No. 895,978. PATENTED AUG. 11, 1908.

J. A. L. DEARLOVE.

APPARATUS FOR TRANSMITTING AND REPRODUCING SOUNDS.

APPLICATION FILED JAN. 30, 1905.

3 SHEETS—SHEET 1.

Fig. 2.

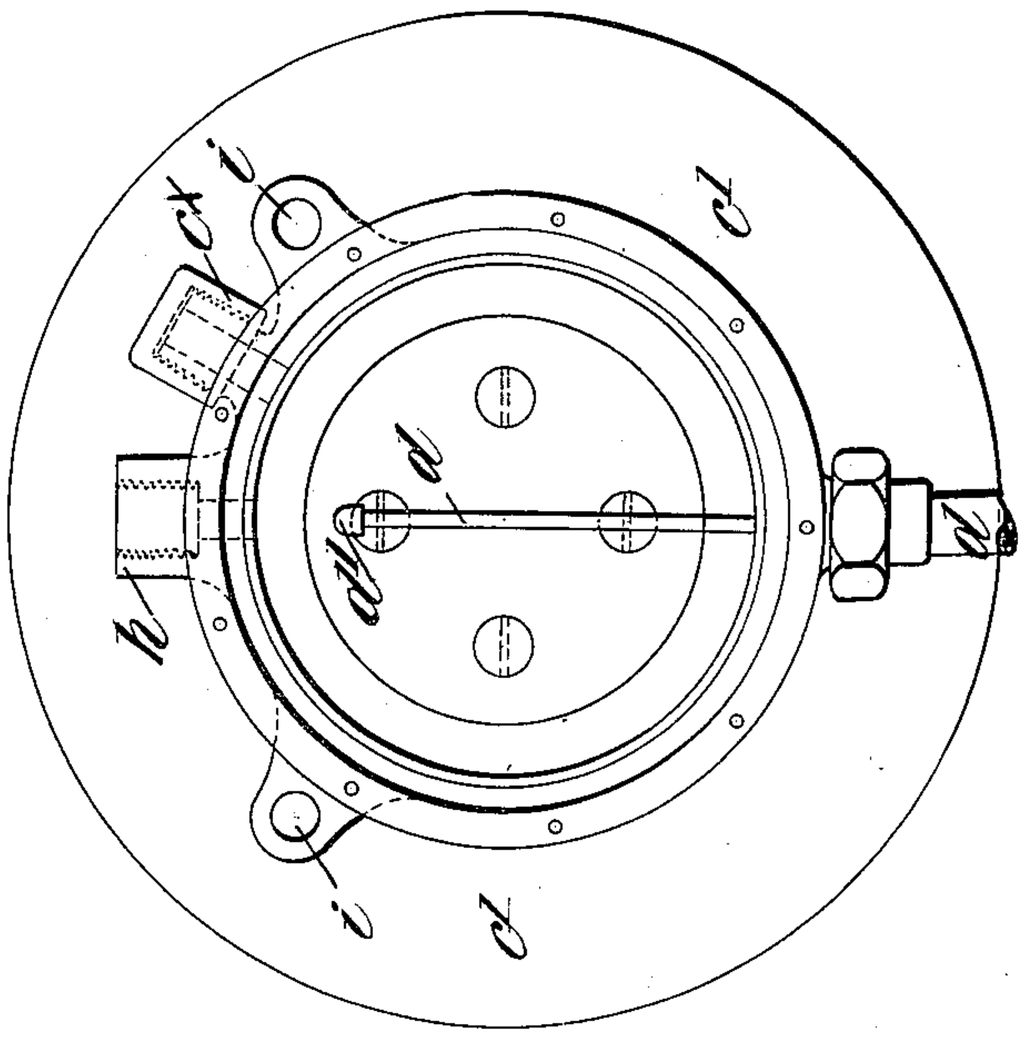
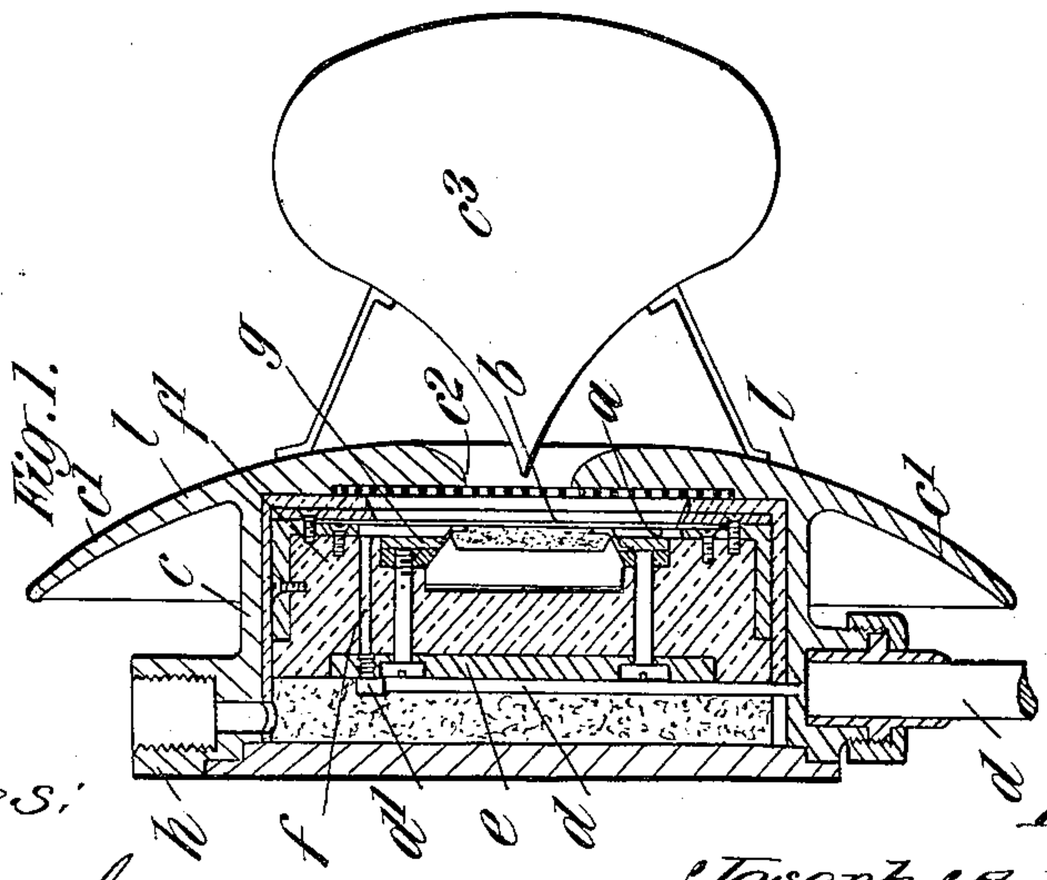


Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 4.

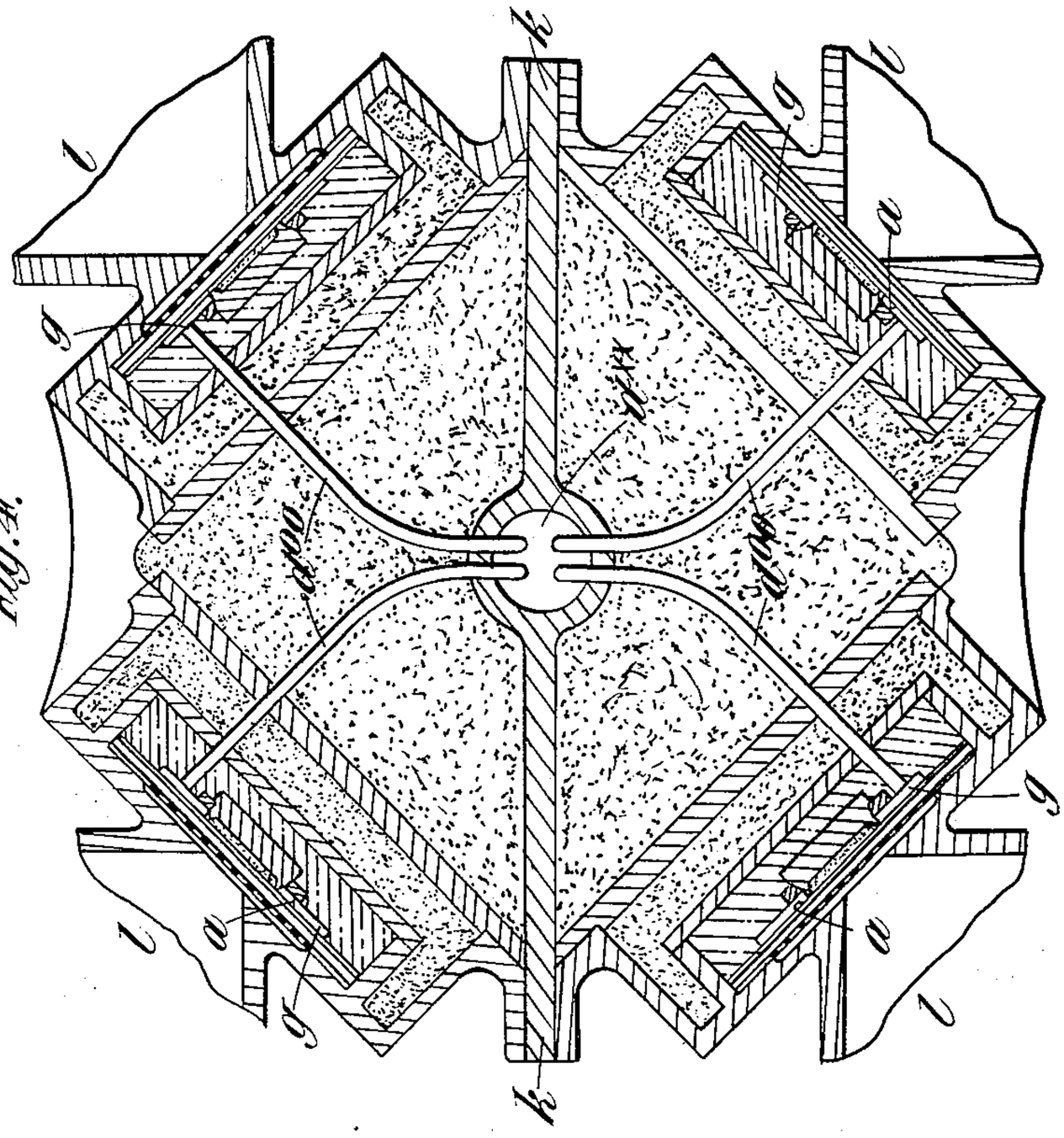
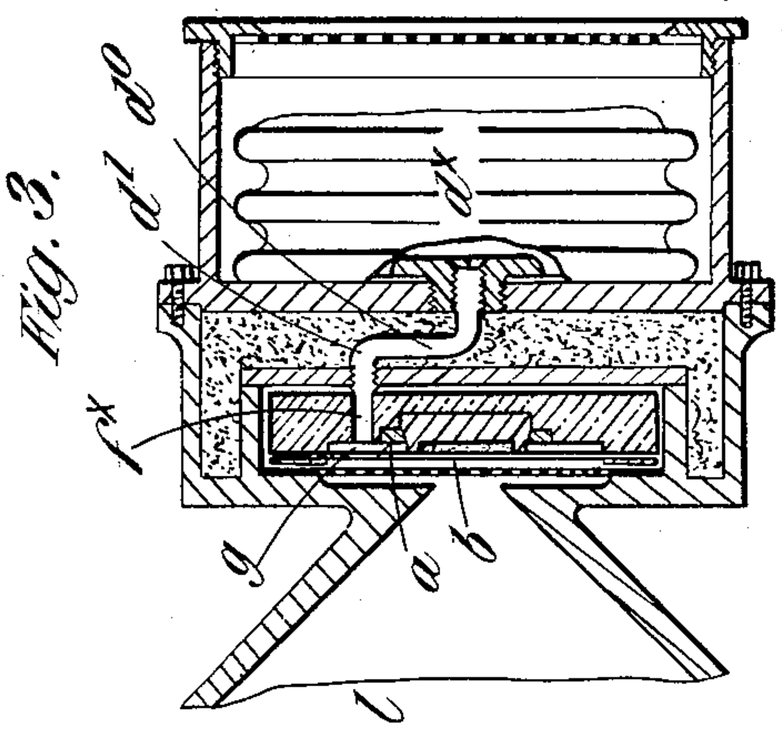


Fig. 3.



