PHYSICS

Fusion Control Near

A "magnetic bottle" that uses interlocking fields of magnetic force to confine hot hydrogen plasma will help speed harnessing of the hydrogen bomb.

See Front Cover

➤ AN IMPORTANT STEP toward solution of a fundamental problem that has plagued scientists for years in their efforts to bring about a controlled fusion, or thermonuclear reaction, has been achieved with a new type of "magnetic bottle" using interlocking multipole fields of magnetic force to contain hot hydrogen plasma (ionized gas). It was developed by Dr. Tihiro Ohkawa of General Dynamics Corporation's General Atomic Division, San Diego, Calif.

The fusion reaction is achieved in an uncontrolled manner in the hydrogen bomb.

A prototype of the new-concept "bottle," based on multipole cusped geometry and the inherent stability of convex magnetic fields, recently was placed in experimental use in the controlled fusion research program jointly sponsored by General Atomic and the Texas Atomic Energy Research Foundation. The Foundation is composed of ten investor-owned electric utility companies in Texas.

The new experiments demonstrated that relatively hot plasma injected into the multipole device through an unstable magnetic field, which is concave to the plasma on the entry side, will not escape through the magnetic field forming the opposite wall of the "bottle." The opposite magnetic field, being convex to the plasma, has a stability that bounces back toward the center of the confinement area.

The multipole concept was developed by Dr. Ohkawa and Dr. Donald W. Kerst at General Atomic's fusion laboratories. Dr. Kerst is now professor of physics at the University of Wisconsin where he is continuing work in plasma physics.

The photograph on this week's front cover shows plasma being contained by convex lines of magnetic force in the new multipole device. Brightest region is plasma being injected into the magnetic field. The dark circular areas are current-carrying rods that produce the magnetic fields.

Scientists in laboratories around the world, in their efforts to reproduce on earth the energy-making process of the sun and stars, have been trying to devise a stable and leakproof "magnetic bottle" in which plasma can be brought to fusion ignition temperatures on the order of 400-million degrees centigrade.

The ultimate goal is the generation of electricity in fusion power plants which would be fueled with deuterium (heavy hydrogen) taken from the oceans and rivers, thereby assuring the world of abundant supplies of energy for millions of years to come.

Any container made of solid material would be vaporized in an instant at the required thermonuclear temperatures.

• Science News Letter, 86:311 November 14, 1964

IIT Research Institute

DISAPPEARING CARTRIDGES—The first fully combustible gun cartridges have been supplied by IIT Research Institute, under a contract with the U.S. Army Materiel Command. William Abel, associate engineer at IIT, removes the case from the felting die for the 152 mm weapon.

PHYSICS

New 3-D Photos Permit A Peek Behind Objects

➤ IF SOME OBJECT in a newly developed kind of three-dimensional photograph is blocking your view, just move your head a bit and look around it.

No lenses are used to produce the pictures, which are made by the light of a gas laser beam. The beam, which first passes through a diffusing screen, is then reflected, partly from a mirror and partly from the object to be photographed, onto a piece of photographic film.

The light beam from the mirror mixes with the beam from the object, resulting in phase variations between the beams, which appear as light and dark spots on the film. This produces what is called a diffraction patterns.

The result is a transparency on a photographic film viewed by shining a laser beam through it from behind. When a person looks at the finished picture, it appears as though the object were behind the film. Several three-dimensional images can be stored on one piece of film, because diffraction patterns, the images on the film, do not interfere with each other the way real images do in a double exposure. To see each of the three-dimensional images one need only view the transparency from different angles.

The technique, developed by Emmet N. Leith and Juris Upatnieks of the University of Michigan, Ann Arbor, was reported in the Journal of the Optical Society of America, 54:1295, 1964. The scientists are developing techniques for processing 3-D images at infrared, ultraviolet and X-ray wavelengths.

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MILITARY SCIENCE

Combustible Cartridge Saves Weight, Money

➤ A CARTRIDGE CASE that is completely combustible, lightweight and cheap to manufacture has been developed for the U.S. Army by the IIT Research Institute, Chicago.

The cases vaporize completely, leaving no residue. The shells are made of a resin-impregnated felt in 57 mm and 152 mm sizes. They are less than half the weight of conventional cases and less costly.

One civilian manufacturer is planning to produce a commercially available .22 caliber cartridge with a completely combustible case.

In military applications, the cases will greatly reduce the noxious fumes drawn into gun turrets by the necessary ejection of conventional metal cases.

Made by a process similar to that used in manufacturing fiber egg cartons, speaker cones and luggage, the cases are the result of 12 years of research.

Future elimination of the need for a mechanism to eject used shells could result in increased accuracy in rifles. This would come from having fewer moving parts or from carrying the barrel tube back into the space now occupied by the breech opening.

• Science News Letter, 86:311 November 14, 1964