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NOTICE

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TRANSLATION

The following definitions apply for the transliterated organization entities included in the text:

chast' (plural: chasti) - administrative, line, and supply unit of the [branches] of troops which has a number and banner, e.g., a regiment, separate battalion, and troop organizations equal to them.

ob"yedineniye (plural: ob"yedineniya) - large-scale unification of various soyedineniya of the branches of troops which is nonpermanent in composition and is intended to conduct operations in a war.

podrazdeleniye (plural: podrazdeleniya) - troop unit of permanent organization and homogenous composition in each branch of troops which unit forms a larger podrazdeleniye or chast'.

soyedineniye (plural: soyedineniya) - combination of several chasti of one or various branches of troops into a permanent organization (division, brigade, or corps) headed by a command and staff and including chasti and podrazdeleniya of auxiliary troops and services necessary for combat operations.

Source: Russian-English Dictionary of Operational, Tactical, and General Military Terms, 1958

GREAT DESIGNS

(Unattributed Article)

The soviet people speak of their Communist Party, their conviction to its ideas, their readiness to follow its leadership to new glorious successes, with a sense of great respect and love. This is understandable. The great energy of Lenin's genius and the beat of Lenin's warm heart continue to live in the affairs of the Party. "Lenin's Party," Comrad L. I. Brezhnev has stated, "follows its words with action. The course to the victory of the socialist revolution, the course to socialism, the course to the building of communism: these are the words of the Party, expressed in its three programs. The victory of October, the triumph of socialism, the successful movement along the path to the communist tommorow are the concerns of the Party and of all the people."

The Party approached its XXIV Congress with a strong, monolithic closing of its ranks and an indestructible relationship with the people, enriched by the tremendous experience of the creation of communism. Thanks to the course of Lenin followed by our party and its central committee, our home land has reached new milestones in the building of communism. A clear indication of this is the successful performance of the economic and social tasks of the eighth five-year plan. During the years between the two party congresses, the moral and political unity of soviet society has been still further strengthened, socialist democracy has been further developed, and the growth rates of the well being of the workers have been significantly accelerated.

Comprehensively analyzing the international situation, vigilantly watching the intrigues of the imperialist aggressors, the party has shown its unweakening attention to the problems of reinforcing the armed might of our country, increasing the fighting ability and combat readiness of the army and navy, special training and moral tempering of the military cadres. Brave utilization of the growing economic capacities of the country in military construction plus careful consideration of the trends in scientific and technological developments have created a firm basis for constant improvement of all branches of the armed forces.

The soviet people, including the members of the army and navy, are gladened by the successes of the past five-year plan period, demonstrating the great panorama of the growing scale of the building of communism. The people have been inspired by the new creative program included in the plan for the directives of the XXIV CPSU Congress. This impressive document literally moves us five years forward, allowing us to see clearly what new, grandiose transformations will occur in the boundless spaces of the land of the soviets.

The ninth five-year plan is an important stage in the further advance of soviet society along the path to communism, the construction of its material and technical base, the reinforcement of the economic and armed might of the country. The most important task of the new five-year plan has been laid down in great clarity. This task is to PROVIDE A

SIGNIFICANT INCREASE IN THE MATERIAL AND CULTURAL LEVEL OF THE LIFE OF THE PEOPLE ON THE BASIS OF HIGH RATES OF DEVELOPMENT OF SOCIALIST PRODUCTION, INCREASING ITS EFFECTIVENESS, SCIENTIFIC AND TECHNICAL PROGRESS AND ACCELERATION OF THE GROWTH OF THE PRODUCTIVITY OF LABOR.

In order to bring this task to life, we must provide high growth rates and proportional development of social production, particularly agriculture, light and food industries, we must increase significantly the effectiveness of all branches of the national economy. All of this will result in an increase in the gross national product of 37-40% in five years. Powerful levers for successful performance of this task will be acceleration of the rates of scientific and technical progress, increasing the level of education and qualifications of workers, improvement of administration, planning and economic stimulus in correspondence with the requirements of the current stage in the building of communism.

Scientific and technical progress provides tremendous capabilities for increasing the effectiveness of social production, and also for increasing the armed might of our armed forces. It is for this reason that it is important to accelerate the rate of scientific progress by comprehensive development of research in the most promising areas of science and reduction of the time required to realize the results of scientific research. The times require replacement of manual labor with machines, creation and introduction of new tools of labor and technological processes, rapid increases in the technical level of the technological equipment available.

An important task of the ninth five-year plan is the expansion and improvement of the industrial base for development of the socialist economy. Electric power engineering, particularly atomic electric power engineering, machine building, the chemical, petrochemical and gas industries are to be developed at accelerated rates. During the five-year plan period, the production of industrial products will be increased by 42-46%, including the production of the means of production by 41-45%, the production of consumer goods by 44-48%.

In the area of agriculture, the task is to provide for most complete satisfaction of the increasing requirements of the population for food products, and the requirements of industry for raw materials. The mean annual volume of agricultural production is to be increased over the preceding five-year plan period by 20-22%. One decisive condition for fulfillment of this task is improvement of the material and technical base of agriculture, including particularly intensification of agriculture.

The plan for the directives reflects a harmonious combination of the interests of the country as a whole and of the interests of each man individually. Whether we speak of the unceasing growth of social production or the rapid development of agriculture, the expansion of the output of consumer goods or the increased scale of the service industries, all of this should result in a new and significant increase in the quality of life of the soviet people. Real income per citizen will increase by approximately 30%; the average working wage will increase by 20-22%, the wages of collective farm workers in social production of the collective farm -- by an average of 30-35%. The public consumption funds will increase by 40%. A broad program of housing construction is planned.

Significant steps are to be taken in the area of improvement of the arrangement of productive forces and improvement of the territorial economic relationships as well. The most important task here is further accelerated assimilation of natural resources and increases in the economic potential of the eastern regions of the country. The main trends in the development of the economies of the union republics and economic regions have been determined on the basis of economic expediency, an intelligent combination of the interests of each republic and of the Soviet Union as a whole.

Successful fulfillment of the ninth five-year plan will be closely related to improvement of the system and methods of administration of the economy and its planning. The task includes primarily provision of further, comprehensive intensification of social production and increases in its effectiveness. This is to be the main line of economic development of the country both in the next few years and in the distant future, the most important condition for the creation of the material and technical basis of communism.

The successful building of communism, the reinforcement of the economic might and defense capability of the country are seen by the Party as its most important international duties. The new five-year plan calls for improvement and development of scientific relationships between the USSR and the socialist member countries of CEMA. Stable economic relationships are to be developed with the developing countries of Asia, Africa and Latin America. Economically justified trade and scientific-technical agreements will be signed with the industrially developed capitalist countries.

In solving the tasks of the building of communism, the soviet people are sure that their safety is reliably protected by their valorous armed forces. Their personnel include enthusiastic patriots, living in the work and thoughts of their home land. Drawing closely around Lenin's Party and its central committee, they are always ready to defend their home land and the socialist brother countries, fighting for the great, true work to achieve the complete and decisive defeat of any aggressor.

ASTRONAUTICS AND THE PROGRESS OF SCIENCE

By

Academician A. Blagonravov and Engineer Yu. Zaytsev

> During the next five-year plan, move scientific work in space forward in order to provide for further development of telephone and telegraph communications, television, weather prediction and the study of natural resources, geographic investigations and the performance of other national economic tasks using satellites, automatic and piloted apparatus, and continue fundamental scientific research on the moon and the planets of the solar system.
>
> From Planned Directives of XXIV CPSU Congress

The hitherto unforeseen rapid development of science, continually increasing its influence on all aspects of the material and spiritual life of our society is a characteristic feature of our times. "The progress of science and technology under the conditions of the socialist economic system," says the program of the CPSU, "allows most effective utilization of the riches and power of nature in the interests of the people, the discovery of new types of energy and the creation of new materials, the development of methods of action on climatic conditions and the mastery of cosmic space." Increasing the effectiveness of social production on the basis of accelerated scientific and technical progress is considered by the Communist Party and its central committee and the soviet government to be the most important trend in the building of communism of today.

The launching of the world's first artificial earth satellite in October of 1957, performed by the Soviet Union, informed the entire world of the beginning of the space age. In subsequent years, space studies have been developed at rates unknown to any other area of science or technology. Only three and one-half years following this remarkable event, Yuriy Alekseyevich Gagarin made his legendary flight, the tenth anniversary of which is being celebrated by the soviet people and all progressive mankind on our planet. By performing the world's first orbital flight in space, he entered a new era, unknown to man.

Following the first flight, new launches of spaceships were performed. Great scientific and technical discoveries, related to the mastery of near-earth space, the study of the moon and the planets of the solar system are being made literally before our eyes. In some thirteen years, the concepts which scientists hold concerning the physics of outer space and many phenomena occurring in the universe have been significantly changed.

Before the launch of the satellites, for example, scientists did not dream of the existence of the radiation belts around the earth. It was considered that the magnetic field of our planet extended to extremely great distances and that its influence would be felt at distances of millions of kilometers. However, as measurements performed by instruments carried on spacecraft sent to the moon, Venus and Mars have shown, the magnetic field of the earth is not recorded at a distance of slightly over 100,000 kilometers from the earth.

It has also been established that the sun emits a continuous stream of plasma, which has come to be called the "solar wind." It washes past our planet and deforms its magnetic field. The nature of the interaction between them is quite reminiscent of the flow of a supersonic gas stream around a blunt body. Even a sort of shock wave is observed -- a narrow area with an increased concentration of highly heated particles. Extending in the direction from the sun to the earth, it forms the wake of our planet in outer space.

The boundaries of the magnetosphere, the saturation of the radiation belt with particles, the composition and density of the upper atmosphere are all changed by the influence of the "solar wind"; magnetic storms arise and the polar lights are created, and all of this, as we know, frequently causes disruptions of radio communications. At the present time, such geophysical phenomena as ionospheric and magnetic disturbances, the polar lights, cannot be studied in isolation from the structure and changes of the radiation belts of the earth and the various manifestations of solar activity.

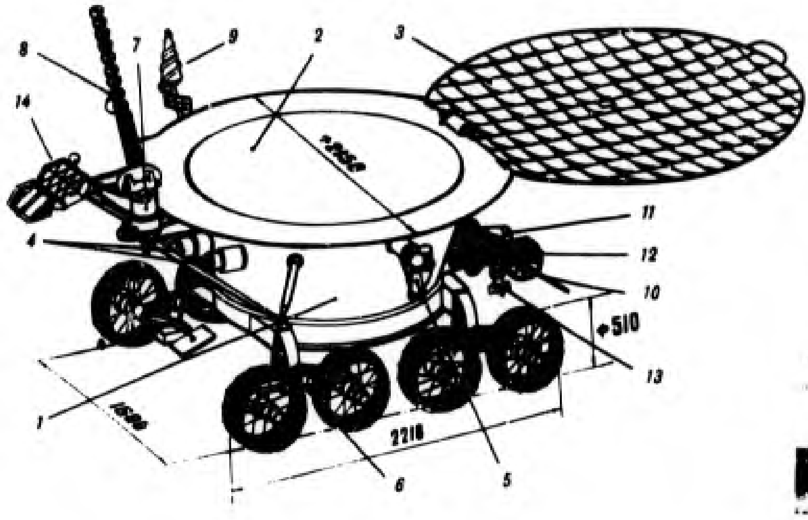
Highly important scientific data have been produced by studying the moon. A mere two years following the launch of the first satellite, the back side of the moon, never seen from the earth, was photographed. Soft landing of automatic stations on its surface allowed the structure, chemical and mineral composition of lunar soil to be studied. Extensive studies of the magnetic field, meteor and radiation situation in near-lunar space, as well as the infrared and gamma radiation of the lunar surface were made using artificial satellites of the moon.

The "Luna-16" soviet automatic space station has returned samples of moon rocks to the earth. The earth's natural satellite and the space near the moon have become today a unique scientific and technical testing range of the Soviet Union. Various scientific investigations are being conducted here, and comprehensive testing of automatic apparatus is progressing.

Late in 1970, we saw a new triumph of our science and technology. The "Lunokhod-1", placed on the surface of the moon, allowed scientists to perform scientific experiments at some distance from the landing site, and to study the most interesting lunar objects. During the development of the self-propelled apparatus, designed to operate on our natural satellite, our specialists solved a number of complex engineering and scientific-technical problems, particularly those related to the peculiarities of the vacuum of space.

The problem is that any unit made of ordinary materials, in which parts slide over the surfaces of other parts, would become inoperable on the moon in but a few minutes. The strength properties of materials are significantly influenced by the simultaneous action of a vacuum and high temperatures during the lunar day. Furthermore, the influence of the electromagnetic and corpuscular radiation and cosmic rays must be considered. On the moon, where there is no atmosphere, solar radiation can cause chemical and physical changes in the structure of many materials, leading, for example, to breakage of plastic parts. The protons in cosmic rays, bombarding the body of a space apparatus, cause errosion on its surface. Thus, the creation of "Lunokhod-1" was possible only as a result of careful selection of materials usable on the moon, their comprehensive testing in conditions of deep vacuum, high and low temperatures and other factors. Reliable sealing and heat-insulating materials were found, as well as new "self-lubricating" coatings for friction couples, which carry great loads.

One of the most difficult tasks was the development of a system to control the self-propelled apparatus from the earth. Several seconds pass while the radio signal from the moon travels to the earth and the driver, after evaluating the situation, transmits a control signal to the antenns of Lunokhod. In order to make sure that the apparatus will not collide with an obstacle, drive into a crater or lose its equilibrium during this time, the control system contains a device which automatically stops Lunokhod when certain load limits are reached. Successful performance of this unique space experiment confirmed the correctness of the technical decisions made in the planning and creation of the Lunokhod system. In order to perform studies, Lunokhod was equipped with scientific apparatus, instruments and control systems, radio communications and television observation equipment.



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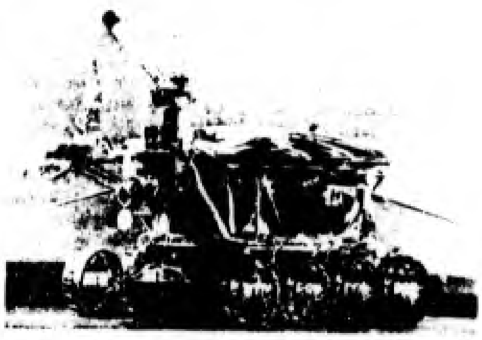


Photograph, Diagram of Arrangement and Dimensions of Lunokhod. 1, sealed instrument section; 2, radiation cooler; 3, solar battery; 4, windows for television cameras; 5, telephoto camera; 6, chassis wheel units; 7, directional antenna drive; 8, directional antenna; 9, broad-beam antenna; 10, rod antenna; 11, isotope thermal energy supply; 12, ninth wheel; 13, device for determination of physical and mechanical properties of soil; 14, optical corner reflector.

During the active functioning of the device in the region of the sea of storms, Lunokhod traveled a distance of several kilometers. New areas of the lunar surface were studied. Over the entire distance covered, the physical and mechanical properties of the lunar soil were determined by a penetrometer, its chemical composition was studied with an x-ray spectrometer.

The corner reflector designed for laser reflection experiments with the moon, manufactured in France and installed on board Lunokhod, has high optical qualities. It has allowed the performance of a number of interesting scientific measurements. For example, using this reflector and terrestrial laser installations, the distance between the earth and the moon has been measured with high accuracy. This study began the combined investigation of space, using scientific apparatus manufactured in France on board soviet spacecraft.

The study of the other planets of the solar system is quite significant for science. The exceptional capabilities of soviet rocket and space technology have been demonstrated by experiments using the "Venera" series of space apparatus. Their flights have allowed us to learn more concerning the properties of the upper atmosphere of Venus than scientists knew concerning the upper atmosphere of the earth fifteen years ago. Data have been produced on the chemical composition of the atmosphere, the temperature, pressure and density at various altitudes.

Scientific information was first obtained from another planet late in 1970 when the soviet automatic station "Venera-7" landed on Venus. During the descent, the apparatus of the station measured the distribution of temperature and pressure in the venusian atmosphere with high accuracy right down to its surface, i. e. solved the difficult problem of producing scientific data under conditions of extremely high pressures and temperatures.

Although automatic apparatus is given a significant role in the mastery of space, direct participation of man himself, the cruise of spacecraft, is also significant. In studying a number of irregular processes occurring in space, a specialist frequently observes accompanying phenomena which cannot as yet be recorded by automata. The direct participation of man in experiments makes it possible to select the most interesting objects, to increase the accuracy of measurements, their reliability and precision.

Space equipment has become a new means by which man studies the world. Experiments in space are being performed increasingly in the interests of the national economy. Even today, space apparatus flying around the earth are of direct aid to man. Using artificial satellites, various areas of our planet are photographed, allowing geologists to accummulate materials on its structure. For example, the types of structural folds in the earth's crust characteristic for various useful minerals have been determined. Thus, deposits of oil and gas accompany convex folds, while reserves of subterranean water are found with concave folds.

The results of observations and measurements performed from space are important for many branches of human economic activity. They are used, for example, to estimate the condition of the plant cover, to trace the movement of the shores of seas, rivers and lakes. Precise hydro-morphological mapping allows prediction of possible changes in river beds, fluctuations in the water regimes of individual regions and areas. The hydrological surface based on orbitol space stations will allow studies of the water resources of our planet and selection of scientific recommendations for their expenditure. This is particularly important since shortages of fresh water are critical already in many areas.

The following example might also be noted. The photographs of the earth made by the "Zond-5" automatic station clearly show the territory of Africa. Based on analysis of one photograph, a geobotanic map of this continent was made. Using the data thus produced, scientists refined an existing map of the distribution of the flora of Africa, particularly in remote and difficultly accessible areas of the continent, which had been composed by the participants of hundreds of expeditions extending over mant decades.

The high development of space communications, in particular the relaying of television programs and the performance of multichannel telephone, photographic and telegraphic communications by means of artificial satellites represent clear evidence that the mastery of space has influenced the life of mankind, ever greater satisfying the needs of people. Weather satellites allow us to study the distribution of cloud cover on the planetary scale, measuring radiation fluxes entering the atmosphere from the sun and returning to space from the earth.

Finally, space itself is a gigantic laboratory created by nature. Physics, chemistry, astronomy, biology, sibernetics and other sciences, the development of which will determine the growth of productive forces of society and scientific and technological process to a great extent are using the new information from space on an ever greater scale. Here we are studying and learning of many phenomena and rules allowing us to solve "terrestrial" practical problems.

Many conditions and processes which are natural in space must be reproduced on earth and used in the production sphere. For example, the use of radioactive radiation many times more powerful than the natural radioactive background near the earth, allowed the production of heat-resistant and oxidation resistant polymer materials. The organization of space research and the solution of the complex problems related to this research significantly influence the general level of development of technology. Many teams of specialists working in the areas of electronics, automation, machine building, metallurgy, medicine and other areas of science and technology cooperate to perform the scientific and technical tasks set forth by astronautics. New technology, new instruments and devices, designed for satellites, automatic interplanetary stations and spaceships are effectively used in the daily practice of many enterprises. Materials created specially for space purposes, capable of withstanding extremely low and extremely high temperatures, resistant to variable loads, vibrations, sharp changes in stresses, have come to be used in other areas as well, for example in those related with plasma processes.

Of course, we are just learning to achieve concrete goods from space research. However, effective application of the achievements of astronautics produced today will allow us in the near future to make space one of the most profitable branches of the economy. In the near future, production and technological complexes will begin to operate in space. For example, an orbital station is an ideal place for the achievement of a deep vacuum, powerful radiation, extremely low temperatures and strong magnetic fields.

Our country is successfully performing a broad program of space research by gradual transition from one stage to another. The most important specific feature of the soviet space program is strict sequence in the performance of each stage, without which further forward progress is impossible. Along with this, gradual complication of the problems solved and a transition, as data are accummulated, from reconnaissance studies to broad, multilevel studies, are clearly seen.

The study of space in the future will be performed on a basis characteristic for soviet science -- comprehensive preparation and reliable support of each new experiment.

ARTILLERYMAN'S TEST

By

Engineer Major G. Chagin, Special Correspondent

Combat firing is a test, during which each soldier, sergeant and officer learns how he has mastered his military profession, his weapon and equipment, how he has learned to service and prepare it for use.

The troops of the battery commanded by guards Captain V. Sivyakov prepared long and with particular effort for their record firing, attempting to make their contribution to the report of the military defenders of the home land for the Congress of Lenin's Party.

One foggy spring morning, the battery moved to the region of the firing positions to fire for record against tanks. The crews were ready to open fire but the fog, contrary to expectations, continued to thicken. The visibility was almost zero. However, everyone was calm: they knew that somewhere nearby the ground artillery reconnaissance radar was in operation.

When the optical artillery reconnaissance equipment is useless, this radar uses its invisible "fingers" -- beams of electromagnetic energy -- to "feel out" the defense line of the "enemy." The powerful radio pulses follow each other, going out to encounter objects before them, are reflected from these objects and return to be received by the radar antenna...

"There is a target!" reports the Senior Operator, Gaurds Sergeant D. Grachev. "A column of tanks! range... azimuth..."

Guards Senior Lieutenant A. Tul'tsev immediately transmits the information to the battery commander. He rapidly performs calculations, gives his commands and after a few seconds the shells fly out to meet the target tanks. The results of the firing are outstanding! This means that the troops of the Battery of Guards Captain V. Sivyakov have successfully performed the obligations which they undertook in honor of the XXIV CPSU Congress.

Less than a year has passed since Guards Captain V. Sivyakov took command of the battery. True, the Podrazdeleniye showed good results of combat and political training even then, but every time it fell just slightly short of becoming outstanding.

The new commander carefully analyzed the state of affairs in each Podrazdeleniye. Together with Guards Senior Lieutenant A. Bulgakov, Guards Lieutenant V. Mokshin and the other officers of the battery, he studied the methods of performance of drills. They decided to use the technical training equipment more fully, particularly in drills with the young soldiers, and to increase the intensity of training sessions with the materiel.

Understanding that the success of their work depended to a great extent on the training of the drill leaders, Guards Captain V. Sivyakov turned his attention to work with his young subordinate officers. Guards Senior Lieutenant A. Bulgakov, for example, was assigned to help Guards Lieutenant V. Gerts, who had recently graduated from the military school, while Sivyakov himself studied with Guards Lieutenant V. Mokshin, who had been activated from the Reserve after he graduated from a civilian university. Now Guards Lieutenant V. Mokshin is one of the leading officers in the battery. His platoon has taken first place in combat and political training not only in the battery, but in the battalion.

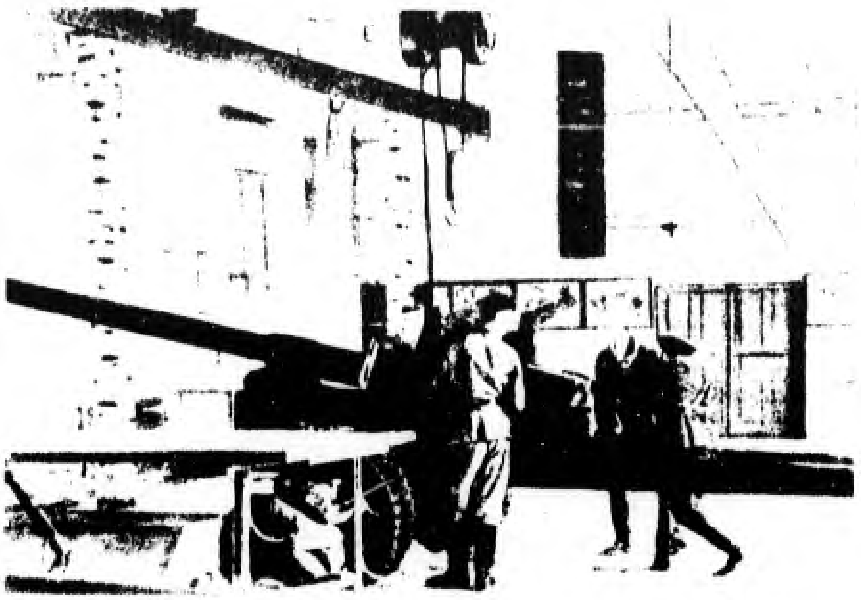
...The successful performance of the record firing was due in no small measure to the successes of the repair workers, headed by Guards Engineer Captain V. Yakimov. For example, during preparation for firing, Guards Senior Lieutenant A. Lyapin and Guards Sergeant A. Negodyayev carefully tested the recoil mechanisms, checked the siting device, helped the second gun crew to correct a defect discovered in the site -- the so-called no-return unsteadiness. In a word, they prepared the battery to go out in the field.

It should be noted that the repair workers, commanded by Guards Engineer Captain V. Yakimov, performed great work in order to completely fulfill their socialist obligations by the Party Congress. It so happened that during the time of preparation for the XXIV CPSU Congress, they were given complex tasks involving the equipment of their permanent repair shop. In a comparatively short time, they repaired a beam crane and installed a saddle crane winch in their shop for transfer of artillery systems. The cable of the winch, passing through rollers placed before each door of their shop, easily rolls the equipment into the shop. Racks and boxes for tools used in the dissembly of hoisting and balancing mechanisms of artillery systems were constructed and installed. Each working position has a daylight lamp. A lathe, drill press and tool grinder were installed in the machine shop.

All work rooms were arranged efficiently, and an area for the repair of recoil devices and rifled weapons was set up. Sectors were set aside for the repair of muzzle covers and tarpaulins, for bench work and for tool work with a full set of tools. Several of these sectors are small in area, but are well planned and equipped, and have sufficient natural illumination and daylight lamps.

Officer V. Yakimov, Guards Master Sergeant in Extended Service N. Moskalyuk and Guards Junior Sergeant V. Lutsenko used standard parts to design and construct a stand for repair, charging and testing of batteries. One new feature of this stand is that in place of the ordinary direct current power supply, it is equipped with a PSO-300 welding transformer. This allows a significant increase in the number of batteries which can be charged at the same time.

Guards Engineer Captain V. Yakimov turned particular attention to the introduction of elements of scientific organization of labor, technical esthetics and especially effective painting of rooms and equipment. For example, in the area for repair of optical artillery sites, everything is painted with oil-base paint in light shades, and the floor is covered with light-colored linoleum. The walls of the shop are also painted in light colors. Now, no one wants to harm their pristine appearance by leaning against them or bumping them with parts. All repair equipment is painted in the same manner. The concern for his people is obvious everywhere. In the winter there is steam heat. The forging shop is located outside the repair shop, in order to avoid unnecessary noise and air pollution. Hot and cold showers are available for the repair workers year round. All of this has lead to the fact that the repair workers are more careful about maintaining cleanliness and order in their working areas, and the work even seems much easier.



The light, spacious workshop contains everything necessary for high quality repair and servicing of the materiel.

Many rationalizer's suggestions have been made by Guards Engineer Captain V. Yakimov. They all lighten the work of the repair workers.

Guards Captain V. Sivyakov carefully inspects the equipment of the battery before each firing exercise.

Guards Senior Lieutenant A. Tul'tsev discusses drills with the radar crew.

The artillery repair shop is now capable of performing technical maintenance cycles numbers 1 and 2, as well as middle echelon repair of artillery systems, earlier performed by special enterprises.

The artillerymen are now getting ready for the summer training period. They must achieve new, higher goals in combat improvement. The guardsmen are inspired for successful performance of their sacred duty to their home land by the resolutions of the XXIV CPSU Congress, the great prospects for the building of communism, guarded by the true sons of the home land.

THE CONTEST IS ON

(Unattributable Article)

Each day, the editors receive reports indicating the increasing number of repair Podrazdeleniye and enterprises which have entered the contest for the development of working positions to be shown at the Exhibition of Achievements of the National Economy of the USSR.

For example, Engineer Major Zakharov reports that at one of the repair enterprises of the Red Banner Northern Caucasus Military District, the rules of the contest have been printed up and distributed throughout the Podrazdeleniye. The commision for inventions is already receiving suggestions. For example, soviet army employee V. Samsukov believes that the welders position recommended by the Journal should be installed in mechanical workshops, so that welding of small parts can be performed without loss of time involved in transportation of the parts.

Soviet army employee G. Pikhomirov suggests introduction of a mobile technician's working position. This will allow repair of equipment parts and units to be conducted more efficiently. He also believes that this type of working position needs additional local battery powered illumination, allowing it to be used directly with the systems being repaired.

From the Red Banner Trans-Caucasus Military District, Lieutenant Colonel P. Gabalin reports that the repair shops and enterprises are finding increasing numbers of entrants for the contest. This indicates that even well equipped locations can be made even more convenient and efficient. For example, at the sector for repair of electric measurement instruments headed by Captain Yu. Yarmolenko, it would seem that everything had been considered and thought of. However, the technicians believe that the working positions can be made even better if they can be equipped with more highly productive tools. The innovators are working on them now.

The Repair Enterprise where the Invention Commission is headed by Engineer Major P. Pogorelov found that there was a bottleneck in the production line at the area for repair of motor vehicle springs. The technicians could not repair each new group of springs needed for assembly in time. This working location was basically reequipped: a boom crane and hydraulic device for dissembly and assembly of springs were installed at the position, drilling and grinding machines were installed and the locations of the equipment were altered. As a result, the technician manning the position can fulfill the plan successfully now.

The contest has been widely supported in all shops of one of our repair enterprises, Writes Reserve Engineer Colonel V. Prostyakov. Here, a good deal has been done to provide efficient equipment for working locations. For example, for each type of device, soviet army employees A. Yegorov and V. Makachev have created tool sets, placed on a tilting support on special boards. Effective placement of measuring equipment, size standards, and part defect cards allows the minimum time to be expended on the performance of technological operations.

Yet another new idea: earlier, many unnecessary motions had to be made during assembly of units and aggregates, since the work benches and parts bins were located in various areas around the shop. The rationalizers have now developed a combined workbench and parts bin. In place of a vise, the workbench carries special clamps for the assembly of units.

The enterprise has also made sure that the working locations are well illuminated, particularly those areas where concentrated attention is required for performance of operations, for example assembly of units. Local light sources and luminescent lamps were provided for these areas with the help of the rationalizers.

At one enterprise, reports Engineer Lieutenant Colonel A. Dyul'din, a plan has been made up for the contest, and is being successfully fulfilled. Based on the specific conditions and capabilities of this unit, working locations have been developed corresponding to the demands of scientific organization of labor. They include for example technician's workbenches, which have already been introduced in the mechanical repair shop. The framework of each workbench is made of angle sections and tubing, the top is faced with sheet steel. The workbench is equipped with additional illumination and a tilting seat.

The section for repair and adjustment of electronic apparatus has provided a convenient working location for each electronic technician, at which the necessary operations can be performed rapidly. Each location consists of a table consisting of a welded framework, covered with a light brown wood fiber board. The middle portion of the table carries a stand, the front panel of which consists of an inclined board containing a set of test and measurement apparatus for the performance of adjustment operations. The face of the panel is covered with decorative plastic. In the left portion of the table at the top are the receiver and tester, while the bottom portion contains a cabinet with four drawers for storage of parts, tools and technical documents. The upper right portion of the table contains signal generators and an oscilloscope, while the lower right portion contains cables for testing of apparatus, a control panel, power supplies and plugs for individual lights and a soldering iron.

The working position of the bearing tester, electric wire and cable repairmen and others are just as well equipped at this enterprise.

