ELECTRONICS

Radar Secrets

Small tube used in instrument develops much more power than broadcast transmitters. Solutions of other research problems revealed.

➤ THE SMALL tube used in radar is the source of stupendous power. This tube may develop as much as hundreds of thousands of watts, as compared with the most powerful transmitter used for radio broadcast, which is limited to 50,000 watts.

The power must be applied in a burst for only a millionth of a second and then turned off completely to wait in repose for the echo to come back.

Development of this oscillator tube is termed a major achievement of the radar art by the official announcement issued by the Joint Board on Scientific Information Policy. The tubes used before the war at radar frequencies could develop only a few thousandths of a watt.

The receiver, which must be sensitive enough to pick up the tiny echo bounced off a distant ship or plane, must be protected against the terrific power burst of the transmitter, which would paralyze it or burn it out completely.

Transmitter and receiver are built in one box and operate on one antenna. This is really necessary because the directional antenna acts as a "searchlight" sending the signal out and as a "telescope" in picking up the echo. Naturally, both searchlight and telescope must be aimed in the same direction. This is sure when one antenna is used for both purposes.

But use of one antenna requires that the receiver be disconnected when the antenna is sending out the burst of power. The means for doing this was a particularly difficult piece of development, details of which are still not revealed.

Not only is it necessary to disconnect the receiver while the transmitter is working, but within a millionth of a second later the receiver must be open to receive the faint echo and the transmitter must be closed off so that it will not absorb any of the weak incoming energy.

To carry the energy from the radar transmitter to the antenna, ordinary wires and coaxial cables are unsatisfactory. For the microwaves used in radar, it is more efficient to use wave guides, which are really carefully proportioned hollow pipes known to radar men as "plumbing." For certain of the equipment these wave guides may look like rectangular rainspouts. The high frequency currents from the transmitter are converted into electromagnetic radiation at the bottom of the pipe and guided through the pipe by successive reflections from the inside surface.

The problem of the antenna design was also a major one. It had to be highly directional. This can be done either by building it up of an array of small antennas, or by using the searchlight principle of spraying the energy into a large parabolic mirror which focusses the energy into a beam. In either case, the larger the antenna, the sharper the beam, but it can be made small enough to go on an airplane.

To use the radar to search the whole expanse of sea and sky, the antenna is turned, swung around or up and down to direct the beam in the various directions.

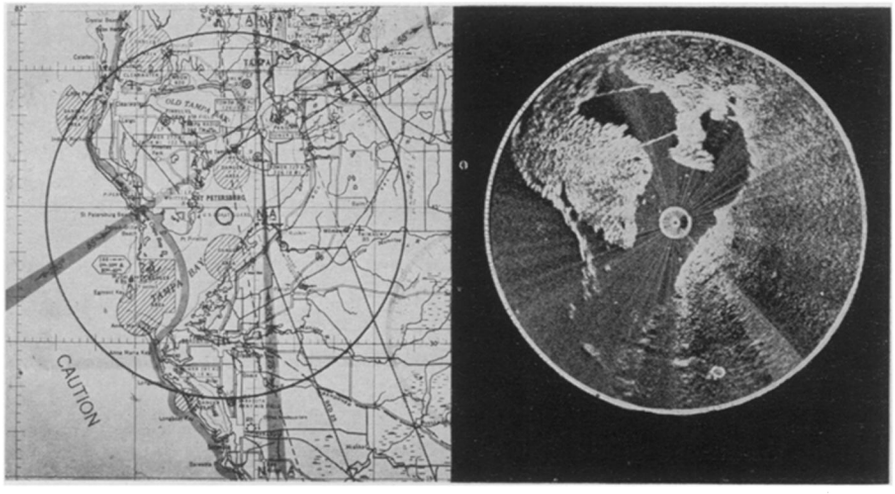
What the radar picks up is shown to the operator on a television-type screen. In the simplest type, an electrical mechanism causes a spot of light to trace a line across the screen at a uniform speed. The spot starts at one side at the instant the transmitter goes off. Whenever an echo comes in, the spot gives an upward bounce or "pip." The distance of this pip from the starting point gives the time required for the echo to return and therefore the distance of the ship or other target.

A target 1,000 yards from the radar will give a pip only six millionths of a second later than the transmitted pulse.

It is possible to set up the radar system to see all directions on one screen, with any ships and the shoreline appearing as in a map with the radar operator and his ship in the center. This is done by rotating the whole antenna system from one to 20 times a minute, scanning the whole horizon.

