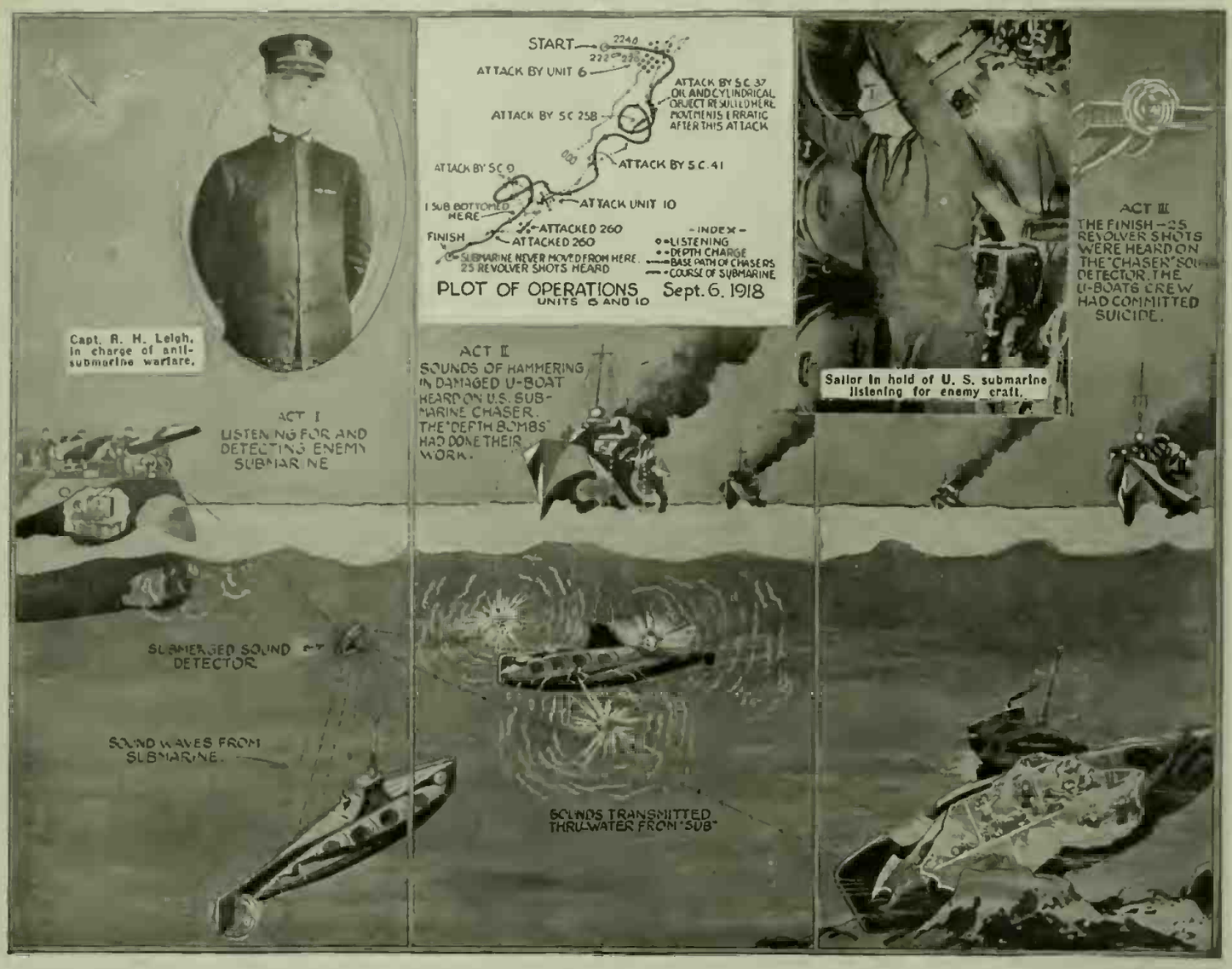


Hunting the U-boats by "Sound" Proved a Successful and Profitable Allied Naval Game—So Successful in Fact That, Had the War Lasted Another Year, the U-boats Would have Been Driven Completely from the Seas.

Hunting Submarines by Sound

By BREWSTER S. BEACH

How Yankee Scientists Beat the German U-Boats

THE United States Navy Department, after nearly two years of the closest censorship, has just given approval to the publication of certain data relating to the development in the United States during the war of submarine detecting devices, which were used to signal advantage by this country and the Allies in prosecuting and bringing to a successful conclusion the campaign against the German U-boat.

The apparatus may be termed the composite work of the General Electric Company, Submarine Signal Company, Western Electric Company, the National Research Council, assisted and advised by many eminent scientists, engineers and research specialists—chief among whom were Drs. W. R. Whitney, Irving Langmuir and W. D. Coolidge, Prof. R. A. Millikan, Prof. Max Mason, and others.

Realizing that the prompt solution of the submarine problem was the key to a successful termination of hostilities, Secretary Daniels, immediately upon America's entrance into the conflict, appointed a special board to devise ways and means to overcome it.

