Feb. 3, 1931. B. SETTEGAST ET AL 1,791,014

SUBAQUEOUS SOUND APPARATUS

Filed July 21, 1928 2 Sheets-Sheet 1

Fig. 1

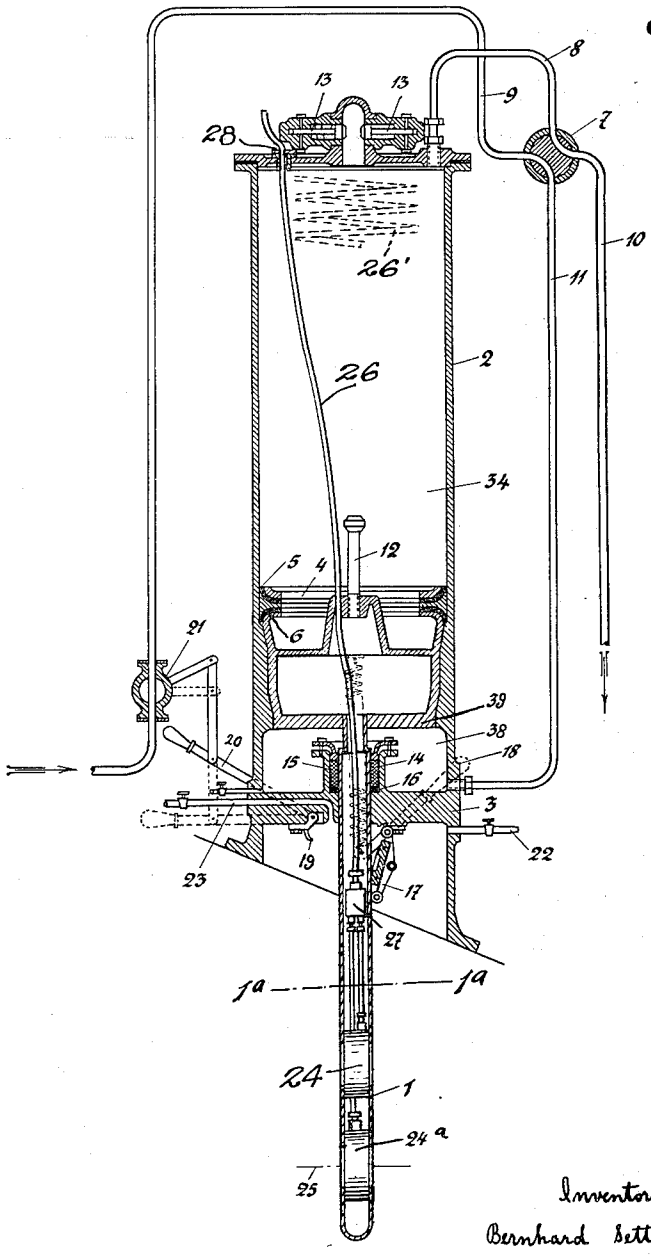
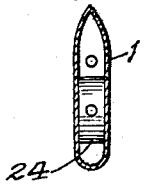


Fig. 1a



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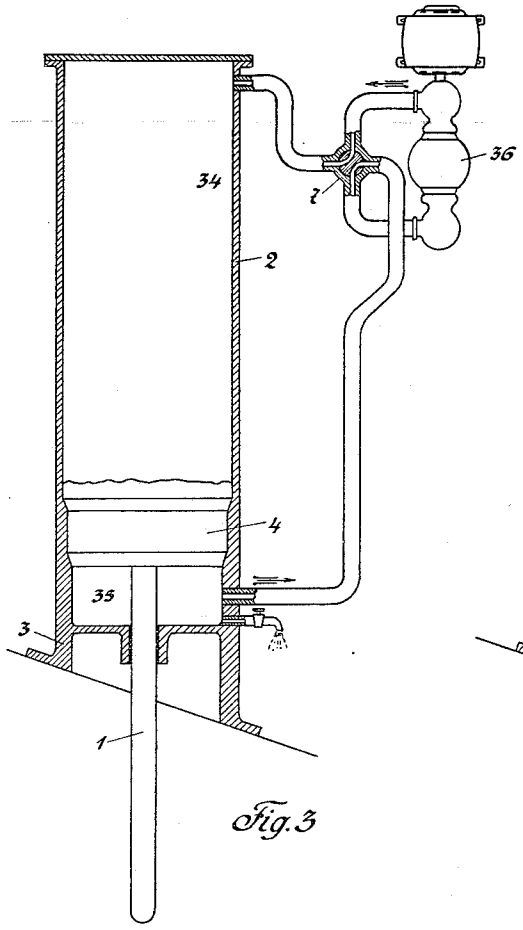


