Jan. 29, 1924. 1,481,946

R. L. WILLIAMS

DIRECTIONAL SIGNAL RECEIVING

Filed July 18, 1918. 2 Sheets-Sheet 1

Fig. 1.

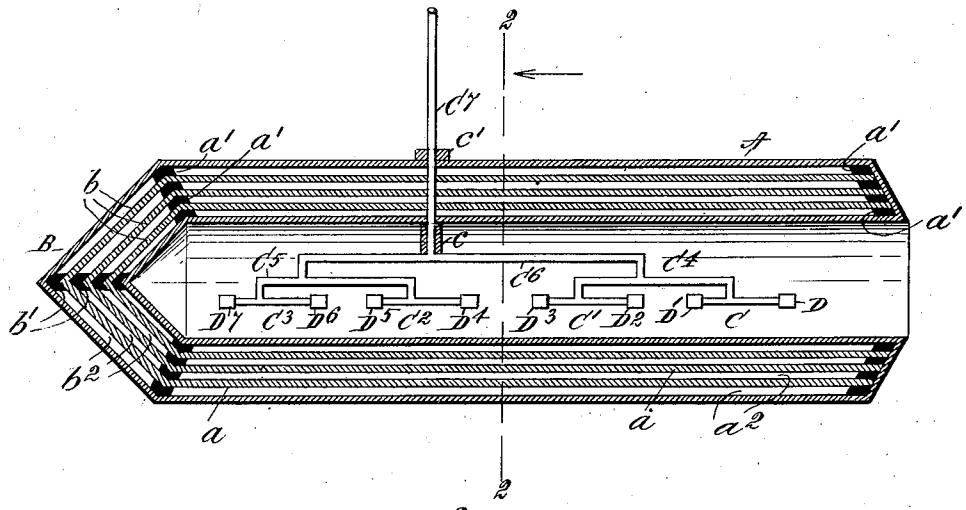


Fig. 2.

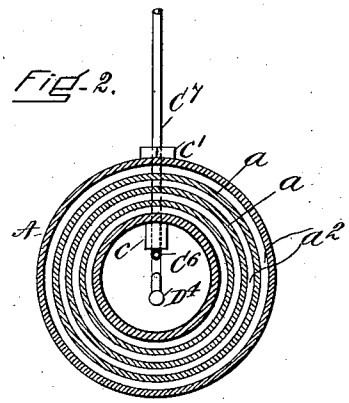
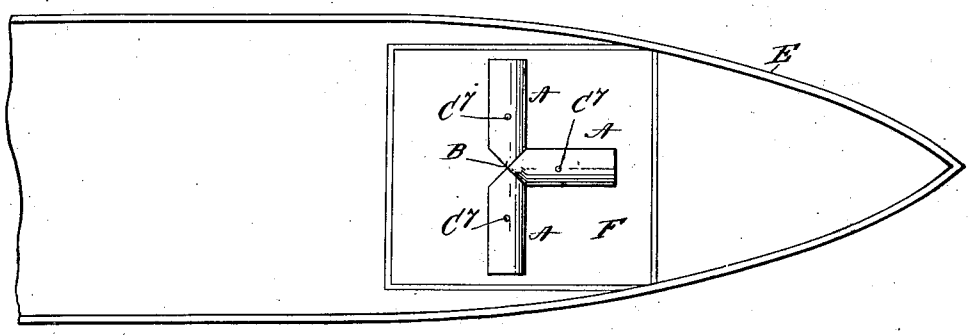


Fig. 3.



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Fig. 4.

