PHYSICS

Future Atom Smashers

Develop new theory on how to build giant particle accelerators that could deliver atomic "bullets" with energies of 100-billion electron volts.

➤ PARTICLE ACCELERATORS of the future may deliver atomic "bullets" with energies of 100-billion electron volts or more than 30 times greater than those from machines now being built. Much less massive than today's accelerators, they would possibly be built in underground tunnels to protect personnel from deadly high-energy radiation.

A new theory on how to build the machines used to probe the mysterious center of the atom has been developed by scientists at the Brookhaven National Laboratory, Upton, N. Y. Using it, scientists could focus the flying atomic particles into a much narrower beam than is now possible.

Comparatively small magnet sections, rather than the four large quadrants now common, would do the focusing. They would act somewhat like the concave-convex mirror systems used to focus light beams.

One short section of magnet would keep the proton beam on the track vertically, although during the time it was passing through such a section it would spread out radially. The next short magnet section would keep the proton beam on the track radially, although it would then stray up and down. After passing through 480 of such sections for the 100-billion volt machine, scientists would have a finely-focused particle beam.

In each case, the spreading out is more than compensated for by the focusing.

The tube, or "racetrack," of the future accelerator would have a relatively small cross-section. The smaller the dimensions of the tube, the less massive the electromagnet required to guide the particles in their path.

The physicists calculate that a 30-billion volt machine would require a magnet comparable in weight to the 2,200-ton magnet of the cosmotron, which is designed to produce three-billion-volt particles.

The cosmotron magnet units have a cross-section of eight by eight feet, as compared to dimensions of one and a half by two feet for the future machine. However, the diameter of the 30-billion-volt machine—that is the space required for the "racetrack" to be laid out—would be 10 times that of the 60-foot diameter of the cosmotron, and the system of building up the speed of the particles would be more complex.

The same methods could, moreover, be applied to a 100-billion-volt machine, with magnet units having about the same cross-section, and a total weight of 3,600 tons for the 480 units. Its diameter would be 2,060 feet, or nearly half a mile.

Although there are at present no plans for building such a machine, the theory and its possible application are described in two papers expected to be published in *The Physical Review* in December. They are written by Drs. Stanley Livingston of Massachusetts Institute of Technology, Ernest D. Courant, Hartland S. Snyder and John W. Blewett of Brookhaven.

The new focusing theory is based on knowledge gained in operation of the cosmotron, which on May 20, 1952, yielded the first billion-volt atomic particles ever produced by man. (See SNL, May 31, p. 341.) Such particles begin to rival in energy the fragments of atomic nuclei found in cosmic rays as they crash into the outer atmosphere of the earth.

By studying the products of such bombardments, scientists can learn new facts about the mysterious forces that hold the particles in the nucleus together. The greater the energy of the bombarding particle, the greater is the fragmentation of the target nuclei; hence the advantage in accelerating particles to higher and higher energies.

By using multi-billion-volt particles as "bullets," it is possible to penetrate the neutrons and protons that are the fundamental building blocks of the nucleus, to transmute one type of particle into another, to change energy into nuclear particles and to reveal new fundamental properties of matter.

Science News Letter, September 27, 1952

TECHNOLOGY

Turbine to Establish Temperature Record

➤ A STEAM-DRIVEN turbine that will drive a 145,000-kilowatt generator is being built in Schenectady, N. Y., to operate at record steam temperatures.

The new turbine will have steam at 1,100 degrees Fahrenheit pushing against its shiny new blades with a force of about 2,350 pounds per square inch. The steam will be generated in a boiler capable of burning coal, gas or oil.

High temperatures and pressures are attractive to electric utilities because these conditions give the companies more for their money. High temperatures create high-pressure steam that can be run through a turbine several times. The higher the boiler steam pressure is, the more often the steam can be reused.

Glenn B. Warren of General Electric's turbine division said the unit now under construction is the first of two scheduled for the Kearny plant of the Public Service Electric and Gas Co. of Newark, N. J.

Science News Letter, September 27, 1952

HIGHEST STEAM TEMPERATURE—This generator rotor will be turned by a turbine that operates with the highest steam temperatures ever used for this purpose. Thirty-two feet long and weighing 100,000 pounds, General Electric reports it will operate at 1,100 degrees Fahrenheit.