ORDNANCE

Proximity Fuze

The VT fuze for the Navy five-inch antiaircraft shell is one of the war's best kept secrets and ranks a close second in hastening the war's end.

➤ THE PROXIMITY fuze, a tiny radio set device in the nose of a projectile, is rated as the U. S. A. No. 2 secret weapon. Its use in antiaircraft fire directed at Jap suicide bombers, in artillery barrages in the famous Battle of the Bulge in France and in neutralizing Nazi buzz bomb attacks on London, is credited with a major help in winning both the European and Pacific wars.

The VT or variable time fuse, as it is also called, explodes a projectile as soon as it comes close enough to a target to inflict damage.

Along with the atomic bomb, the proximity fuse was one of the best kept secrets of the war. For two and a half years of war, projectiles and bombs fuzed with this proximity device inflicted terrific damage on the enemy. The only clue to its existence was what appeared to be unprecedented accuracy of gunfire; it was really a device that caused devastating destruction in spite of slight unavoidable inaccuracies in aim.

The VT fuze was developed by scientists of the Office of Scientific Research and Development at the request of the Navy Bureau of Ordnance. The research program was carried on in facilities provided by the Carnegie Institution of Washington and the Johns Hopkins University.

A record was set by its rapid development from an idea in the minds of ordnance experts to a triumph of quantity production. Research began in August, 1940, and 400 fuzes per day were coming from the assembly lines in September, 1942. By the end of 1944, the daily production was more than 40,000 in the factories of the five firms which did the assembly job. The price was gradually and rapidly reduced from $40 to $18 per fuze.

The VT fuze is an extremely rugged five-tube radio sending and receiving station which fits into the nose of a projectile. The heart of this miniature radio station is a vacuum tube which sends out electro-magnetic waves or impulses at the speed of light—186,000 miles per second. The impulses are reflected back to the tube by any target that gives a radio reflection, such as metal objects, water or earth.

The fuze works on the same principle that causes a train or fire engine whistle to sound higher in pitch as it approaches. The frequency of the electric signals sent out by the fuze is kept constant, but as the shell approaches its target, more impulses per second are reflected by it back to the fuze, the frequency increasing in proportion to the speed of both shell and target. The fuze can, of course, be set to work the detonator at any frequency necessary to insure destruction of the approaching target.

If a VT-fuzed projectile, in flight, passes within 70 feet of an airplane, reflected impulses act on the fuze circuit to trigger a switch. The switch causes an electrical detonator to set off the main explosive charge in the projectile.

The VT fuze has tremendously simplified the task of the men behind the five-inch guns, the Navy's principal long-range antiaircraft weapon. Before the VT fuze was created, time fuzes were used in 5-inch shells to obtain destructive air bursts. But time fuzes required not only that the time of flight from gun to target be calculated accurately, but that each fuze be "set" for this time. A slight error in fuze-setting could cause the shell to explode at a harmless distance from the target.

Use of the VT fuze eliminates fuze-setting, excludes errors inherent in time-fuze mechanisms, and makes possible maximum results at the split second speed demanded by modern antiaircraft fire. A VT-fuzed projectile explodes automatically when it reaches a point where its fragments can shower a target. When the gun is properly directed, all a gun crew has to do is load and fire.