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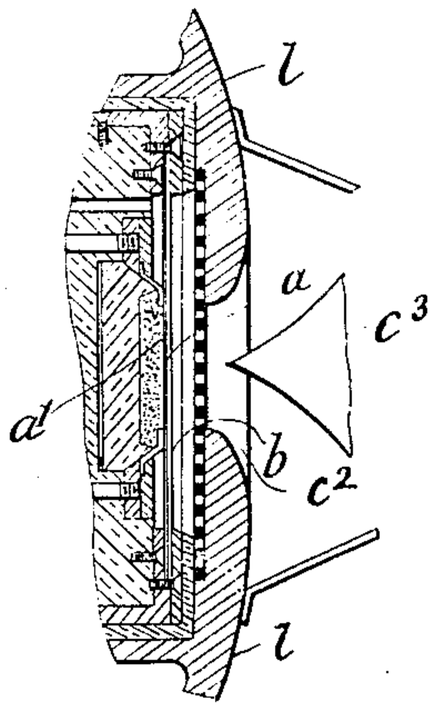
3 SHEETS—SHEET 3.

Fig. 5.



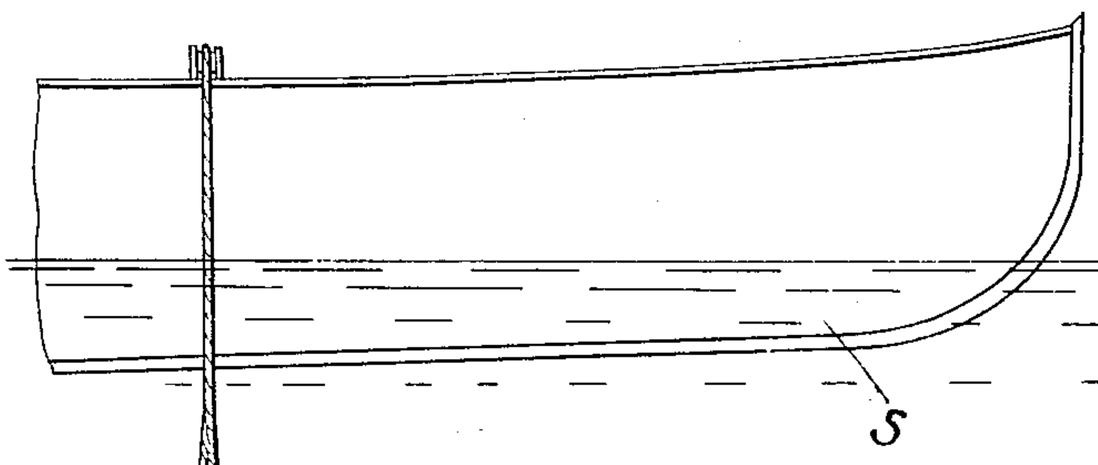


Fig. 7.

