PHYSICS-ENGINEERING

Future Atomic Jobs

The manufacture of special isotopes for future technical developments will be the main use of atomic power plants, Prof. W. G. Pollard declares.

➤ JOBS FOR FUTURE atomic power plants and the conditions for operation of such units were forecast by Prof. W. G. Pollard of Tennessee University's Department of Physics for members of the American Society of Mechanical Engineers meeting in Chattanooga, Tenn.

In addition to atomic energy as a source of power, comparable to any other fuel, the unique products of fission reactions will be a reason for operation of such installations, according to Prof. Pollard. Plants for the production of various isotopes will be required.

"The isotope is as important in a nuclear reaction," says the Tennessee physicist, "as the molecule is in a chemical reaction. A variety of special isotopes will be required for future technical developments and these will require special plants for their production.

"Such plants require unit operations unfamiliar to present engineering practice. They may be based on thermal diffusion columns, gas diffusion through barriers, mass selection of ions in a magnetic field, ultracentrifuges, or special chemical exchange reactions. The engineering of such plants may be expected to be an important new field for oncoming engineers."

In regard to the future of atomic energy, Prof. Pollard discusses two sorts of nuclear reactions. In the first sort both reacting nuclei contain one or more protons. In the second neutrons take part. The first kind of reaction would take place if we could bring together atoms of some of the light elements closely enough to allow their nuclear forces to act.

Hydrogen would react with lithium, under these circumstances, and give out energy of the order of 30 million kilowatt hours per pound of lithium burned, or nitrogen could be reacted with heavy hydrogen to release eleven and a half million kilowatt hours per pound of nitrogen. Neglecting considerations of thermal efficiency, any of these reactions could be used to operate a 50,000 kilowatt power plant on a continuous basis with a fuel consumption of about a pound per week.

"Not only is this perfectly possible," goes on Prof. Pollard, "but a vast number of power plants of this type are at present in continuous operation throughout the universe. These are the familiar stars, including our own sun."

Enormous central temperatures and enormous pressures in the stars hold together these light nuclei so that the reactions which we observe can take place. Such temperatures and pressures are impossible on earth. In the other sort of reaction, resulting from action of neutrons, which has been made to work here on earth for production of the atomic bomb, the difficulty is that neutrons do not exist as such in nature.

"With the exception of a negligible number in cosmic rays," says Prof. Pollard, "they are all to be found captured in atomic nuclei from which they can be removed only with the expenditure of considerable energy. Thus we are faced with a difficult dilemma. Materials for the first class of reactions are abundant but the conditions to make them go are prohibitive. For the second class the conditions of operation are ideal for a practical atomic power plant, but the essential material for them is non-existent as a natural substance."

"The one reaction capable of maintaining a sustained source of neutrons," says Prof. Pollard, "is the fission reaction. In a light nucleus the repulsion between the protons due to their electric charge, although very strong by molecular standards, is yet only a negligible part of the intense nuclear forces binding the particles together.

"In a heavy nucleus near the top of the periodic table there are, however, so many protons that their repulsion becomes comparable to the nuclear cohesive force. As a result a relatively small disturbance of the nucleus can upset the equilibrium so that the nucleus divides into two pieces which are quickly pushed beyond the range of the nuclear forces.

"Under the great force of repulsion between the large positive charge on each, the two fragments then fly apart with enormous kinetic energies. The heat generated in slowing down and stopping them is the major source of energy in a uranium power plant."

Science News Letter, April 13, 1946

RESISTS ACIDS—From a boiling bath of hot sulfuric acid, a laboratory technician lifts two rods of plastic. One has charred and deteriorated. The other, made of Du Pont's new "Teflon" tetrafluoroethylene resin, is not affected at all by the highly corrosive acid. "Teflon" is not attacked even by aqua regia, which dissolves gold and platinum.

SEISMOLOGY

Tidal Wave Caused by Quake off Unimak Island

➤ THE SUBMARINE earthquake that set the destructive tidal wave in motion across the Pacific on Monday, April 1, had its epicenter about 70 miles south of Unimak island, which is the first and largest of the Aleutians, just off the tip of the Alaskan peninsula. Seismologists of the U. S. Coast and Geodetic Survey, who made the determination after studying data wired and radioed to Science Service from seven observatories, gave the geographical coordinates of the spot as latitude 53.5 degrees north, longitude 164 degrees west.

There were three main shocks, all severe. The first and strongest recorded its time of initiation on the instruments as 7:28.8 a.m., EST, which is the equivalent of 1:58.8 on Unimak island—which happens also to be Hawaiian time. The second shock came five hours later, and the third followed 11 hours after the second.

The sea bottom has a very curious formation at the point where the earthquake occurred, the Coast and Geodetic

Survey scientists said. It is about 100 fathoms (600 feet) deep there, but begins to slope downward very steeply, reaching a depth of 1,000 fathoms (6,000 feet) within 15 or 20 miles. Earthquakes have been frequent in this general region, but nothing of major importance has been recorded from this particular locality.

