4, 1349-1351 (November 1978)
Recent years have seen progress in the use of high-current electron beams to produce high-pressure gas lasers for the UV and vacuum-UV ranges. A high-current source of square electron pulses developed for this purpose has an electron energy which can be varied over the range 0.3-0.7 MeV, a pulse length of 30 nsec, and a current density (in the high-pressure laser chamber) of 40-100 A/sq.cm. This electron accelerator uses a rectangular cold cathode with an incomplete discharge over the surface of a dielectric with a high value of epsilon. Experiments have been carried out with cathodes of stainless steel, copper, and graphite. 7 Refs.
Primary Keywords: E-beam Generation; Field Emission Diode; Several Cathode Materials; 700 keV Beam Energy; 100 A/sq.Cm. Current Density
Secondary Keywords: Gas Laser Pumping
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6830
(BREAKDOWN STUDIES)
(Exploding Wires)
INITIAL STAGES OF THE ELECTRICAL EXPLOSION OF A WIRE IN AN LC-LOOP
L.S. Gerasimov, A.I. Pinchuk and Yu.A. Stukalin
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 19, No. 6, pp 721-727 (12/1978).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 6, 18-25 (November-December 1978)
A great amount of work has been devoted to the investigation of the phenomenon of the electrical explosion of a wire, and several models have been proposed to explain its physical mechanism. The fact that there is no single generally accepted point of view indicates that with respect to the phenomenon of the electrical explosion of a wire, all is not yet clear. However, it cannot be disputed that the essence of the phenomenon of the electrical explosion of a wire is competition between two processes: the breakdown of the wire as a whole and the accompanying loss of electrical conductivity, on the one hand, and the evolution of Joule heat, on the other hand. Here the mechanism of the breakdown itself is determined by the rate of introduction of energy. From what has been said it is clear that the moment of an electrical explosion and its physical mechanism are determined by the rate of introduction of energy. A change was observed on a previous article in the character of an electrical explosion as a function of the rate of heating of the liquid phase. The present article poses the problem of the determination of this rate from the initial conditions of the experiments. 16 Refs.
Primary Keywords: Electrical Explosion; Wire Breakdown; Electrical Conductivity Loss; Joule Heat Evolution; Energy Introduction Rate; Quasi-steady-state Heating Model; Theory

6832
(BREAKDOWN STUDIES)
(Liquid, Electrical)
INVESTIGATING PREBREAKDOWN FIELDS IN WATER BY MEANS OF THE KERR EFFECT
I.T. Ovchinnikov, K.V. Yanshin and E.V. Yanshin
Institute Of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 2, pp 294-295 (08/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 472-474 (February 1974)
The electric field distribution in the gap for id by extended electrodes is investigated in fields of 1.3 MV/cm. Space charge, which can distort the field in the gap, is not formed for 200 nsec (measurement error of 0.3%). 5 Refs.
Primary Keywords: *Prebreakdown Field Investigation; Kerr Effect;* 1.3 MV/cm Fields; Space Charge; Electric Field Distribution; Polarity Effect

6834
(ENERGY STORAGE, CAPACITIVE)
(Capacitor Banks)
LOW-INDUCTANCE CAPACITOR MODULE FOR CHARGING TO 100 KV AND ENERGY STORAGE CAPACITY 80 KJ
A.B. Andrezen, V.A. Burtsev, V.M. Vodovozov, A.A. Drozdov and G.M. Makeev
Instruments And Experimental Techniques, Vol. 23, No. 2, pp 407-410 (04/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 109-112 (March-April 1980)
The construction is described of a capacitor module which charges to 100 kV and is equipped with two dischargers with a solid dielectric, a system for triggering the dischargers with insulation from the control circuits effective to 100 kV DC, and a system for guarding and automatically charging the capacitors. The proper period of discharging of the module is T/sub o/ = 5.6 microseconds. The capacitor module was used in experiments studying electrical explosion of flat Al foils in pulverized quartz. An overvoltage U/sub max divided by U/sub o/ approximately 10 was obtained at a maximal electric field intensity E/sub max/ approximately 12 kV/cm. 3 Refs.
Primary Keywords: Capacitor Bank; Modular Construction; Solid Dieletric Switch; 100 kV Output Voltage; Exploding Foil; Quartz Environment

6835
(PULSE GENERATORS)
(Marx)
LOW-INDUCTANCE GENERATOR OF PULSED VOLTAGE AT 1 MV
G.I. Koba, Yu.V. Koba, I.N. Slivkov, A.P. Sukhov and E.Z. Tarumov
Instruments And Experimental Techniques, Vol. 23, No. 1, pp 115-119 (02/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 117-120 (January-February 1980)
A high-voltage generator of pulsed voltage, built on the Arkad'ev-Marx scheme, for a voltage of 1 MV and an energy of 12 kJ with a discharge circuit inductance of 1.3 microhenry is described. The low inductance of the generator is obtained through the use of low-inductance capacitors and a system of double-wound leads. A firing system with resistive coupling between stages of the generator, based on controllable three-electrode dischargers with field distortion, was developed for reliable triggering of the generator. 5 Refs.
Primary Keywords: Marx Generator; Low Inductance Circuit; Double-wound Interconnections; Field Distortion Spark Gap; All Stages Triggered

6836
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
LOW-PRESSURE GAS-DISCHARGE COMMUTATORS
I.I. Aksenov and S.A. Smirnov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Kharkov, USSR
Instruments And Experimental Techniques, Vol. 15, No. 3, pp 945-946 (06/1972).
Trans. From: Pribory i Tekhnika Eksperimenta 3, (May-June 1972)
The paper presents the results of investigating a sealed gas-spark gap device with a cold cathode for commutating powerful current pulses. Tests for service life were made on the device proposed by the authors, which had a hollow cathode and was controlled by a pulse glow discharge, and on a vacuum spark gap having several versions of a trigatron starting device. 5 Refs.
Primary Keywords: Sealed Gas-spark Gap Device; Low Pressure; Hollow cathode, Cold Cathode, Strong Electrode Erosion, Longer Service Life, Electrode Erosion

6837
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)
MAGNETIC ACCUMULATION IN A PLANE LINER OF FINITE THICKNESS
L.S. Gerasimov and V.I. Ikryannikov
Institute Of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 2, pp 147-149 (02/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 244-248 (February 1978)
The diffusion loss of magnetic flux in magnetic accumulation in a plane, uniform liner of finite thickness is studied. This loss is shown to depend on the degree of compression, the nature of the pump, and two magnetic Reynolds numbers. When the liner is thin the flux loss is independent of the nature of the pump, being governed only a single Reynolds number. An equivalent circuit for the system is proposed. 7 Refs.
Primary Keywords: Flux Compression; Magnetic Flux Loss; Magnetic Accumulation; Plane, Uniform Liner; Magnetic Reynolds Number; Theory

6838
(PULSE GENERATORS)
(Flux Compression)
MAGNETIC ACCUMULATION IN A TAILORED-PROFILE, PLANE, EXPLOSIVE-MAGNETIC GENERATOR WITH ARBITRARY LOAD
L.S. Gerasimov and V.I. Ikryannikov
Institute Of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 7, pp 859-861 (07/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 1520-1524 (July 1978)
The diffusive loss of magnetic flux is studied in magnetic accumulation in a tailored-profile, plane, explosive-magnetic generator with an arbitrary load. A method for constructing the equivalent circuit of the device is studied for the inductive and resistive loads. Flux diffusion is taken into account. The profile is optimized for the inductive load. The profile need not be corrected for diffusion with a resistive load. 5 Refs.
Primary Keywords: Flux Compression; Optimum Profile; Arbitrary Load; Diffuse Magnetic Flux Loss; Magnetic Accumulation; Tailored-profile Explosive-magnetic Generator

6839
(PULSE GENERATORS; POWER CONDITIONING)
(Flux Compression; Pulse Transformers)
MATCHING AN EXPLOSIVE-MAGNETIC GENERATOR TO A RESISTIVE LOAD USING A TRANSFORMER
L.S. Gerasimov
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 19, No. 4, pp 460-463 (08/1978).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 4, 50-54 (July-August 1978)
The use of explosive-magnetic generators in modern technology and scientific investigations as pulsed generators of high-power electrical energy has been discussed previously. The circuit for directly connecting the explosive generators into a resistive load is the simplest and most convenient, but it has limitations both with respect to the value of the load resistance and with respect to the value of the voltage developed. In this connection, in a current breaker is regarded as a necessary element in the circuit of an explosive electrical generator. We show below that the use of a pulsed matched transformer enables one to reduce these limitations considerably and to obtain satisfactory matching in many cases between the explosive-magnetic generator and a resistive load without a current breaker. 7 Refs.
Primary Keywords: Resistive Load; Explosive-magnetic Generators; Pulsed Matched Transformer; No Output Switch; Design Considerations

6840
(SWITCHES, CLOSING)
(LASS)
MULTICHANNEL SEMICONDUCTOR NANOSECOND SWITCH FOR EXCITATION OF COPPER VAPOR BY A TRANSVERSE DISCHARGE
V.M. Alekseenkov, O.I. Buzhinskii, I.V. Grekhov, M.E. Levinshtein, A.I. Mochalov and V.G. Sergeev
A.F. Ioffe Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Leningrad
Soviet Journal Of Quantum Electronics, Vol. 11, No. 1, pp 111-113 (01/1981).
Trans. From: Kvantovaya Elektron 8, 191-193 (January 1981)
A high-power semiconductor nanosecond switch, in the form of a thyristor structure activated by a laser pulse, was investigated. This switch could handle currents up to approximately 5 x 10 kA under voltages of 535 kV in a time of approximately 1 nsec. The principle of its operation ensured synchronous triggering of several switches with an accuracy of 0.1-0.01 nsec. These switches could be connected in series and could be used effectively to pump lasers excited by transverse discharges. 11 Refs.
Primary Keywords: Thyristor, Multichannel; Laser Triggering; Very Low Jitter; Parallel Operation; Series Operation

6841
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
OBTAINING POWERFUL MAGNETIC FIELDS BY MEANS OF A POWERFUL CAPACITOR BANK
A.I. Pavlovskii, E.N. Smirnov and V.N. Suvorov
Instruments And Experimental Techniques, Vol. 18, No. 3, pp 932-934 (06/1975)
Trans. From: Pribory i Tekhnika Eksperimenta 3, 214-216 (May-June 1975)
A field having an intensity of 1.9 MOe in a volume approximately 1 cu cm with a rise time approximately 10 microseconds was obtained in the discharge of a powerful MKB-1 capacitor bank having an energy capacity of 1.35 MJ. A qualitative analysis is made of the surface effect in a cylindrical current-carrying conductor; it is noted that for a field approximately 1.7 MOe the explosion of the current-carrying layer is observed. 3 Refs.
Primary Keywords: Magnetic Field Generation; Capacitor Bank Voltage Source; One-turn Solenoid, Low Inductance; Field Diffusion, Peak Field Reduction

6842
(BREAKDOWN STUDIES)
(Electrolytes, Electrical)
ON THE NATURE OF PULSE ELECTRIC BREAKDOWN OF AQUEOUS ELECTROLYTES
V.Ya. Usakov, O.P. Semkina and V.V. Ryumin
Academy of Sciences of the USSR, Tomsk, USSR
Applied Electrical Phenomena, No. 2, pp 37-42 (04/1972).
Trans. From: Elektronnaya Obrabotka Materialov 2, 48 (1972)
The breakdown characteristics of aqueous electrolytes are presented in this paper. The effect of conductivity on pulsed breakdown voltage and delay is presented for highly nonuniform fields in electrolytes 100-1E6 ohm-cm. Voltage pulses in the range of 10 ns to 50 microseconds are used. A model for pulsed electrolyte breakdown is proposed. 15 Refs.
Primary Keywords: Aqueous Electrolytes; Pulse Electrical Breakdown; Electric Strength; Discharge Delay Time; Discharge Development Studies; Ionic Conductivity

6850
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Gas Gaps, Self; Gas, Electrical)
PULSED BREAKDOWN OF SMALL GAPS IN THE NANOSECOND RANGE
Yu.E. Nesterikhin, V.S. Komel'kov and E.Z. Mailikhov
Soviet Physics-Technical Physics, Vol. 9, No. 1, pp 29-39 (07/1964).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 34, 40-52 (January 1964)
Breakdowns in the nanosecond range are interesting not only because of the numerous practical applications (fast circuits, circuits for shaping pulses with steep fronts, etc.), but also because the times of certain elementary processes (for instance, the processes of deexcitation of excited molecules, cumulative increase, etc.) are in this range commensurable with the time of the phenomenon itself. This fact produces a noticable effect on the statistics of the breakdown lag time, which does not conform to the usual normal distribution. In contrast to Fletcher's experiments, we used pulses with steeper fronts, high-resolution equipment, and variation of the gas pressure in the gap, which made it possible to determine breakdown lage times by using overvoltages higher than those in earlier investigations. 14 Refs
Primary Keywords: Spark Gap; Nanosecond Range Breakdowns; Breakdown Lag Time; Steeper Fronts; High-resolution Equipment; Gas Pressure Variation

6857
(BREAKDOWN STUDIES)
(Gas, Electrical)
SPARK DISCHARGE EMISSION IN HELIUM
M.P. Vanyukov, A.A. Mak and V.P. Muratov
Optics And Spectroscopy, Vol. 8, No. 4, pp 233-236 (04/1960).
Trans. From: Opikai Spektrosk 8, 439-445 (April 1960)
This paper reports the spectroscopic study of a high-pressure (2.5-12 atm) discharge in helium. The spectrum is divided into into two categories: spark lines, which occur at the initiation of the discharge; and air lines, which occur later. The temporal profile of the spectrum is presented. The authors present an estimate of electron density as a function of time. 15 Refs.
Primary Keywords: Breakdown Study; Helium; Emission Spectrum; Temporal History; Electron Density

6858
(BREAKDOWN STUDIES)
(Gas, Electrical)
STABILIZATION OF A PINCHED HIGH-CURRENT DISCHARGE BY MEANS OF A PLASMA JET
V.B. Voronich, N.N. Ogurtsova, I.V. Podmoshenskii and P.N. Rogovtsev
Soviet Physics-Technical Physics, Vol. 25, No. 5, pp 608-611 (05/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 1009-1014 (May 1980)
The feasibility of maintaining an unbounded current channel in a high-current gas discharge open to the ambient medium, for a period several times as long as the hydromagnetic instability development time, has been studied. The result was achieved by forcing a hot jet of erosion plasma up the channel. This discharge was supplied from a capacitor bank storing 150 kJ of energy. A single current pulse with an amplitude of 100-200 kA and a 300 microsecond duration was generated. These conditions gave rise to a dense plasma with n/sub e/ approximately 1E19 cu.cm. and T=20.000-30.000 Deg K.. This indicates the feasibility of developing a stable open light source with a bright plasma and a broad radiation spectrum, with flash lasting much longer than the glow life of existing nonsteady open light sources. This phenomenon of discharge stabilization can also be utilized in PHD accelerators. 15 Refs.
Primary Keywords: Discharge Channel; Unbounded Channel; Plasma Jet Stabilization; 200 kA Discharge Current; Plasma Density Measurement; Plasma Temperature Measurement

6865
(ENERGY STORAGE, MECHANICAL; ENERGY STORAGE, INDUCTIVE)
(Rotating Machines; Charging)
THE CHARGING OF INDUCTIVE STORAGE DEVICES BY MEANS OF ELECTRICAL ROTARY AGGREGATES
E.A. Zotova, I.A. Ivanov, A.I. Karasev and V.A. Trukhin
Power Engineering, Vol. 15, No. 4, pp 62-68 (01/1977).
Trans. From: Izvestiya Akademii Nauk SSSR, Energetika i Transport 15, 69-75 (1977)
Inductive energy is a viable form of storing large amounts of energy in a small volume. The author present a scheme for charging the inductor without loading the power grid unnecessarily. A rotary aggregate is used to supply over 1E5 J to the inductor at a rate exceeding 300 kA. Power conditioning of the charging system is discussed. 8 Refs.
Primary Keywords: Electrical Rotary Aggregates; Inductive Storage Device Charging; Maximum Initial Excitation Current; 1E8-1E9 J Energy; 1E12 W Discharge Power

6869
(SWITCHES, OPENING; ENERGY STORAGE)
(Mechanical; Systems)
THE TIME REQUIRED FOR TRANSFER OF CURRENT FROM A LIQUID-METAL COMMUTATOR INTO A SHUNTING CIRCUIT
V.G. Artyukh and S.A. Smirnov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instruments And Experimental Techniques, Vol. 18, No. 3, pp 819-820 (06/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 128-129 (May-June 1975)
The dependence of the time required for transfer of current into a shunting circuit on the magnitude of the current are presented which were obtained experimentally for a high-speed liquid-metal commutator for various parameters of the shunting circuit. For currents in the range from tens to hundreds of amperes this time is several or tens of microseconds. 1 Refs.
Primary Keywords: Opening Switch; Current Transfer; Shunting Circuit; High-speed Liquid-metal Commutator; Time Dependences; Eutectic Alloy

6872
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Systems; Explosive Fuses)
USE OF ELECTRIC EXPLOSION OF WIRES IN A HIGH-PRESSURE GAS TO BREAK A CURRENT CIRCUIT
G.P. Glazunov, V.P. Kantsedal and R.V. Mitin
Khar'kov, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 17, No. 6, pp 835-837 (12/1976).
Trans. From: Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 6, 102-105 (November-December 1976)
The high energy densities stored in the magnetic field of inductive storage devices have promising applications in experimental physics. The greatest energy storage levels are achieved in superconducting storage facilities and pulsed facilities, operating with explosive-magnetic generators (currents up to 3E8 A). To use the energy stored in a magnetic field one must cut the current in the storage circuit and switch it to the load circuit. One method of doing this is to use a switch based on electrical explosion of wires (EEW). There are several difficulties in creating current cut-off devices of this type: After the electric explosion a column of metal vapor forms in which breakdown can occur; then the cut-off process is slowed and the energy-transfer efficiency is decreased. The problem is that the wire material is instantly vaporized, i.e., it is a dielectric subject to stresses arising when the inductive storage device is switched to the load. A series of tests has been conducted with different materials in order to elucidate the possible use of EEW in a high-pressure gas for current switching. 2 Refs.
Primary Keywords: Exploding Wires; High Energy Densities; Current Cut-off Devices; Inductive Energy Storage; Opening Switches

6873
(BREAKDOWN STUDIES)
(Gas, Optical)
VOLUME DISCHARGE WITH UV PREIONIZATION
V.Yu. Baranov, V.M. Borisov, E.Sh. Napartovich, A.P. Napartovich, Yu.A. Satov and V.V. Sudakov
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
Soviet Journal Of Plasma Physics, Vol. 2, No. 3, pp 266-269 (06/1976).
Trans. From: Fiz. Plazmy 2, 486-491 (May-June 1976)
A theoretical and experimental study has been made of the influence of the parameters of the discharge power-supply circuit on the shape of the voltage and current pulses, the maximum energy disposition, and the maximum pressure at which the discharge is still a volume discharge. Measurements were carried out in a mixture of the gases CO/sub 2/, N/sub 2/, and He, which are typical of pulsed lasers, and in the pure components of the mixture. Calculations based on a simple model for the discharge in nitrogen yield time dependences for the voltage, discharge current, and total current; the value of E/P in the plasma is also found as a function of the discharge voltage, the pressure, and the circuit parameters. The calculated and experimental data agree well, permitting the conclusion that there is no typical value of the parameter E/P for the laser mixture. This parameter is found as a function of the pressure at the circuit conditions. 12 Refs.
Primary Keywords: Gas Discharge; CO/sub 2/, N/sub 2/, He Gas Mixture; UV Preionization; Individual Gas Breakdown; Experiment; Theory; Voltage Measurement; Current Measurement

6874
(PULSE GENERATORS)
(Flux Compression)
WORK PERFORMED BY A PLANAR EXPLOSION MAGNETIC GENERATOR ON A RESISTIVE LOAD
L.S. Gerasimov and V.I. Ikryannikov
Institute Of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 22, No. 12, pp 1497-1501 (12/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 2583-2589 (December 1977)
The conversion of the energy of an explosive into electromagnetic energy by a planar explosion magnetic generator operating into a resistive load is studied. Optimization of an explosion magnetic generator on the basis of a specified criterion (a maximum voltage, a maximum power, a maximum energy, or a maximum energy, or a maximum efficiency) is examined. It is shown that explosion energy can only be converted efficiently at voltages below a certain value. Conversion of magnetic flux is not a necessary condition. 4 Refs.
Primary Keywords: Energy Conversion; Planar Explosion Magnetic Generator; Resistive Load; Critical Voltage Value

6876
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ANALYSIS OF THE TRUMP-VAN DE GRAAFF CONDITION FOR VACUUM BREAKDOWN
V.A. Avrutskii and V.N. Koshchienko
Moscow Energetics Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 9, pp 1062-1066 (09/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 1889-1895 (September 1979)

The Trump-Van de Graaff breakdown condition, which is based on the emission of electrons and ions from the electrodes, is analyzed. The starting condition for the discharge implies that each electron leaving the cathode ejects a number of ions from the anode which is sufficient to eject a single electron from the cathode. Account is taken of the ionization which occurs in the gas film adsorbed on the cathode when the electrons interact with this film. Extraction of ions into the interelectrode gap by the applied field is also taken into account. Two cases are considered: two plane electrodes, with a homogeneous field between them, and the case in which there is an insulator in the interelectrode gap. The conditions for a self-sustained discharge in vacuum are obtained. These expressions only contain values which can be found from the literature and handbooks. They explain the breakdown characteristics of vacuum gaps both qualitatively and quantitatively. 7 Refs

Primary Keywords: Vacuum Breakdown; Trump-Van de Graaff Condition; Field Emission; Gas Adsorption; Parallel-plane Electrodes; Interelectrode Insulator

6877
(BREAKDOWN STUDIES)
(Exploding Wires)
BEHAVIOR OF EXPLODING GOLD WIRES
T.J. Tucker
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 42, No. 10, pp 1894-1900 (10/1961).

A square wave generator current source was used to study the behavior of gold wires exploded by current densities in the range of 0.25E8 to 3.26E8 amp/sq.cm. Measurements of wire resistance vs cumulative energy and action at various current densities are compared with a simple theoretical exploding wire model and the results of Kerr cell photographic studies. Experimentally, the total energy input to the time of maximum wire resistance increases with current density and may exceed by threefold the normal vaporization energy. Also, the instantaneous wire resistance at any point is smaller with a larger current density. The resistance depression is first apparent in the region following vaporization. At higher current densities, the effect is observed to occur at progressively earlier phases up to and including the point at which melting occurs. 7 Refs.

Primary Keywords: Exploding Wire; Gold Wire; 3E8 A/sq.cm. Current Density; Wire Resistance Measurement; Temporal Resolution; Resistance Depression

6878
(BREAKDOWN STUDIES)
(Liquid, Electrical)
CIRCUIT TRANSIENT FOLLOWING A PULSED DISCHARGE IN WATER
G.B. Rakovskii
Soviet Physics-Technical Physics, Vol. 17, No. 9, pp 1587-1590 (03/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 42, 1982-1986 (September 1972)

The solution of the equation for a circuit that includes as an active element the spark produced following pulsed breakdown of water is analyzed. An analytic solution of the transient equation is obtained for special cases of the variation of the resistance, in which the experimental curve is approximated. This makes it possible to express the current and its derivative as functions of the time. A preliminary analysis of the limits of applicability of the results is given. 8 Refs.

Primary Keywords: Water Breakdown; Transient Equation; Underwater Pulsed Discharge; Conduction Channel Resistance; Rate Of Energy Release; Circuit Considerations

6880
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Electrodes)
CONDITIONS FOR SPUTTER EMISSION IN HIGH-PRESSURE SPATIAL GASEOUS DISCHARGES
Yu.D. Korolev, G.A. Mesyats and V.B. Ponomarev
Academy of Sciences of the USSR, Tomsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol 20, No. 6, pp 674-678 (12/1979).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 20, 25-29 (November-December 1979)

The contraction of a high-pressure spatial gaseous discharge is associated with formation of a cathode spot and an outgrowth from the latter of a high-conductance spark channel. In an earlier study there was proposed a model of spot initiation under high electric field intensities E(0) at the cathode, when spontaneous emission from individual microasperities becomes significant. Then the cathodic layer is unstable relative to fluctuations of the spontaneous-emission current so that heating of their tips by the electron current and the ion current cause this layer to sputter and a cathode spot is formed. The electric field intensity E(0) is related to the ion current density j according to the law of similitude E(0)/p=f(j/p/sup 2/), with p denoting the gas pressure. This relation yields the dependence of the discharge current density or the pressure at a beforehand given electric field intensity E(0)=E* sufficiently high for initiating a cathodic instability. This study will deal with the determination of the critical electric field intensities E* and the current densities in spatial discharge at which such intensities are attained. 19 Refs

Primary Keywords: Gas Breakdown; Cathode Spot; Cathode Sputtering; Spark Channel; Ion Current; Pressure Dependence

6882
(BREAKDOWN STUDIES)
(Gas, Electrical)
EFFECT OF INHOMOGENEITY OF A TRANSVERSE MAGNETIC FIELD ON BREAKDOWN
P.M. Tyurkanov, I.K. Fetisov and G.V. Khodachenko
Moscow Engineering Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 9, pp 1031-1033 (09/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 1809-1814 (September 1978)

A low-pressure discharge is studied in a homogeneous electric field which is perpendicular to an inhomogeneous, axisymmetric magnetic field. The inhomogeneity of the magnetic field affects the breakdown conditions. A qualitative interpretation is offered for the experimental results. 10 Refs.

Primary Keywords: Gas Breakdown; Low Pressure; Self-breakdown; Transverse Magnetic Field; Inhomogeneous Field; Effect On Breakdown

6883
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Surface Flashover; Solid)
ELECTRIC FIELD CONFIGURATION FOR A GRAZING DISCHARGE
P.N. Dashuk and E.K. Zhistev
M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 6, pp 687-688 (06/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 1241-1244 (June 1979)

The grazing discharge which occurs along the surface of a dielectric, is used in high-current, low-inductance switches and in pulsed light sources. On the other hand, the grazing discharge is a major problem in the normal operation of certain insulating structures and other types of electrical devices. Despite the extensive information which is now available on the electrical and physical characteristics of the grazing discharge, we do not yet have a good picture of this discharge; this situation is in contrast with the free gas discharge which develops in a highly nonuniform field. 13 Refs.

Primary Keywords: Grazing Discharge; Surface Discharge; Closing Switch; Insulation Breakdown; Uniform Field Discharge

6885
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Mechanical; Mechanical)
EXPERIENCE IN SWITCHING KILOAMPERE DIRECT CURRENT BY MEANS OF LIQUID METAL
V.A. Boguslavskii, I.M. Tolmach and E.I. Yantovskii
Magnetohydrodynamics, Vol. 8, No. 1, pp 138-139 (03/1972).
Trans. From: Magnitnaya Gidrodinamika 8, 153-154 (January-March 1972)

The most promising of current designs of liquid-metal switching devices are devices in which an electrically conducting fluid enclosed in a closed vessel takes up the positions necessary for switching an electrical circuit as in response to the action of the magnetic field associated with the control currents. The absence of mechanical displacements of rigid bodies leads to high electrical and mechanical wear resistance and to noiseless operation. These devices can be classified under two headings: conductive devices in which the displacement of the electrically conducting fluid is brought about through the interaction between the control magnetic field and the control current flowing through the liquid-metal contact and inductive devices where the effect is achieved through the interaction between the fluid and a pulsating field or traveling field of control circuits. We describe the results of experiments staged with an inductive device in which the electrically conducting fluid is displaced through its interaction with a rotating magnetic field. 4 Refs.

Primary Keywords: Vacuum Commutator; Liquid Metal Contact; Magnetic Field Control; Performance Test; High Reliability

6886
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Mechanical; Mechanical)
FAST-ACTING VACUUM COMMUTATOR WITH CONNECTION BY LIQUID-METAL CONTACTS
T.G. Galkina, O.A. Gusev, A.G. Nechaev and E.P. Pavlov
Instruments And Experimental Techniques, Vol. 20, No. 2, pp 506-508 (04/1977).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 161-163 (March-April 1977)

The construction and operating principles of a fast-acting commutator with connection by liquid-metal contacts are described. With a contact surface area of approximately 20 mm/sup 2/ and a resistance of no more than 3-5 microohm in the closed state, the commutator transmits a current of up to 5 kA for a long period of time and also conveys current from an inductance tank to a load of 5 ohm and 10 microhenry, with an artificial current zero in 20-30 microseconds. 2 Refs.

Primary Keywords: Vacuum Commutator; Liquid-metal Contacts; Fast Opening; 5 kA Operating Current

6887
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Electrical)
FORMATION OF A MULTICHANNEL SPARK IN AIR
V.P. Belosheev
Soviet Physics-Technical Physics, Vol. 24, No. 10, pp 1201-1202 (10/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2180-2182 (October 1979)

A spark discharge in a gas-filled gap usually develops through a single channel; this feature makes it difficult to switch high-current circuits because with a current >=1E4 A the reduction in the resistance and inductance of the channel results from its expansion while the switching time goes as I/sup .33/. Furthermore, the high resistance of the channel in the early stage leads to a substantial energy loss, especially in the early stage. Because of these circumstances, along with the significant electrode erosion at discharge currents >=1E5 A, it is necessary to develop methods for forming multichannel discharges. In the present paper we propose a new method for obtaining a multichannel discharge. This method used a multichannel barrier discharge, which develops in all discharge gaps with a common ignition electrode. Study of the barrier discharge shows that its multichannel structure is governed by the rate at which the grazing discharge develops along the dielectric barrier. 5 Refs

Primary Keywords: Multichannel Discharge Formation; Multichannel Barrier Discharge; Low Inductance Switch

6892
(BREAKDOWN STUDIES)
(Liquid, Electrical)
INTERFEROMETRIC STUDY OF PULSED BREAKDOWN IN A LIQUID
V.F. Kimkin and A.G. Ponomarenko
Novosibirsk State University, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 9, pp 1067-1071 (09/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 1896-1904 (September 1979)

Certain new features have been observed in the initial stage of an electric discharge in a liquid dielectric at E/sub 0/ approximately (0.3-1) 1E6 V/cm in an interferometer study with time resolution approximately 5E-9 sec and spatial resolution approximately 5E-4 cm. The jumps in the refractive index and the pressure are determined by solving the Abel integral equation by a stepwise-approximation method for a shock wave; behind the shock front the primary ionization processes proceed comparatively slowly. A study of the dynamics of the shock waves lead to estimates of the basic energy relations for the initial, 'hydrodynamic' stage of electric breakdown in distilled water. 15 Refs.

Primary Keywords: Liquid Breakdown; Interferometric Diagnostic; Spatial Resolution; Temporal Resolution; Initial Breakdown Stages; Shock Wave

6893
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Mechanical; Mechanical)
INVESTIGATION OF THE COMMUTATION OF A KILOAMPERE DIRECT CURRENT BY A LIQUID METAL IN A ROTATING FIELD
V.A. Boguslavskii, I.M. Tolmach and E.I. Yantovskii
Magnetohydrodynamics, Vol. 8, No. 4, pp 509-514 (12/1972).
Trans. From: Magnitnaya Gidrodinamika 8, 95-101 (October-December 1972)

A device for investigating the commutation of high currents by means of a liquid metal, consisting of a nonconducting hermetric cylinder partially filled with liquid metal, electrodes inserted into the cylinder, and an external iron-free inductor of a rotating field, is described. On connecting the inductor the liquid metal uncoils, forms a rotating conducting cylinder, and closes the main circuit. Disconnection of the inductor leads to subsidence of the liquid metal under the effect of gravity and to breaking of the circuit. Problems of a comparison of a linear device with a centrifugal device, determination of the maximum short-circuit current, and calculation of the field of an iron-free stator are discussed. Experiments on a model of a contactor with commutation of a direct current up to 1000 A at a voltage of 220 V with boosting of the control voltage upon connection and with counterrotation upon disconnection are described. 6 Refs.

Primary Keywords: Vacuum Commutator; Rotating Mgnetic Field; Liquid Mctal Contact; Field Closing Driver

6894
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
CROWBAR GAP SWITCH WITH TWO TRIGGERING PULSES OF OPPOSITE POLARITIES AND ITS SIMPLIFIED GAP SWITCHES
N. Ikeda and S. Takeda
Electrotechnical Lab, Tokyo, Japan
The Review Of Scientific Instruments, Vol. 41, No. 11, pp 1669-1677 (11/1970).

A crowbar gap switch with a new triggering circuit has been designed and tested. Two trigger pulses of opposite polarities are applied simultaneously. At the time of crowbar, after a quarter cycle of main current, two pulses of opposite polarities are applied simultaneously to the trigger electrodes. These trigger electrodes break down by field emission so that a breakdown path is established. The main current flows along the path and is crowbarred. 0 Refs.

Primary Keywords: Spark Gap; Crowbar Gap; Oval Trigatron Configuration; Double Trigger

6898
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, CAPACITIVE)
(Systems; Systems)
PLASMA INJECTORS WITH CAPACITY AND INDUCTANCE ENERGY STORAGE
N.V. Belan, N.A. Mashtylev and B.I. Panochevnyi
Khar'kov Aviation Institute, USSR
Soviet Physics-Technical Physics, Vol. 16, No. 10, pp 1642-1645 (04/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 2073-2078 (October 1971)

The acceleration of a plasmoid in an injector with capacity and inductance energy storage is treated. A system of equations is derived and solved numerically for capacity and inductive energy storage. The conditions under which an injector provides the same efficiency, regardless of the type of energy storage, are determined. 7 Refs.

Primary Keywords: Plasma Injector; Inductive Energy Storage; Capacitive Energy Storage; Comparison; Efficiency

6902
(BREAKDOWN STUDIES)
(Gas, E-beam)
PULSE DISCHARGES IN GASES UNDER CONDITIONS OF STRONG IONIZATION BY ELECTRONS
Yu.I. Bychkov, Yu.D. Korolev and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Uspekhi, Vol. 21, No. 11, pp 944-958 (11/1978).
Trans. From: Uspekhi Fizicheskikh Nauk 126, 451-477 (November 1978)

A review is given of investigations of pulsed high-pressure volume discharges excited by fast-electron beams. The following topics are discussed: classification of discharges; methods for calculating the current-voltage characteristics, analysis of the optimal ways of depositing energy in the gas in the volume stage of the discharge; discharge instability mechanisms and the corresponding experimental observations; applications of discharges. The results are given of calculations of the electric field in the cathode and anode regions, and also in the discharge column in the case of the spatially inhomogeneous ionization of the gap. It is shown that a stable volume flow of the current in molecular gases in which the specific deposited energy is 0.1-1 J/cu.cm. may be attained in a nonself-sustaining discharge and in a discharge with ionization multiplication. In both cases a spark channel appears in two stages: formation of spark-initiating centers in the form of plasma regions with a higher density near the electrodes is followed by growth of the spark channel from such initiating centers. In some cases the spark channel growth can be described by the available mathematical models. Discharges in mixtures of rare gases with halogen-containing compounds, when electrons are lost mainly by capture by complex molecules, are considered separately. Applications of volume discharges in laser pumping, switching of pulsed currents, plasma chemistry, etc. are described. 106 Refs.

Primary Keywords: Gas Breakdown; Review; Volume Discharge; E-beam Excitation; Spark Channel; Discharge Classification; Initiating Centers

6910
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
THEORY OF THE CNARE EFFECT
H.G. Latal
Illinois Intitute of Technology, Chicago, IL
Annals Of Physics, Vol. 42, No. 2, pp 352-353 (04/1967).

The author presents a theoretical explanation for the Cnare effect (the electrical implosion of conducting liners for magnetic field compression). The diffusion of the field into the liner and subsequent implosion are considered on a quantitative basis. 9 Refs.

Primary Keywords: Flux Compression; Electrical Liner Implosion; Theory

6911
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
THEORY OF THE VACUUM ARC
V.A. Nemchinskii
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 7, pp 764-767 (07/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 1373-1378 (July 1979)

A model is proposed for the cathode region of a vacuum arc. The model is closed; the calculations only require a knowledge of the arc current and the properties of the cathode material. Specific calculations are carried out for a copper cathode. The calculated values of the voltage drop across the arc, the heat transferred to the cathode, the current density, and the current per spot are all in agreement with experimental data. 13 Refs.

Primary Keywords: Cathode Region; Vacuum Arc; Current Density; Cathode Potential Drop; Theory; Modeling

6914
(BREAKDOWN STUDIES)
(Gas, E-beam)
VOLTAGE-CURRENT CHARACTERISTIC OF GAS DISCHARGE WITH EXTERNAL IONIZATION
E V. Chekhunov
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 20, No. 4, pp 403-406 (08/1979).
Trans. From: Zhurnal Prikladnoi Mekhaniki I Tekhnicheskoi Fiziki 4, :6 19 (July-August 1979)

Steady-state solutions of the discharge equations were obtained elsewhere for a range of values of the external ionization source strength Q, discharge current j, and voltage U such that there was no impact ionization in the positive column, and the voltage was below the breakdown value. The present paper treats a broader range of variation of Q, j, and U; in particular, currents are considered for which impact ionization in the positive column is important, and the voltage is above the breakdown value. 4 Refs.

Primary Keywords: Gas Breakdown; External Ionization Source; Self-sustaining Discharge; Theory; Transient Solution

6916
(PARTICLE BEAMS; REVIEWS AND CONFERENCES)
(Reviews; Conferences)
ALL-UNION CONFERENCE ON THE APPLICATION OF CHARGED-PARTICLE ACCELERATORS IN THE NATIONAL ECONOMY
O.A. Gusev (Ed.)
Soviet Atomic Energy, Vol. 40, No. 3, pp 334-335 (03/1976).
Trans. From: Atomnaya Energiya 40, 273-274 (March 1976)

The 2nd All-Union Conference on the Application of Charged-Particle Accelerators in the National Economy was held on October 1-3, 1975 in Leningrad. Specialists from 53 organizations and companies of the Soviet Union participated in the conference, representing the Academy of Sciences of the Soviet Union, the State Committee for Nuclear Energy Research, the chemical, petrochemical, electronic, textile, radio and electrotechnical, timber and tree cultivation, power engineering industries, the Ministries of Public Health and Higher Education. Specialists from Poland, the German Democratic Republic, Czechoslovakia, and Hungary also participated. More than 80 papers were heard on the problems of the development, construction and operation of different types of accelerators, and also their application in radiation chemistry, for industrial defectoscopy and activation analysis; for the sterilization of manufactured goods, the prevention of contamination of the environment, and radiation therapy. 0 Refs.

Primary Keywords: Charged-particle Accelerators; Development Practical Application; Construction And Operation; Radiation Chemistry; Industrial Defectoscopy; Activation Analysis; Radiation Therapy

6917
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic Flux Compression)
APPROXIMATE THEORY FOR AMPLIFICATION OF MAGNETIC FIELDS
N.N. Kalitkin and L.S. Tsareva
Institute Of Applied Mathematics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 14, No. 8, pp 1050-1054 (02/1970).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 1397-1404 (August 1969)
The compression of a magnetic field by a moving shell of finite conductivity which is heated in the process of compression is investigated. The shell material is assumed to be an incompressible fluid (which is justified in fields up to 3-4 MOe), and the diffusion of the magnetic field into the shell is calculated from the skin depth. Under these approximations the mathematical problem reduces to the solution of a system of three ordinary differential equations. Accurate solutions can be obtained in a number of cases. Numerical data are presented which agree quite well with experiment. 11 Refs.
Primary Keywords: Magnetic Field Compression; Moving Shell; Magnetic Flux Leakage; Skin Depth, Theory

6918
(POWER TRANSMISSION)
(Transmission Lines)
CAPACITOR DISCHARGE INTO A LOAD CONSISTING OF TWO PARALLEL LEADS WITH SKIN EFFECT
V.I. Yurchenko
Nuclear Physics Institute, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 18, No. 9, pp 1180-1184 (03/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 1866-1873 (September 1973)
Allowance is made for the skin effect in an analysis of the discharge of a capacitor into a load consisting of two parallel leads. It is assumed that the leads are infinitely thick and that edge effects can be neglected. The exact solution is used to calculate several characteristics of the discharge process which are useful in practice. A method is indicated for solving the problem for other simple geometries. 7 Refs.
Primary Keywords: Parallel Wire Transmission Line; Capacitor Discharge; Skin Effect; Field Gradient

6919
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
COMPUTER CALCULATION OF QUASISTATIONARY PULSED MAGNETIC FIELDS
V.I. Yurchenko
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 8, pp 1025-1030 (02/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 1641-1649 (August 1974)
A procedure for calculating two-dimensional magnetic fields (plane-parallel or with rotational symmetry) is described. The skin effect is taken into account. The procedure is based on the replacement of a differential equation by a system of difference equations relating the values of the vector potential at different points of a rectangular grid at two different times. Two iteration methods, a longitudinal-transverse method and an upper-relaxation method, are used to solve the difference equations. The calculation procedure is illustrated for the case of a pulsed magnet. The calculation is carried out for an impulse function excitation. In this form, the results can be used in a simple manner to determine the field for any functional dependence of the excitation on time. The procedure for calculating the field is described for the case in which a capacitor discharges into a magnet of unit length. 12 Refs.
Primary Keywords: Magnetic Field Calculations, 2-d Field Calculation; Skin Effect; Pulsed Magnet Coil

6920
(BREAKDOWN STUDIES)
(Exploding Wires)
CONDITIONS FOR THE CURRENT PAUSE IN EXPLODING WIRES
E.I. Azarkevich, Yu.A. Kotov and V.S. Sedoi
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 20, No. 1, pp 111-112 (07/1975)
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 175-177 (January 1975)
By exploding wires in an LC circuit we have determined generalized variables that describe the vaporization stage: lambda/sub cr/ = l/sub cr/ divided by nd/sup 2/ SQRT(L/C), nu = SQRT(LC/d), where n, d, and l are the number, diameter, and length of the wires; C and L are the capacitance and inductance of the circuit. By using generalized variables, it is possible to exploit experiments with copper wires to determine the dependence of the current on the initial conditions. lambda/sub cr/ = 1.35E3 (1E-6 epsilon nu)/sup 0.36/, where lambda/sub cr/ = (l divided by nd/sup 2/ SQRT(L/C), l/sub cr/ is the minimum length for which a current pause is observed. The expression holds over a wide range of initial conditions. 9 Refs.
Primary Keywords: Current Pause, Exploding-wire Devices; Critical Conductor Length, Wire Characteristics; Vaporization Stage

6921
(SWITCHES, CLOSING)
(Thyratrons)
CONTROLLED MEGAVOLT GAS-FILLED DISCHARGER
V.M. Evdokimovich, B. Evlampiev, G.S. Korshunov, V.A. Nikolaev, Yu.F. Sviridov and V.V. Khmyrov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 23, No. 5, pp 1190-1192 (10/1980)
Trans. From: Pribory i Tekhnika Eksperimenta 5, 127-128 (September-October 1980)
A megavolt gas-filled thyratron-type discharger is described with a sectional gas-discharge chamber, having a delay or spark ignition of t/sub 3/=10 +or- 0.1 microsecond together with a more than threshold range of operating voltage. A dielectric bushing is used in the ignition assembly of the thyratron projecting above the plane of the base electrode. 3 Refs.
Primary Keywords: Megavolt Gas-filled Discharger; Thyratron, 10 +or- 1 Microsecond Spark Ignition Delay; Trigger Bushing, <= 1 Microsecond Voltage Application Times; Thyratron Ignition Assembly; Sectional Discharge Chamber

6922
(POWER CONDITIONING)
(Saturable Reactors)
DEFORMATION OF INTENSE WAVES TRAVERSING A FERRITE DISCONTINUITY IN A TRANSMISSION LINE
G.A. Mesyats and R.B. Baksht
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 10, No. 5, pp 685-689 (11/1965).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 889-896 (May 1965)
It is shown that if a wave passes through a lumped ferrite discontinuity placed in series or in shunt with a transmission line, it is possible to narrow the width of the leading edge and to reduce the wavelength to 1E-9 sec. 7 Refs.
Primary Keywords: Transmission Line; Lumped Ferrite Discontinuity; Electromagnetic Shock Waves; 1E-9 sec Pulse Front; Narrowed Wave Front, Homogeneous Transmission Lines; Flux-reversal Equation

6923
(BREAKDOWN STUDIES)
(Gas, Electrical)
DELAY IN PULSED BREAKDOWN OF WEAKLY-ILLUMINATED GAPS
Yu.A. Avrutskii
Moscow Institute Of Power Engineering, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 20, No. 10, pp 1375-1380 (10/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 2194-2202 (October 1975)
A theoretical examination is made of the processes taking place in the volume of the gas and at the cathode surface before a discharge develops and the effect on primary electrons, i.e., the statistical delay of the breakdown of nonilluminated or weakly-illuminated gaps operating at considerable overvoltages (fields of the order of 1E5 V/cm). The theoretical investigation is conducted on the assumption of the ion-electron mechanism of primary electron generation. Expressions are obtained which connect the statistical delay time with the field, the gas pressure, the dimensions of the gap, the power of ionizing radiation of the background of natural radiation, and with factors characteristic of the material and the state of the cathode surface. The expressions obtained are in good qualitative and quantitative agreement with experimental data in the literature. 24 Refs.
Primary Keywords: Gas Breakdown; Ionizing Radiation; Prebreakdown Phenomena; Primary Electrons; High Overvoltage

6926
(SWITCHES, CLOSING)
(Gas Gaps, Recovery)
DISCHARGER WITH HIGH PULSE REPETITION FREQUENCY
D.D. Malyuta and V.S. Mozhevov
Instruments And Experimental Techniques, Vol. 23, No. 4, pp 900-901 (08/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 89-90 (July-August 1980)
Construction is described of a discharger capable of operating at a pulse repetition frequency of 4 kHz and duration of 0.1-1 microsecond at an operating voltage of 20-40 kV and current amplitude of 1-10 kA. The discharger operates with a current of nitrogen blown through it with a cycle of duration approximately 0.5 sec. 3 Refs.
Primary Keywords: Gas Spark Gap; Electrical Trigger; Nitrogen Gas; High Flow Rate; 40 kV Operating Voltage; 10 kA Current, Repeated; 4 kHz Repetition Rate

6927
(BREAKDOWN STUDIES)
(Gas, E-beam)
DYNAMIC ATMOSPHERIC PRESSURE DISCHARGE EXCITED BY AN ELECTRON BEAM
Yu.I. Bychkov, Yu.D. Korolev, G.A. Mesyats, V.V. Savin and A.P. Khuzeev
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 20, No. 11, pp 1502-1504 (11/1975)
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 2412-2415 (November 1975)
A study is made of a stationary atmospheric-pressure discharge in a flowing gas; the discharge is excited by a beam of fast electrons. The possibility of utilizing this kind of discharge in a gas laser is investigated. A stable discharge is obtained with dissipated power of 1.5 kW/cu.cm. The current density of the beam of fast electrons is typically 10-50 microamps/sq.cm. and the corresponding discharge current density is 100-300 mA/sq.cm. 6 Refs.
Primary Keywords: E-beam Excited Discharge; CO/sub 2/ Breakdown; Atmospheric Pressure, Flowing Gas; Stable Discharge
Secondary Keywords: Gas Laser Pumping

6928
(BREAKDOWN STUDIES, SWITCHES, CLOSING)
(Electrodes, Gas Gaps, Materials)
EFFECT OF THE MEDIUM ON THE ELECTRICAL EROSION OF ELECTRODES AT HIGH CURRENTS
G.S. Belkin and V.Ya. Kiselev
Moscow Energetics Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 1, pp 24-27 (01/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 42-48 (January 1978)
Devices with high pulsed currents are widely used in the laboratory and in industry. High currents through the working and switching gaps cause electrode wear, so that the electrode shape is changed and the insulation and the medium become contaminated. The quantitative characteristics of the electrode wear are reported by many authors but the effect of the medium on erosion is not well understood. Our purpose in the present work is to compare the erosion processes in discharges in various media and to determine the characteristics of the erosion in dense and low-density media. Electrical erosion due to current pulses with lengths of tens or hundreds of microseconds has much in common with erosion due to 50-Hz currents. We therefore report results for both short pulses and for current pulses at 50 Hz. 10 Refs.
Primary Keywords: Electrode Erosion; Pulsed Current; Power Line Frequency Current, Insulation Contamination; Discharge Parameter Variation; Copper Electrodes; Theory

6929
(BREAKDOWN STUDIES)
(Gas, E-beam)
ELECTRIC FIELD DISTRIBUTION IN THE ANODE LAYER OF A NON-SELF-MAINTAINED VOLUMETRIC DISCHARGE SUSTAINED BY A BEAM OF FAST ELECTRONS
Yu.D. Korolev, V.V. Kremnev and V.B. Ponomarev
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Journal, Vol. 20, No. 3, pp 406-409 (03/1977).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii 20, 150-152 (March 1977)

The interest in the study of the electrode layers of non-self-maintained discharges is connected with the fact that the character of the distribution of charged particle in these layers to a considerable extent determines the mechanism of conduction. An additional stimulus to the research arose when it was noted that the formation of spark channels, which lead to the cutoff of the volumetric flow of current, begins in the regions near the electrodes. In the work done earlier the principal attention was paid to the calculation of the characteristics of the cathode layer. The results of analytical and numerical calculations of the anode region of a non-self-maintained discharge are presented in this report. 9 Refs.

Primary Keywords: Gas Discharge; Volume Discharge; E-beam Sustained Discharge; Spark Channel; Cathode Layer; Anode Layer

6939
(BREAKDOWN STUDIES)
(Explosives)
ELECTRIC STRENGTH OF SCATTERED DETONATION GASES
P.I. Zubkov, L.A. Luk'yanchikov and Yu.V. Ryabinin
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 19, No. 1, pp 109-112 (02/1978).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1, 134-138 (January-February 1978)

One of the most important characteristics in schemes used for the formation of high-power pulses of a given shape by means of condensed explosives is the current density that can be attained in the detonation wave. Whenever the electrical conductivity is determined directly by the detonation process, the maximal current density depends on the maximal electric field strength at which breakdown of the detonation gases no longer occurs, i.e., on their electric strength. This magnitude also determines the characteristics of safety detonators operating at high inverse voltages. Prediction of the parameters of detonators maintained at a high voltage requires knowledge of the electric strength of the detonation gases as a function of pressure. This is because the gaps formed as current is switched off are found under conditions characterized by nonstationarily expanding explosion gases, as a result of which their electric strength is time-dependent as a function of pressure. The required parameters of safety detonators can be obtained from a joint solution of the gasdynamic scatter problems for detonation gases and the motion of current-carrying elements and of electric circuit equations if the dependence of electric strength on pressure is known. In the current work, fundamental results are set forth from an experimental study of the electric strength of expanding detonation gases from bulk density PETN and Hexogen charges. 6 Refs.

Primary Keywords: Electrical Pulse Generator; Condensed Explosive; Detonation Wave; Detonation Product Breakdown; Maximum Current Density; PETN Explosive

6931
(BREAKDOWN STUDIES; SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas, E-beam; Gas Gaps, E-beam; Gas Gaps, E-beam)
ELECTRIC-FIELD INSTABILITIES OF A VOLUME GAS DISCHARGE EXCITED BY AN ELECTRON BEAM
G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Technical Physics Letters, Vol. 1, No. 7, pp 292-298 (07/1975).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 1, 660-664 (July 1975)

A volume discharge excited by an electron beam in a gas at atmospheric pressure and higher is used in CO/sub 2/ lasers, in gas-based switches, in plasmotrons, etc. The principal feature of this discharge is the transition from the volume mode into a channel mode. It has been proposed that this transition is caused by instabilities that arise in the plasma. We believe that under certain conditions this transition can also be due to the spatial inhomogeneity of the electric field. 11 Refs.

Primary Keywords: Volume Gas Discharge; Spatial Inhomogeneity; Cathode Instability; Deionization Instability; Injection Instability

6932
(BREAKDOWN STUDIES)
(Explosives)
ELECTRICAL CONDUCTIVITY IN THE DETONATION ZONE OF CONDENSED EXPLOSIVES
P.I. Zubkov, L.A. Luk'yanchikov and B.S. Novoselov
Novosibirsk, USSR
Combustion, Explosion, And Shockwaves, Vol. 7, No. 2, pp 253-256 (06/1971).
Trans. From: Fizika Goreniya i Vzryva 7, 295-299 (April-June 1971)

It is known that a zone of relatively high electrical conductivity occurs upon detonation of condensed explosives. Thermal ionization, chemical reactions, and high densities that developed in the detonation wave can be the cause of formation of the zone of electrical conductivity. It is not possible to determine separately the effect of each of these phenomena on the basis of what is known, since for this purpose it is necessary to known the character of the carriers and the distribution of conductivity in the region of the detonation wave. Here we present experimental data on a determination of the distribution of conductivity in the detonation zone. The measurements were taken during detonation of powdered PETN with a density of 1.1 g/cu.cm. and RDX with a density of 1.2 g/cu cm. 5 Refs.

Primary Keywords: Explosive Detonation Product; Conductivity Measurement; Conductivity Distribution; Detonation Wave; Powdered PETN Explosive

6933
(BREAKDOWN STUDIES)
(Solid, Electrical)
ELECTRICAL DISCHARGE IN PENTAERYTHRITOL TETRANITRATE POWDER
P.I. Zubkov and L.A. Luk'yanchikov
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 11, No. 4, pp 637-640 (08/1970).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 4, 128-131 (July-August 1970)

The article presents some results of oscillographic investigations of an electric discharge in pentaerythritol tetranitrate (PETN) powder of density (0.5-1.2) g/cu.cm. A hydrodynamic model of the development of the current-conducting channel was used; estimates of the rate of its development and values of its radius and of conductivity in it are given. It is shown that the transformation products of PETN have a conductivity not above 7E6 sec. 5 Refs.

Primary Keywords: PETN Powder Breakdown; Oscillographic Investigations; 5-1.2 g/cu.Cm. Power Density; 7E6 Sec Transformation Product Conductivity; Discharge Plasma Conductivity; Current Cutoff

6934
(BREAKDOWN STUDIES)
(Explosives)
ELECTRICAL STABILITY OF DETONATION PRODUCTS OF CONDENSED EXPLOSIVES
P.I. Zubkov, L.A. Luk'yanchikov and Yu.V. Ryabinin
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 19, No. 3, pp 315-318 (06/1978).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 3, 44-47 (May-June 1978)

The development of the various areas of experimental physics and technology requires the creation of high-power, high-speed switching devices. The most promising from the point of view of obtaining the necessary switching parameters are commutators based on the use of condensed explosives. A study of the electrical properties of the detonation products of explosives, filling the gaps in the electrical chain and defining the switching characteristics of circuit breakers, has been stimulated by the creation of the optimum design of an explosive switch. The electrical stability of the detonation products of a charge of PETN (pentaerythrityl tetranitrate), located between the ends of cylindrical electrodes, was previously investigated. It is shown that, with the experimental accuracy, the stability of the gap up to a specified stage of expansion of the detonation products is constant (E=100-120 kV/cm). Later, the stability falls rapidly. In the present paper the principal experimental results of an investigation of the electrical stability of the exploding detonation products of condensed explosives under the condition that their density is considerably lower than the density in the detonation wave and also of the static stability of the products in the pressure range 1-11 atm are given. 3 Refs.

Primary Keywords: Explosive Detonation Products; Electrical Stability; High-power Switch; Gas Density Dependence

6935
(BREAKDOWN STUDIES)
(Gas, E-beam)
ENERGY INPUT IN ELECTRICAL IONIZATION LASERS
Yu.I. Bychkov, Yu.D. Korolev, Yu.A. Kurbatov and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 4, pp 499-502 (10/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 791-796 (April 1974)

The development of a volume discharge excited by a beam of fast electrons is studied at pressures P>= 1 atm. The current characteristics are calculated allowing for the parameters of the discharge circuit and the energy input to the gas is analyzed. For P=2 atm the specific energy introduced into a mixture of N/sub 2/ and CO/sub 2/ is W/sub g/ approximately 1 J/cu.cm. These values are achieved at a current density in the electron beam j/sub beam/ approximately 5-10 A/sq.cm. and a beam lifetime tau/sub beam/ approximately 4E-8 sec. It is shown that maintenance of the discharge by ionization processes permits a substantial reduction in the beam current while maintaining acceptable energy characteristics and sparkless operation. For example, W/sub gas/ approximately 0.1 J/cu.cm. with j/sub beam/ approximately 0.1 A/sq.cm. and tau/sub beam/ approximately 2E-8 sec. 10 Refs.

Primary Keywords: E-beam Excited Discharge; Volume Discharge; Circuit Parameter Variation; Energy Input; Beam Current

6936
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Electrodes)
EXPLOSIVE PROCESSES AT THE CATHODE OF A GAS DISCHARGE
G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Technical Physics Letters, Vol. 1, No. 10, pp 385-386 (10/1975).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 1, 885-888 (October 1975)

Numerous experimental investigations of the vacuum discharge have demonstrated the fundamental role played by explosive emission of electrons in the initiation of the discharge and maintenance of the cathode spot. The electric field in the gap in vacuum breakdown is approximately 1E6 V/cm, but the field at the cathode becomes stronger because of microscopic inhomogeneities. To observe explosive processes at the cathode in a nanosecond discharge in a gas we have investigated the microstructure of the cathode. It is known from an investigation of the vacuum discharge that the explosive emission leads to the formation of microscopic craters on the cathode. Microscopic craters have been observed in a discharge in atmosphere. 10 Refs.

Primary Keywords: Gas Discharge; Explosive Electron Emission; Cathode Spot; Nanosecond Discharges; Microscopic Craters; Copper Electrodes

6937
(PULSE GENERATORS)
(Flux Compression)
EXPLOSIVELY-DRIVEN MAGNETIC GENERATOR WITH FAST MEGAGAUSS FIELD
L.V. Bebarina, D.P. Sobolev and A.E. Voitenko
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Astronautica ACTA, Vol. 15, pp 292-299 (01/1970).
The authors describe a magnetic flux compression generator utilizing a flat geometry. The generator is designed so that the compression cavity forms it's own closing switch. It is hypothesized that skin-depth evaporation limits magnetic field intensity. Fields of 1.5 MG and current rise rates of 7E11 A/sec are reported. 5 Refs.
Primary Keywords: Flux Compression Generator; Plane Geometry; 7E11 A/sec Current Rise Rate; Self-closing Switch; Aluminum Plates; Copper Plates; Skin-depth Plate Evaporation

6938
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)
FLUX LOSS IN THE PRODUCTION OF ULTRASTRONG FIELDS BY RAPID COMPRESSION OF CONDUCTING SHELLS
V.I. Yurchenko
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 8, pp 1031-1033 (02/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 1650-1655 (August 1974)
The flux-loss problem is written as a system of two equations under the assumption that the shell compressing the flux is solid and that certain parameters, which are functions of the shell geometry alone, are specified. These equations are solved for certain particular cases of compression. Despite the loss through the sliding contact, the field amplification is much higher in systems in which the shell contour decreases in length during the compression. 7 Refs.
Primary Keywords: Flux Compression; Metallic Liner Implosion; Driver Geometry Considerations; Theory; Numerical Calculation

6939
(BREAKDOWN STUDIES)
(Gas, E-beam)
FORMATION OF A SPARK CHANNEL IN A BULK DISCHARGE INITIATED BY A FAST-ELECTRON BEAM
Yu.D. Korolev and A.P. Khuzeev
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
High Temperature, Vol. 13, No. 4, pp 779-780 (08/1975).
Trans. From: Teplofiziki Vysokikh Temperatur 13, 861-862 (July-August 1975)
High-pressure bulk discharges excited by an external ionization source, e.g., a beam of accelerated electrons, have been used to pump gas lasers and to switch powerful pulsed currents. In both cases, it is important to prevent breakdown of the spark channel. Breakdown delay time at different gas pressures and in different mixtures has been measured. In the present paper the dynamics of channel formation are investigated directly by observing the light patterns of discharge development. 8 Refs.
Primary Keywords: Gas Discharge; E-beam Sustained Discharge; Volume Discharge; Spark Channel Formation; Photographic Diagnostic

6942
(BREAKDOWN STUDIES)
(Gas, Electrical)
GROWTH OF A NANOSECOND PULSED DISCHARGE IN A GAS WITH ONE-ELECTRON INITIATION
V.V. Kremnev and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 12, No. 1, pp 33-37 (02/1971).
Trans. From: Zhurnal Prikladnoi Makhaniki i Tekhnicheskoi Fiziki 1, 40-45 (January-February 1971)
Pulse breakdown on gaps of millimeter order at substantial overvoltages is explained in terms of a discharge mechanism involving photoelectric emission from the cathode followed by collisional multiplication in the gas to give avalanches. The mechanism is used to deduce a theoretical equation for the time of discharge buildup in one-electron mutation, which is compared with experiment. 17 Refs.
Primary Keywords: Nanosecond Pulsed Discharge; Discharge Buildup Time; Avalanche Theory; Streamer Mechanism; One-electron Initiation

6946
(SWITCHES, CLOSING)
(Liquid Gaps, Optical)
LASER IGNITION OF THE WATER DISCHARGER FOR THE TWIN PULSE-FORMING LINE OF AN ELECTRON ACCELERATOR
B.A. Demidov, M.V. Ivkin and V.A. Petrov
Instruments And Experimental Techniques, Vol. 23, No. 4, pp 904-906 (08/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 93-95 (July-August 1980)
In experiments on the laser ignition of a water discharger for the twin pulseforming line of the Kal'mar precision pulse electron accelerator using a 500-MW laser pulse, we have been successful in triggering a water discharger with an average time spread of not more than +or- 8 nsec at a voltage between electrodes of 600 kV. Laser switching reduces the rise time of the pulse being formed by 10-15% and reduces the energy loss in the discharger by a factor of 1.5. 6 Refs.
Primary Keywords: Water Spark Gap; Laser Triggering; 600 kV Operating Voltage; 16 ns Jitter; 10% Rise Time Reduction

6947
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
MECHANISM FOR NANOSECOND VACUUM PULSED DISCHARGE
L.P. Babich and M.D. Tarasov
Radiophysics And Quantum Electronics, Vol. 23, No. 11, pp 914-920 (11/1980).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Radiofizika 23, 1365-1372 (November 1980)
Spectral analysis is used to demonstrate the absence of a near-cathode plasma flame for nanosecond electric discharges in a vacuum. Arguments are presented in support of a thermoemission mechanism for the discharge current. The place and role of the desorption mechanism and breakdown of insulating films in the development of the discharges are discussed. 20 Refs.
Primary Keywords: Vacuum Breakdown; Cathode Flare; Thermoemission; Insulating Film; Desorption

6948
(BREAKDOWN STUDIES)
(Liquid, Electrical)
MECHANISM OF THE PULSED ELECTRICAL BREAKDOWN OF WATER
E.V. Yanshin, I.T. Dychinnikov and Yu.N. Vershinin
Institute Of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics Doklady, Vol. 19, No. 2, pp 95-96 (08/1974).
Trans. From: Doklady Akademii Nauk SSSR 214, 1303-1307 (February 1974)
The main factors governing the nature of liquid dielectric breakdown are the conductivity and the duration of the effective voltage. Depending on the combination of these factors, it is assumed that breakdown is accomplished either by a thermal or an ionization mechanism. This last is considered responsible for the breakdown of pure liquids by pulses of <=1E-6 sec duration. However, using ionization mechanisms to explain experimental results encounters significant difficulties and needs additional assumptions. The following mechanism for pulsed breakdown of water is proposed. The action of voltage on the discharge gap is accompanied by the origin of a positive surface charge on the anode, formed by electron vacancies. Polarization and displacement of the nearest water molecules, completing the passage of electrons from these molecules to the anode, occurs in the field of these vacancies. In turn, ionization of the water molecules results in the formation of hydroxone ions near the anode. Further charge transfer to the cathode occurs by ion migration, with the sole difference that the rate of this process is determined to a great extent by the proton skipping time, since the water molecules turn out to be already favorably oriented in a strong electrical field. 7 Refs.
Primary Keywords: Water Breakdown; Pulsed Breakdown; Proton Mobility; Anode Surface Charge; Positive Charge Transfer

6949
(INSULATION, MATERIAL; BREAKDOWN STUDIES; POWER CONDITIONING)
(Liquid; Liquid, Electrical; Systems)
MEGAVOLT ENERGY-CONCENTRATING DEVICE
E.A. Abramyan, V.A. Kornilov, V.M. Lagunov, A.G. Ponomarenko and R.I. Soloukhin
Institute Of Theoretical And Applied Mechanics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk
Soviet Physics-Technical Physics, Vol. 16, No. 11, pp 983-985 (05/1972).
Trans. From: Doklady Akadamii Nauk SSSR 201, 56-59 (November 1971)
In research related to pulsed energy sources, one encounters several problems requiring beams of relativistic electrons with power 1E12 - 1E14 W for heating plasmas, for the coherent acceleration of ions, and for the generation of giant flashes of x-ray radiation or uhf radiation. Powers of this order of magnitude are usually obtained in the following fashion: electric energy with the density rho/sub 0/ is initially stored in a large volume and then transferred, within a short time interval, into an area with increased energy density, wherein rho > rho/sub 0/. Following a suggestion of G.I. Budker, we discuss in the present article the possibility of using specially purified distilled water as a dielectric in energy-density increasing devices operated at voltages in excess of 1E6 V. Due to the high dielectric constant of water, epsilon=80, and the relatively high breakdown strength E=5E5 kV/cm, it is possible to obtain specific powers p approximately 3E9 W at the load in the case of an optimized system for increasing the energy density. We mention for comparison that the use of other dielectric materials (transformer oil or polyethylene) in similar devices decreases p by approximately two orders of magnitude. Water has still another advantage over other dielectrics: the electric breakdown strength of water is restored after uncontrollable discharges. 7 Refs.
Primary Keywords: Pressurized Water Dielectric; Tesla Transformer; Water Transmission Line; Multimegavolt Output; Water Breakdown Tests

6951
(BREAKDOWN STUDIES)
(Gas, Electrical)
NANOSECOND FORMATION TIME OF DISCHARGES IN SHORT AIR GAPS
G.A. Mesyats, Yu.I. Bychkov and A.I. Iskol'dskii
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 13, No. 8, pp 1051-1055 (02/1969).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 38, 1281-1287 (August 1968)
The formation time of a discharge in air gaps about one millimeter long, where the rise time of the breakdown pulse is 2.5E-10 sec, was investigated. It is shown that when breakdown is initiated by single electrons the time is much larger than in the case of multi-electron initiation. This is due to self-arrest of the avalanches by the ion space-charge field. In the case of multi-electron initiation the increase in current during time is due to the development of a large number of avalanches from the initiating electrons. 15 Refs.
Primary Keywords: Formative Time Lag; Air Gaps; 1 mm Gap; Single-electron Initiation; Multi-electron Initiation; Ion Space Charge

6952
(PARTICLE BEAMS, ELECTRON)
(Generation)
ON POSSIBILITIES OF TRANSFORMER TYPE ACCELERATORS
E.A. Abramyan
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Nuclear Instruments And Methods, Vol. 59, No. 1, pp 22-28 (02/1968).
The MeV direct transformer type accelerators are reviewed. Units generating electron beams of mean power of tens of kW and machines with pulse power of 1E8-1E9 W and frequency of several tens of cps are described. The efficiency of the first type accelerators is 90-95% that of the second type is up to 80-90%. The main parameters of several accelerators are given. Possibilities of increasing the highest energies of such driven intensive proton beam accelerators and other problems are discussed.
Primary Keywords: E-beam, Transformer Accelerator; Rep-rated; High Efficiency; Tesla Transformer

6953
(BREAKDOWN STUDIES)
(Liquid, Electrical)
OPTICAL STUDY OF NANOSECOND PREBREAKDOWN PHENOMENA IN WATER
E.V. Yanshin (1), I.T. Ovchinnikov (1) and Yu.N. Vershinin (2)
(1) Institute Of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR
(2) Scientific-Research Institute Of Energetics, Novosibirsk
Soviet Physics-Technical Physics, Vol. 18, No. 10, pp 1303-1306 (04/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 2067-2074 (October 1973)
An experimental study has been made of the characteristic emission and shadow patterns of the initial stage of a discharge in a highly inhomogeneous field with the point electrode held at positive and negative polarities. A 'quasihole' mechanism for the electrical conductivity of water in an intense electric field is proposed to explain the experimental results. A non-ionization criterion is formulated for the pulsed breakdown of water. 12 Refs.
Primary Keywords: Experiment; Inhomogeneous Field; 'Quasihole'; Non-ionization

6955
(PULSE GENERATORS)
(Pulse Forming Lines)
PUMPING OSCILLATOR FOR LASERS HAVING TRANSVERSE EXCITATION
V.F. Losev, V.F. Tarasenko and A.I. Fedorov
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 19, No. 5, pp 1493-1494 (10/1976).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 213-214 (September-October 1976)
An oscillator is described in which strip lines based on ceramic having a high permittivity are used. The oscillator is distinguished by its compactness and allows synchronized radiation pulses to be obtained in several directions. 5 Refs.
Primary Keywords: Pumping Oscillator; High Permittivity Strip Lines; Synchronized Radiation Pulses; Traveling Excitation Wave; Minimum Inductance
Secondary Keywords: Gas Laser Pumping

6956
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas; E-beam; Gas Gaps, E-beam)
SOME CHARACTERISTICS OF A SPARK DISCHARGE INITIATED BY AN ELECTRON BEAM
V.G. Emel'yanov, B.M. Koval'chuk and Yu.F. Potalitsyn
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Journal, Vol. 17, No. 5, pp 720-721 (05/1974).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 17, 136-137 (May 1974)
It has been shown that when a beam of fast electrons is injected into a gas-filled discharge gap, different types of volume or spark discharges can occur. The present paper describes the characteristics of a 250 kV spark discharge initiated by an electron beam. 6 Refs.
Primary Keywords: Fast Electron Beam; Gas-filled Discharge Gap; 250 kV Spark Discharge; 1-20 mm Electrode Gap; 180 keV Maximum Electron Energy; 1-100 A Current Amplitude; 5E-9 sec Current Pulse Length

6957
(POWER CONDITIONING; POWER CONDITIONING;
(Peaking Gaps; Saturable Reactors;
SPARK PULSE PEAKING DEVICES WITH LOW SENSITIVITY TO PULSE HEIGHT
G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 10, No. 3, pp 400-402 (09/1965).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 516-518 (March 1965)
Peaking circuits are devices serving to narrow the wavefront of a pulse down to 1E-9 - 1E-10 sec, leaving the amplitude of the pulse unaffected. Spark-triggered peaking circuits and systems in which electromagnetic shock waves are generated are resorted to in the case of high-voltage pulses. The basic characteristics of peaking circuits are the duration of the pulse front at the output, t/sub f2/, the peaking efficiency k/sub eff/ = t/sub f1/ divided by t/sub f2/ (where t/sub f1/ is the duration of the front of the input pulse), the peak pulse amplitude U/sub max/, the amplitude ratio k/sub a/ = U/sub max/ divided by U/sub min/ and the peaking time tau/sub p/ (from the instant the pulse arrives at the peaking circuit till the appearance of the transformed pulse such that t/sub f2/ = t/sub f2/). The values of t/sub f2/ and of k/sub eff/ may attain 1E-10 sec and about 1E1 sec, respectively, for both types of peaking circuits. 6 Refs.
Primary Keywords: Spark Gap, Ferrite, Pulse Amplitude Dependence; Size Considerations; Pulse Sharpening Efficiency

6960
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Self)
THE DIFFUSE AND CHANNEL STAGES IN THE OVERVOLTAGE BREAKDOWN OF A GAS GAP
Yu.I. Bychkov, Yu.D. Korolev and V.M. Orlovskii
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Journal, Vol. 14, No. 9, pp 1198-1201 (09/1971).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii Fizika 14, 45-49 (September 1971)
An interrupted discharge has been used to examine the production of light in the breakdown of an overvoltage gas gap in air under conditions of E/p = 90-110 V/cm-mm Hg. It is found that there are two types of discharge, the type being dependent on the number of initial electrons: diffuse when there are many electrons and of channel type when there is a single initiating electron. The observed voltage-fall curves for the first type of discharge agree well with theoretical ones derived from the avalanche theory. A study has been made of the dependence of the delay time and switching time on the relative intensity of the illumination used to produce the initial electrons. 10 Refs.
Primary Keywords: Gas Breakdown; Diffuse Breakdown; Spark Channel; Dependence On Initial Electron Number; Switching Delay

6961
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
A NEW METHOD OF HIGH MAGNETIC FIELD GENERATION AND ITS APPLICATIONS
M. Date
Osaka University, Suita, Osaka, Japan
IEEE Transactions On Magnetics, Vol. MAG-12, No. 6, pp 1024-1029 (11/1976).
A new method of generating high pulsed magnetic fields up to about 1 MOe without destroying coils is described. The magnet consists of multi-layer coils which were designed so as to share the strong Maxwell stress within their tensile strength. A small 4-layer model magnet was tested and the maximum field of 1.07 MOe with the pulse width of 0.18 m sec. was obtained without destroying the coil. A three-year project of constructing a high magnetic field laboratory based on the new idea is proceeding in Osaka University. A 1.5 MJ energy source is used to produce up to 1 MOe within a volume of 20 mmD x 20 mm and low temperature experiments will be possible after two years. At present, however, the experiments at liquid helium temperature are limited up to 0.5 MOe. The submillimeter electron spin resonance experiments under the strong field were done using HCN and H/sub 2/O lasers and the determination of exchange constant between dissimilar spins was done. New terms, H/sup 2/ S/sup 2/, H/sup 2/ Si and H/sup 3/ S in the spin Hamiltonian are also discussed. Magnetization measurements in metals and compounds are reported. 21 Refs.
Primary Keywords: Magnetic Field Generation; 1 MOe Field; Multiple Shot Coil; Multi-layer Coil; Stress Sharing; Materials Study

6765
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
LIMITATIONS ON MAGNETIC FIELDS OBTAINED BY FLUX-COMPRESSION: I
G. Lehner, J.G. Linhart and J.P. Somon
Lab Gas Ionizzati, Euratom-CNEN, Frascati, Italy
Nuclear Fusion, Vol. 4, No. 4, pp 362-379 (12/1964).
The losses of a flux compression device are analyzed with the purpose of applying energy balance to estimate limits on magnetic field generation by flux compression. The two primary loss mechanisms considered are field diffusion and liner heating. 20 Refs.
Primary Keywords: Magnetic Field Generation; Flux Compression; Loss Mechanisms; Field Diffusion; Linear Heating; Field Strength Limitation

6968
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
PRODUCTION AND USE OF HIGH TRANSIENT MAGNETIC FIELDS. II
H.P. Furth (1), M.A. Levine (2) and R.W. Waniek (3)
(1) University of California, CA
(2) AFCRL, Bedford, MA 01730
(3) Massachusetts Institute of Technology, Cambridge, MA
The Review Of Scientific Instruments, Vol. 28, No. 11, pp 949-958 (11/1957)
The transient containment of high magnetic energy densities in coils of various geometries is discussed. Inherent mechanical and thermal limitations are shown to apply to coils relying solely on the strength of materials. The usefulness of inertial effects is demonstrated. Instrumentation is described for producing 10 microsecond range pulses of amplitude up to 1.6 megagauss in single-turn coils. Experimental observations document the appearance of 'saw effect' and Kruskal-Schwarzschild instabilities at very high fields. The limitations characteristic of conventional coils can be overcome in force-free geometries. The appropriate mathematics is developed and illustrated with practical examples. 22 Refs.
Primary Keywords: Magnetic Field Generation; Coil Geometry; Coil Materials Strength; 10 Microsecond Pulse Length; 1.6 MG Field Strength; Single Turn Coil

6970
(DIAGNOSTICS AND INSTRUMENTATION)
(B-field)
TECHNIQUE FOR MEASURING MEGAGAUSS MAGNETIC FIELDS USING ZEEMAN EFFECT
W.B. Garn, R.S. Caird, D.B. Thomson and C.M. Fowler
Los Alamos National Labs, Los Alamos, NM 87545
The Review Of Scientific Instruments, Vol. 37, No. 6, pp 762-767 (06/1966).

Rapidly varying magnetic fields with peak values in the range from 1 to 5 MG are measured by use of sweeping image spectrographic method. Atomic spectral lines from an exploding wire light source situated in the experimental region are recorded as the magnetic field varies in a few microseconds from a moderate initial value of a few tens of kilogauss to the peak values. Field measurements are generally accurate to within 2-3% as determined by the consistency of measurements made from several different spectral lines. The sodium D lines and the indium I 4102 Angstrom line have proven to be exceptionally useful for field determinations. The highest field determined to date by this method is 5.1 MG, corresponding to a measured separation of 164 Angstroms between the centers of the shorter and longer wavelength doublets which the Na/sub D/ lines assume in very high fields. The doublets, of approximately 4 Angstrom separation, are not themselves resolved. 9 Refs.

Primary Keywords: Magnetic Field Measurement; Zeeman Effect; 5 MG Measurement Range; 3 Per Cent Accuracy; 164 Angstrom Give Separation

6971
(PARTICLE BEAMS, ELECTRON)
(Generation)
'MINUS' PULSED, HIGH-CURRENT, NANOSECOND, ELECTRON ACCELERATOR
I.B. Dzhelepov, G.E. Gladyshev, B.T. Plachenov, B.N. Pugachev, O.S. Sirotyuk, Yu.V. Terent'ev, V.A. Rodichkin and K.I. Finkel'shtein
Lensovet Leningrad Technological Institute, USSR
Instruments And Experimental Techniques, Vol. 23, No. 2, pp 327-330 (04/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 38-40 (March-April 1980)

A description is given of a high-current electron accelerator with an energy of 500 keV, a beam current of 7 kA, and a pulse duration of 5-7 nsec. The electrons, emitted from a multipoint cathode with an area of 20 x 200 mm, are accelerated in a vacuum diode gap. Titanium foil 50 micron thick serves as the anode. The double shaping line of the accelerator is charged from a pulse transformer. 2 Refs.

Primary Keywords: E-beam Generation; 500 keV Beam Energy; 7kA Current; 5-7ns Beam Duration; Multipoint Cathode; Titanium Anode

6972
(PARTICLE BEAMS, ELECTRON)
(Generation)
A GENERATOR PRODUCING NANOSECOND PULSES OF FAST ELECTRONS
N.V. Belkin, V.V. Bogolyubov, V.I. Kolesov and L.N. Khudyakova
Instruments And Experimental Techniques, Vol. 18, No. 2, pp 341-343 (04/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 19-21 (March-April 1975)

The principle of operation and the characteristics of a portable pulsed source of fast electrons are described. The generator is fabricated according to a circuit with recharging of a capacitor. An autoelectronic tube with a foil cathode, which is equipped with a beryllium window for release of the electron beam into the atmosphere, is used in the generator. The source creates electron pulses having a length of approximately 1.5 nsec at the half-height. The amplitude of the accelerating voltage is approximately 200 kV. The maximum electron current is at least 200 A. 5 Refs.

Primary Keywords: E-beam Generation; Portable Apparatus; Autoelectronic Tube; Foil Cathode

6973
(PULSE GENERATORS)
(Spiral)
A HELICAL PULSE-VOLTAGE GENERATOR
A.B. Geresimov, I.M. Roife, E.B. Seredenko and B.A. Stekol'nikov
Scientific-Research Institute Of Electro-Physical Equipment, Leningrad, USSR
Instruments And Experimental Techniques, No. 3, pp 819-821 (06/1970)
Trans. From: Pribor, i Tekhnika Eksperimenta 3, 163-165 (May-June 1970)

The results are presented of a study of models of a spiral generator (SG). It is found that for certain values of the parameters the selection of the width of the stripline affects the SG efficiency. An empirical formula is presented for estimating the optimum number of turns of the spiral. The load characteristics of the SG are also presented, and the possibility is discussed of using a SG in laboratory practice. 1 Refs.

Primary Keywords: Spiral Generator; Stripline Width; Efficiency; Design Considerations

6974
(PULSE GENERATORS)
(Trigger)
A 20-CHANNEL GENERATOR OF HIGH-VOLTAGE PULSES
P.S. Anan'in and A.P. Kashirin
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 23, No. 1, pp 119-121 (02/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 121-123 (January-February 1980)

A 20-channel generator of high-voltage pulses operating on an unmatched load is described. The wave impedance of the channels is 50 ohm. The maximum amplitude of the pulses is up to 15 kV on a high-impedance load and 7.5 kV on a matched load. The pulse duration is 100 nsec with a front duration of 12 nsec; the delay introduced by the generator is 200 +or- 2.5 nsec. Compensation of the pulse duration formed and isolation of the pulse reflected from the load are provided for in the monitoring systems. The parameters of the load can be characterized from the shape and amplitude of the reflected pulse. 3 Refs.

Primary Keywords: Pulse Generator, 20 Channel Output; Fixed Delay, Load Characterization, 50 ohm Load, 7.5 kV Output

6975
(PARTICLE BEAMS, ION)
(Generation)
ACCELERATION OF IONS FROM AN EXPLOSIVE-EMISSION PLASMA
E.I. Logachev, G.E. Remnev and Yu.P. Usov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Technical Physics Letters, Vol. 6, No. 11, pp 605-606 (11/1980).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 6, 1406-1406 (November 1980)

Much progress has been achieved in recent years in the production of high-current beams of light ions with energies of a few hundred keV and power levels up to 1E12 W. In most cases the ion source has been the plasma produced when a discharge is produced along the surface of a hydrocarbon insulator by the accelerating-voltage pulse. Ions of intermediate mass, in particular, carbon ions, are accelerated during injection of plasma from an auxiliary plasma source into the accelerating gap. In this letter we report the results of the first experiments on the acceleration in a plane diode of ions from an explosive-emission plasma, which is produced by applying to the anode (the high-potential electrode) a negative-polarity pulse before the positive accelerating-voltage pulse. 6 Refs.

Primary Keywords: Intense Ion Beam Production; Intermediate And Heavy Elements; Explosive-emission Plasma; Plasma Production

6976
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
CURRENT DIFFUSION IN CYLINDRICAL EXPLODING WIRES AND FUSES DURING MICROSECOND ELECTRICAL PULSES
F.D. Bennett
Army Amament Research and Development Command, Aberdeen Proving Ground, MD 21005
Journal Of Applied Physics, Vol. 42, No. 7, pp 2835-2839 (06/1971).

Existing solutions to the diffusion equation for current in a cylindrical conductor are used to provide estimates of the nonuniformity of current density during typical wire explosions. These estimates are given in the form of inequalities which are then used to specify the conditions under which current distribution and heating effect can be considered uniform. 7 Refs.

Primary Keywords: Exploding Wire; Current Density Nonuniformity; Diffusion Equation; Uniform Heating; Current Ramp Solution; Theory

6977
(BREAKDOWN STUDIES)
(Liquid, Electrical)
BREAKDOWN OF WATER IN A SYSTEM WITH 'DIFFUSION' ELECTRODES
V.V. Vorob'ev, V.A. Kapitonov, E.P. Kruglyakov and Yu.A. Tsidulko
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 25, No. 5, pp 598-602 (05/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 993-999 (May 1980)

Results are presented of experiments pertaining to breakdown of water in an interelectrode gap with conducting layers near the surface of the electrodes. The electric field strength in the gap varied up to approximately 1.5 MV/cm. The conducting layers shielded the electrodes, causing the electrical strength to increase over that of pure water by approximately fourfold. 9 Refs.

Primary Keywords: Water Breakdown; 1.5 MV/cm Electric Field Strength; Conducting Layers; Uniform Magnetic Field; Diffusion Electrode

6978
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
CERTAIN FEATURES OF EXPLODING WIRES
V.S. Sedoi
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 21, No. 8, pp 983-985 (08/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 1707-1710 (August 1976)

One of the remarkable properties of exploding wires is the rapid increase of resistance during the explosion. Because of this resistance increase exploding wires can be used as fast, high-voltage current breakers, as fuses, and in devices for shaping high-voltage pulses. The mechanism for the resistance increase and the characteristics of the wire during the destruction stage have not yet been established, and experimental work in this field is of both practical and scientific interest. In the present paper we report a continuation of the work of several other workers. We offer a quantitative description of the electrical characteristics of the explosion during the destruction stage, the input energy before the current pause and the height U/sub i/ and length t/sub i/ of the voltage pulse which arises during the rapid increase in the resistance. 13 Refs.

Primary Keywords: Exploding Copper Wires; Rapid Resistance Increase; Destruction Stage Characteristics; Opening Switch; Input Energy; Current Pause

6979
(PARTICLE BEAMS, ELECTRON)
(Generation)
CHARACTERISTICS OF A HOLLOW ELECTRON BEAM IN A MAGNETICALLY INSULATED DIODE
S.Yu. Belomyttsev, S.P. Bugaev, V.I. Koshelev, G.A. Mesyats, G.S. Repova, V.M. Sveshnikov, K.N. Sukhushin and M.N. Timofeev
Soviet Technical Physics Letters, Vol. 4, No. 12, pp 582-583 (12/1978).
Trans. from: Pis'ma Zhurnal Tekhnicheskoi Fiziki 4, 1438-1442 (December 1978)

Foil-free diodes with magnetic insulation are frequently used to form hollow electron beams. In electron sources of this kind it is important to know whether the beam current is limited by the diode or by the transport system. The ratio of the beam current i/sub b/ to the maximum current for the transport system, i/sub max/, determines the beam potential (or energy) in the drift volume. The authors report on experiments with a long-pulse, plasma cathode, magnetically insulated diode. Two geometries are considered: coaxial and end-free types. 9 Refs.

Primary Keywords: E-beam Generation; Field Emission Diode; Magnetic Insulation; Coaxial Geometry; End-free Geometry

6980
(BREAKDOWN STUDIES)
(Gas, E-beam)
CONDITIONS FOR THE MAINTENANCE OF THE CURRENT IN THE CATHODE LAYER OF A SEMI-SELF-MAINTAINING VOLUMETRIC DISCHARGE EXCITED BY AN ELECTRON BEAM
Yu.D. Korolev (1), V.B. Ponomarev (2) and V.S. Synakh (2)
(1) Academy of Sciences of the USSR, Tomsk, USSR
(2) Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 20, No. 1, pp 15-18 (02/1979).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 20, 21-25 (January-February 1979)
The distribution of an electric field in a gas gap with the flow of a semi-self-maintaining discharge through the gap is characterized by the presence of preelectrode regions with an increased intensity of the field and the column of the discharge, where the field is approximately homogeneous. With a small rate of generation of electron-ion pairs psi and small applied voltages U/sub o/, there are strong screening conditions. Under these conditions shock ionization, as a rule, is insignificant. With high values of psi and U/sub o/, the electrical field in the cathode region rises so much that the principal mechanism of the generation of charged particles can become shock ionization. Then, the processes in the cathode layer of a discharge excited by a beam and of a glow discharge are similar in many respects. Therefore, the use of methods of calculation developed for the investigation of a glow discharge has made it possible to obtain certain evaluations for the case of large currents. 7 Refs.
Primary Keywords: Volume Discharge, Current Maintenance; Semi-self-maintaining; Shock Ionization; Cathode Layer Transformations; E-field Calculation

6981
(POWER CONDITIONING)
(Pulse Forming Lines)
CORRECTION OF THE CHARACTERISTIC OF A SPARK COMMUTATOR WITH A HETEROGENEOUS SHAPING LINE
B.M. Koval'chuk, V.V. Kremnev and G.A. Mesyats
Scientific-Research Institute Of Nuclear Physics, Electronics, And Automation, USSR
Instruments And Experimental Techniques, No. 6, pp 1409-1411 (12/1966).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 119-121 (November-December 1966)
A formula is derived for the profile of a heterogeneous shaping line for pulse correction, under the assumption that the voltage decay across the commutator, which causes elevation of the pulse peak at the load, is practically independent of the impedance of the discharge circuit. The obtained relation is confirmed experimentally with 4-ohm strip lines at 5 kV. The characteristic impedance of the heterogeneous line varied from 2.8 to 4.1 ohm. 4 Refs.
Primary Keywords: Heterogeneous Shaping Line; 2.8-4.1 Ohm Line Impedance; Spark Commutator; Strict Pulse Peak Current Stability; Strip Line

6982
(PARTICLE BEAMS, ELECTRON; INSULATION, MAGNETIC)
(Generation)
CROSS-FIELD CURRENT FLOW IN A MAGNETICALLY INSULATED DIODE
I.Z. Gleizer, A.N. Didenko, Yu.P. Usov, V.I. Tsvetkov and A.A. Shatanov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 25, No. 6, pp 760-762 (06/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 1323-1326 (June 1980)
Magnetically insulated diodes are widely used for producing high-current electron beams and find application for generating powerful superhigh-frequency radiation of microsecond duration. In this paper we study the passage of current across the magnetic field in high-current magnetically insulated electron diodes in the microsecond range, where failure of the magnetic insulation can limit the pulse length. 9 Refs.
Primary Keywords: Magnetic Insulation; Cross-field Current Flow; High-current Electron Beams; Magnetically Insulated Electron Diodes; Variable Pulse Length

6983
(BREAKDOWN STUDIES)
(Liquid, Electrical)
DEVELOPMENT OF A DISCHARGE IN A LIQUID DIELECTRIC WITH RAMP FUNCTION VOLTAGE PULSES
V.Ya. Ushakov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 10, No. 10, pp 1420-1423 (04/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1844-1847 (October 1965)
Earlier we have published preliminary results of an investigation of the breakdown of distilled water in the case of ramp-function voltage pulses of positive polarity. In the present article we describe the results of investigations of breakdown in pure transformer oil, ethyl alcohol, and distilled water (rho=3E5 ohm/cm) in a rod-plate electrode system, the rod having either positive or negative polarity. 7 Refs.
Primary Keywords: Water Breakdown; Discharge Development; Ramp Function Voltage Pulses; Rod-plate Electrode System; Liquid Dielectric Breakdown; Ionization Process

6985
(BREAKDOWN STUDIES; SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas, E-beam; Gas Gaps, E-beam; Gas Gaps, E-beam)
DISCHARGE IN A HIGH-PRESSURE GAS, INITIATED BY A BEAM OF FAST ELECTRONS
B.M. Koval'chuk, V.V. Kremnev, G.A. Mesyats and Yu.F. Potalitsyn
Academy of Sciences of the USSR, Tomsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 12, No. 6, pp 803-809 (12/1971).
Trans. From Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 6, 21-29 (November-December 1971)
It has been shown that, to avoid forming a discharge channel in a high pressure gas, one must have many initiating electrons before the start of the discharge, distributed over the cathode or through the discharge gap volume. To achieve this Koval'chuk et al. proposed using a beam of fast electrons. The present paper presents results of investigation of a discharge in nitrogen at pressures up to 16 atm, initiated by a beam of electrons with an average energy of 100 to 350 keV. A channel-less type of discharge was obtained for voltages above 1E5 V and for switched currents of tens of kiloamperes. This type of discharge has typically a specific absorbed power in the gas of the order of 1E7 to 1E9 W/cu cm, or more for a time of the order of 1E-8 sec. 7 Refs.
Primary Keywords: Discharge Channel Formation; 100 To 350 keV Average Beam Energy; High-voltage Nanosecond Pulse Generator; 1E-8 sec Beam Duration; 3E-9 sec Current Rise Time

6986
(BREAKDOWN STUDIES)
(Liquid, Electrical)
EFFECT OF THE INITIAL CONDITIONS ON THE DYNAMICS OF AN UNDERWATER SPARK. I. EFFECT OF THE PARAMETERS OF THE GENERATOR AND THE MEDIUM
E.V. Krivitskii, V.D. Kustovskii and A.P. Slivinskii
Planning And Design Bureau Of Electrohydraulics, Academy of Sciences of the Ukrainian SSR, Nikolaev, USSR
Soviet Physics-Technical Physics, Vol. 25, No. 8, pp 993-998 (08/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 1705-1712 (August 1980)
The dynamics of an underwater spark are investigated by using a numerical-analytical method. The system of equations for the channel, which consists of an equation for the discharge circuit and another for the internal energy balance in the discharge channel, are closed by using an experimentally established proportionality between the internal energy and the electrical conductivity of the plasma. Satisfactory agreement is obtained between the experimental and calculated curves for the current, resistance, and radius of the channel. The range of discharge conditions under which the system is valid is established. The channel dynamics are very sensitive to such initial conditions as the electrical conductivity of the plasma and the parameters of the discharge circuit. 9 Refs.
Primary Keywords: Underwater Spark Dynamics; Plasma Conductivity; Discharge Circuit Parameters Established; Discharge Channel Energy Balance; Channel Current; Channel Resistance; Emperical Formula

6987
(BREAKDOWN STUDIES)
(Liquid, Electrical)
EFFECT OF THE INITIAL CONDITIONS ON THE DYNAMICS OF AN UNDERWATER SPARK. II. EFFECT OF AN EXTERNAL SOURCE OF PUMP ENERGY
E.V. Krivitskii, V.D. Kustovskii and A.P. Slivinskii
Planning And Design Bureau Of Electrohydraulics, Academy of Sciences of the Ukrainian SSR, Nikolaev, USSR
Soviet Physics-Technical Physics, Vol. 25, No. 8, pp 998-1000 (08/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziziki 50, 1713-1716 (August 1980)
The effect of a source of pump energy on the dynamics of a pulsed underwater discharge is investigated. A system of equations, describing the dynamics of the underwater spark channel with a linear voltage drop is used. A numerical solution is obtained for this system. The electrical characteristics of different discharge conditions are determined. An additional source of pump energy has a strong effect on the electrical and hydrodynamic characteristics of the underwater spark channel. 1 Refs.
Primary Keywords: Underwater Spark Dynamics; External Pump Energy Source; Maximum Electroacoustical Efficiency; Maximum Pulse Pressure; Constant Discharge-channel Length

6988
(BREAKDOWN STUDIES)
(Gas, RF)
EFFICIENCY OF ENERGY TRANSFER TO AN ELECTRODELESS HIGH-FREQUENCY DISCHARGE
S.I. Andreev, M.P. Venyukov, A.A. Egorova and B.M. Sokolov
Soviet Physics-Technical Physics, Vol. 12, No. 7, pp 910-913 (01/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1252-1257 (July 1967)
The efficiency of energy transfer from an oscillatory circuit to a gas discharge occurring inside a quartz vessel which is located in the coil is considered. The investigation is carried out in inert gases for pressures of 10-100 Torr for various circuit parameters and dimensions of the plasma vessel. The experimental data are in good agreement with theory. 8 Refs.
Primary Keywords: Gas Breakdown; RF Discharge; Quartz Vessel; Energy Transfer Efficiency

6989
(BREAKDOWN STUDIES)
(Solid, Electrical)
ELECTRIC BREAKDOWN IN SOLID DIELECTRICS
G.A. Vorob'ev and N.S. Nesmelov
Tomsk Institute Of Automatic Control Systems And Radioelectronics, USSR
Soviet Physics Journal, Vol. 22, No. 1, pp 70-80 (01/1979).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 22, 90-104 (January 1979)
It is known that three main forms of solid-dielectric breakdown may be distinguished: 1) electrothermal; 2) electrical; 3) electrochemical. The laws of electrothermal and electrochemical breakdown are required for the design and construction of power-station insulation. The laws of electrical breakdown are important in constructing the insulation of equipment for the application of a pulsed load. In addition, in the case of electrical breakdown, it is usual to consider the interaction of electrons with a solid structure, and therefore the laws of electrical breakdown give certain information on the solid structure. It is now half a century since the first scientific hypotheses appeared, but much work remains to be done on dielectric breakdown. Various explanations of breakdown have been proposed. These explanations have been given in many monographs and reviews and there is no point in repeating them here. It is sufficient to note that over the last 30 years theoreticians have tended to the view that the electrical breakdown of solid dielectrics is due to impact ionization by electrons and that the theory must be based on the solution of the kinetic equations. There is definite interest in giving an account for all these processes within the scope of a single paper, which has not been done before. 85 Refs.
Primary Keywords: Solid-dielectric Breakdown; Electrothermal; Electrical; Electrochemical; Impact Ionization; Prebreakdown Phenomena

6990
(BREAKDOWN STUDIES)
(Liquid, Electrical)
ELECTRICAL CHARACTERISTICS OF A SPARK DISCHARGE IN A CIRCULATING TRANSFORMER OIL
G.S. Korshunov, G.A. Kiselev and Yu.B. Fortes
Applied Electrical Phenomena, No. 4 (28), pp 282-286 (08/1969).
Trans. From: Elektronnaya Obrabotka Materialov 4, 41-46 (July-August 1969)

At the present time gas-filled and vacuum-type peaked spark dischargers of various constructions are widely used as sources of high-voltage, sharp-fronted pulses. This is largely because the working medium of such dischargers has a sufficiently long-term stability when subjected to the effects of the electrical discharges occurring periodically between the electrodes. For this reason the electric field strength in the gap remains nearly constant from breakdown to breakdown; to a large extent this makes possible the stabilization of the parameters set up during the peaking of the high-voltage pulses. 6 Refs.

Primary Keywords: Oil Breakdown; Circulating Transformer Oil; Peaking Discharger; Stable Voltage Pulse Parameters; Almost Constant Breakdown Characteristics; Good High Frequency Operation; Minimal Energy Losses

6991
(BREAKDOWN STUDIES)
(Liquid, Electrical)
ELECTRICAL CONDUCTION AND DEVELOPMENT OF BREAKDOWN IN LIQUID DIELECTRICS
V.Ya. Ushakov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics Journal, Vol. 22, No. 1, pp 81-94 (01/1979).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 22, 105-121 (January 1979)

The development of electrical power, associated with increase in the volume of power transmission, in operational-stress levels, and in the power and reliability of individual units, imposes ever more stringent requirements on electrical-engineering materials and, in particular, on insulating materials. The high electrical strength of insulating liquids, their good heat-conduction and arc-suppression properties, their technological convenience, their cheapness, and their self-repair after breakdown--these and a whole series of other qualities are responsible for the wide use of liquids as insulation in high-voltage equipment. The rapid increase in the electrical strength of liquids with decrease in the time of application of the potential and the high dielectric permittivity of most insulating liquids, in combination with the properties already noted, mean that they provide an irreplaceable insulating medium in accumulator and line-forming generators of high-voltage pulses, which, as is known, have been widely used in recent years to obtain powerful beams of relativistic electrons, giant x-ray scintillations, strong pulsed electromagnetic fields, etc. Because of restrictions of space, the present work deals extremely briefly with some aspects of liquid-dielectric conduction and breakdown, while no consideration at all is given to others. 80 Refs.

Primary Keywords: Weak Electrolytes; Electrical Conduction; Breakdown Development; Liquid Dielectrics; Strong Electric Field; Ionization

6995
(BREAKDOWN STUDIES)
(Solid, Electrical)
ENERGY BALANCE FOR A SPARK IN A SOLID DIELECTRIC
N.T. Zinov'ev and B.V. Semkin
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 3, pp 369-370 (03/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 624-626 (March 1978)

In the boundary-value problem associated with the properties of the flow around an expanding spark in a condensed dielectric the boundary condition is incorporated in the energy-balance equation for the spark channel. For a 'buried' discharge in a solid dielectric, in which case measures are taken to prevent the products produced in the spark channel from escaping into the ambient medium, the energy-balance equation contains only three terms (in a first approximation), by analogy with discharges in liquids. The authors compare experimental results to those obtained with the proposed breakdown model. 8 Refs.

Primary Keywords: Solid Dielectric; Energy-balance Equation; Spark Channel; Boundary Condition; 5000 pF Discharge Capacitance; 9 Microhenry Circuit Inductance; Theory, Comparison With Experiment; Plexiglas

6997
(BREAKDOWN STUDIES)
(Gas, E-beam)
EXTERNALLY MAINTAINED DISCHARGE WITH A GASDYNAMIC WINDOW FOR A LOW-ENERGY ELECTRON BEAM
Yu.I. Bychkov, Yu.D. Korolev, G.A. Mesyats, D.A. Moskov, V.V. Osipov, L.N. Orlikov, A.G. Filonov and E.V. Chikin
Soviet Technical Physics Letters, Vol. 4, No. 5, pp 206-207 (05/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 4, 515-518 (May 1978)

Systems in which fast electron beams are used to excite volume discharges generally include an accelerator with an exit window made of a thin foil, which isolates the accelerating gap from the gas-filled gap and which isolates the discharge cell with its power supply. This exit window complicates the design and operation of the system because it tends to fail in cw operation; moreover, the electrons must be accelerated to high energies in order to pass through the window without losing energy (high-energy electrons are not the optimum choice for ionizing the gas because the ionization cross section decreases with increasing energy). In this letter we report the first results on the use of a special accelerator with a quasidynamic window for the excitation of a volume discharge. 7 Refs.

Primary Keywords: Volume Discharge; E-beam Sustained; Gas Dynamic Window; Low Loss; Glow Discharge

6998
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
FORMATION OF A HIGH-CURRENT VACUUM SPARK BY THE HIGH-SPEED INTERFEROMETRY METHOD
S.P. Bugaev, R.B. Baksht, E.A. Litvinov and V.P. Stas'ev
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
High Temperature, Vol. 14, No. 6, pp 1027-1032 (12/1976).
Trans. From: Teplofizika Vysokikh Temperatur 14, 1145-1150 (November-December 1976)

This article gives the results of an investigation of the distribution of the electron concentration in a vacuum spark with a duration of 100 nsec, with a current of 4 kA and an interelectrode distance of 0.7 mm. The work was carried out using a Michelson interferometer with a spatial resolution of 30 micron. It is shown that the maximal concentration is attained at the anode in the final phase of the discharge, and amounts to 1E19 cu.cm. 8 Refs.

Primary Keywords: High-current Vacuum Spark; Electron Concentration Distribution; 100 ns Spark Duration; 4 kA Current; 0.7 mm Interelectrode Distance; 1E19 cu.cm. Maximal Concentration; Anode And Cathode Flares; Michelson Interferometer

6999
(BREAKDOWN STUDIES)
(Liquid, Electrical)
FORMATION OF ELECTRICAL BREAKDOWN IN AQUEOUS SODIUM CHLORIDE SOLUTIONS
N.P. Mel'nikov, G.A. Ostroumov and M.Yu. Stoyak
A.A. Zhdanov Leningrad State University, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 9, No. 5, pp 730-733 (11/1964).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 34, 949-951 (May 1964)

A high-speed SFR-2M camera has been used to refine some previous results, obtain new data on the rate at which the discharge channel and its gas envelope develop, and follow the development of shock waves (spherical and cylindrical). 2 Refs.

Primary Keywords: Electrolyte Breakdown; NaCl Solution; Photographic Diagnostic; Spark Channel; Gas Envelope; Shock Wave

7000
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Vacuum Gaps, Electrical)
FORMATION OF NEW EMISSION CENTERS ON A CATHODE DURING CURRENT SWITCHING IN VACUUM. I. FORMATION OF NEW EMISSION CENTERS
D.I. Proskurovskii and V.F. Puchkarev
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 12, pp 1474-1478 (12/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2611-2618 (December 1979)

The conditions prevailing in the cathode sheath are analyzed. It is shown that the formation of new emission centers below the plasma of the cathode spot by a mechanism involving explosion of microscopic fine tips can occur at distances approximately 1E-4 cm from the primary emission center, while a mechanism involving the breakdown of nonmetallic inclusions and films on the cathode can explain the formation of new emission centers at distances out to 1E-2 cm. The appearance of emission centers on a narrow probe separated from the point of ignition on the cathode by a distance of 4E-3 - 1.2 cm is studied in the spark and arc stages of a vacuum discharge. The experimental results can be explained well by the second mechanism for the formation of new emission centers. 30 Refs.

Primary Keywords: Current Switching; New Emission Center Formation; Microscopic Fine Tip Explosions; Cathode Spots; Cathode Potential Drop Increase; Cathode Inclusions; Cathode Film

7001
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, Electrical; Vacuum Gaps, Electrical)
FORMATION OF NEW EMISSION CENTERS ON A CATHODE DURING CURRENT SWITCHING IN VACUUM. II. EXPERIMENTAL CONFIRMATION FOR VACUUM DISCHARGES
D.I. Puchkarev and V.F. Proskurovskii
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 12, pp 1479-1481 (12/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2619-2622 (December 1979)

The results derived in part 1 of this work are used to show that nonmetallic inclusions and films on the cathode determine the nature and velocity of the rapidly moving cathode spots, the nature of the cathode erosion in nanosecond vacuum discharges, the spontaneous appearance of new cathode spots in vacuum sparks, and the appearance of cathode spots and moving double layers in 'straight-discharge' devices. 14 Refs.

Primary Keywords: Vacuum Breakdown; Experimental Confirmation; Nonmetallic Inclusions And Films; Cathode Spot Appearance; Cathode Spot Motion

7003
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
FORMATION OF PLASMA CHANNEL BY A VACUUM SPARK
R.B. Baksht, B.A. Kablambaev and N.A. Ratakhin
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 25, No. 6, pp 779-780 (06/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 1350-1351 (June 1980)

In recent years there has been growing interest in processes which occur in the plasma of a vacuum spark in connection with the discovery that such plasma contains high-temperature regions, dubbed 'plasma points'. The initial phase in the formation of a plasma point follows immediately after vacuum breakdown, and the transition from a weakly ionized metal vapor to a plasma with classical conduction is of unquestionable interest for the study of this effect. In the present paper Thomson scattering was used to study the plasma of a pulsed vacuum spark, induced in a two-electrode apparatus with an igniting device, an apparatus such as is usually employed in investigations of this kind. 5 Refs.

Primary Keywords: Vacuum Breakdown; Plasma Channel Formation; Plasma Points; Thomson Scattering; Pulsed Vacuum Spark; Electron Density Distribution; Spark Channel Temperature

7004
(BREAKDOWN STUDIES)
(Gas, Electrical)
FORMATION OF THE SPARK CHANNEL AND CATHODE SPOT IN A PULSED VOLUME DISCHARGE
R.B. Baksht, Yu.D. Korolev and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Journal Of Plasma Physics, Vol. 3, No. 3, pp 369-371 (06/1977).
Trans. From: Fiz. Plazmy 3, 652-656 (May-June 1977)

The formation of the cathode spot was studied in a nanosecond volume discharge in an atmosphere of industrial-grade nitrogen at a pressure of 50-100 Torr. The electrode separation was 1 cm, and the height of the voltage pulse applied to the electrodes was 10-30 kV. Spectrograms and photographs of the emission of the discharge in various stages are shown. Photoelectric detection of the spectral lines of atomic copper was used to determine the time at which the cathode spot appears. The formation of the cathode spot is shown to be preceded by the appearance of diffuse channels with a relatively high current density. These channels lead to an increase in the electric field at the cathode and to a subsequent explosion of microscopic protuberances on the cathode. 12 Refs.

Primary Keywords: Spark Channel Formation; Cathode Spot; Nanosecond Volume Discharge; 50-100 Torr Pressure Nitrogen; 1 cm Electrode Separation; 10-30 kV Pulse Height

7006
(BREAKDOWN STUDIES)
(Liquid, Electrical)
GAS FORMATION IN LIQUID IN INITIAL STAGES OF A PULSED DISCHARGE
V.Ya. Ushakov and V.M. Muratov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics Journal, Vol. 15, No. 11, pp 1568-1572 (11/1972).
Trans. From: Izvest za Vysshikh Uchebnykh Zavedenii Fizika 15, 42-47 (November 1972)

Gas formation in electrolytes with gamma=1E-2 - 1E-4 ohm cm, distilled water gamma=1E-3 - 1.5E-6 ohm cm, and chemically pure nehexane in the initial stages of formation of discharge with rectangular voltage pulses of 0.67 and 1.85 microsecond duration is investigated. The experimental results are compared with the results of approximate calculations. 13 Refs.

Primary Keywords: Liquid Breakdown; Electrolyte Breakdown; Gas Formation; Pulsed Discharge Channel Formation; High Electrical Conductivity; Experiment; Theory

7007
(PULSE GENERATORS)
(Pulse Forming Lines)
GENERATOR OF HIGH-VOLTAGE RECTANGULAR PULSES
M.U. Buletov, B.K. Toropov, V.G. Filippov and E.M. Chernov
Instruments And Experimental Techniques, Vol. 22, No. 6, pp 1589-1591 (12/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 101-103 (November-December 1979)

A generator of high-voltage rectangular pulses, built in the form of four series-connected, 10-element, two-stage shaping lines (TSL), is described. Each TSL is switched by a multigap discharger controlled by a spiral generator. The triggering range of the discharger is 80%. The maximum load voltage is 320 kV, the pulse duration is 20 microseconds, the current is 10 kA, and the irregularity of the top of a pulse is <=1-2%. 7 Refs.

Primary Keywords: Pulse Generator; Pulse Shaping Line; Rectangular Output; Spiral Generator; 320 KV Output Voltage; <2% Droop

7009
(PARTICLE BEAMS, ELECTRON)
(Generation)
IMPROVED STABILITY OF EXPLOSIVE-EMISSION MULTIPLE-TIP CATHODES
V.A. Burtsev, M.A. Vasilevskii, I.M. Roife, E.V. Seredenko and V.I. Engel'ko
Soviet Technical Physics Letters, Vol. 4, No. 9, pp 436-437 (09/1978).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 4, 1083-1087 (September 1978)

Bazhenov et al. have shown that explosive-emission cathodes can be used to produce electron-current pulses approximately 1E-4 sec long. Comparable pulse lengths are achieved elsewhere with multiple-tip cathodes. However, the operation of a diode with an explosive-emission cathode in a long current pulse has certain characteristics that can restrict the practical use of these diodes. For example, the electron current fluctuates; the number of working tips decreases at low diode voltages; and the operation of the diode can be unstable. To study the factors responsible for these effects, we have carried out experiments with a multitip explosive-emission cathode. The emitters are bundles of graphite fibers; in the present experiments these fibers are attached to the metal substrate through insulators. 3 Refs.

Primary Keywords: E-beam Generation; Multitip Cathode; Explosive Emission; 1E-4 sec Pulse Length; Guard Electrode

7010
(BREAKDOWN STUDIES)
(Liquid, Electrical)
INITIATION AND DEVELOPMENT OF NANOSECOND DISCHARGES IN LIQUIDS
V.V. Lopatin, V.Ye. Ushakov and V.P. Chernenko
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics Journal, Vol. 18, No. 3, pp 376-381 (03/1975).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 18, 100-106 (March 1975)

The initiation and development of discharges in purified water and hexane were studied for pulse rise times of T/sub r/ approximately 2-3 nsec and pulse lengths of T/sub p/ approximately 10-50 nsec by an oscilloscopic method and with an electron-optical image converter. The results are compared with data on the nanosecond breakdown of gases. A physical interpretation is offered for the observed behavior. 13 Refs.

Primary Keywords: Liquid Breakdown; Purified Water; 2-3 nsec Pulse Rise Times; 10-50 nsec Pulse Lengths; Pulsed Electrical Breakdown; Discharge Development; Pure Hexane; 400 kV Pulse Amplitude; Point-plane Electrode System

7011
(BREAKDOWN STUDIES)
(Gas, RF)
INVESTIGATION OF THE ENERGY TRANSFER EFFICIENCY FOR A PULSED INDUCTION DISCHARGE
S.I. Andreev, O.G. Baikov, P.N. Dashuk, E.A. Sergeenkova and M.D. Yarysheva
Soviet Physics-Technical Physics, Vol. 14, No. 6, pp 774-778 (12/1969).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 1032-1038 (June 1969)

An investigation was carried out of the energy transfer efficiency for a noninductive capacitor discharge at conditions near the upper limit of rate of current increase in xenon, argon, and neon plasmas. It was found that the most efficient energy transfer to the plasma (of the order of 80%) occurs when multi-turn exciting solenoids are used, and takes place under conditions of high plasma conductivity as determined by its temperature. The temperature reached 25,000 Deg.K. for a xenon discharge at pressures from 2 to 50 Torr. Data are presented for the relative spectral radiant energy distribution. 19 Refs.

Primary Keywords: Gas Breakdown; Neon; Argon; Xenon; Energy Transfer Efficiency; Multiturn Solenoid

7012
(BREAKDOWN STUDIES)
(Solid, Electrical)
MECHANICAL ASPECTS OF THE ELECTRICAL BREAKDOWN OF SOLID DIELECTRICS
B.V. Semkin and V.S. Korolev
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics Journal, Vol. 15, No. 9, pp 1348-1351 (09/1972).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 15, 128-132 (September 1972)

The possibility of mechanical failure of a solid dielectric due to ponderomotive forces being the first cause of its impulse electrical breakdown has been studied on a number of occasions. It was shown that the mechanical stresses in dielectrics in an electric field of the order of 1 MV/cm are considerable, and in a number of cases are sufficient for the failure of the material. However, so far the hypotheses of the mechanical failure of dielectrics due to field forces have not been substantiated experimentally. 10 Refs.

Primary Keywords: Solid Dielectric Breakdown; Mechanical Stresses; Point-plane Electrode Field; Crack-formation; Incomplete Breakdown Channels; Ponderomotive Force

7014
(PARTICLE BEAMS, ELECTRON)
(Generation)
MICROSECOND HIGH-CURRENT ELECTRON-BEAM ACCELERATOR
V.A. Burtsev, M.A. Vasilevskii, O.A. Gusev, I.M. Roife, E.V. Seredenko and V.I. Engel'ko
Instruments And Experimental Techniques, Vol. 22, No. 5, pp 1223-1226 (10/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 32-35 (September-October 1979)

The main constructional and physical characteristics of a high-current electron accelerator with energy of approximately 0.5 MeV, current of approximately 5 kA and current pulse length of approximately 10 microseconds are given. 6 Refs.

Primary Keywords: E-beam Generation; 0.5 MeV Energy; 5 kA Current; 10 Microsecond Beam Duration; Magnetic Insulation; Cathode Plasma

7016
(BREAKDOWN STUDIES: INSULATION, MATERIAL)
(Solid, Electrical; Solid)
NANOSECOND BREAKDOWN OF POLYMERS
G.A. Vorob'ev and V.S. Korolev
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 21, No. 10, pp 1222-1225 (10/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 2088-2093 (October 1976)

Nanosecond breakdown is studied for several polymers: polyethylene, polystyrene, polymethyl methacrylate, polyvinyl chloride, nylon-6, and teflon. 7 Refs.

Primary Keywords: Nanosecond Breakdown; Several Polymers; Homogeneous Field; Dielectric Strength; Inhomogeneous Field; Point-plane Electrode System; Polarity Effect; Impact Ionization

7017
(BREAKDOWN STUDIES)
(Gas, Electrical)
NANOSECOND GAS DISCHARGE IN AN INHOMOGENEOUS FIELD WITH EXPLOSIVE PROCESSES ON THE ELECTRODES
Yu.D. Korolev, V.A. Kuzmin and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 25, No. 1, pp 418-420 (04/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 699-704 (April 1980)

Air breakdown at pressures 20-500 Torr was investigated in a needle-and-plane electrode configuration with rectangular voltage pulses applied to the gap. Depending on the needle tip polarity, a cathode or anode spot is produced during the first few nanoseconds and the discharge burns in the form of a diffuse channel with a spot on the tip electrode. The contraction process is connected with the growth of spark channels from the cathode and anode spots. 11 Refs.

Primary Keywords: 20-500 Torr Pressures; Air Breakdown; Needle-and-plane Electrode Configuration; Spark Channels; Cathode And Anode Spots; Nonuniform Field; Tip Electrode; Dark Cathode Potential-drop Region

7018
(BREAKDOWN STUDIES)
(Gas, Electrical)
PREBREAKDOWN PROCESSES IN HIGH-PRESSURE GASES
I.M. Bortnik
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 2, pp 156-160 (02/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 259-265 (February 1978)

A current of 1E-11 - 1E-5 A flows through the gap at high gas pressures in a homogeneous field with field intensities well below the breakdown level. Analysis of this current as a function of the gap properties in special experiments shows it results from ionization processes which occur in the local fields near microscopic inhomogeneities of the electrodes. These ionization processes lead to a breakdown of the entire gap or to a self-sustained discharge which is limited by its own space charge. The qualitative and quantitative features of the evolution of the total breakdown of the gap from a localized breakdown agree with the behavior observed for prebreakdown effects in a homogeneous field in a high-pressure gas. On this basis a qualitative picture of the evolution of a high-pressure discharge is given. Appropriate topics for further study are identified. 7 Refs.

Primary Keywords: Prebreakdown Current; High-pressure Gases; 1E-11 1E [illegible] A Current; Homogeneous Field; Ionization Processes

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7019
(BREAKDOWN STUDIES)
(Gas, E-beam)
PROPERTIES OF A SPACE DISCHARGE EXCITED BY AN ELECTRON BEAM OF 1E-5 SEC DURATION
Yu.I. Bychkov, S.A. Genkin, Yu.D. Korolev, Yu.E. Kreindel, G.A. [illegible] and A.G. Mesyats
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics JETP, Vol. 39, No. 2, pp 299-300 (08/1974).
Trans. From: Zhurnal Eksperimental'noi I Teoreticheskoi Fiziki 66 620-625 (February 1974)

A space discharge maintained by a fast-electron beam of 1E-5 sec duration is investigated. Volt-ampere characteristics in CO_2 [illegible] gas mixtures are obtained at different pressures and modes of energy delivery to the discharge volume. The conditions are found for which the space discharge is stable (does not become a spark discharge). 6 Refs.

Primary Keywords: Space Discharge; 1E-5 sec Duration; Fast-electron Beam; Stable Sparkless Discharge Regimes; 250 kV Volt Amplitude

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7025
(BREAKDOWN STUDIES: SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Self)
STABILIZATION OF IGNITION VOLTAGE IN HIGH-PRESSURE SPARKS
N.V. Belkin and E.A. Avilov
Soviet Physics-Technical Physics, Vol. 16, No. 10, pp 1717-1719 (04/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 2167-2169 (October 1971)

Voltage stabilization of pulsed gaps at high values of pd is considered. In two-electrode gaps 1 to 2 mm long at a pressure of 20 to 40 atm it is possible to reduce the spread in ignition voltage by a factor of 3, if the surface of the cathode electrode has a large number of inhomogeneities whose height is 10 to 15% of the gap width. 8 Refs

Primary Keywords: Self-breakdown Spark Gap; High pd; 40 atm Pressure; 2 mm Gap Distance; Cathode Structure; Jitter Reduction

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7026
(BREAKDOWN STUDIES: INSULATION, MATERIAL)
(Liquid, Electrical; Liquid)
STUDY OF THE PULSE ELECTRICAL STRENGTH OF SOME LIQUIDS
N.S. Rudenko and V.I. Tsvetkov
Tomsk Polytechnic Institute, Tomsk, [illegible]
Soviet Physics-Technical Physics, [illegible]
Trans. From: Zhurnal Tekhnicheskoi [illegible]

Relatively large capacit[illegible] intrinsic inductance are [illegible] high-voltage pulse [illegible] is desirable to use as the diel[illegible] constant. In the present articl[illegible] with large dielectric [illegible] application time [illegible]

Primary Keywords: [illegible] Dielectric Constant; [illegible] Dielectric [illegible] Water; [illegible] Glycerine; Ethyl Alcohol

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7028
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
TIME FOR THERMAL INSTABILITY TO DEVELOP IN MICROSCOPIC PROTRUSIONS ON THE CATHODE DURING VACUUM BREAKDOWN
V.A. Nevroskii and V.I. Rakhovskii
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 25, No. 10, pp 1239-1244 (10/1980).
Trans. From: Zhurnal Tekhnicheskoi [illegible] 50, 2127-2135 (October [illegible])

The heating of m[illegible] cathode surface [illegible] electron emission [illegible] It is [illegible] previously proposed relation for calculating [illegible] is not universal and is [illegible] for [illegible] densities [illegible] sufficiently high [illegible] density [illegible] at which thermal instability a[illegible] the mic[illegible] protrusions of the cathode. The problem of heating of a [illegible] protrusion is solved rigorously, taking into account the threshold nature of this instability, and the [illegible] established [illegible] relation from which [illegible] was determined [illegible] as a function of j/s, b o/ and [illegible] of the protrusion. The application of the present [illegible] to different types of [illegible] vacuum is discussed [illegible]

Primary Keywords: [illegible] Vacuum [illegible]

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7033
(BREAKDOWN STUDIES)
(Gas, Electrical)
BREAKDOWN OF THE NEAR-ELECTRODE LAYER IN A FLOW OF IONIZED GAS
G.A. Lyubimov
Journal Of Applied Mechanics And Technical Physics, Vol. 14, No. 3, pp 307-312 (06/1973).
Trans. From: *Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 14, 16-23 (May-June 1973)*

An electric discharge in a flow of ionized gas is widely used in many physics and engineering problems. Among them are problems associated with current flow in various magnetohydrodynamic devices (generators, accelerators), arc shunting in plasmatron, physical experiments in shock tubes, etc. It is known that with cold electrodes providing the contact between the plasma and the external circuit and relatively high pressures, two modes of current flow occur: the discharge abruptly shifts into a discharge with a clearly developed cathode spot at some critical current density (we call this form of discharge an arc discharge). Existing experimental data refers to varying experimental conditions. Furthermore, the critical voltage (or current) at which the transition of the discharge from a distributed discharge to an arc discharge occurs varies within very broad limits. From an analysis of the experimental data, a condition is formulated which the discharge parameters satisfy at the time of transition from a distributed discharge to an arc discharge. 26 Refs.

Primary Keywords: Gas Discharge; Hot Plasma Core; Cold Wall Gas; Low Current, Diffuse Discharge; High Current; Spark Channel; Empirical Formula

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703[illegible]
(ELECTROMAGNETIC FIELD GENERATION)
(Mag[illegible])
COMPRESSION OF A MAGNETIC FIELD BY A CYLINDRICAL CONDUCTING BLANKET OF FLUID
N.I. Akarnov and A.P. Kuznetsov
Magnetohydrodynamics, Vol. 4, No. 4, pp 85-87 (12/1968)
Trans. From: Magnitnaya Gidrodinamika 4, 124-128 (1968)

At present, the literature contains a considerable number of studies devoted to various problems in the theory and use of magnetic cumulative generators intended for creating short-duration high strength magnetic fields. The operation of these generators is based on the fact that the magnetic flux is compressed by a hollow metal cylinder. In this study an attempt is made to analyze the compression of a cylinder with a magnetic flux inside it. The authors consider the compression of a magnetic flux by an axisymmetric infinitely long cylindrical conducting blanket of fluid. In addition, the penetration of the latter by a magnetic field owing to conductivity of the blanket of fluid is examined. The solutions allow for the effect of thickening of the blanket during its compression. 12 Refs.

Primary Keywords: Flux Compression; Liquid Shell; Cylindrical Geometry; Infinite Length; Finite Conductivity; Blanket Deformation

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703[illegible]
(BREAKDOWN STUDIES: SWITCHES, CLOSING)
(Liquid, Electrical; Liquid Gaps, Electrical)
CONTROLLED DISCHARGE IN A LIQUID
[illegible] Ksenov, V.K. Bocharov and S.A. Smirnov
Soviet Physics-Technical Physics, Vol. 13, No. 10, pp 1389-1392 (04/1969).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 38, 1714-1718 (October 1968)

The results are reported of an experimental investigation of the breakdown of technical water by a trigger spark at the surface of one of the electrodes of the main discharge gap in the liquid. It is shown that such a spark can be used to trigger the discharge between the electrodes of the main gap. The trigger spark has the greatest effect on breakdown in water when the voltage is applied to the main gap a certain time after the instant of breakdown of the trigger gap. [illegible] the maximum discharge current, the smallest breakdown [illegible] voltage at which spark breakdown of the gap can occur. The effect of the trigger spark is [illegible] when the energy dissipated in it is increased. 11 Refs

Primary Keywords: Water Breakdown; Technical Water; Trigger, Trigger Energy Dissipation; Delay Optimization

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[illegible]
(BREAKDOWN STUDIES)
[illegible]
[illegible] OF ELECTRICALLY EXPLODING CONDUCTORS IN THE CASE OF CURRENT PULSE LIMITATION
[illegible], V.A. Letyagin, Yu.M. Kasnurnikov and N.V. Grevtsev
Soviet Physics Doklady, Vol. 19, No. 8, pp 530-532 (02/1975).
Trans. From: Doklady Akademii Nauk SSSR 217, 812-815 (August 1974)

The question of the disruptive mechanism of material in an electric explosion continues to be controversial. To a considerable degree this is due to the fact that the usual investigation of the disruptive process in exploding conductors is greatly complicated by the concurrent action of many factors (strong magnetic and electric fields, the influence of the surrounding medium, various nonuniformities in the structure of the conductors, energy supply conditions, etc.). In this connection, the purpose of the research was to study the disruptive process of the conductors after disconnecting the current passing through them at various stages of the electric explosion and, thereby, photographing the subsequent action of the current's electromagnetic field on the conductor. 10 Refs

Primary Keywords: Exploding Wire; Copper Wire; Photographic Diagnostic; Current Pause; Kink Instability; Wire Expansion

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7041
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
ELECTRICAL CHARACTERISTICS OF CONTROLLED HIGH-CURRENT TRIGGERED AIR SPARK GAPS
P.I. Shkuropat
M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 11, No. 6, pp 779-783 (12/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 1058-1064 (June 1966)
Triggered spark-gap devices of the trigatron type are gaining popularity in high pulse-current work and in the production of strong magnetic fields, owning to their simplicity of design and reliability of performance. There are several theories regarding the mechanism by which the discharge is initiated in such devices. The purpose of this investigation was to study the electrical characteristics of high-current trigatron spark gaps, and to elucidate the discharge initiation mechanisms in trigatrons. Two types of trigatron were investigated. In one of them, the one most frequently utilized in practice, the trigger electrode was insulated from the main electrode by a porcelain bushing. The second type of trigatron, investigated earlier, did not incorporate a readily damaged insulator bushing, so that it had a higher current handling capacity. 14 Refs.
Primary Keywords: Trigatron Spark Gap; Triggering Probability; Operating Voltage Range vs Gap Length, Polarity Effects, Voltage Fall Measurement
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7043
(BREAKDOWN STUDIES)
(Exploding Foils)
ELECTRICAL EXPLOSION OF A CYLINDRICAL FOIL IN AIR. CURRENT DISTRIBUTION IN THE HIGH-CURRENT SHUNTING DISCHARGE
V.A. Burtsev, V.A. Dubyanskii, N.P. Egorov, M.P. Kasatkina, A.B. Produvnov and I.V. Shestakov
D.V. Efremov Institute, Leningrad, USSR
Soviet Technical Physics Letters, Vol. 4, No. 6, pp 264 (06/1978).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 4, 654-656 (June 1978
In this letter we report a continuation of the study of the electrical explosion of cylindrical aluminum foils in air. Earlier electrical and optical measurements and the results obtained in work on these foils are given in detail. In the present part of the work we give a more complete physical picture obtained by using magnetic probes to study the spatial and temporal variations in the magnetic field generated by the current in the plasma produced in the electrical explosion of an aluminum foil. 2 Refs
Primary Keywords: Cylindrical Foil Explosion; Aluminum Foil; Air Environment; Magnetic Field Measurement; Current Density, Spatial Resolution
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7044
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRON-OPTICAL OBSERVATION OF INITIATION AND DEVELOPMENT OF PULSED BREAKDOWN IN A NARROW VACUUM GAP
S.P. Bugaev, A.M. Iskol'dskii, G.A. Mesyats and D.I. Proskurovskii
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 12, No. 12, pp 1625-1627 (06/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 2206-2208 (December 1967)
There are several hypotheses explaining the initiation and development of high-vacuum breakdown breakdown. As far as pulsed vacuum breakdown in the nanosecond range is concerned, the set of hypotheses assigning primary significance to field emission from microregions of the cathode appears most encouraging. However, one author prefers an anode mechanism for the initiation of breakdown by electron beams, and others consider the reason for breakdown to be the explosion of microscopic projections on the cathode because of heating by field emission. This paper contains results of an experiment to study the luminosity of the development of nanosecond vacuum breakdown. Cathode processes are described. 10 Refs
Primary Keywords: Vacuum Breakdown; Nanosecond Breakdown; Optical Output; Framing Camera; Cathode Processes
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7045
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
ENERGY-TRANS[illegible] SYSTEM
A.M. Timonin
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics-Technical Physics, V[illegible] (08/19[illegible]
Trans. From: Zhurnal Tek[illegible] February [illegible]
The efficiency with which energy is converted from the energy of magnetic field in a magnetic implosion system is found as a function of the flux compression and the field amplification. If the flux compression is limited, and extremely strong initial compression field is required for high efficiency. 2 Refs.
Primary Keywords: Flux Compression; Theory, Efficiency Calculation; High Initial Field
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7046
(ENERGY STORAGE, INDUCTIVE; PULSE GENERATORS)
(Inductors, Flux Compression)
EXTRACTION OF ENERGY FROM INDUCTIVE STORES AND EXPLOSIVE-MAGNETIC GENERATORS INTO AN INDUCTIVE LOAD USING CIRCUIT BREAKING
V.A. Fomichev, E.I. Zharinov, [illegible] Kazakov and [illegible]K. Chernyshev
Moscow, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 19, No. 4, pp 464-465 (08/1978).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 4, 54-61 (July-August 1978)
In recent years the problem of obtaining high power current pulses using inductive energy storage has been given increasing attention. The increased interest in such devices is due to the fact that the magnetic energy density in inductive store considerably exceeds the energy density of capacitive sources. These advantages are most obvious in the case of pulsed stores supplied from explosive-magnetic generators operating on the principle of the rapid compression of magnetic flux. The [illegible] inductance in explosive [illegible] the currents in [illegible] over thousands of [illegible] amperes. The purpose of [illegible] is to consider the [illegible] by which the energy [illegible] inductive [illegible] and explosive-magnetic [illegible] taking into account the [illegible] inductances of the switch and determine the optimal [illegible] between the inductances of the [illegible] circuit and the load [illegible]. [illegible] Refs
Primary Keywords: Inductive Energy Storage; Flux Compression Generators; Opening Switch; Inductive Load; Load Matching; Transfer Efficiency
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7047
(PARTICLE BEAMS, ELECTRON)
(Generation)
GENERATION AND FOCUSING OF A STRONG-CURRENT ELECTRON BEAM IN A LOW-IMPEDANCE DIODE
V.I. Liksonov, Yu.L. Sidorov and V.P. Smirnov
JETP Letters, Vol. 19, No. 8, pp 273-275 (04/1974).
Trans. From: ZhETF Pis'ma V Redaktsiyu 19, 516-520 (April 1974)
Results are presented on the generation of an electron beam in a low-impedance diode. There is no conventional cathode for such diodes. The construction of the cathode amplifies the influence of the preliminary charging pulse on the formation of the plasma current carrying channel between the electrodes of the accelerating gap. A beam current density >5E6 A/sq.cm was obtained at a power flux >=1E12 W/sq.cm. The amplitude of the preliminary discharge pulse current was [illegible] kA. 7 Refs.
Primary Keywords: E-beam Generation; Field Emission Diode; Diode Closure; Prepulse Suppression
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7048
(BREAKDOWN STUDIES)
(Gas, Electrical)
HIGH-CURRENT, HOLLOW-CATHODE GLOW DISCHARGE
I.I. Aksenov, V.A. Belous and S.A. Smirnov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Kharkov, USSR
Soviet Physics Technical Physics, Vol. 20, No. 8, pp 1094-1098 (08/1975)
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 1717-1724 (August 1975)
A study has been made of the voltage drop in hydrogen, deuterium, and oxygen for pressures of 0.2 to 1 Torr at currents up to 2000 A in pulses lasting 3 and 18 microseconds with repetition rates of 50 Hz. The cathode is stainless steel or aluminum and the size of the cathode cavity is varied from 0.5 to 40 mm. The measurements are made after warm up and processing with the apparatus sealed off. The dynamic resistance of the discharge decreases as the current increases and, in certain circumstances, can take on negative values. The dependence of the voltage drop on the size of the cathode cavity is characterized by a minimum at 2 to 5 mm. 15 Refs. 4
Primary Keywords: Gas Breakdown; Hydrogen, Deuterium; Oxygen; Arc Voltage Drop; 0.2 1 Torr Pressure; Stainless Steel Cathode; Aluminum Cathode
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7049
(SWITCHES, CLOSING)
(Thyratrons, Materials)
HYDROGEN GENERATORS FOR SEALED SWITCHES
V.K. Bocharov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Kharkov, USSR
Soviet Physics-Technical Physics, Vol. 21, No. 4, pp 487-489 (04/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 839-843 (April 1975)
Hydrogen generators made from titanium and zirconium with automatic pressure regulation and getters are described. The ranges of the ambient temperature and pressure over which these generators can operate are broader than for other generators, and when the getters are used these generators are more efficient in pumping impurities in a discharge. When these generators are used in switches the range of working pressure is double that for generators without automatic pressure regulation. 7 Refs.
Primary Keywords: Hydrogen Generator; Titanium; Zirconium; Pressure Regulation; Large Pressure Range
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[illegible]
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Systems, Reviews)
INDUCTIVE ENERGY STORAGE IN PULSED ACCELERATORS
[illegible] A. Glukh[illegible], D.A. Gusev, E.G. Komar and M.P. Svin'in
Soviet Physics-Technical Physics, Vol. 19, No. 5, pp 660-661 (11/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 1047-1050 (May 1974)
[illegible] inductive energy-storage banks as [illegible] voltage sources for direct accelerators is discussed. [illegible] currents are given, and the results of experiments with [illegible] accelerators are reported. 4 Refs.
Primary Keywords: Inductive Energy Storage; Design Considerations; Prototype, Performance Test; Opening Switch
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(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
INVESTIGATION OF PREIGNITION PROCESSES IN TRIGATRONS OPERATING IN AIR
P.I. Shkuropat
Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 14, No. 7, pp 943-948 (01/1970).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 1256-1263 (July 1969)
Results of an experimental investigation of preignition processes in trigatrons are reported. The development of the discharge is found to proceed in two stages. Some of the characteristics of these stages are determined. 16 Refs.
Primary Keywords: Trigatron Switch; Preignition; Self-breakdown; Two-stage Discharge; Optical Diagnostics
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7052
(BREAKDOWN STUDIES)
(Surface Flashover)
INVESTIGATION OF THE PULSED BREAKDOWN MECHANISM AT THE SURFACE OF A DIELECTRIC IN A VACUUM II. NONUNIFORM FIELD
S.P. Bugaev and G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 12, No. 10, pp 1363-1369 (04/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1861-1869 (October 1967)
Experimental studies were made of the luminous phenomena accompanying breakdown along the surface of a dielectric in a vacuum and in a nonuniform field with a significant component of the electric field normal to the dielectric surface. When the cathode diameter was less than the dielectric diameter, the rate of propagation of luminosity along the cathode face was an order of magnitude less than along the anode face and amounted to 1E7 cm/sec. The nature of prebreakdown currents was investigated. An explanation is given for the previously observed reduction in pulsed electrical stability. Questions of initiation and development of the discharge are discussed. 8 Refs.
Primary Keywords: Surface Flashover; Photographic Observation; Nonuniform Field; Prebreakdown Current; Cylindrical Cathode; Sharp Cathode Edges
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7053
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
INVESTIGATION OF TRIGGERING DELAY IN A LOW-PRESSURE HOLLOW-CATHODE SPARK GAP
I.I. Aksenov, V.A. Belous and S.A. Smirnov
Soviet Physics-Technical Physics, Vol. 16, No. 7, pp 1119-1123 (01/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 1423-1429 (July 1971)
A controllable spark gap with a hollow cathode and a trigger electrode in the cathode cavity has been investigated. Hydrogen at a pressure of a few tenths of a Torr is used. The dependence of the trigger delay and discharge formation time on pressure, anode voltage, magnitude and polarity of the trigger pulse, and pre-ignition current has been studied. The triggering mechanism and possible applications are discussed. 5 Refs.
Primary Keywords: Spark Gap; Hollow Cathode; Trigger In Cathode; Delay Measurement; Variable Pressure; Variable Voltage, Preignition Current
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7055
(PARTICLE BEAMS, ELECTRON)
(Generation)
LINEAR INDUCTIVE ACCELERATORS WITHOUT IRON
A.I. Pavlovskii and V.S. Bosamykin
Soviet Atomic Energy, Vol. 37, No. 3, pp 942-947 (09/1974).
Trans. From: Atomnaya Energiya 37, 228-233 (September 1974)
In order to obtain powerful single pulses of ultrarelativistic electrons, linear inductive accelerators without iron are conveniently employed. The total voltage in those accelerators, which consist of similar inductor components, acts only along the accelerating section, in analogy to accelerators with ferromagnetic cores. Linear inductive accelerators without iron make it possible to reach the energy range above 1E7 eV and to obtain still the high currents which are characteristic of the recently developed directly operated nanosecond accelerators. The first accelerator of this type provided an electron beam current of up to 2 kA at an energy of 2 MeV and a frequency of 6.2 MHz of the accelerating voltage. The design elements of this accelerator and the conditions of guiding the [illegible] have been described. The present paper discusses possible [illegible] both the electrodynamic details and design considerations of the inductors to be used in a linear inductive accelerator without iron. 14 Refs.
Primary Keywords: E-beam Generation; LINAC; Iron-free Accelerator; [illegible] MeV Beam Energy; 2 kA Beam Current
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7056
(PARTICLE BEAMS, ELECTRON)
(Generation)
MICROSECOND [illegible] ELECTRON B[illegible]
I.M. Roife, V.A. Smo[illegible]
D.V. Efremov Insti[illegible]
Soviet Physics-Technical Physics [illegible] 1513-1521 (12/1976).
Trans. From: Zhurn[illegible] Tekhnicheskoi Fiziki 46, [illegible]-2576 (Decem[illegible]
A high-current [illegible] which pulses longer than [illegible] are [illegible] a magnetic [illegible] located near the anode, the mirror slows down plasma [illegible] bursts. The characteristics of the diode are described. The [illegible] velocity and the [illegible] is an order of magnitude lower than with no magnetic field. The diode impedance remains constant for 2-4 microseconds. The beam is extracted at a central aperture in the anode and drifts over a distance approximately 70 cm. Inspection of the traces left by the beam on metal foils with the naked eye and with a microscope reveals that under certain conditions the beam [illegible] unstable in the drift region. 11 Refs.
Primary Keywords: E-beam Generation; Field Emission Diode; 1 Microsecond Beam Duration, Magnetic Mirror; Anode Shielding
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7058
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
MOTION OF A CYLINDRICAL CONDUCTING SHELL UNDER MAGNETODYNAMIC COMPRESSION
A.M. Timonin and V.A. [illegible]
D.V. Efremov Institute [illegible]
Soviet Physics-Technical Physics, Vol. [illegible], pp 788-792 (11[illegible]
Trans. From: Zhurnal Tekhnicheskoi Fiz[illegible] 995-1000 (May 1972)
The magnetodynamic compression [illegible] conducting shell of arbitrary wall thickness is st[illegible] The magnetic flux within the [illegible] shell is assumed to be constant [illegible] energy losses are [illegible] the compression [illegible] inductive energy [illegible] The time and [illegible] are obtained [illegible] of the initial [illegible] field with [illegible]
Primary Keywords: [illegible] Magnetodynamic Compression [illegible] Analysis [illegible]
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7059
(PARTICLE BEAMS, ELECTRON)
(Generation)
NANOSECOND ELECTRON ACCELERATOR
K.A. Zheltov, V.I. Matekov, A.V. Malygin and V.F. Shalimanov
Instruments And Experimental Techniques, Vol. 19, No. 6, pp 1605-1607 (12/1976).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 20-22 (December 1976)
The present article describes a high-current pulsed electron accelerator with a maximum energy of approximately 1 MeV and a 2-5-kA beam current at a duration of approximately 2.5 nsec of the current pulses at the halflevel. The electrons are accelerated in a sealed vacuum diode with a field-emission cathode. Two types of diodes were tested. In diodes designed for obtaining bremsstrahlung, a 0.1-mm-thick tantalum target is the anode. In the diodes of the other type, the target is replaced by a beryllium window which allows the transmission of the electron beam into the atmosphere. 4 Refs.
Primary Keywords: E-beam Generation; Field Emission Diode, Two Anode Materials; Tantalum, Beryllium; 1 MeV Beam Energy; 5 kA Beam Current; 2.5 ns Beam Duration
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7060
(PARTICLE BEAMS, ELECTRON)
(Generation)
NUMERICAL ANALYSIS OF THE FORMATION OF AN INTENSE NANOSECOND ELECTRON BEAM
B.V. Efimov, Yu.P. Kubor'kov, A.A. Drozdov and G.R. Kablotskaya
Research Institute For Electrophysics Apparatus, Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Technical Physics Letters, Vol. 1, No. 10, pp 391-392 (10/1975).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 1, 899-903 (October 1975)
New information on processes that determine the main features of the behavior of an electron beam in modern strong-current accelerators can be obtained not only by direct measurements in experiments, but also by comparing the experimental data with the results of detailed numerical calculations that employ various models. In this note we present the result of a numerical analysis of the formation of a pulsed relativistic electron beam (REB) in accelerator systems like REP-5, RIUS-5, and others, with maximum current amplitudes below the critical value. 9 Refs.
Primary Keywords: E-beam Generation; Numerical Simulation; Shaping Line; Spark Gap; Field Emission Diode; Circuit Considerations; Diode Impedance; Fowler-Nordheim Equation
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7061
(PULSE GENERATORS; ELECTROMAGNETIC FIELD GENERATION)
(Flux Compression; Magnetic)
NUMERICAL CALCULATION OF THE MAGNETIC CUMULATION PROCESS
A.V. Kashinskii and V.A. Odintsov
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 11, No. 3, pp 404-408 (06/1970).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 11, 51-55 (May-June 1970)
A numerical calculation is made of the process in the MK-1 magnetocumulative generator under the assumption that the magnetic flux is constant and the tube contraction process is one-dimensional. The instantaneous detonation scheme is adopted. The effect of initial magnetic field intensity and relative size of the cavity on the magnitude of the maximal magnetic field intensity obtained inside the tube is studied. 4 Refs.
Primary Keywords: Flux Compression; Theory; Numerical Calculation; 1-d Calculation; Maximum Field Intensity; Initial Field, Cavity Size
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7062
(ENERGY STORAGE, CHEMICAL; PULSE GENERATORS)
(Flux Compression Generators; Flux Compression)
[illegible] POWERED FROM A MAGNETOCUMULATIVE GENERATOR
A.I. Pavlovskii, G.D. Kuleshov, R.Z. Lyudaev, L.N. Robkin and A.S. Fedunin
Soviet Atomic Energy, Vol. 41, No. 2, pp 757-760 (08/1976).
Trans. From: Atomnaya Energiya 41, 142-144 (August 1976)
The power supply for charged-particle accelerators, operating in the single-pulse regime, usually is effected from condensers of inductive storage devices of electrical energy. More frequently, condenser banks are used, whose power capacity often reaches tens and hundreds of kilojoules and have a mass of many tons. These power supply sources can be used mainly under steady-state conditions. At the same time, there are problems which require the use of transportable accelerator facilities. Because of this, a power supply system has been considered for high-powered pulsed air-cored betatrons from magnetocumulative generators (MCG), with a specific power capacity which is greater by a factor of thousands and tens of thousands than condenser storage devices. 4 Refs.
Primary Keywords: Flux Compression Generator; Explosive Driver; Low Inductance Load
Secondary Keywords: Betatron
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7063
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Radiation, Gas Gaps, Radiation)
REDUCTION OF GAS BREAKDOWN VOLTAGE WITH PULSED IONIZING RADIATION
A.A. Dentser and V.A. Feoktistov
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 14, No. 6, pp [illegible]-785 (12/1973).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 6, 52-6[illegible] (November-December 1973)
An algorithm is described for computer calculation of the dynamic breakdown voltage of a gas gap affected by a spatially uniform pulse of ionizing radiation. The algorithm is based on numerical integration of a system of nonlinear equations with integral boundary conditions. The program is used to calculate the breakdown voltage of an air gap affected by a bell-shaped ionizing pulse. It is shown that the relative reduction in breakdown voltage can amount to tens of [illegible] for a radiation exposure dose rate P/sub o/ approximately 1E8 [illegible] Refs.
[illegible] Gas Breakdown; Ionizing Radiation; Pulsed Breakdown; Variation With Radiation Exposure; Space Charge; Theory
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7064
(PARTICLE BEAMS, ELECTRON)
(Generation)
REGULATING THE MAGNETIZATION OF FERRITE IN EXPERIMENTS ON THE SELF-ACCELERATION OF AN ELECTRON BEAM
A.A. Rakityanskii
Instruments And Experimental Techniques, Vol. 22, No. 2, pp 327-329 (04/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 37-40 (March-April 1979)

A means of regulating the magnetization of ferrite is described which allows the choice of the optimum conditions in the process of self-acceleration of beams in ferrite structures. The magnetizing is accomplished with two coaxial solenoids which are simultaneously used to focus the beam. The results of an experimental investigation of the described means are presented.

Primary Keywords: E-beam Generation; Self-acceleration; Ferrite Ring; Magnetization; Coaxial Solenoid

7066
(SWITCHES, CLOSING)
(Gas Gaps, Systems)
STUDY OF PARALLEL OPERATION OF CONTROLLED SPARK GAPS
S.L. Zaients, G.S. Kichaeva and P.I. Shkurcapat
M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 7, No. 11, pp 1023-1026 (05/1963).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 32, 1386-1391 (November 1962)

The parallel operation of several controlled spark gaps at a working voltage of 50-150 kV was investigated in a circit similar to that of a generator of large pulsed currents with delay cables. The practicability of parallel operation of the gaps is demonstrated. Recommendations for the design of such generators are given. 6 Refs.

Primary Keywords: Spark Gap, Trigatron; Parallel Operation; 150 kV Operating Voltage; Design Considerations

7067
(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL; SWITCHES, OPENING)
(Flux Compression; Flux Compression Generators; Explosive Fuses)
TAKE-OFF OF ENERGY FROM EXPLOSIVE-MAGNETIC GENERATORS TO AN INDUCTIVE LOAD USING THE BREAKING OF A CIRCUIT
V.A. Demidov, E.I. Zharinov, S.A. Kazakov and V.K. Chernyshev
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 20, No. 1, pp 32-36 (02/1979).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1, 43-48 (January-February 1979)

The use of explosive-magnetic generators (EMG) for plasma experiments and for other physical investigations, along with questions of increasing the electromagnetic energy, poses the problem of the formation, in the external load, of current pulses with steep leading fronts in the microsecond range. One method for the rapid take-off of energy to the load is the breaking of the finite circuit of the explosive-magnetic generator. This is done using commutators based on the electrical explosion of thin conductors or on the basis of the mechanical breakdown of conductors by a charge of explosive. The aim of the present work was a determination of the form of the pulses of the current and the energy in an inductive load as a function of the resistance of the discontinuity introduced into the circit of an explosive-magnetic generator, taking into account of the parasitic inductance of the commutating device. 14 Refs.

