PHYSICS

New Instrument Maps Shoal Bottoms Rapidly, Accurately

Refinement of Fathometer Sends Out Continuous Sound, Receiving Echo With Same "Transceiver"

READING hidden depths and shoals in coastwise waters with all the uncanny accuracy of a blind man running his fingertips across a page of Braille, a new instrument devised by scientists of the U. S. Coast and Geodetic Survey promises to make pilots' and navigators' charts many times as detailed and reliable as they have hitherto been, yet at a small fraction of the present cost for surveying.

The instrument, known as the Shoal Water Fathometer, can take as many as 20 soundings a second in depths of from 6 to 120 feet, and will measure differences in depth with an accuracy of about one inch. If the survey boat is cruising at ten miles an hour, a sounding can be obtained for every ten inches of bottom traversed.

This is contrasted with the old method of sounding with a hand lead, with which a boat moving only about half as fast can obtain only two depth readings a minute in water 60 feet deep, or one sounding for every 254 feet of bottom instead of every ten inches.

Other Uses

The shoal water fathometer has other possible uses besides its intended primary function in depth charting. By anchoring a boat at sea, over a bottom of known depth, the height of tides off shore can be accurately measured, as well as the height of the so-called tidal waves that follow earthquakes. In similar fashion the height of the long "ground-swell" waves that accompany storms can be measured at sea, for the instrument is very sensitive and its pointer swings up and then down every time the boat goes over a large wave. It is probable also that the shoal water fathometer can be used to aid in locating sunken ships and even smaller objects worth recovering, in water that is not too deep.

The shoal water fathometer is a development and refinement of the older deep water fathometer, which is a commercial invention already in use for a considerable number of years. Like its older relative, the shoal water fathometer works by starting a sound from the bottom of a ship, letting the sound reflect against the bottom, and then picking up the echo with suitable microphone and amplifying devices.

Uses Continuous Sound

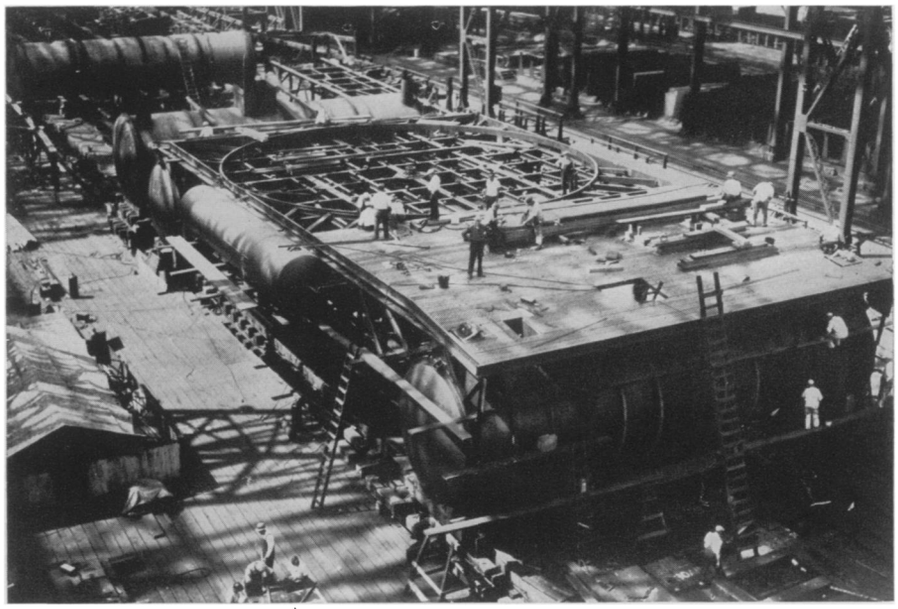
The older deep water fathometer uses discontinuous sounds, picking them up with a separate microphone, "translating" the sound into pointer-readings on a dial by means of a flashing neon tube and a rotating disk driven by a synchronous motor controlled by a governor.

To obviate the "lag" inherent in picking up sounds with a "dead" microphone diaphragm, the new shoal water microphone sends out a continuous one-tone sound from a vibrating diaphragm, and uses the same diaphragm as receiver of the echo-sound also. This part of the apparatus, being both transmitter and receiver, has been christened the "transceiver." This method wipes out practically all of the lag in transmitting the echo-sound on its return from the bottom.

Greater Accuracy

The governor used on the deep water fathometer could not hold the pointer on the dial to an accuracy closer than several feet. This is a matter of no consequence in really deep water; but an error of even one foot in water only ten feet deep would be a ten per cent. inaccuracy—something quite intolerable in shoal waters where the difference of a foot or two in bottom reading might mean the difference between a safe ship arriving on time and a sunk ship with her bottom ripped open.

To obtain a steadier speed in the pointer-disk, thus insuring greater accuracy of the dial reading, the control on the motor was changed from a governor to a tuning fork, which vibrates



FLOATING LANDING RAMPS FOR SEAPLANES

Downtown New York City will soon have facilities for landing seaplanes. Under construction in the Brooklyn Navy Yard are two floating landing ramps for amphibian seaplanes. One will be moored at the foot of Wall Street and the other at 31st Street, both in the East River. Each ramp will be 89 feet long, 56 feet wide and weigh 170 tons complete. Two steel tanks each 12 feet in diameter furnish the buoyancy for the landing unit. Construction is of welded steel throughout with the exception of the pine decking. A motor-operated turntable in the center of the top surface provides means of turning the planes about for take-off. In operation the seaplane taxies onto the surface of the turntable which is one-fourth submerged by partially flooding one tank. The ramp is then raised to level by forcing the water from the tank with pneumatic pressure.

constantly at 1025 cycles a second. This reduces the tolerated inaccuracy of the dial reading from feet to inches.