The editors have received suggestions for equipping working locations. Private A. Asriyev, for example, thinks that each technician's workbench should have legs of adjustable length, to make it more convenient for technicians of any height.

The Commanders of Chast' and Enterprises and the Inventions Commissions are reading the suggestions of the innovators for the introduction of elements of the Scientific Organization of Labor with great attention.

The contest is being widely publicized in the army and navy press. For example, in *Zashchitnik Rodiny*, the newspaper of one Soyedineniye, published the rules of the contest, and subsequent issues have presented descriptions and photographs of working locations. Calling upon the rationalizers to introduce the working locations suggested, the newspaper has emphasized that it is the duty of participants in the contest not only to copy these working locations, but to improve them, considering the specific requirements of the Chast' and Podrazdeleniye and based on local conditions.

SCIENTIFIC ORGANIZATION OF LABOR -- A REQUIREMENT OF THE TIMES

From the Exhibition to Life

The workers of our repair enterprise are taking active part in the competition for the introduction of the most efficient equipment for working locations. The best rationalizers, in order to study the leading experience in this area, have visited the thematic exhibition on scientific organization of labor at the Exhibition of Achievement of the USSR National Economy, where they familiarize themselves with various designs of working locations, their equipment and planning, means of mechanization of supplementary operations and automatic production control systems.

All of this has helped in the development of working locations corresponding to today's level of technical esthetics and the introduction of which has resulted in an increase in the productivity of labor by 6%. Furthermore, it has become possible to perform more efficient planning of work rooms. It has become cleaner, brighter and more spacious in these rooms.

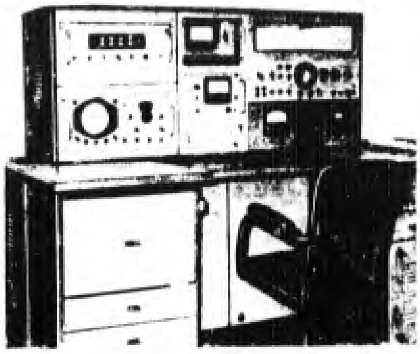
The introduction of a working location for the repair of electronic equipment developed by the innovators has had a great economic effect. It consists of a work table, a chair with height adjustment, an electric soldering iron support, soldering iron and trash bin. The design of the table is original and convenient. Its central portion (see figure) is removable, mounted on wheels and can be moved around the shop with the electronic equipment placed on it. The middle portion of the table can be used as a transport dolly inside the shop. Another feature of the table is that the central portion contains a circular rotating section on which the unit being repaired is placed. This makes it easy to place the unit in any position.

All types of necessary power are connected to the table. Tools, parts, fasteners and technical documentation are placed in drawers in the right and left sides of the table.

Engineer Lieutenant Colonel Yu. Gorstkin,
Chairman of Inventions Commission

Specially for the Radio Repairman

Major V. Yamchuk, Engineer Majors I. Belash and I. Korzun and Sergeant V. Pichugin have developed a special location for a radio repairman. It differs from the location suggested in *Tekhnika i Vooruzheniye* (number 11, 1970) in that the table includes a panel with testing and measurement instruments as necessary for testing of various items of radio equipment.



The figure shows one version of the working location for repair of channel separating equipment. The test stand carries a high frequency characteristic meter, an electronic digital frequency meter, types VK7-9 and VZ-2A voltmeters, an oscilloscope, a radio tube tester, and a panel for connection and disconnection of the table and stand power.

Another distinguishing feature of this working location is that the central section of the three-section table can be removed and replaced by the unit being repaired, mounted on built-in rotating supports. The dimensions of the table are 1590 × 1000 × 720 mm. The dimensions of the stand are 1440 × 450 × 570 mm.

Lieutenant Colonel N. Tamanov

Installers Working Position

When electronic apparatus is inspected and repaired in the military shop, units weighing many kilograms must be tilted on the workbench. It is both difficult and dangerous to do this. However, this problem can be easily solved. It requires only a comparatively simple device (see figure).

An electronic unit to be repaired is fastened on a frame with two axes of rotation: a transverse and a longitudinal axis. A lever located on the left side of the frame and a foot pedal fixed the unit in one of twelve positions in each of the planes of rotation.

After selecting the best angle of the electronic unit and height of the swivel chair, the installer finds the most convenient working position, providing high productivity of labor.

Captain of Technical Service A. Zhivov

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IMPROVEMENT OF DOSIMETRY EQUIPMENT

By

Engineer Lieutenant Colonel I. Solov'yev, Candidate of Technical Sciences; Engineer Major Yu. Berezin and Engineer Major V. Levushkin

The principles of detection and measurement of ionizing radiation upon which dosimetric instruments are based are themselves based on phenomena resulting from changes in the irradiated medium arising under the influence of the radiation. These may include ionization, the chemical or photographic effect, heating, glowing, etc. Depending on the type of phenomenon used, various methods of dosimetry are differentiated.

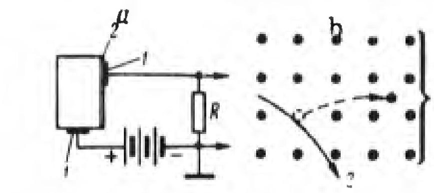
For many years, ionization chambers with dc amplifiers and a gas discharge counter with an electronic pulse recording system have been used to measure the dose of gamma radiation. However, for some time attempts have been made to create small, solid ionization chambers with high stopping power. The first crystal counters based on diamonds and certain other dielectrics could not compete with available detectors. Only the appearance of such semiconductors as silicon and germanium allowed the foreigh specialists to design a new type of counter -- the so-called semiconductor counter. This type has good counting characteristics and, due to its compactness and simplicity, is universal.

Semiconductor detectors are solid ionization chambers. The charge carriers formed upon absorption of ionizing radiation are collected in these chambers on electrodes.

The foreign specialists believe that due to the high density and stopping power of semiconductor detectors, they can fully stop particles having long mean free path lengths. For example, β particles and high energy protons, the free path length of which in air frequently exceeds 1 m, are fully absorbed in a layer of silicon 1 mm thick. Furthermore, these detectors can be made rather simple. The electronic equipment required for operation of the counters is small in size and requires no high voltage power supply.

These detectors, it is believed, can be used for measurement of the dose of gamma radiation as well as determination of the contamination of drinking water and food products with β active material. One particularly important advantage is the ability to separate signals recorded from gamma radiation and β particles. Furthermore, the specialists state, semiconductor detectors can also be used as integral dosimeters for neutron flux.

Although the semiconductor detectors have great potential capabilities, some foreign authors state that the use of this type of detector for ionizing radiation involves certain difficulties. First of all, t e semiconductor crystals have some electrical conductivity. Any electri field applied to the counter to record the ionization pulses causes a direct current to flow through the detector. If this current is great, it hinders the operation of the counter, forming noise which is comparable to the signals, and can influence the process of collection of charge carriers in the semiconductor. Secondly, semiconductors contain traps and other local centers in which the charge carriers arising under the influence of radiation are held or recombined,as they move through the counter, causing a decrease in the observed signal. Furthermore, homogeneous counters made of silicon or germanium have comparatively high concentrations of free charge carriers (conductivity) at room temperature, and must therefore be cooled. However, semiconductor detectors have a number of advantages over other types of ionizing radiation detectors, and therefore their use in dosimetric equipment is considered promising.



The absorption of gamma radiation in an SCD is accompanied by formation of one or more secondary electrons with high energies, resulting in further ionization. The current pulses produced are recorded. The number of pulses (pulse counting rate) is proportional to the dose rate.

The electrical properties of semiconductors change strongly under the influence of a flux of fast neutrons; therefore, neutrons in the semiconductor crystal create recoil atoms which displace neighboring atoms from their normal positions in the crystalline lattice. The lattice defects thus formed change the characteristics of the semiconductor significantly. This property of SCD is used for the creation of instruments designed for measurement of neutron radiation doses.

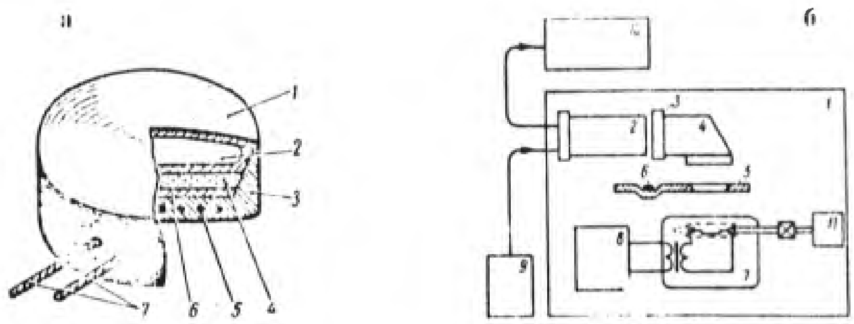
a) schematic diagram of semiconductor detector: 1, electrode; 2, p-n junction.

b) formation of defect in crystalline lattice of semiconductor: 1, crystalline lattice; 2, neutron

Recently, solid scintillation detectors, in particular combined detectors, have become widely used in military dosimetry. Combined detectors consist of various organic and inorganic scintillators, as well as non-scintillation materials acting as moderators, radiators, absorbers and light guides.

Scintillation detectors record the total radiation dose, plus the alpha, beta and gamma radiation doses separately, and their high sensitivity allows low intensity radiation to be recorded. For example, in the sets of radiometric apparatus installed in some aircraft of the US Army, there are radiometers which use thallium-activated sodium iodide crystals as detectors. The use of crystals of various sizes allows dose powers to be measured over a broad range. Scintillation counters can also be used as the receiver devices in radiometric apparatus design to determine the degree of contamination of food and water.

The operation of a scintillation counter device is based on the fact that the ionizing radiation causes a flash of light in the scintillator, a large portion of which is directed by a light guide and reflector to the photocathode of a photoelectronic multiplier. The photoelectrons emitted by the cathode are multiplied on the electrodes of the photomultiplier. The resulting pulse, after passing through a discriminator and a forming cell, is recorded by an electronic recorder.



The operation of luminescent dosimeters is based on the following principle. The charge carriers formed in a luminophor under the influence of ionizing radiation (electrons and holes) are localized at capture centers, causing accummulation of the absorbed energy, which can then be liberated in the form of luminescence upon additional excitation. This is achieved either by shining light on the luminophor in the proper spectrum (radio photoluminescence) or by heating (radio thermoluminescence). In both cases, the luminescence is a measure of the energy absorbed by the detector from ionizing radiation.

a) design of thermoluminescent dosimeter with heater element: 1, transparent glass ccver; 2, volume filled with inert gas; 3, base of dosimeter; 4, pressed luminophor; 5, heating spiral; 6, substrate; 7, heater current leads.

b) block diagram of measuring installation for thermoluminescent dosimeters: 1, luminescent unit; 2, light receiver; 3, light filter; 4, light guide; 5, movable diaphragm; 6, phosphor; 7, heating unit; 8, heating controller; 9, power supply; 10, electronic recording circuit; 11, gas-containing vessel.

Luminescent dosimeters are becoming evermore common in practice.

The materials used as dosimetric luminophors are solid insulators with a broad range of optical transparence. Among the large number of known luminophors, only three are used in practice: calcium fluoride (CaF_2), lithium fluoride (LiF) and luminescent glass. Individual dosimeters for gamma radiation are created on the basis of these materials abroad, allowing the dose of radiation to be measured in a broad range from a few milliroentgens to tens or hundreds of thousands of roentgens, plus thermal neutron fluxes as well as fluxes of fast neutrons, preliminarily measured to thermal energies.

In particular, the individual photoluminescent dosimeters of the US Navy consist of a plastic sealed box made of two parts screwed together within which is a glass plate measuring 19 × 19 × 4.8 mm. Lead filters are used to reduce the hardness. The total weight of the dosimeter is not over 30 g.

The dose recorded by this device is measured by a fluorescent photometer. This requires not over one minute. The source of light for excitation is an ultraviolet lamp. The luminescent light receiver is a photomultiplier (FM), the signal from which is passed through an amplifier to a recording device with a scale graduated in rem's.

The correctness of the indications of the photometer is periodically tested using a standard luminescent glass with a known dose value.

There are two types of installations for thermoluminescent dosimeters -- with and without heaters. In the first type of dosimeter, the luminophor powder is pressed in a capsule with a transparent upper portion, which is filled with an inert gas and hermetically sealed, preventing the oxygen in the air from acting on the luminophor.

In order to record the indications of this dosimeter, the luminophor must be heated to 100-200° and the brightness of the light which it emits recorded using a photomultiplier. For thermoluminescent dosimeters having no internal heating element, a measuring installation is used. Block diagrams of the photometer and measuring installation designed for photoluminescent dosimeters differ only in that the former contains an ultraviolet lamp in place of the heating unit.

A dosimeter based on lithium fluoride containing the isotope Li^6 with high thermal neutron capture cross section, is successfully used to record mixed gamma radiation and thermal neutrons. The composition of the LiF (ratio of isotopes Li^6 and Li^7) is selected so that the recording of 1 rem of thermal neutrons and 1 r of gamma radiation produces an identical effect.

In spite of the successes achieved in luminescent dosimetry, it has still been noted abroad that there are many unsolved problems in the field, concerning both the luminiphors themselves and the measuring installations used.

The difficulty of manufacture and use of thermoluminescent luminophors lies in the fact that it is difficult to produce materials with identical properties. Furthermore, a portion of the information is lost due to the autoluminescence of dosimeters at room temperature, and a "dark dose" is created, increasing the lower threshold of sensitivity of the dosimeter to several roentgens.

It is considered that dosimeters whose operation is based on the phenomenon of radio photoluminescence have somewhat higher sensitivity and allow doses as low as a few tens of milliroentgens to be recorded.

High sensitivity with small dimensions of the dosimetric sensor, large measurement range, long storage of dosimetric information, simplicity and speed of measurement have attracted the attention of specialists to the luminescent method which, in their opinion, can take the leading place in individual testing of radioactive radiation.

The attention of foreign researchers is directed toward finding new, improved detectors, simplifying circuits and designs of instruments and providing universality of utilization (for example, roentgenometer-radiometers, roentgenometer-dosimeters).

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CENTRIFUGAL ALL-MODE REGULATOR

By

Engineer Lieutenant Colonel Ye. Vasil'yev, Candidate of Technical Sciences

The operation of a diesel electric power station is always accompanied by increasing or decreasing loads. An increase in load increases the generator current and the torque on the generator shaft, while decreasing load decreases this torque. The rotating speed of the diesel remains unchanged if the torque on its shaft, which depends on the fuel input, is equal to the torque on the shaft of the generator.

In a synchronous generator, the frequency of the current is proportional to its rotating speed and should be constant, which is achieved by regulating the fuel input as the load changes. This is accomplished using a centrifugal speed controller. Its primary mechanisms (Figure 1) include the centrifugal sensing element (speed measuring device), a hydraulic tracking device acting as a hydraulic amplifier for the regulator, an adjustment mechanism for the speed regulator, a hydraulic stop speed limiter, a hydraulic damper, a corrector and a mechanism for adjusting the degree of unevenness, consisting of rigid feedback. Since this regulator causes most of the difficulties during the operating process, let us analyze its design in greater detail.

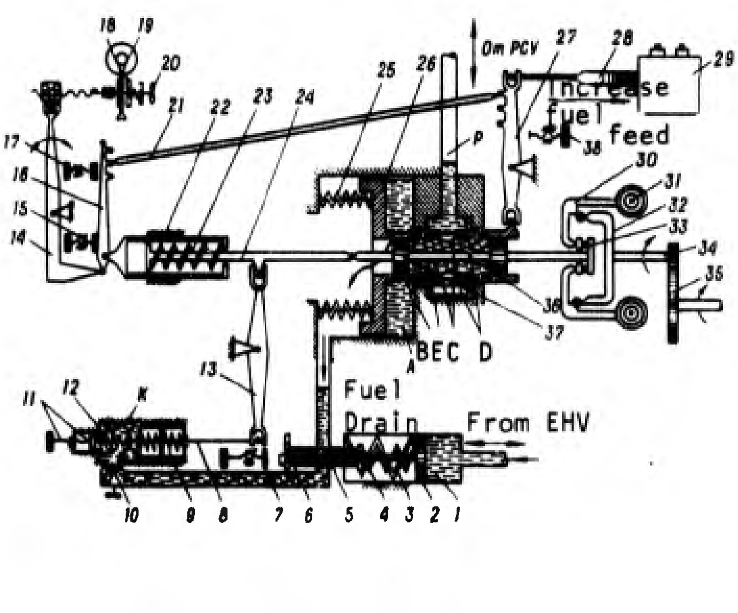

Figure 1. Diagram of Diesel Regulator

The sensing element of the regulator consists of shaft 34, made in one piece with cross member 32, on which dual arm levers 30 are articulated, carrying loads 31. The shaft is rotated by the shaft of the fuel pump through gear set 35. The levers act through thrust bearing 33 on the plunger of hydraulic amplifier 36. As the plunger moves, spring 23 is compressed by bar 24, connected to the plunger. Since clutch 22, coupled to the diesel control mechanism, does not move, when the speed of the machine is stable, each speed of rotation of the diesel crankshaft corresponds to a definite position of the plunger. Increasing the speed of rotation causes the plunger to move to the right since the centrifugal forces of loads 31 exceed the force of compression of the spring (the weights spread). As the speed of rotation decreases, the plunger moves to the left, since the force of the spring exceeds the centrifugal force of the weights (they come closer together).

The elements of the hydraulic amplifier in the regulator are the plunger of the sensing element 36 with disc 37, the piston on the hydraulic amplifier 26 and spring 25. Piston 26 is articulated to lever 27, acting on bar 28 of high pressure fuel pump 29.

During operation of the diesel, oil from the lubricating system is fed under pressure into circular cavity D and passes through holes C in the piston into cavity E. In stable modes, the disc on the plunger fully closes aperture B in the piston of the amplifier. As plunger 36 moves to the left (load on diesel increased, rotating speed decreased), the disc opens window B, and oil moves from cavity E into cavity A, formed by the piston and the slot in the body of the regulator. The piston begins to move to the left at decreasing speed, since window B are gradually closed by disc 37. The movement is accompanied by compression of spring 25 and an increase in the fuel supply to the sprayers of the diesel.

When the load on the diesel decreases, its rotating speed increases, weights 31 spread somewhat and plunger 36 moves to the right. The windows in piston B are opened by disc 37 and the piston moves to the right due to the pressure of spring 25. The oil from cavity A moves into the case of the regulator. The movement of the piston causes closing of window B. When the window is fully closed, the movement of the piston stops, the fuel feed drops and the rotating speed of the diesel is restored. Since the sensing element acts on bar 28 in the fuel pump through the hydraulic amplifier, the regulator is called an indirect-action regulator.

The oil is fed into cavity D of the amplifier from the oil system of the diesel through channel P through a valve in the working stop device. This valve can be set in a position such that channel P is disconnected from the oil system and connected to the cavity in the crank case of the engine. In this case, the oil is forced out by springs 25 from cavity A through window B, cavity E, windows C and channel P. Piston 26 moves to the right, the fuel supply to the diesel is stopped, and the diesel stops operating.

The mechanism for adjustment of the diesel to the required speed mode is designed to adjust the frequency of the current within slight limits and consists of double-arm lever 14, clutch 22, regulating device 20, remote control current frequency electric motor 18 with worm reducer, limiting torque clutches 19, maximum rotating speed stop 17 and minimum speed stop 15. The mechanism acts so that as lever 14 is rotated, clutch 22 is moved and changes the compression of the spring of regulator 23.

Let us assume that the load on the diesel is constant and lever 14 is moved slightly clockwise. Clutch 22 in this case moves to the left and increases the compression on the regulator spring. Due to this disruption of the equilibrium between forces of the spring and the centrifugal force of weights 31, plunger 36 moves to the left. Piston 26 also moves to the left, while lever 27 moves the bar on the fuel pump 28 to the right. The supply of fuel is increased, causing a slight increase in the rotating speed of the diesel and the frequency of the generator current. Rotation of lever 14 in the counterclockwise direction is accompanied by a decrease in current frequency. Lever 14 may be moved either manually by the flywheel or by electric motor 18 through a worm drive and torque-limiting clutch 19.

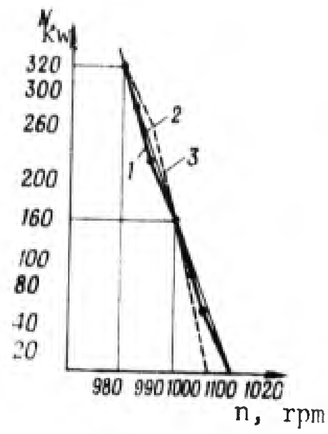

Figure 2. Regulator (static) Characteristics of Diesel: 1, with correcting device; 2, linear; 3, without correcting device.

The hydraulic stop speed limiter is designed to prevent great increases in the rotation of the diesel during the start-up process, and also to provide for heating and cooling of the diesel during low speed warm-up, and consists of cylinder 1, piston 2, shaft 5, clutch 6 with stop, springs 3 and 4 and adjustable stop 7. It operates as follows. Before starting the diesel, oil is pumped through and enters circular cavity D of the hydraulic amplifier under pressure. Since the crankshaft is not moving, weights 31 develop no centrifugal force and spring 23 tends to move plunger 36 to the extreme left position. Lever 13, articulated with arm 25, rotates counterclockwise. If oil is fed to cylinder 1 under pressure, piston 2 begins to move to the left, compressing spring 3. Clutch 16 also moves to the left under the influence of spring 4 and limits not only the rotation of lever 13 in the counterclockwise direction, but also the movement of the plunger to the left. If oil is not pumped into the hydraulic stop as the diesel is started, plunger 36 would take up the extreme left position, and arm 28 of the fuel pump, due to the tracking effect of the hydraulic amplifier, would be set in the position of maximum fuel feed. Since the diesel is started without load, a dangerous increase in speed could occur. But when oil is fed into cylinder 1 of the hydraulic stop, the movement of plunger 36 to the left is limited, and therefore the movement of piston 26 and the quantity of fuel fed into the diesel is also limited. The dangerous increase in motor speed does not occur. The hydraulic stop of the regulator allows starting and stopping of the diesel to be performed in stages, but it must be adjusted to a strictly defined current frequency. The start-up speed is regulated by stop 7. In order to increase the speed, the stop is moved to the right.

The hydraulic damper of the regulator achieves smoothness of transient processes by means of arm 8 with its stop ring, piston 9 and regulating device 10. Preliminarily compressed springs are placed within the piston, resting against thrust washer 8. Due to the damper, no sharp fluctuations in load on the diesel occur as power consumers are switched on and off.

Since the displacement of plunger 36 is accompanied by a rotation of lever 13 and motion of piston 19, during the process of fluctuation in engine speed, oil from the crank case of the regulator is pumped into cavity K of the damper or pressed out of it through the slot in regulating device 10 and the spaces between piston 9 and arm 8. Due to the hydraulic resistance to the motion of the piston, proportional to the speed of the motion, plunger 36 moves smoothly, which has a favorable influence on the nature of the transient processes. Regulation of the degree of damping is by needle 10. As the cross section is decreased, smoother transient processes are observed, but the time of damping of the processes increases. The springs of piston 3 help to provide smooth transmission of forces from the piston to lever 13. The mechanism of regulation of the degree of unevenness adjusts the static characteristic (Figure 2) of the diesel over the entire range of loads and consists of arm 21, lever 16 and regulating devices allowing the hinges of the arm to be moved in the vertical direction. The mechanism acts in such a way that as the load and fuel supply change during the process of regulation, the position of plunger 22 also changes slightly, in spite of the fact that lever 14 remains still. Let us assume that the load on the diesel has decreased. The regulator, in response to this perturbation, moves arm 28 of pump 29 to the left, lever 27 by means of arm 21 slightly rotates lever 16 counterclockwise, and the compression of the spring of regulator 23 is increased.

Since the drop in load and the increase in spring compression are accompanied by increasing speed, the mechanism increases the degree of unevenness of the operation of the diesel. Obviously, after movement of the right hinge of arm 21 upward by lever 27, and movement of the left hinge of arm 21 downward by lever 16, the rotation of lever 16 and the displacement of plunger 22 increase. This causes an increase in the degree of unevenness and in the slope of the static characteristic, plus an improvement of the distribution of load between the generators of the diesel electric power station and the external power network operating in parallel.

In order to change the form of the static characteristic of the diesel in the area of low loads, a static characteristic corrector is used. Its elements include regulating bolt 11 attached to spring 12. At low loads on the diesel, when its speed is near maximal, weights 31 move plunger 36 to the right and lever 13 moves the arm of damper 8 to the left. Spring 12 is compressed by the stop on arm 8. When operating without load, the speed of the diesel increases, but plunger 36 does not move as far to the right, since it is stopped by the spring of regulator 22 and the spring of corrector 12. The supply of fuel in the no-load mode remains somewhat greater, but the speed is retained within the necessary limits.

A comparison of the characteristics of a diesel (Figure 2) without the correcting devices (dotted line 3) and the characteristics of a diesel with correcting devices (broken line 1) indicates the improvement of the static characteristics of regulation by the correcting device, since the actual characteristic is near linear (straight line 2). The adjustment of the correcting devices of the regulator is performed at the manufacturing plant, and should not be changed during operation. Only the degree of unevenness can be regulated.

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TO THE BTR-40 DRIVER

(Unattributed Article)

If an engine in good operating condition refuses to start after two or three tries, the reason is almost always that the mixture is too rich. In order to eliminate this phenomenon, the cylinders must be blown out. After turning on the ignition, press the fuel pedal slowly down to the stop, then press the starter pedal. Do not pump the gas, since each time you do this the accelerator pump will feed more gasoline into the mixing chamber of the carburetor and cause flooding.

After the cylinders have blown out, the engine should be started in the ordinary manner. When a warm engine can be started only in "drain," the reason is dirt in the jets, particularly in the idle jet.

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TWO-BARREL CARBURETORS

By

Engineer Colonel N. Vishnyakov, Reader, Candidate of Technical Sciences

Two-barrel downdraft carburetors with balanced float chambers are widely used on the engines of modern trucks. These carburetors distribute the fuel mixture to the cylinders more evenly than one-barrel carburetors and retain the composition of the fuel mixture constant regardless of the condition of the air filter.

Two-barrel carburetors have five primary systems and devices: the main dosing system, in which a fuel mixture of optimal composition is prepared for the entire range of partial (medium) loads; an economizer, which enriches the mixture prepared by the main dosing system for the full (maximum) load mode; an accelerator pump, which prevents the mixture from becoming too lean upon rapid transition from low to high loads; the idle system; and the starting device.

The arrangement of these systems varies. For example, each chamber of the K-126B carburetor (Figure 1), installed on the engines of the GAZ-53A and GAZ-66 vehicles, contains two main dosing devices and two idle systems. The float chamber, economizer, accelerator pump and air valve are common.

The two sides of the carburetor operate independently of each other and each one feeds four cylinders of the engine. One barrel feeds cylinders 1, 4, 6 and 7, while the other feeds cylinders 2, 3, 5 and 8.

The carburetor is connected to the top of the intake manifold. Body 8 of the float bowl and its cover 12 are made of a zinc alloy and fastened together with screws. Body 3 of the mixing chambers is made of gray cast iron. Sealing gaskets are used where the main elements are connected together.

Air valve 15 and two automatic valves 16 are connected into the throat of cover 12. The gasoline enters the float bowl through a nozzle and screen filter 22, covered with a plug. The feed of gasoline is regulated by needle valve 23, the needle of which rests on the lever of a brass float on its own axis. The cover also contains the accelerator pump drive and economizer.

The body of the float bowl contains glass viewing window 24, a drain hole with plug, two small diffusors 21 and two large diffusors 42. The sprayers of the main dosing system, consisting of the main fuel jets 41 and air jets 14, emulsion tubes 25, are lead into the narrowest parts of the small diffusors.

The two vertical wells connecting the channels to the main fuel jets contain idle jets 20, hollow brass rods. The fuel passes through the calibrated apertures, first entering the internal cavity of these rods, then passing through the horizontal apertures, it enters the emulsion channels B. The upper portion of the rod ends in a throat with a slot for a screw driver. The air enters the channels through air jets 43. Each of these channels has two spray apertures: the upper spray apertures 44 are located somewhat above the covered choke valves, while the lower apertures, the cross sections of which can be changed by adjusting screws 1, and beyond them. The position of the regulating screws is fixed by springs.

The accelerator pump and economizer are mounted in special wells connected to the float chamber. Valve 7 of the economizer is screwed into the bottom of the well and is operated by shaft 10. The fuel from the economizer moves through a channel to sprayers 18, which are connected to sprayers 17 of the accelerator pump. The well of the accelerator pump is connected to the sprayer channels, the output to which is covered with delivery valve 19. Back valve 6 is screwed into the bottom of the well. The well itself contains piston 9 with its shaft.

In the mixing chambers, two choke valves 2 are installed on common shaft 40 on roller bearings. One end of the shaft is connected with lever 5 of the control drive, the other end is connected to the actuating mechanism of the motor speed governor.

In the partial load mode of the engine, the rarefaction arising in small diffusors 21 due to the high air speed is transmitted into both wells C of the main dosing system. As a result, fuel from the float chamber enters these wells, where it is partially mixed with air from jet 14. Leaving the sprayer, the emulsion is captured by the main air stream and enters the small and large diffusors. Here it is mixed with the air of the main stream and forms the fuel mixture.

As the choke valves are opened, the rarefaction in the diffusors increases. However, it changes differently in wells C than in the diffusors. This is achieved by the fact that the dimensions of the fuel and air jets are selected so that over the entire range of partial loads, regardless of the increase in rarefaction in the diffusors, the carburetor prepares a fuel mixture with an economical composition.

Under maximum loads, the choke valves 2 are fully opened. Shaft 10 of the economizer drops downward and opens valve 7. The fuel passes through the channel to sprayers 18 and enriches the fuel mixture in both barrels of the carburetor. In this way, simultaneous operation of the main dosing device and the economizer provides for preparation of an enriched fuel mixture in the maximum load mode.

In case of a sudden opening of the choke valves, the accelerator pump is engaged. When bar 11 moves downward, the spring is compressed. This spring causes piston 9 to drop, extracting the gasoline which begins to flow into the float chamber. Back valve 6 is closed. As a result, the well of the accelerator pump and the float chamber are separated. Feed valve 19 is opened and an additional portion of fuel passes through sprayer 17 into both barrels of the carburetor, which prevents the mixture from becoming too lean.