At the suggestion of Dr. Whitney, director of General Electric Company's research laboratories, a group of scientists was formed at Nahant, Mass., under Dr. Irving Langmuir, where the results of extensive research activity were put to practical tests under actual conditions as nearly as possible approaching those in European waters.

Another group under Prof. Millikan, head of the Physics Department of the University of Chicago, was organized at New London, Conn., where the work of both bodies was later co-ordinated.

Out of the efforts of these two groups and the work carried on in Schenectady assisted by Allied commissions of scientific men, there grew the American Submarine Detector—a development of the old principles of sound wave transmission in water in an altogether new and startling manner, and just how efficient this "detector" proved we shall see later.

The apparatus finally perfected and put to immediate use, was first designed to hang overhead from naval craft amidship below the water line and it depended for its direction-getting qualities on the peculiar and heretofore little understood faculty

THIS article describes the effort made by American scientists, under the stress of tremendous urgency, to invent and perfect an instrument to successfully locate submarines while in a submerged condition, at a time when every instant of delay meant further loss to shipping, and the fate of the Allied cause practically depended on the immediate defeat of German U-boat warfare. The Submarine Detector, as eventually evolved by them, utilizes old principles in a new and startling way. It is based on the theory of sound-wave transmission thru the water and depends for its direction-getting qualities on the peculiar and heretofore little understood faculty of the human ear to detect the direction of sound by the shifting of that sound from one ear to the other.

of the human ear to detect the direction of sound by the shifting of that sound from one ear to the other.*

Early Experiments

Every possible application to which electricity had been put was studied with painstaking care by experts during the development of the "Submarine Detector," and many experiments were carried on at New London and at Nahant with pliotrons, with amplifiers, with the Fessenden oscillator, which had been developed by the Submarine Signal Company, and with other similar instruments, before the proper combination of the principles of electricity and acoustics produced the final and successful device subsequently used.

Specialists in physics and acoustics from the great technical schools, such as Columbia University and Harvard, from the Research Laboratory of the G. E. Co. and the W. E. Co., and in fact from all over the United States, played a prominent part in the work done, particularly by the New London Group, altho unfortunately the armistice was signed before the latest devices developed here could be put into extensive use on the other side of the water.

Owing to the interference of sounds made by the listening ship's own motors, it was found more practical to stop the engines when about to take observations and this added greatly to the effective range of the instrument.

To overcome this obstacle, another device was developed *which could be trailed off the stern a hundred or so feet away* where the engine noises of the ship were out of range and the sound was then brought into the operator in the ship's hold.

A third adaptation of the listening principle was an instrument which protruded thru the hull and was a stationary part of the vessel's equipment. A somewhat circular device was constructed for use on submarines, but all of them were used to advantage.

While demonstrating the device to the British Admiralty, our American engineers were asked to study the question of fitting submarine detection units to airplanes, balloons and dirigibles.

After some experimentation, followed by more practical tests and conferences with the Lancashire Group of scientists at Harwich, apparatus was developed which met these needs and many *aircraft* were equipt with sound detectors *which rendered it possible for them to follow the course of the enemy submarine after they had seen her submerge, a valuable faculty which such craft did not possess until the introduction of the American detector.*

Allies Adopt Yankee Invention

However, when the devices had proved themselves eminently satisfactory after exhaustive experimentation here, the Navy Department organized a special Service Party under Capt. R. H. Leigh of the Bureau of Steam Engineering to demonstrate the detectors to the British Admiralty. Shortly after the arrival of this party abroad, the American submarine detectors were universally adopted by all the Allied navies.

It was found to be much superior in many ways to any of previous development, and came to be considered one of the most effective offensive weapons ever used against the submarine.

To sum up the results achieved by these American listening devices it is only necessary to recount a few pertinent points to illustrate the device's practicability.

In spite of it all, initial experiments proved slow of entirely satisfactory developments until the fall of 1917, when it was decided to go out to sea off Cape Cod for more thorogoing tests.

The sea was clear of craft as far as the eye could see—yet the operator with his ear to the detector distinctly heard a vessel approaching—nearer—nearer—nearer. The captain from the bridge eagerly scanned the horizon with the ship's glasses—nothing in sight.

"Send a man aloft with powerful glasses," he commanded. "The detector has picked up a craft 3 points on our starboard bow."

The sailor returned. "Nothing in sight, sir."

"I'll go aloft myself. That boat sounds as if it were very near. Why, we can hear her engine as clearly as if she were alongside."

Puzzled, the captain returned from the masthead after a disappointing vision of a calm and perfectly clear sea.

"How's she coming?" shouted the first lieutenant down the hatchway.

"Heading straight for us, sir. Sound getting louder every minute."

There was nothing to do but wait.

The captain pulled out his watch and sat down. Fifteen minutes—half an hour—an hour—ticked on!