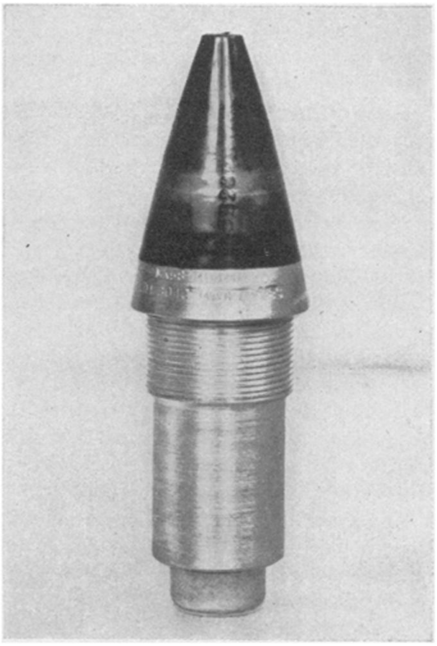
The threat of the airplane to the surface ship stimulated the search for a practical proximity fuze. In the summer of 1940, the Navy pushed the development of such a device, requesting the National Defense Research Committee, a research division of the Office of Scientific Research and Development, to begin research on various types of proximity fuzes. The actual research program was carried out by a section of NDRC, headed by Dr. Merle A. Tuve, of Chevy Chase, Md., chairman of the scientific group which brought the difficult research problem to a successful conclusion.

The importance of proximity fuzes for high velocity shells launched Dr. Tuve's section immediately on the development of vacuum tubes and other miniature electronic parts so rugged that they could withstand the shock of being fired from a gun with a force of 20,000 times that of gravity and the centrifugal pressure created by projectile rotations as high as 475 a second. The components had to be so small that a complete radio transmitter-receiver, with amplifier and power supply, could be installed in the nose of a projectile. Photoelectric triggering devices were the first to be successful, but circuits based on radio reflection were later adopted as the most effective for the purpose.

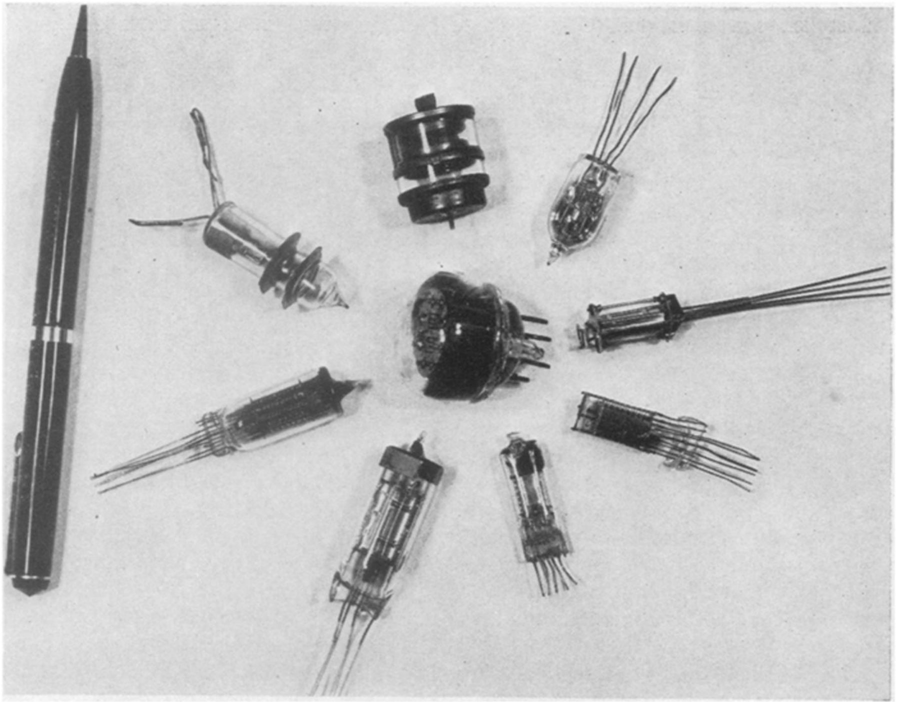
Large scale production of a peculiarly complex device was a marvel of production skill. Assembly operations were carried on by five companies—Crosley Corporation, Sylvania Electric Products, Inc., Radio Corporation of America, Eastman Kodak Company, and McQuay-Norris Manufacturing Company. A total of 87 different firms using 110 different factories were engaged in some phase of production work.

Science News Letter, October 6, 1945

The *wood bison* is larger, darker in color, and shaggier than the bison found on the Plains.