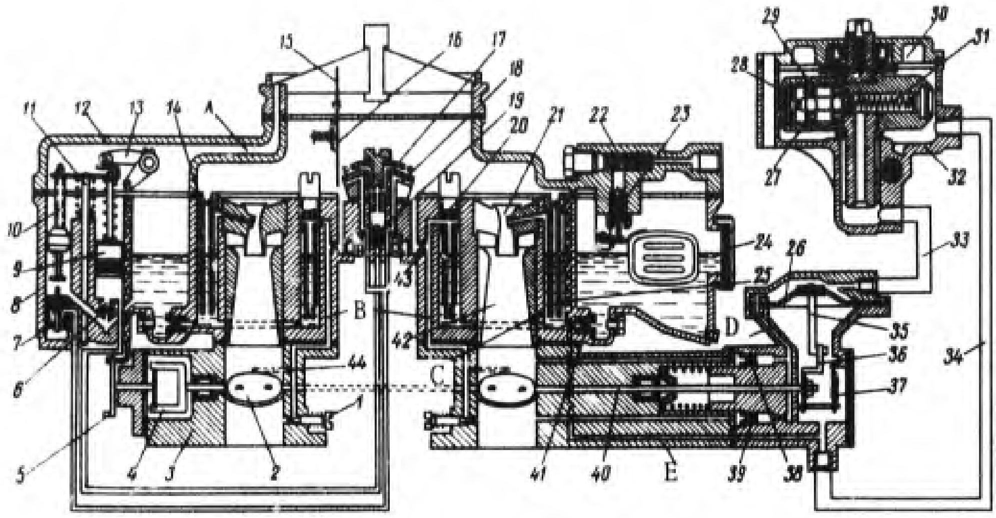

Figure 1. The K-126B Carburetor and Governor

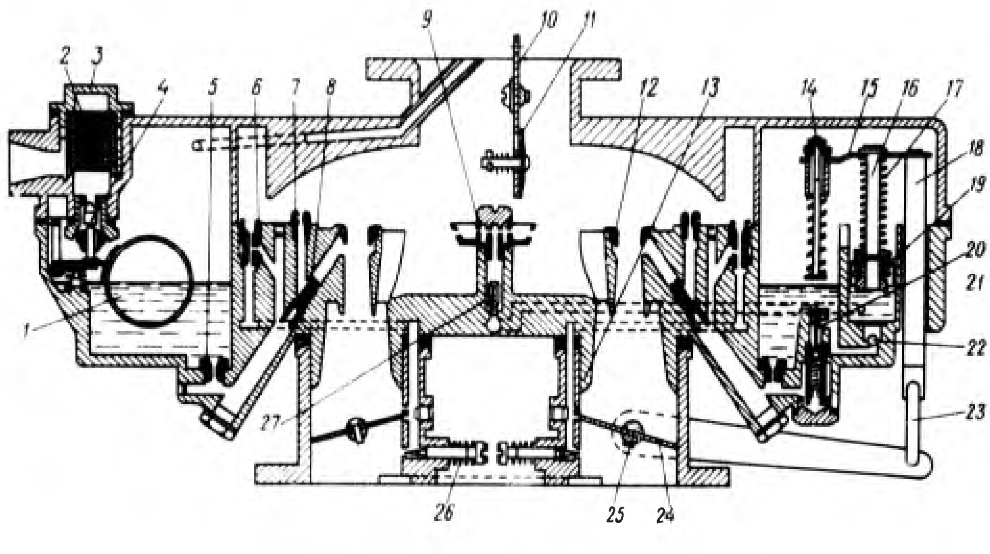

Figure 2. The K-88A Carburetor

As the choke valves are opened smoothly, the pressure produced by piston 9 on the fuel is slight. Delivery valve 20 remains closed. Therefore, fuel from the accelerator pump well is forced through back valve 6 into the float chamber.

At the idle, the choke valves are closed. Since the rarefaction in the small diffusers is slight due to the slight flow rate of air, the main diffusing device does not operate. However, the idle system creates a significant rarefaction in the mixing chambers located over the choke valves and also in emulsion channels B. This causes the fuel passing through jets 14 and 20 to enter emulsion channels B, where it is mixed with the air passing through jets 43. The emulsion formed is sent to the spraying apertures. Since the rarefaction at the upper spraying apertures 44 is slight, air passes through them into the emulsion channels, decreasing the rarefaction and making the emulsion leaner. Passing through the lower spraying apertures, the emulsion enters the mixing chambers where, mixing with the air passing through the choke valves and walls of the tubes, it forms the fuel mixture.

During a transient period (from the idle to the partial load mode), the emulsion enters the mixing chambers through both the upper and the lower spraying apertures. This prevents the fuel mixture from becoming lean before beginning of operation of the main dosing device and provides a smooth transition from one mode of operation to the other.

During start-up of a cold motor, air valve 15 is usually closed. Increased rarefaction arises beyond it even at the low starting speed of the motor shaft. Under the influence of this rarefaction, the fuel enters the mixing chambers through the main dosing devices and the idle system, while air enters through automatic air valves 16.

The K-88A carburetor (Figure 2) is designed for the ZIL-130 and ZIL-131 engines. The body of its float chamber contains float 1 on its axis, small diffusor 12 and large diffusor 13, made as two units, two main fuel jets 5 included in the main dosing system, two main air jets 7 and two full power jets 8. The well of the body contains piston 19 of the accelerator pump (on shaft 16), ball back valve 22, needle delivery valve 27 and sprayer 9. The piston is connected with the drive of the choke valves by spring 17, moving lifter 18 and arm 23. The float chamber contains valve 21 of the economizer with intermediate pusher 20. Shaft 14 of the economizer is fastened to bar 15 of the accelerator pump drive. The cover of the float chamber contains air valve 10 with automatic valve 11. The fuel enters this chamber through screen filter 2. The fuel supply is regulated by needle valve 4, screwed into the cover of the chamber.

Two choke valves 24 are mounted on common axis 25 on ball bearings in the body of the mixing chamber. Here also are the emulsion channels for unloaded operation and two sprayer apertures: the upper rectangular cross section channels are located slightly over the edges of the closed valves, while the lower, circular cross section channels (with cross sections changed by screws 26) are located below the choke valves. The emulsion enters the channels through jets 6.

The dosing devices and systems included in the K-88A carburetor operate the same as the corresponding devices of the K-126B carburetor. One specific feature is that during operation of the main dosing device and economizer, a portion of the fuel is transmitted through full power jets 8.

In order to limit the maximum speed of the crankshaft, two types of pneumatic mechanisms are employed: pneumatic-centrifugal and pneumatic. The former are designed for V-type engines, the latter -- for in-line engines.

The centrifugal sensor of the pneumatic-centrifugal governor for the GAZ-66 engine consists of three main parts: body 32, covers 30 and rotor 29 (see Figure 1). The rotor contains valve 27 and its seat 28, a spring and a regulating screw. The hollow shaft of the rotor spins in a bushing. The sensor is connected by two pipes to the actuating mechanism. Diaphragm 26 of this mechanism is connected by an arm and a lever to the axis of choke valves 36. The lower arm of the lever is connected to a spring which pushes the choke valves open and tends to cause the diaphragm to move downward into its lower position. The cavity beneath the diaphragm of the actuating mechanism is connected by channel I to the air intake of the carburetor. The cavity over the diaphragm is connected to one of the mixing chambers of the carburetor by channel D through jets 38 and 39.

When the speed of the crankshaft is less than the speed to which the limiter is set, the centrifugal force acting on the valve of the sensor is slight. Valve 27 cannot overcome the resistance of spring 31 and close the hole in seat 28. It remains open, and air passes through the valve, tube 34, body 32, the aperture in the seat, the channel of the rotor axis, tube 33 and jets 38 and 39 under the influence of the pressure difference. During this time, only the force of the spring acts on the diaphragm. The diaphragm takes up its bottom position.

At the maximum speed, the centrifugal force overcomes the resistance of the spring and valve 27 drops into the seat. The motion of air through the sensor is stopped. The rarefaction over the diaphragm increases sharply. It moves upward and, overcoming the resistance of spring 37, rotates the axis of the choke valves to a predetermined position. The speed of the crankshaft reaches 3200-3400 rpm and will not increase further, since the quantity of fuel mixture entering the cylinders corresponds to the fuel consumption rate at this speed.

These two-barrel carburetors are far from the last word in design. The development of effective, fully automatic models is continuing.

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SUBMACHINE GUNS

(Unattributed Article)

While planning and testing automatic pistols, the arms designers increased the power of the cartridges, increased the length of the barrel, made attached butts, changed the design of the trigger mechanism to allow both individual and automatic fire. During this creative research, the idea was born of creating a new automatic weapon for close order combat, combining the combat qualities of the pistol (light weight and portability) and the machine gun (high fire power).

Top to Bottom: The 7.62 mm Degtyarev submachine gun; the 7.62 mm Shpagin submachine gun; the 7.62 mm Sudayev submachine gun.

The new type of weapon, which is called the "submachine gun," differs from automatic rifles in that it was planned to use a pistol cartridge. The comparatively low power of this cartridge allows a more simple automatic action to be used, based on the recoil of the bolt itself.

The well known soviet small arms designer V. G. Fedorov wrote in 1939, "submachine guns are a comparatively young type of weapon, produced following the experience of the First World War... Submachine guns solve the problem of providing machine gun fire in combat at close distances, when there is no need for the more powerful rifle cartridges."

The first soviet submachine gun model was produced by F. V. Tokarev. This talented small arms designer properly evaluated the future of this weapon and began testing his experimental model, planned to use the 7.62 mm revolver cartridge, in 1927.

The Tokarev submachine gun, 1927 model, was a non-moving barrel type with free bolt. The weapon was fed by a two-row box-type magazine with a capacity of 21 cartridges. Comparative tests confirmed the complete superiority of the soviet model over the German Folmar submachine gun. Due to its lighter weight and longer barrel, the Tokarev submachine gun had high ballistic qualities. As the commission which performed the tests noted, this model was of significant interest due to its design and ballistic qualities.

V. A. Degtyarev made his first test model in 1929. This remarkable designer, who achieved great successes in the planning of his hand-held machine gun, used this weapon as the basis for a variety of models of rifled weapons, including a submachine gun designed for pistol cartridges. At the same time, S. A. Korovin designed a submachine gun.

After a short period of time had passed, 14 models of submachine guns using the systems of V. A. Degtyarev, V. F. Tokarev, S. A. Korovin, S. A. Prilutskiy and I. N. Kolesnikov had been produced. The best model was the Degtyarev type weapon which was adopted for use by the Commanders of the Red Army on 9 June 1935 and was called the "7.62 mm Degtyarev Submachine Gun, model 1934." Somewhat later, the designer improved his submachine gun, producing the "7.62 mm Degtyarev Submachine Gun, model 1940 ("PPD-40").

During the pre-war years, G. S. Shpagin, A. I. Sudayev, N. V. Rukavishnikov and other designers worked on the development of new, improved submachine guns. For example, G. S. Shpagin, working on the planning of a submachine gun in early 1940, set himself the task of retaining the high tactical and technical qualities of the PPD-40 while at the same time simplifying its design as much as possible, and also reducing the difficulty of manufacture of the weapon. In September of that same year, a test model was made. After testing, it was accepted by the Red Army as the "Shpagin Submachine Gun, 1941 model" (PP-41 or PPSh). Without its magazine it weighed 3.5 kg, its length was 840 mm. It was fed by a disc magazine designed for 71 cartridges.

The design of the PPSh was so simple that mass production was begun by Autumn of 1941 not only at weapons plants but also at enterprises which had earlier not specialized in the production of armaments. During the Great Patriotic War, the PPSh came to be known as a simple, light, fool proof and reliable weapon in combat.

The veterans of the Great Patriotic War gratefully recall also the name of A. I. Sudayev. When Leningrad was under Hitler's siege, he designed the PP-43 submachine gun (PPS), unequaled in its size (length 623 mm) weight (3.04 kg) and simplicity of design. All of this allowed the PPS to be widely used in the paratroop and tank forces. It was a favorite reconnaissance weapon.

The weapon is fed by a two-row box-type magazine with a capacity of 35 cartridges. The PPS has a folding metal butt and a pistol grip. The low rate of fire (600 rounds per minute) helped to improve the accuracy of fire and decreased the expenditure of ammunition. It can also be fired in single shots, even though the trigger mechanism is designed only for automatic fire. The PPS not only has good combat qualities, but also good technological qualities. Its manufacture requires only half as much metal and one-third as much machine tool time as the PPSh.

During the Great Patriotic War, submachine guns were widely used by the soviet army. During the first few months after the beginning of the war, mass production was begun in many cities of the Soviet Union. Whereas in 1941, 98,644 submachine guns were manufactured, in 1942 the

Soviet Arms Industry manufactured 1,499,269 submachine guns, i. e. 16 times more. In all between 1 July 1941 and 30 June 1945, 6,103,000 submachine guns were manufactured.

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THE TEMPERATURE AND PROPERTIES OF AVIATION FUELS

By

General-Major of Engineering and Technical Service
K. Shpilev, Reader; Engineer Lieutenant Colonel A. Kruglov,
Candidate of Technical Sciences

Modern aircraft and helicopters are operated under widely varied climatic conditions, and are subjected to the influences of various temperatures. As we know, this factor of the external medium influences many properties of aviation fuels. For example, at low temperatures their viscosity is increased, dissolved water and high-melting hydrocarbons may precipitate. Heating causes fuel losses due to evaporation, vapor lock may develop in fuel lines and, as a result, cavitation may occur in pumps. Furthermore, the corrosion activity of the fuel is increased.

Aviation fuels, manufactured of petroleum products, differ from each other in the quantities of various fractions of petroleum which they contain, the relationship of which also determines their physical and chemical properties, as well as the changes of these properties as functions of temperature.

The properties of fuels also influence certain flying and technical characteristics of aircraft, for example such characteristics as the range and duration of flight. When a fuel with a density of 0.81 g/cm^3 is replaced by another fuel with a density 7% lower with the same tank volume, the maximum flight duration may be decreased by 6%. A similar result is achieved by the decrease in the specific gravity of fuel caused by increasing its temperature. The ceiling of an aircraft is also significantly influenced by such fuel properties as volatility. The problem is that at high altitudes, intensive evaporation of fuel may begin, causing great fuel losses, as well as the formation of vapor lock in fuel lines.

The rapid climbing rates of airplanes cause them to reach high altitudes with very little change in the temperature in the fuel tanks. Consequently, the fuel losses from evaporation are determined by the initial temperature on the ground. In closed, pressurized systems, the evaporation losses are less.

If the pressure created in the tanks does not prevent boiling of the fuel, its losses may increase significantly. Therefore under conditions of high surrounding air temperature, fuels with low volatility should be used.

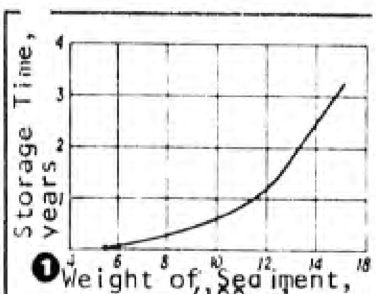
The operating characteristics and life of aircraft and engines change under the influence of the corrosive activity of fuel and its stability at both high and low temperatures, as well as the anti-wear (lubricating) properties. The influence of fuel temperature on its thermal stability is estimated on the basis of the quantity of sediment formed in the LSA RT instrument at 150° C in a predetermined period of time. The insoluble residue which precipitates from the fuel settles on the internal surfaces of the bodies of fuel pumps, plungers, filter elements and sprayers. This may cause increased wear of parts, plugging of filters and reduction of cross sections, as well as sticking of valves. When heated to temperatures over 100° C, almost all fuels designed for jet engines become unstable. The composition of the material decomposing under these conditions varies over wide limits. They are primarily organic components (products of oxidation of hydrocarbons, sulphur and organic nitrogen compounds), corrosion products, dust particles and other impurities.

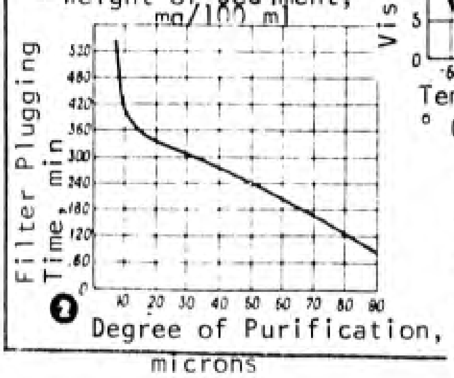
The resinous materials in the fuel in the unstable state, as well as the solid dirt particles, which are centers of tar formation, also help to produce sediment in fuel. When the fuel is heated, this process is speeded up and at 130-180° C (depending on the properties of the fuel) it reaches a maximum. Not only the intensity of formation of sediment changes, but also its composition -- the relative content of larger particles (50-115 microns) increases.

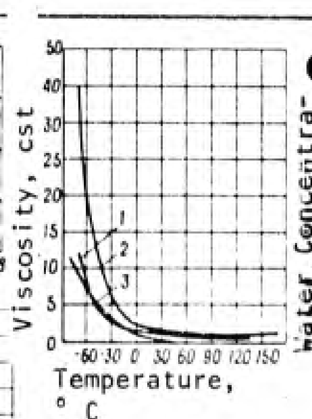
The process of tar formation begins at comparatively low temperatures (45-70° C). First the fuel becomes darker, a result of the formation of soluble tar compounds. These compounds then polymerize: colloidal particles are produced, and the fuel becomes turbid. As a result of coagulation of these particles, a sediment appears, the rate of formation of which depends on the temperature and thermal stability of the fuel. This process occurs so intensively that the filters of the fuel system may become clogged in a few minutes.

The stability of the fuel, defined by the weight of sediment, depends significantly on the conditions and duration of storage (Figure 1). This is explained by the fact that during storage, the content of oxidation products of unsaturated compounds increases, and at the same time the quantity of oxidized sulphur- and nitrogen-containing organic materials decreases, thus increasing the dimensions of sediment particles.

If the degree of preliminary purification of the fuel is increased (Figure 2), the number of coagulation centers for tar products is decreased and, consequently, the operating life of filters is increased.







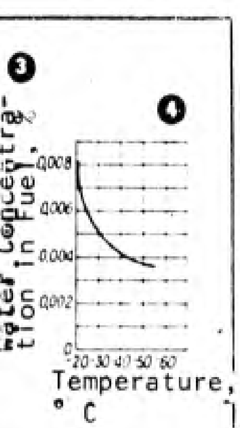


Figure 1. Influence of storage time of fuel on formation of insoluble sediment (TS-1 fuel).

Figure 2. Filter element life as a function of degree of purification of fuel.

Figure 3. Viscosity of various fuels as functions of temperature: 1, TS-1; 2, T-1; 3, T-2;

Figure 4. Concentration of water in fuel as a function of temperature.

Anticoagulants are added to increase the thermal stability of fuel. Furthermore, the contact time of the fuel with atmospheric air is reduced to the minimum. Plugging of filters is prevented by maintaining the temperature at which the fuel begins to crystallize within predetermined limits. The technical conditions are written to indicate that it should not be above -60° C. Filters are most frequently plugged in areas of the fuel system far from the engine, since the lines and apparatus located near the engine are heated as it operates. The temperature corresponding to most probable disruption of normal filter operation depends on the friction and chemical composition of the fuel and its viscosity. The viscosity of fuel depends greatly on temperature (Figure 3). Pumping of fuel with high viscosity results in increased hydraulic losses in lines, decreased pump delivery and poor quality of spraying in sprayers. The maximum value of viscosity at which the power plant of an aircraft can still operate is determined by its arrangement, the design and operational specifics of the engine and the fuel system. These values change for various engines over broad limits. They also depend on the quantity of high-melting hydrocarbons, even a slight (10%) content of which sharply increases the temperature at which crystallization begins.

A number of properties of fuel are significantly influenced by the water which may be contained in the fuel either in the free state or in the form of an emulsion, or in the dissolved state (hygroscopic water). Water not only increases the corrosive activity of fuel, but can also make its delivery to pumps more difficult, precipitating in the form of ice on parts. The temperature of a fuel (Figure 4) at which its delivery is significantly (by 20%) decreased due to blocking of filters with ice crystals depends on the moisture content.

It is particularly difficult to detect and remove water contained in fuel in the form of an emulsion, which has significant stability, resulting from the small dimensions of the drops. The stability of an emulsion is increased if the quantity of tar contained in the fuel increases. Favorable conditions for its formation are created during movement of fuel in the presence of free or dissolved water, particularly with changing temperature and relative humidity of the air. Emulsions are most likely to appear when fuel is cooled, for example during a long flight at high altitudes. For example, if the fuel temperature changes from +20 to 0° C, up to 60 g of water can be separated from each ton of fuel in the form of an emulsion. The drops, in the supercooled state, do not solidify even at very low temperatures (down to -35 - -50° C). As they contact the surface of a filter element, they are converted to ice crystals, which may disrupt the operation of the filters.

Free water, which has higher density than fuel and does not mix with it, is easily detected and removed by settling. The quantity of water dissolved in fuel depends on the composition of the fuel and its temperature, as well as the humidity of the surrounding air.

Water can be separated from fuel if the atmospheric pressure is decreased, particularly during a climb. In order to assure reliable operation of power plants under low temperature conditions, various additives are added to the fuel to prevent the formation of ice crystals. For example, fluid "I" (ethylcellosolv), added to fuel in quantities of 0.1-0.3% by volume, prevents the formation of ice at temperatures down to -50° C.

The experience of operation of aviation equipment has demonstrated that when the effective instructions for storage and filling of aviation fuel are observed, all of its properties are retained and reliable operation of aircraft under all natural weather conditions is assured.

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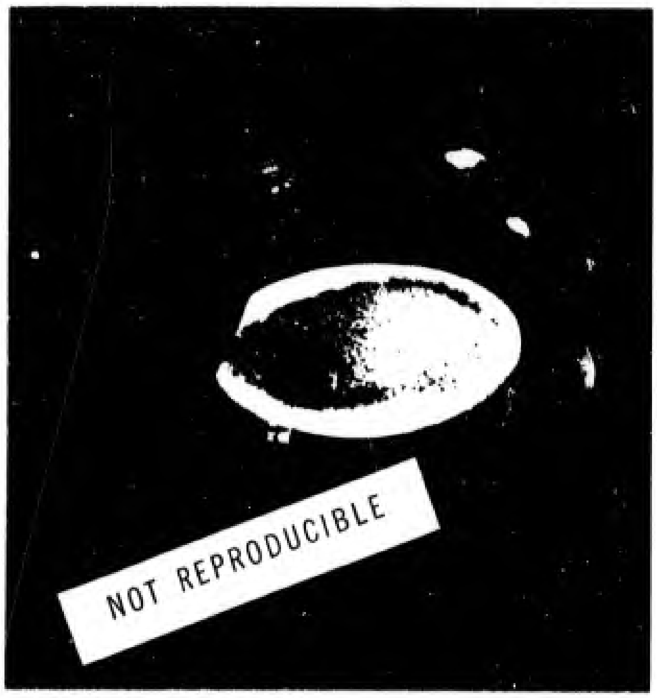
AT THE BOUNDARY OF THE NEW FIVE-YEAR PLAN

By

A. Ivanov, Director of Exhibition of Achievements of
the USSR National Economy

On the eve of the XXIV Congress of the Communist Party of the Soviet Union. about 70 new pavillions were opened at the Exhibition of Achievements of the USSR National Economy, exhibiting machine tools with programmed control, models of nuclear accelerators, powerful tractors, construction machines, precision instruments for physiological research and many other objects indicating the tremendous achievements of soviet science and industry in the period between the last two-party congresses. Special expositions in these pavillions demonstrate the successes achieved in fulfillment of the eighth five-year plan and the promise of further social, economic and scientific-technical development of our country.

Perhaps the most impressive advances in our science and technology are to be seen in the "space" pavillion. During the day before the congress, this pavillion was filled with new, unique rockets and satellites. On 24 September of last year, the "Luna-16" automatic space station returned from the moon with samples of lunar soil. This apparatus and its valuable cargo are on exhibit in the spacious halls of the "space" pavillion in the industrial area of the exhibit. Comparing the equipment of the "VOSTOK" spacecraft which carried Yuriy Gagarin into space 10 years ago with the mechanisms and devices of the Luna-16 automatic interplanetary station, we see immediately the tremendous successes which have been achieved by our sciences, engineers and workers in this short period of time.



Lunar Soil Returned to the Earth by "Luna-16" on 24 September 1970.

The achievements of the leading industrial enterprises, scientific research institutes, universities, cultural institutions and public health organizations of the capital form the subject of the multidisciplinary exhibit "Achievements of the Workers of the City of Moscow in the Development of Economics, Sciences and Cultural." Its participants include the teams and best people from the largest plants. They include ZIL; the first state ball-bearing plant, where two-thirds of the products are manufactured in automatic shops and on automatic production lines; the Kompressor and Borets Chemical and Petroleum Machine Building Plants, known in the USSR and abroad; the Electromechanical Plant Imeni Vledimir Il'ich; the Krasnyy Proletariy and Imeni Sergo Ordzhonikidze Machine-Tool Plants. Many interesting exhibits are dedicated to the sewing, furniture and other enterprises.

Among the exhibits are the model 1B72F3 semi-automatic lathe with program control, designed for complete lathe working of shafts up to 320 mm in diameter and superior in its technical qualities to similar foreign models. The Kvant-9 laser device is used to drill holes in all materials. It is particularly effective in processing diamonds. The productivity of the Kvant-9 is 20 times higher than the productivity of installations based on electrophysical processing, and 200 times higher than devices based on mechanical drilling. The halls of the exhibit include many novelties from the automobile industry, black and white and color television sets, products from the dress and shoe factories of the capital.

A great quantity of work performed by our scientists for the collective and state farms is demonstrated in the interbranch exhibit "Science and Technology for Agriculture." This exhibit also describes the relationship of science to the practice of the fields and farms, the role of science in the development of agriculture. Over 250 of the most modern machines and instruments, around 6,000 specimens of agricultural crops and products made from them, various types of fertilizer, pesticides and hericides are on display for the visitors to this exhibit.

One unit manufactured at the Moscow Plant for Oxygen Machine Building is original in design. The purpose of this unit is to fuse solid alloys onto the worn cutting edges of plows. Operation of this machine requires no special training: the operator turns on the facing mechanism and after 3-5 minutes the plow is ready. Its strength is one and one-half times the strength of sormite, a special plowing steel. This unit has been given an award by the exhibition.

The same type of award was given to the 1-PTU-3.5M fertilizer spreader, manufactured at the Bobruyskiy Agricultural Machine Building Plant. This universal device is significantly lighter than its predecessor, but is capable of lifting and transporting the same cargo -- 3.5 t. In place of two frames, the new device carries but one. It not only transports but also evenly spreads peat, manure, lime and mineral fertilizers. In December of 1970, the workers in the fields received about 1,000 such units. Orders for these units already number in the tens of thousands.

One interesting novelty is the URP-1.4 cleaning machine. This portable machine not only cleans hot beds, but also prepares them for new planting. The feet and supporting wheels of the KOP-2.8 cultivator are fastened onto a metal bar. In one hour, the machine cleans hundreds of meters of earth.

Many specialists, including military motor vehicle specialists, are interested in the mobile water and oil heater created at one of the motor pools of "Melitopol'sel'stroy" trust. It can provide hot water and heated oil for motor vehicle columns located far from their main base in the winter time. At 10 below zero, the installation can heat 2,000 liters of water to 90° C in one and one-half hours, consuming only 40 liters of fuel, consisting of 70% spent oil. At the same time, 210 liters of oil are heated to the required temperature. In one full cycle, this water and oil heater can supply 35-40 trucks.

In the steppes, where combined machines were used for the first time in our country to lay drain pipes, yet another machine has completed its testing. It can operate under the most difficult and swampy conditions, opening great possibilities for mechanization of draining operations in all areas. One specific feature of the new combine is that it digs a trench only 16 cm wide, so precisely that the earth is not piled up.

The "Land Reclamation and Irrigation" pavillion is showing a drain layer based on a T-100 tractor. It cuts through to a depth of 3 meters, lays polyethylene pipes and closes the seam using two blades installed behind the machine.

The number of thematic exhibits at the exhibition has been significantly increased. It is planned to organize about 180 of these exhibits in the next year. These exhibits, in the light of the directives of the XXIV CPSU Congress, are designed to reveal the most pressing problems in the development of the national economy, to show further paths of scientific and technical progress in the leading branches of industry.

Based on these thematic exhibits and inspections, over 500 five-day training courses and about 1,000 one-day training courses are planned for the next year. Seminars, scientific-technical conferences and conferences of specialists from various republics, krays and oblasts will be used to exchange working experience, to familiarize the participants with technical innovations and to produce specific plans for the application of all the leading and most progressive techniques and equipment in production.

The discussions, seminars and conferences will doubtless help to see that the experience of each worker, each shop, enterprise and collective farm is available to many workers, shops, enterprises and farms. This means that one of the most important tasks of the exhibition will be fulfilled -- active propagandizing of scientific and technical achievements, helping to assure their rapid introduction to the national economy of our socialist home land.

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ELECTRIFICATION OF THE AIRCRAFT

By

Engineer Lieutenant Colonel A. Soldatenkov

Until recently, it was considered that electrification of aircraft in flight caused only an increase in the level of radio interference. However, experience of operation of high-speed aircraft have shown that electrification can be a cause of more dangerous phenomena as well. For example, cases have been reported of shutdown and surging in turbojet engines at altitudes of 500-600 m when the aircraft entered stratified and stratified-cumulous clouds. As a rule, the personnel on board the aircraft have observed bright flashes of light just before shutdown of the engines, and post-flight inspections of these aircraft have shown burned spots caused by static electricity, indicating that the reasons for the disruption of stable operation of the engines are closely related to electrostatic phenomena.

As we know, electrification of an aircraft during flight occurs primarily as a result of friction of particles of dust, ice, snow and water droplets with the skin of the aircraft. The potential of the electrostatic charge which arises is negative and may reach several hundreds of thousands of volts. This process occurs particularly energetically during flights at low altitudes with air temperatures near 0° C. In this case, the liquid and solid phases of atmospheric moisture are most likely to be produced.

Significant charges can also be induced by the external field during flights through electrified atmosphere. This type of electrification is observed primarily during flights near charged clouds, as charge separation occurs on the skin of the aircraft. Thus, the surface near the cloud receives a charge opposite in sign to the charge of the cloud. The potential of the aircraft in this case depends on the magnitude of the charge of the cloud and sometimes reaches several millions of volts.

One source of intensive electrification of an aircraft might be generation of charges during operation of the turbojet engines without the afterburner. It has been established that electrification increases with increasing engine speed, sometimes reaching one million volts in a cloudless sky. When the afterburner is turned on, the potential drops practically to zero in a fraction of a second, since the stream of hot gases acts as a ground. Even with the afterburner off, as the altitude is increased, electrification of the aircraft by the engines decreases and is practically absent at altitudes of over 5000 m.

The mechanism of electrification of an aircraft by the operating engines can be explained as follows. The negative ions in the exhaust gases, striking the hot walls of the engine at high speed, are retained by the walls, so that the engine, and with it the skin of the aircraft, receives a negative charge. The exhaust gases, having lost negative ions, take on a positive charge. This type of electrification depends on the structural specifics of the engine, the velocity of the gas stream, and, furthermore, the concentration of solid particles (products of incomplete fuel combustion) contained in the exhaust gases.

High electrostatic charge potentials cause intensive ionization of the air near sharp pointed parts of the aircraft and may cause discharges between the clouds and an aircraft, or between two clouds through an aircraft. These cases are possible not only under conditions of active thunderstorm activity, but also during flights in layered clouds or near them. Electrostatic discharges are particularly frequently observed when an aircraft passes through a zone of precipitation in the region of the so-called zero isotherm, i. e. the line on the map connecting points where the air temperature is equal to 0° C.

Electrical discharges between an aircraft and a cloud generally do not cause significant damage, due to the relatively low energy of these discharges. Discharges between two oppositely charged clouds through an aircraft, particularly during flights through thunderstorms, may liberate extremely high quantities of energy.