In this case, the dot of light starts from the center and moves outward in a direction corresponding to the direction of the antenna. Each echo, instead of making a pip, makes a bright spot of light, indicating both the direction and the distance of the ship that reflected it. The screen thus is an accurate map showing the positions of all the surrounding ships. The radar operator can, in fact, watch the shells move across the screen toward the target pip, and can even see the splashes they make when they hit the water.

An incident quoted in the official report tells of the commodore of a destroyer force who was watching the radar screen. It was a spectacular battle with blazing Japanese ships. (*Turn page*)



RADAR BOMBSIGHT—At the left is an ordinary air navigator's chart of Tampa Bay, Fla. At the right is the same "target" as seen on the radar bombsight screen. The straight lines across the water near the top of the picture are bridges and causeways. The small white dots show how boats and ships look to the radar eye. Notice how clearly land and water masses are distinguished.

"Come up here, for the sight of your life!" the captain called down to the commodore.

"No thanks," replied the commodore, "I can see better from here."

Science News Letter, August 25, 1945

MEDICINE

Water Spreads Hepatitis

First experimental evidence shows that the infectious liver disease is acquired in this way. Gamma globulin from blood gives protection.

➤ FOR apparently the first time, medical scientists have experimental evidence that infectious hepatitis spreads through contaminated drinking water. This is an inflammatory liver disease sometimes accompanied by jaundice which became widespread among both civilians and military forces during the war.

With this medical first comes also the first satisfactory evidence that a virus disease can be naturally acquired by humans through water.

Studies showing these facts are reported in the *Journal of the American Medical Association* (Aug. 11) by Capt. John R. Neefe, of the Army Medical Corps, and Dr. Joseph Stokes, Jr., of Philadelphia.

Gamma globulin from human blood, which is used to give protection against measles, will also protect against this infectious hepatitis, it was found in trials during an epidemic in a heavy bombardment group and various regiments of the ground forces in the Mediterranean Theater last winter. These trials are reported in the same issue of the medical journal by Dr. Stokes and Capt. Sydney S. Gellis, Maj. George M. Brother, Maj. William M. Hall, Col. Hugh R. Gilmore and Maj. Emil Beyer of the Army Medical Corps and Capt. Richard A. Morrissey of the Army Sanitary Corps.

Tests of gamma globulin as a protective against infectious hepatitis in the armed forces followed a test of the material by Dr. Stokes and Capt. Neefe during an outbreak of the disease in a camp for boys and girls last summer. The discovery that the virus causing the disease could be spread through contaminated water was made in further studies of this same epidemic. The water became contaminated through intestinal wastes from infected persons.

Chlorination of drinking water according to procedures commonly used for rapid disinfection under emergency conditions did not inactivate or weaken the virus, Dr. Stokes and Capt. Neefe found in studies made with Maj. James B. Baty, of the Army Sanitary Corps, and Dr. John G. Reinhold, principal biochemist of the Philadelphia General Hospital.

"Superchlorination" of infected water definitely reduced the ability of the virus to cause disease. Treatment of contaminated water with sodium carbonate and aluminum sulfate, used to remove extraneous material from drinking water by coagulation, and activated carbon, also used to remove materials from water, did not completely remove or inactivate the virus or germ of infectious hepatitis.

Methods used to disinfect water, the scientists report, may have to be modified further in order to inactivate completely the germ that causes infectious hepatitis.

Human volunteers had to be used for the studies, since there is no way of knowing whether the virus of the disease is present in a given material except by demonstrating the ability of that material to produce the disease in humans. Conscientious objectors and members of the Civilian Public Service Unit 140 of Philadelphia were among those volunteering for the studies. Besides drinking suspected and known to be infected water, these volunteers had blood serum, nose and throat washings and material from body wastes of patients given them, in order to learn how the germ spreads.

All the studies were carried out under the direction of the commission on measles and mumps of the Army Epidemiological Board.

Science News Letter, August 25, 1945

CHEMISTRY

Excelsior Planks for Your Postwar House

➤ THAT NEW house you are going to build now that the war is over may be made of excelsior instead of solid boards and planks sawed out of big logs. A process for making planks out of excelsior and Portland cement has been patented by Armin Elmendorf of Winnetka, Ill.

The excelsior, which may be made from such cheap, low-grade timber varieties as cottonwood or aspen, is first immersed successively in sodium silicate and calcium chloride. These chemicals react together to precipitate calcium silicate on the fibers; common salt, the other product of the reaction, is removed by washing. The excelsior is then mixed with a concrete slurry, molded to the desired dimensions, cured for a suitable period in a moist room, and set aside to dry.

Rights in Mr. Elmendorf's patent, No. 2,377,484, are assigned to the Celotex Corporation.

Science News Letter, August 25, 1945

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