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PHYSICS

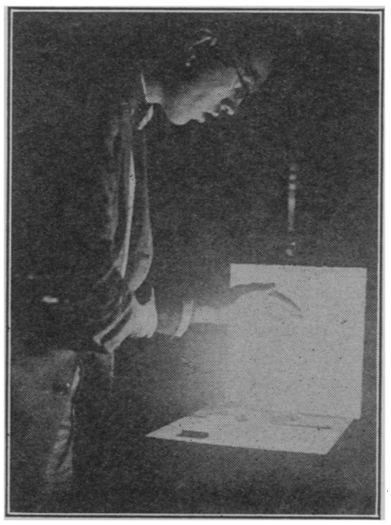
Wire Explosions Give Light Brighter Than Sunlight

By James Stokley

The hottest place in the world, where a scientist has created a temperature of 45,000 degrees Fahrenheit, far higher than the hottest oven, electric furnace or arc light, and a light more brilliant than the sun—such is the distinction of a medium-sized white building in the pleasant California city of Pasadena. This is the physical laboratory of the Mt. Wilson Observatory, of the Carnegie Institution of Washington, where Dr. John A. Anderson has been literally blowing apart iron wires by passing extremely powerful electric currents through them. With the attainment of such a temperature, the experimenter is able to imitate conditions on the stars themselves, and in fact, this is attested by the spectrum photographs which he has made. The spectrum of the exploded wires consists of a continuous spectrum crossed by numerous dark lines, similar to the spectrum of the sun itself.

Dr. Anderson thought of this experiment from a consideration of one theory of the source of the sun's heat. According to this theory, the fuel which keeps the sun going is supplied by meteorites or "shooting stars" from outer space, which are constantly falling into it, and according to his calculations an inconceivably great amount of energy can be supplied. The attraction of gravitation at the sun is such that a meteor falling into it from outer space will land with a speed of 3700 miles per second, or about 5000 times as fast as a rifle bullet, and its energy will be so great that, if it were all converted into heat, a meteor weighing only one ounce would be able to melt seventy tons of ice to water and raise it to the boiling point!

When such a meteor is brought to a quick stop, as it would be when it hits the sun, this vast store of energy, or at least a large part of it, would be liberated, and to find out what would happen Dr. Anderson set about to duplicate the effect experimentally. To do this, he says, it was necessary to "throw a large amount of energy into a small amount of matter in as short a time as possible," and though it seems impossible to do it by mechanical means, as by the actual stopping of a rapidly moving mass, it seemed worth trying by electrical means.



Despite the high temperature of the explosion, it is so short that it does not have time to heat nearby objects, and it is safe to hold one's hand within a few inches of the flash. This picture was made entirely by the light of the explosion.

It was evident that a very heavy electric charge would have to be piled up, and then released in an instant of time. So he constructed a large condenser, similar to those used in radio work, but much bigger. It consisted of a series of 98 glass plates, each 16 by 20 inches, covered with tin foil, and could be charged to 25,000 volts. An improvement was obtained in a second condenser he constructed, in which sheets of wired glass, the kind that is frequently used in office buildings, was used instead of the foil covered plates. This one can be charged to 50,000 volts. In use, the wire is connected to the condenser, the generator is started and the current begins to flow into the condenser. As the condenser becomes charged, it finally holds enough electricity to make a spark jump across a gap. The current then flows into the iron wire, exploding it with a sharp report and a brilliant flash.

When the experimenter is standing near the exploding wire, he first sees the flash—is nearly blinded by it, in fact—then he feels a puff of air on his face and hands. This is the sound wave, carrying the noise of the explosion.