What is the physical essence of the phenomena causing the shutdown and surging of turbojet engines after electrostatic discharges in the atmosphere? As we know, stable operation requires that certain temperatures, pressures and velocities of the air stream be maintained at the intake to the engine. During a lightning discharge, a shock wave develops between the aircraft and the cloud (the pressures in a lightning bolt are on the order of 30-40 kg/cm^2); this shock wave, by disrupting the even field of pressures, velocities and temperatures, causes a brief change in the velocity of air flow through the engine and, consequently, shifts its operating mode into an unstable area.

The surging which develops sharply decreases the efficiency of the compressor, causing a decrease in the air pressure head and, consequently, a decrease in turbine power, a reduction in rotation speed of the engine and a sharp increase in the temperature of the exhaust gases. The automatic fuel system controls of the engine, designed to maintain fixed rotating speeds, increase the supply of fuel, which causes the gas temperature to rise still further.

The increase in temperature, particularly at low altitudes, occurs very rapidly and causes significant overheating and even melting of the turbine blades. With increasing altitude, the rate of propagation of the flame in the combustion chamber of the engine decreases. Therefore, as a rule, surging at high altitudes causes only shutdown of the engines and is not accompanied by significant overheating of turbine blades.

One of the most probable lightning discharge channels in an aircraft consists of the gas streams of the engines. In this case, the discharges accompanied by a bright flash behind the engines, resulting from the strong heating of the gas in this area and its ionization.

The shock wave developing during the discharge can, under certain conditions, create compression in the cross section of the jet nozzle of the engine and cause a flameout.

Flyers have observed lightning discharges in the nose portion of an aircraft, on the antiflutter weights and the wings. These discharges are usually preceded by coronas (glowing) around the sharp portions of the aircraft, which can be particularly clearly seen at night.

This corona formation may be a warning signal of the possibility of a lightning strike on the aircraft.

In order to avoid undesirable results due to electrostatic discharges, the crew should select a flight path whenever possible to avoid intersecting the zero isotherm, particularly at low altitudes in stratus and strato-cumulous clouds, and also when thunderstorms are present.

If the signs of ionization of the air develop, it is best to leave the danger zone. If an electrostatic discharge has occurred or the aircraft has been struck by lightning, particular attention should be given to checking the operation of the engines.

One effective means of preventing dangerous results of electrification of an aircraft in flight is reliable connection of all elements of the aircraft by current-conducting elements, and maintenance of the static electric dischargers in good condition, so that they will provide continuous drainage of charges and thereby prevent an increase in the electrostatic charge potential to dangerous levels.

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THE TRAINING OF OFFICERS AT SEA

By

Captain B. Kiselev

Long cruises provide inexhaustible opportunities to increase the sea and special training of ships officers. This occurs primarily because at sea each sailor must act in an actual, concrete situation (storms, fog, snow, swells, navigation and other dangers), and the combat equipment, not training equipment, is used. The sea allows us to create conditions similar to the conditions of modern armed combat as the tactical background when firing tasks and other combat exercises are performed. Nowhere can the men learn to control their weapons and equipment, to evaluate a situation rapidly and properly, to make proper decisions and carry them out bravely so well as at sea.

Doubtless, the organization of training at sea has certain specific features and depends to a great extent on the ability of the commander to select the most effective methods as applicable to the specific conditions of each cruise, on the nature of the assignments performed by the ship, and on the level of training of the officers. Not all forms of training are usable at sea. For example, it is very difficult to perform drills, seminars or group exercises under the leadership of the senior officer. The constant maintenance of watches in combat shifts, the control of the personnel and increased readiness require great amounts of officers time as well as serious physical and mental stress. Therefore, individual training of officers is most suitable for use at sea.

Training sessions at command points and at the main command point (MCP) of the ship, as well as test questions put to officers before going on watch, are quite effective. The transmission of experience in commanding the combat unit and ship under various cruising conditions is successfully used.

Certain forms of training (with small groups) have been found to be quite acceptable. Such measures as discussion of the actions of the officers after each watch, drill or firing exercise, as well as discussion of cases of failure of materiel, are used.

Experience has shown that careful preliminary training, which must also be expedient, is decisive in the organization of individual training. It should be based on the problems which, in the ship and precise knowledge of the level of knowledge of each officer. Before the ship leaves port, it should be precisely determined who must be taught what, who must be checked on what subjects. This is done by composing lesson plans for independent training of subordinates and determination of exercises, drills and other measures, during which the officers will be trained and their level of training will be checked. Before the ship goes out to sea, for example, the regions in which the cruise is to be conducted should be studied, the situations in them should become familiar. Certain administrative documents should also be studied and memorized.

For example, let us see how the officers of one submarine prepared themselves for a long cruise. They first had to cruise to a remote area.

Before going out to sea, the officers had a plan for independent work affirmed by the ship commander, calling for the performance of individual drills, improvement of tactical and technical knowledge, and increases in class ratings. The ship commander also had a personal plan for training of his officers, which included secondary versions in case of possible changes in cruising conditions.

The sea, as we know, is a strict tester and this cruise confirmed this once more. During the first few days, the cruising conditions unexpectedly became more difficult (unfavorable hydrological situation, poor visibility, thick traffic), requiring close attention from the officers. This allowed the level of practical training of certain officers to be tested, and revealed how effectively they had studied earlier.

In spite of the difficulties which arose, the ship commander fulfilled the plan for training of his officers from the very first days. Training exercises were performed regularly at the main command point, the organization of observation of the situation and its analysis were worked out as well as classification of targets detected, means for avoiding opposing forces and equipment, control of weapons and technical gear under various conditions.

The commander tested the knowledge of his officers concerning the applicable documents and conditions for each upcoming exercise or drill, then checked their actions by assigning situations. Using every opportunity, he involved one or two additional officers in individual training, allowing them to study the examples of the actions of their comrads. The commander gave his men full independence and interferred only if one of them made a serious error. After completion of a maneuver or other action called for by the plan, he performed a critique immediately at the main command post, analyzing the errors and showing when necessary how to perform each action properly. These training drills required a great deal of the commanders' and officers' time, but it all paid off. The quality of training was high.

On long cruises, such methods as question and answer sessions before going on watch, asking officers to estimate the situation and make decisions are also used. These very effective methods of individual training should not be used unsystematically in an impromptu manner. In no case should the commander do this in order to "trap" an officer with weak knowledge of his subjects. All questions and situations set should be designed to teach new skills or reinforce knowledge and skills gained earlier by practice. The questions and situations should not be random or disconnected, but rather specific, practically important for the conditions at hand. They should be selected as applicable to the theme, region and cruising situation at hand, as well as the individual peculiarities and knowledge of each officer in order to facilitate the optimal solution of the problem at hand and attainment of the training goal.

Due to the reduction in the term of service of sailors and petty officers, practical experience of officers has become even more significant. Now every officer should be able to achieve the norms at the combat posts of his subordinates. Demonstration and personal example are evermore common in practical training. Therefore, great attention should be given in training of the officers to drills at the combat stations and command points helping to develop strong practical skills in the use of the equipment and technical devices. They will help the officer to learn to do everything or almost everything that his subordinates do rapidly and accurately, so that he can more capably command them from his command point, correctly organizing their training, maintaining the weapons and technical equipment in good condition.

Their attempts to constantly improve their knowledge and skills distinguish such officers as Engineer Captain-Lieutenant Mikhaylov, who finds time for systematic practice at the combat posts and the command point. His high activity in personal training and persistent training of his subordinates have yielded good results -- the Podrazdeleniye which he commands has won the rank of outstanding and 90% of its members are rated specialists.

Individual training of officers at sea is widely used because it is convenient and its expediency has been tested by the practice of combat training. However, even at sea one should not limit oneself to these types of training alone. The combat units of a ship and the ship itself are of course teams, which must operate smoothly together. The Podrazdeleniye commanders for good reason feel a definite need for combined study of officers, development and testing of their actions together with the actions of all personnel under conditions similar to combat conditions. We must also recall that long cruises are made not just by individual ships, but also by groups of ships, frequently of different types. The detachment may include surface ships, submarines, floating bases and other service ships. The actions of ships officers have become significantly more varied and difficult for this reason. They demand knowledge and practical skills in the solution of complex problems of combat training, in the ability to act with a detachment of different ships. The significance of combined cruising has increased greatly, as has the role of the watch officers.

How should training be organized under these conditions? Research in this area has lead to the idea of the necessity of using, along with individual training, methods of group training such as practical drills, similar in organizing principle to group exercises.

A detachment of ships from the Red Banner Pacific Fleet has accummulated instructive experience in the performance of this type of drill using communications equipment.

The assignment for participation in the group exercise was given to the commanders and officers of the ships in advance and was quite familiar to them: they studied the situation and combat capabilities, both their own and those of the "enemy," performed calculations on the use of their weapons and technical equipment, and analyzed various possible versions of solutions.

The participants in the exercises were on different ships. The episodes were played out using communications equipment, organizing communications so that all participants were as if combined into one group. The leader was able to speak with the officers on both ships, hear their decisions and commands and to change the situation assigned. All of this was heard by the participants in the exercise both on the cruiser and on the ASW ship. Due to this, each man could evaluate the responses and actions of the other officers, determine the level of his own knowledge, understand and fix in his memory that which he had not been sure of before. The specifics of the situation and organization of the exercise using communications of equipment required that the men be calm in their responses, report that which was most important, essentially necessary. During the process of performance of this exercise, unity in evaluating the situation was developed along with unity in actions, smoothness and understanding, as they say, with the first half word,was achieved. If any of the officers made a mistake, the leader corrected him or discussed his mistake, although without robbing him of his initiative.

During the "combat operations" the ships maneuvered, calculations were performed at their command points and combat posts, data were selected for evaluation of the situation and the use of weapons, decisions were made, and the men fought for the life of their ships. The dynamics of the "combat" were reflected on the maps of the exercise leader on the cruiser, from which the situations for the ships were assigned.

In conclusion, a critique was held, at which the leader analyzed the actions of the participants, evaluated their training and showed where necessary the results which could follow from the mistakes of the officers and how they should act correctly. The group exercise, in the opinion of the participants themselves, was quite instructive, helping each officer to see his mistakes and allowing the detachment commander to evaluate the level of training of the officers of the ships and their readiness to perform complex training combat assignments.

The high technical level of modern ships requires that many problems of specialized training be restated. For example, the training of watch officers must be raised to a new, higher level. The ships of the Navy require that a watch officer know the principles of navigation, the amplication of artillery, missile, torpedo and mine equipment, the use of the power plant, observation equipment, communications, recognition and warning equipment.

The methods of theoretical training of watch officers have remained essentially unchanged. As concerns the accummulation of practical skills, the best method, experience has shown, is training at sea. Good results are also achieved by duplication of experienced watch officers, fulfillment of the duties of the artillery fire controller, torpedo fire controller and navigator.

On one submarine, practical training of the watch officers is achieved by systematically allowing them to balance the submarine with negative bouyancy and a bouyancy differential, using the diving planes. These exercises are generally begun at the post of the diving plane controller, then continued at the post ballast pump operator, where the officer performs his duties during surfacing, prepares and starts the water pumping equipment. These exercises have helped the officers to "feel" the submarine better, and to understand the dynamics of the processes and sequence of operations involved.

During a submarine cruise, the commander trains his officers as navigators as well. Calculation of the course considering drift, current and maneuvering is performed independently by each man. Then, comparing his data with the data of the navigator, the officer determines how correctly he has solved the navigation problem.

Systematic training with constant testing by the ship commander has significantly increased the practical ability and skill of the watch officers. For example, Officer Sorokin was given permission for independent conduct of watches while underway in a short period of time, while Officers Timoshenkov, Kulikov and Reznikov achieved good navigation practice.

The question of the organization and method of application of tests during independent training of a group or combat unit is quite important. The problem is that at the present time the order of testing is far from standardized. Of course, the organization of testing depends to some extent on the composition of the Soyedineniye, its location, the basing conditions and other specific conditions. However, even considering these specifics, a common, most expedient approach to testing can be suggested on the basis of collective experience. For example, it would be intelligent to begin by handing each officer a test paper or book, indicating all questions of the program and giving some methodological development. As the main problems are worked out, the officer hands the papers to the flagman specialist of his Soyedineniye, then is tested by the ship commander (knowledge of the structure of the ship, ship watch services, etc.) and graded. Testing should include the entire program, with obligatory testing of practical skills.

As they prepare to take their tests, the young officers are in great need of methodological recommendations. Therefore, along with each test paper, a methodological paper should be handed out giving examples of the calculation of time, indications of the sequence of training and a list of required literature on each theme. It is good for each officer during the process of training to enter the most interesting and necessary information in his notebook. The study of the devices on the ship can be greatly facilitated by the use of special notebooks containing the most important data and diagrams of the placement of mechanisms and systems. When an officer is preparing for a test, he should not be required to do any work which can be temporarily performed by his subordinates, and his participation in maintenance of watches and cleanup work should be somewhat reduced.

The formation and growth of an officer depend on many components, particularly on his personal qualities -- his eagerness to work, his persistence, etc. Therefore, many, even experienced leaders believe that the successes of a young officer depend only on himself. Of course, they do depend on himself. However, training experience has shown the great significance of timely and qualified help and leadership by the direct and senior superiors. On ships, where training is well planned and carefully controlled, the formation of officers occurs more rapidly and the quality of their training is better. For example, Lieutenants Kryukov, Tkachev, Petrash and Mochul'skiy were simultaneously assigned to the duty of combat unit commander on identical patrol vessels. But, whereas Officers Kryukov and Tkachev were given permission for independent command of their combat units within the established time limits, the two other officers required twice as much time to reach this goal, although they could not be criticized for lack of enthusiasm. Investigations showed that their commanders did not give them the help they needed. It was considered that they were grown men and should learn everything themselves. The young officers managed the tasks at hand, but required too much time to do it.

As before, among all existing forms of training, the most important is independent training according to each man's personal plan. The new ships, modern weapons and technical devices, which have significantly increased the level of knowledge of petty officers and sailors, require that the officer of today meet very high requirements. Actually, if we consider that a single submarine, for example, may have several petty officers and warrant officers studying in college, it becomes clear that a modern ship officer must have a high level of knowledge. He must now not only understand his own specialty deeply, but also must be erudite in many related areas of science and technology. An officer can become a well and widely educated specialist only by systematic independent study.

The most important role in the organization of independent study is that of the flagship specialists and ship commanders. The officers make up their plans for independent study under their direct leadership and with their help. These plans should be designed for short periods of time -- best of all for one month, since it is difficult to predict the changes which will arise in the process of cruising and combat training for a longer period of time. The thematics of the plans should include the most important problems for each officer for the period of training in question and the assignments set before the Podrazdeleniye (ship). The themes must be grouped according to types of training: tactical, special, general, political. It is considered useful to make up the plans for familiarization with materials from the periodical press, including the study of new ships, aircraft, weapons and the tactics of the probable enemy as applicable to the conditions of combat activity of ships of each man's class and type. Ten-fifteen percent reserve time should also be included.

In confirming the individual plans for independent study by the officers, the commander must turn particular attention to the importance of the themes, the proper sequence and methods of their development and realistic times and materiel support for each plan (availability of training literature and training aids, possibility of practical work on training equipment or operating equipment). If the plans are correctly composed, if testing and aid for the officers is well organized, their growth as ship service specialists will be very rapid. This is facilitated also by long ship cruises, giving all personnel irreplaceable practice in the actual performance of their complex and responsible functions.

We have spoken only of some of the experience in the training of officers during sea cruises and have not touched on all problems of their training by far. We hope that the considerations and recommendations which we have given will be useful both to ship officers and to commanders organizing training, and will help them to increase the effectiveness of existing forms of training and to seek out new forms.

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AFTER THE COMBAT ASSIGNMENT IS RECEIVED

By

Colonel V. Shamin and Engineer Lieutenant Colonel
Ye. Pateyuk

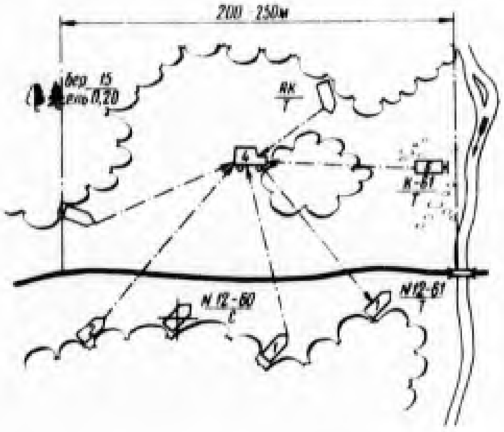
The organization of technical support of small engineering podrazdeleniye has its peculiarities. These peculiarities result primarily from the great variety of equipment used. Furthermore, the engineering podrazdeleniye, for example a platoon, frequently performs tasks individually, and its commander must solve a great variety of problems independently. In this case, the platoon commander is the direct organizer of technical services. He must not only know his equipment well, including the specifics of its operation, the fuel and lubricant materials used, but also must be able to solve problems related to servicing of the machines and even sometimes their repair, rapidly and correctly. The volume of work involved in preparation of the equipment performed by the platoon commander depends on the conditions of the combat situation, the nature of the tasks to be performed, the availability and condition of machines in the platoon, the time set aside for preparation, the time of year and time of day, the weather and many other factors.

Let us study one possible version of the actions of the commander of an engineering-bridge building platoon, who is assigned the task of working separately from his chast'. Let us assume that the platoon has just returned from an assignment, its personnel are bringing the equipment and engineering supplies up to condition, when the commander receives the order to prepare for construction of a shallow-water bridge on pile supports. First of all, he must determine the nature and volume of work to be performed. For example, he might learn from the order of the company commander that he must place pile supports under a wooden bridge to bear a load of 60 tons across a river 35-40 m wide in an area located 50 km from the present location of the platoon. The platoon is given six hours to prepare its equipment, engineering supplies and pile support elements. The necessary technical aid will be provided by the truck mounted engineering repair shop, which will be in the area where the platoon is located in two hours. Enemy aviation may be active, so that measures should be taken to disperse and camouflage the equipment.

In order to perform the task assigned, the platoon commander must determine the nature of the obstacle (depth, width, low characteristics and soil conditions), must prepare or obtain the necessary materials for construction, prepare the equipment and personnel, make the decision to march, determine the organization of work to be used and a number of other problems. We will discuss one aspect of his activity -- the preparation of the equipment.

In our opinion, this work should be organized as follows. First of all, after calling together the commanders of squads and teams, determine the technical condition of the machines and mechanisms on the basis of their reports, determine how well the machines are equipped with spare parts, tools, decontamination and degassing sets, light masking devices, determine the requirements for fuel and lubricants. It is possible that some machines will have to be inspected immediately.

Let us assume that it has been determined that about 10 man hours must be expended in servicing of the LAZ-690 crane. Furthermore, the cable of the cargo drum of the winch (14 mm diameter, 20 m long) must be replaced. The crane will require 50 liters of gasoline. One ZIL-157K requires technical maintenance number 1 (10 man hours), another -- technical maintenance number 2 (about 25 man hours). Several high voltage wires and spark plugs must be replaced on the engine. Two other vehicles have been damaged and require repair: one requires medium echelon repair, the other -- low echelon repair. The platoon commander receives similar information concerning the other machines and mechanisms.



Approximate diagram of placement of equipment of platoon on terrain: 1, 2, ZIL-157K and ZIL-157 trucks with sets of KMS [expansion unknown] equipment; 3, transport vehicle with pile support elements; 4, truck mounted engineering repair shop; 5, LAZ-690 crane; 6, K-61 transporter;

×, vehicle not to be serviced;
-·→, movement of equipment to be serviced and truck mounted engineering repair shop.

This information should be written in prepared tables. As experience has shown, this facilitates calculation of the time required, planning of servicing operations and checking of operations. After determining that performance of all work required will require about 100 man hours, the platoon commander performs a general calculation of the time required for performance of preparatory work. He evaluates the terrain (in particular, deciding where the needed bridge support elements should be made, in the region where the plattoon is located or on the work site), considers the weather and the time of day. He determines how many men will be required for preparation of the materials and other work, what time is required for preparation of the personnel. After deciding how many men should be set aside for servicing of the equipment, he calculates the actual volume of work which can be performed and how the engineering shop should be most effectively used.

After answering all of these questions, the platoon commander gives his preliminary order to the squad and crew leaders. He indicates the assignments for the platoon, the sequence in which primary operations involved in preparation of the machines should be performed, as well as the performance times allotted, the time and order of instructions to be given to drivers. At the same time he shows on the terrain the locations for parking vehicles and the placement of areas for servicing and repair (see figure), and gives camouflaging instructions.

After organizing the work of the personnel, the platoon commander reports to the company commander concerning the technical condition of vehicles, his suggestions for their utilization and the organization of servicing and repair, the supply of spare parts, tools and special equipment, and also the total needs for fuel and lubricants, the desired times and order for refilling of vehicles.

Considering the situation, the platoon commander should request that the company commander give him permission to postpone work involved in preparing the vehicle (ZIL-157K) to be sent in for medium echelon repair. This vehicle should be replaced by another vehicle from a different podrazdeleniye. The low echelon repair should be performed by engineering shop personnel, sent to the location of the damaged vehicle. Here also, all welding and adjustment operations should be performed on other vehicles. The vehicles, crane and transporters should be filled with fuel and oil where they are parked. The work involving replacement of small parts on engines, diesel hammers and motorized saws should be performed by the drivers and mechanics, helped by one specialist from the shop.

After the company commander has confirmed the decision, the platoon commander clarifies the assignments for his squad and crew leaders (each individually or all together, depending on the situation). He indicates what work should be performed on the vehicles and where it should be performed, where to obtain the necessary materials and spare parts, the order of refilling of the vehicles, cooperation with repair workers of the shop. The tasks must be stated briefly and clearly. For example, the leader of the bridge building equipment group is told: "By 0900 refill all vehicles, obtain fuel and oil for all engineering equipment. The POL filling truck will arrive in the region of the platoon by 0800. Servicing of vehicles, diesel hammers and engines must be completed by 1300. Adjustment and welding work will be performed by the shop in this area (indicates location). After servicing of diesel hammers and engines is complete, operation test, load onto trucks and fasten in place. Filter fuel for diesel hammers. Prepare burners for heating of hammers before starting. Each vehicle must carry a towing cable. I will personally instruct the drivers at 1320 in the area of the repair shop."

Assignments are given to the leaders of the bridge building teams in approximately the same manner.

Subsequently, the platoon leader checks to see that the servicing is performed well, that the technical equipment is received and properly distributed. He personally checks the equipment prepared for operations. After he is sure that all vehicles and machines are in good order, he reports this to the company commander.

Of course, depending on the specific conditions, individual tasks may be performed differently and the work may be organized otherwise. We have shown what we feel is the most efficient sequence of actions of the platoon leader in solving problems of technical maintenance.

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In the article of Engineer Colonel T. Papushin, "At the Change of Seasons," published in this journal, No 10, 1970, the expediency of performing additional measures for sealing, heating and protecting radar apparatus from moisture and snow was discussed.

The Chief of the Air Defense Radar Forces of the Country, Lieutenant General M. Beregovoy, has reported that the recommendations presented in this article are of great practical value and are being successfully used in the podrazdeleniye of the radar forces. Problems of preparation of the equipment for operation under conditions of high humidity and sharp temperature changes are always at the center of attention of the command and engineering and technical staff of the Radar Air Defense Forces of the Country. The commanders consider further popularization of the leading experience of operation of radar equipment in the armed forces to be quite useful and necessary.

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TESTING THE MASTERY OF KNOWLEDGE

By

Engineer Captain V. Titov

In order to facilitate testing the mastery of new material and self-testing during independent training, we use a simple device. The correct answer is automatically coded in the device when the question is input, but recoding can be performed by changing plugs in jacks, so that the students cannot "learn" the device. In the "self-test" mode, he can learn the correct answer, while in the "examination" mode the student cannot correct an answer after the grade has been given. However, after the questions are answered he can see which questions he has answered incorrectly.

Twenty-three tickets have been prepared, each of which contains three questions in the form of circuits graphically characterizing processes, individual characters, formulas and numerical problems (Figure 1). Four possible answers are given to each question, only one of them being correct. Switches on the face of the device are used to answer the questions.

After all questions have been answered, the devices a grade of "excellent", "good" or "satisfactory." If all questions are answered incorrectly, no grade is given. The "examination" or "self-test" mode is set by switch S2 "type of operation" (Figure 2) on the rear panel.

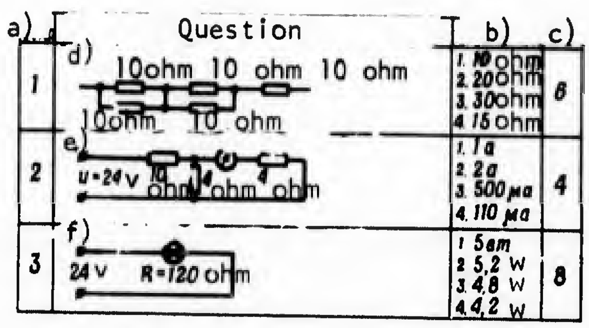

Figure 1. One Ticket on the Principles of Electronics

Key: a) Question Number; b) Answer; c) Code; d) Calculate Resistance of Circuit:; e) Determine Current Passing Through Device; f) Determine Power Consumption of Lamp

Before beginning operations in the "examination" mode, the assignment input switch S1 "ticket number" is set in the "zero" position and power switch BK is turned on. After lamp L1 "ready for operation" comes on, switch S1 is set in the position corresponding to the number of the ticket to which answers must be given.

Answers are given by turning on one switch in each of the three groups BL-B4, B5-B8 and B9-B12, "answer to question." If the answers given are correct, the circuits of the answer relays P1, P2 and P3 are prepared for operation. When "answer" button KH1 is pressed, the voltage from the power supply is sent to the winding of actuating relay P1 and the windings of the answer relays. Relays P1, P2-P4 then operate and block themselves.

After the actuating relays operate, the initial circuits of the answer relays are broken by contacts P1-2, P1-3, P1-4, so that it is impossible to select another answer by turning on different switches. Naturally, the operating time of the answer relays must be less than the operating time of the actuating relay. After the actuating relay is switched on, its contacts P1-5 close the circuit of "answer ready" lamp L8, and the leader can determine the results of the answer. At the same time as operation of the answer relays, lamps L2-L4 come on, showing which questions have been answered correctly.

In the "self-test" mode, the operation of the circuit differs in that the "operating mode" switch shunts the open contacts of the actuating relay, allowing the student to determine the correct answer by switching the switches for each of the answers in turn. When the correct answer is given, lamps L2-L4 come on. The grading section is disconnected.

Since the teaching device uses RES-10 low-impedance relays, the grading section consists of transistor T1 (type P4B) connected as an emitter repeater, the base circuit of which contains a voltage divider. In the initial state, resistors R1, R2 and R3 are shunted by the opening contacts of answer relays P2-2, P3-2 and P4-2. The collector circuit includes the windings of the grade relays. When one of the answer relays operates, the voltage fed to the base of the transistor is tapped from one of the resistors, while the collector current is so low that it can cause operation only of relay P7. In this case, its contacts P7-1 close and connect the power supply to lamp L7, "satisfactory." When two answer relays operate, the base circuit of the transistor carries a collector current capable of switching relay P6. This relay breaks the circuit of the winding of relay P7 by its contacts P6-1, while contacts P6-2 close the circuit of lamp L6, "good."

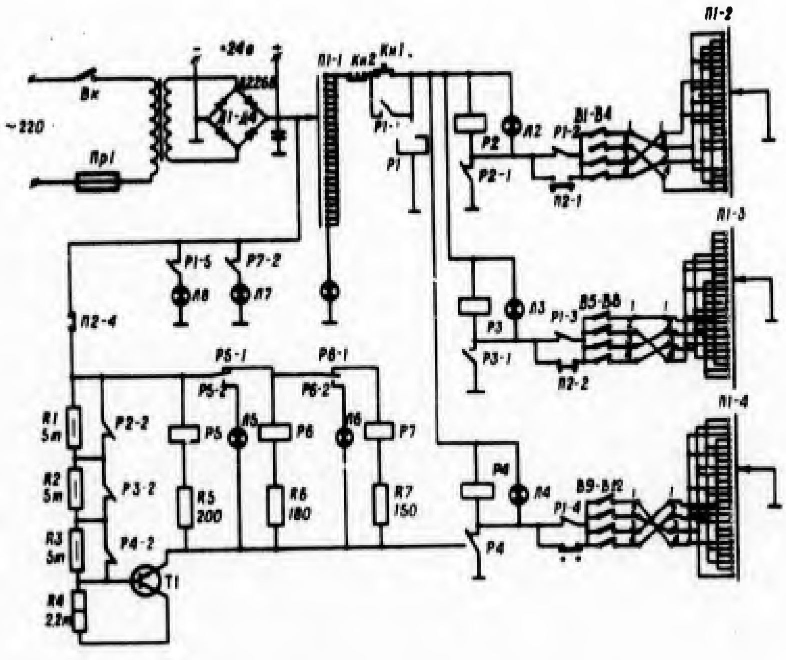

Figure 2. Schematic Diagram of Testing Device

If all three answers are correct, the voltage on the base is taken from the entire divider. The collector current in this case is maximal and causes operation of relay P5, the contacts open the circuit of the winding of relay P6 and connect the "excellent" lamp. The operating mode of the grade relays is selected by resistors. If all answers are incorrect, no relays operate, and the device gives no grade.

The machine is operated by a 220 v ac power supply, or by any supply of 24 v dc. The power consumption is 60 watts, the size of the device is 340 × 260 × 180 mm.

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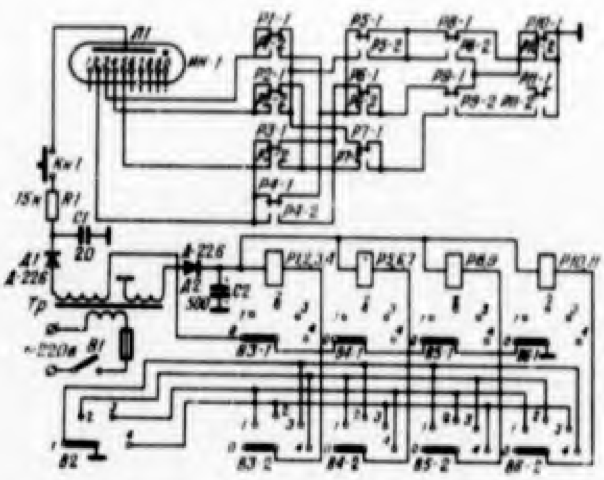
DEVICE FOR SELF-TESTING

By

Engineer Captain B. Kukharchuk

This device, used for self-testing, requires the student to answer for questions. Four answers are given for each question, only one of which is correct. It corresponds to certain positions of the answer switches B3, B4, B5 and B6. For example, after switch B2 is placed in position 2, the correct answers will be selected if the answers which is B3, B4, B5 and B6 are placed in positions 4, 3 and 2 respectively. When the test questions are changed, switch B2 is moved to the next position.



The correct answer to all four questions will cause a grade of "5" to be displayed by neon indicator L1, type IN-1, the correct answer to three questions will result in a grade of "4," the correct answer to two questions will produce a grade of "3," and the correct answer to one question will produce a grade of "2." Beginning training exercises, the student sets all answer switches to the zero position, charging capacitor C1. Let us assume that switches B3 and B5 are set in positions 3 and 1 respectively, while switches B4 and B6 are set in positions 4 and 2, i. e. the correct answer is given to two questions, an incorrect answer is given to the other two. This causes relays P1, P2, P3, P4, P8 and P9 to operate.