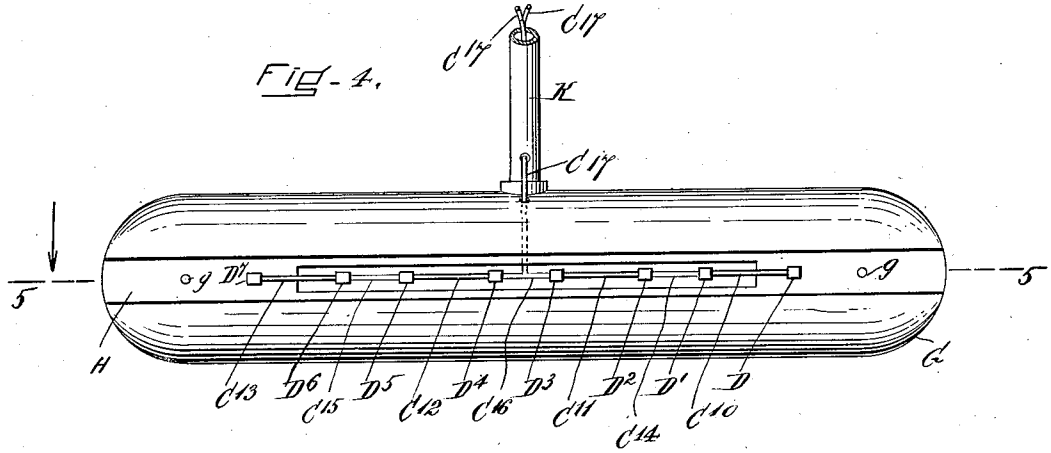


Fig. 5.

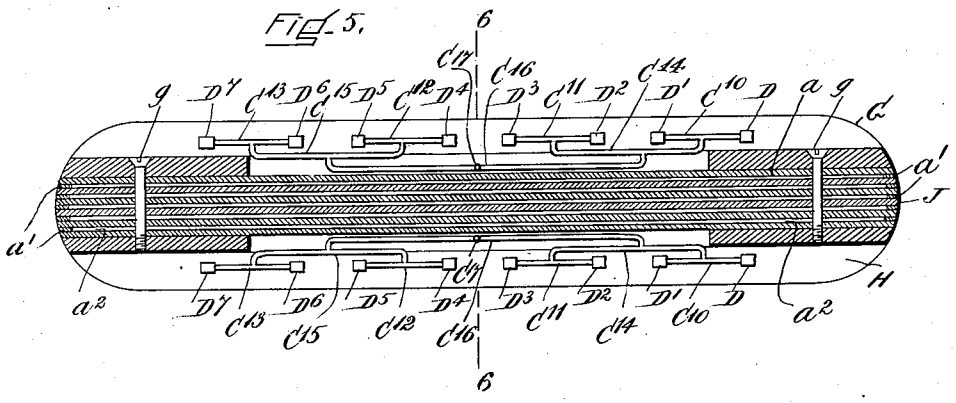
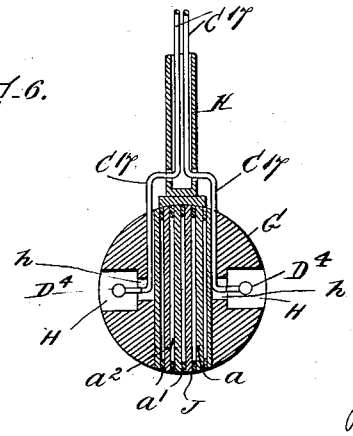


Fig. 6.



INVENTOR:
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Patented Jan. 29, 1924. 1,481,946

UNITED STATES PATENT OFFICE.

ROBERT L. WILLIAMS, OF NEWTON, MASSACHUSETTS, ASSIGNOR TO SUBMARINE SIGNAL COMPANY, OF PORTLAND, MAINE, A CORPORATION OF MAINE.

DIRECTIONAL SIGNAL RECEIVING.

Application filed July 18, 1918. Serial No. 245,567.

To all whom it may concern:

Be it known that I, ROBERT L. WILLIAMS, of Newton, in the county of Middlesex and State of Massachusetts, a citizen of the United States, have invented a new and useful Improvement in Directional Signal Receiving, of which the following is a specification.

While several devices are available for detecting the direction from which signals or other sounds are received, especially in submarine work, they are mainly based on the use of electrical apparatus. My present invention relates to the receipt and transmission of such sounds acoustically to the observer, that is, by means of apparatus which is mechanical or rather acoustical in its nature, relying mainly upon the receipt and transmission of compressional waves by mechanical means. In an application for a United States patent filed by me April 25, 1918, Serial No. 230,802, I have shown and described apparatus by which sounds from a given point strike various diaphragms located in the sides of a vessel at varying distances apart and are communicated to a microphone by paths which are of different lengths, thus compensating for the difference apart of the diaphragms and hence for the length of travel of the sounds before reaching the microphone.

My invention will be understood by reference to the drawings in which it is shown in its preferred form.

Figure 1 shows a longitudinal section of a cylindrical screen containing my invention, and

Fig. 2 a cross section on line 2—2 of Fig. 1.

Fig. 3 shows diagrammatically a way in which three of my devices may be mounted with relation to each other on board ship.