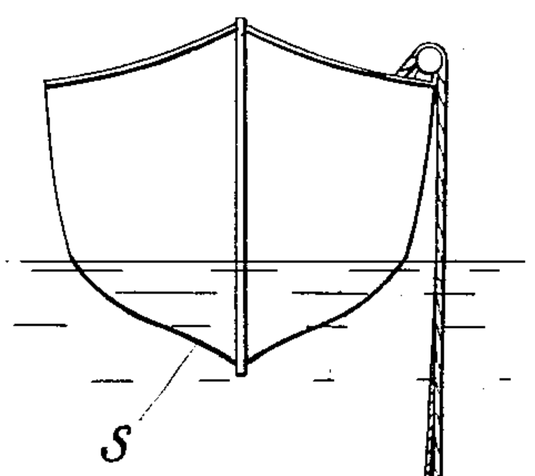
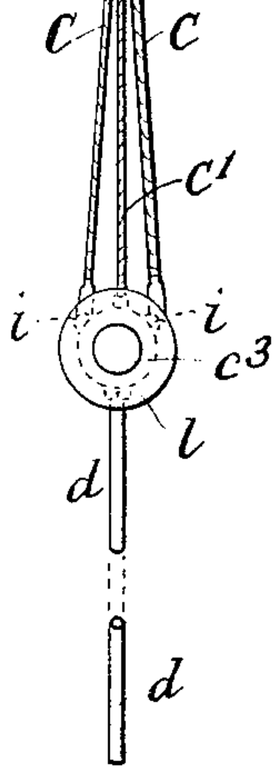
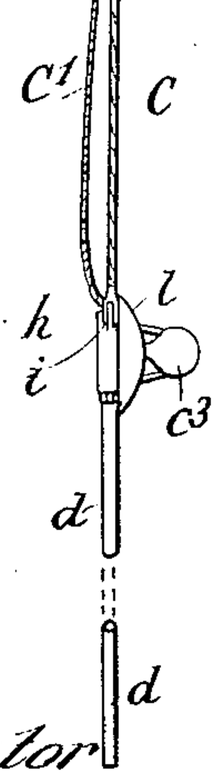


Fig. 6.





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UNITED STATES PATENT OFFICE.

JOSEPH ARTHUR LOVEL DEARLOVE, OF LONDON, ENGLAND.

APPARATUS FOR TRANSMITTING AND REPRODUCING SOUNDS.

No. 895,978. Specification of Letters Patent. Patented Aug. 11, 1908.

Application filed January 30, 1905. Serial No. 243,419.

To all whom it may concern:

Be it known that I, JOSEPH ARTHUR LOVEL DEARLOVE, a subject of the King of Great Britain, residing at 4 Great Winchester street, in the city and county of London, England, electrical engineer, have invented certain new and useful Improvements Relating to Apparatus for Transmitting and Reproducing Sound, of which the following is a specification.

This invention relates to apparatus for transmitting and reproducing sounds, such as telephones, microphones or the like; the present improvements being designed more particularly with a view to enabling the apparatus to be submerged to any desired degree without impairing the action of the apparatus.

As ordinarily constructed a microphone is rendered useless on being submerged not merely by reason of the water destroying its action because even if a watertight form of microphone, such, for instance, as described in the specification of British Letters Patent, No. 591 of 1898, or other type of microphone in which both electrodes are protected, be immersed to a depth of a few feet or fathoms the water pressure on the diaphragm destroys the usefulness of the apparatus.

To obviate the aforesaid defect and to render it possible to secure the ordinary functions of a carbon telephone transmitter while the latter is submerged and under considerable pressure the instrument is constructed in such a manner that the water pressure on the exterior surface of the diaphragm is balanced by, practically, an equivalent air pressure on the opposite or interior surface of the diaphragm.

In order that the said invention may be clearly understood and readily carried into effect, I will proceed to describe the same with reference to the accompanying drawings, in which:—

Figure 1 is a transverse section illustrating one arrangement by which the objects of the invention may be accomplished. Fig. 2 is an elevation of the rear side of Fig. 1; the back plate being removed. Fig. 3 is a transverse section of another arrangement whereby an equable or an approximately equable pressure may be preserved on each side of the diaphragm pertaining to the transmitter. Fig. 4 is a horizontal section illustrating a mode of applying the invention when using a number of transmitters arranged for enabling sounds to be transmitted when same arrive from various directions. Fig. 5 is a section of so much of the device shown in Fig. 1 as is necessary to illustrate the insertion of a protective extensible diaphragm. Fig. 6 is a diagrammatic view illustrating the apparatus in use, the hull of a ship being shown in end view, and, Fig. 7 is a similar diagrammatic view taken at right angles to Fig. 6.