As installed on the working vessels of the U. S. Coast and Geodetic Survey, the dial readings are taken off at suitable intervals by an officer and jotted down manually. It would be possible to make the instrument self-recording, and this has been done in one experimental installation; but at present the Survey does not feel that general use of automatic recording is necessary.

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GEOLOGY

Meteorite Explosion May Have Formed Meteor Crater

Study of High-Velocity Bullets Shows Masses of Iron Coming From Outer Space Would Be Vaporized on Impact

METEOR Crater in Arizona, and similar great pits elsewhere in the world, may well have been gouged out by the cannonball-like impact of a great mass of meteoric iron roaring in from outer space. But there is little use hunting for the iron now, if the calculations set forth by Prof. C. C. Wylie of the University of Iowa are correct (*Popular Astronomy, October*). Practically all of it, he holds, was literally blown into thin air, in a tremendous explosive vaporization of the erstwhile solid metal.

Prof. Wylie's studies, based on the impact behavior of high-velocity rifle bullets, lend strong support to the "explosion" theory of meteorite crater formation, held by himself and a number of his colleagues, as opposed to the "cannonball" theory, which supposes that the meteorite buried itself on striking, without losing any great part of its mass through conversion into vapor.

Prof. Wylie states that lead bullets, striking at a velocity of 2,700 feet a second, which is the muzzle velocity of the American service rifle, melt completely and convert about five per cent. of their mass into lead vapor. As the velocities are stepped up, larger percentages of the solid lead flash over into vapor on striking the target, until a bullet moving at 5,000 feet (nearly a mile) a second would have 94 per cent. of its mass instantly vaporized.

Much Higher Speeds

Large meteorites, the Iowa astronomer states, travel at much higher velocities than that, and are not seriously impeded by atmospheric resistance as they approach the earth.

"If an iron meteorite strikes at 14,000 feet per second, the total energy would be sufficient to melt and vaporize the iron," he declares. "The energy of the explosion would be approximately that of the explosion of its own weight of nitroglycerin. . . . For higher velocities the energy of the explosion increases rapidly. At 25 miles per second it would be 120 times that of an equal weight of nitroglycerin."

Assuming a mass of about 700,000 tons for the iron mass that formed Meteor Crater in Arizona, and a striking velocity of 25 miles per second, Prof. Wylie calculates an explosive force from its vaporization equivalent to that of one hundred million tons of nitroglycerin.

"Even this estimate," he comments, "is evidently much too large. Comparison with the craters produced by the largest mines set off during the World War indicates that two hundred thousand tons of nitroglycerin would have been sufficient to produce the famous crater."

Explains Fragments

Iron fragments, however, are found in and near meteorite craters, which would seem at first to contradict Prof. Wylie's theory. However, he calls attention first to the fact that the nose of a high-velocity bullet is sometimes found, unmelted, in the target, and argues that something of the same nature might happen to the "impact end" of a meteorite. Furthermore, when the explosion occurs, unmelted portions of the meteorite might be blown out. Finally, the vaporized iron left in the crater would of course immediately re-condense into liquid iron, so that rock falling back in would have a considerable amount of iron melted into it.

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AGRICULTURE

Peru Restricts Exports Of Rotenone Plants

PLANTS containing the valuable insect-poisoning compound known as rotenone have been placed under very severe export restrictions by the government of Peru, the bureau of entomology, U. S. Department of Agriculture, has learned. Living plants or their roots, which might be used for the establishment of cultivation in other countries, are barred from export altogether. Only dried roots, containing not more than ten per cent. of water, may leave the country; and that only until mills for the extraction of rotenone shall have been established in Peru.

Six different genera of plants are affected by the Peruvian order. They all belong to the legumes, or bean family, and are known to the trade collectively as "cubé," a name originally applied by South American Indians to any fish-poisoning plant. These rotenone-containing plants were originally used by the natives in wholesale fish-killing, as related plants were also used by the Malays in the East Indies. Subsequently their active principle was found to be a most efficient insecticide, so that the dried plants now have a world-wide market.

Provides Major Source

Peru has been a major source of the rotenone used in the United States, so that the effect of the Peruvian export restriction will probably be a material rise in price. However, the effect is not expected to be permanent, for other South American countries have large "cubé" resources, and Brazil is already exporting quantities of the plants, from the port of Pará. The United States might conceivably also send to the East Indies for a part of its rotenone-plant requirements, though at present the entire product of that region is being absorbed by Great Britain and Japan.

If a general export embargo should force the price of rotenone too high for toleration in the American market, it might be possible for this country to develop its own supply. There are several rotenone-containing legumes native to the United States, most notably the Southern seashore plant known as "Devil's shoestring." However, it is still more economical to import materials for rotenone extraction.

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