PHYSICS

H-Bomb Power Plant

Design for thermonuclear power plant proposed by physicist. One plant would furnish more power than entire United States output in 1954.

➤ A DESIGN for a thermonuclear, or H-bomb, power plant has been proposed by Dr. Hsue-Shen Tsien of the California Institute of Technology's Daniel and Florence Guggenheim Jet Propulsion Center, Pasadena, Calif.

Successful development of an H-bomb power plant might make one pound of water equivalent to 60 pounds of coal as an energy source.

Dr. Tsien calculates that one thermonuclear power plant, even of small size, would produce more than five times the electric energy put out in the United States in 1954, or 2,710,000,000,000 kilowatt hours compared to 500,000,000,000 kilowatt hours.

The nuclear reaction chamber proposed by Dr. Tsien would be 328 feet in diameter and 3,280 feet long. The gaseous mixture of hydrogen, deuterium and tritium, which burns in the chamber to produce energy, would be at a pressure of 100 atmospheres, one atmosphere being the pressure of air at sea level, about 14.7 pounds a square inch.

The flame would be a little less than 200 feet in diameter and 400 feet long.

Commenting on Dr. Tsien's proposal, Dr. Jesse L. Greenstein, an astrophysicist at Mt. Wilson and Palomar Observatories, states he believes further steps than those suggested by Dr. Tsien would be needed to contain the reaction to a small volume of the chamber.

"New technical methods are required for isolating a hot gas volume," Dr. Greenstein concludes.

To cool the chamber walls so they would not evaporate at the reaction temperature of 160,000,000 degrees, Dr. Tsien suggests "transpiration cooling." The wall would be made of porous material, such as porous carbon or graphite, and cold deuterium gas would be forced by pressure through the wall into the reaction chamber, where it picks up heat and returns the heat to the reaction chamber.

By using a large enough quantity of coolant gas, he says, the walls can be kept at the desired low temperature of about 2,000 degrees absolute.

Hot gas discharged from the chamber at high pressure could be used to generate power through a gas turbine. It would be only weakly radioactive and would not present difficulties to the power generating machinery.

Exhaust from the chamber, after being cooled by a heat exchanger, would be processed to remove the nuclear "ash," or helium formed in the nuclear flame. The purified gas would contain mainly deuterium, with small amounts of hydrogen and tritium.

After adding enough deuterium to make up for that burned, the gas would be compressed to high pressure and fed through the porous wall back to the reaction chamber, completing the cycle.

Thus, Dr. Tsien states, "the reaction chamber effectively converts deuterons to helium," producing a high energy yield per pound of deuterium burned.

To start the reaction would require a temperature of about 10,000,000 degrees absolute, so high it seemed unobtainable before fission and atomic bombs were discovered. It may be possible, Dr. Tsien suggests in a report to the American Rocket Society's journal, *Jet Propulsion* (July), to ignite the nuclear flame without using the fission reaction.

Shock waves produced by suddenly releasing a gas at high pressure into one at low pressure have been proposed as one method of obtaining the necessary temperatures, as have electric sparks.

Dr. Tsien's calculations are based on published scientific information, including a 1938 paper by Dr. G. Gamow, now at George Washington University, Washington, D. C., and Dr. E. Teller of the University of California, Berkeley. Dr. Greenstein refers to information on thermonuclear reactions published in 1939 by Dr. Hans A. Bethe of Cornell University, Ithaca, N. Y.

Science News Letter, August 11, 1956

TECHNOLOGY

Improved Wools Being Developed

➤ SCIENTISTS are developing new varieties of wool that will combine all the most desirable qualities of present day treated wools with other advantages.

Wool that will retain pleats and creases, that will resist moths and microorganisms and at the same time not shrink, and that will withstand caustic dyes are among the goals of U. S. Department of Agriculture scientists reported in *Agricultural Research* (Aug.).

Present wool treatments usually accomplish one aim at the expense of others. No single wool has been developed that will do all the things scientists want it to do.

Besides combining many desirable features, scientists are trying to:

Make wool softer to permit easier felting in heavy fabrics.

Make wool more dirt-resistant.

Improve bleaching methods.

Prevent discoloration from storage, perspiration and exposure to light.

They are studying the structure of wool fiber, down to the tiny, thread-like molecules that constitute its heart. They are learning what keeps these threads together and how they react to various chemicals. They have found, for example, that propiolactone softens the fibers.

They have invented a machine, a rustleometer, that can "hear" the "feel" of wool fabrics. The device tells the texture of wool by the sound the fabrics make rubbing together. Scientists hope a refined model of this instrument will give exact physical measurements of the way wool handles.

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