When the student now presses button KH1, the "grade" button, condensor C1 discharges through the following circuit: resistor R1 -- button KH1 -- lamp L1 -- the closing contact of relay P1 -- the opening contact of relay P5 -- the closing contact of relay P8 -- the opening contact of relay P10 -- chassis. The number "3" lights on the indicator. The time the number stays lit is determined by selecting the values of R1 and C1. The limitation of the time the lamp stays lit prevents determination of the proper answers by trial and error.

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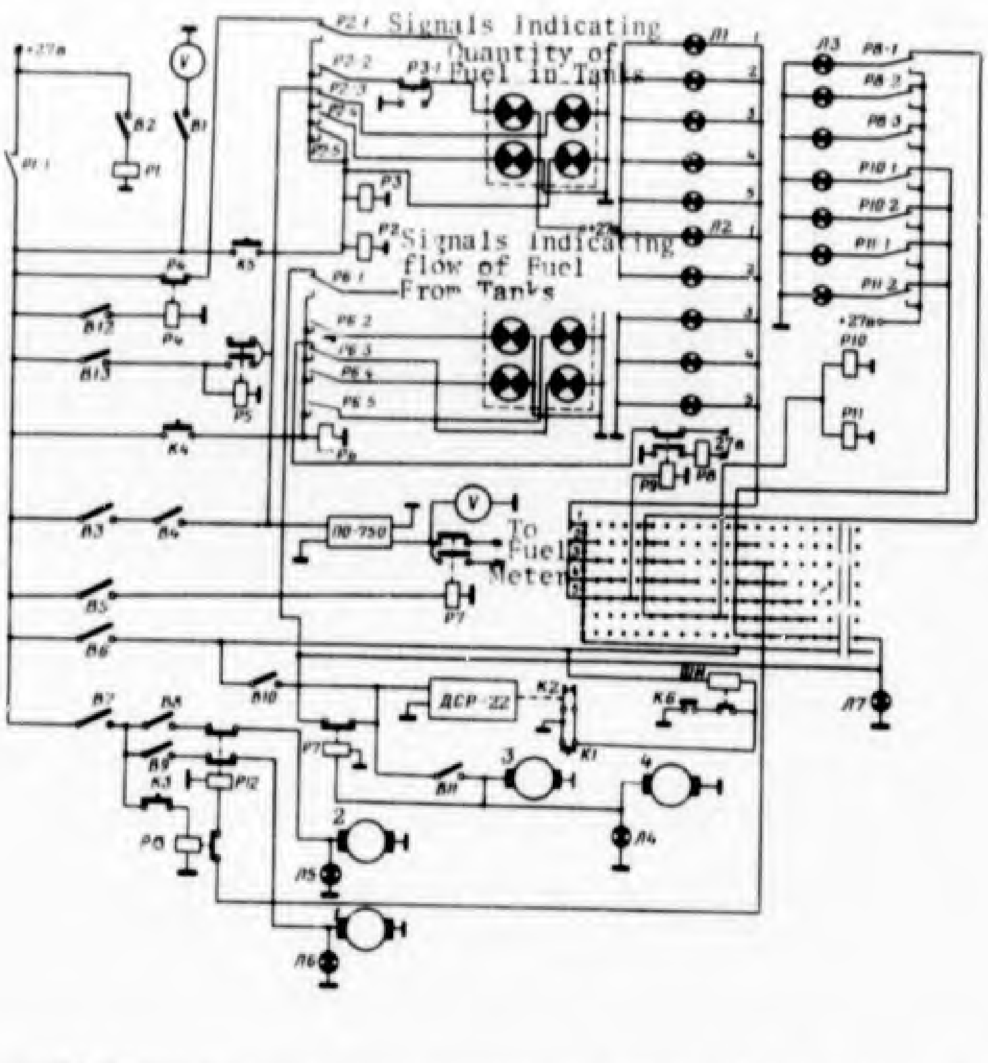
A TRAINER-IMITATOR

By

Captain of Technical Service F. Kolesnik

The trainer-imitator for an aircraft fuel meter allows the student to study the operation of the automatic portion of the fuel system of an aircraft, to gain an idea of the order in which fuel tanks are emptied, as well as the proper sequence for testing of the fuel meter.



Light indicators involving successive burning of lamps L1, L2 and L3 is used to demonstrate the order in which fuel is expended. This system operates automatically (when button K1 is pressed) by means of a time relay consisting of two contacts K2 and a four-cam disc, rotated by a type DSR-22 electric motor through a reducing drive. This same motor rotates the plates of the variable condensors in the fuel meter.

When the minimum permissible reserve of fuel in the tanks is imitated, lamps on the display light and the contact of the step switch immediately looses current and pumps 1, 2, 3 and 4 are turned on.

The correct operation of lamps on the display can be checked using two buttons K4 and K5, labeled "lamp test." When button K6 "fuel fill" is pressed, the SHI-25 step switch returns the fuel level indicator needle to its initial position, corresponding to full fuel tanks.

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ELEMENTS OF INFORMATICS

By

Engineer Commander V. Dem'yanov

Any specialist of the Army or Navy can study an area of knowledge, learning it in sufficient volume for his work, either independently or using his senior comrads. The propagandist should bring him to deep study of the most important and promising problem areas, to the application of the latest achievements of science and front rank experience to his practical activity. Expanding the military and technical horizons of his students, he also indicates to them, either directly or indirectly, possible means for solving pressing problems of military practice.

In order to become this sort of propagandist, it is necessary to have the art of extracting the latest information useful for the students with whom one must work from various sources. This cannot be done unless one understands the means and methods of collection and transmission of military, scientific and technical information, unless one becomes familiar with the specific properties of the information processes, i. e. to say unless one is familiar with that which we call informatics. This scientific discipline studies the structure and properties of scientific and technical information, the regularities of information activity, its theory, methods, organization, develops optimal methods and means for writing, collection, transmission, storage and distribution of information.

The tremendous streams of information poured upon us each hour seem at first glance to be disorganized and random. However, if we look at them carefully, we can differentiate two main streams: descending and ascending. The first of these, produced as a result of processing of the world and domestic scientific and technical literature, moves from top to bottom, feeding all units of the information service of our country. Its primary stream beds are the periodical and individual publications (newspapers, magazines, books, patents). The second stream, containing primarily documents which have not been printed (reports on scientific research work, tests of equipment, etc.) arrives from lower units to the central organs. It is called ascending. The information which it carries is most frequently of a service nature, requiring serious analysis, comparison and generalization, and is therefore not used in mass propaganda work. The military propagandist must orient himself well in the descending stream. It is in this stream that he can find generalized material on the development of various sciences, areas of technology and military affairs.

Like any science, the science of control of the armed forces cannot continue without a well ordered information service. New models of combat equipment, methods of its application, servicing and repair, equipment and methods for training specialists, valuable military experience and particularly the experience of large scale training exercises and maneuvers such as "dvina", "okean," must be rapidly and broadly introduced to the chast' and ships. The performance of this important task depends to a significant extent on how clearly the officers understand the information service of the Armed Forces, how well they can use it and how precisely they perform their information functions.

The system of central and branch informati[illegible] organs created in our Armed Forces performs an extremely important s[illegible] to increase the c[illegible]bat power and readiness of the forces. The information organs of the Ministry of Defense locate, collect, process, store and distribute information relating directly to military affairs, including military technical information. The leader of this service is the Central Institute for Military and Technical Information (TSIVTI). The scientific research institutions of the Army and Navy and the military school collect and accummulate scientific and technical information in correspondence with their profile and assignments. To do this, the institutes, academies and schools have information bureaus. Of course, the military libraries are also involved in the performance of information functions. A significant volume of important information is collected in the military districts and fleets, in the staffs and political departments of soyedineniye, in the chast' and on ships, in officers homes, clubs and libraries.

All of the experience of mankind, accummulated over the centuries, all of the ideas and scientific facts which the scientist, designer, production organizer, scientific and technical propagandist must use, are reflected in various documents. As to their form, they are usually differentiated into text (books, journals, manuscripts, etc.), illustrative (drawings, plans, maps, etc.) and audio visual (sound recordings, motion pictures, film strips, etc.). The most convenient form for exchange and publication is the text form, while the most convenient and accessible store houses of knowledge for the military propagandist are the libraries. Every propagandist must be able to orient himself rapidly and accurately in the library, otherwise his search for needed information will be drawn out and he will utilize other than the best of the available materials in his work on his chosen theme. As he begins to search for scientific and technical documents (literature), the propagandist should consider also the division of this material into primary and secondary. The primary documents contain the direct results of scientific and technical activity, while the secondary documents contain the results of processing of information concerning this activity. It might seem best to begin work by studying the primary documents in order to produce the information, so to speak, at first hand. However, this view is mistaken. In order to avoid risking confusion for the young propagandist, we recommend that he begin his familiarity with each new problem by studying the secondary documents. This approach will avoid the danger of becoming lost in material selected at random, of becoming confused by unnecessary detail, which always results in a narrow view on the problem, which is hardly desirable for a propagandist.

Among the secondary documents which should be read are such fundamental publications as the Great Soviet Encyclopedia, the small Soviet Encyclopedia, the Annual Supplements to the Great Encyclopedia, the three volume, or the later two volume Encyclopedic Dictionary, the Technical Encyclopedia, the Physical Encyclopedic Dictionary, the Bibliographic Dictionary for the Natural Scientist and Technologist, the Philosophical Dictionary, various types of production handbooks and interpretive dictionaries. If these publications are not used, incorrect interpretations may result, as well as terminological confusion and serious errors in the development of the theme. The reference works are useful to the propagandist also due to the fact that they contain a list of literature necessary for deeper study of each problem.

Among the many soviet encyclopedic publications, we cannot, unfortunately, note a military encyclopedia. There is none such. But today's scientific and technical revolution, the significant changes which it has caused in all areas of military affairs, make the need for publication of such a work pressing, to generalize all of the latest results which have appeared in the means and methods of armed combat. The Soviet Military Encyclopedia would be the best source for military and technical information.

More complete and fresher information concerning the literature on a given area of knowledge and the achievements of science can be found in reviews such as the results of science and technology, in various abstract journals, in the express information publications, bibliographic indices, catalogues and card files. We should emphasize particularly familiarity with library catalogues, which are the primary means for looking into the stocks of the library, popularization of books and search for necessary literature. The alphabetic catalogue can easily provide answers to two questions: does the library contain a work, the author and title of which are known, and what works by a given author can be found? It would seem that there are not too many. However, the alphabetic index, together with the stock of books allows the searcher, after "latching on" to even a single author, to determine all available literature on a given theme. This is facilitated by the lists of literature and various types of references encountered in almost every book.

The information organs and large libraries produce systematic catalogues (in addition to alphabetic catalogues), in which works are grouped according to branches of knowledge, classes and subclasses in correspondence with the classification used. Thematic groupings of works significantly accelerate the search for required literature. A systematic catalogue answers immediately the question: What documents does the library have on a given area of science and technology? Work with the systematic catalogue is significantly facilitated by an alphabetic subject index, a key for transition of one system of grouping of the literature to another.

In special libraries, for example technical libraries, subject catalogues are composed as well.

In these catalogues, the descriptions of works are grouped by subject. All of the subject references are placed in alphabetical order an consist of words or word combinations most significant for a given area of knowledge, for example: training, "training, military", "training, programmed."

Capably using the various types of catalogues and card files, like other secondary documents, without which it is impossible to be oriented in the primary documents (monographs, collections of articles, textbooks, journal articles), the experienced propagandist rapidly finds everything he needs for successful work. No matter how difficult it is to find the literature in small garrisons, far from scientific centers and training institutions, small libraries, book rooms, experienced specialists, and book clubs can be found which can help by providing advice or finding a suitable book. In addition to his personal library and other collections of books available in the garrison, the propagandist can use the thematic plans of publishing houses (even old plans from previous years) and can make use of the services of the mail book club as he seeks material on a pressing theme. He will come up with a great deal of useful information if he studies the December issues of the scientific, technical and military journals, in which the contents of all issues for the past year are published.

One should not become discouraged if a book on some trend in the development of military technology cannot be immediately found. A more careful search will generally show that there is no pressing military technical problem which has gone unnoticed by the military publishing house, all military journals, the newspaper Krasnaya Zvezda, the other central, district and fleet newspapers.

Enthusiasm for his work, a sense of his social duty as a military technical propagandist, an ability to orient himself in the stream of scientific and technical information and use it to solve the pressing problems of military practice -- these are what are needed for success as a military propagandist. Let us hope that familiarity with the elements of informatics, which we have discussed, will help to assure success.

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WHEN THERE IS CONCERN FOR THE RATIONALIZERS

By

Engineer Lieutenant Colonel G. Biryukov, Engineer Lieutenant Colonel A. Burdenko

In one chast', a great deal of work and time was expended in dismounting and reinstalling the slides and hubs of track laying machines. The commanders set the task before the rationalizers -- develop a device to facilitate and accelerate the performance of this operation. A boom and winch designed by Major P. Denisov allowed this labor consuming operation to be performed considerably more rapidly with fewer men.

This is but one of many examples of capable utilization of the creative energy of the innovators. Their keen intelligence is directed toward the solution of pressing problems, which are presented in a special theme book. Each man desiring to participate in rationalizers work can familiarize himself with the thematic assignments for the current training period, selecting the required theme.

The Commission on Inventions of the Chast', chaired by Lieutenant Colonel V. Nechayev, shows constant concern that the rationalizers are given favorable conditions for their work. On the initiative of this commission, in particular, a rationalizer's room has been equipped, containing a workbench, lathe and grinding machine, the necessary materials and tools, as well as literature. On the assignment of the commission, the innovators carefully study suggestions, the descriptions of which are published in the periodical press and technical information pages, in order to apply them to their own chast'. Recently, for example, the district newspaper published material on a device shown at the Exhibition of Achievements of the USSR National Economy, facilitating the removal of battery cells from bodies. It interested the repair workers. Junior Sergeant V. Litovkin not only made such a device, but even made significant improvements to its design.

Great attention is given in this chast' to material stimulation of creative labor. Here, innovations introduced are evaluated and the authors are given the proper rewards rapidly. Monotary prizes are given for many suggestions and to those who actively cooperate in their introduction.

The Commission on Inventions works in close contact with the Party and Komsomol Organizations. They regularly hold meetings of rationalizers and organize exhibits of technical creativity. The chairman and secretary of the Commission have reported to the Party and Komsomol meetings.

During the current training year, a plan has been developed for measures for further development of creative activity of the personnel. Performance of the plan will facilitate the development of new and valuable suggestions directed toward successful solution of the problems set before the members of the chast'.

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STORAGE AND PREPARATION OF TANKS FOR REUSE

By

Major General of Engineering and Technical Service
A. Shvebig, Chief of Armor Service, Red Banner North
Caucasus Military District

The conservation of combat equipment in constant readiness is one of the most important tasks performed by the Armed Forces. The experience in the storage of armor equipment accummulated in our district, we believe, is worthy of attention.

Tanks placed in open areas are generally conserved by the "cocoon" method, while tanks stored in unheated storage areas undercover are conserved by the "gluing" and "hood" methods. In any case, the parking area for the combat machines must be equipped in strict correspondence with the requirements of the regulations for tank equipment support of the Armed Forces.

Machines placed in covered storage areas are stored fully equipped with all units in their standard positions. In order to warm up the engines indoors, the storage areas are equipped with systems to carry away the exhaust gases. In addition to the permanent electric power network, battery lights are also provided. Special stands carry the technological diagrams showing how to prepare the machines for use and bring them to full combat readiness. These diagrams, glued to plywood or cardboard, should also be placed in each tank stored.

The fluid for the cooling system is poured into tanks equipped with distributing hoses. These tanks are placed on the additional fuel tanks of the tanks and held in place with special supports (brackets).

The tools and equipment necessary for deconservation (two 14 × 17 mm wrenches, a 27 × 27 L-shaped wrench, a portable electric light, torch, funnel and bucket) are placed on the floor of the tank turret. The diagram for connection of the battery should also be glued to carboard or plywood and stored in this same area. The blades for removal of the ZZK paste are fastened to the nose armor.

Special boxes are provided for placement of the paste, fabric or paper removed during deconservation. The batteries are stored in the machines and are recharged (trickle charged) by a low voltage external dc power line. As an additional means for starting the engines, each podrazdeleniye is assigned a buffer group of batteries, mounted on a truck.

As we know, deconservation of machines stored in open areas and sealed by the "cocoon" method is labor consuming work. The technology for unsealing these tanks must be particularly carefully thought out. In our opinion, preliminary preparation is very significant.

The set of tools for deconservation is prepared in advance (consisting, in addition to the tools listed above, of cutting pliers and knives for removal of the film). This set of tools and the diagram for connection of the batteries are placed on the seat of the driver mechanic (Figure 1).

In order to allow opening of the emergency exit hatch, it is put in place using either a supplementary wire or a screw support. The wire is fastened to the stopper wheel and passes beneath the hatch lever (Figure 2). The rubber ring is removed from the hatch and placed on the driver mechanics seat. The clamps are unscrewed (counterclockwise) to their stops. After putting the supplementary wire in place, the hatch cover is put in place so that the end of the wire passes out between the hatch cover and bottom. The space is then sealed with ZZK paste.

A screw attachment is not difficult to manufacture in the unit shop (Figure 3). After the external portion of the attachment is raised to the necessary height, its position is fixed with the counternut. Soft wire is passed through the brackets and fastened with solder.

The cooling fluid should be stored in 200 liter barrels equipped with fillers. The barrels are set on special stands (for each pair of machines) at a sufficient height to allow filling of the tank cooling systems by gravity flow. Another version is also possible. The cooling liquid is poured into a rather large special tank, placed on the roof. The tank is connected to a system of tubing, through which the liquid is fed to each machine.

Figure 1. Set of Tools for Deconservation of Tanks Stored by the "Cocoon" Method.

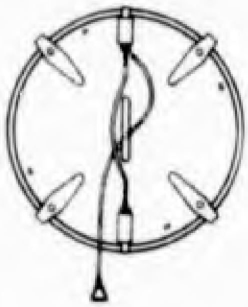

Figure 2. Fastening of Supplementary Wire to Hatch Cover Stop.

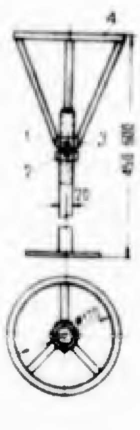

Figure 3. Attachment for Hatch Cover: 1, bracket; 2, threaded bushing (nut); 3, counternut; 4, support wheel

Dry charged batteries are stored in special rooms equ ped with storage shelves with roller conveyors, tanks to hold the electrolyte and dosing devices for pouring the electrolyte into the batteries. Here also we find two to three tool and parts kits, means for loading the batteries onto transport equipment (transporter, electric winch), charging machines and devices for trickle charging of batteries stored in operating condition. In each storage room, in addition to the accounting documents, a schedule is posted for restoring the batteries to operating condition and charging, along with a plan for the location of the personnel during the process of restoring the batteries to working condition.

Either all of the personnel of the podrazdeleniye, or a portion of the personnel are used for this work, depending on the capacity and available equipment in the storage area, when deconservation of tanks and preparation of batteries occurs simultaneously. In the first case, special teams are formed to prepare the batteries, fill them with electrolyte, adjust the level, and set the batteries in groups for charging. In the second case, teams of four men each are organized for preparation of batteries. One member (the operator) pours in the electrolyte. Another passes the battery along the roller conveyor to the filling position, removes the covers and plugs of the battery. A third takes the batteries from the operator, returns the plugs and covers. The fourth man passes the batteries along a roller conveyor to the pickup station.

A debate sometimes arises as to whether it is necessary to charge batteries after they are filled. Experience has shown that in the summer time (during hot weather), dry charged batteries can be immediately used as soon as the active mass of the plates has been wet. Otherwise, the batteries must be charged after filling.

Of course, one important condition for proper maintenance of combat machines during storage is high quality preparation of all units and systems, careful conservation and sealing. Experience has shown that only if the technology is unwaiveringly followed, if each operation is carefully tested, will the machines be conserved in good condition over long periods of time. Placement of tanks in storage should be preceded by careful preparation. All work must be specifically planned, material support must be provided and timely and accurate testing must be performed.

If machines are not carefully prepared for conservation, the pressure in the air cylinders sometimes drops, air leaks from the air start system, fuel leaks through the durite joints and fuel distributing valves. Insufficient sealing may cause corrosion of parts. Cases have been observed when carelessly cleaned and prepared heating boilers have quickly rusted, to the extent that they required repair.

Before placing machines in storage, the cruise must be carefully trained; they should know the volume of work and its sequence. This problem is given primary attention in the chast'. Special drills are organized, during which the men are taught the methods of conservation, the order of preparation of individual units and systems of their tank.

In each podrazdeleniye which has equipment for storage, stands should be set up carrying the applicable documentation. This documentation should include the technology of preparation of machines for long-term storage and their reconservation, the annual plan schedule for servicing of the equipment, the list of adjustment operations to be performed on the tanks, the volume of work of the annual inspection and an operation-by-operation calculation of the time, technology of deconservation of the tank, preparation of the tank to leave the storage area and work required to bring it up to full combat readiness.

The equipment requires constant care during storage as well. Inspections of equipment must be performed strictly on the schedule defined by the manual. Particular attention must be given to the body, turret and running gear, since they are always exposed to the atmosphere. They must be periodically inspected and, if necessary, painted. The internal surfaces of the body and turret, as well as parts not protected by lubricant will be well conserved as long as the vehicle is sealed.

In order to estimate the quality of conservation and to make a comprehensive check of the condition of the equipment placed in long-term storage, test runs of individual tanks for 80-100 km are performed. During the test run, the tank must be stopped several times and inspected. The indications of the instruments, condition of all units and aggragates are checked. The fuel and oil consumption is measured. The average speed is determined over a measured sector. During the test run, such defects as leakage of air in the supply system, control system problems, leakage of cooling fluid and oil through seals and at the oil filter are located. Sometimes fuel feed failures are observed due to intensive resin formation on the fuel filter.

The condition of the tanks is evaluated by a commission, which must always include an officer from the Armor Service of the district. The results of the testing of each tank are entered in the test run report. This report indicates the condition of the tank, defects located when it was opened, during the test run and afterward. The number of inspections of the tank during its term of storage is noted. The report also indicates the time of year, air temperature and terrain over which the test run was made. Analysis of these reports will indicate shortcomings in the organization of storage and will prevent the development of defects in the equipment.

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*An engine must not be operated with a dirty or clogged breather pipe. Otherwise, the oil will be forced out through the crankcase gasket and the gasket may be damaged.

*During operation, the test hole in the body of a water pump must be clean. Leakage of water through this hole (10-15 drops per minute) indicates that the gland is defective.

*Fuel pumps should not be taken apart unless absolutely necessary. Many fuel feed problems can be solved by simply removing the settling tank, cleaning and replacing it.

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REPAIR OF PIPES

By

Engineer Major V. Kuznetsov

When aviation equipment is operated under field conditions, it is sometimes necessary to repair and make new pipes for various systems. This is usually done using standard seamless pipe. The defective pipes are used as models. The necessary length of pipe is determined as the sum of the lengths of the straight and curved sectors, with an allowance added for finishing the ends.

During bending, which is performed both in the cold and in the hot states, the pipes are deformed due to the development of tensile stresses in one wall and compressive stresses in the opposite wall. Therefore, one must be careful during this operation to observe evenness of deformation of the pipe walls, not permitting the formation of ridges in the compressed areas. The amount of deformation depends on the physical properties of the material, the radius of the bend, the thickness of the tube walls and the bending method. Various devices are used to decrease deformation of sections. In one of these (Figure 1a) when guide 5 is rotated, roller 6 rolls around forming roller 4, bending the pipe.

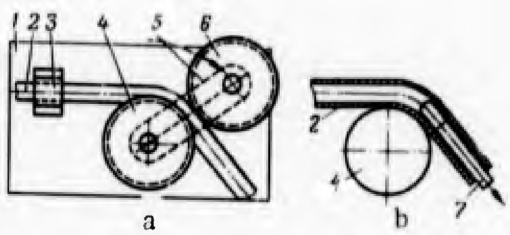

Figure 1. Diagram of Bending of Pipe Using Pipe Bender (a) and Mandrel (b): 1, base; 2, pipe; 3, clamp; 4, roller; 5, guide; 6, roller; 7, mandrel.

The radius of the slots in the rollers is selected depending on the maximum diameter of pipe to be bent. By supporting the walls of the pipe on the outside, the slots prevent folding of pipes of diameters not over 8 mm. Pipes of larger diameters require support of the walls from the inside as well. This is done by filling the pipes with sand (except for hydraulic and air system pipes), fillers with low melting points (Table 1) or emulsols (Table 2).

Another method of bending is based on support of the walls on the inside using a sliding support -- a mandrel (Figure 1b) inserted into the pipe. Since the lengthwise motion of the mandrel is kinematically connected to the rotation of the guide supporting the roller, as the pipe is bent the mandrel is gradually moved. This prevents folding of the pipe. In order to improve the deformation conditions of the wall of the pipe, the bending zone may be heated, for example using high frequency current.

The technology of manufacture of conical or spherical tips on the ends of pipes is selected depending on the type of material. Bending is performed either using hydraulic fillers or other fillers. Then rolling (formation of tips) is performed in the first case before bending, in the second case after bending. This operation is performed using a tool with a working surface corresponding to the tip form desired. The tool is given both rotary and forward motion along the axis of the pipe, so that pipes with external diameters of 4 to 40 mm and wall thicknesses of 0.5 to 2 mm can be given very high quality tips.

This operation is performed using three and five roller finishing tools (Figure 2). Steel pipes are worked with three roller tools with a working angle of 74° 30'. This same type of tool, but somewhat smaller in size, is used to work pipes 6 mm in diameter made of aluminum alloys. Rolling of pipe tips of larger diameter is performed using a 5 roller tool.

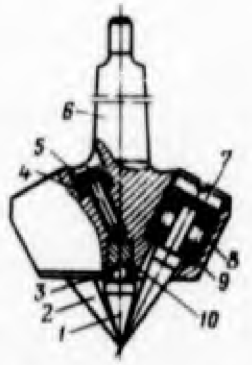

Figure 2. Roller Tool for Rolling of Pipe Tips: 1, cone; 2, roller; 3, ball; 4, screw; 5, nut; 6, body; 7, plug; 8, bushing; 9, radial-thrust ball-bearing; 10, support

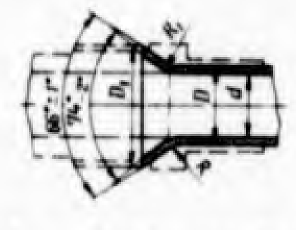

Figure 3. Spherical Rolling of Pipe Tip

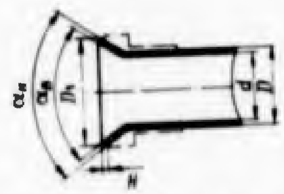

Figure 4. Rolling of Pipe Tip

Spherical rolling of pipes (Figure 3) is performed by tools having a shaped working surface. Sulfofrezol oil is used as the lubricant.

During the process of working of pipe tips, plastic deformation of the wall is generally observed. The degree of extension is determined by the difference in circumferences of the initial pipe of diameter D and the widest tip diameter D_1 (Figure 4). If the degree of relative extension, defined as

$$\delta_p = \left(\frac{D_1}{D} - 1\right)\cdot 100\%,$$

exceeds the lower limit of relative elongation of the pipe material, the rolled edge may be ruptured. When a rolled edge greater than that permitted by the ductility of the material must be produced, the rolling operation is performed in two or even three passes, with the tip annealed between each operation in order to remove work hardening.

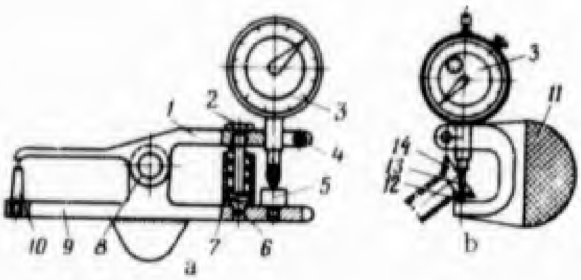

Figure 5. Indicator (a) and Micrometer (b) Devices for Measurement of Thickness of Rolled Portion of Pipe: 1, upper lip; 2, bolt; 3, indicator; 4, draw bolt; 5, support spot; 6, cup; 7, spring; 8, axle; 9, lower lip, 10, tip; 11, bracket; 12, lower support; 13, upper support; 14, pipe

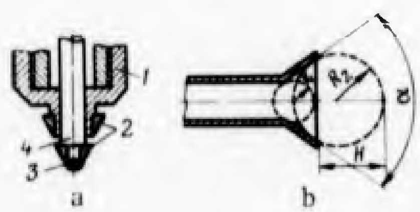

Figure 6. Working Portion of Device for Measurement of Internai Angle Using Indicator or Micrometer Screw (a) and Two Balls (b): 1, cap; 2, interchangeable conical washers; 3, nut: 4, pusher

Table 1

Filler Type	GOST	State, Color	Melting (Softening) Point, ° C
Technical Urea	2081-63	White & Yellow Crystals	130-234
Potassium Nitrate	1949-43	White Crystals	334
Calcium Nitrate	4142-48	Colorless Crystals, Soluble in Water	42.8
Pine Rosin	797-64	Transparent Glassy Mass	54-68

The finishing of tube ends by a rigid dye is significantly simpler. However, the extension conditions in this case are less favorable, since the forces are applied simultaneously around the entire cross section of the pipe.

If there are local thin spots in the wall, uneven edges or other defects, increased stress concentration occurs, so that the edges may rupture significantly earlier than with even deformation of the metal.

The tolerance for tip formation added to the length of a section can be determined from Table 3. The wall thickness of the spread portion is measured using a special indicator device (Figure 5a) or micrometer (Figure 5b). The wall thickness is tested using a thickness meter gauge with 6 to 8 edges with notches. The length of the spread tip extending over the nipple is determined by a measuring gauge. The rolled portion of a normally finished pipe should extend not more than 0.5 mm past the nipple.

Table 2

Emulsol Components	Content of Components, %		
	3 - 1	3 - 2	3 - 3
Oil Acidols (with acid no. 210mgKOH per 1 g) and Alkaline Oil Wastes	10-12	7-10	4-7
Caustic Soda	0.75-1	0.75-1	0.5-0.7
Ethyl Alcohol	1.75±0.25	0-2	-
Mixture of Industrial Oils and Distillates	75±5	75±5	80±5

Table 3

Type Material	od, mm	Allowance for One Pipe Tip, mm
Type X18N10T Stainless Steel	6-12	0.43-0.51
	Over 12	0.51-1.5
Type 20A Carbon Steel	6-20	0.63-1.2
	Over 20	1.2-1.5
Aluminum Alloys AMg-M, AMts-M	6-15	0.51-0.84
	over 15	0.84-1.5

The device for measurement of the internal angle using an indicator or micrometer screw with a ratchet (Figure 6a) includes a set of interchangeable conical washers (two for each pipe size). The working portion of the device is introduced to the conical portion of the pipe until both interchangeable washers 2 contact it evenly. Depending on the movement of pusher 4, connected to the micrometer screw or blade indicator, the actual angle of the cone is determined.

