

## ENGINEERING

# Self-Guided Loran

May in the future guide ships and planes without human assistance on fixed courses. May also be developed to guide V-bombs.

► SHIPS AND PLANES of the future may be guided by Loran without human assistance and with no possibility of deviating from a fixed course, declared J. A. Pierce of Harvard University at the recent meeting of the Institute of Radio Engineers in New York City. He painted, also, an awe-inspiring picture of how Loran may be developed to guide pilotless aircraft and bombs in future warfare.

Loran is a wartime development of American scientists used with great success to guide military planes and ships straight to their targets and back again over vast expanses of land or water. It is similar to radar in its techniques, but differs in having the transmitters at fixed points on the ground along coast lines or on islands, and only receivers in the planes or ships.

The basic operation Loran performs is the determination of "lines of position," Mr. Pierce explained. This is done by measuring the relative time of arrival of two different pairs of radio pulses, which are known to have emanated from four fixed transmitters at times differing by a known interval, he said. The time difference of arrival is measured by the Loran receiver to a millionth of a second.

From this information, Mr. Pierce continued, the navigator can draw two curves which represent the lines of position. The point where these lines cross is the exact position of the plane or ship. The entire operation requires but a few minutes and is a big improvement over the age-old method of "shooting the stars" with a sextant, he asserted.

Mr. Pierce was head of the Loran division at Radiation Laboratory on the campus of the Massachusetts Institute of Technology during the war. He is now a fellow at Harvard's Cruft Laboratory, continuing research work on radio propagation.

Standard Loran now in use operates at several frequencies between 1700 and 2000 kilocycles, he stated, and radiates pulses twice as powerful as the largest United States broadcasting stations. In the daytime the device has a range of about 800 miles over water, but at night,

by utilizing waves reflected from the upper portion of the earth's atmosphere, the range is about 1,600 miles.

The average error in using Loran is very small, he said, but a new technique still in the laboratory shows promise of radical reduction of even the present errors.

The development of receivers which will perform all functions automatically will be relatively simple, Mr. Pierce declared, and also of equipment that will trace on a chart a permanent record of the ship's movement. It is then but a short step, he added, to make "connection between the map and the rudder of a vessel so that a predetermined track may automatically be followed."

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## ELECTRONICS

## Power Lines Used For Telephone Service

► TELEPHONE service over rural electric lines bringing light and power to farm homes is under test in the area around Jonesboro, Ark., it is announced. In the new system, speech is transmitted by means of a carrier wave of radio frequency which travels on the power lines along with the power supply.

Electronic transmitting and receiving equipment is installed at the central switchboard and at each subscriber's end of the line. The dial instrument is used as in regular telephone service. Technical steps have been taken to prevent mutual interference between the two currents flowing on the same line. The power current has low frequency and high voltage, the telephone carrier current has high frequency and low voltage.

Steps have been taken, also, to eliminate reflections from branch lines, and to assure safety of users and maintenance men. The tests are encouraging, but the engineers in charge of the project point out that the new system is just emerging from the laboratory and that further experimentation is necessary before commercial application can be made.

This test installation is on power lines of the Rural Electrification Administra-



**OUR ANSWER**—This non-metallic mine-detector located enemy mines made of clay, wood, glass and plastics. It consists essentially of an ultra-high-frequency radio wave transmitter and picks up both metallic and non-metallic mines at depths ranging from three to 12 inches. Official U. S. Army photograph.

tion, with equipment in daily use by four telephone subscribers of the REA-financed Craighead Electric Cooperative Corporation. When the system is perfected it can be used to bring telephones to many of the nation's 2,750,000 farm families now served by power lines, but for many of which regular telephone lines are not available.

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## ENGINEERING

## Combination Gas and Oil Burner for Furnaces

► A BURNER for furnaces, in which either gas or oil can be used, and the switch from one to the other be made instantaneously, is offered by William A. Clements of Glendale, Calif., for patent 2,393,887. The same pipe and nozzle that blow in the gas inject a blast of high-pressure air when one valve-handle is turned. Opening another valve admits the oil. The air blast atomizes this into spray, which burns in a long, hot flame.

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Nearly 6,000,000 pounds of sunflower seed were grown in the United States in 1945 to produce table oils and animal feed.