PHYSICS

Scientist Directs Huge Magnet In Attack to Smash Atom

SMASHING the atom is a favorite laboratory occupation these days, when physicists are energetically attacking the hearts of atoms to discover their secrets. The intentional disintegration of atoms is not a new achievement in science, for Lord Ernest Rutherford knocked H out of light chemical elements in 1919. The H in this case stands for the element hydrogen. Rutherford used fast-flying helium atom hearts, called alpha particles, for his bombarding projectiles. These came from naturally disintegrating radioactive substances, like radium.

The projectiles emitted from the atom in Rutherford's early smashing were the hearts of hydrogen atoms, called protons, which carry most of the mass of the atom. Protons in their turn are now being used as bullets with which to bombard other elements.

Artificial Radioactivity

In Cambridge's famous Cavendish Laboratory, which is presided over by Lord Rutherford, J. D. Cockcroft and E. T. S. Walton, gave protons a push of 125,000 and more electron-volts and aimed them at lithium metal. Some of the atomic nuclei were disrupted. A lithium heart, weight seven, combined with a proton, weight one, to give two alpha particles or helium nuclei, each of weight four.

More exciting was the discovery that the smashing of the lithium heart starts a sort of explosion within the atom which causes it to give off more energy than is fired into it. This is artificial radioactivity. The physicists can write a balance sheet or formula for the reaction and this is an important step in the chemistry of the interior of the atomic nucleus. It promises to lead to more accurate knowledge and theory of how the stars are stoked and how matter can be changed into energy.

Whirls Protons

Prof. E. O. Lawrence of the University of California has a unique method of whirling protons in magnetic fields until they acquire high energies. He can produce atomic particles with an energy of 3,600,000 electron volts. The apparatus that is used contains one of the world's largest electromagnets.

With these atom smashing machines working at a fraction of their abilities, Prof. Lawrence has confirmed the Cavendish Laboratory work on lithium.

Nature provides atomic bullets with energy far exceeding those that can be energized in the laboratory. These are the cosmic rays themselves or the particles that fly off when cosmic radiation smashes into earthly gases and solids. With the use of such projectiles at the California Institute of Technology, the existence of a positive particle of as little mass as an ordinary electron seems to have been demonstrated within the last month. (*SNL, Sept.* 24, 1932, *p.* 197; *Oct.* 8, *p.* 223) This positive electron promises to do its constructive smashing of present atomic theory.

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ENGINEERING

Life Expectancies For Machinery Worked Out

AFTER MORE than fifteen years of research, scientists connected with the Iowa Engineering Experiment Station have succeeded in establishing mathematical laws describing the mortality data for many kinds of physical property, according to Prof. Edwin B. Kurtz, head of the department of electrical engineering at the University of Iowa, and Robley Winfrey, editor on the Experiment Station staff. Assisted by Prof. G. W. Snedecor and Prof. A. E. Brandt of the department of mathematics at the Iowa State College of Agriculture and Mechanic Arts, these men have announced results of research on life characteristics of physical property which will permit engineering valuations and depreciation allowances for some industrial equipment to be made with accuracy hitherto unattainable.

Just as life insurance actuaries make mass studies of human mortality records, so are the cooperating Iowa professors making mass studies of the service lives of such physical equipment as passenger automobiles, waterworks pumps, incandescent lamps, crossties, disc harrows, and freight cars.

Among the records studied by Prof. Kurtz and his fellows in their investigations of machine mortality are data extracted from public utility valuation reports, publications of such organizations as the American Waterworks Association, the Illuminating Engineers' Society, and the Forest Products Laboratories, and reports of the North German and Prussian telegraph systems as far back as 1852.

Mathematical equations descriptive of thirteen type mortality curves have been obtained for sixty-five separate property groups in such industries as water supply, telephone and telegraph, electric service, steam and electric railway, motor vehicle, and agricultural implement. These mortality studies are not restricted to "death" rates alone in the service lives of the equipment units involved.

Such tables as the Iowa professors have prepared could be employed in the determination of proper premium rates for "life" insurance policies on the effective working lives of industrial equipment of all kinds, under methods altogether comparable to those used by human-life insurance companies. However, it is to engineering and business planning rather than to "life" insurance that the investigations of Prof. Kurtz and his colleagues will chiefly contribute. The equations, graphs, and tables resulting from their mortality studies will give cost accountants more accurate estimates of depreciation than have previously been possible.

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