Primary Keywords: Explosive Flux Compression Generators; Inductive Load; Analysis; Theory; Comparison With Experiment

7068
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
DETECTION OF ELECTRODE VAPOR BETWEEN PLANE PARALLEL COPPER ELECTRODES PRIOR TO CURRENT AMPLIFICATION AND BREAKDOWN IN VACUUM
D.K. Davies and M.A. Biondi
Westinghouse Research and Development Center, [illegible] PA
Journal Of Applied Physics, Vol. 41, No. [illegible]

Simultaneous, time-resolved measurements of [illegible] resonance line absorption have been made for the [illegible] and 0.8 microsecond, respectively [illegible] plane-parallel copper electrodes [illegible] been carried out for an electrode separation [illegible] residual pressures in the low 1E-9 Torr range. The experimental data show that neutral copper vapor is absent in the interelectrode volume before the current increases sufficiently [illegible] that the vapor is generated during times [illegible] some microseconds prior to breakdown, and is highly localized in the region of the subsequent spark channel. Further, the vapor density decreases from cathode to anode along the path of the subsequent spark channel. The results are consistent with a model for vacuum breakdown proposed recently in which the transient production of vapor immediately prior to breakdown occurs by the evaporation of an anode macroparticle during its transit to the cathode; amplification of the prebreakdown current in this vapor then leads to breakdown. From the data obtained in the present experiment, it appears that breakdown occurs primarily while the macroparticle is located between midgap and the cathode. 9 Refs.

Primary Keywords: Vacuum Breakdown, Prebreakdown Current; Current Growth; Copper Vapor; 1E-9 Torr Pressure; Resonance Line Absorption

7070
(BREAKDOWN STUDIES)
(Gas, E-beam)
VOLUME DISCHARGE EXCITED IN A GAS BY AN ELECTRON BEAM IN THE CASE OF [illegible] IONIZATION
D.B. Evdokimov, G.A. Mesyats and V.A. Ponomarev
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Journal Of Plasma Physics, Vol. 3, No. 2, pp 202-206 (04/1977)
Trans. From: Fiz. Plazmy 3, 357-364 (March-April 1977)

A phenomenological system of equations is used to analyze the processes occurring with the column of a gas discharge excited by an electron beam in the case in which there is an inhomogeneous distribution of the rate of production of electron ion pairs across the discharge gap. The early stage of the process and the steady state are studied. The steady state distributions of the electric field and the specific power in the discharge column are found [illegible] voltage-current characteristic is also found. The time dependent solution for the electric field in the column has an extremum at an early time (after a time short [illegible] the time required to reach steady-state recombination [illegible]. At a beam current density on the order of a few [illegible] the thermalized electrons can distort the field distribution at early times. 11 Refs.

Primary Keywords: Gas Breakdown; E-beam Excited [illegible] Volume Discharge; [illegible] Theory

7071
(SWITCHES, OPENING)
(Explosive Fuses)
A MEGAAMPERE SWITCH WITH AN EXPLODING FOIL FOR THE INVESTIGATION OF MAGNETIC CUMULATION
V.G. Kuchinskii, V.T. Mikhkel'soo and G.A. Shneerson
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 16, No. 3, pp 783-786 (06/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 108-112 (May-June 1973)

A device with an exploding foil allows the rise time of the current in the discharge current of a capacitor bank into a one-turn solenoid to be reduced by a factor of 10 to 15, and a current having an amplitude of 1 MA to be obtained. A switch device is described which is used in a circuit for investigating magnetic cumulation. A procedure for choosing the parameters of the foil is expounded, and the possibility of using simple phenomenological models to describe the variation of the foil resistance during the commutation process is considered. 8 Refs.

Primary Keywords: Exploding Foil; Pulse Front Sharpening; 1 MA Current; Foil Parameterization; Design Considerations; Phenomenological Explosion Model

7073
(BREAKDOWN STUDIES)
(Liquid, Electrical)
CHARACTERISTICS OF AN UNDERWATER SPARK
V.V. Shamko and E.V. Krivitskii
Planning And Design Bureau Of Electrohydraulics, Academy of Sciences of the Ukrainian SSR, Nikolaev, USSR
Soviet Physics-Technical Physics, Vol. 22, No. 1, pp 52-57 (01/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 93-101 (January 1977)

The energy balance in the channel of an underwater spark is analyzed for the main stage of the discharge, the first current pulse. It is shown that for a homogeneous discharge the specific internal energy is proportional to the conductivity of the spark during this time interval. The radiation energy is calculated roughly for a broad range of discharges under the assumption that the channel emits as an absolute blackbody. The radiation energy constitutes a small fraction of the overall energy balance and can be neglected. The diameter of the spark channel visible in transmitted light is related to the channel resistance. Approximate expressions are found for the motion of the spark channel and for its initial parameters-the radius and the electrical resistance. 12 Refs

Primary Keywords: Water Breakdown; Energy Balance; Homogeneous Discharge; Blackbody Radiation; Channel Resistance Calculation; Theory

7074
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Liquid, Electrical; Surface Flashover)
CREEPAGE DISCHARGE ALONG THE SURFACE OF SOLID DIELECTRICS IN WATER
P.M. Dastuk, A.S. Emel'yanov and T.A. Ivanova
Soviet Physics Journal, Vol. 11, No. 2, pp 71-74 (02/1968).
Trans. From: Izvestiya VUZ. Fizika 11, 111-117 (1968)

Experimental data is given for the discharge voltage for creepage discharge in tap water as a function of the thickness, flange length, (creepage path over dielectric surface), permittivity of the solid dielectric, field configuration, polarity of the applied voltage pulse, and a number of other parameters. The experimental data discussed are the delay time with dielectric flange sparkover by creepage discharge, the average discharge propagation rate for both polarities, and the creepage discharge current and leakage resistance. 5 Refs.

Primary Keywords: Creepage Discharge; Tap Water; Dielectric Surface; Flange Length, Solid Insulator Permittivity; Field Configuration, Pulse Length

[illegible]
(BREAKDOWN STUDIES)
([illegible])
CURRENT [illegible] AND REPEATED BREAKDOWN IN ELECTRICAL DISCHARGES IN LIQUIDS
[illegible] Kuzhekin
[illegible] Institute, Moscow, USSR
[illegible] Physics, Vol. 11, No. 2, pp 245-248 (08/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 338-341 (February 1966)

New experimental data have been obtained on anomalous electrical discharges in liquids. Current cutoffs occur at different times, and repeated breakdowns take place under the effect of positive or negative residual voltage unless the electrical strength of the [illegible] gap is restored. 2 Refs.

Primary Keywords: Liquid Breakdown, Several Liquids; Current Cutoff; Reignition, Oscillatory Discharge

7077
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
EFFECT OF A TRANSVERSE MAGNETIC FIELD ON THE BREAKDOWN IN A HIGH-VACUUM DISCHARGE GAP
V.A. Petrosov and N.V. Cherkasskii
Soviet Physics-Technical Physics, Vol. 22, No. 5, pp 565-569 (05/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 946-953 (May 1977)

The effect of a transverse magnetic field on the breakdown field of a vacuum discharge gap is studied experimentally for residual gas pressures p=1E-4 - 1E-7 Torr in the working volume. The length of the discharge gap, d, and the shape of the working surface of the electrodes are varied in the experiments. The magnetic field is varied over the range H=0-6000 Oe. The experimental data on the breakdown voltage of a high-vacuum discharge gap, U/sub s/ are fitted by empirical functions, U/sub s/=f(p,d,H). 6 Refs.

Primary Keywords: Vacuum Breakdown; Transverse Magnetic Field; Variable Gap Spacing; Variable Electrode Geometry; 6000 Oe Field, Emperical Formula

7078
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; INSULATION, MATERIAL; INSULATION, MATERIAL)
(Electrodes: Gas, Electrical; Gas; Liquid)
EFFECT OF CATHODE SURFACE STATE ON THE DIELECTRIC STRENGTH OF GASES AND LIQUIDS
Yu.L. Stankevich and V.G. Kalinin
Soviet Physics-Technical Physics, Vol. 14, No. 7, pp 949-954 (01/1970).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 1264-1271 (July 1969)
Effects of the cathode surface state on the dielectric strength of gases at high pressures and of capacitor oil in thin (<= 0.2 mm) gaps have been studied. The mechanisms for the possible effects of various types of surface irregularities and contaminents on the pressure dependence of the static and pulsed breakdown voltages for gases have been examined. The experimental results show that the polycrystalline structure of the cathode is one reason for the scatter and nonreproducibility of breakdown voltages in gases at high pressures, especially with small interelectrode gaps. The use of single-crystal cathodes permits higher prebreakdown voltages in both gases and liquids. Covering the cathode surface with a thin liquid-dielectric film significantly increases the pulsed dielectric strength in a gas-filled gap. The results agree with the hypothesis that the main souce of primary electrons during breakdown by short voltage pulses is field emission from the cathode surface. 7 Refs.
Primary Keywords: Gas Dielectric Strength; Liquid Dielectric Strength; Cathode Surface Effects; Several Gases; Transformer Oil; Single-crystal Cathode; Polycrystalline Cathode; Dielectric Liquid Cathode Film

7079
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
EFFECT OF ELECTROSTATIC FORCES IN VACUUM BREAKDOWN
I.L. Gufel'd and V.V. Postnov
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 8, pp 994 (08/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 1750-1751 (August 1978)
Electrostatic forces play two roles in the prebreakdown state: They activate diffusive mass transport and damage the surface layers, thus increasing the field at surface irregularities and reducing the average breakdown field. If these processes are to occur the field magnification at the microscopic protuberances must be a factor of a hundred or more. In certain cases, e.g., removal of aggregates which are weakly bound to the surface (polishing products) or the removal of elements of deposited film, the field magnification need not be high. 5 Refs.
Primary Keywords: Vacuum Breakdown; Prebreadown Current; Field Magnification; Microprojections

7080
(BREAKDOWN STUDIES)
(Liquid, Electrical)
ELECTRICAL BREAKDOWN IN WATER BY 0.5-1.7-MV PULSES 0.5-5 MICROSECOND LONG
V.D. Tarasov, V.A. Balakin and O.P. Pecherskii
Soviet Physics-Technical Physics, Vol. 16, No. 8, pp 1379-1380 (02/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 1749-1750 (August 1971)
The electrical strength of outgassed and purified water is investigated in a uniform field produced by a sinusoidal voltage with amplitude 0.5-1.7 MV and a pulse length of 0.5-5 microseconds. The breakdown field is about 300 kV/cm for 5-microsecond pulses and increases to 480 kV/cm for 0.5-microsecond pulses. 5 Refs.
Primary Keywords: Water Breakdown; 0.5-5 Microsecond Pulse Length; 300-480 KV/cm Breakdown Field; Coaxial Lines; Electrical Strength Of Water, 0.5-1.7 MeV Voltage

7081
(BREAKDOWN STUDIES)
(Exploding Wires)
ELECTRICAL CHARACTERISTICS OF UNDERWATER EXPLODING [illegible]
V.K. Sholom, E.V. Krivitskii and [illegible]
Soviet Physics-Technical Physics, Vol. 19, No. 10, pp [illegible] (04/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, [illegible] (October 1974)
Using the condition of approximate similarity for the electrical characteristics of an underwater explosion of a wire, empirical equations are obtained which make it possible to determine the inductive peak overvoltage, the minimum [illegible] value for which the arc is struck, and the maximum current in the arc stage of the discharge as functions of the parameters of the discharge circuit and the wire. The parameters of the maximum discharge are obtained [illegible] discharges corresponding to the boundary of the curret break conditions are defined for producing the maximum rate of energy deposition in the discharge gap. 11 Refs.
Primary Keywords: Exploding Wire; Underwater Explosion; Emperical Equation; Peak Voltage Calculation, Minimum Arc Current Calculation

7082
(INSULATION, MATERIAL)
(Solid)
ELECTRICAL CONDUCTIVITY OF DIELECTRICS IN STRONG SHOCK WAVE
A.A. Brish, M.S. Tarasov and V.A. Tsukerman
Soviet Physics JETP, Vol. 11, No. 1, pp 15-17 (01/1960).
Trans. From: Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki 38, 22-25 (January 1960)
The electrical conductivity of air, water, and certain solid dielectrics subjected to strong shock waves has been measured by electrical contact method. The measured values of the specific conductivity in the shock front are as follows: air, 0.5 ohm/cm water [illegible] 2 ohm/cm. At shock front pressure [illegible] approximately [illegible] kg/sq km it is found that the electrical conductivity of Plexiglass or paraffin reaches [illegible] to 2E2 ohm/cm, a value which approximate [illegible] conductivity of a metal. 3 Refs.
Primary Keyword: [illegible] American Institute Of Physics [illegible]

7084
(BREAKDOWN STUDIES)
(Electrodes)
EROSION RATE AND PROPERTIES OF A CATHODE SPOT OF THE FIRST KIND WITH SILVER ALLOYS
A.I. Struchkov and N.L. Pravoverov
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 11, pp 1322-1324 (11/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 2309-2312 (November 1978)
The erosion rate of silver alloys in the solid-solution region is governed by the electrical resistivity at the melting point. This feature explains why the erosion rate is essentially independent of the heat treatment of the alloy. Estimates of the erosion rate for high-resistivity alloys on the basis of the explosive model agree with the experimental results. The theoretical values of the erosion rate for low-resistivity alloys are twice the experimental values; the discrepancy arises because the explosive model neglects the heat removal from the current-concentration region. 10 Refs.
Primary Keywords: Cathode Spot Properties; Erosion Rate Estimates; Explosive Model; High Thermal Conductivity; High Electrical Conductivity; Silver Alloys

7085
(BREAKDOWN STUDIES)
(Exploding Wires)
EXPLODING WIRE MECHANISM
E.V. Krivitskii and V.P. Litvinenko
Planning And Design Of Bureau Of Electrohydraulics, Nikolaev, USSR
Soviet Physics-Technical Physics, Vol. 21, No. 10, pp 1218-1221 (10/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 2081-2087 (October 1976)
The models which have been proposed for exploding wires are analyzed in terms of the destruction of wires caused by high current pulses for various external conditions. The initial point of the explosion can be determined from superimposed simultaneous oscilloscope traces of the voltage across the test samples. The time constant (the scale time of the explosion) is governed by the properties of the wire, the rate at which energy is supplied, and the hydrodynamic characteristics of the surrounding medium. Confirmation is found for the suggestion that the loss of metallic conductivity is due to processes which occur simultaneously throughout the wire volume. 21 Refs.
Primary Keywords: Exploding Wire; Initial Point Of Explosion; Time Constant, Wire Geometry; Environment Considerations; Theory

7086
(PARTICLE BEAMS, ELECTRON; BREAKDOWN STUDIES)
(Generation; Exploding Wires)
EXPLOSIVE ELECTRON EMISSION AND EXPLODING WIRES
M.M. Martynyuk
Patrice Lumumba University of International Friendship, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 7, pp 837-844 (07/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 1482-1493 (July 1978)
The role played by explosive boiling (phase explosion) of a liquid metal in exploding wires and exploding sharp metal points is studied. If the pulse length t/sub i/ = 1E-7 - 1E-5 sec, the explosion is governed by the stationary *homogeneous nucleation of vapor nuclei* (stationary phase explosion). If the pulse length t/sub i/ <= 1E-8 sec the process is not stationary. Data on exploding wires are used to calculate the temperature and the current density in the thermionic emission from several metals at the beginning of the stationary phase explosion. The effect of the electric field on the thermionic emission is taken into account. At the initial stage in the electrical explosion of a sharp metal tip the field emission decreases giving way to explosive emission of electrons. The current rise in the initial stage of explosive emission is due to the rapid increase in the emitting surface area in the explosive formation of a finely dispersed vapor-liquid mixture. The decomposition of this thermodynamically unstable phase may play a role in the nonstationary electrical explosion of sharp metal points and in exploding wires. The results are used to estimate the temperature, current density, and [illegible] of an explosive cathode spot in a vacuum arc. 33 Refs.
Primary Keywords: Explosive Electron Emission; Exploding Wires; Liquid Metal; Vaporization; Vapor Nucleation; Long Pulse Length; Stationary Process; Short Pulse Length; Non-stationary Process; Theory

7088
(POWER CONDITIONING; POWER CONDITIONING)
(Pulse Forming Lines; [illegible]able Reactors)
FORMATION AND [illegible] OF ELECTROMAGNETIC SHOCK WAVES IN TRANSMISSION LINES CONTAINING UNSATURATED FERRITE
L.A. Ostrovskii
Soviet Physics-Technical Physics, Vol. 8, No. 9, pp 805-813 (03/1964).
Trans. From: Zhurnal [illegible]cheskoi Fiziki 33, 1080-1092 (September 1963)
A discussion is given of the nonlinear phenomena observed in transmission lines containing a ferrite, in which the remagnetization takes place incoherently. A study is made of the dissipative mechanism of shock wave formation, as well as the development of strong discontinuities. 10 Refs.
Primary Keywords: Unsaturated Ferrite, Nonlinear Phenomena; Transmission Lines; Remagnetization; Electromagnetic Shock Wave Formation; Magnetic Field Rate Of Change

7089
(PULSE GENERATORS; SWITCHES, CLOSING; SWITCHES, OPENING)
(Capacitor Banks; Gas Gaps, Electrical, Gas Gaps, Magnetic Field)

A GENERATOR THAT PRODUCES POWERFUL PULSES USING GAS-DISCHARGE COMMUTATORS OF THE TRIOTRON AND TRIOPLASMATRON TYPE

A.I. Vishnevskii, A.I. Kuz'michev, V.I. Krizhenovskii, A.I. Soldatenko and A.I. Shendakov
Kiev Polytechnic Institute, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1417-1419 (10/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 104-106 (September-October 1973)

The possibility of creating a pulse generator (modulator) with partial discharge of the storage device using gas-discharge devices having a cold cathode and two-way control (triotrons and trioplasmatrons) is demonstrated. The ignition of the discharge in the devices takes place when a positive pulse is applied to the control electrode. Extinction occurs when the magnetic field is removed or reduced below a critical value H/sub cr/. The generator operates in a stable manner at a voltage of up to 15 kV and allows current pulses of close to 300 A to be obtained with smooth control of their length in the 10 to 150 microsecond range. 4 Refs.

Primary Keywords: Pulse Generator; Triotron Gas Switch; Magnetic Field, Coaxial Geometry; Partial Store Discharge

7090
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, E-beam; Vacuum Gaps, E-beam)

INITIATION OF ELECTRICAL BREAKDOWN IN VACUUM BY AN ELECTRON BEAM

M.V. Belan, E.K. Ostrovskii, V.F. Gaidukov, I.V. Strelkov and L.N. Kalashnikov
Soviet Physics-Technical Physics, Vol. 16, No. 3, pp 436-438 (09/1971).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 563-566 (March 1971)

A system has been investigated for initiating a discharge in high vacuum using an electron beam. The dependence of discharge delay time on electron-beam parameters is presented. It is shown that the breakdown time is associated with a specific temperature in the region of the anode bombarded by the electrons. 7 Refs.

7091
(BREAKDOWN STUDIES)
(Exploding Wires)

MHD CALCULATION FOR EXPLODING WIRES

Yu.D. Bakulin, V.F. Kuropatenko and A.V. Luchinskii
Soviet Physics-Technical Physics, Vol. 21, No. 9, pp 1144-1147 (09/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 1963-1969 (September 1976)

A method of analyzing electric circuits with exploding wires is presented. This MHD analysis describes the entire explosion of copper wires with an accuracy suitable for practical purposes. The conductivity of copper is found as a function of the density and specific thermal energy by a method based on theory and experiment. The calculations use an equation of state for the metal which takes the evaporation of the metal into account. Calculated results are given, and compared with experimental data. 11 Refs.

Primary Keywords: Exploding Wires; Copper Wires; MHD Analysis; Copper Conductivity, Equation Of State; Theory

7092
(BREAKDOWN STUDIES)
(Liquid, Electrical)

PREDISCHARGE PHENOMENA IN LIQUIDS

L.E. Balygin
Soviet Physics JETP, Vol. 3, No. 3, pp 355-361 (10/1956).
Trans. From: Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki 30, 464-470 (March 1956)

The results of an investigation of prebreakdown phenomena in transformer oil, castor oil, xylene and distilled water are presented. At voltages sufficient for breakdown, it is shown that ionization by collision occurs during the statistical delay period, resulting, in a time of approximately 1E-8 sec, in the production of electron avalanches and small streamers. The latter do not always lead to cumulative breakdown, but are a preparatory stage. It has been established that breakdown can occur when the stress [illegible] is greater than 5-8 x 1E-5 [illegible] also shown that in a still water with highly inhomogeneous fields the breakdown mechanism depends on the polarity of the point. If the latter is positive, [illegible] during the statistical delay period [illegible] positively charged column of very small radius is formed in about 5E-6 sec. 15 Refs.

Primary Keywords: Liquid Breakdown, Prebreakdown Phenomena; Coll[illegible] [illegible] Statistical Delay; Mem[illegible] [illegible] avalanches; at [illegible] Water; Transformer Oil; Castor Oil; Xylene

7094
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, Electrical; Vacuum Gaps, Electrical)

SPECTROSCOPIC STUDY OF A CONTROLLED DISCHARGE IN A HIGH-VOLTAGE VACUUM SWITCH

G.S. Kichaeva and M.L. Chepkalenko
M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 16, No. 10, pp 1704-1707 (04/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 2151-2155 (October 1971)

Spectral methods have been used to study effects due to the materials used in the elements of a controlled high-voltage switch (cathode, anode, triggering systems, and insulating wall) at an initial pressure of [illegible] Torr in the working chamber. A nonperiodic (0.15-1.5 microsecond) current at 1-7 kA is used. The emission spectra are studied in the gas as a whole and in individual regions during the [illegible], and discharge spectra are studied in the primary gap with various electrode materials. The materials of the primary and control electrodes, the insulation of the triggering system, and the insulating walls of the vacuum chamber (near the electrodes) affect the discharge. The discharge in a controlled gap is due to propagation of a plasma jet from the ignition region. [illegible] Refs.

Primary Keywords: Vacuum Breakdown, Triggered Vacuum Gap; Spectroscopic Diagnostic; Several Electrode Materials; Material's Effects; 7 kA Current

7095
(PARTICLE BEAMS, ELECTRON)
(Generation)

THE LIU-10 HIGH-POWER ELECTRON ACCELERATOR

A.I. Pavlovskii, V.S. Bosamykin, V.A. Savchenko, A.P. Klement'ev, K.A. Morunov, V.S. Nikol'skii, A.I. Gerasimov, V.A. Tananakin, V.F. Basmanov, D.I. Zenkov, V.D. Selemir and A.S. Fedotkin
Soviet Physics Doklady, Vol. 25, No. 2, pp 120-122 (02/1980).
Trans. From: Doklady Akademii Nauk SSSR 250, 1118-1122 (February 1980)

During the past few years a new direction has been explored in the creation of high-power generators of charged-particle beams with energies of several tens of MeV-linear induction accelerators (LIA) with inductors employing radial lines, which combine the possibility of variation of the acceleration energy, by varying the scale of the accelerating system, with the high current capacity associated with direct discharge of low-impedance lines with distributed parameters. This paper gives a short description of the construction and performance of the LIU-10 accelerator. 5 Refs.

Primary Keywords: Linear Induction Accelerators; Radial Lines; Acceleration Energy Variation; High Current Capacity; LIU-10 Accelerator; Electron Flux

7096
(POWER CONDITIONING)
(Pulse Forming Lines)

THE STRUCTURE OF THE FRONT OF ELECTROMAGNETIC SHOCK WAVES IN TRANSMISSION LINES WITH NONLINEAR PARAMETERS

A.M. Belyantsev, A.V. Gaponov and G.I. Freidman
Radiophysical Scientific Research Institute, Gorki State University, USSR
Soviet Physics-Technical Physics, Vol. 10, No. 4, pp 531-539 (10/1965).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 677-689 (April 1965)

The profile of an electromagnetic wave which propagates in a nonlinear, nondispersive medium is distorted during the propagation process in such a manner that breaks can occur in the continuity of the field vectors, and electromagnetic shock waves are generated. In exactly the same ways as in the corresponding problem of gasdynamics or magnetohydrodynamics, the presence of scatter in the high-frequency region eleminates the discontinuities in the solutions which describe the electromagnetic waves in nonlinear media; in particular, it also leads to the establishment of a finite width of the shock-wave front. In the present article one-dimensional electromagnetic waves are considered in transmission lines with nonlinear parameters. Particular attention shall be paid to the relation between the structure of the shock-wave front and the scattering properties of the transmission line. 12 Refs.

Primary Keywords: Pulse Forming Line; Shock Wave; Dispersion; Finite Shock Front; Stationary Wave; Theory

7098
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

TRANSIENT BEHAVIOR OF A HIGH-VOLTAGE LOW-PRESSURE TRIGGERED SPARK GAP

G.S. Kichaeva
M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 16, No. 9, pp 1552-1555 (03/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 1963-1968 (September 1971)

Delay times and jitter of a triggered spark gap have been investigated at 5-50 kV and initial pressures in the range approximately 6E-5 - 6E-2 mm Hg as a function of gap size (3-34 mm), voltage polarity, triggering arrangement, and triggering current. At pressures approximately 4E-3 mm Hg and greater the triggering mechanism is associated with ionizing collisions between the residual gas and electrons from the trigger spark. At lower pressures (1E-3 - 1E-5 mm Hg) the role of the plasma jet from the ignition region dominates. 13 Refs.

Primary Keywords: Triggered Spark Gap; Trigatron; Delay Measurement; Jitter Measurement; 6E-5 - 6E-2 Pressure Range; 50 kV Operating Voltage; Triggering Mechanism

7099
(PARTICLE BEAMS, ELECTRON)
(Generation)

A PULSED ELECTRON BEAM ACCELERATOR 'AQUAGEN'

A.P. Avrorov, V.T. Bovarintsev, E.L. Astrelin, V.A. Kapitonov and V.M. Lagunov
Institute of Nuclear Physics, Siberian Div. of the USSR Academy of Sciences, Novosibirsk, USSR
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-11 (11/1976).

The accelerator 'Aquagen' is designed for producing the pulsed electron beam with a current of 400 KA, an electron energy of 1.2 MeV for 60 ns. The expective total beam energy is about 10 to 15 kJ. The accelerator will be used for plasma heating by relativistic electron beam in the model experiments on the dense plasma confinement in the multiple mirror device 'GOL-II'. 20 Refs.

Primary Keywords: 'Aquagen' Accelerator; High Current; High Energy; Water Dielectric; Numerical Calculation; Field Calculation

Secondary Keywords: Plasma Heating

7100
(PULSE GENERATORS; SWITCHES, CLOSING)
(Trigger; Tacitrons)

A PULSE GENERATOR BASED ON TACITRONS

V.D. Dvornikov, S.T. Latushkin, L.I. Yudin and V.M. Komarov
Atomic Energy Institute, Moscow, USSR
Instruments And Experimental Techniques, Vol. 18, No. 2, pp 455-458 (04/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 107-110 (March-April 1975)

A circuit is presented for shaping voltage pulses across a distant capacitive load of approximately 70 pF using industrial TGUI-5/12 tacitrons as the commutating elements. The output pulses have an amplitude of 20 kV at a rectifier voltage of 5 kV, and a length of approximately 70 nsec for a leading-edge duration not exceeding 35 nsec. The instability of the delay of the output pulses relative to the pulses at the input of the tacitrons is approximately 1 nsec. The repetition frequency of the pulses is 120 kHz. 8 Refs.

Primary Keywords: Pulse Generator; Tacitron Switch; 20 kV Output Voltage, 70 ns Pulse Length; 1 ns Jitter

7101
(POWER CONDITIONING)
(Pulse Forming Networks)
A SHAPER THAT PRODUCES SHORT PULSES ACROSS A CAPACITIVE LOAD
L.Z. Gogolitsyn
Leningrad Electrical Engineering Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1350-1351 (10/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 93-94 (September-October 1974)
The circuit of a shaper is considered that produces pulses across a capacitive load and whose circuit includes and additional capacitor and resistor which permit the shaping of pulses with a length shorter than the time required to restore the controlling properties of the commutating instrument. 3 Refs.
Primary Keywords: Pulse Shaping Circuit; Rectangular Pulse; Capacitive Load; Short Pulse; Switch Recovery

7104
(ENERGY STORAGE, INDUCTIVE)
(Inductors)
CALCULATION OF TOROIDAL INDUCTIVE ACCUMULATORS WITH A D-CROSS SECTION FROM PARAMETERS OF A DISCHARGE PULSE AND OF THE CHARGING DEVICE
I.A. Ivanov, V.V. Sizov and V.A. Trukhin
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 18, No. 4, pp 473-479 (08/1977).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 18, 55-61 (July-August 1977)
One method of increasing the power of the discharge pulse of an inductive accumulator is based on the use of a scheme with a switch-over. With charging, the sections of the accumulator are connected in series and with discharge, in parallel. In this case, rigid requirements are imposed on the symmetry of the cross section. Such requirements are satisfied by constructions with a toroidal field (another of their advantages is the absence of scattering fields. The internal rectilinear section of the coil is subject to compression in the direction of the principal axis and to longitudinal elongation. In a construction with such a profile, with uniform equilization of the radial compression, the action of the bending moments is everywhere completely excluded. The form of the profile, with which the winding does not undergo the action of the bending moments, is called a D-section. A construction with a D-section is optimal with respect to energy capacity. Therefore, in comparison with other variants of toroidal constructions in coils with a D-section, the specific parameters are found to be the highest. 2 Refs.
Primary Keywords: Toroidal Inductive Accumulators; D-cross Section; Discharge Pulse; Toroidal Field; Optimal Mechanical Strength; Optimal Energy Capacity

7105
(POWER CONDITIONING)
(Pulse Transformers)
CO/SUB 2/ LASER HIGH-VOLTAGE POWER SUPPLY BASED ON A PULSED AUTOTRANSFORMER
V.V. Apollonov, A.I. Barchukov, S.I. Derzhavin, I.G. Kononov, K.N. Firsov, Yu.A. Shekir, V.A. Yamashchikov, A.V. Krivonosenko, S.S. Pel'tsman and B.V. Semkin
Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Instruments And Experimental Techniques, Vol. 21, No. 6, pp 1602-1604 (12/1978).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 131-133 (November-December 1978)
We describe the construction of a high-voltage system with a pulsed autotransformer for the supply of a CO/sub 2/ laser with transverse discharge. The system parameters are U/sub max/ = 150 kV, I/sub max/ = 20 kA, and the length of the discharge current T/sub d/ = 1 microsecond. Several models were tested, with different core cross sections, transformation coefficients, and numbers of turns in the windings. Stable glow discharges were obtained in gas mixtures CO/sub 2/: N/sub 2/: He = 1:2:3, 1:2:2, 1:2:1.5 in a volume 60 [illegible] 500 mm at energy inputs up to 400 J/liter atm. 4 Refs.
Primary Keywords: Pulsed Autotransformer; Transverse Discharge, 150 kV Voltage; 20 kA Current; Maximum Energy-transfer Efficiency; Minimum Energy Release Duration; <= 10W Instantaneous Power, <= 1 Microsecond Current Duration; <= 400 J/cu.cm. Energy Input
Secondary Keywords: CO/sub 2/ Laser Power Supply

7106
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
COMPRESSION OF MAGNETIC FIELD IN AN IMPLODING SPHERICAL CA
V.K. Bodulinskii and Yu.A. Manvedov
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 11, No. 6, pp 991-993 (12/1970).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 11, 114-115 (November-December 1970)
The equations describing the compression of a magnetic field, produced by a system of meridional currents, in an imploding spherical cavity are solved in the present communication. 4 Refs.
Primary Keywords: Flux Compression; Plane Parallel Conducting Surfaces, Cylindrical Geometry; Design Optimization

7107
(BREAKDOWN STUDIES)
(Gas, Electrical)
CONTRACTION OF THE DECAYING PLASMA IN A NITROGEN DISCHARGE
V.Yu. Baranov, F.I. Vysikailo, A.P. Napartovich, V.G. Niz'ev, S.V. Pigul'skii and A.N. Starostin
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
Soviet Journal Of Plasma Physics, Vol. 4, No. 2, pp 201-205 (04/1978).
Trans. From: Fiz. Plazmy 4, 358-365 (March-April 1978)
The stability of a nitrogen glow discharge plasma in a static electric field has been studied. Gas-dynamic effects in the discharge gap were studied with an interferometer. Experimental results on the electrode effects in pulsed discharges are reported. The discharge was photographed during the transition from the homogeneous phase to an arc, using an LV-03 time-loop unit. The experimental data on the time of this transition are compared with numerical calculations. The model used for these calculations incorporates stepwise ionization from metastable electronic states of the molecule and the time evolution of the gas density in the discharge gap. The rate constants for the elementary processes involving electrons are calculated with a non-Maxwellian electron velocity distribution which is a function of E/n and the average vibrational temperature of the gas. It is concluded that the time required for the discharge contraction is very sensitive to the gas-dynamic perturbations, the stepwise ionization, and the variation with vibrational temperature of the rate constants for the elementary processes. 15 Refs.
Primary Keywords: Nitrogen Discharge; Glow Discharge; Discharge Contraction; Static E-field; Gas Density; Electrode Effects, Experiment, Theory

7111
(BREAKDOWN STUDIES)
(Liquid, Electrical)
DEVELOPMENT OF A PULSE DISCHARGE IN LIQUIDS
V.S. Komel'kov
Soviet Physics-Technical Physics, Vol. 6, No. 8, pp 691-699 (02/1962).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 31, 948-960 (August 1961)
We show experimentally that pulse discharges in polarized (distilled water) and nonpolarized (transformer oil) liquids are the result of a leader process. In a low resistance discharge circuit the leader develops continuously. In high resistance discharge circuit a stepwise movement of the leader from electrode to electrode is noted. In oil a secondary discharge takes place after the completion of the leader stage. We present a qualitative analysis of the phenomena under study. 28 Refs.
Primary Keywords: Liquid Breakdown; Water Breakdown; Transformer Oil Breakdown; Leader Process: Continuous Leader; Photographic Diagnostic

7113
(BREAKDOWN STUDIES)
(Liquid, Electrical)
DISCHARGE PHENOMENA IN LIQUIDS
I.S. Stekol'nikov and V.Ya. Ushakov
G.M. Krzhizhanovskii Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 10, No. 9, pp 1307-1313 (03/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1692-1700 (September 1965)
In the present work we have investigated the development of discharges in transformer oil (of GOST strength 45 to 54 kV), distilled water (gamma = 1E-5/ohm cm.), and ethyl alcohol (industrial grade) under a pulsed voltage in rod-to-plane (+r-p and -r+p) and rod-to-rod (r-r) geometries. The interelectrode gap was varied from 50 to 165 mm. The voltage pulse length was varied from 1.5 to 70 microseconds at the amplitude corresponding to 50% of the discharge value. 10 Refs.
Primary Keywords: Liquid Breakdown; Water Breakdown; Transformer Oil Breakdown; Alcohol Breakdown, Rod-rod Gap; Rod-plane Gap; Breakdown Development, Photographic Diagnostic.

7115
(BREAKDOWN STUDIES)
(Gas, Electrical)
GAS-DISCHARGE CONTRACTION
E.A. Muratov, I.G. Persiantsev, V.D. Pis'mennyi and A.I. Rakhimov
Nuclear Physics Scientific-Research Institute, Moscow State University, Moscow, USSR
High Temperature, Vol. 13, No. 3, pp 592-594 (06/1975).
Trans. From: Teplofizika Vysokikh Temperatur 13, 654-656 (May-June 1975)
A diffuse gas discharge in a cylindrical tube contracts as the current increases; the degree of contraction is dependent on many detailed characteristics such as the degree of ionization, the charged particle recombination mechanism, and the electronegative impurity concentration, but the usual contraction mechanism for a long cylindrical tube is radial displacement of the heated gas from the axis towards the periphery. This is due to the radial temperature gradient, which itself arises from the surface heat loss. To establish the importance of the heating in the contraction, we made some experiments with a glass tube filled with a gas carrying a normal glow discharge, and the pressure, current, and voltage were chosen such that the discharge filled the entire cross section. Such a discharge will burn in a stable fashion if the circuit contains a ballast resistance whose value is governed by the discharge current, and which usually has to be much greater than the plasma resistance. In that case, any current fluctuation in the plasma results in a change in the balance of potential differences between the ballast resistance and the discharge tube, which tends to stabilize the situation. 7 Refs.
Primary Keywords: Gas Discharge; Diffuse Discharge; Discharge Contraction; Current Dependence, Impurity Concentration

7116
(POWER CONDITIONING)
(Pulse Transformers)
GENERALIZED CHARACTERISTICS OF THE OSCILLATORY SYSTEM OF A TUNED HIGH-VOLTAGE TRANSFORMER FOR SUPPLYING HIGH-CURRENT PULSED ACCELERATORS
S.M. Mezentsev, V.I. Mikhailov and S.V. Naek
All-Union Institute, Moscow, USSR
Instruments And Experimental Techniques, Vol. 17, No. 6, pp 1559-1562 (12/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 14-17 (November-December 1974)
Generalized characteristics are given for the coupled circuits of a tuned high-voltage transformer, which enables one to calculate the circuit parameters when there is nonlinear loading, which is typical of high-current pulsed electron accelerators. 6 Refs.
Primary Keywords: Tuned Transformer; Nonlinear Load; Electron Accelerator; Theory; Experiment; Switching Considerations

7117
(PARTICLE BEAMS, ELECTRON)
(Generation)
HIGH-CURRENT PULSED ELECTRON GUN BASED ON AN ELIT-1 ACCELERATOR
V.A. Denilychev and V.E. Khodkevich
Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Instruments And Experimental Techniques, Vol. 14, No. 3, pp 110-113 (06/1971).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 157-158 (May-June 1971)
The construction of an electron gun based on an ELIT-1 accelerator is proposed which allows pulsed electron current of up to 1 kA having a current-pulse length of 10 nsec to be obtained at an accelerating voltage of 1 MeV. 2 Refs.
Primary Keywords: Electron Gun; ELIT-1 Accelerator; <=1 KA Pulsed Electron Current; 10 nsec Current-pulse Length; 1 MeV Accelerating Voltage; Insulator Dielectric Strength

7120
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)
MAGNETIC CUMULATION
A.D. Academician, R.Z. Sakharov, R.Z. Lyudaev, E.N. Smirnov, Yu.I. Plyushchev, A.I. Pavlovskii, V.K. Chernyshev, E.A. Fenktistova, E.I. Zharinov and Yu.A. Zysin
Soviet Physics-Doklady, Vol. 10, No. 11, pp 1045-1047 (05/1966).
Trans. From: Doklady Akademii Nauk SSSR 165, 65-68 (November 1965)
Any explosion is an abundant source of mechanical and thermal energy. In 1951 Sakharov proposed a possible way of converting this energy to magnetic form together with the general lines of devices for producing very strong fields and currents by the explosive deformation of current-carrying conductors. The process has been called magnetic cumulation. Here we describe briefly two typical generators of this type: the MK-1 (which employs compression of an axial magnetic field) and the MK-2 (ejection of the magnetic field from a solenoid and subsequent compression by the walls of a coaxial line). 3 Refs.
Primary Keywords: Flux Compression; Magnetic Cumulation; Axial Magnetic Field Compression; Coaxial Line Wall Compression; Aluminum Tube

7121
(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL)
(Flux Compression; Flux Compression Generators)
MAGNETOIMPLOSIVE GENERATORS
A.D. Sakharov
Soviet Physics Uspekhi, Vol. 9, No. 2, pp 294-299 (10/1966).
Trans. From: Usp. Fiz. Nauk 88, 725-734 (April 1966)
Several recent experimental and theoretical papers are devoted to the use of explosions to produce ultrastrong magnetic fields. The same topic was also the subject of a recent international conference (Rome, September 1965). In the USA and the USSR, fields of 15-25 million gauss were attained in individual experiments. Somewhat weaker fields 15-25 million gauss) can be attained relatively simply. In this article we describe the physical and structural principles of magnetoimplosive generators and their characteristics and touch upon problems involving their application. 10 Refs.
Primary Keywords: Flux Compression Generator, Explosive Driven; Detonation Lens; Lenses; Cylindrical Geometry; Theory

7122
(BREAKDOWN STUDIES)
(Gas, Electrical)
ONSET OF THE IONIZATION INSTABILITY IN A PERIODIC, EXTERNALLY SUSTAINED DISCHARGE IN NITROGEN AND A N/SUB 2/-CO/SUB 2/ MIXTURE AT HIGH PRESSURES
E.A. Muratov, V.D. Fis'mennyi and A.T. Rakhimov
Scientific-Research Institute Of Nuclear Physics, Moscow State University, Moscow, USSR
Soviet Journal Of Plasma Physics, Vol. 3, No. 2, pp 230-232 (04/1977).
Trans. From: Fiz. Plazmy 3, 405-408 (March-April 1977)
When an externally sustained discharge is operated in a train of pulses in a high-pressure gas, the maximum specific energy which can be pumped into the gas is quite different from that in the case of single-pulse excitation. The time evolution the instability which limits the number of pulsed of a homogeneous, externally sustained discharge in nitrogen is different from that in an N/sub 2/-CO/sub 2/ mixture. The difference is attributed to an essential difference in the instability. 9 Refs.
Primary Keywords: Gas Discharge; Nonselfsustained Discharge; Breakdown Instability; Temporal Resolution; Chang Electrodes; N/sub 2/-CO/sub 2/ Mixture

7123
(BREAKDOWN STUDIES)
(Gas, Electrical)
SOME CHARACTERISTICS OF A DOUBLE, HOLLOW CATHODE WITH THE PULSED SUPPLY OF THE CATHODE-EXCITER
Yu.B. Atnashev and V.N. Muzgin
Journal Of Applied Spectroscopy, Vol. 23, No. 3, pp 1153-1156 (09/1974).
Trans. From: Zhurnal Prikladnoi Spektroskopii 21, 414-418 (September 1974)
The use of a double, hollow cathode with separated zones for evaporation and excitation made it possible to obtain a quantity of new data on the mechanism for a discharge in hot and cooled hollow cathodes. In connection with this it was of interest to use the method of the independant control of the processes for the evaporation of the sample material and for the excitation of its spectrum to study such little investigated variations of the discharge in a hollow cathode as the pulsed discharge. In this study a discharge tube was used with a double hollow cathode, analogous to that described earlier. The cathode-evaporator was supplied by means of a direct current and the cathode-exciter was supplied by a pulsed current having an amplitude of from 0.5 to 10 amps for a following frequency of the pulses of from 20 to 1000 Hz. 12 Refs.
Primary Keywords: Helium Gas Breakdown; Optical Diagnostic; Emission Spectrum; Hollow Cathode; Impulse Voltage

7124
(SWITCHES, OPENING)
(Explosive Fuses)
SWITCHING CHARACTERISTICS OF EXPLOSIVE DISCONNECTORS WITH RAPID DESTRUCTION OF THE CONTACT ELEMENT
E.A. Azizov, N.A. Akhmerov, K.I. Kozorezov and V.V. Senchenko
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 19, No. 4, pp 456-459 (08/1978).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 4, 66-50 (July-August 1978)
The extension of the range of application of inductive stores, including their use to obtain high-power electron beams and to supply plasma-dynamic systems with energies greater than 1 MJ, involves the design of ultra-low-resistance (approximately 1E-6 ohm) switches for power levels of 1E11 - 1E12 W and switching rise times of 1E-6 - 1E-7 sec. It would seem that such switches can be designed using the principles of the rapid destruction of a contact element by an explosive charge. However, a number of problems arise in this direction which can only be solved experimentally: 1) What should the length of the destroyed part of the contact for a given switching voltage be, and how does it depend on the current and geometry? 2) What is the minimum switching time determined by the interaction between the explosion products and the arc which occurs at the points of destruction? 3) The relation between the ratio of the masses of the explosive charge M/sub e/ and the contact junction m, alpha= m/M/sub e/, and the switching power for a given thermal stability of the current-carrying elements. In this paper we present the results of a study of the switching characteristics of some versions of explosive switches (ES) with rapid destruction of the contact element. 3 Refs.
Primary Keywords: Load Circuit Characteristics And Parameters; Rapid Contact Element Destruction; Ultra-low-resistance Switches; 1E11 - 1E12 W Power Levels; 1E-6 - 1E-7 sec Switching Rise Times; Explosive Switches

7125
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
VOLTAGE WAVEFORM FOR EXPLODING WIRES
V.I. Budovich and I.P. Kuzhekin
Moscow Power Institute, Moscow, USSR
Soviet Technical Physics Letters, Vol. 1, No. 11, pp 440-441 (11/1975).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 1 1023-1026 (November 1975)
It is shown elsewhere that a conductor through which a high current flows can be destroyed by MHD instabilities. The development of such instabilities in a liquid conductor leads, in the final analysis, to the formation of numerous breaks in the conductor in which electric arcs are ignited. Ignition of each arc raises the voltage across the conductor by an increment to a value not less than the sum of the electrode voltage drop in the arc, this effect being manifested as a voltage step. The number of such breaks and arcs increases rapidly, and after the first arc is ignited, the voltage across the exploding wire increases rapidly. To be able to record the steps corresponding to the ignition of arcs in the breaks, it is necessary to measure the voltage with high time resolution. The measurement has been performed here in the following manner: When current begins to flow from a 0.0156 F capacitor bank through a wire connected in series with a 0.34 ohm ballast resistor, a signal is applied to a G5-27 generator, and this delays the pulse triggering the S8-2 oscilloscope. The delay is chosen approximately equal to the time between the start of the current flow and the very rapid growth of the voltage. 3 Refs.
Primary Keywords: Exploding Wire; Voltage Measurement; High Temporal Resolution; Voltage Steps; Magnetohydrodynamic Instability; Wire Constriction

7128
A NANOSECOND PULSE GENERATOR FOR SPARK CHAMBERS
A.I. Alikhanyan, A.S. Aleksanyan, G.A. Vorb'ev, R.L. Kabalov and V.K. Krol
FTD, Wright-Patterson AFB, OH
Rpt. FTD-ID(RS)T-1848-79, 17p (12/1979).
Availability: AD-A087 876/9 NTIS
No abstract available.
Primary Keywords: Pulse Generators; Spark Chambers; Magnetic Fields; Translations; USSR
Secondary Keywords: Strip Lines; Arkad'yev Marx Generators; Coaxial To Strip Crossover; NTISDODXA; NTISFNUR

7130
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, INDUCTIVE)
(Inductors; Systems)
AN INDUCTIVE STORE WITH ELECTROMAGNETIC CURRENT MULTIPLICATION
A.V. Ivlev, A.S. Kibardin, A.V. Komin, V.G. Kuchinskii, K.M. Lobanov and Yu.A. Morozov
D.V. Efremov Institute, Leningrad, USSR
Electric Technology USSR, Vol. 100, No. 1, pp 24-33 (01/1980).
Trans. From: Elektrichestvo 100, 47-49 (1980)
An inductive energy store is described in which electromagnetic current multiplication is used to increase the output current to the load without increasing pump current. A toroidal geometry is chosen with a circular coil utilized. A shield is imposed to alter the value of the store at an appropriate moment to increase current without elaborate switching systems. High efficiency is reported. 2 Refs.
Primary Keywords: Inductive Store; Electromagnetic Current Multiplication; 65% Efficiency; Fewer Switches; Greater Mechanical Strength; Mechanical Multiplication; Simpler Commutation System; Ensured Electric Strength; Increased Metal Mass

7134
(BREAKDOWN STUDIES)
(Gas, Electrical)
DEVELOPMENT OF A SPARK DISCHARGE. I
S.I. Andreev and B.I. Orlov
Soviet Physics-Technical Physics, Vol. 10, No. 8, pp 1097-1101 (02/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1411-1418 (August 1965)
It is shown that the electrical phenomena and the expansion of a spark channel during the first current half-cycle can be described with good accuracy if it is assumed that the specific electrical conductivity of the plasma remains constant during this time interval. 16 Refs.
Primary Keywords: Spark Discharge; Constant Electrical Conductivity; Spark Channel; Channel Expansion; Power Line Frequency; Theory; Hydrodynamic Theory

7135
(PARTICLE BEAMS, ELECTRON)
(Generation)
DEVELOPMENT OF HIGH-CURRENT ELECTRON ACCELERATORS
M.V. Babykin and A.V. Bartov
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
Soviet Technical Physics Letters, Vol. 1, No. 3, pp 123-124 (03/1975).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 1, 257-262 (March 1975)
To realize the suggestions advanced by Zavoiskii, Winterberg, and others of initiating thermonuclear reactions by heating a dense target with a beam of relativistic electrons using inertial confinement, the power required is 1E15-1E16 W; when a heavy tamper is used to compress the target, the power is approximately 3E14 W. the beam current is I 1E7-1E8 A, and the heating time is approximately 10 nsec. When the voltage pulse used to accelerate the electrons is shaped by a transmission line, the power W, and the total line current I are determined by the allowable field E in the dielectric and by the dimensions of the line. To obtain large power it is necessary to use large and expensive systems and optimization is important. 11 Refs.
Primary Keywords: Electron Accelerators; Relativistic Electrons; Multiple Breakdown; 5 nsec Rise Time; Cylindrical Line

7136
(INSULATION, MATERIAL; INSULATION, MATERIAL)
(Liquid; Solid)
DIELECTRIC MATERIALS FOR HIGH-VOLTAGE PULSE GENERATORS
B.A. Demidov, V.A. Petrov and S.D. Fanchenko
Soviet Physics-Technical Physics, Vol. 17 No. 1, pp 124-126 (07/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 42, 179-181 (January 1
Experiments carried out to study the electric strength E_{max} of transformer oil, distilled water, and polyethylene under 250-kV pulses 0.35 microsecond long are described. The dielectric materials are compared on the basis of the parameter equal to epsilon x electric strength squared which characterizes the no energy flux per unit cross section of the dielectric. 9 Refs.
Primary Keywords: Transformer Oil; Distilled Water; Polyethylene; Dielectric Strength; Impulse Voltage

7138
(PULSE GENERATORS)
(Flux Compression)
EXPLOSION-MAGNETIC GENERATOR WITH AN INDUCTIVE LOAD
I.I. Divnov, Yu.A. Gus'kov, N.I. Zotov, O.P. Karpov and B.D. Khristoforov
Institute Of Earth Physics, Academy of Sciences of the USSR
Combustion Explosion And Shock Waves, Vol. 12, No. 6, pp 841-843 (12/1976).
Trans. From: Fizika Goreniya i Vzryva 12, 959-962 (November-December 1976)
The authors describe a design for an explosively driven magnetic flux compression generator driving an inductive load through a transformer. Performance data are presented with conversion efficiency included. The very flux loss encountered is discussed. A qualitative analysis of the coupling transformer is given. 6 Refs.
Primary Keywords: Flux Compression Generator; Explosively Driven; Transformer Coupling; Inductive Load; Conversion Efficiency

7142
(PARTICLE BEAMS, ELECTRON)
(Generation)
HIGH-CURRENT, MICROSECOND-RANGE RELATIVISTIC ELECTRON BEAM
B.A. Demidov, M.V. Ivkin, V.A. Petrov and S.D. Fanchenko
Soviet Physics-Technical Physics, Vol. 20, No. 12, pp 1597-1600 (06/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 2568-2573 (December 1975)
An experimental study is reported of the possibility of producing a microsecond, kiloampere pulse of relativistic electrons in an accelerator with a gap consisting of a point cathode and a plane anode. Because of the radial beam divergence in this configuration, the electron current density near the anode is reduced. This reduction makes it possible to prolong the spontaneous breakdown of the accelerating gap. The spectrum of accelerated electrons is studied. The absolute energy calibration is carried out with a beta source. 7 Refs.
Primary Keywords: Delayed Accelerating Gap Breakdown; 1 MV Pulse Voltage Generator; Accelerating Tube; Relativistic Electron Beam; Microsecond Kiloampere Pulse; Electron Current Density Reduction; Inhomogeneous Magnetic Field
Secondary Keywords: Radial Beam Divergence

7145
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, CAPACITIVE)
(Systems, Capacitor Banks)
INDUCTIVE STORAGE BANK FOR DYE-LASER PUMPING
I.I. Artamonov, B.A. Barikhin, V.V. Borovkov and V.I. Kashintsov
Soviet Physics-Technical Physics Letters, Vol. 4, No. 12, pp 573 (12/1978).
Trans. from: Pis'ma Zhurnal Tekhnicheskoi Fiziki 4, 1416-1418 (December 1978)
In this letter we describe an experimental study of the pumping of an ethanol solution of the dye Rhodamine 6G. The experiments are carried out in a system in which energy is supplied to the discharge in a coaxial flash lamp in two ways: directly from the capacitive storage bank, or by transfer of the energy stored in the capacitor bank to an inductance. In the second case the same amount of energy as in the first case is then transferred from the inductance to the flash lamp with no change in the parameters of the discharge circuit. 5 Refs.
Primary Keywords: Inductive Energy Storage; Increased Laser Output Energy; Comparison With Capacitive Storage
Secondary Keywords: Dye-laser Pumping

7146
(SWITCHES, OPENING)
(Mechanical)
INFLUENCE OF A DIELECTRIC MEDIUM ON THE CHARACTERISTICS OF A HIGH-SPEED EXPLOSIVE CIRCUIT BREAKER
E.A. Azizov, N.A. Akhmerov and V.A. Yagnov
Soviet Technical Physics Letters, Vol. 2, No. 4, pp 121-123 (04/1976).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 2, 316-321 (April 1976)
In an explosive circuit breaker that uses shunting of the disconnect arc, a section of the current conductor is destroyed with an explosive. The destroyed section is a hollow cylinder, along the axis of which the explosive charge is located. The space between the charge and the wall of the destroyed element is filled with a dielectric. 1 Refs.
Primary Keywords: Explosive Circuit Breaker; Mechanical Spreading; Current Conductor; Dielectric Medium Influence; Plasma Pressure

7150
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
MOTION OF THE CATHODE SPOT OF A VACUUM ARC
V.A. Nemchinskii
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 7, pp 767-771 (07/1979).
Trans. from: Zhurnal Tekhnicheskoi Fiziki 49, 1379-1385 (July 1979)
A mechanism is proposed for explaining the motion of the cathode spot of a vacuum arc. The spot velocities estimated on the basis of this mechanism agree with the experimental results for spots on tungsten, copper, and mercury. 22 Refs.
Primary Keywords: Vacuum Arc; Cathode Spot; Spot Motion; Theory; Comparison With Experiment. Several Cathode Materials

7154
(PARTICLE BEAMS, ELECTRON)
(Generation)
OBTAINING HEAVY CURRENT ELECTRON BEAMS (SURVEY)
V.P. Smirnov
Instruments And Experimental Techniques, Vol. 20, No. 2, pp 337-364 (04/1977).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 7-31 (March-April 1977)
The most important results of the development of heavy current accelerating with >= 10 kA current and <= 100 nsec pulse duration are collected in this survey and their main elements: the pulse supply sources based on capacitive storage, the shaping line dielectrics, the shaping and transport lines, the shaping line commutators, the inductive storage, the accelerator tube insulators, and the diodes, are described. Certain possible accelerator schemes with energy storage in a >= 1 MJ beam and the power approximately 1E14 W are considered. 160 Refs.
Primary Keywords: 10 kA Heavy Current Accelerators; <= 100 nsec Pulse Duration; 1E13 W Maximum Beam Power; 2 ms Beam Energy; Relativistic Electron Beams

7158
(PARTICLE BEAMS, ELECTRON; BREAKDOWN STUDIES)
(Generation; Vacuum, Electrical)
PREPULSE DISCHARGES IN THE DIODES OF A HIGH-CURRENT ACCELERATOR WITH A DOUBLE SHAPING LINE
V.A. Tsukeman, I.A. Troshkin, K.F. Zelenskii and N.V. Belkin
Soviet Technical Physics Letters, Vol. 5, No. 2, pp 67-68 (02/1979).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 5, 169-172 (Feburary 1979)
High-current accelerators with vacuum diodes with double shaping lines have recently been adopted widely for generating short pulses of relativistic electrons and bremsstrahlung. Such lines are usually charged with a pulsed Marx system. During charging a preliminary high-voltage pulse appears across the electrodes of the vacuum diode. We have found the prepulse useful in a comparatively small high-current generator of fast electrons and bremsstrahlung, the GONG generator. 7 Refs.
Primary Keywords: E-beam Generator; Prepulse Discharges; High-current Accelerator; Double Shaping Line; Vacuum Diodes; GONG Generator

7159
PULSE CURRENT GENERATOR
M.I. Kozlov and N.S. Rudenko
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-1936-79, 8p (12/19799).
Availability: AD-A084 534/7
NTIS
No abstract available.
Primary Keywords: Pulse Generators; Electric Generators; High Voltage, Patents; Translations
Secondary Keywords: Foreign Technology; NTISDODXA; NTISFNUR

7165
(SWITCHES, CLOSING)
(Surface Discharge, Electrical)
TIME CHARACTERISTICS OF A MULTICHANNEL GRAZING-DISCHARGE HIGH-VOLTAGE SWITCH
G.I. Belyaev, P.N. Dashuk and M.A. Chernov
M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 5, pp 578-581 (05/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 980-986 (May 1979)
The temporal characteristics of multichannel grazing-discharge switches capable of repeatedly switching currents up to 1E6 A have been tested experimentally. Short delay times and switching times are found (1E-7 sec). In addition, the spread in these times is small (1E-8 sec). The characteristics of the ignition device and the magnitude and polarity of the main voltage affect the controllability of the switch. 9 Refs.
Primary Keywords: Multichannel Grazing-discharge Switches; 1E6 A Currents; Short Delay Times; Fast Rise Time, Low Inductance

7166
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
TWO-CHAMBER HEAVY-CURRENT HIGH-VOLTAGE SWITCH
O.G. Bespalov, A.S. Knyazyatov, A.I. Nastyukha, P.A. Smirnov and A.N. Udovenko
Instruments And Experimental Techniques, Vol. 18, No. 1, pp 125-126 (02/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 113-114 (January-February 1975)
A description is given of a switch that will handle currents of about 500 kA at 1-20 kV with a length of 5-100 microseconds for the first half-cycle in the pulse and a repetition frequency of 0.1 Hz. The device works with residual gas at 3 - 8E-2 Torr. A study has been made of the gas composition. 5 Refs.
Primary Keywords: 1-20 kV Switch; 500 kA Currents; Hollow Cold Cathode Arc Switches; Two Chamber Switch; Copper Anode

7167
(BREAKDOWN STUDIES)
(Vacuum, E-beam)
VAPOR PRESSURE AND LOCAL ANODE TEMPERATURE IN ELECTRICAL BREAKDOWN IN VACUUM BY AN ELECTRON BEAM
V.I. Mikhailov and N.I. Timofeev
Soviet Physics-Technical Physics, Vol. 15, No. 1, pp 169-170 (07/1970)
Trans. From: Zhurnal Tekhnicheskoi Fiziki 40, 214-215 (January 1970)
Electrical breakdown in vacuum can result from local heating of the anode. The anode is heated by an artificially produced beam of electrons. The increment of electron current in the gap is measured, and the vapor pressure of material from the stainless steel anode, n/sub 0/=1E19 cu cm, is determined. A local anode temperature T approximately 3100-3200 Deg.K, is calculated from other experimental parameters. The order of magnitude of the values is close to that obtained in other work. 6 Refs.
Primary Keywords: E-beam Initiated Electrical Breakdown; Vacuum Breakdown, 3100-3700 Deg K, Local Anode Temperature, Anode Material Evaporation, 1E19 cu cm Evaporation Vapor Density

7168
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
A SIMULATION APPROACH TO HIGH AVERAGE POWER REPETITIVELY PULSED SWITCH TESTING
R.W. Clark
Maxwell Labs Inc, San Diego, CA 92123
IEEE Transactions on Industrial Electronics and Control Instrumentation, Vol IECI-23, No. 1, pp 98-101 (02/1976).
A technique is discussed which can be used to simulate the very high average power environment encountered when high power switches are operated in a repetitively pulsed mode. An operational test facility is described which has been used to test spark gap switches at voltages up to 80 kV, pulse repetition rates up to 500 pps, and simulated average power levels of several megawatts. The power consumed in the test facility depends on the power simulation and the voltages used in the test circuit. Typically, the electrical activity experienced by a switch transferring several megawatts average power can be provided with a few hundred kilowatts average power using the simulation concept described here. 4 Refs.
Primary Keywords: Spark Gap; Simulation; Low Power Operation, High Power Simulation; Rep rated

7169
(BREAKDOWN STUDIES)
(Gas, Electrical)
A MODEL FOR THE STUDY OF SWITCHING-SURGE BREAKDOWN OF LONG AIR GAPS
E.J. Los
General Electric Co, Pittsfield, MA 01201
IEEE Transactions On Power Apperatus And Systems, Vol. PAS-97, No. 6, pp 2382-2392 (12/1978).
A model of the discharge process leading to the switching surge flashover of long air gaps is presented. This model is based on a new non-thermal equilibrium model of the discharge channel. Depending on temperature and current, the volt ampere characteristics of the discharge channel simulation behave either like a resistor or a zener diode. This channel simultion is combined with an electric field calcuation to produce a breakdown model for arbitrary gap geometries and applied voltage waveforms. The model is currently implemented on a minicomputer system. 34 Refs.
Primary Keywords: Non-thermal Equilibrium Model; Discharge Channel; Resistor Behavior; Zener Diode Behavior; Arbitrary Gap Geometries; Arbitrary Voltage Waveform

7170
(DIAGNOSTICS AND INSTRUMENTATION)
(Miscellaneous)
A DOUBLE FREQUENCY METHOD FOR THE DETERMINATION OF THE VOLTAGE DEPENDENT CAPACITANCE VARIATION OF COMPRESSED GAS CAPACITORS
J. Zinkernagel
Physikalisch Technische Bundesanstalt, Braunschweig, FRG
IEEE Transactions on Power Appreratus and Systems, Vol. PAS-98, No. 1, pp 304-309 (02/1979).
This paper describes the development of a double frequency measurement method by the aid of which the voltage dependent capacitance variation of high voltage compressed gas capacitors is determined with most methodical exactitude. The measurement method makes use of a modified Schering-bridge and of a specially developed turning device for bridge balancing, the selectivity of which is extremely high, and new in the range of low frequency measurement technique. 6 Refs.
Primary Keywords: Compressed Gas Capacitor, Schering-bridge; Very High Selectivity; Double Frequency; Electrostatic Force

7171
(SWITCHES, OPENING)
(Mechanical)
THE TRANSIENT RECOVERY VOLTAGE APPLICATION OF POWER CIRCUIT BREAKERS
R.G. Colclaser
University of Pittsburg, Pittsburgh PA
IEEE Transactions On Power Apperatus And Systems, Vol. 91, No. 5, pp 1941-1947 (10/1972).
The proposed transient recovery voltage standard for high voltage circuit breakers will specify application requirements on a recovery voltage basis. This paper studies the inherent circuit parameters required to generate the required TRV envelope. A simplified application procedure is developed based on miles to the first line discontinuity and the number of lines connected on the bus side of the circuit breaker. 12 Refs.
Primary Keywords: Transient Recovery Voltage; Standard; Application; Current Rating; Voltage Rating

7172
(PULSE GENERATORS)
(Blumlein Lines)
THE USE OF A PLANAR THREE-ELECTRODE BLUMLEIN LINE FOR THE SUPPLY OF SYMMETRIC STREAMER CHAMBERS
V.A. Mikhailov and T.A. Tomtadze
Institute of Physics, Academy Of Sciences of the Georgian SSR, Tbilisi, USSR
Nuclear Instruments And Methods 130, Pp 61-63 (08/1975).
The paper suggests a principally new supply circuit of the symmetric streamer chamber, aplicable for the supply of the multilayer system of the spark gaps by a step-down voltage as well. The photoes of the showers registered in the chamber having the sensitive volume (100 x 75 x 10) x 2 sq. cm. are given. 4 Refs.
Primary Keywords: Blumlein Line; Double Forming Line
Secondary Keywords: Streamer Chamber

7173
(REVIEWS AND CONFERENCES)
(Conferences)
IEEE 2ND INTERNATIONAL PULSED POWER CONFERENCE DIGEST OF TECHNICAL PAPERS
A.H. Guenther (1) and M. Kristiansen Eds (2)
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(2) Texas Tech University, Lubbock, TX 79409
(06/1979).
This conference record contains 104 papers (4 are included as abstracts only), 102 of which are referenced individually in the bibliography. Topics include energy storage, pulse generation, pulse shaping, switching, partical beam generation and transport, applications, and reviews of the state-of-the-art. 0 Refs.
Primary Keywords: Energy Storage, Pulse Generation; Pulse Shaping; Switching, Particle Beam Generation And Transport; Applications

7174
(PARTICLE BEAMS, ELECTRON)
(Generation)
SIMULATIONS OF INTENSE RELATIVISTIC ELECTRON BEAM GENERATION BY FOILLESS DIODES

M.E. Jones and L.E. Thode
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 68-71 (06/1979).

Foilless diodes used to produce intense annular relativistic electron beams have been simulated using the time-dependent, two-dimensional particle-in-cell code CCUBE. Current densities exceeding 200 kA/sq.cm. have been obtained in the simulations of a 5 MeV, 35 ohm diode. Many applications, including microwave generation, collective ion acceleration and high-density plasma heating require a laminar electron flow in the beams. The simulation results indicate that foilless diodes immersed in a strong external magnetic field can achieve such a flow. Diodes using technologically achievable magnetic field strengths (approximately 100 kG) and proper electrode shaping appear to be able to produce beams with an angular scatter of less than 35 mrad at the current densities and energies mentioned above. Scaling of the impedance and temperature of the beam as a function of geometry, magnetic field strengths and voltage is presented. 11 Refs.
Primary Keywords: Annular E-beam; High Impedance; Laminar Flow; Good Collimation; Numerical Calculation

7175
(ENERGY STORAGE, MECHANICAL; PULSE GENERATORS)
(Rotating Machines, Rotating Machines)
FUNDAMENTAL LIMITATIONS AND DESIGN CONSIDERATIONS FOR COMPENSATED PULSED ALTERNATORS

W.F. Weldon, W.L. Bird, M.D. Driga, K.M. Tolk, H.G. Rylander and H.H. Woodson
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 76-82 (06/1979).

Since the beginning of a project intended to demonstrate the feasibility of using a compensated pulsed alternator (compulsator) as a power supply for NOVA and other solid state laser systems, a great deal of interest has been generated in applying this type of machine to supply energy for other types of loads. This paper outlines the fundamental limitations imposed on the design of such a machine by the mechanical, thermal, magnetic, and electrical properties of the materials used. Using these limitations, the power and energy available from the machine are calculated as functions of machine dimensions. Several configurations for the machine and their relative merits for various applications are also discussed. 5 Refs.
Primary Keywords: Compulsator; Limitations; Pulse Transformer; Load Coupling; Pulse Width Determination

7176
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)
COMMAND CHARGE USING SATURABLE INDUCTORS

S. Black and T.R. Burkes
Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 102-105 (06/1979).

Line-type pulsers operating at rep-rate greater than a few kilohertz require special circuits to insure proper operation of the switch. Specifically, thyratrons and other closing switches require a 'grace period' of several microseconds or more before anode voltage is reapplied, this delay allows recovery and prevents reclosure of the thyratron. One method of achieving the required delay time is by using a slightly mismatched PFN and slower-than-resonant charging. However, repetition rates of line-type modulators are limited by the characteristics of resonant charging. In order to increase rep-rates, these characteristics may be modified by using a saturable reactor as a charging inductor. This paper describes design considerations and laboratory performance of saturable inductors used to resonantly charge an energy storage network up to 25 kV with a delay as much as 16.5 microseconds. 1 Refs.
Primary Keywords: Saturable Reactor; Charging Inductor; Line-type Pulser; Rep-rated; Thyratron

7177
(BREAKDOWN STUDIES)
(Surface Flashover)
INVESTIGATIONS OF FAST INSULATOR SURFACE FLASHOVER

J.E. Thompson (1), L. Lin (1), K. Mikkelson (2) and M. Kristiansen (2)
(1) University of South Carolina, Columbia, SC
(2) Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 106-113 (06/1979).

Electro-optical measurements of the electric fields along insulator surfaces have been made to determine the mechanisms associated with fast insulator flashover. Data will be presented that show the temporal and spatial performance of the surface fields prior to and at flashover for insulator surfaces oriented at 0 Deg. and 45 Deg. with respect to the applied field. Results show that the surface field near the cathode is enhanced and the field near the anode is reduced during the excitation. The results further show a temporal reduction in the field non-uniformity as flashover is approached. The field collapse for 45 Deg. surfaces begins at the anode and propagates at 0.83 cm/ns towards the cathode. Mechanisms consistent with these experimental measurements will be postulated. 10 Refs.
Primary Keywords: Electro-optical Measurement; Surface Field Profiles; Temporal Field Profiles; Field Collapse

7178
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Self)
BREAKDOWN IN SMALL, FLOWING GAS SPARK GAPS

W.K. Cary Jr., D.D. Lindberg and J.W. Rice
Naval Surface Weapons Center, Dahlgren, VA 22448
2nd IEEE International Pulsed Power Conference Proceedings, pp 114-118 (06/1979).

An improved method for studying electrical breakdown in small, flowing gas spark gaps is described. The apparatus and data processing yield the time to breakdown, current, resistance, power dissipation and energy loss in the spark gap during the 4 nS in which the current rises from zero to a near constant value. A specially constructed transmission line terminated in a spark gap and instrumented with a B-dot probe and sampling oscilloscope is used to observe the breakdown. The initial charge on the transmission line and the current, obtained by integrating the B-dot signal, provide the information needed to define the spark gap operation in a well characterized coaxial arrangement. With a temporal resolution better than 50 ps, current components with frequencies to 10 GHz could be measured. An electronic circuit held the gap breakdown voltage and the subsequent charge in the transmission line to precise, predetermined values. A computer based data reduction system determined the current waveform from data corrected for the frequency response of the signal delay line. Results are given for argon and nitrogen, each at two overvoltages. 5 Refs.
Primary Keywords: Time to Breakdown, Current; Resistance; Power Dissipation; B-dot Probe; Transmission Line Spark Gap

7179
(BREAKDOWN STUDIES)
(Liquid, Electrical)
ELECTRICAL BREAKDOWN IN WATER IN THE MICROSECOND REGIME

D.B. Fenneman and R.J. Gripshover
Naval Surface Weapons Center, Dahlgren, VA 22448
2nd IEEE International Pulsed Power Conference Proceedings, Pp 122-126 (06/1979).

This paper describes the research on electrical breakdown in water currently being pursued at NSWC/DL. The experimental apparatus is described in some detail. Results of over 500 tests are presented. Breakdown events were observed predominantly in the 2-10 microsecond time domain for applied electrical fields in the range 200-500 KV/cm. The wide scatter of the breakdown time which is intrinsic to the phenomena requires a careful examination of the statistics of the data. 2 Refs.
Primary Keywords: High Fields; Water Conditioning; Wide Statistical Variation

7180
(PARTICLE BEAMS, ELECTRON)
(Generation)
PULSED ELECTRON FIELD EMISSION FROM PREPARED CONDUCTORS

G.B. Frazier
Physic International Co, San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 127-132 (06/1979).

The electron emission characteristics of metal cathodes subjected to pulsed electric fields in the absence of insulating magnetic fields has been investigated experimentally. Uniform electric fields in the range of 0.2-0.8 MV/cm were applied to 50 sq.cm. surfaces under vacuum in single pulses of approximately 60 ns duration at a voltage of approximately 0.5 MV. Bare metals and metals coated with dielectric materials were studied. Results show that bare metals with freshly prepared surfaces can withstand fields of >= 300 kV/cm for >= 40 ns without significant emission. Emission-induced discharges degrade the surfaces such that full space-charge-limited current densities (100-250 A/sq.cm. for this experiment) are obtained at fields as low as 200 kV/cm on subsequent pulses. In the case of coated surfaces, it was found that dielectrics could occasionally suppress emission completely up to approximately 300-400 kV/cm, and various metals could partially suppress emission after having passed significant current at fields up to 0.6 MV/cm. 12 Refs.
Primary Keywords: Metal Cathode; High Fields; No Magnetic Field, Discharge

7181
(BREAKDOWN STUDIES)
(Lightning)
INVESTIGATION INTO TRIGGERING LIGHTNING WITH A PULSED LASER

C.W. Schubert Jr. and J.R. Lippert
USAF Flight Dynamics Lab, Atmospheric Electricity Hazards Group
2nd IEEE International Pulsed Power Conference Proceedings, pp 132-135 (06/1979).

Theoretical and experimental considerations for the triggering of lightning with a high-power pulsed laser are discussed. The mechanisms of laser-induced clean air breakdown, aerosol breakdown, and channel heating over a long path for the purpose of initiating and possibly guiding lightning are reviewed. It is shown that long path (of the order of one kilometer) ionization through laser-induced clean air breakdown is theoretically possible. Channel heating over a long path appears possible, but requires prohibitive energies. Indications are that long path ionization can be enhanced by taking advantage of the significantly reduced power requirements for aerosol breakdown. The Mt. Baldy, New Mexico, experimental test site for 1978-1979 experiments and triggering attempts is briefly described. 4 Refs.
Primary Keywords: Clean Air Breakdown; Aerosol Breakdown; Channel Heating; Long Path; Theory; Experiment

7182
(SYSTEMS)
()
ANALYSIS OF A DISTRIBUTED PULSE POWER SYSTEM USING A CIRCUIT ANALYSIS CODE
L.D. Hoeft
BDM Corp, Albuquerque, NM 87106
2nd IEEE International Pulsed Power Conference Proceedings, pp 149-152 (06/1979).
A sophisticated computer code (SCEPTRE), used to analyze electronic circuits, was used to evaluate the performance of a large flash X-ray machine. This device was considered to be a transmission line whose impedance varied with position. This distributed system was modeled by lumped parameter sections with time constants of 1 ns. The model was used to interpret voltage, current, and radiation measurements in terms of diode performance. The effects of tube impedance, diode model, switch behavior, and potential geometric modifications were determined. The principal conclusions were that, since radiation output depends strongly on voltage, diode impedance was much more important than the other parameters, and the charge voltage must be accurately known. 3 Refs.
Primary Keywords: Flash X-ray Machine; Numerical Calculation; Modelling; Transmission Line; Gas Insulation; Impedance; Switching
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7183
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
DETERMINATION OF LINE VOLTAGE IN SELF-MAGNETICALLY INSULATED FLOWS
C.W. Mendel Jr., J.P. Vandevender and G.W. Kuswa
Sandia Labs, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 153-156 (06/1979).
Resistive and capacitive voltage monitors for self-magnetically insulated lines have been found to be unsatisfactory. However, it is know that the boundary current I/sub B/ and total current I/sub T/ are related to line voltage V and the total and boundary current can be used to infer the voltage. In this presentation we show relationships between V, I/sub T/ and I/sub B/ which are fairly insensitive to the canonical momentum distribution of flowing electrons. Using these relations we conclude that the voltage can be calculated from I/sub T/ and I/sub B/ with moderate accuracy with no knowledge about the particular flow involved, and quite accurately if only two, experimentally determined parameters are known. The inferred voltage waveforms will be compared to experimental voltage data. 7 Refs.
Primary Keywords: Voltage Measurement; Boundary Current; Total Current; Canonical Momentum
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7184
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
THE DESIGN OF SOLENOIDS FOR GENERATING HIGH MAGNETIC FIELDS
P. Byszewski
Institute Of Physics, Polish Academy Of Sciences, Warsaw, Poland
2nd IEEE International Pulsed Power Conference Proceedings, pp 148 (06/1979).
Magnetic fields of high intensity are usually generated by the pulsed discharge of capacitor banks through solenoids. In order to generate the highest fields, exploding coils or field compression techniques are used. However, for experiments it is essential that the coil withstand the electrodynamical forces. This is achieved by employing coils in which the stress exerted by the current density and the magnetic field does not exceed the strength of the material used to build the coil. 0 Refs.
Primary Keywords: Field Compression; Mechanical Forces; Current Den[illegible]
Secondary Keywords: Abstract Only
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7185
(ENERGY STORAGE, CAPACITIVE)
(Systems)
VERSATILE HIGH ENERGY CAPACITOR DISCHARGE SYSTEM
V.M. Martin
GTE Labs Inc., Waltham, MA 02154
2nd IEEE International Pulsed Power Conference Proceedings, pp [illegible] (06/1979).
The requirements for generating [illegible] waves of current [illegible] amplitudes over a range of [illegible] kA at [illegible] up to 1.6 kV are being met through the development of a compact [illegible] critically damped LCR discharge system containing 0.75F capacitance which can store up to 60,000J of energy. The system comprises five [illegible], electrically isolated capacitor banks, each containing 0.15F capacitance and charged to a nominal value of [illegible], which is controlled by a multielement SCR switch and can be discharged through inductors and resistors to provide one-half of a 60-cycle sinusoid at peak current values up to 36,000A. Circuit designs are presented for the isolation and status indication of each of the 500 capacitors, for inverse diodes to protect the polarized capacitors from reverse recovery voltage experiments performed after the main capacitor bank discharge, and for protection of the capacitors from overvoltage conditions. 0 Refs.
Primary Keywords: LCR Discharge System; Sinusoidal Output; Low Frequency; Low Voltage
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7186
(PULSE GENERATORS)
(Line Type)
A HIGH CURRENT PULSER FOR EXPERIMENT 225, 'NEUTRINO ELECTRON ELASTIC SCATTERING'
C. Dalton, G. Krausse and J. Sarjeant
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 232-235 (06/1979).
With the advent of low cost honeycomb extrusions of polypropylene sheets, flash chambers have become very attractive for large nuclear particle detector arrays. This has brought about the need for a pulse power system that will provide high peak currents and low levels of spurious radiation. Each module of 10 flash chambers will require a peak current of 20 kA with a rise time (t/sub r/) of [illegible] ns, giving a maximum rate of current rise di/dt of 400 kA/microsecond. The pulser output must develop [illegible] kV across a load of 0.36 ohm with a pulse width of 500 ns. The repetition rate will be one per second. This paper describes the development of such a system and the impact of the physical limitations of present component technology on [illegible] and pulse fidelity. 4 Refs.
Primary Keywords: Pulse Generator; Very Fast Rise; Rep-rated; High Pulse Fidelity
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7187
(SWITCHES, CLOSING: BREAKDOWN STUDIES)
(Liquid Gaps, Self, Liquid, Electrical)
A STREAMER MODEL FOR HIGH VOLTAGE WATER SWITCHES
F.J. Sazama and V.L. Kenyon III
Naval Surface Weapons Center, Silver Spring, MD 20910
2nd IEEE International Pulsed Power Conference Proceedings, pp 187-190 (06/1979).
An electrical switch model for high voltage water switches has been developed which predicts streamer-switching effects that correlate well with water-switch data from recent Aurora/AMP experiments. Preclosure 'rounding' and postclosure resistive damping of pulseforming line voltage waveforms are explained in terms of spatially-extensive, capacitive-coupling of the conducting streamers as they propagate across the gap and in terms of time-dependent streamer resistance and inductance. The arc resistance of the Casino water switch and of a gas switch under test on Casino was determined by computer fit to be 0.5±0.1 ohms and 0.3±0.06 ohms respectively, during the time of peak current in the power pulse. Energy lost in the water switch during the first pulse is 18% of that stored in the pulseforming line while similar energy lost in the gas switch is 11%. The model is described, computer transient analyses are compared with observed water and gas switch data and the results - switch resistance, inductance and energy loss during the primary power pulse are presented. 3 Refs.
Primary Keywords: Modelling; Preclosure Phenomena; Capacitive Coupling Of Streamers
Secondary Keywords: Aurora; Casino
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7188
(POWER TRANSMISSION)
(Connectors)
CONTACTS FOR PULSED HIGH CURRENT: DESIGN AND TEST
P. Wildi
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 195-197 (06/1979).
The TEXT Tokamak required the development of a special contact for pulsed high currents for the split coils of the poloidal system at a location which is highly inaccessible. A solution was found in the form of a special plug contact. A prototype was tested to the failure point using the discharge of a homopolar machine. Design, test setup and test results are described and the results are evaluated in view of other uses such as larger contacts and switches. 3 Refs.
Primary Keywords: Plug Contact; Failure Test; High Current; Mechanical Flexibility
Secondary Keywords: TEXT Tokamak
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7189
(PARTICLE BEAMS, ELECTRON)
(Generation)
DEVELOPMENT OF HIGH CURRENT ELECTRON PULSE ACCELERATORS AT THE INSTITUTE OF HIGH TEMPERATURES
E.A. Abramyan and G.D. Kuleshove
Academy of Sciences of the USSR, Moscow, USSR
2nd IEEE International Pulsed Power Conference Proceedings, pp 202-204 (06/1979).
A short analysis of the problems encountered in the acceleration of long (1E-4 sec and longer) pulsed, relativistic electron beams (REB) is given. A description of the parameters of the experimental facilities developed to study these long-pulsed beams is presented, as well. One of the main directions of research on REB conducted at our institute is related to finding ways to create long-pulsed electron beams with currents of the order of 1 kA at an energy of 1 MeV. The program is aimed at studying new energy transfer techniques. 4 Refs.
Primary Keywords: Long Pulse; Relativistic E-beam; Breakdown Time; Collective Ion Acceleration
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7190
(SWITCHES, OPENING)
(Explosive Fuses)
EFFECTS OF S[illegible] MEDIUM ON THE PERFORMANCE OF EXPLODING ALUMINUM FOIL FUSES
[illegible] L. Berger
Naval Surface Weapons Center, Dahlgren, VA 22448
2nd IEEE International Pulsed Power Conference Proceedings, pp 237-241 (06/1979).
[illegible] foil fuses were exploded electrically by discharging a capacitor bank into a series combination inductance (approximately [illegible] nH) and fuse. The 2.54 x 2.54 x 0.0023 cm foils were exploded in a sealed chamber. The time to burst and fuse voltage characteristics were investigated as a function of the fuse environment. Results are given for foils exploded in various gases and liquids. 17 Refs.
Primary Keywords: Aluminum Foil Fuse; Voltage Characteristics; Environmental Considerations
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7191
(PARTICLE BEAMS, ELECTRON)
(Generation)
EMITTANCE MEASUREMENTS ON FIELD EMITTER DIODES
S. Kulke and R. Kihara
Lawrence Livermore Lab, Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 209-213 (06/1979).
On the basis of time-integrated emittance measurements, several different types of field emitter diodes were investigated at 1-3 kA, 1 MeV. The experimental parameters were the cathode type, the anode mesh texture, the diode spacing and voltage, and the level of collimation of the merging beam. Over a wide range, the emittance was found to be proportional to the level of collimation. With the diode spacing left fixed, the emittance was found to be essentially independent of the diode voltage and current. The lowest emittances ([illegible] mr-cm at 400 A) were obtained with a foil-type cathode in a [illegible]-plane configuration. 5 Refs.
Primary Keywords: Field Emission Vacuum Diode; Cathode Type; Anode Mesh; Spacing; Diode Voltage; Collimation
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7192
(POWER CONDITIONING)
(Voltage Regulation)
HIGH POWER VERY LONG PULSE TESTING OF A 200 KV. TETRODE REGULATION TUBE
J.D. Stabley (1) and B. Gray (2)
(1) RCA Corp. Moorestown, NJ 08057
(2) Rome Air Development Center
2nd IEEE International Pulsed Power Conference Proceedings, pp 242-245 (06/1979).

Tests at very long pulse lengths were conducted to evaluate the design concepts of the S94000E regulator tube at the Rome Air Development Center. Voltages as high as 200 KV have been switched for pulse lengths of 0.5 seconds and at anode dissipation levels that exceeded 2.0 million Watts. Tubes similar to the one tested will be employed as series regulators in the TOKAMAK Fusion Test Reactor. This paper discusses the tube, test results, and operational experiences associated with those tests. 3 Refs.

Primary Keywords: Regulator Tube; Very High Power; High Voltage; Long Pulse; Multiple Electron Guns
Secondary Keywords: Neutral Beam Generation

7193
(SWITCHES, OPENING)
(Mechanical)
THE EARLY COUNTERPULSE TECHNIQUE APPLIED TO VACUUM INTERRUPTERS
R.W. Warren
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 198-201 (06/1979).

Interruption of DC currents using counterpulse techniques is investigated with vacuum interrupter and a novel approach in which the counterpulse is applied before contact separation. Important increases have been achieved in this way in the maximum interruptible current and large reductions in contact erosion. The factors establishing these new limits are presented and ways are discussed to make further improvements to the maximum interruptible current. 7 Refs.

Primary Keywords: Counterpulse, Counterpulse Before Separation; Low Erosion

7194
(SWITCHES, CLOSING; POWER CONDITIONING)
(Vacuum Gaps, Electrical; Systems)
VACUUM ARC SWITCHED INVERTER TESTS AT 2.5 MVA
R.N. Miller and A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226
2nd IEEE International Pulsed Power Conference Proceedings, pp 250-253 (06/1979).

A mathematical analysis of the unloaded vacuum arc switch (VAS) inverter is undertaken; a key element in this analysis is the assumption of a constant voltage drop of 50 volts across each VAS while it is conducting. From this analysis a constant VAS-voltage model is developed to explain the VAS inverter operation. A comparison of data obtained from laboratory tests of the inverter is made with data obtained from this model, and agreement is found to be within 10% for up to 15 alternations. 7 Refs.

Primary Keywords: Inverter; Vacuum Arc Switch (VAS); Switch Dissipation; Switch Modelling

7195
(PARTICLE BEAMS, ELECTRON)
(Generation)
A DOUBLE-SIDED ELECTRON BEAM GENERATOR FOR KRF LASER EXCITATION
L. Schlitt
Lawrence Livermore Lab, Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 269-272 (06/1979).

Several laser systems excited by electron beam have been identified as candidates for pump sources for laser fusion applications. The electron beam generators required must be compact, reliable and capable of synchronization with other system components. A KrF laser, designated the A amplifier, producing a minimum output of 25 J was needed for the RAPIER (Raman Amplifier Pumped by Intensified Excimer Radiation) system. A double-sided electron beam system was designed and constructed specifically for this purpose and has produced >35 J of KrF output. Each of the two electron beam machines in the system operates with an rms jitter of 0.4 ns and together occupy 3.5 m/sup 2/ of floor space. 1 Refs.

Primary Keywords: Low Jitter, Small Size; Design Considerations; Blumlein Line
Secondary Keywords: KrF Laser Pumping

7196
(PARTICLE BEAMS, ELECTRON)
(Generation)
A [illegible]-AREA COLD-CATHODE GRID-CONTROLLED ELECTRON GUN FOR ANTARES
W.R. Scarlett?, R.R. Andrews and H. Jansen
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 261-264 (06/1979).

[illegible]

Primary Keywords: [illegible] Design Considerations; Prototype [illegible]

7197
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
APPLICATION OF PFN CAPACITORS IN HIGH POWER SYSTEMS
R.F. Parker
Hughes Aircraft Co. Culver City, CA 90230
2nd IEEE International Pulsed Power Conference Proceedings, pp 351-354 (06/1979).

The application of lightweight reliable capacitors in a mobile energy store is discussed. The relationship of system design parameters to capacitor size and life is displayed. Electric fields and weights of a 21 J/lb and a 77 J/lb pulse discharge capacitor design are given. Estimates of future near term development are made. 0 Refs.

Primary Keywords: Mobile Energy Storage System; Light Weight; Application Considerations

7198
(ENERGY STORAGE, INDUCTIVE)
(Systems)
CONSIDERATIONS FOR INDUCTIVELY DRIVEN PLASMA IMPLOSIONS
D.L. Smith, R.P. Henderson and R.E. Reinovsky
AFWL, Kirtland AFB, NM 87117
2nd IEEE International Pulsed Power Conference Proceedings, pp 287-294 (06/1979).

Inductive pulse forming techniques appropriate for the driving of imploding plasmas have been explored with special attention given to a suitable opening switch. Parametric investigations of circuit models indicate that imploding load performance is relatively independent of opening switch parameters. Extrapolation of existing experimental and computer simulated data leads to conceptual design criteria for a fused metal foil opening switch which will be implemented on a 1.9 MJ system. The inductive system compares favorably with the direct capacitor driven system in terms of kinetic energy with the definite advantage of shorter time scales on which the energy is delivered to the implosion. 6 Refs.

Primary Keywords: Pulse Forming Techniques; Exploding Wire, Fast Discharge
Secondary Keywords: SHIVA; Plasma Implosion

7199
(POWER CONDITIONING)
(Pulse Forming Networks)
ELECTRIC DISCHARGE CHARACTERISTICS OF CABLE PFN USED AS A PUMP
R.R. Butcher and S.H. Gurbaxani
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 273-275 (06/1979).

The cable pulse forming network (PFN) is an excellent pump for transverse discharge lasers. The effect of load characteristics on PFN design is discussed in detail. Experimental results are presented for a rare gas halide laser pump by a cable PFN. 0 Refs.

Primary Keywords: Pulse Forming Line; Low Impedance; Short Pulse; Low Energy
Secondary Keywords: Gas Laser Pumping

7200
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Systems; Explosive Fuses)
PRELIMINARY INDUCTIVE ENERGY TRANSFER EXPERIMENTS
R.P. Henderson, D.L. Smith and R.E. Reinovsky
AFWL, Kirtland AFB, NM 87117
2nd IEEE International Pulsed Power Conference Proceedings, pp 347-350 (06/1979).

The use of inductive storage systems has been studied as an attractive alternative to the more conventional capacitive energy storage systems to drive a cylindrical imploding plasma and produce X-rays for nuclear simulation. Preliminary experiments have been conducted using a 200 kJ, 4 microsecond capacitor bank and a 100 kJ, 1 microsecond capacitor bank to explore the basic performance of electrically exploded foil opening switches. Peak voltage and opening time has been characterized as a function of quench media and capacitor bank rise time. Rise time and energetic efficiency of current transfer to inductive dummy loads have also been measured. These experimental results are contributing to conceptual designs for a 1.9 MJ capacitor driven 6 Refs.

Primary Keywords: Exploding Foil; Performance Test; Quench Media; Maisonnier Criteria

7201
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
PULSAR: AN INDUCTIVE PULSE POWER SOURCE
E.C. Cnare, W.P. Brooks and M. Cowan
Sandia Labs, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 343-346 (06/1979).

The PULSAR concept of inductive pulsed power source used a flux-compressing metallic or plasma armature rather than a fast opening switch to transfer magnetic flux to a load. The inductive store may be a relatively unsophisticated DC superconducting magnet since no magnetic energy is taken from it, and no large current transients are induced in it. Initial experimental efforts employed either expendable or reusable metallic armatures with a 200 kJ, 450 mm diameter superconducting magnet. Attention is now being focused on the development of much faster plasma armatures for use in larger systems of one and two meters diameter. [illegible]

Primary Keywords: [illegible]

7202
(SAFETY)
[illegible]
SAFETY GROUNDING SWITCHES IN [illegible] GENERAL CONSIDERATIONS AND THE [illegible] APPLICATION
[illegible]
2nd [illegible] International Pulsed Power Conference Proceedings, pp [illegible] (06/1979).

[illegible] of the switches in the overall control and safety system is discussed. 0 Refs.

Primary Keywords: Grounding for Safety; Automatic Safety Interlocks

7203
(SWITCHES, CLOSING)
(Miscellaneous)
STABILIZATION OF METAL-OXIDE BULK SWITCHING DEVICES WITH DIFFUSED BI CONTACTS
B. Lalevic (1), M. Shoga (1), M. Gvisni (1) and S. Levy (2)
(1) Rutgers University, Piscataway, NJ 08854
(2) ECOM, Fort Monmouth, NJ 07703
2nd IEEE International Pulsed Power Conference Proceedings, pp 376-380 (06/1979).
Threshold switching from the high to low resistance state has been investigated in the polycrystalline and single crystal NbO/sub x/ (where x approximately equal 2) metal-oxide devices. Stable and reproducible switching performance is observed in a configuration Bi-NbO/sub 2/-Bi where Bi electrodes were covered with Au films. Improvement in the device performance is attributed to the Bi diffusion into NbO/sub x/ which has been confirmed by the Auger electron spectroscopy. Typical off state resistance of these devices is approximately 100 K ohm and threshold switching voltage in the range from 100 to 2500 V. The delay time r/sub d/ is exponentially dependent on the applied voltage V/sub appl/ and at larger V/sub appl/ the delay time is less than a nanosecond. Recovery time of a device is approximately 0.5 microsecond as determined by the method of decreasing time interval between two successive pulses. Holding voltage is approximately 40 V. The pulsed switched devices can withstand pulse durations between 0.1-3 microsecond, repetition rate of 100 Hz and current intensities of 10-15 A, or 25 A peak with the applied pulse duration of 20 microsecond, single shot. 6 Refs.
Primary Keywords: Threshold Switching; High Off State Resistance; Low Voltage, Low Current

7204
(SWITCHES, CLOSING)
(Gas Gaps, Self)
TESTING OF A 100 KV, 100 HZ REP-RATE GAS SWITCH
A. Ramrus and J. Shannon
Maxwell Labs Inc, San Diego, CA 92123
2nd IEEE International Pulsed Power Conference Proceedings, pp 320-324 (06/1979).
A two-electrode gas switch with a self-breakdown voltage of 100 kV was operated at a pulse-repetition rate of 100 Hz with bursts up to 10 seconds in duration. The output of a pulse transformer provided the (1-cos omega x t) waveform which charged the switch in about one-half millisecond. The switch discharged with a peak current of about 10 kA and a total charge transfer of about 10 mC into a damped LC circuit. A continuous purge of air through the interelectrode spacing enabled the switch to recover its breakdown voltage between discharges. Flow rates up to 35 SCFM were employed. This paper discusses the dependence of switch jitter and waveform reproducibility on air-flow rate. 3 Refs.
Primary Keywords: Self-breakdown Switch; Rep-rated; Life Test; Performance Test

7206
(DIAGNOSTICS AND INSTRUMENTATION)
(Systems)
A COMPUTERIZED MEASURING SYSTEM FOR NANOSECOND RISETIME PULSED ACCELERATORS
D. Pellinen, S. Ashby, P. Gillis, K. Nielson and P. Spence
Physic International Co, San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 410-413 (06/1979).
We have developed a new computerized diagnostic system for high voltage, high current pulsers. This diagnostic system uses electronic circuits connected to nanosecond response transducers to measure machine performance at critical points. The voltage outputs of these circuits are converted to digital form and directly read by a computer. The major advantages of this system are cost effectiveness and greater accuracy than commonly used oscilloscope or transient analyzer systems in applications where it is not necessary to record full analog diagnostic waveforms. Operation is fully computerized and requires a minimum number of personnel; the system is scalable to very large multi-module generators. 4 Refs.
Primary Keywords: Current Diagnostic; Voltage Diagnostic; High Accuracy; Low Cost

7207
(INSULATION, MATERIAL; POWER TRANSMISSION)
(Solid, Transmission Lines)
A LOW-INDUCTANCE 2-MV TUBE
Y G. Chen, K. Mashima and J. Benford
Physic International Co, San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 487-490 (06/1979).
A new multi-stage low-inductance tube for the coaxial water generator OWL II has been designed. Low inductance is achieved by means of a plastic lens in the water, which produced a field distribution with improved uniformity. 2 Refs.
Primary Keywords: Vacuum Interface; Electric Field Grading; Low Inductance

[illegible]
(SWITCHES, OPENING; DIAGNOSTICS AND INSTRUMENTATION)
(Mechanical, Systems)
[illegible] INTERRUPTER TEST FACILITY
[illegible]
Los Alamos Scientific Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 414-418 (06/1979).
The use of commercial [illegible] circuit breakers for DC switching operations requires that they be evaluated to determine their DC limitations. Two [illegible] facilities have been constructed and used for this purpose at LASL during the last several years. In response to the increased demands on switching technology, a [illegible] facility has been constructed. Novel features incorporated into this facility include (1) separate capacitive and cryogenic inductive energy storage systems, (2) fiber optic controls and optically coupled data links, and (3) a digital data acquisition system. Facility details and planned tests on an experimental rod-array vacuum interrupter are presented. 4 Refs.
Primary Keywords: Circuit Breaker; Test Facility; Medium Power, Capacitive Source, Inductive Source

7209
(POWER CONDITIONING)
(Systems)
ANALYSIS OF THE MULTIPHASE INDUCTOR-CONVERTER BRIDGE
M. Ehsani, R.L. Kustom and R.E. Fuja
Argonne National Lab, Argonne, IL
2nd IEEE International Pulsed Power Conference Proceedings, pp 419-424 (06/1979).
Analytical derivations are presented for inductor-converter bridge (ICB) circuits in which energy is transferred from a storage inductor to a load inductor with solid state bridges. These derivations provide complete analytical circuit solution in contrast to previously available numerical (non-analytical) procedures. The analysis is based on two parallel methods: (1) Fourier expansion of the inverter waveforms and (2) a novel method based on the inherent waveforms of the ICB, labeled square functions. Our analytical values of power flow, inductor currents, and voltages compare favorably with the results of a three-phase ICB experiment at Argonne National Laboratory. 5 Refs.
Primary Keywords: Inverter; Analytical Analysis; Solid State Bridge

7210
(POWER CONDITIONING)
(Systems)
APPLICATION OF SUBSYSTEM SUMMARY ALGORITHMS FOR HIGH POWER SYSTEM STUDIES
F.C. Brockhurst
Air Force Aero Propulsion Lab, Wright-Patterson Air Force Base, OH 45433
2nd IEEE International Pulsed Power Conference Proceedings, pp 406-409 (06/1979)
This paper describes the application of subsystem summary algorithms for self-contained power system configuration trade-off studies, and presents the results of a recently completed study. The development of summary weight algorithms for rocket turbines and rotating electrical generators is described. These new algorithms are combined with previously developed power conditioning subsystem algorithms in a computer program to automatically study various system configurations. A flow chart of the computer program is included in the paper. The computer program was used to find a minimum weight self-contained power system. Results of the study are presented in this paper. 0 Refs.
Primary Keywords: Computer Aided Design; Continuous Duty

7211
(PULSE GENERATORS)
(Applications)
APPLYING A COMPENSATED PULSED ALTERNATOR TO A FLASHLAMP LOAD FOR NOVA
B.M. Carder and B.T. Merritt
Lawrence Livermore Lab, Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 439-462 (06/1979).
The Compensated Pulsed Alternator (CPA) is a large rotating machine that will convert mechanical, rotationally stored energy into a single electrical impulse of very high power. It is being optimized for driving flashlamps in the very large Nova Nd:glass laser system. The machine is a rotary flux compression device, and for maximum performance, it requires start-up current. We report upon a circuit that will provide this current and that will also assist in triggering the flashlamps. This circuit has been tested with a 200 kJ capacitor bank and it is now being tested with a small 200 kJ CPA. Large Nova-size machines will require output energies in excess of 5 MJ. We also present empirically tested formulae that will assist in matching the Nova Flashlamp load to any given size CPA machine. 4 Refs.
Primary Keywords: Compulsator; Start-up Current; Flashlamp Triggering; Impedance Matching

7213
(POWER CONDITIONING)
(Systems)
BALANCED, PARALLEL OPERATION OF FLASHLAMPS
B.M. Carder and B.T. Merritt
Lawrence Livermore Lab, Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 454-458 (06/1979).
A new energy store, the Compensated Pulsed Alternator (CPA), promises to be a cost effective substitute for capacitors to drive flashlamps that pump large ND:glass lasers. Because the CPA is large and discrete, it will be necessary that it drive many parallel flashlamp circuits, presenting a problem in equal current distribution. Current division to +-20% between parallel flashlamps has been achieved, but this is marginal for laser pumping. A method is presented here that provides equal current sharing to about [illegible], and it includes fused protection against short circuit faults. The method was tested with eight parallel circuits, including both open-circuit and short-circuit fault tests. 1 Refs.
Primary Keywords: Flashlamp Current Sharing, Mutual Inductance, Compulsator

7214
(POWER TRANSMISSION, INSULATION, MAGNETIC)
(Transmission Lines)
COMPTON SCATTERING OF PHOTONS FROM ELECTRONS IN MAGNETICALLY INSULATED TRANSMISSION LINES
K. [illegible] Prowse and J.P. VanDevender
Sandia Labs, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 429-432 (06/1979).
Self-magnetically insulated transmission lines are used for power transport between the vacuum insulator and the diode in high current particle accelerators. Since the efficiency of the power transport depends on the details of the initial line geometry, i.e., the injector, the dependence of the electron canonical momentum distribution on the injector geometry should reveal the loss mechanism. We propose to study that dependence experimentally through a Compton scattering diagnostic. The spectrum of scattered light reveals the electron velocity distribution perpendicular to the direction of flow. The design of the diagnostic is in progress. Our preliminay analysis is based on the conservation of energy and canonical momentum for single electron in the E and B fields determined from 2-D calculations. For the Mite accelerator with power flow along Z, the normalized canonical momentum, mu, is in the range -0.7 < micro M 0. For k/sub i/ parallel Y and k/sub s/ parallel X, our analysis indicates that the scattered photons have 1.1 eV <= h x nu/sub s/ < 5 6 eV for ruby laser scattering and can be detected with PM tubes. 8 Refs.
Primary Keywords: Energy Loss; Canonical Momentum; Compton Scattering; Electron Velocity Distribution

7215
(PULSE GENERATORS; ENERGY STORAGE, MECHANICAL)
(Rotating Machines, Rotating Machines)
DESIGN OF THE ARMATURE WINDINGS OF A COMPENSATED PULSED ALTERNATOR ENGINEERING PROTOTYPE
J.H. Gully, W.L. Bird, T.M. Bullion, H.G. Rylander, W.F. Woodson and H.H. Weldon
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 385-391 (06/1979).
The design of the armature windings of a 6 kV, 70 kA compensated pulsed alternator engineering prototype now under construction at The University of Texas at Austin is presented. Electromagnetic forces acting on the windings and the resulting mechanical and electrical stresses placed on the armature insulation are given. Test results of a program to select the ground plane insulation system are described. Finally, fabrication methods, tooling, and problems encountered during construction are discussed. 7 Refs.
Primary Keywords: Compulsator; Analysis; Insulation System

7216
(BREAKDOWN STUDIES)
(Electrodes)
FAST RISING TRANSIENT HEAVY CURRENT SPARK DAMAGE TO ELECTRODES
A. Watson
Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 471-474 (06/1979).
Crests of displaced metal have been observed in rings beyond the crater produced on electrodes by short duration (10-100 ns) heavy current sparks in a variety of dielectric media. Metal is presumed to have melted and flowed radially. The hydromagnetic forces supporting a standing canal wave which is identified with the crest. Analysis shows this situation to be invariant under steady melting and the ring diameter is proportional to the square root of spark current as measurement verifies. Erosion is proposed to occur by the breaking of this crest or by its removal under the action of electrostatic forces, in accord with reported experimental data. 2 Refs.
Primary Keywords: Electrode Erosion; Displaced Metal; Crests

7217
(PULSE GENERATORS, ELECTROMAGNETIC FIELD GENERATION)
(Flux Compression, Magnetic)
MAGNET OPTIMIZATION FOR PULSED ENERGY CONVERSION
W.K. Tucker (1), E.C. Cnare (1), W.P. Brooks (1), R.E. Wilcox (2) and W.D. Markiewicz (2)
(1) Sandia Labs, Albuquerque, NM 87115
(2) Intermagnetic General, Guilderland, NY
2nd IEEE International Pulsed Power Conference Proceedings, pp 381-384 (06/1979).
A flux compression generator called PULSAR is being developed to meet power requirements for future fusion reactors. Key components of the generator are superconducting magnet, generator coil of normal conductor, and an armature, either a metallic conductor or plasma. Chemical energy is used to increase the mutual inductance between the armature and nested generator coil and superconducting magnet. Flux compression occurs and electrical energy is transferred to a load inductance. This paper will present the results of a study that was conducted to design a suitable superconducting magnet for the PULSAR device. 6 Refs.
Primary Keywords: PULSAR; Flux Compression; Generator; Initial Flux Generator; Superconducting Magnet Coil; Direct Load Connection

7218
(PULSE GENERATORS)
(Rotating Machines)
THE DESIGN, ASSEMBLY, AND TESTING OF A DESK MODEL COMPENSATED PULSED ALTERNATOR
M.A. Pichot, W.L. Bird, M. Brennan, M.D. Driga, J.H. Gully, H.G. Rylander, K.M. Tolk, W.F. Weldon and H.H. Woodson
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 398-401 (06/1979).
The Center for Electromechanics (CEM) at The University of Texas is currently involved in the design, fabrication, and testing of a prototype compensated pulsed alternator (compulsator). This machine, a new concept in pulsed power technology, utilizes the principles of magnetic induction and flux compression to convert rotational energy directly into electrical energy. The subject of this paper is a one-fifth scale version of the CEM prototype. This desk model compulsator is a portable demonstration machine designed to operate in the same fashion as the full scale model. 5 Refs.
Primary Keywords: Compulsator; Prototype; Design Considerations

7219
(PULSE GENERATORS, ENERGY STORAGE, MECHANICAL)
(Rotating Machines, Rotating Machines)
THE MECHANICAL DESIGN OF A COMPENSATED PULSED ALTERNATOR PROTOTYPE
M. Brennan, W.L. Bird, J.H. Gully, M.L. Spann, K.M. Tolk, W.F. Weldon, H.G. Rylander and H.H. Woodson
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 392-397 (06/1979).
A prototype of a compensated pulsed alternator (compulsator) is presently under construction at the Center for Electromechanics (CEM) of The University of Texas at Austin. The unique machine configuration and peak output current (150 kA) generate large forces not typically seen by conventional rotating machines. The rotor is made of 2915 laminations shrink fitted on a vertical shaft. Since the rotor has an [illegible] of 3.2 and a maximum speed of 5400 rpm, these insulated laminations are clamped on the ends with large Belleville washers to increase the effective stiffness. The stator is mounted on a torque frame which allows it to rotate during discharge to reduce the forces transmitted to ground. The mechanical considerations and design of this machine are presented. 4 Refs.
Primary Keywords: Compulsator; Mechanical Design; Rotor Design; Stator Design

7220
(PULSE GENERATORS)
(Applications)
APPLYING A COMPENSATED PULSED ALTERNATOR TO A FLASHLAMP LOAD FOR NOVA-PART II
W.L. Bird, D.J.T. Mayhall, W.F. Weldon, H.G. Rylander and H.H. Woodson
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 463-466 (06/1979).
The compensated pulsed alternator (compulsator) has been proposed as a possible alternative to capacitor banks for driving xenon flashlamps for pumping neodymium glass laser amplifiers for NOVA. An algorithm for sizing rotor diameter and angular velocity as a function of flashlamp impedance, peak current, and delivered energy is described. It is shown that the armature inductance variation is a major consideration when matching the pulsed alternator to the load. Finally, conceptual design parameters of a four pole, laminated rotor compulsator are presented. 5 Refs.
Primary Keywords: Compulsator; Start-up Current; Flashlamp Triggering; Impedance Matching

7221
(ELECTROMAGNETIC LAUNCHERS, PULSE GENERATORS)
(Railguns; Systems)
A COMPACT 5E12 AMP/SEC RAIL-GUN PULSER FOR A LASER PLASMA SHUTTER
L.P. Bradley, E.L. Orham and I.F. Stowers
Lawrence Livermore Lab, Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 467-470 (06/1979).
We have developed a rail-gun plasma source to produce a plasma of 1E21 cm/sup -3/ particle density and project it with a velocity of 3.9 cm/microsecond. This device will be used in an output spatial filter of Nova to project a critical density plasma across an optical beam path and block laser retroreflected light. The object of this paper is to describe the design of a pulser appropriate to the Shiva laser fusion facility, and to describe the preliminary design of a higher current prototype pulser for Nova the laser fusion research facility under construction at Lawrence Livermore Laboratory. 3 Refs.
Primary Keywords: Exploding Wire; Multiple Switches; Low Jitter; Triggering; Nonlinear Load Effect
Secondary Keywords: Shiva (LLL); Nova

7222
(ENERGY STORAGE, CAPACITIVE)
(Marx Generators)
REVIEW AND STATUS OF ANTARES
J. Jansen
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 31-41 (06/1979).
The laser fusion effort at the Los Alamos Scientific Laboratory (LASL) has evolved from early experiments with an electron-beam-controlled large-aperture CO/sub 2/ laser to the massive engineering task of designing and building a 100-kJ laser fusion machine. The design of Antares is based on the design of its predecessors. It builds upon technology which was developed or advanced during the design and construction of earlier machines. On one hand it is dictated by the requirements for the output, i.e., energy on target; on the other hand it is limited by existing technology or reasonable extensions thereof. Reliability and maintainability play important roles in the design considerations. 10 Refs.
Primary Keywords: Gas Laser; Beam Propagation; E-beam Pumping; Marx Generator

7223
(REVIEWS AND CONFERENCES)
(Reviews)
THE NEAR AND LONG TERM PULSE POWER REQUIREMENT FOR LASER DRIVEN INERTIAL CONFINEMENT FUSION
W.L. Gagnon
Lawrence Livermore Lab, Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 49-54 (06/1979).
Inertial confinement fusion research is being vigorously pursued at the Lawrence Livermore Laboratory and at other laboratories throughout the world. At the Lawrence Livermore Laboratory, major emphasis has been placed upon the development of large, Nd:glass laser systems in order to address the basic physics issues associated with light driven fusion targets. A parallel program is directed toward the development of lasers which exhibit higher efficiencies and shorter wavelengths and are thus more suitable as drivers for fusion power plants. This paper discusses the pulse power technology which has been developed to meet the near and far term needs of the laser fusion program at Livermore. 14 Refs.
Primary Keywords: Laser Pumping; Optical Shutter
Secondary Keywords: Inertial Fusion

7224
(POWER TRANSMISSION, INSULATION, MAGNETIC)
(Transmission Lines)
SELF-MAGNETICALLY INSULATED POWER FLOW
J.P. VanDevender
Sandia Labs, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 55-60 (06/1979).
Electromagnetic power transport through self-magnetically insulated vacuum transmission lines has been developed into a useful and reliable technology. A power density of 160 TW/m sup 2/ has been transported at approximately 100 percent efficiency over six meters. The theoretical understanding of power flow through lines of constant cross section has progressed through analytical theory and [illegible] electromagnetic particle simulations. However, work needs to be done on the effects of line transitions in which the cross section changes in the direction of power flow. The major features of our present understanding will be reviewed and some promising hypotheses now under investigation will be presented. 34 Refs.
Primary Keywords: High Power Density; Configuration Transition; Convolute; Uniform Cross Section; Load Impedance

7225
(PARTICLE BEAMS, ELECTRON)
(Generation)
VOLTAGE DISTRIBUTION AND CURRENT IN A CYLINDRICAL RELATIVISTIC DIODE
N.W. Harris
Ion Physics Corp, Burlington, MA 01803
2nd IEEE Inernational Pulsed Power Conference Proceedings, pp 65-67 (06/1979).

The voltage distribution and current in a space charge limited cylindrical diode are calculated by means of a simple computer program. Relativistic formulation is used, and the results are applicable up to the limit of significant beam pinch. The accuracy is 0.1%. 3 Refs.

Primary Keywords: Voltage Distribution; Current; Space Charge Limited, Numerical Calculation; High Accuracy
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7226
(SWITCHES, OPENING)
(Mechanical)
DEVELOPMENT OF A HIGH-POWER VACUUM INTERRUPTER
J.A. Rich, G.A. Farrall, I. Imam and J.C. Sofianek
General Electric Co, Schenectady, NY 12301
EPRI Report No. EPRI EL-1895 (06/1981).
Availability: EPRI EL-1895
EPRI

Despite their many advantages and their wide use in distribution systems, vacuum interrupters have been too limited in curent and voltage for application on today's transmission systems. The goal of this investigation is to assess the feasibility of designing and building a vacuum interrupter for such application; to specifically develop a vacuum interrupter with a voltage capability in the 72-80 kV range and a current capability in the 63-80 A range with a continuous current rating of 3000 A. To implement this undertaking, analytical and experimental work was carried out in four major problem areas: arc physics; vacuum breakdown; mechanical problems; interrupter fabrication and test. The leading concept is that of the diffuse vacuum arc, particularly as embodied in electrode structures of rod array type, structures which are capable of carrying very large arcing curents without suffering damage. Corollary to the diffuse arc concept is that of arc transfer from the butt contacts to the fixed-gap diffuse arc structure and the separation of functions which this allows. 0 Refs.

Primary Keywords: Vacuum Interrupter; Circuit Breaker; High Voltage, High Current; Vacuum Arc Physics
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7228
(SWITCHES, OPENING; SWITCHES, OPENING)
(Vacuum Gaps, Self; Vacuum Gaps, Magnetic Field)
DEVELOPMENT OF A VACUUM ARC FAULT CURRENT LIMITER
R. Dollinger and A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226
EPRI Report No. EPRI EL-1947 (07/1981).
Availability: EPRI EL-1947
EPRI

The primary purpose of this program was to develop an understanding of the operating principles of the vacuum arc devices under development at the State University of New York at Buffalo for fault current limiting applications. The general operating characteristics are given for two basic vacuum arc devices. One is the Vacuum Arc Fault Current Limiter and the other is the Magnetically Controlled Vacuum Arc Switch. The results of detailed studies of the phenomena occurring with the two devices are described. In particular, the repetitive voltage spiking phenomenon that occurs in the Vacuum Arc Fault Current Limiter is treated in substantial detail. The mechanism of the voltage spiking (the repetitive formation and collapse of an anode sheath) is described along with measurements that were made of parameters associated with repetitive spiking. Techniques for enhancing current limiting by enhancing spiking development are discussed. Work on the magnetically controlled vacuum arc switch and the cooperative efforts with the industrial partner (Gould-Brown Boveri) are described. 57 Refs.

Primary Keywords: Current Limiter; Vacuum Interrupter; Vacuum Spark Gap; Magnetic Control; Modeling, Characterizati[illegible]
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7230
(POWER TRANSMISSION; DIAGNOSTICS AND INSTRUMENTATION)
(Transmission Lines; Systems)
FEASIBILITY STUDY OF THE USE OF AN ENVIRONMENTAL CHAMBER FOR THE EXAMINATION OF TRANSMISSION LINE ELECTRIC FIELD AND CORONA EFFECTS
S.A. Sebo, R.V. DeVore and D.G. Kasten
Ohio State University, Columbus, O
EPRI Report No. EPRI EL 1953 (07/1981).
Availability: EPRI EL-1953
EPRI

The report investigates the feasibility of an environmental chamber combined with model-scale and full-scale (with reduced spacings) conductors for the examination of transmission line electric field and corona effects. The feasibility of tests in a 5m x 5m x 4m [illegible] environmental chamber related to ground level electric field strength, corona starting voltage, conductor surface conditions, corona mechanisms, corona losses, ozone emission, audible noise, radio noise, and DC corona phenomena for changes in energizing voltages, geometry, conductor types and materials, and atmospheric conditions are reviewed. Environmental chamber design considerations and preliminary specifications are also outlined with a review of supply requirements and guidelines for instrumentation. The recommendation of this report is positive. The use of an environmental chamber combined with model-scale and full-scale (with reduced spacings) conductors for the examination of transmission line electric field and corona effects is feasible and meaningful. Such a special-purpose environmental chamber is not a replacement of full-scale test lines but it is a new tool that serves development and design. The performance of the chamber is comparable to that of a high-voltage outdoor test cage; however, the scope of experiments in the chamber is much greater than in an outdoor test cage. 23 Ref.

Primary Keywords: Transmission Line; Corona; Atmospheric Pressure; Test Chamber; Design Considerations
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7231
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Solid, Electrical; Solid)
INVESTIGATION OF MECHANISM OF BREAKDOWN IN XLPE CABLES
A.L. McKean, H.C. Doepken, K. Tsuji and A. Zidon
Phelps Dodge Cable and Wire Co, Yonkers, NY 10702
EPRI Report No. EPRI-TD-138 (07/1976).
Availability: EPRI-TD-138
EPRI

This research program explores the basic hypothesis that microporosity plays a significant role in the mechanism of breakdown of XLPE cable. In Part I, the potential improvement achieved by impregnating the microporous regions of the cable core with a neutral liquid is evaluated, with relation to AC voltage life and impulse strength. The effect at higher frequency is also demonstrated. In Part II, a similar test program is pursued on model cables, designed to explore the effects of gas-pressure and gas type on breakdown and life, since it is reasonable to expect that only the microporous regions of the insulation should be sensitive to the gas-pressure environment. 26 Refs.

Primary Keywords: Electric Cable; Crosslinked Polyethylene Insulation; Dielectric Breakdown; Microporosity; High Frequency; Impulse Voltage
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7234
(SWITCHES, OPENING; BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Mechanical; Gas, Electrical; Vacuum, Electrical)
MODELING OF ARC DISCHARGES IN POWER CIRCUIT BREAKERS
I.M. Cohen and A.M. Whitman
University of Pennsylvania, Philadelphia, PA 19104
EPRI Report No. EPRI EL-452 (11/1977).
Availability: EPRI EL-452
EPRI

The question that this model attempts to answer is: 'What effect does electrode geometry have on an electric arc?' This problem is attacked in a quantitative way in terms of the curvature of the electrodes. The next question is whether, after a given interruption attempt, the fault will be cleared. A new type of mathematical attack on this problem was initiated with the model, and it shows that an interruption criterion can be obtained in a rigorous and physically meaningful way. The analysis is based on the stability of the mathematical model. The results show how much any interruption depends on arc characteristics and circuit parameters. Real power circuit breakers are influenced by convection and radiation, which are mechanisms for energy dissipation. In order to make the model more realistic, it has been extended to incorporate these effects. Previous experience with the simpler models has given an insight as to how to deal with these complications. 282 Refs.

Primary Keywords: Circuit Breaker; Arc Modeling; Electrode Geometry Effects; Radiation
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7237
(INSULATION, MATERIAL)
(Composite)
SF/SUB 6/ FOAMED INSULATION
E.G. Griesner
Gould Inc, Colmar, PA 18915
EPRI Report No. EL-520 (08/1977).
Availability: EPRI EL-520
EPRI

This study describes sulfur hexafluoride (SF/sub 6/) epoxy foam, a novel material which consists of a highly electronegative gas (SF/sub 6/) confined in a network of closed epoxy cells. SF/sub 6/ epoxy foam can be prepared by mixing liquid epoxy and molecular sieves that have been previously loaded with SF/sub 6/ (molecular sieves adsorb approximately 15% by weight SF/sub 6/). When the mix is heated, the molecular sieves release their adsorbed SF/sub 6/, thus foaming the epoxy, which subsequently traps the SF/sub 6/ in small, evenly distributed, closed cells. Some of the measured properties of SF/sub 6/ epoxy foam indicate this unique material is suitable for high voltage electrical insulation. These properties include a low dielectric constant, a high dielectric strength, the ability to [illegible] dielectric strength when punctured (by a low power source), [illegible] does not require vacuum casting. 6 Refs.

Primary Keywords: SF/sub 6/; Epoxy Foam; Low Dielectric Constant; Self-Healing; Aging
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7238
(BREAKDOWN STUDIES)
(Gas, Electrical)
SUPERPOSITION GAS BREAKDOWN
[illegible] Dale
Westinghouse Research and Development Center, Pittsburgh PA
EPRI Report No. EPRI EL-1484 (08/1980).
Availability: EPRI EL-1484
EPRI

Results are described of a research program investigating breakdown in a 76/250 mm coaxial electrode system in compressed SF/sub 6/ as a result of superposition of impulse voltages on the 60 Hz power frequency voltage in the presence of conducting particles. The object of this program was to experimentally determine if impulse superposition is a more severe condition for particle initiated breakdown than the 60 Hz voltage alone, which can result in breakdown as low as only ten percent of the dielectric strength of SF/sub 6/. Breakdown voltages were measured for particles both isolated and in contact with the center conductor and also for multiple free conducting particles in the system for impulse voltages, 60 Hz voltage and with impulses superposed on the 60 Hz voltage. The results showed that the lowest values obtained with the superposition of impulse voltages on the 60 Hz voltage were equal to the lowest values of the 60 Hz or impulse voltages alone. The probability for particle initiated breakdown as a result of superposed impulse voltages with realistic magnitudes of the 60 Hz voltage was found to be negligible and was entirely dominated by the 60 Hz breakdown probability. 13 Refs.

Primary Keywords: SF/sub 6/ Gas; Coaxial Electrodes; Power Line Frequency Voltage; Impulse Voltage; Superposition; Particulate Suspension; Transmission Line
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7240
(PULSE GENERATORS)
(Hard-tube)
A MODULATOR FOR THE SEASAT-A RADAR ALTIMETER
K.Y. Ishikawa, C.T. McCown and G.E. Stronks
Hughes Aircraft Co, Torrance, CA 90509
1978 IEEE Thirteenth Modulator Symposium, pp 235-241 (06/1978).
This paper describes the modulator for the Seasat-A Radar Altimeter. The unit, which consists of a grid modulator, power supply and traveling wave tube (TWT), has been delivered to the Applied Physics Laboratory for their altimeter system in the Seasat-A Global Weather and Ocean Survey satellite. The TWT power supply develops 12 kilovolts at an average power of 90 watts and peak power of 18 kilowatts during pulse operation. The grid modulator which operates at the TWT cathode potential swings the grid voltage over a 350 volt range with rise and fall times of less than 80 nanoseconds to gate the TWT RF signal on and off. Transition times of approximately 13 nanoseconds are realized for the RF output pulse. During the pulse operation the cathode voltage is held to within 2 volts by the wide bandwidth cathode voltage regulator. 1 Refs.
Primary Keywords: Grid Modulator; Fast Rise; Fast Fall; Low Voltage; Transistor Switch

7241
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
A STABLE LOAD-INVARIANT HIGH-FREQUENCY SCR SERIES RESONANT INVERTER FOR RADAR TRANSMITTER APPLICATIONS
R.C. Cole
ITT, Nutley, NJ
1978 IEEE Thirteenth Modulator Symposium, pp 14 (06/1978).
A high-frequency series resonant SCR inverter has been developed for radar transmitter power conversion and regulation applications that overcomes most of the limitations of present-day high-frequency SCR inverters. Significant characteristics of the inverter circuit include stable operation and controlled resonant capacitor voltages over a wide range of input line voltages and load resistances (including short-circuit loads), fast response, and high efficiency. Low internal stored energy permits automatic reset of faults without destructive failure or reliance on fusing. The inverter is ideally suited for charging of capacitor loads typical of radar transmitter and other pulse-discharge applications. An experimental inverter, operating from 208-V 3-phase ac, provides 30-kW output into a load resistor connected to the inverter through a bridge rectifier and energy storage capacitor. The inverter switching frequency is 10 kHz. Reliable operation with complete freedom from commutation failures has been demonstrated using non-preselected SCRs. Predicted control of inverter resonant capacitor voltages has been shown for all loads, including a short circuit. Two such units can be paralleled to develop a 40-kV 60-kW regulated high-voltage power supply for a radar transmitter. 0 Refs.
Primary Keywords: Stable Operation; Short Circuit Load; Small Internally Stored Energy
Secondary Keywords: Abstract Only

7242
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)
A 100 KV, 80 AMP, LONG PULSE SWITCH TUBE
S.G. McNees
Varian EIMAC Div., San Carlos, CA 94070
1978 IEEE Thirteenth Modulator Symposium, pp 180-182 (06/1978).
A high power vacuum grid tube has several characteristics which make it ideally suited for repeated DC high voltage, high current, interrupt applications. It has no moving parts, no arc quenching problems, adjustable current limiting in the case of a shorted load, and the ability to dissipate power. This latter feature can be used to advantage to pre-program any desired di/dt during the turn 'on' or turn 'off' interval. The ability to handle large amounts of dissipation during the 'on' cycle permits the high vacuum power grid device to be used as a voltage regulator; a very attractive feature when constant voltage over the load is required as in neutral beam sources. The power grid tubes described here have 100 kV and 80 Amps. DC ratings and typically operate at 97 to 98 percent efficiency. They require approximately 25 KW of auxilliary power for filament and driver circuits. 0 Refs.
Primary Keywords: Vacuum Grid Tube; DC Current Interruption; Adjustable Current Limiting; High Efficiency

7243
(PULSE GENERATORS)
(Pulse Forming Lines)
DRIVING POCKELS CELLS IN MULTI-ARM LASERS
B.M. Carder
Lawrence Livermore Lab, Livermore, CA 94550
1978 IEEE Thirteenth Modulator Symposium, pp 5-8 (06/1978).
This paper describes the method used to drive Pockels cells on the 20-arm Shiva laser for inertial confinement fusion research at the Lawrence Livermore Laboratory. Shiva became operational last fall, and has just completed a series of 20-arm target shots. It uses two Pockels cell gates in each laser arm for suppression of amplified spontaneous emission (ASE) that can damage or destroy the target before the main pulse arrives. Two additional Pockels cells are used in the preamplification stages, so that a total of 42 cells must be driven by the pulser system. 1 Refs.
Primary Keywords: Transmission Line Pulser; Spark Gap Switch; Variable Load
Secondary Keywords: Pockels Cell Driver

7244
(DIAGNOSTICS AND INSTRUMENTATION)
(Data Transmission)
ELECTRO-OPTIC TRANSDUCERS AND OPTICAL FIBERS IN HIGH VOLTAGE MICROWAVE MODULATORS
P. Cervone and G. Scerch
Selenia SPA, Rome, Italy
1978 IEEE Thirteenth Modulator Symposium, pp 75-78 (06/1978).
This paper describes a new solution for the transfer of information through different voltage levels in a high voltage modulator for grid-pulsed microwave tubes. The new solution is realized with the use of electro-optical transducers coupled by optic fibres. A description of the transmission channel, the control unit and the failure indicators is presented. 2 Refs.
Primary Keywords: Data Transmission; Fiber Optic Link; Real Time Processing; Fast Response

7245
(POWER CONDITIONING)
(Current Limiters)
ENERGY CONSIDERATIONS IN THE PULSED OPERATION OF A VACUUM ARC CURRENT LIMITER
C.D. Bowman, A.S. Gilmour Jr., R. Dollinger and D.P. Malone
State University of New York at Buffalo, Buffalo, NY 14226
1978 IEEE Thirteenth Modulator Symposium, pp 213-216 (06/1978).
It has been demonstrated at SUNYAB that current peaks as high as approximately 120 kA can be limited to approximately 1 kA using a vacuum arc current limiter (VACL). During current limiting a large voltage is developed across the VACL and so a very large impulse of energy is applied to the anode. This paper describes the results of a study that has calculated the current amplitudes with and without the VACL in the system. The resulting energy impulses applied to the device were determined and a transient analysis of the temperature distribution within the anode was made. 4 Refs.
Primary Keywords: Current Limiter; Magnetic Field; High Limiter Voltage; Anode Temperature Distribution

7246
(PULSE GENERATORS)
(Line Type)
HAYSTACK HILL LONG-RANGE IMAGING RADAR TRANSMITTER
W. North
GTE Sylvania, Inc, Needham Heights, MA 02194
1978 IEEE Thirteenth Modulator Symposium, pp 247-253 (06/1978).
The Long-Range Imaging Radar (LRIR), developed by MIT Lincoln Laboratory for the USAF, is presently installed at the Haystack Hill NEPOC radio telescope facility, in Westford Mass, and uses its 120-foot diameter parabolic reflector antenna. Its transmitter is designed around the Varian VTX-5681 TWTA, which was developed specifically for this application under the sponsorship of MIT Lincoln Laboratory. TWT beam voltage is 42 kVdc at 10 amperes, which is gated by means of the output of a direct-coupled floating deck modulator connected to the unity-mu modulating anode of each parallel-connected TWT. The modulator, which uses Eimac 8960 switch tubes, is capable of pulse durations of from less than 10 microseconds to CW, and PRF's up to 2000/second. Output amplitude control is accomplished by a direct-coupled grid-cathode circuit applied to the upper switch tube grid. Low-level signal coupling is by means of a balanced, capacitively-coupled 10 MHz links, using microcircuit components. Maximum use was made of the existing 58 kVdc, 21 ampere n/PS and the 80 kV, 156 mf capacitor bank and crowbar. It was necessary, however, to augment them with a 20-ampere electronic current regulator, between rectifiers and capacitor bank, and a 40-ampere electronic voltage regulator, between capacitor bank and TWT beam input, and an output buffer capacitor bank and separate crowbar. Both regulators use Eimac 4CW250,000 tetrodes. 0 Refs
Primary Keywords: Floating-deck Modulator; High Average Power; Component Descriptions

7247
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
HIGH VOLTAGE DC POWER CONDITIONER
D.L. Pruitt
RCA Corp, Moorestown, NJ 08057
1978 IEEE Thirteenth Modulator Symposium, pp 15-21 (06/1978).
Modern radar systems, particularly mobile systems, require high quality, compact, lightweight DC power sources. High frequency (e.g., 10 kHz) power conditioners have been used to obtain the desired qualities. By adapting a variation of the series inverter circuit, liberally infused with artificial line type pulse modulator technology, an effective, simple, and high performance technique has been developed. Low frequency (50 to 400 Hz) transformers are eliminated by direct full wave rectification of the AC power source. With appropriate input filter design, power source frequencies from 50 to 400 Hz can be accommodated in one design. A pair of suitable high frequency thyristors alternately charge and discharge a pair of capacitors through the primary of a pulse power transformer. Since the effective frequency is high (thousands of hertz), the transformer and load filter capacitor are small compared to the equivalent 3 phase, power frequency components. Operating Q is low (approaches 1), minimizing the reactive power. Regulation of the output voltage is achieved by varying the pulse recurrence frequency from as low as 2000 to some maximum (e.g., 20 kHz). No load to full load regulation of 2% has been demonstrated. The circuit is not harmed by overload, and has a current fold-back feature. Normal operation goes on automatically when an overload is removed. 1 Refs.
Primary Keywords: DC Power Supply; Light Weight; High Frequency Inverter; Good Regulation

7248
(SWITCHES, CLOSING)
(Miscellaneous Solid State)
HYBRID SCR SWITCH
D.L. Pruitt
RCA Corp, Moorestown, NJ 08057
1978 IEEE Thirteenth Modulator Symposium, pp 157-162 (06/1978).
Hybrid solid state switches were designed and constructed using SCR (silicon controlled rectifier) chips on a beryllia substrate. Both pulse currents of up to 6000 A with 2 microsecond rise time, or up to 3000 A with 1 microsecond rise time, were achieved. A series stack was constructed to produce a 10 kV air cooled switch. 4 Refs.
Primary Keywords: SCR Network; High Current; Slow Rise

7249
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)
LONG PULSE HIGH EFFICIENCY SWITCH TUBE DEVELOPMENT
A.F. Morrell
RADC, Griffiss AFB, NY 13440
1978 IEEE Thirteenth Modulator Symposium, pp 183-188 (06/1978).
A high power linear beam tetrode switch tube was tested and evaluated at RADC's High Power Laboratory. Utilizing the device as a series modulator for a klystron amplifier, parameters attained were 120 KV anode output at 0.05 duty cycle with pulse lengths up to 300 microseconds. Measurements of efficiency, collector depression, perveance, control grid interception, anode (screen grid) current and collector dissipation were performed. The ability to control the pulse width and shape was demonstrated at a variety of voltage and power levels. These results indicated that operation at 140 KV, 100 amperes at 0.1% duty could be achieved with an appropriate load tube. This switch tube was designed and fabricated by Varian Associates under RADC sponsorship. Details of the advantages of this device and of Varian's preliminary testing are covered, in addition to RADC's extensive evaluation. 2 Refs.
Primary Keywords: Linear Beam Tetrode; Series Modulator; Pulse Shaping; High Efficiency

7250
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Gaps, Electrical; Vacuum Gaps, Magnetic Field)
MAGNETIC FLUX CONCENTRATION WITH THE ANODE IN A VACUUM ARC SWITCH
Y. Swen and A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226
1978 IEEE Thirteenth Modulator Symposium, pp 208-212 (06/1978).
The anode of a vacuum arc switch may be used as a magnetic flux concentrator. This is done to permit the use of a large diameter field coil, perhaps located outside the vacuum envelope, for generating large magnetic flux densities in the anode-cathode interelectrode region. The time required for the magnetic flux to decrease substantially in density because of diffusion through the anode is of interest in switch applications where it is necessary for the arc interruption process to be relatively slow. In this paper measured flux diffusion speeds through a vacuum arc switch anode are compared with those calculated using the diffusion equation subject to boundary conditions in two limiting cases. 2 Refs.
Primary Keywords: Magnetic Flux Concentrator; Field Diffusion; Anode Processes

7251
(SWITCHES, OPENING; SWITCHES, CLOSING)
(Vacuum Gaps, Magnetic Field; Vacuum Gaps, Electrical)
MAGNETICALLY MODULATED VACUUM ARC FOR DC SWITCHING
R. Dethlefsen and J. Mylius
Gould Inc., Greensburg, PA 15601
1978 IEEE Thirteenth Modulator Symposium, pp 222-226 (06/1978).
Experiments are reported on vacuum arcs in a magnetron-type discharge geometry. Magnetic fields up to 0.6 Tesla are applied. Various de-gassed cathode materials are tested at currents up to 10 kA. Depending upon geometry, the magnetic field can raise the vacuum arc voltage from typically 150 V to several kV. The probable cause is an electron space charge current limitation in front of the ring shaped anode. Dependent upon parallel capacitance, strong oscillations are excited by the magnetic field. Application of the magnetic field can reduce the arc current from several kA to the current chopping level, where circuit interruption is followed by rapid dielectric recovery. High repetition rates in the kHz region appear feasible. 4 Refs.
Primary Keywords: Magnetron-type Discharge; Magnetic Modulator; Low Field; Self-generated Field

7252
(PULSE GENERATORS)
(Hard-tube)
PEAK SWITCH CURRENT ENHANCEMENT FILTER
J.P. O'Loughlin (1) and W.M. Mooney (2)
(1) AFWL, Kirtland AFB, NM 87117
(2) Tetra Corp, Albuquerque, NM
1978 IEEE Thirteenth Modulator Symposium, pp 52-54 (06/1978).
One method of providing ionization in a controlled gaseous discharge is to apply very short over voltage pulses. The voltage is typically several times the breakdown voltage of the gas but the time duration is less than the arc formation time so a complete breakdown does not occur but the gas is ionized. The level of ionization achieved depends on the total charge or equivalently the peak current delivered during the over voltage pulse. Typical parameters used on one experiment were 50 to 100 nanosecond pulses at 35 KV and repetition rates up to 500,000 PPS. A hard tube modulator was designed and built to deliver up to 200 peak amperes. Later in the experiment higher currents were desired and it was found that by using a peak current enhancement filter it was possible to deliver peak current of 350 amperes to the load while the hard tube modulator was only switching 200 peak amperes. The design and characteristic of such a filter is described in the paper. 3 Refs.
Primary Keywords: Peak Current Enhancement; 50% Peak Current Increase; Hard Tube Pulser; Pi Section Filter; Narrow Pulse

7253
(POWER CONDITIONING)
(Pulse Forming Networks)
PFN LOSS CALCULATIONS
S.I. Rambo and R.A. Gardenghi
Westinghouse Electric Corp, Baltimore, MD 21203
1978 IEEE Thirteenth Modulator Symposium, pp 43-45 (06/1978).
Approximation methods for the calculation of PFN losses have been used for many years. With the availability of computer facilities to most electronic engineers today, more precise calculations can be made. Many PFN's designed for thyratron switching have had characteristic impedances high enough that losses could be ignored safely. The recent trend to all-solid-state pulsers requiring very low Z-sub-0 (less than 1 ohm) and high pulse current capability makes it essential that distribution of losses be determined more accurately. This paper describes a proven useful approach, using simple time-shared computer programs. Methods are described for loss calculations by first determining the pulse current shape in each coil and capacitor in the time domain. Then these pulses are transformed into the frequency domain to determine their spectra. By knowing the Q of the coils and the dissipation factor of the capacitors and how they vary with frequency, it is easy to sum the losses for each spectral line for each component. Results agree well with experiments. 0 Refs.
Primary Keywords: Loss Calculation; Numerical Calculation; Solid State Pulser; Low Impedance; Comparison With Experiment

7255
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
PULSED TWT POWER SUPPLY: A TECHNIQUE FOR MINIMIZING R.F. PHASE INSTABILITY AND HIGH VOLTAGE ENERGY
F. Terenzino and P. Marchi
Selenia SPA, Roma, Italy
1978 IEEE Thirteenth Modulator Symposium, pp 22-26 (06/1978).
The ripple voltages on the electrodes of the power microwave tube limit the performances of M.T.I. radar system. When the radar employs staggered P.R.F., pulse-to-pulse ripple arises due to load duty change. For TWT power amplifier, the variations of the cathode-body voltage cause phase and amplitude modulation of the transmitted wave form. It is possible to reduce the cathode voltage variation by increasing the value of the H.V. capacitors, but with this solution the stored energy increases too. Series regulator is another alternative but this means more sophisticated circuitry with decreasing of reliability and more design efforts. This paper describes a H.V.P.S. configuration which allows to solve the problem with limited H.V. stored energy. 5 Refs.
Primary Keywords: Detailed Analysis; Voltage Multiplication; Ripple Compensation; Minimum Stored Energy

7256
(SWITCHES, CLOSING)
(Gas Gaps, Crossed-field)
THE CROSSED-FIELD CLOSING SWITCH-A STATUS REPORT
R.J. Harvey (1), R.W. Holly (1), J. Creedon (2) and H. Gauch (2)
(1) Hughes Research Labs, Malibu, CA 90265
(2) ECOM, Fort Monmouth, NJ 07703
1978 IEEE Thirteenth Modulator Symposium, pp 79-82 (06/1978).
The crossed-field closing switch (CFCS) has been evaluated using a modulator consisting of 25 cables each 15.24 m long. A low-inductance 2-ohm copper sulfate load was used to terminate the modulator in its characteristic impedance. Before evaluating the CFCS in the cable modulator, studies were made of firing characteristics and mode of operation using a conventional pulse forming network of 0.5 ohm impedance matched to a copper sulfate load. The pulse width was a nominal 12 microsecond. Preliminary results were then obtained with the cable modulator at an anode voltage of 23 kV at a peak current of 6 kA and pulse repetition rates up to 500 Hz. The pulse width, measured at the half power points on the load, was 160 ns. Experimental results are shown for the cable modulator test, and the dependence of operating mode on circuit parameters is discussed. 6 Refs.
Primary Keywords: Performance Test; Rep-rated; Parameter Study

7257
(SWITCHES, OPENING)
(Mechanical)
THE USE OF VACUUM INTERRUPTERS AND BYPASS SWITCHES TO CARRY CURRENTS FOR LONG TIMES
E.M. Honig and R.W. Warren
Los Alamos National Labs, Los Alamos, NM 87545
1978 IEEE Thirteenth Modulator Symposium, pp 194-199 (06/1978).
Vacuum interrupters are normally designed for use in AC utility circuits where they typically carry a maximum continuous current of 2 kA but must interrupt fault currents well in excess of 25 kA. Vacuum interrupters are also used to carry and interrupt the large DC currents found in fusion devices such as tokamaks. In contrast to AC uses, however, these DC applications usually require that the continuous current limit be the same as the interruptible current limit. In a previous paper we have reported tests performed at the Los Alamos Scientific Laboratory (LASL) which show that the interruption ability of standard vacuum interrupters used with DC currents is satisfactory for currents in excess of 20 kA. Little, however, is known about the ability of standard interrupters to carry such large currents for long times. It is the purpose of this paper to describe measurements which determine the period of time conventional interrupters can carry currents as large as 20 kA without compromising their interruption ability; describe special interrupters which should extend this period; describe a bypass switch we have built and two ways of using it to relieve the vacuum interrupter of its heating load; describe the bypass switch experimental setup and test results; and discuss ways to extend the life of the bypass. 8 Refs.
Primary Keywords: DC Current Rating; Bypass Switch

7258
(SWITCHES, OPENING)
(Mechanical)
THE USE OF VACUUM INTERRUPTERS AT VERY HIGH CURRENTS
R.W. Warren and E.M. Honig
Los Alamos National Labs, Los Alamos, NM 87545
1978 IEEE Thirteenth Modulator Symposium, pp 189-193 (06/1978).
There is a slowly growing, widely based need for switches which can be used to interrupt DC currents. In recent years the demands of fusion devices such as tokamaks have overshadowed all others and have illuminated the need for conventional switches with vastly improved performance or for battery entirely new kinds of switches. Switches presently being developed for tokamak uses must interrupt 25 kA at 25 kV with a reliability of 99% or so for a total of many thousands of cycles. Next generation tokamaks may operate at 100 kA and 100 kV and require switches with a reliability of 99.9% and a much longer life. No existing switch can meet these requirements. A promising approach to these goals is based upon a vacuum interrupter used in conjunction with a commutation or counterpulse capacitor bank. This bank is used to create a forced current zero at which interruption can occur. 10 Refs.
Primary Keywords: Vacuum Interrupter; DC Current Interruption; Current Commutation; High Reliability; Magnetic Field

7260
(PARTICLE BEAMS, ELECTRON)
(Generation)
AURORA, AN ELECTRON ACCELERATOR
B. Bernstein and I. Smith
Physic International Co, San Leandro, CA 94577
IEEE Transactions On Nuclear Sciences, Vol. NS-20, No. 3, pp 294-300 (06/1973).
Aurora was designed to produce a brief, intense radiation pulse, and the electrical specifications derive from the radiation output required. A 'test volume' was defined that was roughly a meter cube. It was desired to irradiate this from one side to an average of 50,000 Roentgens throughout. In the laboratory, such yields can only be obtained as the bremsstrahlung from a high intensity electron beam stopped in a high density 'converter'. To maximize the efficiency of conversion of electron energy into photon energy, the highest possible kinetic energy was selected, consistent with the desire not to produce an excessive quantity of photo-neutrons. The kinetic energy chosen was 15 MeV. Calculations then showed that the dose in the test volume could be achieved with minimum electron energy if the radiation source were a uniformly energized surface about 1.5 m in diameter, placed near one face of the test volume. This source suface is the converter, which must be illuminated by a fairly uniform electron beam. The total charge of 15 MeV electrons needed per pulse was calculated to be about 0.2 Cb. An electron beam pulse duration of 120 ns was chosen to give the desired radiation pulse duration to allow for the finite rise and fall times of the beam pulse. Thus an electron beam specification of 1.6 MA at 15 MeV was arrived at, giving a peak power of 24 terawatts and a total beam energy of almost 3 MJ per pulse. 2 Refs.
Primary Keywords: AURORA Accelerator; Design Considerations; Field Emission Diode; Blumlein Line; Marx Generator; System Integration

7266
(PULSE GENERATORS; POWER CONDITIONING; PARTICLE BEAMS, ELECTRON)
(Marx; Pulse Transformers; Generation)
COUPLED MARX-TESLA CIRCUIT FOR PRODUCTION OF INTENSE RELATIVISTIC ELECTRON BEAMS

A. Luches and A. Perrone
Universita di Lecce, Lecce, Italy
The Review Of Scientific Instruments, Vol. 49, No. 12, pp 1629-1630 (12/1978).

A two-stage Marx circuit was built and is used to multiply the input energy of our Tesla resonant transformer accelerator without missing resonance conditions. The present output characteristics of our coupled Marx-Tesla circuit are compared to those of the previous Tesla transformer. With the same input voltage and cathode to anode distance, we succeeded in doubling output voltage and current of the beam. 4 Refs.
Primary Keywords: E-beam Generation, Marx Generator; Tesla Transformer; 1 MV Accelerating Voltage

7268
DESIGN AND DEVELOPMENT OF A 350 KV, 100 PPS ELECTRON BEAM ACCELERATOR

G.J. Rohwein, M.T. Buttram and K.R. Prestwich
Sandia Labs, Albuquerque, NM 87115
No. CONF-771035-10, 24p (01/1977)
Available-type: SAND-77-1282C
NTIS

A 350 kV, 300 J/pulse, 100 pulse/sec electron beam accelerator was designed and constructed. A description of the physical features of the machine is included along with performance data from the initial operation of the system. (ERA citation 03:010865)
Primary Keywords: Accelerators; Design; Electron Beams; Kev Range 100-1000; Performance; Pulse Circuits; Pulses; Switches; Transformers
Secondary Keywords: ERDA/430100; ERDA/700208; NTISDE

7275
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
FUSION APPLICATIONS OF FAST DISCHARGING HOMOPOLAR MACHINES

K.I. Thomassen
Los Alamos National Labs, Los Alamos, NM 87545
EPRI Report No. ER-625 (01/1978).
Availability: EPRI ER-625
EPRI

The use of fast discharging homopolar machines, with 1-5000 ms delivery times, are described for toroidal and linear theta pinches, toroidal z-pinches, liners, and tokamaks. Typical circuits and machine designs are described. 10 Refs.
Primary Keywords: Fast Discharge; Modeling
Secondary Keywords: Fusion Driver

7276
(PARTICLE BEAMS, ELECTRON)
(Generation)
HIGH CURRENT PULSED ELECTRON BEAM GENERATOR

I. Smith, P. Champney, L. Hatch, K. Nielsen and S. Shope
Physic International Co, San Leandro, CA 94577
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 3, pp 491-492 (03/1971).

A review is given of a simple and economical method of generating high current electron beams in the range of a few hundred kiloamperes to multi-megamperes at voltages from 100 kV to 1 MV. Mylar dielectric parallel plate transmission lines, switched with either solid dielectric spark gaps or gas spark gaps constitute the pulse forming network. Several such generators have been built that feed a 50 nsec width pulse through a low inductance insulator/vacuum interface to a field emission diode. The electron beam is generated in the diode region and accelerated through a thin window into a drift chamber. One such generator is described in detail. 2 Refs
Primary Keywords: Field Emission Diode; Drift Tube; Strip Line; Mylar Insulation; Water Encapsulation; Boundary Considerations; Pulse Forming Network

7280
(POWER TRANSMISSION; POWER CONDITIONING)
(Transmission Lines; Pulse Transformers)
IMPEDANCE MATCHING BY TAPERED TRANSMISSION LINES

A.W. Gent and P.J. Wallis
Standard Telephones And Cables, Ltd.
Proceedings Of The IEE, Vol. 93, Part IIIA, No. 3, pp 559-563 (03/1946).

Tapered transmission line sections are analyzed in this paper. The standing wave ratio is measured for a tapered line terminated in a coaxial line. It is found that best performance is obtained when the tapered line is equal in length to one half-wavelength. It is also found that the preferred geometry is to taper the inner and outer conductors together. 7 Refs.
Primary Keywords: Tapered Line, Impedance Matching; SWR Measurement; Simultaneous Tapering Of Conductors; Tapered Section Length

7284
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
NANOSECOND RESPONSE 'GASKET-TYPE' MAGNETIC LOOP CURRENT MONITOR FOR RELATIVISTIC ELECTRON BEAM CURRENT MEASUREMENTS

R.L. Copeland (1), J.L. Adamski (1), W.D. Doggett (2), D.L. Morrow (2) and W.H. Bennett (2)
(1) Boeing Aerospace Co, Seattle, WA 98124
(2) North Carolina State University, Raleigh, NC 27607
The Review Of Scientific Instruments, Vol. 50, No. 2, pp 233-235 (02/1979).

A fast response magnetic loop current monitor has been developed to measure relativistic electron beam return currents. The monitor has a rise time of about a nanosecond and a high degree of symmetry with moderate sensitivity, variable from about 1 to 10 V/kA. This simple monitor, with a thickness of 1.254 mm or less, is thin enough to be placed between segments of return current path in the diode or drift tube regions, is insensitive to flashover, beam and plasma bombardment, and radiation effects, and measures net current, thus offering some advantages over conventional magnetic probes, since the main components are outside of the vacuum region. Design criteria, an equivalent circuit analysis, and typical calibration waveforms are presented. Experimental current measurements for a pinched electron beam diode configuration using both conventional magnetic probes and 'gasket-type' current monitors with the FX-75 relativistic electron beam accelerator are presented. 5 Refs.
Primary Keywords: Current Monitor; E-beam Return Current; Return Current Path; Fast Response; 1 ns Rise Time; Environmental Insensitivity; Design Considerations

7285
(BREAKDOWN STUDIES)
(Surface Flashover)
NANOSECOND SURFACE DISCHARGE STUDY BY USING DUST FIGURE TECHNIQUES

Y. Murooka and S. Koyama
Defense Academy Of Japan, Chuo-dai, Yokosuka, Japan
Journal Of Applied Physics, Vol. 44, No. 4, pp 1576-1580 (04/1973).

