

PHYSICS

# Extremely Powerful X-Rays Made With Speeding Electrons

Whirling With Velocity Close to That of Light,  
Electrons Are Far More Penetrating Than Is Radium

See Front Cover

**X**-RAYS, more powerful than would be given by the world's total supply of radium, have been produced at the General Electric Research Laboratory by 20-million volt electrons whirling with a velocity near to that of light, which is 186,000 miles a second.

The electrons were accelerated to their enormous speeds, more than double any previously obtained, by a new instrument of research devised by Dr. Donald W. Kerst of the University of Illinois, and called by him the rheotron.

At these high speeds, the electrons are far more penetrating than those of radium, and when they strike a target generate equally powerful X-rays. The volume of output exceeds that of 1,000

grams of radium, more than the world's supply.

Although resembling the cyclotron, the rheotron is much smaller for the same voltage and its action is quite different.

The cyclotron can only accelerate heavy-weight atomic particles, at least 1,800 times heavier than the electron. This it does by giving the particle a push at each half revolution, or each half cycle of the alternating current.

In the rheotron, the entire acceleration of the electron takes place during a quarter cycle, less than a two-thousandth of a second, in which brief time the electron makes 400,000 revolutions and travels some two hundred miles.

The electrons from a hot filament are whirled in a doughnut-shaped glass tube

from which the air has been exhausted. The tube fits between the poles of an electromagnet which is supplied with an alternating current. They are speeded up while the strength of the magnetic field is increasing.

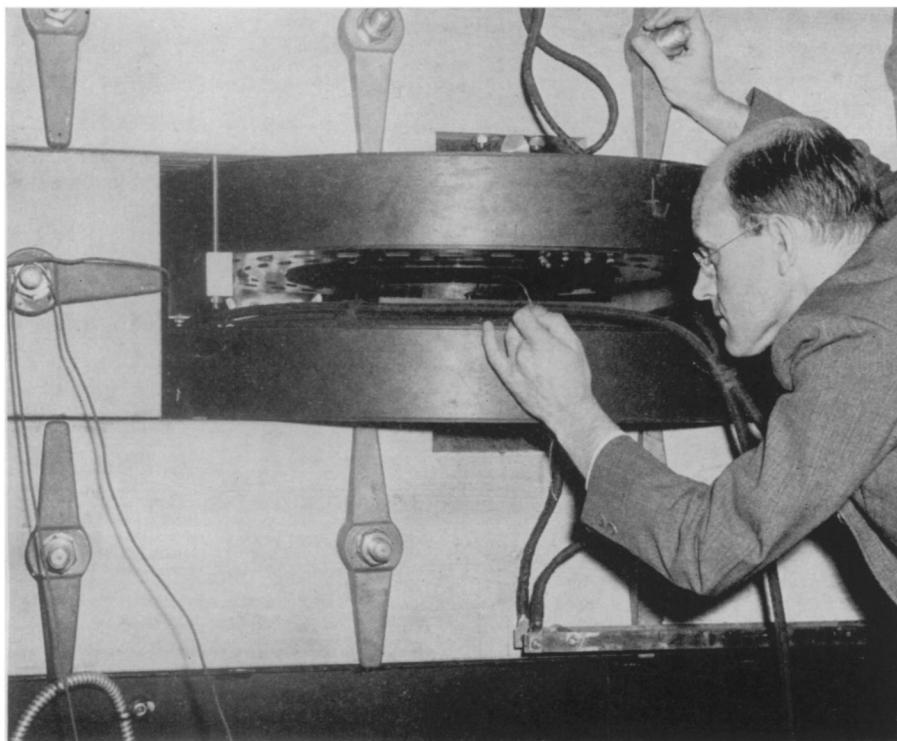
The present 20,000-000-volt rheotron is patterned after a smaller table-size machine of 2,300,000 volts built by Dr. Kerst at the University of Illinois. Last year he obtained leave from the University to work with the General Electric Company on the present machine.

Work has already started on a still larger machine that will whirl electrons up to an energy of 100,000,000 volts.

There is no evident limit to the energy that can be imparted to an electron by this method, Dr. Kerst declares. It has the advantage that the electron is continuously accelerated while the magnetic field is increasing, and is kept within a comparatively small orbit which it goes around many times. Previous electron accelerators, whether linear or spiral, which boosted the speed in steps like the cyclotron, soon reached a limit because of the enormous size of the apparatus required—many times larger than a cyclotron of the same energy.

The new method is expected to be of enormous value in further atom smashing experiments. It may put at the disposal of the physicist man-made radiation almost as powerful as the cosmic rays.

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## RHEOTRON

*It is in this instrument that the electrons are accelerated to enormous speeds, more than double those previously attained. Adjusting the apparatus is W. F. Westendorp, of the General Electric Research Laboratory. Shown on the front cover with the doughnut-shaped vacuum tube from the rheotron is Dr. Donald W. Kerst, of the University of Illinois, who developed the rheotron.*

ZOOLOGY

## National Zoological Park Takes Raid Precautions

**P**RECAUTIONS against the off chance of an air raid have been taken at the National Zoological Park. In addition to the usual instructions on what to do to prevent fire from spreading, rifles have been placed in certain of the animal houses for use in case the more formidable specimens should be accidentally released from their cages and prove impossible to round up. Zoo attendants are cautioned not to remove these weapons, unless they should be needed for combating parachute troops.

Poisonous reptiles have not been killed, as they were in European zoological parks at the beginning of the war. The reason is, that if even cobras or rattlesnakes were to get out, the chill winter air would numb them in a short time. Only in case a poisonous reptile gets loose and remains within the reptile house, where it is warm, is it considered necessary to kill it.

*Science News Letter, December 27, 1941*