For pipes 6-12 mm in diameter, the internal angle is measured by the method of two balls (Figure 6b). In this case for each diameter of the pipe, a pair of steel test balls of different diameters is selected, such that the point of contact of the balls with the conical surface of the tip lies at the base of the cone. The balls are placed into the tip and a micrometer is used to determine the difference of the height by which they extend beyond the end of the tip.

All liquid and gas system pipes after repair must be tested for strength and tightness of seal. Sometimes the tests are combined and performed with the pipe connected once to the test stand. Usually, pipes of different systems are tested assembled under pressure equal to one and one-half to two times the operating pressure. Tests are performed on hydraulic test stands equipped with a system for cleaning the working fluid and devices for pressure measurement. The working fluid used for hydraulic pipe test systems is AMG-10 oil, for all other systems -- 7-50S-3 oil with a 2% aqueous solution of bichromate. Testing of the system under compressed air pressure is allowed only if safety devices as called for by the safety rules are used.

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T AND A CONSULTATION

(Unattributed Article)

Senior Lieutenants B. Gorash and Ye. Neyumin ask: Why should a tank heater not be allowed to slope at over 7° during operation and why does the engine wander if the bar of the NK-10 pump is wedged at the idle point? They are answered by Engineer Colonel V. Chernyayev and Engineer Lieutenant Colonel A. Ivanov.

When a tank is inclined at more than 7°, steam plugs are formed in the external jacket of the heater boiler, which may cause local overheating or burning of the walls after long operation.

At the idle speed with the fuel pump operating properly and the regulator in good order, equilibrium is established between the force of the springs and the centrifugal force of the balls, which take up a certain position between the flat and conical plates of theregulator. At the same time, as experience has shown, the cyclical supply of fuel is increased. This increases the forces of friction, but to a lesser extent than the increase in the pressure in the cylinder. The rotating speed of the engine therefore begins to increase.

If the fuel pump bar is wedged at this moment, the balls of the regulator cannot change their position between the flat and conical plates. The flat plate, under the influence of the increasing centrifugal forces of the balls, can no longer move the bar of the pump in the direction of decreased motor speed -- the regulator ceases to operate (becomes an ordinary clutch). The motor then gradually increases its operating speed.

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ADJUSTMENT OF THE LEVEL METER

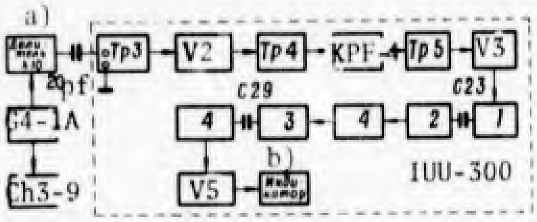
By

Engineer Major A. Krasnov

The selective level meter type IUU-300 is widely used in the performance of selective measurements on high frequency telephone apparatus. Maintenance of its technical characteristics within the established limits depends on the ability to adjust and regulate the output parameters well.

Adjustment should be begun by testing and regulating the operating mode of the tubes of the device. The primary purpose must be precise setting of the filament voltage. The tubes in the device are connected in series, so that the filamentary resistances should be identical. The filament voltages of tubes V1, V2 and V6 are set by variable wire resistor R65, those of V3, V4 and V5 -- by resistor R66. If the limits of regulation of these resistors are insufficient, the initial filament voltage is selected by using the additional taps of the filament winding of transformer Tp7 (taps 16-22).

Experience in adjusting the IUU-300 level meter has shown that an optimal tube operating mode can be found (see Table 1). The necessary measurements should be performed by a type VK7-3 cathode voltmeter relative to the chassis of the device.



Block Diagram of IUU-300 Level Meter With Devices Connected for Adjustment of IF Amplifier

Key: a) Divider × 10; b) Indicator

After selecting tubes, the intermediate frequency amplifier (IF amp) is adjusted (see figure). First resistor R56 is removed (thus breaking the anode circuit of tube V6), then the portable divider of a G4-1A (G4-42) standard signal generator is connected to the fourth tap of transformer Tp3 through a decoupling capacitance on the order of 20-30 pf. After setting the output frequency of the G4-1A at 353 KHz, preparation of the circuit for adjustment of the IF amp is completed. The accuracy of the frequency generated is tested by an electronic frequency meter type ChZ-9. The frequency error should be not over ±10 Hz.

The "factor" and "microvolts" levers of the G4-1A generator are adjusted until the needle of the IUU-300 indicator rests at middle scale.

After this, by rotating the cores of the RF coils, the circuits are adjusted to achieve maximum indication. We note that adjustment should be begun with the last stage of the IF amp, by adjusting the inductance of coils L4, L3, L2, L1 and transformers Tp5, Tp4 and Tp3 in sequence. After completion of regulation, resistor R56 is soldered back in place and the extra devices are disconnected from the IUU-300.

Table 1

Indication on Diagram	Tube Type	Distribution of Voltage on Tube Pins								
		1	2	3	4	5	6	7	8	9
V1	6N3P	—	56	40	175	0	175	40	56	—
V2	6Zh1P	22	29	—	—	150	150	29	—	—
V3	6Zh1P	3,2	4,1	—	—	130	60	4,1	—	—
V4	6Zh1P	2,7	3,9	—	—	130	50	3,9	—	—
V5	6Zh1P	8,9	—	—	—	120	80	9	—	—
V6	6Zh1P	13	4,9	—	—	150	150	4,3	—	—

Note. The filament voltage of the tubes is measured between pins 3 and 4 of tubes V2-V6 and pins 1 and 9 of tube V1.

Table 2

Subrange, KHz	5—7	70—130	130—190	190—250	250—300
Condensor number	C64	C48	C50	C52	C54

After adjusting the IF amp, one must make sure that the selectivity and transmission band of the device correspond to the requirements placed on it. Selectivity is checked by a type IG-300 measuring generator and a type ChZ-9 frequency meter. This is done by feeding a voltage at 50 KHz from the IG-300 to the input of the IUU-300 with a zero indication on the neper scale. Then the IUU-300 is tuned to the frequency being tested. By regulating the output voltage of the generator, the needle of the indicator is moved to the zero mark of the scale. The IG-300 generator is then detuned by 500 Hz relative to the optimal value. In this case, the knob of the measurement limit switch of the IUU-300 must be in the "-4 nep" position, and the needle of the indicator should not move beyond the "-0.5 nep" scale division. If the instrument is detuned by ±3000 Hz relative to the optimal value, its selectivity should be no worse than 2.5 nep.

The width of the transmission band of the IUU-300 and the selectivity of the device can be tested simultaneously. To do this, the IG-300 generator is detuned relative to the optimal tuning first to one side, then to the other side, until the indications of the meter are decreased by 0.2 nep, which determines the transmission band at the 0.7 level. The amount of detuning must be tested by an electronic frequency meter. The transmission band of the IUU-300 at the 0.7 level should be not over 75±25 Hz (for the narrow band) and 1000±250 Hz (for the wide band).

If the selectivity and transmission band width do not correspond to the requirements, the capacitance of adjustable condensors C13 and C14 of the crystal band pass filter must be adjusted until the selectivity is no worse than 4.5 nep, while the transmission band width is 75±25 Hz. The same parameters in the wide band mode are adjusted by selecting the necessary coupling between circuits L1, C22 and L2, C24 (by changing the capacitance of condensor C23) and circuits L3, C28 and L4, C30 (by changing the capacitance of condensor C29).

The next stage in adjusting the IUU-300 level meter is testing and adjustment of the sensitivity of the device. A voltage is fed to its input from the IG-300 generator at a frequency of 50 KHz. The level of the voltage is tested using the IU-600 wide band level meter. The measurement limit switch of the IUU-300 is set in the "0 nep" position. The device is adjusted to the measured frequency in the narrow band mode. By rotating the "amplifier gain" lever, the needle of the indicator is set to the zero position on the scale. With the IF amp tuned, the gain reserve should be at least 0.5±0.2 nep.

When the "amplifier gain" knob cannot be rotated sufficiently to set the needle of the instrument on the zero scale mark of the indicator, the gain can be adjusted within slight limits (±0.3 nep) by selecting the value of resistor R48 (3300-5600 ohms). Equality of the gain of the device in the narrow and wide band modes is achieved by selecting the value of resistor R36 (150-360 ohms).

The frequency converter must be tested and adjusted. The essence of this operation consists of balancing the ring circuit of the converter using potentiometers R23 and R24. Adjustment is performed in the wide band mode -- "1000 Hz." The subrange knob is set in the "5-70 KHz" position. By changing the frequency of the local oscillator in the sector below 5 KHz, the arrow of the indicator is moved to the middle of the scale of the instrument. The moving tap of potentiometer R23 is also set in the middle position. Then, rotating the axis of potentiometer R24, the minimum indication of the indicator is achieved. This completes adjustment of the frequency converter.

The final operation is adjustment of the local oscillator of the IUU-300. The local oscillator of the device is always adjusted so that the difference between the local oscillator frequency and the frequency of the signal being measured is 353 KHz. The scale of the local oscillator is graduated in values of measured frequency for convenience in reading. The lower side band is used as the working frequency.

The local oscillator must be adjusted if the error in calibration of the device exceeds a predetermined value during operation. In this case, the scale of the vernier mechanism must be rotated to the stop. The axis of the scale is then disengaged from the axis of the rotor of variable condensor C37. Then, by maintaining the position of the rotor of condensor C37 unchanged and rotating the scale of the local oscillator, the end mark on the scale is aligned with the notch. After this, the vernier mechanism is assembled and the error of the frequency setting is checked. If it is higher than the permissible error, it must be eliminated by adjusting the capacitance of the variable condensors of the corresponding subranges (see Table 2) and the inductance of transformer Tp6.

Changing the inductance of transformer Tp6 influences the frequency of the local oscillator in all subranges simultaneously. Therefore, it is recommended that the core of transformer Tp6 be used to adjust the local oscillator only to the 5 KHz frequency of the first subrange. In the remaining subranges, the frequency of the oscillator should be regulated using the condensors.

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THE MACHINE HAS BECOME MORE RELIABLE

By

Engineer K. Yudin

Analysis of the experience of operation of tracked, self-propelled ferries (TSF) has allowed the manufacturer to improve their design somewhat.

First of all, the body of the vehicle has been strengthened and its nose fairings has been slightly changed. The bodies of the first vehicles produced were sometimes deformed between the second and third torsion beams due to blows (generally during crossing of obstacles). Now at this point, three box-section skids have been welded at this point to the beam (bottom), torsion beams and body shell. An L-shaped beam has been placed between the torsion beams. Furthermore, beneath the skin at the point where the side connects to the deck, an equal-sided angle member has been included. These slight changes, experience has shown, have increased the strength of the body of the vehicle.

The nose fairings of the body of the vehicle at first had the shape (in plan) of an equilateral trapezoid. As the vehicle moved over wet roads, the windshield of the control cabin, even with windshield wipers operating, was frequently splattered with mud. When a float, the nose slope not only expanded the wetted surface of the body, but also increased the drag of the vehicle. The driver mechanics were sprayed with water on vehicles without canvass tops.

In later vehicles, the bodies have been straightened, protective mud shields (metal) have been attached to the bottoms of the bodies, and a canvas top has been included over the control cabin. The body of the vehicle is made of stamped, corrugated steel. We must note that (early) vehicles can also be found with flat bodies, reinforced with stringers. When operating these machines, particular attention must be given to the condition of the body. At points where the stringers bend, and also at the ends and joints of the stringers, leaks may develop. In this case water passes through the cracks into the stringers, resulting in corrosion of the body. This is most frequently observed in the area of welded seams, where the protective base coat is frequently burned. First of all, the condition of the body on the decks should be checked. Machines with stamped bodies do not have these defects, but their bodies must also be protected from water.

Some changes have also been made in the running gear. The supporting wheels have been strengthened: reinforcement has been welded to their hubs and discs on the insides. Stressed torsion bars are used. All of this has improved the characteristics of the suspension and slightly increased the road clearance of the machine. Later vehicles utilize an engine with heated crankcase and more productive standardized heater, significantly facilitating starting the engine during the winter. The valve on the tank in which fuel is collected after it soaks through the plunger pairs of the fuel pump is more conveniently located than earlier (on the side wall of the tank).

The fuel tank of the heating system has been moved to the deck of the vehicle. This has increased the fuel pressure at the sprayer. Furthermore, it is possible when necessary to increase the pressure in the tank by means of a manual fuel force pump. The tank can now be filled with fuel directly from the fuel system of the engine. Additional fuel tanks (two per vehicle) have been installed. The range of the vehicle has thus been significantly increased.

Modern amphibious vehicles are equipped with night vision devices, allowing movement at night at full speed. The equipment also includes a portable search light (a standard headlight equipped with a handle) with interchangeable optical elements. Experience has shown that when a tank drives onto the ferry at night, the mechanic driver cannot see the ferry commander leading the loading operation, since the lights of the tank at this moment will be directed upward and will not shine down onto the deck. The portable search light allows the deck and ferry commander to be illuminated with infrared light regardless of the position of the tank. The driver mechanic of the tank, using his night vision device, can drive his vehicle onto the ferry with confidence. The search light is also used as the ferry approaches the shore and when necessary on the water.

The addition of one more communications unit significantly facilitates the work of pontoon workers. They can now maintain communications with the other members of the crew from their standard position, which is particularly important when ferries are being connected together (or disconnedted) and deployed. Other changes have also been made, improving the working conditions of the crew. For example, in order to protect the pontoon workers from the cold during the winter, the tool and parts kit includes a protective sleeve. The driver mechanics seats are more comfortable. The back of the two place seat reclines.

The changes in the design of the TSF are being made during overhauls. The officers of podrazdeleniye which are equipped with self-propelled ferries should consider these changes in organizing their operation and servicing.

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CALIBRATION OF INSTRUMENTS

By

Lieutenant Colonel V. Shatunov

The significant number of radiation and chemical reconnaissance instruments in the Armed Forces and the planned preventative nature of their technical servicing require strict planning of the operation of the repair and calibration shop (RCS), as well as provision of modern equipment and conditions for the work of the personnel in this shop.

It is most effective to check the calibration and operation of instruments in the shop, equipped with the permanent test equipment. The experience of technical servicing of instruments has allowed us to develop the requirements for the design and equipment of repair and calibration shops, and also to create a method for calibration and a technology for the repair of instruments.

Let us note the requirements which should be met by this shop. The area of the RCS (Figure 1) should have rooms for calibration, repair and testing, receipt and storage of instruments, as well as supplementary rooms (storage room, wash room, etc.). Various types of non-residential buildings can be used for RCS. However, it is best to place the shop in an individual building, far from residential and service buildings and well protected.

The calibration room should have walls designed so that the gamma radiation dose in neighboring rooms will not exceed the natural background level. The working location where calibration of instruments is performed carries the gamma radiation sources and the calibration track (line), which must be at least 1.5 m from the walls, floor and ceiling. The distance should not be decreased to less than 1 m, since this increases the scattered gamma radiation and requires an increase in the thickness of the protective walls.

The calibrating line is made of angle steel or aluminum and is rigidly fastened at 120-150 cm from the floor. The recommended line length is 3.5 to 4 m, and the scale divisions should not be over 1 mm. The gamma radiation sources are placed at the end of the line.

As practice has shown, it is most suitable to place the source and a line as shown on Figure 2. Small sources can be placed on either side of a larger source. This placement does not require lateral movement of the line or carriage during calibration, since the large source is placed directly on the axis of the line, while the small sources are not more than 2-3 cm to the side, which has no practical influence on the accuracy of indications of the devices.

The sources are lifted using an electric motor controlled from the operator's panel. The block for lifting small sources, together with the electric motor, is mounted on a frame. In the working position, it is lifted together with the block by the electric motor and fixed in a position for lifting sources.

The carriage to which the detectors of the instruments being checked are fastened moves on ball bearings along the guiding line. The motor which moves the carriage may be on the carriage itself or at the end of the line. In this case, the carriage is moved along the line by a block and pulley drive system.

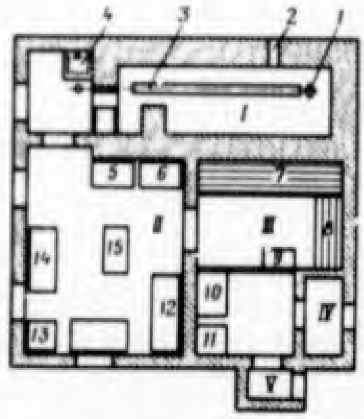

Figure 1. Diagram of Repair and Calibration Shop: I, instrument calibration room; II, repair room; III, receiving room; IV, storage room; V, entrance foyer; 1, gamma source; 2, fan; 3, calibrating line; 4, control panel; 5, 6, cabinets; 7, 8, instrument storage shelves; 9, table; 10, working location for technician; 11, washroom; 12, location for calibration of radiometers; 13, drying oven; 14, 15, workbenches.

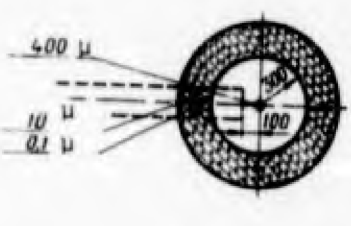

Figure 2. Diagram of Placement of Gamma Sources in Well.

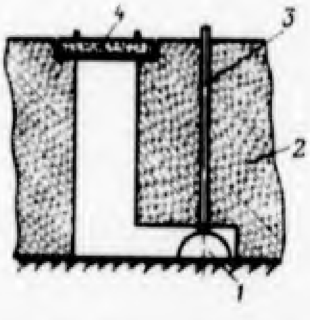

Figure 3. Emergency Well: 1, gamma radiation source container; 2, concrete wall; 3, pipe; 4, hatch cover.

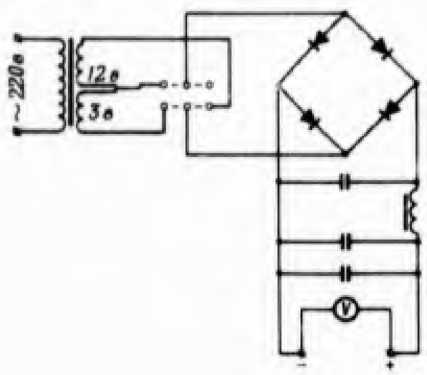

Figure 4. Diagram of Rectifier

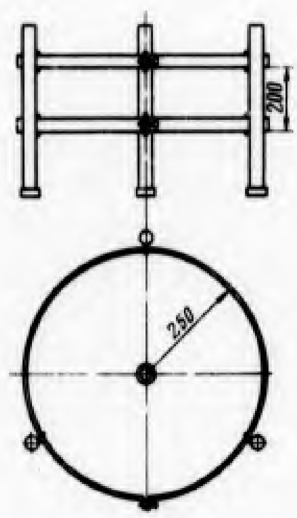

Figure 5. Device Accelerating Calibration of Dosimeters

In order to stop the carriage at the required distance from the source, microswitches are placed at the corresponding points on the line. They are fastened so that they can be rapidly moved, depending on the activity of the gamma radiation source.

The carriage includes a remote device for adjustment of sensitivity of the devices (in case the indications go beyond permissible limits). It is operated by an electric motor through a reducing drive or by various copying devices.

In order for the operator to check the calibration of the device in all ranges without entering the room with the radiation source, the line must include a device for remote switching of subranges. A remote screw driver from the set of protective adapters to the PRKHM-1 can be used for this purpose. Copying devices are most effective.

When the operator is at the control panel, radiation may reach him from the source penetrating through the most vulnerable portions of the walls (electric cable leads, optical devices, etc.). Therefore, these locations must be additionally covered with lead shields. All operations -- installation of the carriage on the line, raising and lowering of the gamma radiation sources -- are recorded at the control panel using indicator lamps. When the radiation sources are up, furthermore, a light signal is turned on at the entrance to the shop building and to the calibration room, and the door to the room in which the radiation sources are located is automatically locked.

The gamma sources must be placed in containers beneath the floor 1.5 to 2 meters deep. The sources are lifted from the containers to the working position through metal tubes 30-50 mm in diameter. A well for access to the containers under emergency condition is placed 1-1.5 m from the tubes (in case of a break in the capron line) and for replacement of sources. The hatch of the well is covered with a lead or concrete plate (Figure 3).

When the working location is equipped in this manner, reliable shielding of operators is provided. In some repair and calibration shops, a moving holder (container) for the gamma radiation source is used in place of the calibrated line. Although this device has a number of advantages, it should not be used in military RCS, since the protection of the operator becomes more difficult, and all three sources cannot be used in the same room; when calibration is performed using a single 400 μ gamma source, a larger room is required.

The room for testing and repair of dosimetric devices includes two or three tables for dosimeter repair men, the desk of the RCS chief, a table on which radiometers for beta preparates are calibrated, shelves where tools, repair materials, parts and special clothing are stored and a drying cabinet. The working positions of the dosimeter repair men are equipped with electric measuring instruments (TS-52, AVO-5M, VK7-3), installation tools on a special shelf, expendable materials, spare parts and supplementary documentation. The desk includes plugs for electric soldering irons, lights, test and measurement and heating devices.

Furthermore, the working location should have a special rectifier attachment (Figure 4), with which the devices arriving for repair are powered directly from a 220 v (or 127 v) ac line. This attachment can be made by the RCS crew. It allows time to be saved in switching power supplies and eliminates the necessity of dry batterie

The working location for calibration of radiometers for beta preparates is usually set up in the room where instruments are repaired. In order to protect the operator, a glass screen 8-10 mm thick is used.

The room for receiving and storage of instruments includes a working location for a mechanical technician. During testing of the calibration of instruments, the shop crew first checks all devices of one type which have entered the shop, then goes on to another type. The operator records the data of calibration in his notebook, which is then used to make entries to the technical journals.

The most labor consuming process in calibration is checking sets of individual dosimeters, for which self-charging and measuring panels must be tested.

In order to check the self-charge of individual dosimeters, they are charged at the charging and measuring panels and then placed in a closed box for 24 hours. This operation is usually performed at the beginning of the working day, and the time of charging of the set of dosimeters is recorded. The next day, the indications of the ES-50 dosimeters are measured by the control panel, while the DKP-50 dosimeters are checked using the scale on the devices.

Calibration of measuring panels and DKP-50 dosimeters is tested by exposure of the dosimeters already checked for self-charging to a dose of 12 r. Usually the calibration table is used for this purpose, allowing 50 individual dosimeters to be placed at a distance of 25 cm from the gamma source. The calibration time is significantly reduced if the simple device shown on Figure 5 is used. It allows calibration of two sets of type DP-23-A or four sets of DP-22-V dosimeters simultaneously.

The attachment consists of two steel rings fastened onto uprights. With a radius of curvature of the rings of 25 cm, 200 dosimeters can be carried, 100 on each ring. The gamma source is in the center of the dosimeters of the first and second levels when in its working position.

The dosimeters are placed onto the device at the working position of the dosimeter technician, after which they are carried to the point of installation of the source. The device can be easily and simply installed near the radiation source.

A concrete ring 280-300 mm in radius is used for additional shielding of the personnel of the shop from radiation, since the source must be left in the raised position for some time (up to 2 hours) during calibration of individual dosimeters. The shield ring can be used to hold the mounting rings and dosimeters. This eliminates the necessity of the uprights. The source is raised to a height of 200-250 mm over the floor of the room. The total time of calibration of the sets of individual dosimeters when this attachment is used is decreased by a factor of four.

After calibration, the devices to be stored are once more sealed. Various devices for the manufacture of covers and welding of films are included at the working locations for this purpose. The simplest device, allowing easy welding of covers both under shop and under field conditions, can be made in a chast'.

This device is a bent steel plate fastened onto a wooden support. One end of the plate butts against a steel strip 1-1.5 mm thick at the top of the plate, with two notches 5-6 mm wide made over the entire length of the strip. The other end of the strip fits into a lock fastened onto the plate, so that the strip is pressed tightly against the plate. This device allows seams to be welded in synthetic films using an electric soldering iron or open flame. This is done by placing the unwelded cover between the plates so that the end of the cover sticks out by 3 mm. A burner flame is passed over the edge of the film at 20-25 cm per minute.

For compact welding (using a soldering iron), paper sheets are placed between the plate and the strip, then the cover is placed between them.

Indicator paper is placed in the covers with the devices. If the air inside the covers becomes wet, the paper changes its color from dark green to pink. The change in color indicates that the silica gel must be replaced. Before the silica gel is placed in the covers, its moisture content should not exceed 2%. If the moisture content is higher, the entire batch of gel must be heated in the drying cabinet.

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TRICKLE CHARGING

By

Engineer Major G. Koryakin

In order to decrease the time required to bring vehicles from long-term storage to operation, we trickle charge their batteries. The batteries in the vehicles as well as those in storage are continually trickle charged. In both cases, we use a type BEA 9814-02 AO(BEA 9814-02 VO) charging unit, providing automatic stabilization of the voltage within limits of ±0.5 v, with variations in line voltage from 180 to 240 v and current from 0 to 12 a.

The batteries are placed on shelves so that eight batteries are connected to each panel. The charging unit services 15 such panels (120 types 6-STEN-140 batteries can be charged simultaneously).

The current from the unit to the batteries is fed through a main line consisting of conductors 5-10 mm^2 in cross section. Groups of batteries are connected to the main line using connecting wires 1.5 mm^2 in cross section, the plus line having a 20 a fuse. The batteries are interconnected in groups using insulated connectors with a cross section of 4 mm^2, with lead tips. Fuses are mounted in BZ-30 units beneath the shelves.

The installation can also be used to charge the batteries of trucks or tractors parked in open areas (see figure). In this case, the power supply of the charging unit is from the standard ac line. An insulated cable (in steel tubing) and lines from the charging unit to the charging panels are laid underground. From the charging panels to the vehicles, lines are strung through the air. Using this equipment, a rather large number of batteries can be trickle charged simultaneously (see table).

Number of Connecting Panels	Number of Batteries Connected to Panels (by Types of Vehicles)				
	AT-L AT-S	ATS-59	AT-T	URAL-375	ZIL-157
1	8	6	8	8	16
5	40	30	40	40	80
10	80	60	80	80	160
15	120	90	120	120	240

Batteries being charged are periodically inspected. Each day we check the condition of the connecting panels, charging unit and the voltage which must be between 26 and 27 v. Once each month we check the charging network. By connecting a voltmeter in turn to the plugs of the connecting cables of the connecting panels, we measure the voltage across each group of batteries. This operation is performed first of all with the fuses in place, then with the fuses removed. If we discover that some battery is being overcharged, we send it off for repair. Each quarter we check the level and density of the electrolyte in each battery. Once each year we remove the batteries and test them.

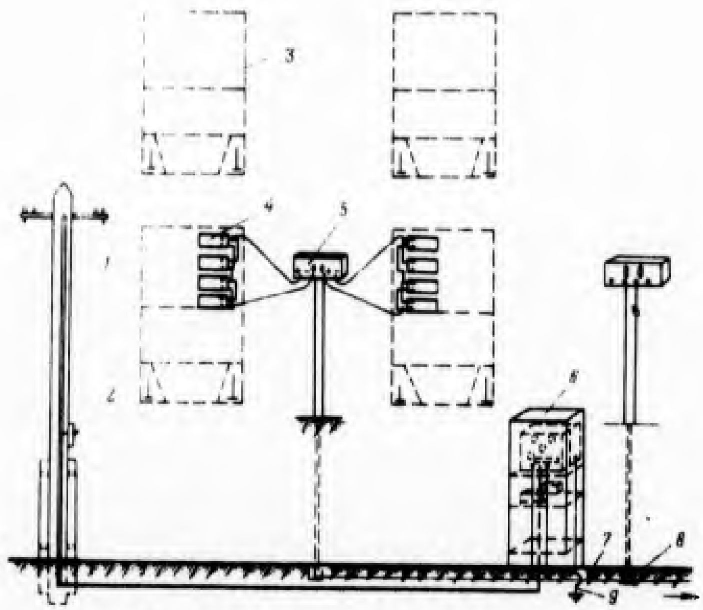

Diagram of Installation for Charging Batteries in Vehicles Parked in the Open: 1, insulated cable; 2, fuse panel; 3, vehicle (tractor); 4, batteries; 5, connecting panels; 6, metal cabinet containing charging unit; 7, main line; 8, side lead; 9, ground

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CHARGING-DISCHARGING SHELF

By

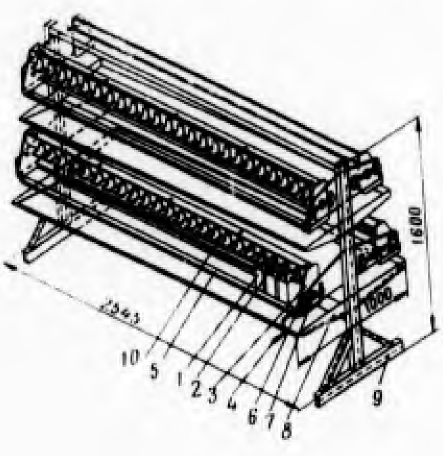
Engineer Lieutenant Colonel N. Konov

Our industry produces cadmium-nickel alkaline batteries with high specific characteristics (types KN-14, 2KNB-15, KNP-20, 2KNP-20, 2KNP-24, 2KN-32 and 2KNB-32). Improvement of the characteristics has been achieved by using a fabric separator 0.25-0.5 mm thick (in place of ebonite fingers 1.5-3 mm thick), dense placement of plates and new methods of manufacture.

Fabric separator batteries operate without free electrolyte and cannot be refilled. The electrolyte is contained only in the pores of the separators and plates, which makes its replacement considerably more difficult. However, timely and complete removal of old electrolyte (after each 25 cycles or once each two months) is an important condition for normal operation of these batteries. In order to eliminate the old electrolyte completely from the batteries, they must be charged for 10 to 15 minutes in the "throat down" position or the electrolyte must be removed immediately after charging. In this case, the gases being liberated expel the dirty electrolyte out of the separators and plates. The batteries are cleansed of carbonates (K_2CO_3) and individual active mass particles, which sharply increase the internal resistance and frequently serve as shunting bridges between the positive and negative plates.

After pouring out the old electrolyte, clean electrolyte should be immediately poured into the battery up to the level of the lower portion of the throat. During the charging process, the fress electrolyte will drop, as it penetrates into the separator and active mass pores, and the batteries will be underfilled. The batteries must be charged 3 to 4 times, with electrolyte poured in each time in this manner.

The experience of operation of batteries with high specific characteristics shows that all of these operations consume a great deal of time. The process can be accelerated using special charging and discharging shelves (see figure). Using these shelves, batteries 1 can be rotated into the "throat down" position by turning handle 3 without interrupting the electrical circuit. This is done by rotating arm 4 by worm drive 7. The position is determined by stop 6. Pressure bar 5, which prevents the battery from shifting as it is rotated, is installed half way up the batteries.



Contacts 2 are placed so that batteries of other types can be charged (discharged) on the shelf, for example the 2FKN-9, 2KN-10, 2KN-24. When 2KN-24, 2KNB-32 or 2KN-32 batteries are charged, the metal plates are set in special notches 10 on the insulated portion of the rotating plates.

The size of frame 9 is determined by the number of batteries to be charged simultaneously and the area of the room. The retaining bars and rotating plates are made of an electrical insulating and alkaline resistant material (textolite, vinyl plastic). This charging and discharging shelf is simple in design and can be made in military shops. It significantly simplifies the servicing of the new alkaline batteries.

