FOREIGN TECHNOLOGY DIVISION

THE SURPRISES OF EGE

by

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EDITED TRANSLATION

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ABSTRACT

People have long used the power of explosions — to destroy. Now work is being carried out for creative explosions. Explosions move mountains, build dams, lay out canals, and smooth river beds. EGE is also an explosion, but a very special, electrical one. The place of its discovery is the Soviet Union.

1. EGE
2. Electric Explosions
3. Electrodes
4. Shock Waves

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THE SURPRISES OF EGE

N. Bobrov

In the World of Science and Technology

People have used the force of an explosion for a long time. But this force found only one use today-destruction. Now scientists have forced the explosion to work for creation. The explosion moves mountains, builds dams, digs canals and smooths out river beds. The force of explosive substances is also used in mining, in fighting forest fires, and in dry mud. According to a plan computed by Soviet specialists, any ground can be thrown in the necessary direction and to the prescribed distance.

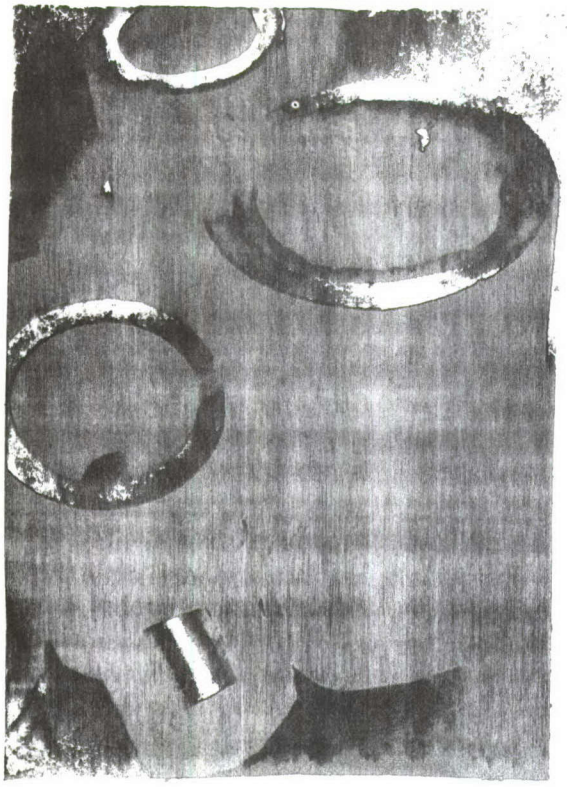
EGE – this is also an explosion, but only a completely special, electric explosion. The place of its discovery is the Soviet Union.

Lightning in Water

It was first seen and scientifically founded by the inventor Lev Yutkin. By experimenting, he placed electrodes in a tank of water and charged them with a current from a high voltage capacitor battery.

A bright spark sputtered in the water, an explosion thundered, and instantaneously a shock wave arose. Here, a steam-gas bubble formed around the electrode. The unexpected phenomenon was called EGE, which means electrohydraulic effect. This is what it consists of.

A capacitor battery is charged with a high voltage dc current. After going through a spherical spark-gap of air, the energy which has been accumulated discharges in the space between the positive and negative electrodes which have been placed inside a special housing. The electric breakdown of the liquid occurs. EGE appears in the spark zone.



