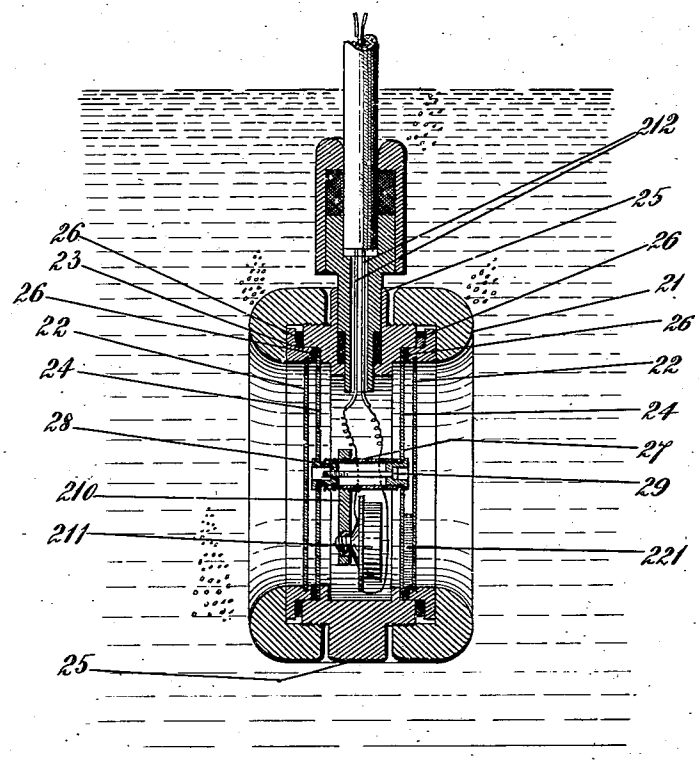
Dec. 26, 1922. 1,440,361

F. L. HOPWOOD.

SUBMARINE SIGNALING APPARATUS.

FILED JUNE 6, 1922.



INVENTOR:
Frank Lloyd Hopwood
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UNITED STATES PATENT OFFICE.

FRANK LLOYD HOPWOOD, OF WOOD GREEN, LONDON, ENGLAND, ASSIGNOR TO SUBMARINE SIGNAL COMPANY, OF BOSTON, MASSACHUSETTS.

SUBMARINE SIGNALING APPARATUS.

Application filed June 6, 1922. Serial No. 566,373.

To all whom it may concern:

Be it known that I, FRANK LLOYD HOPWOOD, a subject of the King of Great Britain, residing at 416 Alexandra Park Road, Wood Green, in the county of London, England, have invented certain new and useful Improvements in Submarine Signaling Apparatus, of which the following is a specification.

This invention relates to submarine signaling apparatus of the hydrophone type and its chief objects are to increase the efficiency of reception of submarine sound vibrations, to enable both the sensitivity and the tuning to be varied in a predetermined manner and to obtain and vary the directional properties of the instrument as required.

The accompanying drawing shows in section a hydrophone embodying this invention.

The apparatus comprises a casing or central ring 25, on which are carried flanged rings 23 each of which carries a diaphragm 22 fixed thereto. 24 are diaphragms which are held in place against the central ring 25 by the flanged rings 23, which in turn are held in place by rings 21 that screw on to the central ring 25, 26 being suitable packing rings.

Mounted centrally between the inner pair of diaphragms 24 is a tube 27 one end of which receives a bush 28 which slides on through an aperture in one diaphragm and has a flanged head to prevent any inward movement of the bush with respect to the diaphragm. Passing through the other diaphragm is a bush threaded on its exterior to receive the threaded interior of that end of the tube 27 and which houses the head 29 of a screw, the threaded part of which engages with a thread in the bush 28. Attached to the tube 27 by threads or otherwise by a suitable depending piece 210 is a microphone 211, the leads for which are indicated by 212.

By rotating the head 29 of the screw, the inner pair of diaphragms 24 can be brought closer together or can be allowed to move away from each other, thus altering the distance between the internal and external pair of diaphragms. Or the distance can be varied by screwing up the rings 21 more or less tightly, the packings 26 admitting of adjustment through the small movements required. Also the air backed surfaces of the diaphragms 28 can be varied in area by introducing into the space between the diaphragms suitable solid (say, gelatine paraffin or rubber) or liquid (say, water, or alcohol) separating medium filling up a proportion of the flat spaces as indicated at 221 for one side of the instrument, means of access being provided for the introduction of the substance, for example by removing the outer diaphragm.

By varying the distance between the diaphragms or the air backed areas or both, not only are the sensitivity and the tuning varied but by different adjustments at the two sides the directional properties are controlled. Thus if the two sides of the instrument are balanced acoustically by adjustments on the lines described the instrument is bidirectional, being most sensitive to waves approaching in either direction along the axis. If the symmetry or balance is slightly disturbed the instrument becomes unidirectional in a variable degree while if the acoustic asymmetry is considerable the instrument becomes non-directional. Moreover by the adjustments of distance and air backing the sharpness of the directional properties can be regulated to obtain a maximum effect.

The whole instrument may be enclosed in jelly or other acoustically transparent material contained in an outer body of rubber or like material and without any air spaces.

What I claim and desire to secure by Letters Patent of the United States is—

1. A hydrophone comprising a body, two external diaphragms, two internal diaphragms coupled together and spacially separated from the external diaphragms, and means for adjusting the distance between the internal and external diaphragms.

2. A hydrophone comprising a body, two external diaphragms, two internal diaphragms coupled together and spacially separated from the external diaphragms, and a screw adjustment for varying the distance between the internal and external diaphragms.

3. A hydrophone comprising a body, two external diaphragms, two internal diaphragms coupled together and spacially separated from the external diaphragms, and means for varying the acoustic symmetry of the instrument.

4. A hydrophone comprising a body, two

external diaphragms, two internal diaphragms coupled together and spacially separated from the external diaphragms, and means whereby the distance between the two pairs of internal and external diaphragms may be independently adjusted at each side of the instrument.

5. A hydrophone comprising a body, two external diaphragms, two internal diaphragms coupled together and spacially separated from the external diaphragms, and means for varying the acoustic symmetry of the instrument comprising non-gaseous material introduced between the inner and outer diaphragms of at least one pair of diaphragms.

6. A hydrophone comprising a body, two external diaphragms, two internal diaphragms coupled together and spacially separated from the external diaphragms, and means for varying the area of the air backed surfaces of the outer diaphragms comprising non-gaseous material introduced between the inner and outer diaphragms of at least one pair of diaphragms.

7. A hydrophone comprising a body, two external diaphragms, two internal diaphragms coupled together and spacially separated from the external diaphragms, means for adjusting the distance between the internal and external diaphragms, and means for enclosing said hydrophone containing acoustically transparent non-gaseous material completely surrounding said hydrophone without air spaces.

FRANK LLOYD HOPWOOD.