According to one construction, described by way of example, and illustrated in Figs. 1 and 2, the microphone, having the outer side of its diaphragm *a* protected from the water by a metal sheet *b* which may be an electro-deposited coating of copper subsequently burnished or by other suitable means, may be inclosed in an air and watertight box *c* which may be constructed of metal or other suitable material to which is attached a tube *d* whereof the capacity is such that its cubic contents, would be so much greater than the vacant space in the box containing the microphone that the resulting air pressure within the box in rear of the diaphragm would be almost equal to or in balance with the water pressure due to the depth to which the apparatus is submerged. The tube *d* for convenience is preferably carried through the rear portion of the box *c* and connected with an elbow joint *d'*. The latter may be secured in the plate *e* pertaining to the transmitter, a hole or perforation *f* being drilled or otherwise formed through the ebonite block *f'* to convey the air under pressure to the space *g* in the rear of the diaphragm *a*. If required more than one perforation *f* may be formed through the ebonite block, but, in practice, I have found that one such perforation suffices. *h* is a nozzle or perforated boss through which the insulated cables or leads (not shown) are taken for effecting their connection with the electrodes of the instrument. *i i* are eyes for receiving the cords or cables by which the instrument is suspended, when in use. Other suitable means may be employed for securing the same result—the equalizing of the pressure on both faces of the carbon or other diaphragm *a* of the transmitter—such as a compressible chamber $d^{\times}$ (Fig. 3) preferably of a form similar to that of an aneroid barometer, in watertight communication with the space *g* behind the diaphragm and arranged in such a manner and of such dimensions that the air pressure in the chamber is

proportional to the pressure incidental to the depth of submersion. The said watertight communication may be established by means of a perforation or passage $f^{\times}$ through the ebonite block f' and a short length of pipe d^{0}, an elbow joint d' establishing connection between the pipe d^{0} and the perforation $f^{\times}$.

Several instruments may be contained in a single air-tight chamber or envelop into which the necessary insulated cables or leads may be taken or connected to the two electrodes of the instrument, in any manner that may be found most suitable, contained in nozzles or perforated bosses such as h. In the case of several instruments being placed in the same watertight chamber or envelop, they may be connected up in series or "multiple arc" or used singly as may be desired.

An example of the manner of arranging several instruments is shown in Fig. 4, in which I have illustrated four instruments of the type described with reference to Figs. 1 and 2 arranged upon a carrier or supporting plate k; the latter being formed with a central tubular extension $d^{\times\times}$ which projects into the water upon the instrument being submerged. The tubes d^{00} serve to convey the compressed air to the several spaces g at the rear of the respective diaphragms a. By arranging several groups or series of instruments upon a carrier or supporting plate, such as k, and locating the planes of the several diaphragms at different relative angles, sounds may be intercepted from any direction.

The box c may be formed or provided with a bell mouth l which may be constructed as illustrated in Fig. 1 wherein the box c is shown as formed with a circular rearwardly curved flange c' having a central aperture c^{2} into which the apex of a pear-shaped body c^{3} projects, the object being to direct the sound into the central aperture c^{2}. The bell mouth may, however, be of simple form as shown in Figs. 3 and 4.

To protect the inner surface of the diaphragm an extensib e diaphragm such as india rubber or other suitable material may be inserted in the interior of the air-tight box in such a manner as to protect the carbon electrodes from spray or damp.

In Fig. 5 the diaphragm is indicated at a and the protective extensible diaphragm at a'. This diaphragm a' may be india rubber or other suitable material and serve to protect the carbon electrodes from spray or damp.

According to an alternative method, the microphone to be submerged may be connected with a compression air pump and gage in such a manner that the air pressure in the air-tight box in which the microphone is fitted may be regulated so as to be equal to the pressure of the water on the exterior of the diaphragm of the microphone; the object being to avoid the loss of intensity of the sound due to the partial admission of the sound-waves to the interior of the box by way of the open water tube previously described or by the aneroid chamber, such admission neutralizing, to some extent, the action of the sound waves on the outer side of the diaphragm. To provide for this alternative method of operating, the box c may be furnished with a nozzle or perforated boss $c^{\times}$ (Fig. 2) whereby connection may be made by flexible hose or other convenient means with a compression air pump. The space in the box c, not occupied by the tube, is preferably filled with non-hygroscopic material such as ozocerite, wax or other substance possessing the requisite properties.