The developing mechanisms of the positive and negative corona streamers on the insulation surface have been studied by using the Dust figure technique together with a line pulser. The present method has the advantage of measuring the velocity of corona discharge development and the discharge mechanism, because the distributions of the positive and negative charges in the discharge figure can be colorfully separated and recorded. By applying shorter time pulses from 10- to 920-nsec duration to a needle point where a glass plate is sandwiched in between the needle and plate electrodes, the diameter of the recorded discharge and the charge quantities and their distributions against the pulse duration were obtained. The observed average velocities of the developing corona streamers at a voltage of 12.0 kV were 2.05E8 cm/sec in the positive and 0.63E8 cm/sec in the negative, respectively. Moreover, when the negative pulse voltage was applied to the needle point the formation time lag of the cathode fall was about 10 nsec and the resulting high densities of the positive and the negative charges induced a back discharge. 20 Refs.
Primary Keywords: Surface Flashover; Corona; Polarity Effect; Dust Figure Technique; Corona Velocity; Point Cathode

7290
(PARTICLE BEAMS, ELECTRON)
(Generation)
SELF-ACCELERATION EXPERIMENT BY INTERRUPTION OF AN INTENSE ELECTRON BEAM

Yu.A. Grishaev, V.V. Zakutin, M.N. Nasonov, A.A. Rakityanskii and A.M. Shendenovich
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Kharkov, USSR
Soviet Technical Physics Letters, Vol. 1, No. 7, pp 275-276 (07/1975).
Trans. From: Pisma Zhurnal Tekhn. Fiziki 1, 612-615 (July 1975)

One of the most promising methods of accelerating a strong current electron beam is self-acceleration with the aid of an accelerating system excited by the beam. In the published experiments on self-acceleration of kiloampere electron beams it is found that the beam energy is increased by less than two times. The present paper is a brief communication of the results of experiments on self-acceleration of electrons by excitation of an accelerating system by the trailing edge of a current pulse of high-intensity electrons in a tube in which a much larger energy increment is obtained. 8 Refs.
Primary Keywords: E-beam Generation; Self-acceleration; Short Trailing Edge; Beam Energy Measurement; Gun Voltage; Gun Current; Tank Circuit

7292
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)
(Generation; Diagnostics)
THE GENERATION AND DIAGNOSIS OF PULSED RELATIVISTIC ELECTRON BEAMS ABOVE 1E11 WATTS

S.E. Graybill and S.V. Nablo
Ion Physics Corp, Burlington, MA 01803
IEEE Transactions On Nuclear Sciences, Vol. NS-14, No. 3, pp 782-788 (06/1967).

A review of the several approaches to the generation of intense electron streams in the megavolt energy regime is presented. The techniques used in the diagnosis of the 30,000 ampere, 3 MeV beam from a gas insulated coaxial system with a characteristic pulse length of 25 nanoseconds are discussed. The general features of such a stream drifting under self-focused conditions are presented and the results compared with the theory of such an idealized beam. The results of work conducted with cathode arrays of varying geometry are discussed. In particular, the dynamics of 20,000 ampere streams at 2 MeV, from arrays with 1 <= n <= 4, are presented. Based on these data, a prognosis is made for the limitations of future high peak power electron accelerators at energies in the 10 MeV range. 8 Refs.
Primary Keywords: E-beam Generation; E-beam Diagnosis; 3 MeV Beam Energy, 30 kA Beam Current; 25 ns Pulse Length; Self-focusing; Cathode Array

7296
(POWER CONDITIONING)
(Saturable Reactors)
THE USE OF SATURABLE REACTORS AS DISCHARGE DEVICES FOR PULSE GENERATORS
W.S. Melville
British Thomson-Houston Co., Ltd.
Proceedings Of The IEE, Vol. 98, Part III, No. 53, pp 185-208 (05/1951).
The use of saturable reactors as pulse sharpening elements is the subject of this paper. The author begins with a short historical background of saturable reactor uses and proceeds to define the requirements of such a reactor for pulse sharpening technique. The hysteresis loops of typical magnetic materials are studied with pulse sharpening in mind. A study of several parameters is presented, as well as several possible applications. 8 Refs
Primary Keywords: Saturable Reactors; Recurrent High-power Pulse Generation; Electronic Discharge Devices; Historical Background, Post-pulse Oscillations; Pulsactor Circuits; Long Life; Instantaneous Operability; Added Condenser Bulk
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7298
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
ULTRAFAST HIGH VOLTAGE PROBE
G.E. Leavitt, J.D. Shipman and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
The Review Of Scientific Instruments, Vol. 36, No. 9, pp 1371-1372 (09/1965).
We have developed high voltage probes that have operated in a range of 50 to 600 kV. The high frequency response of the probe was determined to be about 500 MHz. These probes have been applied in exploding wire and theta-pinch work. The probes consist of a capacitive voltage division to a level at which single non-inductive film resistors can be used. One such resistor in series with the transmission line, terminated by a matched recording oscilloscope input impedance, serves both as an additional voltage divider and as a part of an RC network with a time constant chosen to be much longer than the pulses to be measured. 5 Refs.
Primary Keywords: Voltage Probe; Capacitive Divider; Resistive Divider/terminator; 100 kV Operating Voltage; 18 MHz Bandwidth
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7300
(BREAKDOWN STUDIES)
(Liquid, Electrical)
'DIFFUSION' ELECTRODES FOR INVESTIGATION OF THE BREAKDOWN OF LIQUID DIELECTRICS
D.D. Ryutov
Journal Of Applied Mechanics And Technical Physics, Vol. 13, No. 4, pp 596-597 (08/1972).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 4, 186-187 (July-August 1972)
A method which excludes the effect of electrode micro-inhomogeneities on the breakdown of a liquid is proposed. The method consists in forming at the surface of each electrode a transitional layer with a conductivity which gradually decreases with increasing depth in the liquid. 1 Refs.
Primary Keywords: Liquid Breakdown; Diffusion Electrodes; Electrode Effects Eliminated; Transitional Layer; Electrical Conductivity; Spatial Resolution
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7303
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Liquid, Electrical; Liquid)
INCREASE OF DIELECTRIC STRENGTH OF WATER IN A SYSTEM WITH 'DIFFUSE' ELECTRODES
V.V. Vorob'ev, V.A. Kapitonov and E.P. Kruglyakov
Nuclear Physics Institute, Academy of Science of the USSR, Novosibirsk, USSR
JETP Letters, Vol. 19, No. 2, pp 58-59 (01/1974)
Trans. From: ZhETF Pis'ma V Redaktsiyu 19, 95-98 (January 1974)
Results are presented of an investigation of the dielectric strength of pure water when the electrodes are shielded with thin conducting layers. It is established that shielding the electrode surfaces greatly increases the electric strength of water. 2 Refs.
Primary Keywords: Dielectric Strength; Diffusion Electrodes; Ion-to Surface Shielding; Surface Breakdown; Field Intensity Calculation; Diffusion Layer
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7315
(BREAKDOWN STUDIES)
(Gas, Electrical)
DEVELOPMENT OF SPARK IN AIR FROM A NEGATIVE POINT
E. Nasser
Iowa State University, Ames, IA 50010
Journal Of Applied Physics, Vol. 42, No. 7, pp 2839-2847 (06/1971)
An old phenomenon used as a new detecting and diagnostic technique has been applied to the study of the voltage breakdown of air between a point cathode and a positive plane. 'Feathers' were found to propagate at velocities almost 5% of the velocity of light. When they approach the positive plane, they produce 'retrograde streamers' that bridge the gap and eventually lead to the completion of a plasma channel of high conductivity. 12 Refs.
Primary Keywords: Point-plane Gap; Air Gap; Streamer; Very High Propagation Velocity; Retrograde Streamer
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7385
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum; Electrical; Electrodes)
EFFECT OF ELECTRODE TEMPERATURE ON MICRODISCHARGES IN VACUUM
V.I. Gordienko and I.I. Pivovar
Soviet Physics-Technical Physics, Vol. 11, No. 2, pp 273-274 (08/1966)
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 374-376 (February 1966)
The effect of the temperature of metal electrodes on the breakdown voltage in microdischarges in vacuum was investigated. It is shown that higher electrode temperature means higher threshold voltage (starting at 150-200 deg C). Contamination of the electrode surface is considered as a possible cause. A significant difference in the nature of microdischarges is observed when hot cathodes are used. 2 Refs.
Primary Keywords: Microdischarge; Breakdown Voltage; Electrode Effect; Temperature Effect; Heated Anode, Heated Cathode
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7433
(PARTICLE BEAMS, ION)
(Generation)
NEW TYPE OF ACCELERATOR FOR HEAVY IONS
G.S. Janes, R.H. Levy, H.A. Bethe and B.T. Feld
Avco Everett Research Lab, Inc., Everett, MA 02149
Physical Review, Vol. 145, No. 3, pp 925-952 (05/1966).
A new device, called the heavy ion plasma accelerator (HIPAC) which may be capable of accelerating ions of any atomic number to energies sufficient to overcome the nuclear Coulomb barrier, is described. A closed potential well is created by filling a toroidal vacuum chamber with electrons; the electrons are contained by a magnetic field whose intensity is so low that its effect on the ions can be neglected. Ions are both accelerated and trapped in the well; the trapping effect allows sufficient time for the ions to become highly stripped by electron impact. The very large ion energies that can be achieved in this way would allow a wide variety of nuclear reactions to be studied, including inverse fission. The present primitive state of development of the HIPAC is described, and the future prospects assessed. 51 Refs
Primary Keywords: Ion-beam Generation; High Particle Ionization; Heavy Ion Plasma Accelerator; High Energy; Toroidal Geometry, Magnetic Field
Secondary Keywords: Nuclear Fusion
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7447
(PARTICLE BEAMS, ELECTRON)
(Generation)
PHYSICAL PROPERTIES OF THIN-FILM FIELD EMISSION CATHODES WITH MOLYBDENUM CONES
C.A. Spindt, I. Brodie, L. Humphrey and E.R. Westerberg
Stanford Research Institute, Menlo Park, CA 940.5
Journal Of Applied Physics, Vol. 47, No. 12, pp 5248-5263 (12/1976)
Field emission cathodes fabricated using thin-film techniques and electron beam microlithography are described, together with effects obtained by varying the fabrication parameters. The emission originates from the tip of molybdenum cones that are about 1.5 micron tall with a tip radius around 500 A. Such cathodes have been produced in closely packed arrays containing 100 and 5000 cones as well as singly. Maximum currents in the range 50-150 microAmpere per cone can be drawn with applied voltages in the range 100-300 V when operated in conventional ion-pumped vacua at pressures of 1E-9 Torr or less. In the arrays, current densities (averaged over the array) of above 10 A/sq cm have been demonstrated. Life tests with the 100-cone arrays drawing 2 mA total emission (or 3 A/sq cm.) have proceeded in excess of 7000 h with about a 10% drop in emission current. Studies are presented of the emission characteristics and current fluctuation phenomena. It is tentatively concluded that the emission arises from only one or a few atomic sites on the cone tips. 37 Refs.
Primary Keywords: E-beam Generation; Thin Film Cathode; Molybdenum Cones; 10 A/sq.cm. Current Densities; Cone Arrays
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7470
BASIC PRINCIPLES GOVERNING THE DESIGN OF MAGNETIC SWITCHES
D.L. Birx, E.J. Lauer, L.L. Reginato, J. Schmidt and M. Smith
Lawrence Livermore Lab, Livermore, CA 94550
(11/1980).
Availability: UCID-18831
NTIS
The idea of using saturable reactors as the basis of high power pulse generators is not a new concept, but there have been few recent applications of this technology. Here the principle of magnetic pulse generation is briefly described and some of the basic guidelines used to design these circuits are discussed. A demonstration of the principles by a small scale pulse amplifier is presented, and finally there is an extrapolation to a large scale system. (ERA citation 06:046645)
Primary Keywords: Pulse Generators; Design; Operation
Secondary Keywords: FRDA/620860; NTISDE

7476
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
HYDROMAGNETIC CAPACITOR
C. Andersen, W.R. Baker, A. Bratenahl, H.P. Furth and W.B. Kunkel
Lawrence Berkeley Lab, Berkeley, CA
Journal Of Applied Physics, Vol. 30, No. 2, pp 188-196 (02/1959).
Very high electric constants can easily be achieved by means of a plasma in a strong magnetic field. When an orthogonal electric field is applied, the resultant particle drift stores electrical energy. In a coaxial capacitor, which makes use of a rotating plasma disk, dielectric constants in the range 1E6 to 1E8 have been measured. The potential usefulness of hydromagnetic capacitors in fast-discharge work is considered. 8 Refs.
Primary Keywords: Capacitor Design; Magnetically Confined Plasma; 1E6 Dielectric Constant; Very High Energy Density Capacitor
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7485
(PULSE GENERATORS)
(Reviews)
PULSE POWER REQUIREMENTS FOR LASER ISOTOPE SEPARATION
P.N. Mace and W.L. Willis
Los Alamos National Labs, Los Alamos, NM 87545
1978 IEEE Thirteenth Modulator Symposium, pp 274-276 (06/1978).
Laser systems being developed for laser isotope separation applications have pulse power requirements which will demand the ultimate capability of pulse power technology. Although the energy per pulse is small by many pulse power standards, the requirement for currents in excess of 100 kA, voltage of about 100 kV, and pulse repetition rates of 1 kHz constitute a set of requirements not previously imposed on pulse power systems. In this paper measurements made at low repetition rates on excimer laser discharges are presented, and the implications for pulse power components are discussed. Currently available switches and energy storage systems are discussed, and requirements for future development are given. 0 Refs.
Primary Keywords: Laser Loads; Pulsed Power Requirements; Switching; Energy Storage; Repetrated
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7487
(PARTICLE BEAMS, ELECTRON)
(Transport)
EXTENDED WORKING RANGE FOR ELECTRON BEAMS IN THE ATMOSPHERE
J.F. Lowry and B.W. Schumacher
Westinghouse Research and Development Center, Pittsburgh PA
Nuclear Instruments And Methods 130, pp 577-596 (09/1975).
The range and the power density at a given work distance for a high power electron beam outside the vacuum depend upon a number of factors besides the beam voltage, for instance temperature (i.e. density) and composition of the atmosphere in which the beam travels. These factors were investigated experimentally. The heating of the air in the beam path by a high power beam itself can increase the range by as much as a factor of 2 and the power density at a given distance from the electron gun by a factor of 10. This heating of the gas can be enhanced by surrounding the beam path by a fairly wide guard-tube through which, in addition, helium may be flowed. Another way to create a high temperature low atomic number path for the beam consists of a coaxial hydrogen flame. With these devices we found the range could be extended by a total factor of 3, and the power density for a given total power increased by a factor of about 50. The results of the present measurements agree with earlier theoretical calculations, as far as applicable. We also found that the visible, flourescent beam plume gives a misleading impression: it is much wider than the actual scatter-broadening of the high-energy electron component of the beam. 10 Refs.
Primary Keywords: Beam Propagation; Air; Parameter Study; Simulation; Numerical Calculation; Optimization
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7489
(PARTICLE BEAMS, ELECTRON)
(Generation)
THE CURRENT IN A CYLINDRICAL RELATIVISTIC DIODE
N.W. Harris
Ion Physics Corp, Burlington, MA 01803
Journal Of Physics D; Applied Physics, Vol. 13, pp 789-792 (10/1979).
The current in a space-charge-limited cylindrical diode working at very high voltages has been calculated. The results are presented graphically for a wide range of electrode diameter ratios and for voltages up to 10 MV. The results are given for the exterior cathode and interior cathode configurations. 9 Refs.
Primary Keywords: Diode; Space-charge-limited; Current Measurement; Several Electrode Diameters; Radially Convergent Beam
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7490
(BREAKDOWN STUDIES)
(Liquid, Electrical)
THE EFFECT OF ORGANIC ADDITIVES ON THE BREAKDOWN AND GASSING PROPERTIES OF MINERAL OILS
A.A. Zaky, I.Y. Megahed and C. Evangelou
University of Alexandria, Alexandria, Egypt
Journal Of Physics D; Applied Physics, Vol. 9, pp 841-850 (11/1976).
The effect of organic additive content on the direct voltage breakdown strength of degassed transformer oil and liquid paraffin is reported for a wide range of concentration of additives known to be effective gassing inhibitors. Their effect on the breakdown strength of oils saturated with hydrogen, nitrogen and oxygen is also reported. Measurements of the gassing properties of the oils were carried out for the same extended range of additive concentrations. The observed breakdown and gassing versus concentration characteristics indicate the presence of maximum and minimum points at concentrations which are independent of the matrix liquid and of dissolved gas and gas phase. There is a remarkable degree of correlation between the breakdown and the gassing properties of the liquids tested. This and other relevant observations indicate that gas generation is an intrinsic part of the breakdown process and strongly support the bubble theory of breakdown. This forms the basis for the discussion of the results. 20 Refs.
Primary Keywords: Organic Additive; DC Voltage; Degassed Oil; Gas-saturated Oil; Gassing-breakdown Correlation
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7491
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)
THE EFFECT OF ROTATING ARC VELOCITY ON COPPER CATHODE EROSION
A.E. Guile and A.H. Hitchcock
Leeds University, Leeds, UK
Journal of Physics D; Applied Physics, Vol 7, pp 597-601 (01/1974)
In a number of devices, transverse magnetic fields are used to rotate arcs to minimize electrode erosion. Measurements are reported here for 45 A arcs rotating in air at atmospheric pressure which show that the cathode loss, which exceeds that of the anode, can be determined with good accuracy if allowance is made for oxidation. These results, which have been made over a much wider range of arc velocity than any work reported previously, show that the variation of cathode erosion rate with arc velocity is not a simple one, and that an abrupt fall or increase can occur for a very small change in arc velocity. Whereas it has commonly been assumed that increasing the magnetic field will continuously reduce the loss of electrode material. It is suggested that these considerable variations in cathode erosion are associated with changes in electron emission caused by differing oxide film conditions on the cathode surface. 23 Refs.
Primary Keywords: Rotating Arc; Magnetically Driven; Atmospheric Air; Low Current; Wide Air Velocity Range
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7492
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Vacuum Gaps, Electrical; Vacuum, Electrical)
THE EFFECT OF TEMPERATURE ON THE ELECTRICAL CHARACTERISTICS OF A VACUUM GAP
D.A. Swift
Central Electricity Research Labs, Leatherhead, Surrey, UK
Journal Of Physics D; Applied Physics, Vol. 5, pp 1588-1591 (05/1972).
An experiment has been done in which the electrodes of a vacuum gap were operated at widely different temperatures over a range 4 to 300 Deg.K. The temperatures of both the anode and cathode were found to effect the prebreakdown current and breakdown voltage of a 0.8 mm uniform field gap between niobium electrodes of industrial surface finish. 7 Refs.
Primary Keywords: Temperature Effects; 4-300 Deg.K Range; Prebreakdown Current; Breakdown Voltage; Uniform Field Gap; Niobium Electrodes
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7493
(SWITCHES, CLOSING)
(Thyratrons)
THE HOLLOW THERMIONIC CATHODE SYSTEM USED IN THYRATRONS
J. Gower
MO Valve Co, London, UK
Journal Of Physics D; Applied Physics, Vol. 3, No. 9, pp L37-L39 (07/1970).
A simple explanation for the high currents obtained from hydrogen thyratron cathodes is put forward. It is suggested that the 'hollowness' of the cathode structure and the high secondary emission coefficient for low energy hydrogen ions incident on barium covered surfaces leads to a self-maintained discharge with a modest running voltage. This static theory does not explain the large amplitude oscillations (about 160 MHz) that have been observed in the cathode region of thyratrons during the first 0.2 microsecond of pulsed discharges. 3 Refs.
Primary Keywords: High Cathode Current; Analysis; Secondary Emission; Self-maintained Discharge
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7494
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE MECHANISM OF ELECTRICAL BREAKDOWN OF GASES, INITIATED BY A LARGE NUMBER OF ELECTRONS
P. Sulwebke and Rau. R.S.N.
Indian Institute of Science, Bangalore, India
Journal Of Physics D; Applied Physics, Vol. 5, pp 2055-2063 (07/1972).
The mechanism of breakdown in uniform fields was investigated by humid air, dry air, oxygen, hydrogen and nitrogen at atmospheric pressure, using a large number of initial electrons (approximately 1E4) released from the cathode as a delta function at the start of a high-voltage rectangular pulse applied to the discharge gap. The threshold breakdown voltages were about 30% higher than the DC breakdown voltages reported by others. The formative times at threshold and at overvoltages indicated that up to a critical overvoltage, breakdown takes place by the multiple-avalanche Townsend mechanism, due to a photoelectric secondary effect at the cathode. The magnitudes of the critical overvoltages were not significantly less than those with a single initial electron obtained by other workers. For overvoltages higher than the critical, there was a transition region, at the end of which, breakdown transforms to the single-avalanche streamer mechanism. 17 Refs.
Primary Keywords: Uniform Field; Several Gases; 1E4 Initiating Electrons; Formative Time Lag; Single-avalanche Streamer
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7495
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
THE PARALLEL OPERATION OF LOW-INDUCTANCE HIGH-CURRENT SPARK GAPS WITHOUT TRANSIT TIME ISOLATION
P.M. Barnes, J.E. Gruber and T.E. James
Culham Lab, Abingdon, Oxfordshire, UK
Journal Of Scientific Instruments, Vol. 44, pp 599-605 (03/1967).
The necessary conditions for the satisfactory parallel operation of spark gaps, with no transit time isolation between them, are deduced theoretically. Such a capacitor bank with closely connected parallel spark gaps has been operated successfully. The development of a 66 kV pressurized field-distortion spark with an inductance of 15-18 nh is described, and the influence of electrode arrangement and trigger circuit parameters on breakdown time and jitter has been investigated. 8 Refs.
Primary Keywords: Close Coupling; Field Distortion Gap; Low-inductance; Variable Geometry; Variable Trigger Parameters; Experiment; Theory
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7496
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
TESTING AND ANALYSIS OF A FAST DISCHARGE HOMOPOLAR MACHINE (FDX)
J.M. Bullion, K. Zowarka, M.D. Driga, J.H. Gully, H.G. Rylander, K.M. Tolk, W.F. Weldon and H.H. Woodson
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 333-342 (06/1979).
The Fast Discharge Experiment (FDX) is a 0.36 MJ, 200 V homopolar machine designed to discharge in one millisecond. This experiment is intended to establish the fundamental limitations involved in extracting energy in the shortest time from a flywheel using homopolar conversion. FDX features a room temperature 1.6E6 A-t copper coil pulsed by a 5 MJ slow discharge homopolar machine, two 30.5 cm diameter counterrotating aluminum rotors with flame sprayed copper slip rings, low inductance return conductors, coaxial transmission line, four fast closing (30 microseconds) 1/2 MA making switches, hydrostatic journal bearings, squeeze film thrust bearings and dual brush activation systems. After initial testing of FDX was completed and data was analyzed, problems limiting performance were identified. Various components of the machine were redesigned and modified to correct these problems. A second set of tests, including short circuit discharges from various speeds, has recently been conducted. Results and analysis of these tests will be presented. New problems encountered as well as recommendations for additional work will also be given. 4 Refs.
Primary Keywords: Homopolar Generator; Aluminum Rotor; Copper Slip Ring; Hydrostatic Journal Bearing; Analysis; Performance Limitations
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7498
(BREAKDOWN STUDIES)
(Liquid, Electrical)
ELECTRICAL CONDUCTIVITIES AND BREAKDOWN RESISTANCE OF MIXTURES OF SOME LIQUID DIELECTRICS UNDER VOLTAGE PULSES
Yu.A. Korsunovskii and A.A. Protopopov
Applied Electrical Phenomena, No. 4, pp 257-261 (08/1967).
Trans. From: Elektronnaya Obrabotka Materialov 4, 29-34 (July-August 1967)

Studies of the breakdown resistance of liquid dielectrics began long ago, but only in 1941 was it discovered by Ruhle that certain concentrations of some polar substances increased the breakdown resistance of n-pentane to an alternating voltage of frequency 50 cps. Chong and co-workers observed an increase of 30% in the breakdown resistance of n-hexane with an admixture of 5% ethyl alcohol. This result was obtained for a constant voltage. Kao and Higham established that the addition of 5% carbon tetrachloride, chlorobenzene, chloroform, or ethyl alcohol increased the breakdown resistance of n-hexane, measured for voltage pulses, by 35%, 28%, 13%, and 7%, respectively. Electrical conductivities and breakdown resistance E/sub b/ of mixtures of carefully purified n-hexane with n-octane, benzene, m-xylene, chlorobenzene, chloroform, and carbon tetrachloride were studied as functions of the concentrations of these solutes. Measurements of electrical conductivity in pre-breakdown fields and breakdown resistance were carried out with voltage pulses of rectangular shape and 6 microsecond durations, isolated pulses being used. Analytical grade and chemically pure materials were used as solutes, being filtered through a No. 3 glass filter. 8 Refs

Primary Keywords: Liquid Dielectric; N-hexane; Mixture; Polar Dielectric; Non Polar Dielectric; Parallel-plane Electrodes; Short Gap

7503
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines, Materials)
DESIGN OF BRUSH GEAR FOR HIGH CURRENT PULSES AND HIGH RUBBING VELOCITIES
E.A. Marshall
Australian National University, Canberra, Australia
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-85, No. 11, pp 1177-1187 (11/1966).

This paper describes the mechanical brush gear designed for carrying the 1.6 million-ampere 1-second pulses from the rotors of the Canberra homopolar generator. Current density in the copper graphite brushes rises to about 10000 A/sq in. at full current. The brushes are also required to operate at rubbing speeds of up to 33000 ft/min. The experiments that were made to set the design limits for the brushes and the results obtained from these experiments are described; the design requirements and details of the brush gear as manufactured are given, and their operation in the homopolar generator is discussed. 7 Refs

Primary Keywords: Homopolar Generator; Brush Gear Design; 10 kA/sq.in Brush Current Density; 33000 ft/min Rubbing Velocity; Performance Test

7506
(BREAKDOWN STUDIES)
(Gas, Electrical)
DEVELOPMENT OF OVERVOLTAGE BREAKDOWN AT HIGH GAS PRESSURE
E.E. Kunhardt and W.W. Byszewski
Texas Tech University, Lubbock, TX 79409
Physical Review A, Vol. 21, No. 6, pp 2069-2077 (06/1980).

A model for the development of electrical breakdown in dense gases is presented. It describes the initial phase of breakdown in the regime where the Townsend avalanche mechanism does not apply. The main features of the model are as follows: (1) it gives a continuous picture of the development both in the structure of the breakdown and the physics of the processes, and (2) it is based on electron kinetics, so that the theory is general in scope. In light of this model a brief discussion of experimental results is given. 25 Refs

Primary Keywords: Gas Breakdown; High Pressure Gas; Townsend Avalanche; Streamer Theory, Theory; Electron Kinetics

7508
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Exploding Fuses)
EFFECTS OF SURROUNDING MEDIUM ON ELECTRICALLY EXPLODED ALUMINUM FOIL FUSES
T.L. Berger
Naval Surface Weapons Center, Dahlgren, VA 22448
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 213-216 (09/1980).

Flat aluminum foil fuses were exploded electrically by discharging a capacitor bank into a series combination inductance (approximately 600 nH) and fuse. The 2.54 x 2.54 x 0.0025 cm foils were exploded in a sealed chamber. The time-to-burst (TtB) and fuse voltage characteristics were investigated as a function of the fuse environment. Results are given for foils exploded in various gases and liquids. 17 Refs

Primary Keywords: Aluminum Foil Fuse; Environmental Effects, Several Gases, Several Liquids, Fuse Voltage vs Time

7509
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN IN HIGH VACUUM
W.S. Boyle, P. Kisliuk and L.H. Germer
Bell Labs, Murray Hill, NJ 07974
Journal Of Applied Physics, Vol. 26, No. 6, pp 720-724 (06/1955).

Currents preceding breakdown have been measured between closely spaced tungsten electrodes in high vacuum. It is found that field emission currents sufficient to evaporate anode metal flow before breakdown. These currents follow the Fowler-Nordheim equation when field magnification due to surface irregularities on the cathode is taken into account. The field magnification is a function of distance at electrode separations less than 4E-4 cm. Explanation of the observed breakdown at low voltage and small spacing requires an unusually high yield of electrons at the cathode per ion formed in the gap. Furthermore there is no measurable direct enhancement of the current by ion space charge at higher voltages. The high electron yield must therefore exist over the entire observed range of breakdown voltages. This high yield is satisfactorily accounted for by the increase in field emission due to the positive ion space charge, which in turn increases the positive ion current density until there is breakdown. It is shown that breakdown occurs when the field emission current is increased by only 55 percent. This condition is reached with the ion current density much smaller than the electron current density. 5 Refs

Primary Keywords: Prebreakdown Current; Tungsten Electrodes; Field Emission; Anode Evaporation; Fowler-Nordheim Equation

7515
(BREAKDOWN STUDIES)
(Liquid, Electrical)
EXPERIMENTS ON ELECTRICAL BREAKDOWN IN WATER IN THE MICROSECOND REGIME
D.B. Fenneman and R.J. Gripshover
Naval Surface Weapons Center, Dahlgren, VA 22448
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 209-213 (09/1980).

This paper presents experimental results from research on electrical breakdown in water carried out at NSWC/DL. The experimental apparatus is described in some detail. Results from approximately two thousand tests are presented. Breakdown events were observed predominantly in the 2-10 microsecond regime for applied fields in the range 150-500 kV/cm. The shot-to-shot variation of breakdown time intrinsic to the phenomena requires statistical measures of performance. The performance of four electrode materials-copper, brass, stainless steel, and aluminum-is presented. The first three performed similarly; aluminum was significantly different. 7 Refs.

Primary Keywords: Water Breakdown; 2000 Breakdowns; Microsecond Regime; Copper Electrode; Brass Electrode; Stainless Steel Electrode; Aluminum Electrode; 500 kV/cm E-field

7543
(BREAKDOWN STUDIES)
(Exploding Wires)
CHARACTERISTICS OF ENERGY RELEASED IN A CHANNEL FORMED BY AN EXPLODING WIRE
V.N. Ocheretin
FSTC Report No. FSTC-HT 23 131-74 (05/1974).
Trans. From: Elektronnaya Obrabotka Materialov 3, 74-75 (1973)
Availability: AD A035559
NTIS

A theoretical study is made of the conditions for energy release in a discharge channel by an exploding wire, at which the maximum power is successfully obtained. It was found that the energy density in the channel is determined mainly by the magnitude of the discharge current and the discharge channel radius, and that the energy density is greater in materials with greater magnetic permeability, i.e., steel or iron, rather than copper, aluminum or brass. The study showed that the skin effect can be disregarded. The curve of the instantaneous power given off in the channel can be plotted from current and voltage oscillograms, and the equations used show that high-voltage, low-capacitance capacitors are preferable to low-voltage, high-capacitance ones. It is shown that the pressure at the channel boundary can be determined, which permits proceeding to calculation of the hydrodynamic pulse parameters. 5 Refs

Primary Keywords: Exploding Wire; Plasma Channel; Theory, Numerical Calculation; Dependence On Current Magnitude, Dependence On Wire Material

7546
A STUDY OF POWER AND ENERGY IN THE AURORA MODIFICATION PROJECT
J.D.J. Shipman
Naval Research Lab, Washington, DC 20375
Final rept. No. NRL-MR-4281, 28p (07/1980).
Availability: AD-A088 051/8
NTIS

This report summarizes the results of a series of computer runs at NRL which were designed to determine if the measured loss of power and energy in the Aurora Modification Project tests in the fall of 1978 was due to increasing capacitance in the water switches during the transit times of the streamers or was due to resistive losses in the water switches. From the results of these analyses, it is concluded that the losses were mainly due to resistance in the intermediate store and pulse forming liner output switches and that the changing switch capacitance mainly rounded the pulse shapes near the peak values without contributing to a major loss of energy. It is suggested that oil switches be considered as a replacement for the water switches since they have less loss, although there are risks and problems involved in their use. (Author)

Primary Keywords: Pulse Generators, Electromagnetic Pulses; Electronic Switches; Transmission Lines; Computations; Computer Applications
Secondary Keywords: Aurora Gamma Ray Facility; Nanosecond Time; NTISDODXA

7557
(REVIEWS AND CONFERENCES. ENERGY STORAGE; POWER CONDITIONING; SWITCHES)
(Conferences: Reviews; Reviews; Reviews)
ENERGY STORAGE, COMPRESSION, AND SWITCHING
W.H. Bostick (Ed.) (1), V. Nardi (Ed.) (1) and O.S.F. Zucker (Ed.) (2)
(1) Stevens Institute of Technology, Hoboken, NJ 07030
(2) Lawrence Livermore Lab, Livermore, CA 94550
Publisher; Plenum Press, New York And London (01/1976).

The papers contained in this conference record encompass several aspects of energy storage and compression, switching, particle beam generation and plasma physics. Pulsed power systems for the generation of e-beams are presented in several papers, as is the use of collective effects for ion acceleration. The plasma focus is considered as both a plasma device and as a source of e-beams. Flux compression is considered both as a source of electrical power and as a means of producing intense magnetic fields. Capacitive and inductive energy storage systems are, of course, well represented. Several kinds of closing switches and exploding wire opening switches are considered in some detail. 694 Refs.

Primary Keywords: E-beam Generation; Collective Effects; Capacitive Energy Storage; Inductive Energy Storage, Homopolar Generator, Thyristor; Gas Spark Gap; Oil Spark Gap; Exploding Wire

7561
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Solid, Electrical; Solid)
ELECTRODE-LIMITED AND SPACE-CHARGE-LIMITED TRANSIENT CURRENTS IN INSULATORS

S.Z. Weisz (1), A. Cobas (1), S. Trester (2) and A. Many (3)
(1) Puerto Rico Nuclear Center, San Juan, Puerto Rico
(2) University of Puerto Rico, Rio Piedras, Puerto Rico
(3) Hebrew University, Jerusalem, Israel

Journal Of Applied Physics, Vol. 19, No. 5, pp 2296-2302 (04/1968).

The equations governing the transient-current flow in insulating crystals are solved for two categories of boundary conditions corresponding to situations in which the current is partly space-charge controlled and partly electrode limited. The carrier-reservoir at the injecting electrode is assumed to arise from photoexcitation by a pulse of highly absorbed light. In one category, the light intensity is taken to be sufficiently strong such that initially the current is completely space-charge limited. The time dependence of the current after the collapse of the carrier reservoir is calculated, with the time interval elapsed between the onset of the light pulse and the reservoir collapse taken as a parameter. The other category considered corresponds to sufficiently weak pulse excitation such that the field at the illuminated electrode is never zero. The duration of the pulse for this category is assumed to be short compared to the carrier transit time. The time and voltage dependence of the current is calculated in this case in the presence of surface recombination. Both categories of boundary conditions are often encountered in practice, and a comparison between theory and experiment is expected to yield valuable information on carrier generation and recombination processes at the surface. 9 Refs.

Primary Keywords: Insulating Crystal; Space Charge Limited Current; Electrode Limited Current; Electrode Illumination

7568
GENERATING HIGH VOLTAGE PULSES BY INTERRUPTING CURRENY IN AN INDUCTIVE CIRCUIT

M. Friedman and M. Ury
Naval Research Lab, Washington, DC 20375

Interim rept. No. NRL-MR-3326, 14p (07/1976).
Availability: AD-A028 075/0ST
NTIS

A new approach to the problem of developing an opening switch for inductive systems is described. The switch (fuse) consists of an aluminum foil immersed in water. Heat transfer processes and chemical reactions between the Al and water determine switch performance. Six kilojoules of electrical energy was handled by the switch and voltages of up to 100 kV were generated across the switch electrodes. (Author)

Primary Keywords: Pulse Generators; Interrupters; Electric Switches; Inductors; Energy Storage; High Power; Fuses(Electrical); Aluminum; Foils(Materials); Immersion; Water; Heat Transfer; Chemical Reactions Electric Power
Secondary Keywords: Inductive Storage; NTISDODXA

7570
(ENERGY STORAGE, INDUCTIVE; POWER CONDITIONING)
(Inductors; Pulse Transformers)
HALF-MEGAMPERE MAGNETIC-ENERGY-STORAGE PULSE GENERATOR

R.C. Walker and H.C. Early
University of Michigan Research Institute, Ann Arbor, MI

The Review Of Scientific Instruments, Vol. 29, No. 11, pp 1020-1022 (11/1958).

Energy is stored in the magnetic field of a large air core transformer having a very low impedance, tightly coupled secondary winding. The energy can be effectively delivered in less than 5 msec to a noninductive load having a resistance of less than 1E-4 ohm. 2 Refs.

Primary Keywords: Pulse Transformer; Inductive Energy Store; Resistive Load; 5 ms Pulse Length

7574
(PULSE GENERATORS; ELECTROMAGNETIC LAUNCHERS)
(Rotating Machines; Railguns)
HOMOPOLAR CURRENT SOURCE FOR MASS ACCELERATORS

I.M. Vitkovitsky, R.D. Ford, D. Jenkins and W.H. Lupton
Naval Research Lab, Washington, DC 20375

IEEE Transactions On Magnetics, Vol. MAG-18, No. 1, pp 157-159 (01/1982).

Acceleration of sub-kilogram mass to velocities of several kms by magnetic forces requires a multi megajoule source of energy. Constraints associated with the length of the circuit arm and with the structural integrity of the accelerated mass as well as with the problem of contact erosion bracket the accelerating time and current to the millisecond and megampere regimes, respectively. Homopolar generators (HPG) combined with appropriate switching can provide such output pulses more economically than other sources. 11 Refs.

Primary Keywords: Electromagnetic Accelerator, Rail Gun; Contact Erosion; Millisecond Current Pulse; Homopolar Generator; Transfer Switch

7576
(PARTICLE BEAMS, ELECTRON)
(Generation)
IMPEDANCE CHARACTERISTICS OF DIODES OPERATING IN THE SELF-PINCH MODE

G. Cooperstein and J.J. Condon
Naval Research Lab, Washington, DC 20375

Journal Of Applied Physics, Vol. 46, No. 4, pp 1535-1538 (04/1975)

The impedance characteristics of large aspect ratio diodes employing hollow field emission cathodes operating in the self-pinch mode have been studied at electron kinetic energies between 400 and 800 keV and currents between 100 and 500 kA. The importance of correcting the anode-cathode gap spacing for closure due to plasma motion is recognized and taken into account in the definition of the diode aspect ratio in impedance calculations. With this correction, the impedance at peak diode voltage and current is found to be nearly independent of voltage and cathode surface area and inversely proportional to the diode aspect ratio. Its amplitude is approximately 50% higher than that predicted by paraxial potential flow theory. 12 Refs.

Primary Keywords: E-beam Generation; Field Emission Diode; Carbon Cathode; Hollow Cathode; Beam Pinch; Large Aspect Ratio Diode

7580
(PARTICLE BEAMS, ELECTRON)
(Generation)
INTENSE FOCUSING OF RELATIVISTIC ELECTRONS BY COLLAPSING HOLLOW BEAMS

A.E. Blaugrund and G. Cooperstein
Naval Research Lab, Washington, DC 20375

Physical Review Letters, Vol. 34, No. 8, pp 461-464 (02/1975).

Low-impedance diodes with hollow tapered cathodes produce strong self-pinching in intense relativistic electron beams. Early in the pulse a thin hollow beam is formed, based on evidence of electrons striking the anode. This hollow beam collapse, accelerating toward the diode axis with velocities (1 to 5 mm/nsec) which depend locally on the anode material. An efficient and stable pinch, less than 3 mm in diameter, is formed at the anode. In the center 0.1 sq.cm., the power rises to 1E11 W in less than 3 nsec. About 50% of the total diode energy (approximately 9 kJ) is dissipated within the pinch region. 8 Refs

Primary Keywords: E-beam Generation; Hollow Cathode; Tapered Cathode; Hollow Beam; Beam Pinching; Anode Material

7582
(BREAKDOWN STUDIES)
(Vacuum; Optical)
EVIDENCE FOR REVERSE PHOTOELECTRONS IN LASER-INDUCED CURRENT

S.W. Ahmed
University of Oxford, Oxford, UK

Journal Of Applied Physics, Vol. 43, No. 1, pp 244-245 (01/1972).

Strong experimental evidence has been obtained for the significant contribution of 'reverse photoelectrons' in the production of current signal induced by focusing laser light onto a metal target and biasing the collector negative with respect to the target. Reverse photoelectrons are essentially normal photoelectrons from the collector region. The source of these photons is the laser-produced hot spot on the target. 6 Refs.

Primary Keywords: Photoelectrons; Laser Irradiated Anode; Thermal Radiation; Cathode Photoemission

7583
(PARTICLE BEAMS, ELECTRON)
(Generation)
INTERACTION OF ACCELERATING HIGH-CURRENT ELECTRON BEAMS WITH EXTERNAL MAGNETIC FIELDS

D.A. Hammer (1), W.F. Oliphant (1), I.M. Vitkovitsky (1) and V. Fargo (2)
(1) Naval Research Lab, Washington, DC 20375
(2) Lockheed Missile And Space Co., Palo Alto, CA 94305

Journal Of Applied Physics, Vol. 43, No. 1, pp 58-60 (01/1972).

When the current and current density of electrons accelerated in the anode-cathode gap of a field emission tube reach sufficiently high values, the induced self-magnetic field begins to dominate the electron trajectories. As a result, the spatial distribution of electrons arriving at the anode becomes strongly peaked in the center of the anode. It has been found possible to prevent such beam collapse with relatively modest external magnetic fields. The field is applied parallel to the electron flow (perpendicular to the anode plane). A scaling law which determines the necessary field strength based on a simple orbit model is found to agree with experimental results over a wide range of electron-beam parameters. 8 Refs.

Primary Keywords: E-beam Generation; Field-emision Diode; Self-magnetic Field; Beam Collapse; External Magnetic Field

7584
(BREAKDOWN STUDIES)
(Gas, Optical)
GAS BREAKDOWN WITH 10.6-MICRON-WAVELENGTH CO/SUB 2/ LASER RADIATION

D.C. Smith
United Aircraft Research Labs, East Hartford, CT 06108

Journal Of Applied Physics, Vol. 41, No. 11, pp 4501-4505 (10/1970).

The gas breakdown threshold or the minimum power density required to ionize a gas with 10.6-micron-wavelength radiation has been examined using the radiation of a q-switched CO/sub 2/ laser. The studies show that the focused beam cannot initiate the breakdown process for irradiances as high as 1E9 W/sq.cm.. If an initial low degree of ionization is provided by an external source, the subsequent growth of the breakdown is in agreement with a cascade model, as evidenced by the experimentally determined gas pressure and laser-radiation frequency dependence. 17 Refs

Primary Keywords: Gas Breakdown; CO/sub 2/ Laser; Breakdown Threshold; Argon Gas; Cascade Model

7587
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Gas, Electrical; Gas)
IMPULSE VOLTAGE TESTS ON AIR AND C/SUB 3/ F/SUB 8/

L.C. Whitmen
South Dakota State University, Brookings, SD

IEEE Transactions On Electrical Insulation, Vol. EI-1, No. 2, pp 44-48 (11/1965).

There is continual need for the evaluation of the electric strength of the various new gases that are becoming available and their comparison with the electric strength of some standard such as air. The impulse voltage strength of a new gas is not easily and quickly obtained, yet is essential in the proper design of equipment using these gases. It is the purpose of this paper to describe briefly the equipment that was used for this impulse voltage testing work, and to record some impulse voltage breakdown data on octafluorocyclopropane (C/sub 3/ F/sub 8/) and its comparison to air. 5 Refs.

Primary Keywords: Air Breakdown; C/sub 3/ F/sub 8/ Breakdown; Electric Strength Comparison; Test Apparatus Description

7588
(SWITCHES, CLOSING)
(Liquid Gaps, Self)
MULTIPLE CHANNEL SWITCHING IN WATER DIELECTRIC PULSE GENERATORS
J.K. Burton, D. Conte, W.H. Lupton, J.D. Shipman Jr. and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
1973 IEEE Proceedings Of The Fifth Symposium On Engineering Problems Of Fusion Research Conference Record, pp 679-683 (11/1973).
Criteria have been developed for multiple channel switching without triggering of water dielectric pulse power systems. The channel-to-channel jitter time, the current partition between channels, and the mechanical integrity of the switch have been determined for switching high voltage pulse lines at energies up to 30 kJ. The operation of switches has been compared for voltages applied for 100 and 600 nsec. The results can be projected to the design of 1E13 W pulse generators. 7 Refs.
Primary Keywords: Self-triggered Water Switch; Multichannel Operation; Performance Test; Jitter; Current Sharing

7596
(SWITCHES, OPENING)
(Mechanical)
NEW TYPE OF ULTRAFAST CIRCUIT BREAKER: ITS PRINCIPLE AND PERFORMANCES
P. Caupens, C. Rioux and F. Rioux-Damidau
Lab d'Electrotechnique, Orsay, France
The Review Of Scientific Instruments, Vol. 52, No. 1, pp 118-122 (01/1981).
The replacement of conventional voltage sources by inductive storage techniques in high-voltage pulse generation requires the successful operation of a suitable circuit breaker. The proposed device is composed of two different parts, the mechanical switch and the energy absorber. The magnetically activated mechanical switch operates in nitrogen under pressure and requires a low command energy (10%-15% of the primary stored energy). We present the mechanical switch basic principle and its performances, namely its restriking voltage and the parameters which affect it. The complete circuit breaker (switch plus energy absorber) can be used to open successfully currents up to 70 kA in times less than 10 microseconds. The restriking voltage (here, 40 kV after 20 microseconds) is proportional to the numb of knives and can be improved by having longer conductors and a large number of knives. The switch jitter is very low (approximately 1 microsecond). 12 Refs.
Primary Keywords: Mechanical Opening Switch; Inductive Energy Store; Nitrogen Working Gas; Magnetic Activation; Performance Test; 70 kA Opening Current; 40 kV Operating Voltage

7605
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
RECOVERY CHARACTERISTIC OF EXPLODING WIRE FUSES IN AIR AND VACUUM
I.M. Vitkovitsky and V.E. Scherrer
Naval Research Lab, Washington, DC 20375
Journal Of Applied Physics, Vol. 52, No. 4, pp 3012-3015 (04/1981).
The dielectric strength of exploded wire fuses during the vaporization and after recovery period and fuse resistivity are functions of time and depend on the medium surrounding the fuse channel. When fuses are used as opening switches in inductive storage systems, the above parameters determine the efficiency of power flow from the storage to the load. Specifically, design of experiments using loads with variable impedance, such as imploding plasma, requires detailed information on the fuse characteristics during the time when the load impedance is changing. To provide data that determine the interaction between fuses and variable impedance loads, inductive and recovery electric fields and fuse resistance in air and vacuum were studied. The results show that inductive field amplitude follows the dependence on time needed to vaporize the fuse in a manner similar to that established for fuses in other media. The characteristics of recovery rates of fuses in air and vacuum differ drastically due to the early onset of ionization in fuse channels in vacuum. 19 Refs.
Primary Keywords: Exploding Wires; Vaporization Stage; Recovery Stage; Dielectric Strength; Load Considerations

7606
(PARTICLE BEAMS, ELECTRON)
(Generation)
RELATIVISTIC ELECTRON BEAM PINCH FORMATION PROCESSES IN LOW IMPEDANCE DIODES
A.E. Blaugrund (1), G. Cooperstein (1) and S.A. Goldstein (2)
(1) Naval Research Lab, Washington, DC 20375
(2) University of Maryland, College Park, MD 20742
The Physics Of Fluids, Vol. 20, No. 7, pp 1185-1194 (07/1977).
The process of pinch formation in large aspect ratio diodes has been studied by means of streak photography and time-resolved x-ray detectors. A right pinch is formed at the anode center by a collapsing thin hollow electron beam emitted from a hollow cathode. The collapse velocity depends, amongst other things, on the type of material in the top 1 micron layer of the anode. In the suggested model it is assumed that the anode plasma is created from gases released from the surface layer of the anode by the heating action of the beam. These gases are ionized by avalanche breakdown aided by primary, backscattered, and secondary electrons. Ions emitted from this plasma modify the electron trajectories in the diode leading to a radial collapse of the hollow electron beam. The observed monotonic dependence of the collapse velocity on the atomic number of the anode material can be explained by the smooth dependence on Z of both the specific heat and the electron backscatter coefficient. In the case of high-Z anodes the ion expansion time is calculated and shown to be the factor limiting the collapse velocity. The use of thin foils to speed up the collapse rate is suggested. Detailed experimental data are presented. 23 Refs.
Primary Keywords: E-beam Generation; Hollow Cathode; Beam Pinching; Anode Effects; Anode Plasma; Thin-foil Anode

7613
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
THE DQ SWITCH OPERATION AT 4 MILLION VOLTS AND 800 KILOAMPERES
J.W. Douglas, W.F.J. Crewson and C.H. Jones Jr.
Pulsar Associates Inc, San Diego, CA 92121
DNA Report No. DNA 5160F (12/1979)
Availability: DNA 5160F
NTIS
This report describes the progress to date with high voltage gas switching using the DQ switch developed by Pulsar Associates, Incorporated. Self-breaking operation has been achieved at 4 million volts and 800 kiloamperes. Triggered operation has been achieved at 2 million volts. The control of insulator tracks is described, along with the engineering of the switch. 6 Refs.
Primary Keywords: DQ Switch; Gas Gap; Trigatron; Multi-section; UV Illumination
Secondary Keywords: Casino Simulator

7620
(PULSE GENERATORS; SWITCHES, CLOSING)
(Blumlein Lines; Solid Dielectric, Electrical)
TRAVELING WAVE EXCITATION OF HIGH POWER GAS LASERS
J.D. Shipman Jr.
Naval Research Lab, Washington, DC 20375
Applied Physics Letters, Vol. 10, No. 1, pp 3-4 (01/1967).
Experiments are described in which nitrogen and neon lasers are excited by a wave of current excitation which effectively travels from one end of the laser to the other with its velocity matching that of the stimulated emission. This type of excitation is accomplished with a low-impedance flat-plate Blumlein pulse generator. The power output in the direction of the wave of excitation is at least ten times that in the other direction. A 2.5-MW pulse of about 4-nsec duration is obtained with nitrogen and a 190-kW pulse of about 1.5 nsec with neon. 8 Refs.
Primary Keywords: Blumlein Line; Solid Dielectric Switch; Travelling Wave; 4 ns Pulse Length
Secondary Keywords: Gas Laser Pumping

7640
(BREAKDOWN STUDIES)
(Exploding Foils)
CALCULATION OF HEATING AND BURST PHENOMENA IN ELECTRICALLY EXPLODED FOILS
J.D. Logan, R.S. Lee, R.C. Weingart and K.S. Yee
Lawrence Livermore Lab, Livermore, CA 94550
Journal Of Applied Physics, Vol. 48, No. 2, pp 621-628 (02/1977).
A method is presented for computing the transient current and temperature distributions in electrically exploded foils. The model employed is applicable up until the time of burst. Calculations are presented for Al, Cu, and Au foils showing good agreement with experimental current waveforms and burst times over a wide range of capacitor-bank charging voltages and for varying foil cross sections. The two-dimensional nature of the calculation permits investigation of effects associated with nonuniform heating of the foil and gives an estimate of the simultaneity of burst. 33 Refs.
Primary Keywords: Exploding Foils; Aluminum Foil; Copper Foil; Gold Foil; Current Calculation; Current Distribution; Temperature Distribution; Theory; Comparison With Experiment

7650
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN OF A POINT-PLANE GAP IN HIGH VACUUM AND WITH VARIATION OF PRESSURE IN THE RANGE 1E-7 - 1E-2 TORR OF AIR, NITROGEN, HELIUM, SULPHUR HEXAFLUORIDE, AND ARGON
R. Hackam and G.R. Govinda Raju
University of Sheffield, Sheffield, UK
Journal Of Applied Physics, Vol. 45, No. 1', pp 4784-4794 (11/1974).
The DC breakdown potential of a point-plane electrode configuration is measured in high vacuum (approximately 1E-7 Torr) using the point as the negative voltage polarity of the point electrode as a function of gap separation. Air, nitrogen, helium, sulphur hexafluoride, and argon are used in turn to alter the electrode coverage by adsorption of various gases in high vacuum. It has been found that helium gives the highest breakdown voltage at a given gap length, in high vacuum. It has also been found that very high (workable) potential values are obtained using positive-point-negative-plane electrodes (90 kV at 0.3 mm gap length, helium at 3E-7 Torr). The effect of AC (50 Hz) glow discharge conditioning on the dielectric strength of the gap is investigated and found to give considerable improvement in the voltage that the gap can withstand before a vacuum breakdown occurs. The effect of introducing various gases in the pressure range 1E-7 - 1E-2 Torr on the breakdown potential of point-plane gaps is investigated. Maxima are observed in the breakdown voltage and pressure curves in the range of 1E-4 - 1E-3 Torr. Helium and nitrogen give the highest breakdown voltage of about 90 kV for a gap length of 0.2 mm at about 1E-4 Torr. The observed improvements in the breakdown potential that the gap can withstand with certain gases are attributed to the increase in the work function of the combined metal-gas system. 74 Refs.
Primary Keywords: DC Breakdown; Gas Adsorption; Positive-point Gap

7658
(BREAKDOWN STUDIES)
(Gas, Electrical)
EXPERIMENTAL STUDY OF THE PROPAGATION OF AN IONIZING WAVE IN A COAXIAL PLASMA GUN
J.M. Wilcox, E. Pugh, A. Dattner and J. Eninger
Royal Institute of Technology, Stockholm, Sweden
The Physics Of Fluids, Vol. 7, No. 11 (Supplement), pp S51-S56 (11/1964).
A coaxial plasma gun experiment is described. The gun has an azimuthal bias magnetic field, which is strong compared to the field from the discharge current. The discharge voltage is shown to depend linearly on the bias field, thus defining a velocity that is found to be almost independent of the pressure and the discharge current. This velocity is close to the 'critical velocity' which has been found in rotating-plasma experiments. The velocity of the current layer is also measured; it is always smaller than or equal to the critical velocity and it decreases with increasing pressure and decreasing magnetic field. 9 Refs.
Primary Keywords: Plasma Gun; Ionizing Wave; Ionization; Magnetohydrodynamics; Bias Magnetic Field; Current Sheet; Critical Velocity

7665
(BREAKDOWN STUDIES)
(Surface Flashover)
HIGH SPEED PHOTOGRAPHY OF SURFACE FLASHOVER IN VACUUM
J.D. Cross
University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 3, pp 145-148 (06/1978).
The method and results of high speed streak photography of surface flashover in vacuum are presented. It is shown that the bright phase of the flashover arc bridges at 12.5 mm gap in 0.15 ns. The streak records indicate that the flashover arc is preceded by an intense electron burst from the cathode-insulator junction. 7 Refs.
Primary Keywords: Surface Flashover; Streak Photography; Bright Phase; Cathode-insulator Junction; Electron Burst

7666
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
HOMOPOLAR GENERATOR EFFECT OF SUDDEN SHORT CIRCUIT
A.K. Das Gupta
Regional Engineering College, Rourkela, Orissa, India
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-87, No. 3, pp 655-659 (03/1968).
The effect of a sudden short circuit on a homopolar generator is analyzed and the transient time constant is deduced. The effect of nonuniform air gap flux is considered. It is shown that the time constant of a machine with a very small air gap and thick cylinder is quite large, while the time constant of a thin cylinder machine with a larger air gap is small. 11 Refs.
Primary Keywords: Homopolar Generator; Load Short Circuit; Air Gap; Cylinder Thickness; Machine Time Constant

7672
(PARTICLE BEAMS, ELECTRON)
(Generation)
MAGNETIC CUTOFF IN HIGH-CURRENT DIODES
J.M. Creedon
Physic International Co, San Leandro, CA 94577
Journal Of Applied Physics, Vol. 48, No. 3, pp 1070-1077 (03/1977).
The process of magnetic cutoff in diodes is investigated for several geometrical configurations. Generalized coordinates are used to show that the cutoff mechanism has certain basic properties which are common to all of the configurations considered. Theoretical solutions for two different one-dimensional flow patterns are compared and shown to have similar mathematical properties. Measurements are compared to theory for several types of magnetic cutoff. 21 Refs.
Primary Keywords: Field Emission Diode; Transmission Line; Magnetic Cutoff; Load-limited Cutoff; Theory; Numerical Calculation

7678
(BREAKDOWN STUDIES)
(Gas, Electrical)
PRESSURE DISTRIBUTION IN THE STRUCTURE OF A PROPAGATING CURRENT SHEET
T.M. York (1) and R.J. Jahn (2)
(1) Pennsylvania State University, University Park, PA
(2) Princeton University, Princeton, NJ
The Physics Of Fluids, Vol. 13, No. 5, pp 1303-1309 (05/1970).
The structure of the current sheet in a dynamic z pinch in argon is studied with a specialized high speed piezoelectric pressure transducer capable of following profiles of axial and radial pressure within the discharge. Correlation of these data with electric and magnetic field profiles, luminosity, and voltage records, indicates three distinct zones within the sheet in sequence, regions of electron current conduction, mass accumulation with ion current conduction, and induced flow of unswept gas. Profiles of particle density, velocity, and temperature are evaluated on the basis of a simplified gas-kinetic model. The current sheet is found to entrain a large percentage of the gas encountered, and a momentum balance across the sheet is in approximate agreement with snowplow predictions, but the distributions of current and mass density differ categorically from conventional piston-shock wave models. 9 Refs.
Primary Keywords: Z-pinch; Current Sheet; Plasma Temperature; Plasma Density; Pressure Measurement; Self-magnetic Field

7685
(BREAKDOWN STUDIES)
(Exploding Wires)
RESISTANCE AND ENTHALPY OF REFRACTORY EXPLODING WIRES
M.M. Martynyuk, T. Kerimkhodzhaev and V.I. Tsapkov
Patrice Lumumba University of International Friendship, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 11, pp 1458-1461 (05/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 2367-2373 (November 1974)
A pulsed oscilloscope method has been used to measure the relative electrical resistance R divided by R/sub o/ as a function of the enthalpy H for Zr, Hf, Nb, Mo, W, and Pt as the wire samples are heated by current pulses with t/sub 3/=400-500 and 30-35 microseconds. In the prolonged heating the samples are ruptured immediately after melting; with a briefer heating, there is a deeper penetration into the liquid-state region, up to temperatures far above the normal boiling point of the metal. The values of R divided by R/sub o/ and H for the solid and liquid phases of these metals are measured at the boiling point and at the temperature corresponding to the beginning of the electrical explosion, T/sub 3/; in pulsed heating in water at t/sub 3/=30-15 microseconds, the values of R divided by R/sub o/ for Zr, Hf, Nb, and Mo remain essentially constant in the liquid-state region up to T/sub 3/. The temperature T/sub 3/ which is identified as being approximately equal to the critical temperature, is evaluated. In pulsed heating in air there is a dip in the value of R divided R/sub o/ for the liquid state of all these metals; this behavior is attributed to discharge shunting the sample. 14 Refs.
Primary Keywords: Exploding Wires; Several Wire Materials; Wire Resistance; Wire Enthalpy; Boiling Temperature

7692
(BREAKDOWN STUDIES)
(Liquid, Electrical)
INVESTIGATION OF THE BREAKDOWN BY RECTANGULAR VOLTAGE PULSES OF A LIQUID IN AN INHOMOGENEOUS FIELD
I.P. Kuzhekin
Moscow Power Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 11, No. 12, pp 1585-1589 (06/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 2125-2130 (December 1966)
An investigation is made of the breakdown time of a liquid. For water with a conductivity of 2.5E-4 Ohm/sup -1/ cm/sup -1/ the breakdown time is determined by the duration of the preleader stage and the velocity of propagation of the leaders. The voltage-time characteristics of gaps 1 and 2 cm in length under the action of rectangular voltage waves with amplitudes of up to 100 kV are presented. Descriptions are given of the peculiarities of breakdown of various gaps at various voltages. An empirical formula is given for estimating the mean breakdown time of positive rod-plane gaps of length 1 to 30 cm. 7 Refs.
Primary Keywords: Water Breakdown; Preleader Stage; Streamer Velocity; Rectangular Voltage Pulse; Rod-plane Gap; Formative Time Lag

7694
(INSULATION, VACUUM)
()
VACUUM INSULATION OF HIGH VOLTAGES UTILIZING DIELECTRIC COATED ELECTRODES
L. Jedynak
University of Wisconsin, Madison, WI
Journal Of Applied Physics, Vol. 35, No. 6, pp 1727-1733 (06/1964).
An experimental research program has demonstrated that the high-voltage performance of a vacuum gap can be improved by the simple expedient of coating the cathode surface with a suitable thin insulating film. Steady voltages ranging to 340 kV were obtained with 5-mm gaps composed of 15-cm-diam Rgowski electrodes. Simultaneously the average gap currents were suppressed to the 1E-8 to 1E-10 A range. Further, it was shown that an insulating film on the anode can be severely detrimental to gap performance. Experiments were performed, at voltages up to 380 kV, involving 12 different film materials. Film thickness ranged from 0.2 to 135 micron and film resistivities ranged from 1E11 to 1E19 ohm-cm. The dielectric constants were between 1.7 and 3.5, except for one at 90. Based upon the experimental results and their interpretation, a tentative set of specifications can be given for a good cathode film: (1) resistivity of at least 1E11 ohm-cm; (2) dielectric constant in the range 1.5 to 4; (3) dielectric strength of at least 1E6 V/cm; (4) film thickness between 10 and 25 micron; (5) mechanically hard and smooth with high abrasion resistance and high adhesion strength (6) no gas bubbles within the film. If bubbles are unavoidable they must be substantially smaller than the film thickness; (7) low vapor pressure; (8) the cathode substrate should be of a highly polished metal suitable for quality deposition of the desired film material. 45 Refs.
Primary Keywords: Vacuum Insulation; Electrode Surface Coating; Current Reduction; Several Film Materials; Variable Film Thickness; Design Criteria

7706
(PARTICLE BEAMS, ELECTRON)
(Generation)
PULSED FIELD EMISSION CATHODE EMITTANCE MEASUREMENTS
J.R. Uglum, S.E. Graybill and S.V. Nablo
Ion Physics Corp, Burlington, MA 01803
The Review Of Scientific Instruments, Vol. 40, No. 11, pp 1413-1414 (01/1969).
A technique is described for the precise determination of the emittance diagrams for megavolt electron beams at energy fluences of up to 100 J/sq.cm. Two megaelectron volt beams from both single point hemispherical stainless steel and planar graphite emitters were studied, and emittance figures of 6.4 and 10.4 mrad cm, respectively, were obtained for the central 4 mm diameter portion of the streams generated by each configuration. 5 Refs.
Primary Keywords: Field Emission Diode; Emittance Measurement; MeV Electron Beam; Spherical Stainless Steel Cathode; Planar Graphite Cathode

7726
(ELECTROMAGNETIC LAUNCHERS)
(Railguns)
MAGRAC-A RAILGUN SIMULATION PROGRAM
R.J. Deadrick, R.S. Hawke and J.K. Scudder
Lawrence Livermore Lab, Livermore, CA 94550
UCRL Report No. UCRL-84877 (10/1980).
Availability: UCRL-84877
NTIS
We have developed and validated a computer simulation code at the Lawrence Livermore National Laboratory (LLNL) to predict the performance of a railgun electromagnetic accelerator. The code, called MAGRAC (MAGnetic Railgun ACcelerator), models the performance of a railgun driven by a magnetic flux compression current generator (MFCG). The MAGRAC code employs a time-step solution of the nonlinear time-varying element railgun circuit to determine rail currents. From the rail currents, the projectile acceleration, velocity, and position is found. We have validated the MAGRAC code through a series of eight railgun tests conducted jointly with the Los Alamos Scientific National Laboratory. This paper describes the formulation of the MAGRAC railgun model and compares the predicted current waveforms with those obtained from full-scale experiments. 8 Refs.
Primary Keywords: Simulation, Numerical Calculation; MAGRAC; Flux Compression Generator; Rail Current; Projectile Acceleration; Velocity; Position

7735
(BREAKDOWN STUDIES)
(Gas, Optical)

A PHYSICAL MODEL ON THE INITIATION OF ATMOSPHERIC-PRESSURE GLOW DISCHARGES

A.J. Palmer
Hughes Research Labs, Malibu, CA 90265
Applied Physics Letters, Vol. 25, No 3, pp 138-140 (08/1974).
A model on the preionization requirements for initiating a volume-stabilized glow discharge is proposed. The basic requirement of the model is that the preionized electron density be large enough to cause appreciable spatial overlap of the primary avalanches and consequent smoothing of space-charge field gradients at the stage when streamer formation would otherwise occur. A minimum required preionized electron density of approximately 1E4 cu.cm. is predicted for a typical CO_2 TEA laser discharge and is consistent with experimental observations. 11 Refs.
Primary Keywords: Glow Discharge; Volume Stabilization; Preionization; Degree Of Preionization; Theory, Modeling
Secondary Keywords: Gas Laser Pumping

7738
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid, Solid, Electrical)

A TUTORIAL ON TREEING

E.J. McMahon
DuPont Co, Wilmington, DE 19898
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 4, pp 277-288 (08/1978).
Test methods for studying electric breakdown in solid dielectric materials through the mechanism of 'Treeing' are described. While this tutorial is directed to internally initiated breakdown, the same basic progressive failure occurs in surface initiated breakdown, but at a different rate. Water treeing is discussed briefly, not because it is unimportant, but because in most cases water trees can lead to the development of electrical trees which cause the ultimate failure. 10 Refs.
Primary Keywords: Insulation Breakdown; Electrical Treeing; Volume Breakdown; Surface Flashover; Water Tree

7739
(BREAKDOWN STUDIES)
(Gas, Electrical)

ANOMALIES IN IONIZATION COEFFICIENTS AND IN UNIFORM FIELD BREAKDOWN IN ARGON FOR LOW VALUES OF E/P

D.E. Golden and L.H. Fisher
New York University, University Heights, New York, NY
Physical Review, Vol. 123, No. 4, pp 1079-1086 (08/1961).
Prebreakdown ionization currents in argon have been measured in uniform fields for low values of the ratio of field strength to pressure E/p 5 to 12 V (cm mm Hg). Currents obtained with varying electrode separation d at constant E/p and constant p could not be analyzed to yield values of the Townsend coefficients alpha/p and gamma. Currents obtained with varying p at constant E/p and constant d could be analyzed to yield values of alpha/p and gamma, but such currents yielded coefficients which depend on d. The dependence of the values of alpha/p on d is attributed to the production of highly excited atoms by resonance radiation at some distance from the positions where the electrons lose their energy; these highly excited atoms then produce molecular ions and electrons in collisions with ground-state argon atoms. The secondary mechanism and the dependance of gamma on d are associated with resonance radiation. Sparking potential measurements in argon made by varying both p and d for values of pd corresponding to breakdown for the above range of E/p show deviations from Paschen's law. 29 Refs.
Primary Keywords: Gas Breakdown; Argon Gas; Low E/p; Uniform Field Breakdown; Prebreakdown Current; Variable Gap Spacing; Variable Gas Pressure

7741
(BREAKDOWN STUDIES)
(Liquid, Electrical)

BREAKDOWN AND PREBREAKDOWN PHENOMENA IN LIQUIDS

J.C. Devins, S.J. Rzad and R.J. Schwabe
General Electric Co, Schenectady, NY 12301
Journal Of Applied Physics, Vol. 52, No. 7, pp 4351-4365 (07/1981).
In this paper we present a comprehensive account of our results on streamer propagation in dielectric liquids in point-plane geometries. Propagation velocities for both positive and negative streamers have been determined as a function of the following parameters: temperature, pressure, density, viscosity, composition, and conductivity. Effects of voltage and interelectrode spacing were examined. Current and light emission during streamer growth were measured. The relation between shock wave and streamer velocities was investigated. Small concentrations of low ionization potential additives markedly accelerated the positive streamers, while electron scavengers accelerated the negative streamers. Mechanisms to account for these observations are discussed. 36 Refs.
Primary Keywords: Liquid Breakdown; Prebreakdown Current; Point-plane Gap; Optical Diagnostic; Streamer Propagation

7742
(BREAKDOWN STUDIES)
(Gas, Electrical)

BREAKDOWN MECHANISMS IN SULPHUR-HEXAFLUORIDE

N.H. Malik and A.H. Qureshi
University of Windsor, Windsor, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol EI-13, No. 3, pp 135-144 (06/1978).
The well known breakdown theories, Townsend's generation mechanism and the streamer mechanism, are reviewed and applied to the results of the breakdown in the strongly electronegative gas, sulphur-hexafluoride. Experimental results reported in the literature on the breakdown behavior of sulphur-hexafluoride are examined in the light of these theories. The breakdown theories are used for the estimation of the breakdown voltages in pure SF_6. Other factors that may affect the breakdown characteristics of SF_6 have been discussed. Further areas of work have been proposed in order to obtain a better understanding of the breakdown mechanism. 76 Refs.
Primary Keywords: SF_6 Breakdown; Breakdown Mechanism; Avalanche Streamer; Breakdown Voltage Prediction

7743
(BREAKDOWN STUDIES)
(Gas, Electrical)

CALCULATION OF DISCHARGE INCEPTION VOLTAGES IN SF_6-N_2 MIXTURES

N.H. Malik and A.H. Qureshi
University of Windsor, Windsor, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-14, No. 2, pp 70-76 (04/1979).
A simple method based on the streamer criterion is proposed to calculate the discharge inception voltages in SF_6-N_2 mixtures with SF_6 content between 1 and 100%. It is shown that the calculated values are in good agreement with experimental measurements for gaps having varying degrees of field non-uniformities. 17 Refs.
Primary Keywords: Gas Breakdown; Nitrogen Gas; SF_6 Gas; Theory; Streamer Criterion; Breakdown Vltage Calculation; Nonuniform Field

7744
(BREAKDOWN STUDIES)
(Gas, Products)

CARBON INHIBITION IN SPARKED PERFLUOROCARBON-SF_6 MIXTURES

I. Sauers, T.J. Havens and L.G. Christophorou
Oak Ridge National Lab, Oak Ridge, TN 37830
Journal Of Physics D: Applied Physics, Vol. 13, No 7, pp 1283-1290 (07/1980).
Decomposition products from sparked 2-C_6F_6 (2-perfluorobutyne)-SF_6 mixtures have been identified. These include the perfluorocarbons, CF_4 & C_2F_4, C_2F_6 & C_3F_6, C_3F_8 and C_4F_8 & C_4F_{10} and two isomers of C_5F_{12} & C_5F_{10}. Saturated perfluorocarbon products are shown to increase in abundance with increasing concentration of SF_6 in 2-C_6F_6 up to approximately 70% SF_6 in 2-C_6F_6. The most abundant decomposition product perfluoromethane (CF_4), was measured quantitatively for varying concentrations of SF_6 in 2-C_6F_6 and found to show a maximum for the (70%) SF_6-(30%)2-C_6F_6 composition. The data suggest that the suppression of solid carbon deposits is effected by conversion of carbon to gaseous products (mostly saturated perfluorocarbons). Comparisons are made with sparked 2-C_6F_6-N_2 mixtures which show no evidence of carbon inhibition. These results indicate that proper tailoring of SF_6-perfluorocarbon mixtures can effectively inhibit carbon formation. 1 Refs.
Primary Keywords: Gas Discharge; Decomposition Products; Perfluorocarbon-SF_6 Mixtures; Carbon Deposits; Deposit Inhibition

7746
(PARTICLE BEAMS, ELECTRON; PULSE GENERATORS)
(Generation; Pulse Forming Lines)

CHARGED, INTERNALLY SWITCHED TRANSMISSION LINE CONFIGURATIONS FOR ELECTRON ACCELERATION

D. Eccleshall, J.K. Temperley and C.E. Hollandsworth
Army Amament Research and Development Command, Aberdeen Proving Ground, MD 21005
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 3, pp 4245-4247 (06/1979).
High current pulsed electron beams may be accelerated with nominally 100% efficiency using induction accelerators based on stages of charged internally-switched constant-impedance transmission lines. Under certain conditions one obtains a repeating open circuit voltage waveform which can, in principle, be used to transfer 100% of stored energy to a beam which is recirculated and this would permit a higher overall acceleration gradient. We have also identified some efficient three line arrangements which could be exploited in the single pass mode. Some of the fundamental practical limitations to these concepts, such as the pulse distortion at line discontinuities and coupling to the beam, have been addressed. 4 Refs.
Primary Keywords: LINEC; Transmission Line Pulser; Closing Switch; High Transfer Efficiency; Pulse Distortion; Theory

7747
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid; Partial Discharges)

DEGRADATION PRODUCT ANALYSIS FOR POLYMERIC DIELECTRIC MATERIALS EXPOSED TO PARTIAL DISCHARGES

K.D. Watson, I.W. Johnson and J. Tanaka
University of Connecticut, Storrs, CT 06268
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 5, pp 327-336 (10/1978).
Partial discharge phenomena appear to play an important role in insulation failure, and thus the analysis of products resulting from such degradation may lead to an understanding of insulation breakdown mechanisms and more accurate determination of insulation lifetimes. Progress in the area of degradation product analysis is reviewed for solid and liquid insulating materials. 107 Refs.
Primary Keywords: Insulation Aging; Insulation Failure; Insulation Lifetime Calculation

7750
(INSULATION, MATERIAL)
(Gas)

DIELECTRIC GAS MIXTURES WITH POLAR COMPONENTS

L.G. Christophorou, D.R. James and R.A. Mathis
Oak Ridge National Lab, Oak Ridge, TN 37830
Journal Of Physics D: Applied Physics, Vol. 14, No. 4, pp 675-692 (04/1981).
Dielectric gas mixtures comprising mainly one electron-attaching component and one dipolar component have been investigated. It has been found that polar electron-slowing-down components effect a sharp increase in the breakdown voltage, V/sub s/, with small percentages of electron-attaching additives. The effect of electron-dipole scattering on V/sub s/ for multicomponent gas dielectrics is assessed, especially in combination with indirect electron scattering via negative ion states. The results demonstrate further the beneficial effect of large electron scattering cross-sections at subexcitation energies on V/sub s/ and suggest that a careful combination of gases slowing down electrons via dipole scattering and via negative ion states can effect large V/sub s/ values. This and earlier studies suggest that a number of dielectric gas mixtures containing one or two electron-attaching components from c-C_4F_8, C_4F_8, 2-$C_4H_6F_2$, SF_6 and a dipolar component from CHF_3, CH_2F_2 or 1,1,1-CH_3CF_3 with or without N_2 are excellent candidates for large-scale testing for possible eventual industrial adoption. 32 Refs.
Primary Keywords: Gas Insulation; Gas Mixtures; Polar Gas; Electron-attaching Gas; Electron Scattering; Several Mixtures

7751
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid; Gas, Electrical)
DISCHARGES
J.H. Mason
Polytechnic Of The South Bank Borough Road, London, UK
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 4, pp 211-238 (08/1978).
The electric strength of solid insulation may decrease greatly with time of voltage application if discharges occur within gaseous inclusions, at sharp-edged conductors embedded in the solid, on the surface from adjacent conductors, or as a result of surface contamination. Mechanisms of breakdown and factors which affect the electric strength of gases are surveyed, as a basis for understanding the complex behavior of internal and surface discharges: particularly terporal changes in their magnitude and recurrence frequency. Mechanisms by which discharges cause progressive degradation and ultimate failure are considered, also techniques for assessing the relative resistance of materials to surface or internal discharges of 'treeing'. Finally the review surveys the merits of different methods for ensuring against failure by discharges. Reliance on short-term over-voltage tests reduces the cost of testing but there is considerable risk of trees or tracking being initiated, rendering the insulation more likely to fail in service. Discharge measurements reduce this risk, but it is important to discriminate between discharges in the test object and external interference. There is as yet inadequate information for specifying acceptable discharge levels for the many types of insulation and service conditions. 161 Refs.
Primary Keywords: Solid Insulation; Insulation Dielectric Strength; Inclusion; Conductor Edge; Effect Of Voltage Duration; Insulation Testing
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7752
(INSULATION, MATERIAL)
(Liquid)
EFFECT OF DISSOLVED GASES, ORGANIC ADDITIVES AND FIELD CONFIGURATION ON CO-FIELD MOTION IN INSULATING OILS
A.A. Zaky (1), I.Y. Megahed (2) and M.S. Khalil (2)
(1) College Of Engineering, Riyadh, Saudi Arabia
(2) University of Alexandria, Alexandria, Egypt
IEEE Transactions On Electrical Insulation, Vol. EI-14, No. 1, pp 21-27 (02/1979).
The effect of dissolved gases (O/sub 2/, air and N/sub 2/) and a wide range of concentration of organic additives (quinoline, toluene and napthalene) on the electrohydrodynamic head due to co-field motion in transformer oil and liquid paraffin has been measured for both uniform and nonuniform fields using direct voltages. The effect of gap length on the head was also examined. The results indicate that all the dissolved gases investigated as well as toluene and naptholene reduced the developed head, whereas quinoline increased the head. With a highly nonuniform field the effect of O/sub 2/ and toluene was found to be strongly dependent on the polarity of the point electrode. 10 Refs.
Primary Keywords: Liquid Insulation; Transformer Oil; Dissolved Gas; Oxygen; Air; Nitrogen; Organic Additive; Quinoline; Toluene; Napthalene; Co-field Induced Motion
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7753
(INSULATION, MATERIAL)
(Solid)
ELECTRIC FIELDS AND SECONDARY EMISSION NEAR A DIELECTRIC-METAL INTERFACE
J.W. Robinson and N. Quoc-Nguyen
Pennsylvania State University, University Park, PA
IEEE Transactions On Electrical Insulation, Vol. EI-14, No. 1, pp 14-20 (02/1979).
Dielectric surface charge distributions near a metal dielectric interface in vacuum depend upon secondary emission processes in the presence of normal and tangential components of electric fields. From measured charge distributions created by exposing a specimen of fluorinated ethylene-propylene to monoenergetic electron fluxes, it has been possible to calculate potentials and fields on and near the dielectric surface. The effect of normal electric field upon secondary emission is measured directly and the effect of the tangential field is inferred from the charge distribution data. The critical point (unity crossover) for secondary emission is shifted by the application of fields so that it occurs at much higher primary energies than normally. Primary beams having energies up to 20 keV are used and surface fields are as high as 20 kV/mm. 6 Refs.
Primary Keywords: Solid Insulation; Surface Charging; Dielectric-electrode Interface; Secondary Emission; Vacuum Environment
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7756
(BREAKDOWN STUDIES)
(Gas, Recovery)
ELECTRON ATTACHMENT TO SF/SUB 6/
F.C. Fehsenfeld
Aeronomy Lab, ESSA Research Labs, Boulder, CO 80302
The Journal Of Chemical Physics, Vol. 53, No. 5, pp 2000-2004 (09/1970).
The attachment rate for electrons to SF/sub 6/ has been measured between 293 and 523 Deg.K. in a helium-buffered flowing afterglow over the pressure range of 0.1-1.5 Torr. The attachment has a rate constant of 2.2E-7 cu.cm./sec, independent of temperature and pressure. The primary reaction product over the measured range of temperatures is SF/sub 6/sup -/. However, the rate of production of SF/sub 6/sup -/ increases rapidly with temperature. 17 Refs.
Primary Keywords: SF/sub 6/ Gas; Attachment Rate Measurement; 293-523 Deg.K. Temperature Range; 0.1-1.5 Torr Pressure Range; Constant Rate
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7757
(BREAKDOWN STUDIES)
(Gas, Electrical)
ELECTRON-OPTICS STUDY OF THE DEVELOPMENT OF AN ELECTRIC DISCHARGE IN A GAS AT HIGH-ELECTRIC FIELD INTENSITIES AND WITH ONE-ELECTRON IGNITION
L.G. Bychkova, Yu.I. Bychkov, G.A. Mesyats and Ya.Ya. Yurike
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics Journal, Vol. 12, No. 11, pp 1389-1391 (11/1969).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii Fizika 12, 24-27 (November 1969)
A study was made of the luminous region in a discharge gap with copper electrodes, a field of E 80 kV/cm, air at atmospheric pressure, and a gap width of 4 or 2 mm. The cathode was irradiated with a spark to ignite the initial electrons. The electron current from the cathode was 0.2E9 electrons/sec. The exposure time per frame was 3E-9 sec. With a gap width of delta=4 mm, a luminous region is observed at the cathode 2 nsec after voltage is applied to the gap; this region propagates toward the anode, simultaneously increasing in diameter, at a velocity of approximately 1E3 cm/sec. A voltage drop is established across the gap approximately 0.5 nsec after the luminous front arrives at the cathode. In narrower gaps, the voltage drop is established across the gap a considerable time after the luminous region has crossed the gap. 9 Refs.
Primary Keywords: Spark Discharge; Copper Electrodes; Air Gas; Atmospheric Pressure; Channel Luminosity; Photographic Diagnostic; Voltage Measurement; Correlation
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7759
(PARTICLE BEAMS, ION; PARTICLE BEAMS, ION)
(Generation; Transport)
EXTRACTION AND FOCUSING OF INTENSE ION BEAMS FROM A MAGNETICALLY INSULATED DIODE
S. Humphries Jr., R.N. Sudan and L. Wiley
Cornell University, Ithica, NY 14850
Journal Of Applied Physics, Vol. 47, No. 6, pp 2382-2390 (06/1976).
A magnetically insulated diode has been used to produce cylindrically converging intense proton beams. By providing electron neutralization along field lines, the beams can be propagated across the magnetic field to within 1 cm of the axis. Proton currents up to 5 kA have been propagated to achieve current densities up to 70 A/sq.cm. Divergences less than 3 deg have been achieved with new plasma anode designs. Calculations are presented on the extrapolation of magnetic diodes to achieve power densities needed for ion-beam pellet-fusion breakeven. 19 Refs.
Primary Keywords: Ion-beam Generation; Field Emission Diode; Plasma Anode, Solid Cathode; Magnetic Insulation; Self-focusing Beam
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7761
(BREAKDOWN STUDIES)
(Gas, Electrical)
GROWTH OF THE SPARK DISCHARGE CANAL FOR A DISCHARGE CIRCUIT WITH A RAPIDLY INCREASING CURRENT
S.T. Andreev, M.P. Vanykov and A.B. Kotolev
Soviet Physics-Technical Physics, Vol. 7, No. 1, pp 37-40 (07/1962).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 32, 57-62 (January 1962)
Using apparatus with a 1E-9 sec (nanosecond) solution time we studied the development of the spark discharge canal in air for the case of a discharge circuit with a rapidly increasing current. We compared our results with the results calculated by means of Drabkin's and Braginskii's theories. We registered, experimentally, canal widening rates of 10-12 km/sec. 11 Refs.
Primary Keywords: Gas Discharge; Spark Channel; 1E12 A/sec Current Rise Rate; Cahnel Growth; Experiment; Theory
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7762
(BREAKDOWN STUDIES)
(Gas, Electrical)
HIGH CURRENT SPARK CHANNELS
J.E. Allen and J.D. Craggs
University of Liverpool, Liverpool, UK
British Journal Of Applied Physics, Vol. 5, pp 446-453 (12/1954).
Measurements have been made on high current (up to 265 kA) spark channels in air, argon and hydrogen. The voltage gradients existing in the channels were determined by oscillographic measurements and were found to increase with increasing current in the range studied. Power inputs of tens of megawatts per centimetre length of channel were deduced from the measured voltage gradients. Rotating-mirror photographs of the discharges were taken, using a camera with a resolution better than 1/5 of a micron. The photographs obtained show a number of interesting features which are peculiar to these high current discharges, the chief of one being the bright central core of the discharge, which was photographed in every case. Temperatures of about 1E5 Deg.K were estimated from electron mobility considerations. The central core of the discharge appears to be due to the self-magnetic 'pinch' effect, and calculations based on this inference suggest that high ion densities (approximately 1E19 per cu.cm.) exist in the centre of the core; the energy requirements for such conditions are compatible with the measured power inputs. 29 Refs.
Primary Keywords: Spark Channel; Air Breakdown; Argon Breakdown; Hydrogen Breakdown; Voltage Measurement; Current Measurement; Temperature Measurement; 265 kA Current
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7765
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
HIGH-POWER VACUUM SPARK GAP
DC Hagerman and A.H. Williams
Los Alamos National Labs, Los Alamos, NM 87545
The Review Of Scientific Instruments, Vol. 30, No. 3, pp 182-183 (03/1959)
The design and construction of a voltage graded vacuum spark gap is described. The gap is capable of switching currents as large as 1E6 amp at voltages up to 75 kV. The effect of the insulating walls of the gap is briefly discussed. 2 Refs.
Primary Keywords: Vacuum Spark Gap; Voltage Grading; Insulation Effects; 75 kV Operating Voltage; 1 MA Switch Current
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7766
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical, Electrodes)
HIGH-TEMPERATURE EFFECTS ON FLASHOVER IN AIR
L.L. Alston
A. Reyrolle & Co. Ltd., Hebburn, County Durham, UK
Proceedings Of The IEE, Vol. 105, Part A, No. 24, pp 549-553 (12/1958).
The authors report a study of electrode temperature effects on gas breakdown. Experiments were conducted with hot spots to 1200 Deg.C. These hot spots were found to lower the breakdown voltage considerably in uniform-field gaps but had lesser effect in the non-field regions of non-uniform-field gap. This effect is used to explain the triggering mechanism of trigatron gaps. 6 Refs.
Primary Keywords: Gas Breakdown; Electrode Effects; Electrode Hot Spot; Gas Heating; Breakdown Voltage Reduction; Trigatron Operation; Circuit Breaker Operation

7767
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH-VOLTAGE, LOW-INDUCTANCE SWITCH FOR MEGAMPERE PULSE CURRENTS
W.R. Baker
Lawrence Berkeley Lab, Berkeley CA
The Review Of Scientific Instruments, Vol. 30, No. 8, pp 700-702 (08/1959).
A switch is described that will handle pulse currents of several millions of ampere and stand off DC supply voltages of over thirty kilovolts. It is useful in powering fast pinch devices such as those used in thermonuclear research. 3 Refs.
Primary Keywords: Low Pressure Gas Switch; Low Inductance; High Reliability; Long Switch Life; Plasma Baffle; Frozen Dielectric

7769
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid; Surface Flashover)
LICHTENBERG FIGURES ON VARIOUS ELECTRICAL INSULATING MATERIALS
A. Kawashima and S. Hoh
College Of Technology, Saikei University, Tokyo, Japan
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 1, pp 51-56 (02/1978).
The surface discharge on insulating solid materials was recorded by a camera with high speed films. This simple method was found to be useful for the investigation of the surface discharge on various insulating materials. Lichtenberg figures on the surface of seven types of insulating material were determined by this method. The starting voltage for the formation of Lichtenberg figures was found to depend on the surface resistance of the insulating material, while the rate of the development of surface discharge with the applied voltage depends on the relative permittivity of the insulating materials. It is expected that the dielectric strength of an insulating material can be improved by covering its surface with highly resistive materials. 5 Refs.
Primary Keywords: Lichtenberg Figure; Surface Flashover; Photographic Diagnostic; Flashover Voltage; Surface Resistance; Insulator Permittivity

7771
(PARTICLE BEAMS, ION; INSULATION, MAGNETIC)
(Generation)
MICROSECOND-PULSE INSULATION AND INTENSE ION BEAM GENERATION IN A MAGNETICALLY INSULATED VACUUM DIODE
S.C. Luckhardt and H.H. Fleischmann
Cornell University, Ithica, NY 14850
Applied Physics Letters, Vol. 30, No. 4, pp 182-185 (02/1977).
The insulation and ion generation characteristics of coaxial magnetically insulated diodes were tested using microsecond voltage pulses from a Marx generator with magnetic fields ranging up to 20 kG, voltages of 150-300 kV, and gap widths of 0.3-2.9 cm. Voltage standoff was observed for up to 4 microseconds when using graphite or metallic electrodes. With plasma-producing flying filament anodes, high-energy ion beam pulse lengths of up to 1 microseconds and total charge generation densities of up to [illegible] microcoulombs/sq.cm were obtained. 16 Refs.
Primary Keywords: Vacuum Diode; Ion Beam Generation; Microsecond Pulse Length; Marx Generator; Graphite Electrodes; Puta Electrodes

7773
(BREAKDOWN STUDIES)
(Gas, Electrical)
ON THE ROLE OF THE ELECTRON IMPACT IONISATION AND ELECTRON SCATTERING CROSS-SECTION IN THE BREAKDOWN STRENGTH OF DIELECTRIC GASES
L.G. Christophorou, D.R. James and R.A. Mathis
Oak Ridge National Lab, Oak Ridge, TN 37830
Journal Of Physics D: Applied Physics, Vol. 12, No. 8, pp 1223-1236 (08/1979).
In this paper we discuss the role of the electron impact ionisation cross-section sigma/sub i/(epsilon) and the electron scattering cross-section sigma/sub sc/(epsilon) as a function of electron energy epsilon in the breakdown strength of gases/mixtures: four gases (Ne, Ar, N/sub 2/ and S/sub 6/) were chosen for which sigma/sub i/(epsilon) and sigma/sub sc/(epsilon) at low energies are known. Direct-current breakdown strength measurements on Ne, Ar, (Ne + SF/sub 6/), (Ar + SF/sub 6/), (N/sub 2/ + Ne + SF/sub 6/) and (N/sub 2/ + Ar + SF/sub 6/) were made and are reported, using sphere-sphere, sphere and square rod to plane electrode geometries. On the basis of these measurements and the data on sigma/sub sc/(epsilon) and sigma/sub i/(epsilon), it was concluded that the magnitude of sigma/sub sc/(epsilon) at subionisation (epsilon < 1) and especially at subexcitation (epsilon < energy of lowest excited electronic state) energies is much more significant in effecting a high dielectric strength than is sigma/sub i/(epsilon). The effect of perfluorination and static polarisability on sigma/sub i/(epsilon) is also discussed. 28 Refs.
Primary Keywords: Gas Breakdown; Electron Impact; Electron Scattering; Ionization Cross Section; Sphere-sphere Gap; Sphere-plane Gap; Rod-plane Gap; Neon Gas; Argon Gas; Helium Gas; SF/sub 6/ Gas

7775
(PARTICLE BEAMS, ION; INSULATION, MAGNETIC)
(Generation)
PRODUCTION OF INTENSE PROTON FLUXES IN A MAGNETICALLY INSULATED DIODE
P. Dreike, C. Eichenberger, S. Humphries and R. Sudan
Cornell University, Ithica, NY 14850
Journal Of Applied Physics, Vol. 47, No. 1, pp 85-87 (01/1976).
A magnetically insulated diode has been used to produce intense fluxes of protons with high efficiency. Currents in excess of 4 kA with current density greater than 50 A/sq.cm. have been produced in a 50 nsec bursts at energies up to 200 keV. The system appears to be easily scalable to higher parameters. The extraction of the beams, as well as geometries in which current densities of kA/sq.cm. may be realized, are discussed. 8 Refs.
Primary Keywords: Ion Beam Generation; Magnetically Insulated Diode; 200 keV Beam Energy; 4 kA Beam Current; 50 ns Pulse Length

7776
(BREAKDOWN STUDIES, INSULATION, MATERIAL)
(Liquid, Electrical; Liquid)
PROGRESS IN THE FIELD OF ELECTRIC BREAKDOWN IN DIELECTRIC LIQUIDS
A.H. Scarbrough, C. Devins and S.J. Read
General Electric Co, Schenectady, NY 12301
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 4, pp 249-276 (08/1978).
For some fifty years the mechanism of electric breakdown in liquid insulation has been a subject of great interest for both theoretical as well as practical reasons. Over the years a number of promising hypotheses of breakdown have been advanced and it has been necessary to modify, and sometimes reject, interpretations of the breakdown data as additional experimental evidence has been accumulated. In this report, we shall first examine some of the difficulties which are encountered in the measurement and interpretation of breakdown phenomena in the liquid state. Comparisons and generalizations with breakdown in gases and solids will be made, wherever possible. The concept of the 'intrinsic strength' of a liquid will be discussed, as well as the development of the very important experimental techniques which have been used in conduction and breakdown studies. 122 Refs.
Primary Keywords: Review; Liquid Breakdown; Diagnostics; Comparison With Gas Breakdown; 'Intrinsic' Dielectric Strength; Thermal Runaway

7779
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
SOME PROPERTIES OF A GRADED VACUUM SPARK GAP
J.W. Mather and A.H. Williams
Los Alamos National Labs, Los Alamos, NM 87545
The Review Of Scientific Instruments, Vol. 31, No. 3, pp 297-303 (03/1960).
A high power, low inductance vacuum spark gap combination (crowbar and main switch) is described which is capable of DC operations over a wide voltage range. The electrical properties are discussed in regard to shorting and multiple switch operation. The principal difficulty of vacuum spark gaps, the coating of the inner surface of the insulator with evaporated and sputtered electrode material, is absent in this design after conditioning. A mechanism to account for this, based on the establishment of a large number of nucleation centers on the insulating walls, is shown to be consistent with observation. 15 Refs.
Primary Keywords: Vacuum Spark Gap; Crowbar Switch; Starting Switch; High Power; Low Inductance; Insulation Conditioning; Metal Vapor Absorption

7780
(INSULATION, MATERIAL)
(Composite)
SOME PROPERTIES OF SOLID-LIQUID COMPOSITE DIELECTRIC SYSTEMS
A.J. Parker
Electrical Research Association, Leatherhead, Surrey, UK
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 4, pp 289-305 (08/1978).
The rheomorphological aspects of the electrical properties of solid-liquid dielectrics are discussed with special relevance to the utilization of such systems at high electric stresses. The mechanisms of conduction, dielectric loss and breakdown in the solid-liquid system have been related to the performance of the solid-liquid system as a whole. The effects of solid dielectric structure and thickness have been developed and associated with possible breakdown processes for the impregnated dielectric in practical situations. The use of plastic films, with or without paper, in impregnated capacitors is treated at some length as a useful device for developing the criteria which are important in all highly stressed solid-liquid systems. Considerable attention is given to aging phenomena and the way in which they may lead to various forms of failure in impregnated systems. Comprehensive data are provided from a summary of the literature relating to effects of temperature and electric stress applied singly and in combination. The effects of life-prolonging additives have been discussed briefly. 64 Refs.
Primary Keywords: Solid-Liquid Composite Insulation; High Insulation Stress; Losses; Insulation Breakdown; Plastic Film Insulation

7783
(BREAKDOWN STUDIES)
(Gas, Electrical)
STATIC FIELD BREAKDOWN OF SF/SUB 6/-N/SUB 2/ MIXTURES IN ROD-PLANE GAPS
M.H. Malik, A.H. Qureshi and G.D. Theophilus
University of Windsor, Windsor, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-14, No. 2, pp 61-69 (04/1979).

The static field breakdown and corona characteristics of SF/sub 6/-N/sub 2/ mixtures in non-uniform field gaps for applied voltages of positive and negative polarities are discussed. Mixtures containing 0 to 100% SF/sub 6/ are studied over a pressure range of 100 to 500 kPa. The results show that for such gaps, the dielectric behavior of SF/sub 6/-N/sub 2/ mixtures is very similar to that of pure SF/sub 6/. A discontinuity is reported in the breakdown voltage-pressure characteristics of SF/sub 6/ and SF/sub 6/-N/sub 2/ mixtures when the rod electrode is positive. The pressure at which this discontinuity is observed is higher for the mixtures than for pure SF/sub 6/ and is affected by the mixture ratio. The breakdown voltage for certain mixtures is up to 70% higher than that of pure SF/sub 6/. When the rod electrode is negative, breakdown strength of N/sub 2/ is very sensitive to the presence of small amounts of SF/sub 6/ and is almost doubled if 0.2% of SF/sub 6/ is added to N/sub 2/. The breakdown and corona characteristics are discussed in detail. 23 Refs.

Primary Keywords: Gas Breakdown; Nitrogen Gas; SF/sub 6/ Gas; Gas Mixture; Rod-plane Gap; Both Polarities; Breakdown Discontinuity; 100-500 KPa Pressure Range

7785
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE CHANNEL OF THE SPARK DISCHARGE
J.W. Flowers
General Electric Co, Pittsfield, MA 01201
Physical Review, Vol. 64, Nos. 7 And 8, pp 225-235 (10/1943).

The luminous channel of the spark discharge and the discharge current are simultaneously measured. It is concluded that the spark discharge in air attempts to establish a channel in which the current density is a constant value of the order of 1E3 amperes/sq.cm. During the formation of the channel, which takes place by an expansion process producing a pressure or sound wave, the current density is much greater. Throughout most of the formation time and the subsequent history of the channel, the light energy which is radiated is proportional mainly to the current within the channel. From potential measurements and the photographic records, the energy requirements for development are considered, and some possible relations of these requirements to the electrical circuits are discussed. The data are also discussed in relation to the progression of streamers. The pilot streamer theory of the lightning discharge is indicated to be unsatisfactory by comparison with measured discharge characteristics and the associated roles assumed for diffusion and recombination processes in the spark discharge channel do not appear valid. 23 Refs.

Primary Keywords: Spark Discharge; Radiation Measurement; Current Measurement; Air Breakdown; Pressure Wave; Streamer

7788
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Electrodes; Vacuum, Electrical)
THE INFLUENCE OF SOLID-STATE COHESION OF CONDITIONED METAL ELECTRODES ON THE ELECTRICAL STRENGTH OF THE VACUUM GAP
A.K. Vijh
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-11, No. 4, pp 160-162 (12/1976).

The solid-state cohesion of metals maintaining electrical stress across a vacuum gap appears to determine the magnitude of the electric strength of the vacuum gap. For conditioned electrodes (presumably free of adsorbed and oxide layers) under direct-voltage conditions, higher electric strengths are associated with metals having high metal-metal bond energies and vice versa. 7 Refs.

Primary Keywords: Vacuum Breakdown; Electrode Effects; Solid State Cohesion; Microparticle; Electrode Conditioning

7789
(SWITCHES, OPENING)
(Mechanical)
THE NATURE OF METAL-ELECTRODES/SF/SUB 6/ REACTIONS IN SF/SUB 6/ DECOMPOSITION DUE TO DIRECT-CURRENT INTERRUPTION UNDER SIMULATED CIRCUIT-BREAKER CONDITIONS
A.K. Vijh
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-11, No. 4, pp 157-161 (12/1976).

The nature of metal/SF/sub 6/ reactions under direct-current (DC) simulated circuit-breaker conditions has been examined in order to explore: 1) the identity of the process(es) responsible for the different magnitudes of electrode consumption for various pure metals; 2) the factors determining the different rates of reaction with SF/sub 6/ observed for different metals. It is concluded that high-current arc erosion, which would be expected to consume the metal in the absence of SF/sub 6/ is also the primary mode of weight loss of electrodes in the presence of SF/sub 6/. The rates of reaction of the evaporated metals seem to be related to their tendencies to attack SF/sub 6/ at the sulphur 'site' and not, as is generally assumed, at the fluorine 'sites.' Rather good correlations are observed between the reaction rates and the heats of formation per equivalent for metal sulphides or the electrode potentials for metal/metal sulphide electrodes. 5 Refs.

Primary Keywords: DC Circuit Breaker; Gas electrode Reaction; SF/sub 6/ Gas; Electrode Erosion

7791
(BREAKDOWN STUDIES)
(Gas, Electrical)
THEORY OF THE DEVELOPMENT OF A SPARK CHANNEL
S.I. Braginskii
Soviet Physics JETP, Volume 7, No. 6, pp 1068-1074 (12/1958).
Trans. From: Zhurnal Eksperimental'noi I Teoreticheskoi Fiziki 34, 1548-155? (June 1958)

The principle processes taking place in a spark channel at moderate currents are examined. Solutions are obtained for the motion of the gas outside the channel. A new type of hydrodynamic jump is considered-a strong discontinuity with external supply of heat. Certain solutions are found which describe the state of the gas inside the channel, and expressions are obtained for the characteristic parameters of the channel (radius, temperature, ect.). 12 Refs.

Primary Keywords: Spark Channel; Hydrodynamic Model; Moderate Current; Shock Wave; Channel Interior, Channel Exterior, Theory

7792
(BREAKDOWN STUDIES)
(Surface Flashover)
THEORY OF THE SECONDARY ELECTRON AVALANCHE AT ELECTRICALLY STRESSED INSULATOR-VACUUM INTERFACES
K.D. Bergeron
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 48, No. 7, pp 3073-3080 (07/1977).

Several aspects of the secondary emission avalanche along an insulator surface (which is believed to play a role in insulator flashover) are addressed theoretically. The saturation condition for the two extremes of supply-limited and space-charge-limited current are obtained in analytic form, and comparison with the computer simulation of Anderson is made. Also, the effect of a strong magnetic field parallel to the insulator surface and perpendicular to the electric field is analyzed, taking into account of the distribution of emission angles. It is found that the critical magnetic field for inhibition of flashover is reduced by a factor of about 2 when the distribution of angles is included in the calculation. 14 Refs.

Primary Keywords: Surface Flashover; Vacuum Environment; Polyethylene Dielectric; Glass Dielectric; Secondary Emission; Supply-limited Current; Space-charge-limited Current

7799
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
CALIBRATION OF UNIFORM-FIELD SPARK-GAPS FOR HIGH-VOLTAGE MEASUREMENT AT POWER FREQUENCIES
F.M. Bruce
English Electric Valve Co Ltd, Chelmsford, Essex, UK
Proceedings Of The IEE, Vol. 94, Pt. II, No. 38, pp 138-154 (04/1947).

Spark gaps have been used to measure high voltage. The best design allows breakdown through a uniform field to provide good repeatability. The authors describe such a spark and derive an empirical relationship for the gap breakdown in the range 9-315 kV. An accuracy of 2% is claimed for the formula. 11 Refs.

Primary Keywords: Voltage Measurement; Spark Gap Diagnostic; Gap Calibration; Emperical Formula; Gap Preparation

7800
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Lightning; Gas, Electrical)
COMPARISON OF LIGHTNING AND A LONG LABORATORY SPARK
M.A. Umar
Westinghouse Research and Development Center, Pittsburgh PA
Proceedings Of The IEEE, Vol. 59, No. 4, pp 657-660 (04/1971).

Long laboratory sparks are often considered to be miniature lightning. The salient properties of 4-m sparks created by impulse breakdown between a negative rod and a grounded plane by the Westinghouse Trafford 6.4 MV impulse generator are compared with those properties of natural lightning. In particular, a comparison is made of the luminous processes associated with breakdown, the current, voltage, power, and energy inputs to the discharges, the radiated visible spectra, the temperature, electron density, and pressure in the discharge channels, the absolute broad-band radiation in the visible and near infrared wavelength range, and the radiated acoustic signals. The spark return stroke most resembles a weak subsequent stroke in a multiple stroke lightning flash. The leader processes of the spark differ considerably from those of lightning. 13 Refs.

Primary Keywords: Lightning; Air Breakdown; Rod-plane Gap; Voltage Measurement; Current Measurement; Luminosity Measurement

7801
(PARTICLE BEAMS, ELECTRON)
(Generation)
DEVELOPMENT OF AN ADVANCED PULSED ELECTRON BEAM ACCELERATOR
P. Champney, G.I. Hatch, K. Nielsen, S. Shope and I. Smith
Physic International Co, San Leandro, CA 94577
Final rept. Jan Aug 77, No. PIFR-226, 105p (10/.972).
Availability: AD-791 593
NTIS

The report covers the development of a 50-kJ generator capable of producing currents in excess of one megampere at voltages approaching one megavolt with a pulse width about 55 nsec. The concept is to feed an electron accelerating tube from two modules, each containing multiple Mylar striplines arranged in a series-parallel configuration. Each module contains 8 Blumleins with a total output of 0.5 to 1 MV. The modular concept permits the individual Mylar sheets to be assembled in air and vacuum-impregnated with copper sulphate solution. The module and its striplines are easily attached to the accelerating tube. Additional modules can be added to the present design to increase the machine power output. (Author)

Primary Keywords: Electron Accelerators_Design, Electron Beams_Pulse Generators; Electrodes; Strip Transmission Lines; Dielectrics; Electric Switches
Secondary Keywords: Marx Generators

AD-A131 753 PULSED POWER BIBLIOGRAPHY VOLUME 2 ANNOTATED BIBLIOGRAPHY(U) AIR FORCE WEAPONS LAB KIRTLAND AFB NM J BEMESDERFER ET AL. AUG 83 AFWL-TR-83-74-VOL-2 3/3

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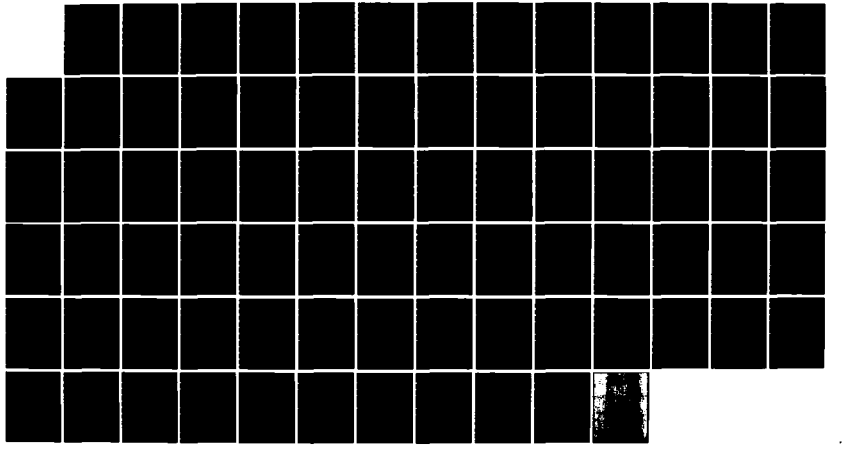

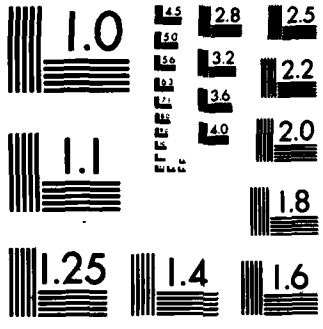

7802
(BREAKDOWN STUDIES)
(Gas, Electrical)
EFFECTS OF FORCED CONVECTION UPON THE CHARACTERISTICS OF A STEADY-STATE CROSS-FLOW ARC IN THE PRESENCE OF AN APPLIED TRANSVERSE MAGNETIC FIELD
A.J. Baker and D.M. Benenson
State University of New York at Buffalo, Buffalo, NY 14226
Proceedings Of The IEEE, Vol. 59, No. 4, pp 450-456 (04/1971).
Experiments were conducted upon a 130-A 1.1-atm balanced argon arc over a range of velocities from 5.09 to 13.13 m/s; electrode spacing was 12.7 mm. Two stable modes of operation were found: the colinear mode, with arc attachments fix at the apexes of the electrodes, and the upstream mode, with arc attachments on the upstream sides of the electrodes. Below a critical velocity of about 5 m/s, the colinear mode only was found. For the colinear mode, arc isotherm distributions, cross-sectional shape, and profile varied markedly with distance along its length; these were observed to be relatively uniform for the upstream mode. Significant lateral broadening of both configurations was found. The effect of velocity upon the upstream mode was to decrease the relative broadening of the plasma. 7 Refs.
Primary Keywords: Steady Arc; Cross-flow Arc; Transverse Magnetic Field; Two Operating Modes; Critical Velocity; Arc Broadening

7803
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
EFFECTS OF TARGET-ELECTRODE POLARITY AND FOCAL-PLANE POSITION ON A LASER-TRIGGERED GAP
V.A. Rodichkin and G.Ya. Rusakova
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 18, No. 2, pp 223-224 (08/1973).
Transl. From: Zhurnal Tekhnicheskoi Fiziki 43, 345-348 (February 1973)
Delay measurements are given for breakdown in an 11.7 mm dir gap triggered by a ruby laser with a power of 20 MW. The triggering time is measured as a function of applied voltage for various positions of the focal plane of the lens and target polarities. In the voltage range (0.6-1.0)U/sub os/ is the gap breakdown voltage, the delay is reduced as the focal plane recedes from the surface of the target; the delay is smaller when the target electrode acts as the anode. If U <= 0.6 U/sub os/, minimum delays are observed when the radiation is focused on the cathode in the gap. The results are interpreted in terms of shadow studies of channel formation. 6 Refs.
Primary Keywords: Polarity Effects; Ruby Laser; Air Gap; Delay Measurement; Delay Variation With Focal Point

7804
(INSULATION, MATERIAL: DIAGNOSTICS AND INSTRUMENTATION)
(Solid; E-field)
ELECTRIC STRESSES AT CONDUCTING SURFACES LOCATED IN THE FIELD BETWEEN PLANE PARALLEL ELECTRODES
B. Salvage
Queen Mary College, London, UK
Proceedings Of The IEE, Vol. 111, No. 6, pp 1173-1176 (06/1964).
Following the reasoning of a previous paper, the authors calculate the E fields at the boundaries of conducting bodies placed between parallel-plane electrodes. Elliptical cylinders and oblate spheroids are considered with their major axes parallel to the field. Several specific calculations are performed with results presented. 4 Refs.
Primary Keywords: E-field Calcultion; Elliptical Cylinder; Oblate Spheroid; Parallel-plane Electrodes; Laplace's Equation

7805
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid; Gas; Electrical)
ELECTRIC STRESSES IN GASEOUS CAVITIES IN SOLID DIELECTRICS
B. Salvage
Leeds University, Leeds, UK
Proceedings Of The IEE, Vol. 111, No. 6, pp 1162-1172 (06/1964).
The E-fields in elliptic cylindrical and oblate spheroid cavities in a solid insulator are the subjects of this paper. The E-fields are calculated for the general case of these cavities for several cases of parallel-plane electrodes. Several specific cases are considered with data presented. 18 Refs.
Primary Keywords: Solic Insulation; Gaseous Cavity; Elliptic Cylindrical Cavity; Oblate Spheroid Cavity; E-field Calculation; Parallel-plane Electrodes

7807
(ELECTROMAGNETIC LAUNCHERS)
(Railguns)
ELECTROMAGNETIC ACCELERATION OF MACROPARTICLES TO HIGH VELOCITIES
S.C. Rashleigh and R.A. Marshall
Australian National University, Canberra, Australia
Journal of Applied Physics, Vol 49, No. 4, pp 2540-2542 (04/1978).
An inductively driven rail-gun macroparticle accelerator has been built in which velocities of 5.9 km/s have been obtained using an arc as the driving armature. Simple theory is shown to be adequate for predicting rail-gun performance up to that velocity and for designing rail guns for launching large masses. 7 Refs.
Primary Keywords: Rail Gun; Inductive Energy Store; Arc Driver; Performance Test

7808
(BREAKDOWN STUDIES)
(Gas, Electrical)
FORM FACTOR METHOD YIELDS THERMAL CONDUCTIVITY AND RADIATED POWER OF NITROGEN ARC
H.M. Pflanz (1) and D.T.J. Ter Morst (2)
(1) Allis-Chalmers, Boston Plant, Boston, MA
(2) Eindhoven University of Technology, Eindhoven, Netherlands
Proceedings Of The IEEE, Vol. 59, No. 4, pp 601-606 (04/1971).
The form factor method for the determination of thermal conductivity is applied to experimental results obtained with a cascade arc in nitrogen. Experimental and theoretical thermal conductivities agree, even at temperatures above 10000 Deg K, if rather high radiation losses are taken into account. This result does not change significantly when reabsorption is considered by means of an absorption form factor and the total absorbed power. 11 Refs.
Primary Keywords: Nitrogen Arc; Cascade Arc; Thermal Conductivity; Radiated Power; Experiment; Theory; Form Factor Method

7809
HIGH VOLTAGE PULSER TECHNIQUES FOR ELECTROMAGNETIC PULSE (EMP) SIMULATORS
J.S. Granados, J.T. Haff, W.F.J. Crewson and C.M.J. Jones
AFWL, Kirtland AFB, NM 87117
Final rept. Sep 72-Jun 74 (07/1975).
Availability: AD-A013 783/6ST
NTIS
This report presents the results of both theoretical and practical investigations aimed at improving the performance of a number of key components that are common to many EMP high voltage generators. The advantages of component redundancy over attempting to achieve extreme individual component reliability are outlined. Common capacitor faults are discussed together with methods of their detection and techniques for circumventing a failed capacitor in a Marx generator. Marx switch faults and timing irregularies are also discussed. A specific design for a high voltage fuse for use in Marx generator circuits which was developed and tested is presented. A cascade high voltage ropeswitch is discussed.
Primary Keywords: Electromagnetic Pulse Simulators; Pulse Generators; High Voltage; Electric Switches
Secondary Keywords: NTISDODAF

7810
(BREAKDOWN STUDIES)
(Gas, Electrical)
INDUCED RADIAL VELOCITY IN NONSTATIONARY ELECTRIC ARCS
R.L. Phillips
University of Michigan, Ann Arbor, MI
Proceedings Of The IEEE, Vol. 59, No. 4, pp 466-473 (04/1971).
An analysis is presented of the effects of induced radial velocity on the thermal behavior of a nonstationary electric arc. An interrupted DC arc is simulated by treating the linearized equations for a cylindrical plasma, initially at a uniform temperature, when the wall temperature is suddenly changed by a small amount from the gas temperature. Due to compressibility, a radial wave motion is set up within the gas which causes rapid interior temperature changes on a time scale much smaller than the conduction time constant. For example in a 5-mm diameter SF/sub 6/ arc, which is initially at a temperature of 11000 Deg.K., the central temperature will change by 20 percent in 1 microsecond, while the conduction time constant is 100 microseconds. The possible importance of this behavior for circuit breaker arcs is discussed. 12 Refs.
Primary Keywords: Nonstationary Arc; DC Arc; Theory; Cylindrical Geometry; Wall Cooling; Radial Motion; SF/sub 6/ Arc

7811
(BREAKDOWN STUDIES)
(Gas, Electrical)
INFLUENCE OF DIFFUSION AND NONEQUILIBRIUM POPULATIONS ON NOBLE-GAS PLASMAS IN ELECTRIC ARCS
J.F. Uhlenbusch and E. Fischer
The Technical University, Aachen, FRG
Proceedings Of The IEEE, Vol. 59, No. 4, pp 578-587 (04/1971).
Measurements and calculations of temperature, densities, and field-strength-current characteristics of cascade arcs burning in noble gases under atmospheric pressure are reported. The evaluation of measured arc data assuming Saha equilibrium, complete local thermal equilibrium (LTE), is not in agreement with the detailed solution of the balance equations. Solutions of these equations are compared with results following from measured line intensities only solving the rate equations in connection with the electron energy balance and the equation of state. For helium, both methods give results which agree within a few percent. The deviations from Saha equilibrium are caused by diffusion and the overpopulation of ground state atoms. The excited atoms, however, are nearly in equilibrium with free electrons in the range of electron densities reached in our experiment (partial LTD). Measurements of E-I characteristics agree with calculated data, if diffusion is taken into account. A simple criterion for the limit between diffusion-dominated plasma and a plasma in thermal equilibrium is derived. 19 Refs.
Primary Keywords: Noble Gas Breakdown; Atmospheric Pressure; Temperature Measurement; Experiment; Theory; Saha Equation

7812
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Gas; Gas, Electrical)
INSULATION PROPERTIES OF COMPRESSED ELECTRONEGATIVE GASES
F.R. Howard
Proceedings Of The IEE, Vol. 104, Part A, No. 14, pp 123-138 (04/1957).
The breakdown voltages of several gases are determined for AC, DC, and impulse voltages and for RF in this paper. Among the gases tested are SF/sub 6/, CF/sub 4/, CF/sub 3/Cl, and CF/sub 2/ Cl/sub 2/. Several field configurations were used, gas pressure was varied, and the experiments were conducted both with and without ionizing radiation present. 35 Refs.
Primary Keywords: Gas Insulation; Dielectric Strength; Gas Breakdown; Several Gases; SF/sub 6/ Gas; Fluorocarbon Gases; DC Voltage; AC Voltage; Impulse Voltage; Radiation

7815
(BREAKDOWN STUDIES)
(Gas, Electrical)
IONIZING GAS BREAKDOWN WAVES IN STRONG ELECTRIC FIELDS
R. Klingbeil, D.A. Tidman and R.F. Fernsler
University of Maryland, College Park, MD 20742
The Physics Of Fluids, Vol. 15, No. 11, pp 1969-1973 (11/1972).
An analysis of ionizing potential waves is made which includes photoionization. It is found that photoionization plays an important role in the avalanche propagation. Velocities, electron densities, and temperatures are given as a function of electric field for both negative and positive breakdown waves in nitrogen. 11 Refs.
Primary Keywords: Ionizing Potential Wave; Avalanche Breakdown; Photoionization; Avalanche Velocity; Nitrogen Gas

7817
(BREAKDOWN STUDIES)
(Liquid, Electrical)
OBSERVATIONS ON THE INTERMITTENT ELECTRON EMISSION IN LIQUEFIED NITROGEN
Y. Mureoka
Defense Academy Of Japan, Hashirimizu, Yokosuka, Japan
Journal Of Applied Physics, Vol. 48, No. 1, pp 136-142 (01/1977).
The prebreakdown mechanism in liquefied nitrogen has been studied by using a modified optical Schlieren system. The present method has the advantage of observing the drift velocity of the disturbance in liquids and the prebreakdown mechanism by using a small disk instead of a knife edge. Thus the disturbance occurring due to the charge carriers can be recorded on the screen with an intensity which is proportional to the rate of the refractive index change. The mobilities of the negatively charged carriers derived from the drift velocity of the disturbance fall in the range of 1.1 x 1E-2 - 1.85 x 1E-1 sq.cm./V sec) in liquefied nitrogen, and also that of the quasifree electrons localized in the tiny bubbles (7.95 x 1E-4 sq.cm./V sec) as calculated theoretically. 17 Refs.
Primary Keywords: Liquid Nitrogen Breakdown; Prebreakdown Mechanism; Schlieren Diagnostic; Disk Beam Obstruction; Charge Carrier Mobility; Gas Bubbles

7818
(BREAKDOWN STUDIES)
(Gas, Electrical)
PREDICTION OF CONDITIONS FOR A SINGLE PULSE DISCHARGE
P.M. Sherman
University of Michigan, Ann Arbor, MI
Journal Of Applied Physics, Vol. 48, No. 1, pp 143-144 (01/1977).
An empirical method is presented for the prediction of conditions necessary to obtain a single pulse discharge with no oscillation, no restrike, and no residual energy stored with zero current and zero voltage at the end of the pulse. An LRC circuit with a 14.7-microFarad capacitor charged to voltages between 2000 and 20000 V and discharging through wires of different metals was employed to obtain necessary conditions. It is shown that specific resistivity and specific heat of fusion of the wires can be used to predict the charge voltage necessary for the single pulse discharge for a given system. 3 Refs.
Primary Keywords: Single Pulse Discharge; No Oscillation; No Restrike; No Residual Energy; RLC Circuit; Capacitor Charging Circuit

7819
(BREAKDOWN STUDIES)
(Gas, Electrical)
PRINCIPLES OF ARC MOTION AND DISPLACEMENT
H.H. Maecker
Universitat Munchen, Munich, FRG
Proceedings Of The IEEE, Vol. 59, No. 4, pp 439-449 (04/1971).
It is shown that the motion of an arc being described as a temperature cloud can be divided into two parts, one being the relative velocity of the arc phenomenon with respect to the mass flow and the other the mass motion itself. The first relative motion is determined by the equation for the change of internal energy with time, the second mass flow has to be calculated by means of the magnetohydrodynamic and continuity equations. Three groups of examples are given in each of which one of the three velocities disappears. In the first group, no mass flow exists and the motion of the arc is caused by various types of inhomogeneous heating. In the second group, the arc itself does not move due to the opposing effects of mass motion and relative arc motion. In the last group, the arc follows the mass flow without relative motion. As long as the boundary conditions do not change from the standpoint of the arc the motion continues steadily. If, however, the boundary conditions form any type of obstacles, the motion of the arc ends up in a new equilibrium position, a displacement occurring. 12 Refs.
Primary Keywords: Arc Motion; Arc Velocity; Mass Velocity; Theory; Energy Balance; Magnetohydrodynamic Mass Flow; Boundary Condition

7821
(BREAKDOWN STUDIES)
(Surface Flashover)
PULSED FLASHOVER OF INSULATORS IN VACUUM
O. Milton
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Electrical Insulation, Vol. EI-7, No. 1, pp 9-15 (03/1972).
Dielectric specimens in the shape of a frustum of a cone were evaluated for surface flashover strength in vacuum of 1E-5 Torr. Data were obtained for positive and negative pulses of several hundred kilovolts amplitude and with rise times in the nanosecond and microsecond region. The results indicate that most materials exhibit a greater resistance to breakdown if the base of the cone is at the cathode and that the strength is greatly affected by the angle that the dielectric makes with the applied field. Lucite, polystyrene, polyethylene, cast Nylon, and 7740 glass are shown to be relatively resistent to flashover in comparison with the ceramics and molded plastics. It is also observed that the surface strength in vacuum is a small fraction (approximately 1/10 or less) of the volume strength and consequently breakdown through the bulk seldom occurs. Data are given for several common insulating materials. 13 Refs.
Primary Keywords: Surface Flashover; Vacuum; Lucite; Polystyrene; Polyethylene; Nylon; Glass; Field Angle; 100 kV Test Voltage

7822
(BREAKDOWN STUDIES)
(Electrodes, Recovery)
REFRACTORY ELECTRODE REGION RECOVERY FOLLOWING ARC INTERRUPTION
K.G. Evans, DC Strachan and H. Edels
University of Liverpool, Liverpool, UK
Proceedings Of The IEEE, Vol. 59, No. 4, pp 525-534 (04/1971).
Measurements are presented of the voltage fall across the electrode region of low-current carbon arcs when test current pulses are injected through the arc gap at some time (less than 100 microseconds) following rapid removal of the arc current. The results thus shed some light upon the thermal reignition phenomena of refractory electrodes. A model is proposed to describe the observed behavior at low injection current levels. This model may also be of assistance in describing the behavior of hot probes in high-pressure plasmas. Although the model is not extended to high current levels, a discussion is presented of the electrode region behavior for currents at which mechanisms apparently form, which are necessary for reignition and steady-state conduction through the electrode regions. 11 Refs.
Primary Keywords: Gas Discharge; Carbon Electrodes; Arc Interruption; Recovery Processes; Voltage vs Current
Secondary Keywords: Plasma Probe

7823
(BREAKDOWN STUDIES)
(Gas, Electrical)
SPECTROSCOPIC STUDY OF HIGH CURRENT DISCHARGES
T. Ito, Y. Ueda, M. Komura and T. Nitta
Mitsubishi Electric Corp, Amagasaki, Japan
Proceedings Of The IEEE, Vol. 59, No. 4, pp 573-577 (04/1971).
A high current arc was developed between carbon electrodes in H/sub 2/, SF/sub 6/, He, Ar, and air at an initial pressure higher than 1 atm. The current peak was above 5 kA and the duration of the current was 250 microseconds. The temporal and spatial changes of plasma parameters were measured by time-resolved spectrography and high-speed framing camera. The electron density of the plasma was estimated from the Stark broadening of the lines H/sub beta/ C 4267 Angstrom, He 1 4471 Angstrom, and He 1 5876 A. Our observations show the following: The arc space is divided into two regions, the bright narrow core and the broad outer flame. The electron density of the core is estimated to be of the order of 1E18 cm/sup -3/ and an electron temperature of the order of 1E4 Deg.k is obtained at current peak. Even after current zero, the electron density keeps the order of 1E17 cm/sup -3/ regardless of the kind of gas. 8 Refs.
Primary Keywords: High Pressure Discharge; 5 kA Current; 250 Microsecond Duration; Spectroscopy; Framing Camera; Electron Density

7827
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Gas, Electrical; Mechanical)
THE TIME CONSTANT OF HIGH VOLTAGE CIRCUIT BREAKER ARCS BEFORE CURRENT ZERO
J. Urbanek
Brown, Boveri & Co Ltd, Baden, Switzerland
Proceedings Of The IEEE, Vol. 59, No. 4, pp 502-508 (04/1971).
It has been shown that the relative rate of decrease of conductance of the arc, in the following called RRDC, can be split in terms depending on the changing of the quantities: arc length, arc cross section, peak arc temperature and temperature profile, and the order of magnitude of the different terms has been estimated. For an experimental air blast breaker current and voltage near current zero have been measured for the case of a short line fault and the RRDC function has been calculated in the time interval 20-1 microns before current zero. It has been shown that the often used theory of Mayr is not applicable over the whole of the investigated time interval and also that the theory of Cassie does not apply in the time interval preceding 10 microsec before current zero. In the last 10 microns before current zero Cassie's theory describes the investigated air blast breaker quite well. The transient behavior of the arc conductance (e.g., Cassie's time constant) in the air blast breaker has been found to be of the same order of magnitude (approximately 0.5 microns) as has been reported for SF/sub 6/ gas blast breakers. This has been explained by the fact that the RRDC function is mainly dependent on the variation in the arc cross section, which seems to be only slightly dependent on the quenching medium. Because this reasoning is only valid before current zero, greater differences of the transient arc behavior of different breakers may occur at and after current zero. 7 Refs.
Primary Keywords: Air-blast Circuit Breaker; Conductance; Temporal Resolution; Variable Length; Variable Cross Section

7836
(BREAKDOWN STUDIES)
(Gas, Optical)
CHARACTERISTICS OF LASER-INITIATED IONIZATION CHANNELS IN AIR
R. Fernsler, I.M. Vitkovitsky, A.W. Ali, J.R. Greig, R.E. Pechacek and M. Raleigh
Naval Research Lab, Washington, DC 20375
1977 IEEE International Conference On Plasma Science, pp 63 (05/1977).
The production of ionized channels in air has many applications such as the understanding and controlling of lightning, switching in high pressure gasses and propagation of electron beams. Initiation and direction control are common requirements in these applications. Among the methods for producing the ionized channels is the use of intense laser beams. Such beams form intermittent ionization. Sufficiently strong superimposed electric fields lead to discharges that produce uniform ionization channels. Characteristics of these types of ionization channels have been studied to determine the channel length and electrical properties as a function of laser parameters. 3 Refs.
Primary Keywords: Uniform Ionization Channel; Channel Length; Electrical Properties

7845
(BREAKDOWN STUDIES)
(Exploding Wires)
ELECTRICALLY EXPLODED WIRES-EXPERIMENTS AND THEORY
J.B. Langworthy, R.C. O'Rourke, M.P. Shuler, I.M. Vitkovitsky, C.B. Dobbie, R.J. Veith and D.F. Hansen
Naval Research Lab, Washington, DC 20375
NRL Report No. 5489 (06/1960).
Availability: AD 258144
NTIS
This report theoretically traces the absorption of electrical energy by the wire and the behavior of the wire as its energy content is increased. Several simplifying assumptions are made to make the problem tractable while retaining physical significance. The application of exploding wires to soft X-ray production is discussed. An extensive description is given of the NRL exploding wire laboratory with mylar, water, and combination mylar-water capacitors characterized. 0 Refs.
Primary Keywords: Exploding Wire; Soft X-ray Production; Water Capacitor; Mylar Capacitor; Mylar-water Capacitor; Experiment; Theory

7874
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
PULSED HIGH VOLTAGE AND HIGH CURRENT OUTPUTS FROM HOMOPOLAR ENERGY STORAGE SYSTEM
R.D. Ford, D. Jenkins, W.H. Lupton and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
Memorandum rept. No. NRL-MR-4433, 16p (02/1981).
Availability: AD-A094 918/7
NTIS

Large energy storage capability of inertial-inductive systems provides an attractive option for satisfying the pulse power requirements associated with such applications as plasma confinement and heating, electromagnetic projectile acceleration and with production of intense radiation. These applications require high rate of energy delivery to the load at specific current and voltage levels. In conjunction with self-excited homopolar generator current source, an opening technology has been developed to provide up to 1 MJ output pulses, alternately, at hundreds of kilovolts or at megampere levels. The over-all system efficiency, that depends sensitively on the load requirements, was measured over a range from 10% to more than 90% for different pulser-load circuit arrangements. (Author)

Primary Keywords: Pulse Generators; Electromagnetic Pulses; Plasma Generators; High Voltage; Prototypes; Efficiency; Heating; Plasmas(Physics); Confinement(General); Energy Transfer
Secondary Keywords: Homopolar Generators; High Current; NTISDODXA

7880
(INSULATION, MATERIAL)
(Liquid)
LIQUID MOTION AND INTERNAL PRESSURE IN ELECTRICALLY STRESSED INSULATING LIQUIDS
J.S. Mirza, C.W. Smith and J.M. Calderwood
University of Salford, Salford, UK
Journal Of Physics D: Applied Physics, Vol. 3, pp 580-583 (03/1970).

The electrical conductivity of hexane and transformer oil was found to be reduced by filtering the liquid through filters of pore size down to 10 nm, whereas no change in the liquid motion under the applied electric stress could be detected. It is concluded that a part of the measured conductivity is due to the charge carried by particles and that the particles are not the main cause of the liquid motion. Effects of the pressure developed in electrically stressed insulating liquids and of cavitation at the electrodes are discussed. At high fields, liquid jet motion from a point electrode is reported and evidence suggests that the charge in the jet may be carried within a spray of bubbles produced by cavitation at the electrodes. 11 Refs.

Primary Keywords: Insulating Liquids; Hexane; Transformer Oil; Conductivity Measurement; Liquid Circulation Measurement; Cavitation Effects

7900
(PARTICLE BEAMS, ELECTRON)
(Reviews)
ELECTRON BEAM FUSION PROGRESS REPORT APRIL THROUGH SEPTEMBER 1977
Authors Unknown
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND78-0080 (04/1978).
Availability: SAND78-0080
NTIS

This report provides an overview of the progress made on the electron beam fusion program at Sandia laboratories from April through September 1977. Results from Proto II and the superfast Z-pinch experiment are presented along with theoretical studies of the physics power flow and e-beam generation. Refinements in the design of EBFA are also discussed. 157 Refs.

Primary Keywords: Electron Beam Fusion; Magnetic Insulation; Marx Generator; Trigatron; Vacuum Diode; Vacuum Flashover
Secondary Keywords: Diagnostics

7901
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH REPETITION RATE SPARK GAP
Authors Unknown
MLR Report No. MLR-668 (03/1977).
Availability: UCRL 13718
NTIS

The design construction, and testing of a high repetition rate spark gap are described. The gas flow control, the high voltage trigger generator, the Blumlein charging system, and the proper control of these components are discussed. Lack of working equipment and funds limited the project so that the finished spark gap could only produce three pulses at 1 ms intervals with an amplitude of 1.5 kV. 0 Refs

Primary Keywords: Field Distortion Gap; Rep-rated; Blumlein Line; Triggering; Diagnostics

7902
(PARTICLE BEAMS)
(Generation)
A NEW COLLECTIVE PARTICLE ACCELERATOR
M. Friedman
Naval Research Lab, Washington, DC 20375
NRL Report No. NRL 3724 (02/1978).
Availability: AD A055759/7
NTIS

A simple and novel mechanism for a collective particle accelerator is proposed. It is suggested that a density modulated intense relativistic electron beam propagating in a spatially modulated magnetic field can drag particles (electrons or ions) and accelerate them to high energies. This new mechanism can generate high particle current. A strong radial electric field exists in the mechanism ensuring radial confinement of the accelerated ions. 12 Refs.

Primary Keywords: Electron Acceleration; Ion Acceleration; Heavy Ion Acceleration; Collective Acceleration

7903
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Systems; Explosive Fuses)
INDUCTIVE CHARGING OF PULSE LINES IN 0.1 TO 1.0 MJ RANGE USING FOIL FUSES STAGED WITH EXPLOSIVELY ACTUATED SWITCHES
D. Conte, R. Ford, W.H. Lupton, J.D. Shipman Jr., P. Turchi and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
NRL Report No. NRL 3472 (03/1978).
Availability: NRL 3472
NTIS

The use of inductive storage techniques to replace the conventional high voltage sources, such as Marx generators, for the charging of high voltage transmission line pulse generators (i.e., capacitive loads) is discussed. The proposed opening switch system consists of exploding foil fuses staged with high explosive actuated switches. The low resistance of the explosive switches in the closed stage allows the inductive store to be charged at relatively slow rates without significant energy loss. Upon opening, current is commutated to the foils which rapidly explode to generate the inductive voltage necessary to charge the load. A detailed analysis of fuse performance in the basic inductive storage circuit is presented using empirically obtained data on the resistivity vs. dissipated energy characteristic of vaporized aluminum foils. The results are used to outline the design of inductive storage systems for pulse charging capacitors to 1 MV at energies from 100 to 1000 kJ, with rise times of 2 to 10 microseconds (1E11 to 1E12 W rate) and efficiencies of 20 to 65%. 17 Refs.

Primary Keywords: Inductive Storage; Fuses; Current Interruption; Pulse Charging Capacitors; Transmission Line Pulse Generators

7904
(DIAGNOSTICS AND INSTRUMENTATION; SWITCHES, OPENING)
(Miscellaneous; Explosive Fuses)
INTERPRETATION OF X-RAY LINE SPECTRA FROM EXPLODED-WIRE ARRAYS
P. Burkhalter (1), J. Davis (1), J. Rauch (2), W. Clark (2), G. Dahlbacka (3) and R. Schneider (3)
(1) Naval Research Lab, Washington, DC 20375
(2) Maxwell Labs Inc, San Diego, CA 92123
(3) Physic International Co, San Leandro, CA 94577
NRL Report No. NRL 3723 (03/1978).
Availability: NRL 3723
NTIS

Temperatures and densities were determined from the plasma implosion formed at the center of symmetrical exploded-wire arrays. Temperatures of 500-850 eV were found from line ratios in Al and Si shots using various plasma models. The recombination temperatures for these elements were 400-500 eV. Higher implosion temperatures of 1.5 to 2 keV were found in Ti and Fe shots and of 2.5 to 4 keV for Mo wire shots. The densities were approximately 1E20 cm/sup -3/ for the spatially-integrated implosion region. Intense emitting regions of approximately 500 micron in size were observed in densitometer contours of Al plasma pinhole images. 13 Refs.

Primary Keywords: X-ray Spectra; Exploded-wires

7905
(SWITCHES, OPENING; DIAGNOSTICS AND INSTRUMENTATION)
(Explosive Fuses; Miscellaneous)
SPECTROSCOPY AND X-RADIATION FROM EXPLODED-WIRE ARRAYS AND GAS PUFF PLASMAS
P. Burkhalter and J. Davis
Naval Research Lab, Washington, DC 20375
NRL Report No. NRL 3934 (03/1979).
Availability: AD-A072 018/5ST
NTIS

In this report results are presented for three separate experiments involving multiple exploded wire arrays and puff gas plasmas. The first section deals with the analysis and interpretation of x-ray line spectra from a variety of exploded multiple wire arrays including Al, glass, Ti, SS, Mo, and W wires. The second section deals with x-ray spectra from a gas puff Z-pinch device, operated at the University of California, Irvine, that provides both spatial and spectral information of Ar x-ray emission. 25 Refs.

Primary Keywords: Exploding Wire Arrays; Wire Plasmas; Gas Puffs; Spectroscopy

7906
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON; DIAGNOSTICS AND INSTRUMENTATION)
(Generation, Transport; Miscellaneous)
INTENSE ELECTRON BEAM GENERATION AND COMPRESSION
R. Ecker, V. Buck, T.S.T. Young, D. Lopez and S. Chao
Physic International Co, San Leandro, CA 94577
DNA Report No. DNA 4523F (01/1978).
Availability: AD A059715
NTIS

Intense electron beam generation and compression in a converging magnetic guide field has been studied experimentally and theoretically. Beams from the OWL II generator with peak parameters of typically 350 kA, 1.2 MeV, and 120 nsec (FWHM of power pulse) have been diagnosed before and after factor-of-three area compression, using a newly constructed multi-collector Faraday cup for current density profile measurements, and a multi-layered or filtered Faraday cup for time-resolved electron angle measurements and time-integrated charge deposition profile measurements. Both diagnostics were successfully used at dose levels up to about 4000 cal/gm. The effect of reflected electrons on diode behavior has been examined and found to be non-negligible for certain target configurations. Experimental results have been used to test the calculations of the REEFER diode code and of the new code, REFLEX, which was developed in this program to evaluate compressed-beam transport according to the Young-Spence model. 13 Refs.

Primary Keywords: Pulsed Electron Beams; High Dose; Beam Compression; Faraday Cup; Beam Transport Efficiency; Beam Current Profile; Diode Code (REEFER); Transport Code

7907
(PARTICLE BEAMS, ION)
(Generation)
ELECTRODE EROSION PROCESSES IN PULSED PLASMA THRUSTERS
D.J. Palumbo, M. Begun and W.J. Guman
Fairchild Industries Inc, Farmingdale, NY 11735
AFRPL Report No. AFRPL-TR-79-14 (03/1979).
Availability: AD A069276
NTIS

During the course of this program it was determined that material melting is the primary physical phenomenon leading to erosion of the anode electrode. Experimentation with various materials indicated that minimum erosion of the anode was obtainable using Poco Graphite but significant impulse bit reduction due to the high resistivity of this material would be incurred if this material were used. The material yielding the next least amount of anode erosion was shown to be copper (OHFC). Various modifications in the thruster propellant/electrode configurations were attempted using Graphite in attemping to recover the loss of thruster performance associated with the use of this material as an anode electrode. These attempts were unsuccessful, and the decision was made about midway through the program to concentrate on minimizing the effects of the arc heat load on a copper anode surface by reconfiguring the electrodes and/or propellant rods. This approach to the problems not only led to a successful solution of the anode erosion problems, but also resulted in improved thruster performance and the capability of storing sufficient propellant to meet a total impulse requirement far in excess of the program goal using the original helical rod storage system with modified propellant rod width. 9 Refs.
Primary Keywords: Plasma Propulsion; Electrode Erosion; Arc Discharges
Secondary Keywords: Electric Propulsion; Space Propulsion

7908
(INSULATION, MATERIAL)
(Liquid)
FLUID DIELECTRIC CUTS SIZE AND WEIGHT OF HIGH-POWER AIRBORNE EQUIPMENT. IT'S PARTICULARY EFFECTIVE WITH HIGH-FREQUENCY RADIO AND RADAR TRANSMITTERS
L.K. Findley
Electronic Communications, Inc., St. Petersburg, FL 33733
Electronic Design, Vol. 18, No. 26, pp 44-45 (12/1970).
The use of dielectric fluid instead of air in high-power airborne equipment is proposed. Higher dielectric strengths, lower operating temperature, and other advantages are discussed. The potential disadvantage of the temperature dependence of the dielectric constant is addressed. 8 Refs.
Primary Keywords: Silicon Oil; High Dielectric Strength; Good Heat Transfer; Lubrication
Secondary Keywords: Airborne Equipment

7909
(INSULATION, MATERIAL)
(Solid)
A NOVEL CONDUCTING GLAZE
E.A. Dancy
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
Ceramic Bulletin, Vol. 55, No. 6, pp 569-571 (06/1976).
Molybdenum disilicide is used as the conducting material in a conducting glaze with a very small temperature coefficient of resistance. Resistances of 1E4 to 1E5 ohm/square were easily obtained, and resistances of 1E6 to 1E8 ohm/square were obtained when particle size and composition were carefully monitored. 7 Refs.
Primary Keywords: Conducting Glaze; Wide Conductivity Range; Good Stability

7910
(PULSE GENERATORS)
(Trigger)
HIGH-VOLTAGE PULSER SPARES BATTERY SUPPLY
W.J. Orr
National Research Council, Ottawa, Ontario, Canada
Electronics, Vol. 44, No. 1, pp. 58 (05/1971).
A design for a high-voltage pulse generator which drains little current from the batteries is presented. An input pulse is used to trigger the generator, and delays are variable between 0.5 and 20 microseconds. Pulses of 300V with a rise time of 30 ns are generated. 0 Refs.
Primary Keywords: Battery Power; Low Duty Cycle; Monostable Multivibrator; Solid State; Low Jitter; Hundreds Of Volts Output

7911
(SWITCHES, CLOSING)
(Gas Gaps, Optical
A SIMPLE LASER-TRIGGERED SPARK GAP FOR KILOVOLT PULSES OF ACCURATELY VARIABLE TIMING
B. Trevelyan
Fighting Vehicles Research and Development Establishment, Chertsey, Surrey, UK
Opto-Electronics, Vol. 1, No. 1, pp 62-63 (02/1969).
Results of the performance testing of both a solid- and gas-dielectric laser-triggered spark gap are presented. Both gaps exhibited low jitter and low delay. The air gap produced somewhat more pulse distortion than the solid-dielectric switch, which utilized Melinex as the dielectric. 8 Refs.
Primary Keywords: Laser-triggered Spark Gap; Air Gap; Melinex Gap; Jitter Measurement

7913
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)
AN ELECTRICAL DISCHARGE THROUGH TWO LASER SPARKS
V.I. Vladimirov, G.M. Malyshev, G.T. Razdobarin and V.V. Sewenov
A.F. Ioffe Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Leningrad
Soviet Physics-Technical Physics, Vol. 13, No. 12, pp 1694-1695 (06/1969).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 38, 2109-2111 (December 1968)
In this paper it is shown experimentally that an electrical discharge can occur between two separate laser sparks. From shadow photographs it is established that the electrical discharge arises at the time when the hot regions of the two sparks come in contact in the process of expansion. For an electrode voltage of 550 V the electrical discharge takes place for distances between the centers of the laser sparks up to 10 mm. The resistance of the discharge gap agrees well with the value of the discharge resistance through one laser spark. 1 Refs.
Primary Keywords: Double Laser Spark; Spark Expension; Spark Contact; Current Flow

7915
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Gas Gaps, Optical; Gas, Optical)
BREAKDOWN OF A SPARK GAP IN AIR TRIGGERED BY A LASER
Y. Miyoshi, T. Hosokawa and M. Shintani
Nagoya University, Nagoya, Japan
Japanese Journal Of Applied Physics, Vol. 8, No. 5, pp 620 (05/1969).
In this paper, the self-breakdown voltage of a nonuniform field rod-plane gap is compared to the breakdown voltage of the same gap when irradiated with a giant pulse laser. The laser is focused on the plane electrode. The transition from corona self-breakdown to corona-less self-breakdown is studied and polarity effects of self-breakdown and laser-triggered breakdown are considered. 2 Refs.
Primary Keywords: Nonuniform Field Gap; Polarity Effects; Brass Electrodes; Formative Time Lag; Measurement

7918
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Gas, Optical)
CONTINUOUS LASER-SUSTAINED PLASMAS
D.L. Franzen
National Bureau of Standards, Boulder, CO 80302
Journal Of Applied Physics, Vol. 44, No. 4, pp 1727-1732 (04/1973).
Continuous plasmas sustained by a focused high-power CO/sub 2/ laser are described. The power required for maintaining a cw plasma following preionization has been determined for Xe, Kr, and Ar, and attempted for Ne and He. Measurements indicate the noble gases with the lowest ionization potentials have the lowest sustaining thresholds. Radiative properties of some of the plasmas were studied with calorimetric techniques. Under certain conditions, more than half of the incident laser radiation can either be scattered or absorbed by the plasma. A major loss mechanism for the plasma is shown to be radiation in the visible and ultraviolet. Spectra of low-pressure Xe plasmas indicate the presence of ultraviolet transitions with a high contrast over the continuum. 8 Refs.
Primary Keywords: CO/sub 2/ Laser; Preionized Plasma; Laser-maintained Plasma; Various Gases

7924
(BREAKDOWN STUDIES: SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)
INVESTIGATION OF BREAKDOWN IN N/SUB 2/ UNDER THE INFLUENCE OF A PICOSECOND RUBY-LASER PULSE
I.K. Krasyuk, P.P. Pashinin and A.M. Prokhorov
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics JETP Letters, Vol. 9, No. 10, pp 354-356 (04/1969).
Trans. From: ZhETF Pis. Red. 9, 581-584 (May 1969)
Marked progress has been made by now in the generation and amplification of picosecond pulses of optical radiation. This extends greatly the experimental possibilities of studying optical breakdown in transparent media. Breakdown in gases can be produced, by varying the conditions of the experiment, both via the avalanche mechaneism and by direct ionization of the atoms or molecules in the field of the strong light wave, whose frequency is much lower than the ionization potential. In the present study, we investigated the dependence of the breakdown threshold on the pressure in nitrogen gas *at pressures from 2* to 1E4 mm Hg. The generation pulse duration ranged from 30 to 100 psec. 9 Refs.
Primary Keywords: Avalanche Breakdown; Threshold Intensity; Pulse Length Dependence

7926
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)
LASER INITIATED SPARK DEVELOPMENT IN AN AIR GAP
F.W. Lindner, W. Rucolph, G. Brumme and H. Fischer
Angewandte Physik, Technische Hochschule Darmstadt, Darmstadt , FRG
Applied Optics, Vol. 14, No. 9, pp 2225-2228 (09/1975).
The authors utilyze an image converter camera to follow the breakdown stages in a laser triggered spark gap. The phases seen were the production of a metal vapor jet, prechannel (leader), filament, and breakdown. It is surmised that the prechannel is caused by field enhancement due to the cloud of metal vapor extending into the gap. 10 Refs.
Primary Keywords: Ruby Laser; Breakdown Phases; Light Emission From Breakdown; Metal Vapor Jet

7927
(PARTICLE BEAMS, ION; BREAKDOWN STUDIES)
(Generation; Solid, Optical)
LASER SOURCES FOR MULTIPLY-CHARGED HEAVY IONS
G.F. Tonon
CEA Centre d'Etudes de Limeil, Villeneuve-Saint Georges, France
IEEE Transactions On Nuclear Science, Vol. NS-19, No. 2, pp 172-183 (04/1972).
We present a review of the main results concerning the interaction between laser and matter; in particular the results concerning the state of charge, the energy and the spatial distribution of the plasma ions. From these results, we propose to use laser produced plasmas as sources of multiply-charged ions for heavy ion accelerators and we define the laser characteristics which would be required. 70 Refs.
Primary Keywords: Ion Source; High Ionization; Theory

7929
(SWITCHES, CLOSING)
(*Vacuum Gaps, Optical*)

LASER TRIGGERED SWITCH STUDY

A.S. Gilmour and R.J. Clark
Cornell Aeronautical Lab Inc, Buffalo, NY 14221
RADC Report No. RADC-TR-67-45 (02/1967).
Availability: AD 818505
NTIS

The feasibility of developing a laser-triggered switch for use in line-type modulator service at a voltage holdoff level of 300 KV and at a conduction current level of *1000 amperes* is being investigated. To date, current peaks as high as 2000 amperes have been easily obtained. Using anode arcs (the laser-stimulated emitter at a positive potential with respect to the collector), a delay of approximately one microsecond occurs between the time when the laser illumination impinges on the emitter surface and the time when the maximum switch current occurs. The rise time of the leading edge of the current pulse has been observed to be about 100 nanoseconds, and was limited by the inductance of the external circuitry in experiments performed to date. *However, a fast-rise-time (t/sub r/ <* 10 nanoseconds) pulse forming network has been constructed and will be used for future experiments. Pulse-length data indicate that operation in the 1 to 100 microsecond pulse-length range is easily achievable. Emitter life tests have shown that the life of the laser-triggered switch should be in excess of 1000 hours. Static voltage holdoff tests were conducted on the first high-voltage device, which after processing, withstood 300 kilovolts for an extended period. 0 Refs.
Primary Keywords: Vacuum Gap; Multichannel Kilovolt Operation; Fast Rise Time; Cathode Arc; Anode Arc

7931
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

LASER-TRIGGERED SPARK GAP

L.L. Steinmetz
Lawrence Livermore Lab, Livermore, CA 94550
The Review Of Scientific Instruments, Vol. 39, No.6, pp 904-909 (06/1968).