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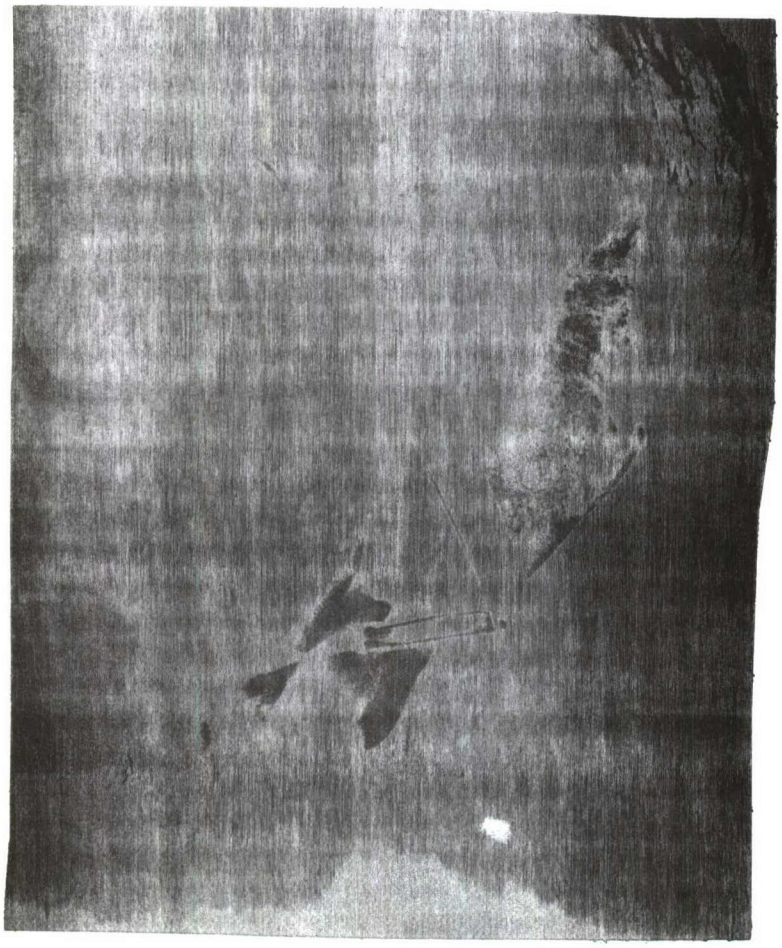
Copper, tungsten, iron are pressed into these sleeves in even layers of the necessary thickness and density by "water lightning."



The director of the group which is studying the spark discharge in a liquid, Engineer Vladimir Korotkov.

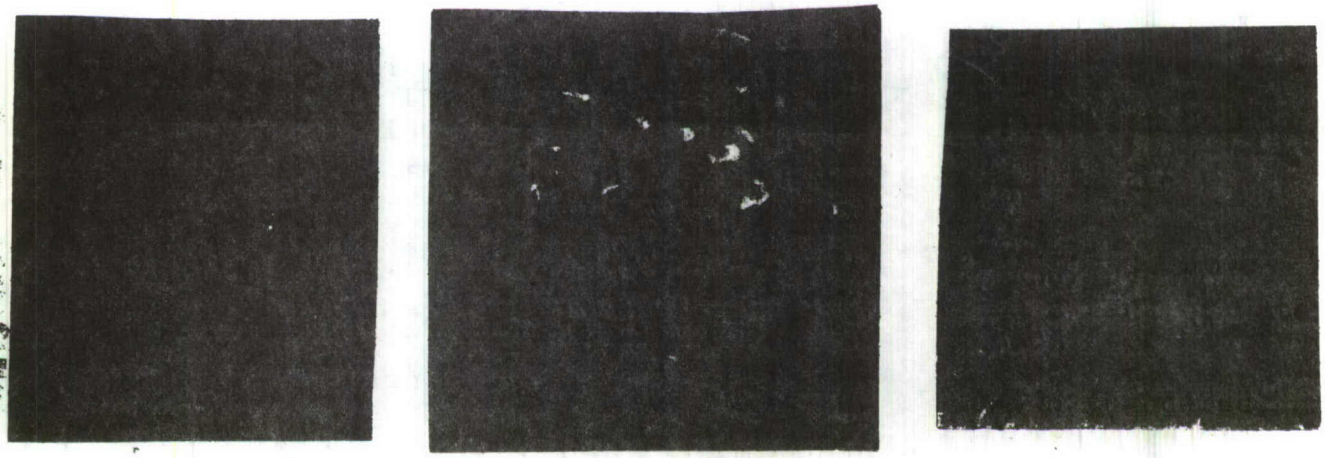
GRAPHIC NOT REPRODUCIBLE

At the front of the shock wave the pressure reaches several thousand atmospheres. It expands faster than the speed of sound. Approximately 30% of the energy accumulated by the capacitors is converted into the shock wave. If a thin wire is placed between the electrodes in the liquid, it explodes, and EGE is obtained more direct and more stable.

