MILITARY SCIENCE

Listening in on War

Microphones Find Both Submarines and Planes; Resemble Mouthpiece of Telephone; Explosions Combat Both

By DR. FRANK THONE

See Front Cover

LISTEN, then look. That is the regular procedure in "spotting" both submarines and airplanes.

There is good reason for this, in the fundamental arrangement of the human senses. Ordinarily, we can hear a sound no matter where it comes from. Our ears perceive the disturbance even if it is behind us. Then we look around, to see if we can locate it visually. We can hear in any direction, but we can see only in the direction in which we point our eyes.

The devices used for auditory pick-up of subs and planes are basically alike, much as they may differ in appearance and in details of construction. Essentially, they are microphones, like the mouthpiece of a telephone. The alert watchers on sub-chaser or at the air-defense listening post have head-sets very much like those of a telephone switchboard operator. And just as modern telephone circuits include vacuum tubes like those of a radio set, the circuits of the listening devices also include these modern electronic aids in magnifying sound.

The picturesque triple or quadruple sets of horns, looking like gigantic versions of old-fashioned ear trumpets, that are used by listeners for airplanes, are only artificial external ears that can be cocked in the direction of suspected approach, just as a rabbit or a donkey can turn his ears. Only they are more nearly perfect, mechanically, than any animal ear because they were made to order along mathematically calculated lines, not slowly evolved out of folds of skin and flesh.

Good Hearing Needed

Naturally, men with above-average hearing are selected for this task. During the World War, many blind men, with ears trained to special acuteness in compensation for loss of sight, volunteered for this service in Britain, and it is likely that such sightless soldiers are again helping their companions to locate enemies in the dark.

The great sets of horns can, of course, pick up the first faint, distant murmurs of an approaching fleet of bombers while they are still far beyond the reach of unaided ears. The operators turn the horns this way and that, until maximum loudness is registered in the head sets. Then the horizontal and vertical angles are telephoned to the searchlight position, and the long fingers of light suddenly stretch out into the sky. Hearing has gone as far as it can; looking has taken over the job.

A British military journal recently reported that automatic coordination between sound detectors and airplanes has been under experimentation. Synchronized motors keep the searchlights pointed in the same direction as the big horns, until the moment comes for switching on the lights and picking up the flying targets. If such an arrangement is really attempted, it will be necessary to apply corrections, for winds aloft, and other weather conditions, can change the apparent direction of sound. Sound waves can be blown about, as light waves can not.

For some years there has been a persistent legend that the United States has an instrument that automatically aims and fires its anti-aircraft guns at an approaching enemy, without a man anywhere near it. A robot set-up like this would be ideal, if it only existed. The only trouble is, it doesn't.

No Horns for Water

Sound detectors for submarine-hunting surface boats do not have horns, or any other kind of external ears, any more than aquatic animals like seals and frogs. They would be in the way in swimming, and they aren't needed anyway, because sound carries ever so much better in a dense medium like water than it does in thin air. Submarines are nowhere nearly as noisy as airplanes, yet the detectors pick them up just the same. Navy men declare that even with the relatively primitive models used during the World War they could sometimes even hear commands and conversations from within German U-boats.

Submarine detectors have been improved tremendously in the past two decades. A good deal of this improvement has been due to the use of devices built on exactly the same principle, and used as sonic depth finders, which chart the hills and hollows on the floor of the sea by timing a sound produced on the ship's bottom and bounced back from the sea floor as an echo. The newest sonic depth finder is able to take soundings as much as six miles straight down. That is, it can detect a sound after it has traveled twelve miles through water.

The task of seeing a submarine, after it has been located approximately by sound, is not easy. Sometimes it cannot be done at all. In that case, the only thing the sub-hunting destroyer can do is race across the area of maximum sound from underneath, dropping a whole series of depth charges.

Airplanes Help

Airplanes are valuable aids in locating submarines. From a height above the water you can see farther into the depths than you can from the deck of a boat near the surface. Try it some time, from a high mast, or a bluff overhanging the water. Observers on planes can often spot the silhouette of a submarine far beneath the surface. If they can, it's goodbye U-boat. They signal the location to the cooperating destroyer, which proceeds to drop a deadly "ash-can" right on the sub's tail. Or if need be, an airplane of the modern patrol-bomber type can drop a few depth bombs on its own account.