A laser-triggered spark gap (LTSG) was developed to meet the need for producing a kilovolt electrical output pulse that is synchronous with the light output pulse of a Q-switched laser. The LTSG output pulse voltage is variable up to 12 kV, which value makes it usable for actuating Pockel cells. A theoretical explanation of the spark gap's triggering mechanism is developed. 4 Refs.
Primary Keywords: Dye Laser; Coaxial Spark Gap; Low Pressure; Thoriated Tungsten Electrode; Xenon Gap

7932
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

LASER-TRIGGERED SPARK-GAP SWITCH

A.I. Babalin, B.I. Petrov, V.A. Rodichkin and A.M. Timonin
Soviet Physics-Technical Physics, Vol. 15, No. 8, pp 1335-1338 (02/1971).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 40, 1718-1722 (August 1970)

A spark gap in air ignited by the beam from a Q-spoiled ruby laser with a power of approximately 20 MW and a pulse length of approximately 30 nsec has been studied. Experimental relations have been found for the trigger time as a function of applied voltage, beam power, and the position of the focal plane of the focusing lens for two interelectrode distances. At a radiation intensity below the threshold for laser breakdown of the gas the best parameters are found when the radiation is focused on the cathodoe. The smallest trigger time for a gap 10 mm long is 25 nsec with a scatter of +or- 3 nsec. The gap ignites satisfactorily in the range (0.25-1.0) U/sub st/, where U/sub st/ is the static breakdown voltage. 7 Refs.
Primary Keywords: Air Gap; Ruby Laser Delay vs Voltage; Delay vs Beam Power; Delay vs Focal Plane Position

7934
(INSULATION, MATERIAL; REVIEWS AND CONFERENCES)
(Liquid; Reviews)

AQUEOUS DIELECTRICS

J.B. Hasted
Birkbeck College, London, UK
Publisher: Chapman And Hall Ltd., London (01/1973).

The dielectric constant of water in several of its forms is the subject of this book. Pure water, ice, electrolytic and non-electrolytic solutions, and biomolecules, are all considered with the theory and many graphs and tables presented for each. Both dispersion and loss are addressed. A model is presented for the structure of water and ice. In addition, the dielectric constants of several materials that contain absorbed water are presented. The dielectric properties and conductivity of moist soil, sand, snow, and naturally occuring ice are considered. Breakdown characteristics and electric strength are not addressed. 451 Refs.
Primary Keywords: Water Insulation; Dielectric Constant; Dispersion; Several Solutions In Water; Properties Of Absorbed Water

7935
(BREAKDOWN STUDIES)
(Gas, Electrical)

PECULIARITIES OF THE DEVELOPMENT OF THE ELECTRIC BREAKDOWN OF AIR IN EXTREMELY LONG DISCHARGE GAPS

G.N. Alaksandrov, B.N. Gorin, V.P. Radkov, I.S. Stekol'nikov and A.V. Shkilev
G.M. Krzhizhanovskii Institute, Moscow, USSR
Soviet Physics-Doklady, Vol. 13, No. 12, pp 1246-1249 (06/1969).
Trans. From: Doklady Akademii Nauk SSSR 183, 1048-1051 (December 1968)

The existing experimental data on the electric breakdown of air in long discharge gaps are limited to gaps 1-6 m long. It seemed desirable to undertake an investigation of the phenomenon in longer gaps. This would allow one to determine the tendencies in the modifications of the breakdown development which are associated with an increasing gap length. A knowledge of such tendencies has a considerable practical significance for problems involving the dielectric strength of a r and is of interest for physics in general. This paper gives a brief account of the results of such an investigation, which has been conducted at the M.I. Kalinin Leningrad Polytechnical Institute and at the G.M. Krzhizhanovskii Power Institute. 3 Refs.
Primary Keywords: Meter Gap; Atmospheric Air; Breakdown Stages; Flashing Stage; Continuous Leader Stage; Through Stage; Light Emission Measurement; 10 A Currents

7937
(BREAKDOWN STUDIES)
(Gas, Optical)

REVIEW OF GAS-BREAKDOWN PHENOMENA INDUCED BY HIGH-POWER LASERS-I

I.P. Shkarofsky
RCA Limited, Quebec, Canada
RCA Review, Vol. 35, pp 48-78 (03/1974).

This paper discusses the two optical breakdown mechanisms: multiphoton ionization and cascade ionization. The author begins with a short qualicative review of the theory of optical breakdown in gases, and proceeds to describe several experiments performed by several researchers which demonstrate the theory. Attempts are made to explain several anomalies in the results seen. The dependence of breakdown on several factors, such as spot size, impurity level and pulse duration is discussed. Laser maintained discharges are also considered. 71 Refs.
Primary Keywords: Laser Breakdown; Gas Composition; Impurity; Spot Size; Pulse Length; Pressure Dependence

7939
(SWITCHES, CLOSING)
(Solid Dielectric, Optical)

SOLID-DIELECTRIC NANOSECOND SPARK GAP WITH LASER TRIGGERING

A.I. Babalin, V.A. Rodichkin, G.Ya. Rusakova and A.M. Timonin
Soviet Physics-Technical Physics, Vol. 16, No. 8, pp 1318-1320 (02/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 1675-1677 (August 1971)

A solid-dielectric spark gap which is triggered by a Q-spoiled ruby laser is described; the unit generates pulses with amplitudes as high as 15-20 kV and lengths of 2-4 nsec with rise times of 0.5-0.? nsec. The response time of the spark gap is measured as a function of the voltage applied to various types of films with different thickness. The results are discussed. 7 Refs.
Primary Keywords: Ruby Laser; Delay Measurement; Various Dielectric Materials; Variable Thickness

7940
(PULSE GENERATORS; SWITCHES, CLOSING)
(Capacitor Banks; Gas Gaps, Optical)

SOME DESIGN CONSIDERATIONS OF A LASER TRIGGERED IMPULSE GENERATOR

J.J. Bleeker and C.G. Morgan
(12/1965).
Availability:
NTIS

In a number of Divisions at CERN considerable interest is being taken in the possibility of the production of large current and high voltage impulse generators. This interest arises from requirements, for example, in the MPS and AR Divisions for work on kicker magnets, and in the NPA Division for basic research and development of particle separators. 10 Refs.
Primary Keywords: Review; Vacuum Electrode Emission; Electron Multiplication; Jitter Estimate; Ruby Laser

7941
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)

SPARK DISCHARGE TRIGGERED BY A PULSE LASER BEAM

K. Horii, T. Noguchi and M. Yano
Electrotechnical Lab, Tokyo, Japan
IEE International Conference On Gas Discharge Proceedings, pp 6-10 (01/1970).

The spark discharge in an air gap can be triggered by a giant pulse laser beam focused on an electrode surface. This type of gap is called the Laser Triggered Spark Gap, which can meet the need for a high speed switch of heavy current impulse generator. An experimental study of the breakdown mechanism of the gap was performed. 4 Refs.
Primary Keywords: Ruby Laser; Air Gap; Electrode Irradiation; Breakdown Mechanism; Double Current Pulse

7943
(PULSE GENERATORS; ELECTROMAGNETIC FIELD GENERATION)
(Capacitive; Magnetic)

A COMPACT MAGNETIC-FIELD-PULSE GENERATOR

I.I. Ushakov
Leningrad Technological Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 16, No. 6, pp 1797-1799 (12/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 154-156 (November-December 1973)

A simple device is described which generates monopolar magnetic field pulses having an intensity ranging from 4 to 2.5 MA/m for a discharge-current amplitude ranging from 4 A to 2.5 kA. The repetition frequency of the pulses may be controlled in the range from 25 to 0.5 Hz. The possibility is provided for the operation of the generator in a one-shot mode. The length of the magnetic field pulses at the base is approximately 160 microseconds; the discharge energy of the capacitor bank is <=200 J. The stability of the amplitudes of the current and magnetic-field pulses is +or- 0.05%. 7 Refs.
Primary Keywords: Pulse Generator; 4 A - 2.5 kA Current Range; 2.5 MA/m Field; Thyristor; Crowbar

7948
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)

TIME CONSTANTS OF SPARK DISCHARGES INITIATED BY A GAS-LASER BEAM OF LAMDA = 0.3371 MICRONS

Yu.A. Kurbatov and V.F. Tarasenko
Soviet Journal Of Quantum Electronics, Vol. 2, No. 6, pp 567-568 (06/1973).
Trans. From: Kvantovaya Elektron 12, 108-109 (1972)

An investigation was made of the time constants of spark discharges initiated by a laser beam of Lambda = 0.3371 microns and 10 kW peak power. The experiments were carried out at pressures of 1-8 atm in a discharge chamber. The discharge gap was 1-10 mm and the applied voltage was 10-200 kV. The laser beam was directed onto a copper cathode through a grid-like anode. The discharge delay time varied depending on the conditions, from 1 to 100 nsec. The fluctuations of the delay time did not exceed +or- 3 nsec even at voltages close to the static breakdown value. This high stability of the triggering of the discharge gaps indicated that the laser beam in question was a suitable source for initiation of high-power spark discharges. 4 Refs.
Primary Keywords: Nitrogen Laser; Variable Pressure; Variable Gap Spacing; Copper Electrode; Delay Measurement; Jitter Measurement

7951
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
12.2-LASER-TRIGGERED MEGAVOLT SWITCHING
A.H. Guenther and J.R. Bettis
AFWL, Kirtland AFB, NM 87117
IEEE Journal Of Quantum Electronics, Vol. QE-3, No. 11, pp 581-588 (11/1967).
Laser-initiated breakdown of high-voltage spark gaps has been extended to the megavolt range through the use of a novel coaxial triggering geometry. In this configuration, a 100-to 250-megawatt ruby laser of 1.4-to 3.5-joules output was aligned along the interelectrode axis of the spark gap. The laser beam passed through a hemispherical electrode, mounted on a hollow shaft, and was focused by a lens internal to this electrode at the opposite-switch electrode surface. Based on investigations of the effect of polarity on switch performance, i.e., least delay and jitter, it was concluded that 1) irradiation of the charged electrode was preferred and 2) irradiation of positive-rather than negative-charged electrodes gave best performance. Delay times between arrival of the laser pulse and complete gap closure as short as 2 ns with unmeasurable jitter (< 1 ns) were readily attainable under various conditions (high-pressure and high-reduced fields). By recourse to classical arc breakdown theories, i.e., Townsend avalanche and streamer mechanism, it was concluded that the variation of delay with reduced field follows an avalanche process. However, for an explanation of extremely short delays observed (high-velocity closure rates), a streamer mechanism is necessary. 15 Refs.
Primary Keywords: Ruby Laser; Air Gap; Nitrogen Gap; Megavolt Operating Voltage; Single-channel Discharge; Experiment; Theory

7966
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
FIELD EMISSION: LARGE CURRENT DENSITIES, SPACE CHARGE, AND THE VACUUM ARC
W.P. Dyke and J.K. Trolan
Linfield College, McMinnville, OR
Physical Review, Vol. 89, No. 4, pp 799-808 (02/1953).
Field emission was obtained from a single crystal tungsten emitter under conditions of very high vacuum and clean surfaces. The geometry of the emitter was determined by electron microscopy permitting accurate calculation of both the surface electric field and an average current density. The use of pulse electronic techniques extended the observations to the upper limit of the current densities for which the normal field emission was stable. Above this limit an explosive vacuum arc occurred between electrodes. From these experiments the following conclusions were drawn. (1) The wave mechanical, image force corrected theory quantitatively predicted the observed average current density up to that density of the order of 1E7 amperes/cu.cm., where a marked deviation occurred from the usual current-voltage relationship. (2) Space charge effects permitted the simultaneous operation of multiple emitting areas of differing geometries. (3) At a still higher critical current density in the range to 1E8 amperes/cu.cm., a field emission initiated vacuum arc occurred between electrodes resulting in a change of emitter geometry. Current density was the dominant criterion for the initiation of the vacuum arc. 25 Refs.
Primary Keywords: Field Emission; Tungsten Cathode; Clean Surface; Surface E-field; Emission vs Voltage; Vacuum Arc

7971
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, Electrical; Vacuum Gaps, Electrical)
INITIAL STAGES OF LOW-PRESSURE PULSE DISCHARGE
A.B. Boim and E.M. Raikhrudel
Moscow State University, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 6, No. 9, pp 821-826 (03/1962).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 31, 1127-1134 (September 1961)
A study was made of the ignition of a pulse discharge in a tube containing a cold cathode with a trigger electrode, at initial pressures 1E-4 - 1E-6 mm Hg and initial voltages 30-60 kV. A study of the current and voltage variation with time by oscillography and simultaneous measurement of the integral intensity of the x-ray emission of the discharge showed that ignition of the pulse discharge passes through a stage of predischarge pulses prior to the stage of the gas-focused beam. The lifetime (tau/sub 1/) of the predischarge pulse stage with fixed initial conditions (capacitance and initial voltage of pulse generator, degree of outgassing of electrodes, pressure) depends on the emissive properties of the cold cathode; tau/sub 1/ can be prolonged from one microsecond to several milliseconds by variation of the resistance (R/sub t/) in the trigger-gap circuit. The investigated prolongation of ignition can be used for control of the duration (r) of the electron-optical stage, which includes the above-mentioned stages, of the pulse discharge. 9 Refs.
Primary Keywords: Vacuum Breakdown; Cold Cathode; Trigger Electrode; 1E-6 Torr Pressure; 60 kV Voltage; Current Measurement; Voltage Measurement; Temporal Resolution

7974
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
LOW VOLTAGE FIRING CHARACTERISTICS OF A TRIGGERED VACUUM GAP
G.A. Farrall
General Electric Co, Schenectady, NY 12301
IEEE Transactions On Electron Devices, Vol. ED-13, No. 4, pp 432-438 (04/1966).
The triggerd vacuum gap is a normally nonconducting device in which a high-current metal-vapor arc can be established by a suitable pulse of current to a triggering electrode. While this gap is well suited to switching applications at high voltage, it has properties which make it useful at low voltage as well. The operation of the triggered vacuum gap has, therefore, been studied in the range of 100 to 1000 volts. It was found that, although the gap could be triggered with currents as low as 0.02 amperes, consistant triggering with firing delays less than a microsecond required trigger pulses of 10 amperes or more. Little or no dependence of firing time on main gap voltage was observed. Below a few hundred volts, however, the probability of establishing a stable main discharge with a short duration trigger pulse falls of rapidly with decreasing gap voltage. The polarity of the main gap voltage and of the trigger pulse strongly influenced the firing characteristics of the gap in the range studied. These effects are discussed in detail. 11 Refs.
Primary Keywords: Vacuum Spark Gap; Metal Vapor Arc; 100-1000 V Operating Voltage; Very Low Trigger Current; Delay Measurement; Jitter Measurement

7976
(BREAKDOWN STUDIES)
(Surface Flashover)
NANOSECOND TIME DEVELOPMENT OF A PULSED DISCHARGE AT A DIELECTRIC-VACUUM INTERFACE
S.P. Bugaev and G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 10, No. 7, pp 930-932 (01/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1202-1204 (July 1965)
The time development of a discharge at a dielectric-vacuum interface must be studied to clarify the mechanism underlying the phenomenon and to facilitate the selection of vacuum insulation, the development of switching devices, electron tubes, etc. Breakdown at the surface of a dielectric in vacuum has not been studied adequately to date. The effect of various factors on breakdown voltage has been investigated previously, prebreakdown currents have also been studied, and the voltage-time characteristic have been studied in the microsecond range. However, the literature contains no information on the time required for breakdown to develop over a dielectric-vacuum interface so that it is difficult to explain the processes taking place during breakdown. 7 Refs.
Primary Keywords: Surface Flashover; Vacuum Environment; Flashover Voltage; Flashover Delay; Several Dielectrics; Sample Conditioning

8000
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
THE INITIATION OF ELECTRICAL BREAKDOWN IN VACUUM
L. Cranberg
Los Alamos National Labs, Los Alamos, NM 87545
Journal Of Applied Physics, Vol. 23, No. 5, pp 518-522 (05/1952).
The hypothesis is suggested that initiation of high voltage breakdown in vacuum is due to traversal of the high voltage gap by a clump of loosely adhering material. The implication of this hypothesis for uniform-field gaps is that the breakdown voltage is proportional to the square root of the gap length. A summary of the literature is presented which supports this conclusion for a range of gap distance from 0.2 mm to 6 meters. Additional qualitative evidence is presented which tends to support the proposed hypothesis. 15 Refs.
Primary Keywords: Vacuum Breakdown; Uniform Field; Microparticle; Breakdown Voltage vs Gap Spacing; Square Root Dependence; Literature Review

8009
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
INVESTIGATION OF LASER PULSE FORMING BY LTSG AND POCKELS CELLS
K. Yoshida, T. Yamanaka, T. Sasaki, K. Shimamura and C. Yamanaka
Osaka University, Suita, Osaka, Japan
Electrical Engineering In Japan, Vol. 92, No. 6, pp 117-122 (11/1972).
Trans. From: Denki Gakkai Ronbunshi 92C, 377-383 (November 1972)
This paper describes a laser-triggered gas gap used to switch a Pockels Cell for laser light switching. The gap is filled with an argon-nitrogen mixture with the laser focused on the cathode. Electrodes are stainless steel. The gap distance is adjustable. Graphs of delay vs. self-breakdown voltage, delay vs. electrode spacing, and rise time vs. electrode spacing are presented. 24 Refs.
Primary Keywords: Glass Laser; Argon Gap; Nitrogen Gap; Stainless Steel Electrode

8011
(BREAKDOWN STUDIES)
(Gas, Electrical)
SOME PROPERTIES OF HIGH CURRENT SPARK CHANNELS
C. Braudo and J.D Craggs
University of Liverpool, Liverpool, UK
International Journal Of Electronics, Vol. 22, No. 4, pp 329-353 (04/1967).
Spark channels carrying currents of 200 kA were studied in hydrogen, argon, and helium at 760 Torr. Measurements were taken of the gap voltage drop, the gap resistance, the channel expansion velocities, and the current waveform. Other spark channel characteristics, such as shock wave velocity, pinch temperature, drift velocity, ion and electron density, and channel resistance, are then calculated from the results. 26 Refs.
Primary Keywords: Spark Channel; High Current; Voltage Drop; Expansion Rate; Discharge Temperature

8043
(BREAKDOWN STUDIES)
(Gas, Electrical)
DEVELOPMENT OF ELECTRON AVALANCHES AND STREAMERS
E.D. Lozanskii
Soviet Physics Usp. Vol. 18, No. 11, pp 893-908 (11/1975).
Trans. From: Usp. Fiz. Nauk 117, 493-521 (November 1975)
The article presents a review of the current state of the theory of avalanche-streamer processes, i.e., processes occurring during the development of discharges in dense gases. The principal attention is devoted to description of the physical picture of the phenomena. A systematic presentation is given of the theory of the main stages of formation of a discharge; the theory of electron avalanches, the theory of a self-maintaining discharge, the theory of the avalanche-streamer transition, and the theory of streamers. The question of breakdown of long spark gaps is discussed briefly. 126 Refs.
Primary Keywords: Review; Theory; Dense Gas; Discharge; Physical Picture; Self-maintaining

8044
(BREAKDOWN STUDIES)
(Gas, Optical)
EFFECT OF HIGH MAGNETIC FIELDS ON THE THRESHOLD OF LASER-INDUCED GAS BREAKDOWN
E.J. Button and A.H. Guenther
AFWL, Kirtland AFB, NM 87117
Journal Of Applied Physics, Vol. 47, No. 2, pp 522-530 (02/1976).
A quantum rate analysis of laser-induced breakdown in deuterium and helium gas was used to predict the dependence of the breakdown-threshold intensity on gas pressure, laser-pulse length, and the magnitude of an applied external magnetic field parallel to the direction of propagation of the laser beam. Diffusion, elastic and inelastic collisions, and multiphoton ionization of atomic and molecular states excited by electron impact were considered. The threshold data indicate the presence of three distinct regions: the pulse-length dominated, intermediate, and the diffusion dominated, as well as the importance of a dimensionless parameter omega in determining the magnitude of the magnetic field effect on the breakdown threshold for a given set of experimental conditions. The results are in excellent agreement with experimental data. 36 Refs.
Primary Keywords: Laser-induced Breakdown; Helium; Threshold Intensity; Parallel Magnetic Field; Numerical Calculation; Experiment

8045
(PARTICLE BEAMS, ELECTRON)
(Generation)
LOCALIZATION OF FIELD EMISSION IN SMALL SOLID ANGLES
G.N Fursei and S.A. Shakirova
A.A. Zhdanov Lenningrad State University, Lenningrad, USSR
Soviet Physics-Technical Physics, Vol. 11, No. 6, pp 827-832 (12/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 1125-1131 (June 1966)
A field-emission cathode is a point surface of electrons with very small linear dimensions (0.01 to 1 micron). This makes it possible to focus the electron beam by direct electron-optical methods and to simplify electron-optical systems significantly. These sources, however, exhibit spherical symmetry with a radially diverging beam. Thus, the aperture angle of the emitted cone is very large, being for average emission densities (1E4-1E5 A/sq.cm.) approximately equal to 60 Deg. and, for the limiting densities (1E7-1E8 A/sq.cm.), approximately equal to 100 Deg. In order to obtain a fine electron probe a very narrow pencil is usually isolated from the beam. The apertures necessary for ensuring the minimum permissible aberrations in the beam are to 1E-3 - 1E-2 rad. 17 Refs.
Primary Keywords: Field-emission Diode; Large Divergence; Collimating Aperture; High Losses; Selective Electron Emission

8046
(PARTICLE BEAMS, ION)
(Generation)
PARTICLE ACCELERATION BY COLLECTIVE EFFECTS
D. Keefe
Lawrence Berkeley Lab, Berkeley CA
1976 Proton Linear Accelerator Conference, pp 352-357 (09/1976).
Successful acceleration of protons and other ions has been achieved experimentally in this decade by a number of different collective methods. The attainment of very high accelerating fields has been established although so far the acceleration distance has been confined to only a few centimeters. Efforts are in progress to understand the accelerating mechanisms in detail and, as a result, to devise ways of extending considerably the acceleration distance. This paper is intended to review the current progress, expectations, and limitations of the different approaches. 20 Refs.
Primary Keywords: Proton Acceleration; Ion Acceleration; Collective Effects; Review

8047
(BREAKDOWN STUDIES)
(Gas, Electrical)
PHOTOPREIONIZATION OF THE 3371-ANGSTROM PULSED N/SUB 2/ LASER
N.A. Kurnit, K. Bidhichand, L.W. Ryan Jr., A. Javan and S.J. Tubbs
Massachusetts Institute of Technology, Cambridge, MA
IEEE Journal Of Quantum Electronics, pp 174-176 (04/1975).
Photopreionization of the 3371-Angstrom pulsed N/sub 2/ laser by use of a seed gas of low ionization threshold and flashlamp excitation is observed to result in increased laser output and reproducibility. Preionization also increases the range of permissible operating pressures, enabling operation with atmospheric-pressure mixtures of N/sub 2/ and He without reduced intensity. 8 Refs.
Primary Keywords: Photoionization; Flashlamp; Arc Suppression; Large Volume
Secondary Keywords: Nitrogen Laser Pumping

8049
(PULSE GENERATORS; SWITCHES, CLOSING)
(Systems: Gas Gaps, Electrical)
SUBNANOSECOND RISETIME MULTIKILOVOLT PULSE GENERATOR
D.F McDonald (1), C.J. Benning (1) and S.J. Brient (2)
(1) BDM Corp, El Paso, TX
(2) University of Texas at El Paso, TX
The Review Of Scientific Instruments, Vol. 36, No. 4, pp 504-505 (04/1965).
A multikilovolt nanosecond pulse generator has been developed which uses a new approach to the design of an extremely fast gas-discharge switch. The design concept is based on the statistical time lag which precedes an electrical breakdown. The generator also employs large coaxial geometry so that extremely high operating voltages may be used. A description of instrumentation required to measure the fast rise time, high voltage pulses is included along with some typical oscilloscope traces. 8 Refs.
Primary Keywords: Fast Rise; High Pressure Spark Gap; Pulse Forming Line; Statistical Time Lag

8050
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
CHARACTERISTICS OF THE TRIGATRON SPARK-GAP
A.M. Sletten and T.J. Lewis
Queen Mary College, London, UK
Proceedings of the IEE, Vol. 104, Pt. C, No. 5, pp 54-61 (03/1957).
The behaviour of a trigatron three-electrode spark-gap in air has been investigated and its characteristics obtained with particular reference to its use as a controlled high-voltage switch. It is found that the voltage range over which it may be triggered satisfactorily depends, not only on the polarities of the main gap and triggering voltages, but also on the energy of the discharge. The breakdown time-lag is also determined by these same voltage polarities and also by the time-constant of the trigger discharge circuit. From these characteristics and certain other relevant observations, a theory of the breakdown process in such a spark-gap is suggested, involving the propagation from the trigger of a low-density easily-ionized region. Finally, a brief investigation of the successful use of a trigatron in a diverter circuit capable of diverting the discharge energy in a spark-gap subjected to direct and impulse voltages of 300 kV and in a circuit providing accurate 'chopping' of impulse voltage waves, is reported. 12 Refs.
Primary Keywords: Trigatron; Air Gap; Operating Characteristics; Voltage Operating Range; Trigger Polarity Dependence

8051
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
THE CHARACTERISTICS OF THE TRIGATRON SPARK-GAP AT VERY HIGH VOLTAGES
T.E. Broadbent
University of Manchester, Manchester, UK
IEE Monograph No. 364 M, pp 213-215 (03/1960).
Curves are given showing the working range and time-lag characteristics of a trigatron spark-gap working in air at voltages up to 1 MV. It is shown that, for voltages of this magnitude, a single-stage trigatron spark-gap of suitable design provides a simple and convenient method of chopping the voltage at any required instant. Factors which affect the performance of the gap are discussed. 7 Refs.
Primary Keywords: Trigatron; Operating Characteristics; Time Lag; Voltage Range; Air Gap; Geometry Dependence

8052
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
THE DEVELOPMENT OF THE DISCHARGE IN THE TRIGATRON SPARK GAP AT VERY HIGH VOLTAGES
T.E. Broadbent and A.H.A. Shlash
University of Manchester, Manchester, UK
British Journal Of Applied Physics, Vol. 14, pp 687-691 (06/1963).
The optical phenomena occurring during the initiation of breakdown in the trigatron spark gap in air have been investigated with voltages up to 1 MV and inter-electrode spacings up to 60 cm, using an image converter as an electro-optical shutter. Measurements of gap current flowing during the breakdown initiation process have also been made. The optical phenomena are similar in nature to those occurring in long untriggered gaps. One or more leader strokes occur, followed by a main stroke. Leader stroke velocities fall within the range 5E6 to 3.2E8 cm/sec depending on experimental conditions. The average mainstroke velocity is about 1E8 to 1E9 cm/sec. Under certain conditions the path taken by the complete spark is partly governed by the production of a short leader stroke originating at one electrode. It is shown that this leader occurs only in the region of the gap where conditions laid down by Loeb and Meek and Raether as being suitable for streamer formation and propagation are satisfied. 10 Refs.
Primary Keywords: Trigatron; Optical Observation; Gap Current Measurement; Leader Stroke; Main Stroke; Discharge Propagation Speed

8061
(BREAKDOWN STUDIES)
(Gas, Electrical)
ELECTRON EMISSION AT HIGH FIELDS DUE TO POSITIVE IONS
P Kisliuk
Bell Labs, Murray Hill, NJ 07974
Journal Of Applied Physics, Vol. 30, No. 1, pp 51-55 (01/1959).
Two mechanisms have been proposed to account for the observed large yield of secondary electrons in gaseous breakdown at high electric fields. In one of those a single ion in approaching the cathode surface creates a 'pass' by decreasing the width of the potential barrier. In the other the increased over-all fields due to a large number of ions in the gap is supposed to account for the increased emission. The first effect is re-examined and appears to be effective in the observed breakdowns of extremely small gaps in air. It may also be effective in breakdown at high pressure and in liquid and solid dielectrics. 21 Refs.
Primary Keywords: Gas Breakdown; High-field Breakdown; Secondary Electrons; Cathode Effect; Potential Barrier Decrease; Ionic Field Increase

8063
(BREAKDOWN STUDIES)
(Electrodes)
FIELD-DEPENDENT SECONDARY EMISSION
H. Jacobs
ECOM, Fort Monmouth, NJ 07703
Physical Review, Vol. 84, No. 5, pp 877-884 (12/1951).
Experiments have been conducted with magnesium oxide surfaces in which high DC fields were applied to the surface, while at the same time secondary emission measurements were being made. Very high secondary emission ratios were obtained reproducibly (100 to 1 and greater). Under static conditions it was found that the ratios would increase exponentially with increasing fields. In addition, for constant fields, the ratio of liberated electrons to bombarding electrons was constant, over a wide range of bombardment energy. Measurements were made of secondary emission with a square wave field applied to the surface and time lag effects were noted. Decay time in the order of 30 microseconds were measured. The rise time was found to be dependent upon field and bombarding currents. The mechanism of field dependent secondary emission was shown to be related to an avalanche effect, triggered by the bombarding electrons. 12 Refs.
Primary Keywords: Electron Emission; Secondary Emission; Magnesium Oxide Surface; High Secondary Emission; Exponential Variation With Field

8080
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

WHISKER GROWTH IN HIGH-VOLTAGE HIGH-VACUUM GAPS

L. Jedynak
University of Wisconsin, Madison, WI
Journal Of Applied Physics, Vol. 36, No. 8, pp 2587-2589 (08/1965).
The verification by Little and Whitney of the existence of whisker-like microprojections on the cathode electrode of a vacuum gap offers strong support for the field-emission concept of prebreakdown currents and for the field-emission-initiated and clump theories of vacuum breakdown. The cathode whiskers correlate well with the electron beam discussions of Maitland and also match Dyke's description of breakdown due to vaporizaton of a field-emitting point. The clump theory and time lag of breakdown are both describable in terms of microprojections as done by Denholm in his article on growth and fracture of points in the vacuum gap. The existence of the microprojections, or whiskers, supports the present belief that breakdown does not have a single primary cause, but is instead caused by any one of several mechanisms depending upon the local conditions existing within the gap. 8 Refs.
Primary Keywords: High-vacuum Gaps; Vacuum Breakdown; Cathode Whiskers; Clump Theory; Prebreakdown Current

8081
(BREAKDOWN STUDIES)
(Gas, Optical)

CHANNELING OF AN IONIZING ELECTRICAL STREAMER BY A LASER BEAM

D.W. Koopman and T.D. Wilkerson
Versar Inc. Springfield, VA 22151
Journal Of Applied Physics, Vol. 42, No. 5, pp 1883-1886 (04/1971).
Long electrical spark discharges have been directed through air along predetermined paths defined by a concentrated laser beam. At apparent optical power densities of 50-100 GW sq.cm., 35-nsec half-width laser pulses at 10.6 microns have been effective in channeling streamer discharges from a 350-kV positively charged electrode for distances up to 28 cm in a total streamer length of 71 cm. The average E-field required to obtain a discharge between electrodes was reduced from 7.3 to 5.5 kV/cm with the laser power employed. 12 Refs.
Primary Keywords: Laser Channeling; Directed Discharge; Long Distances; Low Level Ionization By Laser

8083
(PARTICLE BEAMS, ELECTRON)
(Reviews)

ELECTRON BEAM FUSION PROGRESS REPORT OCTOBER 1976 THROUGH MARCH 1977

Authors Unknown
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND77-1414 (10/1977).
Availability: SAND77-1414
NTIS
This report provides an overview of the progress made on the electron beam fusion program from October 1976 through March 1977 at Sandia Laboratories. The authors begin with a review of the concept of the EBFA and proceed to briefly discuss the progress made and problems encountered in the development of vacuum insulation systems, Marx generators, intermediate energy stores, switches, and diode construction. Predicted target interactions and projected diagnostics are also discussed. 126 Refs.
Primary Keywords: Electron Beam Fusion; Magnetic Insulation; Marx Generator; Trigatron; Vacuum Diode; Vacuum Flashover
Secondary Keywords: Diagnostics

8084
(POWER CONDITIONING)
(Saturable Reactors)

MAGNETIC SWITCHES AND CIRCUITS

W.C. Nunnally
Los Alamos National Labs, Los Alamos, NM 87545
Los Alamos Report No. LA-8862-MS (09/1981).
This report outlines the use of saturable inductors as switches in lumped-element, magnetic-pulse compression circuits. The operation of the three basic types of magnetic pulse compression circuits is discussed and the characteristic use of each is defined. In addition, the geometric constraints and magnetic pulse compression circuits used in short-pulse, low-inductance systems are considered. The scaling of prematuration leakage currents, magnetic energy losses, and switching times with geometrical and material parameters are developed to aid in evaluating magnetic pulse compression systems in a particular application. Finally, a scheme for increasing the coupling coefficient in saturable stripline transformers is proposed to enable their use in the short-pulse, high-voltage regime. 8 Refs.
Primary Keywords: Pulse Compression; Saturable Inductor; Lumped Element; Switching Characteristics; Design Considerations

8085
(ELECTROMAGNETIC LAUNCHERS)
(Railguns)

RESULTS OF RAILGUN EXPERIMENTS POWERED BY MAGNETIC FLUX COMPRESSION GENERATORS

R.S. Hawke (1), A.L. Brooks (1), F.J. Deadrick (1), J.K. Scudder (1), C.M. Fowler (2), R.S. Caird (2) and D.R. Peterson (2)
(1) Lawrence Livermore Lab, Livermore, CA 94550
(2) Los Alamos National Labs, Los Alamos, NM 87545
UCRL Report No. UCRL-84875 (10/1980).
Availability: UCRL-84875
NTIS
Researchers from LLNL and LANSL initiated a joint railgun research and development program to explore the potential of electromagnetic railguns to accelerate projectiles to hypervelocities. The effort was intended to 1) determine experimentally the limits of railgun operation, 2) verify calculations of railgun performance, and 3) establish a data base at megampere currents. The program has led to 1) the selection of a particular magnetic flux compression generator (MFCG) design for a set of initial experiments and 2) the design of small-and large-square bore railguns to match the expected MFCG power profile. The bore sizes are 12.7 and 50 mm, respectively. In this paper, we briefly describe the design of the railguns and the diagnostic and data reduction techniques, followed by the results of eight experiments with the two railgun types. 8 Refs.
Primary Keywords: Theory; Experiment; Numerical Calculation; Flux Compression Generator; Railgun Design Consideration

8087
(BREAKDOWN STUDIES)
(Gas, Electrical)

SURGE VOLTAGE BREAKDOWN OF AIR IN A NONUNIFORM FIELD

J.H. Park and H.N. Cones
Journal Of Research Of The National Bureau Of Standards, Vol. 56, No. 4, pp 201-224 (04/1956).
The discharge and breakdown phenomena in air when a surge voltage is applied to sphere-plane electrodes were investigated. A steeply rising surge of 145 kilovolts peak value was applied to the plane placed 86 centimeters above the laboratory floor. A 1.6 centimeter diameter sphere, mounted an adjustable distance below the plane, was connected to ground through the surge impedance of a coaxial cable. Experimental data consisted of oscillograms of the current to the sphere and pictures of the discharge between the electrodes. A method for chopping the applied voltage surge at an accurately controllable time was used to study the discharge at gap spacings for which a full-wave applied surge would cause breakdown. 17 Refs.
Primary Keywords: Pulsed Voltage; Sphere-plane Electrodes; Variable Gap Spacing; Variable Pressure; Current Waveform

8088
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)

OPTICALLY-INITIATED DIRECTED ELECTRIC BREAKDOWN IN A GAS

A.G. Akmanov, L.A. Rivlin and V.S. Shil'dyaev
Soviet Physics JETP Letters, Vol. 8, No. 8, pp 258-259 (10/1968).
Trans. From: ZhETF Pis'ma V Redaktsiyu 8, 417-419 (October 1968)
The advances in generation of intense coherent ultraviolet radiation uncover a possibility of observing plasma traces of an ultraviolet beam in a gas and various associated electric phenomena. These include in first order a directional electric breakdown along a prolonged ionized channel (plasma column), and also reflection of radio waves from the column or their propagation along the column. It is known that analogous phenomena are observed in optical breakdown of a gas by laser radiation in the infrared or visible band at high optical energy density (approximately 1E5 MW/sq.cm.) An increase of the light frequency (up to the ultraviolet), which increases the photoionization probability), should lead to an appreciable lowering of the necessary energy density and to a possibility of experimentally separating these phenomena from optical breakdown. 8 Refs.
Primary Keywords: Ultraviolet Radiation; Optically Directed Breakdown; Low Power Density; Theory

8089
(BREAKDOWN STUDIES)
(Gas, Electrical)

THE REIGNITION VOLTAGE CHARACTERISTICS OF FREELY RECOVERING ARCS

F.W. Crawford (1) and H. Edels (2)
(1) College Of Advanced Technology, Birmingham
(2) University of Liverpool, Liverpool, UK
IEE Paper No 3135 S (04/1960).
The recovery characteristics of an arc are studied in this paper. The authors consider a pulsed discharge in air, nitrogen, argon and hydrogen with carbon electrodes. Current is interrupted by external means, and a second pulse of variable voltage and delay is applied. In this way, the reignition voltage of the arc can be determined as a function of time. Currents considered are from 10-50 A with pressures between 100-750 Torr and gap distances of 1-5 mm. Full gap recovery is seen to require a current interruption of about 1 sec. The process is found to closely follow the extended Paschen law. 16 Refs.
Primary Keywords: Arc Recovery Time; Restrike Voltage; Temporal Resolution; Recovery Pause Horizontal Arc; Vertical Arc

8090
(ELECTROMAGNETIC LAUNCHERS)
(Railguns)

RAILGUN ACCELERATORS FOR GRAM-SIZED PROJECTILES

R.S. Hawke
Lawrence Livermore Lab, Livermore, CA 94550
UCRL Report No. UCRL-84623 (10/1980).
Availability: UCRL-84623
NTIS
In this paper, we describe the operation and critical parameters of railguns, we compare the potential and actual performance with other types of microparticle accelerators, and we discuss their research and industrial applications. Railgun accelerators have the potential to accelerate massive projectiles to very high velocities in very short distances. Recent research has demonstrated the usefulness of railguns for research and industrial applications. The railgun accelerator is essentially a linear DC motor consisting of a pair of rigid *parallel* conductors that carry current to and from an interconnecting moveable conductor. The connecting link functions as an armature, and the parallel rails serve as a single-turn field winding. The resulting Lorentz force on the armature is proportional to the square of the current. A 1-MA current will produce about 2E5 N of thrust. A one-gram projectile will experience an acceleration of 2E8 m/s/sup 2/ and in one meter achieve a velocity of 20 km/s. Conventional projectile launchers are limited to launch velocities of the order of 10 km/s. Hence railguns will enable research and applications at previously unattainable velocities. Velocities in excess of 10 km/s will lead to new research at high pressure and high-energy density. Behavior of matter in the 1-10 TPa or perhaps 100 TPa range will provide valuable insight to terrestrial and extraterrestrial phenomena. 14 Refs.
Primary Keywords: Small Projectiles; Operating Parameters; Tutorial Overview

8091
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Gas, Optical)

CW GAS BREAKDOWN IN ARGON USING 10.6-MICRON LASER RADIATION

D.L. Franzen
National Bureau of Standards, Boulder, CO 80302
Applied Physics Letters, Vol. 21, No. 2, pp 62-64 (07/1972).
A very intense gas breakdown spark has been extended to a continuous arc in argon using a focused cw CO/sub 2/ laser. To achieve cw breakdown, the focal volume of a mirror focusing a high-power CO/sub 2/ laser was preionized by a single pulse from a CO/sub 2/ TEA laser. The electron density created by the pulsed laser is sufficient to start the cw plasma. This letter reports accurate measurements of pulsed thresholds as well as preionized cw thresholds for breakdown in argon. Also, a study of the time development of the cw plasma is presented. 5 Refs.
Primary Keywords: CO/sub 2/ Laser; Argon Gas; Laser Sustained Discharge; Ionizing Threshold; Sustaining Threshold

8092
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Gas, Optical)
EFFECTS OF CW POWER ON THE PULSED GAS BREAKDOWN THRESHOLD IN ARGON AT 10.6-MICRON RADIATION

C.D. Moody
Army Missile Command, Redstone Arsenal, AL 35809
Applied Physics Letters, Vol. 22, No. 1, pp 31-32 (01/1973).
When the focussed beams of a pulsed CO/sub 2/ laser and a cw CO/sub 2/ laser were superimposed, the pulsed gas breakdown threshold was raised. It was found that the increase in the threshold was denendent on the gas pressure and cw power. When the intensities obtained with different focal diameters were compared, it was found that the the cw gas breakdown threshold has a 1/y/sup 2/ dependence on the radius of the focussed cw power spot. 3 Refs.
Primary Keywords: CO/sub 2/ Laser; Argon Gap; CW Laser; Pulsed Laser; Superimposition Of Beams

8093
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Gas, Optical)
SIMILARITY BETWEEN PHYSICAL PROCESSES IN A PULSED DISCHARGE AND IN THE EFFECT OF LASER RADIATION ON A METAL

L.I. Grechikhin and L.Ya. Min'ko
Institute Of Physics, Academy of Sciences of the BSSR, Minsk
Soviet Physics-Technical Physics, Vol. 12, No. 6, pp 846-849 (12/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1169-1172 (June 1967)
High-current pulsed discharge and concentrated laser radiation on a metal both provide strong heat sources which are comparable in magnitude (approximately 1E4-1E8 W/sq.cm.) and which erode the surface of a metal. In this connection it is of interest to consider general physical processes taking place on the surface of a metal and in the resulting plasmas and to use this as a basis to explain some specific properties of each source. Detailed studies were made of the physical processes associated with the disintegrating effect of concentrated laser radiation on a metal. Experiments were performed using a neodymium laser which provided an energy density of 1E4-1E8 W/sq.cm.; this is equivalent to densities realized in high-current pulsed discharges. 11 Refs.
Primary Keywords: Laser Erosion Of Metal; Pulsed Electrical Discharge; Plasma Jet; Light Emission Measurement; Dark Space

8095
(SWITCHES, CLOSING)
(LASS)
HIGH-POWER SWITCHING WITH PICOSECOND PRECISION

G. Mourou and W. Knox
University of Rochester, Rochester, NY 14623
Applied Physics Letters, Vol. 35, No. 7, pp 492-495 (10/1979).
Up to 10 kV have been switched with Si and GaAs laser-activated switches. We show that in spite of the thermal instability shortcoming experienced in Si, quasi-DC bias operation can be utilized in a manner which relaxes stringent synchronization requirements. In the case of GaAs the thermal instability is less severe and up to 8 kV DC has been held off and efficiently switched. In both cases a fast switching time of approximately 40 ps is observed. This time is a combination of the laser pulse width, geometry bandwidth, and jitter time. Efficient switching action requires only a few tens of microjoules of laser energy. *Electrical* pulses ranging from subnanosecond to hundreds of nanoseconds duration have been readily generated. 6 Refs.
Primary Keywords: Silicon Switch; Light Activated; Thermal Instability; Quasi-DC Bias; 40 ps Switching Time

8098
(SWITCHES, CLOSING; POWER CONDITIONING)
(LASS; Systems)
PICOSECOND OPTOELECTRONIC SWITCHING AND GATING IN SILICON

D.H. Auston
Bell Labs, Murray Hill, NJ 07974
Applied Physics Letters, Vol. 26, No. 5, pp 191-101 (02/1975).
Quasimetallic photoconductivity produced by the absorption of picosecond optical pulses in silicon transmission line structures has been used to devise electronic switches and gates which can be turned on and off in a few picoseconds. Electrical signals as large as 100 V can be switched by a few microjoules of optical energy. The switching speed was measured by correlating the response of two transmission gates in tandem, each having an aperture time of 15 psec. 5 Refs.
Primary Keywords: Photoconductivity; Double Pulse; 0.53 Micron Light; 1.06 Micron Light; Surface Ionization; Volume Ionization; Start Switch; Crowbar Switch

8099
(BREAKDOWN STUDIES)
(Gas, Electrical)
PROGRESSIVE LIGHTNING. IV-THE DISCHARGE MECHANISM

B.F.J. Schonland
University of the Witwatersrand
Royal Society Of London Proceedings, Vol. A164, No. A916-7, pp 132-150 (01/1938).
The authors present a model of the lightning process based on extensive experimental observation. The paper begins with a short review of the general discharge process. The leader process is then described in detail followed by a description of the mechanisms involved in the main stroke. Multiple strokes are also considered 22 Refs.
Primary Keywords: Lightning; General Survey; Modeling; Leader; Pilot Streamer; Stepped Leader; Current; Luminosity; Main Stroke

8100
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE POSSIBILITY OF PHOTODETACHMENT IN THE IMPULSE BREAKDOWN OF POSITIVE POINT-PLANE GAPS IN AIR

F.D.A. Boylett and B.G. Williams
Central Electricity Research Labs, Leatherhead, Surrey, UK
British Journal Of Applied Physics, Vol. 18, pp 595-595 (05/1967).
The relative importance of the roles of photodetachment and photoionization in the propagation of positive point-plane impulse corona in air is discussed. Consideration of the magnitudes of the cross sections for the two mechanisms as a function of photon energy reveals a higher efficiency for the photodetachment process. Further support for the conclusion that photodetachment is more probable than photoionization, in the circumstances considered, is drawn from experimental evidence such as the visual form of the corona and its dependence upon meteorolgical conditions. 5 Refs.
Primary Keywords: Point-plane Gap; Air Gap; Photoionization; Photodetachment; Corona Propagation; Cross Section; Theory

8103
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
WIDE FREQUENCY RANGE CURRENT TRANSFORMERS

J.M. Anderson
General Electric Co, Schenectady, NY 12301
The Review Of Scientific Instruments, Vol. 42, No. 7, pp 915-926 (07/1971).
Current transformers with resistive loads are examined experimentally to determine some of the limitations to high frequency response. Coil resonances are avoided by placement of damping resistors around the secondary winding. This permits a relatively large numer of secondary turns (50 or 100), improving low frequency response and increasing the i n t product, even for the highest frequency transformers. Uniform response to several gigahertz is obtained in a transformer with 6.4 mm window, while a range approximately 1 Hz to approximately 300 MHz is found in a larger transformer (12.7 cm diam and 2.5 cm window). Both ferrite and iron alloy cores are utilized. 8 Refs.
Primary Keywords: Current Transformer; Wide Bandwidth; Resistive Load; Damping Resistor; Frequency Response Measurement

8104
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
TESTS ON THE CANBERRA HOMOPOLAR GENERATOR ARRANGED TO SUPPLY THE 5 MEGAWATT MAGNET

E.K. Inall
Australian National University, Canberra, Australia
Journal Of Physics D; Applied Physic, Pp 1-9 (08/1965).
The design and testing of the Canberra Homopolar Generator are discussed. The temporal histories of the temperatures of several components are presented for high (1 MA) and low (25 kA) current discharges. The dependence of performance on brush pressure is studied. 2 Refs.
Primary Keywords: Homopolar Generator; Brush Temperature Study; Brush Pressure Study; High Current Discharge; Low Current Discharge

8105
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Surface Flashover)
CONFIGURATIONS AND MODES OF AN H-PRESSED DISCHARGE

L.D. Gorshkova, A.I. Pavlovskii, I.V. Podmoshenskii and V.A. Savchenko
High Temperature, Vol. 9, No. 4, pp 762-764 (08/1971).
Trans. From: Teplofizika Vysokikh Temperatur 9, 844-846 (July-August 1971)
The H-pressed discharge is a process in which a gas discharge is pressed against a dielectric by a magnetic field. The authors analyze the plane, coaxial, and annular H-pressed discharge. Instabilities are discussed, as are the effects of wall vaporization. The radiation of the H-pressed discharge is found to agree well with that of an absolute black body. 5 Refs.
Primary Keywords: Gas Discharge; H-pressed Discharge; Magnetic Field; Dielectric Trough; Stability Considerations

8106
(BREAKDOWN STUDIES)
(Gas, Optical)
RESONANCE EFFECTS IN MULTIPHOTON IONIZATION OF ATOMS

G. Mainfray and C. Manus
CEA Centre d'Etudes Nucleaires, Saclay, France 92260
Applied Optics, Vol. 19, No. 23, pp 3934-3940 (12/1980).
The resonance effects in multiphoton ionization over a moderate laser intensity as observed in experiments is compared, with a close agreement found, to the effects predicted by theory. The observed resonance effects in a high intensity range cannot be as easily understood, and the authors give a qualitative explanation using the characteristic ionization time in the vicinity of the resonance. 23 Refs.
Primary Keywords: Multiphoton Effect; Experiment; Theory; Good Agreement; Polarization Effects

8108
(PARTICLE BEAMS, ELECTRON)
(Target Interactions)
HIGH-POWER ELECTRON BEAM PREIONIZED CO/SUB 2/ CW LASER MODELLING I: DESCRIPTION OF THE INVESTIGATED DEVICE AND NUMERICAL CALCULATIONS ON E-BEAM IONIZATION

S. Martellucci, J. Quartieri, G. Mastrocinque and S. Solimeno
Universita degli Studi-Napoli, Napoli, Italy
Nuovo Cimento, Vol. 54, No. 1, pp 99-117 (11/1979).
Part I of the paper devoted to modelling high-power CW lasers gives a brief description of the investigated device and uses an analytical approximation to Bathe's formula to calculate the following quantities: the space profiles in the discharge chamber of the electron beam energy, the stopping power and the source term under operating conditions for four-component mixtures of practical interest. The energy loss of the primary beam in travelling through a thin Al foil is calculated. Parts II and III will be published promptly. Part II will be devoted to the plasma characteristics in the discharge chamber and to the kinetic and fluid-dynamic model of the laser. Part III will be devoted to an assessment of the numerical results obtained from the model and their comparison with experimental data. 20 Refs.
Primary Keywords: Energy Deposition; Gas Dynamics; Modeling; Analytical Solution
Secondary Keywords: Gas Laser Pumping

8109
(BREAKDOWN STUDIES)
(Lightning)
SIMULATION OF LIGHTNING CURRENTS IN RELATION TO MEASURED PARAMETERS OF NATURAL LIGHTNING

J. Phillpott
Culham Lab, Abingdon, Oxfordshire, UK
1975 Conference On Lighting And Static Electricity, pp 1-13 (06/1975).
The authors begin this paper with a short discourse on the characteristics of natural lightning. Intracloud discharge and both positive and negative ground discharges are discussed with emphasis on stroke duration and peak current. The effects of these lightning strokes on aircraft are then discussed with a proposed new airworthiness requirement included. Lastly, requirements for effective lightning simulation are discussed. 30 Refs.
Primary Keywords: Lightning Characteristics; Intracloud Discharge; Ground Discharge; Effects On Aircraft; Airworthiness Specification; Simulation

8110
(BREAKDOWN STUDIES)
(Gas, Electrical)
FORMATION OF A POSITIVE BURST PULSE CORONA IN AIR, NITROGEN AND OXYGEN

T. Tamura
Shizuoka University, Hamamats, Japan
Journal Of The Physical Society Of Japan, Vol. 17, No. 9, pp 1436-1439 (09/1952).
The author utilizes Loeb's condition to derive an analytical solution for the onset of positive pulse burst pulse corona in a point-point gap. Avalanche and photo-ionization are included to derive a formula to predict the onset of burst pulse corona and to estimate the effective absorption coefficient for the radiation produced. 16 Refs.
Primary Keywords: Loeb's Condition; Point-point Electrodes; Ionizing Photons; Absorption Coefficient; Experiment; Theory

8111
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
THE EXPLODING WIRE PHENOMENON

C.A. Privette
Jet Propulsion Lab, Pasadena, CA
JPL Technical Report No. 33-113 (01/1963).
Availability: N63-19203
NTIS
A brief outline of the exploding wire phenomenon together with a description of some techniques employed in measuring various parameters of the explosion process is presented. Two copper wires, 1 and 3 mils in diameter, were exploded, utilizing a 16,000-J capacitor bank. These explosions are used as models for various theoretical descriptions conerning temperature and current histories. Results of these theoretical treatments predict maximum temperatures of approximately 100,000 amp. 12 Refs.
Primary Keywords: Experiment; Theory; Simulation; Numerical Calculation; Copper Wire; Measurement Technique

8112
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
THEORETICAL ANALYSIS OF THE HYDRODYNAMIC FLOW IN EXPLODING WIRE PHENOMENA

C.A. Rouse
Lawrence Livermore Lab, Livermore, CA 94550
UCRL Report No. UCRL-5519-T (03/1959).
Availability: UCRL-5519-T
NTIS
Theoretical calculations of exploding wire phenomena have been carried out with an IBM 704 Lagrangian code. The model for this analysis assumes instantaneous energy deposition in the wire. Calculations were made with different conditions. Among those presented are (1) different effective equations of state for the copper wire and (2) different equations of state for the surrounding air. The equations of state for the air are (a) a constant gamma-law gas and (b) the variable gamma-law gas calculated by F.R. Gilmore. The shock wave propagation in each is shown to require significantly different energies. The results are compared to calculations made without copper wire (energy assumed deposited in a volume of air equal to that of the wire) and with an analytic similarity solution for cylindrical shock waves. The propagation of the shock wave in air calculated with the Gilmore equation of state for air shows excellent agreement with that observed by F.D. Bennett. The second shock wave in the copper shows qualitative agreement with that observed by Bennett, but indicates that in the range of EWP, copper does not act like a constant gamma-law gas. As for similarity, it is known that hydrodynamic flow during the explosion of wires is not similar. 7 Refs.
Primary Keywords: Exploding Wire; Copper Wire; Numerical Calculation, Shock Wave; Double Shock

8113
(INSULATION, MATERIAL; PULSE GENERATORS)
(Liquid, Systems)
DIELECTRICS STUDY FINAL REPORT

G.K. Simcox
Energy Sciences Inc., Burlington, MA 01803
DNA Report No. DNA2823F (06/1972).
Availability: AD 743178
NTIS
This reports the findings of an experimental study to investigate the dielectric strength of deionized water when pulse stressed by a 'double resonance' transformer. The data provide evidence that the prestress conditions do not significantly affect the results. Additionally, it is suggested that the relationship for maximum stress as a function of time and electrode area can be applied for stress times of 5-10 microseconds. The transformer generator is discussed in some detail. The conclusion is drawn that this generator form could be a sensible choice in a pulse system using pressurized water dielectric. High dielectric strengths are now claimed for this treatment with effective stress times of tens of microseconds, a range which is compatible with the transformer pulse signature. 2 Refs.
Primary Keywords: Dielectric; Deionized Water; 'Double Resonance' Transformer; Prestress, Waveshape Dependence

8114
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)
(Target Interactions; Generation)
PRODUCTION OF DENSE THERMONUCLEAR PLASMAS BY INTENSE RELATIVISTIC ELECTRON BEAMS

F. Winterberg
University of Nevada System, Las Vegas, NV 89109
Proceedings Of The International School Of Physics 'Enrico Fermi' Course XLVIII (07/1969).
The author discusses various aspects of thermonuclear fusion. The necessary characteristics of the target and the relativistic electron beam which it is to be bombarded with are discussed. Generation of the electron beam and its interaction with the target are also examined. Conversion of the nuclear reaction into useful power, and the application of the process as a rocket propulsion system are considered. A method for producing an intense ion beam is briefly presented. 17 Refs.
Primary Keywords: Target Interaction; Collective Effects; Superconducting Ring Generator
Secondary Keywords: E-beam Fusion

8115
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
100-KPZ QUENCHING SPARKGAPS HAVE 1E12 A/S CURRENT RISE

W E. Austin
General Electric Co, Valley Forge, PA
Laser Focus, Vol. 11, No. 6, pp 79-80 (06/1975).
A sparkgap using perforated quenching electrodes is presented. The sparkgap will allow a rise of 1E12 A/sec with repetition rates up to 100 kHz at an energy of 0.22 joules per pulse. A schematic of a high repetition rate pulseforming network using the sparkgap is given. 1 Refs.
Primary Keywords: Quenching Spark Gap; Quenching Screen; Fast Current Rise; Repetrated; High Frequency; Low Energy Per Pulse

8116
(PULSE GENERATORS)
(Trigger)
A MAGNETIC-THYRISTOR GENERATOR PRODUCING HIGH-VOLTAGE NANOSECOND PULSES

A.N. Vorob'ev, V.M. Bogdanov, F.L. Gerchikov, V.G. Guk and A.A. Ushakov
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 17, No. 1, pp 110-111 (02/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 103-104 (January-February 1974)
A compact generator which produces powerful nanosecond pulses is described. The length of the pulses across the load of 200 to 300 ohm is 9 to 12 nsec for a duration of the leading edge equal to 4 to 5 nsec. The repetition frequency of the pulses is up to 1.0 kHz; the power in the pulse is <=25 kW; the amplitude of the pulse is <=2.5 kV. The generator weight is 120 g. 2 Refs.
Primary Keywords: Pulse Generator; Repetrated; 2.5 kV Output; 1 kHz Repetition Rate; Light Weight; Thyristor; Ferrite Peaking Line

8117
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Systems; LASS)
A LIGHT-CONTROLLED, HIGH-POWER PULSE SHAPER

V.G. Gladov and G.G. Kobiashvili
Soviet Journal Of Optical Technology, Vol. 39, No. 9, pp 578-579 (09/1972).
The authors present a design for a system which shapes pulses that can then turn on a high power thyristor. The system has a high noise immunity, and the frequencies it can handle depend primarily on the time constant of the photodetector. 0 Refs.
Primary Keywords: Radiation Detector; Pulse Amplifier; Thyristor Trigger

8118
(BREAKDOWN STUDIES)
(Gas, Electrical)
ARC MOTIONS DRIVEN BY MAGNETIC FIELD IN SULFUR HEXAFLUORIDE (SF_6) AND IN AIR

T. Susuki (1) and H. Oimachi (2)
(1) Toshiba Research and Development Center, Ukishima-cho, Kawasaki-ku, Kawasaki
(2) Toshiba High Power Lab, Ukishima-cho, Kawasaki-ku, Kawasaki
Japanese Journal Of Applied Physics, Vol. 14, No. 4, pp 487-493 (04/1975).
A magnetic field set up transverse to the field line was used to drive arcs in sulfur hexafluoride and in air. The arc motions were photographed using a high speed camera, and the arc speed was found to be faster in air than in sulfur hexafluoride. The arc moved relatively smoothly when copper electrodes were used, but arc spots could not be driven in the first stage when brass electrodes in sulfur hexafluoride were used. 10 Refs.
Primary Keywords: Magnetic Field Driven Arc Motion; Various Gases; Lightning Arresters, Copper Electrode; Brass Electrode

8119
(POWER CONDITIONING)
(Pulse Transformers)
EFFECT OF CORE CHARACTERISTICS ON PULSE-SHAPE DISTORTION BY A PULSE TRANSFORMER

S.S. Vdovin
Radioelectronics And Communications Systems, Vol. 22, No. 3, pp 96-97 (03/1979).
Trans. From: Izvestiya VUZ, Radioelektronika 22, 87-88 (1979)
Expressions are derived which relate the shape of the core to the pulse-shape distortion. The effect of the shape of the cross section of the core on the core volume, the rise time of the pulse, and the voltage drop of the transformed pulse is discussed. 1 Refs.
Primary Keywords: Core Characteristics; Minimum Volume; Short Rise Time, Design Considerations

8122
(ENERGY STORAGE, INDUCTIVE)
(Systems)
A PROPOSAL FOR THE CONSTRUCTION AND OPERATION OF AN INDUCTIVE STORE FOR 20 MEGAJOULES

E.K. Inall
Culham Lab, Abingdon, Oxfordshire, UK
Journal Of Physics E: Scientific Instruments, Vol. 5, pp 679-685 (07/1972).

A proposal for coupling 20 MJ of energy initially stored in the Canberra homopolar generator, to a load in about 1.0 ms is described. The energy is first transferred to a coaxial inductor at a peak current and voltage of 1.5 MA and 190 V respectively. The opening of a fast mechanical switch which is being developed transfers the energy from the inductor to the load, producing a voltage of 1000 V across the latter. The system is intended for use with high energy lasers. 10 Refs.

Primary Keywords: Homopolar Generator; Coaxial Inductor; Mechanical Switch; Low Voltage; High Current
Secondary Keywords: Flash Lamp Driver
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8123
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
KILOVOLTMETER MEASURES AC AND DC WITH OVER 1E16-OHM INPUT RESISTANCE

R.J. Gardner
University of Alberta, Edmonton, Alberta, Canada
Electronic Design, Vol. 27, No. 20, pp 90 (09/1979).

The circuit presented measures high AC or DC voltages under true no-load conditions. Capacitors are used instead of the conventional resistive divider which eliminates loading problems and simplifies different al measurement. 0 Refs.

Primary Keywords: Capacitive Voltage Divider; High Input Impedance; High Stability; DC Measurement Capability
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8124
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Gas Gaps, Optical; Gas, Optical)
NANOSECOND TRIGGERING OF AIR GAPS WITH INTENSE ULTRAVIOLET LIGHT

T.F. Godlove
Naval Research Lab, Washington, DC 20375
Journal Of Applied Physics, Vol. 32, No. 5, pp 1589-1596 (08/1961).

Measurements are presented of the breakdown time of a conventional two-electrode air gap. The applied voltage is maintained below the sparking threshold and breakdown is caused by the emission of a 6-nanosec burst of photoelectrons from the cathode, which produces space-charge distortion of the electric field. An auxiliary trigger spark provides the necessary light and results in cathode emission up to approximately 10 ma/sq.cm.. The dominant wavelength region is found to be approximately 1100 A because of the relatively low air absorption and high photoelectric yield in this region. For a fixed gap spacing and using the highest light intensity available, the time delay is typically found to decrease from approximately 5t/sub -/ to a minimum delay t/sub -/ as the main gap voltage is increased from approximately 8% below threshold up to threshold. The minimum delay ranges from 10-60 nanosec for the gap spacings studied and agrees with calculated values of gap spacing/electron drift ocity. The techniques developed have direct application to the triggering of conventional spark-gap switches and t pulsed light sources and may provide an additional tool for investigating some of the basic parameters of gaseous electronics. 15 Refs

Primary Keywords: Cathode Effects; Photoemission; Space Charge, Analysis, Overvoltage
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8125
(DIAGNOSTICS AND INSTRUMENTATION; DIAGNOSTICS AND INSTRUMENTATION)
(Current; Voltage)
OPTICAL METHODS FOR MEASUREMENT OF VOLTAGE AND CURRENT ON POWER SYSTEMS

A.J. Rogers
Central Electricity Research Labs, Leatherhead, Surrey, UK
Optics And Laser Technology, Vol. 9, No. 6, pp 273-283 (12/1977).

Methods of optically measuring voltage and current in high voltage systems are examined. The magneto-optic effect, the electro-optic effect, the piezo-optical effect, and the electrogyration effect are discussed. Free and enclosed path systems are considered along with the necessary detection and noise reduction techniques. 12 Refs.

Primary Keywords: Basic Principles; Electro-optic Effect; Magneto-optic Effect; Electrogyration Effect; Noise Reduction
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8126
(PARTICLE BEAMS, ION)
(Generation)
SERT II: DESIGN REQUIREMENTS FOR INTEGRATING ELECTRIC PROPULSION INTO A SPACECRAFT

R.J. Rulis
Lewis Research Center, Cleveland, OH
Journal Of Spacecraft And Rockets, Vol. 8, No. 3, pp 209-213 (03/1971).

Design requirements for SERT II (Space Electric Rocket Test), and the way they were implemented are presented. Discussed are mechanical thermal design considerations, electrical requirements, high-voltage handling methods, and thruster-power conditioner system requirements. Methods for testing the system just before launch are considered. 7 Refs.

Primary Keywords: Ion Thruster; Performance Test; Power Transmission
Secondary Keywords: Thermal Design; Mechanical Design
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8127
(POWER CONDITIONING)
(Transient Suppressors)
SIX WAYS TO CONTROL TRANSIENTS: VARISTOR, GAS-DISCHARGE AND RC SUPPRESSORS PROTECT CIRCUITS FROM DESTRUCTIVE SURGES

R.W. Fax
General Electric Co, Syracuse, NY 13201
Electronic Design, Vol. 11, pp 52-57 (05/1974).

Six different types of suppressors are given as possible devices for protecting circuits from high-voltage transients. Zener diodes, selenium devices, metal-oxide devices, silicon-carbide devices, gas-discharge (spark gap) devices, and resistor-capacitor networks are discussed. The devices are compared using their peak idle current, maximum current, peak power, effective clamping ratio, voltage range, and cost. 0 Refs.

Primary Keywords: Zener Diode; Selenium Rectifier; Metal-oxide Device; Silicon-carbide Device; Spark Gap; RC Network; Design Considerations
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8128
(PARTICLE BEAMS, ION)
(Generation)
COMPUTATIONAL STUDY OF MAGNETIC DAM EFFECTS IN A HIGH IMPEDANCE DIODE

R.J. Barker, S.A. Goldstein and A.T. Drobot
Naval Research Lab, Washington, DC 20375
NRL Report No. 4642 (10/1981).
Availability: AD A106154
NTIS

Computer simulations have been conducted to test the 'magnetic dam' concept as a means for boosting the overall ion efficiency of high impedance diodes. The 'dam' consists of a coil located immediately behind the anode foil containing a wire along its central axis which carries a current flowing in a direction opposite to that in the diode gap. The azimuthal magnetic field generated by the wire current, I/sub w/, reflects the electrons crossing the foil back into the A-K gap at higher radii where their space charge can enhance ion emission over relatively large areas. Significant increases in the ion current were observed for several values of I/sub w/ but a simultaneous increase in electron current prevented gains in overall ion efficiency. Instead, only decreased impedances were observed. The cause of this phenomenon is explained and solutions which could benefit a wide range of future diode designs are presented. 7 Refs.

Primary Keywords: 'Magnetic Dam' Diode; Numerical Calculation; Intense Ion Beam Generation; Magnetic Field Electron Reflection

8129
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
CONSTRUCTION AND EVALUATION OF A PROTOTYPE ELECTROMAGNETICALLY SHIELDED ROOM

M.A. Lassiter
Naval Civil Engineering Lab, Port Hueneme, CA
Technical Report No. R-454 (06/1966).
Availability: AD 636179
NTIS

An electromagnetically shielded room composed of 20-gage sheet-metal wall material with continuously soldered seams was constructed and evaluated at the Naval Civil Engineering Laboratory. The 20 x 20 x 8-foot room is a prototype model designed as a basis for determining specifications for the construction of large shielded room installations. Electromagnetic shielding evaluation of the room was performed in accordance with MIL STD-285, along with additional measurements at 1.0, 2.5, and 9.0 GHz. The lowest value of shielding effectiveness was 65 decibels at 14 kHz. Construction techniques for such design features as sheet-metal joints, soldered seams, power-line filtering, ventilation ducts, and cable raceways are discussed. Techniques for providing penetrations into the room for gas, water, and sewage were investigated. Measurements of the effect of small, controlled openings into the room were determined. The acoustic shielding properties of the room are also given in this report. 7 Refs.

Primary Keywords: Screen Room; Shielding Evaluation; Penetration Techniques; Line Filtering; Reliability

8130
(BREAKDOWN STUDIES)
(Gas, Electric..)
GAS BREAKDOWN CALCULATION: A COMPARATIVE STUDY

D.A. Klor
AFI., Wright-Patterson AFB, OH
GEP Report No. GEP/PH/76-7 (12/1976).
Availability: AD A034434
NTIS

An attempt is made to develop a simple yet accurate gas breakdown model which can be easily coupled to the hydrodynamic equations governing fluid flow in laser-target interactions. The accuracy of three relatively simple models is investigated. Each is compared with the more accurate and complex quantum kinetic model, to determine the conditions under which it maintains reasonable accuracy. A gas consisting of a single monatomic species is assumed and attention is restricted to the early portion of the electron cascade. A temperature model is found to agree reasonably well with the quantum kinetic model at values of incident laser flux greater than 5E9 W/sq.cm.. A diffusion model is found to yield similar results. A two-temperature model, which is derived in an attempt to extend the range of the temperature model to lower values of incident flux, is found to be invalid. 15 Refs.

Primary Keywords: Optical Breakdown; Air Breakdown; Threshold; Breakdown Modeling; Temperature Model; Two Temperature Model

8131
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
GUIDE FOR SHIELDED ENCLOSURE CONSTRUCTION PROBLEMS

Authors Unknown
Naval Civil Engineering Lab, Port Hueneme, CA
N Report No. N-877 (03/1967).
Availability: AD 831828
NTIS

This report touches on the important aspects of shielded room design. Shielding materials, door seals, and seams are discussed with recommendations given. Penetration of the shielding and power line filtering are shown to be important considerations needing attention from the outset. Long term reliability is addressed with typical problem areas identified and repair procedures presented. Test procedures are included. 8 Refs.

Primary Keywords: Shielded Room, Soldered Joint; Door Seal; Shielding Penetration; Line Filtering; Test Procedure

8132
INVESTIGATING THE LUMINESCENCE ORIGINATING DURING THE ELECTRIC FULMINATION OF THIN WIRES
M.P. Vanyukov and V.I. Isayenko
Report No. FTD-TT-62-77/1 (06/1962).
Trans. From: Zhurnal Tekhnicheskoy Fiziki 32, 197-201 (1962)
Availability: AD 286190
NTIS

With the aid of an electron-optical scanner was investiated the development of luminescence and cloud of fulmination products originating during the fulmination of wires. Established were certain laws governing the rate of expansion of the luminous channel and cloud of fulmination products, as well as the localization of the zone of luminescence. 10 Refs.

8134
(BREAKDOWN STUDIES)
(Surface Flashover)
THE RELATION BETWEEN THE CHARGE TRANSPORTED AND NUMBER OF PHOTONS EMITTED IN PARTIAL DISCHARGES ON DIELECTRIC SURFACES
J.S. Brzosko, J. Grudzinski, A. Korerzewski, E. Zukowski, W. Wojewodzka, W. Zukowski and J. Kunicki
Bielystok Div, Warsaw University, Bialystok, Poland
Journal Of Physics D: Applied Physics, Vol. 10, pp L155-L158 (05/1977).

Experiments are described in which two-dimensional measurements were taken of the relationship between charge transported and photons emitted during creep discharges. This relation was found to be linear, N=kQ, with k differing for positive and negative corona. The difference is thought to be due to the different average energy of the electrons in the discharge channel. 10 Refs.

Primary Keywords: Partial Discharge; Charge Transport; Light Emission; Creep Discharge
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8135
(POWER CONDITIONING)
(Pulse Transformers)
MEGAMPERE PULSE TRANSFORMER FOR COAXIAL LOAD
W.H. Clark and J.E. Myrberg
Utah Research and Development Co., Inc., Salt Lake City, Utah 84106
The Review Of Scientific Instruments, Vol. 37, No. 7, pp 883-885 (07/1966).

A transformer is described which delivers 2 MA into a low impedance load through a coaxial output line of about 6.35 mm inner conductor diameter and 12.7 mm cavity diameter. The transformer primary is connected to a 20 microfarad, 50 kV capacitor bank by forty-eight flexible coaxial cables. The ringing frequency of the system with the secondary shorted is 70 kc. 0 Refs.

Primary Keywords: Step Down Transformer; Pulse Transformer; 2 MA Current
Secondary Keywords: Plasma Gun
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8136
(BREAKDOWN STUDIES)
(Gas, Electrical)
DIELECTRIC BEHAVIOR OF SOME FLUOROGASES AND THEIR MIXTURES WITH NITROGEN
G. Camilli, T.W. Liao and R.E. Plump
General Electric Co, Pittsfield, MA 01201
Electrical Engineering, Vol. 74, No. 7, pp 580-584 (07/1955).

The authors present data on several fluorogases and flourogas-nitrogen mixtures in this paper. The breakdown voltage and corona threshold voltage for the gases and mixture are tabulated for AC, DC, and impulse voltages as a function of gas pressure and electrode spacing. Both uniform and nonuniform fields are considered using parallel-plane and rod-plane gaps. Correlations are made between gas molecular weight and breakdown voltage. Comparisons with air and sulfurhexaflourides are shown. 15 Refs.

Primary Keywords: Flourocarbon; Dielectric Strength; AC Voltage; DC Voltage; Impulse Voltage; Corona Test; Comparison With Sulfurhexafluoride
COPYRIGHT: 1955 AIEE

8137
(BREAKDOWN STUDIES)
(Gas, Electrical)
EXPANSION OF INITIAL HIGH-CURRENT SPARK CHANNELS
C.C. Gallagher and H. Fischer
AFCRL, Bedford, MA 01730
Applied Optics, Vol. 4, No. 9, pp 1151-1154 (09/1965).

The paper describes experiments in which a gated Kerr cell, with exposure times of 2-8 nsec, is used to observe the expansion in air of spark channels. The sparks are triggered by a 50 nsec, 7 kv pulse resulting in a time jitter of less than a nanosecond. A current rise of 2E12 A/sec is observed along with a maximum expansion velocity of 1.6E6 cm/sec 2.6 nsec into the breakdown. 9 Refs.

Primary Keywords: Spark Channel Expansion; Several Gases; Erosion Cloud; Light Emission Measurement
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8138
(BREAKDOWN STUDIES)
(Solid, Optical)
LASER-INDUCED ELECTRON EMISSION FROM SOLIDS: MANY-PHOTON PHOTOELECTRIC EFFECTS AND THERMIONIC EMISSION
E.M. Logothetis and P.L. Hartman
Cornell University, Ithica, NY 14850
Physical Review, Vol. 187, No. 2, pp 460-474 (11/1969).

The intensity dependence and energy distribution of laser-induced electron emissions were measured. The results are analysed in terms of multiphoton ionization and thermionic emission. The materials used were Au, stainless steel, CsI, KI, and KCl. Two-photon photoelectric spectroscopy was performed in CsI and KCl, and the spectrum obtained is discussed. 36 Refs.

Primary Keywords: Photoelectric Emission; Laser Induced Breakdown; Multi-photon Effects; Experiment; Theory
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8139
(PULSE GENERATORS; DIAGNOSTICS AND INSTRUMENTATION)
(Line Type, Voltage)
PRODUCTION AND MEASUREMENT OF ULTRA-HIGH SPEED IMPULSES
R.C. Fletcher
Massachusetts Institute of Technology, Cambridge, MA
The Review Of Scientific Instruments, Vol. 20, No. 12, pp 861-869 (12/1949).

The capabilities and limitations of several impulse generators and voltage dividers, and a micro-oscillograph sweep circuit for dealing with kilovolt impulses in the millimicrosecond range, are described. The most successful combination produces and measures an impulse of a rise time equal to 4E-10 sec. 4 Refs.

Primary Keywords: Transmission Line; Pulse Generator; Three Gap Spark Gap; Voltage Divider; 20 kV Voltage; Subnanosecond Rise Time
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8140
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
STEP RESPONSE OF MEASURING SYSTEMS FOR HIGH IMPULSE VOLTAGES
F.C. Creed (1), G. Newi (1) and T. Kawamura (2)
(1) National Research Council, Ottawa, Ontario, Canada
(2) University of Tokyo, Institute Of Industrial Science, Tokyo, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-86, No. 11, pp 1408-1420 (11/1967).

The generalized impulse voltage measuring system is analyzed as a complete entity using the step response approach. The analysis shows that the response time of the system is not determined correctly by conventional methods and a new method is presented. Revisions to the conventional methods are proposed which will enable the true response time of the system to be determined. Five separate measuring systems are investigated experimentally using both techniques and the predicted and measured values of the conventionally measured response time are shown to be in very good agreement. As a result of the investigation, certain specific suggestions are made for revisions to existing standards for this type of measurement. 6 Refs.

Primary Keywords: Calibration; Probe Characterization; Step Response; Predicted Response; Good Agreement
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8141
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A HIGH-IMPEDANCE, NANOSECOND RISE TIME PROBE FOR MEASURING HIGH-VOLTAGE IMPULSES
G. Newi
National Research Council, Ottawa, Ontario, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-87, No. 9, pp 1780-1786 (09/1968).

Normal voltage dividers for high-voltage impulses are connected to the test object by an open air line which, when considered as part of the measuring system, gives an initially low input impedance to that measuring system due to the characteristic impedance of the line. This initially low impedance has been overcome by building a divider which can be used as an attenuator probe connected directly to the point on the test object at which the voltage is to be measured. By having the probe at a distance from the ground plane, the input capacitance can be kept low thus allowing the probe to have a shorter rise time. Examples of results are given. 6 Refs.

Primary Keywords: Resistive Voltage Divider; Direct Connection To Test Point; Small Input Capacitance; Analysis
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8143
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
A CURRENT TRANSFORMER FOR LOW LEVEL MICROSECOND PULSES
W.J. Sarjeant and E. Beannen
University of Western Ontario, London, Ontario, Canada
The Review Of Scientific Instruments, Vol. 41, No. 5, pp 775-776 (05/1970)

This note describes the design and operating characteristics of two large aperture (18 and 65 mm) current transformers. The small aperture unit was constructed with a Philips K-300-500 toroidal core. A single turn of enameled wire was first wound around the periphery of the toroid and held in place by a wrapping of 3 mm wide masking tape. The 55-turn main winding was then close wound on by hand with each turn [illegible] through the center aperture of the toroid, continuing [illegible] around the core. For external magnetic fields, the main winding looks like a single turn. By connecting the single turn first wound around the periphery of the toroid in series opposing to the main winding, effectively no net flux due to external fields is coupled to the circuit. 1 Refs.

Primary Keywords: Current Transformer; Fast Rise; Sub-ampere Current
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8144
(DIAGNOSTICS AND INSTRUMENTATION)
(B-field)
A SUBNANOSECOND RISETIME FLUXMETER
D.G. Pellinen
Physic International Co, San Leandro, CA 94577
The Review Of Scientific Instruments, Vol. 42, No. 5, pp 667-670 (05/1971)

A self-integrating search coil with a rise time of approximately 0.4 nsec has been developed for measuring kilogauss magnetic fields in adverse environments. A coaxial calibration fixture with a field rise time of 0.85 nsec was built to calibrate the fluxmeters. 10 Refs

Primary Keywords: Fluxmeter; Kilogauss Fields; Half-nanosecond Rise Time; Self Integrating
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8146
(ENERGY STORAGE, INDUCTIVE)
(Systems)
ADVANCED CONCEPTS FOR PHOTON SOURCES VOLUME 2: FAST SWITCHING OF VACUUM MAGNETIC ENERGY STORES
V. Bailey, L. Demeter, J. Benford, A. Hoeth and D. Sloan
Physic International Co, San Leandro, CA 94577
DNA Report No. DNA 3680F-2 (10/1973).
Availability: AD A015386
NTIS
Inductive (magnetic) energy storage systems are analyzed in terms of their application to generation of ultra-high power pulses. Such systems can transform low-power energy inputs into high-power outputs (power multiplication) by shortening the energy delivery time. Energy transfer from magnetic store to resistive load can approach 100 percent efficiency. Models of several accelerated metallic plasma transfer switch geometries indicate that such switches can be energetically efficient and can produce substantial voltage multiplications. Using a versatile and extensively diagnosed apparatus, experiments were conducted to test these predictions. The experiments confirmed the modeling and established design criteria for metallic wire plasma switches. Operating at 25 kV energy level, a coaxial switch produced narrow (60 to 300 nsec) voltage spikes with voltage and power multiplications of 3. 8 Refs.
Primary Keywords: Magnetic Energy Stores; Fast Switching; Power Multiplication; Power Pulse Compression; Vacuum Switch; Metallic Plasma Switch

8149
(INSULATION, MATERIAL; BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Reviews; Gas, Electrical; Gas Gaps, Electrical)
HIGH VOLTAGE INSULATION OF LINES AND EQUIPMENT
M.K. Kalinina
FTD Report No. FTD-MC-23-749-71 (09/1971).
Trans. From: Leningrad. Polytechnic Institute. Transactions, 258, 3-9, 61-78, 88-105, 116-117, 132-137, 161-171 (1965)
Availability: AD 734055
NTIS
This report includes nine selected papers on insulation testing, pulse generators, and switching. The first article describes a 2.2 MV pulse generator. Due to space limitations, the authors chose a stacked Marx generator. The design philosophy and testing are presented. The next five papers concern the theory and operation of spark gaps. Low power simulation of high power operation, arc quenching, parallel operation, and jitter studies are included. The last three papers are devoted to insulation of high voltages. Breakdown of liquid and solid insulations are included. 56 Refs.
Primary Keywords: Marx Generator; Ceramic Capacitor; High Power Switch; Simulation; Arc Extinction; SF/sub 6/ Gas; Dielectric Strength; Insulation Breakdown; Insulation Polarization

8151
(PULSE GENERATORS)
(Current)
CURRENT PULSE GENERATOR
G.L. Chakhlov
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 21, No. 2, pp 398-400 (04/1978).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 123-125 (March-April 1978)
A new scheme for a current pulse generator with a combined 'coil-capacitance' is discussed. The operation is analyzed in terms of an equivalent circuit. The efficiency of the generator is tested on a model made from sections of a pulsed capacitor of 40 microfarad and 800 V at a frequency of 400 Hz and a maximum current of 80 A. 3 Refs.
Primary Keywords: 'Coil Capacitance'; Equivalent Circuit; Analysis; Model Test; Rep-rated
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8153
(BREAKDOWN STUDIES)
(Gas, Electrical)
NANOSECOND PULSE BREAKDOWN IN GASES
P. Felsenthal and J.M. Proud
Space Sciences Inc, Waltham, Mass
Physical Review, Vol. 139, No. 6A, pp A1796-A1804 (08/1965).
A theory describing the formative period of breakdown in gases following the sudden application of a DC electric field has been developed and applied to the design of experiments to measure lag times in nine gases. It is shown analytically that under certain conditions pulsed-DC and pulsed-microwave breakdown are directly comparable. A pulsed-DC experimental system is described which permits measurements of the formative period over a wide range of applied field, gas pressure, and gap space. For those gases where sufficient basic data are available, theoretical and experimental results are in good agreement. 13 Refs.
Primary Keywords: Gas Breakdown, Nine Gases; Formative Time Lag; Step Voltage Breakdown; Microwave Breakdown; Theory; Experiment; Comparison Of Results
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8154
(BREAKDOWN STUDIES)
(Exploding Wires)
OBSERVATION OF A CORE IN AN EXPLODED LITHIUM WIRE PLASMA BY REFLECTION OF LASER LIGHT
T.A. Leonard
University of Michigan, Ann Arbor, MI
Journal Of Applied Physics, Vol. 44, No. 3, pp 1380-1381 (03/1973).
A thin lithium wire which was extruded and exploded in vacuo was probed with a Q-switched ruby laser. Strong reflections of the ruby laser light were observed from a 'core' in the plasma when the pressure was greater than 5E-4 Torr. Changes in the plasma and discharge properties near this pressure suggested the possibility of a core of unvaporized wire due to current shunting through the surrounding air. The presence of this core was unexpected because of the relatively large discharge current and small wire diameter. When the pressure was below 5E-4 Torr a 'core' was never observed and there was no evidence of current shunting. 9 Refs.
Primary Keywords: Exploding Wire; Lithium Wire; Vacuum Environment; Ruby Laser Diagnostic; High Density Plasma 'Core'
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8155
(PARTICLE BEAMS, ELECTRON; BREAKDOWN STUDIES)
(Generation; Electrodes)
ON THE THEORY OF FIELD EMISSION FROM METALS
F.I. Itskovich
Khar'kov Military Engineering College
Soviet Physics JETP, Vol. 23, No. 5, pp 945-953 (11/1966).
Trans. From: Zhurnal Eksperimental'noi I Teoreticheskoi Fiziki 50, 1425-1437 (May 1966)
Field emission from a metal single crystal is investigated for an arbitrary electron dispersion law. If the Fermi surface is intersected by an axis p/sub z/ perpendicular to the emitting surface of the sample, the free electron theory formula for the field emission current remains valid except for the pre-exponential factor. Otherwise the conservation of the tangential quasimomentum of an electron emitted from the metal leads to the results that the work function W in the exponential must be replaced by a larger quantity W. The distance between the Fermi surface and the p/sub z/ axis can be estimated from the difference W - W, which thus yields definite information concerning the electron spectrum of the metal. 5 Refs
Primary Keywords: Field Emission; Metal Crystal; Fermi Surface; Free Electron Theory; Electron Energy Spectrum
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8157
(BREAKDOWN STUDIES)
(Gas, Electrical)
PULSED HIGH-PRESSURE ARC IN HELIUM AND HYDROGEN
Yu R. Knyazev, E.S. Borovik, R.V. Mitin and V.I. Petrenko
Soviet Physics-Technical Physics, Vol. 12, No. 3, pp 374-380 (09/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 521-532 (March 1967)
This paper gives the results of an investigation of a pulsed high-pressure arc in helium and hydrogen at pressures up to 665 Nm/sup 2/ and currents up to 40 kA. The pulsed arc is produced by the discharge of a capacitor bank through a long, DC, high-pressure arc, or through a thin wire. The results of electrical and spectral investigations and of measurements of the visible brightness of the steady and pulsed arcs are given. Photographs of steady and pulsed arcs obtained by means of a camera obscura are also shown. 5 Refs.
Primary Keywords: Steady Arc; Pulsed Arc; High-pressure Arc; Capacitor Banks; DC Arc; Thin Wire
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8160
(BREAKDOWN STUDIES)
(Gas, Electrical)
SPARKING POTENTIALS OF SATURATED HYDROCARBON GASES
J.S. Mirza, C.W. Smith and J.H. Calderwood
University of Salford, Salford, UK
Journal Of Physics D: Applied Physics, Vol. 4, No. 8, pp 1126-1133 (08/1971).
The Paschen curves of sparking potential as a function of the pressure - gap length product (pd) are given for normal pentane, hexane, heptane, octane and decane. The measurements of sparking potential have been made from a pd of about 30 Torr cm through the minimum sparking potential, about 1 Torr cm, to approximately 3E-3 Torr cm. A previous empirical equation giving the sparking potential for values of pd greater than minimum sparking potential has been modified by the addition of two constants and an extra term, so that it now fits the Paschen curves for the whole of the extended range of the measurements while retaining the constants introduced by previous workers. Values of the constants are tabulated for the hydrocarbons listed above and a detailed comparison between the sparking potentials calculated from the equation and experimental results is given for n-octane. 9 Refs.
Primary Keywords: Hydrocarbon Gas; Several Gases; Paschen Curve; Emperical Equation
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8161
(BREAKDOWN STUDIES)
(Exploding Wires)
THE BEHAVIOR OF INPUT-POWER DENSITY IN EXPLODING-WIRE RESTRIKES
A.E. Vlastos
Royal Institute of Technology, Stockholm, Sweden
Journal Of Applied Physics, Vol. 43, No. 4, pp 1985-1987 (04/1972).
The input power per unit volume of the restrike channel of thin exploding wires reaches its maximum slightly before the electrical conductivity has reached its maximum. In its turn, the electrical conductivity reaches its maximum before the current and the total power input. dI/dt and dV/dt have reached their maxima but slightly after the ledge observed on the voltage oscillograms. The reason why the input power per unit volume and the electrical conductivity reach their maxima much earlier than the current and the total power input seems to be closely connected with the magnetogasdynamics of the restrike channel, which have not yet been satisfactorily treated because of the complexity of the problem. 5 Refs.
Primary Keywords: Exploding Wire; Current Pause; Current Restrike; Input Power; Plasma Conductivity; Magnetogasdynamics
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8164
(BREAKDOWN STUDIES)
(Liquid, Electrical)
THEORY OF BREAKDOWN OF THIN LIQUID DIELECTRIC LAYERS
G.S. Kuchinskii
Soviet Physics-Technical Physics, Vol. 11, No. 7, pp 966-969 (01/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 1297-1304 (July 1966)
The breakdown of thin liquid dielectric layers (thickness of the order of 1E-3 cm) is of considerable significance in the treatment of partial discharges initiated in layers of insulating material (e.g., paper impregnated with a dielectric fluid). In this case the initial partial discharges are struck in layers of the impregnating compounds between layers of the solid insulator in the normal technological practice of drying and impregnation. This paper discusses the theory of breakdown in thin layers of liquid dielectric, using mineral oil as an example. 12 Refs.
Primary Keywords: Liquid Breakdown; Thin Layer; Partial Discharge; Insulation Breakdown; Townsend Coefficient Measurement
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8165
(BREAKDOWN STUDIES)
(Solid, Electrical)
TIME LAGS IN THE ELECTRICAL BREAKDOWN OF GLASS IMMERSED IN WATER
M.N. Azom and H. Dickinson
University College of Swansea, Singleton Park, Swansea, Wales
British Journal Of Applied Physics, Vol. 12, pp 419-420 (08/1961).
When measuring the electric breakdown strength of cover glass immersed in deionized water, time lags to breakdown were observed. The mean statistical time lag was (12 +or- 1) microsec. The breakdown strength between spherical electrodes was found to be (11.4 +or- 1) x 1E6 V/cm. 8 Refs.
Primary Keywords: Cover Glass Breakdown; Water Insulation; Sphere Electrodes; Delay Measurement

8166
(PULSE GENERATORS; POWER CONDITIONING)
(Capacitive; Nonlinear Resistors)
TIME-DEPENDENT CRITICAL DAMPING OF A CAPACITOR-DISCHARGE CIRCUIT
H. Piller, P.C. Archibald and J.H. Johnson
Naval Weapons Center, China Lake, CA 93555
Journal Of Applied Physics, Vol. 42, No. 12, pp 4899-4901 (11/1971).
Optimal design of a heat-sensitive variable resistor in the circuit of a pulsed capacitor discharge provides a physically simple method of damping without the ringing currents which may shorten capacitor life. Computer simulation is utilized to determine the optimum design parameters and materials of the variable resistor. 3 Refs.
Primary Keywords: Pulse Generator; Spark Gap; Ringing Circuit; Capacitor Damage; Nonlinear Damping Resistor

8167
(BREAKDOWN STUDIES)
(Liquid, Electrical)
USE OF THE DIMENSIONAL AND SIMILARITY METHODS IN INVESTIGATING PULSE DISCHARGE IN WATER
I.Z. Okun
Soviet Physics-Technical Physics, Vol. 12, No. 9, pp 1267-1273 (03/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1729-1738 (September 1967)
The present article is concerned with the discharge of a storage capacitor across the discharge gap in water. By using the dimensional and similarity methods and some other considerations, we shall derive the relationships determining the amplitude of cylindrical compression waves in a liquid and the portion of the energy released in the channel that is transformed into the energy of the cylindrical compression wave. Similarity criteria which make it possible to simulate pulse discharge in the same liquid were obtained. The similarity relationships were checked experimentally. We also derived crit[illegible]s which secured the similarity of only the electric char[illegible]teristics of discharge. The discharge channel shape was stabilized (straightened) by means of a thin wire (Nichrome, d = 0.03 mm). 6 Refs.
Primary Keywords: Water Gap; Numerical Calculation; Simulation; Cylindrical Geometry; Compression Wave; Theory; Experiment; Discharge Stabilization

8169
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
VACUUM BREAKDOWN WITH NANOSECOND PULSES
M.V. Belkin and E.A. Avilov
Soviet Physics-Technical Physics, Vol. 15, No. 8, pp 1339-1340 (02/1971).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 40, 1723-1724 (August 1970)
The time response of 1-2 mm long vacuum gaps to the application of 20[illegible] nanosecond pulses is studied. It is found that an increase of the pulse factor from 1.5 to 3.2 reduces the decay time of the voltage pulse across the gap from 55 to 5 nsec. 7 Refs.
Primary Keywords: Vacuum Gap; Millimeter Gap; Hemisphere-plane Gap; Disc-plane Gap; Voltage Fall

8170
(PULSE GENERATORS; PULSE GENERATORS)
(LC; Systems)
VOLTAGE-MULTIPLICATION OF STEEP PULSES
G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 6, pp 1097-1100 (12/1963).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 95-97 (November-December 1963)
It is shown that if LC networks are connected in series through spark discharge gaps DG, and if the capacitance and inductance of each subsequent loop are lower than those of the previous one by one order of magnitude approximately, a voltage U/sub n/ = 2/sup n/U/sub 0/ may be obtained across the capacitor C/sub n/, U/sub 0/ being the input voltage. The influence of the internal loop-resistances and of the capacitance-inductance ratio of adjacent loops upon the value of U/sub n/ is calculated. The obtained expressions are verified by experiment. 3 Refs.
Primary Keywords: LC Generator; Series Connection; Voltage Multiplication; 10 ns Rise Time; Design Considerations; Experimental Verification

8171
(BREAKDOWN STUDIES)
(Gas, Electrical)
FAST ELECTRONS AND X-RAY RADIATION DURING THE INITIAL STAGE OF GROWTH OF A PULSED SPARK DISCHARGE IN AIR
Yu.L. Stankevich and V.G. Kalinin
Soviet Physics-Doklady, Vol. 12, No. 11, pp 1062-1063 (05/1968).
Trans. From: Doklady Akademii Nauk SSSR 177, 72-73 (November 1967)
In order to explain the mechanism of formation of a spark discharge in gases at high pressure, it is necessary to consider the energy of avalanche electrons during the initial stage of the discharge. It has been shown that for voltages close to the static breakdown value the kinetic energy of electrons in isolated avalanches does not exceed several electron volts. However, when the avalanche grows into a streamer the field in the vicinity of the avalanche should increase by several times. When this occurs, an electron during each free path can acquire more energy than is required to compensate the losses during elastic collisions, excitation, and ionization. Under these circumstances the electron is continually accelerated and in some instances can acquire an energy comparable to the applied voltage. 3 Refs.
Primary Keywords: Avalanche Breakdown; Streamer Formation; Bremsstrahlung Radiation; Electrode Material Effect

8172
(REVIEWS AND CONFERENCES; ENERGY STORAGE, INDUCTIVE, CIRCUIT CALCULATIONS)
(Reviews; Inductors; Inductance)
INDUCTANCE CALCULATIONS: WORKING FORMULAS AND TABLES
F.W. Grover
Union College
Publisher: Genera. Publishing Company Ltd. (01/1946).
This book is a treatise on inductance calculation and inductor design. The author begins with a short discussion of the basic theory of inductance and proceeds to present general and specific calculations for several coil designs. Geometry considerations, such as calculation of mean distances between wires of various cross sections and corrections for large cross section wires, are considered in some detail. Compact working formulas for several common coil configurations are presented along with examples of their use. The effect of high frequencies on coil performance is discussed. 119 Refs.
Primary Keywords: Inductance Calculations; Basic Theory; Working Formulas; Several Coil Configurations; Geometry Considerations; High Frequency Corrections

8173
(REVIEWS AND CONFERENCES)
(Reviews)
AN INTRODUCTION TO HIGH-VOLTAGE EXPERIMENTAL TECHNIQUE
D. Kind
Technische Universitat Braunschweig, Braunschweig, FRG
Publisher: Friedr. Vieweg & Sohn Verlagsgeselischaft mbH, Braunschweig (01/1978).
The fundamentals of high voltage technique should be studied not only by someone entering the field of high voltage engineering, but should be reviewed periodically by everyone that utilizes high voltages. This book provides an introduction to the basics of high voltage AC, DC, and impulse voltage generation and measurement; nondestructive testing; safety; and laboratory organization consistent with the principles discussed. The book includes several safe and simple experiments to familiarize novices with high voltage technique. Rigorous mathematics are not included so that the student need not have an advanced education to benefit from the information included. 126 Refs.
Primary Keywords: Review; AC Voltage; DC Voltage; Impulse Voltage; Generation; Measurement; Safety; Laboratory Layout; Example Experiments

8174
(REVIEWS AND CONFERENCES; BREAKDOWN STUDIES)
(Reviews; Reviews)
ELECTRICAL BREAKDOWN OF GASES
J.M. Meek Ed. and J.D. Craggs Ed.
University of Liverpool, Liverpool, UK
Publisher: John Wiley & Sons (01/1978).
Electrical breakdown is a very complex phenomenon that is very difficult to treat comprehensively. This book does just that, however, edited by J.M. Meek and J.D. Craggs, the book includes seven chapters on fundamentals of breakdown, vacuum breakdown, spark breakdown in uniform and nonuniform fields, corona, effect of radiation and laser initiated breakdown, RF breakdown, time delay and voltage fall, and electrode effects. Each chapter is written by an expert in the field and is both complete and accurate. Each chapter also contains many useful references for a more detailed treatment. 1956 Refs.
Primary Keywords: Electrical Breakdown; Fundamental Process; Vacuum Breakdown; Spark Breakdown; Uniform Field; Nonuniform Field; Corona; Voltage Fall; Time Lag; Radiation; Laser Breakdown; RF Breakdown; Channel Characteristics

8175
(BREAKDOWN STUDIES)
(Gas, Electrical)
PULSED ARC IN ARGON AT PRESSURES UP TO 1E8 N/M/SUP 2/ (1000 ATM)
F.S. Borovik, V.P. Kantsedal, Yu.R. Knyazev, R.V. Mitin and V.I. Petrenko
Soviet Physics-Technical Physics, Vol. 12, No. 4, pp 502-506 (10/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 703-709 (April 1967)
This paper describes an apparatus which can be used to investigate pulsed arcs in argon at pressures up to 1E8 N/m/sup 2/, currents up to 50 kA, and pulse lengths of approximately 1E-3 sec. The high pressure is obtained by the evaporation of liquefied argon in a closed space. The parameters of the plasma formed in the discharge are: charged particle density up to approximately 4E19 cm/sup -3/, temperature approximately 1E4 Deg.K, and degree of ionization almost unity. Radiation absorption processes are shown to play a significant role in such a plasma. 7 Refs.
Primary Keywords: Pulsed Arc; Very High Pressure; Argon Gas; Very High Plasma Density; Low Temperature; High Ionization

8176
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
CATHODE EMISSION MECHANISM IN AN ARC DISCHARGE
V.I. Rakhovskii
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 10, No. 12, pp 1707-1709 (06/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 2228-2231 (December 1965)
The theory of the vapor cathode was first proposed by Slepian about forty years ago. The idea of using a vapor cathode was subsequently proposed by Rothstein, who suggested an entirely new concept of the possibility of metal-type conductance in the cathode vapor cloud due to a high concentration of neutral particles in that region. A reappraisal of Rothstein's ideas in the light of new developments is the object of this article. At the present time the emission processes in cathodes made from materials with high vapor pressure and low melting and boiling points (Hg, Ag, Cu) are attributed to field emission. It is assumed that the electron emission occurs at the metal surface in an extremely large (approximately 1E7 - 1E8 V/cm) electric field; this field is generated by the ion space charge at the surface which causes the field emission. 14 Refs.
Primary Keywords: Vacuum Breakdown; Vapor Virtual Cathode; Ion Impact; Cathode Heating; Hot Spots; Field Emission

8177
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Materials; Liquid Gaps, Materials)
DESTRUCTION OF ELECTRODES BY ELECTRIC DISCHARGES OF HIGH CURRENT DENSITY
V.E. Il'in and S.V. Lebedev
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 7, No. 8, pp 717-721 (02/1963).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 32, 986-992 (August 1962)
A possible mechanism for the erosion of electrons is considered on the basis of an assumption as to the decisive role of Joule heat. It is shown that, for a current density on the electrode surface j < 1E6 A/sq.cm., the Joule model correctly describes the qualitative aspects of the fundamental characteristics of the erosion. 29 Refs.
Primary Keywords: Electrode Erosion; Anode Erosion; Cathode Erosion; Electrode Heating Model; Air Gap; Kerosene Gap

8178
(BREAKDOWN STUDIES)
(Electrodes)
DETERMINATION OF THE ELECTRIC FIELD ENHANCEMENT FACTOR AND CRATER DIMENSIONS IN ALUMINUM FROM SCANNING ELECTRON MICROGRAPHS
R. Hackam
University of Sheffield, Sheffield, UK
Journal Of Applied Physics, Vol. 45, No. 1, pp 114-118 (01/1974).
An electron stereoscan microscope is used to examine the surfaces of an aluminum cathode and an aluminum anode which have been subjected to repeated sparkings, under an ultrahigh vacuum (1E-9 Torr), at voltages of up to 45 kV. The cathode surface is observed to contain large numbers of protrusions which give rise to an enhanced local electric field at the tip of the protrusions. The field enhancement factor, Beta, at the microprojections is determined from the scanning electron micrographs. The values of Beta are in reasonable agreement with those obtained from the Fowler-Nordheim theory when applied to the current-voltage measurements in the region prior to breakdown. The anode surface is completely devoid of protrusions and contains large numbers of craters. The diameters and depths of typical craters are also determined. 41 Refs.
Primary Keywords: Vacuum Breakdown; Aluminum Electrodes; Cathode Microprojections; Anode Craters; Field Enhancement Factor; Fowler-Nordheim Theory

8179
(BREAKDOWN STUDIES)
(Electrodes)
EFFECT OF ELECTRODE ROUGHNESS OF BREAKDOWN VOLTAGE
V.A. Avrutskii
Moscow Power Engineering Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 18, No. 3, pp 389-393 (09/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 191-1920 (October 1967)
Experimental data are given on the electrical strength and statistical scatter in the breakdown voltages for gaps with electrodes with rough surfaces for air pressures of 1-5 atm (absolute). The surface state is checked before each series of strength measurements. The experimental results are compared with theory using expressions that allow for the effect of irregularities of the cathode surface on the electrical strength of the gap. Expressions are derived for the breakdown probability distribution as a function of voltage; these are in good agreement with the experimental statistical characteristics. 7 Refs.
Primary Keywords: Cathode Microprojections; Field Enhancement; Several Discharges; Breakdown Voltage Scatter; Experiment; Comparison With Theory

8180
(BREAKDOWN STUDIES)
(Electrodes)
EFFECT OF ELECTRODE ROUGHNESS ON THE ELECTRICAL STRENGTH OF COMPRESSED GASES
V.A. Avrutskii, G.M. Goncharenko and F.N. Prokhorov
Moscow Power Engineering Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol 18, No 3, pp 386-388 (09/1973).
Trans From: Zhurnal Tekhnicheskoi Fiziki 43, 615-619 (March 1973)
Using the Townsend mechanism, the effect of impact ionization processes on the electrical strength of compressed gases is studied in the strong field of electrode surface microirregularities. A self-maintained discharge condition is derived for the case in which the microprojections of the surface are shaped like a prolate semiellipsoid of revolution. Good agreement between the calculations and the known experimental data is obtained for air, nitrogen, and hydrogen if the height of the microprojections used in the calculations is 1E-3 - 1E-4 cm. 14 Refs.
Primary Keywords: Cathode Microprojections; Field Enhancement, Theory Prolate Semiellipsoid Of Revolution; Numerical Calculation; Comparison With Experiment

8181
(BREAKDOWN STUDIES)
(Gas, Electrical)
ELECTRICAL BREAKDOWN IN CSF/SUB 8/
R. Gebalie and F.S. Linn
University of Washington, Seattle, WA
Journal Of Applied Physics, Vol. 21, No. 1, pp 592-594 (01/1950).
The breakdown potential of a new gas, CSF/sub 8/, has been measured over the range from p x delta = 4 to 200 mm x cm under conditions approximating plane parallel geometry. A comparison of breakdown in air Freon 12 and CSF/sub 8/ in the same apparatus indicates the ratio of the strengths of these gases to be approximately 1:2:3, respectively. CSF/sub 8/ decomposes rapidly during breakdown into CF/sub 4/ and SF/sub 4/ with a consequent doubling of pressure and appreciable increase in breakdown potential. 12 Refs.
Primary Keywords: CSF/sub 8/ Gas Breakdown; Parallel-plane Electrodes; Freon; Air; Comparison; Decomposition Products

8182
(SWITCHES, CLOSING; ELECTROMAGNETIC LAUNCHERS)
(Vacuum Gaps, Materials; Railguns, Materials)
ELECTRODE EROSION IN SPARK DISCHARGES
D.J. Vargo and F.L. Taylor
Lewis Research Center, Cleveland, OH
Journal Of Applied Physics, Vol. 33, No. 9, pp 2911-2912 (09/1962).
Performance of rail-type plasma accelerators may be strongly affected if electrode erosion processes add mass to the moving plasma. The dependence of the erosion rate on the characteristics of the discharge has not been clearly defined in previously published data. Therefore, in the study of a zero length plasma accelerator, an attempt was made to determine the electrode erosion characteristics of capacitor discharge systems in high vacua (3 to 5E-6 mm Hg). 3 Refs.
Primary Keywords: Plasma Accelerator; Rail Gun; Electrode Erosion; Vacuum Discharge; Dependence On Waveform

8183
(BREAKDOWN STUDIES)
(Exploding Wires)
EXPERIMENTAL STUDY OF ELECTRICAL EXPLOSION
B.P. Peregud and K.B. Abramova
Soviet Physics-Doklady, Vol. 9, No. 8, pp 665-668 (02/1965).
Trans. From: Doklady Akademii Nauk SSSR 157, 837-840 (August 1964)
The first paper devoted to a study of electrical explosion of fine metal wires and foils dates from the year 1774. Although a number of papers have been published on the question, electrical explosion has still not been investigated to a sufficient extent. A study has been made of electrical explosion of copper wires at the A.F. Ioffe Physicotechnical Institute, AN SSSR. Most attention was given in this work to the energy side of the matter and to the accompanying radiation process. The most important results of this study are given in the present paper. 6 Refs.
Primary Keywords: Exploding Wire; Threshold; Wire Voltage; Wire Current; Photographic Diagnostic; Comparison With Black Body Radiation

8184
(SWITCHES, OPENING)
(Explosive Fuses)
EXPLODING FOIL DEVICES FOR SHAPING MEGAMP CURRENT PULSES
R. Bealing and P.G. Carpenter
Atomic Weapons Research Establishment, Aldermaston, Berkshire, UK
Journal Of Physics E; Scientific Instruments, Vol. 5, pp 889-892 (09/1972).
High speed condenser banks provide pulsed magnetic fields for impulsive loading experiments. The capability of the methods can be extended by using exploding foils to shape the current that forms the magnetic field. Two circuit applications, the crowbar switch and dynamic damping resistance, are detailed and their use in pulse shaping is illustrated. The necessary principles of exploding foils are discussed, and results comparing calculated and measured 'action integrals' for a range of common foil materials are given. The multichannel crowbar switch described is novel in that it requires no ancillary circuitry and is timed automatically by the primary bank discharge. An exploding foil ruptures insulant mechanically in many sites, giving a low inductance closure 0.3 microsec after the foil explodes. 7 Refs.
Primary Keywords: Exploding Foil; Pulse Shaping; Capacitor Discharge; Nonlinear Resistor; Low Inductance

8185
(BREAKDOWN STUDIES)
(Gas, Electrical)
INVESTIGATION OF A CYLINDRICAL, AXIALLY BLOWN, HIGH-PRESSURE ARC
W. Hermann, U. Kogelschatz, K. Ragaller and E. Schade
Brown, Boveri & Co Ltd, Baden, Switzerland
Journal Of Physics D; Applied Physics, Vol. 7, No. 4, pp 607-619 (03/1974).
An experimental arrangement for the production of a quasi-stationary, high-current arc is described. It is stabilized by an axial gas flow in a high-pressure environment (current: 1000 A, pressure: 23 atm, gas: nitrogen). The conditions are described under which part of the arc assumes a cylindrical form. For such an arc the radial temperature distribution was measured. Because of the cylindrical shape a relatively simple evaluation yields quantitative data about the local radiative energy balance and the other energy transport mechanisms. This leads, for the first time, to a quantitative understanding of the different physical processes in this arc, and makes it possible to formulate a simplified arc model which is useful in practical applications. 24 Refs.
Primary Keywords: High-current Arc; Nitrogen Arc; Axially Flowing Gas; 23 atm Pressure; Radial Temperature Distribution

8186
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
INVESTIGATION OF THE CHARACTERISTICS OF FAST-RESPONSE SEALED DISCHARGERS TRIGGERED BY LASER RADIATION
L.N. Bykhovskaya, I.M. Gurevich, V.V. Lopukhin and L.F. Selivanova
All-Union Institute, Moscow, USSR
Soviet Journal Of Quantum Electronics, Vol. 7, No. 8, pp 968-971 (08/1977).
Trans. From: Kvantovaye Elektron (Moscow) 4, 1708-1713 (August 1977)
An investigation was made of new sealed cermet dischargers with a wave impedance of 50 ohm triggered by a train of picosecond pulses or by pulses of 100 nsec duration and 1060 nm wavelength. The minimum triggering energy was 2E-6 - 5E-7 J and the duration of the leading edge of the resultant voltage pulses was approximately 0.5 nsec. The dependences were obtained of the discharger delay time t/sub d/ on the triggering energy and the voltage across the electrodes. The conditions were found under which the delay time was t/sub d/ <= 10 nsec and the scatter of the delay time was delta t/sub d/ <= 1 nsec. 13 Refs.
Primary Keywords: Sealed Cermet Switch; 50 Ohm Impedance; Nd-Glass Laser; Mode Locked Laser; Q-spoiled Laser

8188
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
LOW-RESISTANCE SHUNTS FOR IMPULSE CURRENTS
A.J. Schwab
University of Karlsruhe, Karlsruhe, FRG
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 5, pp 2251-2257 (10/1971).
In high-voltage technology, plasma physics and power electronics low-ohmic resistors are frequently employed to measure high, rapidly changing currents. Their voltage drop is adversely affected by stray inductances and skin effect. A more complete analysis of low-ohmic tabular type and squirrel cage type resistors including such effects is presented. This paper also develops a compensation network of passive electronic components that permits improved measurement of high energy impulse currents. 12 Refs.
Primary Keywords: Current Shunt, Resistor Design; Stray Inductance; Skin Effect; Tabular Shunt; Squirrel Cage Shunt

8189
(INSULATION, MATERIAL)
(Gas)
THE DIELECTRIC STRENGTH OF GASEOUS FLUOROCARBONS
W.A. Wilson, J.H. Simons and T.J. Brice
Pennsylvania State College, State College, PA
Journal Of Applied Physics, Vol. 21, No. 3, pp 203-205 (03/1950).
The sixty-cycle dielectric strengths of some gaseous fluorocarbons have been measured between three differently shaped electrode pairs at pressures up to three atmospheres. The breakdown potentials for propforane, butforane, and pentforane were found, in most instances, to be equal to or greater than those for sulfur hexafluoride under comparable conditions, and to be far greater than those for nitrogen. Fluorocarbons thus have possible uses as gaseous insulators in high voltage apparatus. 4 Refs.
Primary Keywords: Fluorocarbon Insulation; Propforane; Butforane; Pentforane; SF/sub 6/; Relative Breakdown Voltage; Power Line Frequency

8190
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE EFFECT OF PRESSURE ON THE POSITIVE POINT-TO-PLANE DISCHARGE IN N/SUB 2/, O/SUB 2/, CO/SUB 2/, SO/SUB 2/, SF/SUB 6/, C.L/SUB 2/F/SUB 2/, A, HE, AND H/SUB 2/
H.C. Pollock and F.S. Cooper
General Electric Co. Schenectady, NY 12301
Physical Review, Vol. 56, No. 2, pp 170-175 (07/1939).
The voltage at which corona first appears in a 3-mm point-to-plane gap and the breakdown voltage of the gap have been determined with N/sub 2/, O/sub 2/, CO/sub 2/, SO/sub 2/, SF/sub 6/, CCl/sub 2/F/sub 2/, A, He, and H/sub 2/, and certain mixtures of these gases. This has been done with both positive and negative point polarity and over a pressure range of about 30 atmospheres. The types of corona which were observed are discussed and in all cases the marked dependence of the positive point breakdown voltage on pressure in those gases which form negative ions is noted. 5 Refs.
Primary Keywords: Breakdown Voltage, Corona Voltage; Point Plane Gap; Several Gases; Variable Pressure; Both Polarities

8191
(PULSE GENERATORS)
(Line Type)
A HIGH POWER RF LINE GENERATOR OF NOVEL DESIGN
W.M. Mugrass, I.R. Jones and M.G.R. Phillips
Flinders University of South Australia, Australia
Journal Of Physics E: Scientific Instruments, Vol. 13, pp 276-278 (03/1980).
A modification of the Weibel radio frequency line generator is described. The modification substantially reduces the necessary number of spark gap switches and yields both a significant saving in construction costs and a greater ease of construction and reliability of operation. The construction and performance of an eight-period line generator incorporating this design modification are described. The equivalent root mean square open circuit voltage and generator impedance are 14.1 kV and 9.7 Ohm. 8 Refs.
Primary Keywords: Modified Weibel Pulse Generator; Fewer Spark Gaps; 15 kV Output

8193
(PULSE GENERATORS; SWITCHES, CLOSING)
(Capacitive; Relays)
A HIGH-VOLTAGE MERCURY-WETTED REED PULSE GENERATOR WITH SECONDARY PULSE SUPPRESSION
T.J. Godfrey, R.M. Cripps and G.D.W. Smith
University of Oxford, Oxford, UK
Journal Of Physics E: Scientific Instruments, Vol. 10, pp 329-330 (04/1977).
A simple electronic circuit has been developed to eliminate the secondary pulses obtained when mercury-wetted reed relays are used for producing high-voltage pulses in the nanosecond region at high repetition rates. 5 Refs.
Primary Keywords: Mercury Wetted Reed Switch; Capacitor Discharge, Secondary Pulse Suppression; Vacuum Tube Crowbar

8194
(POWER CONDITIONING; SWITCHES, CLOSING)
(Diodes; Gas Gaps, Electrical)
A KILOAMPERE CURRENT DIODE BASED ON THE QUENCHED SPARK PRINCIPLE
E. Penarella and V. Guty
National Research Council, Ottawa, Ontario, Canada
Journal Of Physics E: Scientific Instruments, Vol. 7, pp 835-841 (10/1974).
A novel type of unidirectional current device is described, particularly useful in a resonant RLC circuit with kiloampere current flow. Basically, the device is a high voltage spark gap switch where the single switching spark has been replaced by a series of elementary sparks separated by a set of copper plates. The unidirectional property of the current is achieved by the behaviour of the current conducting sparks. These, being in contact with the copper plates, are cooled and deionized as soon as the current flow reduces to zero in the oscillatory circuity. The resistance of the circuit then becomes very large and no reversal in the current direction is possible. In this respect, the circuit behaviour is similar to one in which a diode is incorporated. Detailed information on the mechanical design of the switch is given and it is shown that the electrical parameters for which the device can find application are in the range of several tens of kilovolts and kiloamperes and power flow in the range of several megawatts. 10 Refs.
Primary Keywords: High Current Diode; Multiple Spark Gaps; Quenched Spark Gap

8195
(SWITCHES, CLOSING)
(Krytrons)
A LASER-TRIGGERED KRYTRON-BLUMLEIN ELECTRO-OPTIC SWITCH
R.L. Hyde, D. Jacoby and S.A. Ramsden
University of Hull, Hull, UK
Journal Of Physics E: Scientific Instruments, Vol. 10, pp 1106-1107 (11/1977).
A Krytron, triggered by focusing the output from a mode-locked Nd:YAG oscillator on to its grid, is used to discharge a Blumlein into a Pockels cell switch to isolate a single pulse from the mode-locked train. 10 Refs.
Primary Keywords: Laser-triggered Krytron; Blumlein Line; Nd-YAG Laser; Mode Locked Laser
Secondary Keywords: Pockels Cell

8198
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)
CARBON SEGREGATION AND ARC DAMAGE OF TUNGSTEN ELECTRODES
F.W. Ostermayer Jr. and F.B. Koch
Bell Labs, Murray Hill, NJ 07974
Applied Physics Letters, Vol. 36, No. 4, pp 266-268 (02/1980).
Eruptions that occur on tungsten electrodes after repeated 35-A arcs of 1.44-msec duration have been studied with a scanning Auger microprobe and found to contain high concentrations (20-30 at.%) of carbon. This is much greater than the average carbon concentration in the tungsten and is in the vicinity of the W-W/sub 2/C eutectic at 25 at.%. Further evidence that the eruptions are rich in W/sub 2/C comes from their solubility in hot HNO/sub 3/. Therefore it appears that carbon progressively segregates in the arc spots due to its low solid solubility in tungsten and the resultant lowering of the melting point is responsible for the eruptions. 5 Refs.
Primary Keywords: Electrode Erosion; Tungsten Electrodes; 35 A Arc; 1 ms Duration; Anode Peaks; No Cathode Erosion

8197
(BREAKDOWN STUDIES)
(Gas, Electrical)
COMPOSITION AND PROPERTIES OF A SULPHUR HEXAFLUORIDE ARC PLASMA
R. Aubrook
University of Manchester, Manchester, UK
British Journal Of Applied Physics, Vol. 18, pp 419-426 (04/1967).
The particle composition and the electrical and thermal conductivities of an SF/sub 6/ arc plasma have been calculated. The significant differences between the properties of SF/sub 6/ and those of nitrogen or air have been shown to explain the different behavior of steady and transient arcs in the two media. In particular, the excellent arc-quenching ability of SF/sub 6/ when used in circuit breakers is discussed. 22 Refs.
Primary Keywords: SF/sub 6/ Arc; Plasma Composition; Low Arc Voltage Gradients; Filamentary Arc; Strong Temperature Dependence

8200
(BREAKDOWN STUDIES)
(Gas, Electrical)
COMPOSITION AND TRANSPORT PROPERTIES OF SF/SUB 6/ AND THEIR USE IN A SIMPLIFIED ENTHALPY FLOW ARC MODEL
J.S. Frost and P.W. Liebermann
Westinghouse Research and Development Center, Pittsburgh PA
Proceedings Of The IEEE, Vol. 59, No. 4, pp 474-485 (04/1971).
The equilibrium composition of SF/sub 6/ was calculated for temperatures from 1000 to 45000 Deg K. and for pressures from 1 to 16 atm. The usual thermodynamic functions and transport properties were also computed. Considering the arc column in axially flowing gas as a plasma generator, the power balance and momentum conservation equations are formulated and solved with certain simplifying assumptions. The solution gives the developing flow and electrical parameters as a function of distance along the nozzle. Arc voltages are predicted which agree with available data. Clarification is given on two processes contributing to dielectric recovery: axial sweeping away of the arc channel, and its conductance decay by thermal diffusivity, during the current fall approaching current zero. 25 Refs.
Primary Keywords: SF/sub 6/ Plasma; Composition; Transport Properties; Flowing Gas; Effect On Arc Extinguishing

8203
(BREAKDOWN STUDIES)
(Gas, Electrical)
THEORETICAL PROPERTIES OF SPHEROIDALLY-SYMMETRIC STATIC ARCS
A.R. Melder and D. Whittaker
University of Liverpool, Liverpool, UK
British Journal Of Applied Physics, Vol. 18, pp 427-441 (04/1967).
A steady-state spheroidally-symmetric discharge with losses solely by conduction is analysed theoretically and its main properties summarized in dimensionless form in a nomogram. Included as special cases are the unbounded arc, the cylindrical arc and the filled-tube model. Radial variations are described by Legendre functions of complex degree. 5 Refs.
Primary Keywords: Steady-state Arc; Conduction Losses; Nomogram; Unbounded Arc; Cylindrical Arc; Thermal Equilibrium

8205
(REVIEWS AND CONFERENCES; POWER TRANSMISSION)
(Reviews: Transmission Lines)
TRANSMISSION LINES WITH PULSE EXCITATION
H.G. Booker Ed. and N. DeClaris Ed.
Publisher; Academic Press, Inc. (London) Ltd. (01/1969).
The transmission of electrical signals is essential for research in pulsed power. Transmission lines under pulsed and sinusoidal excitation are considered in this book. The general equations are derived for general transmission lines including losses and then are shown to simplify to the lossless approximation. Laplace transforms are introduced and several simple line geometries are solved as examples. The Bergeron diagram is demonstrated by example and lumped and nonlinear problems are shown to be solvable by this method. Sinusoidal solutions are given for several geometries using phasor notation. Pulse distortion by losses is discussed in detail with a brief discussion of dispersion included. 0 Refs.
Primary Keywords: Transmission Line; Basic Equations; Losses; Laplace Transform Solution; Graphical Solution; Pulse Distortion; Reflections

8215
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)
ELECTRON DENSITIES IN LASER-TRIGGERED HYDROGEN SPARKS
S.K. Dhali, P.F. Williams, R.J. Crumley and M.A. Gundersen
Texas Tech University, Lubbock, TX 79409
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 164-167 (09/1980).
We have used Stark broadening measurements of the H/sub Beta/ emission line to determine the temporally and spatially resolved electron density in laser-triggered hydrogen sparks. In this paper the results of this work are presented and compared with earlier work on conventional overvolted sparks. 14 Refs.
Primary Keywords: Laser-triggered Breakdown; N/sub 2/ Laser; Uniform Field Breakdown; Hydrogen Gas; Electron Density Profile; Stark Broadening

8225
(PULSE GENERATORS)
(Capacitive)
A PULSE CIRCUIT FOR EXCITATION OF A PARTICLE ACCELERATOR ELECTROMAGNET
E.I. Lukonin, V.D. Semenov and E.G. Furman
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 17, No. 6, pp 1563-1564 (12/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 17-19 (November-December 1974)
A new method of betatron electromagnet excitation is considered using current pulses of quasitriangular form. The energy storing capacitor operates in a unipolar mode with respect to voltage and the pulse repetition frequency is regulated. 5 Refs.
Primary Keywords: Pulse Generator; Triangular Output; Partial Capacitor Discharge; Thyristor Switch
Secondary Keywords: Betatron Magnet

8229
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ATMOSPHERIC EFFECTS ON THE DIELECTRIC STRENGTH OF A VACUUM GAP WITH PROCESSED ELECTRODES
N.V. Tatarinova and N.E. Novikov
Engineering Physics Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 22, No. 7, pp 905-906 (07/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 1568-1569 (July 1977)
High dielectric strengths in vacuum systems are achieved and maintained for considerable lengths of time. With molybdenum electrodes 1.7 cm in diameter, a vacuum gap of 1 mm can withstand a voltage 55-60 kV without a single breakdown for 50 h. The current in these experiments does not exceed 1E-8 A. At higher voltages and at the same current level, the time delay before the first breakdown is shorter, 2 h at 70 kV and 20 min at 90-110 kV. The high dielectric strength is achieved by means of a glow discharge, through the removal of contaminants, through the removal of the surface layer damaged during the mechanical treatment, and through the formation of a surface microrelief by the discharge. Both electrodes are treated in an oil-free vacuum and in a pure inert gas. In this paper we report a study of the dielectric strengths of a vacuum system after electrodes processed in the manner described above are exposed to the atmosphere. The dielectric strength of the vacuum system is compared for gaps of d=1 mm and d=0.5 mm. 3 Refs.
Primary Keywords: Vacuum Breakdown; Electrode Conditioning; Exposure To Atmosphere; Change Of Breakdown Characteristic

8230
(PARTICLE BEAMS, ELECTRON)
(Generation)
BEAM GENERATION IN FOIL-LESS DIODES
J. Chen and R.V. Lovelace
Cornell University, Ithica, NY 14850
The Physics Of Fluids, Vol. 21, No. 9, pp 1623-1633 (09/1978).
A study is made of the generation of intense relativistic electron beams in rectangular and cylindrical foilless diodes. The diode space charge is treated self-consistently. The electron emission from the cathode is assumed to be space-charge-limited. A strong axial magnetic field is assumed to prevent the electrons from reaching the anode surface(s) directly, and to constrain the electron motion to be approximately one-dimensional. A useful dimensionless measure of the diode potential phi/sub c/ is epsilon, where epsilon is proportional to phi/sub c/, the electron rest mass and charge, and the speed of light. Properties of the diodes are first analyzed in the ultra-relativistic limit, epsilon=0, where the condition for space-charge-limited emission gives rise to a linear singular integral equation. This equation is solved for rectangular diode geometry, and the solutions are studied in detail. In particular, the diode impedance is independent of phi/sub c/, and the beams are, in general, hollow. The beam particle kinetic energy flux, GAMMA/sub p/, decreases as the beam width, b, increases; for b=a, GAMMA/sub p/=0 where a is the diode width. A treatment of the diodes is then given for small but nonzero values of epsilon. For finite epsilon, there is a nonrelativistic Child-Langmuir sheath of thickness approximately epsilon_a at the cathode surface. 12 Refs.
Primary Keywords: Field Emission Diode; Foilless Diode; Theory; Space-charge-limited Emission; Axial Magnetic Field; Numerical Calculation; 1-d Calculation

8231
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Electrodes)
CONDITIONS FOR INITIATION OF A DISCHARGE IN A SPHERICAL GAS GAP WITH A PLASMA CATHODE
Yu.E. Kraindel and N.Ya. Levina
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics Journal, Vol. 17, No. 3, pp 383-386 (03/1974).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 17, 113-117 (March 1974)
The flow of current in a gas gap between a concave plasma cathode and a positive electrode is considered. A simplified theoretical model is used to obtain the conditions for electrical breakdown and the equations for prebreakdown values of the current and the gap width. 8 Refs.
Primary Keywords: Gas Breakdown; Plasma Cathode; Plane Anode; Space-charge Layer; Prebreakdown Current; Variable Gap Spacing; Experiment; Theory

8233
(BREAKDOWN STUDIES)
(Exploding Wires)
DETERMINATION OF TEMPERATURE AND OTHER PARAMETERS OF AN EXPLODING-WIRE PLASMA BY MEANS OF SELF-REVERSAL OF LINES AND ABSORPTION SPECTRA
G.G. Il'in, E.M. Nurmatov and I.S. Fishman
Kazan State University, Kazan, USSR
High Temperature, Vol. 13, No. 2, pp 266-271 (04/1975).
Trans. From: Teplofizika Vysokikh Temperatur 13, 288-294 (March-April 1975)
Measurements are made on the plasma formed by an exploding copper wire of 0.15 mm diameter by means of time-resolved emission and absorption spectra. The radial distribution of the atomic density and the temperature are obtained using various copper emission lines. The temperature is found by the method of Bartels. 11 Refs.
Primary Keywords: Exploding Wire; Copper Wire; Plasma Diagnostics; Plasma Temperature

8236
(BREAKDOWN STUDIES)
(Gas, Electrical)
DISSOCIATION OF SF/SUP 6/, CF/SUB 4/, AND SiF/SUB 4/ BY ELECTRON IMPACT
V.H. Dibeler and F.L. Mohler
Journal Of Research, Vol. 40, pp 25-29 (01/1948).
The dissociation by electron impact of SF/sub 6/, CF/sub 4/, and SiF/sub 4/ has been studied with a consolidated mass spectrometer. Data are also given on the appearance potentials of various ions in the mass spectra and measurements on the isotope abundance of sulfur, carbon, and silicon. The observed appearance potentials of the F/sup +/ ion in SF/sub 6/ and CF/sub 4/ and the C/sup +/ ion in CF/sub 4/ were found to be lower than the calculated value assuming formation of a positive atom ion and a free electron, but nearly equal to the calculated value assuming the formation of a positive atom ion and a negative fluorine ion. The large relative abundance of the SF/sub 4/sup ++/ ion and SF/sub 6/ and the CF/sub 2/sup ++/ ion in CF/sub 4/ is taken to indicate the formation of these ions by removal of two F/sub -/ ions in the former and possibly an F/up -/ ion and a free electron in the latter case. 16 Refs.
Primary Keywords: Molecular Dissociation; Electron Impact; Ion Formation Probability; Mass Spectometer Diagnostic

8237
(BREAKDOWN STUDIES)
(Gas, Electrical)
EFFECT OF GAS PRESSURE ON ELECTRICAL BREAKDOWN AND FIELD EMISSION
D. Alpert, D. Lee, E.M. Lyman and H.E. Tomaschke
University of Illinois, Urbana IL
Journal Of Applied Physics, Vol. 38, No. 2, pp 880-881 (02/1967).
In a recent paper, we presented a physical picture for the initiation of electrical breakdown between metallic electrodes in an ultra-high vacuum. Based on the enhancement of the electric field at sharp submicroscopic projections on the cathode, this picture related the initiation process to the properties of prebreakdown, field-emission currents. One of the significant consequences of this work has been the development of a physical explanation for an effect which has often been noted but heretofore not understood. To explain this so-called gas effect, we assume as a starting point the breakdown model based on field emission from submicroscopic projections. When gas is introduced, the significant decrease in field emission is here attributed to the selective sputtering of the emitting whiskers by ions formed in the volume by electron bombardment of the gas molecules. 8 Refs.
Primary Keywords: Gas Breakdown; Variation With Gas Pressure; Field Emission; Cathode Microprojections; Dependence On Microprojection Size

8238
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRON EMISSION PRECEDING ELECTRICAL BREAKDOWN IN VACUUM
R.P. Little and W.T. Whitney
Naval Research Lab, Washington, DC 20375
Journal Of Applied Physics, Vol. 34, No. 8, pp 2430-2432 (08/1963).
An applied field of 1E5 V/cm produced electron emission from apparently smooth surfaces at room temperature. It is found experimentally that this prebreakdown emission is independent of emitter temperature up to 1000 Deg.K. Using a shadow electron microscope, projections about 2 micron high capable of producing field enhancements on the order of 100 have been found on optically polished cathodes at prebreakdown emission sites. This, with other evidence, strongly indicates that prebreakdown emission is Fowler-Nordheim field emission, due to a geometrical field enhancement. 11 Refs.
Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Temperature Dependence; Microprojections; Fowler-Nordheim Equation

8239
(PARTICLE BEAMS, ELECTRON)
(Generation)
EXACT RELATIVISTIC SOLUTION FOR THE ONE-DIMENSIONAL DIODE
H.R. Jory (1) and A.W. Trivelpiece (2)
(1) Varian Associates, Palo Alto, CA 94304
(2) University of Maryland, College Park, MD 20742
Journal Of Applied Physics, Vol. 40, No. 10, pp 3924-3926 (09/1969).
Exact relativistic solutions for the one-dimensional space-charge limited diode, and for the one-dimensional diode with finite field at the cathode plane are given. The results are compared with approximate solutions which are useful in different energy ranges. 5 Refs.
Primary Keywords: Space-charge-limited Diode; Electron Flow; Theory; 1-d Simulation; Relativistic Solution; Exact Solution

8240
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)
HIGH-VOLTAGE PULSE GENERATOR IN THE NANOSECOND RANGE
V.M. Knyazev and V.A. Lyubimov
Institute Of Theoretical And Experimental Physics, Moscow, USSR
Instruments And Experimental Techniques, Vol. 1, pp 85-86 (02/1969).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 82-84 (January-February 1969)
The article describes a 26-stage generator of high-voltage pulses (g.v.p.) intended as a supply for a streamer-type flash camera operating with a 0.5-m gap. This g.v.p. produces pulses with a rise time of 16 nsec and a nominal amplitude of 1 MV. 4 Refs.
Primary Keywords: Pulse Generator; 1 MV Output Voltage; Compact Size; 16 ns Risetime; 8 ns Fall Time

8242
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Gas Gaps, Materials; Electrodes)
INVESTIGATION OF THE NEAR-ELECTRODE REGIONS OF AN ARC DISCHARGE BETWEEN ELECTRODES OF DIFFERENT CHEMICAL COMPOSITION
I.F. Seliverstova, N.F. Tsygankov and N.K. Zaitsev
Journal Of Applied Spectroscopy, Vol. 24, No. 2, pp 138-142 (02/1976).
Trans. From: Zhurnal Prikladnoi Spektroskopii 24, 208-213 (February 1976)
In arcs at atmospheric pressure, current transfer in the interelectrode gap is effected with the assistance of ionized atoms of the electrode material. Vaporization of the electrodes takes place by the action of 'hot spots' - high-temperature, local sources of heat. If the cathode and anode have identical chemical compositions, then the predominant entry of the material of one or other electrode into the discharge gap is determined by the polarity of the electrode, i.e., by the characteristics of the current transfer at the electrode-plasma boundary. Therefore, by using dissimilar electrodes, a change of the rate of vaporization of the counter-electrode should lead to a change of the dynamics of the near-electrode region and, consequently, of the nature of striking of the electrode. This paper is devoted to a study of the dynamics of the near-electrode region, when materials with different properties are used as counterelectrodes. These investigations can be used, for example, when selecting a cycle of operation for difficult-to-replace electrodes (MHD generators) in facilities where the preferential vaporization of one of the electrodes is necessary (spot welding), etc. 9 Refs.
Primary Keywords: Gas Breakdown; Electrode Effects; Hot Spots; Polarity Effects; Similar Electrode Materials; Dissimilar Electrode Materials

8243
(PARTICLE BEAMS, ION)
(Generation)
METHOD OF GENERATING VERY INTENSE POSITIVE-ION BEAMS
J.M. Creedon, I.D. Smith and D.S. Prono
Physic International Co, San Leandro, CA 94577
Physical Review Letters, Vol. 35, No. 2, pp 91-94 (07/1975).
The combination of multiply reflected electrons and positive ion flow in a reflex triode arrangement is analyzed. Under certain conditions it is possible to generate very intense beams of positive ions with this device. The analysis demonstrates that the energy loss and scattering of the electrons as they pass through the anode have a major effect on the ion and electron currents. Solid fractional-range anodes are shown to produce more intense ion beams than semitransparent mesh anodes. 8 Refs.
Primary Keywords: Reflex Triode; Analysis; Theory; Electron Reflection; Ion Flow; Foil Anode

8244
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
MULTIPLE-SPARK OPERATION OF A MEGAVOLT TRIGATRON
A.S. El'chaninov, V.G. Emel'yanov, V.M. Koval'chuk, G.A. Mesyats and Yu.F. Potalitsyn
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 17, No. 2, pp 416-418 (04/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 103-105 (March-April 1974)
A megavolt gas-filled trigatron having a spark ignition delay time $t/sub d/ = 5.1 \pm 0.5$ nsec and double the range of working voltages is described. A dielectric bushing that projects above the plane of the main electrode is used in the firing section of the trigatron. It is revealed that an optimal amplitude of the starting pulse exists for obtaining the minimal $t/sub d/$. For parallel operation of two trigatrons the commutation time was reduced almost by a factor of 2 for a discharged current of 26 kA. 2 Refs.
Primary Keywords: Trigatron; Multichannel Operation; Multiple Triggers; 1 MV Operating Voltage; Subnanosecond Jitter

8245
(INSULATION, MAGNETIC)
()
NEGATIVE ION LOSSES IN MAGNETICALLY INSULATED VACUUM GAPS
J.P. VanDevender, R.W. Stinnett and R.J. Anderson
Sandia Labs, Albuquerque, NM 87115
Applied Physics Letters, Vol. 38, No. 4, pp 229-231 (02/1981).
Negative ion losses have been observed in a long, self-magnetically insulated transmission line after the electrons are insulated. Time of flight spectra are consistent with $H/sup -/$, $H/sub 2/sup -/$, $O/sub 2/sup -/$, $C/sub 2/sup -/$, and heavier molecular ions with energies corresponding to the full anode-cathode potential difference. The negative ion current density $J/sub i/$ is a sensitive function of the conditions under which the cathode plasma is produced. 11 Refs.
Primary Keywords: Magnetic Insulation; Ion Lasers; Cathode Plasma; Loss Reduction

8246
(PARTICLE BEAMS, ELECTRON)
(Generation)
PRODUCTION OF ANNULAR ELECTRON BEAMS BY FOILLESS DIODES
R.B. Miller, K.R. Prestwich, J.W. Poukey and S.L. Shope
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 51, No. 7, pp 3506-3515 (07/1980).
A number of important aspects of the production of annular electron beams by foilless diodes are examined, both theoretically and experimentally. The theories of Ott, Antonsen, and Lovelace (OAL) and Chen and Lovelace (CL) are compared, and the CL theory is extended to include the effect of an axial gap in an approximate fashion. For the case of finite magnetic field strengths, Larmor orbits are examined and radial oscillations of the beam profile are predicted from a beam envelope analysis. Experimental results obtained with both low- and high-impedance sources have been compared with the theory, and based on such studies, the design and construction of an intense hollow beam generator are described. Experimental results obtained with the new diode compare favorably with both the analytic theory and the results of numerical simulations. The device currently produces 2-MeV electrons at beam currents of 65-70 kA. 18 Refs.
Primary Keywords: Field Emission Diode; Foilless Diode; Annular Beam; Beam Oscillation; Comparison With Theory; 2 MeV Beam Energy

8247
(PARTICLE BEAMS, ION)
(Generation)
PRODUCTION OF 0.5-TW PROTON PULSES WITH A SPHERICAL FOCUSING, MAGNETICALLY INSULATED DIODE
D.J. Johnson, G.W. Kuswa, A.V. Farnsworth Jr., J.P. Quintenz, R.J. Leeper, E.J.T. Burns and S. Humphries Jr.
Sandia Labs, Albuquerque, NM 87115
Physical Review Letters, Vol. 42, No. 9, pp 610-613 (02/1979).
The production, focusing, and numerical simulation of a 0.5-TW proton beam is reported. This beam is produced with a spherical, magnetically insulated, ion diode fed symmetrically by the dual-pulse-line Proto I generator. The ions are accelerated with electric fields due to a virtual cathode supported by magnetic field surfaces. Approximately 75% of the diode electrical power is delivered to ions and 25% of the ion beam is focused upon thin, 1-cm-diam, 1-cm-long conical targets to produce the first experimental ion-driven implosions. 14 Refs.
Primary Keywords: Proton Beam; Virtual Cathode, High Efficiency; Contoured Magnetic Field; Experiment; Theory; Numerical Calculation

8248
(PARTICLE BEAMS, ELECTRON)
(Generation)
RELATIVISTIC PLANAR DIODE IN A MAGNETIC FIELD
E.M. Waisman
Systems Science and Software, La Jolla, CA 92038
Applied Physics Letters, Vol. 39, No. 5, pp 447-449 (09/1981).
The exact steady-state solution for the planar relativistic diode in space-charge-limited conditions is given in the presence of magnetic fluxes below magnetic insulation. It is shown that, as in the classical case, at fixed diode voltage the value of the current density reaching the anode goes discontinuously from a finite value to zero as a function of the magnetic flux at the magnetic insulation cut-off point. The limiting current density just below cutoff is given as a function of voltage and gap distance. This steady-state one-dimensional result below and very near the magnetic insulation threshold is in contradiction with experimental observations. 11 Refs.
Primary Keywords: Planar Diode; Space-charge-limited Operation; Transverse Magnetic Field; Magnetic Insulation; Cutoff Field; Theory; Comparison With Experimen.