Fig. 4 is a form of overboard apparatus in which two sets of similar receivers are used, screened from each other.

Fig. 5 is a section on the line 5—5 of Fig. 4, and

Fig. 6 a section on line 6—6 of Fig. 5.

In Figs. 1 and 2, A is the casing which is made of cylinders a of wood or metal spaced at the ends and at any other desired points by spacers a^1 which serve not only to hold the cylinders in concentric positions but also to make chambers a^2 which shall be tight and, being filled with air or the like, will serve with the cylinders a as a sound screen in a manner now well known.

One end of this casing is closed preferably with a conical closure B of similar construction, b being conical partitions, b^1 being the spacers therefor and b^2 being the air spaces between them.

Within the casing is mounted the receiving mechanism which as shown comprises four tubes C, C^1, C^2 and C^3 open at both ends and connected with tubes C^4 and C^5. These tubes C^4 and C^5 are connected with a tube C^6 which in turn is connected with the tube C^7 leading to any convenient point and terminating in any convenient earpiece, of which there are many well known. This tube C^7 passes out through the side wall of the casing and is fastened in place by a spacing block c and nut c^1 or in any other convenient way.

The end of each tube C, C^1, C^2 and C^3 is closed by a watertight cap D, which may be of any desired shape and of any material so long as it is sensitive to compressional waves arriving through the water. In its preferred form and as shown this closure comprises a cap of rubber or the like which is slipped over the end of the tube forming a membrane which is responsive to each sound wave which strikes it and by its vibration excites compressional waves in the tubular system of which it is a part.

While the tubes C, C^1, C^2, C^3 in Fig. 1 are of the same length, points of connection between them and the tubes C^4 and C^5, it will be noted, are not similarly placed; for example, the connection between C and C^4 is longer than the connection between C^1 and C^4. In other tubes the arrangement is similar as can be seen from the drawings. Moreover, the tube C^7 is not joined to C^6 at its middle point. The purpose of this construction is to cause all the sounds received by the membranes of the service caps D to reach the observer at the same phase. Thus by making the path of the compressional wave between the observer and the cap D somewhat longer than the path between the observer and the cap D^7 the distance between the caps D and D^7 will be compensated for.

In using one of these devices it is lowered overboard and turned about the tube C^7 as an axis until it reaches a point at which the loudest sound is heard. It will then be pointing to the source of sound, the screening cas-

ing A serving to keep off sounds from other directions. It is desirable that the outside of the casing be made of a fairly heavy material to prevent damage to the device.

A convenient way of using such a device on board ship is shown in Fig. 3 where E is the ship and F is a water tank therein in which three of these devices A are suspended below the water line. In this case, while the devices are stationary, sounds can be heard from three directions and by turning the ship according to the direction from which the sound seems to come the strongest, the direction of its source can easily be determined.

In Figs. 4, 5 and 6 I have shown another means of mounting tubes. As in this case the purpose is to receive sounds coming to the side of the device, no compensation is provided for, the corresponding caps being all the same distance from C^7. In this case two sets of tubes are mounted one on each side of a sound screen J, constructed each out of tubes, being lettered as in Figs. 1 and 2 C^{10}, C^{11}, C^{12} and C^{13} and supported from tubes C^{14}, C^{15}, C^{16} and C^{17}, the ends of the tubes C^{10}, C^{11}, C^{12} and C^{13} being closed as before by caps D, D^1, etc. In these views G, G are what are called fairing pieces, which serve as the support for the various paths. The fairing pieces are located one on each side of the sound screen J and bolted together through the sound screen by screws *g*. Each fairing piece has a recess H in which the tubes are located and suitable passages *h* through the tubes C^{17} lead to the pilot house or the point of observation. I also prefer to provide this device with a protecting tube K mounted on its top through which the tubes C^{17} pass up and by which the device may be suspended in open water.

I do not mean to limit my invention to the precise construction shown, as other constructions may embody the principles of my invention. The caps D may be made of any vibratory material, though preferably of rubber, and of any shape which will keep the tubes free from water and at the same time will transmit the vibrations received to the observer so that the observer may get the result.

While the form of my invention shown in Figs. 4 and 5 is especially designed for receiving sounds coming in laterally, by substituting tubes like those shown in Fig. 1 compensation for dead-ahead receiving will be had.

