



#### TO BATTLE CANCER

*The outlet tubes of this giant X-ray machine, directed at the patients, permit only a narrow beam of X-rays to strike them at the proper places for the therapy.*

PHYSICS

## New 1,200,000-Volt X-Ray Machine Aids Cancer Fight

**N**EWEST aid of science in the fight on cancer was revealed as the giant 1,200,000-volt X-ray machine of Columbia University's Institute for Cancer Research. Dr. Francis Carter Wood, widely known cancer specialist and director of the Institute, exhibited the apparatus which took two years to construct.

Uniqueness of the new development, which makes it an improvement over previous apparatus having a comparable voltage, is that it is completely housed in a large steel tank which is continuously evacuated. Both the voltage generating circuits and the X-ray tube are thus shielded from any possible accidental contact. Patients are protected, in addition, by four inches of lead which permits only a narrow beam of X-rays to strike them at the proper places for X-ray therapy.

Five outlet openings for the rays are provided: four for patients and one reserved for research purposes. Cost of the apparatus was \$25,000.

The pressing search of science for improved ways of splitting the atom and studying its intricate nucleus is directly responsible for the new Columbia X-ray

machine. Back in 1934 Dr. D. H. Sloan at the University of California developed a similar apparatus for accelerating charged particles in atomic bombardment experiments.

It was found, shortly, that by a simple change of only one essential part of the apparatus it was possible to make a highly compact and efficient X-ray machine of high voltage. Such an apparatus was built for the University of California Medical School and the present Columbia equipment is copied and improved in design over this prior equipment.

In operation the new type X-ray machine utilizes 15,000 volts of alternating current electricity and applies this to twin radio oscillator tubes generating radio waves 50 meters in length, in the shielding tank. The electrical circuit of these tubes is so designed that when resonance is obtained more than 200,000 watts of electrical power flows in the hollow copper tubes of the equipment. Swift-flowing streams of water help dissipate the great heat generated.

Eight hundred thousand volts potential have been obtained in Dr. Sloan's

original apparatus and the Columbia equipment has already been operated at 1,200,000 volts. Upper potential limit of the design is limited only by the effectiveness of cooling the enclosed apparatus. Potential 5,000,000 volts could be obtained with existing oscillator radio tubes if there were any way of cooling the apparatus and making it work without burning up.

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PHYSICS

## Relativity and Quantum Theories Are Harmonized

**A**LTHOUGH they may not understand the exact research being done, most laymen have a rough idea of what an experimental physicist does in his experiments; how he sets up controlled conditions and then takes measurements with great patience and much ingenuity.

Less clear, perhaps, are the doings of the theoretical physicists who use only paper and pencil and the rules of mathematics as found in scientific literature or stored in their head. The layman may well ask: "What do famous men like Einstein, Eddington, Dirac or De Broglie think about? What problems are they studying? And why are they interested in them?"

The new book "Relativity Theory of Protons and Electrons" (Macmillan) by Sir Arthur Eddington gives a partial answer to these questions. Sir Arthur may be best known throughout the world for his popular books on science but the reading public who devoured Eddington's "Nature of the Physical World" will be disappointed if they expect something similar in his new volume.

Here Sir Arthur writes strictly for his fellow scientists and rounds up his thinking on some means of harmonizing two great physical theories—Relativity theory with its wide usefulness in the scale of larger things, and Quantum theory which works with equal success in the tiny world within the atom. Relativity treats matter as continuous while quantum theory breaks things up into discontinuous units and handles them accordingly.

The hitch has been that quantum theory, as a younger upstart, has been surprisingly successful in getting along without relativity. Cause and effect and rigid determinism was the basis of older thinking. An indeterminate "looseness" in the relationships of physical science is the fundamental concept of the new