8249
(REVIEWS AND CONFERENCES)
(Reviews)
MILLIMICROSECOND PULSE TECHNIQUES (SECOND EDITION)
I.A.D. Lewis (1) and F.H. Wells (2)
(1) Royal Radar Establishment, Malvern, Worcestershire, UK
(2) Atomic Energy Research Establishment, Harwell, Berkshire, UK
Publisher: Pergamon Press (01/1959).
'Millimicrosecond Pulse Techniques,' though somewhat dated, contains a wealth of material concerning basic pulse generation and diagnostic techniques. The book contains chapters on lossless and lossy transmission line analysis, pulse generators, pulse transformers and transforming lines, pulse amplifiers, and cathode ray oscilloscopes. In addition, chapters on practical aspects of using pulsed power techniques in nuclear physics are included. Many practical applications are given. Detailed mathematical analyses are included. 711 Refs.
Primary Keywords: Transmission Line; Pulse Transformer; Pulse Generator; Pulse Amplifier; Pulse Diagnostics; Voltage Divider; Analysis; Application

8250
(PARTICLE BEAMS, ELECTRON)
(Generation)
THEORY OF FOIL-LESS DIODE GENERATION OF INTENSE RELATIVISTIC ELECTRON BEAMS
E. Ott, T.M. Antonsen Jr. and R.V. Lovelace
Cornell University, Ithica, NY 14850
The Physics Of Fluids, Vol. 20, No. 7, pp 1180-1184 (07/1977).
A study is made of the generation of intense hollow relativistic electron beams in a foilless diode. A strong magnetic field is assumed so that the electron motion is one dimensional. Also, the electron motion is considered to be ultra-relativistic. The problem of the self-consistent space charge in the diode is reduced to a singular integral equation. This integral equation is solved and the nature of the solutions is discussed. The beam density increases at the beam edges and has a minimum in the beam interior. The diode impedance as a function of the beam thickness and geometry is discussed. 19 Refs.
Primary Keywords: Field Emission Diode; Foilless Diode; Strong Axial Magnetic Field; 1-d Electron Flow; Space Charge; Theory

8252
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)
ARKAD'EV-MARX GENERATOR IN A CONDUCTING SHIELD
I.M. Roife, E.V. Saredenko and B.A. Stekol'nikov
Scientific-Research Institute Of Electro-Physical Equipment, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 14, No. 6, pp 1681-1683 (12/1971).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 87-88 (November-December 1971)
Results are presented of an investigation of a pulse-voltage generator which is designed to operate in a tank filled with N/sub 2/ under pressure and differs from well-known pulse-voltage generator networks for the nanosecond range in that the high-voltage pulse shaping is achieved under conditions of a noticeable influence of the tank. 3 Refs.
Primary Keywords: Marx Generator; Pulse Shaping; Interaction With Container; Delay Measurement; Spark Gap

8254
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)
CONSUMPTION AND DEGREE OF USE OF ELECTRODE MATERIAL IN A HIGH-FREQUENCY CONDENSED SPARK DISCHARGE
G.G. Barvinko, A.M. Borbat and A.S. Dem'yanchuk
Journal Of Applied Spectroscopy, Vol. 7, No. 2, pp 117-118 (12/1966).
Trans. From: Zhurnal Prikladnoi Spektroskopii 7, 163-165 (1967)
Electrode consumption becomes of primary importance in the analysis of thin wires, finished components, etc. The degree of use of the material is also important. We have examined the consumption rate and degree of use of the material in a high-frequency condensed spark discharge. 7 Refs.
Primary Keywords: Electrode Erosion; AC Arc; Condensed Spark; High-frequency Condensed Spark

8256
(BREAKDOWN STUDIES)
(Electrodes)
DYNAMICS OF ELECTRODE SPOTS IN AN ELECTRIC ARC
A.V. Brichkin, A.V. Bolotov and T.V. Borisova
Soviet Physics-Technical Physics, Vol. 11, No. 7, pp 929-934 (01/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 1251-1258 (July 1966)
The mechanisms of expansion and movement of the cathode and anode spots in a DC arc is considered in relation to the thermal state and emissive properties of the electrode. The experimental technique used to investigate a moving arc and the nature of the operation of copper electrodes is described. A plot of the current density in the electrode spots of arcs on copper electrodes against the electrode temperature is given. 11 Refs.
Primary Keywords: DC Breakdown; Cathode Spots; Temperature Measurement; Copper Electrodes; Spot Movement; Erosion

8257
(BREAKDOWN STUDIES)
(Gas, Electrical)
EFFECT OF CORONA CHARGE ON THE FORMATION OF A LONG POSITIVE SPARK UNDER THE ACTION OF A VOLTAGE PULSE
E.M. Bazelyan
G.M. Krzhizhanovskii Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 11, No. 2, pp 267-272 (08/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 365-373 (February 1966)
The formation of a long positive spark is accompanied by injection of a certain portion of the space charge into the spark gap; this results in distortion of the initial field distribution at the electrodes and affects the subsequent development of the discharge. This is true, in particular, of the charge in a corona pulse which forms at the beginning of the discharge and is capable of affecting the subsequent stages of the spark. In the first part of this work it has been shown that the distortion of the field by the corona charge pulse is a considerable one and that it should be taken into account when investigating gas discharge processes. The results of an experimental evaluation of the effect of a corona pulse on the subsequent formation of a long positive spark are presented here. 4 Refs.
Primary Keywords: Long Discharge; Corona; Field Distortion By Space Charge; Discharge Development

8260
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
HIGH-VOLTAGE PULSE MEASUREMENT WITH A PRECISION CAPACITIVE VOLTAGE DIVIDER
M.M. Brady and K.G. Dedrick
Stanford University, Stanford, CA 94305
The Review Of Scientific Instruments, Vol. 33, No. 12, pp 1421-1428 (12/1962).
The capacitive voltage divider can be designed to have an accurately known division ratio over a wide range of operating frequencies. A coaxial, guard-ring type geometry is described, and an analysis of possible errors due to geometrical anomalies and temperature variations is given. Due to the particular method of construction used, the division ratio of the divider itself is essentially independent of the dielectric constant of the dielectric oil used. Bridge circuits and their pertinent equations for calibrating the divider are presented. An experimental divider designed to operate on pulsed voltages up to 350 kV is described, having an over-all division ratio of 1042.3 +or- 6.0 with an expected temperature dependence of 0.01%/Deg.C. 11 Refs.
Primary Keywords: Capacitive Divider; Coaxial Geometry; Guard Ring; Error Analysis; Temperature Effects; Experiment; Theory

8262
(BREAKDOWN STUDIES)
(Gas, Electrical)
LONG HIGH-PRESSURE ARCS
E.S. Borovik, R.V. Mitin and Yu.R. Knyazev
Soviet Physics-Technical Physics, Vol. 6, No. 11, pp 968-973 (05/1962).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 31, 1329-1336 (November 1961)
An apparatus for the production of long arcs (up to 8 cm long) at pressures of several tens of atmospheres is described. The arc is stabilized by rotation of the gas surrounding the arc. The plasma temperature, calculated with the aid of the equations for the electrical conductivity of the plasma and the energy balance in the arc column, was 2.2E4 Deg.K. for a power consumption of 2E5 W/cu.cm. 10 Refs.
Primary Keywords: Long Arc; High-pressure Arc; Stabilized Arc; Surrounding Gas Rotation; Energy Balance; Pinching

8264
(BREAKDOWN STUDIES)
(Gas, Electrical)
MEASUREMENT OF IONIZATION AND ATTACHMENT COEFFICIENTS IN SULPHUR HEXAFLUORIDE IN UNIFORM FIELDS
M.S. Bhalla and J.D. Craggs
University of Liverpool, Liverpool, UK
Proceedings Of The Physical Society, Vol. 80, pp 151-160 (07/1962).
The growth of pre-breakdown currents in uniform field conditions in sulphur hexafluoride at different pressures for values of E/P in the range of 90 to 160 V/Torr-cm (5-200 mmHg pressure) indicated very large electron attachment. It is assumed that the mechanism of negative ion formulation is due to dissociative attachment; therefore values of alpha and the dimensionally equivalent attachment coefficient eta have been computed from the semi-logarithmic plots of current against electrode separation by employing the modified Townsend equation for the growth of current. Further, static breakdown potentials have been measured up to a value of pd (pressure x gap length) approximately 400 mmHg cm, and a comparison with the data for dry air gives the relative dielectric strength of SF/sub 6/ as about 2.8 at 380 mmHg cm. 19 Refs.
Primary Keywords: Ionization Coefficient; Attachment Coefficient; SF/sub 6/ Gas; Current Measurement; Comparison With Air

8265
(BREAKDOWN STUDIES)
(Vacuum, Particle)
MICROPARTICLE-INITIATED VACUUM BREAKDOWN-SOME POSSIBLE MECHANISMS
M.M. Menon and K.D. Srivastava
University of Waterloo, Waterloo, Ontario, Canada
Journal Of Applied Physics, Vol. 45, No. 9, pp 3832-3836 (09/1974).
It is known that micron- and submicron-sized metallic particles are released from the electrode surfaces when a vacuum gap is subjected to a high DC stress. It is also well known that larger particles (>10 micron) are generated within the interelectrode gap when a vacuum gap is subjected to conditioning or severe prebreakdown current flow. This paper examines the role of such particles in inducing the breakdown of a vacuum gap. While the larger particles induce breakdown by way of a trigger discharge, it is shown that the smaller particles can initiate breakdown because of effects associated with impact. The various effects associated with the high speed impact of a metallic microparticle on a target electrode, viz., cratering, production of metal vapor, and production of thermally generated plasma and their relative significance on vacuum breakdown, are examined. 11 Refs.
Primary Keywords: Particle Initiated Breakdown; Electrode Particle Source; DC Voltage; Prebreakdown Current; Discharge Initiation Mechanism

8266
(BREAKDOWN STUDIES)
(Gas, E-beam)
NEGATIVE ION FORMATION AND ELECTRIC BREAKDOWN IN SOME HALOGENATED GASES
W.M. Hickam and D. Berg
Westinghouse Research and Development Center, Pittsburgh PA
The Journal Of Chemical Physics, Volume 29, No. 3, pp 517-523 (09/1958).
Utilizing a conventional electron gun and mass spectrometer, the formation of negative ions at low electron energies have been investigated for a number of halogen containing gases used in electric breakdown studies. The SF/sub 6/sup -/ peak is used as an energy calibration for establishing the appearance potential and the energy width over which capture occurs for the individual gases. It is found that the relative areas of the negative ion curves can be correlated with the electric strength of the gases. The results suggest that the formation of SF/sub 5/sup -/ rather than SF/sub 6/sup -/ may be the important process in providing the relatively high electric breakdown value for SF/sub 6/. Electron attachment associated with SF/sub 6/ and CCl/sub 4/ is found to be an extremely sensitive function of the gas temperature. The gases investigated include CCl/sub 4/, CCl/sub 3/F, CCl/sub 2/F/sub 2/, CClF/sub 3/, CF/sub 4/, CF/sub 3/SF/sub 6, SeF/sub 6/, C/sub 2/F/sub 3/Cl, CHCl/sub 2/F, CF/sub 2/Cl-CF/sub 2/Cl, and ClO/sub 3/F. 12 Refs.
Primary Keywords: Negative Ion Formation; E-beam Electron Supply; Electron Capture Energy Range; Correlation With Breakdown Voltage

8269
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes: Vacuum Gaps, Materials)
PLASMA EXPANSION AS A CAUSE OF METAL DISPLACEMENT IN VACUUM-ARC CATHODE SPOTS
G.W. McClure
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 45, No. 5, pp 2078-2084 (05/1974).
The pressure on the molten surface of a vacuum-arc cathode due to the recoil from outward-directed ion jets is calculated for copper arcs. The calculation uses current density data and electrode force per unit current data from experiment. In addition, the force per unit current measured by Tanberg is shown to be consistent with a calculation of the same quantity based on the energy of outgoing ions measured by Davis and Miller and the so-called saturated positive-ion current measured by Kimblin. The ion recoil pressure is shown to be sufficient to remove molten metal from a cathode-spot crater in time of the order of 25-250 nsec with a velocity of 2E3-2E4 cm/sec. It is shown that motion of molten metal in the cathode-spot crater must be considered as a first-order effect in rigorous calculations of surface temperature and heat flow in the metal in contact with the cathode-spot plasma. It is suggested that the rapid removal of metal by the plasma pressure causes molten droplets to be ejected, as has been observed experimentally, and causes a preference for the cathode to operate, after the liquid is ejected, on the rim of the crater or nearby on the surface where hotter metal may exist due to liquid-metal overflow and spatter. 35 Refs.
Primary Keywords: Vacuum Arc; Cathode Spot; Copper Electrodes; Ion Jet; Ion Recoil; Metal Droplets

8270
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
ROGOVSKII LOOP FOR MEASUREMENT OF CURRENTS OF NANOSECOND DURATION
A.M. Stefanovskii
GKAE Atomic Energy Institute, Moscow, USSR
Instruments And Experimental Techniques, No. 2, pp 375-378 (04/1967).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 149-152 (March-April 1967)
A Rogovskii loop for the measurement of pulsed currents of nanosecond duration is considered on the basis of a formula which yields the frequency response of the loop and the magnitude of spurious signals associated with external fields. Constructional and electrical data are cited for loops which have been employed to study the acceleration of plasma electrons in toroidal systems. 5 Refs.
Primary Keywords: Rogowskii Coil; Analysis; Frequency Response; Response To External Fields; Analytical Formula

8271
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
ROGOWSKI COILS: THEORY AND EXPERIMENTAL RESULTS
V. Massisi and A. Luches
Universita di Lecce, Lecce, Italy
The Review Of Scientific Instruments, Vol. 50, No. 7, pp 900-902 (07/1979).
The theory is given of the voltage output of a Rogowski coil excited by a current pulse flowing along the axis of the coil. In this theory the Rogowski coil is considered as a delay line. The results do not differ from those obtained usually by considering the coil as a voltage source with an inductive output impedance. Details are also given of the design of two Rogowski coils and their working modes are fully analyzed. 5 Refs.
Primary Keywords: Rogowski Coil; Delay Line Model; Design Considerations; Magnetic Shield; Performance Test

8272
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Gas, Electrical; Gas)
SOME MEASUREMENTS OF THE RELATIVE DIELECTRIC STRENGTH OF GASES
N.R. McCormick and J.D. Craggs
University of Liverpool, Liverpool, UK
British Journal Of Applied Physics, Vol. 5, pp 171-173 (05/1954).
Measurements of the breakdown voltages of small sphere gaps in various gases have been made, partly to check existing results but also to provide new data. Various electro-negative gases, such as SF/sub 6/ Cl/sub 2/, etc., were studied, taking nitrogen as a standard gas, and the data are tabulated. A brief discussion of these results is given. 18 Refs.
Primary Keywords: Gas Breakdown; Several Gases; Breakdown Voltage; Nitrogen Gas; Electronegative Gases; Hydrogen; Chlorine; Variable Gap Spacing

8273
(BREAKDOWN STUDIES)
(Gas, Electrical)
STATISTICAL TIME LAGS IN GAS DISCHARGE GAPS IRRADIATED WITH A RADIOACTIVE MATERIAL
D.T.A. Blair and D. Farish
University of Strathclyde, Glasgow, Scotland
British Journal Of Applied Physics, Vol. 18, pp 597-604 (05/1967).
Theoretical values of mean statistical time lag have been estimated for overvoltages of up to 5% for a uniform-field discharge gap of 2 cm length in nitrogen at 400 Torr and 20 Deg.C., with 2 mCi of cobalt 60 located in the cathode. The results are in reasonable agreement with measured value, and indicate that in order to render the mean statistical time lag negligible in comparison with the formative time lag under these conditions it would be necessary to increase the strength of the radioactive source to about 30 mCi. When the source is located in the anode it is not possible to estimate reliable theoretical values because of the difficulty of making reasonable simplifying assumptions regarding the distribution of initial ionization close to the cathode surface: the measured values do not differ by a factor of more than two from those obtained with the source in the cathode. 12 Refs.
Primary Keywords: Nitrogen Breakdown; Statistical Time Lag; Uniform Field; 5% Overvoltage; Cobalt 60; Theory

8274
(BREAKDOWN STUDIES)
(Gas, Electrical)
TEMPERATURE DETERMINATION FOR ARCS IN SULPHUR HEXAFLUORIDE ACCOUNTING FOR DEMIXING
E. Schulz-Gulde
Institut fur Plasmaphysik, Garching, FRG
Journal Of Physics D: Applied Physics, Vol. 13, No. 5, pp 793-803 (05/1980).
Methods of temperature determination for arcs in sulphur hexafluoride (SF/sub 6/) are presented for the temperature range from 9000 to 20000 Deg.K. Temperatures are derived from combinations of measured S I, S II, F I and F II absolute line intensities and computed equilibrium plasma composition data by means of iterative procedures. Demixing effects are accounted for as both the temperature and the fluorine to sulphur concentration ratio M are determined from the measured data. The methods are applied to experimental line intensity data obtained from steady-state wall-stabilized arcs in SF/sub 6/ at atmospheric pressure, at axis temperatures of about 15000 K. Simple approximation formulae are given for calculating the various partition functions at a pressure of p=1 bar for M=6, 12, 24 and 48; and at p=2, 4, 8 and 16 bar for M=6. 25 Refs.
Primary Keywords: SF/sub 6/ Breakdown; Temperature Measurement; Spectroscopic Observation; Demixing Effects; 1-16 Bar Pressure Range; Approximate Temperature Formula

8276
(SWITCHES, CLOSING)
(Avalanche Transistors, Electrical)
THE APPLICATION OF AVALANCHE TRIODES IN NUCLEAR-ELECTRONICS CIRCUITS
L.E. Gavrilov
Moscow Engineering-Physics Institute, Moscow, USSR
Instruments And Experimental Techniques, Vol. 16, No. 6, pp 1615-1627 (12/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 5-17 (November-December 1973)
The physical foundations of the operation of avalanche transistors are considered along with their distinguishing features, possibilities, and the most promising fields for their application. Characteristics are given of Soviet and foreign avalanche transistors, as well as practical recommendations on the use of low-power transistors operating in the avalanche mode which are manufactured by industry. The main attention is devoted to circuits for the generation and shaping of pulses having nanosecond lengths, including: rectangular- and triangular-pulse generators, staircases, and sawtooth voltage generators, powerful voltage and current pulse generators, etc. Circuits for amplitude and time selection of pulses are given which are designed using avalanche triodes, as well as counting circuits. 90 Refs.
Primary Keywords: Avalanche Transistor; Characterization; Application; Pulse Shaping; Pulse Generation; Nanosecond Pulses

8278
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Electrical; Gas Gaps, Thermal)
THE BREAKDOWN MECHANISM OF CERTAIN TRIGGERED SPARK GAPS
T.E. Broadbent
University of Manchester, Manchester, UK
British Journal Of Applied Physics, Vol. 8, pp 37-40 (01/1957).
Experiments designed to investigate the breakdown mechanisms of certain triggered spark gaps in air are described. Possible theories of the breakdown mechanism of the trigatron and the thermally triggered spark gap are put forward, based on experimental voltage and time lag to breakdown characteristics, corona measurements, and on optical studies using a photomultiplier. It is shown that the mechanism of breakdown for the two forms of triggered spark gap may be similar and depend, with positive charging polarities, on the movement of positive ions followed by a streamer process, and, in the case of negative charging polarities, on a streamer process only. 9 Refs.
Primary Keywords: Spark Gap; Air Gap; Trigatron; Thermally Triggered Spark Gap; Breakdown Mechanism; Streamer; Experiment; Theory

8279
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Liquid Gaps, Materials)
THE MECHANISM OF ELECTRICAL EROSION OF METALS IN LIQUID DIELECTRIC MEDIA
B.N. Zolotykh
Soviet Physics-Technical Physics, Vol. 4, No. 12, pp 1370-1375 (06/1960).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 29, 1484-1486 (December 1959)
The nature of the forces responsible for the ejection of metal from craters created on the surface of electrodes under the effect of impulse discharge is not yet completely known. High-speed photography of the erosion process has made it possible to obtain new information concerning these forces. We photographed the erosion process resulting from a single discharge in kerosene lasting 180 microseconds. We used a unipolar current impulse: the value of the maximum current was 1000 amperes; the spark gap was 30 microns; the value of maximum voltage was 200 volts; the energy of the impulse was 2.5 joules. The anode was a copper plate 0.1 mm thick; the cathode was a copper wire 1 mm in diameter; the electrodes were placed at an angle of 90 Deg to each other. 3 Refs.
Primary Keywords: Electrode Erosion; Kerosene Gap; Impulse Voltage; Photographic Diagnostic; 1000 A Current; Point-plane Gap

8280
(BREAKDOWN STUDIES)
(Electrodes)
THE VAPORIZATION OF THE CATHODE IN THE ELECTRIC ARC
R. Holm
Stackpole Carbon Co., St. Marys, PA
Journal Of Applied Physics, Vol. 20, No. 7, pp 715-716 (07/1949).
Calculations are carried out which show that, because of the smallness of the cathode spot, the cathode is not able to dissipate the heat generated with heavy currents by conduction. Therefore, a much higher vaporization of cathode material per coulomb occurs for heavy currents than for low currents. 9 Refs.
Primary Keywords: Electrode Erosion; Cathode Spot; Metal Vaporization; Low Current; High Current; Comparison; Theory; Energy Balance

8281
(BREAKDOWN STUDIES)
(Gas, Electrical)
TIME-RESOLVED RADIAL TEMPERATURE PROFILES FOR 10 KA SF/SUB 6/ ARCS
D.R. Airey, P.H. Richards and J.D. Swift
Marchwood Engineering Lab, Southampton, UK
Journal Of Physics D: Applied Physics, Vol. 8, No. 16, pp 1982-1993 (11/1975).
Radial temperature profiles for pulsed SF/sub 6/ arcs burning in high-pressure, approximately 5 bar, supersonic gas flow have been measured for discrete current levels in the range 10 kA-1.0 kA. The current pulse was a 10 6 ms half-sine wave and all the temperature measurements were carried out as the current decayed from 10 kA towards zero. The temperature distribution was obtained by comparing the calculated and measured emission intensities of spectral lines due to excited fluorine and ionized sulphur in local thermodynamic equilibrium. No evidence has been found for the sulphur/fluorine demixing effect previously reported in steady, free-burning, cascade arcs, but strong column instabilities have been observed. The temperature profiles were measured for times when the arc exhibited reasonable radial symmetry. The results for currents above 3.5 kA show that the axis temperature is 20000 Deg.K +or- 1000 Deg.K and is independent of the arc current. Also the temperature profile is essentially parabolic, and any increase in arc current is accompanied by a corresponding increase in arc cross section to maintain a constant current density. Below 3.5 kA the axis temperature falls rapidly with current down to 15500 Deg.K +or- 1000 Deg.K and the temperature profiles show very steep temperature gradients less than 1 mm from the arc axis. 22 Refs.
Primary Keywords: SF/sub 6/ Breakdown; Radial Temperature Profile; 5 Bar Pressure; Supersonic Gas Flow; 1-10 kA Current Range

8282
(BREAKDOWN STUDIES)
(Gas, Electrical)
TIME-RESOLVED SPECTROSCOPY OF SPARK DISCHARGES
F. Tsui
University of Liverpool, Liverpool, UK
British Journal Of Applied Physics, Vol. 3, pp 139-140 (05/1952).
Using a rotating-mirror and a spectrometer, the spectra of the light emission from spark discharges in several gases have been photographed at different instants after the current-initiation. By triggering the discharge recurrently in synchronism with the mirror, the time-resolved spectral images of a number of sparks were superposed to obtain sufficient blackening on the photographic plate. The triggering circuit was activated by the rotating-mirror, and, when provided with a counter, the system could be left in automatic operation. 1 Refs.
Primary Keywords: Spark Discharge; Spectroscopy; Rotating Mirror Streak Camera; Several Frames; Image Averaging; Several Gases; Tungsten Electrodes; Point-point Gap; 200 A Current

8283
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)
VAPORIZATION OF METAL ELECTRODES BY PULSED CURRENTS
G.S. Belkin
Moscow Power Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 13, No. 9, pp 1256-1260 (03/1969).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 38, 1565-1551 (September 1968)
Experiments have shown that the mass of metal vaporized from a copper cathode at currents less than 40 kA in helium at a pressure of 1 atm is proportional to the charge and is given by M/sub v/ = (0.6-1.2) X 1E-5 g/C. In this case the anode loss is many times smaller than the cathode loss. The constancy of M/sub v/ for large current variations is explained by the fact that vaporization of a copper cathode occurs at individual spots of currents less than 40 kA. At currents greater than 150 kA, the ratio of the mass of vaporized metal to the integral of i dt can be 30-40 times greater than M/sub v/ for a copper cathode at currents smaller than 40 kA. At high currents vaporization occurs not only from cathode spots, but from the entire surface of the electrode covered by the spots. For this reason a marked increase in the mass of vaporized metal is possible at currents above 150 kA. Calculation of the mass of vaporized metal, averaging the thermal flux over the area of the electrode covered by spots (allowing for the increase in path cross section by the end of the discharge), gave a value of 24 mg for a current of 500 kA with a period of 140 microseconds and a damping factor of 8.7E3/sec; the experiment gives 32 mg. 11 Refs.
Primary Keywords: Electrode Erosion; Copper Cathode; Helium Gas; Atmospheric Pressure; 150 kA Current; Dependence On Charge Transfer; Cathode Spot

8284
(BREAKDOWN STUDIES)
(Gas, Electrical)
VOLTAGE-TIME CHARACTERISTIC OF ELECTRICAL BREAKDOWN IN SF/SUB 6/
T. Nitta, Y. Shibuya and Y. Fujiwara
Mitsubishi Electric Corp, Amagasaki, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-94, No. 1, pp 108-115 (02/1975).
V-t characteristic of impulse and switching surge breakdown in SF/sub 6/ is studied on various gaps. The characteristic is categorized into three patterns depending on the configuration of the gap and gas pressure. The properties of the V-t characteristic in these patterns are generalized as a semi-empirical formula which will be useful in the quantitative evaluation of the insulation coordination and the abnormal voltage protection of SF/sub 6/ gas insulated power equipments. The gap conditions in which those patterns of V-t characteristic are observed are also discussed in the Appendices. 15 Refs.
Primary Keywords: SF/sub 6/ Breakdown; Voltage Measurement; Semi-empirical Formula; Sphere-sphere Gap; Corona Stabilization

8285
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
WIDEBAND HIGH VOLTAGE PROBE
R. Keller
Lab de Recherches sur la Physique Des Plasmas, Lausanne, Switzerland
The Review Of Scientific Instruments, Vol. 35, No. 8, pp 1057-1060 (08/1964)
A high voltage probe is described which is based on the principle of consecutive differentiation and integration. The voltage to be measured is applied to a coupling capacitor of a few picofarad and related at several tens of kilovolts. The capacitor is connected to a cable which propagates a signal proportional to the derivative of the voltage. At the other end of the cable a transistorized integrator integrates the current and produces a signal proportional to the voltage. It is thus possible to obtain a bandwidth of 300 Hz to 200 MHz. 6 Refs.
Primary Keywords: Differentiating Probe; Integrating Sensor; 70 kV Operating Voltage; 200 MHz Bandwidth

8286
(BREAKDOWN STUDIES)
(Gas, Electrical)
CATHODE SPOTS IN THE TRANSIENT GLOW DISCHARGE IN NITROGEN
D. Farish and D.J. Tedford
University of Strathclyde, Glasgow, Scotland
British Journal Of Applied Physics, Vol. 17, pp 965-966 (07/1966).
Cathode spots, arranged in a regular pattern of concentric circles, have been observed to occur during the transient glow discharge stage of the impulse breakdown of uniform field gaps in nitrogen. 3 Refs.
Primary Keywords: Glow Discharge; Nitrogen Discharge; Cathode Spot; Spot Pattern; Copper Electrodes, Nickel Plating

8287
(REVIEWS AND CONFERENCES; INSULATION, MATERIAL)
(Reviews; Reviews)
INSULATING MATERIALS FOR DESIGN AND ENGINEERING PRACTICE
F.M. Clark
General Electric Co, Schenectady, NY 12301
Publisher: John Wiley And Sons, Inc., New York (01/1962).
Mr. Clark has produced a very thorough treatise on insulation in this book. The book begins with a short review of the purpose of insulation and some of the constraints and proceeds to consider in depth several of the important aspects of insulating systems' design and maintenance. The book includes chapters on insulating material selection, writing specifications, long-term temperature and environmental effects, and manufacture and maintenance. Complete characterization of many gaseous, liquid, solid, and composite insulation systems are a very important part of the book. Breakdown mechanisms are discussed. Pulsed voltages are not considered extensively. 1709 Refs.
Primary Keywords: Material Insulation; Review; Insulation Selection; Insulation Maintenance; Environmental Effects; Insulation Characterization; Gaseous Insulation; Liquid Insulation; Solid Insulation; Insulation Systems

8288
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Liquid, Electrical; Ignitrons, Materials)
FIELD ELECTRON EMISSION FROM LIQUID MERCURY
J.W. Beams
University of Virginia, VA
Physical Review, Volume 44, pp 803-807 (11/1933).
Field emission from liquid mercury has been investigated by applying an impulsive potential of approximately 1E-6 sec. duration between a spherical steel anode and a plane mercury cathode. The field just necessary to produce breakdown gave a measure of the field necessary to produce emission because rotating mirror photographs showed that the field emission from the cathode initiated the discharge. The liquid mercury cathode was cooled to a few degrees above its freezing point and the mercury vapor pressure still further reduced by solid CO/sub 2/ traps. The mercury could be distilled repeatedly in vacuo and the surface of the cathode changed by 'overflowing'. The electric field necessary to produce sufficient field emission to start the discharge depended upon the purity of the mercury surface. It varied from 3.5E6 volts per cm for impure mercury to 1.8E6 volts per cm for mercury that had been repeatedly distilled in vacuo. 17 Refs.
Primary Keywords: Field Emission; Mercury Surface; Spherical Anode; Steel Anode; Variable Purity

8289
(BREAKDOWN STUDIES)
(Liquid, Electrical)
A THEORY OF LIQUID SURFACE RUPTURE BY A UNIFORM ELECTRIC FIELD
L. Tonks
General Electric Co, Schenectady, NY 12301
Physical Review, Vol. 48, pp 562-568 (09/1935).
Surface distortion and rupture permits field emission from liquid surfaces at field strengths less than those effective for equally smooth solid surfaces. An approximate mathematical theory of the rupture of a plane liquid surface in a uniform electric field has been developed. The relation between initial distortion, rupture time, and field strength has been calculated for fields which are large when compared to that which just renders the surface unstable. Typically, the theory shows that a hump initially 4E-5 cm high and of diameter 9E-4 cm will lead to rupture in 5E-6 sec. in a field of 1E6 V/cm. Relative to initial humps in the surface whose linear dimensions vary inversely as the square of the field, the time to rupture varies inversely as the cube of the field strength. This calculation shows that a lowered sparking potential to liquid mercury can be ascribed to surface rupture and shows that it is possible that surface rupture plays a part in Beams' low field emission from liquid mercury. Possible application of the theory to the high field condition at the cathode spot of the Hg arc is not clear. 4 Refs.
Primary Keywords: Liquid Surface Distortion; Surface Rupture; E-field Strength; Rupture Theory

8292
ADVANCED CONCEPTS FOR PHOTON SOURCES: VOLUME 2. FAST SWITCHING OF VACUUM MAGNETIC ENERGY STORES
V. Bailey, L. Demeter, J. Benford, A. Hoeth and D. Sloan
Physic International Co, San Leandro, CA 94577
Final rept. Sep 72-Jul 73 No. PIFR-398-Vol-2, 228p (10/1973).
Availability: AD-A015 386/6ST
NTIS
Inductive (magnetic) energy sotrage systems are analyzed in terms of their application to generation of ultra-high power pulses. Such systems can transform low-power energy inputs into high-power outputs (power multiplication) by shortening the energy delivery time. Energy transfer from magnetic store to resistive load can approach 100 percent efficiency. Models of several accelerated metallic plasma transfer switch geometries indicate that such switches can be energetically efficient and can produce substantial voltage multiplications. Using a versatile and extensively diagnosed apparatus, experiments were conducted to test these predictions. The experiments confirmed the modeling and established design criteria for metallic wire plasma switches. Operating at 25 kJ energy level, a coaxial switch produced narrow (60 to 300 nsec) voltage spikes with voltage and power multiplications of 3.
Primary Keywords: Energy Storage; Power Supplies; Pulse Generators; Magnetic Cores; Vacuum; Toroids; Switching Circuits; Plasma Devices
Secondary Keywords: Inductive Energy Storage; Magnetic Energy Storage; NTISDOD:D

8297
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
ADVANCED SIMULATION RESEARCH: VOLUME II. VACUUM ENERGY STORAGE
W. Clark, P. Korn, A. Mondelli and N. Rostoker
Maxwell Labs Inc, San Diego, CA 92123
Final rept. 1 Aug 74-31 Jul 75 No. MLR-498, 150p (09/1975).
Availability: AD-A048 158/0ST
NTIS
The STP experiment has been placed in operation during this contract period. A number of electron injectors have been explored with the injected charge shown to scale linearly with the injector bias voltage. Injected charge levels approximately 100 micro-coulombs, which corresponds to potential well depths of approximately 300 kV, have been measured as will be described in this report. Vertical magnetic field coils have been installed on the experiment, and preparations for high-energy electron injection have been completed. Theoretical studies of high-energy injection, including single-particle and fully-relativistic self-consistent calculations, are presented. In addition, a theoretical study of switching energy stored in the torus is reported. (Author)
Primary Keywords: Energy Storage; Electron Beams; Particle Accelerators; Toroids; Magnetic Fields; Simulation; High Voltage; Vacuum; High Energy
Secondary Keywords: Charge Injection; STP Experiment; NTISDODXA

8300
(POWER CONDITIONING)
(Pulse Forming Networks)
CONTROL OF THE SHAPE OF HIGH-CURRENT, HIGH-VOLTAGE PULSES GENERATED BY AN ARTIFICIAL LINE
L.I. Pivovar and E.G. Teller
Sandia Report No. SAND-77-6016 (09/1975).
Trans. From: KNFTI-73-20, pp 57-58 By P. Newman
Availability: SAND-77-6016
NTIS
Several devices used in plasma physics, accelerator technology, etc., are supplied by current and voltage pulses of rectangular shape. When the load is variable or nonlinear, circuits containing active and passive loops incorporating a time delay are used to obtain the required pulse shape. These circuits are so expensive and time-consuming to design and develop, that it is desirable to develop a way to model them on a computer. Calculations necessarily include some simplifications, since some parameters can only be determined precisely by physical measurements on the finished device. The solution is described. (ERA citation 03:007763)
Primary Keywords: Accelerators; Power Supplies; Thermonuclear Reactors; Control Systems; Electronic Circuits; Pulse Shapers; Pulses; Shape
Secondary Keywords: ERDA/700203; ERDA/430300; Translations; USSR; Delay Circuits; Computerized Simulation; NTISDET

8302
(PULSE GENERATORS)
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DEVELOPMENT AND USE OF 60 KV, AND 150 KV FLOATING DECK MODULATORS FOR HIGH VOLTAGE PROTECTION OF MULTI-MEGAWATT ION BEAM ACCELERATORS
G.C. Barber, N.S. Ponte and G. Schilling
Oak Ridge National Lab, Oak Ridge, TN 37830
Availability: CONF-771029-67
NTIS
Extraction currents of 60 A at 40 kV have been produced by utilizing a 60 kV floating deck modulator interfaced to a high voltage power supply. The modulator is operated in a series mode to repetitively pulse power to the ion beam accelerator. Current monitoring and other protective circuits provide interrupt commands to the series switch tube when faults occur. The constant current characteristics of the water cooled tetrode and the rapid response of the protective circuits effectively limit the fault energy to the ion source. Three of the 60 kV decks have been modified and stacked in a series configuration to supply 150 kV, 50 A pulses. This system supplies power for development of higher-energy multi-grid sources. In this system attention has been focussed on forced voltage sharing of the three decks and on protective circuits for fault conditions. All control signal processing and conditioning is performed at ground level. Fiber optic links are used to interface with the high potential associated with the floating decks. A shunt modulator incorporated with this system provides regulation of the voltage to the ion source gradient grid. Future modulator development includes a system to deliver 100 A at 80 kV. (ERA citation 03:016254)
Primary Keywords: Ion Sources; Switching Circuits; Electric Currents; Electric Potential; Electronic Circuits; Modulation; Neutral Atom Beam Injection; Neutral Beam Sources; Ormak Devices; Pit Devices; Power Supplies; Specifications; Beam Injection; Tokamak Devices
Secondary Keywords: ERDA/700203; ERDA/700205; NTISDE
Distribution Restriction: U.S. SALES ONLY

8305
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
GASEOUS DISCHARGE SWITCH IN OVERSIZED WAVEGUIDE
J.P. Quine and C Younger
General Electric Co, Schenectady, NY 12301
Final rept. 1 Oct 64-30 Sep 65 (02/1966).
Availability: AD-A019 506/3ST
NTIS
The purpose of this investigation is to develop fast ultra high power switches compatible with the TE1C mode in oversized rectangular waveguide for which the height and width dimensions are of the order of two free space wavelengths. Experimental switches are to be designed for operation at X-band. This report presents the results that were obtained in a theoretical and experimental investigation of DC Triggered Spark Gap Switches for oversized Rectangular Waveguide. These switches which operate at atmospheric pressure employ a symmetrical arrangement of several spherical spark gaps in order to prevent the generation of higher order propagating modes. The results of a theoretical and experimental study of low pressure gaseous electronic switches employing a Penning type of discharge are also presented. (Author)
Primary Keywords: Waveguide Switches_X Band; Waveguides; Microwave Equipment; Gas Discharges; Electrodes; Standing Wave Ratios; Electronic Switches
Secondary Keywords: Spark Gaps; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

8306
(POWER TRANSMISSION)
(Cables)
HIGH POWER, LOW NOISE PULSE CABLE
J. Argetsis and R. Feller
ECOM, Fort Monmouth, NJ 07703
(01/1954).
Availability: AD-656 503
NTIS
Four new types of high power, low noise rubber pulse cables have been developed that have high power handling capacities, considerable flexibility over the ambient temperature range of -55C to +55C, exhibit good corona stability after thermal cycling and effective shielding against the electromagnetic radiation eminating from these cables. A program has been established for the development of triaxial terminations for these cables. The terminations for the RG-190(),/U, RG-192(),/U, RG-193()/U and RG-194()/U pulse cables will be of the nut-head type and the cable assemblies will be manufactured at the factory, which will insure corona free operation and ease of assembly to the equipments. Triaxial connectors for the RG-190()/U pulse cable are currently being developed. It is anticipated that the termination for the RG-190()/U, RG-191()/U and RG-192()/U pulse cables will be available by May 1957. A hydrogen thyratron test and aging equipment has been installed to experimentally verify the performance characteristics and curves based on calculated data under high pulse voltage and short pulse conditions. The equipment is capable of 40 megawatts peak power output.
Primary Keywords: Pulse Cables_Radiofrequency Power; Electric Insulation; Butyl Rubber; Silicone Plastics; Metal Coatings; Performance(Engineering); Voltage; Attenuation; Electromagnetic Shielding; Electric Connectors; Noise(Radar); Radar Equipment

8310
(PULSE GENERATORS, SWITCHES, CLOSING)
(Line Type; Gas Gaps; Electrical)
PRODUCTION OF MILLIMICROSECOND CURRENT PULSES USING A PRESSURIZED SPARK GAP

J.H. Adlam and L.S. Holmes
Atomic Energy Research Establishment, Harwell, Berkshire, UK
Journal Of Scientific Instruments, Vol. 37, No. 10, pp 385-388 (10/1960)

A pressurized spark gap has been designed to discharge a number of coaxial cables in parallel, thus producing a rectangular pulse of 1E4 A with a rise time of 4.5 nanoseconds. It is designed to use a number of these spark gaps in parallel, to test the feasibility of doing this, measurements have been made of the statistical variation of the time lag for breakdown after triggering. 3 Refs.

Primary Keywords: Coaxial Line Pulse Transformer; Multiple Spark Gap Switching; Nanosecond Jitter; Parallel Gap Operation; Performance Test

8311
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid, Surface Flashover)
MEASUREMENTS OF THE CHARGE DISTRIBUTIONS ON AN ALUMINA INSULATOR IN VACUUM RESULTING FROM HIGH-VOLTAGE STRESS

J.P. Brainard and D. Jensen
Sandia Labs, Albuquerque, NM 87115
No. CONF-741009-1, 15p (10/1960).
Availability: SAND-74-5555
NTIS

For abstract, see NSA 30 09, number 26300.

Primary Keywords: Dielectric Materials_Electric Charges; Aluminium Oxides; Electric Potential; Electric Probes; High Vacuum; Measuring Methods; Stresses; Surfaces
Secondary Keywords: NTISAEC

8312
(INSULATION, MATERIAL)
(Solid)
METHODS FOR CREATION OF HIGH-VOLTAGE, HIGH-TEMPERATURE ELECTRIC INSULATION

V.I. Kalitvyanskii, A.M. Tuchinskii, M.N. Aleksandrov, E.Z. Asnovich and V.A. Kolganova
Availability: GEFR-TR-802
NTIS

Methods for the production of high voltage (up to 6 kV) and high temperature (500 to 600 exp 0 C) electric insulation were studied. Insulation of this class can be produced using artificial mica and aluminophosphate. (ERA citation 03:010071)

Primary Keywords: Electrical Insulation; Aluminium Phosphates; Dielectric Materials; Dielectric Properties; Electrical Equipment; Fabrication; High Temperature; Mica; Performance Testing
Secondary Keywords: ERDA/200300; Translations; USSR; NTISDEI
Distribution Restriction: Translated from Elektrotekhnika 43 n5 p10-12 1972.

8314
PARTICLE-INITIATED BREAKDOWN IN GAS DIELECTRIC CABLE INSULATION EXPANDED SCOPE PROGRAM (FINAL REPORT)

C.M. Cooke
Massachusetts Institute of Technology, Cambridge, MA
Availability: EPRI-EL-1264
NTIS

The adverse influence of conducting particle contaminants in gas-insulated power apparatus was investigated in a series of experiments that employed coaxial configurations and dc voltages to 1500 kV. Particle dynamics was shown to be important and related to breakdown initiation in the gas. Both SF sub 6 and N sub 2 gases at pressures from 1 to 14.6 atm absolute were used. Ine particles were intentionally introduced and ranged from 1.6 to 6.4 mm spheres and wires. Effects in the gas gap as well as along surfaces of solid insulators were studied. Visual observations, photographs, and electrical measurements helped in distinguishing various processes. Particles could reduce the insulation performance by factors of 3 to 5 and were especially significant when moved to the center conductor By coordination of this work with a separate study at the Westinghouse R and D laboratory a comparison between dc and ac performance was made. Generally the dc breakdown values exhibited wider scatter, though their lower limit was similar to that found under ac. Overall fundamental forces and processes which involve particle contamination effects were identified and found to be the same for dc and ac voltage stresses. (ERA citation 05:015703)

Primary Keywords: Gas-insulated Cables; Dhv Dc Systems; Aluminium; Breakdown; Coaxial Cables; Comparative Evaluations; Dielectric Materials; Electrical Insulation; Experimental Data; Graphs; Nitrogen; Particles; Power Transmission Lines; Pressure Dependence
Secondary Keywords: ERDA/200302; NTISDE

8317
(SWITCHES, OPENING)
(Gate Turnoff Rectifier)
POWER AMPLIFICATION WITH GATE TURN-OFF CONTROLLED RECTIFIERS

R.G. Camacho
Naval Postgraduate School, Monterey, CA 93940
Master's thesis (10/1960).
Availability: AD-680 466/2ST
NTIS

With ever larger amounts of power being required by present day active sonars, studies are being made towards improving the efficiency of the power train. A gain in efficiency is possible if non-linear switching type amplifiers are used in lieu of the linear amplifiers presently used. Due to its high switching efficiency, fast switching, and ability to be turned on or off by gate signals, the Gate Turn-off Controlled Rectifier was investigated for possible application in an amplifier circuit. The circuit examined readily met the required criteria, however, the real value of this study lies in the method of predicting transient performance. Use of the derived equivalent circuit, and an analog computer model based on transfer functions (E sub L/E and I sub L/E), provide analytical solutions that can be arrived at more readily than by other methods. (Author)

Primary Keywords: Transistor Amplifiers_Sonar Equipment; Rectifiers_Sonar Equipment; Power Amplifiers_Sonar Equipment; Gates(Circuits); Gain; Voltage; Electric Currents; Transducers; Silicon; Theory; Trigger Circuits; Diodes, Active
Secondary Keywords: Semiconductor Junctions; NTISDODXD
Distribution Restriction: Distribution limitation now removed

8318
(PULSE GENERATORS)
(Marx)
PULSE CIRCUIT FOR N/SUB 2/ LASERS

O. Steinvall, A. Widen, A. Anvari and R. Nilsson
Research Inst. of National Defence, Stockholm (Sweden).
No. FOA-2-C-2503-El, 32p (11/1971).
Availability: N74-13210/1
NTIS

A very simple pulsed gas laser has been constructed for generating short laser pulses with high power, high repetition frequency and good stability. The system has been tested for nitrogen at 3371 A. The following data have been obtained: Pulse length 5 ns, output power 500 kW, and repetition frequency 100 pps. The cavity can be used for laser wave lengths with less reinforcement. Some of the physical parameters have also been examined, such as coherency characteristics of amplifiers and beam divergence, etc. The electrical circuit used was built on the well known Marx generator principle and can also be used as a pulser, are required, for example, for producing short X-ray flashes. A disadvantage of the circuit is that it has rather many spark gaps which produce certain problems concerning flash overs. (Author)

Primary Keywords: Circuits; Gas Lasers; Pulse Generators; Pulsed Lasers; Flashover; Laser Outputs; Nitrogen; Spark Gaps
Secondary Keywords: IN SWEDISH; NASA

8319
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: A VERSATILE HIGH-VOLTAGE BIAS SUPPLY FOR EXTENDED RANGE MIS C(V) AND G(V) MEASUREMENTS

P.H.H.O. Kuczer and A.M. Goodman
RCA Labs, Princeton NJ 08540
Special rept. (12/1977).
Availability: PB-274 939/8ST
NTIS

Recently developed technology has enabled the measurement of MIS C(V) and G(V) at bias-voltage magnitudes as large as 25 kV. This report describes a versatile high-voltage power supply intended for use as a bias source in carrying out such measurements. The design allows the user a wide variety of options in the selection of the sweep function (waveform), sweep time, initial bias voltage, and the amplitude of the bias sweep. There are six possible sweep functions: (1) increasing ramp, (2) decreasing ramp, (3) positive polarity half-wave sawtooth (increasing ramp followed by decreasing ramp), (4) negative polarity half-wave sawtooth (decreasing ramp followed by increasing ramp), (5) full-wave sawtooth starting with increasing ramp, and (6) full-wave sawtooth starting with decreasing ramp. Either single or repetitive sweeps may be selected. The sweep time from the initial value to the end of the first ramp segment may be varied from 1 to 2000 s. Operator convenience is enhanced by certain features of the design; among these are light-emitting diodes which display the state of the sweep and automatic pen control if the sweep is used with an x-y recorder.

Primary Keywords: Semiconductors; Measurement; Power Supplies; High Voltage; Bias; Capacitance; Electrical Resistance; Function Generators; Semiconductor Devices; Sweep Circuits; Electric Measuring Instruments
Secondary Keywords: Metal Insulator Semiconductors; Silicon On Sapphire; NTISCOMNRS; NTISDODSD

8321
(BREAKDOWN STUDIES)
(Exploding Wires)
STRIATIONS IN EWP

M Gorenkin
Temple University, Philadelphia, PA 19122
Doctoral thesis No. Scientific-2. 19p (10/1968).
Availability: AD 685 17?
NTIS

Striations in exploding wires have been examined in sequential frame studies to investigate the possibility that gas discharge type striations are formed in the electron-vapor sheath. These electrical striations, due to localized space charge formed by impact, move in the direction of major ty electric current carrier motion. Explosions were carried out on samples immersed in distilled water in order to impose outgassing which could mask striations. No. 28 copper wire samples in 1 and 2 cm lengths were connected across a 45 microfarad capacitor bank charged to 3 to 8 kV. Within the range of electric fields used in this experiment, no movement of striations were observed. Comparison of striations in annealed and unannealed wires show that it is not likely that low velocity striations are present. The existence of mechanical striations has been firmly established. (Author)

Primary Keywords: Exploding Wires_Electric Fields; Gas Ionization; Ionization Potentials; Vaporization; Charged Particles; Theses
Secondary Keywords: EWP(Exploding Wire Phenomena); Exploding Wire Phenomena; Mechanical Striations; Electrical Striations; Striations

8322
(PARTICLE BEAMS, NEUTRAL)
(Generation)
STUDY OF EFFICIENT HIGH-POWER, HIGH-ENERGY NEUTRAL BEAMS FOR THE REFERENCE MIRROR REACTOR

J.H. Fink, W.L. Barr and G.W. Hamilton
Lawrence Livermore Lab, Livermore, CA 94550
(11/1976).
Availability: UCRL-52173
NTIS

An injector design for the Reference Mirror Reactor is described which uses negative ions created by charge-exchange in a cesium vapor cell and neutralized by photodetachment. Some of the innovations discussed include a continuously operating cathode for an LBL/LLL ion source, a negative ion beam line with cooled grids, a high voltage accelerator configuration with insulators shielded from the neutron and gamma flux, and cryopanels which continuously cycle between pumping and outgassing modes. (ERA citation 02:031659)

Primary Keywords: Magnetic Mirror Type Reactors; Neutral Atom Beam Injection; Cathodes; Design; Efficiency; Electrodes; Ion Sources; Performance
Secondary Keywords: ERDA/700205; NTISERDA

8324
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE EFFECT OF HUMIDITY ON A CORONA DISCHARGE IN AIR
B.R. Haskell
Royal Aircraft Establishment, Farnborough, UK
No. RAE-TR-70106, 27p (06/1970).
Availability: N71-24373
NTIS

Primary Keywords: Electric Corona; Humidity Measurement; Moisture Meters; Atmospheric Moisture; High Voltages; Pressure Effects; Response Time (computers); Temperature Effects; Volt-ampere Characteristics

8325
(BREAKDOWN STUDIES)
(Gas, Optical)
THE GUIDANCE OF HIGH-VOLTAGE ELECTRICAL BREAKDOWN STREAMERS BY LASER INDUCED IONIZATION IN AIR
Markels
Versar Inc. Springfield, VA 22151
Final scientific rept. (06/1973).
Availability: AD-763 827
NTIS

Experimental studies and theoretical analysis have shown that the breakdown paths and propagation velocity of high voltage electrical streamers can be modified and controlled by laser radiation at intensities less than the optical breakdown threshold. In air at atmospheric pressure, 450 KV negative streamers have been guided along straight paths about 70 cm in length, and the propagation velocities of the streamers have been increased from 2 x 10 to the power of 7 cm/sec to 3 x 10 to the power of 8 cm/sec, by 1.06 micrometer radiation pulses of 200 Joules energy and 60 nsec half-width. Direct measurements of the degree of ionization along the laser beam path showed about 10 to the power of 10 - 10 to the power of 11 ion pairs/cc are produced at the beam intensities used in the studies. (Modified author abstract)

Primary Keywords: Gas Ionization_Coherent Radiation; Electric Discharges_Lasers; Optical Equipment; Electrodes; Recombination Reactions; Ions; Electron Density
Secondary Keywords: Laser Beams; Dielectric Breakdown; Q Switched Lasers; Nuclear Fusion; AF

8326
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
THEORETICAL AND EXPERIMENTAL STUDY OF THE CURRENT DISTRIBUTION IN COILS COUPLED TO IMPULSE DYNAMOS
B. Geoffrion and M. Legentil
Paris University, Orsay, France
No. (F-10, 29p (03/1973).
Availability: N74-17456/6
NTIS

The features of coils to be coupled to homopolar impulse generators were determined in order to maximize transfer efficiency from kinetic to magnetic energy. The current distribution inside the coils was computed, together with the resulting magnetic induction, and a comparison was made with experimental results obtained using a 5 MJ generator. (Author)

Primary Keywords: Electric Energy Storage; Energy Conversion Efficiency; Impulse Generators; Magnetic Coils; Current Distribution; Electrical Engineering; High Voltages; Impedance; Magnetic Induction; Time Dependence
Secondary Keywords: NASA

8329
(POWER CONDITIONING)
(Pulse Forming Networks)
A PULSE-FORMING NETWORK FOR PARTICLE PATH VISUALIZATION
K.W. McAlister
Ames Research Center, Moffett Field, CA
Technical memo. No. NASA-A-8671, 18p (11/1981).
Availability: AD-A108 424/3
NTIS

A procedure is described for visualizing nonsteady fluid flow patterns over a wide velocity range using discrete nonluminous particles. The paramount element responsible for this capability is a pulse-forming network with variable inductance that is used to modulate the discharge of a fixed amount of electrical energy through a xenon flashtube. The selectable duration of the resultant light emission functions as a variable shutter so that particle path images of constant length can be recorded. The particles employed as flow markers are hydrogen bubbles that are generated by electrolysis in a water tunnel. Data are presented which document the characteristics of the electrical circuit and establish the relation of particle velocity to both section inductance and film exposure. (Author)

Primary Keywords: Pulse Generators; Electrical Networks; Water Tunnels; Flash Lamps; Xenon Lamps; Flow Fields; Particles; Paths; Shutters(Optics); Images; Bubbles; Patterns; Hydrogen; Electrolysis; Exposure(General); Functions; Films; Electricity; Circuits; Light
Secondary Keywords: Pulse Forming Networks; Flow Visualization; Unsteady Flow; Streamline Visualization; NTISDODXA, NTISNASA; NTISDODA

8337
(SWITCHES, CLOSING)
()
DEVELOPMENT OF HIGH VOLTAGE-HIGH CURRENT SWITCHES (FINAL REPORT)
H.N. Price
General Electric Co, Schenectady, NY 12301
No. NASA-CR-61519, 48p (02/1966).
Availability: N68-17073
NTIS

Primary Keywords: Electrical Properties; High Voltages; Switches; Trigger Circuits; Tube Anodes; Vacuum Tubes; Electric Potential; Envelopes; Hydrogen Plasma; Ignitrons; Tube Cathodes

8347
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
FDX: A FAST DISCHARGE HOMOPOLAR GENERATOR
H.H. Woodson (1), D.J. Meyhall (1) and H.G. Rylander (2)
(1) University Of Texas At Austin, Austin, TX 78712
(2) Department Of Energy
No. CONF-771132-4, 12p (01/1977).
Availability: ORO-5594-8
NTIS

A study was undertaken to determine the fundamental limitations to the discharge times of homopolar generators. As a result of the study, a Fast Discharge Experiment (FDX) was proposed. FDX is a small (365 kJ), counterrotating disk type homopolar generator designed to explore the limits to homopolar generator discharge times. The FDX rotors are forged aluminum alloy with flame sprayed copper slip rings. Solid copper graphite brushes are used with a 95% packing factor on the slip rings. The high magnetic field required for fast discharge (3.6 T average) is provided by discharging the CEM 5.0 MJ homopolar generator into a four-turn, graphite-reinforced, room temperature copper coil. Since the field is pulsed and FDX rotors cannot be self motored, they are brought up to speed with two 37 kW air turbines. The two aluminum rotors are 30 cm in diameter and of a rimmed, modified constant stress configuration. They are designed for a maximum operating speed of 28,000 r/min at which point they each store 182.5 kJ and develop 104 V. The aluminum discharge coax is approximately 36 cm in diameter and is designed to carry the 1.88 MA anticipated from a half speed (14,000 r/min) short circuit discharge which would stop the rotors in 1.0 ms. It is predicted that the machine will ring on its own internal impedance for approximately five cycles in this mode. The discharge coax is shorted by four very fast making switches.

Primary Keywords: Electric Generators; Thermonuclear Reactors; Aluminium; Configuration; Gas Turbines; Operation; Rotors; Specifications
Secondary Keywords: ERDA/700203; DC Generators; Fast Discharge Experiment; NTISDE

8355
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
HOMOPOLAR GENERATOR DEVELOPMENT AT THE UNIVERSITY OF TEXAS
W.F. Weldon (1), H.H. Woodson (1) and Rylander H.G. (2)
(1) University Of Texas At Austin, Austin, TX 78712
(2) Department Of Energy
No. CONF-771132-3, 9p (01/1977).
Availability: ORO-5594-7
NTIS

Homopolar generator development since 1972 is reviewed. The first homopolar generator stored 0.65 MJ was capable of self motoring to 6000 r/min in about 12 min with an armature current of 1.0 KA and could discharge in about 3.0 s at a current of 14.0 kA. A high brush tester to evaluate mechanical and electrical properties of the various grades of solid brushes available is mentioned. The second homopolar generator stores 5.0 MJ of energy inertially at 5600 r/min and is basically a scaled-up version of the first generator with improved bearings and brush mechanism. Work on fast discharge and industrial programs is mentioned. (ERA citation 03:025509)

Primary Keywords: Electric Generators; Thermonuclear Reactors; Design; Fabrication; Operation; Performance Testing; Power Supplies; Specifications
Secondary Keywords: ERDA/700203; DC Generators; NTISDE

8361
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
MODEL AIR-SUPPORTED DRUM-TYPE HOMOPOLAR GENERATOR
R.L. Kustom, R.E. Fuja, R.B. Wehrle, R.P. Smith and T.J. Koverik
Argonne National Lab, Argonne, IL
(01/1977).
Availability: CONF-771132-6
NTIS

A single cylinder, drum-type homopolar generator has been designed and built for the purpose of developing a simple air support system for thin cylinder rotors operated at high surface velocities and significant radial drum growth. The model has an aluminum cylinder which is 0.32 cm thick, 25 cm in diameter, and 12.7 cm long. It is designed to operate at a peak current of 2500 A and to store a total of 40 kJ with a surface velocity of 305 m/sec. (ERA citation 03:049215)

Primary Keywords: Electric Generators; Air; Cylindrical Configuration; Design; Electric Contacts; Levitation; Power Supplies; Rotation; Thermonuclear Reactors
Secondary Keywords: ERDA/700203; DC Generators; NTISDE

8363
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
OPTICAL METHODS OF ELECTRICAL MEASUREMENT AT HIGH VOLTAGE LEVELS
R.E. Hebner, R. Malewski and E.C. Cassidy
National Bureau of Standards, Washington, DC
Final rept. (11/1977).
Availability: PB-282 879/6ST
NTIS

Optical methods to measure electric parameters and transmit the information from high voltage circuits to ground potential are described and evaluated in the light of the specific requirements of high voltage measurement applications. The history and physics of a variety of opto-electrical methods found suitable for electrical measurement applications are introduced. Existing optical devices for measuring alternating, direct, and impulse currents and voltages in high voltage circuits are reviewed with emphasis on the operation and features of several selected methods. The use of these techniques in high voltage and industrial power systems, in research laboratory apparatus, and in reference standards laboratories is discussed.

Primary Keywords: Electrical Measurement; Optical Measuring Instruments; High Voltage; Faraday Effect; Kerr Magnetooptical Effect; Electrooptics; Birefringence
Secondary Keywords: NTISCOMNBS
Distribution Restriction: PUB. IN PROCEEDINGS OF IEEE, V65 N11 P1524-1548 NOV 77.

8367
(REVIEWS AND CONFERENCES; PARTICLE BEAMS)
(Conferences; Reviews)
PROCEEDINGS OF THE INTERNATIONAL TOPICAL CONFERENCE ON HIGH POWER ELECTRON AND ION BEAM RESEARCH AND TECHNOLOGY (2ND), OCTOBER 3-5, 1977: VOLUME I
J.A. Nation and R.N. Sudan
Cornell University, Ithica, NY 14850
Final rept. (03/1978).
Availability: AD-A057 218/8ST
NTIS
Contents: Generation and Transport of Intense Beams; Energy Deposition in Targets; Beam Plasma Interactions; and Charged Particle Rings.
Primary Keywords: Electron Beams; Ion Beams; Particle Accelerators; High Energy; Nuclear Fusion; Confinement(Nuclear Reactors); Implosions; Ion Bombardment; Plasmas(Physics); Meeting; Symposia
Secondary Keywords: Storage Rings; Meetings; NTISDODXA

8368
(REVIEWS AND CONFERENCES; PARTICLE BEAMS)
(Conferences; Reviews)
PROCEEDINGS OF THE INTERNATIONAL TOPICAL CONFERENCE ON HIGH POWER ELECTRON AND ION BEAM RESEARCH AND TECHNOLOGY (2ND), OCTOBER 3-5, 1977: VOLUME II
J.A. Nation and R.N. Sudan
Cornell University, Ithica, NY 14850
Final rept. (03/1978).
Availability: AD-A057 219/8ST
NTIS
Contents: Collective Accelerators; Microwaves and Unneutralized E-Beams; Technology; and Laser Applications.
Primary Keywords: Electron Beams; Ion Beams; Electron Accelerators; Ion Accelerators; Relativity Theory; Mesers; Transport Properties; Laser Pumping; Symposia
Secondary Keywords: Reflex Triodes; Meetings; NTISDODXA

8383
(INSULATION, MATERIAL)
(Liquid)
WATER AS DIELECTRIC IN HIGH-VOLTAGE IMPULSE DEVICES
V.Y. Ushakov
(10/1976).
Availability: UCRL-Trans-11185
NTIS
In exploding-wire and ultrafast plasma-heating experiments, for the production of high-power x-ray flashes and fast-electron pulses, and in a number of other situations, generators of large impulse currents (10 exp 6 A) and voltages (10 exp 6 to 10 exp 7 V) with nanosecond fronts are needed. The results available in the literature and the author's data on the principal aspects of the use of water as a dielectric in high-voltage impulse storage and switching devices are summarized. (ERA citation 02:023161)
Primary Keywords: High-voltage Pulse Generators; Water; Dielectric Properties; Electrical Insulation. Energy Storage; Switches
Secondary Keywords: ERDA/420800; ERDA/360603; Translations; USSR, Dielectrics; NTISERDAT
Distribution Restriction: TRANSLATED FROM PP 96-113 OF POWERFUL NANOSECOND IMPULSE SOURCES OF ACCELERATED ELECTRONS, IZDATEL'STVO ''NAUKA'', NOVOSIBIRSK, 1974.

8390
A SIMPLE GENERATOR OF SEVERAL-HUNDRED-KILOVOLT PULSES WITH NANOSECOND RISE TIMES
J.C. Blackburn and R.D. Genuario
Harry Diamond Labs, Washington, DC 20438
No. HDL-TM-73-24, 21p (11/1973).
Availability: AD-780 027/9
NTIS
A system for producing rectangular 0.5 MV pulses with rise times of about 1 nsec and duration between 5 and 20 nsec is described. A coaxial line is pulse-charged from a Martin-type autotransformer and then discharged by a fast-rise high pressure switch into a matched CuSO4 load resistor. A low-inductance capacitive voltage divider allows monitoring of the pulse. The jitter and delay in the discharge switch total less than a microsecond, allowing synchronization with other events. The system has been in use for 1-1/2 years with satisfactory results. (Author)
Primary Keywords: Pulse Generators; Short Pulses; Nondestructive Testing; Ceramic Materials
Secondary Keywords: NTISA

8399
ANTARES PROTOTYPE 300-KJ, 250-KA MARX GENERATOR (FINAL REPORT)
K.B. Riepe, L.L. Barrone, K.J. Bickford and G.H. Livermore
Los Alamos National Labs, Los Alamos, NM 87545
(01/1981).
Availability: LA-8491
NTIS
A high-energy, low-inductance, low prefire rate, low trigger jitter, high-voltage, pulsed-power supply was needed to drive the gas discharge in the Antares laser power amplifier. This report describes the design and testing of a Marx generator that meets these requirements, the development and testing of a high-capacity spark gap, and the selection of suitable capacitors and resistors. (EPA citation 06:010021)
Primary Keywords: Antares Facility; Carbon Dioxide Lasers; Power Supplies; Capacitors, Design; Performance Testing; Resistors, Spark Gaps
Secondary Keywords: ERDA 760208, ERDA/420300; NTISDE

8403
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Marx Generators; Marx)
COAXIAL MARX GENERATOR FOR PRODUCING INTENSE RELATIVISTIC ELECTRON BEAMS
Y. Kubota, S. Kawasaki, A. Miyahara and H. Sead
Nagoya University, Nagoya, Japan
Japanese Journal Of Applied Physics, Vol. 13, No. 2, pp 260-263 (02/1974).
The construction and operation of a coaxial Marx generator is described in this paper. An output voltage of 600 kV, 80 nH inductance, and stored energy of 160 J make this Marx generator a good candidate for e-beam generation. With a diameter of 25 cm and length of 140 cm, the device is also very compact. 6 Refs.
Primary Keywords: Marx Generator; Coaxial Configuration; 80 nH Inductance; 600 kV Output Voltage; 160 J Stored Energy

8407
(REVIEWS AND CONFERENCES; ENERGY STORAGE, CAPACITIVE)
(Reviews; Reviews)
CRITICAL PULSE POWER COMPONENTS
W.J. Sarjeant (1) and G.J. Rohwein (2)
(1) Los Alamos National Labs, Los Alamos, NM 87545
(2) Sandia Labs, Albuquerque, NM 87115
Los Alamos Report No. CONF-810812-9 (08/1981).
Availability: LA-UR-81-1249
NTIS
Critical components for pulsed power conditioning systems will be reviewed. Particular emphasis will be placed on those components requiring significant development efforts. Capacitors, for example, are one of the weakest elements in high-power pulsed systems, especially when operation at high-repetition frequencies for extended periods of time are necessary. Switches are by far the weakest active components of pulse power systems. In particular, opening switches are essentially nonexistent for most applications. Insulation in all systems and components requires development and improvement. Efforts under way in technology base development of pulse power components will be discussed. 37 Refs.
Primary Keywords: Pulsed Power Conditioning Systems; Long Life Energy-transfer System Components; High Energy Density Capacitors; Capacitor Development

8414
DEVICE FOR GENERATING POWERFUL ELECTRICAL PULSES
B.I. Kulikov, V.M. Lagunov, Y.Y. Nesterikhin and V.M. Fedorov
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-2139-78, 8p (12/1978).
Availability: AD-A066 677/6ST
NTIS
No abstract available.
Primary Keywords: Pulse Generators; Translations; USSR
Secondary Keywords: Patents; NTISDODXA; NTISFNUR

8594
ACTIVE LAMP PULSE DRIVER CIRCUIT
K.E. Logan
Goddard Space Flight Center, Greenbelt, MD
Patent Application No. PAT-APPL-6-276 748, 24p (12/1978).
Availability: N82-10390/4
NTIS
A flashlamp drive circuit is described in detail. The device uses an unsaturated transistor as a current mode switch to periodially subject a partially ionized gaseous laser excitation flash-lamp to a stable, rectangular pulse of current from an incomplete discharge of an energy storage capacitor. A monostable multivibrator sets the pulse interval, initiating the pulse in response to a flash command by providing a reference voltage to a non-inverting terminal of a base drive amplifiers. A tap on an emitter resistor provides a feedback signal sensitive to the current amplitude to an inventory terminal of the amplifier, thereby controlling the pulse amplitude. The circuit drives the flashlamp to provide a square-wave current flashlamp discharge.
Primary Keywords: Patent Applications; Flash Lamps; Optical Pumping; Pulse Generators; Pulsed Lasers; Switching Circuits; Current Regulators; Feedback Circuits; Ionization; Laser Pumping; Optical Resonators; Pulse Amplitude; Square Waves; Transistor Circuits
Secondary Keywords: NTISGPNASA
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF APPLICATION AVAILABLE NTIS.

8595
AN ELECTROMECHANICAL PULSE SOURCE
G.A. Sipeylov, A.V. Loos, Y.a. Romanov and V.F. Sergeyev
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-0662-81, 8p (08/1981).
Availability: AD-A103 779/5
NTIS
No abstract available
Primary Keywords: Pulse Generators; Alternators; Short Circuits; Electric Coils; Stators; Rotors; Translations; USSR
Secondary Keywords: Electromechanical Sources; Synchronous Generators; NTISDODXA; NTISFNUR

8651
AN X-RAY DIAGNOSTIC FOR LIGHT-ION CURRENT MEASUREMENTS
R.D. Bleach, D.J. Nagel, D. Mosher and S.J. Stephanakis
Naval Research Lab, Washington, DC 20375
Memorandum rept. No. NRL-MR-4462, 29p (03/1981).
Availability: AD-A095 923/9
NTIS
A technique to determine the number and current density of MeV protons in an intense beam was tested on the GAMBLE II generator. Diode current and voltage and an absolute measurement of K-line radiation emitted from a 6 micrometer thick aluminum target were used to determine the number and current density of protons incident on the target. Time-dependent x-ray measurements can be used to infer variations in the ion-beam current density.
Primary Keywords: Proton Beams; X Ray Diagnostics; Current Density; Spectrum Analysis; Pulse Generators; Metal Films; Targets; Aluminum; Emission Spectra
Secondary Keywords: GAMBLE 2 Pulse Generators; NTISDODXA

8602

ARC DISCHARGE SOURCES

C.M. Church and R.G. Schlecht
Westinghouse Research and Development Center, Pittsburgh PA
Semiannual technical summary rept. no. 1, 16 Oct 64-15 Apr 65 No. 65-921-148-R3, 129p (05/1965).
Availability: AD-462 792/3ST
NTIS

A simple theoretical model for the high energy pulsed arc discharge has been proposed, in which thermal conduction and radiative transfer occur within the arc. Radiative transfer is discussed both in general and as applied to the model. The theoretical evaluation of the various physical properties of the arc plasma, that are required in finding a solution to the model, including absorptivity, thermal and electrical conductivities are described using simple and relatively complete expressions. Calculations which consider the arc to be of homogeneous temperature of the form of a plane parallel slab and a cylinder are described, with results indicated for the plane parallel slab using a simplified representation of the electron density and absorptivity. Experimental measurements necessary to validate the model are discussed. Measurements of the spectral radiance in the ultraviolet at different radial points are presented. (Author)

Primary Keywords: Electric Arcs_Lasers; Mathematical Models; Electric Discharges; Electron Density; Programming (Computers); Ultraviolet Radiation; Measurement; Thermal Conductivity; Electrical Conductivity; Argon; Krypton; Xenon; Transport Properties; Emissivity
Secondary Keywords: Defender Project; Electric Discharge Lasers; Laser Pumping; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

8603

BLUMLEIN LINE GENERATION OF LONG-PULSE, PRECISELY REGULATED WAVESHAPES FOR NONLINEAR RESISTIVE LOADS

W.A. Reass
Los Alamos National Labs, Los Alamos, NM 87545
No. LA-UR-81-1670, 4p (01/1981).
Availability: DE81025380
NTIS

This paper describes the criteria utilized in the design of a long-pulse, offset-tuned Blumlein line. It is capable of 100- mu s, medium repetition rate (1kC), 200-kV pulses for nonlinear loads (such as klystrons), with a total power deviation of less than 0.5% (ripple, overshoot, and droop, inclusive). (ERA citation 06:027550)

Primary Keywords: High-voltage Pulse Generators; Experimental Data; Klystrons; Pulse Shapers; Pulses; Tuning
Secondary Keywords: ERDA/420800; NTISDE

8604

CALCULATIONS FOR EXPLOSIVE MAGNETIC GENERATORS

S.G. Hibben
Informatics, Inc., Rockville, MD
Interim rept. (10/1976).
Availability: AD-A107 746/0
NTIS

This is a translation of a Soviet paper which develops generalized criteria for optimum design of an explosive magnetic generator. Studies on techniques for pulsed compression of magnetic fields, with the resultant high pulse power generation, were actively pursued in the late 1960s and the early 1970s both here and abroad. In recent years the interest in these techniques appears to have dwindled, notably in the U.S. A recent search by the Smithsonian Science Information Exchange, in fact indicates no current U.S. research program under way on explosive compression of magnetic fields. In contrast, a continuing study of explosive cumulation is being maintained in the USSR, in particular under the direction of Bichenkov and Lobanov at Novosibirsk. These authors have published a series of papers on theoretical and experimental aspects of explosive compression, in which both coaxial and planar sandwich geometries have been investigated.

Primary Keywords: Explosive Decompression; Pulse Compression; Pulse Generators; Magnetic Fields; Explosive Charges
Secondary Keywords: Explosive Magnetic Generators; Magnetic Flux; Magnetic Field Compression; NTISDODXA

8607

COLLECTIVE ION ACCELERATION AND ELECTRON BEAM PROPAGATION IN DIELECTRIC GUIDES

W.D. Halverson
Spire Corp, Bedford, MA 01730
Final rept. 1 Feb 79-31 Jan 81 No. PR-10067, 59p (05/1981).
Availability: AD-A102 874/5
NTIS

The propagation of electron beam currents much greater than the space charge limit and collective ion acceleration in evacuated dielectric guides was investigated. Experiments at Spire and at the Gamble I facility of NRL show that the beam front propagation velocity is not effected by the dielectric guide downstream from the anode region of the accelerator. The propagated current, however, depends strongly on guide parameters, and is considerably diminished in a shortened guide configuration. Collectively accelerated ions were not observed using the 40 ns, 200 keV electron accelerator at Spire, although earlier experiments using longer, lower energy pulses showed considerable ion acceleration. Proton energies more than 14 times the electron beam energy were observed during the experiment on Gamble I. An estimated 2x(10 to the 9th power) protons at 12 MeV or greater along with 1x(10 to the 11th power) protons at 5 MeV or greater were observed in a single shot. The origin of the collectively accelerated protons was principally in the anode foil of the accelerator. Suggestions for increasing the energy and yield of collectively accelerated ions include improving the homogeneity of the downstream plasma and reducing the magnetic field of the propagating electron beam current. (Author)

Primary Keywords: Ion Accelerators; Dielectric Waveguides; Limitations; Space Charge; Current Density; Vacuum; Electron Beams; Ion Beams; Plasma Diagnostics; Neutron Activation
Secondary Keywords: Gamble I Pulse Generator; NTISDODXA; NTISDODAF

8608

COLLECTIVE ION ACCELERATION WITH INTENSE RELATIVISTIC ELECTRON BEAMS

R.B. Miller and D.C. Straw
AFWL, Kirtland AFB, NM 87117
Final rept. No. AFWL-TP-75-236, 80p (04/1976).
Availability: AD-A025 943/2ST
NTIS

Recent theoretical and experimental investigations of ion acceleration occurring when an intense relativistic electron beam is injected into low pressure neutral gases have yielded a fairly complete description of the process. In this report the experimental procedure and results of the collective ion acceleration program at the Air Force Weapons Laboratory, including related diode and beam propagation work, are examined in detail. Important conclusions pertaining to the existence of an ion acceleration threshold current, to accelerated ion energy spectra, and to process efficiency are reported. (Author)

Primary Keywords: Ion Accelerators; Electron Beams; Pulse Generators; Cations; Threshold Effects; Energy; Spectra; Streak Cameras; Space Charge; Electric Current; Ionization; Neutralization
Secondary Keywords: Relativistic Beams; Collective Acceleration; Beam Propagation; Neutral Gases; Drift Tubes; NTISDODXA; NTISDODAF

8617

DIELECTRIC MATERIALS FOR STRUCTURAL APPLICATIONS AND HIGH-VOLTAGE INSULATION IN DEIONIZED WATER FOR PARTICLE-BEAM ACCELERATORS

J.P. Furaus
Sandia Labs, Albuquerque, NM 87115
No. SAND-81-1713C, 4p (01/1981).
Availability: DE81027203
NTIS

The pulsed energy programs at Sandia National Laboratories (SNLA) have often required dielectric materials that provide a dual role of high voltage insulation as well as critical structural support. One typical application is the dielectric tension rods for the trigatron gas switch used on the PBFA-I Accelerator. This paper describes the performance of dielectric materials used in the past and recent evaluations of alternative materials that have resulted in significant cost and performance improvements. (EPA citation 06:029174)

Primary Keywords: High-voltage Pulse Generators; Linear Accelerators; Electrical Insulators; Mechanical Structures; Performance; Pulse Techniques; Switches
Secondary Keywords: ERDA/430303; NTISDE

8618

DIRECT CONTROL OF LARGE POWER SERIES TRIODES WITH TRANSISTORS FOR HIGH VOLTAGE POWER SOURCE

M. Fukuda and K. Matsuura
Nagoya University, Nagoya, Japan
(02/1979).
Availability: IPPJ-DT-62
NTIS

The control of high voltage, large power output is often required in high frequency power sources for plasma experiments. For this purpose, power transmitter tubes such as triodes or tetrodes have been used as the series control tubes. However, in case of large power, the driving power for the series control tubes also becomes large, and it leads to the requirement of large space and high cost. In order to solve such problem, the driving with transistor circuits has been experimented. Transistor circuits permit large current, but have comparatively low withstand voltage. However, the problem of withstand voltage has been solved by employing multi-stage series connection. First, the transistor circuit used has been analyzed, and the testing circuit was produced for trial and tested. The selected transistors were 2SD520 of Darlington connection as the main transistor, and 2SC995 or FET 2SK96C as the prestage transistor. The power source of +250 V to -1400 V has been prepared. In general, such a circuit tends to cause parasitic oscillation (of several MHz). To prevent this oscillation, capacitors of approximately 100 pF were connected in parallel with bleeder resistors. These capacities did not affect the response speed of the system. Since the transistor failures in such a system may cause load breakage, the circuit must be protected by employing current limiters such as fast blowing fuses and Zener diodes for the protection from surge voltage. In the practically applied

Primary Keywords: Thermonuclear Devices; Dc Amplifiers; Electronic Circuits; High-voltage Pulse Generators; Klystrons; Plasma; Power Conditioning Circuits; Power Supplies; Rf Systems; Transistors
Secondary Keywords: IN JAPANESE; Foreign Technology; ERDA/700203; NTISIDIS; NTISFNJA
Distribution Restriction: U.S. SALES ONLY.

8620

ELECTRIC MACHINE SOURCE OF IMPULSES

S.A. Sipaylov and A.V. Loos
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-0663-81, 8p (07/1981).
Availability: AD-A103 466/9
NTIS

No abstract available.

Primary Keywords: Pulse Generators; Synchronization(Electronics); Magnetic Drives; Patents; Translations
Secondary Keywords: NTISDODXA; NTISFNUR

8627

EXPERIMENTS IN MAGNETIC SWITCHING

D.L. Birx, E.J. Lauer, L.L. Reginato, D.J. Rogers and M.W. Smith
Lawrence Livermore Lab, Livermore, CA 94550
No. CONF-810659-6, 9p (05/1981).
Availability: UCRL-85738
NTIS

Magnetic switching offers an alternative to overcoming the rep rate and life limitations of the spark gaps in the ETA/ATA induction accelerators. The principle has been applied for many years to radar modulators but at much lower power levels and longer pulse lengths. Comparatively recent developments in magnetic materials together with some optimal circuits have made it possible to go well beyond the state of the art. A magnetic modulator has been built which steps up and compresses a 25 kV, 5 mu s pulse into a 250 kV, 50 ns pulse. A second magnetic modulator has been built and installed to replace four Blumleins and spark gaps in order to provide triggers for the complete ETA injector and accelerator. The paper outlines some practical and theoretical considerations affecting the design of the magnetic pulse generator. (ERA citation 06:024087)

Primary Keywords: Linear Accelerators; Switching Circuits; Kev Range 100-1000; Kilo Amp Beam Currents; Magnetic Fields; Modulation; Performance; Pulse Generators; Trigger Circuits
Secondary Keywords: ERDA/433303; NTISDE

8628
EXPERIMENTS ON THE INTERACTION OF HIGHPOWER MICROWAVES WITH AIR
W.M. Bollen, R.K. Parker and W.M. Black
Mission Research Corp, Alexandria, VA
Final rept. 4 Apr 80-4 Jun 81 No. MRC/WDC-R-015, 37p (07/1981).
Availability: AD-A106 390/8
NTIS

The physics of gas breakdown for large collision frequency, nu/omega > 1, is being pursued at the Naval Research Laboratory. The hybrid inverted coaxial magnetron, 500MW, 3.2 Ghz, 30ns pulse width, allows investigation of gas breakdown in the high nu/omega regime. The 35 Ghz gyrotron, 150KW, 300pps, allows investigation in a moderate nu/omega regime. Large gas breakdown plasma densities have been measured, n approx. 100 n sub c. Spectral measurements have been made showing only excitation of molecular bands. Preliminary propagation experiments have also been performed. (Author)

Primary Keywords: Gas Breakdown; Plasma Generators; Air; Molecular Spectroscopy; Emission Spectra; Pulse Generators; Band Spectra; Radiofrequency Power; Molecular Structure; Ka Band; Langmuir Probes; S Band; Magnetrons; Physics
Secondary Keywords: Inverted Magnetrons; Coaxial Magnetrons; Circular Modes; Collision Frequencies; Gyrotrons; NTISDODXA

8632
FAST, VERSATILE POCKELS CELL DRIVER
J.A. Dicles, DC Downs and D.J. Kuizenga
Lawrence Livermore Lab, Livermore, CA 94550
No. UCRL-85202-Sp (06/1981).
Availability: DE81024365
NTIS

Vacuum planar triodes, normally used in S-Band radar applications, can also serve as excellent switch tubes in fast, low jitter pulse generators. Laser systems have need of such generators for driving Pockels cells. Development work in this area has resulted in three successive driver designs. The present two-chassis unit will serve as a standard driver in the Nova and Novette laser systems. This assembly is capable of driving nine kilovolts into 75 ohms with three nanoseconds risetime and less than 100 picoseconds short term jitter. Rise and fall times of approximately two nanoseconds are available at half output voltage swing. (ERA citation 06:032764)

Primary Keywords: Lasers; Nova Facility; Pockels Cell; Pulse Generators; Design; Performance; Pulse Rise Time; Pulse Shapers; Switches; Switching Circuits; Triode Tubes
Secondary Keywords: ERDA/700208; ERDA/420300; NTISDE

8633
FIBER OPTIC TELEMETRY SYSTEM FOR LLL HIGH-VOLTAGE TEST STAND
J.P. Richter
Lawrence Livermore Lab, Livermore, CA 94550
No. CONF-771529-79, 6p (10/1977).
Availability: UCRL-79688
NTIS

This paper describes the Fiber Optic Telemetry System designed to operate in the hostile particle and electromagnetic radiation environment of the High Voltage Test Stand. It discusses system criteria, components, packaging, and performance. In all tests to date, the system exceeds its design goals with very comfortable margins. It is well advanced into the fabrication stages with all crucial components tested and only straightforward TTL (Transistor Transistor Logic) circuitry to be completed. (ERA citation 03:020715)

Primary Keywords: Data Transmission; Neutral Beam Sources; Optical Equipment; Design; Telemetry; Test Facilities
Secondary Keywords: ERDA/700205; Fiber Optics Transmission Lines; Telemetering Equipment; High Voltage Test Stand; NTISDE

8649
HIGH VOLTAGE PULSE GENERATOR FOR INFLECTOR
S. Asaoka, M. Mutou and T. Yamakawa
Tokyo Univ. (Japan). Inst. for Nuclear Study.
(05/1979).
Availability: INS-TH-121
NTIS

Recently, an injector linac for INS 1.3 GeV electron synchrotron was reconstructed and the output beam energy of the linac was increased from 9 MeV to 14 MeV. Therefore, in order to increase the inflector voltage a new power supply has been reconstructed. The new power supply consists of a line type pulser and a pulse transformer with step up ratio 1 : 12, and generates the pulse of 96 KV height, 6 mu sec width with repetition rate of 22 Hz. It has been operating very well. (Atomindex citation 11:538354)

Primary Keywords: Tokyo Synchrotron; High-voltage Pulse Generators; Hz Range; Linear Accelerators; Performance; Power Supplies; Specifications; Transformers
Secondary Keywords: IN JAPANESE; Foreign Technology; ERDA/430300; NTISINIS; NTISFNJA
Distribution Restriction: U.S. SALES ONLY.

8651
HIGH VOLTAGE, MAGNETICALLY SWITCHED PULSED POWER SYSTEMS
J.P. VanDevender and R.A. Reher
Sandia Labs, Albuquerque, NM 87115
No. SAND-81-0754C, 12p (01/1981)
Availability: DE81026290
NTIS

The principles of magnetic switching are briefly described. Then the results of experiments on the following substantive topics for magnetic switching are presented: material properties and how they relate to switch performance, risetime limitations, and core insulation. Magnetic switching is then evaluated from a system perspective. An idealized pulse power system with 200 kJ of stored energy and a 40 ns output pulse is examined. The multi-megavolt electrical insulation requirements impose limitations on the switches. The cost of the magnetically switched system exceeds the cost of the conventional super power generator system by up to 75%. The potential for reliability, reproducibility, and repetitive pulse capability must be evaluated for each application to offset the increased cost. (ERA citation 06:033658)

Primary Keywords: High-voltage Pulse Generators; Design; Performance; Pulse Techniques; Reliability; Switching Circuits
Secondary Keywords: ERDA/420800; ERDA/420300; NTISDE

8653
HIGH-VOLTAGE AIR-CORE PULSE TRANSFORMERS
G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
No. SAND-80-0451, 34p (08/1981).
Availability: DE81030999
NTIS

High voltage air core pulse transformers are best suited to applications outside the normal ranges of conventional magnetic core transformers. In general these include charge transfer at high power levels and fast pulse generation with comperatively low energy. When properly designed and constructed, they are capable of delivering high energy transfer efficiency and have demonstrated superior high voltage endurance. The general types designed for high voltage pulse generation and energy transfer applications are described. Special emphasis is given to pulse charging systems which operate up to the multi-megavolt range. (ERA citation 06:033657)

Primary Keywords: High-voltage Pulse Generators; Transformers; Design; Eddy Currents; Electrical Insulation; Electronic Circuits; Equivalent Circuits, Operation; Trigger Circuits; Uses
Secondary Keywords: ERDA/420800; NTISDE

8659
LOW FREQUENCY PULSE GENERATOR APPARATUS
D.C. La Pierre
Department of the Air Force, Washington, DC
Patent Application No. PAT-APPL-6-227 557, 13p (08/1981).
Availability: AD-D008 749/4
NTIS

The present invention utilizes one of a plurality of variable capacitors which may be switched into an R-C timing network to establish the pulse repetition rate of the pulse generating circuit. The output of the pulse generator unit is amplified and applied to a predetermined counter unit wherein, upon accumulation of the desired count, an interrupt signal is generated. The interrupt signal which is applied to the pulse generator unit disables the pulse output and thereby allows the generation of a predetermined number of pulses. It is one object of the present invention, therefore, to provide an improved low frequency pulse generator apparatus. It is another object of the invention to provide an improved low frequency pulse generator apparatus wherein the pulse sequence is terminated upon reaching a predetermined pulse count. It is another object of the invention to provide an improved low frequency pulse generator apparatus to provide preset total number of output pulses at a selected pulse rate. It is yet another object of the invention to provide an improved low frequency pulse generator apparatus wherein the preselected pulse counting sequence will resume uninterrupted after an interruption in the counting sequence.

Primary Keywords: Patent Applications; Pulse Generators; Variable Capacitors; Pulse Counters; Counting Methods; Low Frequency; Pulse Rate; Output; Counters; Pulses; Circuits; Sequences; Inventions; Accumulation
Secondary Keywords: RC Networks; Timing Networks; NTISGFAF
Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF APPLICATION AVAILABLE NTIS.

8661
LOW NOISE, LARGE DYNAMIC RANGE PULSE AMPLIFIER
J. Colas and J.C. Lacotte
Grenoble-1 University, Annecy, France
(03/1980).
Availability: LAPP-80-02
NTIS

We have developed a low noise, high dynamic range low cost amplifier. This amplifier will equip the shower position detector (current division readout) and the photomultipliers of the forward electromagnetic calorimeter in the UA1 experiment (CERN anti pp collider). (Atomindex citation 11:566133)

Primary Keywords: Pulse Amplifiers; Shower Counters; Calorimeters; Design; Photomultipliers; Proton-antiproton Interactions
Secondary Keywords: Foreign Technology; ERDA/440104; NTISINIS; NTISFNFR
Distribution Restriction: U.S. SALES ONLY.

8664
MPD INTENSE BEAM PULSER
P.J. Turchi and I.M. Virkovitsky
Department of the Navy, Washington, DC
Patent Application No. PAT-APPL-6-285 690, 36p (03/1980).
Availability: AD-D008 730/4
NTIS

An MPD intense beam pulser for generating high voltage, intense charged particle beams utilizing an electromechanical energy source and inductive energy storage in combination with a plasma opening switch including a source of directed plasma flow, a diode for accelerating particles in the plasma flowing from the source, and a plasma flow truncation circuit. In operation, a controlled plasma flow is used to conduct current from the energy source in order to supply a desired amount of energy to the magnetic field in the volume surrounding the plasma flow. Truncation of the plasma flow between the electrodes forming the diode then provides a high voltage in a short pulse which generates a high energy charged particle beam. Thus, the magnetic energy store surrounding the diode plasma flow is coupled directly to the intense particle beam. (Author)

Primary Keywords: Patent Applications; Pulse Generators; Plasma Generators; Particle Beams; Magnetic Fields; Electromechanical Devices; High Voltage; Plasmas(Physics); Charged Particles; Beams(Radiation); Plasma Control; Opening(Process); Diodes; Switches; Sources
Secondary Keywords: NTISGPN
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8674

PARTIAL DISCHARGE TESTING OF BULK TRANSFORMER OIL

G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
No. SAND-81-0551C, 4p (01/1981).
Availability: DE81023683
NTIS

The generation of partial discharges in bulk transformer oil has been investigated experimentally to determine the dominant conditions which contribute to their formation and growth under repetitive impulse stresses. The motivation for conducting these experiments arose from a problem with partial discharges and breakdowns occurring in the insulating oil around the high voltage switch in a continuous running 1.5 MV repetitive pulser system. From the experiment it was found that repetitive stressing caused low level field ionization around the electrodes which led to bubble formation and eventually partial discharges. There were also qualitative indications of charge accumulation in the oil. Photographic records of numerous shot sequences were used to study the phenomena. (ERA citation 06:023659)

Primary Keywords: Insulating Oils; Transformers; Breakdown; Dielectric Properties; Electric Discharges; Experimental Data; Pulse Generators
Secondary Keywords: ERDA/200300; NTISDE
Distribution Restriction: MICROFICHE ONLY AFTER ORIGINAL COPIES ARE EXHAUSTED.

8675

PERFORMANCES OF THE OUTLET PULSE VALVE FOR THE PROTON SOURCE OF THE I-2 LINEAR ACCELERATOR

V.A. Batalin, A.A. Kolomiets and B.K. Kondrat'ev
GKAE Atomic Energy Institute, Moscow, USSR
(01/1979).
Availability: ITEF-97(1979)
NTIS

Described are the design, operating characteristics and work peculiarities of a pulse valve, fixed on the outlet of ion duoplasmatron source of the I-2 linear accele-ator for the reduction of gas flow rate. The average gas flow rate constitutes 10 cm exp 3 /h, beam current on the outlet of the injector is 1.2 A, duration of the current pulse is 30 mu s, repetition frequency - up to 2 pulses a second. Given are an equation, describing gas regime of the ion source and its solution for the regime with pulse gas injection in the source and the regime with pulse gas extraction from the source. Considered are the curves of gas pressure change in a discharge chamber depending on time for both regimes. Evaluations, made on the example of the ion source of the I-2 linear accelerator show that the use of the pulse valve on the outlet permits to essentially decrease average gas flow rate as well as to avoid shortcomings, connected with operation at large volume of the discharge chamber and essential duration of the beam current pulse. (Atomindex citation 11:555263)

Primary Keywords: Proton Sources; Flowsheets; Gas Flow; High Vacuum; Linear Accelerators; Operation; Pulse Generators; Pulse Techniques; Pulses; Specifications; Valves
Secondary Keywords: IN RUSSIAN; Foreign Technology; ERDA/430301; NTISINIS; NTISFNUR
Distribution Restriction: U.S. SALES ONLY.

8677

POWER FLOW FOR VACUUM-INSULATED INDUCTIVE LOADS

J.P. VanDevender
Sandia Labs, Albuquerque, NM 87115
No. SAND-81-0753C, 3p (01/1981).
Availability: DE81023691
NTIS

The transport of power through a vacuum insulator without flashover and through a short, self-magnetically insulated transmission line without gap shorting severely constrains the stored energy of the inductive load for 30 ns to 300 ns drive times. An electrostatic gap closure mechanism is presented and evaluated. The gap closure constraints are then combined with constraints imposed by magnetic insulation of the electrons from the cathode and by the vacuum insulator flashover to examine the vacuum power flow from a system- point of view. It is concluded that multimegajoule drivers will be multi-megavolt sources. (ERA citation 06:027997)

Primary Keywords: Inertial Confinement; Pulse Generators; Electrodes; Performance; Power Supplies, Spark Gap.
Secondary Keywords: ERDA/700208; ERDA/700211; NTISDE

8680

PRIME POWER TO PULSE CONDITIONING INTERFACE METHODS

J.R. Silva
AFIT, Wright-Patterson AFB, OH
Master's thesis No. AFIT/GE/EE/80D-29, 77p (12/1980).
Availability: AD-A100 827/5
NTIS

AC and DC resonant charging hardware tests were conducted with a 15KW DOD standard 400 HZ generator as prime power. DC resonant charging caused vibrations of the generator at the pulsing frequency and instability of the voltage regulator due to the very irregular generator voltage waveform. The input DC voltage to the pulser sagged causing the performance to be lower than expected. An analysis of this problem and the theory to account for this sag is presented. Problems with the triggering of AC resonant charging were not solved in time for this report. The experimental set up of AC resonant charging is presented. AC resonant charging caused no negative impact on the generator which is a great advantage over DC resonant charging. (Author)

Primary Keywords: Electric Generators; Pulse Generators; Direct Current; Ultralow Frequency; Alternating Current; Input; Impart; Waveforms; Voltage; Power; Theses
Secondary Keywords: Resonant Charging; Pulse Conditioning; NTISDODXA

8683

PRODUCTION AND FOCUSING OF A HIGH-POWER RELATIVISTIC ANNULAR ELECTRON BEA

M.U.M Friedman
Cornell University, Ithica, NY 14850
No. LPS-36, 14p (01/1970).
Availability: AD-706 040
NTIS

A new electron beam injection gun has been developed to produce pulsed relativistic electron beams with a power of 10 to the 10th power watts. The annular - shaped beam propagates in a magnetic field with efficiencies approaching 100%, and its radius may be controlled by the magnetic field configuration. Typical results obtained with a 4-inch diameter cathode are reported. (Author)

Primary Keywords: Plasma Physics_Electron Beams; Electron Beams_Focusing; Electron Guns; Diodes

8689

PULSED POWER FOR ELECTROMAGNETIC LAUNCHING

M. Cowen
Sandia Labs, Albuquerque, NM 87115
(12/1980).
Availability: SAND-80-1987
NTIS

There are system advantages to producing power for electromagnetic propulsion by real-time generation rather than by a sequence of generation-storage-switching. The best type of generator for this purpose is the flux compression generator. Different types of flux compression generator which have been developed at Sandia National Laboratories are reviewed and their applications to electric launching are discussed. New experimental facilities for producing more powerful generators are described and cost comparisons are made. (ERA citation 06:022626)

Primary Keywords: Pulse Generators; Railgun Accelerators; Cost; Design; Magnetic Compression; Power Demand; Propulsion; Pulsar Concept; Research Programs; Superconducting Magnets
Secondary Keywords: ERDA/420201; ERDA/700208; NTISDE

8691

PULSED POWER RESEARCH COLLOQUIUM

M. Kristiansen
Texas Tech University, Lubbock, TX 79409
Annual rept. 1 Mar 80-28 Feb 81 (07/1981).
Availability: AD-A105 770/2
NTIS

A Pulsed Power Lecture Series is being conducted by Texas Tech University for the U.S. Air Force. Modular instructional material for use in this lecture series is being developed. Each module is a self-consistent discussion of some aspect of pulsed power technology. The contents range from the very basic (e.g. basic EM field theory) to advanced, modern topics, such as magnetic switching. The lectures are delivered every two weeks at the Air Force Institute of Technology and the Air Force Weapons Laboratory. The speakers then provide a written text of their lecture, which is edited and published in modular form by Texas Tech University. It is planned to reissue these modules in report or book form at a later date. A total of about 50 modules are planned. Some 30 lecturers have been presented, to date, and about 12 modules have been issued. (Author)

Primary Keywords: Power Supplies; Pulse Generators; Bibliographies; Lectures; Research Management; Symposia; Technology Forecasting
Secondary Keywords: NTISDODXA; NTISDODAF

8697

STRIPLINE MAGNETIC MODULATORS FOR LASERS AND ACCELERATORS

W.C. Nunnally
Los Alamos National Labs, Los Alamos, NM 87545
No. LA-UR-81-1553, 5p (01/1981).
Availability: DE81025258
NTIS

The basics of magnetic modulators including magnetic element and circuit considerations as applied to accelerators and lasers requiring repetitive (1 to 10 kHz), high voltage (50 to 500 kV), short pulse (50 to 100 ns) are discussed. The scaling of energy losses and switching parameters with material are included. (ERA citation 06:027548)

Primary Keywords: High-voltage Pulse Generators; Accelerators; Design; Lasers; Magnets
Secondary Keywords: ERDA/420800; NTISDE

8699

SUB-NANOSECOND JITTER, REPETITIVE IMPULSE GENERATORS FOR HIGH RELIABILITY APPLICATIONS

G.J. Krausse and W.J. Sarjeant
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-810659-3, 7p (01/1981).
Availability: LA-UR-81-1655
NTIS

Low jitter, high reliability impulse generator development has recently become of ever increasing importance for developing nuclear physics and weapons applications. The research and development of very low jitter (< 30 ps), multikilovolt generators for high reliability, minimum maintenance trigger applications utilizing a new class of high-pressure tetrode thyratrons now commercially available are described. The overall system design philosophy is described followed by a detailed analysis of the subsystem component elements. A multivariable experimental analysis of this new tetrode thyratron was undertaken, in a low-inductance configuration, as a function of externally available parameters. For specific thyratron trigger conditions, rise times of 18 ns into 6.0- ohmage loads were achieved at jitters as low as 24 ps. Using this database, an integrated trigger generator system with solid-state front-end is described in some detail. The generator was developed to serve as the Master Trigger Generator for a large neutrino detector installation at the Los Alamos Meson Physics Facility. (ERA citation 06:024100)

Primary Keywords: Flash Tubes; High-voltage Pulse Generators; Capacitive Energy Storage Equipment; Capacitors; Design; Electronic Circuits; Neutrino Detection; Pulse Generators; Pulse Rise Time; Thyratrons; Trigger Circuits
Secondary Keywords: ERDA/440104; ERDA/420800; NTISDE

8707

TEST STAND FOR MAGNETRON H NEGATIVE ION SOURCE AT IPP-NAGOYA

H. Okamura, T. Kuroda and A. Miyahara
Nagoya University, Nagoya, Japan
No. IPPJ-1-33, 22p (02/1981).
Availability: N81-25811/3
NTIS

Test facilities for the development of magnetron H(-) ion source consists of the vacuum system, power supplies, diagnostic equipment, and their controlling electronics. Schematics are presented and relevant items described including sequence control, optical links, the charged pulse forming network, the extractor power supply, magnet power supply, temperature control of the cesium feeder, and the pulsed valve driver. Noise problems and diagnostics are also considered.

Primary Keywords: Ion Sources; Magnetrons; Negative Ions; Test Facilities; High Voltages; Optical Waveguides; Pulse Generators; Temperature Control; Vacuum Chambers
Secondary Keywords: Foreign Technology; NTISNASAE; NTISFNJA; NTISNASAE; NTISFNJA

8716
THYRATRON MARX HIGH VOLTAGE GENERATOR
T.F.J. Ewanizky
Department of the Army, Washington, DC
Patent Application No. PAT-APPL-6-224 604, 16p (02/1981).
Availability: AD-D008 183/6
NTIS

This invention relates to a high voltage pulse generator of the Marx type, in which capacitors are charged in parallel and discharged in series. Amongst the many techniques for producing high voltage pulses, the Marx generator is probably the best known and most widely used. For the combination of short risetime and low output impendance (i.e. high power), large energy, high efficiency and waveform flexibility -- the Marx principle is peerless. In response to the recognized need for a Marx generator capable of a high repetition rate, I have investigated Marx circuitry using modern thyratrons as the switching elements. Because of the relatively high voltage trigger requirements of spark gaps, Marx circuitry developed for these devices has concentrated on achieving a balance between hold off reliability and triggering schemes that produce an orderly erection mode, so that predictable output pulses may be realized. High repetition rate capability, low voltage trigger requirements, and high reliability are well known thyratron characteristics when used in a conventional manner. However, particular problems arise with the use of thyratrons in a Marx circuit, such as both external and internal arcing, because of progressively increasing overvoltages.

Primary Keywords: *Patent Applications; Pulse Generators; Transformers;* Winding, Thyratrons; Switching, Secondary, Pulses, Inductors; Output
Secondary Keywords: MARX Generators; NTISGPA
Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF APPLICATION AVAILABLE NTIS.

8726
VARIABLE PULSE-WIDTH GENERATOR
L.E. BOLLINGER
Ohio State University, Columbus, OH
(11/1954).
Availability: AD-051 660/9
NTIS

No abstract available.

Primary Keywords: Pulse Generators; Recording Systems; Rocket Engines; Timing Circuits; Design; Rockets, Tests
Secondary Keywords: NTISDODXD; NTISDODXDB
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

8730
4TH INTERNATIONAL TOPICAL CONFERENCE ON HIGH-POWER ELECTRON AND ION-BEAM RESEARCH AND TECHNOLOGY
J.R. Neighbours
Office of Naval Research, London, UK
Conference rept. No. ONRL-C-6-81, 16p (10/1981).
Availability: AD-A108 353/4
NTIS

The Fourth International Topical Conference on High-Power Electron and Ion-Beam Research and Technology program included electron and ion beam generators, beam transport plasma heating and free electron lasers. This report is principally about foreign research results. It also contains a list of speakers and the topics discussed.

Primary Keywords: Electron Accelerators; Ion Accelerators; Heating; Plasmas(Physics); Pumping(Electronics); Electrical Lasers; Relativity Theory; Electron Beams; Ion Beams; Free Electrons; High Power; Pulse Generators, Symposia; France
Secondary Keywords: Foreign Technology; Free Electron Lasers; Inertial Confinement Fusion; Marx Generators; Power Density; NTISDODXA; NTISFNUK, NTISFNZZ

8732
A HALF MEGAWATT PULSE FORMING NETWORK (PFN)
J.E. Creedon and R.A. Fitch
ECOM, Fort Monmouth, NJ 07703
Research and development technical rept. No. ECOM-4494, 8p (04/1977).
Availability: AD-A039 709/1ST
NTIS

A lightweight half megawatt average power pulse forming network (PFN) designed a store 4 kilojoules (kJ) at 40 kilovolts has been developed. The energy storage system produces a 10 microsecond pulse at a repetition rate of 125 hertz and has a one ohm impedance. It is designed to operate adiabatically for durations of 60 seconds. A lifetime capability of over 400,000 pulses has been demonstrated. (Author)

Primary Keywords: Pulse Generators; Energy Storage; Capacitors, Pulse Modulation; Networks; Power
Secondary Keywords: NTISDODXA

8895
(ELECTROMAGNETIC FIELD GENERATION; PARTICLE BEAMS)
(Electromagnetic; Generation)
IMPROVED DESIGN AURORA MODIFICATION PROGRAM (IDAMP)
S.E. Graybill, A.G. Stewart, G.A. Huttlin, D.A. Whittaker and K.G. Kerris
Harry Diamond Labs, Adelphi, MD 20783
HDL Report No. HDL-SR-81-8 (12/1981).
Availability: HDL-SR-81-8
Harry Diamond Labs

The AURORA High-Intensity Flash X-Ray Facility could be modified to provide a high-energy, medium (2 to 10 ohm) impedance, multiterawatt pulse power source. This Improved Design AURORA Modification Program (IDAMP) could be achieved with only modest restructuring of the existing AMP water-insulated pulser. Tranformer oil, rather than deionized water, would be the insulating medium. A power output of >5 TW in a pulse of <5 MV amplitude and approximately 140 ns FWHM is feasible in either positive or negative polarity. This power source could be applied to high-intensity electron, ion, and microwave beams. 0 Refs.

Primary Keywords: High-intensity Electron Beam, High-intensity Ion Beam, Source-region Electromagnetic Pulse; AURORA Blumlein Line, Marx Generator
Secondary Keywords: Microwave Source, Gamma Source

8815
LARGE OUTPUT MILLIMICROSECOND IMPULSE GENERATOR USING ELECTROMAGNETIC SHOCK WAVES
J. Oravec, P. Gabco and F. Virsik
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)I-2207-75, 13p (12/1975).
Availability: AD-A020 152/5ST
NTIS

No abstract available.

Primary Keywords: Pulse Generators; Electromagnetic Wave Propagation; Shock Waves, Electric Discharges; Plasmas(Physics); Semiconductors, Magnetic Fields, Permeability(Magnetic); Nonlinear Systems; Czechoslovakia; Translations
Secondary Keywords: Seignetto Electronics, NTISDODXA; NTISDODAF

8834
OPERATION OF A 300 KV, 100 HZ, 30 KW AVERAGE POWER PULSER
M.T. Buttram and G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
No. CONF-780676-1, 6p (01/1978).
Availability: SAND-78-0933C

Applications for efficient and reliable pulse power systems with long lifetimes (>10 exp 8 shots) are foreseen for electron beam generators, heavy ion accelerators and lasers leading eventually to inertially confined fusion reactors. These systems will have to be capable of continuous operation for sustained periods without requiring major maintenance or repair. High operating efficiency will be required not only to minimize power consumption but also to avoid heat build up and consequent damage to components. The system described in this paper represents an initial effort to develop an efficient energy handling high voltage pulser to study the problems of long life components. (ERA citation 04:002080)

Primary Keywords: Linear Accelerators, Power Supplies; Design; Efficiency, Electron Beam Injection; Electron Beam Targets, Electron Sources; Inertial Confinement; Lifetime; Pulse Generators; Thermonuclear Reactors, Transformers
Secondary Keywords: ERDA/700203; ERDA/700208; High Voltage; NTISDE
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8909
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
A MODEL FOR DC INTERRUPTION IN DIFFUSE VACUUM ARCS
S.E. Childs and A.N. Greenwood
Renselaer Polytechnic Institute, Troy, NY 12181
IEEE Transactions On Plasma Science, Vol PS-8, No. 4, pp 289-294 (12/1980).

A theoretical model for current interruption in a diffuse vacuum arc with DC commutation is described. *Before current zero the* interelectrode plasma is modeled as an ion-neutral fluid through which electrons are flowing. After current zero a positive ion sheath grows into the plasma from the former anode, driven by the transient recovery voltage. Using the basic laws of conservation, the decay of the plasma during commutation is evaluated numerically, enabling the post-arc current, the electric field at the former anode, and the power input to this electrode after current zero to be calculated. For copper electrodes, with a commutation time of 30 microseconds, the ion density and velocity at current zero are 23 percent and 35 percent of their respective steady state values. The calculated post-arc currents of tens of amps are in good agreement with experimental data. The post-arc data generated with this model can be used to study reignition mechanisms and the interrupting capability of different contact materials. 19 Refs.

Primary Keywords: Vacuum Arc; Diffuse Arc; Fluid Model; Ion Sheath; DC Current Interruption; Copper Electrodes; Theory

8912
(ENERGY CONVERSION, THERMAL)
(Magnetohydrodynamic)
ACCURACY OF THE NET METHOD OF CALCULATING THE ELECTRICAL CHARACTERISTICS OF THE CHANNEL IN A MHD GENERATOR
A.A. B...shtein, Yu. ... Gusev, V.I. Pishchikov and S.I. Pishchikov
Academy of Sciences of the USSR, Moscow, USSR
High Temperature, Vol. 19, No. 1, pp 123-127 (02/1981).
Trans. From: Teplofizika Vysokikh Temperatur 19, 158-163 (January February 1981)

The integral electrical parameters of the channels in MHD generators have been calculated by means of electrical networks consisting of active and passive components. If there is substantial transverse inhomogeneity in the plasma parameters, the error in the calculation is determined by the number and dimensions of the net cells in the transverse direction. A simplified model has been used to estimate the error magnitude. The results are compared with calculations on channel No. 1 in the U-25B apparatus. 8 Refs.

Primary Keywords: MHD Generator; Circuit Modeling; Error Analysis; Theory, Comparison With Experiment

8914
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
AN INVESTIGATION OF THE TIME LAG OF THE DISCHARGE IN THE ELECTRICAL BREAKDOWN OF VACUUM GAPS
G.M. Kassirov and B.M. Koval'chuk
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 9, No. 3, pp 377-379 (09/1964).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 34, 484-487 (March 1964)

The time lag of the discharge in the electrical breakdown of vacuum gaps of 0.1, 0.3, 0.5, and 1.0 mm with different degrees of overvoltage on the gap is investigated. It is shown that the time lag of the discharge in the breakdown of vacuum gaps decreases almost linearly with increase in the degree of *overvoltage on the gap. With* an equal and small degree of overvoltage on the vacuum gap, the time lag of the discharge varies nonlinearly with the interelectrode distance. In the region of interelectrode distances 0.3-0.5 mm there is a sharp increase in the time lag with increase in the interelectrode distance. 5 Refs.

Primary Keywords: *Vacuum Breakdown;* Formative Time Lag; 0.1-1.0 mm Gap; Delay vs Voltage Measurement; Dependence On Gap Spacing

8916
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ANODE SHEATH GROWTH AND COLLAPSE IN A HOLLOW-ANODE VACUUM ARC
R. Dellinger, D.R. Dettman, J.L. Lee, A.S. Gilmour Jr., D.P. Malone and P.R. Schwartz
State University of New York at Buffalo, Buffalo, NY 14226
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 302-307 (12/1980).
Experimental diagnostics in a hollow-anode vacuum arc device have shown that the repetitive growth and collapse of an anode sheath is responsible for observed tens-of-kV voltage spikes. A dynamic model of device operation based on circuit effects and a time varying quasi-Child-Langmuir sheath is presented. The scaling of the repetition rate with respect to cathode material is discussed. The device is being investigated for use as a current limiter for approximately 10 MW pulses. 12 Refs.
Primary Keywords: Vacuum Breakdown; Hollow Anode; Anode Sheath Modulation; Voltage Spikes; Child-Langmuir Sheath; Theory; Comparison With Experiment

8917
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, OPENING)
(Gas, Electrical; Gas, Recovery; Mechanical)
ARC-GAS FLOW INTERACTIONS IN A DOUBLE-NOZZLE FLOW SYSTEM
W. Tiemann
Siemens Research Center, 8520 Erlangen, FRG
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 368-375 (12/1980).
The physical phenomena in cold and arc heated double-nozzle gas flows have been investigated for SF/sub 6/ by interference and shadow methods. The cold-flow phenomena are discussed as a basis for a better understanding of the arc-gas flow interactions, and their interference pattern is clearly interpreted: the observed fringes, which also can be calculated theoretically, are lines of constant flow velocity. In the case of arc heated flows a sharp distinction is made for the first time between different types of arc-gas flow interactions. At low peak currents the interference pattern still shows a cold gas flow around the arc. At higher current levels a fringe system, which indicates a density reduction, expands into the volume around the nozzles; however, the flow is still directed towards the gap between the nozzles. In contrast to this case the strongest form of interaction is characterized by the appearance of arc heated gas, which flows turbulently back into the high-pressure volume. The radial temperature distribution for a special arc has been calculated theoretically and is discussed in detail. 27 Refs.
Primary Keywords: Circuit Interruption; Gas Blast Circuit Breaker; Double-nozzle Configuration; Cold Flow; Arc-heated Flow; Holographic Interferometer Diagnostic; Shadography

8919
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
BEHAVIOR OF A HIGH CURRENT VACUUM ARC BETWEEN HOLLOW CYLINDRICAL ELECTRODES IN A RADIAL MAGNETIC FIELD
R.L. Boxman, E. Gerby and S. Goldsmith
Tel Aviv University, Tel Aviv, Israel 69978
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 308-313 (12/1980).
Experimental observations were conducted on the behavior of a high current vacuum arc on cylindrical electrodes in a radial magnetic field. The arc was sustained between the ends of two cylindrical Cu electrodes, 54 mm diam and 1.5 mm wall thickness seperated by 5 mm. Arc current pulses with peak values in the range 4-15 kA with a half amplitude full width (HAFW) duration of 8 ms were investigated with rapid magnetic fields proportional to the instantaneous current with proportionality constants of 4.0 and 6.5E-6 T/A. The arcs were photographed simultaneously with a streak camera and by a high speed framing camera and the arc voltage was recorded on a digitizing transient recorder. The results indicated that the arc in this geometry, both with and without an imposed radial magnetic field, can be characterized by three development stages: a) arc formation, b) diffuse arc along the electrode perimeter, and c) simultaneous existence of several concentrated arc columns. When a radial magnetic field was imposed two changes were noted: 1) the arc appeared somewhat more distributed in that a greater number of constricted columns were observed, and they were distributed more evenly; and 2) the constricted columns moved in the J x B direction with velocities in the range 5-15 m/s. 9 Refs.
Primary Keywords: Vacuum Breakdown; Cylindrical Geometry, Radial Magnetic Field, Copper Electrodes; Arc Development, Arc Movement; Photographic Diagnostic

8920
(BREAKDOWN STUDIES)
(Gas, Electrical)
CALCULATION OF THE TEMPERATURE IN A CONDUCTIVE TRACK OF AN ARC ON THE SURFACE OF A MAGNET-BLAST CHUTE
A. Tslaf
Ben Gurion University of The Negev, Beer-Sheva, Israel
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 455-460 (12/1980)
The space and time temperature distribution is analyzed for a conductive track of a high current arc that was burned in the insulating channel of a magnet-blast chute. The thermal conditions in absence of boiling and ablation were considered by a combination of the methods of continuous and instantaneous energy sources, when the energy consumption for the phase transition is assumed to be uniform. The purpose of such analysis was a study of possibilities for using the additional energy absorption capacity of chutes by increasing the permissible temperature of their walls up to the boiling point. 10 Refs.
Primary Keywords: Magnet-blast Chute; Arc Quenching, Insulation Arc Track; Arc Re-ignition

8922
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, OPENING; BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Gas, Electrical, Mechanical; Gas, Recovery; Vacuum, Recovery)
CURRENT CHOPPING INTRODUCED BY ARC COLLAPSE
W.M.C. Van Den Heuvel
Eindhoven University of Technology, Eindhoven, Netherlands
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 326-331 (12/1980).
The intensive cooling by a moving gas can cause violent elongations and curls of the circuit breaker arc, especially when small currents are interrupted. During the elongation the arc voltage increases rapidly. This introduces a breakdown across a smaller distance by short circuiting a part of the arc. Here, such a breakdown is called arc collapse. The abrupt decrease in resistance and arc voltage may give rise to an oscillating discharge of the circuit breaker parallel capacitance into the arc path. This oscillation can force the main current to zero and thus cause current chopping. In this paper this kind of current chopping is studied and compared with chopping by instability oscillation. It is theoretically explained why these independent origins for chopping produce the same chopping levels. 17 Refs.
Primary Keywords: Vacuum Breakdown; Gas Breakdown; Circuit Breaker; Current Chopping; Arc Motion; Theory

8924
(BREAKDOWN STUDIES)
(Gas, Electrical)
DETERMINATION OF TEMPERATURE, VELOCITY DISTRIBUTION, AND POPULATION DENSITIES OF NEUTRAL HELIUM BY MEANS OF LASER LIGHT TUNED ON ATOMIC RESONANCES
M. Odenthal and J. Uhlenbusch
Universitat Dusseldorf, Dusseldorf, FRG
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 431-436 (12/1980)
Temperature, velocity distribution, and population density of neutral Helium in the 2/sup 3/P level in a discharge of different current and pressure values are measured by absorption, dispersion, and resonant scattering experiments. The light source for these investigations is a tunable dye laser with linewidth of 2 MHz. The measurements show that there is a good mutual agreement among each of these methods and that these diagnostic methods are very easily adapted to investigated discharges with low densities of population, where Doppler-broadening mechanisms predominate. In addition, the experimental values of the index of refraction are compared with the linear dispersion theory confirming the predicted theoretical profiles. 7 Refs.
Primary Keywords: Helium Breakdown; Neutral Helium Population; Several Diagnostics; Good Agreement

8925
(BREAKDOWN STUDIES)
(Gas, Microwave)
DISTRIBUTION FUNCTION AND MEAN ENERGY OF ELECTRONS IN A HIGH-FREQUENCY MOLECULAR-GAS DISCHARGE
A.V. Evseev and A.V. Eletskii
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
High Temperature, Vol. 19, No. 1, pp 7-12 (02/1981).
Trans. From Teplofizika Vysokikh Temperatur 19, 8-15 (January-February 1981)
On the basis of solving the Boltzmann kinetic equation for electrons in a high-frequency discharge, taking account of elastic and inelastic electron-molecule collisions, and also the diffusional drift of the electrons to the wall of the discharge tube, it is established that, from the viewpoint of electron energy balance in a discharge of the given type, two different operating modes may be realized. In one of these a considerable fraction of the energy introduced in the discharge is consumed in exciting vibrational degrees of freedom of the molecules, while in the other the basic mechanism of electron energy loss is associated with elastic electron-molecule collisions. The conditions for the discharge to pass from one mode to the other are obtained, and the dependence of the mean electron energy on the discharge parameters is calculated. 9 Refs.
Primary Keywords: High-frequency Gas Breakdown; Boltzmann Equation; Elastic Molecule Collision; Electron Diffusion; Two Discharge Modes; Theory

8927
(BREAKDOWN STUDIES)
(Gas, Electrical)
EFFECT OF PLUG FLOW ON THE STABILITY OF TWO-DIMENSIONAL ARCS
I.M. Cohen, P.S. Ayyaswamy and T. Sundararajan
University of Pennsylvania, Philadelphia, PA 19104
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 390-394 (12/1980)
Steady solutions to the governing equations that describe fully two-dimensional arc plasmas in a plug flow have been obtained. The stability of these steady solutions is investigated by calculating the transient created when infinitesmal changes in the electrode potentials are imposed. Comparisons are made with solutions obtained using a one-dimensional electric field. We find that with increasing blowing (Peclet number) the one-dimensional electric field solutions yield increasingly inaccurate results for higher currents. The stability results conform with those given by the classical Kaufmann criterion. We find that convection tends to reduce and eventually to eliminate the declining branch of the current-voltage characteristic. The presence of convection promotes axial temperature gradients in the arc and hastens the transition from the unstable (declining) branch to a stable (increasing) branch of the current-voltage characteristic. 9 Refs.
Primary Keywords: Arc Stability; Plug Flow; 2-d Arc Model; Comparison With 1-d Model; Theory; Comparison With Experiment

8928
(BREAKDOWN STUDIES)
(Electrodes)
EFFECT OF SELF-MAGNETIC FORCES ON THE ANODE MECHANISM OF A HIGH CURRENT DISCHARGE

H. Hugel
Institut fur Technische Physik, DFVLR, Stuttgart, FRG
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 437-442 (12/1980).

When a DC discharge is operated between a central cathode and a ring-shaped anode at currents up to 6E3 / and pressures on the order of a few Torr, the stable discharge regime is found to be limited. The anode fall voltage is determined experimentally from calorimetric and potential measurements. In a wide range of operating conditions its variation correlates well with the parameter J/sup 2/ divided by dm/dt where J=current, dm/dt=mass flow rate through the discharge. With increasing values of J/sup 2/ divided by dm/dt, the anode fall increases continuously from small negative values, through zero, and up to moderate positive values. Then, within a small increment of J/sup 2/ divided by dm/dt, it jumps to values on the order of the ionization potential of the gas. A theoretical two-dimensional description of the flow field indicates that the self-magnetic forces, which are proportional to J/sup 2/, pinch the gas towards the discharge axis, thereby leading to particle starvation in the vicinity of the anode. Based upon the results of this study it is shown that, as a consequence of the altering boundary conditions, which are characterized by the parameter J/sup 2/ divided by dm/dt, the anode responds by adopting different operating modes. Existing theories yield values for the anode fall which are in good agreement with experimental data. 27 Refs.
Primary Keywords: Gas Breakdown; Low Pressure Discharge; Anode Fall; 6 kA Current; DC Arc; Radial Discharge; Experiment; Theory; 2-d Model; Several Discharge Modes

8931
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)
EROSION OF CATHODE MATERIAL IN A PULSED DISCHARGE BETWEEN PARALLEL ELECTRODES

R. Basharov, E.N. Malkin, O A. Gavrilovskaya and E.S. Trekhov
Moscow Physical Engineering Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 12, No. 10, pp 1383-1390 (04/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1889-1896 (October 1967)

Results are presented of a study of the erosion of a copper cathode in a pulsed discharge. The effects of the condition of cathode surface and of the kind and pressure of gas on the character of erosion and on the surface current density were investigated. It was established that the condition of the cathode surface is of great importance. A hypothesis is proposed about the cause of this phenomenon. The experimental data on cathode-material erosion are compared with the results of calculations based on various theories. 14 Refs.
Primary Keywords: Cathode Erosion; Copper Cathode; Cathode Surface Condition; Gas Gap; Variable Gas Pressure; Various Gases; Experiment; Comparison With Theory

8932
(BREAKDOWN STUDIES; SWITCHES, OPENING; BREAKDOWN STUDIES)
(Vacuum, Electrical; Mechanical; Vacuum, Recovery)
EXPERIMENTAL INVESTIGATION OF LOW-CURRENT VACUUM ARC INSTABILITIES

R. Frohlich
Technical University of Vienna, Vienna, Austria
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 319-325 (12/1980).

The instabilities of 50 Hz low-current vacuum arcs and chopping phenomena were investigated in a test circuit where current was limited either by a resistor or an inductance. Employing a special test method which was developed for statistical evaluation, current zeros were measured oscillographically with a time sweep of 50 to 100 ns/div for durations of <60 div. The effects observed are quantitatively better to assess than with other techniques. It was found that each chopping process is initiated by a partial arc extinction (which as a rule occurs within less than 10 ns). One of the dominant factors of the whole process is the speed of recovery of the contact material. Copper contact: showed a much faster recovery and thus higher chopping currents than contacts of copper-tungsten. Furthermore, that current value at which the first instability occurs was measured as well as the corresponding chopping current. Both values were evaluated statistically. In agreement with previous findings the occurrence of the first instability turned out to be independent of the capacitance parallel to the switching gap. However, the chopping current showed a significant dependence on the capacitance, as is well known from earlier investigations. 15 Refs.
Primary Keywords: Vacuum Breakdown; Vacuum Interrupter; Low-current Breakdown; Current Limiting Resistor; Power Line Frequency; Instability; Current Chopping; Several Contact Materials

8933
(BREAKDOWN STUDIES; SWITCHES, OPENING; BREAKDOWN STUDIES)
(Gas, Electrical; Mechanical; Gas, Recovery)
EXPERIMENTAL INVESTIGATION ON ARC PHENOMENA IN SF/SUB 6/ PUFFER CIRCUIT BREAKERS

A. Kobayashi, S. Yanabu, S. Yamashita and Y. Dzaki
Toshiba Corp, Kawasaki, Japan
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 339-343 (12/1980).

A detailed observation of an arc in a model puffer-type SF/sub 6/ gas circuit breaker in the current range between 10 and 50 kA (rms) has been carried out. It was found that the arc column remained stable on the center axis during the high-current region, then became turbulent near current zero. It was found that the time interval during which the turbulent arc was observed decreased with increasing values of the peak current. These phenomena indicated that the thermal effects of high-current arcs remain even at current zero. It also was observed that the arc diameter at the nozzle throat outlet was smaller than that at the throat (29 mm), even at a current as high as 70 kA (instantaneously), and that the boundary of gas flow at a downstream region had a very large diameter when the arcs were present. However, around current zero the boundary diameter became as small as that without arc. 4 Refs.
Primary Keywords: Gas Blast Circuit Breaker; SF/sub 6/ Gas; 50 kA Current; Arc Instabilities; Thermal Effects

216

8935
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
FIELD EMISSION FROM VACUUM-DEPOSITED METALLIC FILM AND ITS ROLE IN ELECTRIC BREAKDOWN IN VACUUM

R.N. Sudan and F. Gonzalez-Perez
Cornell University, Ithica, NY 14850
Journal Of Applied Physics, Vol. 35, No. 7, pp 2269-2270 (07/1964).

An experiment to study the field emission of vacuum gaps has been performed. Copper vapor from an external arc is allowed to condense on a preconditioned tungsten filament to study the state of aggregation of the copper deposit. Field emission sites are observed photographically and are found to be elliptical in nature. 6 Refs.
Primary Keywords: Field Emission; Metallic Film; Emission Centers; Copper Vapor Deposition; Copper Aggregation

8937
(SWITCHES, OPENING; BREAKDOWN STUDIES)
(Mechanical Gas; Recovery)
FREE RECOVERY OF THE GAS-BLAST ARC COLUMN

E. Richley and T. Tuma
Carnegie Mellon University, Pittsburgh PA 15213
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 405-410 (12/1980).

The decay of the temperature, velocity, and radius of the extinguished gas-blast arc in SF/sub 6/ and N/sub 2/ is theoretically investigated. The conservation equations for mass, momentum, and energy in integral form and on the axis describe the decay process. Local thermodynamic equilibrium (LTE) is taken to apply for the determination of the material and transport properties of the gases. The influence of the hot gas mantle on the decay of the arc column is taken into account. It is found that the temperature decay of the column in N/sub 2/ is much faster than in SF/sub 6/. Thus the superior dielectric strength of the SF/sub 6/ column over that of N/sub 2/ cannot be explained simply by the temperature decay rates. The predicted rate of decay of the column radius in N/sub 2/ is found to agree well with experimental results. The results of this study are expected to be of value in the determination of the dielectric breakdown characteristics of extinguished arcs. 16 Refs.
Primary Keywords: Gas Blast Circuit Breaker; SF/sub 6/ Blast; N/sub 2/ Blast; Air Temperature, Arc Radius; Theory; Magnetohydrodynamic Model

8938
(BREAKDOWN STUDIES)
(Gas, Electrical)
HIGH-CURRENT DISCHARGE IN A DENSE PLASMA SOURCE

A.A. Bogomaz, V.S. Sorodin, B.P. Levechenko and F.G. Rutberg
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 22, No. 1, pp 68-75 (01/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 121-133 (January 1977)

High-current discharges in dense-plasma sources are studied. The working gases are hydrogen, helium, nitrogen, argon, and lithium hydride vapor. The initial hydrogen density is varied over the range 1E-4 - 4E-3 g/cu.cm., the current is varied over the range 30-300 kA, the rate of the rise of the current is varied over the range di/dt approximately 1E7 - 1E9 A/sec, and the lifetime over the range 8.5-70 msec. In hydrogen the discharge is turbulent and fills the entire discharge volume. The mechanism by which energy is transferred from the arc to the gas in the discharge chamber is discussed. The energy balance in a turbulent hydrogen arc is examined. 14 Refs.
Primary Keywords: Gas Breakdown; 30-300 kA Current Range; High di/dt; Several Gases; Energy Balance
Secondary Keywords: Plasma Source

8939
(BREAKDOWN STUDIES)
(Electrodes)
IMPORTANCE OF INSULATING INCLUSIONS IN ARC INITIATION

R. Mancox
Atomic Energy Research Establishment, Harwell, Berkshire, UK
British Journal Of Applied Physics, Vol. 11, pp 468-471 (10/1960).

The initiation of arcs on a metal surface in contact with a plasma (ion density about 1E14 ion/cu.cm.) has been studied with metal specimens known to contain microscopic alumina inclusions. The specimens were biased negatively with respect to the plasma, and for voltages above 300 V the time lag before arcing occurred was inversely proportional to the positive ion current drawn by the specimen from the plasma, but independent of voltage. At lower voltages the time lag increased rapidly with decreasing voltage. Arcing was also independent of the nature of the ions and the pressure of neutral gas in the plasma. These results are consistent with the initiation of the arcs by dielectric charging and breakdown of the inclusions. 9 Refs.
Primary Keywords: Breakdown; Electrode Insulation Inclusions; Alumina Inclusions; Dielectric Charging; Electrode-plasma Contact; Delay Measurement
Secondary Keywords: C.T.R. Tube

8940
(BREAKDOWN STUDIES)
(Electrodes)
INFLUENCE OF THE COPPER ELECTRODE SURFACE ON INITIAL ARC MOVEMENT

K. Poeffel
Technical University of Vienna, Vienna, Austria
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 443-448 (12/1980).

To investigate the influence of the copper electrode surface condition on the initial arc movement and the immobility time respectively, a special experimental device was developed. It permits to keep constant, or vary those parameters independently, which influence the initial movement, i.e., arc current (170 A), magnetic flux density (10-1000 x 1E-4 T), electrode distance (1 mm), and surface condition (oxide-film thickness, roughness). The magnetic field can be applied at any moment and can be varied independently of the arc current. The arc is ignited by means of a dielectrical breakdown in order to eliminate the ignition effects, such as liquid and vaporizing electrode material. The most striking result of the experiments was that only arc movements of various velocities, but no absolute immobility was measured. This observation is due to the elimination of ignition effects as well as to the use of an adequate sensitive measuring technique. Impeded arc motion characterized by shorter or long lasting creeping (v approximately <= 3 m/s) occurs, if certain magnetic flux density or copper surface conditions do not permit velocities v>10 m/s or if the electrode surface is thermally prestressed by a deliberately standing arc. 19 Refs.
Primary Keywords: Breakdown; Copper Electrodes; Electrode Surface Effects; External Magnetic Field; Independent Parameter Variation; Arc Velocity

8941
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Vacuum, Electrical; Vacuum Gaps, Magnetic Field)
INTERACTION BETWEEN VACUUM ARCS AND TRANSVERSE MAGNETIC FIELDS WITH APPLICATION TO CURRENT LIMITATION
P.R. Emtage, C.W. Kimblin, J.G. Gorman, F.A. Holmes, J.V.R. Heberlein, R.E. Voshall and P.G. Slade
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 314-319 (12/1980).

The interaction between diffuse vacuum arcs and magnetic fields applied transverse to the electrode axis has been investigated both theoretically and experimentally. For arc currents <60 kA, Hall electric fields, generated by the interaction, bow the plasma out of contact with the anode and raise the arc voltage. In the presence of a parallel capacitor, the arc current falls to zero and the arc is extinguished. For arc currents of 6 to 15 kA, arc instinction can be achieved with an oscillatory magnetic field; during such extinctions the arc voltage remains in phase with the magnitude of the field. Arc extinction via magnetic field/vacuum arc interaction could have applications to AC-current limiters and DC breakers. The fault current limiter application is discussed in this paper. 17 Refs.

Primary Keywords: Vacuum Breakdown; Diffuse Vacuum Arc; Transverse Magnetic Field; Hall Effect; Opening Switch
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8942
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, OPENING)
(Gas, Electrical; Gas, Recovery; Mechanical)
INTERRUPTION CAPABILITY OF GASES AND GAS MIXTURES IN A PUFFER-TYPE INTERRUPTER
A. Lee and L.S. Frost
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 362-367 (12/1980).

SF/sub 6/ gas has been widely used in arc interruption applications for the past 20 years. Reported here is a systematic, comprehensive effort to search for and evaluate gases and gas mixtures suitable as an arc interruption medium potentially superior to SF/sub 6/. The search began with several hundred gases, narrowed down to about forty, and finally fifteen gases and gas mixtures were evaluated in a full size puffer-type interrupter under 60-Hz high-power conditions. The results showed SF/sub 6/ stood out as having the best interruption ability with several mixtures having approximately 80 percent of SF/sub 6/'s performance. 8 Refs.

Primary Keywords: Gas Blast Circuit Breaker; Several Gas Mixtures; Relative Interruption Capability; Performance Test; Gas Selection Criteria
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8944
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
KRF LASER-TRIGGERED SF/SUB 6/ SPARK GAP FOR LOW JITTER TIMING
M.R. Rapoport, J. Goldhar and J.R. Murray
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 167-170 (8/1980).

KrF laser-triggered spark gaps exploit the high DC-dielectric strength and low ultraviolet (UV) breakdown threshold of SF/sub 6/ gas. Detailed measurements using a DC-charged pulser demonstrate subnanosecod jitter for switching a 0.5-cm gap operated at 80 kV with 7 mJ in 20 ns of 248-nm KrF radiation. A 200-kV pulse-charged 0.7-cm gap gives similar performance. 11 Refs.

Primary Keywords: Laser-triggered Spark Gap; KrF Laser; SF/sub 6/ Gap; DC Charging; 80 kV Operating Voltage; 7 mJ Laser Pulse
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8947
(POWER CONDITIONING; POWER CONDITIONING)
(Pulse Transformers; Materials; Saturable Reactors, Materials)
METALLIC GLASSES: A MAGNETIC ALTERNATIVE
D. Raskin (1) and L.A. Davis (2)
(1) Allied Corp, Parsippany, NJ
(2) Allied Corp, Morristown, NJ
IEEE Spectrum, Vol. 18, No. 11, pp 28-33 (11/1981).

The state-of-the-art in manufacture and application of metallic glasses is the subject of this paper. Recent improvements in manufacturing techniques are discussed qualitatively with predictions on future growth presented. Some of the properties of metallic glasses are shown. Present and future applications are noted. 14 Refs.

Primary Keywords: Metallic Glass; Properties; Manufacturing Technology; Applications
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8951
(ENERGY CONVERSION, THERMAL)
(Magnetohydrodynamic)
NUMERICAL STUDY OF UNSTEADY PROCESSES IN A FARADAY MHD GENERATOR
G.N. Vinogradova and V.P. Panchenko
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
High Temperature, Vol. 19, No. 1, pp 127-133 (02/1981).
Trans. From: Teplofizika Vysokikh Temperatur 19, 164-171 (January-February 1981)

Unsteady processes in a Faraday MHD generator with high power-conversion coefficient are numerically studied. The establishment of steady operating modes of an MHD generator with continuous electrodes is studied when an ohmic load is connected, disconnected, or reduced. A central difference predictor-corrector scheme is used to numerically solve the partial differential equations. 10 Refs.

Primary Keywords: MHD Generator; High Power-conversion Coefficient; Unsteady Process; Continuous Electrodes; Theory; Numerical Calculation
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8952
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ON THE INITIATION OF ELECTRICAL BREAKDOWN OF A HIGH VACUUM GAP
N.B. Rosanova and V.L. Granovskii
Soviet Physics-Technical Physics, Vol. 1, No. 3, pp 471-478 (02/1957).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 26, (1956)

Measurements of the static and pulsed breakdown voltages of vacuum gaps between conductors made of various metals (Al, Cu, Fe, Ni, Mo, W) and of graphite, have shown that the breakdown voltage of the gap U/sub gap/ increases with an increase in the mechanical strength of the material of the anode. There is no causal connection between the onset of breakdown and the intensity of the x-radiation from the anode in the prebreakdown stage contrary to a hypothesis put forward in this connection in the literature. 19 Refs.

Primary Keywords: Vacuum Breakdown; Static Breakdown Voltage; Pulsed Breakdown Voltage; Several Electrode Materials; Anode X-ray Irradiation
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8954
(BREAKDOWN STUDIES)
(Gas, Electrical)
PAUSE IN PLASMA EMISSION AFTER NANOSECOND-PULSE EXCITATION
R.Kh. Amirov, E.I. Asinovskii and V.V. Markovets
Academy of Sciences of the USSR, Moscow, USSR
High Temperature, Vol. 19, No. 1, pp 37-46 (02/1981).
Trans. From: Teplofizika Vysokikh Temperatur 19, 47-51 (January-February 1981)

A study has been made of the characteristics of a glow discharge after perturbation by nanosecond pulse. There is a pause in the plasma emission lasting some tens of microseconds. A model is proposed that explains the results in terms of an excess electron concentration, which reduces the electron temperature and thus reduces the emission intensity. 16 Refs.

Primary Keywords: Glow Discharge, Nanosecond Pulse Perturbation; Plasma Emission Pause; Modeling; Electron Temperature Reduction
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8956
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, OPENING)
(Gas, Electrical; Gas, Recovery; Mechanical)
PRESSURE TRANSIENTS IN A MODEL GAS-BLAST CIRCUIT BREAKER OPERATING AT EXTRA HIGH CURRENT LEVELS
J.L. Leclerc, M.R. Smith and G.R. Jones
University of Liverpool, Liverpool, UK
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 376-384 (12/1980).

Test results for model circuit breakers operating at high current levels and with large diameter nozzles show evidence of pronounced pressure transients although the circuit breaker nozzle is not severely blocked. The magnitude and duration of these transients are suffient to affect the arc properties and hence influence arc control during the peak current phase and to influence arc extinction at current zero. However, despite their inherent importance there exists only limited information concerning such pressure variations. The purpose of this contribution is to identify the nature and sources of the transients, to establish typical thresholds for the onset of the transients, and to determine the influence of different operating conditions upon the transients. Measurements of pressure and thermal mantle variations are used in conjunction with an electrical analog model of the aerodynamic test facility to show that the pressure transients arise not only from arc generated flow impedance effects but also aerodynamic resonances. The resonant pressure transients are shown to be pronounced during the high current phase even below the thermal blocking threshold. Above the threshold, excitation of negative increment resonance following current peak produces depressed pressures during the current-zero period which may lead to a deterioration in circuit breaker performance. Higher frequency resonances also occur and become more pronounced with electrode wear. 10 Refs.

Primary Keywords: Gas Blast Circuit Breaker; Model Breaker; Pressure Transient; 100 kA Current; Modeling
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8957
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
PROPERTIES OF ANCHORED CATHODE SPOTS OF A DC MERCURY VACUUM ARC
G. Eckhardt
Hughes Research Labs, Malibu, CA 90265
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 295-301 (12/1980).

Ensembles of anchored cathode spots of a DC mercury vacuum arc have been studied by fast framing and streak photography. From these photographs, several statistical properties of the cathode spots have been determined: distribution functions for their diameters, velocities, and displacements, as well as spot shape and average values for the spot current and its density. The measurements showed that the anchored cathode spots were quasi-stationary. No indications of a microstructure within the individual cathode spots were found at an optical resolution of 0.37 micron. Strong evidence is presented that the DC cathode spot parameter values reported here are typical for a clean mercury surface, and that those reported in the earlier literature are typical for impurity-covered surfaces. 18 Refs.

Primary Keywords: Vacuum Breakdown; Mercury Arc; Cathode Spot; Spot Diameter; Spot Velocity; Spot Current; Quasi-stationary Spot; No Microstructure; Photographic Diagnostic
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8959
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
QUALITATIVE MODEL OF INITIATION OF A VACUUM ARC I. BREAKDOWN MECHANISM
G.M. Fursei and P.N. Vorontsov-Vel'yaminov
A.A. Zhdanov Leningrad State University, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 12, No. 10, pp 1370-1376 (04/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1870-1879 (October 1967)

The effect of microinhomogeneities on the development of breakdown in a vacuum gap is examined. It is shown that the field intensification in the presence of practically realizable microinhomogeneities can attain values >100. A mechanism of vacuum breakdown based on the explosive destruction of a cathode microinhomogeneity as the primary act of initiation is proposed. 55 Refs.