Soviet scientists have tried very much to study the nature of the new process and its possibilities. It has been ascertained that lightning causes ionization, the breakdown of molecules, magnetic fields, intensive ultrasonic radiation of different frequencies, and that the time of the spark action oscillates in a wide limit and depends on the polarity and form of the electrodes the amount of voltage and the conductivity of the liquid. The study of the effect has not yet been concluded. But the electrohydraulic effect has already found wide application in practice.

Excursion into the Unusual

One of the EGE research centers is located in Minsk, at the Institute of Heat and Mass Transfer of the Academy of Sciences of the Byelorussian SSR. The laboratory which instructs in electrohydrodynamics is directed by a young engineer, Vladimir Korotkov and his co-workers. Several accomadations where Korotkov's group is working are occupied with diverse equipment. There is a number of high voltage insulators in the experimental boxes under the ceiling. Copper brushes interchanging conductors run from them to panels. Behind the curtains are capacitor batteries and some other kind of apparatuses.



After going through the crushing apparatus, formless pieces of marble were converted into grain of a definite size.

I paid attention to the strange sphere which reminded one of a miniature bathyscape where physical researches of spark discharges in a liquid were conducted. The sphere were hermitically sealed, but it was built so that it allowed recording all occurrences inside it on movie film. I was shown a few frames. That which occurs in thousands of fractions of a second in the experimental camera and in the experimental sphere unroll slowly and seemingly very horribly on the screen. These pictures have allowed the scientists to estimate the capabilities of EGE, which they have begun to use in different branches of the national economy.

A semi-industrialized installation for crushing substances under EGE pressure.

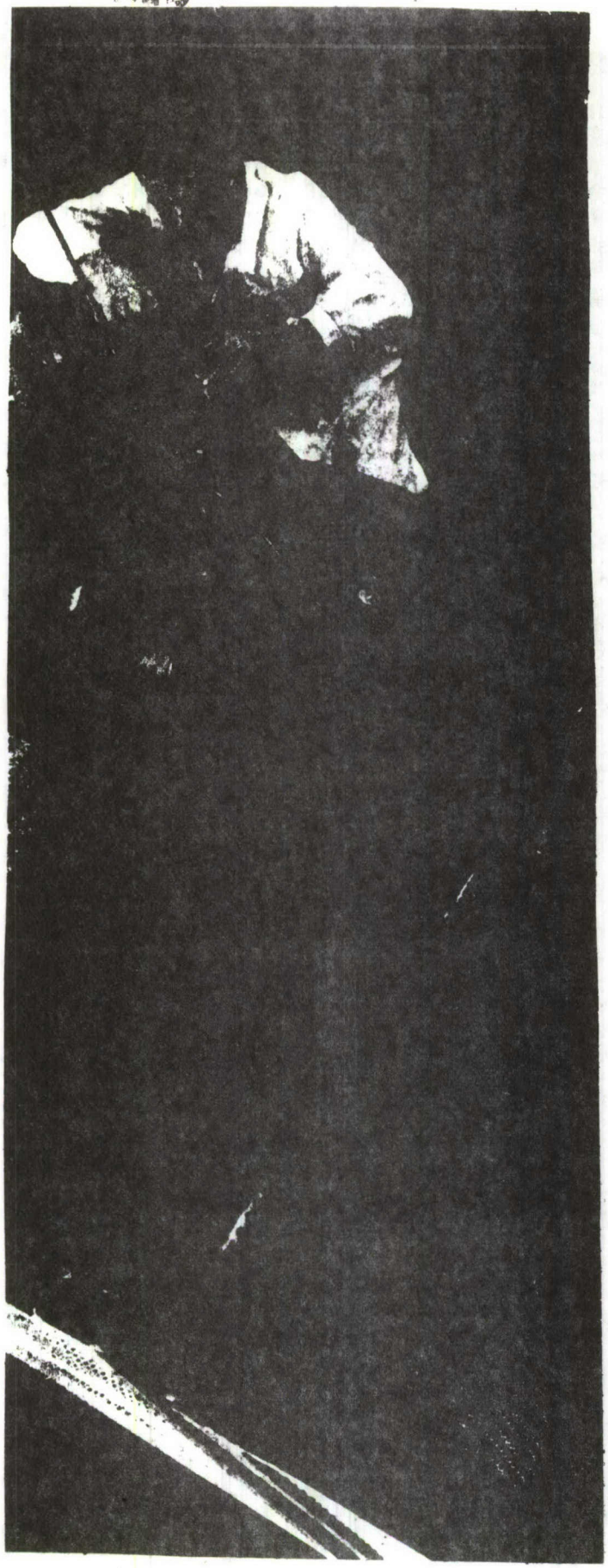
Where and how is the effect used in practice? Vladimir Korotkov answered our question, "Imagine that a hugh boulder has been lying for ages on a ploughed field. It gets in the way of tractors and combines. A glass of water is all that is necessary to break it up. We bore deep into the boulder, pour in some water and insert our electrode. Discharge!..., and the boulder crumbles so that not one fragment flies away. This evaluates the method. With such a method it is possible to conduct explosions in cold places, pits, inside of workshops, and new buildings without any risk for humans. Because the entire force of the shock wave as it were is locked up. Even dust does not appear in our explosions.

