skill, and the proper mechanical use of the body."

Commenting that although the health program is one of the latest to be added to school activities, it should be one of the last to be cut, he pointed out that this program came with a fundamental change in living conditions.

"If we should abandon our health program, our city and consolidated schools would find themselves presented with an epidemic of communicable disease at the beginning of each new term as did the city schools prior to 1890."

Science News Letter, April 1, 1933

CHEMISTRY

Tellurium Added To Lead Protects Against Acid

SMALL AMOUNTS of tellurium added to lead increase remarkably the resistance of the metal to concentrated sulphuric acid, W. Singleton and Brinley Jones of the Associated Lead Manufacturers' Research Laboratories have reported to the Institute of Metals at London, England. The physical properties of the lead are also profoundly affected. Rolled sheet of the tellurium-lead alloy with a wide range of properties can be produced. Tellurium additions also affect similarly various lead alloys.

Science News Letter, April 1, 1933

PHYSICS

Cat's Fur Electricity Ready To Yield Greatest Voltage

Huge Static Machine Will Soon Emit 10,000,000-Volt Discharges With Power of Town Generating Station

TEN MILLION volts will soon be available to a group of Massachusetts Institute of Technology physicists. In an airship hangar on Colonel E. H. R. Green's estate in Massachusetts, the largest building they could borrow for their experiments, a gigantic electrical machine is being groomed for its test run. It consists of two columns surmounted by fifteen-foot hollow aluminum spheres. Men can climb into these hollow metal balls, and the interiors of which will serve as laboratories where the effects of high voltage electricity upon matter can be observed.

The giant electrical machine will provide the world's highest potentials of electricity under human control. Lightning has higher voltage but man cannot effectively harness the lightning.

One surprising thing about this ten million volt generator is that it needs no electrical input. It is its own power house. No large transformers are needed. One of the oldest methods of generating electricity is used in this newest high voltage machine. Benjamin Franklin experimented with static machines and that other great American pioneer in physics, Joseph Henry, used frictional electricity generators to shock students holding hands in a circle.

Stroke a cat or comb your hair on a dry day and see the sparks fly. This method of generating static electricity is essentially the same as that in the ten million volt static machine about to be tested in New England. Static electricity antedates the electro-magnetic method that is used in the generation of practically all of the electric power today. The Greeks knew that by rubbing a piece of amber with a cloth an electric charge could be generated. With the practical application of the discoveries of Faraday and Henry, that motion in a magnetic field can generate a current, with the development of the vast electrical industry based upon these principles, static electricity did not have the opportunity of becoming practically useful but remained within the laboratory in the bags of scientific tricks of physics professors.

A modest young man, just thirty-two, is responsible for the application of the principles of static electricity in the development of the electrical machine which will soon give science useful potentials of many millions of volts. Dr. R. J. Van de Graaff was a Rhodes Scholar in Oxford when it first occurred to him to use static electricity to obtain high voltage. While in England he did not have the opportunity to make the necessary experiment but after leaving Oxford he went to Princeton University as a National Research Council fellow. There with the cooperation of Dr. Karl T. Compton, then professor of physics at Princeton and now president of the Massachusetts Institute of Technology, Dr. Van de Graaff made the first Van de Graaff generator. It cost less than a hundred dollars and it exceeded, in volt- (*Turn to Page* 204)

WEAPONS OF A PIONEER

The two hundredth birthday of Dr. Joseph Priestley, pioneer of chemistry in England and later in America, discoverer of oxygen, philosopher, philanthropist and friend of Washington, Jefferson, Franklin and Adams, was celebrated in connection with the meeting of the American Chemical Society in Washington, D. C., March 27 to 31. A feature of the celebration was the display of many pieces of his scientific apparatus, surviving in spite of the inevitable dispersals and breakages of a century and a half. The photograph reproduced here was taken at an earlier celebration: the centenary of his discovery of oxygen, held in 1874, at Priestley's old home in Northumberland, Pa.

sufficient to allow the cylinder to turn, which is effected as described in the pistol. After the finger is relieved from the lever (when the lock is set) a small spring draws it back to its former place to make room for the end *d* of the hammer, so that its force may not be impaired. By pulling the trigger from the catch of the hammer the mainspring (which is connected to the hammer by the stirrup *o*) forces its end *f* forward against the end *m* of the adopter, the end *l* of which is brought in contact with the percussion-cap placed upon the tube *n*, which discharges the load. To load, it is only requisite to draw the key *j*, which will liberate Section 4. Then by drawing the key that locks the cylinder (which may be effected by drawing back the hammer) the cylinder may be taken from the arbor.