Primary Keywords: Vacuum Breakdown; Microprojections; Field Intensification; Microprojection Explosion; Breakdown Initiation
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8961
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, OPENING)
(Gas, Electrical; Gas, Recovery; Mechanical)
QUENCHING PROCESSES OF AXIALLY INHOMOGENEOUS ARCS IN SF/SUB 6/ CIRCUIT BREAKERS
E.V. Bonin, G. Bruggemann and H.G. Thiel
High Voltage Intitute, Kassel, FRG
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 344-351 (12/1980).
The description of the arc in a modern high-voltage SF/sub 6/ circuit breaker by only one single-arc equation is not sufficiently exact for applications, especially when using constant arc parameters. In typical nozzle configurations, arcs are generally being axial inhomogeneous. For these arcs, a theory is presented taking into account the gas-flow properties determining the axial structure. This is applied for investigating an arc consisting essentially of two different parts. It is shown, how to determine for these parts the arc parameters depending on the conductances, which are required for an appropriate mathematical description. As an example a computer simulation of the performance of the investigated circuit breaker is presented, and compared with corresponding full-scale interruption tests. Breaking capacity limit as well as the complete interaction phenomena between circuit breaker and test circuit are in agreement, proving the presented theory of an axially inhomogeneous arc. 11 Refs.
Primary Keywords: Circuit Breaker; Arc Quenching; Numerical Calculation; Experiment; Theory; Dependence On Flow Properties

8962
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Gas, Recovery; Mechanical)
QUENCHING PROPERTIES OF AN ARC IN A DOUBLE FLOW WITH A VORTEX
Ch. Sturzenegger, R.T. Reinhardt and H.J. Schotzau
Sprecher and Schuh Ltd, Aarau, Switzerland
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 384-389 (12/1980).
The effect of a vortex in a gas flow on an air-blast arc is investigated. The radial density of a vortex in the compressible flow is evaluated with a simple model. The experiments show that the width of a low pressure channel on the axis of the nozzle is comparable to the theoretical values. The measured electric field strength profile is strongly influenced by the presence of such a vortex. In addition, the thermal interrupting capability is drastically lowered by vortex superimposed on the axial gas flow. 7 Refs.
Primary Keywords: Arc Quenching; Double Flow Nozzle; E-field Measurement; Vortex; Interruption Capability Reduction

8964
(BREAKDOWN STUDIES; SWITCHES, OPENING; BREAKDOWN STUDIES)
(Gas, Electrical; Mechanical; Gas, Recovery)
SCALING LAWS FOR GAS-BLAST CIRCUIT-BREAKER ARCS DURING THE HIGH CURRENT PHASE
M.T.C. Fang (1), S. Ramakrishnan (2) and H.K. Messerle (1)
(1) University of Sydney, NSW, Australia
(2) University of Liverpool, Liverpool, UK
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 357-362 (12/1980).
A steady state nozzle arc model based on the boundary layer integral method is established and scaling laws are derived. For affinely related nozzles, the solution is uniquely determined by a nozzle coefficient N, which is related to the stagnation conditions, the arc current, and the dimensions of the nozzle. Tests have been performed on nozzle arcs in air using two geometrically similar nozzles at three stagnation pressures. A good agreement between theory and experiment is obtained which indicates that circuit-breaker arcs can be scaled. To avoid nozzle clogging, the nominal current density at the throat (I/A/sub t/) should not exceed the highest permissible nominal current density at the throat. For all affinely related nozzles, this upper limit of current density at the throat is proportional to (p/sub 0/ divided by z/sub t/) to the 1/2 power, where p/sub 0/ is the stagnation pressure and z/sub t/ the distance of the throat from the nozzle entrance. The overall arc voltage exhibits the pre-current-zero static behavior as indicated by Browne's composite arc model. 12 Refs.
Primary Keywords: Nozzle Arc; Steady State Arc; Arc Modeling; Gas Blast Circuit Breaker; Nozzle Coefficient; Affinely Related Nozzle; Theory

8966
(SWITCHES, OPENING; BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Mechanical; Gas, Electrical; Gas, Recovery)
SIMPLIFIED ESTIMATION OF CRITICAL QUANTITIES FOR SHORT-LINE FAULT INTERRUPTION
T.E. Browne Jr.
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 400-405 (12/1980).
From analyses of equations derived in a previous paper for critical interrupting conditions for an arc shunted by both resistance and capacitance in parallel, or for short-line fault interruption with capacitance shunting, further analytical expressions useful for prediction of limiting conditions are derived. Examples, based on observed relations of Cassie-Mayr arc model parameters to current rate of change for a particular SF/sub 6/ blast circuit breaker, show realistic plots of limiting short-line fault currents versus line length with capacitance shunting. Also shown are required capacitance shunt values as functions of busfault current, fault fraction, line length, and number of series breaks. Included in the equations are circuit voltage and frequency and line surge impedance. Finally, it is shown that similar relations can be derived by using an approach suggested by A.M. Cassie in 1939. 6 Refs.
Primary Keywords: Gas Blast Circuit Breaker; Circuit Parameter Interaction; Cassie-mayer Arc Model

8968
(BREAKDOWN STUDIES)
(Gas, Electrical)
SPECTROSCOPIC APPROACH TO THE ANALYSIS OF HIGH CURRENT ARCS IN SF/SUB 6/
S. Okuda (1), Y. Ueda (1), Y. Murai (1), T. Miyamoto (1), Y. Doi (2) and C. Uenosono (2)
(1) Mitsubishi Electric Corp, Amagasaki, Japan
(2) Kyoto University, Yoshida Hon-machi, Sakyo-ku, Kyoto, Japan
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 395-399 (12/1980).
Spectroscopic observations were carried out on transient free-burning arcs drawn by separating copper/tungsten electrodes in SF/sub 6/ gas. The peak value of the arc current was varied up to 60 kA. A new optical method was developed to measure temperature and pressure profiles of the arc taking the magnetic pinch force into account. The arc voltage calculated from the obtained temperature and pressure profiles agreed well with electrical measurements. The results made it clear that the composition of the arc changes significantly at the critical instantaneous current of 10 kA. Above 10 kA the arc is composed of the electrode vapor, while it contains SF/sub 6/ gas below 10 kA. 6 Refs.
Primary Keywords: SF/sub 6/ Breakdown; 60 kA Arc Current; Spectroscopic Diagnostic; Arc Temperature Profile; Arc Pressure Profile; Calculated Arc Voltage; Comparison With Measured Voltage

8971
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SWITCHING CHARACTERISTICS OF A THREE-ELECTRODE SPARK GAP
G.A. Vorob'ev and G.S. Korshunov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 12, No. 9, pp 1251-1254 (03/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1707-1711 (September 1967)
The switching characteristics of a three-electrode spark gap with an auxiliary 'heater' capacitance operating under atmospheric conditions are discussed. It is shown that the switching time is affected by the magnitude of the 'heater' capacitance, the overvoltage across the second spark gap, the mutual irradiation of the spark gaps in the process of discharge, and the circuit inductance. The shortest pulse rise time was 1.5E-9 sec. 5 Refs.
Primary Keywords: Three-electrode Spark Gap; Start Capacitor; 15 kV Operating Voltage; 200 A Current; Nanosecond Rise Time

8972
(BREAKDOWN STUDIES; DIAGNOSTICS AND INSTRUMENTATION)
(Gas, Electrical; Miscelleneous)
TEMPERATURE DIAGNOSTICS IN TURBULENT ARCS
Y.K. Chien and D.M. Benenson
State University of New York at Buffalo, Buffalo, NY 14226
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 411-417 (12/1980).
Time averaged radial distribution of temperature and its fluctuations have been obtained for turbulent (and laminar) DC-argon arcs operated at 65 A in a 1cm diam channel. With laminar arcs fluctuations proceeded inward from the outer edge; in the present case temperature fluctuations were about 1 percent and 4 percent at the center-line and outer edge, respectively. Relatively large fluctuations in temperature, about 5 percent, were found across the entire column where the arc was turbulent. Counterline temperatures were nearly identical for both laminar and turbulent arcs-about 10610 Deg.K. The analytical development is an extension of the model of Schreiber and Hunter. 24 Refs.
Primary Keywords: Turbulent Arc; Temperature Diagnostic; DC Arc; Argon Gas; 65 A Current; 5 Percent Temperature Variation

8974
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE EFFECTS OF COLD GAS INJECTION ON A CONFINED ARC COLUMN
D.M. Chen, K.C. Hsu, C.H. Liu and E. Pfender
University of Minnesota, Minneapolis, MN
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 425-430 (12/1980).
This paper considers the interaction of a thermal argon arc plasma confined in a relatively long water-cooled cylindrical tube with a cold argon flow injected radially into the tube through a circumferetial slit. An analytical model is established to predict the thermal, the fluiddynamic, as well as the electrical behavior, of such an arc assuming laminar flow and local Thermodynamic Equilibrium (LTE) of the arc plasma. Numerical solutions for the field variables are obtained by solving simultaneously the mass, momentum, energy, and charge conservation equations by an iterative finite difference method. The results show that the arc column becomes constricted at the location of gas injection due to thermal and fluiddynamic effects associated with the injected cold flow. The arc responds to the constriction by an increase of the temperature in the core region which resists the penetration of the cold flow into the arc. This penetration remains relatively small even at high injection ratios because the arc temperature and, therefore, the resistance to flow penetration increases with increasing injection ratio. The enhanced Joule heating in the injection region leads to a minor thermal expansion of the base flow which can be observed upstream of the injection slit. This effect becomes less pronounced as the injection mass flow rate increases. 12 Refs.
Primary Keywords: Confined Arc; Argon Arc; Cold Argon Injection; Theory; Analytical Model; Numerical Calculation

8977
(SWITCHES, OPENING)
(Explosive Fuses)
THE VOLTAGE ACROSS A FUSE DURING THE CURRENT INTERRUPTION PROCESS
L. Vermij
HOLEC N.V., Utrecht, Netherlands
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 460-468 (12/1980).
Results of experiments with fusing wires are discussed and explained theoretically. Multiple arcing is observed; it is explained in a thermodynamic model. Also, the possible absence of multiple arcing at high currents is explained. There, evaporation of superheated fuse material causes the fast increase of the fuse resistance. This evaporation explains the experimentally observed behavior of the fuse resistance as a function of fuse diameter, whereas the concept of multiple arcing fails to do so. Results from experiments confirm energy balance equations, both for fuses in air and for fuses embedded in fine-grained sand. The energy balance equation for the latter case is shown to be equivalent to Mayr's equation. 20 Refs.
Primary Keywords: Fuse; Multiple Arcing; Fuse Resistance; Theory; Energy Balance Equation; Mayr's Equation
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8978
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, OPENING)
(Gas, Electrical; Gas, Recovery; Mechanical)
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE STOCHASTIC BEHAVIOR OF AN SF/SUB 6/ BLAST-SWITCHING ARC
K. Moller, R. Schmidt and B. Sporckmann
High Voltage Lab, Aachen, FRG
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 352-356 (12/1980).
This paper deals with some fundamental guidelines for the establishment of a stochastic arc model. Its aim is to describe the well known statistical behavior of the interrupting limit of circuit breakers taking into account short time fluctuations of the arc properties. This stochastic arc model is based on a phenomenological arc description regarding the switching arc as an electric two-pole. The arc parameters are no longer understood as deterministic functions but as stochastic processes. Their probability density distributions and the respective autocovariance and crosscovariance functions are the mathematical means to establish the model. Pseudorandom generators are used to compute switching processes of an electrical network connected to a stochastic arc. Experiments of an SF/sub 6/ model circuit breaker were carried out with respect to the statistical behavior of its current, arc voltage, conductivity, and interrupting limit. From these experiments the necessary arc parameters were taken in an iterative strategy. With these parameters it was possible to reach good agreement between measured and calculated values of the failure probability of the breaker under test. 8 Refs.
Primary Keywords: SF/sub 6/ Breakdown; Gas Blast Circuit Breaker; Arc Modeling; Breaker Opening Limit; Statistical Analysis; Experiment; Theory
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8979
(BREAKDOWN STUDIES)
(Gas, Electrical)
THEORETICAL MODEL FOR BREAKDOWN OF FLASH-DISCHARGE TUBES CAUSED BY INTERNAL PRESSURE DURING VAPORIZATION OF WALL MATERIAL
V.V. Ivanov, A.I. Kobzar', V.A. Preobrazhenskii and A.G. Rozanov
Moscow, USSR
High Temperature, Vol. 19, No. 1, pp 137-141 (02/1981).
Trans. From: Teplofizika Vysokikh Temperatur 19, 177-181 (January-February 1981)
A theoretical model is proposed for breakdown of flash-discharge tubes caused by internal pressure during vaporization of the wall material. An analytic expression is obtained for the limiting energy of a flash-discharge tube by solving the heat-conduction equations successively for the heating stage and wall vaporization stage. It is shown that the theoretical calculations and known experimental data are in satisfactory quantitative agreement. 18 Refs.
Primary Keywords: Gas Breakdown; Thermal Conduction; Wall Vaporization; Pressure Increase; Theory; Comparison With Experiment
Secondary Keywords: Flash Tube
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8980
(BREAKDOWN STUDIES)
(Gas, Electrical)
THEORY OF POWERFUL NONSTEADY XENON DISCHARGE TAKING VAPORIZATION OF ITS STABILIZING WALLS INTO ACCOUNT
V.M. Gradov, V.V. Ivanov, Yu.I. Merzlov and A.A. Shcherbakov
High Temperature, Vol. 19, No. 1, pp 22-28 (02/1981).
Trans. from: Teplofizika Vysokikh Temperatur 19, 28-35 (January-February 1981)
A complex mathematical model of a nonsteady xenon discharge of average duration (1E2 - 1E3 microseconds) is developed, taking erosion of the quartz walls into account. The processes in the pulse lamp in conditions of shell vaporization are investigated theoretically and experimentally. 23 Refs.
Primary Keywords: Xenon Discharge; Pulsed Discharge; Wall Stabilization; Quartz Wall; Modeling; Experiment; Theory
Secondary Keywords: Flashlamp Operation
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8981
(BREAKDOWN STUDIES)
(Gas, Recovery)
THERMAL LAYERS IN POSTARC CHANNEL
Z. Kolaciński
Technical University of Lodz, Lodz, Poland
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 449-454 (12/1980).
The subject of the investigation is a short arc burning in air between electrodes made of refractory materials. Based on measurements of the electrical conductivity of near-electrode regions, as well as on calculations, it is stated, that thermal reignition takes place in a thermal layer near the new anode. In the paper a model of short arc thermal reignition is presented and the results of calculations are compared with measurements. These results shed light on postarc conditions in low voltage circuit breakers. 7 Refs.
Primary Keywords: Postarc Channel; Temperature Measurement; Electrical Conductivity Measurement; Arc Reignition; Thermal Reignition
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8982
(BREAKDOWN STUDIES, SWITCHES, CLOSING)
(Vacuum, Electrical; Vacuum Gaps, Electrical)
TIME DELAY IN TRIGGERED VACUUM GAP
A.W. Hull
General Electric Co, Schenectady, NY 12301
IEEE Transactions On Electron Devices, Vol. ED-13, No. 6, pp 529-530 (06/1966).
A proposed theory of metal vapor arcs in vacuum, based on the assumption of field emission of electrons, has been used to calculate the time delay of Lafferty's Triggered Vacuum Gap, with excellent agreement with experiment. 7 Refs.
Primary Keywords: Vacuum Breakdown; Field Emission; Vacuum Spark Gap; Delay Measurement; Theory
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8984
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
A CATHODE SPOT MODEL AND ITS ENERGY BALANCE FOR METAL VAPOUR ARCS
J.E. Daalder
Eindhoven University of Technology, Eindhoven, Netherlands
Journal Of Physics D; Applied Physics, Vol. 11, No. 12, pp 1667-1682 (08/1978)
A non-stationary cathode spot model is proposed which is based on an interpretation of experimental data recently obtained. The significance of ion mass generation by Joule heating and the separation of energy flows associated with electron and ion currents in the cathode spot are the main differences with other known cathode spot models. The ion energy balance at the metal-vacuum transition is evaluated quantitatively and applied to a calculation of the ion fraction in the cathode current. For a broad range of metals and independent of the electron emission mechanism, minimum and maximum ion current fractions are found of around 10% and 20% respectively. By considering TF emission it is shown that the ion currents oriented from and towards the cathode have the same size, each being 10% of the arc current or somewhat higher. The dominant influence of the electric field on the electron emission is established. This result is in agreement with the total ion mass produced by Joule heating in the cathode as has been previously calculated for the same range of metals. 49 Refs.
Primary Keywords: Vacuum Breakdown; Cathode Spot; Joule Heating; Ion Generation; Electron Current; Ion Current; Modeling; Field Emission
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8985
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
COMPONENTS OF CATHODE EROSION IN VACUUM ARCS
J.E. Daalder
Eindhoven University of Technology, Eindhoven, Netherlands
Journal Of Physics D; Applied Physics, Vol. 9, No. 16, pp 2379-2395 (11/1976).
The composition of cathode mass loss was analysed for cadmium, copper and molybdenum vacuum arcs. It showed that two dominant flows are present, one consisting of ions, the other of molten droplets which have sizes in the order of microns to tens of microns. The droplet flow is mainly oriented along the cathode plane and is strongly dependent on the fusion temperature of the cathode metal and the charge transfer by the arc. The cathode mass loss in vapour form is considered to be small. 26 Refs.
Primary Keywords: Electrode Erosion; Cathode Erosion; Cadmium Cathode; Copper Cathode; Molybdenum Cathode; Mass Loss Measurement; Ion Migration; Metal Droplet Flow; Charge Transfer Dependence
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8987
(DIAGNOSTICS AND INSTRUMENTATION)
(Systems)
DIGITAL IMPULSE RECORDER FOR HIGH-VOLTAGE LABORATORIES
P. Malewski and A. Dechamplain
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-99, No. 2, pp 636-649 (04/1980).
A digital recorder has been developed for use in HV laboratories as a prospective replacement for conventional impulse oscilloscopes. The new apparatus has a sufficiently high time resolution to record the fastest microsecond impulses used for HV testing and also allows slower switching transients to be monitored. In order to immunize the sensitive electronic circuits of the recorder against the high electromagnetic interference of HV test areas, the authors conducted an experimental study of the nature of this interference and its magnitude and used the results to calculate the shielding and supply line conditioning systems. The recorder is designed as a mobile unit composed of an input attenuator-compatible with the impulse voltage dividers, an analog-to-digital converter, an interface and a graphic computer terminal. The recorded impulses are displayed with the calibrated voltage and time axes on the terminal screen and can be printed or stored on magnetic tape for further processing. The paper points out new problems ensuing from the application of digital recorders to the HV impulse testing technique. 12 Refs.
Primary Keywords: Digital Impulse Recorder; 100 ns Resolution; Stand Alone System; Noise Sensitivity Analysis
COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8988
(SWITCHES, CLOSING)
(Gas Gaps, Crossed-Field)
FEASIBILITY OF A HIGH AVERAGE POWER CROSSED FIELD CLOSING SWITCH
P.A. Lutz, R.J. Harvey and H. Alting-Mees
Hughes Research Labs, Malibu, CA 90265
IEEE Transactions On Plasma Science, Vol. PS-4, No. 2, pp 118-128 (06/1976)
Results of an experimental program to determine the feasibility of using a crossed field device as a high average power triggered closing switch are reported. The tube contained coaxial, cylindrical electrodes and was triggered by pulsing a magnetic field (0.1 T) to a value sufficiently high to trap electrons and initiate conduction. Holdoff voltages up to 60 kV were achieved, with peak (circuit limited) currents as high as 20 kA and pulse durations in the range of 1 to 100 microseconds. Ignition jitter was approximately 0.1 microsecond, and the voltage recovery rate was 2 kV/microsecond after 20 kA conduction and a 50 microsecond deionization time. These single and double shot data indicate that it should be possible to build such a device to operate at high average power levels for use in high power (MW) modulators. 9 Refs.
Primary Keywords: Crossed Field Closing Switch; Coaxial Switch; Magnetic Trigger; 60 kV Operating Voltage; 20 kA Current; 100 ns Jitter; High Average Power
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

8990
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS; POWER CONDITIONING)
(Magnetic; Capacitor Banks; Pulse Forming Lines)
PRODUCTION OF PULSED MAGNETIC FIELDS WITH A FLAT PULSE TOP OF 440 KOE AND 1 MSEC DURATION
G. Dwersehak, F. Haberey, P. Hildebrand, E. Kneller and D. Schreiber
Institut fur Werkstoffe der Elektrotechnik, Ruhr-Universitat Bochum, FRG
The Review Of Scientific Instruments, Vol. 45, No. 2, pp 243-249 (02/1974).
A capacitance discharge unit for the production of pulsed magnetic fields up to 440 kOe is described. The pulse formed by a passive network has a field plateau of approximately 1 msec duration for a half-period of approximately 3.5 msec and a field ripple of delta H/H < 1%. The unit occupies approximately 10 sq.m., the total weight is 600 kg. It can be produced at low cost. 22 Refs.
Primary Keywords: Magnetic Field Generation; Air Core Coil; Mechanical Analysis; Pulse Forming Network; 2.5 kV Output Voltage; 1 ms Pulse Width; Rectangular Pulse; Thyristor

8991
(BREAKDOWN STUDIES)
(Gas, Electrical)
INTEGRAL METHODS OF ANALYSING ELECTRIC ARCS. I. FORMULATION
M.D. Cowley
University of Cambridge, Cambridge, CB21PZ
Journal Of Physics D; Applied Physics, Vol. 7, No. 16, pp 2218-2231 (11/1974).
The equations of continuity, momentum and energy are derived for axisymmetric eletric arcs in terms of overall radial integrals. The external flow is assumed to be adiebatic, reversible and one-dimensional, although compressibility and the possibility of time variation are included. The overall integrals define quantities with the dimensions of area when their integrands are normalized. Arc problems can then be solved in principle if relations between the area quantities can be guessed or found empirically, and a formal structure for such empiricism is suggested. It is shown that the enthalpy-flow model of Frost and Liebermann is equivalent to an integral method at a low level of approximation. The analyses of Topham are related to the present general information. 12 Refs.
Primary Keywords: Gas Breakdown; Axial Gas Flow; Theory; Magnetohydrodynamic Analysis; Theory; Empirical Area Relations

8992
(BREAKDOWN STUDIES)
(Gas, Electrical)
INVESTIGATIONS OF GLOW DISCHARGE FORMATION WITH VOLUME PREIONIZATION
L.E. Kline and L.J. Denes
Westinghouse Research and Development Center, Pittsburgh PA
Journal Of Applied Physics, Vol. 46, No. 4, 1567-1574 (04/1975).
The discharge formation process has been studied experimentally for CO/sub 2/ planar TEA laser discharges. Theoretical models are presented which predict the preionization electron and ion densities, the spatiotemporal development of the discharge plasma, discharge voltage, and current waveform, and the quasisteady operating characteristics of the discharge. The preionization is provided in the experiments by a pulse of ultraviolet radiation. The discharge formation model accounts for cathode photoemission and anode collection of electrons, discharge-circuit interactions, and gaseous ionization processes. The model predicts that photoemission and anode collection can be neglected when strong preionization and moderate overvoltages are used. When photoemission and anode collection are neglected, the discharge formative time is independent of the discharge volume. Calculated and experimental voltage and current waveforms are in very good agreement. The results of the calculations show that the discharge formative time is determined primarily by the characteristics of the external circuit in the experiments. Formation calculations for a large-volume discharge show that a uniform glow discharge will develop even when the preionization is nonuniform along the electric field, and confirm that the formative time is approximately independent of the discharge volume. 38 Refs.
Primary Keywords: Glow Discharge; Ultraviolet Preionization; Volume Preionization; Theory; Plasma Development; Discharge Voltage; Discharge Current; Comparison With Experiment
Secondary Keywords: Gas Laser Pumping

8993
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
ON THE HIGH-FREQUENCY RESPONSE OF A ROGOWSKI COIL
J. Cooper
Imperial College Of Science And Technology, London, UK
Plasma Physics (Journal Of Nuclear Energy Part C), Vol. 5, No. 5, pp 285-289 (01/1963).
In this paper a Rogowski coil with a capacitive shield is treated as a distributed circuit, so that the toroidally wound coil acts as a delay line. It is shown that, in general, the high-frequency response is limited by the transit time around this delay line, and for times greater than this transit time the individual circuit elements act as lumped impedances. However, if the flow of the current to be measured is such that it is symmetrical with respect to the toroidal coil (so that the voltage induced per unit length along the coil, when the current changes, is constant), the transient response becomes less than the transit time for a termination whose impedance is small compared with that of the toroidal coil. The best results may be obtained with an inductive termination whose impedance has the same phase angle as the impedance of the toroidal coil, and for this termination the output is proportional to the rate of change of current. 6 Refs.
Primary Keywords: Rogowski Coil; Capacitive Shield; Modeling; Delay Line, No Transit Time Limitation

8994
(BREAKDOWN STUDIES)
(Exploding Wires)
OPTIMIZATION OF ENERGY CONVERSION IN ELECTRICAL EXPLOSION OF A CONDUCTOR IN A LIQUID
V.K. Rekhuba and N.N. Stolovich
Institute Of Heat And Mass Transfer, Academy of Sciences of the Belorussian SSR, Minsk, USSR
Soviet Physics-Technical Physics, Vol. 18, No. 6, pp 775-778 (12/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 1222-1237 (June 1973)
Optimum relations between the dimensions of the exploding conductor and the parameters of the discharge circuit are found from the condition maximizing the efficiency for the conversion of electrical energy stored in a capacitor into the mechanical energy of the deformation of cylindrical thin-walled transducers. Comparison shows a good agreement between theory and experiment. 15 Refs.
Primary Keywords: Exploding Wire; Liquid Environment; Wire Dimensions; Discharge Circuit Parameters; Optimization; Experiment; Theory; Good Agreement

8995
(BREAKDOWN STUDIES)
(Gas, Diagnostics)
PHOTOELECTRIC SPECTROSCOPY OF TRANSIENT DISCHARGES
Tsui-Feng, C.M. Cundall and J.D. Craggs
University of Liverpool, Liverpool, UK
Spectrochimica Acta, Vol 5, pp 452-459 (01/1953).
Details are given of various optical techniques used with photomultiplier tubes in the measurement of the relative intensities of spectral lines in the emission spectra of transient discharges, notably sparks lasting a few microseconds. 20 Refs.
Primary Keywords: Gas Discharge; Spectroscopy; Optical Techniques; Transient Discharge; Calibration Techniques

8996
(PARTICLE BEAMS, ELECTRON)
(Generation)
KAL'MAR-1 PULSED ELECTRON ACCELERATOR WITH RELATIVISTIC ELECTRON BEAM POWER OF UP TO 5E12 W/SQ.CM.
B.A. Demidov, M.V. Ivkin, V.A. Petrov and S.D. Fanchenko
Soviet Atomic Energy, Vol. 46, No. 2, pp 111-116 (02/1979).
Trans. From: Atomnaya Energiya 46, 100-104 (February 1979)
The possibility of achieving controlled thermonuclear fusion by using relativistic electron beams (REB), first pointed out by Zavoiskii, is arousing ever-increasing interest. As shown by Rudakov, REB with a current of the order of 1E7 A and a power density of the order of 1E13 W/sq.cm. are required to accomplish this. The present paper describes the Kal'mar 1 accelerator producing REB with a power density of 5E11 - 5E12 W/sq.cm. We give the results of investigations on REB focusing in a high-voltage diode as a function of the electrode geometry and the magnitude of the voltage prepulse. 14 Refs.
Primary Keywords: Kal'mar 1 Accelerator; Field Emission Diode; 1 MeV Electrons; 10 MA Current; 1.5 Ohm Diode Impedance; Trigatron

8997
(BREAKDOWN STUDIES)
(Gas, Corona)
PULSES IN NEGATIVE POINT-TO-PLANE CORONA
L.B. Loeb, A.F. Kip and G.G. Hudson
University of California, Berkeley CA
Physical Review, Vol. 60, pp 714-722 (11/1941).
The failure of W.H. Bennett working with very fine negative points and of G.G. Hudson working with larger carefully polished negative Pt points in clean dry dust-free air to observe the regular relaxation oscillator-like pulses reported by Trichel for negative points in room air led to a further study of the Trichel pulses. It was found by Kip and Bennett independently that the onset potentials and the current voltage characteristics of the corona showing Trichel pulses are independent of the metal and thus of the work function of the point. It is further independently shown by Bennett and by Hudson that the regular Trichel pulses originating as they do in the gas require the presence of a source of triggering electrons. These can be furnished from fine points or by roughness on larger points through field emission, by very fine dust specks. Thus room air, yielding negative ions and providing ample numbers of fine dust specks for triggering, yields the regular Trichel pulses while clean, dry dust-free air, giving but rare dust specks, yields random bursts of pulses of irregular form. The theory of the phenomenon is reconsidered in the light of the findings and it is shown that the theory proposed by Trichel is applicable except as modified by the influence of the negative ion space charge and the necessity of triggering electrons. 13 Refs.
Primary Keywords: Corona; Point-plane Gap; Air Gap; Corona Pulses; Trichel Pulse; Effect Of Particles; Field Emission

8998
(BREAKDOWN STUDIES)
(Liquid, Electrical)
SOME FEATURES IN THE ELECTRIC BREAKDOWN OF ELECTROLYTES
N.P. Mel'nikov, G.A. Ostroumov and A.A. Shteinberg
A.A. Zhdanov Leningrad State University, Leningrad, USSR
Soviet Physics-Doklady, Vol. 7, No. 12, pp 1102-1104 (06/1963).
Trans. From: Doklady Akademii Nauk SSSR 147, 822-825 (December 1962)
The characteristics of a capacitor discharge in an aqueous electrolyte are studied. A capacitor is connected across a test cell by use of a trigatron gap to produce a step voltage of 15 kV across a gap of 0.25-20 mm. Several electrolytes are tested over a wide range of concentrations. Three distinct regions of concentration are found: 1) breakdown possible; 2) no breakdown with aperiodic discharge of capacitor; and 3) no breakdown with oscillatory discharge. 13 Refs.
Primary Keywords: Liquid Breakdown; Electrolyte; Three Regions Of Concentration; Several Electrolytes; Wide Range Of Concentration; Variable Gap Spacing

8999
(BREAKDOWN STUDIES)
(Liquid, Electrical)
THE DEVELOPMENT OF AN ELECTRIC DISCHARGE IN AQUEOUS ELECTROLYTES
N.P. Mel'nikov, G.A. Ostroumov and M.Yu. Stoyak
A.A. Zhdanov Lenningrad State University, Lenningrad, USSR
Soviet Physics-Doklady , Vol. 8, No. 2, pp 176-178 (08/1963).
Trans. From: Doklady Akademii Nauk SSSR 148, 1057-1059 (February 1963)
Several emperical formulae are given for the breakdown of aqueous electrolytes in this paper. NaCl dissolved in water is classified into three distinct concentration (conductivity) level ranges and the breakdown properties are found to be consistent within each classification. Pulsed voltages of up to 16 kV are used to produce breakdown. 2 Refs.
Primary Keywords: Electrolyte Breakdown; Salt Electrolyte; Glow Discharge; Brush Discharge; Statistical Sample; Emperical Formula

9008
(BREAKDOWN STUDIES)
(Surface Flashover)
TRACKING IN POLYMERIC INSULATION
M.J. Billings, A. Smith and R. Wilkins
University of Manchester, Manchester, UK
IEEE Transactions On Electrical Insulation, Vol. EI-2, No. 3, pp 131-137 (12/1967).
Chemical mechanisms of tracking and erosion are reviewed by considering mechanisms of conduction and molecular structure of polymers. It is shown that track formation need not necessarily be by graphite formation and that degradation mechanisms cannot always be predicted by inspection of molecular steriochemistry. 25 Refs.
Primary Keywords: Insulator Tracking; Insulator Erosion; Conduction Mechanism; Graphite Formation; Molecular Steriochemistry

9007
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
RECOVERY CHARACTERISTICS OF A TRIGGERED-VACUUM GAP AT HIGH CURRENTS
J.D. Cobine and L.E. Prescott
General Electric Co, Schenectady, NY 12301
Journal Of Applied Physics, Vol. 42, No. 12, pp 4865-4869 (11/1971)
A system has been devised for use with a high-current generator whereby the recovery-strength characteristics of a triggered-vacuum gap (TVG) may be determined. Data are presented for an experimental hydrogen-triggered TVG for currents of 2000, 5000 and 10000 A, the latter value being near the upper limit of the tube studied. The causes of data scattering are discussed. 10 Refs.
Primary Keywords: Metal Vapor; Residual Gases; Thermionic Emission; Varying Recovery Strength

9012
(SWITCHES, OPENING)
(Mechanical, Materials)
DEVELOPMENT OF CONTACT MATERIALS FOR VACUUM INTERRUPTERS
P. Barkan (1), J.M. Lafferty (2), T.H. Lee (1) and J.L. Lento (1)
(1) General Electric Co, Philadelphia, PA 19153
(2) General Electric Co, Schenectady, NY 12301
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 1, pp 350-359 (02/1971).
Conventional contact materials cannot simultaneously meet three of the most critical functional requirements of the high capacity vacuum interrupter. This paper describes the development of a new class of vacuum interrupter contact alloys which offer exceptional properties combining high interrupting capability, high dielectric strength, and anti-welding. The mechanism by which anti-welding is achieved is described and substantiated by test results. 41 Refs
Primary Keywords: Vacuum Interrupter; Several Contact Alloys; High Interrupting Capability, High Dielectric Strength; Anti-welding

9031
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
INDUCTANCE AND INTERNAL RESISTANCE OF VACUUM DISK SWITCHES
G.N. Aratov, V.I. Vasil'ev, M.I. Pergament and S.S. Tserevitinov
Soviet Physics-Technical Physics, Vol. 13, No. 6, pp 818-821 (12/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 38, 1079-1084 (June 1968)
Previous communications have dealt with the control and electrical strength of these switches. Here estimates are made of the inductance and internal resistance, which with the results made previously allow recommendations on the design and use. 5 Refs.
Primary Keywords: Vacuum Disk Switch, Performance Test; Diagnostics; Inductance Measurement, Resistance Measurement; Design Considerations

9121
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
SPECTROSCOPIC STUDY OF THE PLASMA OF A LOW-VOLTAGE PULSE DISCHARGE IN VACUUM
V.A. Derevshchikov and M.A. Deryabina
Moscow, USSR
High Temperature, Vol. 4, No. 1, pp 16-22 (02/1966).
Trans. From: Teplofizika Vysokikh Temperatur 4, 20-26 (January-February 1966)
Results of a spectroscopic study of plasma formed in a pulse discharge between solid electrodes of coaxial geometry are presented, the initial pressure in the vacuum chamber being 1E-5 to 1E-6 mm Hg. The excitation temperatures in various parts of the jet were determined by Ornstein's method. The distribution of doubly-charged aluminum ions over the excited states was determined. A maximum plasma temperature was found for a certain discharge energy. The radial distribution of temperature in the anode jet was determined; the temperature rose with distance from the anode. 7 Refs.
Primary Keywords: Vacuum Breakdown; Pulse Breakdown; Anode Jet; Coaxial Electrodes; Temperature vs Discharge Energy

9126
(BREAKDOWN STUDIES; SWITCHES, OPENING; DIAGNOSTICS AND INSTRUMENTATION; DIAGNOSTICS AND INSTRUMENTATION)
(Exploding Wires, Explosive Fuses; Current; Voltage)
TIME RESOLVED ELECTRICAL MEASUREMENTS IN HIGH CURRENT DISCHARGES
E.C. Cassidy, S.W. Zimmerman and K.K. Neumann
National Bureau of Standards, Washington, DC 20234
The Review Of Scientific Instruments, Vol. 37, No. 2, pp 210-214 (02/1966).
A method for measurement of the resistive component of the instantaneous voltage across a sample installed in a high voltage, high current circuit is described. Simultaneous measurement of the current permitted time resolved determination of electrical energy dissipation, power, and resistance of the sample. The system was calibrated calorimetrically, and measurements were made with exploding wire samples. 14 Refs.
Primary Keywords: Exploding Wire; Current Measurement; Voltage Measurement; Resistance Measurement; Temporal Resolution

9127
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
TRANSIENT CHARACTERISTICS OF RADIATION EMISSION FROM THE PLASMA OF A PULSED DISCHARGE IN VACUUM
V.A. Derevshchikov
All-Union Institute, Moscow, USSR
High Temperature, Vol. 5, No. 3, pp 380-386 (06/1967).
Trans. From: Teplofizike Vysokikh Temperatur 5, 423-432 (May-June 1967)
The present paper gives results of an investigation into the transient characteristics of radiation emission from the plasma of a high-current pulsed discharge between electrodes of coaxial geometry at pressures of 1E-5 - 1E-6 mm Hg in a vacuum chamber. Oscillograph recording of various spectral lines was carried out simultaneously with high-speed photography of the discharge by means of an SFR-2M photorecorder. The transient temperature distributions in the regions near the anode and cathode have been determined. 7 Refs.
Primary Keywords: Vacuum Breakdown; Radiation Emission; Coaxial Electrodes; Spectroscopy

9129
(ELECTROMAGNETIC COMPATIBILITY)
(Lightning)
A PORTABLE SYSTEM FOR FULL-SCALE AIRCRAFT LIGHTNING-INDUCED COUPLING TESTS
W.G. Butters
McDonnell Aircraft Co. St. Louis, MO 63166
IEEE 1981 National Aerospace And Electronics Conference, pp 709 (05/1981).
A complete test system has been developed by the McDonnell Aircraft Company, for remote site lightning testing. The system includes the modular high-voltage Marx generator, a fiber optically-coupled sensor and diagnostic system, and a computer-controlled data acquisition system. It is specifically designed to be easily packaged for shipment and readily assembled at the test site. The complete system has been used recently to perform lightning tests on the space shuttle orbiter for NASA JSC and on the USAF YF-16 aircraft for the Air Force and Navy.
Primary Keywords: Lightning Effects; Laboratory Simulation; Marx Generator; 1.5 MV Output Voltage; Diagnostic System
Secondary Keywords: Abstract Only

9139
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines; Materials)
HIGH CURRENT AND HIGH CURRENT DENSITY PULSE TESTS OF BRUSHES AND COLLECTORS FOR HOMOPOLAR ENERGY STORES
R.A. Marshall
University of Texas at Austin, Austin, TX 78712
IEEE Transactions On Components, Hybrids, And Manufacturing Technology, Vol. CHMT-4, No. 1, pp 127-131 (03/1981).
The incentive exists to use high collector current densities in pulsed duty homopolar generators, the current densities of interest being in the range of 15-45 MA/sq.m. Tests have been conducted in which current pulses of up to 0.25 MA with an equivalent pulsewidth of 0.3 s have been passed between pancake brush assemblies and flat plate collectors with collector current densities of up to 78 MA/sq.m. and current densities in the brush fingers of 570 MA/sq.m. The current carried per brush have been a comparatively low 800 A. These tests have been successful and are providing the data necessary for the design of the all-iron-rotating homopolar pulse generators. 8 Refs.
Primary Keywords: Homopolar Generator; Pancake Brush Assembly; Flat-plate Collector; 78 MA/sq.m. Brush Current Density; Performance Test

9141
(PARTICLE BEAMS, ION)
(Generation)
NEW TYPE OF PULSED ION SOURCE WITH CRYOGENIC ANODE
K. Kasuya, K. Morioka, T. Takahashi, A. Urai and M. Hijikawa
Tokyo Institute of Technology, Nagatsuta 4259, Midori-ku, Yokohama, Japan 227
Applied Physics Letters, Vol. 39, No. 11, pp 887-888 (12/1981).
A magnetically insulated diode with a cryogenically refrigerated anode is proposed and a prototype of such a diode is constructed. Water ice is produced on an anode which is cooled with liquid nitrogen. A small machine, consisting of a Marx generator and a Blumlein line, is used to extract ion beams from the diode. Proton beams of about 50 A and 70 keV are obtained with good reproducibility. Diode electrical characteristics and the extracted beam performance are also examined. 3 Refs.
Primary Keywords: Ion Diode, Magnetic Insulation; Water Ice Emitter; Liquid Nitrogen Cooled; 50 A Proton Current; 70 keV Beam Energy

9146
(INSULATION, MAGNETIC)
()
STRUCTURE OF THE FRONT OF A MAGNETIC-INSULSTION WAVE
A.V. Gordeev
Soviet Physics Technical Physics, Vol. 23, No. 8, pp 991-992 (08/1978).
Trans. From: Zhurnal Teknicheskoi Fiziki, Vol. 48, pp 1746-1748
5 Refs.
Primary Keywords: Coaxial Arrangement; Nonlinear TM Mode; Vacuum Coaxial Waveguides; Hydrodynamic Approximation

9158
(BREAKDOWN STUDIES)
(Gas; Electrical)
ELECTRON DISTRIBUTION FUNCTION IN 4:1 N/SUB 2/-O/SUB 2/ MIXTURE
M.L. Aleksandrov, F.I. Vysikailo, R.Sh. Islamov, I.V. Kochetov, A.P. Napartovich and V.G. Pevgov
High Temperature, Vol. 19, No. 1, pp 17-21 (02/1981).
Trans. From: Teplofizika Vysokikh Temperatur 19, 22-27 (January-February 1981)
The results calculated for the electron distribution function in a 4:1 N/sub 2/-O/sub 2/ mixture are outlined. Tables and graphs of the distribution function and the electronic kinetic constants are given. 25 Refs.
Primary Keywords: Air Breakdown; Electron Distribution Function; Nitrogen-oxygen Mixture; Modeling; Ionization Processes; No UV Radiation; Theory

9200
(BREAKDOWN STUDIES)
(Gas; Electrical)
QUALITATIVE STREAMER THEORY
E.D. Lozanskii and O.B. Firsov
Soviet Physics JETP, Vol. 29, No. 2, pp 367-369 (08/1969).
Trans. From: Zhurnal Eksperimental'noi I Teoreticheskoi Fiziki 56, 670-675 (February 1969)
A simplified calculation of streamer development is proposed, based on the model of an ideally conducting plasma produced on the boundaries by electrons moving in and out of a plasma. The main conclusions are that the streamer propagation velocity is approximately proportional to its length and the streamer thickness is proportional to the square root of the length; this is in good agreement with experiment. The plasma density and the field strength E' in the streamer are also estimated. It is shown that E' is much smaller than the applied field, thus confirming the assumption that the plasma has ideal conductivity. 5 Refs.
Primary Keywords: Streamer Development Calculation; Ideally Conducting Plasma; Estimated Field Strength; Electron Cascade; Streamer Propagation Velocity; Plasma Density Calculation; Field Strength Calculation; Theory

9218
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE GLOW-DISCHARGE-TO-ARC TRANSITION INSTABILITY
A.J.T. Holmes
Imperial College Of Science And Technology, London, UK
Journal Of Physics D; Applied Physics, Vol. 8, No. 6, pp 690-695 (04/1975).
It has been observed that the cathode fall potential of an abnormal glow discharge with a cold cathode has an upper limit, so that if a voltage pulse exceeds this limit the discharge is converted into a vapour arc, within less than 1E-7 s. The discharge voltage and current density at transition have been measured in the gas density range 1E22-1E23 m/cu.cm. in Hg vapour and in Xe, using a liquid Hg anode and cathode. The transition voltage is found to decrease with rising ambient gas density and it depends only slightly on the nature of the gas, whereas the transition current density rises linearly with gas density and is more than one order of magnitude larger in Xe than in Hg. The proposed theory of the instability, which allows for various secondary emission mechanisms and an axial gas density distribution in the cathode fall region, confirms the existence of a maximum value of the cathode fall potential. A current density perturbation changes the gas density distribution causing an increase in total secondary electron emission and current density, and leads to a transition to the arc. Good agreement is obtained between theory and observations. 6 Refs.
Primary Keywords: Glow Discharge; Arc Discharge; Glow-to-arc Transition; Cathode Fall; Xenon Gas; Mercury Vapor; Experiment; Theory

9219
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, Electrical; Electrodes; Vacuum Gaps, Materials)
EXPERIMENTAL STUDY OF THE DYNAMICS OF CATHODE SPOTS DEVELOPMENT
V.I. Rekhovskii
All-Union Institute, Moscow, USSR
IEEE Transactions On Plasma Science, Vol. PS-4, No. 2, pp 81-102 (06/1976).
This paper presents results of a study of cathode spot size and movement in a vacuum arc. The authors utilized an image converter camera to photographically record 16 separate frames of vacuum arcs for several residual gas pressures and times. Several conclusions are drawn regarding the variation of cathode spot size and movement. An extensive literature survey is included. 150 Refs.
Primary Keywords: Vacuum Breakdown; Cathode Spot; Spot Size; Spot Movement; Literature Survey; Photographic Diagnostic; Cathode Erosion

9233
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid; Surface Flashover)
CHARGING OF INSULATOR SURFACES BY IONIZATION AND TRANSPORT IN GASES
C.M. Cooke
Massachusetts Institute of Technology, Cambridge, MA
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 172-178 (04/1982)
Insulator surfaces in gases collect charge when the rate of charge arrival exceeds the rate of conduction by the insulator from the surface region. The source of the collected charge may be in close proximity to, and hence greatly influenced by, the surface. Alternately, the source may be remote so that it releases charge independent of the surface accumulation. For the latter arrangement, charge transport through the gas greatly influences where it is collected. Surface charging is desired in some situations, such as for producing images or for processing. Charging is undesirable and hazardous in other situations; for example, where electrical failure may be triggered. A third possibility makes use of surface charge collection as a diagnostic procedure for materials and transport studies. This paper is concerned with the basic production and accumulation of surface charges from the adjacent gas and presents results on the processes involved. Transport parameters of drift, diffusion, and space-charge effects are considered. Examples of charging and measured distribution under different conditions, including saturation effects, are analyzed. 11 Refs.
Primary Keywords: Insulator Surface Charging; Charge Transport In Gases; Charge Trajectories

9239
(BREAKDOWN STUDIES; INSULATION, MATERIAL; INSULATION, MATERIAL)
(Corona, Gas; Solid)
CORONA AND INSULATION
M. Goldman (1) and R.S. Sigmond (2)
(1) Lab de Physique des Decharges, Gif-sur-Yvette, France
(2) Norwegian Institute of Technology, Trondheim-NTH, Norway
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 90-105 (04/1982).
The aim of this paper is to review our present knowledge of the physics of electrical coronas and their interaction with surfaces, with some emphasis on phenomena which seem of importance for high voltage insulation. We will concentrate on fundamental and general subjects, in order to limit the scope of the paper and to make it serve as an introduction to the more specialized papers that follow. 94 Refs.
Primary Keywords: Corona Discharge; Insulator Tracks; AC Corona; DC Corona; High-voltage Insulation; Theory

9257
(BREAKDOWN STUDIES, DIAGNOSTICS AND INSTRUMENTATION; INSULATION, MATERIAL)
(Partial Discharges; Partial Discharges; Testing)
FUNDAMENTAL LIMITATIONS IN THE MEASUREMENT OF CORONA AND PARTIAL DISCHARGE
S.A. Boggs and G.C. Stone
Ontario Hydro Research , Toronto, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 143-150 (04/1982).
The theoretical sensitivity of conventional partial discharge detectors is compared with that obtained from ultra wideband (UWB) (up to 1 GHz) detection systems. The comparison indicated that for relatively lossfree distributed systems, such as SF/sub 6/ insulated bus, the UWB system is up to two orders of magnitude more sensitive. UWB detection also embodies additional advantages such as facilitating the location of discharge sites and the rejection of external electrical noise. For discharge detection in plastic-insulated cables, true UWB detection is not practical because of frequency-dependent attenuation effects, although certain gains in sensitivity can be achieved with a detector bandwidth of up to 10 MHz. 22 Refs.
Primary Keywords: Partial Discharge Detector; Ultra Wideband Detector; Comparison; Discharge Site Location; Dielectric Loss

9270
(DIAGNOSTICS AND INSTRUMENTATION; SWITCHES, CLOSING)
(Current, Thyratrons)
LOW INDUCTANCE CURRENT VIEWING RESISTORS FOR HYDROGEN THYRATRONS
C.A. Mueller
T&M Research Products Inc, Albuquerque, NM 87108
3rd 1981 IEEE International Pulsed Power Conference, pp 167-170 (06/1981).
Special low inductance current viewing resistors have been designed and tested for use with low inductance thyratrons. The CVR's add less than 1 nH measurement capability. Bandwidth of these devices has been calculated to be DC to 300 MHz and measured to be DC to 466 MHz. Power handling and peak current capabilities of these devices exceed that which can be switched by hydrogen thyratrons. Design methods and a brief summary of construction techniques will be discussed. 0 Refs.
Primary Keywords: Current Viewing Resistors; 300 MHz Bandwidth; Hydrogen Thyratrons; Data Acquisition Systems; Passive Integrators

9273
(BREAKDOWN STUDIES)
(Corona)
MECHANISMS FOR INCEPTION OF DC AND 60-HZ AC CORONA IN SF/SUB 6/
R.J. Van Brunt and M. Misakian
National Bureau of Standards, Washington, DC 20234
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 106-120 (04/1982).
Using a pulse counting technique, inceptions of positive and negative point plane corona in SF/sub 6/ under DC and 60-Hz AC conditions were measured. Effects of gas pressure, UV-radiation, and point electrode size on differences between AC and DC, and between positive and negative inceptions were investigated. Inceptions were also calculated using the streamer criterion. Agreement was obtained with measured negative inceptions for both AC and DC conditions, but not with positive inceptions. The growth in the active-electron initiation volume with applied voltage was calculated and used to explain the observed polarity effect. The magnitude of the polarity effect is predictably reduced, either by irradiating the gap or by increasing the diameter of the point electrode. The difference between AC and DC positive inceptions is attributed to the enhancement of avalanche-initiating electron production by the residual ion space charge from negative corona in the previous half cycle. 39 Refs.
Primary Keywords: Corona Pulses; DC Corona; AC Corona; SF/sub 6/ Gas; Corona Inception; Polarity Effect

9282
(BREAKDOWN STUDIES)
(Corona)

PARTICLE CHARGING IN DC CORONA FIELDS-A REVIEW

I.I. Inculet
University of Western Ontario, London, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 168-171 (04/1982).
After a brief review of the currently accepted theory of particle charging in corona fields in air by both ionic bombardment and diffusion in the dark space surrounding the DC corona glow, the paper presents some of the recently published findings on particle charging within the corona glow. The study was made possible by the discovery that additions of CO/sub 2/ to air in a 5 to 20 percent range will increase a cylindrical positive corona glow to a size which is sufficiently large to allow particles to be dropped onto various trajectories parallel to the corona wire and their charge to be measured. The influence of the shape of the particles when exposed to corona charging is also discussed. 7 Refs.
Primary Keywords: DC Corona; Macroparticle Charging; Charge Measurement; CO/sub 2/-Air Mixture

9287
(BREAKDOWN STUDIES)
(Gas, Electrical)

PRE-BREAKDOWN DISCHARGES IN HIGHLY NON-UNIFORM FIELDS IN RELATION TO GAS-INSULATED SYSTEMS

H. Anis and K.D. Srivastava
University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 131-142 (04/1982).
In clean SF/sub 6/ gas-insulated power transmission systems significant pre-breakdown discharges are rarely observed. This is so because the prevailing electric field is only moderately non-uniform. In practical systems, however, conducting particle contamination creates regions of highly non-uniform fields. Rod-to-plane gaps provide a convenient way of studying pre-breakdown discharges in SF/sub 6/ under highly non-uniform fields under controlled laboratory conditions. The relatively few published reports of investigations of pre-breakdown discharges in SF/sub 6/ are reviewed. Based on the authors' and other published experimental results, several pre-breakdown regimes (for example, single pulse and multiple pulse pre-discharges and incomplete breakdowns etc.) are identified. The randomness of the time delay of the first pre-discharge current pulse is attributed to the rate of production of initiatory electrons near the anode and the growth of electron avalanches thus generated. The importance of the spatial electric field distribution around the rod electrode (anode) is emphasized. 44 Refs.
Primary Keywords: SF/sub 6/ Breakdown; Prebreakdown Phenomena; Highly Nonuniform Field; Several Prebreakdown Regimes

9288
(BREAKDOWN STUDIES)
(Corona)

PULSE CORONA DISCHARGE IN ELECTROSTATIC PRECIPITATORS

M.I. Milde
Ion Physics Corp, Burlington, MA 01803
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 179-186 (04/1982).
In electrostatic precipitators (ESPs) the electric field is responsible for producing ions in the vicinity of the corona wires, charging particles, and transporting charged particles to the collecting plate. In standard Cottrell-type precipitators, these functions are performed by applying a DC voltage between corona electrodes and collecting plates. Because ion production requires a high electric field strength near the cathode while particle transport is optimized in a uniform field, this arrangement is always a compromise, and sometimes a poor one. Energizing precipitators with both a DC base voltage and superimposed pulse voltage, on the other hand, provides for a separation of the functions; particle transport being performed by the DC base voltage and ion production by the pulse voltage. 21 Refs.
Primary Keywords: Corona; Pulsed Corona, Wire Erosion; Voltage Decay; Particle Charging
Secondary Keywords: Electrostatic Precipitator

9291
(BREAKDOWN STUDIES)
(Gas, Electrical)

PULSED GLOW DISCHARGES IN LASER EXCITATION AND BREAKDOWN

L.E. Kline
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 121-124 (04/1982).
The spatiotemporal development of discharges in uniform field gaps has been studied for many years in order to understand the physical mechanisms of breakdown. These studies have shown that a glow discharge structure is produced as an intermediate stage in the breakdown process which finally leads to the formation of a filamentary arc. Recently these pulsed or transient glow discharges have been used to pump a wide variety of gas lasers including CO/sub 2/ lasers and rare gas-halide excimer lasers. Preionization of the gas volume is usually used to 'stabilize' these laser glow discharges, i.e. to increase the duration and/or energy density of the pulsed glow discharge and delay the onset of arc formation. Recent experimental work also has shown that the corona discharges which are observed in point-plane gaps have a glow discharge-like structure. These two types of discharges are compared and some speculations are offered about the 'corona stabilization' process in point plane gaps and its relationship to arc formation in uniform field gaps. 14 Refs.
Primary Keywords: Gas Breakdown; Pulsed Discharge; Glow Discharge; Glow to Arc Transition; Preionization; Discharge Stabilization
Secondary Keywords: Gas Laser Pumping

9295
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)

RESPONSE OF A TWISTED PAIR EXCITED BY THE NONUNIFORM ELECTROMAGNETIC FIELDS OF NEARBY LOOPS

J.G. Bredenson and M. Singh
University of Oklahoma, Norman, OK 73019
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-24, No. 1, pp 52-58 (02/1982).
This paper derives equations for the noise induced in a twisted pair when the pair is embedded in a nonuniform electromagnetic field of a small current loop. The derived equations are applied to calculate the noise induced in a typical 135-ohm twisted pair. In the frequency range of 10 kHz-100 MHz, the noise induced in this twisted pair is shown to be less by about 70-135 dB when compared to a similar parallel-conductor line without twist that is embedded in the same field. Included is a simplified method of applying the derived equations to the problem of finding the response of the twisted pair to distinct uncorrelated noise sources, assuming that the sources can be approximated by small current loops. 10 Refs.
Primary Keywords: Twisted Pair; Transmission Line; Response To Electromagnetic Wave; Nonuniform Field; 135 dB Attenuation; Comparison To Nontwisted Pair

9298
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)

SHIELDING EFFECTIVENESS OF METALLIC HONEYCOMBS

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(2) University of Colorado, Boulder, CO 80309
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-24, No. 1, pp 58-61 (02/1982).
The shielding effectiveness (SE) of infinitely large metallic honeycombs is calculated from expressions derived by Weinstein, Mittra, and Lee for receiving and transmitting infinite parallel-plate arrays. A simple formula for the transmitted fields is presented, which is applicable for honeycomb dimensions employed in practice. 4 Refs.
Primary Keywords: Metallic Honeycomb, Shielding Effectiveness; Infinite Array; Theory, Parallel-plate Array

9310
(BREAKDOWN STUDIES)
(Gas, Electrical)

TOPICAL PHENOMENA OBSERVED IN A SHORT-GAP ATMOSPHERIC DISCHARGE USING ROTOR AND POST ELECTRODES

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(1) Ibaraki University, Hitachi-shi, Ibaraki, Japan
(2) Toshiba Corp, Fuchu-shi, Tokyo, Japan
(3) Takaoka Electric Mfg Co, Aichi, Japan
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-24, No. 1, pp 20-25 (02/1982).
Correlation of light emission, discharge structure, waveform of the discharge current, electrode configuration, and electromagnetic radiation is examined with the intent of obtaining an effective means for preventing electromagnetic interference (EMI) due to a short-gap discharge. The electromagnetic radiation (EMR) level resulting from a current step which, in turn, was formed by a discrete movement of a cathode spot was clearly recognized. A combination of needle rotor and needle post gave the smallest electromagnetic radiation level in the experiments. 12 Refs.
Primary Keywords: Air Breakdown; Light Emission; Electromagnetic Radiation; Electrode Configuration; Current Waveform; Correlation Of Properties; EMI Shielding

9350
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

HIGH-CURRENT VACUUM ARCS: PART I. AN EXPERIMENTAL STUDY

G.R. Mitchell
General Electric Co, Philadelphia, PA 19153
Proceedings Of The IEE, Vol. 117, No. 12, pp 2315-2326 (12/1970).
In this paper an experimental study is presented on freeburning vacuum arcs with currents up to about 100 kA peak. As the current is increased, it is shown that the arcing voltage continues to increase until electrode melting occurs for electrodes equal to or exceeding 1.5 cm in diameter. This happens during sinusoidal current loops above 10 kA peak. Once grossly melted, high-current-density spots are formed on the anode, bright constricted high-pressure columns will develop, and the mean level of the voltage may drop, even though the current is increasing. During most short arcs involving gross anode spot temperature are discussed and estimates range from 2730 to 3350 Deg K. Part two of this article presents the theoretical interpretations of this study. 15 Refs.
Primary Keywords: Vacuum-arc; Anode Spot; Gross Electrode Melting; Spot Temperature; High-pressure Columns; 100 kA Peak Current; Power Line Frequency

9381
(PULSE GENERATORS)
(Line Type)

TRANSIENTS IN HIGH-POWER MODULATORS

S. Schneider and G.W. Taylor
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-13, No. 12, pp 977 (12/1966)
The physical size involved in the design and construction of high-power modulators introduces high inductance and stray capacitance in the circuit. Analysis shows that under normal operation any inductance between the energy source and the RF device, together with stray capacitance, produces damped oscillations after the 'turn-on' and 'turn-off' of the RF generator beam. Unfortunately, the need for adequate protection of the RF generator and modulator requires the introduction of an additional inductor in the circuit to limit the rate of rise of fault current. Improper placement of this inductor can also produce detrimental oscillations under fault conditions. Proper design can minimize these unwanted transients. An analysis of the circuit and the results obtained in a high-power modulator are discussed. 0 Refs.
Primary Keywords: Fault Transient; Transient Suppression; Effect On Normal Operation; Minimization Of Effect

9384
(PULSE GENERATORS)
(Trigger)
HIGH-VOLTAGE PULSE GENERATOR WITH RISE TIME <10 NSEC
V.B. Lebedev and G.A. Pryanikova
Instruments And Experimental Techniques, Vol. 21, No. 4, pp 969-970 (08/1978).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 119-120 (July-August 1978)
A generator of high-voltage pulses is described, based on a controlled vacuum commutator to control an electrooptical laser shutter. 4 Refs.
Primary Keywords: Pulse Generator; 15 kV Output; 8 V Trigger; 30 pF Storage Capacitor; Vacuum Spark Gap

9386
(BREAKDOWN STUDIES)
(Gas, Electrical)
STABLE STATES OF A VOLUME DISCHARGE EXCITED BY AN ELECTRON BEAM IN AR WITH AN SF/SUB 6/ ADMIXTURE
Yu.I. Bychkov, Yu.D. Korolev, G.A. Mesyats, A.P. Khuzeev and I.A. Shemyakin
Soviet Physics-Technical Physics Letters, Vol. 3, No. 11, pp 461-462 (11/1977).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 3, 1121-1125 (November 1977)
The study of volume discharges in argon with fluoride admixtures is motivated by the effort to develop lasers that are halides of noble gases as active media. The experiments reported in the present letter have been carried out to determine the range of conditions corresponding to a stable volume discharge for input energies W=0.1-1 J/cu.cm. The discharge is excited by an electron beam with pulse length tau/sub b/=1E-7 sec and current density j/sub b/=1.5 A/sq.cm. The area of the electrodes and the exit window of the accelerator S=5 sq.cm., the gap d=1.4-2 cm, the gas pressure p=1 atm, and the SF/sub 6/ concentration is (0.025-1.2)%. 4 Refs.
Primary Keywords: Volume Discharge; Argon Gas; SF/sub 6/ Admixture; E-beam Excited Discharge; Effect Of SF/sub 6/ Concentration

9387
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Partial Discharges; Testing)
PARTIAL DISCHARGE EVALUATION OF POLYETHYLENE CABLE-MATERIAL BY PHASE ANGLE AND PULSE SHAPE ANALYSIS
H.G. Kranz
University of Wuppertal, FRG
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 151-155 (04/1982).
This paper reports on the correlation of chemical and physical degradation as a result of discharge activity and partial discharge measurements, using only real quantities. The materials investigated are LDPE and peroxide crosslinked PE. An 8-channel test arrangement, controlled by a real-time micro-processor system, has been employed for time-critical evaluation and data organization. It was concluded that the lifetime of polymeric insulating materials depends on the type of internal partial discharges as well as on space charge and conductivity distribution. Two competing mechanisms make it difficult to evaluate discharge behavior near inception voltage: (1) Concentration of discharges to eroded surface areas causes an increase in deteriorating energy, and (2) Surface charges and electron trapping cause a decrease in the field strength. A scanning electron microscope was used to correlate electrical measurements to physical deterioration. 8 Refs.
Primary Keywords: Partial Discharge Measurement; Physical Insulation Degradation; Chemical Insulation Degradation; Polyethylene Insulation; Lifetime Prediction

9388
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Corona; Solid)
INTERACTION OF CORONA WITH DIELECTRIC MATERIAL UNTIL DAMAGE
C. Mayoux (1), J. Sarlaboux (1) and G. Garcia (2)
(1) C.N.R.S. Universite P. Sabatier, Toulouse, France
(2) Lab Central des Industries Electriques, Fontenay aux Roses, France
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 156-162 (04/1982).
A study of polyethylene terephthalate (PET) and polypropylene (PP) treated by corona discharge for a short time is presented. Different techniques of analysis such as inverse chromatography, infrared spectroscopy, loss tangent and electric strength were used. Working at 50 Hz with a gap of 2 mm and different gases, the analysis of the polymer after treatment has shown that a limit in the transformation of the surface may be considered. Thus a critical time is defined between a pure transformation and a degradation. This latter phase is also studied with a cross linked polyethylene (XLPE). The infrared analysis and electric strength measurements have shown the role played by the relative humidity present in air. 24 Refs.
Primary Keywords: Corona; Plastic Insulation Interaction; Insulation Degradation, Several Analysis Techniques; Correlation Of Physical And Electrical Degredation, Humidity Effects

9390
(BREAKDOWN STUDIES)
(Lightning)
ANALYSIS OF LIGHTNING DATA FROM THE DMSP SATELLITE
B.N. Turman
Patrick AFB, Florida 32925
Journal Of Geophysical Research, Vol. 83, No. C10, pp 5019-5024 (10/1978).
A lightning detector, consisting of 12 silicon photodiodes, each with a field view of 700 x 700 km on the earth, has been flown on a Defense Meteorological Satellite Program satellite. Peak amplitude of the lightning flash was digitized within a range of 16 discrete levels, and the largest amplitude observed within a 1-s sample interval was recorded. Approximately 10,000 lightning flashes were analyzed. The frequency of occurrence of peak lightning power within the range 1E8-1E10 W has been obtained. The median power level was 1E9 W, and about 2% of the lightning flashes had peak powers greater than 1E10 W. These data are compared to similar results from a ground-based experiment. Lightning flash rate per unit surface area on the earth was 6E-8/sq km-sec but this value may be biased toward high rates by the method of selecting the data base. 7 Refs.
Primary Keywords: Satellite Lightning Detection, Silicon Photodiode Array, Lightning Analysis, Flash Brightness, Lightning Electrical Power, Large Statistical Sample

9391
(PARTICLE BEAMS, ELECTRON)
(Generation)
EXACT SOLUTION OF POISSON'S EQUATION FOR SPACE-CHARGE-LIMITED FLOW IN A RELATIVISTIC PLANAR DIODE
J.E. Boers and D. Kalleher
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 40, No. 6, pp 2409-2412 (05/1969).
Poisson's equation, governing space-charge-limited flow in a relativistic planar diode, is solved assuming the initial velocities of the accelerated particles are zero, through the use of two power series convergent in the potential range 0<=V<=2m/sub 0/c/sup 2/2e and 2m/sub 0/c/sup 2/2e<=V<=infinity. In the region of lower potential the solution is expressed in a power series in U, a normalized potential. As U becomes small the solution reduces to the well-known Child's law. In the region of higher potential, a power series in inverse powers of U is employed. As U becomes large the solution reduces to the ultra-relativistic form obtained if v, the particle velocity, can be considered equal to the speed of light. Convergence of both series is rapid, and it is only necessary to retain a few terms to realize a high degree of accuracy. 4 Refs.
Primary Keywords: Poisson's Equation; Convergent Power Series; Space-charge-limited Flow; Child's Law; Theory; Numerical Calculation; Ultra-relativistic Solution

9393
(INSULATION, MAGNETIC)
()
ONE- AND TWO-SPECIES EQUILIBRIA FOR MAGNETIC INSULATION IN CO-AXIAL GEOMETRY
K.D. Bergeron
Sandia Labs, Albuquerque, NM 87115
The Physics Of Fluids, Vol. 20, No. 4, pp 688-697 (04/1977).
A cold-fluid, self consistent model of electron and ion flow in coaxial cylindrical geometries is applied to the problem of magnetically insulated diodes. The one species, nonrelativistic problem is studied to determine in what configurations and parameter domains equilibria corresponding to magnetic insulation exist. It is proved that when the outer electrode is the cathode, equilibria always exist. For an inner cathode, whether or not equilibria exist and whether they are unique depends on whether the field is azimuthal or longitudinal and on the ratio of the radii. The two-species relativistic problem is then analyzed with the help of a computational routine which integrates the cold-fluid differential equations and searches the parameter space for the point corresponding to space charge limited emission. As the critical field is approached from above, the resulting values of ion current show an enhancement over the single species prediction by a factor which increases with voltage and with anode radius. Patterns of nonexistence of equilibria similar to those observed for the one-species, nonrelativistic case are also found. 17 Refs.
Primary Keywords: Field Emission Diode; Magnetic Insulation; Theory; Electron Flow; Ion Flow; Cold-fluid Model; Two-species Relativistic Flow; Comparison With One-species Flow

9405
(DIAGNOSTICS AND INSTRUMENTATION)
(E-field)
MINIATURE ELF ELECTRIC FIELD PROBE
M. Misakian, F.R. Kotter and R.L. Kahler
National Bureau of Standards, Washington, DC 20234
The Review Of Scientific Instruments, Vol. 49, No. 7, pp 933-935 (07/1978).
A miniature AC electric field probe having direct electrical connections with its battery-operated electronics is described. Because its small size introduces little field perturbation, fields generated by relatively small electrode structures in laboratory environments can readily be characterized. 10 Refs.
Primary Keywords: E-field Probe, Small Size, Small Field Perturbation; Power Line Frequency

9408
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
TEMPERATURE DEPENDENCE OF THE ELECTRO-OPTIC KERR COEFFICIENT OF NITROBENZENE
R.E. HEBNER and M. MISAKIAN
National Bureau of Standards, Washington, DC 20234
Journal of Applied Physics, Vol. 50, No. 9, pp 6016-6017 (09/1979).
The Kerr coefficient of nitrobenzene was measured over the temperature range 285-340 K. To within experimental error, the data indicate that the Kerr coefficient can bee expressed as a quadratic function of reciprocal temperature. Fitting the data to this quadratic function yields an equation which can b used to correct the response of a pulse-voltage measuring system based on the Kerr effect for variations in the ambient temperature. 7 Refs.
Primary Keywords: Kerr Cell; Kerr Coefficient Measurement; Temperature Variation; Nitrobenzene Coefficient, Emperical Function

9424
(PULSE GENERATORS)
(Marx)
IGNITRON-SWITCHED 0.6- TO 90-KV IMPULSE GENERATOR
E.H. Beckner and R.H. Kotoski
Sandia Labs, Albuquerque, NM 87115
The Review Of Scientific Instruments, Vol. 33, No. 9, pp 914-915 (09/1962).
An ignitron-switched impulse generator has been developed, capable of providing a variable output voltage of from 0.6 to 90 kV with no circuit alterations. The generator consists of 6 capacitor stages, yielding a total energy of 5000 J at 90 kV, and is discharged with a single trigger pulse. The discharge time can be controlled to within 0.1 microsecond. 3 Refs.
Primary Keywords: Pulse Generator; 0.6 To 90 kV Impulse Generator; 5000 J Total Energy; Single Trigger Pulse; Ignition-switched; Low Impedance; Marx Generator

9429
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
CREATION OF MEGAGAUSS FIELDS BY THE METHOD OF MAGNETODYNAMIC ACCUMULATION
S.G. Alikhanov, V.G. Belan, G.I. Budker, A.I. Ivanchenko and G.N. Kichigin
Soviet Atomic Energy, Vol. 23, No. 6, pp 1307-1311 (12/1967).
Trans. From: Atomnaya Energiya 23, 536-541 (December 1967)

Interest in the problem of creating superstrong magnetic fields has greatly increased in recent years. Works have been published describing experiments which involve the creation of pulsed magnetic fields with high intensity and also works dealing with theoretical studies of this problem. A conference was held on megagauss fields and the possibilities of creating and using intense magnetic fields are studied in various laboratories. A method of creating a strong magnetic field has found the most widespread application. This method is based on the compression of the magnetic flux by a conducting cylindrical shell which is accelerated by external forces. If the rate of compression of the shell is greater than the rate of flux leakage, the magnetic field strength increases. The maximum strength and the characteristic time of existence of the magnetic field are determined by the mass of the shell, the maximum attainable velocity and the trapped flux, the properties of the shell material, etc. The present work gives the results of the experiments on the creation of an intense magnetic field through flux compression by a collapsing liner. 7 Refs.

Primary Keywords: Magnetic Field Generation; Flux Compression; Explosive Driver; Electrical Driver

9430
(BREAKDOWN STUDIES)
(Exploding Wires)
ELECTRICAL BREAKDOWN OF CYLINDRICAL FOILS IN AIR. III. HIGH-CURRENT EXPANDING DISCHARGE
V.A. Burtsev, A.M. Bezdol'nyi, V.A. Dubyanskii, N.P. Egorov, M.P. Kasatkina, A.B. Produvnov and I.V. Shestakov
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 25, No. 6, pp 697-703 (06/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 1216-1226 (June 1980)

Results of an experimental study are described, pertaining to electrical breakdown of cylindrical aluminum foils in air and to the expanding high-current discharge initiated by this breakdown with the geometry of an inverse longitudinal pinch. The time dependence of the plasma brightness temperature in the case of 'thin' (h=6 micron) foils is characterized by an initial fast-rise phase (Tau/sub phi/ approximately 1 microsecond) and a phase of almost constant temperature throughout the entire first current half-period (Tau approximately 35 microseconds). The maximum plasma brightness temperature in this case reaches T/sub b/=3.2 eV. Determination of the plasma column temperature averaged over the cross section from the electrical conductivity of the discharge, according to electrical measurements, and from high-speed photographs taken from the end of the chamber has confirmed that there is a quasi-steady discharge phase. 14 Refs.

Primary Keywords: Electrical Breakdown; Cylindrical Aluminum Foils; Expanding High-current Discharge; Plasma Column; 3.2 eV Maximum Plasma Brightness Temperature

9432
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
PRODUCTION OF PULSED MAGNETIC FIELDS UP TO 700 KOE
A.K. Soika and V.V. Valyavko
Physics Institute, Academy of Sciences of the Belorussian SSR, USSR
Journal Of Applied Spectroscopy, Vol. 27, No. 1, pp 956-959 (07/1977).
Trans. From: Zhurnal Prikladnoi Spektroskopii 27, 177-181 (July 1977)

A pulsed magnetic field of high intensity is usually obtained by the discharge of a capacitor bank through a solenoid. The efficiency of this process is determined by the expression eta=eta/sub b/ x eta/sub s/, where eta/sub b/ is the ratio of the energy of the magnetic field of the solenoid at the first current maximum to the energy originally stored in the capacitor bank; eta/sub s/ is the coefficient of effectiveness of the solenoid, equal to the ratio of the energy in the magnetic field in the useful volume to the energy of all the magnetic fields of the solenoid. L/sub p/ divided by L/sub s/ is the ratio of the parasitic inductance of the discharge circuit to that of the solenoid; gamma=R sup 2 C divided by 4L is the damping constant; the function f(gamma) is determined by a given expression. We have developed and used extensively a pulsed solenoid, the distinguishing feature being that the coil, the discharge, the connecting lines, and the power strip are all structurally fulfilled as one whole. This allowed us to bring elements with opposite currents as close to each other as possible and thereby decrease the loop of the discharge curve. To achieve the largest values of the efficiencies under the given conditions, it was also important to assure a value of gamma on the order of 1E-2, which will then yield an insignificant decrease in eta/sub b/ due to f(gamma). 8 Refs.

Primary Keywords: Magnetic Field Generation; Solenoid Magnetic Coil; No Flux Compression; Analysis; High Efficiency

9450
(ENERGY STORAGE: MECHANICAL)
(Rotating Machines, Materials)
DESIGN OF THE LIQUID-METAL CONTACTOR IN HOMOPOLAR MACHINES
A.L. Genkin, V.A. Dievskii and Yu.P. Kos'kin
Magnetohydrodynamics, Vol. 13, No. 2, pp 238-244 (06/1977).
Trans. From: Magnitnaya Gidrodinamika 2, 127-129 (April-June 1977)

We consider the steady flow of liquid metal in a contact device with coaxial cylindrical electrodes. This liquid-metal contactor is assumed to be in a uniform magnetic field b/sub 0/ oriented along the z axis; the induced magnetic field has no radial and axial components. 4 Refs.

Primary Keywords: Homopolar Generator; Current Contact; Liquid Metal Brushes; Magnetic Field; Theory

9451
(ENERGY STORAGE, INDUCTIVE; BREAKDOWN STUDIES)
(Systems; Gas, Electrical)
DISCHARGE OF ENERGY OF A SUPERCONDUCTING INDUCTANCE INTO A FLASH LAMP
A.I. Bertinov, V.G. Manulov and O.M. Mironov
Soviet Physics-Technical Physics, Vol. 16, No. 7, pp 1136-1141 (01/1972)
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 1443-1451 (July 1971)

The discharge of the energy stored in a superconducting inductance into a flash lamp is analyzed. Solutions are obtained for the discharge equation assuming linear and power-law approximations for the lamp characteristic. Equations are given for the parameters of the discharge circuit. The analysis has been verified with an IFP-200 flash lamp. The discharge is oscillatory at voltages near the lamp extinction voltage. The experimental results agree with the theory. 14 Refs.

Primary Keywords: Inductive Energy Store; Superconducting Coil; Flashlamp Load; Time Resolved Resistance

9453
(SWITCHES, OPENING)
(Explosive Fuses)
EXPLOSIVE SWITCHING OF AN ELECTRIC CURRENT
E.I. Bichenkov and V.A. Lobanov
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 16, No. 1, pp 52-54 (02/1975).
Trans. From: Zhurnal Prikladnaya Mekhanika i Tekhnicheskoi Fiziki 1, 66-68 (January-February 1975)

Experiments are described involving a circuit-breaker element capable of switching a current with a line density of up to 3E5 A/cm in a time of 5 microseconds. A suggested application for this device is explosive-magnetic generators with tuned back inductance. 8 Refs.

Primary Keywords: Opening Switch; Explosive Fuse; 3E5 A/cm, Line Current Density; 5 Microsecond Opening Time; Inductive Store

9461
(ENERGY STORAGE, INDUCTIVE)
(Systems)
INDUCTIVE ENERGY STORAGE FOR PULSED DISCHARGES
Yu.A. Anan'ev, V.M. Irtuganov, V.P. Kalinin and V.V. Sergeev
Soviet Physics-Technical Physics, Vol. 16, No. 2, pp 283-286 (08/1971).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 376-380 (February 1971)

Standard energy storage devices (capacitor banks) can be replaced by inductive storage. Details of power supplies with such devices are discussed; switching devices and switching processes are also discussed. 3 Refs.

Primary Keywords: Inductive Energy Store; Storage Coil; Switching System; Parallel Loads; Flashlamp Load; Thyristor; Explosive Fuse

9503
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
MAGNETIC FIELD COMPRESSION BY A STRONG SHOCK WAVE
A.I. Bertinov, D.A. But and V.I. Yudas
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 15, No. 3, pp 427-429 (06/1974).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 15, 173-175 (May-June 1974)

Compression of a magnetic field by a strong shock wave impinging on a solid wall is considered in a kinematic formulation. Variation of the magnetic field in the gap between the wall and the shock front is described by a Volterra integral equation which is solved numerically. The field distribution in gas and wall is obtained, as well as the dependence of the magnetic energy stored in them on the magnetic Reynolds number and the gas velocity in a coordinate system fixed on the shock front. Similar relations for the field and energy in the gap are also calculated. The results obtained are in good agreement with the data of other investigators. 5 Refs.

Primary Keywords: Flux Compression; Shock Wave Liner Implosion; Theory; Numerical Calculation

9505
(PULSE GENERATORS: SWITCHES, OPENING)
(Flux Compression; Gas Gaps, Compression)
MAGNETOIMPLOSIVE GENERATORS FOR RAPID-RISETIME MEGAMPERE PULSES
A.I. Pavlovskii, V.A. Vasyukov and A.S. Russkov
Soviet Technical Physics Letters, Vol. 3, No. 8, pp 320-321 (08/1977).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 3, 789-792 (August 1977)

Recent years have seen rapid development of sources of intense current pulses that use inductive storage units in conjunction with rapid breaking of the current circuit. The most promising device for this purpose is the magnetoimplosive generator, which can produce an energy approximately 1E7 J with a specific energy (1-5) 1E9 J/cu.m. and current 1E7-1E8 A. The energy is delivered from the magnetoimplosive generator to the external load rapidly (in approximately 1E-6 sec) by using an explosive charge to destroy a metal foil which is part of the circuit of the magnetoimplosive generator. In this letter we report an experimental study of a switch in which a rapid increase in the resistance of a plasma channel is obtained by compression by explosion products. 4 Refs.

Primary Keywords: Flux Compression Generator; Opening Switch; Plasma Compression; Opening Mechanism

9513
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
THE PRODUCTION OF PULSED MEGAGAUSS FIELDS BY COMPRESSION OF THE METALLIC CYLINDER IN Z-PINCH CONFIGURATION
S.G. Alikhanov, V.G. Belan, A.I. Ivanchenko, V.N. Karasjuk and G.N. Kichigin
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Journal Of Scientific Instruments (Journal Of Physics E), Series 2, Vol. 1, No. 5, pp 543-545 (05/1968).

The experimental apparatus is described and the experimental results are given for the production of high magnetic fields, up to 3 MG, by flux compression with metallic shell accelerated in Z-pinch configuration. The experimental data are compared with computer calculations. 7 Refs.

Primary Keywords: Magnetic Field Generation; Flux Compression; 3 MG Field; Z-pinch; Experiment; Comparison With Theory

9517
(PULSE GENERATORS)
(Pulse Forming Lines)
A GENERATOR FOR SHAPING SINGLE HIGH-VOLTAGE NANOSECOND PULSES ACROSS AN UNMATCHED LOAD
D.I. Proskurovskii and E.B. Yankelevich
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1423-1426 (10/1973).
Trans. From: Pribory Tekhnika Eksperimenta 4, 108-111 (September-October 1973)
The construction of a generator is described which shapes single pulses having an amplitude of up to approximately 50 kV and a leading edge duration of approximately 2 nsec across an unmatched load. The controlled spark gap is implemented in the form of a separate element in the commutating section. For tests at a frequency of 50 Hz the service life of a gap exceeded 1E6 operations. 4 Refs.
Primary Keywords: Transmission Line Pulser; Spark Gap; Unmatched Load; No Reflections; 50 kV Output Voltage; 2 ns Rise Time

9518
(PULSE GENERATORS)
(Current)
A GENERATOR WHICH PRODUCES CURRENT PULSES OF UP TO 10 KA AT A VOLTAGE APPROXIMATELY 100 V
V.P. Lebedev and V.P. Voinov
Khar'kov State University, USSR
Instruments And Experimental Techniques, Vol. 18, No. 4, pp 1112-1113 (08/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 88-89 (July-August 1975)
A circuit for obtaining single or continuously repetitive electrical current pulses having an amplitude of up to 10 kA and a length of approximately 1E-5 - 1E-4 sec voltage 60-450 V is described. The spark gap can withstand approximately 1E5 pulses. 3 Refs.
Primary Keywords: Pulse Generator; 10 kA Current Pulse; 100 V Output Voltage; Single Pulse; Rep-rated; Spark Gap

9520
(PULSE GENERATORS)
(Marx)
A MOBILE GENERATOR OF 300 KV, 10 CPS VOLTAGE PULSES
V.S. Barantsev, I.I. Kalyatskii and R.E. Klein
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 2, pp 371-372 (04/1964).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 108-109 (March-April 1964)
A generator of 300 kV voltage pulses with a repetition rate of 10 cps is described. The generator uses capacitors charged through a protected choke and decoupling inductances. The voltage pulse has an energy of 800 J, and a rise time of 1E-7 sec. 0 Refs.
Primary Keywords: Marx Generator; Arked'ev Marx; 100 kV Output Voltage; 800 J Stored Energy; 10 ns Rise Time; Rep Rated; 10 Hz Repetition Rate

9527
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
BREAKDOWN MECHANISM OF SHORT VACUUM GAPS
G.M. Kassirov and G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 9, No. 8, pp 1141-1145 (02/1965).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 34, 1476-1481 (August 1964)
From the breakdown time characteristics of vacuum gaps up to 1 mm long in the nanosecond range, and from known experimental data, a hypothesis regarding the retardation of the discharge and the process of its transition into an arc is developed. Experimental data are clearly explained within the framework of the proposition set out. 19 Refs.
Primary Keywords: Vacuum Breakdown; Experiment; Theory; 1 mm Gap Spacing; Breakdown Mechanism

9528
(SWITCHES, CLOSING)
(Gas Gaps, Self)
BREAKDOWN-VOLTAGE STABILITY OF GAS-FILLED SWITCHES FOR VOLTAGE PULSE GENERATOR
E.I. Zolotarev, V.D. Mukhin, L.E. Polyanskii and V.N. Trapeznikov
Soviet Physics-Technical Physics, Vol. 21, No. 3, pp 340-344 (03/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 595-600 (March 1976)
In many applications of voltage pulse generators the system must be highly stable against spontaneous breakdown and the pulse length and repetition period must be controlled very precisely. Suitable circuits, varying in complexity, are availble for this purpose. Switches with a stable breakdown voltage permit simpler solutions. 5 Refs.
Primary Keywords: Spark Gap; Breakdown Voltage Stabilization; 100 kV Operating Voltage; 40 kA Current; Reliability

9531
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
CONTROLLED DOUBLE-TRIGGER SPARK GAP
S.I. Lobov and M.A. Kanunov
Instruments And Experimental Techniques, No. 6, pp 1133-1135 (12/1961).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 94-96 (November-December 1961)
The double-trigger principle in spark gaps operating on the right branch of Paschen's curve provides very fast action with a high safety factor. In instruments of this type at a working voltage of 1.5 kV the testing voltage is at least 3 kV, and the lag of the main discharge behind the trigger pulse does not exceed 0.05 microsecond. The spark gap is designed for a current up to 3 kA and electric pulses of several microsecond duration. 4 Refs.
Primary Keywords: Spark Gap Switch; Double-trigger Gap; Field Distortion Gap; 3 kV Operating Voltage; 50 ns Switching Delay; 3 kA Current

9536
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Gas, Electrical; Electrodes; Gas)
DIELECTRIC STRENGTH OF COMPRESSED SULFUR HEXAFLUORIDE AND THE ELECTRODE MATERIAL AND SURFACE STRUCTURE
B.A. Goryunov
Soviet Physics-Technical Physics, Vol. 20, No. 1, pp 66-67 (07/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 111-114 (January 1975)
The effects of the electrode material and the methods used to finish the electrode surfaces on the ignition voltage in compressed sulfur hexafluoride have been studied. Experiments with plane-electrodes at gas pressures up to 8 atm show that the dielectric strength is a function of the mechanical strength of the electrode metal, its melting temperature, and, in particular, the technique used to finish the electrode surface. 5 Refs.
Primary Keywords: SF/sub 6/ Insulation; Electrical Strength; Electrode Effects; Electrode Surface

9568
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
TRANSITION FROM FIELD EMISSION TO A VACUUM ARC
G.N. Fursei and G.K. Kartsev
Leningrad State University, USSR
Soviet Physics-Technical Physics, Vol. 14, No. 10, pp 1442-1443 (04/1970).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 1917-1919 (October 1969)
The very rapid explosive transition from the compartively low conductivity of the vacuum gap to high conductivity limited only by the parameters of the external circuit is the decisive and irreversible moment in the development of the vacuum breakdown during the destruction of the field emitter. It was our purpose to study the time characteristics of the transition during a gradual approach to the critical stage, i.e., the 'slow' transition, and for an increased rate of the supply of energy, i.e., 'forcing' (after reaching the critical stage), the amplitude of the high voltage pulse at the specimen increased discontinuously by the specified factor). Monocrystalline tungsten points were used for the investigation. 0 Refs.
Primary Keywords: Vacuum Breakdown; Prebreakdown Currents; Field Emission; Arc Transition

9582
(SWITCHES, CLOSING; SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Electrical; Gas Gaps, Self; Liquid Gaps, Electrical)
AMPLITUDE STABILIZATION OF HIGH-VOLTAGE PULSES USING POWERFUL COMMUTATORS
A.T. Matyushin, V.T. Matyushin, V.S. Pak, N.S. Rudenko, V.I. Tsvetkov and V.I. Smetanin
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 18, No. 2, pp 469-471 (04/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 118-119 (March-April 1975)
The characteristics of three forms of discharge gaps are examined in order to establish the possibility of creating amplitude-stable high-voltage pulses. An amplitude stability of approximately 2% or better may in fact be obtained from one pulse to another. 6 Refs.
Primary Keywords: Spark Gap; Gas Gap; Self Trigger; Field Distortion Gap; Liquid Gap; Field Distortion Gap

9583
(BREAKDOWN STUDIES)
(Surface Flashover)
AN INVESTIGATION OF PULSE FLASHOVER OF SOME SOLID DIELECTRICS IN VACUUM
I.I. Kalyatskii and G.M. Kassirov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 9, No. 8, pp 1137-1140 (02/1965).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 34, 1471-1475 (August 1964)
Pulse flashover of various solid insulating materials in high vacuum was investigated in the range of pulse durations 0.1-3.0 microseconds and interelectrode distances up to 20 mm. The pulse ratios were determined in this range of pulse durations. The pulse flashover voltage depended on the material of the specimens, the finish of the surface, and field inhomogeneity at the electrodes. 5 Refs.
Primary Keywords: Surface Flashover; Vacuum Insulation; Solid Insulation; 0.1-3.0 Microsecond Pulse Durations; <= 20 mm Interelectrode Distances; Pulsed Vacuum Spark Gaps

9584
(PARTICLE BEAMS, ELECTRON; ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Generation; Systems; Diodes; Self)
ANODE FOR AN ACCELERATOR WITH AN INDUCTIVE ENERGY ACCUMULATOR
G.I. Dolgachev, F.I. Blinov and I.N. Slivkov
Instruments And Experimental Techniques, Vol. 21, No. 1, pp 11-13 (02/1978).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 14-16 (January-February 1978)
An analysis is made of the operation of an anode proposed by the authors for an electron-optical system with a longitudinal magnetic field, which fills the role of a current commutator and accelerating system in accelerators with inductive energy accumulators. It is shown to be possible to create an anode capable of receiving a stream of low-energy electrons without significant reflection in the accumulation mode and of emitting a beam of accelerated electrons into a gaseous volume in the acceleration mode. 4 Refs.
Primary Keywords: E-beam Generation; Inductive Energy Store; Diode Design; Anode Development; Anode-switch Combination

9599
(PULSE GENERATORS; POWER CONDITIONING; POWER CONDITIONING)
(Systems; Saturable Reactors; Pulse Forming Lines)
HIGH-FREQUENCY MAGNETOTHYRISTOR GENERATOR OF POWERFUL NANOSECOND PULSES
E.A. Gromov, A.N. Meshkov and V.I. Shishke
Gork'ii Polytechnic Institute, USSR
Instruments And Experimental Techniques, Vol. 23, No. 3, pp 667-669 (06/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 118-119 (May-June 1980)
A magnetic generator for the modulation of devices of powerful pulsed electronics and optics is described. The generator system contains a thyristor generator of the inverter type, magnetic compression units based on ferrite, and shaping line with a distributed commutator - a line segment containing a saturable magnetic substance. The repetition frequency of the rectangular output pulses is 20 kHz, the pulsed power is 1 MW, the duration is 70 nsec, the duration of the front and decay is 6 nsec, and the voltage is 3 kV. The supplying voltage is 300 V, with oil cooling. The possibility of increasing the pulsed power is discussed. 11 Refs.
Primary Keywords: Pulse Generator; Saturable Reactor Pulse Sharpening; Pulse Forming Line; Thyristor Switch; 3 kV Output Voltage; 300 V Input Voltage; Power Multiplication; Rep Rated; 20 kHz Repetition Rate

9631
(PULSE GENERATORS; POWER CONDITIONING)
(Systems; Saturable Reactors)
HIGH-POWER MAGNETOTHYRISTOR PULSE GENERATOR
G.P. Gordeev, N.P. Polyakov, P.P. Rumantsev, V.V. Sinenko and Yu.P. Yarushkin
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 23, No. 5, pp 1179-1181 (10/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 117-119 (September-October 1980)
The paper describes a magnetothyristor generator which forms bipolar voltage pulses of amplitude 40 kV and a leading edge of 0.4 microseconds repeated at a rate of up to 1 kHz on a 6.25-nF capacitor. 5 Refs.
Primary Keywords: Pulse Generator; Saturable Reactor Pulse Sharpening; Thyristor Switch; Unipolar Output; Bipolar Output; Loss Analysis; 40 kV Output Voltage; Rep Rated: 1000 Hz Repetition Rate

9604
(PULSE GENERATORS)
(Linear Amplifiers)
HIGH-VOLTAGE LINEAR PULSE AMPLIFIER
P.A. Ekstrom, D.A. Crosby and K.B. MacAdam
University of Kentucky, Lexington, KY 40506
The Review Of Scientific Instruments, Vol. 51, No. 12, pp 1700-1703 (12/1980).
This linear amplifier employs moderate-voltage power supplies and components to generate high-voltage pulses of arbitrary shape on a microsecond time scale. A linear version of the Marx generator, it is limited to a small duty fraction, but can deliver a large multiple of its supply voltage. Its initial application was generation of specially shaped field-ionization pulses in studies of Rydberg atoms. 3 Refs.
Primary Keywords: Pulse Amplifier; Linearized Marx Generator; Low Duty Factor; 5 kV Output Voltage

9606
(PULSE GENERATORS)
(Line Type)
HIGH-VOLTAGE SQUARE-PULSE GENERATOR WITH ENHANCED PULSE-TOP STABILITY
V.G. Filippov
Instruments And Experimental Techniques, Vol. 24, No. 1, pp 125-126 (02/1981).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 120-122 (January-February 1981)
The paper describes a high-voltage square-pulse generator made of four connected five-section twin shaping lines, commutated by a controlled multigap discharger. The stability of the pulse top is enhanced by delaying the connection of two of the shaping lines. The voltage across the load is 400 kV, the pulse duration is 70 microseconds, and the current is up to 1.5 kA. The pulse-top irregularity was <= 1%. 3 Refs.
Primary Keywords: Pulse Generator; Twin Pulse Shaping Line; Five-section Line; Four Interconnected Lines; 400 kV Output Voltage; 1 Per Cent Pulse Drop; 70 Microsecond Pulse Duration

9612
(PULSE GENERATORS)
(Trigger)
LIGHT CONTROL-PULSE DETECTOR FOR THE CURRENT SWITCHES IN A HIGH-VOLTAGE PULSE GENERATOR
V.N. Eliseev, N.A. Ivanov and V.F. Kondakov
Instruments And Experimental Techniques, Vol. 23, No. 1, pp 150-153 (02/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 149-151 (January-February 1980)
A light-pulse detector immune to interference is described for an optoelectronic control system for the effectors for charging-current switching in a pulse generator. The threshold for the light pulse is 50 lx. The permissible parameters for interfering pulses at the supply terminals are amplitude 12 V and duration 100 microseconds. The device is powered from the high-voltage circuits. 2 Refs.
Primary Keywords: Trigger Pulse Generator; Optical Trigger; Spiral Generator; Phototransistor; Pulse Transformer; 100 kV Output Voltage; Theory; Experiment

9635
(PULSE GENERATORS; SWITCHES, CLOSING; POWER CONDITIONING)
(Systems; Thyratrons; Saturable Reactors)
THYRATRON GENERATOR OF HIGH-POWER NANOSECOND PULSES WITH INCREASED EFFICIENCY
V.A. Vizir', N.A. Lashuk, V.P. Orel and V.P. Shcherbinin
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 22, No. 4, pp 1046-1049 (08/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 158-160 (July-August 1979)
A circuit of a thyratron generator for short pulses with increased efficiency and decreased commutator-current overload coefficient has been described. The generator according to this circuit using a TGI1-2500/50 thyratron with a pulse power of 25 MW and a duration of 50 nsec achieves an overload coefficient of approximately 1.5, the pulse power efficiency is approximately 0.8, and the average power efficiency is approximately 0.3. 6 Refs.
Primary Keywords: Pulse Generator; Thyratron Switch; Nonlinear Ferrite Line; Filter Capacitor; High Transfer Efficiency

9643
(SWITCHES, CLOSING)
(Hollow-cathode)
A TWO-CHAMBER HEAVY-CURRENT HIGH-VOLTAGE SWITCH
O.G. Bespalov, A.S. Knyazyatov, A.I. Nastyukha, P.A. Smirnov and A.N. Udovenko
Instruments And Experimental Techniques, Vol. 18, No. 1, pp 125-126 (02/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 113-114 (January-February 1975)
A description is given of a switch that will handle currents of about 500 kA at 1-20 kV with a length of 5-100 microseconds for the first half-cycle in the pulse and a repetition frequency of 0.1 Hz; the device works with residual gas at 3-8E-2 Torr. A study has been made of the gas composition. 5 Refs.
Primary Keywords: Hollow Cathode Arc Switch; 20 kV Operating Voltage; 500 kA Current; Two-chamber Switch; Copper Anode

9649
(BREAKDOWN STUDIES; ELECTROMAGNETIC FIELD GENERATION)
(Exploding Wires; Magnetic)
ELECTRICAL EXPLOSION OF THE SKIN LAYER
V.P. Gordienko and G.A. Shneerson
Soviet Physics-Technical Physics, Vol. 9, No. 2, pp 296-297 (08/1964).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 34, 376-378 (February 1964)
The destruction of single-turn solenoids due to the ejection of molten metal from the skin layer as its is heated by the current pulse constitutes one of the difficulties met in using such solenoids to produce rapidly increasing magnetic fields. The destruction of the solenoid takes place before plastic deformation can ensue, and occurs the more violently the faster the field rises. We have studied the 'slow explosion' of the skin layer using single-turn solenoids of Wood's alloy, when violent destruction occurs at moderate fields and on the leading edge of the current pulse; in solenoids of conventional materials (copper, steel, etc.) and at induction amplitudes of 120-150 Wb/cu.m. this process begins after the first current maximum, other things being the same. 6 Refs.
Primary Keywords: Magnetic Field Generation; Coil Destruction; Skin Layer Explosion; Fast-rise Fields

9650
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Systems; Explosive Fuses)
ENERGY TRANSFER FROM AN INDUCTIVE STORAGE TO AN INDUCTIVE LOAD BY MEANS OF AN EXPLOSIVE CURRENT DISCONNECT
L.S. Gerasimov, V.I. Ikryannikov and A.I. Pinchuk
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 16, No. 1, pp 43-46 (02/1975).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1, 55-59 (January-February 1975)
A study is made of switching of current from an inductive storage by electrical explosion of a wire shunting an inductance in conformity with a model based on surface vaporization waves. It is established that the nature of the process is determined by certain generalized dimensionless parameters of the system. The modes of most efficient transfer of energy to the load are determined. 4 Refs.
Primary Keywords: Inductive Energy Store; Inductive Load; Opening Switch; Exploding Wire; Explosion Modeling; Efficiency Considerations

9651
(BREAKDOWN STUDIES)
(Exploding Wires)
EXPLOSION OF A METAL BY AN ELECTRIC CURRENT
S.V. Lebedev
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics JETP, Vol. 5, No. 2, pp 243-252 (09/1957).
Trans. From: J. Exptl. Theoret. Phys. (U.S.S.R.) 32, 199-207 (February 1957)
The destruction of metal wire at currents of 5E5 x 5E6 amp/cu.cm. was investigated. Two different types of processes were observed: rupture of the melted wire into macroscopic fragments by surface tension forces, and explosion of the melted wire caused by changed in its volume properties. The abrupt change in the electrical conductivity of melting tungsten, molybdenum, platinum, or nickel was measured. A previous conclusion, that the energy of the metal at which its electric conductivity vanishes depends on the current density, is confirmed. 19 Refs.
Primary Keywords: Exploding Wire; Tungsten Wire; Molybdenum Wire; Platinum Wire; 5E6 A/sq.cm.; Current Density; Conductivity Change; Several Explosion Regimes

9660
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Surface Flashover; Gas, Optical)
PHOTOINDUCED SURFACE DISCHARGE
A.G. Bedrin, V.E. Lavrentyuk, I.V. Podmoshenskii and P.N. Rogovtsev
Soviet Physics-Technical Physics, Vol. 24, No. 10, pp 1181-1185 (10/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2146-2152 (October 1979)

The surface discharge at a dielectric surface illuminated by a xenon flashlamp is studied. The breakdown field is two orders of magnitude lower than that for a conventional surface discharge. There is a threshold irradiance below which a surface discharge does not occur. A direct relation exists between the discharge and the appearance of a vapor layer at the surface. The discharge delay time is found as a function of the irradiance and the electric field. At the threshold electric field the delay time is much longer than the light flash. Various factors which contribute to the photoinduced surface discharge are discussed. 14 Refs.

Primary Keywords: Surface Flashover; Xenon Flashlamp Illumination; Effect On Flashover Voltage; Surface Vapor Layer; Delay Measurement

9675
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
USE OF AN EXPLODING WIRE AS A CURRENT COMMUTATOR
Yu.A. Aran'ev and V.P. Kalinin
Instruments And Experimental Techniques, No. 5, pp 1164-1166 (10/1968).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 140-142 (September-October 1968)

Powerful electrical discharges through a conductor are characterized by the presence of a so-called 'current pause' stemming from the large resistance of the high-pressure plasma formed upon explosion of the conductor. This phenomenon leads to the possibility of using an exploding wire (or foil) as a fast acting current commutator. Such commutators are used presently mainly for fast transmission of magnetic energy to an inductive or active load and for protection of a capacitor bank against discharge to the disrupted section of the bank. In this article we present information on the operation of a commutator which is based on an exploding wire with a comparatively long current-redistribution time, about 100 microseconds. A capacitor bank with a capacitance of 2 or 3.5 mF served as the current source in the charging inductance circuit L=0.475 mH, and the discharger acted as the switch. The currents in the charging and discharging circuits were measured by means of shunts. A powerful IFP xenon flashtube was used as the nonlinear load. A long duration of the redistribution of the currents was secured by a high resistance of the tube at the initial stage of dischare. We note that when using this system of admitting energy to the tube, the discharge in it develops in the presence of a rapidly varying voltage equal to the voltage at the commutator and determinable by the properties of both the tube and commutator. 0 Refs.

Primary Keywords: 5
Secondary Keywords: Exploding Wire; Opening Switch; Current Pause; 100 Microsecond Opening Time; Flashlamp Load; Copper Wire

9695
(INSULATION, VACUUM)
(Reviews)
VACUUM ELECTRICAL INSULATION, PRINCIPAL PROPERTIES AND RESEARCH PROBLEMS
I.N. Slivkov
Power Engineering, Vol. 13, No. 1, pp 19-29 (01/1975).
Trans. From: Izvestiya Akademii Nauk SSSR. Energetika i Transport 13, 24-36 (1975)

The viability and desirability of vacuum insulation are discussed in this paper. The author points out that vacuum insulation can theoretically withstand voltage gradients of over 5 MV/mm, is self healing, and displays a conditioning. Areas for future work are pointed out. 13 Refs.

Primary Keywords: Vacuum Insulation; Review; Vacuum Insulation Properties; Present Performance Limitations; Future Performance Improvement

9696
(POWER CONDITIONING)
(Saturable Reactors)
THREE-DIMENSIONAL ANALYSIS OF THE MAGNETODYNAMIC FIELDS IN ELECTROMAGNETIC DEVICES TAKEN INTO ACCOUNT THE DYNAMIC HYSTERESIS LOOPS
Y. Saito
Hosei University, Tokyo, Japan
IEEE Transactions On Magnetics, Vol. MAG-18, No. 2, pp 546-551 (03/1982)

A new magnetic field equation exhibiting dynamic hysteresis loops is proposed. Based on this magnetic field equation, a system of two-dimensional magnetic circuit equations taken into account the dynamic hysteresis loops is derived by the method of magnetic circuits. By means of magnetic power inveriant transformation, a system of two-dimensional magnetic circuit equations is transformed into a system of three-dimensional magnetic circuit equations. This system of three-dimensional magnetic circuit equations is discretized in time by a finite difference method. A system of three-dimensional magnetic circuit equations discretized in time is solved by a simple iteration method, using a relaxation parameter. As an example, a system of three-dimensional magnetic circuit equations of a simple saturable reactor is derived. Also, the numerical solutions of dynamic hysteresis loops in a saturable reactor are presented together with those of experimental results. 6 Refs.

Primary Keywords: Saturable Reactors; Dynamic Hysteresis Loop; Theory; Numerical Calculation; Magnetic Circuit Model

9697
(ELECTROMAGNETIC FIELD GENERATION; REVIEWS AND CONFERENCES)
(Magnetic; Conferences)
CONFERENCE ON MEGAGAUSS MAGNETIC FIELD GENERATION BY EXPLOSIVES AND RELATED EXPERIMENTS
H. Knoepfel (Ed.) and F. Herlach (Ed.)
Publisher: European Atomic Energy Community (Euratom), Brussels (07/1966).

This conference record contains 27 papers relating to the generation of very high magnetic fields. Explosive compression of a weak field is the chief method considered. Several papers consider the effects of these fields upon materials and the generating apparatus. There is also a brief session concerning explosive MHD generators. 279 Refs.

Primary Keywords: Magnetic Field Generation; Flux Compression Generators; Materials Interaction; Explosive MHD Generator; Current Amplification

9700
(ENERGY STORAGE, INDUCTIVE)
(Systems)
MATCHING OF AN INDUCTIVE ENERGY STORE AND A COIL WITH LINER WITH LIMITING OF BREAKING VOLTAGE
E.A. Zotova, I.A. Ivanov, A.P. Lototskii and V.A. Trukhin
Power Engineering, Vol. 16, No. 6, pp 7-11 (01/1978).
Trans. From: Izvestiya Akademii Nauk SSR. Energetika i Transport 16, 9-14 (1978)

An inductive energy storage system is described for powering a metallic liner driver. The mismatch of generator and load impedances is considered quantitatively and limits are placed on that mismatch. The peak discharge voltages are calculated as a function of impedance mismatch and its effect on liner acceleration is considered. 4 Refs.

Primary Keywords: Discharge-pulse Voltage; Inductive Energy Store; Liner Acceleration System; Peak Discharge-pulse Voltage; Limiting Parameters; Impedance Mismatch

9701
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE PHYSICS OF HIGH-VOLTAGE NANOSECOND DISCHARGES IN DENSE GASES
L.P. Babich, T.V. Loiko and L.V. Tarasova
Radiophysics And Quantum Electronics, Vol. 20, No. 4, pp 436-442 (04/1977).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Radiofizika 20, 637-645 (April 1977)

The article sets forth the results of experimental investigations of nanosecond electrical discharges in air at atmospheric pressure in fields with an intensity of 1E5 V/cm. Information is obtained on voltage pulses, attained during a discharge, on the conductivity currents in the discharge gap, and on the light emission of different regions of the discharge. It is shown that electrons with energies exceeding the applied voltage are generated in accordance with the rise in the conductivity current. A conclusion is drawn with respect to the determining role of 'runaway' electrons in the development of discharges. 35 Refs.

Primary Keywords: Gas Breakdown; Air Breakdown; Atmospheric Pressure; Voltage Measurement; Current Measurement; Light Emission Measurement; Theory; Runaway Electrons

9702
(PARTICLE BEAMS, ELECTRON; SWITCHES, OPENING; ENERGY STORAGE, INDUCTIVE)
(Generation; Explosive Fuses; Systems)
DIRECT-ACTION ACCELERATORS WITH INDUCTIVE ENERY STORAGE AND EXPLODING CONDUCTORS
Yu.D. Bakulin, V.S. Diyankov, V.P. Kovalev, A.I. Kormilitsyn, B.N. Lavrent'ev, A.V. Luchinskii and V.I. Martynov
Instruments And Experimental Techniques, Vol. 22, No. 2, pp 325-327 (04/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 34-37 (March-April 1979)

Two generators of pulsed bremsstrahlung and electron beams are described, the IGUP-I and IGUR-II instruments, in which inductive storage devices with exploding conductors are used. At a voltage of 2.8 MV on the accelerator tube and a current of 44 kA through the tube the IGUR-I provides a bremsstrahlung dose of 110 R at a distance of 1 m from the anode, while the IGUR-II at a voltage of 3.7 MV on the tube and a current of 70 kA provides a dose of 700 R. On both instruments the half-width of the bremsstrahlung pulse is regulated in the range of 0.1-0.5 microseconds. Electron beams with an energy density of 300 J/sq.cm. are extracted from the accelerator tubes. 6 Refs.

Primary Keywords: Field Emission Diode; Direct-action Accelerators; Exploding Wire; 300 J/sq.cm. Energy Density; High-voltage Pulse Generator; Inductive Energy Storage; Magnetohydrodynamic Calculations; Reduced Electromagnetic Induction
Secondary Keywords: Bremsstrahlung Radiation Generation

9704
(ENERGY STORAGE, CAPACITIVE)
(Capacitor Banks)
EFFECT OF ELEMENT DISTRIBUTION IN A CAPACITOR BANK ON THE CURRENT PULSE IN A PULSED PLASMA INJECTOR
N.V. Belan, N.A. Mashtylev, B.I. Panachevnyi and L.V. Shushlyapin
Khar'kov Aviation Institute, USSR
Soviet Physics-Technical Physics, Vol. 18, No. 6, pp 749-751 (12/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 1179-1183 (June 1973)

A system of equations is derived for the operation of a pulsed plasma injector whose capacitor bank consists of distributed elements. The amplitude and length of the current pulse in the injector are analyzed as functions of the element distribution in the bank. 5 Refs.

Primary Keywords: Distributed-element Capacitor Bank; Plasma Gun; Bank Analysis; Analytical Solution

9705
(PULSE GENERATORS)
(Line Type)
SYSTEM FOR TWO-PULSE SUPPLY OF A LARGE STREAMER CHAMBER
V.V. Govorov, V.A. Davidenko, B.A. Dolgoshein, V.A. Kantserov, A.N. Lebedev and S.V. Somov
Moscow Engineering-Physics Institute, Moscow, USSR
Instruments And Experimental Techniques, Vol. 19, No. 1, pp 32-34 (02/1976).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 32-34 (January-February 1976)

A high-voltage circuit for supplying a streamer chamber with two pulses spaced in time is described. Two-pulse supply is used to achieve brightness separation of muon and electron tracks during the recording of muon-e decays in the 8-m streamer chamber used on the proton synchrotron of the Institute of High-Energy Physics. 5 Refs.

Primary Keywords: 2 Pulse Supply System; 800 kV Amplitude High-voltage Pulse; Marx VPG Generator; Track Brightness; Stabilization System
Secondary Keywords: Streamer Chamber

9786
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines, Materials)
HIGH-CURRENT BRUSHES, PART IV: MACHINE ENVIRONMENT TESTS
J.L. Johnson and O.S. Taylor
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Components, Hybrids, And Manufacturing Technology, Vol. CHMT-3, No. 1, pp 31-36 (03/1980).
Brush performance has been investigated with a view to establish whether or not continuous very high-current density operation is feasible for many parallel brushes running under machine environment conditions. The ultimate objective is the development of sliding-brush contact systems for advanced powerful electrical machines that require large currents in order to achieve high efficiencies and small volumes. Using a homopolar generator designed for that purpose, the performance of a full complement of 92 brushes was evaluated under conditions that included electrical loads to 9500 A (1.6 MA/sq.m.) and a slip ring speed of 42 m/s. Based on test data presented, asymmetry in the anode and cathode brush electrical contact resistances and wear rates of about 2:1 were found. Under the maximum imposed load conditions, the anode and cathode brush interface contact voltage drops are 0.17 and 0.08 V, respectively. Typically, the highest dimensionless linear wear rate (anode brush) is <= 1.7E-11. This wear rate is about one-sixth that of diesel-electric locomotive motor brushes, which slide on contact surfaces of similar peripheral speed but with less than one-tenth the electrical load imposed here. The high feasibility demonstrated for multiple-brush high-current operation is attributed to the use of silvergraphite brushes (0.75 mass fraction silver), a nonair (e.g. humidified carbon dioxide) environment, and cooling of the brush holders and slip rings. 7 Refs.
Primary Keywords: High-Current Brushes; Machine Environment Conditions; 1.6 MA/sq.m. Electrical Loads; 42 m/s Slip Ring Speed; <= 1.7E-11 Linear Anode Brush Wear Rate; Contact Voltage Drop; 2-1 Anode and Cathode Brush-to-ring Contact Resistance

9730
(BREAKDOWN STUDIES)
(Exploding Wires)
MECHANISM FOR INTERRUPTION OF CURRENT FLOW AND PRODUCTION OF SHOCK WAVES IN A METAL HEATED BY HIGH-DENSITY CURRENT PULSES
N.A. Protopopov and V.M. Kul'gavchuk
Soviet Physics-Technical Physics, Vol. 6, No. 5, pp 399-404 (11/1961).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 31, 557-564 (May 1961)
One of the most complicated unsolved problems in the heating of a metal is the interruption in current flow and the relation of this effect to the shock waves which are observed experimentally. In the present work we have investigated explosions of wires characterized by a high rate of energy introduction. In order to indicate the rate at which the process takes place, we may say that in the present explanation the duration of the first pulse (up to the first current interruption) varies from 2E-7 to 1.5E-6 sec while the total length of the explosion process (except for cases in which low voltages are used) is less than 4 microseconds. 9 Refs.
Primary Keywords: Exploding Wire; Current Interruption; Shock Wave; Tungsten Wire; Air Environment; Glass Environment
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9742
(POWER TRANSMISSION)
(Cables)
RESISTANCE OF METALS AT HIGH CURRENT DENSITIES
V.V. Bondarenko, I.F. Kvartskhava, A.A. Pliutto and A.A. Chernov
Soviet Physics-JETP, Vol. 1, No. 2, pp 221-226 (09/1955).
Trans. From: J. Exper. Theoret. Phys. USSR 28, 191-198 (1955)
Results are given of an investigation of the dependence of resistance of a few metals on current density. Comparison is made of experimental curves, presenting the dependence of resistance for copper, silver, platinum and other metals on the amount of energy introduced, with curves and calculations from tabulated data. For these metals, Ohm's law is maintained up to current densities of about 1E7 A/sq.cm. 7 Refs.
Primary Keywords: High-current Cable; Cable Resistivity; Resistivity vs Current; Copper; Silver; Platinum
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9748
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE DEVELOPMENT OF THE SPARK DISCHARGE
T.E. Allibone and J.M. Meek
Proceedings Of The Royal Society Of London, Vol. A166, No. A924, pp 97-126 (05/1938).
Pulsed gas breakdown with several electrode geometries is the subject of this paper. Point-plane, point-point, sphere-point, and sphere-plane electrode configurations are considered with both polarities used for each configuration. The velocity of the leader and main stroke are measured photographically for each case and reported. Multiple strokes are considered. 23 Refs.
Primary Keywords: Gas Breakdown; Long Spark; Several Electrode Geometries; Point Electrode; Plane Electrode; Leader Velocity; Spark Velocity
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9757
(ELECTROMAGNETIC FIELD GENERATION; ENERGY STORAGE; PULSE GENERATORS)
(Magnetic; Reviews; Reviews)
A METHOD OF PRODUCING STRONG MAGNETIC FIELDS
P.L. Kapitza
Cavendish Laboratory, Cambridge
Proceedings Of The Royal Society Of London, Vol. 105, No. A734, pp 691-710 (06/1924).
This paper provides a review of energy storage techniques known at this time. Capacitive, inductive, and flywheel stores are all discussed with the inherent limitations and practical difficulties pointed out. Switching problems and diagnostic systems are discussed. The generation of magnetic fields to 500 kG are shown to be feasible by using the described methods. 2 Refs.
Primary Keywords: Energy Storage; Review; Capacitive Store; Inductive Store; Mechanical Store; Switch; Explosive Fuse; Magnetic Field Generation; Solenoid
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9762
(BREAKDOWN STUDIES)
(Exploding Wires)
ELECTRONIC SHUTTER PHOTOGRAPHS OF EXPLODING BRIDGE WIRES
W.A. Allen, C.H. Hendricks, E.B. Mayfield and F.N. Miller
Michelson Lab, China Lake, CA
The Review Of Scientific Instruments, Vol. 24, No. 1, pp 1068-1069 (11/1953).
The experiment reported in this note is intended to yield some idea of the macroscopic and microscopic phenomena associated with an exploding bridge wire during the first few microseconds of the event. 8 Refs.
Primary Keywords: Exploding Wire; Bridge Wire; Photographic Diagnostic; Repatronic Shutter; High Temporal Resolution
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9785
(BREAKDOWN STUDIES)
(Exploding Wires)
VISUALIZATION OF CYLINDRICAL SHOCK WAVES
F.D. Bennett and D.D. Shear
Army Amament Research and Development Command, Aberdeen Proving Ground, MD 21005
The Physics Of Fluids, Vol. 2, No. 3, pp 338-339 (06/1959).
In a previous paper a method of mirror back-lighting is introduced to make visible the cylindrical shock wave formed by an exploding wire. The present note offers an alternative scheme which has the advantage of tracing the path of the shock wave over a longer interval of time than in the earlier method. 1 Refs.
Primary Keywords: Exploding Wire; Shock Wave; Diagnostics; Backlit Wire; Long Observation Time
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9786
(ELECTROMAGNETIC COMPATIBILITY)
(Hardness)
ELECTROMAGNETIC VULNERABILITY (EMV) TESTING OF AIR LAUNCHED VEHICLES
V. Morets
Wright-Patterson AFB, OH
IEEE 1981 National Aerospace And Electronics Conference, pp 688-690 (05/1981).
The electromagnetic environment from military emitters, worldwide, has increased significantly in the past two decades. It is anticipated there will be further increases as new high powered radar systems and other emitters are introduced into defense inventories. This paper addresses the need to consider the effect of these environments in the design of missile systems and the testing that is required to insure hardness. The new family of cruise missiles and tactical air launched missiles are typical of the systems where EMV must be a major consideration. The author also discusses operational environments, test facilities, instrumentation and EMV hardening. 7 Refs.
Primary Keywords: EMP; System Hardening; Environment Characterization; Test Chamber
Secondary Keywords: Missile Systems
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9787
(ELECTROMAGNETIC COMPATIBILITY)
(Lightning)
A RECURSIVE TIME DOMAIN ANALYSIS OF DISTRIBUTED LINE GRID NETWORKS WITH APPLICATION TO THE LTA/EMP PROBLEM
W.S. McCormick
Wright State University, Dayton, OH 45435
IFEE 1981 National Aerospace And Electronics Conference, pp 783-788 (05/1981).
Modeling the aircraft fuselage as a two-node, TEM, lossy distributed network, a recursive time domain technique is presented to estimate the fuselage skin-current induced by a remote lightning strike. The technique involves the determination of the two discrete nodal transfer functions followed by an application of Duhemel's theorem to the distributed electromagnetic excitation case. The Fourier transformer of the induced fuselage skin-current is presented as a function of the azimuth and elevation angles of the incident, plane electromagnetic lightning excitation. Reference to the PORTER and NOAA flight programs is made along with a discussion of future application areas. 2 Refs.
Primary Keywords: Distributed Network; Modeling; Lightning Effect; Theory
Secondary Keywords: Aircraft Shielding

9788
(ELECTROMAGNETIC COMPATIBILITY)
(Lightning)
ASSESSMENT METHODOLOGY OF THE LIGHTNING THREAT TO ADVANCED AIRCRAFT
R.A. Perala (1) and G.A. DuBro (2)
(1) Electromagnetic Applications, Inc., Denver, CO
(2) Wright-Patterson AFB, OH
IEEE 1981 National Aerospace And Electronics Conference, pp 691-697 (05/1981).
One research and development area of primary interest to the avionics community is that of assessment methodology for lightning vulnerability. The work in this area is concentrated on increasing the general understanding of the physics of the aircraft-lightning interaction and on developing specific laboratory threat simulation testing techniques. This area has two complementary facets; testing/simulation and analytics. The prime objective of the assessment methodology activity is to provide design inputs for aircraft protection as well as for qualification for safety of flight. In this paper, recent advancements are discussed in both facets-testing/simulation and analytics. These advancements have been made possible with the incorporation of nuclear electromagnetic pulse technology and recent indications from measurements of natural lightning that suggest significantly greater electromagnetic energy exists in the frequency range where increased coupling efficiency of such energy is possible to the aircraft. 19 Refs.
Primary Keywords: Lightning Characterization; Laboratory Simulation; Waveform Synthesis
Secondary Keywords: Aircraft Hardening
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9789
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
THE NAVY F/A-18A HORNET ELECTROMAGNETIC COMPATIBILITY PROGRAM
J.R. Kattarer (1) and J.J. Fisher (2)
(1) McDonnell Aircraft Co, St. Louis, MO 63166
(2) Naval Air Systems Command, Washington, DC 20361
IEEE 1981 National Aerospace And Electronics Conference, pp 698-402 (05/1981).
The F/A-18A Hornet is a first line carrier-deployed aircraft employing advanced composite structures and state-of-the-art digital electronics including a digital fly-by-wire flight control system. Because the electromagnetic environment (EME) generated on present day carrier decks can reach field strengths over 10,000 Volts/meter at some frequencies, electromagnetic compatibility (EMC) challenges were presented. The approach to aircraft EMC design established for the F/A-18A required using the airframe as an enclosed electromagnetic (EM) shield. This shielding concept allowed equipment located within the airframe shield (e.g. equipment bays) to be designed to a less severe EM environment than equipment located outside the airframe shield (e.g. the cockpit or wheel wells). Using the airframe as an electromagnetic shield presented a significant challenge, particularly because graphite/epoxy (Gr/Ep) composites represent more than one-third of the F/A-18A surface area. Overall, this concept was found to represent the least cost, weight, and design impact both to the airframe and to the electrical or electronics equipments. 1 Refs.
Primary Keywords: RF Shielding; Design Considerations; Materials Study, Performance Testing
Secondary Keywords: Aircraft Shielding

9790
(SWITCHES, OPENING)
(Mechanical)
A HALF CYCLE AIR BLAST GENERATOR BREAKER FOR HIGH POWER TESTING FIELDS
K. Kriechbaum
Allgemeine Elektricitats-Gesellschaft, AEG-TELEFUNKEN Hochspannungsschaltgeratefabrik, Kassel, FRG
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 3, pp 747-752 (06/1972).
Generator breakers in high-power testing fields, the back-up breakers, have the function of safety breakers: they have to protect both the generator and the test breaker from being overstressed by a short-circuit current of undesired duration. The heavy short-circuit currents of modern generators enforce the development of generator circuit-breakers of high breaking capacities. In this paper a generator c.b. is described having a rated breaking capacity of 160 kA at a service voltage of 15.4 kV. This circuit-breaker is a half-cycle breaker capable of interrupting a symmetrical current at the first current zero passage. Due to its short minimum arcing time this breaker is suitable for synchronized breaking operations and so permits an economical testing of circuit-breakers. This testing method is also described. 7 Refs.
Primary Keywords: Circuit-breakers; High Power Testing Fields; 160 kA Breaking Capacity; 15.4 kV Service Voltage; Power Line Frequency

9791
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Capacitor Banks; Capacitors)
A PULSE GENERATOR FOR SHORT MEGAVOLT PULSES WITH A RISETIME IN THE NANOSECOND REGION
N.R. Nilsson, L. Hogberg, A. Swedberg and J. Hipple
Research Institute of National Defense, Stockholm, Sweden
Physica Scripta, Vol. 1, pp 193-196 (01/1970).
The design of a Marx-Goodlet pulse generator is described. Circular plate capacitors are used to produce a fast-rise 20 ns duration pulse at voltages up to 1.2 MV and load impedances from 40 to 120 ohms. The diagnostics used to characterize the generator are also described. 8 Refs.
Primary Keywords: Megavolt Pulse Generator; 20 Nanosecond Voltage Pulse Duration; Circular Plate Capacitors; Center Discharge; 1.2 MV Output Voltage

9792
(BREAKDOWN STUDIES)
(Gas, Optical)
ELECTRICAL DISCHARGE IN NITROGEN AND SULFUR HEXAFLUORIDE IN A UNIFORM FIELD
A.S. Perlin
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 17, No. 5, pp 813-817 (11/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 42, 1027-1032 (May 1972)
Electrical discharges in nitrogen and sulfur hexafluoride due to photoelectric processes in a uniform field are considered for pressures p >= 760 mm Hg with gaps greater than 0.1 cm. On the basis of the experimental and theoretical data, the conditions for a change in the discharge mechanism are determined. The dependence of the critical gas density (at which the transition to a streamer mechanism takes place) on the discharge gap is also obtained. 16 Refs.
Primary Keywords: Gas Breakdown; Nitrogen; SF/sub 6/ Uniform Field; Photoelectric Process; Discharge Mechanism

9797
(PULSE GENERATORS; PARTICLE BEAMS, ELECTRON)
(Line Type; Generation)
DEVELOPMENT OF 36-MEGAWATT MODULATORS FOR THE ASTRON 1000-MEGAWATT ELECTRON ACCELERATOR
V.L. Smith
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Nuclear Science, Vol. NS-9, No. 2, pp 57-67 (04/1962).
A 1000-megawatt peak-power linear electron accelerator is required for the injection of electrons into a thermonuclear fusion experimental device, called the Astron, which is now under construction at the Lawrence Radiation Laboratory in Livermore, California. The Astron will determine the feasibility of an actual power-producing fusion reactor utilizing the principles of confinement and heating of a plasma by establishing a long rotating layer of relativistic electrons. The linear electron accelerator under construction is designed to produce a pulsed electron beam with an energy of 5 MeV +or- 0.5%, a pulse current of 200 amperes, with a pulse duration of 0.25 microseconds and at 60 pulses per second. The accelerator will be of the induction type utilizing large magnetic cores. Approximately 400 cores will be used and each one will contribute a minimum acceleration of 12,000 volts. The details of the design and development of a line-type modulator used for pulsing cores and capable of an output peak power of 36 megawatts will be discussed in detail. A type 6587 and type 5949A thyratron were life-tested at 32 kV, 2000 amperes, and 60 pps. Useful life in excess of 1000 hours was obtained. In addition, it was necessary to develop corona-resistant connectors for this application. Life data and final design for a small connector suitable for operation at 16-kV, 0.4-microseconds (70% amplitude points) pulses with 60-nanosecond rise time, and at 60 pps are presented. 15 Refs.
Primary Keywords: 36-megawatt Modulator; 1000-megawatt Linear Electron Accelerator; 5 MeV Pulsed Electron Beam Energy, 200 Amperes Pulse Current; .25 Microsecond Pulse Duration; Accelerating Induction Electric Field; Thermonuclear Fusion

9799
(BREAKDOWN STUDIES)
(Exploding Wires)
ELECTRICAL EXPLOSION OF METAL WIRES
I.F. Kvarkhtsava, A.A. Pliutto, A.A. Chernov and V.V. Bondarenko
Soviet Physics JETP, Vol. 3, No. 1, pp 60-51 (08/1956).
Trans. From: J. Exper. Theoret. Phys. USSR 30, 42-53 (January 1956)
Shadow photography and oscillograms of the current and voltage are used to investigate wires exploded by electric current. It is shown that the energy liberated in the wire at the instant of the first current pulse is sometimes less than the energy needed to evaporate the wire fully, and sometimes considerably more. Shadow photographs of the successive stages of wire explosion show a strong dispersion of the wire material after the flow of the first current pulse. A qualitative explanation is given for the basic features of the wire explosion phenomenon, taking into account the high mechanical stresses produced by heating and the radial pressures due to the magnetic field produced by the current. 20 Refs.
Primary Keywords: Exploding Wire; Voltage Measurement; Current Measurement; Photographic Diagnostic; Shadowgraphy Energy Balance

9800
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Surface Flashover; Solid)
ELECTRON AVALANCHE AND SURFACE CHARGING ON ALUMINA INSULATORS DURING PULSED HIGH-VOLTAGE STRESS
J.P. Brainard and D. Jensen
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, Vol. 45, No. 8, pp 3260-3265 (08/1974).
This paper describes a model for insulator surface charging in high-voltage ceramic vacuum diodes. The model involves electron emission from the insulator-cathode vacuum junction followed by electron avalanches on the insulator surface which leave the wall positively charged. Experiments were performed to measure (i) the triple-junction (cathode-vacuum-insulator interface) emission and its relation to the initiation of the avalanche, (ii) the dynamic current in the avalanche and (iii) the saturated surface charge resulting from the avalanche. The experimental results were interpreted by computer simulation in terms of the model and were found to be in close agreement with the predictions. 11 Refs.
Primary Keywords: Electron Avalanche; Pulsed High-voltage Stress; Insulator Surface Charging; Avalanche Current Termination; Cylindrical Vacuum Diodes; Secondary Electron Multiplication

9801
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid, Surface Flashover)
EXPERIMENTAL OBSERVATION OF SURFACE CHARGING OF HIGH-VOLTAGE INSULATORS FOR VACUUM APPARATUS
C.M. Tourreil (1), K.D. Srivastava (2) and U.J. Woelke (3)
(1) Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
(2) University of Waterloo, Waterloo, Ontario, Canada
(3) H.G. Acres, Ltd., Niagara Falls, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-7, No. 4, pp 176-179 (12/1972).
The surface of cylindrical insulators placed in high vacuum becomes positively charged when subjected to a high-voltage stress parallel to the dielectric surface. A study is made of the variation of the surface charge density as a function of the voltage applied to insulators made of alumina ceramic, nylon, Teflon, and Plexiglas. Direct and pulsed voltages were used in the experiments. 11 Refs.
Primary Keywords: Surface Charging Of Cylindrical Insulators; High Voltage Stress; Surface Charge Density Variation; Several Insulating Materials; Spatial Resolution

9802
(BREAKDOWN STUDIES)
(Electrodes)
EXPLOSIVE ELECTRON EMISSION FROM COPPER POINTS
V.M. Zhukov and G.N. Fursei
M.A. Bonch-Bruevich Leningrad Electrotechnical Institute Of Communications, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 21, No. 9, pp 1112-1117 (09/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 1910-1917 (September 1976)
The explosive emission of copper points is studied. In many of the experiments the emission is excited in the chamber of an electron microscope. A stage of a rapid current increase followed by saturation is a general feature of the explosive emission of point cathodes. A comparatively slow current increase is also observed during the explosion of microscopic protuberances on a large point. This behavior is attributable to the different roles played by the cathode surface in explosive emission. With a point cathode the explosive-emission current is higher than the current predicted by the three-halves law. The volumes of material transported in the explosions of Cu and W are approximately the same for similar conditions. 21 Refs.
Primary Keywords: Explosive Electron Emission; Copper Point Cathodes; High Electric Field; Rapid Current Growth; Current Saturation; Three-halves Law; Poor Agreement

9804
(BREAKDOWN STUDIES)
(Exploding Wires)
HIGH-TEMPERATURE CORES IN EXPLODING WIRES
F.D. Bennett
Army Amament Research and Development Command, Aberdeen Proving Ground, MD 21005
The Physics Of Fluids, Vol. 8, No. 6, pp 1106-1108 (06/1965).
Our recent studies show that the precipitous rise in resistance during the initial expansion of the wire occurs because of a radially symmetrical, inward travelling, vaporization wave which transforms the wire to a nonconducting gas. Presence of the inward travelling vaporization wave implies longer heating of the wire interior and a temperature rise with decreasing radius. An approximate theory of the expansion is given which allows estimates to be made of the core temperatures achievable by varying the wire and circuit parameters. The experimental production of high-temperature cores is limited at present by the occurrence of voltage breakdown at the interface between wire and ambient atmosphere. 7 Refs.
Primary Keywords: Exploding Wires; Vaporization Wave; High-temperature Cores; Temperature Gradients; Voltage Breakdown; Theory; Core Temperature Prediction

9806
(SWITCHES, CLOSING; PARTICLE BEAMS, ELECTRON)
(Mechanical; Generation)
NANOSECOND PULSED ELECTRON SOURCE CONTROLLED WITH A MERCURY-WETTED SWITCH
T. Yamamoto and M. Kawanishi
Memoirs Of The Institute Of Scientific And Industrial Research, Osaka Univ., 30, pp 91-96 (01/1973).
The authors present a method of 1 ns duration E-beam generation utilizing no exotic pulse shaping or energy storage techniques. The voltage pulse is produced by discharging a coaxial line through a mercury-wetted, hydrogen-filled relay. The resulting beam is a 70 keV, 240 mA, 1 ns duration E-beam. 3 Refs.
Primary Keywords: E-beam Generation; Mercury-wetted Switch; Electron Gun Grid; 70 keV Pulsed Electron Beam; Coaxial Cable; 240 mA Current

9807
(SWITCHES, CLOSING; PARTICLE BEAMS, ELECTRON)
(Mechanical; Generation)
NANOSECOND PULSED ELECTRON SOURCE WITH DOUBLE PULSE CONTROL
T. Yamamoto, S. Takeda and M. Kawanishi
Osaka University, Suita, Osaka, Japan
The Review Of Scientific Instruments, Vol. 45, No. 4, pp 591-592 (04/1974).
A nanosecond pulsed electron beam is obtained by controlling the grid of the electron gun with sequential positive and negative pulses. Two mercury-wetted switches are operated to generate the double pulses. The source can deliver a 100 keV pulsed beam of the order of 1 A with 1 nsec time duration. 3 Refs.
Primary Keywords: E-beam Generation; Double Pulse Control; 100 keV Pulsed Electron Beam; 1 nsec Time Duration; Electron Gun Grid; Coaxial Cable; 1 A Current

9810
(BREAKDOWN STUDIES)
(Gas, Electrical)
ON THE EARLY STAGES OF ELECTRIC SPARKS
E.O. Lawrence and F.G. Dunnington
University of California, CA
Physical Review, Vol. 35, pp 396-407 (02/1930).
With the Kerr-cell electro-optical shutter of Abraham-Lemoine and Beams, phenomena in the early stages of sparks between electrodes of Zn, Cd and Mg have been studied. It was found that during 50E-8 sec after beginning of the sparks, the spark doublet lines of Zn have widths of 45A, while the corresponding lines of Cd and Mg are about 30A in width. The luminosity of the metallic vapors of ZN, Cd and Mg was observed to spread from the electrodes with speeds of 2.1E5 cms/sec, 1.5E5 cms sec, and 1.2E5 cms sec, respecitively. Photographs of the early stages of single sparks with exposure times as short as 4E-8 sec were obtained. The snapshots showed that during these short intervals of time after beginning of a spark the discharge is confined to a filament having a cross-section at the anode of 5E-4 sq.cm., which broadens out to four times this size at the cathode. From the circuit constants and these dimensions of the discharge it was accordingly estimated that the discharge current density attained the magnitude of 1.7E6 amps/sq.cm. The asymmetry of the photographed images of the sparks disappeared when the exposure times were extended to include a complete cycle of the discharge, thereby proving the satisfactory operation of the shutter. 19 Refs.
Primary Keywords: Gas Breakdown; Zinc Electrodes; Cadmium Electrodes; Magnesium Electrodes; Spectroscopic Diagnostic; Streamer Propagation Velocity, Streamer Cross Section

9822
(BREAKDOWN STUDIES)
(Surface Flashover)
THE FLASHOVER VOLTAGE OF POLYMETHYLMETHACRYLATE IN VACUUM UNDER DIRECT, ALTERNATING, AND SURGE VOLTAGES OF VARIOUS FRONT DURATIONS
S. Grzybowski, E. Kuffel and J.P.C. McMath
University of Manitoba, Winnipeg, Manitoba, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-7, No. 4, pp 180-185 (12/1972).
This paper presents results on flashover voltages across insulation surfaces and on the rate of surface deterioration in a vacuum of 1E-5 Torr under direct, alternating, and surge voltages of front duration in the range from 1-600 microseconds. The insulation material used was polymethylmethacrylate (PMMA) of cylindrical shape fitted between uniform field electrodes. The measurements were carried out on insulator specimens 25 mm in diameter and 5, 10, and 20 mm in length. 15 Refs.
Primary Keywords: Surface Flashover; 1E-5 Torr Vacuum; Direct, Alternating, And Surge Voltages; 1-600 Microsecond Front Duration; Organic Insulation Materials; Voltage Measurement

9826
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Electrodes)
AN EXTENSION OF THE RAMSAUER-TOWNSEND EXPERIMENT IN A XENON THYRATRON
G.A. Woolsey
University of New England, Armidale, NSW, Australia
Americal Journal Of Physics, Vol. 39, pp 558-560 (05/1971).
Ramsauer-Townsend effects in xenon are observed. Differences in calculated and experimentally obtained data are shown to be a function of contact potential and electron emission energy. This series of tests improves the accuracy of earlier experiments done by Kukolich. 5 Refs.
Primary Keywords: Ramsauer-Townsend Experiment; Contact Potential; Electron Energy Distribution; Elastic Collision

9827
(PULSE GENERATORS)
(Capacitive)
A RELIABLE 60KV FLASHLAMP TRIGGERING SYSTEM
R.E.W. Pattifer, R.G. Flavell and G.A. Robinson
The Meteorlogical Office, London Road, Bracknell, Berks
Journal Of Physics E; Scientific Instruments, Vol. 8, pp 875-877 (05/1971).
The unit described is an external high voltage parallel triggering system capable of opration at high repetition rates. It is controlled by a 3.5 v logic-compatible pulse and delivers a 60 k pulse to a pair of laser flashlamps. The problem of applying such pulses to the flashlamps without current leakage to the laser cavity has been dealt with in a novel way. 1 Refs.
Primary Keywords: Transformer Output; Thyratron Switch; High Voltage Trigger Transformer

9866
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH POWER SPARK GAP SWITCHES-A NUMERICAL MODEL AND EXPERIMENTAL INVESTIGATION
J.F. Driscoll (1), R.E. Heckl (1) and J. Ponsenby (2)
(1) University of Michigan, Ann Arbor, MI
(2) Naval Surface Weapons Center, Silver Spring, MD 20910
AIAA Conference On The Future Of Aerospace Power Systems, pp 1-6 (03/1977).
This paper concentrates on optimization of spark gap parameters in the laboratory and by numerical simulation. A self-triggered, 100 pps rep-rated gap is simulated and tested while varying gas flow rate, gas type, gas pressure, current waveshape, charge transfer, and gap geometry. An optimum configuration is found and rules are presented for optimization. 13 Refs.
Primary Keywords: Spark Gap Optimization; Rep-rated; Recovery Time; Parameter Variation; High Average Power Transfer

9867
(REVIEWS AND CONFERENCES; INSULATION)
(Conferences; Conferences)
IEEE 1981 CONFERENCE ON ELECTRICAL INSULATION AND DIELECTRIC PHENOMENA (10/1981).
This conference record contains 71 papers (13 include only abstracts) concerning basic insulation phenomena, insulation conductivity, corona, and failure modes. Other sessions pertain to charge storage and transport, dielectric breakdown, composite structures, and surface flashover; a poster session deals with polymer morphology and measurement techniques. A special one-day symposium on 'Corona and Nonspark Discharges' has been incorporated into this year's Conference. This symposium consists of invited papers that will be published in the April 1982 issue of the IEEE Transactions on Electrical Insulation. 451 Refs.
Primary Keywords: Electrical Insulation; Insulation Charging; Insulation Conductivity; Insulation Breakdown; Surface Flashover, Corona

9868
(REVIEWS AND CONFERENCES; BREAKDOWN STUDIES; INSULATION)
(Conferences; Conferences; Conferences)
1981 IEEE 7TH INTERNATIONAL CONFERENCE ON CONDUCTION AND BREAKDOWN IN DIELECTRIC LIQUIDS
W.F. Schmidt (Ed.)
(07/1981).
This conference record contains 90 papers relating to conduction and breakdown of liquid dielectrics. The topics of the papers presented range from fundamental studies on generation, transport and properties of the application of insulating oils in electrical equipment. Some contributions from adjacent fields which relate directly to the main theme are also included. This conference is very relevant to both liquid insulation and liquid switching. 729 Refs.
Primary Keywords: Liquid Breakdown; Insulation Conductivity; Charge Transport; Photoconductivity; Liquid-solid Interface; Gas Bubble Effects

9918
(REVIEWS AND CONFERENCES)
(Conferences)
5TH INTERNATIONAL CONFERENCE ON GAS DISCHARGES
(09/1978).
This conference record contains 91 papers concerning basic breakdown phenomena, circuit breaker operation, insulation systems, lightning research, spark gaps, and even laser aided chemical analysis. Many of the included papers present a fresh approach to previously investigated problems. 811 Refs.
Primary Keywords: Conference; Breakdown Mechanism; Circuit Breaker; Insulation; Spark Gap; Laser Breakdown

9919
(BREAKDOWN STUDIES)
(Gas, Electrical)
EXPERIMENTAL INVESTIGATION OF STREAMER DISCHARGE DEVELOPMENT IN NEON
V.A. Davidenko, B.A. Dolgoshein and S.V. Somov
Moscow Engineering-Physics Institute, Moscow, USSR
Soviet Physics JETP, Vol. 28, No. 2, pp 227-230 (02/1969).
Trans. From: Zhurnal Eksperimental'noi I Teoreticheskoi Fiziki 55, 435-442 (August 1968)
An image converter has been used to study the development of an electrical discharge in pure neon and in neon with a molecular impurity. We have measured the rate of development of direct and reverse streamers as a function of the electric field strength and streamer length. Possible mechanisms of photoionization of the gas are discussed. 20 Refs.
Primary Keywords: Mechanisms Of Gas Photoionization; Streamer Breakdown; Neon Gas; Discharge Velocity; Particle Track Originated Discharge

9920
(BREAKDOWN STUDIES)
(Surface Flashover)
INVESTIGATION OF THE PULSED BREAKDOWN MECHANISM AT THE SURFACE OF A DIELECTRIC IN A VACUUM I. UNIFORM FIELD
S.P. Bugaev, A.M. Iskol'dskii and G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 12, No. 10, pp 1358-1362 (06/1968).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1855-1860 (October 1967)
Experimental data are presented which were obtained in an investigation of luminous phenomena at, and in front of, a dielectric in pulsed breakdown along its surface in the nanosecond time range. The luminosity propagation rate along the dielectric was 2.7E7 cm/sec for a field of 137 kV/cm, and the prebreakdown current reached several amperes. A statistical study was made of the discharge dela/ time for pulsed breakdown. It was shown that the discharge was initiated by individual electrons and may have developed in a layer of gas adsorbed on the surface of the dielectric. 6 Refs.
Primary Keywords: Surface Flashover; Uniform Field Breakdown; Dielectric; Pulsed Breakdown; 2.7E7 cm/sec Luminosity Propagation Rate; 40 kV Voltage Pulse

992:
(INSULATION, MATERIAL)
(Solid)
THE APPLICATON OF WEIBULL STATISTICS TO INSULATION AGING TESTS
G.C. Stone (1) and J.F. Lawless (2)
(1) Ontario Hydro Research , Toronto, Ontario, Canada
(2) University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-14, No. 5, pp 233-239 (10/1979).
The results of accelerated aging tests on solid electrical insulation are difficult to evaluate objectively, primarily due to the inherently large variability of the test data. This variability is often represented by the Weibull or other extreme-value probability distributions. This paper demonstrates an hypothesis test procedure which permits the objective and unambiguous evaluation of comparative dielectric tests on two different sets of data. The computation techniques are facilitated through the use of a FORTRAN computer program. A significant difference must be established at low probabilities of failure. Analysis of typical aging tests from the literature indicate that many experiments performed to date may not be statistically significant at utilization levels. The number of tests required to achieve unambiguous significance at low probability levels may render meaningful accelerated aging tests uneconomic. 9 Refs.
Primary Keywords: Electrical Insulation Aging Tests; Weibull Statistics; Constant-stress Test; Stepped-stress Test; Correlation With Normal Aging

9980
(BREAKDOWN STUDIES)
(Lightning)
LIGHTNING: VOLUME I, PHYSICS OF LIGHTNING
R.H. Golde (Ed.)
Publisher: Academic Press Inc. (01/1977).
Many researchers are now studying lightning phenomena. To assist students and researchers in this field, R. Golde has gathered the works of several authors together in one volume to present a history of the study of lightning and to give a comprehensive tutorial on the physics of lightning. Such topics as the physics of electrical breakdown, the charging process, lightning diagnosis, and lightning simulation are covered in detail. 1011 Refs.
Primary Keywords: Lightning; History; Lightning Physics; Electrical Discharge; Lightning Diagnostics; Lightning Simulation; Cloud Discharge; Ground Strike

9981
(PULSE GENERATORS)
(Trigger)
'CROWBAR' TRIGGERING METHOD FOR HIGH POWER PULSE CIRCUITS
M.A. Levine, L.S. Combes and C.C. Gallagher
AFCRL, Bedford, MA 01730
The Review Of Scientific Instruments, Vol. 32, No. 9, pp 1054-1055 (09/1961).
In dealing with high power pulse circuits required in plasma research with energies on the order of hundreds and thousands of joules being transferred in times on the order of a microsecond, the problems of timing are complicated by large voltage pickups. Of particular concern has been the development of a so-called 'crowbar' triggering pulse. A crowbar switch or circuit is designed to short out a large capacitor at the instant it is delivering maximum current and the potential difference across it is zero. This prevents the energy from being re-stored in the capacitor. An ideal method of generating a pulse to trigger a crowbar circuit and of delaying it through specific and controllable times has been developed utilizing the breakdown characteristics of a high voltage spark gap. A spark gap with an overvoltage of only 2% will break down in about 1 microsecond with faster breakdown at higher voltage. 1 Refs.
Primary Keywords: High Power Pulse Circuits; Trigger Circuit; Crowbar Circuit; Low Jitter; Noise Immunity

9987
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)
GENERATION OF MEGAGAUSS MAGNETIC FIELDS USING A LINER COMPRESSED BY HIGH-PRESSURE GAS
E.P. Velikhov, A.A. Vedenov, A.D. Bogdanets, V.S. Golubev, E.G. Kasherskii, A.A. Kiselev, F.G. Rutberg and V.V Chernukha
Soviet Physics-Technical Physics, Vol. 18, No. 2, pp 276-279 (08/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 429-438 (February 1973)
The design of a device for generating pulsed megagauss fields in a large volume is described. The magnetic field is amplified by adiabatic compression in a cylindrical metal shell imploded by high-pressure gas (1-2E3 atm). The design energy in the compressed magnetic field is several megajoules and the lifetime is tens of microseconds. Unlike devices that use explosives, the present device is not destroyed. Unlike devices that use the energy of an electromagnetic field to compress a liner, the problem of storing and switching very large amounts of electromagnetic energy does not arise. 18 Refs.
Primary Keywords: Flux Compression; Megagauss Magnetic Field Generation; High Pressure Gas Adiabatic Compression; Efficient Energy Transfer

9983
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
LOW-INDUCTANCE 100 KV SWITCH (SPARK GAP) FOR STARTING, DIVERTING AND CLAMPING CAPACITOR DISCHARGES
A.E. Bishop and G.D. Edmonds
Culham Lab, Abingdon, Oxfordshire, UK
Proceedings Of The IEE, Vol. 113, No. 9, pp 1549-1556 (09/1966).
The authors describe a field distortion switch designed to operate reliably to 100 kV voltage. Operating in a cascade mode, the switch can be triggered with such reliability to allow operation as a crowbar switch either at zero current or at maximum current. The design and testing of the switch is considered in some detail. 6 Refs.
Primary Keywords: Spark Gap; Clamping Capacitor Discharges; Field-distortion Switch; 25 ns Minimum Breakdown Time; Divert-switch; Clamp-switch; >200 kA Currents; 20-100 kV Voltage Range

9997
(SWITCHES, OPENING)
(Mechanical)
SWITCHING IN VACUUM: A REVIEW
A. Selzer
Cutler-Hammer Inc, Deer Park, NY
IEEE Spectrum, pp 26-36 (06/1971).
The growing use of vacuum interruption devices by the power and control industries in the past decade has introduced these mechanisms to many people to whom the area of vacuum switching is somewhat new. It is felt that a review of vacuum switching from a historical and technological standpoint will facilitate a more general understanding of this important subject. 24 Refs.
Primary Keywords: Vacuum Interruption Devices; Vacuum Technology; Electric Discharge; Historical Review

10002
(BREAKDOWN STUDIES)
(Liquid, Electrical)
VARIATIONS IN THE RESISTANCE OF SPARK GAPS IN WATER UNDER THE EFFECT OF HIGH PULSE VOLTAGE
I I. Kalyatskiy, G.S. Korshunov and G.A. Kiselev
Academy of Sciences of the USSR, Tomsk, USSR
Applied Electrical Phenomena, No. 6, pp 28-31 (12/1971).
Trans. From: Elektronnaya Obrabotka Materialov 6, 32-36 (1971)
The authors study the resistance of a water spark in the context of electrical discharge machining. The resistance of the spark is measured as a function of pulse shape, geometry, gap length, and initial water resistivity. A large prebreakdown current is found. 3 Refs.
Primary Keywords: Liquid Spark Gap; Spark Gap Resistance; High Pulse Voltage; Electric Field Configuration; Spark Gap Length; Initial Voltage Pulse Parameters

10003
(BREAKDOWN STUDIES)
(Gas, Electrical)

GAS-HEATING EFFECT ON PLASMA RESISTIVITY

J.E. Creedon and S. Schneider
ECOM, Fort Monmouth, NJ 07703

Journal Of Applied Physics, Vol. 40, No. 13, pp 5212-5216 (12/1969).

Measurements of hydrogen-plasma resistivity were made under conditions where the dominant loss mechanism was electron-neutral collisions. Three-inch-diameter tubes with electrode spacings ranging from 2-22 in. were used. Measurements were made at 15 and 22 kA, 56-microsecond pulse duration, and pressures of 0.5, 1.0, and 5.0 Torr. Electron-density and temperature measurements were obtained from Stark-broadening and line-intensity-ratio techniques. The predicted resistivity was calculated from electron-proton and electron-neutral collisions and compared with the absolute resistivity calculated from the voltage-current measurements. The gas-temperature rise was determined from the resistance difference obtained from the two calculations. The energy expended in gas heating was determined to be 2.4%-4.2% of the input energy. 10 Refs.

Primary Keywords: Hydrogen Discharge; Plasma Resistivity; Neutral Gas Heating; Electron-neutral Collision; Energy Balance

10004
(BREAKDOWN STUDIES)
(Lightning)

LIGHTNING: VOLUME II, LIGHTNING PROTECTION

R.H. Golde (Ed.)

Publisher: Academic Press Inc. Ltd. (01/1977).

Lightning protection is a necessary part of ensuring safety of personnel, equipment, and structures in all parts of the world. Threat-level determination, lightning detection, and lightning stroke diversion effectiveness are all addressed in this book. The book begins with a thorough discussion of the development of lightning early warning systems and proceeds to discuss the effects on humans, flora, electronic equipment, structures, and aircraft. A chapter is included on grounding. 510 Refs.

Primary Keywords: Lightning Protection; Lightning Effects; Lightning Prediction; Lightning Diversion; Lightning Prevention

10005
(POWER CONDITIONING)
(Pulse Transformers)

A PULSE TRANSFORMER FOR LARGE WIRE SPARK CHAMBERS

L. Andersson, E. Radermacher and C. Rubbia
CERN, Geneva, Switzerland

Nuclear Instruments And Methods, Vol. 75, No. 2, pp 341-343 (11/1969).

It is remarked that by interposing a stepdown transformer between the high-voltage generator and wire spark chambers, the pulsing of the larger size chambers can be eased considerably. A simple transformer made solely of coaxial cables has been built and tested. 5 Refs.

Primary Keywords: Stacked Line Transformer; Large Wire Spark Chambers; Coaxial Cable Pulse Transformer; 2.0 Ohm Chamber Impedance; 5.0 kV Peak Pulse Voltage; 1.25E7 W Peak Transformer Power

10007
(PULSE GENERATORS)
(Stripline)

A SIMPLE STRIPLINE PULSER FOR SPARK CHAMBERS

M.R. Howells, P.E. Osmon and A.G. Sheldon
Westfield College, London, UK

Nuclear Instruments And Methods, Vol. 79, No. 2, pp 325-328 (03/1970).

A spark chamber pulser has been constructed using a stripline as both feeder cable and storage capacitor. The inductance of the unit is thereby minimized in a simple and inexpensive way and a pulse rise time of 10 ns into a 1000 pF load is achieved. 0 Refs.

Primary Keywords: Spark Chamber Pulser; 10 ns Pulse Rise Time; 1000 pF Load; Low Inductance Layout; Stripline Energy Store

10009
(POWER CONDITIONING)
(Pulse Inverters)

A TRANSMISSION-LINE PULSE INVERTER

R.W. Rochelle
Naval Research Lab, Washington, DC 20375

The Review Of Scientific Instruments, Vol. 23, No. 6, pp 298-300 (06/1952).

The polarity of fast rise-time pulses can be inverted with a minimum of distortion by means of a transmission-line network. The features in the design of a typical pulse inverter for obtaining push-pull cathode-ray-tube deflection voltages from single-ended signals are presented. The normalized design graphs are a considerable aid in the calculation of pulse-inverter characteristics. 0 Refs.

Primary Keywords: Pulse Polarity Inverter; Fast Rise-time Pulses; Transmission-line Network; Polarity Switching; Shield Impedance; Design Considerations

10013
(POWER CONDITIONING; POWER CONDITIONING)
(Pulse Transformers; Materials; Saturable Reactors, Materials)

EDDY-CURRENT-LIMITED GROWTH OF FERROMAGNETIC DOMAINS ON THE SURFACE OF SQUARE-LOOP ALLOY TAPES

J.E.L. Bishop
University of Sheffield, Sheffield, UK

Journal Of Physics D: Applied Physics, Vol. 9, No. 14, pp 2095-2110 (10/1976).

The expansion of small, initially hemicylindrical domains on the surface of square-loop alloy tapes has been simulated numerically under conditions of (i) constant drive field H/sub A/; and (ii) constant flux-reversal rate phi dot. The calculations treat each element of domain wall as being individually in dynamic equilibrium under the pressure of the applied and local eddy-current magnetic fields and the domain wall surface tension. The 'coercive field' H/sub c/ is also ignored as the model is intended to apply to situations in which the applied field greatly exceeds the coercive field. By expressing the equations of motion in reduced units, it has been possible to condense all constant H/sub A/ growth sequences onto a single sequence and similarly all consont phi dot sequences onto another. When expressed in compatible units these two reduced sequences are found to be closely equivalent. This demonstrates that growth at any instant depends mainly on the value of a single growth parameter and is only very weakly influenced by the history of the growth. The changing shape of the domain wall during the motion has been represented to high accuracy by the use of up to 92 symmetric pairs of wall segments. At fast flux-reversal rates per domain phi dot, the field required to drive the expansion is shown to be proportional to phi dot/sup 0.616/ and to the domain cross-sectional area to the power -0.191. 19 Refs.

Primary Keywords: Domain Expansion; Constant Drive Field; Constant Flux-reversal Rate; Eddy-current Magnetic Fields; Ferromagnetic Alloy Tape Cores

10018
(BREAKDOWN STUDIES)
(Gas, Electrical)

FORMATIVE TIME LAGS IN THE ELECTRICAL BREAKDOWN OF GASES

J. Dutton, S.C. Haydon and F. Llewellyn Jones
University College of Swansea, Singleton Park, Swansea, Wales

British Journal Of Applied Physics, Vol. 4, pp 170-175 (06/1953).

The time rate of growth of ionization currents in a gas in a uniform electric field greater than that corresponding to the static sparking potential is investigated theoretically. This theoretical analysis is then applied to the breakdown of a gas at high values of the parameter pd. It is shown that the same primary and secondary ionization processes which lead to a growth of pre-breakdown currents in agreement with experiment, and to the calculation of static sparking potentials in agreement with those measured, also lead to a rapid decrease of the formative time lag with increasing overvoltage. The introduction of some other quite different process to account for the short formative time lag is unnecessary. The present theoretical investigation, together with previous experimental and theoretical studies, therefore, lay the basis of a comprehensive view of the electrical breakdown of gases covering a wide range of parameters. Curves showing the dependence of the formative time lag on overvoltage, calculated by means of the above analysis, are given; these curves may be used to elucidate the various secondary ionization processes operative in the breakdown mechanism. 25 Refs.

Primary Keywords: Ionization Current Growth; Uniform Electric Field; Static Sparking Potential; Formative Time Lag Decrease

10019
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)

FRINGING FIELDS IN A PARALLEL-PLATE CAPACITOR

A. Naini and M. Green
University of Washington, Seattle, WA

American Journal Of Physics, Vol. 45, No. 9, pp 877-879 (09/1977).

The fringing fields in capacitors are studied both experimentally and theoretically to determine a correction to the basic capacitance formula for a circular, parallel-plate capacitor. Plate separation is varied to allow comparison at several values of capacitance. A constant offset in capacitance is also found but is believed to be due to stray capacitance in the apparatus. 2 Refs.

Primary Keywords: Capacitor Fringing Field; Idealized Model Corrections; Circular Parallel-plate Capacitor

10028
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

PLASMA PROPERTIES OF A METAL VACUUM ARC. I

V.M. Lunev, V.D. Dvoretenko and V.M. Khoroshikh
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR

Soviet Physics-Technical Physics, Vol. 22, No. 7, pp 855-861 (07/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 1486-1490 (July 1977)

Certain characteristics of the plasma of a metal (Mo) vacuum arc are measured. The measurements are carried out with single and double electrostatic probes and a multigrid analyzer. The plasma density, the spatial distribution of the plasma density, the electron and ion temperatures, etc., are determined. The fluxes of ions and neutrals are estimated. It is found that a metal vacuum arc generates plasma streams with a directed ion energy of 20-30 eV. The plasma density is 1E9 - 1E11 cu.cm., and the electron temperature is approximately 3 eV. 9 Refs.

Primary Keywords: Metal Vacuum Arc; Plasma Properties; Electrostatic Probes; Multigrad Analyzer; 1E9 - 1E11 per cu.cm. Plasma Density; 3 eV Electron Temperature; Spatial Distribution; Molybdenum Electrodes

10029
(POWER CONDITIONING)
(Pulse Transformers, Materials)
POTENTIAL OF AMORPHOUS ALLOYS FOR APPLICATION IN MAGNETIC DEVICES
F.E. Luborsky, J.J. Becker, P.G. Frischmann and L.A. Johnson
General Electric Co, Schenectady, NY 12301
Journal Of Applied Physics, Vol. 49, No. 3, pp 1769-1774 (03/1978).
Amorphous alloys have potential applications in all types of magnetic devices, in both the electronic and power areas of application. For electronic devices, the properties are comparable to those of commercial alloys and the materials offer potentially much lower cost. In power applications such as transformers, losses are far lower than in materials used at present. This results in a potential favorable trade-off between first cost and a substantial energy savings throughout the life of the device. Although power applications have not been emphasized up to now, they appear to hold great promise, especially as wider amorphous tapes become available. 39 Refs.
Primary Keywords: Amorphous Alloys; Magnetic Devices; Market Structure; Fabricability; Annealing; Cost
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10030
(BREAKDOWN STUDIES)
(Exploding Wires)
PULSED LASER STEREOPHOTOGRAPHY OF MINIATURE EXPLODING FOILS
D.L. Parsley
Monsanto Research Corp, Miamisburg, OH 45342
SPIE, Vol. 97, pp 184-188 (01/1976).
The results of a photographic study of exploding foils are presented. A pulsed ruby laser is used to illuminate the foil to 'freeze' the explosion and to allow filtering of the plasma radiation. The image is recorded on a stereocamera. The analysis of the photographs is described, and a short discussion of results is presented. 4 Refs.
Primary Keywords: Miniature Exploding Foils; Pulsed-laser Stereophotography; Optically Intense Plasma; Framing Camera; Stereo Imaging
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10031
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
REDUCING ELECTRICAL INTERFERENCE
E.S. Ida
DuPont Co, Wilmington, DE 19898
Control Engineering, Vol. 9, No. 2, pp 107-111 (02/1962).
Grounding and shielding of remote sensors is the subject of this paper. Several definitions are presented and corrective measures for several grounding and shielding problems are considered. The author stresses that each problem is unique and should be considered so. 0 Refs.
Primary Keywords: Electrical Interference; Cleaner Control Signals; Shielding; Ground Loops; Electrostatic Induction; Balanced Line
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10035
(DIAGNOSTICS AND INSTRUMENTATION)
(Specifications)
SPECIFYING POWER CONDITIONING EQUIPMENT
R.L. Anderson
Maxwell Labs Inc, San Diego, CA 92123
Electro-Optical Systems Design, pp 10-15 (03/1975).
This paper should be very helpful to those who must specify a power conditioning system, whether it is to be constructed in-house or contracted. The process of specifying a system is considered in several steps with important points considered at each step. Some points of prime concern when specifying a system to a contractor are also discussed. 0 Refs.
Primary Keywords: Power Conditioning System Specification; Specification Determination
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10036
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
THE BEHAVIOR OF POLYESTER FILM ENERGY STORAGE CAPACITORS
B.R. Hayworth
Maxwell Labs Inc, San Diego, CA 92123
IEEE Transactions On Electrical Insulation, Vol. EI-3, No. 2, pp 47-49 (05/1968).
An experimental study of the electrical properties of energy storage capacitors utilizing Mylar polyester films has shown how the weight and volume of such capacitors could be reduced while improving reliability and energy density. Test data relate the lifetime of a capacitor to its operating voltage, discharge frequency, and temperature. The effect on life of percent current reversal and dielectric film thickness is also demonstrated. The results should enable capacitor designers to tailor products to specific applications, thereby achieving optimum performance. 0 Refs.
Primary Keywords: Energy Storage Capacitors; Mylar Polyester Films; Percentage Current Reversal; Dielectric Film Thickness; Energy Density
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10037
(BREAKDOWN STUDIES; INSULATION, VACUUM)
(Vacuum, Electrical)
THE INSULATION OF HIGH VOLTAGES IN VACUUM
J.G. Trump and R.J. Van De Graaff
Massachusetts Institute of Technology, Cambridge, MA
Journal Of Applied Physics, Vol. 18, No. 3, pp 327-332 (03/1947).
Breakdown studies have been made between electrodes in high vacuum at constant voltages from 50 to 700 kV. These further demonstrate the inadequacy of the field emission theory to account generally for high voltage breakdown in vacuum. Experiments are described which investigate some of the 'total voltage' breakdown mechanisms, including positive-ion emission by electron impact, electron emission by positive-ion impact and by photons. In the DC case these processes contribute to a steady interchange of charged particles between cathode and anode which increases with voltage until breakdown ensues. At higher breakdown voltages the cathode gradient has diminished far below the value for field emission. Measurements of electron emission by electrons with energies up to 300 kV for tungsten, steel, aluminum, and graphite are reported. The possibilities of predicting and of improving the insulation strength of electrode gaps in high vacuum by the study of the coefficients of the electrode materials are discussed. 13 Refs.
Primary Keywords: Vacuum Insulation; 50 to 700 kV Constant Voltages; High Voltage Breakdown; Insulating Strength; Electrode Materials; Field Emission
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10039
(BREAKDOWN STUDIES)
(Gas, Electrical)
TIME LAGS AND THE BREAKDOWN AND CORONA CHARACTERISTICS IN SULPHUR HEXAFLUORIDE
E. Kuffel and R.D. Radwan
University of Manchester, Manchester, UK
Proceedings Of The IEE, Vol. 113, No. 11, pp 1863-1872 (11/1966).
Uniform field breakdown of SF/sub 6/ with variation of several gap parameters is the subject of this paper. DC voltages are utilized with superimposed square pulse voltages to overvolt air and SF/sub 6/ gaps. Breakdown delay is measured as a function of gap spacing, pressure, irradiation, and breakdown history. SF/sub 6/ is found to exhibit large jitter for low overvoltage. 20 Refs.
Primary Keywords: Sulphur Hexafluoride Breakdown; Variable Gas Pressure; Electrode Conditioning; Time Lag; Breakdown Characteristics; Corona Current
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10040
(POWER TRANSMISSION)
(Transmission Lines)
USE OF RADIAL TRANSMISSION LINES IN PULSED ACCELERATORS
V.I. Kazacha and I.V. Kozhukhov
Soviet Physics-Technical Physics, Vol. 21, No. 7, pp 841-844 (07/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 1477-1483 (July 1976).
Radial transmission lines with various electrode shapes are studied. An electrode configuration with a double-radial line can produce a voltage pulse in which the flat top droops by less than 10%. A multiple-gap pulsed accelerator can be constructed with double radial transmission lines of this kind. 8 Refs.
Primary Keywords: Radial Transmission Lines; Various Electrode Shapes; Multistage Pulsed Accelerator; Radial Transmission Lines; Optimum Voltage Pulse; Transfer Characteristics
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10041
(BREAKDOWN STUDIES)
(Exploding Wires)
VISIBLE AND NEAR-UV EMISSION IN THE ELECTRICAL EXPLOSION OF A THIN METAL FOIL
V.I. Baikov, V.V. Blagoveshchenskii, B.G. Komkov and Yu.T. Mazurenko
Soviet Physics-Technical Physics, Vol. 20, No. 5, pp 708-710 (05/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 1128-1132 (May 1975).
In a study of the electrical and optical characteristics of the electrical explosion of a thin aluminum foil in air it has been found that the light pulses obtained at energy inputs of up to 20 kJ/sq.cm. of foil have a brightness temperature of up to 35,000 Deg.K., a length of 4-6 microseconds, and a short rise time. It is found that approximately 35% of the electrical energy is converted into radiation. 10 Refs.
Primary Keywords: Exploding Foil; Visible And Near-UV Emission; 35,000 Deg.K. Brightness Temperature; 4-6 Microsecond Light Pulse Length; 35% Electrical Energy Conversion Rate; Radiation Characteristics; High-Current Pulsed Discharge
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10043
(BREAKDOWN STUDIES)
(Exploding Wires)
67 KERR-CELL STUDIES OF EXPLODING WIRES IN VACUUM
S. Nyberg, S.K. Mandel and B. Stenerhag
Institute Of Physics, University of Uppsala, Uppsala, Sweden
Journal Of The Society Of Motion Picture Television Engineers, Vol. 82, No. 3, pp 187 (03/1973).
The authors compare the optical emission of tungsten, molybdenum, and nickel wires using a single-frame Kerr-cell camera. Tungsten and molybdenum wires are chosen specifically for their high melting points while nickel is used for comparison. A model is presented. The explosion is found not to be dependent on radial electric field. 4 Refs.
Primary Keywords: Exploding Wire; Kerr-cell Camera Shutter; Tungsten Wire; Molybdenum Wire; Nickel Wire; Radial E-field Independence
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10048
(PULSE GENERATORS)
(Systems)
NANOSECOND CURRENT PULSE GENERATOR FOR SUPPLYING SEMICONDUCTOR LASERS
B.M. Kevel'chuk
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 4, pp 884-887 (08/1968).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 116-119 (July-August 1968).
A generator of nanosecond current pulses for powering semiconductor lasers is described. Current pulses with an amplitude to 1 kA and edge of 0.5 nsec at a repetition frequency of up to 1E4 Hz are obtained.
Primary Keywords: Pulse Generators; Semiconductor Lasers; 1 kA Amplitude; 0.4 nsec Pulse Edge; 1E4 Repetition Frequency; 10-30 nsec Duration; 200 W Total Required Power; Rep-rated
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10049
(BREAKDOWN STUDIES, SWITCHES, CLOSING)
(Gas, Radiation; Gas Gaps, Optical)
VOLT-AMPERE CHARACTERISTIC AND TRANSITION CURRENT OF A GAS GAP WHEN ACTED UPON BY PULSED IONIZING RADIATION
V.A. Arguunov, V.V. Zakharov, G.F. Ioilev and E.V. Chekhunov
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 18, No. 2, pp 156-156 (04/1977).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 2, 14-18 (March-April 1977)
The problem of the reduction of the breakdown voltage of a gas gap when it is acted upon by a high-power ionizing pulse is considered. The prebreakdown transition currents are calculated for argon and air in the case of a wide gap (the distance between the electrodes d>1 cm). The problem of the form of the volt-ampere characteristic in the high-current range (the 'glow' discharge mode) was not considered. The purpose of the present paper is to calculate the volt-ampere characteristics of a narrow gas gap (d=2E-2 cm) in both the high- and low-current regions (the range of currents limited by space charge). 8 Refs.
Primary Keywords: Gas Breakdown; Ionizing Radiation; Radiation Effect On Breakdown, Theory; Voltage Calculation; Current Calculation
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10050
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

BREAKDOWN OF VACUUM SPARK GAPS

R.C. Mason
Westinghouse Electric Corp. Pittsburgh PA
Physical Review, Vol 52, No. 2, pp 126-127 (07/1937).