DESTRUCTIVE!—This fuze weighs 1.9 pounds and is 7.5 inches long. It is used in the three inch Navy shell.



PINT-SIZED—This fuze, holding its own five-tube radio sending and receiving set, explodes a projectile as soon as it comes close enough to a target to inflict damage.

CHEMISTRY

Gas Attacks Anticipated

Soldiers were equipped with the latest type of gas masks, protective coverings, protective ointment and special eyeshields.

➤ NO SERIOUS attempts were made by either the Nazis or the Japs to use gas against American troops during the war, but if they had, relatively little harm would probably have resulted because the American forces at all times, wherever located, were fully prepared for large-scale gas attacks. Details of protective methods adopted are now revealed by the Army Chemical Warfare Service.

Soldiers were equipped with the latest types of gas masks, protective coverings, protective ointment and special eyeshields. Decontamination companies of the Chemical Warfare Service were ready with vehicular and portable equipment to clear the way through contaminated areas by chemical neutralization or other scientific means.

Gas masks, perhaps, come first in the individual protective devices. They purify the air the wearers breathe and also protect eyes and faces. The canister is the gas mask's most important part if the mask is properly fitted to the face. It is a metal container through which the wearer inhales. He exhales through an outlet valve near his mouth. Inhaled air passes through a filter in the canister that removes microscopic particles, poisonous or otherwise, and then through layers of activated charcoal which absorb remaining molecules of irritants.

Since adsorbent charcoal can soak up only a given quantity of poisonous molecules before becoming saturated, no military mask will afford indefinite protection in heavy concentrations. The standard canister will not protect against certain industrial gases such as carbon monoxide, ammonia, hydrocyanic acid and oil vapors, but will protect against all toxic gases likely to be used in war.

Protective covering is a cellophane cover designed to protect individual soldiers against blister gas sprayed from the air. It is an envelope large enough to cover a crouching man and his pack. The top part is transparent. It is very light in weight, and occupies, when folded, very little space. In use the soldier punches a hole through its side through which he sticks his rifle. It is discarded after being used.

The protective ointment issued the soldiers is in a tiny kit and is spread on all exposed skin of the body. It prevents injury from a gas, and can also be used as first-aid treatment and for decontamination of personal equipment.

The special eye shields are stamped out of a clear, flexible plastic, and protect the eyes from blister gases and toxic agents. Four were issued with each gas mask. Held by an elastic band around the head, they can be worn in an alert position on the forehead like an eyeshade, or pulled down on the bridge of the nose in the ready position.

Science News Letter, October 6, 1945

ELECTRONICS

Electrical System Defects Shown in Flight

➤ A PROJECTED image on a screen showing defects in the electrical system of aircraft engines is one of the outstanding features of the new ignition analyzer developed by D. Napier and Son and the English Electric Company.

About the size of a portable typewriter, the analyzer, taking power from 220 volt A. C. mains or a 6, 12 or 24 volt accumulator, may be adapted as a permanent instrument on multi-motored planes. Peaked figures on the screen, one for each spark plug, arranged in the firing order of the engine, remain unchanged in shape and intensity when the ignition system is functioning properly, but flicker and alter shape in direct ratio to defects in corresponding spark plugs.

Easily diagnosed by visual characteristics of the fault, excessive spark gaps give a high figure, short-circuited gaps a correspondingly low figure, while an occasional miss shows instantly as a definite flicker. Defects in the magneto or distributor alter the entire row of figures as a unit.

By locating and diagnosing minor defects, dormant until the moment of breakdown, this tester can minimize loss of flying time and aid maximum engine efficiency. Operated in flight, potentially serious engine failure due to faulty ignition may be revealed, giving the pilot adequate time to find suitable terrain should a forced landing be necessary.

Science News Letter, October 6, 1945

Less *sugar* is required in a cake if dried fruits are used as filling.