With such a brilliant light, the explosion may easily be photographed by merely pointing a camera at the wire. If the room is darkened, and the camera shutter opened, the explosion's own light records itself on the plate. These photographs have been used by Dr. Anderson to measure the intensity of the flash, for the photographic negative may be compared with a similar negative of the sun, and by comparing the amounts of light that can go through each, the brightness of the explosion as compared with the sun can be found. In this way, Dr. Anderson has found that the brightness of the explosion is at least 100 times as bright as an equal area of the sun's surface, so that he has produced the most brilliant source of illumination in the world, or indeed, so far as we are aware, in the entire solar system!

But Dr. Anderson was interested not only in the brightness of the explosion, but also in the way in which it developed, and he set out to take what is practically a moving picture of the explosion from the start. By means of a revolving mirror, the pic-

(*Just turn the page*)

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Wire Explosions

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ture of the explosion is spread out into a long, comet-like trail, increasing in width as the mass of expanding gases become larger. The speed of the turning mirror is known, and so the speed of the expanding gases has been determined, and they are found to move as fast as a mile a second.

Despite the energy of the explosion, and the high temperature, it is not dangerous to persons nearby, and one's hand may be safely held within a few inches of the wire when it goes off. The air wave is felt on the palm, but it is not unpleasant. The sharp report, however, is hard on the ear drums, and, like gunners who operate large guns, it is necessary to keep the mouth open during the explosion in order that the pressure on the ear drum may be equalized.

Though the temperature is so high, the explosion is so short that it does not have time to heat up nearby objects, and if a piece of tissue paper is placed over the wire, it is torn by the force, but not even slightly charred. However, no attempt has been made to hold the wire as it explodes, for the result would probably be disastrous.

The chief value of these experiments, thinks Dr. Anderson, is in the fact that here we have an imitation, inadequate though it may be, of what occurs in the sun, or any star, in fact, when a meteor falls into it. For the first time in the history of science we are able to study in the laboratory what occurs at a temperature approaching that of some of the stars.

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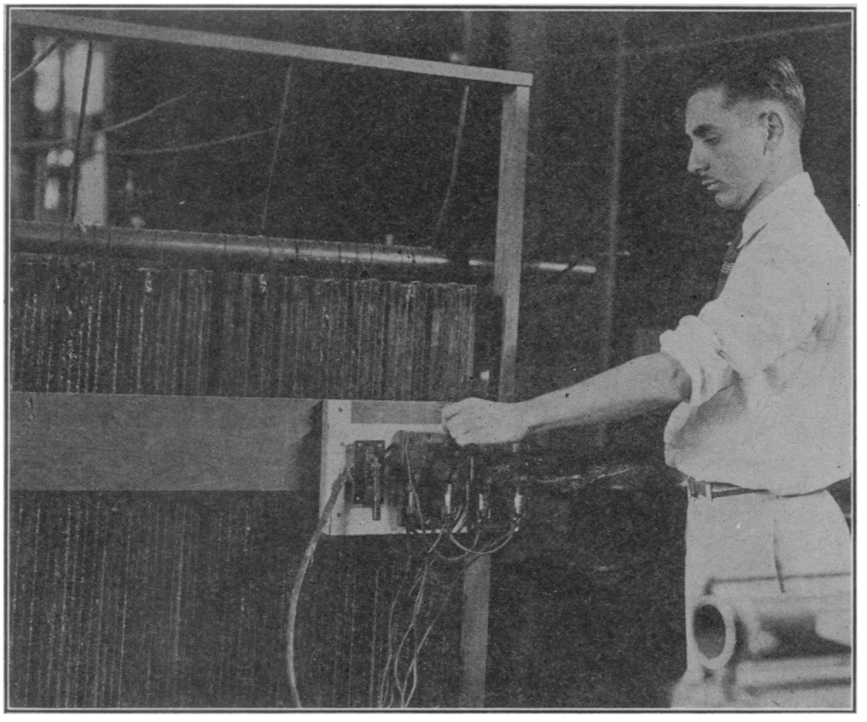

Part of the big glass condenser that supplies the 50,000 volt current used to explode the wires. Mr. Pompio is shown turning on the current to make an explosion.

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