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RAPID PREPARATION OF BATTERIES

By

Engineer Lieutenant Colonel N. Konstantinov

Rapid preparation of portable communications apparatus is facilitated by rapid preparation of alkaline batteries for operation following long-term storage in the discharged condition.

This method should be used, generally speaking, only when absolutely necessary. It must be recalled that during rapid preparation of batteries, up to 60-80% of the nominal capacity is utilized. After normal discharging in operation, they must be charged in the normal mode, then a test discharge must be performed. If the batteries do not provide nominal capacity, the complete cycle of preparation in the normal mode according to the instructions for operation should be performed. It must also be recalled that batteries with zero electromotive force (except for silver-zinc batteries) should not be subjected to forced rapid preparation.

Each group of batteries, depending on its purpose, has various peculiarities of forced rapid preparation for operation. Let us study the optimal sequence of operations of this method for three groups of batteries.

Batteries types KN-2.25(3), 2FKN-8(9), KN-10(13), 2KN-24, KN-22(28), KN-45(55), KN-60(80) and KN-100(125)[1] are widely used in portable communications equipment. They all have the "classical" plate construction. Its primary distinctions are the excess quantity of electrolyte (5-12 mm over the upper surface of the plates) and the use of ebonite strips as separators. These features also determine the order of operations during rapid preparation of these batteries.

First of all, electrolyte should be poured into the battery and left to stand under normal surrounding conditions for 30-60 minutes to allow full soaking of the plates. Then, the electrolyte level should be topped up to normal (5-12 mm over the upper edge of the plates) and the batteries should be charged with a current equal to half of the nominal capacity for three hours. If the charging current is decreased, the charging time must be correspondingly increased. Batteries prepared in this manner are ready for use. Some types of batteries, for example the 2FKN-8(9), KN-10(13), KN-22(28) and 2KN-24, should be left with plugs open for one or two hours in order to avoid accummulation of gas.

Forced preparation of batteries installed in portable communications apparatus also has its specific features. These batteries include the types KN-14, 2KN-32, KNP-20, 2KNP-20, 2KNB-15 and 2KNB-32. They are called "spill proof" since these batteries operate without excess electrolyte. The use of fabric separators requires that the batteries be charged with current changed in stages; therefore, it is recommended that rapid preparation be begun by pouring in electrolyte to the lower portion of

[1] The parentheses contain the capacities of the modernized versions.

the throat, then letting the battery stand for one hour for soaking. The excess electrolyte is then poured out. This is done by turning the battery throat down, at 5-10° from the vertical, then holding it in this position for at least a half minute.

The operation is completed by charging the battery in a staged mode: the first stage is charging for two hours with a current equal to one-half the nominal capacity; the second stage is charging for two more hours with a current equal to one-fourth the nominal capacity. If the current is changed, it must be decreased. The charging time must be increased if the current is changed in order that the number of ampere hours is not over 150% of the nominal capacity. After charging is completed, the battery must be stored for two or three more hours with plugs open to allow the gas to escape.

The silver zinc batteries types SPD-12A and SPD-12M form a third group. Their separators are made of cellophane, requiring 24 hours of soaking. This determines the requirements for rapid preparation of these batteries.

Preparation is begun by pouring 26 ml of electrolyte, heated to 100° C, into each battery. The battery is then allowed to stand for two to four hours. The final level of the electrolyte should be slightly below the upper red mark on the wall of the battery, or slightly over half the height of the electrodes. After this, the battery is charged for four to five hours with a current of 3 a until a voltage of 2.1 v is reached. It can be used in this condition.

Whereas the normal methods of preparation of batteries require 76 to 80 hours, rapid preparation can be achieved in 4 to 8 hours.

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A SEMIAUTOMATIC MACHINE TESTS CABLES

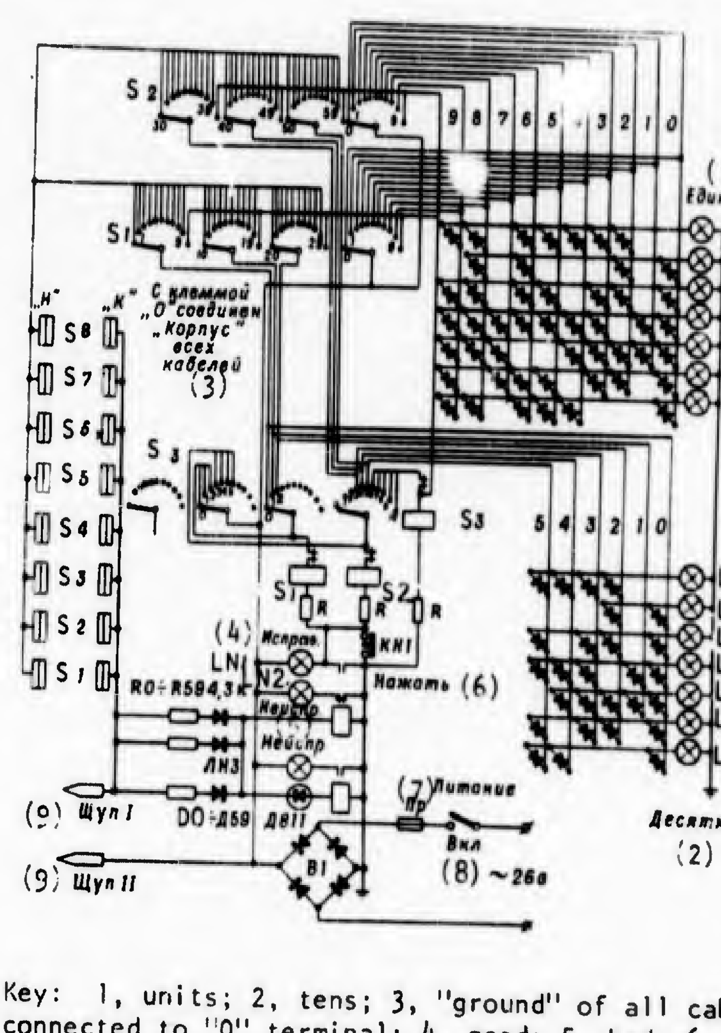
By

Engineer Lieutenant M. Chekrygin

Connecting cables, widely used in the adjustment, regulation and testing of electronic apparatus, are stored in special locations (storage boxes). Since aging of the insulation materials with the passage of time may cause changes in the physical properties of cables, the cables must be tested to be sure they correspond to their basic operational parameters before being used for technical servicing. This is generally performed by two or three crew members using a tester.

In order to decrease the time required for preparation of connecting cables for operation, we have developed a semiautomatic device which significantly facilitates the performance of tests for breakage and shorts in cable cores for cables with multiple-contact plugs (14 to 59 contacts), as well as unsoldering during repair. All of these operations are performed by one man.

The electrical circuit of the device (see figure) consists of "AND" and "OR" logic elements, a digital display panel, and stepping switches SS1, SS2 and SS3.



Key: 1, units; 2, tens; 3, "ground" of all cables connected to "0" terminal; 4, good; 5, bad; 6, push; 7, power; 8, on; 9, probe

The circuit of the "OR" element consists of resistors RO-R59 (4.3 Kohm), diodes DO-D59 (type D7G), relay P1 (type RDCHG), signal lights LN1, LN2 (type SM-28). The circuit is used to test cable cores for open circuits. Relay P1 operates and turns on signals lamp LN1 "good," if a signal reaches any of the inputs of the circuit through a good cable core.

The "AND" circuit includes resistors RO-R59 and diodes DO-D59 plus stabilitron D811, relay P2 and signal lamp LN3 "bad." The circuit is designed to test for shorts between the cores of the cable and the ground sheath. Relay P2 operates and turns on lamp LN3 if in addition to the input signal through the core connected to the input, any other signal reaches the input from another core connected to the core being tested.

The digital display panel consists of a diode matrix with incandescent bulbs, forming two identical screens displaying the units (from 0 to 9) and tens (up to 5). The screens are made of seven strips of incandescent bulbs. By placing the strips in clockwise order, a code can be made up forming the order of burning of the strips of the display (see table). The seven logic units convert the decimal code to the display code. These units contain a diode "OR" circuit and incandescent bulb in the corresponding strip. By using the table, diode strip circuits are produced. For example, in the diode circuit of the logic unit controlling incandescent bulb L1, the diodes are connected to the busses tapping the voltage of cores 0, 4, 5, 6, 8 and 9. The number of the core being tested appears on the light display panel when the voltage is fed through stepping switches SS1, SS2 and SS3 to the inputs of the diode matrices for units and tens.

Cables are tested as follows. After turning on the power, button KH1 clears the light display panel to its initial status (sets 00). The plugs of the cable being tested are connected to the jacks on the front panel. When button KH1 is pressed briefly, the device begins to operate, and the numbers of the cores of the cable being tested flash in sequence on the display. Signal lights LN1 and LN2 record any defects in case of an open circuit, while signal light LN3 indicates a short. If any core of the cable is defective, signal light LN3 comes on first, after which the number of the core appears on the display. The device stops. In order to continue testing, button KH1 must be pressed once more.

Units or Tens	Strip Number						
	1	2	3	4	5	6	7
0	1	1	1	1	1	1	0
1	0	0	1	1	0	0	0
2	0	1	1	0	1	1	1
3	0	1	1	1	1	0	1
4	1	0	1	1	0	0	1
5	1	1	0	1	1	0	1
6	1	1	0	1	1	1	1
7	0	1	1	1	0	0	0
8	1	1	1	1	1	1	1
9	1	1	1	1	1	0	0

Multiple core cables are unsoldered using the installation as follows. First all cores of the cable are soldered to the jack with index "H" on the front panel of the device. Then, pressing button KH1 on the display, the number of the desired core is selected. By using probe I, the core being worked is selected on the basis of the flashing of signal lamp LN1, then soldered to the corresponding contact of the jack with index "K".

After all cores are disconnected, the electric circuits are tested using probes I and II and signal lights LN1 and LN2.

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TESTING SUBSCRIBER LINES

By

Senior Engineer Lieutenant B. Kuz'min

We have developed and manufactured a device for testing subscriber lines with an attachment for automatic testing of cable cores. The operating principle is that of sequential testing of communications lines first for open circuits, then for resistance of insulation. If the telephone network is operating properly, the device, after testing all free subscribers lines, automatically returns to its initial position. In case a defect is discovered, it indicates the number of the defective line and the nature of the defect.

The device (see figure) consists of three small panels installed on a normal size rack at the automatic telephone exchange. Th first panel is a type SPI-2 insulation decrease signaling device. The sensitivity of the first input of line L1 of the signaling device, connected to the instrument, is selected on the order of a few tens of kilohms. The sensitivity of the second line L2 connected to the attachment is on the order of hundreds of megohms. The precise value of the sensitivity at the input of the SPI-2 is established on the basis of the length of the subscriber lines and the type of cables used.

Since the SPI-2 has only one signal unit for two measuring units, and the sensitivity of the inputs of the two measuring units differ from each other significantly, the circuits of the automation and signaling units include some slight changes. Switching of the measuring units to the signaling unit is achieved by the contacts of special relay P10-1. One terminal of the internal bell and the signal contact for interrupted signaling of relay P1-1 are included in the circuit of the instrument.

The second panel contains the relays of the automation unit and a relaxation telegraph pulse generator consisting of neon lamp MN-3, operating once per second. The front panel carries the open and reduced insulation signal lights, switch KL, switching from testing of lines ("instrument") to testing of cable insulation ("attachment"), button KH which starts the testing instrument, two jacks for measurement of insulation of damaged communication lines and testing cable cores.

The third panel carries type SHI-50 four-brush stepping switches and two relays, supplementing the automation unit and the SPI-2 signaling unit. Relay P10 is used to switch the inputs of the SPI-2 from testing of subscriber lines to testing of cable insulation. Relay P11 converts the interrupted signal indicating a decrease in insulation resistance to a constant signal.

If the number of subscriber lines or cable cores being tested exceeds the capacity of the selector, the circuit allows for testing in stages. When the first selector reaches its last position, a second selector is engaged. When the second selector reaches its last position, the third selector is engaged.

Before checking the operation of subscriber lines for open circuits and insulation, switch KL is set in the "instrument" position. When the "on" button is pressed, the selector of the device is moved to its initial position and a check is made to see if the line is busy. The ground from field d of the selector is fed to the relaxation pulse generator. Relay P10 then operates and connects relay P1 to input L1 of the signaling unit. The operation of the electromagnet of the selector is subsequently controlled by the current pulses by closing the contacts of polarized relay P7, a type RP-5. If the subscriber line is not busy, test relay P8 operates and connects the automation unit of the instrument to the subscriber line. It is first checked for an open circuit by sending an alternating 25 Hz voltage from the signaling and calling device (SVU), then the insulation resistance is checked.

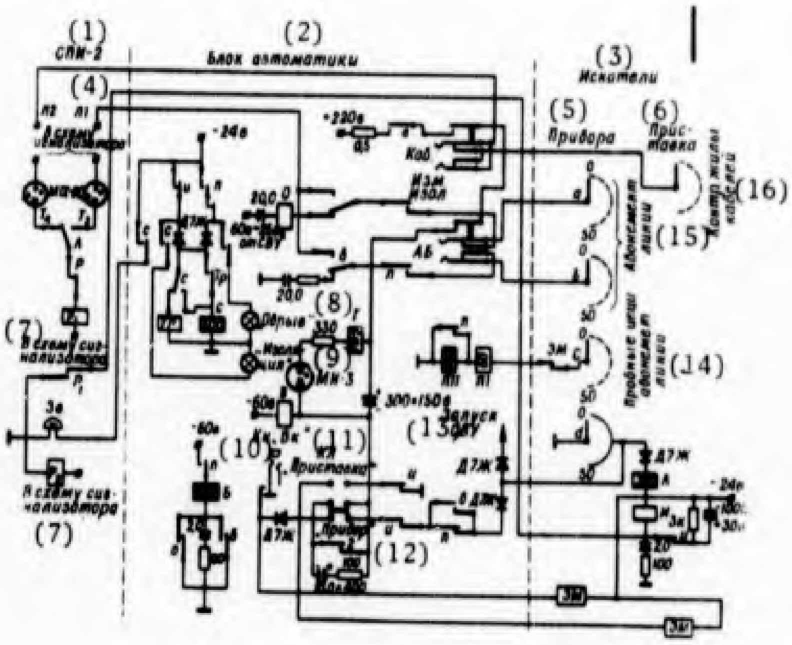

Diagram of Device for Automatic Testing of Subscriber Lines.

Key: 1, SPI-2; 2, automation unit; 3, selectors; 4, to signaling circuit; 5, instrument; 6, attachment; 7, to signaling circuit; 8, "open"; 9, "insulation"; 10, "button on"; 11, "attachment"; 12, "instrument"; 13, start SVU; 14, test subscriber lines; 15, subscriber lines; 16, test cable cores

In case of an open circuit in the line, thermal relay TP is connected and creates a power supply for signaling relay P3. The "open" signal lamp lights and the bell sounds. The instrument circuit is not restored.

When the resistance of the insulation drops, the contact of relay P1-1 periodically creates a power supply for relay P11, which is always in the operating position. Relay P11 opens the circuit of the instrument and closes the circuit of thermal relay TP. This relay, operating, creates a power supply for the signaling relay P3, which turns on the "insulation" signal light and bell.

A technician records the number of the subscriber with damaged line according to the position of the selector. He then proceeds to check out the reason for the defect while the selector tests the remaining subscriber lines.

When the selector of the device is switched to check the next subscriber line, the test relay circuit is broken by additional contact EM. When the selector returns to its initial position, the operation of the device stops.

Before checking the insulation of test cables, switch KL must be moved to the "attachment" position. When this is done, the pulse generator and relay P5 are grounded through the contact of relay P11. Relay P1 is connected through the normally closed contacts of relay P10 to input L2 of the signaling device. The test cores are checked just as subscriber lines are checked. When the resistance of the insulation is low, the attachment circuit is broken. The technician records the number of the test core damaged according to the position of the selector, isolates it on the input and commutation rack and begins working to find the reason for the damage. With normal insulation, the selector performs continuous circular rotation.

As experience has shown, the device need only be used once per day during the morning hours when the subscriber lines carry their minimum load, and each time the circuit is repaired. The rest of the time, the device can be used for cable testing.

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FOULING IS DANGEROUS

By

Engineer Lieutenant Colonel V. Botin

Each shot fired from a pistol, automatic rifle or machine gun is accompanied by deposition of scale onto the parts of the weapon. This process is natural: the products of combustion of the powder and decomposition of the cartridge composition are not fully carried away with the powder gases and deposit primarily on the walls of the barrel. The quantity of scale depends not only on the number of shots fired, but also on the condition of the barrel. For example, after 100 shots, up to 60 mg of scale are deposited in a new barrel, 178 mg in a barrel with rust spots and up to 220 mg in a barrel with blisters.

Fouling is dangerous since it causes intensive rusting of the metal. For this reason, the rule has long existed: immediately after firing, rub down, then carefully clean your weapon. In order to perform these operations intelligently, one must have an idea of the physical essence of the processes of fouling, development of corrosion, and removal of scale from weapons parts.

First of all, the composition of the scale. It contains salts of potassium, antimonic oxide, oxides of nitrogen, hydrogen sulphide, as well as resinous substances and ash. During firing, the salts of potassium, particularly potassium chloride, are evaporated, mixed with the powder gases, then precipitate on the walls of the barrel. If the time intervals between shots are long, the salts crystallize, accummulating primarily in various impressions (rifling), cracks and pores. When the weapon is fired again, the salt crystals melt, saturate all scale particles, cementing them, forming a glassy layer on the surface of the barrel. Particles of wadding, copper, brass, lead, tin and iron which break away from the surface of the bullets and cartridges, will be found beneath this layer.

What happens if this scale is not immediately removed?

After completion of firing, the barrel cools rapidly and, generally, sweats. This process occurs most intensively in the winter time. The scale salts, particularly calcium chloride, absorb this moisture and form corrosive solutions. The corrosion begins immediately and develops rapidly, particularly in cracks and depressions of nonchrome plated barrels. Deep blisters will form in a barrel in one day at 90% relative humidity.

The rate of corrosion is even higher in those areas where deposits of brass or copper form. Galvanic couples (brass or copper and steel) are formed, and the scale salt solution acts as an electrolyte.

The rusting processes occur somewhat more slowly in chrome plated barrels. However, it must be recalled that the chrome plating is corrosion resistant only as long as it does not touch other nonferrous metals while in contact with the scale salt solution. If deposits of brass or copper appear, the chromium will corrode rapidly.

It must also be recalled that the chromium layer contains fine cracks and pores. As time passes, these cracks become deeper under the influence of the powder gases, fluctuations in temperature, vibrations and mechanical action of the bullets, and scale accummulates in the cracks. Absorbing water, the scale forms a solution of potassium salts which penetrates to the base metal. Microscopic cavities are formed under the chrome layer in these areas, filled with porous rust, which does not obstruct the penetration of powder gases. As they burst outward after each shot, these gases can rip off chunks of chrome. These chrome flakes occur most frequently at the base of the barrel and on lands near grooves.

These processes indicate that chrome plated barrels also require care and that the layer of chromium, although it increases wear resistance, does not eliminate the possibility of corrosion. However, with care, as practice has shown, chrome plated barrels can be kept rust free for extended periods. Maintenance of weapons without corrosion for long periods of time under various weather conditions depends primarily on timely and high quality servicing.

The materials used to clean the barrels must dissolve potassium salts and the deposits of metals capable of causing corrosion. RCHS solution has these properties. The ammonium carbonate, water and bichromate which it contains dissolve salts, and, when air is present, copper and brass as well.

A barrel should be cleaned (with a surrounding air temperature down to -9° C) with a cloth or rag wet with this solution and placed on a ramrod until no traces of scale are left. One day later, the cleaning should be repeated. During this time, the scale in cracks and pores of the chrome plating will be wet, increased in volume and will be forced out to the surface.

RCHS solution should not be poured into the barrel, since in this case the air cannot reach the metal, and the effectiveness of the solution for copper and brass is therefore decreased.

If there is no RCHS available, if the temperature is above freezing solutions of calcined soda (30 g per liter of water) or soak can be used. However, since they do not have any effect on brass, the weapon must be cleaned with RCHS as soon as possible.

During the winter under field conditions, liquid gun lubricant (RZH) is used to clean weapons. However, we should not forget that this lubricant does not dissolve the scale salts; therefore, upon return to the barracks the weapon should be cleaned with RCHS, soda or soaked solution.

After cleaning, the weapon must be immediately carefully dried and lubricated.

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SERVICING OF SPECIAL EQUIPMENT

By

Engineer Lieutenant Colonel V. Golovko

The essence of the planned preventative system of seasonal maintenance is that special machines, regardless of their use or number of hours of operation, are subjected to technical maintenance twice per year (generally during preparation for summer and winter operation). Work is performed on the chassis and the special equipment. We should note here that if the equipment is mounted on vehicles in long-term storage, it is serviced only once per year.

One of the primary measures called for in the plan for annual operation of special machines is seasonal servicing of special equipment of degasing and decontamination vehicles. Properly organized and performed, strictly within the established times and volumes, this maintenance provides for timely detection and elimination of both defects in the systems and of their causes.

At the present time, the Armed Forces have the necessary equipment for performance of all types of maintenance of the chassis of special vehicles. Continuous lines are available for this purpose. Servicing of special equipment of these vehicles during preparation for summer or winter operation is sometimes performed in the field, and at times the established technology is not followed and the required volume of work is not performed. As a result of this, failures in the operation of certain units may occur.

For example, the liquid lines of degasing and decontamination machines, instruments and sets are not always prepared for operation under low temperature conditions. Nipples and valves of fuel tubes will not prevent the flow of fluid to the sprayers in the summer time if abundantly lubricated with solidol. However, under low temperature conditions, this lubricant solidifies and the liquid cannot reach the sprayer even if the pressure is high. This appears particularly clearly when new vehicles and sets are put in use. Naturally, in this case the norm is not fulfilled, since the solution is not properly supplied. It is not sufficient to have the necessary men and equipment for servicing; they must also be taught to organize and perform their work properly.

Therefore, the chast' must compose a plan for measures involved in preparing the motor vehicles and special equipment for the transition to summer or winter operation. The plan must note the time for performance of inspection of the special equipment, the beginning and end of assemblies of specialists. The organizational measures required for the formation of teams for servicing of individual units of hydraulic systems and special equipment are also indicated, with the work being performed on identical machines using continuous methods. Specific personnel are noted, who will be responsible for providing the tools and equipment to working locations where the servicing of manual and mechanical pumps, rubber-fabric and rubber-metal hoses, fuel tubes and RP-4 pistols, etc. will be performed.

Furthermore, plan schedules must be developed, establishing the order of material and technical support and preparation of working locations.

At the assemblies, the specialists study the general organization of work involved in preparation of the special equipment for summer or winter operation, the specifics of the design of individual units and the duties of specialists performing seasonal servicing. The participants of the assemblies study in detail what, how and in which order they must do in order to provide high reliability of operation of units, aggragates and all special equipment. In this respect, technological charts made up in the podrazdeleniye in correspondence with the requirements of the commanders of technical servicing of the special processing equipment are quite useful. Studying these charts, the participants in the assemblies can see clearly the order and volume of work involved in servicing various types of vehicles.

The participants of the assembly must turn particular attention to the safety techniques involved in performing this work.

As practice has shown, the base chassis should be serviced before the special equipment, since it is almost impossible to do this on a single moving line, due to the requirement for setting up new working locations or adding equipment to existing locations.

Work with the special equipment is performed at the technical servicing point. If room is available, working locations are organized for each type of special vehicle. If for some reason this is impossible, the working locations are prepared in correspondence with the schedule for conversion of the equipment to summer or winter operation.

For all vehicles, instruments and sets (ARS-12D, ARS-12M, ARS-12U, ADM-48D, DKV, ADDK, DK-4 and IDK-1), characteristic features include the reservoir, source of pressure, siphons and liquid lines with stop cocks and valves, test instruments, fuel tubes with sprayers or RP-4 pistols, various operational tools and equipment. Since the primary working units and aggragates are standardized, the technical servicing point is equipped with a universal stand for hydraulic testing of pumps and liquid lines and several working positions. One of these services and repairs the manual and mechanical pumps, another repairs the stop cocks and valves, a third performs technical servicing of the terminal devices such as fuel tubes, sprayers and RP-4 pistols. Furthermore, special chambers must be set up for painting of the surfaces of the special equipment parts; baths containing lubricant materials are used to lubricate the threaded joints.

The experience in operating degasing and decontaminating vehicles has shown that even when servicing is done completely properly, the equipment must be painted during seasonal maintenance after operations are performed with corrosive liquids.

Commanders must give the chief of the technical maintenance point the registration document, defect list and equipment list with list of parts requiring supplementation or replacement for all vehicles to be services.

Particular attention is given to testing of measuring devices, to the presence of testing laboratory cards and the corresponding notations in the notebooks. For this purpose, it is expedient to plan the work of representatives of the testing laboratories in advance, to be performed during the times set aside for seasonal maintenance. This allows all defects requiring repair or additional test checks of instruments, replacement with new instruments or used instruments to be performed simultaneously.

The sealing of liquid lines is performed during hydraulic tests. These tests are generally performed for individual lines and reservoirs, and also for the entire system. In order to be sure that DKV devices are in good condition, for example, the safety valve of the reservoir is replaced with a plug, the system consisting of the reservoir, hoses and fuel tubes with closed valves is filled with water and the pressure is increased to 6 kg/cm^2 with the plunger pump. The system is observed for five minutes from the moment of creation of this excess pressure. If leakages appear in the joints, the threaded connections must be tightened or the gaskets must be replaced.

Painting of parts or units of special equipment during technical servicing can be performed either partially or fully. In either case, the old paint is removed from the surface to be painted, rust is removed, it is cleaned until shiny, the base coat is applied and fresh paint is applied. When replacing removable special equipment, the hoses and reservoirs should be carefully emptied of water.

Special equipment serviced in this manner and maintained complete will be capable at any moment of fulfilling its assignments of degasing or decontaminating equipment and armament.

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THE WORK AND NEEDS OF THE RATIONALIZERS

By

Engineer Major G. Kuznetsov, Senior Inspector For
Inventions of Volga Area Military District

The innovators of our military chast' and the military educational institutions of the Volga Area Military District have developed many valuable suggestions, the introduction of which helps to increase the quality of combat training. These include trainers, electrical circuits, operating stands and other technical training devices.

The great contribution made by these capable men in the improvement of the training materiel base can be seen using the Kazan' Higher Tank Command School as an example. Here over ten creative groups are occupied in the development and introduction of rationalizers suggestions. These groups, in which there are some hundred students, are headed by experienced rationalizers Lieutenant Colonels V. Kursikov, Sh. Rakhmatulin, Engineer Majors A. Martynov, E. Fomin and others. In one year of operation, these groups have reequipped the tank range, expanded and automated the tank trace line, and also constructed a firing range, where under the leadership of Senior Teacher of Fire Training Lieutenant Colonel Z. Shukunda, over ten rationalizers suggestions have been introduced. The rationalizers of the school have shown great thought and initiative also in equipping a new training wing. Almost every classroom in this ring is equipped with electrified stands and trainers, operating models and other visual aids. Of course, this has had a positive influence on the quality of training of the students -- many of them have received grades of excellent on their final examinations.

A great deal of useful work has also been done by the rationalizers of the Ul'yanovsk Guards Higher Tank Command School imeni V. I. Lenin. Not long ago, drills on firing and tactical training with the students had to be performed outside the city. Training time and vehicle operating time were wasted on driving to the areas. Furthermore, several tanks and a complex target set-up were required for exercises on fire control. It was decided to equip a classroom for tank fire control. The creative group was headed by the head of the department, Colonel Z. Sabitov. Several months of work were contributed by teachers, laboratory assistants and students. Now fire, the target situation and moving trainers can be controlled in the classroom according to a predetermined program, and many tactical problems can be worked out.

The inventive creativity of the chast' also has a great influence on the improvement of training methods. For example, a simple device developed by Private A. Vavilov allows students working out the norms during tank firing training to check their results without leaving the tank.

The method of performing training drills was changed significantly by the introduction of an information panel for the company commander: the necessity of interruption of drills to collect information on the results of imitation firing and fulfillment of the norms has been eliminated. At the end of the drill, the company commander receives these data at his information panel. Furthermore, all control of the exercises is concentrated at this same panel.

The successes of the innovators, as practice has shown, depend on the relationship of commanders and inventors commissions toward rationalization. More must be done than simple publication of an order. In order to attract the troops to rationalizers work, they must be given a love for this work, interest must be taken in the pressing nature of the technical problems before the chast', help must be given, and labor must be morally and materially stimulated. This is how it is done in the chast' where Lieutenant V. Meshankov is the Secretary of the Inventors Commission. For example, when the necessity arose of creating a podrazdeleniye command point, the commander turned to the rationalizers and gave them a precise and specific assignment, explaining which requirements must be met by the technical solution. After a short time, the commission received several plans. The best plan was that developed by Captain A. Chistyakov and Sergeant V. Kleptsov. It was introduced, and its authors were given awards.

We must note that the commander teaches his subordinates a creative attitude toward their business by his personal example. In particular, he developed a point allowing more operative control of the podrazdeleniye both in place and when on the move, and reducing the time required for preparation of initial data and for the solution of a number of specific problems.

It would seem that the great significance of rationalizers work is beyond doubt. Inventive creativity must be developed by all possible means. However, some officers advise rationalization in words but do not give it proper attention in deeds. For example, in the chast' where the Inventors Commission Secretary is I. Demin, a number of significant shortcomings have been found in consideration of suggestions, in the time required and correctness of their analysis, in the development of thematic assignments and in the awarding of monetary rewards. The reasons for these shortcomings are also known. They include primarily the lack of control of the work of the members of the commission, their weak knowledge of the applicable documents on inventions.

These shortcomings can be easily eliminated, if the commission takes its business seriously. Considerably greater difficulties arise at times in connection with the realization of rationalizers suggestions, particularly when the question arises of centralized manufacture. Let us discuss an example.

At the Kazan' Higher Command and Engineering School in 1967, several models of electronic-optical firing trainers, as suggested by Engineer Colonel I. Merkutov, were manufactured. The introduction of the trainers allowed the trainees to study siting. As a result, most of the students were prepared for firing exercises, achieving grades of "good" and "excellent", without expending ammunition.

In 1968, this trainer was exhibited at a district exhibition. It was highly evaluated by the commanders and visitors at the exhibit. A description of the trainer, published in a technical information sheet, was sent to the chast' and military schools. Some time later, reports and requests for centralized manufacture began to be received, since the conditions in the local units did not always allow manufacture. The question thus arose as to where the order should be given for the development of technical documentation and manufacture of the trainer. The first group of trainers was not manufactured until 1970.

Some times the realization of valuable suggestions in the chast' is delayed due to a shortage of necessary materials and parts. The rationalizers find it particularly difficult to obtain electrical and electronic parts. It would be good if these needs could be considered centrally and satisfied rapidly.

Speaking of the negative aspects of rationalizers work, we must note that many suggestions, the descriptions of which are published in sheets or technical information bulletins, are not introduced in the chast'. Why? We believe there are several reasons.