Fig. 3

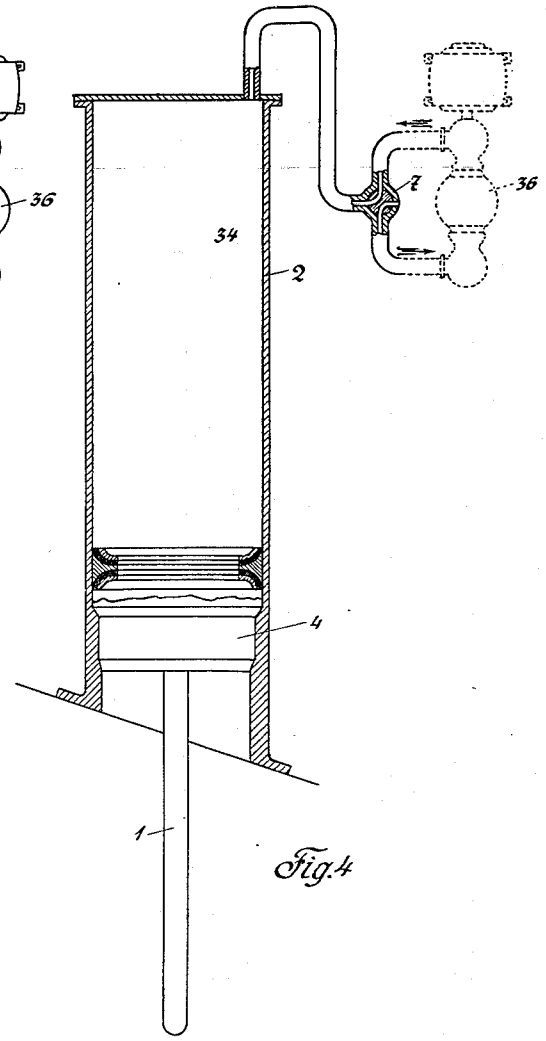


Fig. 4

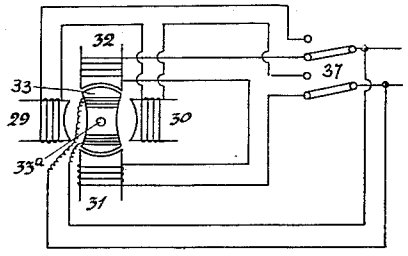


Fig. 2

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UNITED STATES PATENT OFFICE

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SUBAQUEOUS SOUND APPARATUS

Application filed July 21, 1928, Serial No. 294,337, and in Germany August 2, 1927.

The invention relates to apparatus for transmitting and receiving sound waves, for use particularly on ships. The device depends upon the principle, which of itself is well-known, of bringing out from underneath the ship a body, preferably of stream line cross-section, which serves as carrier of the actual sound transmitter or receiver.

The invention consists in moving this body in the inward and outward directions by means of a liquid or gaseous pressure medium.

It has already been proposed to bring out of the ship by means of a pressure medium firing devices for firing explosive cartridges, but in this case the conditions are substantially different and simpler than in the case of electrical sound transmitters operated with alternating current, which have quite different dimensions and, since they must serve at the same time as receivers, must be mounted in a carrier free from disturbances, i. e. of stream line form and free from vibrations.

The invention exhibits therefore the further additional feature that the carrier is constructed as a rigid stream line body and is provided at the top with a piston, which is packed over a considerable length and is guided in a tube closed pressure-tight towards the interior of the ship. The guides may be divided. A further feature of the invention is the arrangement of a relatively steep conical seat for the piston of the device in protruded position.

Another feature of the invention consists in an arrangement in which excess pressure or reduction of pressure is employed in sequence in the same chamber or simultaneously in both chambers.

The invention is illustrated in Figures 1 to 4 of the accompanying drawing in which:

Fig. 1 represents in longitudinal vertical section the device as installed in the ship's bottom.

Fig. 1[a] represents a transverse section through the projector 1 on the line 1[a]—1[a] in Fig. 1.

Fig. 2 represents in diagrammatic illustration the electric relay for remotely controlling cock 7.

Fig. 3 represents in longitudinal vertical section a modification of Fig. 1 so far as the supply of pressure fluid is concerned, and

Fig. 4 represents in similar section a simplified modification of Fig. 3.

The device consists of three main parts, the protrudable member or projector 1, the guide cylinder 2 and an intermediate member 3, which connects the guide cylinder with the hull of the ship and at the same time serves as carrier of the closing member for the outlet. The projector carries at its upper end a piston 4, to the bottom 39 of which it is suitably attached. The piston in this modification runs freely in cylinder 2, and is provided with leather sleeves 5 and 6 which serve for tight packing. Piston 4 is preferably provided with two conical seats, as shown at 8 and 9, in order to firmly seat the piston when the element 1 is projected from the cylinder. Alternatively the piston 4 itself may be ground in tight to a close fit in the cylinder 2, or be provided with a packing of any other suitable kind. The control of the pressure medium alternately on the top for extrusion and on the underside for drawing in the piston 4 is effected with the aid of a control cock 7. This cock is bored and connected in such a way that on the outward piston movement the space above the piston 4 is connected by the pipes 8 and 9 with the source of pressure medium and the space below the piston 4 is connected with the discharge pipe 10. On the inward piston movement the pipe 9 is connected with pipe 11 as shown in the drawing, so that the pressure medium is introduced below the piston 4 whilst the space above the piston is connected through pipe 8 with the discharge pipe 10.