What I claim as my invention is:—

1. A subaqueous sound receiving device comprising a tubular sound screen closed at one end by said sound screen and exposed at the other end to the sound conducting medium, a plurality of receivers positioned at points within the said tubular sound screen, conducting tubes, a main tube, said conducting tubes connecting said receivers with said main tube, said receivers, said conducting tubes, said main tube, all containing a compressible fluid, said receivers being positioned so that the sound coming to the main tube from said receivers is in phase.

2. A subaqueous sound receiving device comprising a tubular sound screen closed at one end by said sound screen and exposed at the other end to the sound conducting medium, a plurality of receiving tubes positioned at points within the said tubular sound screen, said receiving tubes containing a compressible fluid, each tube having a vibratory closure at the outer end thereof, a plurality of conducting tubes, a main tube, said conducting tubes connecting the receiving tubes to said main tube, said receiving tubes being positioned so that the sound coming to the main tube from the said receiving tubes is substantially in phase.

3. A subaqueous sound receiving device comprising a tubular sound screen closed at one end by said sound screen and exposed at the other end to the sound conducting medium, a plurality of receiving tubes positioned in a line parallel with the axis of said sound screen within said tubular sound screen, said receiving tubes containing a compressible fluid, each receiving tube having a vibratory closure at the outer end thereof, a plurality of conducting tubes, a main tube, said conducting tubes connecting the receiving tubes to said main tube, said receiving tube being positioned so that the sound coming to the main tube from the said receiving tubes is substantialy in phase.

4. A subaqueous sound receiving device comprising a tubular sound screen closed at one end by said sound screen and exposed at the other end to the sound conducting medium, the inner walls of said sound screen abutting against the subaqueous sound medium, a plurality of receiving tubes positioned in a line parallel with the axis of said sound screen within said tubular sound screen, said receiving tubes containing a compressible fluid other than the subaqueous sound medium, each receiving tube having a vibratory closure at the outer end thereof, a plurality of conducting tubes, a main tube, said conducting tubes connecting the receiving tubes to said main tube, said main tube extending through the wall of the sound screen and supporting in a fixed position said sound screen whereby a rotation of the main tube will change the direction of the sound screen.

5. A subaqueous sound receiving device comprising a tubular sound screen closed at one end by said sound screen and exposed at the other end to the sound conducting medium, the inner walls of said sound screen abutting against the subaqueous sound medium, a plurality of receiving tubes posi-

tioned in a line parallel with the axis of said sound screen within said tubular sound screen, said receiving tubes containing a compressible fluid other than the subaqueous sound medium, each of said receiving tubes having a vibratory closure at the outer end thereof, a plurality of conducting tubes, a main tube, said conducting tubes connecting the said receiving tubes to said main tube, said conducting tubes and main tube forming a rigid structure, said main tube extending through the wall of the sound screen and supporting said sound screen, said conducting tubes and main tube being in a fixed position with reference to the sound screen.

6. A tubular sound screen comprising concentric tubes sealed at one end and open to the sound conducting medium at the other end, said outer end having the space between the concentric tubes sealed from the sound conducting medium whereby the volume between the concentric tubes is entirely sealed from the sound conducting medium.

7. A tubular sound screen comprising concentric tubes sealed at one end and open to the sound conducting medium at the other end, said outer end having the space between the concentric tubes sealed from the sound conducting medium whereby the volume between the concentric tubes is entirely sealed from the sound conducting medium, and spacers positioned between the concentric tubes.

8. A subaqueous sound directional receiving device comprising a tubular sound screen closed at one end by said sound screen and exposed at the other end to the sound conducting medium, the inner walls of said sound screen abutting against the subaqueous sound medium, a plurality of receiving tubes positioned in a line parallel with the axis of said sound screen within said tubular sound screen, said receiving tubes containing a compressible fluid other than the subaqueous sound medium, each of said receiving tubes having a vibratory closure at the outer end thereof, a plurality of conducting tubes, a main tube, said conducting tubes connecting the said receiving tubes to said main tube, said conducting tubes and said main tube forming a rigid structure, said main tube extending through the wall of the sound screen and supporting said sound screen, said conducting tubes and main tube being in a fixed position with reference to the sound screen, said receiving tubes being positioned whereby the sound wave front traveling perpendicular to the axis of the tube is transmitted by the said receiving tubes to the main tube in phase and whereby the maximum sound energy is transmitted to the receiving tubes when the sound screen has its axis perpendicular to and facing the approaching sound wave.

ROBERT L. WILLIAMS.