PHYSICS

Control H-Bomb Reaction

British and American scientists report success in the first steps preliminary to producing what will one day result in peaceful power from thermonuclear reactions.

See Front Cover

➤ FIERY HYDROGEN bomb reactions have been controlled momentarily at temperatures up to 6,000,000 degrees centigrade in laboratories in the U. S. and England, the atomic energy agency of each country has reported.

This does not mean peaceful power from taming thermonuclear reactions is going to be available soon. It does mean scientists in both countries, and presumably Russia as well, are on the right track in their efforts to harness H-bomb forces, but several years of research are needed before the many remaining problems will be solved. (See page 70.)

Key to the progress announced is the production of thermonuclear neutrons, fundamental nuclear particles also produced when uranium and other atoms fission, or split.

Obtaining these neutrons in a plasma of deuterium gas, even though only for thousandths or millionths of a second, brings mankind a step closer to having limitless power, using the world's oceans as a deuterium source.

The achievement is reported in several scientific papers by both U. S. and British scientists in *Nature* (Jan. 25).

The few millionths of a second during which the thermonuclear neutrons are generated by U. S. scientists is an "appreciable length of time" in this field. Dr. Arthur E. Ruark, chief of the Atomic Energy Commission's controlled thermonuclear branch, has said in explaining the U. S. research.

He cautioned, however, that the research was not yet at a point comparable to the start-up of the first fission reactor in December, 1942.

Much longer containment and temperatures on the order of a hundred million degrees would be required for a power-producing thermonuclear reactor.

In both the British and U. S. experiments, large numbers of neutrons have been produced. The difficult and delicate test is to make sure these neutrons result from thermonuclear reactions. They could be "false" neutrons resulting from collisions with the container's walls or from other unwanted effects.

Dr. Ruark said results to date "encourage" the belief that the undesirable "false" neutrons are not generated in such large quantities as to spoil the desired reactions. Definite proof the neutrons result from thermonuclear reactions is being sought in both countries.

With more powerful and somewhat larger apparatus, he predicted, the present hopeful results "will be exceeded."

The British research was conducted by the United Kingdom's Atomic Energy Authority at its Harwell facility. Their most promising results were obtained with ZETA, for Zero-Energy Thermonuclear Assembly, which started operation last August.

The photograph on the cover of this week's SCIENCE NEWS LETTER is a diagram of ZETA with a cut-away view of the torus and, on the right, the transformer. The white strip in the center of the torus is the hot plasma or hot gas being pinched by the current of electricity.

With ZETA, temperatures of two to five million degrees centigrade were generated and the hot gas was isolated from the container's walls for periods of two- to five-thousandths of a second. The heating process was repeated every ten seconds.

For useful power output, the hot deuterium gas must be kept from touching the walls for much longer times, probably several seconds.

The number of neutrons produced by each pulse of energy in the ZETA apparatus was roughly double that expected from a thermonuclear reaction at the measured temperatures. Some yet unknown process must be the reason, Dr. Lyman Spitzer Jr., director of Princeton University Observatory, concluded after a careful analysis.

U. S. scientists are now working on developing a machine similar to ZETA, but somewhat larger, called the "Model-C Stellerator." Until recently the time schedule for the machine's installation at Princeton University indicated it would be mid-1960 before the stellerator would go into operation. Now, the $23,000,000 machine is expected to be operating in early 1960.

Scientists associated with the development of the stellerator have "great expectations of it," hoping to achieve temperatures as high as 50,000,000 degrees centigrade with it.

Work on pinched discharges in heavy hydrogen, or deuterium, is now going on in a number of countries. These efforts are inspired by the hope that the gas can be made hot enough, and be confined long enough by its own magnetic field to yield thermonuclear power.

When the gas is fairly dense and very hot, the nuclei, the deuterons, will collide violently and repeatedly. Scientists emphasize the key is "repeatedly." For the last 25 years, scientists have fused deuterons in suitable accelerators.

The joint fusion announcement resulted from a desire on the part of AEC Chairman Lewis L. Strauss and Sir Edwin Plowden, chairman of the United Kingdom Atomic Energy Authority, to correct what they labeled "misinterpretations" about the status of progress in both countries.

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ISOLATING REACTION — An organic chemist at Lederle Laboratories Division, American Cyanamid Company, completes a reaction in the isolation of Aristocort triamcinolone.

PHARMACOLOGY

New Arthritis Drug Announced

➤ A NEW STEROID drug for treating arthritis, called Aristocort triamcinolone, has been announced by the Lederle Laboratories Division of American Cynamid Company, Pearl River, N. Y.

Steroids are substances secreted by the adrenal glands and are useful in reducing the painful swelling and inflammation of joints found in arthritis and allied diseases.

The drug is chemically related to four other well-known arthritis drugs, cortisone, hydrocortisone, prednisone and prednisolone, and is reported to create fewer side effects than the older drugs.

Human trials in over 800 arthritic patients have shown the new steroid does not cause sodium and water retention and the loss of potassium.

These side effects had been a problem with cortisone and to a lesser degree with the other steroids.

Persons who could not receive ordinary steroid therapy because of water retention, high blood pressure or overweight have responded to Aristocort treatment without these side reactions, the company said.

Cortisone was first synthesized in 1948 and is one of the 28 steroids secreted by the adrenal glands. It proved extremely valuable for reducing arthritic swelling and pain but in some people caused peptic ulcers, bone softening and other effects. The newer steroids were then synthesized and each has had the desirable anti-inflammatory effects but with milder side reactions.

Aristocort is not a cure for arthritis or asthma, the company said, but it does promise to make steroid therapy available to many more patients.

Science News Letter, February 1, 1958