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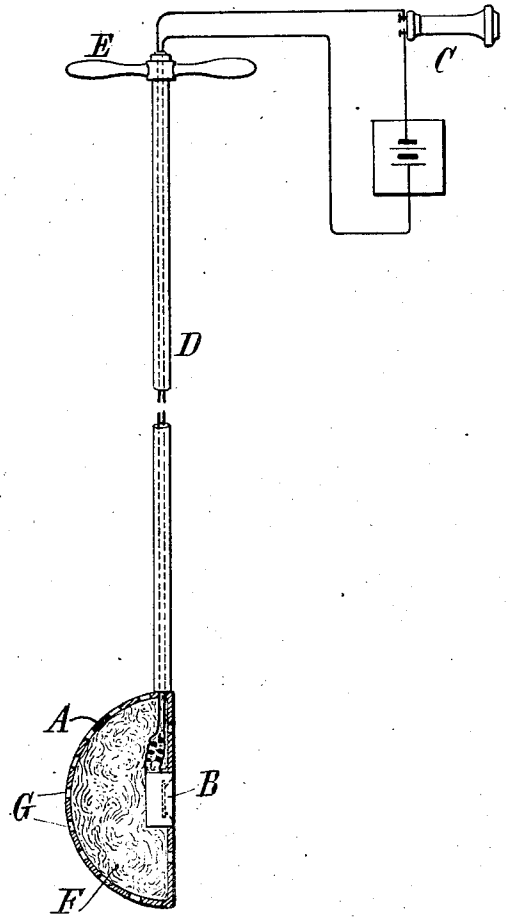
DIRECTION FINDER FOR SUBMARINE SIGNALS.

APPLICATION FILED APR. 30, 1912.

1,051,543. Patented Jan. 28, 1913.



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UNITED STATES PATENT OFFICE.

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DIRECTION-FINDER FOR SUBMARINE SIGNALS.

1,051,543. Specification of Letters Patent. Patented Jan. 28, 1913.

Application filed April 30, 1912. Serial No. 694,200.

To all whom it may concern:

Be it known that I, LUCIEN IRA BLAKE, a citizen of the United States, residing at London, England, have invented certain new and useful Improvements in Direction-Finders for Submarine Signals, of which the following is a full, clear, and exact description.

This invention is an improvement in devices for determining the direction, from a given point, of a source of subaqueous sounds, and is designed for application to those instruments employed in submarine signaling which are commonly known as direction finders.

In explanation of the principle of the invention, it may be stated that it is well known that submarine sounds pass readily through all submerged solids and that the latter are not capable of casting acoustic shadows. The hull of a ship, for example, whether of wood or of steel, offers no appreciable resistance to the transmission of sound signals through it, and in practice, receiving devices for such signals are usually placed inside of a vessel's walls. Sound conduction under such circumstances is dependent wholly upon the property of elasticity of these substances, and as all substances are more or less elastic, they are all conductors of sound to varying degrees. I have discovered, however, that submerged solids may be rendered substantially opaque to subaqueous sounds and thus made available for various submarine signaling purposes, by breaking them into small fragments and using a mass of such fragments as a sound screen, thus solving in a novel way a problem that has been the subject of much experimental investigation, hitherto with results of the most meager and unsatisfactory character.

By many experimental tests I have demonstrated that by thus breaking up a solid into small fragments, not only is the elasticity of the integral mass destroyed, but that the individual fragments, when submerged, are capable of absorbing sound vibrations by virtue of their property of inertia, and that their aggregate mass becomes acoustically opaque, while the same fragments in air do not appreciably insulate sounds. I have further demonstrated that the character of the material itself is of little moment, but that matter not varying widely in specific gravity from water has the most marked absorbtive power. The shape of the divided matter is also largely unimportant, that is, it may be filar or fragmental, symmetrical or irregular, but I have found that when a substance in filar form is used the threads must be flexible and not rigid, as otherwise they are elastic and conduct sounds. Thus broom straw and abestos fibers conduct, but wool yarn and spun glass insulate. I have moreover found that if the substance, although in a divided or fragmental state, be tightly packed, it acquires a quasi-elasticity and becomes conductive, and hence that for the best results it should be in a loosely packed condition while submerged.