The piston 4 has at the top a projection 12 which, when the piston is in its uppermost position of the protrudable body, is caught between the spring buffers 13. This device serves the double purpose of diminishing the blow on inward movement of the protrudable body and of dispensing with the maintenance of pressure below the pis-

ton 4 when the protrudable body is in the inner position.

In order to provide a tight seal of the protrudable body in the opening the stuffing box 14 with the packing 15 is used. In order to clean the protrudable body on its movement, the stuffing box is also provided with a scraper 16, made of any suitable rough material, such as wire gauze.

For closing the outlet opening a flap 17 is provided which can be opened and closed with the aid of a lever 18. In the closed condition, it can be held tight by means of a claw 19 controlled by the lever 20. The lever 20 is coupled with the handle of the main cock 21 of the pressure medium in the pipe 9 in such a way that an introduction of the pressure medium can only take place when the claw is opened. The object of this arrangement is to prevent the protrudable member from being moved out whilst the claw is in locking position, thereby causing damage to the device. Instead of a flap other closing members, such as locks, slides or the like, can be employed.

In order to control the condition of operation of the device various testing cocks and pipes are provided. Pipe 22 serves for controlling the dead space below the bottom member as regards accumulated air and for blowing it off. The cock 23 serves for control of the small space between flap 17 and stuffing box 14 and thus for controlling the tightness of the flap. The tightness of the stuffing box itself is controlled with the aid of the pipes 10 and 11. If water has collected in the space 38 between piston and stuffing box, it will be forced out on the outward movement of the piston through pipes 10 and 11.

The actual sound apparatus, transmitter or receiver, the nature of which is immaterial for the present invention, is indicated at 24 and 24a. The casings of these instrumentalities may be assumed as cylindrical bodies whose axes are located at right angles to the projector as shown in dotted line at 25, their plane surfaces being flush with the outer surface of the projector.

The several sound apparatus which may be contained in the projector may be connected by individual cables to a junction element 27, whence a main cable 26 leads through the upper portion of projector 1, piston 4 and cylinder 2, which latter has a bushing 28 in its cover through which the cable is led to the outside for connection to the remainder of the transmitting or receiving apparatus, not shown here, but assumed to be located in the interior of the ship. When piston 4 is in the position shown in Fig. 1, cable 26 is substantially straightened out within the cylinder. When the piston is moved into its uppermost position, the cable, which may have been given several twists before it is inserted, will coil itself up in the cylinder on top of the piston, as shown in dotted lines at 26'.

The horizontal cross-section of projector 1 is clearly shown in Fig. 1a. In order to cut the water smoothly and without disturbance it is important that the protrudable body should have substantially stream line shape, i. e. be blunt and substantially parabolic at its leading end and be pointed at its trailing end, as shown in Fig. 1a. The ratio of the longitudinal axis of the cross-section of the body to the thickness should lie approximately between the values 4:1 and 6:1. Below this value a bad stream-line form is obtained and if this value is much exceeded (on account of the thickness of the sound apparatus itself which cannot be crowded below a predetermined value, flush with the exterior surface of the protrudable body) highly inconvenient dimensions of the whole device are obtained.

The kind of pressure medium serving for operation is not of decisive importance. For reasons of convenience and on account of other advantages, such as control of the water-tightness of the device and so on, it will generally be decided on board to use compressed air.

The cock serving for controlling the device may be arranged at any suitable point on the ship and in some cases remote control may be provided for as illustrated in Fig. 2. In this case 29, 30 and 31, 32 indicate corresponding pole pairs of an electromagnet, in the field of which a suitably formed and wound armature 33 is adapted to rotate through 90°. On the shaft 33a of this armature is mounted the rotatable member of the control cock 7. According to whether the pole changing switch 37 is brought into the one or other position, the armature changes over the control cock.

For protrudable devices, which are not moved through the water, the use of stream line bodies is not necessary. For the sake of constructural simplicity, circular bodies will then be employed.

In Fig. 3 the numeral 2 again indicates the guide cylinder, 4 the piston, 1 the extrudable body of the device. The two chambers above and below the piston are 34 and 35. Each of the chambers is connected through a two-way cock 7 with a suction and pressure pump 36 for gas or liquid, the one passage of the cock being connected with the suction side, the other passage of the cock with the pressure side of the pump. When chamber 35 is connected with the suction side and chamber 34 with the pressure side, the piston moves downward. When, on the other hand, chamber 34 is connected with the suction side and chamber 35 with the pressure side, the piston moves upward.