First of all, the information is not sufficiently clear and precise. Sometimes the description alone is simply not enough to allow manufacture of a device. Therefore, the rationalizers, after picking up the idea from the information, must find their own solution and formulate it as a new suggestion.

Cases arise when the technical information is not given sufficient interest in the chast'; it is believed that the rationalizers themselves are able to develop a suggestion if needed. "We can do as well," some officers believe. The reason for this is that the introduction of an innovation recommended in the information materials is hardly stimulated. The forms for reporting the results of inventors and rationalizers work do not even contain a column for reporting the number of suggestions introduced, borrowed from technical or patent information.

The elimination of these shortcomings in inventors and rationalizers work will allow even greater creative successes to be achieved by introducing new, improved technical innovations, designed to increase the combat readiness and the quality of combat training of chast' and podrazdeleniye.

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ORDER DEPARTMENT

(Unattributed Article)

Order Number 9

Captain B. Mal'tsev: Is there any special device for testing the parameters of electric power units types AB-1, AB-2, AB-4, AB-8 and AD-30, called for under the technical conditions?

This device would help us to reduce the time expended in the testing of aggragates.

Order Number 10

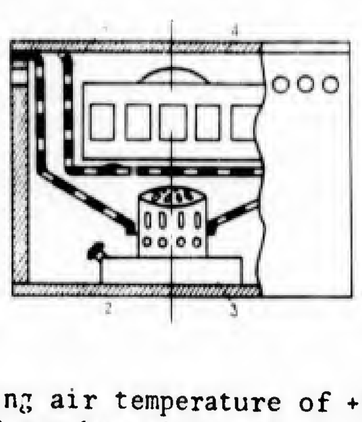
Colonel N. Tsvetkov: Are there any convenient, portable devices for hammering nails?

We make wood products by hand, which requires much time.

Order Filled

Engineer Lieutenant Colonel Yu. Sudakov (No. 1, 1971) request sharing experience in heating special tools and wrenches for repairing tanks in the winter time under field conditions.

Engineer Lieutenant Colonels V. Sakeyev and I. Sorochkin recommended that catalytic gasoline heaters be used for this purpose. Their operation is based on the chemical (exothermic) reaction of oxidation of gasoline vapors by oxygen in the air in the presence of a catalyst. Depending on the purpose, the heaters may differ in size, shape and dimensions of catalytic burner. The figure shows a diagram of a device for heating small apparatus, tools, liquids, etc. (1, internal heated container; 2, external container; 3, catalytic furnace; 4, apparatus heated). The heat productivity of a type KFP-1-180 catalytic furnace is 600 kcal/hr, the gasoline consumption is 45-55 g/hr, the mean continous operating time on one full tank is 60 hr.



When a surrounding air temperature of +5° C to -50° C, temperatures of from +15° C to 90° C can be maintained within the internal container.

Catalytic gasoline heaters are simple in design, convenient in operation and servicing, reliable, economical, designed for long-term continuous operation with readily available fuel, noiseless, fire and explosion safe.

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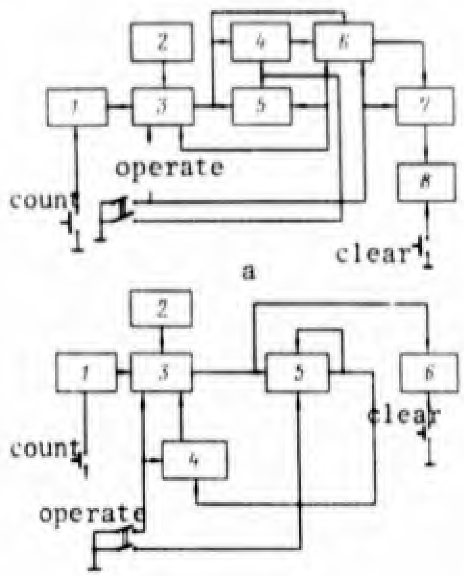
THE INNOVATORS RELAY RACE

(Unattributed Article)

∇ A COMPUTER DEVICE created by Engineer Major M. Val'dman, allows the number of various parts to be counted, outputs control signals when a fixed number of pulses is received at the input, and solves such simple problems as A - B, (A - B)/C, A × B, A: B, A + C to be solved very rapidly. It is used at the chast' CP to solve firing and tactical problems in controlling podrazdeleniye. The results of the solution are output in one second either directly at the working location, or at distances of 20-30 m from it. Numbers A, B and C can be represented as any 5-digit decimal number. The device is powered by a 220 v ac line, its power consumption is 50 watts.

For example, the problem (A - B)/C is solved as follows. Pulse generator 2 (Figure a), a balanced multivibrator, outputs rectangular pulses at about 15 KHz into first electronic switch 3. In its initial state it is blocked. When the "count" button is pressed, the pulses from the generator pass through the first switch to first sensor 4 and second sensor 5, and also to second switch 6. Numbers A and B are set in these sensors using switches.



a

b

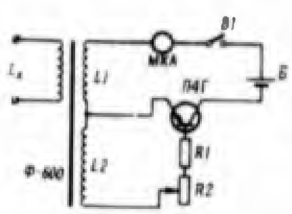
When pulses reach the input of the second sensor B, the signal clearing the second switch is taken from its output. Then the A pulses reach the input of sensor 5, and the cutoff signal is produced, blocking second switch 6. Thus, the time during which this switch is open is determined by the difference between numbers A and B. From the output of switch 6, the pulses move in series to divider 7 with division factor adjustable between 1 and 9999. The results of division of difference A - B by C are taken from the output of the divider to the input of indicator 8, which shows the result of the calculation.

During multiplication (Figure b) the switch, as in the first example, is unblocked after pressing on the "count" button. Number B is fixed in the third sensor, while number A is selected in the first sensor. The pulses from pulse generator 2 move through first switch 3 to third sensor

5 and indicator 6. Third sensor 5 outputs a clear pulse, which also moves to the first sensor. As soon as A pulses reach it, it outputs a cutoff signal which blocks the first switch.

In order to perform the operation A + C, the indicator is used as an adder. Number A is first input to it, followed by number C. The operation A - B is performed by setting number C in divider 7 equal to 1. The algorithm for the operation A × B is performed by feeding number B to the indicator (counter with indicator) A times.

A GENERATOR FOR DETERMINATION OF SHORTED TURNS during operation of coils, transformers and chokes has been suggested by Engineer Major M. Khanov and Captain E. Ryabov. It consists of coils L1 (PEV2 wire, 240 turns) and L2 (PEV2 wire, 80 turns), measuring head MKA type M-52, 50-100 μa, switch B1, a type MLT resistor of 0.5-300 ohms, potentiometer R2, type SP10S-3-1.2 kilohm, a type P4G transistor, battery B type KBS-0.5 and ferrite core Φ.

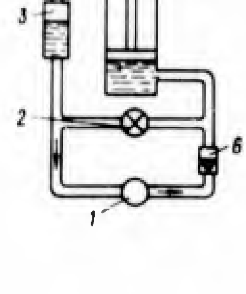


The coils are wound on a plastic or cardboard frame 10 mm in diameter. The width of the winding is 3 mm. To tune the device, a short circuited turn is placed around the ferrite rod and the resistance is changed until oscillation is interrupted. After the short circuited turn is removed, oscillation is restored and the device is ready for operation.

BRAKING PARACHUTE INSTALLATION TIME IS REDUCED by a portable hydraulic lifting device developed by Sergeant N. Uchambrin. The lifter consists of a body, hydraulic cylinder 5, pump 1, removable bracket 4, 200 g capacity tank 3, valve 2 for drainage of the mixture and back valve 6.

The braking parachute is placed in the container, the valve is closed and the bracket is placed beneath it.

A hand pump is used to raise the bracket, the lock is closed and the mixture drainage valve is opened.

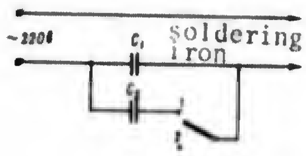


∇ LEAKAGE OF COMPRESSED AIR IN AIR SYSTEMS can be detected by a method suggested by Engineer Major N. Burov. The indicator used is a type URV-175-U aviation airflow meter with rubber or vinyl chloride tubing placed over the nipples and connected to the interchangeable tips. Even a slight leakage or discharge of air will be recorded if the device is connected in the system. Its needle is deflected to the right in case of a leak or to the left in case of a discharge. The scale of the device can determine the flow rate of air per second and therefore indicate the time which the air supply will last.

The device is placed in a special body which includes an electric light for taking of measurements at night.

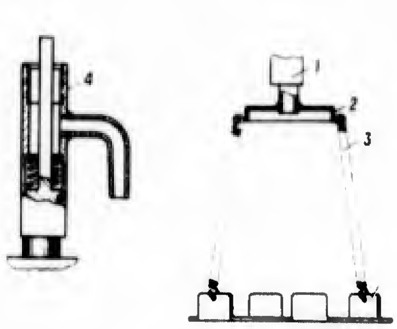
Highly sensitive medical manometers such as the model 0-25 mercury manometer can also be used as air leak indicators.

∇ A SIMPLE CIRCUIT PROTECTING A SOLDERING IRON from overheating has been suggested by soviet army employee A. Medennikov.



The nominal capacitance of each of the condensors (C1 and C2 of any type) must be between 2 and 3 microfarads, and depends on the operating mode. During soldering, the switch is placed in position 1, thus maintaining the necessary temperature of the iron. During brief interruptions, the switch is shifted to position 2, and the temperature of the iron drops somewhat.

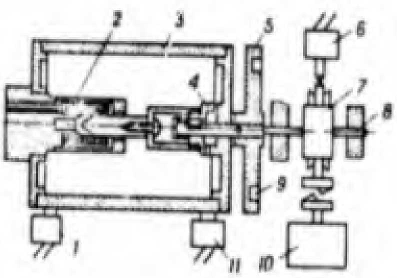
∇ OIL SAMPLES FROM AN AIRCRAFT SYSTEM CAN BE TAKEN for subsequent analysis, Captain S. Anisimov suggests, using a simple device which he has created. It not only allows the time required for performance of this work to be reduced, but also eliminates the possibility of contamination of the specimen with foreign particles.



The device consists of a case with spaces for four 0.5 l glass bottles, tightly sealed with metal covers 2. The seal is provided by rubber inserts pressed against the tops by springs 3. Oil samples from the drainage nipples of systems on the aircraft are taken through collector 4, connected to the bottles by flexible hose 1. When the top of the rod is pressed down, the oil passes through the internal channel from the nipple to the bottle.

∇ A PROJECTOR (authors certificate number 243888) in which slides can be fed from a magazine into the projecting window either in sequence, one after the other, or selectively without showing intermediate slides, has been developed by Engineer Colonel V. Mezhekov, Engineer Lieutenant Colonels A. Zolotarev and M. Rudenko, Engineer Major N. Kostyayev, Engineer Captain V. Savinkov, Reserve Engineer Major M. Ivanov and Soviet Army employee Yu. Pisarevskiy.

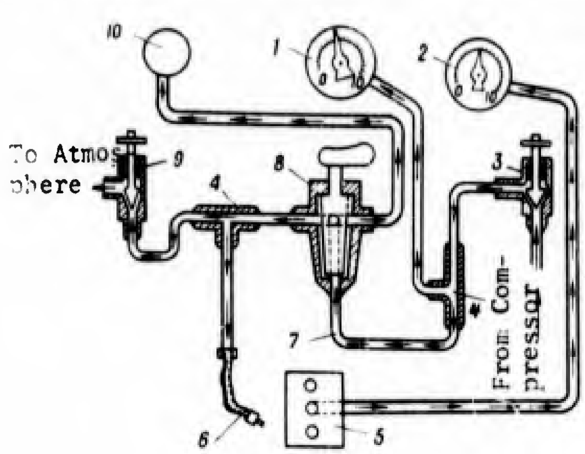
The slide feed mechanism consists of hollow drum 3, fastened to the magazine moving mechanism by electromagnetic clutch 4. This clutch consists of drive disc 5 on shaft 8 with shaped slot 9, which contacts the magazine.



In the initial position, when a slide is in the projection window, terminal switch 1 is open, electromagnet 6 carries no current and the worm couple is disconnected from drive 10. In order to change the slide, the button on the control panel is pressed and quickly released. This operates electromagnet 2, and worm couple 3 is connected to the drive. The shaft, carrying disc 7, rotates, and the slide change mechanism is put in motion through the electromagnetic clutch and the hollow drum. The terminal switch is closed and blocks the button on the control panel. After the slide is withdrawn from the projecting window to the magazine, contact pair 11 which moves the magazine forward by one step by means of the shaped slot, is closed, then opened. The slide feed mechanism moves the next slide into the projection window. The terminal switch opens the supply circuit of electromagnet 2, and the entire mechanism is disconnected from the drive.

When selective showing of slides is desired, the button is pushed down and held until the desired slide is in the projection window.

∇ THE SAFETY VALVE AND PRESSURE REGULATOR in motor vehicle and armored transporter brake systems can be checked and regulated during technical maintenance using a device developed by Soviet Army employee P. Filonov and Senior Sergeant of Extended Service I. Boyko.



This device, as Lieutenant Colonel N. Tamanov reports, consists of manometers 1 and 2, blocking valves 3 and 9, T-connectors 4, flexible hose 6 and T-valve 8. The parts of the device, mounted on a metal panel, are connected by brass tubing 7.

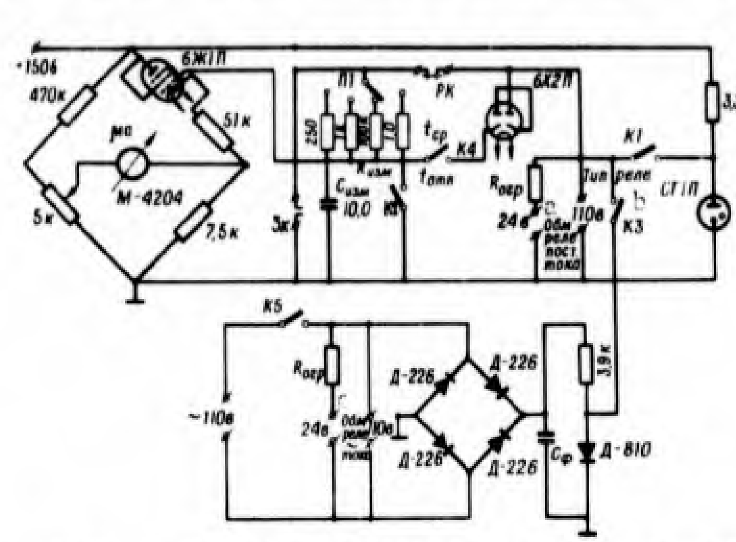
The safety valve to be tested is screwed into hole 10 and connected to the line from the compressor to manometer 1 by means of valve 8. Air is fed to the valve by valve 3. The safety valve should operate at a pressure of 9-9.5 kg/cm^2.

A pressure regulator is placed in connection 5 and flexible hose 6 is connected to it. Valves 3 and 8 allow air to enter the regulator. Valve 9 should be closed in this case. Manometer 2 is used to observe the pressure at which the regulator operates. Then valve 9 is used to decrease the pressure in the system to 5-5.6 kg/cm^2, allowing the operation of the valve to be tested.

∇ AN ELECTRONIC RELAY TIME PARAMETER METER has been suggested by Engineer Lieutenant Colonels M. Nazarov and V. Narushevich. It consists of a measuring circuit and stabilized power supply, vacuum tube voltmeter consisting of a bridge circuit, one arm of which contains an amplifying pentode as a measuring element.

A microammeter is connected into the diagonal of the bridge circuit. Its indications are proportional to the operating time (t_{op}) or disconnect time (t_d). Balancing of the bridge is achieved by changing the resistance. The time parameters of relays are determined by the charging time of the condensor through a known resistance from a constant voltage source.

Condensor C_m and series connected resistor R_m are connected to a source of stabilized voltage through the opening contacts of the relay being studied (PK) as parameter t_{op} is changed. Condensor C_m begins to discharge at the moment when button K1 is pressed. At the same time, the voltage reaches the winding of the relay through limiting resistor R_{lim}. After a time equal to t_{op} has passed, the contacts of the relay are opened, and charging of C_m stops. The voltage on the condensor, measured using the vacuum tube voltmeter, depends on the operating time of the relay.



Key: a, dc relay winding; b, relay; c, ac relay winding

In order to measure t_d, discharging of condensor C_m through resistor R_m is used, by placing switch K4 in the "t_d" position and feeding voltage to the winding of the relay through limiting resistor R_{lim}. When button K1 is released, the relay loses current and condensor C_m begins to discharge through R_m and the closing contacts of the relay (3K). After a certain time is passed, equal to t_d, the relay opens contacts 3K. Thus, the voltage measured by the vacuum tube voltmeter at the end of discharging depends on t_d.

The measurement limits of t_{op} or t_d can be varied by switch П1, which has several subranges: 0.0025, 0.01, 1.0 and 10 sec. For convenience in determining t_{op}, t_d, the scale of the vacuum tube voltmeter is calibrated in units of time.

The time parameters of ac relays are measured using button K5. When it is pressed, a voltage from an external alternating current power supply is fed to its winding, and the voltage for charging the measuring condensor C_m is fed through a special rectifier, the voltage being fed to the rectifier at the same time as to the relay winding. Diode D-810 stabilizes the rectified voltage fed into a circuit P_mC_m. The scale of the device is calibrated separately for dc and ac relays.

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FOUR YEAR NOTEBOOK

(Unattributed Article)

Motor Oils for Carburetor Engines

Carburetor engines should use type AS-6, AS-8, AS-10 and ASZp-10 oils. They contain multifunctional, viscous, detergent, antifoaming and other additives which improve their operational qualities. Oil type ASZp-10 can be used as an all-season oil in V-shaped carburetor engines.

Type of Oil, GOST	Solidification Temperature, ° C, not over	Ash Content, % Without Additives, not over	Ash Content, % With Additive, not under	Alkalinity, mg koh per g oil	Substitutes
AS-6 (M6b) 10541 -63	-30	0.005	0.45	1.5	ASZp-10, AS-8
AS-8 (M8b), 10541-63	-25	0.005	0.3-0.5*	0.6-1.5	ASZp-10, AS-6**,
AS-10 (M10b), 10541-63	-15	0.005	0.45	1.5	ASZp-10, AS-8
ASZp-10 (M10b-A3), MRTU 12N No 32-63	-36	0.005	0.48	0.6-1.5	AS-6** (winter), AS-10** (summer)

*With additive VNIINP-360 -- at least 0.45; with DF-1 -- 0.3; with SB-3 and DF-11 -- 0.5.

**Used in all carburetor engines except for V-shaped engines.

Motor Oils for Diesel Engines

Lightly and moderately loaded high-speed diesels should use oils DS-8 and DS-11 with additive TSIATIM-339, while heavily loaded engines should use these same oils but with additives VNIINP-360 and MNI-IP-22k. If DS-8 and DS-11 are unavailable, Dp-8 and Dp-11 can be used. Oils DS-8 (M8V) and M-12V motor oil can be used for engines requiring series one oils.

Type MT-16p oil can be used in special 300-700 horsepower diesel engines, as well as for transmissions in geared helical and bevel reducers, rolling and sliding bearings, hinges and other similar mechanisms. However, it should only be used in reducing gears when the engine operates with the same oil. Type MT-16p oil is recommended for cold starting of motor vehicle and tractor engines at surrounding air temperatures down to -15° C. At temperatures to -35° C, oil MT-14p is used in powerful diesels.

In powerful aviation type piston engines, aviation oil type MS-20S should be used, or MS-20 and MK-22 as substitutes (see next page for characteristics of main types of oils).

Viscosity of Motor Oils

One of the primary operating parameters of oils is the viscosity, which changes over broad limits depending on the temperature. The table below shows the viscosity of most motor oils for carburetor engines at various temperatures.

Type of Oil	Viscosity					
	Dynamic, Poise			Kinematic, cst		
	at −30°C	at −20°C	at −10°C	at 0°C	at 50°C	at 100°C
AS-6(M6b)	1300	170	40	1000	40	at least 6
AS-8(M8b)	1800	300	45	1200	50	7,5—8,5
AS-10 (M10b)	7500	800	60	2000	60	9,5—10,5
ASZp-10 (M10b)	300	70	20	1000	45	9,5—10,5

Motor Oils for Gas Turbine Engines

It is recommended that type MK-8P oil be used as the basic lubricant for use turbine engines of transport vehicles and certain stationary installations at temperatures down to -20° C, that type MK-6 and MS-6 be used at lower temperatures (down to -40° C).

Stability to Oxidation

Type of Oil, GOST	Pour Point, ° C, Not Over	Sedament, %, Not Over	Acid No., mg KOH per g oil, not over	Ash Content, %, not over	Substitutes
MK-8p, 6457-66	-55	0.15*	0.6*	0.005	MK-6
MK-6 10328-63	-60	0.1	0.35	0.005	MS-6
MS-6 11552-65	-55	OTS	0.15	0.005	MK-6

*Oxidation of MK-8p oil performed at 175° C.

Type of Oil, GOST	Pour Point, ° C, not over	Ash Content, %: Without Additive, not over	Ash Content, %: With Additive, at least	Alkalinity, mg KOH per g Oil	Substitutes
DS-8 (M8b), 8581-63	-25	0.005	0.4-0.8	1.5	Dp-8, ASZp-10
DS-11 (M10b) 8581-63	-15	0.005	0.4-0.8	1.5	Dp-11
DS-8 (M8B) 8581-63	-25	0.005	0.7	3.5	ASZp-10
M-12V, MRTU 38-182-65	-15	0.005	0.6	2.5-3.5	ASZp-10
Dp-8 MRTU 38-1-243-66	-20	0.005	0.5	1.8	Dp-8(M8b)
Dp-11, MRTU 38-1-243-66	-15	0.005	0.5	1.8	Dp-11 (M10b)
MT-16p, 6360-58 or MRTU 38-1-242-66	-25	0.005	0.25	0.8-2.2	MT-14p
MT-14p, 6360-58	-43	0.005	0.13	-	MT-16p

Viscosity of Motor Oils for Diesel Engines

Type of Oil	Viscosity: Dynamic, Poise at −30°C	Dynamic, Poise at −20°C	Dynamic, Poise at −10°C	Kinematic, cst at 0°C	Kinematic, cst at 50°C	Kinematic, cst at 100°C
DS-8 (M8b)	500	110	30	not over 1200	40	7,5—8,5
DS-11 (M10b)	2700	420	100	not over 2500	60	10,5—11,5
DS-8	550	120	35	not over 1200	40	7,5—8,5
M-12B	1600	260	65	2500	70	11—12
Dp-8	1500	250	60	not over 3000	50	8,5—9,5
Dp-11	2000	400	85	3500	70	11,5—12,5
MT-16p	3000	500	125	6[illegible]00	125	16—17,5
MT-14p	не более 280	60	20	not over 1000	55	13,5—14,5
MT-8p	350	60	20	700	40	8—9
MS-20S	12000	1600	350	8000	150	not under 20

AN OPTICAL SIGHT

(Unattributed Article)

An optical sight is installed on field guns for direct laying fire, consisting of a tube, body with sighting and leading mechanisms, ocular, extraction mechanisms and rubber caps. Within the tube, screwed into the cylindrical portion of the body and retained by three screws are the objective, condensor and inverting lens. A protective glass and light filter are fastened to the tube at the end of the objective.

All parts of the sight are held together by the body. It carries the sighting angle mechanism, lead mechanism and carriage with grid. The grid is a flat plate with several scales -- distance, range correction, lateral velocity component, side correction and range finder scales. Here also are the angles for determination of direct firing range for targets 2.7 and 1.5 m high. We note that the distant scales on the grid may vary. They should correspond to the ballistics of the gun for which the sight is designed.

The grid carries only one central sighting mark, providing for a broader field of view, facilitating tracking of the target and selection of the aiming point. At night, the grids and hairs of the sight are illuminated by a special light fastened over an aperture in the upper portion of the body to the right.

The cover of the body carries the ocular. Also, the carriage for the hairs is fastened to it on the objective side, and the eye piece is fastened to it on the ocular side. The height corrector mechanism is fastened to the top of the body, while the direction corrector mechanism is fastened to the right side. Both mechanisms are identically designed.

Before firing, the sight should be inspected and the zero sighting line adjusted for a remote aiming point or by the shield.

During the inspection, the condition of the optical system and body are primarily checked. Looking into the sight through the ocular, one must make sure that the grid and lenses are clean, and have no dirt spots, scratches, stray hairs, that the lenses of the objective and ocular are securely glued. If "pine trees" like those seen on window glass on cold days are seen, this means that the lenses have come unglued. Defective sights should be sent in for repair.

In order to be sure that the lead and sighting angle mechanisms are operating properly, the direction and distance correcting mechanisms are rotated. They should move smoothly, without sticking or sudden movement. The same thing is done to the correcting mechanism. At the end of the inspection, the security of the fastening of the sight to the bracket and operation of the illumination system are checked.

Since the sight is rigidly connected to the rocking portion, during adjustment in order to avoid errors in the sighting angle and in the lateral direction during aiming, the weapon is placed on a prepared horizontal area. The aiming point is selected with clear and sharp contours, at least 1000 m distant. Then the scratches made on the muzzle of the barrel or the muzzle brake are used to adjust the cross hairs and the firing pin is removed from the breech block. After this, a sight is taken through the hole in the breech and over the cross hairs. The elevation and rotating mechanisms are used to aim the barrel of the weapon at the selected aiming point.

The sight is properly adjusted if the tip of the sighting mark corresponds to the aiming point. If the tip of the mark is not on this point, the screws fastening the covers of the correcting mechanisms are backed off two turns and the covers are opened. Then the wheels of the sighting angle and lead mechanisms are used to move the tip of the sighting mark to the aiming point. The nuts of the correcting mechanisms are used to move the vertical and horizontal cross hairs to the zero scale divisions of the lateral velocity component and distance scale. After adjustment, the covers are closed and the screws are retightened. If a slight deflection of the zero line has occurred as a result of changing of the light filter or protective glass, the sight should not be readjusted. However, if systematic deflection of shells from the target is observed during firing, the zero sighting line should be adjusted once more.

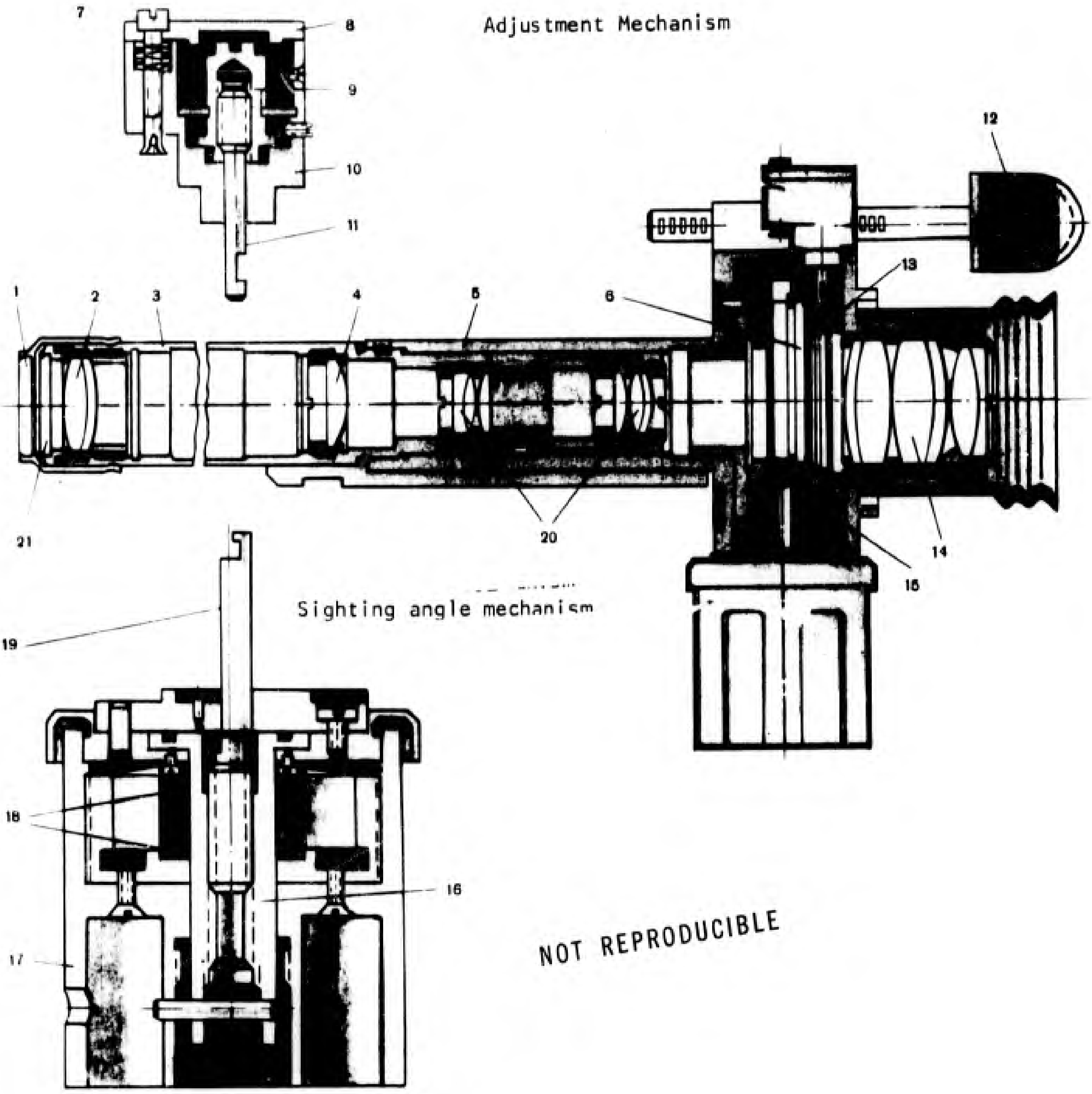
Upon return from firing, the sight is serviced, particularly carefully if the weapon has been rained on or transported over a dirt road. First of all, a clean dry rag is used to wipe down the metal parts of the sight. Depressions and notches are cleaned by wrapping a rag around the fingers. Sand and dust particles are blown off of the external surfaces of the glass or wiped off with a moist rag. Clean flannel is then used to dry the glass with circular motions from the center to the edges.

The optical parts must not be touched with the fingers, oily or dirty rags, since oily spots decrease the quality of the image. During cleaning, in order to avoid breaking the seal of the sight, the sealing grease around the screws and at points of contact of parts should not be removed. Gasoline, kerosene or other liquids which dissolve this sealant should also be avoided.

The unpainted metal surfaces of the sight must be dried with a soft rag and lightly lubricated, very carefully, so that the oil does not contact the optical parts.

We note that only artillery technicians are permitted to repair the sight, in shops specially equipped for this purpose. The gun crew can only replace the protective glass and eliminate defects in the electric lamp unit, electric wires and mounting box.

Sights should be stored installed on the weapons or in a heated room.



KEY: 1, light filter; 2, objective; 3, tube; 4, condensor; 5, body; 6, flat plate; 7, screw; 8, cover; 9, nut; 10, body; 11, adjusting screw; 12, rubber cap; 13, carriage with cross hairs; 14, ocular; 15, cover; 16, nut; 17, wheel; 18, limiting washers; 19, screw; 20, lens with rotating system; 21, protective glass