Many Advantages

Among the many advantages in the use of these guns, independent of the number of charges they contain, are, first, the facility in loading them; secondly, the outward security against dampness; thirdly, security of the lock against the smoke of the powder; fourthly, the use of the partitions between the caps, which prevent fire communicating from the exploding cap to the adjoining ones; fifthly, by the hammer's striking the cap at the end of the cylinder no jar is occasioned, deviating from the line of sight; sixthly, the weight and location of the cylinder, which give steadiness to the hand; seventhly, the great rapidity in the succession of discharges, which is effected merely by drawing back the hammer and pulling the trigger.

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age developed, all of the other devices upon which physicists had been working diligently in a half dozen other laboratories.

So striking was the success of the 1,500,000-volt model that Research Corporation funds were obtained under the auspices of the Massachusetts Institute of Technology to build the ten-million-volt machine which is now about to go into the service of physics.

In principle the Van de Graaff generator is simple. From near the surface of the ground to the elevated hollow cylinders there run moving belts. Electricity is picked up upon these belts at the ground level and it is then conveyed, like water in a bucket pump, to the hollow spheres where it is dumped into them and travels to their surfaces. It is not even necessary to provide a source of low voltage electricity to spray upon the belts as the belts can create and pick up the necessary electricity without aid. One of the hollow cylinders thus has its surface charged positively and the other is charged with negative electricity. How much electricity the hollow cylinders will hold without spilling over, or sparking like artificial lightning, one from the other, depends upon their size and the atmosphere conditions.

A relatively large amount of electricity, a thousand kilowatts, will be generated by the ten million volt machine when it operates. This is as much as the power plant of a small town generates. Actually the current amounts to 100 milliamperes at a potential of ten million volts.

The generator would light 90,000 ordinary 10 watt, 110 volt incandescent electric lamps, if connected in series, and there would be ten per cent. current margin to spare. If these lamps were set as close together as possible, say eight to the foot, they would string out to about two miles.

The conductivity of the air prevents the generation of voltages much higher than ten million. The experimenters are therefore at work upon a Van de Graaff generator which will be immersed in a gigantic vacuum tank. With this electrical machine they expect to develop fifty million volts.

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ASTRONOMY

First Direct Photographs of Sun's Hydrogen Flames Made

SOLAR PROMINENCES, great flames of hydrogen that shoot out from the sun's surface, often to heights of hundreds of thousands of miles, have recently been photographed from the Meudon Observatory, near Paris, without waiting for an eclipse, or using a spectroscope, which has been required hitherto. At a recent meeting of the Academy of Sciences, M. B. Lyot, astronomer at the observatory, described the methods that he had used to accomplish this result, which is considered of great scientific importance.

At the time of a total eclipse of the sun, like that seen in New England last August, the prominences may be seen as brilliant spots of red around the moon's dark disc. Nearly forty years ago Dr. George Ellery Hale, famous American astronomer, and Dr. Henry Deslandres, a Frenchman, independently invented the spectroheliograph, which made it possible to photograph them solely by the hydrogen light which they emit. In this way the intensity of the surrounding glare, which is of all colors, was eliminated. Since the prominences are only about five millionths as bright as the sun itself, the glare that surrounds it usually hides them.

A few years ago M. Lyot made some experiments from the summit of the Pic du Midi to record the sun's corona without waiting for an eclipse. This was successful. Because of the extreme clarity of the atmosphere, the diffuse light around the sun was almost completely absent, and by screening the sun's disc from the plate, it was possible to photograph the prominences directly. It was also possible to see them. Even on poorer days, M. Lyot reported, they could be seen by looking through a red glass filter, which eliminated the diffuse light.

When the experiments were repeated at Meudon, the greater amount of atmospheric haze and dust prevented results being obtained so easily. However, M. Lyot constructed a special filter, consisting of an acid solution of the chemical neodymium nitrate, which was contained in a tube covered at one end with plain glass and at the other with a special red filter. The sun's light was passed through this combination filter, and practically all of the light was removed with the exception of a narrow band of waves in the red, which included all of the red hydrogen light. With this apparatus, revealed M. Lyot, the prominences were photographed successfully. Even on misty days, it was possible to photograph them in an exposure time of one second, with the sun's image 8 centimeters (about 3⅛ inches) in diameter.

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