PHYSICS

11,000,000-Volt Bullets for Use in Attacking Atoms

In Report to National Academy, Prof. Lawrence Tells Of Beam Equal to That From Radium Worth $4,000,000

See Front Cover

THE production of 11,000,000-volt energy atomic bullets for use in attacking other atoms was announced by Prof. Ernest O. Lawrence, University of California physicist, at the meeting of the National Academy of Sciences meeting in Washington, D. C.

This is the greatest man-controlled energy that science has had at its command for use in its study of the problem of the constitution of matter.

Already young Prof. Lawrence has transmuted or blown to pieces most of the atoms known to man, using the cyclotron or giant merry-go-round machine gun, which he invented.

To the academicians he also told how he had devised a successful means of bringing beams of high-powered atomic bullets into the clear for purposes of bombarding matter.

The production of the new, high-energy bullets was made possible by substituting the nuclei of helium gas atoms for the hydrogen or heavy hydrogen formerly used. On theoretical grounds it was believed that these helium nuclei would function in the whirligig machine gun, and that because of their mass and double charge they should come out of the apparatus with double the energy previously attained with lighter, less electrically-active bullets.

Proved By Experiments

Experiments have now demonstrated this theory to be correct. Helium nuclei, also known as alpha particles, have been shot out of the machine with an energy of 11,000,000 electron-volts, in a beam of one-tenth micro-ampere.

With this new tool in their hands it is hoped that physicists will be able to make a new attack on the nuclear structure of the atom, and to discover new facts and new transmutation phenomena which so far have not even been thought about.

Along with this development, Prof. Lawrence announced changes in his cyclotron apparatus which make it possible to send a stream of high energy bullets clear of the machine. In the laboratory such beams have been shot into the air for a distance of twenty-five centimeters, and with evacuated tubes this distance can be greatly increased. The importance of this accomplishment is in adding facility to experimentation with the powerful beams produced.

Broaden Biological Research

With the present status of the cyclotron apparatus, greater scope will be given to biological experiments on the effect of neutron rays upon living tissue. Preliminary studies have indicated that the neutron ray may be even more valuable in certain types of medical therapy than is the X-ray.

Transmutation of platinum, one of the noblest metals of the universe, and the creation of two elements new to science, radio-platinum and radio-iridium, was also reported by Prof. Lawrence.

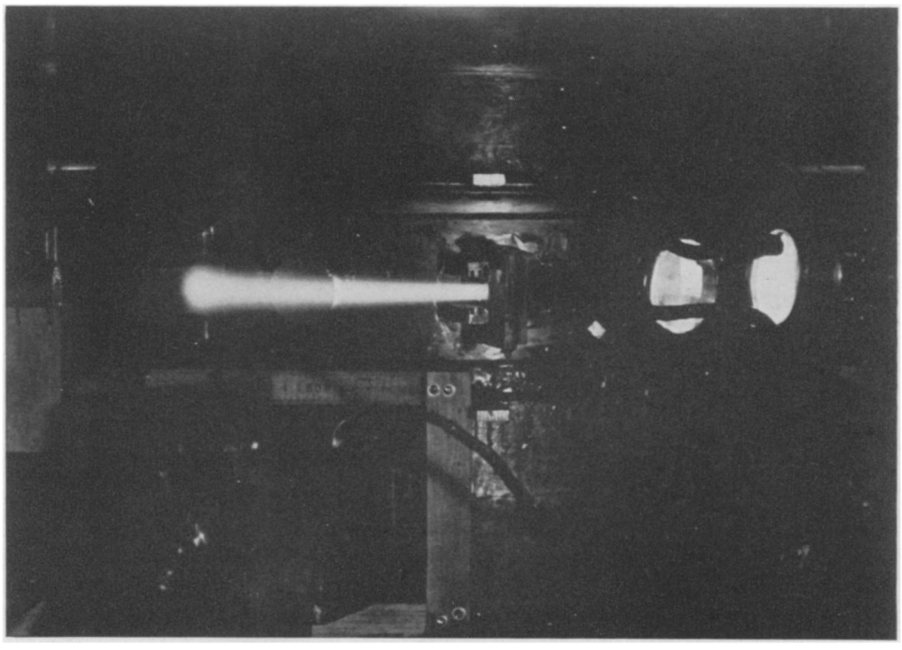
As projectiles in the transmuting bombardment, Prof. Lawrence and his cooperating colleague, Dr. J. M. Cork, utilized the cores of heavy hydrogen atoms, deuterons to chemists and physicists. Thus they made previously unknown varieties of matter through the use of a kind of atom, known as heavy hydrogen or deuterium, which was discovered as recently as 1931.

Produced By Cyclotron

The giant whirligig atom gun, with its 85-ton magnet, produced the 5,000,000-volt deuterons used. The virtue of Prof. Lawrence's famous apparatus, now copied in a score of other laboratories throughout the world, is that relatively low voltages are built up by series of mild electrical pushes into the extremely high voltages used.