"The example with a boulder is only one in particular. This could also be diamonds, Carborundum, limestone, quartz, rock crystal, gravel, marble – oars of any hardness. And they may be crushed into dust or to any limit. And such powders are very necessary in the optical industry, in the paint and varnish industry, in radioceramics, and in construction."

We approached a machine which reminded us of a small hammer.

"Let's have current"! commanded Vladimir Korotkov. A small rumble occurred. Telegraph poles hum like that when you put your ear up to them. This was the capacitors building up their energy. And then suddenly, as if a machine gun began to rattle, a spark appeared in the spherical air spark gap. From the machine there poured granulated marble powder – even, round grains, suitable for trimming walls and decorative panels.

"Of course," continued Korotkov, "marble, limestone, and granite may be crushed even without EGE, although not particularly precisely. And to shape a tube from the inside so that there are embossed regions and pockets on it or to roll it out where wanted, you can't get around it here without the explosive method. At one of our machinery plants, three and a half thousand ends of steel pipes were processed with the aid of EGE in helium gas condensers. It was obtained reliably and accurately, and in addition a lot of time, effort, and means was saved."



The use of the electrohydraulic effect is especially promising for putting in layers of metals inside sleeves and rings. Layers of titanium, tungsten, molybdenum, niobium, and other metals are fastened flush, completely evenly, and so clean that further processing is unnecessary. This is done without the costly, unwieldy pressing equipment. A powdery metal is coated inside the secured sleeve, along with a special cartrige having an explosive wire inserted into it also. The current is applied. There is a bang as if a forty-five had been shot. And the layer of metal is already pressed into the sleeves. Its surface may be compressed with another layer. The stronger the explosion the more densely lies the melty. The explosion is regulated within wide limits.

EGE has been widely used at the Sumskiy Pump Factory for cleaning cast parts from the molding ground. They were dislodged manually from the molding ground. They were dislodged manually from the casting boxes by pneumatic hammers and chisels. The primative method went into the past as soon as they used the "Iskra" machine. The parts are cleaned by the shock wave, and the advantage which has been gained is great. The

This sphere allows Belorussian scientists to investigate the physical nature and phenomena of the electrohydraulic effect. The young scientists Gennadiy Nesvetaylov is preparing the sphere for organizing an experiment.

demand for "Iskra" machines grows with each day.

The main EGE force is the shock wave. If a matrix is placed on its path it is possible to stamp the parts. A press already exists which operates under the EGE shocks. Soviet scientists have received patent number 173105 for this invention. As is has been proved, the electrohydraluic effect is used for pasteurizing juices and obtaining extracts from vegetable products. By this method it is possible to extract rare elements from oars and to dry tea. EGE is used for underwater communication, packing foundations, riveting, altogether more than in a hundred branches of the country's national economy.

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