The depth charge was an invention mothered by the necessities of the World War. Until it was devised, there was no way to attack a U-boat except near the surface, when it could be reached by gunfire or perhaps rammed. If it managed to submerge to more than four or five fathoms, it was safe.

Then a clever young inventor took advantage of the fact that pressure under water increases uniformly with depth. He fitted a pressure diaphragm, set to operate at any desired depth, with an explosive firing mechanism, and attached the whole business to a cylinder of TNT about the size and shape of an oil drum. The "ash-can" had been born —and the U-boat's real troubles lay dead ahead.

A submarine under water is just a big bubble of air with a thin steel shell. A sudden violent push caves in that shell enough to let water pour in through

the sprung seams—and Davy Jones finds lodging for some more brave sailors.

The submarine's concussion woes began during the World War, but explosions did not become Number One enemy of airplanes until quite recently. World War anti-aircraft ammunition was shrapnel that threw showers of leaden pellets at the attacked plane, and practically had to hit the pilot to bring it down. But with the improvement of both anti-aircraft guns in range, accuracy and rapidity of fire, and especially with the change from the old undependable powder-train fuse to the much surer clockwork variety, bursts of high-explosive shell fairly close to the target became possible.

A direct hit on a plane is not necessary. If a shell bursts within 60 yards, and the flying cloud of steel fragments fails to disable the crew, the burst may disable the plane mechanically. Then all the crew can do is take to their parachutes and watch their good ship plummet to earth and crash.

Science News Letter, October 14, 1939

LISTEN, LOOK, SHOOT!

Listening devices (see cover illustration) first pick up the distant rumor of the planes' approach. Searchlights are held in leash until the last practicable moment, because when they flash out, it's a warning to the bomber that he's been detected. A few seconds after the searchlights find him, the guns blaze into action.

PUBLIC HEALTH

Nutrition Problems Topic Of Meeting Of Experts

DR. Hazel K. Stiebeling, one of the United States' best known nutrition experts, who has said, "Ill-fed people are unhappy and suspicious," is the United States' representative to Buenos Aires conferring with Latin American nutritionists on food problems of this half of the world.

Dr. Stiebeling loaded her 77-pound airplane baggage allowance with farmers' bulletins, pictorial charts, and other educational devices found effective in teaching people in this country to buy and eat wisely for good nutrition.

The meeting is an outgrowth of the League of Nations' Mixed Committee on the Problem of Nutrition, which back in 1937 appalled the world by a report declaring malnutrition was world wide. The League's committee recommended that individual countries follow up this evidence, forming their own committees and conferring.

Very little is known about Latin American countries' nutrition problems, Dr. Stiebeling says. They have not figured prominently in the data the League of Nations has been able to gather.

Science News Letter, October 14, 1939

Machinery for harvesting sugar beets is being tried out in the West.

ENGINEERING

Rivers Are Mined To Produce Anthracite Coal For Power

SOME AMERICAN communities are being supplied with heat, power and light through use of anthracite coal that in previous years was sluiced into rivers in order to get rid of it, William Lloyd, engineer of the Combustion Engineering Co. of New York, told a joint meeting of the American Institute of Mining and Metallurgical Engineers and the American Society of Mechanical Engineers at Columbus, Ohio.

"The advent of the traveling-grate stoker opened up a commercial demand for small sizes of anthracite coal that were formerly discarded as waste," said Mr. Lloyd. "As a result large culm banks are reclaimed and rivers dredged for the so-called river coal which in the early days had been sluiced to the rivers as a convenient means of disposal.

"Rivers and small streams, especially during flood conditions, become very efficient in separating the slate and other refuse inherent in the mining process from the coal, and the pockets in the stream beds 50 to 100 miles downstream from the mines are likely to contain clean coal. The streams can justly be termed very efficient jigs or flotation coal separators. Millions of tons of excellent coal have been reclaimed from rivers in the last thirty years.

"In the City of Harrisburg, Pa., alone, the central steam heating, as well as the steam power generating stations, operate entirely on river anthracite reclaimed within a few miles of the city.

"Several years ago, however, laws were passed and quite rigidly enforced, prohibiting the pollution of streams and coal mining operations adjacent to all streams were compelled to dam up and prevent any further sluicing of fines into the rivers. Despite this, the reclaiming plants continue to find sufficient material to keep operating."

Science News Letter, October 14, 1939