As a more specific illustration of the nature of the invention, it may be stated that sheet metal, plate glass, or cork slabs, are conductors of submarine sounds, but the same materials in the form of shot, beads or granulated fragments respectively are opaque when submerged. Spun glass, for example, when loosely packed in a layer not more than an inch in thickness will almost completely intercept the tones of a submarine bell six inches distant, although the same bell may be easily heard for a mile through water alone. Such a layer presents no obstacle to the sound of the same bell in the air.

I propose to apply this discovery to the construction of acoustic screens, and in the drawings hereto annexed I have illustrated a common form of direction finder which constitutes a typical embodiment of the same. The figure represents in part vertical section a device for this purpose.

A is a hollow hemispherical case of non-corrodible material of suitable kind, preferably metal.

B is a microphonic transmitter, inclosed in a water tight casing and secured to the flat or open side of the instrument with its sensitive face exposed to the water.

C is a telephonic receiver or ear-piece in circuit with the transmitter by wires that run up alongside of or through the stem D, by which the device is submerged and manipulated.

E is a bar or handle for turning the device and indicating the position of the exposed side of the transmitter.

F is a mass of fragmental or filar material loosely filling the interior of the casing A, the walls of which contain numerous per-

forations G, through which the water percolates so as to keep the mass thoroughly wet while submerged. Thus partially inclosed by the acoustic screening material, the transmitter will be affected only by sounds which approach in the direction of the flat or open side, and will be affected to the maximum degree when that side is turned directly toward the source of sound, the direction of which will be indicated by the position of the turning handle.

The instrument may be held in the hand and submerged in the open water over the side of a boat, or it may be located in a suitable tank within the ship, for example, in the "trimming tank" in the peak, or elsewhere. It will be understood that the indicating devices may be located at any convenient point, as in the pilot house.

The selection of the material and of the size and form of the fragments is largely a matter of judgment, determined by the character of the sounds to be obstructed and absorbed. If the solid be too finely granulated or powdered, its inertia effects are greatly weakened, so that large quantities, which means large screens, are necessary to insure opacity to loud sounds. Again, the inertia effects may be greatly increased by using comparatively large fragments interspersed with fragments of sponge or spongy material, which serve as cushions to prevent packing and thus to maintain the acoustic opacity. In the drawing the letter H designates fragments of sponge incorporated into the mass of divided material.

Up to the present time no device is used or known, so far as I am aware, whereby small crafts, exposed in fog or storm, can locate the direction of any vessel or station sending out submarine sound signals, and as such sources of signal warnings are already widely distributed over the seas, their helpfulness is seriously limited. By my invention, however, a direction finder is provided which may be submerged in the open water, or in a tank within any vessel below the water line, and by a simple turning of the device, any source of sound signals can be definitely located, and even the position of steamers in their course can be continually determined by the subaqueous noises emanating from their machinery.

While illustrated in connection with a specific form of instrument, the invention is applicable generally to cases where an acoustic screen for submarine sounds is employed, and is not limited to the special device shown as a typical embodiment thereof.

What I claim is:

1. A screen acoustically opaque to subaqueous sounds, comprising a mass of loosely packed fragments of solid material permeated with water.

2. A screen acoustically opaque to subaqueous sounds, comprising a mass of loosely packed fragments of solid material interspersed with fragments of spongy material and permeated with water.

3. A submarine sound direction finder, comprising in combination a transmitter sensitive to subaqueous sounds, a holder therefor having an acoustically opaque screen on one side composed essentially of a solid material in a loosely packed fragmental mass and permeated with water.

4. A submarine sound direction finder, comprising in combination a submerged telephonic transmitter and a rotatable screen therefor, of substantially hemispherical form and composed of a solid material in a loosely packed fragmental mass, permeated with the water in which it is submerged, said screen being open on one side to permit direct access of subaqueous sounds to the transmitter.

In testimony whereof I affix my signature in the presence of two subscribing witnesses.

LUCIEN IRA BLAKE.

Witnesses:
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