Fig. 4 shows another device working with

positive and negative pressures. In this case the arrangement is such that in any case only the upper chamber is connected with a two-way cock. Otherwise two outlets of the two-way cock are connected with the suction and pressure side of a pump and the cock can be so adjusted that either the pressure side of the pump is connected with the chamber 34 and the suction side with the free medium or vice versa the suction side with the chamber 34 and the pressure side with the free medium. The first position is the extruding position of the device and the second the withdrawing position. With this constructional example a sealed chamber underneath piston 4, such as chamber 35 in Fig. 3, is dispensed with entirely and also a stuffing box and special sealing devices become superfluous.

Since on most ships pressure systems as well as reduced pressure systems are provided, it is possible to connect the control cock 7, instead to a special pump directly to the suction and pressure sides of such systems, or one side to a low pressure system and the other side to a high pressure system.

We claim:—

1. Subaqueous sound apparatus for ships or the like comprising a casing disposed within the ship and being water-tight with respect to the interior of the ship, a carrier for sound apparatus movable through the bottom of said casing and consisting of an upper piston shaped part and of a lower part of stream line transverse section, said lower part bearing the sound apparatus flush with its side walls, and a pressure fluid supply and control system for producing a difference of pressure in the casing spaces above and below said piston for projecting and withdrawing said lower sound carrier part.

2. Subaqueous sound apparatus for ships or the like comprising a casing disposed within the ship and being water-tight with repect to the interior of the ship, a carrier for sound apparatus movable through the bottom of said casing and consisting of an upper piston shaped part and a lower part of stream line transverse section, said lower part bearing the sound apparatus flush with its side walls, and a pressure fluid supply and control system for producing a difference of pressure in the casing spaces above and below said piston for projecting and withdrawing said lower sound carrier part, said piston having at least one conical seating surface and a corresponding conical seat in said casing engaging said conical piston surface when the carrier is projected.

3. Subaqueous sound apparatus comprising a casing within the ship and water-tight in relation to the interior of the ship, a carrier containing sound diaphragms and movable into and out of said casing, a piston at the upper end of the carrier and being movable in said casing, a yielding retaining device having one of its retaining elements connected to the piston and the other element connected to the upper part of the casing, and adapted to hold the carrier in the withdrawn position until the extrusion pressure has reached the prescribed value, and means for producing a difference of pressure in the spaces of the said casing below and above the said piston.

4. Subaqueous sound apparatus comprising a casing within the ship and water-tight in relation to the interior of the ship, a carrier containing sound diaphragms and movable through the bottom of said casing, a piston at the upper end of the carrier movable in said casing, a hinged flap adapted to close the opening of the casing through which said carrier is projected, and means for producing a difference of pressure in the spaces of said casing below and above the said piston.

5. Subaqueous sound apparatus according to claim 4 in which the said flap is provided with a retaining device, preferably in the form of a claw, and means for operating said retaining device from the interior of the ship.

6. Subaqueous sound apparatus comprising a casing within the ship and water-tight in relation to the interior of the ship, and means for supplying an operating fluid to said casing, a projectable carrier containing sound diaphragms, a piston movable in said casing and being attached to the upper end of the said carrier, means adapted to produce a difference of fluid pressure in the chambers of the said casing above and below the said piston to operate said piston, a control device for the fluid supply, a flap adapted to close the opening in the casing through which the said carrier passes, a retaining device for the said flap, and an interlocking mechanism between the fluid control device and said retaining device, and arranged to release the retaining device before the control is operated to cause fluid to be supplied to project said carrier.

7. Subaqueous sound apparatus comprising a casing within the ship and water-tight in relation to the interior of the ship, a carrier containing sound diaphragms and projectable through the bottom of said casing, a stuffing box in the bottom of said casing surrounding said carrier, a piston at the upper end of the said carrier and disposed to move in said casing, a hinged flap closing the opening through which the carrier is protruded when the carrier is withdrawn into the casing, and test pipes leading to the exterior of the apparatus and connecting with the spaces between said flap and said stuffing box and between stuffing box and bottom face of the piston.

8. Subaqueous sound apparatus comprising a casing within the ship and water-tight in relation to the interior of the ship, a car-

rier containing sound diaphragms and movable through the bottom of said casing, a piston at the upper end of the carrier and movable in said casing, and means for producing a difference of pressure in the spaces of the said casing below and above the said piston to project said carrier from and to withdraw it into said casing, said carrier having a cross-section of substantially stream line form in the direction of ship's travel.

In testimony whereof we affix our signatures.

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WILHELM RUDOLPH.