Experiments with vacuum spark gaps show that the critical cathode field required for breakdown is not reduced by considerable thermionic emission from the cathode. It is concluded that positive ion emission from the anode under electron bombardment, which apparently enters at higher voltages, is not a factor up to 50 kV. 7 Refs.

Primary Keywords: Vacuum Breakdown, Critical Cathode Field; Thermionic Emission; Anode Ion Emission, Gas Evolution; Metal Vaporization

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10055
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Electrodes)

ELECTRODE PROTRUSIONS PRODUCED BY ELECTRON BEAM BOMBARDMENT AND THEIR ROLE IN VACUUM BREAKDOWN

A. Maitland (1) and R. Hawley (2)
(1) International Research and Development Co Ltd, Newcastle-upon-Tyne, UK
(2) C.A. Parsons & Co Ltd, Newcastle-upon-Tyne, UK
British Journal Of Applied Physics, Vol 16, pp 1591-1592 (10/1965).

It was found that bombardment of copper samples by an electron beam in a vacuum chamber produced the formation of minute metallic projections on the copper surface. The possible bearing of such a process on the mechanism of electrical breakdown in high vacuum is considered. 9 Refs.

Primary Keywords: Vacuum Breakdown; Copper Electrodes, E-beam Bombardment; Microprotrusion Generation

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10073
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

VACUUM SPARK EROSION AT CATHODIC INCLUSIONS

J.T. Maskrey
Atomic Energy Research Establishment, Harwell, Berkshire, UK
British Journal Of Applied Physics, Vol. 16, pp 1583-1584 (10/1965)

Erosion found at inclusion sites in copper and stainless-steel cathodes after vacuum breakdown suggests that the vacuum arc initiation process may be closely related to that in unipolar arcs, where similar cathode damage occurs. 10 Refs.

Primary Keywords: Vacuum Breakdown; Electrode Erosion; Erosion Site Determination; Cathode Inclusions; Copper Cathode; Stainless Steel Cathode

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10074
(PARTICLE BEAMS, ELECTRON)
(Generation)

EXPLOSIVE EMISSION ELECTRONS FROM METALLIC NEEDLES

G.A. Mesyats and D.I. Proskurovskii
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
JETP Letters, Vol. 13, No 1, pp 4-6 (01/1971).
Trans. From ZhETF Pis'ma V Redaktsiyu 13, 7-10 (January 1971)

Metallic needles are widely used as sources of electron current pulses of 1E3-1E5 A. It is customarily assumed that the emission of the electrons from the needles at such currents is due entirely to field emission. Our investigations have shown that the appearance of large electron currents is preceded by an electric explosion of the tip of the needle and the formation of a plasma as a result of resistive heating by the field emission current. 5 Refs.

Primary Keywords: Explosive Emission Electrons; Metallic Needles; 1E3-1E5 A Electron Current Pulses, Plasma Formation; Cathode Flares; 10-500 kV Voltage Amplitude

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10106
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

THE RELATION BETWEEN ELECTRON FIELD EMISSION AND CONTACT ELECTROMOTIVE FORCE FOR LIQUID MERCURY

D.H. Moore
University of Virginia, VA
Physical Review, Vol. 50, No. 4, pp 344-347 (08/1936).

The relation between contact EMF and the impulsive potential necessary to initiate a vacuum spark has been studied for a liquid mercury cathode. The magnitude and time of application of the impulsive potential were determined by a cathode-ray oscillograph so that possible distortion of the mercury surface produced by the electric field could be evaluated. For impure mercury no definite relation could be found. However, for carefully distilled mercury the relation between the work function and breakdown field was in qualitative but not in quantitative agreement with theory. 11 Refs.

Primary Keywords: Vacuum Breakdown; Mercury Cathode; Surface Distortion; Breakdown Voltage; Impulse Voltage; Field Emission

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10107
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

THE RELATION BETWEEN THE ELECTRON FIELD EMISSION AND THE WORK FUNCTION OF LIQUID MERCURY

L.R. Quarles
University of Virginia, VA
Physical Review, Vol. 48, No 3, pp 260-264 (08/1935).

The variation in the field necessary to initiate a vacuum discharge between a mercury cathode and a molybdenum anode and the accompanying variation in the work function of the cathode have been measured. The work function variations were obtained from measurements of the contact potential between the mercury and a platinum filament. The fields were applied by an impulse circuit, the time constant of the voltage wave being very short in order to prevent distortion of the mercury. The final results show a variation of the field with work function which, while in the same direction, is more pronounced than that forecast by the Fowler-Nordheim theory. For a change of work function of one volt the field required to initiate the discharge varied from 175 kV/cm to 575 kV/cm. 8 Refs.

Primary Keywords: Vacuum Breakdown; Mercury Cathode; Molybdenum Anode; Field Emission; Cathode Work Function

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10112
(REVIEWS AND CONFERENCES; BREAKDOWN STUDIES)
(Conferences; Exploding Wires)

EXPLODING WIRES: VOLUME III

W.G. Chace (Ed.) (1) and H.K. Moore (Ed.) (2)
(1) AFCRL, Bedford, MA 01730
(2) Lowell Technological Institute Research Foundation, Lowell, MA
Publisher: Plenum Press, New York (01/1964).

Exploding Wires, Volume 3 contains the proceedings of the Third Conference on the Exploding Wire Phenomenon as its predecessors contained the proceedings of the earlier conferences. There are papers on theory, on shock waves, and on apparatus and instrumentation, recoding the advances in the state of the art in each of these fields. A group of three papers on exploding bridge wires dominates the section on uses, but there is also a paper on chemical synthesis by E.W.'s. Exploding foils' entry into the R&D stage is described in a paper on a pulsed satellite accelerator. 196 Refs.

Primary Keywords: Exploding Wires; Theory; Shock Wave; Instrumentation; Bridge Wire; Opening Switch

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10119
(DIAGNOSTICS AND INSTRUMENTATION)
(B-field)

METHODS OF MEASURING VARYING AND PULSED MAGNETIC FIELDS (REVIEW)

N.S. Poberko
Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, No. 4, pp 963-972 (08/1970).
Trans. From Pribory i Tekhnika Eksperimenta 4, 7-16 (July-August 1970)

Methods of measuring varying and pulsed magnetic fields are reviewed systematically. Particular attention is given to methods of measuring fields up to approximately 1E6 Oe. Six methods are considered: inductive methods; the ferroprobe method; methods using the Hall, Faraday, and Zeeman effects; and the magnetoresistive method. 41 Refs.

Primary Keywords: Magnetic Field Measurement; Pulsed Field; Comparison Of Several Methods; Ferroprobe; Hall Effect; Faraday Effect; Zeeman Effect; Magnetoresistive Method

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10123
(BREAKDOWN STUDIES)
(Solid, Electrical)

ARC-INTERRUPTION AND GAS-EVOLUTION CHARACTERISTICS OF COMMON POLYMERIC MATERIALS

P.F. Hettwer
McGraw-Edison Co., Franksville, WI
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 1689-1696 (06/1982).

An extensive study was undertaken to determine the arc-interruption and gas-evolution characteristics of a number of common polymeric materials. The materials were evaluated to determine their potential use in electrical apparatus. The test results show the composition and distribution of arc-quenching gases produced during interruptions and the importance of volume cooling with gas on energy dissipation. A scheme is proposed for the arc-induced decomposition of a polymer and the predominant chemical reactions that account for the formation of the gas species observed is theoretically discussed. 6 Refs.

Primary Keywords: Polymeric Material; Breakdown; Evolved Gas Composition, Theory

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10124
(BREAKDOWN STUDIES)
(Gas, Recovery)

DEVELOPMENT OF A 7.2 KV - 63 KA ADVANCED PUFFER GAS CIRCUIT BREAKER

Y. Ueda, Y. Murai, A. Ohno and T. Tsutsumi
Mitsubishi Electric Corp. Amagasaki, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 15[illegible]4-[illegible]510 (06/1982).

Design parameters of puffer type SF/sub 6/ gas circuit breakers were discussed based on the thermo-gas dynamic simulation of arc [illegible] including the pressure generation by the arc itself. The results of the simulation revealed that the puffer breaker with high interrupting capacity can be designed with much less cylinder volume and much less driving power compared with the breaker designed by the conventional way of increasing the mechanical [illegible] high interrupting capacity. A compact puffer breaker with the interrupting capacity of 63 kA at 7.2 kV was developed based [illegible] simulation. 2 Refs.

Primary Keywords: SF/sub 6/ Breakdown; Gap Recovery; Numerical Simulation; Geometry Considerations; Puffer Circuit Breaker

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10125
(BREAKDOWN STUDIES)
(Gas, Electrical)

EXPERIMENTAL AND THEORETICAL STUDY OF A DC ARC IN A CONSTANT DIAMETER NOZZLE FLOW

H.T. Nagamatsu
General Electric Co. Schenectady, NY 12301
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 1578-1587 (06/1982).

The cold air flow field for a 1.27 cm constant diameter nozzle was determined for subsonic and transonic flow velocities. In addition, DC arc voltage, current and diameter measurements were made for an arc gap of 5.52 cm and a current of approximately 100A. Arc voltage increased rapidly as the flow velocity increased from zero to sonic velocity. Using a channel flow model with constant arc temperature and the energy integral for the convective cooling, analytical expressions were derived for the arc radius, electric field strength, arc voltage, resistance, and power as functions of the cold flow properties, current, and axial distance. Calculated arc voltages, resistances, and powers compare favorably with measured values. 24 Refs.

Primary Keywords: DC Arc; Flowing Gas; Subsonic Flow; Transonic Flow; Current Measurement; Voltage Measurement; Arc Diameter, Theory; Experiment

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10126
(BREAKDOWN STUDIES)
(Gas, Recovery)
FACTORS INFLUENCING THE INTERRUPTING ABILITY OF SF/SUB 6/ PUFFER BREAKER AND DEVELOPMENT OF 300KV-50KA ONE-BREAK CIRCUIT BREAKER
S. Yanabu, H. Mizoguchi, A. Kobayashi, Y. Ozaki and Y. Murakami
Toshiba Corp. Kawasaki, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 1511-1518 (06/1982).
The factors to be considered at the design stage of the extinction chamber of a SF/sub 6/ puffer gas circuit breaker (GCB) have been examined numerically and analytically. It has been shown that an extinction chamber which satisfies both Short Line Fault (SLF) and Breaker Terminal Fault (BTF) conditions simultaneously is not economical and a capacitor parallel to it should be used. On the basis of the above analysis, a 300kV-50kA one-break chamber has been developed successfully. 16 Refs.
Primary Keywords: SF/sub 6/ Breakdown; Gap Recovery; Puffer Circuit Breaker; Performance Test; Theory; Experiment
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10127
(INSULATION, MATERIAL)
(Solid)
PHYSICAL MODEL OF ELECTRIC AGING AND BREAKDOWN OF EXTRUDED POLYMERIC INSULATED POWER CABLES
C. Bahder (1), T. Garrity (2), M. Sosnowski (1), R. Eaton (2) and C Katz (1)
(1) Cable Technology Labs, Inc., New Brunswick, NJ
(2) U.S. Dept. Of Energy, Washington, DC
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 1379-1390 (06/1982).
This paper postulates a physical model of electric aging and breakdown of polymeric insulated high voltage cables and substantiates this model with results of tests. In accordance with the model, scission of molecular chains and formation of craters at discharging voids are responsible for the electric aging and voltage breakdown of polymeric insulation. A method for the rapid determination of threshold voltage by means of voltage breakdown tests has been developed. These tests indicate that at voltages above the threshold voltage the breakdown voltage decreases with an increase of time of voltage application. At voltages below the threshold voltage electric breakdown is not expected. 33 Refs.
Primary Keywords: Polymeric Insulation; Insulation Aging; Insulation Breakdown; Voids; Threshold Voltage
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10128
(BREAKDOWN STUDIES)
(Gas, Electrical)
RANDOM PREBREAKDOWN DISCHARGES IN SF/SUB 6/ - A POSSIBLE DIAGNOSTIC CRITERION FOR PARTICLE-CONTAMINATED COMPRESSED GAS APPARATUS
M. Anis (1), M.M.A. Salama (2) and K.D. Srivastava (1)
(1) University of Waterloo, Waterloo, Ontario, Canada
(2) Ain Shams University, Egypt
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 1588-1595 (06/1982).
The corona pulse voltage in SF/sub 6/ gaps, under impulse voltages, is random in value; its randomness is related to the electrode geometry and is influenced by the gas pressure and the rate of rise of the applied voltage. An analytical model is presented whereby the relationships among these quantities are derived. The model predicts for a given electrode geometry at a certain gas pressure the distribution of the corona onset voltage. The results of testing rod-plane SF/sub 6/ gaps under switching impulses are presented to verify the applicability of the analytical model. By establishing an electrostatic equivalence between rod-plane gaps and conducting particles in GIS, the above analysis could be extended to the latter problem. The possibility of using the present results and analysis to devise a diagnostic test procedure for particle-contaminated GIS is discussed. 9 Refs.
Primary Keywords: SF/sub 6/ Corona Pulse; Impulse Voltage; Electrode Geometry; Modeling; Onset Voltage Prediction; Nonuniform-field Gap
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10129
(POWER CONDITIONING)
(Pulse Transformers)
SOME TRANSMISSION LINE DEVICES FOR USE WITH MILLIMICROSECOND PULSES
I.A.D. Lewis
Radar Research Establishment
Electronic Engineering, Vol. 27, No. 33, pp 447-452 (10/1955).
Coaxial cables are very useful for implementing pulse transformers and phase inverters. This paper presents a brief theoretical background and design guides for such phase inverters and stacked-line pulse transformers. 8 Refs.
Primary Keywords: Phase Inverters; Impedance Transformers; Nanosecond Pulses; Value Meter Isolating Transformer; Coaxial Cable
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10130
(SWITCHES, CLOSING SWITCHES, CLOSING)
(Thyristors, (ASS)
THYRISTOR DEVICES FOR ELECTRIC POWER SYSTEMS
V.A.K. Temple
General Electric Co, Schenectady, NY 12301
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 7, pp 2285-2291 (07/1982).
Thyristors of higher voltage and current ratings containing new gate and self protective features are being developed at General Electric with EPRI (Electric Power Research Institute) support. Some of the more important of these are described in this paper. Devices include light triggered thyristors (LTT's) now at the 5 and 6 kV level and asymmetric light triggered thyristors (ALTT's) with 50% higher surge capability and 50% faster turnoff times than a regular thyristor. Key features include "controlled turn-on" which protects thyristors from destructive di/dt during turn-on and "voltage breakover" (VBO) protection which prevents destructive avalanche current turn-on. Brief descriptions of recent devices and status reports of our various EPRI supported programs are given. 8 Refs.
Primary Keywords: Thyristor Switch; Light Triggered; High Voltage; Built In Voltage Breakover Protection; Asymmetric Thyristor Blocking; 5 kV Operating Voltage
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10144
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ON THE CATHODE OF AN ARC DRAWN IN VACUUM
R. Holm
Westinghouse Electric Corp, Pittsburgh PA
Physical Review, Vol. 55, No. 9, pp 1089-1089 (05/1939).
It has been found that the cathode is the only electrode which contributes vapor for the maintenance of an electric arc under very low gas pressure. The velocity of this vapor was determined by two methods. Method 1 consisted of measuring the force of reaction of the vapor on the cathode and the rate of vaporization of the cathode material. Method 2 consisted of determining the force exerted by the vapor on a vane suspended in front of the cathode spot and the rate of vapor condensation on the vane. Both these methods gave a vapor velocity of the order of 16x1E6 cm/sec. A temperature of around 50,000 Deg K results when this value for the cathode vapor velocity is substituted for c in the equation, 1/2 mv/sup 2/=3 KT/2. 10 Refs.
Primary Keywords: Vacuum Breakdown; Cathode Effects; Cathode Vapor; Vapor Velocity; Temperature Calculation
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10164
VACUUM VOLTAGE BREAKDOWN AS A THERMAL INSTABILITY OF THE EMITTING PROTRUSION
Breakdown by thermal instability of a field emitter is analyzed taking into account the temperature dependence of field emission and of resistivity. Beyond a certain temperature the emission increases while the necessary field drops. It is shown that for a whisker-like emitter this instability occurs when the emitting tip is only several hundred degrees centigrade hotter than the bulk of the cathode.

10165
(BREAKDOWN STUDIES)
(Electrolytes, Electrical)
PRE-BREAKDOWN PHENOMENA IN AQUEOUS ELECTROLYTES IN ULTRA-HIGH ELECTRIC PULSE FIELDS. PART I
A.A. Vorob'yev, V.V. Ryumin, B.V. Semkin, O.P. Semkina and V.Ya. Ushakov
Applied Electrical Phenomena, No. 3, pp 28-32 (06/1971).
Trans. From: Elektronnaye Obrabotka Materialov 3, (1971)
Prebreakdown currents at high fields are studied in aqueous electrolytes. Several electrolytes with low voltage resistivities on the order of 100 ohm-cm, are subjected to rectangular pulses with fields of 1E5-1E6 V/cm, and pulse rise times <=10 ns. Prebreakdown currents are measured as a function of field intensity and duration. The formation of a gas film near the electrodes is presented as a possible mechanism for current saturation. 10 Refs.
Primary Keywords: Aqueous Electrolytes; 1E5-1E6 V/cm Electric Pulse Fields; Pre-breakdown Currents; Voltage Duration; Electric Field Intensity; Near-electrode Gas Film Formation
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10168
(BREAKDOWN STUDIES)
(Surface Flashover)
DEVELOPMENT OF SURFACE DISCHARGE ALONG A DIELECTRIC WITH LARGE DIELECTRIC CONSTANT IN GAS IN THE NANOSECOND RANGE
B.M. Koval'chuk, V.V. Kremnev, G.A. Mesyats and Ye.Ya. Yurike
Academy of Sciences of the USSR, Tomsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 14, No. 1, pp 39-44 (01/1973).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1, 48-55 (January 1973)
The discharge from a metallic edge along the surface of a dielectric with dielectric constant of the order of 100 or larger is investigated. The dependences of the rate of expansion of the discharge, the time lag, and the volt-ampere characteristics are determined for exposure times of the order of 1E-9 sec for plates made of barium titanate, titanium dioxide, and steatite ceramic with thickness of the order of 1 mm or less at voltages up to 1.5 kV of different polarity. The average rate of expansion of the figure of luminosity after a time of <=3 nsec is equal to 1E6 cm/sec in order of magnitude. It is shown that from a negative point that discharge is initiated by the self-electron emission current, while from a positive point it is initiated by the self-ionization current. The basic equations are given for a commutator utilizing surface discharge from a large number of points. 7 Refs.
Primary Keywords: Surface Discharge Development; Large Dielectric Constant; Discharge Expansion Rate; Volt-ampere Characteristics; Self-electron Emission Current; Self-ionization Current
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10171
(PARTICLE BEAMS, ELECTRON; INSULATION, MAGNETIC)
(Generation)
EXPERIMENTAL STUDY OF A MAGNETICALLY INSULATED DIODE FOR PULSE LENGTHS TO 1E-5 SEC
I.M. Poltev, V.A. Burtsev, M.A. Vasilevskii and V.I. Engel'ko
Soviet Physics-Technical Physics, Vol. 25, No. 5, pp 570-577 (05/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 944-956 (May 1980)
Results of an experimental study of a magnetically insulated high-current diode are presented. It is demonstrated that the length of an electron current pulse in such a diode can be limited by breakdown along the surface of the accelerator chamber, caused by electrons escaping to the surface of the tube. Magnetic insulation of the accelerator has made it possible to achieve pulse lengths >=1E-5 s at voltages <=400 kV across the tube with electron beam currents of 5 kA. The study includes the dependence of the diode characteristics on the strength and the distribution of the magnetic field in the accelerating gap. The feasibility of using multiple-point large-surface-area cathodes to form cylinder electron beams is demonstrated. 9 Refs.
Primary Keywords: Magnetically Insulated High-current Diode; >=1E-5s Electron Current Pulse Lengths; <=600 kV Voltages; 3-4 kA Electron Beam Currents; Cylindrical Electron Beams; Multiple-point Large-surface-area Cathodes; Electron Flux
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10174
(BREAKDOWN STUDIES: SWITCHES, CLOSING)
(Vacuum, Electrical; Vacuum Gaps, Electrical)
FORMATION OF NEW EMISSION CENTERS ON THE CATHODE IN THE PROCESS OF SWITCHING ELECTRICAL CURRENT IN A VACUUM. III. THE EFFECT OF A TRANSVERSE MAGNETIC FIELD
D.I. Proskurovskii and V.F. Puchkarev
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 25, No. 10, pp 1235-1239 (10/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 2120-2126 (October 1980)
The formation of emission centers (EC) on the cathode when electrical current is switched in a transverse magnetic field is studied. It is shown that new EC arise in the direction of the plasma drift and they move with a velocity approximately 3E6 cm/s. The mechanism for their origin is discussed. A qualitative model is proposed for explaining EC, associated with anomalous motion of the cathode spot of the vacuum arc. 18 Refs.
Primary Keywords: Vacuum Breakdown; Emission Center Formation; Transverse Magnetic Field; Plasma Drift; Cathode Spot Motion; Closing Switch

10175
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Surface Flashover; Solid)
MICRODISCHARGES ON THE SURFACE OF A DIELECTRIC IN A VACUUM
E.N. Abdullin and S.P. Bugaev
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Journal, Vol. 18, No. 2, pp 260-262 (02/1975).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 18, 132-134 (February 1975)
It has been previously shown that for a slow rise in the voltage on a dielectric located in a vacuum, a predischarge current is observed. This current has two components. One of them changes slowly in time, and its amplitude does not exceed 1E-11 to 1E-7 A, while the other consists of brief current surges of amplitude up to 1E-3 A. The experiments conducted previously indicate the important role of the constant component of the predischarge current in preparing the flashover process. Meanwhile, the reasons for the appearance of and the role of the microdischarges (self-extinguishing current surges which do not lead to breakdown) remain unclear. 7 Refs.
Primary Keywords: Microdischarges; Predischarge Current; Dielectric Constant; Microscopic Spikes; Surface Dielectric Strength Increase

10177
(REVIEWS AND CONFERENCES; BREAKDOWN STUDIES)
(Conferences; Exploding Wires)
EXPLODING WIRES: VOLUME IV
W.G. Chace (Ed.) (1) and H.K. Moore (Ed.) (2)
(1) AFCRL, Bedford, MA 01730
(2) Lowell Technological Institute Research Foundation, Lowell, MA
Publisher: Plenum Press, New York (01/1968).
This book is the record of the Conference on Exploding Wire Phenomena held October, 1967 in Boston, MA. As in previous cases, this volume contains papers on the relation of shock waves and exploding wires; or uses, particularly as exploding bridge wires; on chemical reactions induced by wire explosions; and on the general theory of the wire explosion itself. In addition, several new areas are covered. There are two papers on the resistivity-density relation in wire explosions. There are papers on the use of lasers and also on the use of x-rays for the study of exploding wires. Spectroscopy as applied to wire explosions is discussed in four papers. 286 Refs.
Primary Keywords: Exploding Wire; Vaporization Wave; Comparison To Spark Discharge; Optical Output; Magnetic Field; Standing Wave; Diagnostics

10178
(ELECTROMAGNETIC FIELD GENERATION; REVIEWS AND CONFERENCES)
(Magnetic; Reviews)
PULSED HIGH MAGNETIC FIELDS
H. Knoepfel
Lab Gas Ionizzati, Euratom-CHEN, Frascati, Italy
Publisher: North-Holland Publishing Co.-Amsterdam (01/1970).
This book considers all aspects of magnetic field generation. The author proceeds from a short discourse on electromagnetic field theory to a thorough presentation on practical magnetic field generation. Field generation using capacitor banks, inductive stores, and flux compression are all discussed in detail. Aspects such as conductor deformation and vaporization are considered. A section on magnetic field and current measurement is included. 405 Refs.
Primary Keywords: Magnetic Field Generation; Field Theory; Capacitor Bank; Inductive Store; Flux Compression, Field Effects, Conductor Deformation; Magnetic Pressure; Field Diagnostics

10179
(PARTICLE BEAMS, ELECTRON)
(Generation)
THE 'TEREK-2' HIGH-CURRENT PULSED ELECTRON ACCELERATOR
Yu.F. Bondar, B.M. Koval'chuk, A.M. Rybalov and P.S. Strelkov
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 17, No. 1, pp 17-19 (02/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 25-27 (January-February 1974)
A pulsed electron accelerator having a current-pulse amplitude of up to 10 kA and a pulse length of 30 nsec is described. The energy of the electrons in the beam may be controlled smoothly from 200 to 550 keV. The structural peculiarities of the accelerator allow injection of a beam into a quasi-stationary magnetic field without introducing substantial distortions into the field. 7 Refs.
Primary Keywords: 10 kA Current-pulse Amplitude; 30 nsec Pulse Length; 200-550 keV Beam Energy; High-current Pulsed Electron Accelerator, Pulse Autotransformer, Double Shaping Line

10180
(BREAKDOWN STUDIES: INSULATION, MATERIAL)
(Surface Flashover; Solid)
BEHAVIOR OF COMPOSITE INSULATION UNDER THE ACTION OF SUPERFICIAL ARCS. APPLICATION TO LINE INSULATORS
B. Ai, C. Huraux and A.M. Rahal
Toulouse Univ. (France). Lab. de Genie Electrique.
Final Report. No. PUBL-378, 21p (12/1978).
Availability: N80-17375/0
NTIS
Laboratory measurements were made in order to define the flashover mechanism observed on high voltage line insulators. Surface discharge propagation is considered to be due to the build-up of pollutants on the insulator surface. The laboratory apparatus, consisting of an open channel filled with an electrolyte, is described. This device represents a linear model of the electric equation under study. Variables are arc length, extent of polluted surface, and type as well as resistance of the electrolyte. Results determine experimentally the lowest voltage at which an arc sufficient to short-circuit the electrolyte develops. Some possible applications of this data to the improvement of insulators are then discussed.
Primary Keywords: Flashover; Insulators, Power Lines; Surface Stability; Electric Arcs, Electrical Insulation; Electrolytes; Electrostatic Charge; High Voltages; Impurities
Secondary Keywords: IN FRENCH; NTISNASAE; NTISFNFR

10181
(ELECTROMAGNETIC LAUNCHERS)
(Exploding Wires
ELECTRIC GUN: A VERSATILE TOOL FOR HIGH-PRESSURE SHOCKWAVE RESEARCH
H.H. Chau (1), G. Dittbenner (2), W.W. Hofer (2), C.A. Honodel (2), D.J. Steinberg (2), J.R. Stroud (2), R.C. Weingart (2) and R.S. Lee (2)
(1) Lawrence Livermore Lab, Livermore, CA 94550
(2) Kansas State University, Manhattan, KS 66502
The Review Of Scientific Instruments, Vol. 51, No. 12, pp 1676-1681 (12/1980).
We have developed a versatile tool for generating planar shock waves. This system, which we call the electric gun, is capable of projecting thin flyer plates with velocities in the range 1-20 km/s. It is presently being used in high-explosives-initiation experiments and is being developed for equation-of-state measurements in the 1-5 TPa range. We describe the electric gun facilities that are operational at Lawrence Livermore Laboratory and discuss applications of electric gun technology to problems of interest to shock-wave researchers. 13 Refs.
Primary Keywords: Dielectric Pellet Launcher; Exploding Wire; Shock Wave; 20 kM/sec Velocity, Plastic/metal Laminate

10182
(BREAKDOWN STUDIES)
(Electrodes)
ELECTRODE MATERIAL RELEASE DURING HIGH VOLTAGE BREAKDOWN (FINAL REPORT)
G.H. Lohnert, T.B.I. Mc Call and R.T. Schneider
University of Florida, Gainesville, FL
No. NASA-CR-107880, 118p (01/1969).
Availability: N70-17442
NTIS

Primary Keywords: Electrical Faults; Electrodes; Electron Emission; Electric Fields; Electric Potential; Electron Beams; Plasmas (physics); Vacuum Tubes

10183
(DIAGNOSTICS AND INSTRUMENTATION)
(Data Transmission)
HIGH VOLTAGE INSTRUMENT CABLES FOR 650 DEG.C IN-VESSEL BREEDER REACTOR SERVICE
C.P. Cannon
Hanford Engineering Development Lab., Richland, WA.; Department of Energy.
No. CONF-791037-5, 16p (07/1979).
Availability: HEDL-SA-19[illegible]
NTIS
MgO insulated nuclear instrument cables have been developed for use in the Fast Flux Test Facility (FFTF) and breeder reactor in-vessel environments. Prototype cables have been successfully fabricated and tested. Voltage Breakdown Pulse Noise (BPN) thresholds in excess of 300 Vdc and cable resistivities in excess of 10 exp 8 ohm . ft were achieved at temperatures to 650 exp 0 C. Factors demonstrated to strongly affect breakdown phenomena and insulation resistance in bulk cable were insulation and backfill gas purity (especially as affected by fabrication processing), compaction density, and high temperature annealing. Substitution of copper electrical conductors did not adversely affect cable performance if fabrication parameters were appropriately adjusted. Preliminary gamma irradiation tests on bulk MgO cable indicate that the gamma flux decreases insulation resistance by an order of magnitude to 5 x 10 exp 9 omega . ft at 450 exp 0 C. (ERA citation 05:008478)
Primary Keywords: Electric Cables, Fftf Reactor; Lmfbr Type Reactors; Breakdown, Electrical Insulation; Magnesium Oxides; Performance; Reactor Instrumentation
Secondary Keywords: ERDA/210500; ERDA/220600; NTISDE
Distribution Restriction: Microfiche copies only.

10184
(PULSE GENERATORS; SWITCHES, CLOSING)
(Pulse Forming Lines; Gas Gaps, Electrical)
HIGH VOLTAGE NANOSECOND PULSE GENERATOR
C. Zavales
ECOM, Fort Monmouth, NJ 07703
Interim technical rept. no. 5, 1 May-31 Oct 79 (07/1980).
Availability: AD-A087 291/1
NTIS
A parallel Blumlein circuit, combined with a spark gap switch, was designed for operation at 24 kV, 5,000 A peak. Tests were conducted with a single Blumlein with a 10 ohm load. Because of problems with breakdown in the triggered spark gap, a slightly larger spark gap was substituted. An acceptable pulse is delivered from the pulse forming network after adjustment of the inductive elements in the network. (Author)
Primary Keywords: Pulse Generators; Tea Lasers; Trigger Circuits; Spark Gaps; Electrical Networks, Electrical Loads; High Voltage, Pulse Rate; Transistors
Secondary Keywords: Blumlein Circuits, Avalanche Transistors; NTISDODXA; NTISDODA

10185
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Gas, Electrical: Gas)
HIGH VOLTAGE RESEARCH (BREAKDOWN STRENGTHS OF GASEOUS AND LIQUID INSULATORS) AND ENVIRONMENTAL EFFECTS OF DIELECTRIC GASES. SEMIANNUAL REPORT, APRIL 1, 1979-SEPTEMBER 30, 1979
L.G. Christophorou, D.R. James, R.Y. Pai, R.A. Mathis and I. Sauers
Oak Ridge National Lab., Oak Ridge, TN 37830
(01/1980).
Availability: ORNL/TM-7173
NTIS

A number of gas mixtures are suggested for industrial-scale testing. Electron attachment rates were measured and unfolded to give attachment cross section functions for CCl sub 3 F, CCl sub 2 F sub 2 , and CClF sub 3 each in N sub 2 , and for CCl sub 3 F in Ar. Electron attachment rates were measured also for n-C sub 6 F sub 14 in both Ar and N sub 2 . The effects of molecular structure on energy, cross section, and lifetime of negative ion states of organic molecules were considered. A study was made of the potential role of electron detachment in breakdown. The role of dipolar scattering of electrons in inhibiting breakdown was investigated. The nature of synergisms among constituents of a gas dielectric mixture is discussed. Examples are cited from recent breakdown measurements. Breakdown measurements in plane-plane geometry were made for CF sub 4 , 1,1,1-CH sub 3 CF sub 3 , and CHF sub 3 . Similar measurements were conducted with binary mixtures containing one of (c-C sub 4 F sub 8 , SF sub 6) and one of (CF sub 4 , CH sub 2 F sub 2 , 1,1,1-CH sub 3 CF sub 3 , CH sub 2 F sub 2). Of special interest in these results were observed synergisms and the effect of dipole moment on the breakdown strengths. The initial fragmentation of 1,1,2-C sub 2 Cl sub 3 F sub 3 under electron impact was studied. Final decomposition products of sparked SF sub 6 /2-C sub 4 F sub 6 mixtures were identified and quantified. The breakdown products of SF sub 6 were studied. Impulse measurements
Primary Keywords: Chlorinated Aliphatic Hydrocarbons; Dielectric Materials; Fluorinated Aliphatic Hydrocarbons; Fluorinated Aromatic Hydrocarbons; Hexane; Sulfur Fluorides; Anions; Breakdown; Cross Sections; Electric Fields; Electron Attachment; Electron Detachment
Secondary Keywords: ERDA/360603; ERDA/640304; Dielectric Breakdown; NTISDE

10186
(DIAGNOSTICS AND INSTRUMENTATION)
(Systems)
MEASUREMENT TECHNIQUES FOR HIGH POWER SEMICONDUCTOR MATERIALS AND DEVICES. ANNUAL REPORT, OCTOBER 1, 1977-SEPTEMBER 30, 1978
National Bureau of Standards, Washington, DC National Engineering Lab.; Department of Energy.
No. NBSIR-79-1756, 144p (10/1979).
Availability: DOE/RA-0041
NTIS

Results of NBS research directed toward the development of measurement methods for semiconductor materials and devices which will lead to more effective use of high-power semiconductor devices in applications for energy generation, transmission, conversion, and conservation are reported. It responds to national needs arising from the rapidly increasing demands for electricity and the present crisis in meeting long-term energy demands. Emphasis is on the development of measurement methods for materials for thyristors and rectifier diodes. Application of this measurement technology will, for example, enable industry to make devices with higher individual power-handling capabilities, thus permitting very large reductions in the cost of power-handling equipment and fostering the development of direct current (dc) transmission lines to reduce energy waste and required rights-of-way. The major tasks under this project are to evaluate the use of thermally stimulated current and capacitance measurements and other deep level measurement techniques as a means for characterizing lifetime-controlling or leakage source defects in power grade silicon material and devices and to develop procedures to enable spreading resistance measurements of thyristor starting material and layer-profiles to be made on a reliable basis. (ERA citation 05:006099)
Primary Keywords: Semiconductor Devices; Semiconductor Materials; Measuring Methods; Operation; Performance Testing; Research Programs
Secondary Keywords: ERDA/420800; NTISDE

10188
(ENERGY STORAGE, MECHANICAL; ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING; SWITCHES, OPENING)
(Rotating Machines, Inductors; Mechanical; Explosive Fuses)
DESCRIPTION OF THE ENERGY SOURCE PROJECT DELIVERING 1 MEGAJOULE IN 1 MICROSECOND
F. Damideau and C. Rioux
Paris University, Orsay, France
No. LF-3, 17p (04/1972).
Availability: N74-17454/1
NTIS

The project for a high energy source delivering one MJ in one microsecond using a unipolar autoexcited ironless rotating generator is presented. Three subsystems are detailed: (1) the primary source mentioned above, delivering one MJ in 0.1 second with one MA current coupled to a magnetic storage coil, (2) a primary transfer coil with high efficiency (transfer time 100 microsecond and associated switching gear), and (3) a secondary transfer coil to reach one microsecond. Circuit breakers required for the various connections are detailed with regard to mechanical devices and exploding wire techniques. Mutually coupled inductances used for high efficiency transfer are described and the sequence of switch operations detailed.
Primary Keywords: Circuit Breakers; Electric Energy Storage, Electrical Engineering; Electromechanical Devices; Impulse Generators; Electric Fuses; Electric Power Transmission; Electrical Insulation; Energy Conversion Efficiency, Inductance
Secondary Keywords: NASA

10189
(ENERGY STORAGE, MECHANICAL; SWITCHES, OPENING)
(Rotating Machines, Mechanical)
FUSION R/D ON ADVANCED FUELS, HOMOPOLAR GENERATORS, CIRCUIT BREAKERS AND TOKAMAK DIAGNOSTICS
W.E. Drummond
University of Texas at Austin, Electric Power Research Inst., Palo Alto, Calif.
Final rept. (09/1975).
Availability: PB-248 322/0ST
NTIS

The general purpose of this program was two-fold: (1) To investigate theoretically the potential for the use of advanced fuel cycles and direct conversion in Tokamak systems and the development of automated data acquisition systems for tokamaks, and (2) to explore both theoretically and experimentally the potential of homopolar generators and inductive energy storage devices as power supplies for future fusion experiments. The general outline of the program is discussed; a detailed description of the work done in each area is given, and a budget showing the actual expenditures incurred in the performance of the work is given.
Primary Keywords: Nuclear Fusion; Nuclear Fuel Cycles; Circuit Breakers; Energy Storage; Numerical Analysis
Secondary Keywords: Tokamaks, NTISEPRI

10190
(PULSE GENERATORS)
(Trigger)
HIGH SPEED TRIGGER SYSTEM FOR TOTAL DEPOSITED ENERGY MEASUREMENT IN A LIQUID ARGON CALORIMETER
J.E. Grund
Stanford Research Institute, Menlo Park, CA 94025
No. CONF-781033-28, 5p (10/1978).
Availability: SLAC-PUB-2216
NTIS

A system to produce trigger signals measuring the total energy deposited in the liquid argon/lead shower counters of the SPEAR Mark II Detector at the Stanford Linear Accelerator Center is described. The trigger signals are developed by summing, filtering, and discriminating the signals from several thousand preamplifiers connected to the liquid argon detector strips. The system requirement of trigger information 430 ns after a particle has entered the shower counter led to a special filter design in which a leading edge sampling technique was utilized. A filtered signal representing the total deposited energy is measured by a fast level discriminator that is strobed in synchronization with the e exp + e exp - beam crossings of the SPEAR storage ring. This sampling of the filtered waveform produces a digital output that is delivered to the trigger logic. (ERA citation 04:024387)
Primary Keywords: Shower Counters; Trigger Circuits; Amplifiers; Argon; Design; Efficiency; Filters; Liquids; Logic Circuits; Preamplifiers; Signals; Stanford Linear Accelerator Center
Secondary Keywords: ERDA/440104; ERDA/430303; NTISDE

10191
(BREAKDOWN STUDIES)
(Electrodes)
HIGH VOLTAGE BREAKDOWN INITIATED BY PARTICLE IMPACT
J.F. Friichtenicht, D.O. Hansen and J.C. Slattery
Space Technology Labs Inc, Redondo Beach, CA
No. NASA-CR-63185, 9p (04/1965).
Availability: N65-25407
NTIS

Primary Keywords: Electrode; Gap; Impact; Particle; Voltage Breakdown; Acceleration; Breakdown; Dependency; Experiment; Formation; Gas; High Voltage; Polarity; Steel; Stress; Voltage

10192
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, Electrical; Vacuum Gaps, Self)
EMISSION CHARACTERISTICS OF AN EXPLOSIVE GALLIUM CATHODE
G.N. Fursei and V.M. Zhukov
A.A. Zhdanov Leningrad State University, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 6, pp 804-807 (12/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 1280-1286 (June 1974)

The temporal characteristics and emission properties of the initial stages of vacuum breakdown are studied. An attempt is made to distinguish processes related to the parameters of the external circuit from those due directly to the emission properties of the cathode. The delay times and switching times are measured during the development of vacuum breakdown on the surfaces of liquid and solid gallium with a limited emitting surface and on extended electrodes. The explosive-emission current displays saturation due to the limited cathode emissivity. 10 Refs.
Primary Keywords: Vacuum Breakdown; Explosive Cathode Emission; Temporal Resolution; Delay Measurement; Switching Time Measurement

10193
(BREAKDOWN STUDIES)
(Electrodes)
HIGH-VOLTAGE CHARACTERISTICS OF A LARGE-GAP COAXIAL-CYLINDER ELECTRODE
K.F. Koral
Lewis Research Center, Cleveland, OH
No. NASA-TN-D-3949, 24p (05/1967).
Availability: N67-24617
NTIS

The splicing and termination of underground electrical distribution cable requires that the integrity of cable conductor and insulation be maintained throughout its length. A large number of commercial cable splice and termination kits are available which are cleared to fulfill these requirements. The Civil Engineering Laboratory (CEL) was requested to investigate the suitability of these kits for use at Naval shore facilities. Of special interest were the slip-on cable splice and cable termination for solid dielectric insulated cable. These slip-on devices proved to be the easiest and fastest to install with good reproducibility, and the electrical characteristics were as good as, or better than, the other types of cable splice and cable termination kits tested. (Author)
Primary Keywords: Concentric Cylinder, Electrode: Performance Characteristics; Conditioning; Current; Electrogenerator; High Voltage; Insulation; Leakage; Micropulsation; Rate; Solid; Vacuum

10194
(INSULATION, MATERIAL)
(Solid)
DESTRUCTION OF POLYMER DIELECTRICS BY PARTIAL DISCHARGES
M.A. Bagrov, M.A. Kurbanov and E.A. Garagashev
Institute Of Physics, Academy of Sciences of the Azerbaidzhan SSR, Baku, USSR
Soviet Physics-Technical Physics, Vol. 20, No. 1, pp 55-57 (07/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 93-96 (January 1975)
The influence of the energetic characteristics of individual microscopic discharges on the destruction (erosion) of polyethylene has been studied. The destruction of a polymer dielectric by partial discharges is shown to be due primarily to the energy which is transferred directly to the surface of the dielectric where it is in contact with the microscopic discharges. 5 Refs.
Primary Keywords: Polyethylene Insulation; Partial Discharges; Insulation Destruction; Microscopic Discharge; Energy Release

10198
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
THERMAL ANODE INSTABILITY IN THE PREBREAKDOWN STAGE OF VACUUM BREAKDOWN
V.A. Nevrovskii
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 11, pp 1317-1322 (11/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 2301-2308 (November 1978)
Local anode heating by the prebreakdown field-emission current is studied. Evaporation of the anode and of adsorbed films on the anode is examined. In the prebreakdown stage of vacuum breakdown, the anode heating can become unstable even before an electron-ion avalanche appears in the vapor. This instability is due to the additional heat evolution at the anode which results from increased electron current associated with ionization of the vapor produced by the hot anode. 28 Refs.
Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Anode Heating; Metal Vapor; Electron Avalanche; Ion Avalanche

10199
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Electrodes)
MOTION OF THE CATODE SPOT OF A VACUUM ARC IN AN INHOMOGENEOUS MAGNETIC FIELD
I.I. Aksenov and A.A. Andreev
Khar'kov Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Soviet Technical Physics Letters, Vol. 3, No. 12, pp 525-526 (12/1977).
Trans From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 3, 1272-1275 (December 1977)
6 Refs.
Primary Keywords: Vacuum Arc; Cathode Spot; External Magnetic Field; Spot Motion; Retrograde Motion; Cold Cathode

10200
(ELECTROMAGNETIC COMPATIBILITY)
(Lightning)
LIGHTNING EFFECTS RELATING TO AIRCRAFT: PART II. CHARACTERISTICS OF SIMULATED LIGHTNING FLASHES AND THEIR EFFECTS ON LIGHTNING ARRESTERS AND AVIONIC EQUIPMENT
F.A. Fisher, B. Macchiaroli and D.L. Jones
General Electric Co, Pittsfield, MA 01201
Final rept. 15 Nov 69-15 Oct 71 No. SRD-72-054-2, 94p (01/1972).
Availability: AD-900 245/2ST
NTIS
Measurements were made of the degree to which a lightning arrester could limit the voltage on avionic equipment when an external lightning arrester was struck by a simulated lightning stroke. The tests show that breakdown is not an instantaneous affair, but rather takes many microseconds. Measurements taken near a point which is struck indicate that the air around any protrusions will be in a state of electrical breakdown whenever the electrical field strength at the aircraft surface approaches 100 kV/meter. Electrical discharges tend to limit the field strength to that value, thus defining the electrical environment to which the avionics equipment is subjected. Data is presented showing how the impedance affects the voltages impressed on avionic equipment both a the spark gaps in the protecting lightning arrester break down. Measurements were made of the spectral density of radiation from long electrical arcs used to simulate lightning strokes to aircraft. The relative amplitude at different frequencies seems to agree with that observed from natural lightning, falling at a 1/f rate in the vicinity of 1 MHz. (Author-PL)
Primary Keywords: Lightning Arresters_Aircraft; Airframes_Lightning; Simulation; Burning Rate; Airplane Panels; Sparks; Shock Waves; Composite Materials; Acoustic Impedance; Electromagnetic Shielding; Electric Fields; Electric Arcs; Voltage; Air; Electrodes; Damage
Secondary Keywords: Avionics; F-106 Aircraft; F-4 Aircraft; NTISDODXD
Distribution Restriction: Distribution limitation now removed.

10201
(ELECTROMAGNETIC COMPATIBILITY)
(Lightning)
LIGHTNING EFFECTS RELATING TO AIRCRAFT: PART III. MEASUREMENTS OF LIGHTNING-INDUCED VOLTAGES IN AN F4H-1
J.A. Plumer
General Electric Co, Pittsfield, MA 01201
Fina. rept. Nov 71-Jan 73 No. SRD-72-054-3, 122p (03/1973).
Availability: AD-910 158/5ST
NTIS
Measurements of possible lightning-induced voltages on several electrical circuits within an F4H-1 aircraft are reported. The measurements were made using the transient analysis technique in which simulated lightning currents identical in waveshape but reduced in amplitude from that of natural lightning are passed through the aircraft. The resulting induced voltages are then scaled upward in direct proportion to natural lightning amplitude. When scaled to a scale lightning stroke of 200,000 amperes as described in MIL-B-5087B, Para. 3.3.4.5, voltages induced in the measured circuits ranged between several millivolts and several thousand volts. Factors influencing the susceptibility of a particular circuit included circuit routing, function, electrical return path and exposure to direct contact with lightning currents at extremities such as NAV lights and pitot heaters. The circuits receiving the highest induced voltages include those in which associated components have been damaged as reported in actual F-4 lightning stroke incident reports. The results indicate that a combination of voltage limiting spark gap devices and lower voltage surge suppressors may be effective in limiting many of these voltages to safe levels, but the maximum transient voltage withstand levels of connected avionic and power system equipment should be determined before maximum safe voltage limits can be established. The advent of solid state avionics and nonmetallic structural materials in future
Primary Keywords: Lightning_Jet Fighters; Jet Fighters_Electrical Equipment; Transients; Damage Assessment; Voltage; Simulation; Electric Discharges; Electronic Equipment; Composite Materials; Circuits; Interference; Lightning Arresters; Electromagnetic Compatibility
Secondary Keywords: Avionics; F-4 Aircraft; Lightning Strikes. Sidewinder; NTISDODXD
Distribution Restriction: Distribution limitation now removed.

10204
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
R.F SHIELDING PERFORMANCE OF REINFORCED METAL FILLED CONDUCTIVE PLASTIC FLAT GASKETS
J.E. Ehrreich and M. Nimoy
Chomerics, Inc., Plainville, MA
IEEE Transactions Or Electromagnetic Compatibility, Vol. 7, No. 1, pp 50-56 (03/1965).
A paper presented at the Fifth Annual Symposium introduced this group to the remarkable R.F. shielding potentials of the electrically conductive plastic materials based on the new types of spherical metal fillers. It was stated in this paper that the conductive plastics have volume resistivities as low as 1E-5 ohm centimeters and, when properly used in a flange, would give total attenuations in the range of 75 to 100 db over the frequency range of 50 kc to 10 Gc. Further testing during the past year has established that these are conservative figures. 1 Refs.
Primary Keywords: Conductive Plastic; EMC Shielding; 100 db Attenuation; 75 kHz-10 Ghz Bandwidth; Easily Machined

10206
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
SHIELDING EFFICIENCY OF ELECTRICALLY CONDUCTIVE PROTECTIVE COATINGS FOR MAGNESIUM AND ALUMINUM SURFACES
A.L. Albin
Fairchild Space and Defense Systems, Syosset, NY
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-6, No. 2, pp 31-35 (07/1964).
Although several proprietory finishes have been available for aluminum and magnesium protection from corrosion, the electrical properties at radio frequencies have never been sufficiently defined. In order to evaluate the relative merits of such finishes for aluminum and magnesium, a test program was established. Fixtures were designed to measure bonding impedance from DC to RF, and to evaluate shielding efficiency and insertion loss from gaskets used in joint interfaces. Marked differences in performance were observed between the radio frequency shielding obtained at radio frequencies and the bonding impedance measurements, indicating that the commonly used criterion of DC or RF bonding impedance is not sufficiently sensitive to provide good control of conductive coatings. Corrosion tests indicated several finishes would be acceptable from both the corrosion and electrical viewpoint. 0 Refs.
Primary Keywords: EMI Shielding; Wideband Measurement; Moving Parts; Corrosion Resistance; Metal Coatings; Life Test

10209
(SWITCHES, OPENING)
(Explosive Fuses)
THE PERFORMANCE OF ELECTRICAL FUSES UNDER IMPULSIVE CONDITIONS I:DC SUPPLIES
C.P. Wheeler
Imperial College Of Science And Technology, London, UK
Journal Of Physics D: Applied Physics, Vol. 5, No. 1, pp 133-140 (01/1972)
The action integral is used to evaluate the rupturing times and rupturing currents of fuse elements in inductive circuits. With a suitable choice of variables it is shown that all fuses and circuits can be represented by the one equation and there is excellent agreement with measurements made on copper fuses. Particular attention is given to the stored magnetic energy at the time of rupture, since this energy has to be dissipated in the ruptured fuse material. Again, with a suitable choice of variables, a general relation between current cut off ratio and pre-arcing energy is derived. The existence of a maximum in this relation has been known for many years but the treatment here puts the whole problem on a general quantitative basis. Impulsive performance is considered in conjunction with steady-state performance in a quest for the best fuse element material. Silver appears to be the outstanding material, with the much-used copper some way down in the list of metals. Finally, the impulsive pressure produced in cartridge fuses is considered and good qualitative agreement with measurements obtained in the case of a treatment based on radiation pressure. 12 Refs.
Primary Keywords: Explosive Fuse; Inducti Creepage Discharge; Tap Water; Dielectric Surface; Flange Length; Solid Permittivity; Field Configuration; Pulse Length

10210
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
THE ROLE OF POSITIVE IONS IN HIGH VOLTAGE BREAKDOWN IN VACUUM
H.C.J.C.R.W. Bourne and J.G. Trump
Massachusetts Institute of Technology, Cambridge, MA
Availability: PB-168 912
NTIS

Measurements were made of the electron emission from targets of aluminum, steel, magnesium, copper, gold, and lead when bombarded by ions from hydrogen, helium, nitrogen, xenon, and mercury. The ions, whose energy was varied over the range from 10 to 140 kilovolts, were produced by ionization of the residual gas in the anode electrode and emerged through a small opening into an essentially uniform accelerating field. An initial rapid rise of electron emission with ion energy was followed in all cases by a slow linear increase. The emission ratio varied from 2 to 20 and was maximum for nitrogen ions on steel. The dependence on extractive gradient at the bombarded metal surface was slight and no simple dependence on the nature of the ion or of the bombarded metal was observed. The significance of these measurements on the electron-ion interaction theory of high voltage breakdown in vacuum is discussed. (Author)

Primary Keywords: Ion Bombarement_Vacuum; Secondary Emission_Metals; Electrons; Ions; Voltage; Gas Ionization; Aluminum; Steel, Magnesium; Copper; Gold; Lead; Hydrogen; Helium; Nitrogen; Xenon; Mercury

10211
(PULSE GENERATORS)
(Capacitor Banks)
CURRENT PULSE GENERATOR WITH AMPLITUDE OF 1,000,000 A AND STABILITY OF *OR- 0.001 AT A REPETITION RATE OF TWO HZ
R.F. Bayanov, A.V. Ilin, V.N. Pakin, A.P. Panov and G.I. Silvestrov
FTD Wright-Patterson AFB, OH
No. FTD-ID(RS)T-1291-77, 16p (08/1977).
Trans. From: Trudy Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits, Vol. 1, pp 283-286 (1970) By C.S. Mack
Availability: AD-A049 390/8ST
NTIS

It is often necessary to create powerful generators which operate on an inductive load in order to obtain strong magnetic fields, as well as to use pulsed systems in acceleration equipment. Furthermore, experimental conditions sometimes place limitations on the duration and form of the current pulse and the stability of current amplitude, and also require high operating reliability. This report examines a generator which provides a unipolar sinusoidal current pulse with a base length of 1.2 ms and an amplitude of 1,000,000 amperes. It is stable with precision of + or - 0.001 at a repetition rate of several hertz for an inductive load of 0.1 microhenry.

Primary Keywords: Pulse Generators; Inductance; Acceleration; Magnetic Fields; Gates(Circuits); Reliability(Electronics); Thyristors; Pulse Transformers; Voltage Regulation; Capacitors; Translations; USSR
Secondary Keywords: NTISDODXA

10213
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
POSSIBILITY OF USING A HOMOPOLAR GENERATOR AS A PULSE GENERATOR
A.K. Das Gupta
Regional Engineering College, Rourkela, Orissa, India
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-87, No. 3, pp 650-655 (03/1968)

A homopolar machine has been analyzed to ascertain whether it is possible to use it as a high-current, low-voltage pulse generator. A transient expression for the field flux has been deduced and the time constant determined. The effect of the eddy currents produced in the solid metal body of the machine has been included and an expression for the flux density due to eddy currents has been deduced, as well as an expression for the transient current in the magnetizing coil. 7 Refs.

Primary Keywords: Homopolar Generator; Horizontal Design; Theory; Field Flux Expression; Eddy Currents; Transient Current Calculation
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10214
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
PULSED HIGH-VOLTAGE AND HIGH-CURRENT OUTPUTS FROM HOMOPOLAR ENERGY STORAGE SYSTEM
R.D. Ford, D. Jenkins, W.H. Lupton and J.M. Vitko Itsky
Naval Research Lab, Washington, DC 20375
The Review Of Scientific Instruments, Vol. 52, No. 5, pp 694-697 (05/1981).

Pulsed energy source with a versatile output, using self-excited homopolar generator for the initial storage of energy, has been developed. Large energy storage of this inertial-inductive system provides an attractive option for satisfying pulse power requirements associated with such applications as plasma confinement and heating, electromagnetic acceleration of projectiles, and with production of intense radiation. These applications require high rate of energy delivery to the load at specific current and voltage levels, have been obtained by incorporating unique current interrupting system. The overall pulser efficiency, which depends sensitively on the load characteristics was measured over a range from 10% to more than 90% for different pulser-load circuit arrangements. 10 Refs.

Primary Keywords: Self-excited Homopolar Generator; Inductive Store; Transfer Efficiency; Opening Switch; Load Considerations
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10215
(BREAKDOWN STUDIES)
(Surface Flashover)
TEMPERATURE DEPENDENCE OF SURFACE FLASHOVER VOLTAGE OF POLYETHYLENE IN VACUUM
Y. Ohki and K. Yahagi
Waseda University, Tokyo, Japan
Journal Of Applied Physics, Vol. 46, No. 8, pp 3695-3696 (08/1975).

The surface flashover voltage over cylindrical spacers made of polyethylene in vacuum under impulse voltage application decreases monotonically with increasing temperature of the sample surface. This temperature dependence may be explained well by the mechanism that electrons injected from a cathode-insulator-vacuum junction bombard the sample surface to cause desorption of adsorbed gases and vaporization of sample material, thereby triggering surface flashover. 5 Refs.

Primary Keywords: Surface Flashover; Polyethylene, Vacuum, Impulse voltage; Surface Preparation
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240

10217
(BREAKDOWN STUDIES)
(Gas, Recovery)
ELECTRON ATTACHMENT IN SULFUR HEXAFLUORIDE USING MONOENERGETIC ELECTRONS
W.M. Hickam and R.E. Fox
Westinghouse Research and Development Center, Pittsburgh PA
The Journal Of Chemical Physics, Vol. 25, No. 4, pp 642-647 (10/1956).

Results are presented of an experiment to determine the attachment processes leading to formation of SF/sub 5/ and SF/sub 6/ ions. Monoenergetic electrons were used to determine the attachment cross section for several energies. The significance of the attachment cross section variation is discussed with respect to measuring electron energy distributions. 9 Refs

Primary Keywords: SF/sub 6/ Attachment; SF/sub 5/ Attachment; Attachment Cross Section; Variation With Energy
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10218
(BREAKDOWN STUDIES)
(Gas, Recovery)
INVESTIGATIONS OF THE PROPERTIES OF SF/SUB 6/ AS AN ARC QUENCHING MEDIUM
W. Hertz, H. Motschmann and H. Wittel
Siemens AG Research Lab, Erlangen, FRG
Proceedings Of The IEEE, Vol. 59, No. 4, pp 485-492 (04/1971).

The results of experiments on stationary and nonstationary arcs in SF/sub 6/ are summarized. High temperature gas properties, like the electrical and thermal conductivity as well as the theoretically predicted plasma demixing effects, are determined by electrical and spectroscopic measurements. Investigations on interrupted DC arcs give insight into the energy transport mechanism of the arcs. The transient temperature behavior of gas blast interrupted arcs is measured. Finally, the application of the investigations to circuit breaker arcs is discussed. The following principal results have been found. From the lower time constant of blown N/sub 2/ arcs in comparison to SF/sub 6/ arcs above 10000 K it follows that the good quenching properties of SF/sub 6/ must be due to processes taking place below 10000 K. This agrees also with the time-constant measurements in the interrupted cascade arc: at lower temperature-below approximately 8000 K-the conductance decay in N/sub 2/ is very much slower than in SF/sub 6/. 13 Refs.

Primary Keywords: SF/sub 6/ Arc Quenching Properties; High-temperature Electrical Conductivity; Thermal Conductivity; Energy Transport; DC Arc Interruption; AC Arc Interruption; Gas Blast Circuit Breaker
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10219
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE INFLUENCE OF GAS STREAMS AND MAGNETIC FIELDS ON ELECTRIC DISCHARGES: PART 5-ARCS AT PRESSURES UP TO 18 ATMOSPHERES IN ANNULAR GAPS
V.W. Adams
Aeronautical Research Council (Gt. Brit.)
No. ARC-CP-983, 22p (01/1968).
Availability: N69-13425
NTIS

Primary Keywords: Angular Velocity; Arc Discharges; Gas Streams; Magnetic Annular Arc; Magnetic Fields; Carbon Arcs; Electric Arcs; Nitrogen; Pressure Effects; Propagation Velocity; Rotation; Spark Gaps

10220
(PULSE GENERATORS)
(Capacitor Banks)
HIGH VOLTAGE, HIGH CURRENT, PULSED ENERGY SOURCE HAVING DI/DT'S OF 2E12 A/S
L.C. Burkhardt, R.S. Dike, J.N. DiMarco, R.A. Haerman and A.E. Schofield
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-751125-51, 4p (01/1975).
Availability: LA-UR-75-2129
NTIS

A hybrid transfer capacitor circuit, combining one back-biased and a forward-biased capacitor bank, plus a resistor (for damping and isolation) and an inductive load has achieved inductive-storage, explosive fuse-like rates of rise, and peak amplitudes, of currents. Initial dI/dt's of approximately 2E12 A/s are measured, with currents in the 200 kA range. The combination of explosive fuses and magnetic energy storage has been successfully used at Los Alamos Scientific Laboratory to obtain currents with risetimes of 2E12 A/s and of 200 kA magnitude, on both linear and toroidal Z pinches. Such a system must have the characteristic of initially high vector E fields during the formation of the pinch, but with low vector E fields along the plasma chamber's wall after the pinch has been formed. The voltage left on a simple capacitor system will cause secondary wall breakdown, which short-circuits the previously formed pinch. (Conceivably a crowbar of extremely low inductance could then remove the residual voltage; in practice, however, the attendant L/R decay time is too short for most pinch experiments.).

Primary Keywords: Power Supplies_Performance; Energy Storage_Performance; Toroidal Pinch Devices_Power Supplies; Linear Z Pinch Devices_Power Supplies; Capacitors; Switching Circuits
Secondary Keywords: NTISERDA

10221
(PULSE GENERATORS; PULSE GENERATORS)
(Marx, Systems)
HIGH-VOLTAGE SYSTEM FOR THE RISK FACILITY: PART 1. BIPOLAR GENERATOR MODEL OF VOLTAGE PULSES WITH THE AMPLITUDE UP TO 200 KV
L.S. Vertogradov, A.V. Zhelamkov, K. Ryuger and G.A. Shelkov
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1976).
Availability: JINR-R-13-9740
NTIS

A bipolar high-voltage pulse generator intended for supplying large streamer chambers is described. This new type of the generator may be regarded as two Arkadiev-Marx generators assembled so that the first controlled discharger is common for both the generators. This ensures high synchronism of two output pulses as compared with a system consisting of two independent unipolar generators. Test results of a bipolar generator model are presented as histograms and dependences of principal characteristics upon external parameters. Based upon the results obtained the following conclusions have been drawn: output signal amplitudes hardly depend upon trigger amplitudes, optimum operating conditions of the generator with respect to pressure and supply voltage are close to the generator self-triggering region, all the parameters of the generator do not depend upon response frequency ranging from 2 to 6 cps. (Atomindex citation 09:376662)

Primary Keywords: High-voltage Pulse Generators; Streamer Spark Chambers; Capacitors; Diagrams; Electrodes; Frequency Dependence; Performance Testing; Resistors; Spark Gaps
Secondary Keywords: IN RUSSIAN; ERDA/440300; USSR; NTISINIS
Distribution Restriction: U.S. SALES ONLY.

10222
(INSULATION, MATERIAL)
(Gas)

SULFUR HEXAFLUORIDE

J.T. Milek
Hughes Aircraft Co, Culver City, CA 90230
Data sheets No. ds-140, 2p (10/1964).
Availability: AD-607 949
NTIS

A compilation of the electrical properties of sulfur hexafluoride, a dielectric gas, is presented. Electrical properties include corona, dielectric constant, dissipation factor and dielectric strength. The latter property data section is segregated into parameter effects as follows: pressure, gap distance, temperature, electrode configurations and gas mixtures. Each property is compiled over widest possible range of parameters obtained in a thorough search of the world's literature. (Author)

Primary Keywords: SULFUR COMPOUNDS_FLUORIDES; FLUORIDES_SULFUR COMPOUNDS; ELECTRICAL PROPERTIES; DIELECTRICS; DATA; GRAPHICS; DIELECTRIC PROPERTIES; ELECTRONICS

10223
(DIAGNOSTICS AND INSTRUMENTATION; INSULATION, MAGNETIC)
(Voltage)

MEASUREMENT OF MAGNETICALLY INSULATED LINE VOLTAGE USING A THOMSON PARABOLA CHARGED PARTICLE ANALYSER

T.D. Stanley and R.W. Stinnett
Sandia Labs, Albuquerque, NM 87115
No. CONF-810325-1, 24p (01/1981).
Availability: SAND-80-2685C
NTIS

The absence of direct measurements of magnetically insulated line voltage necessitated reliance on inferred voltages based on theoretical calculation and current measurements. This paper presents some of the first direct measurements of magnetically insulated transmission line peak voltages. These measurements were made on the Sandia National Laboratories HydraMITE facility. The peak voltage is measured by observing the energy of negative ions produced at the line cathode and accelerated through the line voltage. The ion energy and the charge-to-mass ratio are measured using the Thomson Parabola mass spectrometry technique. This technique uses parallel E and B fields to deflect the ions. The deflected ions are detected using a microchannel plate coupled to a phosphor screen and photographic film. The Thomson Parabola results are compared to Faraday Cup measurements and to calculated voltages based on current measurements. In addition, the significance of observed positive ions is discussed. (ERA citation 06:017881)

Primary Keywords: Inertial Confinement; Beam Transport; Electric Potential; Ion Beams; Measuring Instruments; Photographic Films; Power Supplies; Thomson Scattering
Secondary Keywords: ERDA/700203; ERDA/700208; NTISDE

10224
(REVIEWS AND CONFERENCES)
(Reviews)

HIGH POWER ELECTRON AND ION BEAM CONFERENCE

J.A. Nation and R.N. Sudan
Cornell University, Ithica, NY 14850
(01/1977).
Availability: CONF-771035-P1
NTIS

Separate abstracts were prepared for each of the 37 included papers. (ERA citation 04:037945)

Primary Keywords: Electron Beams; Inertial Confinement; Ion Beams; Meetings; Leading Abstract
Secondary Keywords: ERDA/700208; NTISDE

10225
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

HIGH-VOLTAGE PULSE REFLECTION-TYPE ATTENUATORS WITH SUBNANOSECOND RESPONSE

R.J. Thomas
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Instrumentation And Measurement, Vol. IM-16, No. 2, pp 146-154 (06/1967).

Significant advances have been achieved in high-voltage pulse attenuation and measurement fidelity by utilizing the principle of traveling-wave reflection at an abrupt impedance mismatch along a transmission line. Such 'reflection-type' attenuators allow practically distortionless attenuation of the signal, independent of voltage level. Their rise-time response and attenuation factor can be known very accurately because they are free from voltage and temperature effects making them especially suited as high-voltage pulse calibration standards. The rise-time response for such attenuators can readily attain 100 ps or less, a practical limit being about 30 ps. 14 Refs.

Primary Keywords: Voltage Attenuation; Transmission Line Impedance Mismatch; Reflected Wave; Transmitted Wave; Low Distortion; Fast Rise
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10226
(PARTICLE BEAMS, ELECTRON)
(Generation)

INTENSE, NANOSECOND ELECTRON BEAMS

F.M. Charbonnier, J.P. Barbour, J.L., Dyke, W.P. Brewster and F.J. Grundhauser
Field Emission Corp, McMinnville, OR 97128
IEEE Transactions On Nuclear Science, Vol. NS-14, No. 3, pp 789-793 (06/1967).

Pulsed radiation sources of higher intensity and shorter duration are desired to broaden the scope of experimental studies of radiation-induced phenomena. For this purpose, a family of generators has been developed which can produce intense pulsed beams of electrons. The highly reproducible beam is extracted from the accelerating tube through a thin window and can be injected readily into other experimental apparatus. Available pulse durations range from 1 to 50 nanoseconds. The maximum electron energy can be adjusted continuously from 150 to 600 keV, or from 500 keV to 2 MeV, depending on the specific generator. Available peak beam currents range from 1,000 to 10,000 amperes, and the electron output can be varied from 1E13 to 2E15 electrons per pulse. When desired, the output beam can be concentrated magnetically to energy densities in excess of 100 cal/sq.cm., creating shock waves and permitting study of materials under intense transient stress. The basic design concepts, and diagnostic techniques developed or adapted for reliable measurement of the beam characteristics, will be discussed. 0 Refs.

Primary Keywords: E-beam Generation; Marx Generator; Field Emission Diode; Design Considerations
Secondary Keywords: Bremsstrahlung Radiation
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10227
(BREAKDOWN STUDIES)
(Gas, Optical)

INTERACTION OF LASER-INDUCED IONIZATION WITH ELECTRIC FIELDS

J.R. Greig (1), R. Pechacek (1), M. Raleigh (1), I.M. Vitkovitsky (1), R. Fernsler (2) and J. Halle (2)
(1) Naval Research Lab, Washington, DC 20375
(2) JAYCOR Inc, Alexandria, VA 22304
13th AIAA Fluid And Dynamics Conference, Snowmass, CO, Paper 8-1380, 6p (07/1980).

New results are discussed concerning the guiding of a discharge channel by laser beam. The authors utilize a ND:glass laser to guide an electrical discharge over distances up to 2 m. Aresol breakdown by the laser supplies the guiding mechanism. A wide range of guiding distances and delays are studied. 21 Refs.

Primary Keywords: Laser Discharge Guiding; Nd-glass Laser; 2 m Guiding Distance; Variable Distance; Aresol Breakdown; Variable Delay
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10232
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)

A TRIGGERED VACUUM SPARK-GAP SWITCH

L.Th.M. Ornstein, C.A.J. Hugenholtz and H.A. Van Der Laan
FOM-Instituut voor Plasma-Fysica, Rijnhuizen, Jutphaas, The Netherlands
Journal Of Scientific Instruments, Vol. 42, pp 659-661 (08/1965).

A vacuum spark-gap switch which is triggered by plasmoids has been operated in a voltage range from 18 kV to below 50 V. Delays of 75-60 nsec and a jitter below 3 nsec have been found in the most suitable polarity. The self-induction of the switch is about 3.5 nH; the resistance is in the order of 1 million. 11 Refs.

Primary Keywords: Vacuum Spark Gap; Trigatron Configuration; Delay Measurement; Jitter Measurement; Low Inductance; 1 Milliohm Resistance; 50 V-18 kV Operating Range
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10233
RESEARCH AND DEVELOPMENT ON DC CIRCUIT BREAKERS (FINAL REPORT)
G.A. Hofmann, G.L. La Barbera, N.E. Read and L.A. Shillong
Hughes Research Labs, Malibu, CA 90265
(02/1977).
Availability: EPRI-EL-379
NTIS

The development of a laboratory prototype of an HVDC circuit breaker and testing of this prototype on the Pacific NW-SW DC Intertie is described. A new concept in breaker configuration was implemented and tested. The fundamental difference from previous concepts was the use of separate devices to perform the following breaker functions: carrying the continuous current; interrupting fault or load current; and absorbing energy. A unique electronic interrupter was developed which is capable of interrupting over a thousand amperes against one hundred kilovolts. An ultra-fast, in-line mechanical switch, capable of full opening (1 in.) in 1.6 milliseconds, was developed and tested on a power system. (ERA citation 02:034031)

Primary Keywords: Circuit Breakers; Hvdc Systems: Design; Performance Testing; Research Programs
Secondary Keywords: ERDA/200302; NTISEPDAP

10234
A TECHNIQUE FOR MEASURING NON-SQUARE PULSED HIGH VOLTAGES TO +OR- 0.25 PERCENT ACCURACY

J.W. Holm-Hennedy and T.P.C. Ku
University of California, Los Angeles, CA 90024
Final rept. (02/1972).
Availability: PB-206 686
NTIS

An accurate technique for measuring a wide range of pulsed voltages and currents of large magnitude (kilovolts and amps) and short duration at either low or high repetition rates is described. The technique is accurate for both square and nonsquare pulses. The technique is particularly useful for measuring the J-E characteristics (current density - electric field) of semiconductors at high electric fields. The unknown voltages are matched on a CRO to voltage-divided zener diode limited pulses which are accurately known. The sample circuit and reference pulse circuits are given. (Author)

Primary Keywords: Semiconductors_Electrical Measurement; Tests; Current Density; Electric Field; Electric Potential; Pulse Circuits

10235
(BREAKDOWN STUDIES)
(Gas, Products)

ARC STABILITY OF ELECTRONEGATIVE GASES

J.P. Manion, J.A. Philosophos and M.B. Robinson
Allis-Chalmers, Milwaukee, WI
IEEE Transactions On Electrical Insulation, Vol. EI-2, No. 1, pp 1-10 (04/1967).

The decomposition of electronegative gases in electric discharges was studied to determine relative chemical stabilities and the effect of the discharge on dielectric strength. Rate of disappearance of the parent molecule and variation in dielectric strength with arcing time were determined. Good correlation was noted between atomic composition, molecular complexity and stability of the gases to discharge. In the fluorocarbon series the partial substitution of chlorine for fluorine or an increase in molecular complexity by the introduction of the carbon-carbon bond resulted in decreased discharge stability. The major gaseous product of all fluoro- and chlorofluoro-carbons studied was CF_4 which was itself almost unaffected by the discharge. A group of molecules of relatively simple structure was found to possess a unique degree of discharge stability. 18 Refs.

Primary Keywords: Gas Breakdown; Breakdown Products; Several Gases; Prebreakdown Stability vs Molecular Complexity; Fluorocarbon Gases; Simple Gases
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10236
MILLIMICROSECOND TRIGGERING OF HIGHVOLTAGE SPARK GAPS
G.A. Theophanis
Avco Corp, Wilmington, MA
No. rad-9-TM-59-52, 2p (09/1959).
Availability: AD-608 984
NTIS
Pulse transformers are often employed in circuits which are used to trigger spark gaps. There are limitations in the use of this type of generator when a high degree of accuracy is desired. To operate large-area, high-power light sources with Kerr cell shutters for the photography of high-velocity particle impacts, synchronization of the light source and shutter must be accomplished with a jitter of no more than a few millimicroseconds. Pulse requirements and spark-gap conditions for millimicrosecond triggering are defined. Several transformerless, trigger-pulse generators are described. One of these has been used to trigger 50-kilovolt spark gaps with jitter times as low as 2 millimicroseconds. A number of techniques for synchronizing the firing of spark gaps are discussed, and some uses of these techniques are given. Several methods for pulsing Kerr cells using accurately triggered spark gaps are also described. (Author)
Primary Keywords: TRIGGER CIRCUITS_SYNCHRONIZING SWITCHES; SYNCHRONIZING SWITCHES_TRIGGER CIRCUITS; KERR CELLS; ELECTROMAGNETIC PULSES; TRANSFORMERS; PULSE GENERATORS; HIGH-SPEED PHOTOGRAPHY; SPARKS
Secondary Keywords: SPARK GAP TRIGGER CIRCUITS

10237
THE LEADING-EDGE PRINCIPLE WITH PULSE TRANSFORMERS: REDUCTION OF THE CONTROL RESOLUTION BY A LOW NOISE LEVEL HIGH SPEED PREAMPLIFIER
W. Michaelis
National Aeronautics and Space Administration, Washington, DC
Zur Leading Edge-methode Mit Impulstransformatoren. Erniedrigung Der Ansprechschwelle Durch Einen Rauscharmen Schnellen Vorverstarker No. NASA-TT-F-11930, 11p (10/1968)
Availability: N69-10646
NTIS
Primary Keywords: Preamplifiers; Signal Processing; Transformers; Low Noise; Scintillation Counters

10238
COMBINAION OF PBFA I LINES IN A DISK FEED
J.T. Crow and G.D. Peterson
Sandia Labs, Albuquerque, NM 87115
No. SAND-81-0778C, 6p (01/1981).
Availability: DE81028213
NTIS
Sandia National Laboratories Particles Beam Accelerator PBFA I has 36 radially converging magnetically self-insulated triplate transmission lines. Each of these magnetically insulated transmission lines (MITL's) has a tapered section at the output which changes the configuration from triplate to coaxial. Some ion diodes proposed for testing on PBFA I are cylindrically symmetric about the machine center and require the combination of the individual PBFA I lines a triplate disk feed. The combination of many MITL's presents two potential problems. There is the possibility that an early pulse from one line might reflect into nearby lines destroying the magnetic insulation in these lines. A computer simulation of a two-line combination showed serious losses, but the line coupling in this 2-D simulation was significantly different. Another possibility is loss of energy in the regions of zero magnetic *field between* individual lines at the beginning of the disk feed. An experiment on PBFA I is reported which combined two MITL's into a sector of a disk which showed current losses of 12% or less in the later line for pulse arrival time differences of zero to 200 ns, and no evidence of significant losses in the regions of low magnetic filed (ERA citation 06:032369)
Primary Keywords: Linear Accelerators; Configuration; High voltage Pulse Generators; Kilo Amp Beam Currents, Mev Range 01-10; Performance; Power Transmission Lines
Secondary Keywords: ERDA/430303; NTISDE

10240
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
A METHOD FOR MEASURING VERY HIGH SPEED TRANSIENT CURRENTS
A.M. Zarem and F.P. Marshall
Naval Ordnance [illegible]stion, Pasadena, CA
The Review Of [illegible]fic Instruments, Vol. 20, No. 2, pp 133-134 (02/1949).
A deflection coil suitable for use in measuring very high speed transient currents is described. When used with a type 912 cathode ray tube operated at a 15,000-volt accelerating potential this coil provides a spot deflection of one inch at approximately 50 amperes of current. A mutual inductance device was constructed to extend the range of measurement of the deflection coil. This device consists of two loops of wire 2/4" in diameter and coaxially positioned with adjustable spacing. The current under study is allowed to flow in one coil, and the other coil is connected to the deflection coil. Results are given of an analysis of the transient response of such a circuit, taking into account increased losses caused by the transient skin effect. Accurate design of a transformer and deflection coil system to meet specific requirements is facilitated by the analysis. The deflection coil and transformer described herein has excellent response for transients as long as two microseconds in duration. 0 Refs.
Primary Keywords: Current Diagnostic; Cathode Ray Tube Current Transformer
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10241
(POWER CONDITIONING)
(Pulse Transformers)
COMPACT TRANSFORMER BASED ON SECTIONS OF COAXIAL CABLE
A.N. Meshkov and V.I. Shishkc
Instruments And Experimental Techniques, Vol. 19, No. 5, pp 1460-1462 (10/1976).
Trans. From: Pribory i Tekhnika Eksporimenta 5, 166-168 (September-October 1976)
The possibility is demonstrated of broadening the passband of the transformer using sections of a coaxial cable. The additional transmission lines which shunt the load are in principle inherent in a transformer having the proposed construction are designed in the form of coaxial lines in which the space between the outer and inner conductors is filled with ferrite. The shunting lines have a high impedance, as a consequence of which the dimensions of the transformer and the length of the output connections are reduced. this ensures broadening of the passband in the duration of 1.5 nsec and an amplitude of 20 kV for a repetition frequency 2.5 kHz and transformer dimensions 32 x 64 x 70 mm is obtained at the output of an experimental construction with a turns ratio of three. 6 Refs.
Primary Keywords: Pulse Transformer; Stacked Line Transformer; Finite Loaded Line; 1.5 ns Rise Time
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10243
(PULSE GENERATORS; ELECTROMAGNETIC LAUNCHERS;
(Flux Compression; Railguns)
EXPLOSIVE FLUX COMPRESSION GENERATORS FOR RAIL GUN POWER SOURCES
C.M. Fowler, D.R. Peterson, R.S. Caird, D.J. Erickson, B.L. Freeman and J.C. King
Los Alamos National Labs, Los Alamos, NM 87545
IEEE Transactions On Magnetics, Vol. MAG-18, No. 1, pp 64-67 (01/1982).
A class of explosive magnetic flux compression generators is described that has been used successfully to power rail guns. A program to increase generator current magnitudes and pulse lengths is outlined. Various generator loss mechanisms are discussed and plans to control some of them are outlined. Included are various modifications of the conventional strip generators that are more resistant to undesirable expansion of generator components from magnetic forces. Finally, an integral rail gun is discussed that has coaxial geometry. Integral rail guns utilize the rails themselves as flux compression generator elements and, under ideal conditions, are theoretically capable of driving projectiles to arbitrarily high velocities. Integral coaxial rail guns should be superior in some regards to their square bore counterparts. 9 Refs.
Primary Keywords: Rail Gun; Coaxial Geometry; Flux Compression Generator; Explosive Driver; Component Integration
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10247
(BREAKDOWN STUDIES)
(Exploding Wires)
LIQUID BEHAVIOR OF EXPLODING WIRES
W.G. Chace
AFCRL, Bedford, MA 01730
The Physics Of Fluids, Vol. 2, No. 2, pp 230-235 (04/1959).
Experiments were performed to secure evidence of the mechanism during the early stages of a wire explosion. High-speed (0.3 microsecond) photographs were taken, using a second exploding wire to backlight the first. The results showed no surface irregularities (undulolds) as frequently postulated for the liquid phase of exploding wires. Instead, *the evidence points* to a condition of extreme superheating of the liquid, followed by sudden explosive vaporization ('transplosion'). Striae in the ensuing vapor cloud were found to develop after the explosion is complete. 18 Refs.
Primary Keywords: Exploding Wire; Initial Explosion Stage; Photographic Diagnostic; Surface Irregularity; Wire Vaporization
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10255
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
SURFACE EFFECT IN STRONG MAGNETIC FIELDS. I
O.A. Shneerson
M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 12, No. 3, pp 368-373 (09/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 513-522 (March 1967)
The current distribution in the skin layer is considered in two particular kinds of magnetic fields-one building up exponentially (B/sub i/ approximately t/sup alpha/), the other changing abruptly. The change in resistivity caused by conductor heating and the subsequent transfer of the current into deeper layers of the conductor is taken into account. An approximate solution is obtained which holds in strong magnetic fields (B/sub i/ >= 1E2 T). The depth of the skin layer varies according to x/sub o/ approximately t/sup alpha/sup + 5/ (in weak fields x/sub o/ approximately t/sup .5/, and the current density according to j approximately t/sup -.5/ (in weak fields j approximately t/sup alpha/sup -.5/. The heat content of volume elements of the conductor lying close to its surface is nearly equal to the magnetic-field energy density when alpha=1. 10 Refs.
Primary Keywords: Magnetic Field Generation; Field Interaction With Conductor; Field Diffusion; Conductor Heating; Current Displacement
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10255
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
CRITERION FOR VACUUM SPARKING DESIGNED TO INCLUDE BOTH RF AND DC
Kilpatrick, W.D.
University of California, Berkeley CA
The Review Of Scientific Instruments, Vol. 28, No. 10, pp 824-826 (10/1957).
An empirical relation is presented that describes a boundary between no vacuum sparking and possible vacuum sparking. Metal electrodes and RF or DC voltages are used. The criterion applies to a range of surface gradient, voltage, gap, and frequency that extends over several orders of magnitude. Current due to field emission is considered necessary for sparking, but in addition energetic ions are required to initiate a cascade process that increases the emitted currents to the point of sparking. 14 Refs.
Primary Keywords: Vacuum Breakdown; RF Breakdown; DC Breakdown; Variable Voltage; Variable Gap Spacing; Field Ission; Emperical Relation
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10259
(BREAKDOWN STUDIES; PARTICLE BEAMS, ELECTRON)
(Vacuum, Electrical; Generation)
FIELDS CURRENTS FROM POINTS
C.F. Eyring, S.S. Mackeown and R.A. Millikan
California Institute of Technology, Pasadena, CA
Physical Review, Vol. 31, No. 5, pp 900-909 (05/1928).
The laws governing the extraction of electrons from metals in high vacua by fields, first developed through experiments with crossed wires, then with fine wire cathodes discharging to cylindrical anodes, have been now found to hold throughout for field currents between points and planes. The theory needed for the quantitative determination of the potential gradients at points is here given, and critical gradients then determined experimentally. The generality of the linear relation between log i and the reciprocal of field-strength is experimentally established. 11 Refs.
Primary Keywords: Vacuum Breakdown; Field Emission; Potential Gradient; Crossed Wires; Wire-cylinder Configuration

10260
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
INVESTIGATION OF HIGH-VACUUM ELECTRICAL BREAKDOWN
L.V. Tarasova and V.G. Kalinin
Soviet Physics-Technical Physics, Vol. 9, No. 4, pp 514-520 (10/1964).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 34, 666-675 (April 1964)
Some features of high-vacuum electrical breakdown are investigated for different electrode shapes and materials in various vacuum chambers and in ultra-high vacua in the voltage range 20-300 kV. The pulse coefficients for various pulse shapes and durations from 1E-7 to 9 x 1E-5 sec do not exceed 1.7 as a rule and are independent of distance between electrodes. The delay in the electrical breakdown relative to the instant the voltage is applied may reach several microseconds, but in the majority of cases it is practically absent. 18 Refs.
Primary Keywords: Vacuum Breakdown; Several Electrode Configurations; Several Electrode Materials; Delay Measurement; Voltage Measurement

10261
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, Electrical; Vacuum Gaps, Electrical)
MINIMUM ENERGY FOR INITIATION OF ELECTRICAL BREAKDOWN IN VACUUM
I.N. Slivkov
Soviet Physics-Technical Physics, Vol. 11, No. 6, pp 795-797 (12/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 1084-1086 (June 1966)
The initiation of vacuum breakdown between electrodes of different materials at voltages up to 120 kV by an auxiliary spark is investigated. The minimum energy required to create a pilot spark capable of initiating vacuum breakdown was measured. For an aluminum cathode the minimum energy is 1E-6 J. 1 Refs.
Primary Keywords: Vacuum Breakdown; Different Electrode Materials; 120 kV Gap Voltage; Trigger Spark; Minimum Trigger Energy

10262
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
PHOTOGRAPHIC OBSERVATIONS OF A PREBREAKDOWN DISCHARGE TRANSITION BETWEEN METAL ELECTRODES IN VACUUM
D.J. DeGeeter
Argonne National Lab, Argonne, IL
Journal Of Applied Physics, Vol. 34, No. 4 (Part 1), pp 919-920 (04/1963).
Photomicrographs were made of the electrode gap between a spherical molybdenum anode and a like stainless steel cathode at voltages near the breakdown limit. At a discrete voltage for a particular gap, ionized patches of about 0.05 mm in diameter appeared on the anode surface. These ionized areas increased in luminosity and number with voltage until one or more degenerated into a highly unstable incandescent spot undergoing severe localized heating. Both of these events lead to breakdown at these sites, providing evidence for a complex vacuum breakdown process related to the prebreakdown discharges observed. 7 Refs.
Primary Keywords: Vacuum Breakdown; Prebreakdown Currents; Sphere-sphere Gap; Molybdenum Anode; Stainless Steel Cathode; Anode Spots

10264
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
PRE-BREAKDOWN CONDUCTION IN CONTINUOUSLY-PUMPED VACUUM SYSTEMS
W.K. Mansfield
Nuclear Engineering Lab, London, UK
British Journal Of Applied Physics, Vol. 11, pp 454-461 (10/1960).
Measurements have been made under impulse conditions of the coefficients A', the number of H/sup +/ ions emitted per 250 keV H/sup +/ ion, and B', the number of H/sup -/ ions emitted per 250 keV H/sup +/ ion, for metal surfaces covered with the contaminating layers likely to be formed in continuously-pumped high-voltage apparatus. The values obtained for A' were 1.0, 1.1 and 0.54, and for B' 0.43, 0.24 and 0.44 for copper, aluminum and steel targets respectively. The product of these coefficients is such as to make very probable the hypothesis that pulse discharge conduction in these systems is due to the regenerative exchange of positive and negative ions of hydrogen. The transient nature of this form of conduction is thought to be due to the charging up of the insulating contaminant. 20 Refs.
Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Regenerative Ion Exchange; Insulator Charging

10265
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
PREBREAKDOWN CONDUCTION BETWEEN ELECTRODES IN ULTRA-HIGH AND HIGH VACUUM
L.I. Pivovar and V.I. Gordienko
Soviet Physics-Technical Physics, Vol. 7, No. 10, pp 908-912 (04/1963).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 32, 1230-1236 (October 1962)
The effect of the surface state of the electrodes on prebreakdown conduction was investigated. It was found that after high-temperature heating of the cathode a steady current appears at voltages much less than the microdischarge initiation voltage. The steady current is assumed to be caused by field emission occurring after the heating of the electrodes and after the action of micro-discharges as a result of vacuum etching, which leads to the formation of micro-points on the surface of the electrodes. It was also found that after high-temperature heating of the anode the microdischarge initiation voltage is increased and there is a current due to thermionic emission in the electric field. Oxidation of the anode was found to restore the threshold microdischarge voltage. 10 Refs.
Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Electrode Surface Condition; Cathode Heating; Field Emission; Microprojection

10267
(PARTICLE BEAMS, ION)
(Generation)
SMALL-APERTURE DIAPHRAGMS IN ION-ACCELERATOR TUBES
L. Cranberg and J.B. Henshall
Los Alamos National Labs, Los Alamos, NM 87545
Journal Of Applied Physics, Vol. 30, No. 5, pp 708-710 (05/1959).
An investigation has been made to determine the conditions under which the voltage sustained by a 2-ft length of ion accelerator tube may be made proportional to the length of the tube. It has been found that such linearity may be obtained if the tube is segmented at 4 1/2 in. intervals by diaphragms which are so arranged that no straight path is possible from one end of the tube to the other. No significant deterioration in performance of the tube was observed when axial holes were made in each diaphragm up to 3/4 in. in diameter. The voltage gradient realized on these tests was 60 kv/cm. 4 Refs.
Primary Keywords: Ion Beam Generation; Voltage Linearity; Diaphram Voltage Grader; 60 KV/cm Voltage Gradient

10268
(SWITCHES, OPENING)
(Mechanical)
THE BRIDGE STAGE OF ELECTRODE EROSION IN SWITCHING 1000-5000-A CURRENTS IN VACUUM
V.S. Potokin, V.I. Rakhovskii and V.N. Tikhonov
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 10, No. 10, pp 1424-1427 (04/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1848-1852 (October 1965)
When an electric current is switched off by separating electrodes the entire current passes through the point of last contact. The Joule heat evolved as a result melts the area of current concentration and as the electrodes are further separated this area is formed into a small molten-metal bridge. The study of the bridge stage is interesting, particularly when the contacts are separated in vacuum, because the resulting vapor cloud creates a medium in which a so-called vacuum arc is formed. None of the presently available publications on the bridge stage of erosion treat the behavior of the bridge at very high currents. For these reasons we have studied the bridge stage of erosion that arises when large currents are switched in vacuum. 6 Refs.
Primary Keywords: Mechanical Opening Switch; Current Interruption; Molten Metal Bridge; Vacuum Arc; Electrode Erosion; Tungsten Electrodes

10270
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE ROLE OF INCLUSIONS AND SURFACE CONTAMINATION ARC INITIATION AT LOW PRESSURES
J.T. Mackey and R.A. Dugdale
Atomic Energy Research Establishment, Harwell, Berkshire, UK
British Journal Of Applied Physics, Vol. 17, pp 1025-1034 (08/1966).
This paper is concerned with the initiation mechanism of electric arcs in low-pressure gas discharge apparatus. It is demonstrated experimentally that arcs are initiated at the sites of inclusions in the surfaces of metal cathode probes exposed to a hydrogen plasma. The presence of relatively volatile extraneous contamination is also necessary, however, for arc initiation to occur under the present experimental conditions (hydrogen ion current density 10 A/cu.cm, cathode field 1E5 V/cm. A mechanism for arc initiation involving the production of bursts of cathodic vapour is postulated, in which an essential event is the dielectric breakdown of insulating inclusions. 22 Refs.
Primary Keywords: Gas Breakdown; Low Gas Pressure; Cathode Inclusions; Stainless Steel Cathode; Arc Initiation

10271
(BREAKDOWN STUDIES)
(Exploding Wires)
THE SPECTRAL ENERGY DISTRIBUTION AND OPACITY OF WIRE EXPLOSION VAPORS
J.A. Anderson
Carnegie Mellon University, Pittsburgh PA 15213
Proceedings Of The National Academy Of Sciences Of The U.S.A., Vol. 8, No. 7, pp 231-232 (07/1922).
This paper presents results of a study of the spectra of exploding wires. It is found that a wire exploded between two planes emits a continuous spectrum and the absorption lines of the metal vapor can be studied. Spectra of copper, silver, gold, magnesium, zinc, cadmium, aluminum, tin, lead, tungsten, iron and nickel wires are studied. 3 Refs.
Primary Keywords: Exploding Wires; Absorption Spectrum; Several Wire Matcel Calculation

10272
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
A LOW-INDUCTANCE CONTROLLED VACUUM SPARK GAP OPERATING AT A VOLTAGE OF 100 KV AND CURRENT OF UP TO 1.5 MA
V.B. Ikonnikov, G.A. Kichaeva and P.I. Shkuropat
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 18, No. 6, pp 1798-1800 (12/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 114-116 (November-December 1975)
The construction and characteristics of a low-inductance (15 nH) controlled vacuum spark gap with a working voltage of 1-100 kV is described which commutates currents of up to 1.5 MA. The spark gap has a controllability range 1-100 kV, short actuation time delays 1-0.2 microsecond, and small values of time-delayed scatter. 9 Refs.
Primary Keywords: Vacuum Spark Gap; 1-100 kV Operating Voltage; 1.5 MA Operating Current; Low Jitter; Three Main Electrodes

10273
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, CAPACITIVE; SWITCHES, OPENING)
(Systems, Capacitor Banks; Explosive Fuses)
INDUCTIVE STORE PULSE COMPRESSION SYSTEM FOR DRIVING HIGH SPEED PLASMA IMPLOSIONS
R.E. Reinovsky, D.L. Smith, W.L. Baker, J.H. Degnan, R.P. Henderson, R.J. Kohn, D.A. Kloc and N.F. Roderick
AFWL, Kirtland AFB, NM 87117
IEEE Transactions On Plasma Science, Vol. PS-10, No. 2, pp 73-81 (06/1982).
The Air Force Weapons Laboratory has investigated and developed inductive pulse compression techniques with fuse opening switches for driving high speed plasma implosions. Experiments have demonstrated the delivery of 7.5 MA to a 5-nH load in <200 ns from an initial 1.9-MJ 2-microsecond capacitor bank via inductive pulse compression. Circuit considerations dictate the overall energy efficiency while MHD considerations dictate overall implosion stability and thermalization time. Theoretical considerations along with initial experiment results are presented in this paper. 11 Refs.
Primary Keywords: Inductive Energy Store; Explosive Fuse; 7.5 MA Output Current, Capacitive Energy Store; 1.9 MJ Initial Stored Energy; Experiment; Theory

10274
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Gas, Recovery)
SIMILARITY RELATIONS FOR THE ELECTRIC ARC IN FORCED AXIAL FLOW
K. Ragaller (1) and D.T. Tuma (2)
(1) Brown, Boveri & Co Ltd, Baden, Switzerland
(2) Carnegie Mellon University, Pittsburgh PA 15213
IEEE Transactions On Plasma Science, Vol. PS-9, No. 2, pp 75-79 (06/1981).
The conservation equations of mass, momentum, and energy in different form, Ohm's law, and the experimentally determined dependence of the interruption capability of the arc on current shape are employed to obtain similarity relations for high pressure electric arcs in forced axial flow around current zero. The similarity relations are then applied to assess the validity of laminar and turbulent flow models for the arc by comparing model predictions with experiment. It is found that the laminar flow model quite often predicts arc behavior contrary to experiment, while the turbulent flow model predictions are much more consistent with experiment. Moreover, the similarity relations should also be useful in exploring arc behavior under circumstances not discussed in this work. 12 Refs.
Primary Keywords: Gas Breakdown; High-pressure Arc; Arc Interruption; Axial Flow; Experiment; Theory Conservation Equations; Ohm's Law; Laminar Flow Model; Turbulent Flow Model

10275
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
HIGH FREQUENCY ROGOWSKI COIL RESPONSE CHARACTERISTICS
W. Stygar and G. Gerdin
Fusion Studies Lab, Urbana, IL 61801
IEEE Transactions On Plasma Science, Vol. PS-10, No. 1, pp 40-44 (03/1982).
The high frequency response characteristics of differentiating and self-integrating Rogowski coils have been calculated for arbitrary values of the coil terminating resistance assuming Ampere's law to be valid. Effects due to a reactive terminating impedance are also discussed. When the displacement current is taken into account in the measurement of the current of a charged particle beam, it is found that an effective rise time is introduced into the self-integrating coil response on the order of a/gamma v, where a is the major radius of the coil, v is the velocity of the beam, and gamma=(1 - v/sup 2/c/sup 2/)/sup -1/2. 10 Refs.
Primary Keywords: Rogowskii Coil; Response Characteristic; Frequency Response; Ampere's Law; Terminating Impedance; Current Transformer

10276
(SWITCHES, OPENING; BREAKDOWN STUDIES)
(Mechanical; Gas, Recovery)
MECHANISMS FOR TEMPERATURE DECAY IN THE FREELY RECOVERING GAS BLAST ARC
E. Richley and D.T. Tuma
Carnegie Mellon University, Pittsburgh PA 15213
IEEE Transactions On Plasma Science, Vol. PS-10, No. 1, pp 2-7 (03/1982).
Energy loss mechanisms for the extinguished gas blast arc channel in free recovery are defined and their comparative magnitudes are explored for both N/sub 2/ and SF/sub 6/ gases. The arc channel temperature decay rate is found to follow at least two time constants; one corresponding to the transit time of the channel gas and the other to a later period. In addition, the influence of the gas pressure and of the initial conditions of the arc channel and the surrounding hot gas mantle at current zero on the decay rate of the channel temperature are investigated. 9 Refs.
Primary Keywords: Gas Air Recovery; Gas Blast Arc; Energy Loss; Nitrogen Gas; SF/sub 6/ Gas; Arc Channel Temperature; Variable Gas Pressure

10277
TIME-DEPENDENT ION DIODE PHYSICS AND ION BEAM TRANSPORT IN STABILIZED PLASMA CHANNELS
F.L. Sandel
JAYCOR Inc, Alexandria, VA 22304
Final rept. 19 Jul 79-30 Apr 80 No. JAYCOR-PSD-209-81-001-FR, 55p (01/1981).
Availability: AD-A098 888/1
NTIS
This report summarizes work performed by JAYCOR which has led to significant advances in the understanding of ion diode physics as well as new knowledge of the processes of ion beam transport in the stabilized plasma channel systems previously developed by JAYCOR. The report is divided into three sections. Part A is a comprehensive study of the pinch-beam ion diode. This work was expanded considerably beyond the original scope of the contract and includes studies of anode materials, anode plasma behavior, time-dependent ion beam profiles, beam bunching, ion species and beam neutralization. Part B is a detailed analysis of plasma channel transport experiments in which previously unknown ion energy losses were discovered in the ion diode and/or focusing regions. Part C is a collection of abstracts of papers written during the period of this work.
Primary Keywords: Plasmas(Physics); Ion Beams; Transport Properties; Channels; Stability; Pinch Effect; Diodes; Pulse Generators; Acetates; Vinyl Plastics; Electrical Impedance; Focusing; Shape
Secondary Keywords: Gamble 1 Pulse Generators; NTISDODXA; NTISDODXA

10278
ABSTRACTS OF THE HYDROGEN THYRATRON SYMPOSIUM (4TH), HELD AT SIGNAL COPPS ENGINEERING LABORATORY, FORT MONMOUTH, N. J., NOVEMBER 17 AND 18, 1955
ECOM, Fort Monmouth, NJ 07703
(01/1955).
Availability: AD-660 279
NTIS
Contents: Ratings and new concepts in hydrogen thyratron design; A magnetic assist to hydrogen thyratron switch tubes; A method of paralleling switch tubes for pulsed service; Design notes of high power modulators utilizing hydrogen thyratron types 5948/1754 and VC-1257; Effect of circuit parameters on hydrogen thyratron operating pressures; Contributing factors to hydrogen thyratron jitter; Clipper tube operating parameters in hydrogen thyratron modulators.
Primary Keywords: Thyratrons_Hydrogen; Abstracts; Symposia; Design; Modulators; Performance(Engineering); Clipper Circuits; Electronic Switches; Circuits; Stability; Pulse Modulation

10279
ACCELERATOR TECHNOLOGY PROGRAM. PROGRESS REPORT, APRIL-DECEMBER 1978
E.A. Knapp and R.A. Jameson
Los Alamos National Labs, Los Alamos, NM 87545
(05/1980).
Availability: LA-8350-PR
NTIS
This report presents highlights of activities in the Accelerator Technology (AT) Division from April through December 1978. The report is divided into 10 sections to cover work done by the four groups that make up AT Division (AT-1, AT-2, AT-3, and AT-4). Section I is a brief summary of the whole report. Sections II through VI describe work done by AT-1, the Linac Technology Group. Subjects covered are the Pion Generation for Medical Irradiation Program, the Electronuclear Fuel-Producing Accelerator Program, the Gyrocon rf Amplifier Program, the Electron Linear Accelerator Program, and the Free Electron Laser Program. Section VII covers the Linear Accelerator Beam Dynamics development, and Sec. VIII deals with work with the H exp - Ion Source. Most of the work in Secs. VII and VIII was done by AT-2, the Special Projects Group, although work on factors influencing emittance growth was done by MP-9, and results on emittance growth in the new European Council for Nuclear Research (CERN) linac were reported by an AT-DO/MP-9 team. Section IX concerns the Proton Storage Ring Program for which AT-3, the Storage Ring Technology Group, is responsible. Section X describes the Fusion Materials Irradiation Test (FMIT) Program. This work is done by AT-4, which was organized in April 1978 to design and supervise the construction of the FMIT accelerator. The accelerator team is composed of personnel from AT-4 and the Hanford Engineering Development Laboratory, Richland, Washington. This
Primary Keywords: Lasl; Accelerator Breeders; Accelerator Facilities; Beam Dynamics; Beam Transport; Fmit Linac; Hydrogen Ions 1 Minus; Ion Sources; Lampf Linac; Linear Accelerators; Pion Beams; Proton Beams; Quadrupoles; Research Programs; Rf Systems; Storage Rings
Secondary Keywords: ERDA/430303; NTISDE

10280
AIRCRAFT EMP ISOLATION STUDY
A. Finci, H. Price, P. Chao, S. Mercer and T. Naff
AFWL, Kirtland AFB, NM 87117
Final rept. (07/1980).
Availability: AD-A093 772/2
NTIS
This report presents the results of a preliminary study into methods for electrically isolating the E-4B, the EC-135, and the EC-130 aircraft during EMP tests where the aircraft under test is directly driven by a high-voltage pulser.
Primary Keywords: Electronic Aircraft; Electromagnetic Pulses; Breakdown(Electronic Threshold); Test Methods; Electric Arcs; Pulse Generators; High Voltage; Aircraft Equipment; Airframes; Electric Fields; Intensity; Isolation; Dielectrics; Aircraft; Landing Gear
Secondary Keywords: EC-135 Aircraft; EC-130 Aircraft; E-4B Aircraft; Airplane E-4B; Airplane EC-135; Airplane EC-130; EMP; NTISDODXA; NTISDODAF

10281
THE POSSIBILITY OF THE USE OF LIQUID DISCHARGERS IN HIGH-VOLTAGE NANOSECOND PULSE CIRCUITS
G.A. Mesyats and G.A. Vorob'yev
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-1511-80, 7p (11/1980).
Availability: AD-A092 820/0
NTIS
No abstract available.
Primary Keywords: Commutators; Oils; Breakdown(Electronic Threshold); Spark Gaps; Pulse Generators; Translations; USSR
Secondary Keywords: NTISDODXA; NTISFMUR

10282
MODELLING OF COMPRESSED MAGNETIC FIELD GENERATORS BY EQUIVALENT CIRCUIT APPROACH
M. Jones
Atomic Weapons Research Establishment, Aldermaston, Berkshire, UK
No. AWRE-O-21/80, 54 (07/1980).
Availability: AD-A091 933/2
NTIS

An equivalent circuit model is presented for a helical compressed magnetic field generator. The emphasis has been placed on producing a model which has a short computer run time. Magnetic energy losses due to non-linear field diffusion are taken into account, together with the effects of magnetically-induced conductor motion. Examples of the computer code results are given, together with a comparison with experimental data. (Author)
Primary Keywords: Pulse Generators; Magnetic Fields; Electromagnetic Wave Propagation; Equivalent Circuits; Computerized Simulation; Helical Antennas; Pressure Transducers; Energy Conversion; Explosions; Electric Power; Magnet Coils; Input; Experimental Design
Secondary Keywords: Foreign Technology; NTISDODXA; NTISFNUK

10283
THE ELECTRON BEAM SEMICONDUCTOR (EBS) AMPLIFIER
R.M. True and J.F. Bexendale
ECOM, Fort Monmouth, NJ 07703
Research and development technical rept. No. DELET-TR-80-13, 42p (07/1980).
Availability: AD-A091 283/2
NTIS

The Electron Beam Semiconductor (EBS) concept has existed for three decades; but only within the last decade has an active, well-defined program been underway to develop devices that can operate as high-power radio frequency(RF) amplifiers, fast risetime switches, and current and voltage pulse amplifiers. This report discusses the test procedures, data and results of reliability testing of RF and video pulse EBS amplifiers at Electronics Research and Development Command (ERADCOM), Fort Monmouth, New Jersey. Also, the experimental analysis of the series-connected diode EBS device is described in detail. Finally, the report concludes with a discussion of the state-of-the-art of EBS and future trends of the technology. (Author)
Primary Keywords: Semiconductor Diodes; Current Amplifiers; Control; Electron Beams; Radiofrequency Amplifiers; Pulse Amplifiers; Radiofrequency Pulses; State Of The Art; Reliability(Electronics); Life Tests; Test Equipment; Circuit Analysis
Secondary Keywords: NTISDODXA

10284
DEVICE WHICH TRIGGERS HIGH-VOLT PULSE GENERATOR
I.P. Pekar
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-1934-79, 9p (02/1980).
Availability: AD-A090 985/3
NTIS

No abstract available.
Primary Keywords: Pulse Generators; Trigger Circuits; Spark Gaps; High Voltage; Fixed Capacitors; Translations; USSR
Secondary Keywords: Tripatrons; NTISDODXA; NTISFNUR

10285
STAGE GENERATOR CALCULATION
I.T. Venevtsev, G.M. Skoromnyi and E.I. Revutskii
Akademiya Nauk URSR, Khar'kov Fiziko-Tekhnicheskii Inst. (01/1979).
Availability: KFTI-79-21
NTIS

An engineering calculation of the cascade generator (CG) is made for the two schemes used widely in accelerating techniques, for the stable and pulse regimes of loading. The order of the CG calculation at stable loading is shown, as well as the calculation order at pulse loading for the example of the calculation of high voltage CG(70V, 0.25 A, 500 mu s, 100 Hz). The calculation error is checked at the CG-300 (in operation) and at the low-voltage CG-700 model, and is 1-4% for delta U and deltaU and not worse than 6% for other values. (Atomindex citation 11:508860)
Primary Keywords: Linear Accelerators; Accuracy; Design; Dimensions; Electric Conductivity; Electric Potential; High-voltage Pulse Generators; Numerical Solution; Pulses
Secondary Keywords: IN RUSSIAN; Foreign Technology; ERDA/430300; NTISINIS; NTISFNUR
Distribution Restriction: U.S. SALES ONLY.

10286
ADC DATA ACQUISITION SYSTEM FOR THE ACCELERATOR VICKSI
W. Liebl and M. Martini
Hahn-Meitner Inst, FRG (07/1979).
Availability: HMI-B-309
NTIS

A data acquisition system for experiments with the heavy ions accelerator VICKSI uses fast ADCs with high resolution. The modular CAMAC system used transfers the desired single events in a 'Single Mode' from the ADCs to the computer, while the desired coincidence events from up to 12 ADCs are transfered in a 'Group Mode'. The undesired events are rejected by hardware. This report describes the 'Single Mode' and the 'Group Mode' together with a data check and group checks, and it describes furtnermore an INPUT REGISTER allowing the ADCs to work in both modes simultaneously, as well as a DUAL SHIFT INPUT REGISTER for dual channel measurements in the 'Single Mode'. (Atomindex citation 11:505611)
Primary Keywords: Vicksi; Analog-to-digital Converters; Camac System; Coincidence Circuits; Data Acquisition Systems; Isochronous Cyclotrons; Pulse Circuits
Secondary Keywords: IN GERMAN; Foreign Technology; ERDA/430303; NTISINIS; NTISFNGE
Distribution Restriction: U.S. SALES ONLY.

10287
VECTOR-POTENTIAL FLOW IN RELATIVISTIC BEAM DIODES
D.P. Bacon, S.A. Goldstein, R. Lee and G. Cooperstein
Naval Research Lab, Washington, DC 20375
Memorandum rept. No. NRL-MR-4326, 38p (09/1980).
Availability: AD-A089 135/8
NTIS

Analytic theory, numerical simulations and experiments indicate that a combination of a bias current pinch and an ion induced pinch may allow the efficient pinching of electron beams generated in large aspect ratio diodes. In the new diode geometry, electrons flow radially inward along vector-potential field lines which lie close to the anode. As these electrons do not touch the anode, there is no plasma formation and consequent loss of energy to accelerated ions. Entering a region close to the axis in which an anode plasma does exist, these electrons undergo an ion induced pinch to still smaller radii. Since the bulk of the flow occurs along vector-potential field lines, we have coined this new diode the Paravector-potential diode. (Author)
Primary Keywords: Electron Guns; Beam Forming; Diodes; Aspect Ratio; High Voltage; Pinch Effect; Relativity Theory; Potential Flow; Vector Analysis; Bias; Pulse Generators
Secondary Keywords: Gamble 2 Pulse Generators; NTISDODXA

10288
LOW JITTER SPARK GAP SWITCH FOR REPETITIVELY PULSED PARALLEL CAPACITOR BANKS
G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
No. CONF-800640-2, 8p (01/1980).
Availability: SAND-80-0456C
NTIS

A two-section air insulated spark gap has been developed for switching multi-kilojoule plus-minus charged parallel capacitor banks which operate continuously at pulse rates up to 20 pps. The switch operates with less than 2 ns jitter, recovers its dielectric strength within 2 to 5 ms and has not shown degraded performance in sequential test runs totaling over a million shots. Its estimated life with copper electrodes is > 10 exp 7 shots. All preliminary tests indicate that the switch is suitable for continuous running multi-kilojoule systems operating to at least 20 pps. (ERA citation 05:029532)
Primary Keywords: Linear Accelerators; Experimental Data; Graphs; Performance; Pulse Generators; Spark Gaps; Switching Circuits
Secondary Keywords: ERDA/430303; NTISDE

10289
SYNCHRONIZING THE START OF 400-KV VOLTAGE PULSE GENERATOR (GIN-400) AND MEASURING CIRCUIT DURING OSCILLOGRAPHING OF SHORT-TERM PROCESSES
M.I. Barash, I.S. Lavover and G.I. Chumakov
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-1860-79, 14p (12/1979).
Availability: AD-A087 879/3
NTIS

No abstract available.
Primary Keywords: Oscilloscopes; Electronic Scanners; Synchronization(Electronics); Translations; USSR
Secondary Keywords: Dual Beam Oscillographs; Autostart Registration; NTISDODXA; NTISFNUR

10290
DEVELOPMENT OF A 50 HZ, 250 KV, 500 NS, 500 KW AVERAGE POWER PULSER
M.T. Buttram
Sandia Labs, Albuquerque, NM 87115
No. CONF-800640-8, 6p (01/1980).
Availability: SAND-80-0491C
NTIS

This paper describes the development of a 50 Hz research pulser with per shot specifications of 250 kV, 500 ns FWHM, 10 kJ. It is designed for burst mode service. The pulser is a two element Guillemin Type C pulse forming network with two parallel Marx generators serving as the first element and a single Marx generator serving as the second element. This paper will consider the two Marx generators of the first element only and will outline the important ongoing developmental areas. (ERA citation 05:029534)
Primary Keywords: Accelerator Facilities; Linear Accelerators; Power Supplies; Pulse Generators; Specifications
Secondary Keywords: ERDA/430303; NTISDE

10291
DESIGN AND CONSTRUCTION OF A PRECISION PULSE GENERATOR
J.C. Robles G
Instituto Politecnico Nacional, Mexico City, Mexico
Thesis (06/1977).
Availability: INIS-mf-4230
NTIS

The design and consruction of a pulse generator is considered to simulate in due form and magnitude the pulses obtained in semiconductor detectors of nuclear radiation in a frequency interval to allow its use in testing and calibration of spectrometric systems. A parameters analysis which define the pulse form through the various types of semiconductor detectors was realized with the object to obtain the most important characteristics of the pulse transmitted by the generator. These are the characteristics: Variable frequency from 0.0124 to 120 Hz, variable amplitude from 0 to 1 V, Integral lineality +- 0.25%, amplitude stability -0.031%/degC exponential going up time and variable according to steps of 6.5, 25, 60, 130 and 275 nsec., decay time constant 200 or 400 mu sec. with output ending at 100 omega . According to the results, the stability is less than the established in the design. In order to improve it, an analysis was made in function with the temperature of the components which integrate the circuit that produces the pulse. This analysis allow us to define the specifications related to the components which integrate the circuit that produces the pulse. This analysis allow us to define the specifications related to the components. Finally a compilation was made of the most common applications of the generator in nuclear instrumentation. (Atomindex citation 09:402216)
Primary Keywords: Pulse Generators; Counting Circuits; Design; Pulse Circuits; Pulse Techniques; Semiconductor Detectors
Secondary Keywords: IN SPANISH; ERDA/440300; Mexico; NTISINIS; NTISFNMX
Distribution Restriction: U.S. SALES ONLY.

10292
STABILIZATION OF THE OUTPUTS OF PULSE AMPLIFIERS UTILIZING NON-LINEAR FEEDBACK NETWORKS. APPLICATION TO NUCLEAR SPECTROMETER AMPLIFIERS
K.L. Hanein
CEA Centre d'Etudes Nucleaires, Saclay, France 92260 (02/1978).
Availability: CEA-R-4900
NTIS
In nuclear spectroscopy, baseline instability and random fluctuations at the output of the amplifier create imperfectly solved problems mainly at high counting rates. After a critical examination of current systems, solutions are proposed which surpass existing ones. It is shown that restorers and stabilizers of baselines have their own preferential application. Considering natural limits of performance the proposed solutions give entirely satisfactory results. (Atomindex citation 10:423899)
Primary Keywords: Pulse Amplifiers; Spectrometers; Background Noise; Feedback; Stability
Secondary Keywords: IN FRENCH; ERDA/440103; NTISINIS; NTISFNFR
Distribution Restriction: U.S. SALES ONLY.

10293
PHYSICAL PRINCIPLES OF AVALANCHE TRANSISTOR PULSE CIRCUITS
D.J. Hamilton, J. Gibbons and W. Shockley
Stanford University, Stanford, CA 94305
Technical rept. No. TR-53, 19p (02/1959).
Availability: AD-213 153/0
NTIS
No abstract available.
Primary Keywords: Transistors_Circuits; Theory
Secondary Keywords: Avalanche Transistors; NTISDODXD; NTISDODXDB
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

10294
PRODUCTION AND MEASUREMENT OF ULTRAHIGH-SPEED IMPULSES: IMPULSE BREAKDOWN IN THE 1E-9 SEC RANGE OF AIR AT ATMOSPHERIC PRESSURE
R.C. FLETCHER
Massachusetts Institute of Technology, Cambridge, MA
No. tr21tr20, 10p (06/1949).
Availability: AD-070 882/6
NTIS
No abstract available.
Primary Keywords: Transients; Voltage Dividers; Pulse Generators; Measurement; Oscillographs; Electric Discharges; Air; Baromotric Pressure
Secondary Keywords: NTISDODXD; NTISDODXDB
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

10295
NANOSECOND PULSE TECHNIQUE FOR MULTIPLE FRONT STUDIES IN SHOCK TUBES
M.J. Lubin
Cornell University, Ithica, NY 14850 (08/1963).
Availability: AD-432 779/7
NTIS
A technique for the production of well-defined, precisely timed nanosecond pulses of X-band microwave power is described. A system for the investigation of extremely fast electron density fronts in shock tubes is outlined utilizing the transmitted and reflected pulses generated by this technique. The transmitted and reflected pulses are displayed on a 2000-mc, rastered oscilloscope. (Author)
Primary Keywords: Pulse Generators_Shock Tubes; Shock Tubes_Instrumentation; Timing Circuits; Oscilloscopes; Crystal Detectors; X Band; Pulse Transmitters; Velocity; Waveguides; Periodicals
Secondary Keywords: NTISDODXD; NTISDODXDB
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

10296
THEORY OF SMALL HELICAL MAGNETIC FLUX COMPRESSION AMPLIFIERS
O.M. Stuetzer
Sandia Labs, Albuquerque, NM 87115 (09/1979).
Availability: SAND-79-1075
NTIS
A linear theory is presented of closely wound, helical, magnetic flux compression transducers, the theory is based on an equivalent circuit model. load inductance, load resistance, and eight basic materials and design parameters are taken into account; capacitances are neglected. It was necessary to introduce two parameters which are not well understood, but it can be proven that varying them causes only minor changes in the results. The primary conclusion reached is that device performance is limited by both flux loss and flux remaining in the generator after compression. (ERA citation 05:002348)
Primary Keywords: Flux Pumps; Pulse Generators; Analytical Solution; Electronic Circuits; Magnetic Compression; Magnetic Flux
Secondary Keywords: ERDA/990000; NTISDE

10297
PARALLEL-PLATE TRANSMISSION LINE TYPE OF EMP SIMULATORS: SYSTEMATIC REVIEW AND RECOMMENDATIONS
D.V. Giri, T.K. Liu, F.M. Tesche and R.W.P. King
AFWL, Kirtland AFB, NM 87117
Final rept. No. DC-FR-1299-4, 166p (05/1980).
Availability: AD-A086 814/1
NTIS
This report presents various aspects of the two-parallel-plate transmission line type of EMP simulator. Much of the work is the result of research efforts conducted during the last two decades at the Air Force Weapons Laboratory, and in industries/universities as well. The principal features of individual simulator components are discussed. The report also emphasizes that it is imperative to hybridize our understanding of individual components so that we can draw meaningful conclusions of simulator performance as a whole.
Primary Keywords: Electromagnetic Pulses; Electromagnetic Pulse Simulators; Pulse Generators; Simulators; Transmission Lines; Parallel Orientation; Plates; Van De Graaff Generators; Electrical Impedance; Electric Fields
Secondary Keywords: EMP; EMP Generators; Conical Transmission Lines; Marx Generators; Open Structures; Wave Launchers; Corona Rings; Conical Wave Guides; Characteristic Impedance; NTISDODXA; NTISDODAF

10298
COMPRESSED MAGNETIC FLUX AMPLIFIER WITH CAPACITIVE LOAD
O.M. Stuetzer
Sandia Labs, Albuquerque, NM 87115 (03/1980).
Availability: SAND-79-2339
NTIS
A first-order analysis is presented for a compressed magnetic flux (CMF) current amplifier working into a load with a capacitive component. Since the purpose of the investigation was to gain a general understanding of the arrangement, a number of approximations and limitations were accepted. The inductance of the transducer varies with time; the inductance/resistance/capacitance (LRC) circuit therefore is parametric and solutions are different for the stable regime (high C), the oscillation regime (low C), and the transition case. Solutions and performance depend strongly on circuit boundary conditions, i.e., energization of the circuit by either an injected current or by an applied capacitor charge. The behavior of current and energy amplification for the various cases are discussed in detail. A number of experiments with small CMF devices showed that the first-order theory presented predicts transducer performance well in the linear regime. (ERA citation 05:023357)
Primary Keywords: Magnetic Compression; Pulse Generators; Analytical Solution; Magnetic Flux; Power Supplies
Secondary Keywords: ERDA/700202, NTISDE

10299
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
DESIGNING THE RFI SHIELDED PACKAGE
A.L. Albin
Fairchild Space and Defense Systems, Syosset, NY
Electronic Industries, Vol. 24, No. 1, pp 80-83 (01/1965).
The various problems of shielding electronic systems against EMI are discussed briefly in this paper. Several possible paths for EMI through shielded enclosures are identified with steps to reduce these paths suggested. Materials are discussed briefly, as are means of filtering necessary penetrations to enclosures. 6 Refs.
Primary Keywords: Shielded Enclosure; EMI Reduction; Joint Construction; Materials Consideration; Penetrations; Power Filtering
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10300
(SWITCHES, OPENING)
(Explosive Fuses)
A POWERFUL FOIL BREAKER FOR A CURRENT OF 0.5 MA, WHICH ACTUATES IN 5 MICROSECONDS
L.V. Dubovoi, I.M. Roife, E.V. Seredenko and B.A. Stekol'nikov
Scientific-Research Institute Of Electro-Physical Equipment, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 17, No. 2, pp 421-422 (04/1974).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 107-108 (March-April 1974)
The construction and electrical characteristics of a breaker for a current of up to 0.5 MA are considered; the breaker is based on current heating followed by thermal explosion of a metallic foil in quartz sand. For a time T/4=50 microseconds of current rise to the maximum value, actuation of the breaker takes place in approximately 5 microseconds. 2 Refs.
Primary Keywords: Opening Switch; Exploding Foil; Quartz Sand Environment; 5 Microsecond Opening Time; 500 kA Current
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10301
(BREAKDOWN STUDIES)
(Exploding Wires)
ENERGY PARTITION IN THE EXPLODING WIRE PHENOMENA
F.D. Bennett
Army Amament Research and Development Command, Aberdeen Proving Ground, MD 21005
The Physics Of Fluids, Vol. 1, No. 6, pp 515-522 (12/1958).
Streak camera and oscillographic circuit-damping data are presented for exploded copper wires varying in diameter from 3 to 8 mils. A maximum of specific shock-wave energy in the induced flow is found at a wire diameter different from that of a minimum in the total damping time of the circuit. This displacement is shown to be caused by the presence of residual circuit resistance. The proof is based on a critical analysis of optimum damping conditions in the exploding wire circuit. A maximum of apparent energy within the contact surface appears at about the same wire diameter as the minimum of total damping time. Discussion of the implications of the Taylor-Lin similarity theory indicates that lack of similarity of the flow is probably connected with the displacement of the maximum energies associated with shock-wave and contact surface. 6 Refs.
Primary Keywords: Exploding Wire; Copper Wire; Photographic Diagnostic; Streak Camera; Shock Wave; Wave Damping
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10305
(BREAKDOWN STUDIES)
(Exploding Wires)
PRODUCTS FROM THE ELECTRICAL EXPLOSION OF TUNGSTEN AT CURRENTS OF APPROXIMATELY 1E11 A/SQ.M.
S.V. Lebedev, B.V. Lukin, A.E. Rautbart and A.I. Savvatimskii
Academy of Sciences of the USSR, Moscow, USSR
High Temperature, Vol. 7, No. 5, pp 951-952 (10/1969).
Trans. From: Teplofizika Vysokikh Temperatur 7, 1020-1021 (September-October 1969)
The products give information on the explosion mechanism for a metal subjected to a large current. The usual view is that the conductor (usually a wire) evaporates and acquires the properties of a gas, but evaporation cannot explain some results, and it has been supposed that the molten wire at 5E10 A/sq.m. does not evaporate but breaks up into particles whose size is less than the electron mean free path in the metal. More recent results are of interest here, which indicate that explosion of a wire in air or an inert gas produces an aerosol with articles of size around 0.01 micron. The yield of this aerosol is close to 100% if the supply voltage is high enough, and the size spread of the particles is fairly narrow. Unfortunately, the explosions were not fully characterized; in particular, the current and the energy deposited in the metal were not known, nor was it established what stage in the explosion must be attained in order to produce an aerosol. 3 Refs.
Primary Keywords: Exploding Wire; Tungsten Wire; Aerosol Production; 0.01 Micron Particle Size; 1E11 A/sq.m. Current Density
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10306
(BREAKDOWN STUDIES)
(Surface Flashover)
SURFACE BREAKDOWN IN VACUUM ON BARIUM TITANATE
S.P. Bugaev, V.V. Kremnev, Yu.I. Terent'ev, V.G. Shpak and Ye.Ya. Yurike
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 16, No. 9, pp 1547-1551 (03/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 1958-1962 (September 1971)

Breakdown in vacuum at the surface of a high-permittivity dielectric is studied using high-voltage nanosecond pulse technology, high-speed photography, and observation of the glow spectrum. The discharge is initiated by vaporization of the dielectric under electron bombardment from a cathode. Spectra lines of the dielectric and electrode materials are found in the resulting plasma. The emission edge of the discharge propagates with a velocity of 1E7 cm/sec. The current increases as a result of the charging of a dynamic condenser, one of whose plates is the plasma formed on the surface of the dielectric. 8 Refs.

Primary Keywords: Surface Flashover; High-permittivity Dielectric; Barium Titanate; Photographic Diagnostic; Spectrographic Diagnostic; Discharge Propagation Velocity; Dynamic Capacitor

10309
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Surface Discharge, Electrical; Surface Flashover)
X RADIATION OF A NANOSECOND GRAZING DISCHARGE IN A GAS
P.N. Deshuk and S.L. Kulakov
M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Technical Physics Letters, Vol. 5, No. 1, pp 26-27 (01/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 5, 69-73 (January 1979)

The grazing discharge is continuously finding new applications, for example, in high-current switches, pulsed light sources, and high-power gas lasers. The grazing discharge which occurs along the interface between a gaseous dielectric and a thin solid dielectric, one side of which is metallized, typically grows to a considerable length, l = 5-100 cm, at a modest discharge voltage. A calculation of the electric field at the head of the discharge shows that both the normal and tangential components of the field with respect to the surface of the dielectric can have values approximately 1E5-1E6 V/cm as the discharge propagates. These fields correspond to the typical dielectric thickness, of the order of 2 mm, and pulsed voltages of 50-100 kV. In this letter we report the first experimental demonstration that high-energy electrons are present. These electrons are generated at the head of the discharge because of the strong electric fields and the high longitudinal gradients in the discharge channel at the end of the discharge. The presence of these electrons is inferred from the x rays emitted from the grazing discharge. 11 Refs.

Primary Keywords: Grazing Discharge; E-field Calculation; Experiment; High-energy Electron; X-ray Diagnostic

10310
JOINT ELECTRON BEAM COMMONALITY EXPERIMENTS ON BLACKJACK 3 AND 3 PRIME: PART I. MACHINE CHARACTERIZATIONS
D.V. Keller, A.J. Watts, D.A. Rice and J.J. Powe
Ktech Corp, Albuquerque, NM
Final rept. 1 Jan-31 Dec 79 No. KTECH-TR-79-11-PT-1, 240p (12/1979).
Availability: AD-A090 140/5
NTIS

As part of the DNA Commonality program, material stress generation experiments were performed using the pulsed relativistic electron beam from the Maxwell Laboratories' Blackjack-3 and -3 Prime electron beam machines. Materials used were solid aluminum and tantalum, each of sufficient thickness to be opaque to the beams. The induced stress histories were monitored using X-cut quartz gauges, carbon gauges, and laser velocity interferometry. Fluence levels of up to 150 cal/sq cm were used, giving deposition of up to 750 cal/g, and the deposition time was varied from 30 to 55 ns. The electron beam characterization included measurement of fluences as a function of axial and radial positions relative to the anodes, analysis of machine performance (voltage, current) to give electron energy spectra, and establishment of mean electron angles of incidence by comparison of Monte Carlo computations with experimental dose-depth measurements. The observed stresses and electron beam parameters are to be analyzed by SRI for comparison with their wave propagation codes. The stress pulse shapes and amplitudes agree well with nominal predictions, except that a high amplitude stress tail was observed on the high dose experiments that produced Ta vapor. (Author)

Primary Keywords: Thermal Stresses; Electron Beams, Tantalum; Aluminum; Bulk Materials; Stress Analysis; Strain Gages; Electromagnetic Pulses; Pulse Generators; Calorimetry; Energy Transfer; Electron Beams
Secondary Keywords: Blackjack Generators; Blackjack 3 Generators; NTISDODXA; NTISDODSD

10311
ANALYSIS OF PROTON TRANSPORT EXPERIMENTS
F.C. Young, S.J. Stephanakis, G. Cooperstein, D. Mosher and F.L. Sandel
Naval Research Lab, Washington, DC 20375
Memorandum rept. (09/1980).
Availability: AD-A088 905/5
NTIS

As a part of the NRL light ion beam research program, experiments on the transport of intense pulsed proton beams have been carried out. The NRL GAMBLE II pulser was used to generate proton beams and the measurement of prompt-gamma rays was the primary diagnostic for proton transport. The first sequence of shots was made using a large-diameter (4.5 cm) transport channel with a 2.5-cm diameter aperture. The transport of 1-MeV proton beams of a few hundred kiloamperes a distance of one meter with efficiencies approaching 100% was achieved in this channel. A second sequence of shots with a smaller-diameter (1.6 cm) channel with a 1.2-cm diameter aperture was much less efficient in transporting the beam. Analysis of the prompt-gamma measurements to determine proton currents in the transport channel and transport efficiants is presented in this report.

Primary Keywords: Proton Beams; Transport Properties; Pulse Generators; Focusing; Pinch Effect; Channels; Plasma Diagnostics; Bremsstrahlung; Low Loss; Detectors; Data Reduction; Graphs
Secondary Keywords: Gamble 2 Pulse Generators; Prompt Gamma Rays; NTISDODXA; NTISNRL

10312
TWCP ELECTRON BEAM TESTING PROGRAM: VOLUME IV. TWCP ELECTRON BEAM TESTS
F.A. Bick
Effects Technology Inc, Santa Barbara, CA
Final rept. Jul 77-Dec 78 No. ETI-CR-79-610-VOL-4, 134p (04/1979).
Availability: AD-A086 214/4
NTIS

This volume presents impulse and stress generation data on FM5822A tape wrapped carbon phenolic and 91-LD phenolic resin using the techniques described in Volumes II and III. Preliminary data analysis is presented, however, the final utility of these data is to be determined through the 'TWCP Correlation Program.' Data were generated at a peak electron energy of approximately 1-MeV and at fluence levels ranging from approximately 70 to 120 cal/sq cm. By a unique in situ diagnostical technique, the experimental errors associated with the beam parameters (fluence, peak dose) were approximately halved when compared with prior test programs for this type of facility.

Primary Keywords: Carbon Phenolic Materials; Composite Structures; Tape Wound Construction; Heat Shields; Electron Beams; Pulse Generators; Test Facilities; Impulse Loading; Stress Testing; Measurement; Phenolic Plastics; Hardened Structures; Weapons Effects
Secondary Keywords: NHEP(Nuclear Hardness Evaluation Procedures); Blackjack 3 Generator; NTISDODXA; NTISDODSD

10313
TWCP ELECTRON BEAM TESTING PROGRAM: VOLUME I. SUMMARY
F.A. Bick
Effects Technology Inc, Santa Barbara, CA
Final rept. Jul 77-Dec 78 No. ETI-CR-79-610-VOL-1, 72p (04/1979).
Availability: AD-A086 211/0
NTIS

Volume I of four volumes. Summarizes the results of a series of electron beam tests that: (1) characterized the Maxwell Laboratory's Blackjack III pulsed electron beam facility for material response studies related to nuclear weapons effects on reentry vehicle heat-shield materials; (2) developed a set of instrumentation to diagnose the electron beam environment and measure material response as to impulse and stress generation, and (3) generated impulse and stress data on FM5822A carbon phenolic and 91-LD phenolic resin materials. The data generated demonstrated the utility of the Blackjack III facility and will be used in a separate program entitled, 'TWCP Correlation Program.' The instrumentation developed are applicable to these types of tests on a variety of facilities. The environmental diagnostical instrumentation achieved a significant reduction in experimental uncertainties when compared to prior techniques. This program was conducted within the framework of the Nuclear Hardness Evaluation Procedures Program and the concepts developed therein. (Author)

Primary Keywords: Carbon Phenolic Materials; Composite Structures; Tape Wound Construction; Heat Shields; Electron Beams; Pulse Generators; Test Facilities; Impulse Loading; Stress Testing; Measurement; Phenolic Plastics; Hardened Structures; Weapons Effects
Secondary Keywords: NHEP(Nuclear Hardness Evaluation Procedures); Blackjack 3 Generator; NTISDODXA; NTISDODSD

10314
FOUR-CHANNEL DELAY GENERATOR MODEL 5740
D. Baumetz and M. Milner
Israel Atomic Energy Commission, Beersheba, Israel
(01/1978).
Availability: NRCN(IB)-J18
NTIS

The 4-channel delay generator model 5740 generates 4-pulse groups in independent channels. The device offers the possibility of controlling both the time intervals between the pulses of a group and the rate of generation of groups. (Atomindex citation 10:453933)

Primary Keywords: Pulse Generators; Delay Circuits; Design; Operation
Secondary Keywords: IN HEBREW; ERDA/440300; NTISINIS; NTISFNIS
Distribution Restriction: U.S. SALES ONLY.

10315
SHAPER-AMPLIFIER FOR DRIFT CHAMBERS
S.G. Basiladze and L. Lokhonyai
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
(01/1978).
Availability: JINR-13-11277
NTIS

A shaper-amplifier for drift chambers differing from the prototypes by higher sensitivity, introduction of input impulse differentiation, lesser power consumption and the number of elements is described. The shaper-amplifier containing four identical channels is built on the basis of the integral scheme of the K500LP16 ''differential receiver''. The scheme parameters are the following: input resistance - 300 omega , threshold -1.9 mu A, inherent ''walking'' from the current oscillator - 3.8 ns, intake power - 400 mW/channel. (Atomindex citation 10:441924)

Primary Keywords: Drift Chambers; Diagrams; Pulse Amplifiers; Pulse Shapers; Specifications
Secondary Keywords: IN RUSSIAN; Foreign Technology; ERDA/440104; ERDA/440300; NTISINIS; NTISFNUR
Distribution Restriction: U.S. SALES ONLY.

10316
HIGH-VOLTAGE PULSE GENERATOR WITH A PROTECTIVE SOLENOID
V.D. Volodin, N.S. Glagoleva, N.I. Kominskii, A.T. Matyushin and V.T. Matyushin
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
(01/1977).
Availability: JINR-R-13-10599
NTIS

A pulse generator with a solenoid for protection of condensators from pulse overvoltages is suggested. The protective solenoid is a part of the generator circuit assembled according to the Arkadiev-Marx scheme and it encircles the generator along its length. Besides implementing the basic protective function the solenoid can serve as a radiator with the increased area of heat dissipation in contrast to small surface resistors. The generator is used in the feed system of the JINR 2m streamer chamber and is designed for the output voltage of aproximately 600 kV. (Atomindex citation 10:442065)

Primary Keywords: High-voltage Pulse Generators; Diagrams; Equivalent Circuits; Solenoids; Specifications
Secondary Keywords: IN RUSSIAN; Foreign Technology; ERDA/440300; NTISINIS; NTISFNUR
Distribution Restriction: U.S. SALES ONLY.

10317
PRELIMINARY RESULTS OF EXPERIMENTS WITH MODERATE POWER REB
V.K. Rohatgi, S.K. Iyyengar and K.C. Mittal
Bhabha Atomic Research Centre, Bombay, India
(01/1978).
Availability: INIS-mf-4833
NTIS
No abstract available. (Atomindex citation 10:443085)
Primary Keywords: Plasma Heating; Electron Beams; Pulse Circuits; Pulse Generators; Uses
Secondary Keywords: Foreign Technology; ERDA/700101; NTISINIS; NTISFNIN
Distribution Restriction: U.S. SALES ONLY.

10318
GENERATION OF HIGH VOLTAGE PULSES FROM INDUCTIVE ENERGY STORES BY THE USE OF EXPLODING WIRES
U. Schwarz
Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik.
(01/1977).
Availability: NP-23518
NTIS
This thesis presents investigations and considerations on the generation of high voltages from inductive energy stores charged by a dc power supply. For the proposed method of voltage generation storage coils are needed which can bear high voltages. Design criteria for cylindrical coils for the use at room temperature are given, which show that these coils can withstand voltages of several 100 kV evan if geometrically designed for high energy content. To minimize the power for charging of such a coil it helps to make the inner ohmic resistance of the dc power source lower than the ohmic resistance of the coil. The discussion of the feasibility of the proposed system shows that it becomes useful when using a storage coil with a total volume of more than 1 m exp 3 . Such coils can be built for high voltages and can be charged with a power of some 100 kW to an energy content up in the MWs-range. Finally two possible applications are described, one with an ohmic load and one with a capacitive load. (ERA citation 04:057003)
Primary Keywords: High-voltage Pulse Generators; Design; Exploding Wires; Feasibility Studies; Induction; Performance; Pulses
Secondary Keywords: IN GERMAN; ERDA/420200; ERDA/420800; Theses; NTISDEP; NTISFNGE
Distribution Restriction: U.S. SALES ONLY.