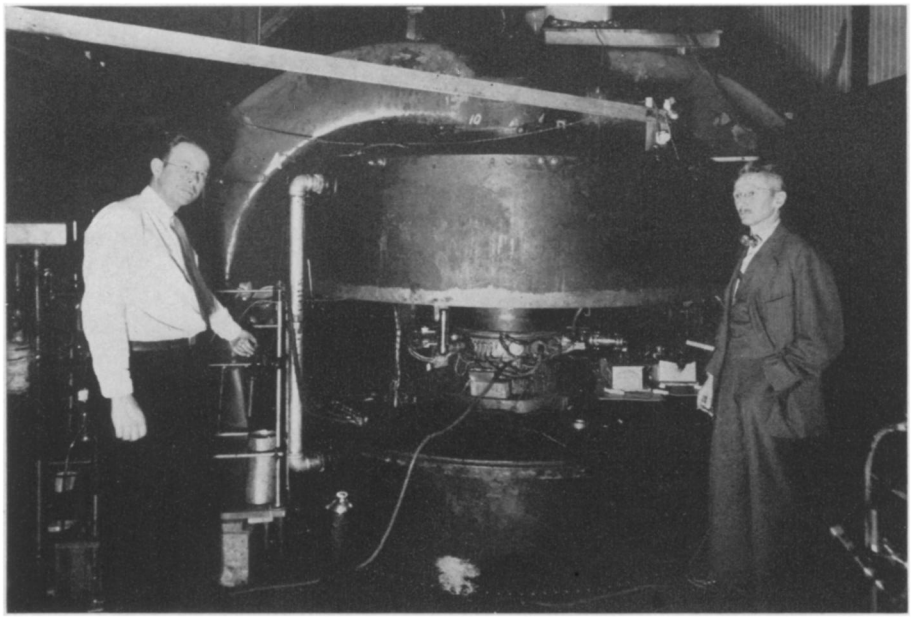
The new radioactive element varieties, called isotopes, were separated chemically from the platinum that was unchanged.

Prof. Lawrence told the academicians just what happened when the transmutation took place. When radio-iridium is created, a deuteron is captured by the core or nucleus of a platinum atom and an alpha particle, which is a helium atom core, is violently ejected. Radio-platinum was synthesized by a process



MOST POWERFUL BEAM OF RADIATION

Scientists marvel at this photograph. It is the most powerful beam of radiation man has produced. Shooting out from the Lawrence atom gun at University of California it makes a luminous beam nearly a foot long and rated at nearly 6,000,000 volts. Dr. Donald Cooksey, University of California physicist, took the photograph.



GIANT ATOM MERRY-GO-ROUND

Here is the powerful cyclotron or atom gun used for record-making high voltage experiments at the University of California. Note the great 85-ton magnet. Prof. Ernest O. Lawrence, who invented the powerful apparatus, stands at the left. Dr. Donald Cooksey, scientist working with Prof. Lawrence, is at the right.

that amounted to the capture of a fundamental building block of matter that is known as the neutron. And radio-platinum disintegrates into gold.

The picture on the front cover shows the great activity caused by a neutron beam from the Lawrence giant atom gun or cyclotron at the University of California. This cloud chamber was photographed in 1/1000 second by Dr. F. N. D. Kurie. A multitude of hydrogen atoms are shown speeding after collision with neutrons, although the test chamber was a full six feet away from the giant machine. The photograph shows an effect equivalent to that which would be produced by one hundred grams of radium worth approximately $4,000,000.

Science News Letter, May 2, 1936

PHYSIOLOGY

Carbon Dioxide a Vital Need; Once Thought Mere Waste

CARBON dioxide, commonly looked upon as nothing but a "waste" product of bodily processes, is "almost as essential to the normal functioning of the body as is oxygen."

This challenge to a long-established tradition of biology was thrown down before the meeting of the American Philosophical Society in Philadelphia, by one of the world's leaders in research on respiration, Prof. Yandell Henderson of Yale University.

True, carbon dioxide is a waste product of respiration, just as it is of the burning of coal, oil or wood; most of it must therefore be got rid of. But it is an error to think that any considerable residue left in the body is a poison, Prof. Henderson contended. A certain amount is absolutely necessary, because carbon dioxide is "the normal stimulus to the circulation as well as to respiration."

Supporting evidence for Prof. Henderson's claim was found in troubles sometimes encountered with hospital patients going under anesthesia. Some patients breathe excessively in the early stages of anesthesia, and thereby decrease the carbon dioxide concentration of the blood. This condition, called acapnia, may result in failure of both circulation and respiration. This tendency to collapse is now counteracted and prevented by the inhalation of carbon dioxide, diluted with oxygen or with air. Also, at the end of the operation, inhalation of carbon dioxide is now the accepted means of speeding up the elimination of the anesthetic and preventing difficulties with the patient's lungs. The same means of stimulating breath and circulation is now used in resuscitating victims of carbon monoxide asphyxiation, and as a better substitute for the time-honored method of spanking newborn babies who fail to start breathing.

The American Philosophical Society, whose annual meeting Prof. Henderson thus inaugurated, is the oldest scientific body in the United States. It was founded in 1727 by Benjamin Franklin, in the days when "philosophy" was considered as embracing all natural knowledge, and hence, as properly including all the sciences. In keeping with this tradition, therefore, the three-day meeting in the Philosophical Society's building, immediately alongside Independence Hall, featured discussions of historical, economic and literary matters, as well as an impressive array of strictly scientific papers.

Science News Letter, May 2, 1936

MEDICINE

New Detection Method for Dangerous Radium Poisoning

THE unfortunate victims of often fatal radium poisoning can now be studied and a new treatment applied through use of a new radioactivity detection method that is 10 to 100 times as sensitive as the older and usual methods. Dr. Robley D. Evans, Massachusetts Institute of Technology physicist, told the National Academy of Sciences of his new way of finding out how much radium the poisoned persons are carrying around in their skeletons.

Persons who drink radium water nostrums, or who submit to injections of radium chloride, as well as girls and others working in factories with radium and similar substances, sometimes get the reactive substances into their systems. There, fixed in the bones, such substances slowly disintegrate into lead, giving off a radioactive gas called radon and bombarding the body with penetrating gamma radiation which is so harmful that the victim often dies.

Dr. Evans used a sensitive kind of radiation detector that was developed during the present push of physicists to discover all about radiations and the make-up of atoms. His new type of "screen-cathode quantum counter" for detecting radium's gamma rays discovered radium in one fatal case that had