The shock was undoubtedly a "world-shaker," for the instruments in the seismological observatory at far-off Wellington, New Zealand, recorded it. Other stations reporting were the Dominion Observatory at Ottawa, Canada; the observatories of the Jesuit Seismological Association at Georgetown University and Weston College in Massachusetts, and the stations of the U. S. Coast and Geodetic Survey at College and Sitka, Alaska, and Tucson, Ariz.

Science News Letter, April 13, 1946

ENGINEERING

Atomic Heat Problem

Thousands of millions of degrees Fahrenheit temperature are reached by individual atoms, but resulting fluid can be handled by already familiar processes.

➤ ENGINEERS faced with new problems in the utilization of heat from atomic power plants will at least have as a starting point the familiar conditions of heat exchange, it appears from a paper given before the American Society of Mechanical Engineers, by Prof. W. G. Pollard of the department of physics of the University of Tennessee.

Thousands of millions of degrees Fahrenheit temperature are reached by the individual atoms of fission products in an operating atomic pile. But after these have been brought into equilibrium with the coolant, the resulting fluid, heated in the process, can be handled in boilers designed for steam or mercury vapor in processes already familiar.

The problem of bringing the intensely hot particles into equilibrium with the coolant is not unlike mixing one's bath water. The user of atomic energy can, within practical limits, choose the temperature of the resulting mixture, for the fission fragments are at so high a temperature that any man-made temperature will still be cool by comparison.

This intense heating results from collision of atomic particles. The fission fragments are stopped, for the most part, in the metal rod where they are produced. This results, says Prof. Pollard, in an intense heating of the rod, so that arrangements must be made for efficient heat transfer from the rods to the coolant, which is air, water or molten bismuth flowing through the pile where fission is carried on.

"It is possible," says Prof. Pollard, "to heat the coolant to any desired temperature because the fission fragments are liberated in the metal at a temperature of many million degrees Fahrenheit. The hot coolant will be radioactive on leaving the pile but it can be passed through a boiler or heat exchanger to produce steam or mercury vapor at high pressure and then returned to the pile."

Another important aspect of pile design and operation outlined by Prof. Pollard involves protection against radioactivity. Throughout the body of the rods of fissionable material in a going pile small amounts of elements like barium, krypton, iodine, yttrium, etc., are being generated. After coming to thermal equilibrium and collecting some electrons to complete their transmutations, these new elements undergo a whole series of radioactive disintegrations, like radium, before reaching stable forms. Gamma rays given off in this process must be absorbed by the thick screens which must always surround the pile, and this absorption again creates heat and the necessity for cooling.

"The fast fission neutrons," says Prof. Pollard, "are produced at a steady rate in the metal at a temperature of some 10,000,000,000 degrees Fahrenheit. They represent a very dilute but very hot gas which diffuses out into the moderator where it is cooled down by mixing to the temperature of the moderator. As a cool gas it diffuses back into the metal where it can produce more fissions. This represents a true convective heat transfer." The problems of nuclear reactions, the energies involved and the problems of handling radiations are well known in physics, says Prof. Pollard, but have not been generally included in engineering training.

Science News Letter, April 13, 1946

Crab grass, the lawn pest, is an annual and prolific seeder; one plant may produce as many as 300,000 seeds.

HORTICULTURE

Garden Favorites Include Tomatoes, Beans

➤ IF YOU HAVE a garden, you will probably plant several of the following, depending upon the size of the plot you plan to cultivate: tomatoes, string or wax beans, onions, lettuce, radishes, beets and carrots. Each of these seven vegetables were grown in more than half of the 1945 Victory Gardens, a survey conducted by the Bureau of Agricultural Economics shows.

Science News Letter, April 13, 1946

American *eels* are confined to the Atlantic and Gulf coasts and streams.

SCIENCE NEWS LETTER

Vol. 49 APRIL 13, 1946 *No. 15*

The weekly summary of Current Science, published every Saturday by SCIENCE SERVICE, Inc., 1719 N St. N. W., Washington 6, D. C. NOrth 2255. Edited by WATSON DAVIS.

Subscriptions—$5.00 a year; two years $8.00; 15 cents a copy. Back numbers more than six months old, if still available, 25 cents.

Entered as second class matter at the post office at Washington, D. C., under the Act of March 3, 1879. Established in mimeographed form March 18, 1922. Title registered as trademark, U. S. and Canadian Patent Offices. Indexed in Readers' Guide to Periodical Literature, Abridged Guide, and the Engineering Index.

The New York Museum of Science and Industry has elected SCIENCE NEWS LETTER as its official publication to be received by its members.

Member Audit Bureau of Circulation. Advertising Representatives: Howland and Howland, Inc., 393 7th Ave., N.Y.C., PEnnsylvania 6-5566 and 360 N. Michigan Ave., Chicago STAte 4439.