(*Continued on page* 167)

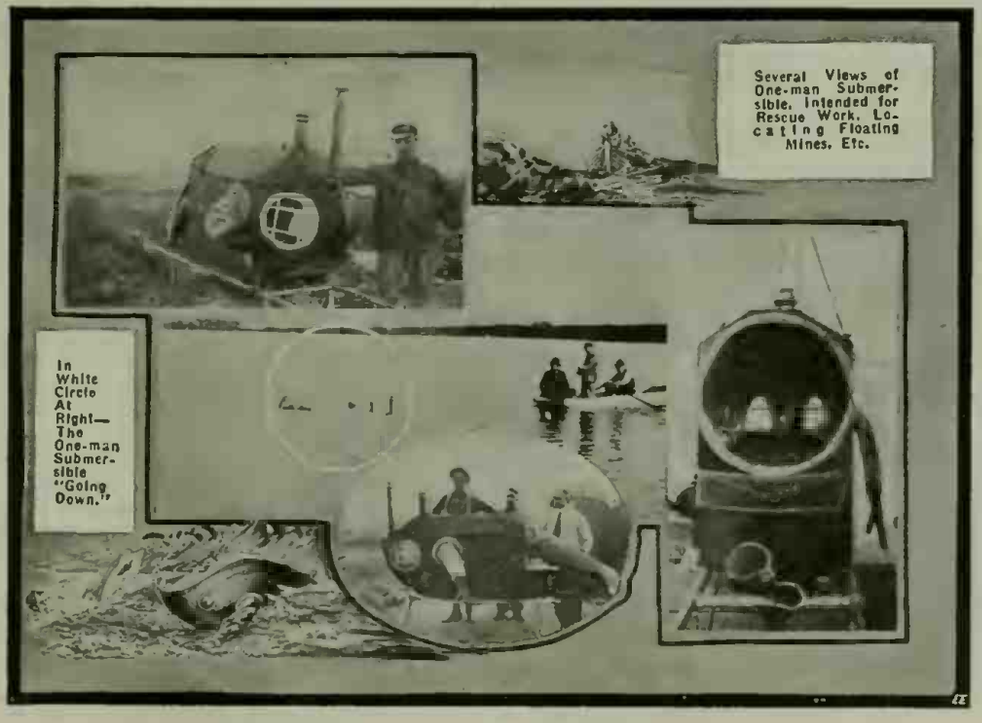
* Another very interesting point is that when mounting microphones on each side of a vessel, the *loudness* of the incoming sound is equal in both telephone receivers, i. e., if a submarine is on the starboard side of the ship, it will be heard just as loud from the port side. But, the difference can be readily detected and very accurately too, by the *phase difference* as heard in the 'phones. In other words, the sound will be heard a fraction of a second earlier in one ear than in the other. Small as this difference is, even a green operator will detect it at once.

—*Excerpt from Mr. H. Gernsback's editorial in the October, 1917 issue of this journal.*

That One-Man Submersible

IN the March issue of this journal there appeared an illustrated article describing a newly invented, one-man submersible boat, intended for purposes of life saving, locating floating mines and other purposes. At the time the article was prepared, the Editors only had the inventor's patent to guide them in its preparation, and the illustration was prepared by one of the staff artists. But behold! This strange animal of the deep really lives, as the accompanying photographs of the actual working device prove. The inventor of the one-man submersible is W. R. Barringer, of Denver, Col., which is a long way from the sea, and it puzzled the Editors how a rank land-lubber such as the inventor appeared to be, could have the heart to work out a complete submarine or anything akin to that device. But now the secret is out, for it appears that the inventor, who was formerly in the United States Army, had gained considerable experience while in foreign lands, and he evolved the principles underlying his submersible boat while observing the methods of pearl and sponge divers in the far-distant Sulu Archipelago.

The makers of the Barringer one-man submersible, claim, among other things, that, due to its peculiar construction, no pressure is required to offset the tremendous external pressure of the water, even when submerged to such depths as 350 feet, for which this submersible is practicable. It is interesting in this connection to mention that the maximum depth reached by U. S. Naval divers in especially constructed diving suits and bells, is less than 300 feet. Moreover, in the ordinary diving suit the tremendous internal pressure of 130 pounds per square inch is necessary to remain at a 350-foot depth for any length of time. This new submersible diving outfit requires but the normal pressure of 15 pounds per square inch, regardless of depth attained. The inventor also claims that no strain is occasioned on the operator, even after a long period under water. The operator rests on a heavy air cushion and suffers no ill effects while below the water's surface. Further, the ascent and descent of the boat need not be done gradually, as in the case of the ordinary diving suit or bell, in order to accustom the body to the changing water pressure. On the contrary, so he claims, ascent may be made rapidly, and the operator's time is, therefore not wasted in slow sinking or rising.



As pointed out in the previous article, there are many interesting electrical features incorporated in this device, including electrical propelling and steering means, an electric searchlight and many other novel devices.