10319
EXPLOSIVE MHD RESEARCH
S.P. Gill, D.W. Baum, W.L. Shimmin and D. Mukherjee
Artec Associates Inc, Hayward, CA
Final rept. 1 Apr 76-31 Mar 77 No. FR-119, 125p (05/1977).
Availability: AD-A079 551/8
NTIS
Research on dense nonideal plasmas used in explosive MHD pulse power generators is described. Experiments were performed with three types of explosive plasma sources producing a plasma pressure about 10 kbar and a plasma temperature about 5 eV (58,000 K). A literature survey was performed on theoretical methods for predicting the properties of nonideal plasmas, and calculations were performed using some of the models. Encouraging progress was made in reducing a discrepancy between theory and experiment. (Author)
Primary Keywords: Magnetohydrodynamic Generators; *Magnetohydrodynamics; Explosive Forming; Plasma* Devices; Energy Conversion; Pulse Generators; Compression; Shock Waves; Experimental Data
Secondary Keywords: Debye Huckel Theory; Chapman Enskog Integrals; NTISDODXA

10320
CALCULATIONS OF THE PERFORMANCE OF EXPLOSIVE IMPULSE GENERATORS
M.W. McKay and R.N. Schlaug
Army Amament Research and Development Commend, Aberdeen Proving Ground, MD 21005
Final rept. No. SAI-78-919-LJ, 42p (08/1979).
Availability: AD-A079 408/1
NTIS
Numerical calculations of the performence of explosive impulse generators were performed. The explosive impulse generators were intended to provide the guidance thrust for a fast response missile guidance system. The objective of the calculations was to provide information to help determine whether an explosive impulse generator could be designed to produce the required impulse without generating a stress environment within the vehicle body that could cause damage either to the internal electronics or to the remaining undetonated impulse generators. Several 1D finite difference calculations were performed to analyze various buffering or stress attentuation schemes while at the same time estimating the impulse generated by the explosive thruster systems. The 1D analyses show that it may be possible to design a system with the required features but further analysis involving 2D explosive loading/structural response calculations is required. (Author)
Primary Keywords: High Explosives; PETN; Sheet Explosives; Pulse Generators; Finite Difference Theory; Thrust; Loads(Forces); Numerical Analysis; Shock Waves; Attenuation; Stresses; Guided Missile Components; Structural Response; One Dimensional; Two Dimensional
Secondary Keywords: Impulse Generators; Explosive Loading; Design; Air Gaps; NTISDODXA; NTISDODA

10321
SMALL HELICAL FLUX COMPRESSION AMPLIFIERS
J.E. Gover, D.M. Stuetzer and J.L. Johnson
Sandia Labs, Albuquerque, NM 87115
No. CONF-790540-2, 33p (01/1979)
Availability: SAND-79-1084C
NTIS
Small, explosively compressed, magnetic flux transducers with many closely spaced helical turns are investigated theoretically and experimentally. The analysis is limited to linear operation, but takes into account load influence, proximity effects, and switching delays. The latter are due to retarded breakdown in the wire insulation and to the finite decay time of the magnetic field in the wire. More than 150 experiments showed considerable data scatter. *Shots which exhibited low clocking and high amplification were in* good agreement with the theory. The main conclusion is that device performance is limited not only by flux loss, but by flux remaining in the generator after compression. (ERA citation 04:052370)
Primary Keywords: Amplifiers; Power Supplies; Thermonuclear Reactors; Explosions; Inertial Confinement; Magnet Coils; Magnetic Compression; Magnetic Flux; Pulse Generators; Switches
Secondary Keywords: ERDA/700203; ERDA/700208; NTISDE

10322
GENERATOR OF CURRENT PULSES WITH AN AMPLITUDE OF 1E6 A AND STABILITY OF +OR- 1E-3 AT A REPETITION RATE OF 2 HZ
B.F. Bayanov , A.V. Il'in , V.N. Pakin , A.P. Panov and G.I. Sil'vestrov
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-0110-79, 17p (02/1979).
Trans. From: Uskoritelyam Zaryazhennykh Chastits 1, pp 283-286 (1978) By C.S. Nack
Availability: AD-A075 180/0
NTIS
No abstract available.
Primary Keywords: Pulse Generators; High Power; Pulse Rate; Repetition Rate; Stability; Circuit Analysis; Translations
Secondary Keywords: NTISDODXA; NTISFNUR

10323
PULSER FOR VERTICALLY POLARIZED DIPOLE FACILITY (VPD-II)
Authors Unknown
AFWL, Kirtland AFB, NM 87117
Final rept. No. PIFR-900, 82p (07/1979).
Availability: AD-A074 838/4
NTIS
This report will provide an outline of the pulser system design features and will give an account of both the factory and site acceptance test procedures and results. During the testing periods certain modifications were found to be necessary in order to improve *the performance. These modifications are described.* Ultimately, a performance limitation was realized when the pulser was operated into the full VPD-II antenna structure, a limitation which could not be removed without a major redesign of the output peaking circuit. This will be discussed in the report summary and some tentative suggestions for a future-up-grading will be offered.
Primary Keywords: Pulse Generators; Electromagnetic Pulse Simulators; Test Equipment; Test Facilities; Dipole Antennas; Systems Engineering; Modification; Acceptance tests
Secondary Keywords: *Marx Generators; NTISDODXA; NTISDODAF*

10324
VERY FAST, HIGH PEAK-POWER, PLANAR TRIODE AMPLIFIERS FOR DRIVING OPTICAL GATES
M.M. Howland, S.J. Davis and W.L. Gagnon
Lawrence Livermore Lab, Livermore, CA 94550
(06/1979).
Availability: UCRL-82538
NTIS
Recent extensions of the peak power capabilities of planar triodes have made possible the latter's use as very fast pulse amplifiers, to drive optical gates within high-power Nd:glass laser chains. These pulse amplifiers switch voltages in the 20 kV range with rise times of a few nanoseconds, into crystal optical gates that are essentially capacitive loads. This paper describes a simplified procedure for designing these pulse amplifiers. It further outlines the use of bridged-T constant resistance networks to transform load capacitance into pure resistance, independent of frequency. (ERA citation 04:047992)
Primary Keywords: Pulse Amplifiers; Neodymium Lasers; Design; Performance; Power Supplies; Triode Tubes
Secondary Keywords: ERDA/700208; ERDA/700203; Neodymium Glass Lasers; Planar Devices; NTISDE

10325
COMPRESSED MAGNETIC FIELD GENERATOR SYSTEMS MODEL
J.E. Gover
Sandia Labs, Albuquerque, NM 87115
No. CONF-790622-5, 8p (01/1979).
Availability: SAND-79-1204C
NTIS
A model relating the volume of a compressed magnetic field generator pulsed power system to its electrical energy output is developed. This systems model includes energy density and/or power density models of the electronic components and a CMF generator model which has been confirmed experimentally for system output energies up to 5000 J. For a given output energy there exists an optimum selection of the pulsed power components to give an overall minimum system volume. Under optimum conditions the volume of the CMF generator is equal to one-half of the overall system volume and the overall system volume increases with the one-half power of the systems output energy. In an all electronic system there is a linear relationship between system volume and output energy. (ERA citation 04:041155)
Primary Keywords: Electric Generators; Chemical Explosives; Design; Magnetic Compression; Mathematical Models; Performance; Pulses
Secondary Keywords: ERDA/420200; Generators; Magnetic Fields; Pulse Generators; NTISDE

10326
(BREAKDOWN STUDIES)
(Grazing Discharge)
MEASUREMENT OF THE GAS TEMPERATURE AND ELECTRON DENSITY IN AN 'INCOMPLETE' GRAZING DISCHARGE
P.N. Dashuk, A.K. Zinchenko, T.G. Merkulova and E.A. Sergeenkova
M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 8, pp 913-915 (08/1978).
Trans. From: Zhurnal Takhnicheskoi Fiziki 48, 1615-1616 (August 1978)
The gas temperature in the channel in the 'incomplete' stage of a grazing discharge in air and SF/sub 6/ is determined from the measured intensity distribution of the components of the resolved rotational structure of the bands of the second positive system of nitrogen over a broad temperature range. The electron density is determined by the Stark broadening of the H alpha line. The *equilibrium of a grazing* discharge in its incomplete stage is discussed on the basis of these measurements and the Saha equation. 10 Refs.
Primary Keywords: Grazing Discharge; Incomplete Discharge; Nitrogen Gas; Optical Spectroscopy; Saha Equation

10327
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A DIVIDER FOR MEASURING NANOSECOND EHT PULSES
Y.M Arkatov, P.I. Vatset, V.I. Voloshchuk, E.A. Gavrilichev, V.A. Zolenko and I.M. Prokhorets
Instruments And Experimental Techniques, Vol. 23, No. 1, pp 123-124 (01/1980).
Trans. From: Pribory I Tekhnika Eksperimenta, No.1, pp. 125-126
A description is given of a voltage divider in which the low-voltage arm is composed of a planar capacitor and a divider composed of MLT resistors. The divider with a division factor of 6.4E-3 provides for transmission of the leading edge of a pulse of duration a few nanoseconds and can be used in the measurement of amplitudes up to 250 kV. 4 Refs.
Primary Keywords: Capacitive Voltage Divider; Resistive Voltage Divider; 250 kV Working Voltage; Nanosecond Rise Time; MLT Resistor

10328
(PULSE GENERATORS; POWER CONDITIONING)
(Marx; Pulse Transformers)
A HIGH-VOLTAGE PULSE GENERATOR WITH AN EXTENDED ZONE OF STABLE OPERATION
A.P. Komarov, Yu.P. Pichugin and I.N. Romanenko
Chuvash State University, USSR
Instruments And Experimental Techniques, Vol. 24, No. 2, pp 419-421 (04/1981).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 124-126 (March-April 1981)
A generator of high-voltage pulses in the nanosecond range is described in which the stages of the dischargers are triggered by means of pulse transformers. The amplitude of the output voltage pulse is approximately 100 kV, the rise time is tau/sub r/ <= 8 nsec, and the recurrence rate of the pulses is up to 50 Hz. 6 Refs.
Primary Keywords: Marx Generator; 100 kV Output Voltage; 8 ns Rise Time; Pulse Transformer Triggering; Rep-rated: 50 Hz Repetition Rate

10329
(BREAKDOWN STUDIES)
(Vacuum; Electrical)
COMPOSITION OF THE INTERELECTRODE PREBREAKDOWN CURRENT IN HIGH VACUUM
H.C. Bourne Jr.
Massachusetts Institute of Technology, Cambridge, MA
Journal Of Applied Physics, Vol. 26, No. 5, pp 625-626 (05/1955).
Thermal rise measurements on vacuum-insulated electrodes subjected to steady gap voltages in the range of 80 to 100 kV show that the interelectrode prebreakdown current is composed chiefly to negatively charged particles. With aluminum electrodes the negative particles outnumber the positive particles (ions) by at least 300 to 1. With steel electrodes, the ratio is greater than 1000 to 1. 4 Refs.
Primary Keywords: Vacuum Breakdown; Prebreakdown Current; DC Voltage; 100 kV Voltage; Charge Carrier Identification

10330
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Electrical; Gas Gaps, Materials)
GAS MIXTURE N/SUB 2/ + SF/SUB 6/ + AR FOR A HIGH-PRESSURE DISCHARGER
B.M. Koval'chuk, V.A. Lavrinovich, Yu.F. Potalitsyn and V.V. Toptygin
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 22, No. 2, pp 434-436 (04/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 135-137 (March-April 1979)
The influence of the composition of a N/sub 2/ + SF/sub 6/ + Ar gas mixture at a pressure of 10 abs. atm on the commutation characteristic and actuation delay time of an eight-channel controllable discharger is investigated. The optimal mixture composition of 80% N/sub 2/ + 10% SF/sub 6/ + 10% Ar is found which will assure maximum steepness of the voltage drop at the discharger. The actuation delay time of the discharger as a function of the gas-mixture composition and a comparison between the obtained and computed commutation times are presented for single-channel commutation. 6 Refs.
Primary Keywords: High Pressure Spark Gap; Argon Gas; Nitrogen Gas; SF/sub 6/ Gas; Gas Mixture Optimization; 10 atm Pressure; Delay Measurement, Theory; Experiment

10331
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Capacitor Banks; Capacitor Banks)
GENERATION OF UNIPOLAR CURRENT PULSES OF 10 TO 100 KA AMPLITUDE
S.L. Zaients, N.N. Nikoleevskaya and G.A. Shneerson
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, No. 5, pp 1146-1151 (10/1965).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 123-128 (September-October 1965)
The design of a circuit is given which produces a unipolar current pulse by connecting a nonlinear resistance into the discharge circuit of a bank of capacitors with an inductive load. The nonlinear resistance may be one of the commercially produced carborundum resistors of the 'vylite', 'tervite' or 'tyrite' type. The calculated results make it possible to select for an arbitrary tuned circuit a resistance which ensures the generation of a current pulse with a preset loss of its initial amplitude. Results are given of experimental tests conducted with the circuit at current pulses exceeding 100 kA with series and parallel connections of vylite discs. It has been established that vylite discs are capable of prolonged operation at current densities of up to 1 to 1.3 kA/sq.cm. (duration of the pulse is 4 to 6 microseconds), and that to increase their current-carrying capacity they may be connected in parallel. 2 Refs.
Primary Keywords: Capacitor Banks; Unipolar Output; Inductive Load, Nonlinear Resistor; Parallel Resistors; 100 kA Current

10333
(PULSE GENERATORS; POWER CONDITIONING)
(Trigger; Pulse Forming Lines)
HIGH-VOLTAGE PULSE GENERATOR FOR A LOW-RESISTANCE LOAD
A.Yu. Ushakov
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 24, No. 4, pp 962-964 (08/1981).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 131-132 (July-August 1981)
A generator is described for the production of rectangular voltage pulses with an amplitude of 1E2 to 4E3 V in a load of approximately 2 ohm. The unregulated duration of the pulses is 0.25 microseconds and their repetition rate can be varied from 1 to 100 Hz. 1 Refs.
Primary Keywords: Pulse Generators; Pulse Forming Line; Spark Gap Switch; 1 kA Output Current; Life Test

10334
(PULSE GENERATORS)
(Marx)
OUTPUT PERFORMANCE OF THE COAXIAL-TYPE MARX GENERATOR CONSISTING OF BATIO/SUB 3/ SERIES CERAMIC CAPACITORS
T. Ogura (1), F. Kannari (1), M. Obara (1), T. Fujioka (1), K. Toyoda (2) and S. Nanba (2)
(1) Keio University, Kohoku-ku, Yokohama-shi, Japan
(2) The Institute Of Physical And Chemical Research, Wako-shi, Saitama, Japan
The Review Of Scientific Instruments, Vol. 52, No 2, pp 273-275 (02/1981).
We have theoretically analyzed the output performance of the coaxial-type Marx generator consisting of BaTiO/sub 3/ series ceramic capacitors. In this analysis, the capacitance of the BaTiO/sub 3/ series ceramic capacitor has been considered to be variable with applied voltage. The results were compared with experimental results, and fairly good agreement was obtained. As a result of this analysis it was clarified that the BaTiO/sub 3/ series capacitor was not able to store efficiently the electrical energy when charged at high voltages. On the other hand, the SrTiO/sub 3/ series ceramic capacitor has an almost constant capacitance against applied voltages, so that stored energy may be extracted efficiently. We have quantitatively revealed the superiority of SrTiO/sub 3/ series ceramic capacitors over BaTiO/sub 3/ capacitors. 2 Refs.
Primary Keywords: Coaxial Marx Generator; Ceramic Capacitor; Capacitance Variation vs Voltage; Theory; Performance Analysis; Comparison With Experiment

10335
(PULSE GENERATORS)
(Systems)
STEPPED HIGH-VOLTAGE PULSE GENERATOR
Yu.N. Nazovibat'ko, P.A. Demchenko and A.G. Reznichenko
Instruments And Experimental Techniques, Vol. 24, No. 1, pp 127-129 (02/1981).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 122-124 (January-February 1981)
The generator described in the paper produces stepped high-voltage pulses for sweeping the trajectories of probing beams of atomic particles in plasma. The impulse consists of 10 voltage steps whose maximum duration is 1 msec with a leading edge duration of <=1.5 microseconds. The maximum pulse amplitude is 10 kV. The irregularity of the plateau of the last steps does not exceed 0.2%. 3 Refs.
Primary Keywords: Stepped Voltage Pulse Generator; 10 Voltage Steps; 1 ms Step Duration; Good Voltage Regulation

10336
(PULSE GENERATORS)
(Marx)
250-KV PULSE GENERATOR FOR ELECTRICAL-PULSE TECHNOLOGY
V.I. Kurets
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 24, No. 1, pp 123-124 (02/1981)
Trans. From: Pribory i Tekhnika Eksperimenta 1, (January-February 1982)
The paper describes the circuit and design of the GIN-250 generator of 250-kV pulsed voltage with adjustable pulse repetition rate of up to 10 Hz and a pulse energy of 780 J. The generator is provided with an acoustically insulated discharger reducing the noise level to 60 dB. 3 Refs.
Primary Keywords: GIN-250 Marx Generator; 250 kV Output Voltage; Spark Gap Switch; Compact Design; Rep-rated; 10 Hz Repetition Rate

10337
ASSEMBLY AND HANDLING APPARATUS FOR THE EBFA MARX GENERATOR
G.E. Staller, G.E. Hiett, I.D. Hamilton, M.F. Aker and G.A. Daniels
Sandia Labs, Albuquerque, NM 87115
(05/1979).
Availability: SAND-78-2239
NTIS
Marx generators, a major slow-pulsed power component in Sandia Laboratories' Electron Beam Fusion Accelerator (EBFA), were assembled at a remote facility modified to utilize an assembly-line technique. Due to the size and weight of the various components, as well as the final Marx generator assembly, special handling apparatus was designed. Time and manpower constraints required that this assembly be done in parallel with the construction of the Electron Beam Fusion Facility (EBFF). The completed Marx generators were temporarily stored and then moved from the assembly building to the EBFF using special transportation racks designed specifically for this purpose.
(ERA citation 04:049411)
Primary Keywords: Electron Beam Fusion Accelerator; Construction; Design; Mechanical Structures; Power Supplies; Supports
Secondary Keywords: ERDA/700208; ERDA/700293; Marx Generators; NTISDE

10338
HIGH CURRENT PULSER FOR EXPERIMENT NO. 225, NEUTRINO ELECTRON ELASTIC SCATTERING
C. Dalton, G. Krausse and J. Sarjeant
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-790622-13, 5p (01/1979).
Availability: LA-UR-79-1571
NTIS
With the advent of low-cost honeycomb extrusions of polypropylene sheets, flash chambers have become very attractive for large nuclear particle detector arrays. This has brought about the need for a pulse power system that will provide high peak currents and low levels of spurious radiation. Each module of 10 flash chambers will require a peak current of 70 KA with a rise time (tau/sub r/) of <50 ns, giving a maximum rate of current rise di/dt of 400 KA/ mu s. The pulser output must develop 7 KV across a load of 0.36 omega with a pulse width of 500 ns. The repetition rate will be one per second. The paper describes the development of such a system and the impact of the physical limitations of present component technology on lifetime and pulse fidelity. (ERA citation 04:049073)
Primary Keywords: Pulse Generators; Radiation Detectors; Design; Gas Scintillation Detectors; Neutrino Detection; Power Supplies
Secondary Keywords: ERDA/440101; NTISDE

10339
(ENERGY STORAGE, KINETIC; PARTICLE BEAMS, ELECTRON)
(Electron Ring; Generation)
CONCEPT FOR ENERGY-STORAGE RINGS AT 10-100 MJ
F.S. Felber and R.O. Hunter Jr.
Western Research Corp, San Diego, CA 92121
Journal Of Applied Physics, Vol. 53, No. 6, pp 3961-3966 (06/1982).
A concept is considered for storing 10-100 MJ of electrical energy in a relatively lightweight and compact device. Energy is stored as electron kinetic energy confined in the verticle betatron field of a toroidal ring. Electrons are injected into a ring at full voltage but low current and low power. The stored electron energy is released on a fast time scale. Synchrotron radiation, wall fields, and instabilities constrain the energy that can be stored in each ring. 13 Refs.
Primary Keywords: Energy Store; Electron Ring; Betatron Concept; Electron Extraction; Design Considerations; Theory

10340
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
UV LASER TRIGGERING OF HIGH-VOLTAGE GAS SWITCHES
J.R. Woodworth, C.A. Frost and T.A. Green
Sandia Labs, Albuquerque, NM 87115
Journal Of Applied Physics, V.1. 53, No. 7, pp 4734-4739 (07/1982).
Two different techniques are discussed for uv-laser triggering of high-voltage gas switches using a KrF laser (248 nm) to create an ionized channel through the dielectric gas in a spark gap. One technique used an uv laser to induce breakdown in SF/sub 6/. For this technique, we present data that demonstrate a jitter of +or- 150 ps for a 0.5-MV switch at 83% of its self-breakdown voltage using a low-divergence KrF laser. The other scheme uses additives to the normal dielectric gas, such as tripropylamine, which are selected to undergo resonant two-step ionization in the uv laser field. 11 Refs.
Primary Keywords: Spark Gap; Laser Triggering; KrF Laser; Volume Ionization; 150 ps Jitter; SF/sub 6/ Gas; Tripropylamine Gas

10341
(BREAKDOWN STUDIES)
(Gas, Electrical)
HIGH-CURRENT HIGH-PRESSURE DISCHARGE CHAMBER. I
G.G. Antonov, V.S. Borodin, A.I. Zaitsev and F.G. Rutberg
Soviet Physics-Technical Physics, Vol. 17, No. 10, pp 1680-1683 (04/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 42, 2121-2126 (October 1972)
A high-current high-pressure discharge is investigated. The current, voltage, temperature, and electron density are determined experimentally. After IE-5 sec a constriction is formed in the discharge channel until the diaphragm opens. The results are discussed. 10 Refs.
Primary Keywords: Gas Discharge; Voltage Measurement; Current Measurement; Temperature Measurement; Electron Density Measurement; Discharge Channel Pinching

10342
MICROPROCESSOR-CONTROLLED, PROGRAMMABLE RAMP VOLTAGE GENERATOR
J. Hopwood
Sandia Labs, Albuquerque, NM 87115
(11/1978).
Availability: SAND-78-8040
NTIS
A special-purpose voltage generator has been developed for driving the quadrupole mass filter of a residual gas analyzer. The generator is microprocessor-controlled with desired ramping parameters programmed by setting front-panel digital thumb switches. The start voltage, stop voltage, and time of each excursion are selectable. A maximum of five start-stop levels may be pre-selected for each program. The ramp voltage is 0 to 10 volts with sweep times from 0.1 to 999.99 seconds. (ERA citation 04:027713)
Primary Keywords: High-voltage Pulse Generators; Mass Spectrometers; Control Equipment; Microprocessors; Pulse Shapers
Secondary Keywords: ERDA/440300; Sweep Generators; Automatic Control; NTISDE

10343
ANALYSIS OF AN INDUCTIVE ENERGY HIGH PERVEANCE ELECTRON BEAM GENERATOR
M. Weiner
ECOM, Fort Monmouth, NJ 07703
Research and development technical rept. No. DELET-TR-78-31, 11p (11/1978).
Availability: AD-A065 114/1ST
NTIS
No abstract available.
Primary Keywords: Pulse Generators; Electron Beams; High Energy; High Voltage
Secondary Keywords: High Perveance; Specific Energy; NTISDODXA

10344
UNIVERSAL PULSE GENERATOR WITH A NANOSECOND FAST RESPONCE
S.G. Basiladze
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. (01/1977).
Availability: JINR-13-10622
NTIS
A pulse generator with nanosecond action is described; it is mainly designed for testing and tuning fast electronic devices operating with pulses in the N/1/M standard. The generator is principally based on integral circuits and has wide functional potentialities: it includes a main-pulse channel, a delayed-pulse channel, and an overall output, which sums up these pulses; in addition to the logic pulse outputs it includes a linear pulse output with an amplitude smoothly regulated in the range from 0.3 to 6.0 V; it can operate in the self-oscillation mode, in the pulse series formation mode, in the starting mode, and in the single-start mode. Two generators are placed in a double-width CAMAC cell. The generation frequency is from 3 Hz to 75 MHz, pulse duration from 8 to 320 ns, and pulse front duration 2 ns. (Atomindex citation 09:392512)
Primary Keywords: Pulse Generators; Camac System; Delay Circuits; Diagrams; Integrated Circuits; Mhz Range 01-100; Nuclear Instrument Modules; Performance; Pulse Rise Time; Specifications
Secondary Keywords: IN RUSSIAN; ERDA/440300; USSR; NTISINIS; NTISFNUR
Distribution Restriction: U.S. SALES ONLY.

10345
SYSTEM FOR HIGH-VOLTAGE SUPPLY OF MAGNETOSTRICTION SPARK CHAMBERS IN THE 'PHOTON' FACILITY
Y.S. Anisimov, L.S. Boitsova, A.F. Elishev, Y.V. Zanevskii and A.B. Ivanov
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. (01/1977).
Availability: JINR-13-10570
NTIS
A system of high-voltage supply to 32 1x1 m exp 2 magneto-striction spark chambers of the experimental unit ''Photon'' is described. Thyratrons TGI1-500/16 are used as commutating elements. The system ensures smooth and independent control of the amplitude of the high voltage pulse at each chamber. Reduction in the amplitude of high-voltage pulses at the spark chambers does not exceed 1%, and the amplitudes of the pulsed sweeping fields are not affected by the presence of limiting stabilitrons in the sweeping field multipliers. (Atomindex citation 09:392421)
Primary Keywords: High-voltage Pulse Generators; Wire Spark Chambers; Control Systems; Diagrams; Electric Potential; Performance; Pulse Shapers; Thyratrons
Secondary Keywords: IN RUSSIAN; ERDA/440104; USSR; NTISINIS; NTISFNUR
Distribution Restriction: U.S. SALES ONLY.

10346
STUDY ON THE TGI1-500/16 THYRATRON CHARACTERISTICS
Y.S. Anisimov, A.F. Elishev, Y.V. Zenevskii, A.I. Malekhov and B.M. Starchenko
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. (01/1977).
Availability: JINR-13-10569
NTIS
The characteristics of 90 TGI1-500/16 cermet thyratrons used in the system of high-voltage supply to the magnetostriction spark chambers of the ''Photon'' unit have been investigated. The operating mode of the thyratrons with a positive current bias has been chosen, which ensures the optimum time parameters. The average values of the delay and the front of the high-voltage pulse are 80 and 45 ns, respectively, at a filament voltage of 6.3 V and an average bias current of 4 mA. (Atomindex citation 09:392422)
Primary Keywords: High-voltage Pulse Generators; Wire Spark Chambers; Diagrams; Electric Currents; Performance; Pulse Rise Time; Thyratrons
Secondary Keywords: IN RUSSIAN, ERDA/440104; USSR; NTISINIS; NTISFNUR
Distribution Restriction: U.S. SALES ONLY.

10347
ANNUAL PROGRESS REPORT NUMBER 1, 1 JANUARY THROUGH 31 DECEMBER 1978
Stanford University, Stanford, CA 94305
No. SU-SEL-78-031, 84p (10/1978).
Availability: AD-A064 744/6ST
NTIS
Contents: Information Systems, Computer Systems, Solid State and Integrated Electronics, Radioscience, and Plasma Physics.
Primary Keywords: Electronics; Digital Computers; Integrated Circuits; Data Processing; Tropospheric Scatter Communications; Single Crystals; Magnetrons; Pulse Generators; Electron Beams; Signal Processing; Aluminum Gallium Arsenide; Transport Properties
Secondary Keywords: NTISDODXA

10348
LOW-RESISTANCE WIDE-BAND LOAD OF KILOAMPERE PULSE GENERATORS
V.A. Shvets
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1976).
Availability: JINR-13-10302
NTIS
The results of studies are given of dissipative loads used in high-power pulse generators. It is shown that in the SHF range loads do not meet broad-band requirements. Made for the electron beam monochromator of a linear induction accelerator low-resistance loads from 0.5 to 8 Ohm operate at a pulse rising time of 10 exp -19 s, a current amplitude of up to 2 kA, a pulse duration of 0.5 to 2 mu s, and a pulse repetition frequency of up to 50 Hz. (Atomindex citation 09:398792)
Primary Keywords: High-voltage Pulse Generators; Linear Accelerators; Diagrams; Electric Conductivity; Mhz Range 100-1000; Performance Testing; Pulse Rise Time; Resistors
Secondary Keywords: IN RUSSIAN; ERDA/430300; USSR; NTISINIS
Distribution Restriction: U.S. SALES ONLY.

10349
GTI-742 STROKE PULSE GENERATOR MADE IN THE CAMAC STANDARD
Kim Yu Zem and A.P. Kryachko
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1976).
Availability: JINR-10-9800
NTIS
A tactstroke generator (GTI-742) made in CAMAC standard is described. The unit ensures output tact pulses with decade frequency intervals from the internal quartz oscillator and can be used as an external signal frequency divider. The number of decades in the unit is 6. Maximum frequency of the quartz oscillator and external signals is 50 mc. Input and output signals have NIM or TTL levels. (Atomindex citation 09:376710)
Primary Keywords: Pulse Generators; Camac System; Flowsheets; Mhz Range 01-100; Microelectronic Circuits; Performance; Quartz
Secondary Keywords: IN RUSSIAN; ERDA/440300; USSR; NTISINIS
Distribution Restriction: U.S. SALES ONLY.

10350
PULSE GENERATOR UTILIZING SUPERCONDUCTING APPARATUS
D.B. Birx
Department of the Navy, Washington, DC
Patent Application No. PAT-APPL-928 218, 12p (07/1981).
Availability: AD-D005 725/7ST
NTIS
High power, phase coherent pulses are generated by superconducting apparatus which includes a superconducting cavity resonator that is pumped by a low power microwave source while being isolated from a load. Switching of the cavity to an emitting mode is accomplished in 5 to 10 nanoseconds by firing a gas discharge tube that acts to couple the cavity to the load while decoupling it from the pumping source. (Author)
Primary Keywords: Patent Applications; Pulse Generators; Cavity Resonators; Superconductivity; Gas Discharges; High Power; Microwave Equipment
Secondary Keywords: NTISGPN
Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF APPLICATION AVAILABLE NTIS.

10351
REFLEX TRIODE WITH UNIDIRECTIONAL ION FLOW
A. Bromborsky, H.E. Brandt and R.A. Kehs
Harry Diamond Labs, Adelphi, MD 20783
Technical memo. No. HDL-TM-78-22, 13p (10/1978).
Availability: AD-A063 597/9ST
NTIS
Experimental results show that the ion beam generated by a simple reflex triode can be made almost totally unidirectional toward the virtual cathode. This flow is accomplished by constructing the triode so that a controlled surface flashover generates plasma on only one side of the dielectric anode foil. (Author)
Primary Keywords: Triodes; Ion Beams; Pulse Generators; Plasma Generators; Ionization; Surface Properties, Dielectric Films; Foils(Materials); Field Emission; Cathodes(Electron Tubes); Anodes(Electron Tubes)
Secondary Keywords: Reflex Triodes; NTISDODXA

10352
HIGH VOLTAGE NANOSECOND PULSER USING A REPETITIVE SERIES INTERRUPTER
M. Weiner
Department of the Army, Washington, DC
Patent Application No. PAT-APPL-895 421, 11p (04/1987).
Availability: AD-D005 442/9ST
NTIS
A pulse generation system using an inductive energy storage technique is described. A high magnitude current flowing in a storage inductor is suddenly halted by means of a repetitive series interrupter device and an accompanying magnetic field coupled control circuit. The resulting high voltage generated causes breakdown across a spark gap and transmission of a high energy pulse to a load. The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalties thereon or therefor. (Author)
Primary Keywords: Patent Applications; Pulse Generators; High Voltage; High Energy
Secondary Keywords: Short Pulses; Inductive Energy Storage; NTISGPA
Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF APPLICATION AVAILABLE NTIS.

10353
DEVICE FOR AUTOMATION CONTROL OF THE MEHP-2 MODULATOR OF THE 'KRION' ION SOURCE
V.G. Mudnikov
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1977).
Availability: JINR-9-10395
NTIS
A device is described for automatic power control at the MEhP-2 modulator outlet. The modulator has a maximum power in the pulse of 40 kw and serves to impart power to the electron beam in the ''K-ion'' electron-ray source of multi-charged ions. The device ensures a remote lead-out and control of powerful pulse systems. (Atomindex citation 09:379490)
Primary Keywords: Ion Sources; Control Systems; Electronic Circuits; High-voltage Pulse Generators
Secondary Keywords: ERDA/640301; NTISINIS
Distribution Restriction: U.S. SALES ONLY.

10354
HIGH INTENSITY ELECTRON BEAM PROPAGATION BETWEEN TWO PLANE CONDUCTORS AND ITS IMPLICATIONS FOR COLLECTIVE ION ACCELERATION
H.S. Uhm and H. Kim
University of Maryland, College Park, MD 20742
No. PUB-78-243, 28p (01/1978).
Availability: AD-A059 337/6ST
NTIS
This paper examines the properties of a high intensity relativistic electron beam propagating between two grounded plane conductors, with particular emphasis on the implications for collective ion acceleration. The steady-state and time averaged equilibrium properties are obtained analytically, by employing a one-dimensional model. Numerical integration of pulsed-beam propagation is shown to result in an oscillatory state around the time averaged equilibrium solution. Based on this investigation, a model of linear beam collective ion acceleration is presented. It is shown that within a few nanoseconds of acceleration time, the ion kinetic energy can be increased to more than ten times electron energy. (Author)
Primary Keywords: Ion Accelerators; Linear Accelerators; Ion Beams; Electron Beams; Pulse Generators; Electron Energy; Plasmas(Physics); Current Density; Constants; Dielectric Properties; Space Charge; Computerized Simulation
Secondary Keywords: NTISDODXA

10355
ROTATING BALL GENERATOR
E. Kunhardt and R. Dollinger
Texas Tech Univ Lubbock Dept of Electrical Engineering
Interim rept. (12/1976).
Availability: AD-A059 265/9ST
NTIS
No abstract available.
Primary Keywords: Pulse Generators; Electromechanical Devices; Pulse Rate; Charge Transfer; Reprints
Secondary Keywords: Steel Balls; Rotating Ball Generators; NTISDODXR
Distribution Restriction: AVAILABILITY: PUB. IN THE REVIEW OF SCIENTIFIC INSTRUMENTS, V48 N12 P1676-1677 DEC 77.

10356
STUDY ON THE MAKING OF COCKROFT WALTON HIGH TENSION
S. Hutapea
Gamma Research Centre, Yogyakarta, Indonesia
(01/1976).
Availability: PPGM-L117-76
NTIS
A prototype of a generator is being developed at the GAMA Research Center. Experience in working with some components, high voltage capacitor, column, and potential divider is discussed. High voltage diode, the type which is usually used in television, is used. The tension of the generator is measured by using the high ohmic resistance of 4000 megaohm. The maximum tension can be reached no more than 150000 volts. (Atomindex citation 09:365746)
Primary Keywords: Cockcroft-walton Accelerators; Capacitors; Electric Potential; Fluctuations; Pulse Generators
Secondary Keywords: ERDA/430300; Indonesia; NTISINIS
Distribution Restriction: U.S. SALES ONLY.

10357
SHF IMPULSE GENERATOR
J.R. Andrews and E.E. Baldwin
National Bureau of Standards, Boulder, CO 80302
Final rept. May-Sep 77 No. NBSIR-78-888, 76p (06/1978).
Availability: PB-285 233/3ST
NTIS
A super-high-frequency (SHF) impulse generator designed and built by the National Bureau of Standards, is described in detail. The generator produces three different waveforms. The first is a simple impulse of 1 volt amplitude (3 V option) and 60 ps duration with a useful spectrum (15 dB down) extending from low frequencies out to 9 GHz. The second waveform is a single cycle 5 GHz sine wave (doublet) of 0.8 volts peak-to-peak amplitude (1.6V option). Its useful spectrum extends from 0.5 GHz to 11.7 GHz. The third waveform is an exponentially damped rf pulse. It has a center frequency of 12.5 GHz and a damping time constant of 1/4 ns. The peak-to-peak amplitude is 0.8 volts. The useful spectrum extends from 6 GHz to 18 GHz.
Primary Keywords: Pulse Generators; Waveform Generators; Superhigh Frequencies
Secondary Keywords: Picoseconds; Time Domain; NTISCOMNBS; NTISDODAF

10358
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)
A SLOW CYCLING FLUX PUMP USING DIGITAL CONTROL
T.F. Droege (1), J.R. Purcell (2) and S.T. Wang (2)
(1) Fermi National Accelerator Lab, Batavia, IL 60510
(2) Argonne National Lab, Argonne, IL
IEEE Transactions On Magnetics, Vol MAG-11, No. 2, pp 580-581 (03/1975).
A slow cycling flux pump has been constructed where operation is controlled by digital logic driving a high power operational amplifier. Hall sensors allow closed loop control of the secondary currents to enable switching the heater driven power cryotrons at the optimum time. Operating efficiency of 87% has been achieved. 2 Refs.
Primary Keywords: Flux Pump; High Power Op-amp Control; 87% Operating Efficiency; Superconductivity; Cryotrons; Air Core Transformer

10359
NONLINEAR QUASI-AXIAL LINE FOR SHOCK ELECTROMAGNETIC WAVE PRODUCTION
R.V. Khar'yuzov and V.A. Shvets
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1975).
Availability: JINR-13-8709
NTIS
Results are given as to the manufacture of sharpeners with a low wave-making resistance for forming shock electromagnetic waves. Kiloampere current amplitudes are obtained with input voltage being some kilovolts. Duration of the shock wave front is 1 nsec. The sharpeners have been designed for the system of electron beam monochromatization in LIU - 30 linear induction accelerator of IBR - 2 exploratory complex. (Atomindex citation 09:352420)
Primary Keywords: Beam Dynamics; Linear Accelerators; Capacitors; Diagrams; Electric Currents; Ferrites; High-voltage Pulse Generators
Secondary Keywords: ERDA/430200; USSR; NTISINIS
Distribution Restriction: AVAILABLE IN MICROFICHE ONLY. U.S. SALES ONLY.

10360

LIGHTWEIGHT LINE PULSER

H.J. Blinchikoff
Westinghouse Defense and Electronic Systems Center Baltimore Md Systems Development Div
Final technical rept. 1 May 76-1 Dec 77 No. 78-0099, 55p (04/1978).
Availability: AD-A054 286/0ST
NTIS

This report describes the work performed under contract F30602-76-C-0207 to study, develop, and demonstrate the feasibility of a compact, lightweight, modular, pulse-forming network (PFN). The PFN evolved is composed of identical LC modules and an input module that is optimized for a pulse-plateau ripple that satisfies the goal of + or - 0.5 percent. The ripple remains within this limit as modules are added or removed from the PFN to change the pulsewidth in 2 microsec steps. This low-ripple response is achieved without incorporating mutual inductance into the design, therefore, easing the module tuning and assembly. Mutual inductance has been considered indispensible in PFN's, but it is a roadblock for modular construction. Its elimination as a design parameter is the key to realizing the modular PFN. All electrical design goals are satisfied and the size goal was achieved by a wide margin. The realized volume energy density of 0.1 joules/cu in was the best achievable with off-the-shelf capacitors. The goal of 0.5 joules/cu in is not compatible with present state-of-the-art components at these power levels. Included herein are results of the following studies undertaken to satisfy the original contract objectives. Theoretical analysis of distributed and lumped constant lines that can realize the PFN.

Primary Keywords: Pulse Generators; Modules(Electronics); Lightweight; Modulators; Radar Equipment
Secondary Keywords: Lightweight Line Pulsers; Pulse Forming Networks; NTISDODXA

10361

INVERSE DIODE STUDY (FINAL REPORT)

Authors Unknown
Physic International Co. San Leandro, CA 94577
(09/1977).
Availability: PIFR-959
NTIS

The experimental work and resultant data of an inverse diode study program sponsored by US ERDA are reported. The thrust of the effort is demonstration of an inverse diode concept, at greater than 150 kA pulsed current and 10 exp 9 W/cm exp 2 energy density levels, for conversion of relativistic electron beam energy into useful electromagnetic energy. The experiments show that the entire injected electron current can be utilized by the inverse diode and more than 70 percent of the injected beam energy can be extracted to supply a secondary diode of matched impedance. An implication of these findings is that design of a vacuum current function, in which multiple beams can be combined to produce beyond state-of-the-art power and current levels in a secondary load, is feasible. A theoretical calculation of electron scattering through thin foils is appended. (ERA citation 03:025404)

Primary Keywords: Electron Sources; Pulse Generators; Aluminium; Design; Electromagnetic Pulses; Electrons; Feasibility Studies; Foils; Performance Testing; Power Range 100-1000 Mw; Research Programs; Scattering; Steinless Steels; Titanium, US ERDA
Secondary Keywords: ERDA/700103; NTISDE

10362

AVALANCHE TRANSISTOR PULSER FOR FAST-GATED OPERATION OF MICRO-CHANNEL PLATE IMAGE-INTENSIFIERS

A. Lundy, J.R. Parker, J.S. Lunsford and A.D. Martin
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-771023-6, 8p (01/1977).
Availability: LA-UR-77-2402
NTIS

Transistors operated in the avalanche mode are employed to generate a 1000 volt 10 to 30 nsec wide pulse with less than 4 nsec rise and fall times. This pulse is resistively attenuated to approximately equal to 270 volts and drives the image intensifier tube which is a load of approximately equal to 200 pf. To reduce stray inductance and capacitance, transistor chips were assembled on a thick-film hybrid substrate. Circuit parameters, operating conditions, and coupling to the microchannel plate image-intensifier (MCPI exp 2) tube are described. To provide dc operating voltages and control of transient voltages on the MCPI exp 2 tube a resistance-capacitance network has been developed which (a) places the MCPI exp 2 output phosphor at ground, (b) provides programmable gains in ''f-stop'' steps, and (c) minimizes voltage transients on the MCPI exp 2 tube. (ERA citation 03:024987)

Primary Keywords: Image Intensifiers; Pulse Generators; Chemical Explosives; Design; Detonations; Logic Circuits; Phosphors; Photocathodes; Resolution; Sensitivity; Switches; Transistors
Secondary Keywords: ERDA/440300, ERDA/450100; Drives(Electronics); NTISCE

10363

AN INVESTIGATION OF THE HOLLOW SPHERICAL CATHODE: PART I. EMISSION MECHANISMS OF HOLLOW SPHERICAL CATHODES: PART II. DEVELOPMENT OF A HIGH LEVEL PULSER

K.R. BRUNN
University of Illinois, Urbana IL
No. SR-10 386p (04/1957).
Availability: AD-117 036/4ST
NTIS

No abstract available.

Primary Keywords: Cathodes; Pulse Generators; Analysis; Design
Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE NO MICROFICHE.

10364

INVESTIGATION OF THE RESISTIVE PHASE IN HIGH POWER GAS SWITCHING (RESEARCH AND DEVELOPMENT REPORT)

R.C. O'Rourke
Science Applications, La Jolla, CA 92037
No. SAI-77-515-LJ, 66p (01/1977)
Availability: UCRL-13776
NTIS

A theoretical study was made of the resistive phase in high pressure gas switching with the regime of interest being (16 to 50) kV from (1J, 10ns, 100KHz) to (100J, 10 mu s, 1KHz). The resistive phase was examined as a function of applied field, gap spacing, inductance, gas type and pressure, and electrode material. The initiating and quenching phases as regards system performance (e.g., the jitter problem) were examined. The cooling and electrode debris removal effects of the vortex gas flow on the operating characteristics of the system were considered. (ERA citation 03:015695)

Primary Keywords: High-voltage Pulse Generators, Design, Gases, Heat Transfer, High Pressure, Laboratory Equipment, Power Supplies, Pulse Circuits, Simulation, Spark Gaps; Electronic Circuits
Secondary Keywords: ERDA/420800; NTISDE

10365

PRELIMINARY DESIGN OF A 300 KEV ELECTRON GUN FOR A HIGH POWER CO/SUB 2/ LASER AMPLIFIER

J. Katzenstein, R.K. Mosovi, Y. Kohanzadeh and M. Taherzadeh
Atomic Energy Organization of Iran, Tehran. Nuclear Research Center.
No. NRC-76-31, 20p (07/1976)
Availability: AEOI-45
NTIS

The object of this report is to describe the design of a 300 KeV electron gun which could be constructed at the Nuclear Research Centre of the Atomic Energy Organization of Iran, in Tehran. Included are, the specifications, circuit diagram and many necessary calculations. The design itself was chosen because of its simplicity, so no attempt was made toward an advanced or sophisticated model. However, the basic design, as presented in the report, should satisfy the present requirements of the program. (Atomindex citation 08:331523)

Primary Keywords: Carbon Dioxide Lasers; Electric Charges, Electron Guns, Kev Range 100-1000, Pulse Generators
Secondary Keywords: ERDA/420300, Iran, NTISINIS
Distribution Restriction: AVAILABLE IN MICROFICHE ONLY, U.S. SALES ONLY

10366

DESIGN AND DEVELOPMENT OF A HIGH-POWER, 500 KV PULSED LINE

A. Nicolas
CEA Centre d'Etudes de Valduc, Is-sur-Tille, France
(09/1977).
Availability: SAND-77-6018
NTIS

A study was made of very high voltage (500 kV) pulse production for 50 ns at half height. A coaxial line was coupled to a Marx generator for obtaining the pulses on an impedance-adapted electron diode. The maximum power obtained was 6.4 x 10 exp 10 W with a current front in the diode of about 30 ns (80 ns pulse length at half height). (ERA citation 03:012963)

Primary Keywords: High-voltage Pulse Generators; Anodes; Cathodes; Coaxial Cables; Design; Electric Generators; Functional Models; Mathematical Models; Power Supplies; Testing
Secondary Keywords: ERDA/420800; Translations; France; NTISDET
Distribution Restriction: TRANSLATION BY P. NEWMAN OF CEA-R--4733.

10367

PULSED POWER SUPPLY FOR INJECTION BUMP MAGNETS

W.F. Praeg
Argonne National Lab, Argonne, IL
(01/1977).
Availability: CONF-770607-4
NTIS

A very precise and relatively inexpensive charging circuit for an energy storage capacitor bank feeds an efficient thyristor-controlled pulse-forming discharge circuit. These circuits, which generate magnet pulses of 300 joules at a rate of 30 per second, are analyzed. (ERA citation 03:007278)

Primary Keywords: Zgs; Beam Bending Magnets; Beam Injection; Capacitors; Electric Discharges; Power Supplies; Pulse Circuits; Stored Energy, Thyristors
Secondary Keywords: ERDA/430302; NTISDE

10368

LONG-DURATION PULSER TO SIMULATE CW OPERATION

G.G. Emert
Harry Diamond Labs, Washington, DC 20438
No. TM64 13, 20p (11/1964).
Availability: AD-453 847/6ST
NTIS

An electronic switch or pulser has been designed to evaluate crossed-field tubes, such as the HDL-developed Rotatron. Feasibility of the pulser design has been proved in simulating CW operation of the Rotatron. The design concept is based on intermittently operating the tube, so that the beam of the injection gun is turned on and off repeatedly by applying a voltage to the control anode. The Rotatron investigation was made at 60 pps with a duty factor of 10%. Also described is a modified pulser with improved pulse shape. This pulser has performed relatively well as a modulator for plate pulsing a microwave triode oscillator at X-band at 1000 pps and a duty factor of 50%. (Author)

Primary Keywords: Radiofrequency Pulses_Circuits; Electronic Switches_Radiofrequency Pulses, Crossed Field Devices; Electron Beams, Electric Guns, Modulators; X Band; Microwave Oscillators; Pulse Amplifiers, Triodes; Voltage
Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

10369
RESEARCH ON THE PHYSICS OF PULSED MHD GENERATORS
M.S.J. Jones, V.H. Blackman, R.C. Brumfield, E.W. Evans and C.N. McKinnon
Mhd Research Inc, Newport Beach, CA
Final rept., 1 July-30 Sep 63 No. 646, 163p (12/1963).
Availability: AD-426 448/7ST
NTIS

Two systems are discussed for producing short pulses of electrical power by MHD principles. The first system is driven by condensed explosives and produces pulses lasting from 1 micro sec to 100 micro sec. The peak power generated to dat is 23 kw, with an energy output of 750 joules. The conversion efficiency, chemical to electrical, is 1%. Higher conversion efficiencies can be readily achieved. The second system uses the combustion of aluminum with cesium nitrate as the energy source for a supersonic MHD channel. The measured conductivity of the combustion products was 1000 mho/m. The highest measured peak power output was 29 watts. The experimental data indicate a large electrode drop which must be overcome before currents can flow in the generator. A favorable scaling potential is indicated. (Author)

Primary Keywords: Magnetohydrodynamics_Pulse Generators; Energy Conversion_Electric Power Production; Shock Waves; Rare Gases; Argon; Explosives; Recording Systems; Combustion; Blast; Electrodes; Magnetic Fields; Probes (Electromagnetic); Pressure; Magnets
Secondary Keywords: MHD Generators; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

10370
RESEARCH ON THE PHYSICS OF CONTINUOUS AND PULSED MHD GENERATORS
M.S.J. Jones, V. Blackman, C. McKinnon, E. Evans and T. Neff
Mhd Research Inc, Newport Beach, CA
Semiannual technical rept. no. 2, 1 Jan-30 Jun 63 (08/1963).
Availability: AD-416 299/6ST
NTIS

No abstract available.

Primary Keywords: Electric Power Production_Magnetohydrodynamics; Pulse Generators; Explosions; Deflagration; Propellants; Explosives; Shock Waves; Energy Conversion; Explosion Gases
Secondary Keywords: Pulsed MHD Generators; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

10371
PENETRATION OF PULSED ELECTROMAGNETIC WAVES INTO CONDUCTING MEDIA
L.M. Vallese
ITT, Nutley, NJ
No. tr2, 20p (12/1961).
Availability: AD-326 888/5ST
NTIS

The distributions of steady state and of transient electromagnetic plane waves at the surface of separation between air and ground (or sea) was computed. These distributions are important for such applications as undersea and geodetic explorations from points located outside the conducting media; the methods of measurement may be simplified by use of a transmission line analogy, which permits the use of comparison or of substitution methods. In addition, it was shown that if a rectangular pulse d-c magnetic plane wave is transmitted from a point within the conducting medium and received at another point of the same, the system may be used for purposes of ranging or for purposes of communication between transmitting and receiving stations. (Author)

Primary Keywords: Communication Systems; Electromagnetic Radiation; Electromagnetism; Geogony; Sea Water; Underwater; Air; Alternating Current; Analysis; Antennas; Antisubmarine Warfare; Detection; Dielectrics; Dipole Antennas; Direct Current; Electric Discharges
Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

10372
(BREAKDOWN STUDIES)
(Exploding Wires)
ALUMINIM FLUORIDE EXPLODING-WIRE LASER
W.W. Rice and R.J. Jensen
Los Alamos National Labs, Los Alamos, NM 87545
Applied Physics Letters, Vol. 22, No. 2, pp 67-68 (01/1973).

Intense aluminum flouride laser pulses in the spectral range 12.5-13.5u were observed when fine aluminum wires were exploded into flourine gas. The laser oscillation occurred during the expansion phase of the wire explosion. 10 Refs.

Primary Keywords: Aluminum Wires Exploded In Flourine Gas; AlF Laser Pulses (12.5-13.5u); F/sub 2/ Pressures 12.7-42.4 Torr

10373
HYBRID EM METHODS
I. Katz, D.E. Parks, A. Wilson, J.M. Harvey and M. Rotenberg
Systems Science and Software, La Jolla, CA 92038
Final rept. No. SSS-R-76-2376, 78p (05/1977).
Availability: AD-A039 771/1ST
NTIS

This report summarizes a study of hybrid electrostatic-electromagnetic techniques for the calculation of SGEMP generated surface currents. Presented are results using the hybrid SQUID code, a technique to treat the currents in small struts, and a theory of nonreflective boundary conditions for electromagnetic SGEMP codes. (Author)

Primary Keywords: Electromagnetic Pulses; Hybrid Circuits; Pulse Generators; Electrostatic Generators; Electromagnetic Radiation; Electric Current; Struts; Photoelectrons; Artificial Satellites; Motion; Reflection
Secondary Keywords: System Generated Electromagnetic Pulses; Surface Currents; Hybrid Squid Codes; NTISDODXA

10374
THE APPLICATION OF STEEP PULSE CURRENTS TO THE ELECTROHYDRAULIC AND MAGNETIC FORMING OF METALS
J. Gzyiewski , T. Les , R. Malewski and I. Bednarski
American Meteorological Society, Boston, MA
No. T-P-3, 20p (04/1966).
Availability: AD-485 505/2ST
NTIS

The results of a project carried out by the authors in electrohydraulic and magnetic metal forming are given. The circuits employed, the pulse current generator, and the properties of such circuit components as capacitors, trigger and working gaps, and working coils, are described in detail. The conditions for the generation of shock waves in connection with exploding wire phenumena are given, and the current curves are presented together with calculations of the power and energy dissipated. In addition, some examples of aluminum and transformer sheet forming are given. Finally, the design of tubular shunts for the measurement of steep current pulses, their properties, and testing methods are discussed. (Author)

Primary Keywords: Material Forming_Metals; Explosive Forming_Shock Waves; Electric Currents; Circuits; Hydraulic Equipment; Electromagnetic Fields; Pulse Generators; Electric Discharges; Underwater; Exploding Wires; Aluminum
Secondary Keywords: Translations; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10375
PULSE COMPRESSION TUBES
H.W. Hadley and E.R.J. Wingrove
General Electric Co, Syracuse, NY 13201
Quarterly progress rept. no. 5, 1 Jul-30 Sep 66 No. 983-GH-155-5, 12p (01/1967).
Availability: AD-807 411/4ST
NTIS

Effort was devoted to finalizing stripline circuits, evaluating vendor items, and adjusting the system to meet the limited funds available. Utilizing the presently available funds will permit the assembly of 16 of the 128 taps orginally planned. These 16 taps will be construction in blocks of 8, as originally planned, to prove the effectiveness of the delay line time-sharing technique. If the performance of the 16-tap unit is satisfactory, the remainder of the system can be readily added when additional funding is available. Design during this quarter was devoted to finalizing a reliable, reproducible coding network and stripline delay trimmer. A preliminary study was made of one 4 equalizers, but is is felt that they will not be necessary in the delay chain. All major components required in the 16-tap system have been ordered, including the chain amplifiers. (Author)

Primary Keywords: Pulse Compression_Matched Filters; Broadband; Pulse Generators; Coding; Strip Transmission Lines; Delay Lines; Amplifiers; Circuits
Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10376
HIGH POWER MODULATOR (SCR)
W.R... Olson, R.A. Smith, S.J. Gourse, T.P. Nowalk and A.H. Knopp
Westinghouse Electric Corp, Baltimore MD Surface Div
Interim technical rept. 1 Apr-1 Oct 66 (03/1967).
Availability: AD-813 081/7ST
NTIS

This report includes the efforts expended on device refinement circuit design and development of a building for high power modulators utilizing the Type 291 flat packaged thyristor in a series stack configuration. An experimental breadboard modulator having a minimum holdoff of 10KV and switching a minimum of 375 amperes has been designed and the preliminary stages of construction are described. The preliminary design of a 65KV modulator using these building blocks as major components is described. (Author)

Primary Keywords: Silicon Controlled Rectifiers_Modulators; Integrated Circuits; Modules(Electronics); Power; Manufacturing; Thermal Properties; Pulse Generators
Secondary Keywords: Thyristors; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10377
HIGH POWER PULSE COMPRESSION TECHNIQUES
A.G. Stewart
Department of the Army, Washington, DC
Patent No. PAT-APPL-631 793, 5p (01/1977).
Availability: AD-D003 946/1ST
NTIS

A method and apparatus are described for compressing high intensity current pulses and for providing an impedance transformation which increases the magnitude of the current of the pulses. A pulse is injected into a transmission line and after the pulse energy is converted to entirely electrostatic form the transmission line is discharged along the length thereof instead of out the end. The transmission line may be longitudinal, or in the shape of a torus, and the discharging may be either synchronous or asynchronous. The method and apparatus may be useful in compressing deuterium/tritium pellets to the point of nuclear burn. (Author)

Primary Keywords: Patents; Pulse Compression; Pulse Generators; High Power; Nuclear Fusion; Deuterium; Tritium; Electric Current; Electric Arcs
Secondary Keywords: PAT-CL-133-20; NTISGPA
Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D. C. 20231 $0.50.

10378
A NEW LASER POWER SUPPLY
C. Cason
Army Missile Command, Redstone Arsenal, AL 35809
No. RR-TR-64-14, 32p (07/1964).
Availability: AD-483 724/1ST
NTIS

The feasibility of a variety of power supply systems which may be pulsed to deliver the required electrical power to a laser flash tube is considered. Recommendations for a special pile-type battery are made, upon its performance superiority for a minimum advance in technology, as compared to the effectiveness of other systems in an assumed advanced state of development. A specific system is recommended to satisfy the requirements of a proposed flash tube. Output power density of the recommended battery is about 250,000 kw per cubic meter while the recoverable stored electrochemical energy is expected to be more than 75 million joules per cubic meter. (Author)

Primary Keywords: Lasers_Energy Conversion; Power Supplies_Pulse Generators; Magnetohydrodynamic Generators; Flash Lamps; Feasibility Studies; Storage Batteries
Secondary Keywords: Flash Tubes; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10379
AN OUTPUT EXPRESSION FOR A DISPERSIVE DELAY PULSE COMPRESSION FILTER UNDER ARBITRARY INPUTS
W.R. Jones
Naval Postgraduate School, Monterey, CA 93940
Master's thesis (05/1966).
Availability: AD-483 555/9ST
NTIS
Pulse compression filters are used extensively in modern radar systems. The nature of output waveforms from dispersive delay pulse compression filters driven by specific matched input waveforms has been studied in great detail for these radar applications. However, little work has been done to generalize these results. This paper obtains an expression for the filter output in terms of arbitrary input signals. Several particular input waveforms are analyzed using an ideal filter with assumed specific characteristics. In an attempt to indicate trends, different pulse widths and linear frequency modulation rates are assumed for the pulse shapes chosen. The resulting output envelopes are plotted graphically. (Author)
Primary Keywords: Pulse Compression_Matched Filters; Waveform Generators; Radar Signals; Delay Lines; Integral Transforms; Frequency Modulation; Statistical Processes; Special Functions(Mathematical); Electromagnetic Pulses
Secondary Keywords: Chirp Filters; Dispersive Delay Lines; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED

10380
ABSORPTION OF LIGHT IN GASES
E.L.I. Sloan and E.L. Kerr
Perkin-Elmer Corp. Norwalk, CT
Final rept. 1 Nov 64-31 Jul 67 No. PE-ER-8884, 61p (07/1967).
Availability: AD-818 134/9ST
NTIS
Two methods of measuring optical molecular absorptivities in gases, potentially capable of approaching theoretical sensitivity limits of 10 to the minus 8th power/cm were studied. An acoustic method was pushed experimentally to a sensitivity of 10 to the minus 5th power/cm absorptivity. Practical obstacles to further improvement have been found for the acoustic method. The second method, a laser illuminated spectrophone, was also investigated. Its performance was much closer to the theoretical limit.
Primary Keywords: Gases_Light Transmission; Light_Absorption; Carbon Dioxide; Water Vapor; Atmospheres; Absorption Spectra; Molecular Spectroscopy; Lasers; Pulse Generators; Acoustic Detectors; Heating; Membranes; Resonators; Gas Lasers; Nitrogen; Prisms(Optics)
Secondary Keywords: Confocal Resonators; Q-switching; Ruby Lasers; Spectrophones; NTISDOTXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10381
GENERATION OF SHORT DURATION PULSES IN LINEAR MHD GENERATORS
M.S.J. Jones, C.N. McKinnon and V.H. Blackman
Mhd Research Inc, Newport Beach, CA
(01/1964).
Availability: AD-821 933/9ST
NTIS
It is demonstrated that short pulses of electrical power can be generated by MHD principles using condensed explosives as the energy source. This work has been particularly successful in that large pulses of power have been obtained with relatively high conversion efficiencies. The scaling of these results to larger sizes to produce systems with greater outputs appears relatively straightforward. Additional work is needed to determine the optimum values for the various parameters, however, the basic principles are well understood and the direction for future work to increase output and efficiency can be clearly outlined.
Primary Keywords: Magnetohydrodynamics_Pulse Generators; Explosive Gases_Magnetohydrodynamics; Shaped Charges; Rdx; Cesium; Ions; Detonations; Velocity; Pressure; Electrical Conductivity
Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10382
GENERATION OF FRACTION OF A TERAWATT PROTON PULSES WITH COAXIAL REFLEX TRIODES
J. Golden, C.A. Kapetanakos, S.J. Marsh and S.J. Stephanakis
Naval Research Lab, Washington, DC 20375
Interim rept. No. NRL-MR-3422, 21p (12/1976).
Availability: AD-A033 873/1ST
NTIS
Results are reported on the generation of MeV, pulsed ion beams at a peak power level in excess of 2 X 10 to the 11th power watts that have an angular divergence of about 3 degrees -4 degrees. Such beams can be used in the formation of field reversing proton rings.
Primary Keywords: Proton Beams_Production; Ion Beams; Pulse Generators; Triodes; Nuclear Reactions
Secondary Keywords: NTISDODN, NTISDODNRL

10383
10-KV PULSE GENERATOR: PULSE TEST ON AUTODIN FILTER DEMONSTRATES GENERATOR CAPABILITY
L.J. Elliott, H.H. Kajihara and M.N. Smith
Naval Civil Engineering Lab, Port Hueneme, CA
Final technical rept. 1 Jul 67-30 Jun 68 No. NCEL-TR-596, 39p (09/1968).
Availability: AD-841 152/2ST
NTIS
This report describes a newly developed pulse voltage generator which provides up to 10 kv of 2-, 10-, and 100-microsecond pulse voltage. These pulses can be superimposed at any phase angle on the base 60-Hertz power provided to operate the test item. Tests with this generator make feasible a more accurate determination of the pulse response behavior of test items under operational conditions because pulse testing is performed with the test item fully energized. To illustrate the type of information obtainable, test data on a radio-frequency interference suppressing AUTODIN power line filter is presented. It was found (1) that this type of filter develops high-frequency oscillatory voltages at the output when the input 60-Hertz power contains a pulse voltage; (2) these oscillatory voltages could be suppressed by placing capacitance across the filter input and output; and (3) filters can be designed to be free of high-frequency oscillatory voltages. (Author)
Primary Keywords: Pulse Generators_Transmission Lines; Low Pass Filters; Transients; Radiofrequency Interference; Electronic Equipment; Failure; Electromagnetic Pulses; Thyratrons; Communication Systems; Voltage; Diagrams
Secondary Keywords: Autodin(Automatic Digital Network); Automatic Digital Networks; Gaussian Filters; Power Lines; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10384
THE CAPABILITIES OF ELECTRON BEAM-SEMICONDUCTOR ACTIVE DEVICES
C.B.J. Norris
Stanford University, Stanford, CA 94305
No. TR-472701, 25p (10/1968).
Availability: AD-844 915/9ST
NTIS
Some properties of a class of active elements employing an electron beam to control the output current of a semiconductor device are discussed in this paper. It is shown that the basic beam-semiconductor devices have high gains, fast response and large output capability. Numerical data are given that allow the capabilities of the device to be evaluated in a given application. It is shown that the extreme configurational flexibility of the device may be employed to enhance its basic performance capability as well as to realize unique devices that can rapidly perform complex functions. (Author
Primary Keywords: Semiconductor Devices_Ionization; Electron Beams, Electron Irradiation; Microwave Amplifiers; Electronic Switches; Gains; Optimization; Response, Pulse Generators; Control Systems
Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED

10385
SPARK GAP NANOSECOND PULSE GENERATOR
B.R. Gray
Department of the Air Force, Washington, DC
Patent No. PAT-APPL-6: 889, (02/1972).
Availability: PATENT-3 644 747
NTIS
An apparatus for generating a short duration higher peak voltage pulse from a basic lower pulse voltage of longer duration. A series of spark gaps are arranged such that the total voltage from the basic long duration pulse is applied to each gap in successio . A delay line with a fixed delay which is equal to the total breakdown time of all the other gaps is connected across each spark gap.
Primary Keywords: Patents; Spark; Gap; Nanosecond; Pulse; Generator
Secondary Keywords: PAT-CL-307-106; NTISGPAF
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10386
RESETTABLE MONOSTABLE PULSE GENERATOR
H.M. Garrahan
National Aeronautics and Space Administration, Washington, DC
Patent No. PAT-APPL-756 511, 29p (02/1972).
Availability: PATENT-3 569 744
NTIS
This disclosure describes a resettable monostable pulse generator including a charge rundown-timing circuit. The charge rundown-timing circuit includes a capacitor that is charged to a peak value by a random pulse from a constant amplitude pulse source. After being charged, the capacitor immediately starts to discharge toward zero. In addition, an output pulse generator starts to generate an output pulse as soon as the capacitor is charged to its peak value and continues to generate the output pulse until the charge drops to a predetermined level. If a second pulse from the constant amplitude pulse source occurs during this rundown period, the capacitor is again charged to its peak value. This reset pulse prevents termination of the output pulse and recycles the termination time of the output pulse (pulse width) to be measured from the inception of the last reset pulse. Each time a reset pulse occurs during a rundown period, the capacitor is recharged to its peak value; hence, the output pulse can exist for a short or long period of time depending on the occurrence of random reset pulses.
Primary Keywords: Patents; Resettable; Monostable; Pulse; Generator
Secondary Keywords: PAT-CL-307-273; NTISGPNASA
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10387
(BREAKDOWN STUDIES)
(Plasma)
DENSE PLASMA DISCHARGES FOR SOLID-TARGET HEATING
I.M. Vitkovitsky, L.S. Levine, D. Mosher and S.J. Stephanakis
Naval Research Laboratory, Washington, DC
Applied Physics Letters, Vol. 23, No. 1, pp 9-11 (06/1973).
19 Refs.
Primary Keywords: Exploding Wire Discharges; High Current Density Electron Beams; Beam-plasma Interaction; Target Damage And Current Density
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10388
CONCEPTUAL DESIGN OF AN AUTO-RESONANT ACCELERATOR EXPERIMENT
W.E. Drummond, G.I. Bourianoff, E.P. Cornet, D.E. Hasti and W.W. Rienstra
Austin Research Associates Inc, TX
Final rept. No. ARA-224, 307p (11/1976)
Availability: AD-A033 946/5ST
NTIS
Conceptual design and specifications for a proof-of-principal Auto-Resonant Accelerator have been undertaken. In particular, the pulse power source and diode configuration, the diode to waveguide transition and compression sections, magnetic field characteristics, phase locking and wavegrowth requirements, and the method of ion loading and acceleration have been examined. Specifications and conceptual designs for these five areas are presented along with several considerations of overall system requirements. (Author)
Primary Keywords: Ion Accelerators; Cyclotron Resonance; Phase Locked Systems; Electron Beams; High Energy; Stability; Pulse Generators; Radio Fields; Diodes; Magnetic Fields
Secondary Keywords: NTISDODXA

10389

WIDE PULSE LOW PRF PULSE GENERATOR

R.A. Boenning and R.W. McNiel
Department of the Air Force, Washington, DC
Patent No. PAT-APPL-808 824, (10/1971).
Availability: PATENT-3 611 204
NTIS

A pulse generator capable of producing wide low PRF pulses having fast rise and fall times is realized by circuits which alternately drive a bistable device. A multivibrator is periodically pulsed in a first stable state by a unijunction transistor relaxation oscillator having a slow period of oscillation. The multivibrator is returned to its second stable state by a unijunction transistor circuit that is activated by the first stable state voltage condition of the multivibrator. A time delay circuit associated with the unijunction transistor circuit delays actuation of the unijunction transistor and thus establishes the pulse width of the pulse generator.

Primary Keywords: Patents; Wide; Pulse; Low; PRF; Pulse; Generator
Secondary Keywords: PAT-CL-331-111; NTISGPAF
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10390

PULSE CIRCUIT FOR RADIAC SETS

R.E. Jehle and D.P. Helm
Department of the Navy, Washington, DC
Patent No. PAT-APPL-816 182, (04/1971).
Availability: PATENT-3 576 440
NTIS

In a G.M. radiac set which has a multivibrator meter circuit having an ammeter between the bistable switchable elements, a pulse generator for providing a periodic feed through pulse to the G.M. tube. The feed through pulse is added to a tube pulse only when they occur simultaneously, to provide a high amplitude counting pulse for the meter circuit.

Primary Keywords: Patents; Pulse; Circuit; Radiac
Secondary Keywords: PAT-CL-250-388; NTISGPN
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10391

PULSE GENERATOR

T.W. Pearce, A.K. Hochberg and T.O. Poehler Jr
Department of the Navy, Washington, DC
Patent No. PAT-APPL-689 358, (06/1970).
Availability: PATENT-3 518 455
NTIS

A pulse generator for the provision of high-energy short-duration pulses. A capacitor is charged by a DC power source and is made to discharge through a load when a first external pulse triggers a first SCR circuit. When it is desired that the high-energy pulse be turned off, a second and delayed external pulse is caused to trigger a second SCR circuit. When said second SCR circuit is triggered, the energy stored in the capacitor is directed toward a dissipative network and is thereby diverted from the load. The duration of the high-energy pulse can be closely controlled since said duration depends basically upon the delay between the initiation of the first and second external triggering pulses.

Primary Keywords: Patents; Pulse; Generator
Secondary Keywords: PAT-CL-307-265; NTISGPN
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10392

ELECTRICAL PULSE GENERATORS

R. Buser, G.K. Gaule and R.L. Ross
Department of the Army, Washington, DC
Patent No. PAT-APPL-672 658, (03/1970)
Availability: PATENT-3 500 078
NTIS

A generator of pulses of high energy level and current wherein a strong magnetic field emanating from a superconducting magnet is interrupted by explosively driving a coil or other electrically conductive member past said magnetic field. One or more load coils in which the high energy pulses are to appear may be driven across the superconductor magnetic field, or a flux displacer can be driven so as to alter suddenly the magnetic field flux from the superconducting magnet passing through a stationary load coil or coils.

Primary Keywords: Patents; Electrical; Pulse; Generators
Secondary Keywords: PAT-CL-310-13; NTISGPA
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10393

EXPLOSIVE PULSE GENERATOR

R.L. Conger and J.H. Johnson
Department of the Navy, Washington, DC
Patent No. PAT-APPL-710 968, (12/1969).
Availability: PATENT-3 484 627
NTIS

An explosive magnetic flux compressor for producing high current pulses with optimum flux build up and maximum current delivered to the output load. A variable load resistance which initially shorts out the output load, operates to switch current generated in the compressor to the output load as resistance is increased in the variable load resistance from heating due to high current generated in the compressor.

Primary Keywords: Patents; Explosive; Pulse; Generator
Secondary Keywords: PAT-CL-310-10; NTISGPN
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10394

ELECTRON PULSE GENERATOR OF THE GROUNDED GRID TYPE EMPLOYING A DELAY LINE STORAGE MEANS

[illegible] Johnson, T.E. Klippert and W.J. Kemler
Energy Research and Development Administration
Patent No. PAT-APPL-645 582, (07/1969).
Availability: PATENT-3 457 [illegible]
NTIS

A high current pulsed electron source including a grounded grid electron gun. A coaxial delay line charged from a voltage source is connected to the cathode of the electron gun via a coaxial mercury-wetted switch to provide a nanosecond duration driving pulse therefor. The components of the system are matched in characteristic impedance.

Primary Keywords: Patents; Electron; Pulse; Generator; Grounded; Grid; Employing; Delay; Line; Storage
Secondary Keywords: PAT-CL-328-231; NTISGPAEC
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10395

HIGH VOLTAGE FIELD-REVERSAL PULSE GENERATOR USING A LASER SWITCHING MEANS TO ACTIVATE A FIELD EMISSION X-RAY TUBE

J.B. Robison
Energy Research and Development Administration
Patent No. PAT-APPL-810 328, (03/1969).
Availability: PATENT-3 432 664
NTIS

A fast high voltage, high current pulse generator wherein high voltage on a first insulated elongated conductor disposed between second and third similar concentric conductors is switched to an end of the second conductor, providing an electric field reversal and generation of a high voltage, high current pulse at the ends of said second and third conductors.

Primary Keywords: Patents; High; Voltage; Field-Reversal; Pulse; Generator; Laser; Switching; Activate; Field; Emission; X-Ray; Tube
Secondary Keywords: PAT-CL-99-455; NTISGPAEC
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10396

TRIGGER PULSE CIRCUIT

W.E. Egan
Department of the Navy, Washington, DC
Patent No. PAT-APPL-662 259, (04/1968).
Availability: PATENT-3 381 146
NTIS

The patent specification and drawings describe a system for controlling the current to an inductive load by utilizing a silicon controlled rectifier capacitor discharge circuit operating from an A.C. source and having a trigger pulse source and a transient suppressor diode.

Primary Keywords: Patents; Trigger; Pulse; Circuit
Secondary Keywords: PAT-CL-307-305; NTISGPN
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10397

FAST PULSE GENERATOR UTILIZING AN ELECTRON BEAM TO CAUSE AN ARC BREAKDOWN ACROSS THE GAP REGION OF A COAXIAL LINE CENTER CONDUCTOR

Q.A. Kerns
Energy Research and Development Administration
Patent No. PAT-APPL-459 484, (12/1967).
Availability: PATENT-3 360 678
NTIS

In a fast pulse generator, the combination comprising a coaxial transmission line having an outer and an inner conductor, a first portion of said inner conductor being spaced from the outer conductor and from the remainder of the inner conductor of said line, means producing an electrostatic field between said first portion of said inner conductor and said outer conductor of said coaxial line, and a pulsed electron beam generator directing energized electrons between said first portion of said inner conductor and an adjacent one of said conductors to effect discharge of said electrostatic field.

Primary Keywords: Patents; Fast; Pulse; Generator; Electron; Beam; Cause; Arc; Breakdown; Across; Gap; Region; Coaxial; Line; Center; Conductor
Secondary Keywords: PAT-CL-315-3; NTISGPAEC
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10398

PULSE GENERATOR WITH STANDING WAVE ENERGY STORAGE

W.R. Baker
Energy Research and Development Administration
Patent No. PAT-APPL-402 042, (07/1967).
Availability: PATENT-3 333 203
NTIS

This invention is an electronic circuit for producing a high power output signal comprising a predetermined number of signal cycles over a precisely defined pulse time period. In the circuit, standing waves are generated in a high 'Q' pulse line from a low power signal generator. The energy stored in the standing waves is discharged by suddenly connecting the line to a matching load.

Primary Keywords: Patents; Pulse; Generator; Standing; Wave; Energy; Storage
Secondary Keywords: PAT-CL-328-59; NTISGPAEC
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10399

REMOTELY CONTROLLED POWER PULSE GENERATOR

L.L. Morse
Department of the Navy, Washington, DC
Patent No. PAT-APPL-367 094, (08/1966).
Availability: PATENT-3 267 415
NTIS

This invention relates to a system for generating short high-powered pulses in a low impedance circuit, such as in a sonar transmitter, and to means for supplying the power and triggering information to the generator through a high impedance circuit.

Primary Keywords: Patents; Remotely; Controlled; Power; Pulse; Generator
Secondary Keywords: PAT-CL-340-3; NTISGPN
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10400

ELECTRICAL PULSE GENERATOR

A.M. Stott
Department of the Army, Washington, DC
Patent No. PAT-APPL-341 470, (07/1966).
Availability: PATENT-3 259 769
NTIS

The invention relates to electro-mechanical energy converters or generators of the type adapted for converting high-magnitude input impulses of mechanical energy into peak output pulses of electrical energy.

Primary Keywords: Patents; Electrical; Pulse; Generator
Secondary Keywords: PAT-CL-310-14; NTISGPA
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10401

MODIFIED MARX GENERATOR

A.E. Schofield
Energy Research and Development Administration
Patent No. PAT-APPL-304 701, (01/1966).
Availability: PATENT-3 229 124
NTIS

This invention relates to voltage multipliers of the Marx type and, more particularly, a modified Marx circuit which minimizes power dissipation and embodies safety features not heretofore found in Marx generators.

Primary Keywords: Patents; Marx; Generator
Secondary Keywords: PAT-CL-307-110; NTISGPAEC
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10402

MARX DEVELOPMENT PROJECT

Authors Unknown
Maxwell Labs Inc, San Diego, CA 92123
Final rept. No. MLR-49, 378p (06/1970).
Availability: AD-868 671/9ST
NTIS

The program requirement was for a compact, fast, highly reliable Marx generator of an 'advanced integrated design utilizing components such as switches and capacitors that have been optimized for these applications'. A plastic-cased 45 kV, 700 joule energy storage capacitor was developed which exceeds the program goal of 99.97% probability of survival for 5,000 shots in typical Marx generator service. A matching switch with 40 kA peak current capability at 0.6 Cb charge transfer for 40,000 shots life expectancy was also developed; both of these key components were extensively tested and proved. A non-folded Marx circuit, using completely graded construction and employing the novel concept of triggering each stage via a small (fast Marx generator was designed). This circuit was realized, using the specialized Marx capacitor and switch hardware, as a 5.8 MV, 185 kJ fast Marx generator for practical demonstration of the design. This 6.8 microhenry generator is now undergoing a full-energy test program without difficulty. The basic design is extendable with minimal effort to a wide range of energy and voltage. (Author)

Primary Keywords: Pulse Generators_Design; Capacitors; Electric Switches; Sparks
Secondary Keywords: Aurora Project; Marx Generators; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10403

SOLID-STATE BWO MODULATOR

M.H. Mott and D.B. Kavanagh
Naval Electronics Lab, San Diego, CA
Research and development rept., Apr 68-Apr 69 No. NELC-1659, 34p (12/1969).
Availability: AD-867 916/9ST
NTIS

An S-band linear FM (chirp) signal generator, utilizing a backward wave oscillator (BWO) and a solid-state BWO modulator-driver circuit, was developed as part of an experimental high-range-resolution radar. The modulator-driven BWO was found to have a 3.5 to 2.9 GHz linear sweep with a 600-MHz bandwidth, a 0.300 microsecond pulsewidth, and a pulse compression ratio or time-bandwidth product of 180. In addition, it has the capability of operating to a maximum prf of 25 kHz without distortion of the chirp signal, and its maximum deviation from linear FM is less than 0.07 percent. (Author)

Primary Keywords: Radar Equipment_Modulators; Modulators_Backward Wave Amplifiers; Signal Generators_Radar Equipment; Pulse Compression; Frequency Modulation; S Band; Resolution
Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10404

CHEMICAL REACTION HERTZIAN GENERATOR

K.S. Kunz
BDM Corp, Albuquerque, NM 87106
Final rept. 31 May-31 Dec 73 No. BDM/A-1-74-TR, 139p (05/1974).
Availability: AD-920 469/4ST
NTIS

This effort represents a first attempt at combining the two separate technologies of explosive flux compression and Hertzian generation for the purpose of obtaining ultra-high energy pulses at microwave frequencies. A number of interesting concepts were analyzed and three were selected by the contractor as most deserving of future attention. It is hoped that this report will stimulate further imaginative and creative thought in this direction leading eventually to a successful technique for accomplishing the aforementioned goal. (Author)

Primary Keywords: Pulse Generators_Microwave Equipment; Magnetic Fields_Compression; Energy Conversion_Pulses; Power Supplies_High Explosives; Ferroelectric Materials_Energy Storage; Microwave Oscillators_Reaction Kinetics; Frequency Shift; Mirrors; Doppler Effect
Secondary Keywords: Flux Compression; Frozen E Field Devices; Frozen B Field Devices; Brillouin Scattering; Hertzian Generators; Chemical Generators; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10405

DUAL MODE GUN DEVELOPMENT (PHASE I)

A. Saharian
Teledyne Mec Palo Alto Calif
Final rept. 17 Sep 71-28 Feb 73 (08/1973).
Availability: AD-915 220/8ST
NTIS

The major limitation on dual mode tube performance in a TWT is caused by the large gain change that accompanies power change when beam current is varied. A technique is described to reduce this by altering the beam size and current distribution as the total current magnitude is varied. Small signal gain calculations are described for a variety of solid and hollow beam sizes, voltages and currents. The effect of varying cathode voltage is calculated and results are presented for both high and low perveance beams. Based on the theoretical calculations two electron guns were designed and built. Current density distribution from these guns was measured in an electron beam analyzer and focusing of the beam produced by one of the guns was measured in a beam tester. (Author)

Primary Keywords: Traveling Wave Tubes_Pulse Amplifiers; Electron Guns_Dual Mode; Electron Beams_Variations; Magnetic Fields; Direct Current; Voltage; Focusing; Gain; Nonlinear Systems; Solenoids; Efficiency; Continuous Waves; Coupling Circuits; Antenna Feeds
Secondary Keywords: Perveance; Hollow Beams; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10406

HIGH CURRENT PULSER CIRCUIT

W.S. Watson
Department of the Navy, Washington, DC
Patent No. PAT-APPL-588 998, 4p (05/1976).
Availability: AD-D002 716/9ST
NTIS

The circuit shapes and amplifies a logic pulse to drive loads which require high current levels such as light emitting diodes or semiconductor lasers. Automatic load protection and high speeds are provided by an inductor shunt within the circuit. The simplicity and lack of capacitors in the circuit make it ideal for gun fired applications such as optical telemetry.

Primary Keywords: Pulse Generators; Patents; Circuits; Drives(Electronics); Logic Circuits; Current Limiters; Stability
Secondary Keywords: PAT-CL-307-270; NTISGPN
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10407

NOTE ON THE USE OF CHARGE INJECTION FOR SGEMP SIMULATION

C.L. Longmire
Mission Research Corp, Santa Barbara, CA
Topical rept. 1-31 Dec 74 No. MRC-N-175, 18p (07/1975).
Availability: AD-A027 218/7ST
NTIS

This note discusses techniques and rationale for using self-contained electrical pulsers for simulating system-generated electromagnetic pulse (SGEMP) generated by x rays striking satellites. (Author)

Primary Keywords: Electromagnetic Pulse Simulators; Pulse Generators; Self Contained; Simulation; Radiation Damage; Nuclear Explosions; X Rays; Artificial Satellites
Secondary Keywords: Charge Injection; SGEMP(System Generated Electromagnetic Pulses); System Generated Electromagnetic Pulses; NTISDODXA

10408

100-KA DIRECT DRIVE EMP PULSER

J.E. Allen
GTE Sylvania, Inc, Needham Heights, MA 02194
(07/1975).
Availability: PEM-39
NTIS

A pulser is described which was built to directly drive 100 kA into a Minuteman silo closure seal. The pulser has a 50-kV charge voltage, a 10-nanosecond rise time and a 50 microsecond fall time. Physical features and performance characteristics are described along with a summary of its successful operation in pulsing the silo cover.

Primary Keywords: Electromagnetic Pulses_Simulation; Pulse Generators_Design; Missile Silos_Physical Radiation Effects; Capacitors; Nuclear Explosions; Power Supplies; Seals
Secondary Keywords: Minuteman; NTISERDA

10409
SPLIT PULSE GENERATOR
D.J. Hoft and P.R. Shutt
Department of the Air Force, Washington, DC
Patent No. PAT-APPL-468 327, 4p (08/1975).
Availability: AD-D001 916/6ST
NTIS
The patent describes a split pulse generator which generates a first half-pulse frequency, f sub 1, which is different from the second half-pulse frequency, f sub 2. The output pulse is continuous throughout the pulse width. Thus during transition time in the center of the pulse, the phase is essentially continuous in progressing from f sub 1 to f sub 2.
Primary Keywords: Pulse Generators; Patents; Splitting; Radiofrequency Generators; Radar Equipment
Secondary Keywords: PAT-CL-328-28; AN/TPN-19; NTISGPAF
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10410
SPLIT-RING MARX GENERATOR GRADING
D.M. Strickland
Department of the Air Force, Washington, DC
Patent No. PAT-APPL-495 672, 5p (09/1975).
Availability: AD-D001 536/2ST
NTIS
The patent concerns metallic tubing bent to a shape consistent with the cross-sectional shape of a Marx generator. Tubing is split into two symmetrical halves and insulated; two halves combined have an initial DC potential equal to one stage voltage, after erection of the Marx the potential collapses to zero.
Primary Keywords: Pulse Generators; Patents; Rings; Control; Transients
Secondary Keywords: Marx Generators; PAT-CL-307-110; NTISGPAF
Distribution Restriction: GOVERNMENT OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10411
ELECTROMAGNETIC ASPECTS OF EMP TESTING
E. Marx
Harry Diamond Labs, Adelphi, MD 20783
Technical memo. No. HDL-TM-75-14, 24p (10/1975).
Availability: AD-A018 450/7ST
NTIS
General considerations related to testing of complicated systems exposed to EMP by means of a simulator are presented, with special emphasis on the similarities and differences between the pulse generated by a high-altitude burst and the one generated by a simulator. Other aspects of a testing program are also discussed. (Author)
Primary Keywords: Electromagnetic Pulse Simulators; Pulse Generators; Test Methods; Electromagnetic Pulses; Airbursts; Energy Transfer; High Altitude; Nuclear Explosions; Electronic Equipment; Vulnerability
Secondary Keywords: NTISDO AB, NTISDODA

10412
PICOSECOND PULSE RESEARCH AT NBS
J.R. Andrews and R.A. Lawton
National Bureau of Standards, Washington, DC
Final rept. (01/1975).
Availability: COM-75-50657/6ST
NTIS
A general review of pulse measurement research at the National Bureau of Standards is described which includes work with electrical pulse generators using mechanical switches, avalanche transistors, snap off diodes, tunnel diodes, and laser pulses. Pulse transmission studies which include skin effect, nonuniform dielectric, lossy liquid dielectric and superconductivity are also mentioned together with pulse measurement techniques which include oscillographic techniques and pulse autocorrelation. The interfacing of picosecond pulse measurement instruments with a minicomputer is also described. This has resulted in an Automatic Pulse Measurement System (APMS) which has already been used to measure transmission coefficient S sub 21 of some microwave networks.
Primary Keywords: Electromagnetic Pulses; Electrical Measurement; Oscilloscopes; Pulse Generators; Pulse Transmitters
Secondary Keywords: Reprints; Pulses; Picoseconds; NTISCOMNBS
Distribution Restriction: PUB. IN PROCEEDINGS OF JOINT MEASUREMENT CONFERENCE, GAITHERSBURG, MD., 12-14 NOV 74 P123-140 1975.

10413
A MODEL FOR THE CURRENT PULSES OF CLOUD-TO-GROUND LIGHTNING DISCHARGES
J.H. Gilchrist and J.B. Thomas
Princeton University, Princeton, NJ
(11/1974).
Availability: AD-A015 501/0ST
NTIS
A model for the current pulses of cloud-to-ground lightning discharges is proposed. Characteristics of lightning pulses such as finite rise time, decay time and time of occurrence are incorporated in the model. The mean current and power spectral density are calculated using a numerical technique. (Author)
Primary Keywords: Lightning; Pulse Generators; Electric Discharges; Ground(Electricity); Clouds; Power Spectra; Mathematical Models; Direct Current; Numerical Methods and Procedures; Reprints
Secondary Keywords: Rise Time, Decay Time; Pulse Response; NTISDODXR; NTISDODA, NTISNSFG
Distribution Restriction: AVAILABILITY: PUB. IN JNL. OF THE FRANKLIN INSTITUTE, V299 N3 P199-210 MAR 75.

10414
MATCHING A PARTICULAR PULSER TO A PARALLEL-PLATE SIMULATOR
R.W. Lethar, M.I. Sancer and A.D. Varvatsis
AFWL, Kirtland AFB, NM 87117
Final rept. 10 Jul-18 Oct 74 (07/1975)
Availability: AD-A013 852/9ST
NTIS
As electromagnetic energy source that incorporates the peaking capacitor arms of a Marx generator as part of its electromagnetic configuration is to be used in an Electromagnetic Pulse simulator to be build under the supervision of the Air Force Weapons Laboratory. In this report, the positions of the peaking capacitors that fulfill certain desirable null-flux conditions are determined. The characteristic impedance and several other useful properties of the conical base of the pulser are also calculated.
Primary Keywords: Electromagnetic Pulse Simulators; Pulse Generators; Capacitors; Matching
Secondary Keywords: Marx Generators; NTISDODAF

10415
TEMPS (TRANSPORTABLE EMP SIMULATOR) FINAL REPORT: VOLUME II. APPENDIXES
H. Aslin and R. Ryan
Harry Diamond Labs, Washington, DC 20438
Rept. for 1 Sep 71-16 Oct 72 No. PJFR-372-D-Vol-2, 220p (08/1973).
Availability: AD-A013 621/8ST
NTIS
:Contents: A laboratory study of horizontal dipoles--TEMPS; Capacitor development and testing; Prototype marx generator switch evaluation; Switch acceptance testing; Solid resistor development; Solid-dielectric gas-graded peaking capacitor; Single-module peaking capacitor tests.
Primary Keywords: Simulators; Electromagnetic Pulses; Pulse Generators; Transportable; Capacitors; Resistors
Secondary Keywords: Transportable Electromagnetic Pulse Simulators; NTISDODA

10416
TEMPS (TRANSPORTABLE EMP SIMULATOR) FINAL REPORT: VOLUME I
H. Aslin and R. Ryan
Harry Diamond Labs, Washington, DC 20438
Rept. for 1 Sep 71-16 Oct 72 No. PJFR-372-D-Vol-1, 23p (08/1973).
Availability: AD-A013 620/0ST
NTIS
This report presents a description of the development, design, fabrication, and field testing of the TEMPS (Transportable EMP Simulator). The basic system is a simulator with the geometry of a cylinder parallel to the ground surface driven at its center by a high voltage capacitive pulser and terminated resistively at its ends to ground. The pulser and cylindrical antenna are supported by means of a dielectric support structure at elevations of up to 22 meters measured from the antenna/pulser centerline to ground. Essentially, TEMPS has three individual subsystems: the pulse generator, the cylindrical antenna, and the support structure.
Primary Keywords: Simulators; Electromagnetic Pulses; Pulse Generators; Transportable; Antennas
Secondary Keywords: Transportable Electromagnetic Pulse Simulators; NTISDODA

10417
PULSE GENERATOR EMPLOYING PLURAL PULSE-FORMING-NETWORKS WITH PULSE PRODUCING MEANS FOR CANCELLATION OF UNDESIRABLE REFLECTED PULSE
M.J. Coyle
Department of the Army, Washington, DC
Patent No. PAT-APPL-283 124, 3p (05/1965).
Availability: AD-D000 830/0ST
NTIS
The patent provides a pulse generating circuit which avoids undesirable re-excitation by providing a thyratron tube in one of the pulse forming networks so that the network is terminated in a short circuit at the time the impulse arrives thereto. Due to the action of the thyratron the polarity of the impulse is reversed in the shorted pulse forming network. Thus, the impulses in the two pulse forming networks will be of opposite polarity and will cancel one another when they are reflected back to the load circuit. Hence there can be no re-excitation of the load. It is the principal object of this invention to provide a pulse generating circuit wherein impulses transmitted thereto can be eliminated rather than reflected.
Primary Keywords: Pulse Generators; Patents; Pulses; Reflection; Cancellation
Secondary Keywords: PAT-CL-328-65; NTISGPA
Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10418
PULSE GENERATOR EMPLOYING PLURAL PULSE FORMING NETWORKS PROVIDING OVERLAPPED PULSES TO EFFECT RIPPLE CANCELLATION
G.F. Grotz and M.J. Coyle
Department of the Army, Washington, DC
Patent No. PAT-APPL-265 600, 3p (06/1965).
Availability: AD-D000 841/7ST
NTIS
The patent relates to pulse forming circuits and more particularly it relates to a pulse forming circuit for supplying very high voltage pulses to microwave transmitter tubes such as klystrons, traveling wave tubes or magnetrons.
Primary Keywords: Pulse Generators; Patents; Microwave Equipment; Ripples; Cancellation; Transmitters; Microwave Tubes
Secondary Keywords: PAT-CL-328-162; NTISGPA
Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10419
CRACK DETECTION APPARATUS AND METHOD
J.G. Sessler and V. Weiss
Department of the Navy, Washington, DC
Patent No. PAT-APPL-345 164, 5 (02/1975).
Availability: AD-D000 730/2ST
NTIS
The patent describes an apparatus and method for non-destructively detecting the presence and the location of crack in materials, using low frequency mechanical vibrations. The material specimen or structure having a crack to be detected is subjected to tensile or compressive forces due to excitation caused by low frequency sound waves or mechanical vibrations from a generator, thus changing the opening and thereby changing the effective size of the crack in the specimen. An ultrasonic search unit is used to follow modulations of reflected energy at the crack interface due to variations of the effective size of the crack. The search unit is controlled by an ultrasonic pulser-receiver which displays the amplitude of echo from the crack on an oscilloscope.
Primary Keywords: Ultrasonic Tests; Ultrasonic Inspection; Nondestructive Testing; Patents; Cracks; Detection; Pulse Generators
Secondary Keywords: PAT-CL-73-67-5-R; NTISGPN
Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10420
DEVICE FOR CHARGING ACCUMULATOR OF A POWERFUL PULSED GENERATOR
A.G. Nikolaev, V.A. Knysh, P.E. Konchunkov and V.A. Naimushin
Army Foreign Sci. and Tech Center, Charlottesville, VA
No. FSTC-HT-23-128-74, 6p (06/1974).
Availability: AD-A008 247/9ST
NTIS
A device for charging the accumulator of a powerful pulse generator, with increased reliability of operation and protection from overloads and overvoltages, is described and illustrated by a diagram. The circuit is kept in resonance with the power supply source; breakdown of the stabilitron in the overvoltage protection unit short circuits the power supply and decreases the voltage in the circuits of the device. This prevents overloads and overvoltages on the accumulator.
Primary Keywords: Pulse Generators; Accumulators; Electric Charge; Patents; Translations; USSR
Secondary Keywords: NTISDODA

10421
ELECTRON BEAM DIODE POWER ACCUMULATOR
M. Braun and K. Gerwel
ECOM, Fort Monmouth, NJ 07703
Final rept. 30 May 72-30 Oct 74 (12/1974).
Availability: AD/A-003 310/0ST
NTIS
A pulse 'power accumulator' amplifier consisting of an output section as power combiner, input tuners and plug-in tubes was designed and fabricated. The output section of the accumulator was designed to operate over a frequency range of 500-1000 MHz and combined r.f. power from four individual plug in tubes operating in a parallel push-pull mode. Plug-in FES tubes capable of operation in the frequency range of 500-1000 MHz were fabricated. The diodes in these tubes were capable of 200V or more, reverse back bias voltage.
Primary Keywords: Electron Tubes; Pulse Amplifiers; Electron Tube Targets, Semiconductor Devices; Electron Beams; Diodes, Silicon
Secondary Keywords: Electron Beam Semiconductor Devices; NTISDODA

10422
ELECTROMECHANICAL PULSER INVESTIGATION
J.P. Craig, M.O. Hagler and K.I. Selin
RADC, Griffiss AFB, NY 13440
Final rept. 1 Mar 73-28 Feb 74 No. A-002-RADC-1-74, 45p (09/1974).
Availability: AD-787 674/1SL
NTIS
The report concerns a feasibility study of electromechanical pulsers for the production of short duration, high power pulses with a low duty cycle. The pulse repetition rate is 0 200 pps. The output pulses are 40 kV, 1kA into a 40 ohm resistive load, with pulse duration between 20 and 40 us and with rise and fall times of 3 us or less. Several different approaches have been considered in an attempt to meet the requirements, including variable capacitance, variable reluctance, piezoelectric and electromagnetic generators with and without cryogenic fields. It was found that it is feasible to use an electromechanical pulser with some recommended switching schemes to meet the required pulse shape. Without switching, rise times approximately 15 us and fall times approximately 10 us are feasible. For some applications, a major advantage of an electromechanical pulser over conventional pulse methods is that high repetition rate bursts for short periods of time can be obtained. (Modified author abstract)
Primary Keywords: Pulse Generators; Electromechanical Devices; Feasibility Studies
Secondary Keywords: NTISDODAF

10423
DELAYED PULSE GENERATOR
G.J. Holub
Department of the Navy, Washington, DC
Patent No. PAT-APPL-236 016, 4 (05/1973).
Availability: AD-164 968/0SL
NTIS
The patent describes a delayed pulse signal of a predetermined pulse width obtained by having a free running clocking pulse generator provide a series of pulses to a first shift register. The first shift register provides a time delay for a predetermined number of pulses before supplying the delayed pulse signal and an enabling signal to a second shift register. The second shift register provides a time delay for a predetermined number of pulses and then supplies an output signal that inhibits the clock and at the same time inhibits the delayed pulse by resetting the first shift register.
Primary Keywords: Pulse Generators; Patents; Delay; Shift Registers
Secondary Keywords: PAT-CL-328-55; NTISGPN
Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10424
A HIGH INTENSITY PULSED SOURCE OF POLARIZED ELECTRONS
M.J. Alguard (1), K.P. Schueler (1), R.D. Ehrlich (2), G. Baum (2) and V.W. Hughes (3)
(1) Yale Univ, New Haven, CT
(2) Office Of Naval Research, Alexandria, VA
(3) Chicago Operations Office(AEC), IL
(01/1974).
Availability: AD-787 001/7ST
NTIS
A polarized electron source using the principle of photoionization of a polarized beam of Li6 atoms has been developed. Originally suggested by Fues and Hellmann in 1930 this method led to one of the earliest successful developments of a low-energy prototype source of polarized electrons. The present source, currently being installed at the Stanford Linear Accelerator Center (SLAC), is based upon the prototype design.
Primary Keywords: Electron Beams; Polarization; Photoionization; Pulse Generators; Lithium, Atomic Beams
Secondary Keywords: Lithium 6; NTISDODN
Distribution Restriction: AVAILABILITY: PUB. IN INTERNATIONAL CONFERENCE ON ATOMIC PHYSICS (4TH), ABSTRACTS OF CONTRIBUTED PAPERS, HEIDELBERG (WEST GERMANY), 22-26 JUL 74.

10425
PICOSECOND PULSE GENERATORS USING MICROMINIATURE MERCURY SWITCHES
J.R. Andrews
National Bureau of Standards, Boulder, CO 80302
Final rept. FY 1973 No. NBSIR-74-377, 45p (03/1974).
Availability: COM-74-11449/7
NTIS
Pulse generators have been built using microminiature mercury switches. A commercial RF coaxial switch was also evaluated as a pulse generator. A superconducting delay line (t sub r = 18 ps, t sub d = 70 ns) and a sampling oscilloscope (t sub r = 22 ps) were used to measure the generated pulse 10%-90% transition time. The best result obtained was a transition time of 39 ps. Pulse amplitudes were independently adjustable up to 50 volts. The microminiature mercury switches in general were found to give very unreliable operation.
Primary Keywords: Pulse Generators; Waveform Generators; Electric Switches; Mercury; Microminiaturization
Secondary Keywords: Mercury Switches; Picoseconds; NTISCOMMBS

10426
HIGH INTENSITY, PULSED THERMAL NEUTRON SOURCE
J.M. Carpenter
Atomic Energy Commission, Washington, DC
Patent No. PAT-APPL-351 893, 6p (12/1973).
Availability: PATENT-3 778 627
NTIS
The invention relates generally to neutron sources and more particularly to pulsed thermal neutron sources. Specifically, this invention is concerned with a novel apparatus for slowing down fast neutrons in such a manner as to create highly intense pulses of thermal neutrons.
Primary Keywords: Neutron Sources; Patents; Pulse Generators; Thermal Neutrons; Moderators
Secondary Keywords: PAT-CL-250-499; NIISGPAEC
Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50

10427
CHEMICAL TO ELECTROMAGNETIC ENERGY CONVERSION TECHNIQUES
R.W. Waniek
Advanced Kinetics Inc., Costa Mesa, CA
Final rept. May 72-Mar 74 (06/1974).
Availability: AD-783 901/2
NTIS
The objective of the work was to develop techniques for conversion of the very high density energy stored chemically to pulses of electrical energy. Reliable low cost single shot convertors have been demonstrated by investigators in explosive flux compression technology. The techniques investigated are for use in high power lightweight transmitter experiments in support of TPO5. Multiple shot magnetic flux compression concepts were analyzed, experimentally verified, and categorized as to potential device use. The concepts investigated have the capability for multiple pulse operation and all involved the rapid deceleration of either explosively driven shock fronts or explosively driven metallic projectiles in a magnetic field. The effects of physical parameters of the decelerated medium and the magnetic field were experimentally verified and parameter tradeoffs were developed.
Primary Keywords: Energy Conversion; Pulse Generators; Magnetic Fields; Exothermic Reactions; Detonation Waves; Pistons; Compression; Explosives; Flux(Rate); Interactions; Projectiles; Magnets; Electromagnetic Pulses; Acceleration; Deceleration; Multiple Operation
Secondary Keywords: NTISDODAF

10428
ANALYSIS OF DISCRETE PULSE FORMING NETWORKS DRIVING NON-LINEAR FLASH LAMP LOADS
D.C. Barr
Naval Research Lab, Washington, DC 20375
Final rept. No. NRL-MR-2808, 76p (06/1974).
Availability: AD-782 399/0
NTIS
An interactive design tool for analyzing discrete lumped parameter pulse forming networks driving time invariant nonlinear flashlamp loads is described. The program is written in FORTRAN IV for the Control Data Kronos timesharing system. The program handles linear (resistive) loads as well as xenon flashlamps. The formulation is structured to allow easy modification. Up to 10 mesh PFN's can be handled. (Author)
Primary Keywords: Pulse Generators; Flash Lamps; Xenon Lamps; Mathematical Models; Electrical Networks; Computer Programs; FORTRAN
Secondary Keywords: Network Analysis Theory; FORTRAN 4 Programming Language; CDC 6400 Computers; Pulse Forming Networks; NTISDODN

10429
ANALYSIS OF THE OPERATING REGIMES OF AN IMPULSE UNIPOLE GENERATOR WITH REGULATION OF EXCITATION FLUX
V.V. Kharitonov
Army Foreign Sci. and Tech Center, Charlottesville, VA
No. FSTC-HT-23-1883-73, 16p (04/1974).
Availability: AD-781 225/8
NTIS
A method of calculating transient processes in the field circuit of an impulse unipole generator with massive magnetic conductor is examined. Based on the method, several generator operating regimes with regulation of excitation flux are analyzed.
Primary Keywords: Pulse Generators; Transients; Excitation; Computations; Translations; USSR
Secondary Keywords: NTISDODA

10430
DEVELOPMENT OF AN ELECTRICAL DISCHARGE IN GAPS WITH GREAT OVERVOLTAGE AT LOW AIR PRESSURE
Y.I. Bychkov, V.V. Osipov, Y.A. Kurbatov and A.G. Filonov
Army Foreign Sci and Tech Center, Charlottesville, VA
No. FSTC-HT-23-1841-73, 8p (08/1973).
Availability: AD-781 157/3
NTIS

The physical processes responsible for breakdown of gas gaps with overvoltages of a few percent have been studied in a number of works both oscillographically and optically. Theoretical calculations have shown that known experimental facts are explained well by the theory of Townsend avalanche generation. In the present work, the authors studied the development of a discharge in gaps of 1-6 cm with overvoltages of 2-20 times, and also measured the time characteristics, both the discharge delay time (t sub d), the time of switching to the 0.5 (U sub 0) level and the duration of the 'step' as functions of the electric field voltage.
Primary Keywords: Electric Discharges; Glow Discharges; Gas Discharges; Pulse Generators; Low Pressure; Translations; USSR
Secondary Keywords: NTISDODA

10431
EBS (ELECTRON BEAM SEMICONDUCTOR) PULSE AMPLIFIER LIFE TEST
Authors Unknown
Watkins-Johnson Co., Palo Alto, CA
Final engineering rept. 13 Feb 73-28 Jan 74. (01/1974).
Availability: AD-779 908/3
NTIS

Highly stable, high voltage, beam shield passivated diodes were fabricated for use in EBS (electron beam semiconductor) grid controlled pulse amplifiers. Six EBS pulse amplifiers were fabricated using these diodes and four of the EBS amplifiers were operated on life test for a total socket time of 14,500 hours. Data is presented showing that stable diode operation was obtained. (Author)
Primary Keywords: Pulse Amplifiers; Electron Beams; Semiconductor Diodes; Electron Tube Targets; Electron Tubes; Life Tests
Secondary Keywords: NTISN

10432
A DEVICE FOR FORMING PULSES WITH A STEEP FRONT
I.G. Kataev
Naval Research Lab, Washington, DC 20375
No. NRL-Trans-1293, 3p (05/1974).
Availability: AD-779 897/8
NTIS

The patent describes a device for forming pulses with a steep front, which includes an artificial delay line with lumped parameters and which differs in that, for the purpose of increasing the steepness of the pulse front, the elements of the line are capacitors with a ferroelectric and inductance made of ferrites connected by one of the familiar circuits for a delay line.
Primary Keywords: Electrical Networks; Pulse Generators; Pulses; Patents; Delay Lines; Translations; USSR
Secondary Keywords: NTISN

10433
EXPLOSIVE ELECTRON EMISSION AND THE CHARACTERISTICS OF HIGH-CURRENT ELECTRON FLOW
R.K. Parker
AFWL Kirtland AFB, NM 87117
Final rept. Oct 70-Jan 73 No. AFWL-TR-73-92, 298p (02/1974).
Availability: AD-775 992/1
NTIS

Within the past several years, an increasing effort has been concentrated on the development of high-current, relativistic electron beams. Initially, this effort had been impeded by limitations in the high-voltage and pulsed-power technology required to develop pulsed, high-power electron accelerators. These technologies have been developed to a level where powers on the order of 10 to the 13th power watts are now available for time durations of approximately 100 nanoseconds. Emphasis has more recently been centered on controlling and concentrating these beams. The initial behavior of the beam within the diode region of the accelerator becomes an extremely critical element. The high-current, cold-cathode diode which is distinguished by non-self-convergent electron flow has been studied to define operative electron emission mechanisms, to determine the dominant plasma phenomena within the interelectrode volume, to classify the modes of electron flow, and to verify the Friedlander beam convergence criterion. (Modified author abstract)
Primary Keywords: Electron Beams; Electron Accelerators; Electron Emission; Pulse Generators; Plasmas(Physics); Diodes; X Rays; Relativity Theory; Wave Equations
Secondary Keywords: AF

10434
HERTZIAN GENERATOR DEVELOPMENT
S.D. Houston and D. Bailey
BDM Corp, Albuquerque, NM 87106
Technical rept. (Final) No. BDM/A-90, 74p (12/1973).
Availability: AD-774 567/2
NTIS

The report summarizes the results of a one-year theoretical and experimental study of the frozen wave Hertzian concept for electromagnetic wave generation. The bulk of the effort was devoted to the switch problem, in particular, switch synchronization. Several configurations are evaluated and the design of a 200 MHz generator is treated in some detail. Limitations on frequency, efficiency, power, etc., are discussed in terms of available switch technology, materials, etc. (Author)
Primary Keywords: Radiofrequency Generators; Ultrahigh Frequency; Very High Frequency; Pulse Generators; Generators; Microwaves
Secondary Keywords: AF

10435
ELECTRON BEAM SEMICONDUCTOR DEVICES
M. Braun and K. Gerwal
Machlett Labs Inc, Stamford, CT
Final rept. 1 Mar 72-21 Feb 73 (07/1973).
Availability: AD-766 740/5
NTIS

During the course of the contract, five EBS amplifiers, designated as EE-155, and 15 mounted EBS diodes, designated as EE-154 A and B, were developed, fabricated and delivered to the USAECOM. Diode area was 10 sq. cm and 20 sq. mm, active width of N region 25 micrometers, with resistivity of 20 ohm-cm. The electron beam of the amplifiers is generated and modulated by a cathode grid structure, with a focus electrode for beam diameter control. Best back bias voltage of the 20 diodes delivered exceeds 400 volts, with an average of 300 volts. First tests at USAECOM were done on a 20 sq. mm diode tube at 235V back bias voltage. Peak current into 3.8 ohm load was 46A, a peak power of 8 KW with a pulse risetime of 1.5 ns. Risetime, when corrected for the input pulse, is approximately 1 ns. (Author)
Primary Keywords: Microwave Amplifiers_Pulse Amplifiers; Diodes(Semiconductor)_Radiofrequency Amplifiers; Electron Tube Targets; Reliability(Electronics); Manufacturing Methods; Electron Beams
Secondary Keywords: Electron Beam Semiconductor Devices; A

10436
SOLID STATE PULSER USING PARALLEL STORAGE CAPACITORS
D.J. Amberger and R.A. Gulentano
Department of the Army, Washington, DC
Patent No. PAT-APPL-72 954, 4p (07/1972).
Availability: AD-163 796/6
NTIS

The patent describes a solid state pulse generator that produces high current narrow pulses and includes a bank of parallel silicon controlled rectifier-capacitor combinations, designed for driving a gallium arsenide diode laser. A trigger circuit is connected to all the gate circuits of the silicon controlled rectifiers, through separate adjustable resistors. The adjustable resistors make it possible to simultaneously fire the silicon controlled rectifiers with a single trigger pulse.
Primary Keywords: Lasers_Pulse Generators; Pulse Generators_Patents; Photodiodes; Gallium Arsenides; Lasers
Secondary Keywords: PAT-GL-320-1; Gallium Arsenide Lasers; Semiconductor Lasers; Light Emitting Diodes; Injection Lasers; GPA
Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10437
CIRCUIT PROTECTING, GAS-TUBE, DISCHARGE INTERRUPTER
S. Schneider and G.W. Taylor
Department of the Army, Washington, DC
Patent No. PAT-APPL-791 460, 4p (11/1970).
Availability: AD-163 603/4
NTIS

The patent relates to energy control and particularly to energy control in the form of isolation and protection for multiple, amplifier circuits operating from a common power source. More particularly, this disclosure is of the use of gas tubes as switches for isolating and protecting individual pulse-amplifier circuits or units of a multiple-unit system having a common power supply. This disclosure teaches the connection of a gas tube controlled by a magnetic field to each of the circuits to switch it off when the circuit faults or short circuits and to switch the circuit back on when the fault clears itself. This avoids draining the main capacitor bank through the short-circuit, which could damage the individual circuit and interfere with the operation of other circuits using the same, common, power supply.
Primary Keywords: Switching Circuits_Discharge Tubes; Patents_Switching Circuits; Power Supplies; Control Systems; Pulse Amplifiers; Electric Switches
Secondary Keywords: PAT-CL-317-51; GPA
Distribution Restriction: AVAILABILITY: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10438
GAS TUBE ISOLATOR AND CHARGING CIRCUIT FOR PULSE AMPLIFIERS IN PHASED ARRAYS
S. Schneider
Department of the Army, Washington, DC
Patent No. PAT-APPL-95 174, 5p (12/1971).
Availability: AD-163 579/6
NTIS

The patent relates to energy control and particularly to energy control for charging energy storage devices and for isolating and protecting multiple amplifier circuits operating from a common power supply. More particularly, disclosure relates to the use of a gaseous tube as a switch for charging the energy storage capacitor bank of an individual pulse amplifier circuit or unit of a multiple unit system having a common power supply.
Primary Keywords: Switching Circuits_Discharge Tubes; Patents_Switching Circuits; Pulse Amplifiers; Phased Arrays; Power Supplies; Control Systems
Secondary Keywords: PAT-CL-317-51; GPA
Distribution Restriction: AVAILABILITY: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10439
DISCHARGING OF INDUCTIVE POWER ACCUMULATOR FOR GENERATING SHORT-FRONT PULSE
V.N. Bolshakov
Joint Publications Research Service, Arlington, VA
(05/1973).
Availability: JPRS-58892
NTIS

The report contains a discussion of the basic parameters of the discharge circuit of an inductive accumulator for generating a current pulse with a short front.
Primary Keywords: Pulse Generators_Electric Coils; Discharge; Power Supply Circuits; USSR; Translations
Secondary Keywords: JPRS

10440
ELECTRON BEAM SEMICONDUCTOR SHORT PULSE GENERATOR
A. Silzars and R.I. Knight
Watkins-Johnson Co., Palo Alto, CA
Final rept. 1 Aug 70-1 Oct 72 No. W-J-22-4083-F, 91pH (05/1973).
Availability: AD-761 111
NTIS
Detailed analysis, design, and experimental verification of an electron beam semiconductor (EBS) amplifier for a high-speed high-current switching application has been completed. A large-signal computer simulation predicts that with an ideal diode structure over 450 amperes of output current can be achieved into an 8.5 ohm load with a risetime of less than 0.7 nanosecond. A gridded gun design was used as the most suitable approach. The cathode-grid structure showed over 80 percent of the design goal performance with uniform current density at the target position. Large area semiconductor targets of 0.35 sq. cm. and 1.40 sq. cm. active area have been successfully fabricated from 37 micrometers thick, 22 ohm/cm epitaxial silicon. The best diodes have leakage currents of less than 10 mA at 250 volts reverse breakdown voltage. Tube processing and pulsed operation did not change the diode characteristics. (Modified author abstract)
Primary Keywords: Pulse Amplifiers_Design; Electron Tube Targets_Diodes(Semiconductor); Electron Guns; Silicon; Reliability(Electronics); Manufacturing Methods
Secondary Keywords: Computer Aided Design; A

10441
HIGH EFFICIENCY CURRENT DRIVER
L. Simpson
Department of the Army, Washington, DC
Patent No. PAT-APPL-717 196, 4p (12/1970)
Availability: AD-163 516/8
NTIS
The driver is concerned with providing high current pulses of positive and/or negative polarity as desired. The device is charged by a D.C. voltage through a high impedance resonant network and discharges through a low impedance resonant network that includes a SCR that is turned on as desired by small current gating signals. A large current pulse, on the order of 25 amps during discharge, is inductively coupled to an output winding.
Primary Keywords: Pulse Generators_Patents; Electric Currents
Secondary Keywords: PAT-CL-320-1; CPA
Distribution Restriction: AVAILABILITY: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10442
EXPERIMENTAL AND ANALYTICAL RESEARCH ON A TWO MEGAWATT, HIGH PERFORMANCE MHD GENERATOR
D.K. Sonju and J. Teno
Avco Everett Research Lab, Inc, Everett, MA 02149
Interim rept. 1 Apr 71-1 Oct 72 (10/1972).
Availability: AD-756 489
NTIS
The report presents the initial results of a combined analytical and experimental program whose broad objectives are to achieve a more complete understanding of the operation and appropriate design techniques of compact high-performance MHD generators by further establishing the detailed analytical basis of the performance of these generators and to demonstrate the feasibility of operating compact high-performance MHD generators under a repetitively pulsed mode of operation at high power levels--in this case at the 2 MW level. In particular, the results of studies of stability, end effects, transient response, diagnostic, rapid startup, channel voltage breakdown and performance optimization are discussed and summarized. A parallel effort under this program has been directed to constructing a generator test facility and designing and fabricating a 2 MW high-performance MHD generator system to be used in the test facility. (Author)
Primary Keywords: Magnetohydrodynamic Generators_Scientific Research; Magnetohydrodynamics; Combustion Chambers; Nozzles; Heat Transfer; Cooling; Magnets; Water; Pulse Generators; Electrodes; Mass Transfer; Circuits; Graphics; Efficiency; Transients
Secondary Keywords: Viking 1 Program

10443
A 750 KW PULSE GENERATOR AND ITS USE FOR THE PRODUCTION OF X-RAY AND ELECTRON FLASHES
F. Hatterern, F. Jamet and G. Thomer
Institut Franco-Allemand Recherches, St. Louis, France
No. ISL-10/72, 37p (03/1972).
Availability: N73-12472
NTIS
A Marx generator producing in vacuum impluses from 200 to 750 kV is described. Its elements are immersed in e-eldite and coaxially mounted in a nitrogen pressurized chamber. The self-induction of the set-up is 1.5 micro H when used with a flash tube, the X-ray impulses are characterized by their high intensity and a 25 nsec pulse duration. This generator is suitable for electron pulse production and therefore for photographic or semiconductor pumping when used in conjunction with beryllium window tubes. (Author)
Primary Keywords: Electrons; Pulse Generators; X Rays; Electron Photography; Experimental Design; Flash Lamps; Optical Pumping; Pulse Duration; Radiography

10444
DISCHARGE IN GAS AT HIGH PRESSURE INITIATED BY A BEAM OF FAST ELECTRONS
B.M. Kovalchuk
Defence Research Information Centre, Orpington (England).
No. DRIC-TRANS-2857, 16p (08/1971).
Availability: N73-11716
NTIS
Discharge in nitrogen at pressures up to 16 atm, initiated by a beam of electrons with an average energy of 100 to 350 keV was investigated. A channel-free form of discharge was obtained with voltages above 100,000 V and switching currents of some tens of kA. The channel-free form of discharge is characterized by absorption in the gas of specific power of the order of 10 to 1000 MW/cu cm or more in a time interval of the order of 100 microseconds. (Author)
Primary Keywords: Electron Beams; Gas Discharges; High Pressure; Nitrogen; Electric Pulses; Electron Avalanche; Pulse Amplitude; Pulse Generators; Spark Gaps

10445
METHOD OF GENERATING UNIPOLAR AND BIPOLAR PULSES
N.E. Dixon
Atomic Energy Commission, Washington, DC
Patent No. PAT-APPL-111 957, 10p (04/1972).
Availability: PATENT-3 656 012
NTIS
The method for generating bipolar and unipolar mechanical pulses is described. The unipolar pulses can be in a form of a single unipolar pulse or pairs of unipolar pulses of opposite polarity. (Author)
Primary Keywords: Transducers_Patents; Ultrasonic Tests_Transducers; Pulse Generators; Nondestructive Tests
Secondary Keywords: Pat-cl-310-8-1
Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 $0.50.

10446
EXPLOSIVE-DRIVEN EMP GENERATOR
K.M. Soo Hoo
Aerospace Corp, El Segundo, CA 90245
Rept. for Jul 71-Jun 72 No. TR-0073(3542-02)-1, 33p (11/1972).
Availability: AD-751 907
NTIS
The feasibility of radiating large quantities of energy from a satellite is discussed. A system comprised of an explosive generator source, switching and matching networks, and a bent-dipole antenna is theoratically analyzed. The calculations indicate that an electric field of 4000 V/m can be produced at a distance of 1 mile from the source. (Author)
Primary Keywords: Pulse Generators_Electromagnetic Pulses; Explosions; Dipole Antennas; Satellites(Artificial)
Secondary Keywords: Explosive Generators

10447
THE POSSIBILITY OF USING LIQUID DISCHARGERS IN HIGH-VOLTAGE NANOSECOND PULSE CIRCUITS
G.A. Mesyats and G.A. Vorobev
FTD, Wright-Patterson AFB, OH
No. FTD-HT-23-939-72, 10p (09/1972).
Availability: AD-751 170
NTIS
The article compares the commutation time t sub k of air and oil dischargers and shows that in the latter t sub k is less. It is also found that the durability of the oil during short pulses does not depend on its humidity. (Author)
Primary Keywords: Electric Discharges_Dielectrics; Oils; Air; USSR
Secondary Keywords: Insulating Oil; Translations; Dielectric Breakdown

10448
MULTIMEGAJOULE PULSED POWER GENERATION FROM A REUSABLE COMPRESSED MAGNETIC FIELD DEVICE
M. Cowan, E.C. Cnare, W.K. Tucker and D.R. Wesenberg
Sandia Labs, Albuquerque, NM 87115
No. CONF-741163-2, 4p (09/1972).
Availability: SAND-75-5574
NTIS
For abstract, see NSA 32 08, number 19584.
Primary Keywords: Pulse Generators_Design; Combustion; Performance; Superconducting Magnets; Switching Circuits
Secondary Keywords: NTISERDA

10449
THREE-GAP SPARK DISCHARGER FOR SPARK CHAMBER SUPPLY
G.D. Alekseev and D.M. Khazins
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
(01/1974).
Availability: JINR-P13-8398
NTIS
For abstract, see NSA 32 01, number 00919.
Primary Keywords: Spark Chambers_High-voltage Pulse Generators; High-voltage Pulse Generators_Design; Performance; Pulse Rise Time; Timing Properties
Secondary Keywords: NTISERDA
Distribution Restriction: IN RUSSIAN. U.S. SALES ONLY.

10450
UNTRIGGERED MULTICHANNEL OIL SWITCHING
D.L. Johnson
Sandia Labs, Albuquerque, NM 87115
No. CONF-741113-2, 16p (01/1974).
Availability: SAND-74-5590
NTIS
For abstract, see NSA 31 06, number 14735.
Primary Keywords: Electrostatic Accelerators_High-voltage Pulse Generators; High-voltage Pulse Generators_Switching Circuits; Operation; Performance; Pulse Rise Time; Switches
Secondary Keywords: NTISAEC

10451
2 MV, MULTICHANNEL, OIL-DIELECTRIC, TRIGGERED SPARK GAP
K.R. Prestwich
Sandia Labs, Albuquerque, NM 87115
No. CONF-741113-3, 22p (01/1974).
Availability: SAND-74-5270
NTIS
For abstract, see NSA 31 06, number 14734.
Primary Keywords: Electrostatic Accelerators_High-voltage Pulse Generators; High-voltage Pulse Generators_Switching Circuits; Spark Gaps; Switches; Trigger Circuits
Secondary Keywords: NTISAEC

10452
HIGH-VOLTAGE POWER SUPPLY FOR A HIGH-CURRENT INJECTOR
I.T. Venevtsev, G.M. Skoromnyi, Z.E. Ptukhina, E.I. Revutskii and V.V. Verbovskii
AN Ukrainskoj SSR, Khar'kov Fiziko-Tekhnicheskij Inst.
Availability: BNL-tr-579
NTIS
For abstract, see NSA 31 02, number 04064.
Primary Keywords: High-voltage Pulse Generators_Specifications; Accelerators_High-voltage Pulse Generators; Beam Injection; Electronic Circuits; Power Supplies
Secondary Keywords: NTISAEC
Distribution Restriction: TRANSLATED BY S.J. AMORETTY FROM PP 66-68 OF KHFTI--73-13.

10453

PULSED CASCADE TRANSFORMER

I.T. Yanovtsov, G.M. Skoromnyi and E.I. Ravutskii
AN Ukrainskoj SSR, Khar'kov Fiziko-Tekhnicheskij Inst.
Availability: BNL-tr-577
NTIS
For abstract, see NSA 31 02, number 04863.
Primary Keywords: Linear Accelerators_High-voltage Pulse Generators; Beam Injection; Particle Boosters; Power Supplies; Transformers
Secondary Keywords: NTISAEC
Distribution Restriction: TRANSLATED BY S.J. AMORETTY FROM PP 69-71 OF KHPTI--73-13.

10454

SOME PECULIARITIES OF OPERATION OF CURRENT COMMUTATOR ON INDUCTIVE LOAD

L.S. Barabash, S.M. Bliskii and V.A. Timokhin
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1974).
Availability: JINR-P9-7773
NTIS
For abstract, see NSA 30 03, number 07489.
Primary Keywords: Accelerators_Pulsed Magnet Coils; Pulsed Magnet Coils_Pulse Circuits; Electronic Circuits; Power Supplies; Pulse Generators; Semiconductor Diodes; Thyristors
Secondary Keywords: NTISAEC
Distribution Restriction: IN RUSSIAN. U.S. SALES ONLY.

10455

INVESTIGATION OF THE RE-ESTABLISHMENT OF IMPULSE ELECTRICAL STRENGTH AFTER DISCHARGE IN SPARK CHAMBERS WITH SMALL CLEARANCE

V.I. Martynov and V.V. Ryl'tsov
Gosudarstvennyj Komitet Po Ispol'Zovaniyu Atomnoj Ehnergii Sssr, Moscow. Inst. Teoreticheskoj I Ehksperimental'Noj Fiziki.
(01/1973).
Availability: ITEF-25
NTIS
For abstract, see NSA 29 07, number 15764.
Primary Keywords: Spark Chambers_Operation; Electric Discharges; Electric Potential; High-voltage Pulse Generators; Timing Properties
Secondary Keywords: AEC
Distribution Restriction: IN RUSSIAN. U.S. SALES ONLY.

10456

SMALL PULSE BREAKDOWN PHENOMENON IN MINERAL INSULATED CABLES

K.W. McMinn
Ukaea Reactor Group, Winfrith, Atomic Energy Establishment.
(11/1973).
Availability: AEEW-R-910
NTIS
For abstract, see NSA 29 07, number 15673.
Primary Keywords: Neutron Detectors_Electric Cables; Electric Cables_Breakdown; Dielectric Materials; Gases; Minerals; Pulse Circuits
Secondary Keywords: AEC
Distribution Restriction: U.S. SALES ONLY.

10457

ELECTRON-BEAM-CONTROLLED GAS LASERS: DISCUSSION FROM THE ENGINEERING VIEWPOINT: PART II. PROBLEMS IN THE ELECTRICAL DESIGN OF VERY HIGH ENERGY SYSTEMS

K.B. Riepe and R.E. Stapleton
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-731114-40, 17p (01/1973).
Availability: LA-UR-73-1638
NTIS
For abstract, see NSA 29 06, number 13151.
Primary Keywords: Lasers_Electron Beams; Efficiency; Energy Transfer; Excitation; Pulse Generators; Specifications
Secondary Keywords: AEC

10458

SUSCEPTIBILITY OF PULSE NUCLEAR MEASURING EQUIPMENT TO ELECTRICAL INTERFERENCES

J. Buisson
CEA Centre d'Etudes Nucleaires, Saclay, France 92260
(02/1973).
Availability: CEA-R-4425
NTIS
For abstract, see NSA 28 01, number 00568.
Primary Keywords: Pulse Circuits_Interference; Measuring Instruments_Interference; Electric Currents; Variations
Secondary Keywords: AEC
Distribution Restriction: IN FRENCH. U.S. SALES ONLY.

10459

SHOP DRAWINGS FOR A MEDIUM SIZE MARX GENERATOR: TECHNICAL REPORT NO. 73-009

W.S. Rish
University of Maryland, College Park, MD 20742
(08/1972).
Availability: ORO-2504-184
NTIS
For abstract, see NSA 27 06, number 14416.
Primary Keywords: Pulse Generators ELECTRONICS
Secondary Keywords: AEC

10460

HIGH-VOLTAGE PULSE GENERATORS FOR STREAMER CHAMBERS

M.M. Kulyukin, D.B. Pontekorvo, V.M. Sereko, I.V. Falomkin and Y.A. Shcherbakov
Joint Inst. For Nuclear Research, Dubna (USSR). Lab. Of Nuclear Problems.
(01/1972).
Availability: JINR-P13-6533
NTIS
For abstract, see NSA 26 21, number 50698.
Primary Keywords: Pulse Generators ELECTRONICS; Radiation Detectors/ Spark Chamber

10461

GENERATOR OF EXTENDED DURATION HIGH VOLTAGE PULSES

J. Gaucher and G. Roux
CEA Centre d'Etudes Nucleaires, Saclay, France 92260
(02/1972).
Availability: CEA-N-1516
NTIS
For abstract, see NSA 26 17, number 40984.
Primary Keywords: Pulse Generators ELECTRONICS

10462

ELECTRON BOMBARDED SEMICONDUCTOR SHORT PULSE GENERATOR

A. Silzers
Watkins-Johnson Co., Palo Alto, CA
Triennual rept. no. 5, 1 Dec 71-31 Mar 72 (09/1972).
Availability: AD-748 898
NTIS
Improved fabrication processes for large area semiconductor targets and complete high current amplifiers were developed. Large area (1.40 sq. cm active area) semiconductor diodes, with leakage current of less than 10 mA at reverse bias voltages of 250 volts were fabricated. Initial tests were made on a completely processed tube with an internal getter instead of a two liter appendage pump. Three complete high current pulse amplifiers were fabricated and tested for diode saturation characteristics and pulse performance. The performance was determined for both grid-driven and cathode-driven operation. (Author)
Primary Keywords: Pulse Amplifiers_Design; Pulse Generators_Performance(Engineering); Electron Tube Targets; Semiconductors; Electron Guns; Diodes(Semiconductor); Silicon; Manufacturing Methods

10463

MULTITUBE GENERATOR BANK

G.I. Zverev, V.L. Lyulev, V.B. Maiburov, I.S. Savchenko and I.A. Yampolskii
Joint Publications Research Service, Arlington, VA
(04/1972).
Availability: JPRS-56371
NTIS
Four-phase tube generators for excitation of the circuits shaping the high-frequency fields of various configurations used in plasma physics research are described. The generators can operate in two modes: independent excitation and autooscillation. In the autooscillation mode the load is the field-shaping circuit. The total installed power of the generator bank tubes is about 80 megawatts per pulse lasting 1-1.5 milliseconds with a duty cycle frequency of 0.5 to 2 megahertz and a pulse repetition rate of 0.05 to 0.1 hertz. The problem of obtaining high power is solved by adding the powers of groups of generator tubes included in parallel in the load. (Author)
Primary Keywords: Pulse Generators_Design; Plasmas(Physics)_Pulse Generators; Tube Components; Voltage Regulators; Translations, USSR

10464

(DIAGNOSTICS AND INSTRUMENTATION)
(Power)

KDS AND BKD CALORMETRIC ENERGY METERS FOR HIGH-POWER LASER PULSES

Soviet Journal Of Quantum Electronics, Vol. 8, No. 3, pp 419-420 (03/1978).
Trans. From: Kvantovaya Elektronika (Moscow), Vol. 5, pp 709 (March 1978)
Primary Keywords: Thermal Radiation Detectors; Thermoelectric Battery; High Damage Threshold; Specifications Given

10466

(PARTICLE BEAMS, ELECTRON)
(Generation)

NANOSECOND MEGAJOULE ACCELERATOR FOR BEAM INDUCED THERMONUCLEAR MICROEXPLOSIONS

F. Winterberg
Univ Of Nevada, Reno, Nevada
Nuclear Instruments And Methods 136 (1976), pp 437-440 (12/1976).
A novel concept for an intense relativistic beam accelerator is proposed which can deliver megajoule energies on the time scale of one nanosecond with a toral beam power of 10e15 W thereby reaching conditions as they are required for the ignition of thermonuclear microexplosions. 11 Refs.
Primary Keywords: One Ns Pulse; 10e15 W Beam Power; Ignition Of Thermonuclear Microexplosions; Transmission Line Type Accelerator

10467

(INSULATION, MAGNETIC)
()

ONE- AND TWO-SPECIES EQUILIBRIA FOR MAGNETIC INSULATION IN COAXIAL GEOMETRY

K.D. Bergeron
Sandia Labs, Albuquerque, NM 87115
The Physics Of Fluids, Vol. 20, No. 4, pp 688-697 (04/1977).
A cold-fluid, self-consistent model of electron and ion flow in coaxial cylindrical geometries is applied to the problem of magnetically insulated diodes. The one species, nonrelativistic problem is studied to determine in what configurations and parameter domains equilibria corresponding to magnitic insulation exist. It is proved that when the outer electrode is the cathode, equilibria always exist. For an inner cathode, whether or not equilibria exist and whether they are unique depends on whether the field is azimuthal or longitudinal and on the ratio of the radii. The two-species relativistic problem is then analyzed with the help of a computational routine which integrates the cold-fluid differintial equations and searches the parameter space for the point corresponding to space charge limited emission. As the critical field is approached from above, the resulting values of ion current show an enhancement over the single species prediction by a factor which increases with voltage and with anode radius. Patterns of nonexistence of equilibria similar to those observed for the one-species, nonrelativistic case are also found. 17 Refs.
Primary Keywords: Coaxial Magnetically Insulated Diodes; Cold-fluid, Self-consistent Model; Electron And Ion Flow; Determination Of When Equilibria Exist; Outer Cathode; Inner Cathode; Space Charge Limited Emission; Critical Field Enhancement

10468
(PARTICLE BEAMS, ELECTRON)
(Diagnostics)
POTENTIAL OF A HOLLOW ELECTRON BEAM IN A MAGNETICALLY-INSULATED DIODE
S.P. Bugaev, A.A. Kim and V.I. Koshelev
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics Technical Physics, Vol. 24, No. 8, pp 1007-1008 (08/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 49, pp 1790-1792 (August 1979)
9 Refs.
Primary Keywords: Magnetically Insulated Diode; Microsecond Accelerator; Potential Of A Hollow Electron Beam; Capacitive Voltage Divider; Graphite Collector; Burke Curcuit; Plasma Propagation Velocity

10469
(POWER TRANSMISSION)
(Transmission Lines)
PROPAGATION OF POWER PULSES IN MAGNETICALLY INSULATED VACUUM TRANSMISSION LINES
M.S. Di Capua and D.G. Pellinen
Physics International
Journal Of Applied Physics, Vol. 50, No. 5, pp 3713-3720 (05/1979).
25 Refs.
Primary Keywords: Magnetically Insulated Vacuum Lines; 1.8 Mv, 80 KA Pulse; 41.6 Ohm Line; 4ns Risetimes; Peak Power Density 2*10e9 W/cm/sup 2/, Line Wave Impedance; Line Effects On Pulse Shape; Optimal Termination; Reflected Waves

10470
(BREAKDOWN STUDIES)
(Exploding Wires)
RADIATION FROM A DENSE PLASMA GENERATED BY AN EXPLODED WIRE IN VACUUM
E.K. Chekalin and V.S. Shumanov
G.M. Krzhizhanovskii Power Engineering Institute, Moscow, USSR
Soviet Physics Technical Physics, Vol. 14, No. 1, pp 46-48 (07/1969).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 39, No. 1, pp 71-74
4 Refs.
Primary Keywords: Optical And Spectral Properties; Copper And Aluminum Wires; 30 kv, 41 uf Capacitor Bank

10471
(PARTICLE BEAMS, ELECTRON)
(Generation)
RELATIVISTIC ELECTRON BEAM IN MICROSECOND HIGH-CURRENT MAGNETICALLY INSULATED DIODES
S.P. Bugaev, A.A. Kim and V.I. Koshelev
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics Technical Physics, Vol. 24, No. 8, pp 924-925 (08/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 49, pp 1659-1661 (August 1979)
5 Refs.
Primary Keywords: High Voltage Diodes, Magnetic Insulation; Return Current; Reduced Efficiency, Explosive Electron Emission, Electron Space Charge

10472
(BREAKDOWN STUDIES)
(Solid, Radiation)
SGEMP RESPONSE INVESTIGATION WITH EXPLODING-WIRE PHOTONS, PART II
R. Stettner (1), B.M. Goldstein (1), V.A.J. Van Lint (2) and D.A. Fromme (2)
(1) Mission Research Corporation, Santa Barbara, CA 93101
(2) Mission Research Corp, La Jolla, CA
IEEE Transactions On Nuclear Science, Vol. NS-25, No. 6, pp 1342-1348 (12/1978)
7 Refs.
Primary Keywords: SGEMP; Exploding Wire; Discrepancies From Part I Resolved; Peak Skin Currents; Monopole Experiment; Dissimilar Materials Experiment

10473
(PARTICLE BEAMS, ELECTRON)
(Generation)
STRUCTURE OF THE HIGH-CURRENT RELATIVISTIC ELECTRON BEAM FORMED BY A COAXIAL GUN WITH MAGNETIC INSULATION
M.A. Gorshkova, V.P. Il'in, V.M. Nechaev, V. Sveshnikov and M.I. Fuks
Academy of Sciences of the USSR, Gor'kii, USSR
Soviet Physics Technical Physics, Vol. 25, No. 1, pp 63-66 (01/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 50, pp 109-114 (January 1980)
A numerical solution is reported for the problem of the formation of a high-current beam of relativistic electrons in a coaxial diode gun with magnetic insulation. The beam structure and other basic characteristics are analyzed in a comparison with experimental results and analytic solutions based on models. 15 Refs.
Primary Keywords: Magnetic Insulation; Coaxial Gun; Numerical Solution; Comparison Of Numerical Solution With Experimental Results

10474
(BREAKDOWN STUDIES)
(Gas, Electrical)
TECHNICAL PROBLEMS INVOLVED IN H/SUB 2/ STREAMER CHAMBERS
F. Rohrbach (1), J.J. Bonnet (2) and M. Cathenoz (3)
(1) Univ Of Washington, Seattle, Washington
(2) C.N.A.M., Paris, France
(3) CERN, Geneva, Switzerland
Nuclear Instruments And Methods 111 (1973) pp 485-495 (01/1973).
13 Refs.
Primary Keywords: H/sub 2/ Streamer Chambers; Blumlein Line; Brief Pulse; High, Reproducable Field; Additional Impurities; Marx Generator Miniaturization

10475
(PULSE GENERATORS)
(Linear Amplifiers)
A LOW-COST SUB-NANOSECOND PULSE AMPLIFIER
M. Moore, G. Newton and P. Pollard
University of Sussex, Sussex, UK
Nuclear Instruments And Methods, Vol. 115, pp 181-184 (01/1973).
Fast amplifiers for short-duration nanosecond pulses are described. These provide a bandwidth which is near the limit obtainable with conventional construction techniques and discrete component. Each has a gain of approximately 3.3 and a rise time of 0.7 ns. An output of between 0.5 and 1 V into 50 ohms is achieved. 1 Refs.
Primary Keywords: Compact Layout; UHF Wiring Techniques; 50 Ohm Output Impedance, Inverted Output; PNP Or NPN Types; Decoupled Power Supplies

10476
(DIAGNOSTICS AND INSTRUMENTATION)
(Partial Discharges)
A SIMPLE PULSE-HEIGHT ANALYZER FOR PARTIAL-DISCHARGE-RATE MEASUREMENTS
B. Bartnikas and J.M.E. Levi
Research And Development Labs, Ottawa, Ontario, Canada
IEEE Transactions On Instrumentation And Measurements, Vol IM-18, No. 4, pp 341-345 (12/1969).
7 Refs.

10477
(PULSE GENERATORS)
(Miscellaneous)
A TECHNIQUE FOR VERY-HIGH-SPEED PULSE GENERATION WITH VARIABLE REPETITION RATE
J.A. Coakin (1) and R.J.F. Dow (2)
(1) University of Southampton, Southampton, UK
(2) James Cook University, Townsville, Queensland, Australia
Proceedings Of The IEEE, (June 1974), pp 852-853 (06/1974).
A simple technique is proposed for the generation of high-speed variable repetition rate pulse trains by summing the output pulses from a series of variable delay step recovery diode circuits. The diode switching times determine the maximum repetition rate, which is several gigahertz. 1 Refs.
Primary Keywords: Step Recovery Diode Circuit; Multistage System; Delay Lines; Common Base Transistor As Summer

10478
(PULSE GENERATORS)
(Capacitive)
AN ELECTROMAGNETIC, PLANE STRESS-WAVE GENERATOR
R.F. Snell (1), DC MacKellor Jr. (1) and R. Guernsey (2)
(1) McDonnell Douglas Astronautic Company, Huntington Beach, CA
(2) Knolls Atomic Power Labs, Schenectady, NY
Experimental Mechanics, (November 1973), pp 472-479 (11/1973).
This paper describes a unique device that has been developed for the transient loading of models along straight and curved boundaries and that operates by discharge of a high-energy, high-voltage capacitor bank. In its present configuration, this device can generate uniform pressures from 1500 psi (10 MPa) to pressures that approach 100,000 psi (690 MPa) and that rise from zero to maximum pressure in 2 us and decay to approximately zero in another 2 us. The transient stress-wave patterns in photoelastic models loaded with this device have been recorded by a dynamic polariscope. The dynamic polariscope presently in use is identical to a static polariscope except that the light source is of a short enough duration (1/2 us) to photographically stop the movement of the photoelastic-fringe patterns caused by the stress wave. With the stress-wave genrator and the dynamic polariscope transient photoelastic patterns have been recorded in a number of models. These patterns indicate that the scatter from duplicate shots performed with this technique is on the order of 3 percent. This represents considerable improvement over the 15 percent scatter normally experienced with sheet-explosive loading techniques. This improvement and the rapid turnaround between shots (approximately 5 min) are distinct advantages this system has over other methods of dynamic loading. 17 Refs.
Primary Keywords: 1500 psi To 100,000 psi Pressure Pulse, 2 us Rise And Decay Times; Low Scatter; Spark Gap Trigger

10479
(PULSE GENERATORS)
(Line Type)
AVALANCHE TRANSISTOR PULSER FOR FAST-GATED OPERATION OF MICROCHANNEL PLATE IMAGE-INTENSIFIERS
A. Lundy, J.R. Parker, J.S. Lunsford and A.D. Martin
Los Alamos National Labs, Los Alamos, NM 87545
IEEE Transactions On Nuclear Science, Vol. NS-25, No. 1, pp 591-597 (02/1978).
Transistors operated in the avalanche mode are employed to generate a 1000 volt 10 to 30 nsec wide pulse with < 4 nsec rise and fall times. This pulse is resistively attenuated to 270 volts and drives the image intensifier tube which is a load of 200 pf. To reduce stray inductance and capacitance, transistor chips were assembled on a thick-film hybrid substrate. Circuit parameters, operating conditions, and cooling to the microchannel plate image-intensifier (MCPI2) tube are described. To provide dc operating voltages and control of transient voltages on the MCPI2 tube a resistance-capacitance network has been developed which (a) places the MCPI2 output phosphor at ground, (b) provides programmable gains in f-stop steps, and (c) minimizes voltage transients on the MCPI2 tube. 12 Refs.
Primary Keywords: Avalanche Pulser; 2N3700 Transistors (National Semiconductor Corporation), Low Jitter

10480
(PULSE GENERATORS)
(Miscellaneous)
EFFECT OF DISSOCIATION PULSE CIRCUIT INDUCTANCE ON THE CUCL LASER
A.A. Vetter (1) and N.M. Nerheim (2)
(1) California Institute of Technology, Pasadena, CA
(2) Jet Propulsion Lab, Pasadena, CA
IEEE Journal Of Quantum Electronics, Vol. QE-14, No. 2, pp 73-74 (02/1978).
The performance of the double-pulsed CuCl laser is improved by a decrease in the inductance of the dissociation pulse circuit. Higher efficiency is obtained due to a larger ground state copper atom population and lower optimum dissociation energy. 4 Refs.

10481
(POWER TRANSMISSION)
(Transmission Lines)
EHV AC PARALLEL TRANSMISSION LINE CALCULATIONS WITH APPLICATION TO THE NEAR RESONANCE PROBLEM

A. Chaston
Brigham Young University, Provo, UT
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-88, No. 5, pp 627-634 (05/1969).
The use of shunt reactors with EHV transmission lines has introduced new problems, one of which is induction of high voltages on a de-energized circuit of two parallel lines. This paper resents the matrix equations used in developing a digital computer program which takes into account the effects of electromagnetic induction, electrostatic coupling, distributed lines, and transposition. The computer program may also be used to calculate the effects of shunt reactors, series capacitors, and loads. The equations can be adapted to a wide range of applications, although the examples for this paper have been limited to the near resonance problem of parallel transmission lines. 9 Refs.
Primary Keywords: Parallel Lines; Matrix Equations; Digital Computer; Electromagnetic Induction; Electrostatic Coupling; Distributed Lines; Transposition; Shunt Reactors; Series Capacitors; Loads

10482
(PARTICLE BEAMS, ELECTRON)
(Generation)
ELECTRICALLY DRIVEN 200-JOULE PULSED LASER

N.G. Basov, V.A. Danilychev, A.A. Ionin, I.B. Kovsh and V.A. Sobolev
Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Technical Physics, Vol. 18, No. 11, pp 1488-1491 (05/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 43, pp 2357-2363
An electrically driven CO2 laser with a working volume of 10 liters at gas pressures up to 3 atm is described; an electron gun with a multitube cathode is used to ionize the active medium. The energy deposited in the working gas, the output power, and the efficiency are investigated for various mixture compositions and pressures. Emission pulses of 200 J are obtained with a pressure of 760 torr and a 1.5:1.4 mixture of CO2:N2:He. 11 Refs.
Primary Keywords: CO2 Laser; Output Power, Efficiency; 10 Liter Working Volume; Multitube Cathode; Marx Genrator (12nF, 200kV)

10483
(BREAKDOWN STUDIES)
(Gas, electrical)
HIGH-CURRENT DISCHARGES IN NITROGEN WITH AN INDUCTIVE STORAGE BANK

E.A. Azizov, A.A. Bogomaz, B.P. Levchenko, F.G. Rykov and V.A. Yagnov
All-Union Institute, Leningrad, USSR
Soviet Physics Technical Physics, Vol. 24, No. 2, pp 255-256 (02/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 49, pp 441-443
In this note we report an experimental study of a high-current high-pressure discharge in nitrogen initiated by an exploding wire. The initial stage of discharges of this kind has been studied in Refs. 1-3. 7 Refs.
Primary Keywords: Inductive Storage Bank Supply; Electrodes; Exploding Wires; Pulsed Pressure; Temperature

10484
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
INVESTIGATION OF THE INFLUENCE OF THE DISCHARGE MEDIUM ON THE CHARACTERISTICS OF LASER-RADIATION-TRIGGERED DISCHARGE GAPS

L.N. Bykhovskaya
All-Union Institute, Moscow, USSR
Soviet Journal Of Quantum Electronics, Vol. 9, No. 10, pp 1242-1245 (10/1979).
Trans. From: Kvantovaya Elektronika(Moscow), Vol. 6, pp 2117-2121
The results are presented of investigations of new cermant discharge gaps, having operating voltages of 9-7 and 20-16 kV and filled with various gas mixtures (argon and nitrogen, pure nitrogen). The dependences are given of the delays in firing the gaps, as a function of the voltage on the electrodes and of the energy of the laser pulses used for triggering (E=1.06u). The minimum triggering energy of the type 1 discharge gaps was 2 uJ, when using a radiation pulse having (Trad=70 ns). The rise time of the voltage pulse produced was 0.5 nsec. The discharge gaps were used to control anatropic switches in laser systems. A study was made of the radiation produced during the breakdown of the discharge gaps. The radiation pulse had a flat top and a rise time of <1 nsec. 8 Refs.
Primary Keywords: Cermet Gaps, Argon And Nitrogen Vs. Pure Nitrogen

10485
(INSULATION, MAGNETIC)
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MAGNETIC INSULATION OF AN INTENSE RELATIVISTIC ELECTRON BEAM

J. Golden, T.J. Orzechowski and G. Pekeris
Massachusetts Institute of Technology, Cambridge, MA
Journal Of Applied Physics, Vol. 45, No. 7, pp 3211-3212 (07/1974)
A magnetic field is used as an insulator, preventing electrons from crossing the gap of a pulsed field-emission diode subjected to voltages of 100-250 kV. The diode is comprised of two concentric cylinders with a variable gap separation ranging from 2 to 6 mm. A pulsed magnetic field up to 15 kG is applied along the diode axis. When the magnetic field exceeds a certain critical value, the electron current (which is typically 10-30 kA) is reduced by approximately two orders of magnitude. The desired magnetic insulation lasts over the full 50 nsec voltage pulse. 12 Refs.
Primary Keywords: Intense E-beam, 100 250kv, Magnetic Field Up To 15kg; 50ns Pulse Length, Pulsed Field Emission Diode

10486
(BREAKDOWN STUDIES)
(Solid, Electrical)
MECHANISM FOR A SECONDARY SURFACE BREAKDOWN IN A REVERSE BIAS HIGH-VOLTAGE SILICON P-N JUNCTION

B.M. Ataev, I.V. Grekhov, M.A. Magomedov and Sh.R. Mutalibov
Academy of Sciences of the USSR, Makhachkala, USSR
Soviet Physics Technical Physics, Vol. 24, No. 8, pp 992-993 (08/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 49, pp 1768-1770
4 Refs.
Primary Keywords: Photomultiplication; Electroluminescence Spectrum; 700-1500V, 10e-5 to 10e-4 sec Excitation Pulses; Air vs. Vacuum

10487
(ELECTROMAGNETIC COMPATIBILITY)
(Hardness)
MODAL CHARACTERIZATION OF SKYNET RESPONSE TO ELETRICAL AND PHOTON STIMULATION

V.A.J. Van Lint and D.A. Fromme
Mission Research Corporation, La Jolla, CA 92038
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 6, pp 4989-4999 (12/1979)
0 Refs.
Primary Keywords: Structure Currents; Calculated Response; Modal Descriptions; Exploding Wire Radiator Photon Excitation; Internal Sensor Response

10488
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
PLASMA BUILDUP AND BREAKDOWN DELAY IN A TRIGGERED VACUUM GAP

A.J. Green (1) and C. Christopoulos (2)
(1) University of Durham, Durham, UK
(2) University of Nottingham, Nottingham UK
IEEE Transactions On Plasma Science, Vol. PS-7, No. 2, pp 111-115 (06/1979).
The phenomena leading to the surface flashover across solid insulators in vacuum and the subsequent spread of the trigger plasma thus formed to bridge the main gap in a triggered vacuum switch are investigated experimentally. The results show that the breakdown proceeds in two stages. In the first stage a plasma is formed by electrons releasing and ionizing absorbed gases. The electrons are field emitted at the insulator-electrode junction and the breakdown delay is primarily affected by the trigger voltage. In the second stage the trigger plasma expands into the main gap with a speed depending on the trigger current and trigger electrode geometry, in accordance with a simple model. 14 Refs.
Primary Keywords: Time Delay; Flashover Mechanism; Expansion Of The Trigger Plasma

10489
(PULSE GENERATORS)
(Miscellaneous)
SINGLE-CHIP PULSE GENERATOR PROVIDES 50 MHZ WITH ADJUSTABLE DUTY CYCLE

W.A. Palm
Control Data Corporation, Minneapolis, MN 55435
Electronic Design, Vol. 26, pp 72 (12/1976).
0 Refs.
Primary Keywords: MC10114, 50 Ohm Output Impedance

10491
(SWITCHES, CLOSING)
(Liquid, Self)
SWITCHING CHARACTERISTICS OF A DISCHARGE IN WATER

V.M. Kulashov, S.L. Nedoseev, V.P. Smirnov and A.M. Spektor
Soviet Physics Technical Physics, Vol. 19, No. 1, pp 150-151 (07/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 44, pp 230-232
The switching characteristics of discharge gaps are studied in water as a function of the characteristic impedance of the shaping line Rho/sub s/ over the range 2.5-30 Ohms. A line with an electrical length of 50 nsec is charged to < 120 kV. Most of the experiments are carried out at fields up to 10E6 V/cm. The minimum rise time, Tau/sub r/ 7 nsec, and the maximum rate of current increase, I/Tau/sub r/ 10E22 A/sec, are detected with Rho = 13 Ohms. Up to 50% of the energy stored in the line is absorbed in the switch during a pulse. The operation remains qualitatively the same with a voltage of 400 kV on a line with Rho = 15 Ohms. 5 Refs.
Primary Keywords: High Power Shaping Lines; Breakdown @ 10e6V/cm; 7ns Risetime

10492
(PULSE GENERATORS)
(Systems)
SYSTEM FOR CALIBRATION OF SPEAR TRANSPORT LINE TOROIDS

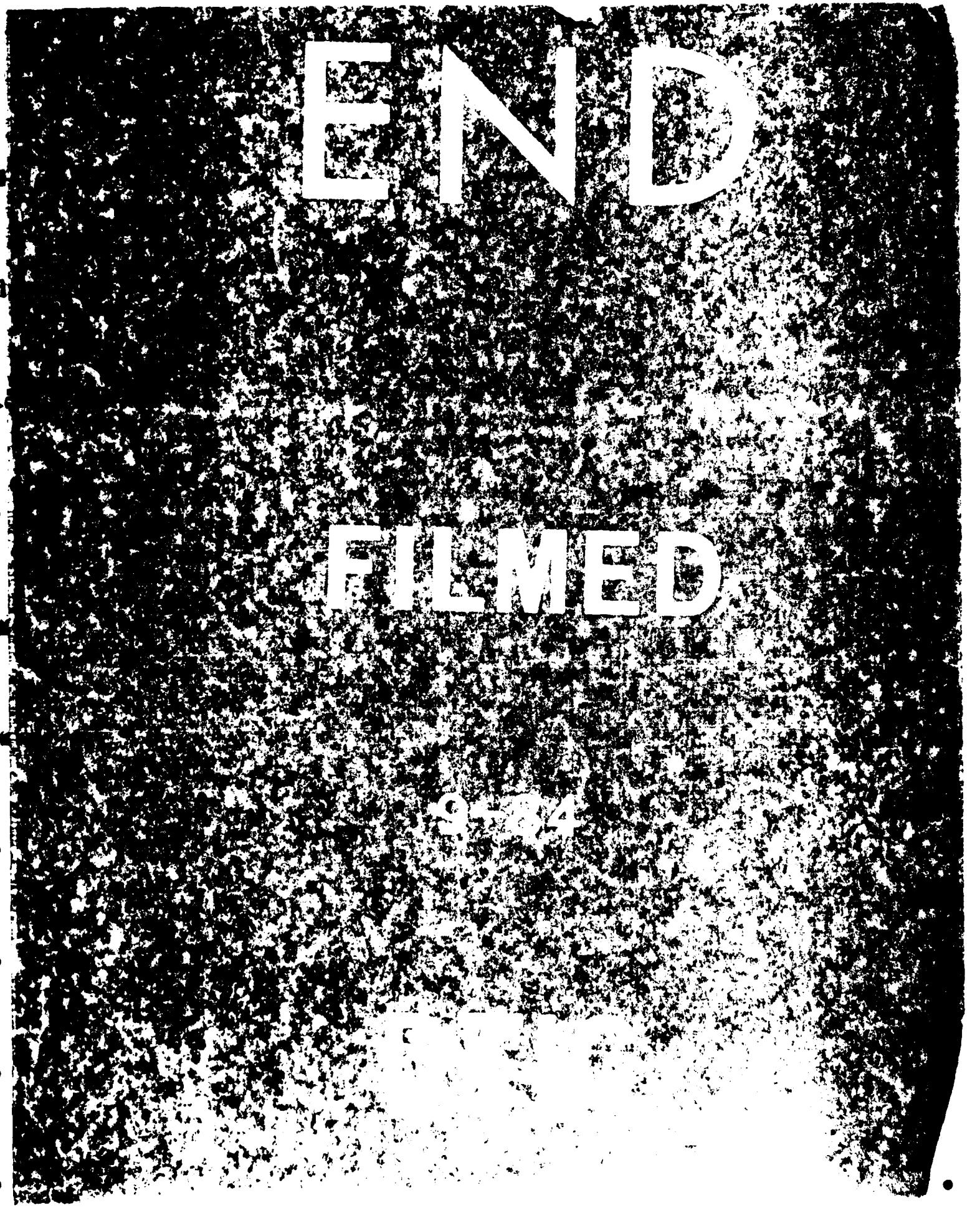
T.V. Huang, M. Smith and K. Crook
Stanford University, Stanford, CA 94305
IEEE Transactions Of Nuclear Science, Vol. NS-24, No. 3, pp 1748-1750 (06/1977).
A one nanosecond pulse generator has been developed for calibration of the intensity monitors (toroids) in the SPEAR transport lines. The generator, located at the toroid, is simple, low cost and resistant to radiation. This paper describes the generator, and its connection to the standard SLAC toroid calibration system. 0 Refs.
Primary Keywords: Ins Local Generator At Each Toroid

10493
(PULSE GENERATORS)
(Miscellaneous)
WIDE-BAND PULSE AMPLIFIER

J. Meyer
Siemens Aktiengesellschaft, Munich, Germany
IEEE Journal Of Solid State Circuits, Vol. SC-13, No. 3, pp 409-411 (06/1978).
In order to build a gigabit/second pulse amplifier for medium power applications a new transistor-distributed amplifier configuration was developed and tested. A five-section amplifier employing 5 GHz f(T) bipolar transistors has a frequency response from dc to 3.6 GHz. Results achieved were a 10 db gain, 130 ps step response rise time, and an amplitude of 4 V peak to peak across a 50 Ohm load. 4 Refs.
Primary Keywords: Dc To 3.6 GHz Response; Bipolar Transistors; Five-section

10494
(DIAGNOSTICS AND INSTRUMENTATION)
(Miscellaneous)
A BACK-MATCHED DELAY-LINE CLIPPING TECHNIQUE FOR USE WITH FAST AMPLIFIERS

B. Griffiths and Z.C. Ten
University of Auckland, Auckland, New Zealand
Proceedings Of The IEEE, May 1975, pp 820 (05/1975)
A modified delay-line clipping amplifier technique which overcomes the drift and low-frequency noise problems of conventional dc-coupled pulse amplifiers is proposed. This technique results in an amplifier system with low output reflection coefficient and excellent overload recovery characteristics. 0 Refs.
Primary Keywords: Delay Line Clipping Amplifier Technique; Low Output Reflection Coefficient; Low Noise And Drift Characteristics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