It will be understood that the instruments employed may be of any suitable type or construction and dimensions. They may be used in circuit with a battery and telephone direct or with a transformer or induction coil and telephone in any of the well known methods which it is unnecessary to describe or detail here. The main object is to provide means whereby an instrument, such as a microphone, may be usefully employed while submerged, for the purpose of detecting the approach of ships, boats or the like, whether submarine or otherwise, by the variations in electrical resistance caused in the microphone or other instrument connected in a circuit, such as described above, or in any other manner, as may be found most suitable.

The system may be employed for effecting communication from ship to ship, beneath the surface of the water; bells, gongs or other apparatus being employed to produce sound-waves which are picked up by the submerged instrument.

Referring to Figs. 6 and 7 the apparatus is shown suspended over the side of the ship indicated at S. The suspension cords, chains or cables are indicated at C C and the conductors or leads are indicated at C'. The suspension cords C C are secured to the eyes $i\,i$, while the conductors C' are taken through the boss h into the interior of the apparatus where they are connected with the respective electrodes pertaining to the instrument. Thus, when the instrument is let down into the water or submerged the pressure of the inclosed air in the tube d and at the rear of the diaphragm a is such as to balance the water pressure on the face of the parts exposed to such water pressure.

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

1. Submergible apparatus for transmitting and reproducing sounds, having a casing, a diaphragm inclosed in said casing, a tube entering the casing and conduits from the tube to the space in rear of said diaphragm, a circular rearwardly curved flange

having a central aperture and a pear shaped body arranged centrally to said flange.

2. In submergible apparatus for transmitting and reproducing sounds, the combination with the water-tight casing of a depending tube, a vibratory disk or diaphragm in said casing, a pipe adapted to effect communication between the tube and the space in the casing at the rear of said diaphragm and an extensible diaphragm on the inner side of the vibratory disk for protecting the carbon electrodes.

3. In submergible apparatus for transmitting and reproducing sounds, the combination of a casing, suspending means on the casing, a cable, means for leading said cable to the electrodes within the casing, a diaphragm, a tube entering said casing, conduits from the tube to the space in rear of the diaphragm, a circular rearwardly curved flange having a central aperture and a pear-shaped body arranged centrally to said flange.

4. Submergible apparatus for transmitting and reproducing sounds having a casing, a diaphragm inclosed in said casing, a protective coating of electro deposited copper upon said diaphragm, a tube adapted to descend into the water and entering the casing, air conduits from the tube to the space in rear of said diaphragm whereby the water pressure on the exterior surface of the vibratory diaphragm, is balanced or counteracted by the aeriform pressure on the interior surface of the said diaphragm, a circular rearwardly curved flange having a central aperture and a pear shaped body arranged centrally to said flange.

5. In submergible apparatus for transmitting and reproducing sounds the combination of a water-tight casing, a carbon disk inclosed in said casing, a depending tube adapted to descend into the water, an ebonite block, air conduits in said block extending from the depending tube to the space in rear of said disk whereby the water pressure on the exterior surface of the vibratory disk is balanced or counteracted, by aeriform pressure on the interior surface of said disk, a boss adapted to receive an air supply, a circular rearwardly curved flange having a central aperture and a pear shaped body arranged centrally to said flange.

6. In submergible apparatus for transmitting and reproducing sounds, the combination of a watertight casing, suspending means on said casing, a depending tube, a vibratory disk in said casing, a pipe adapted to effect communication between the tube and the space in the casing, at the rear of said disk, an extensible diaphragm on the inner side of the vibratory disk for protecting the carbon electrodes and means on said casing adapted to direct and centralize the sound.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses this thirteenth day of January 1905.

JOSEPH ARTHUR LOVEL DEARLOVE.

Witnesses:
T. SELBY WARDLE,
G. F. WARREN.