

May 28, 1946.

R. E. BATES

2,400,870

SUBMARINE SIGNALING APPARATUS

Filed Dec. 7, 1942

4 Sheets-Sheet 1

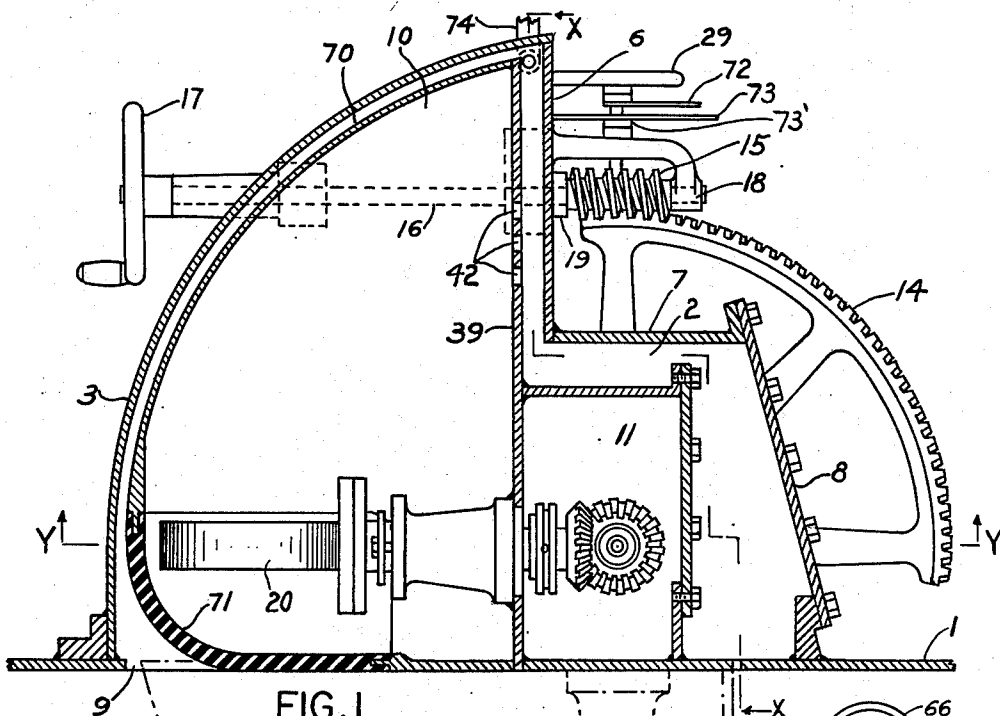


FIG. 1

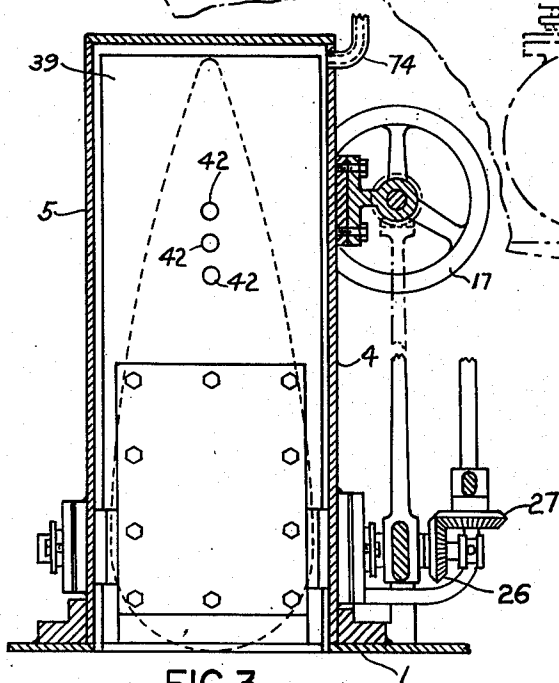


FIG. 3

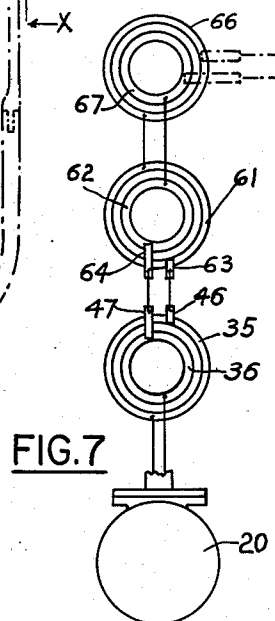


FIG. 7

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4 Sheets-Sheet 2

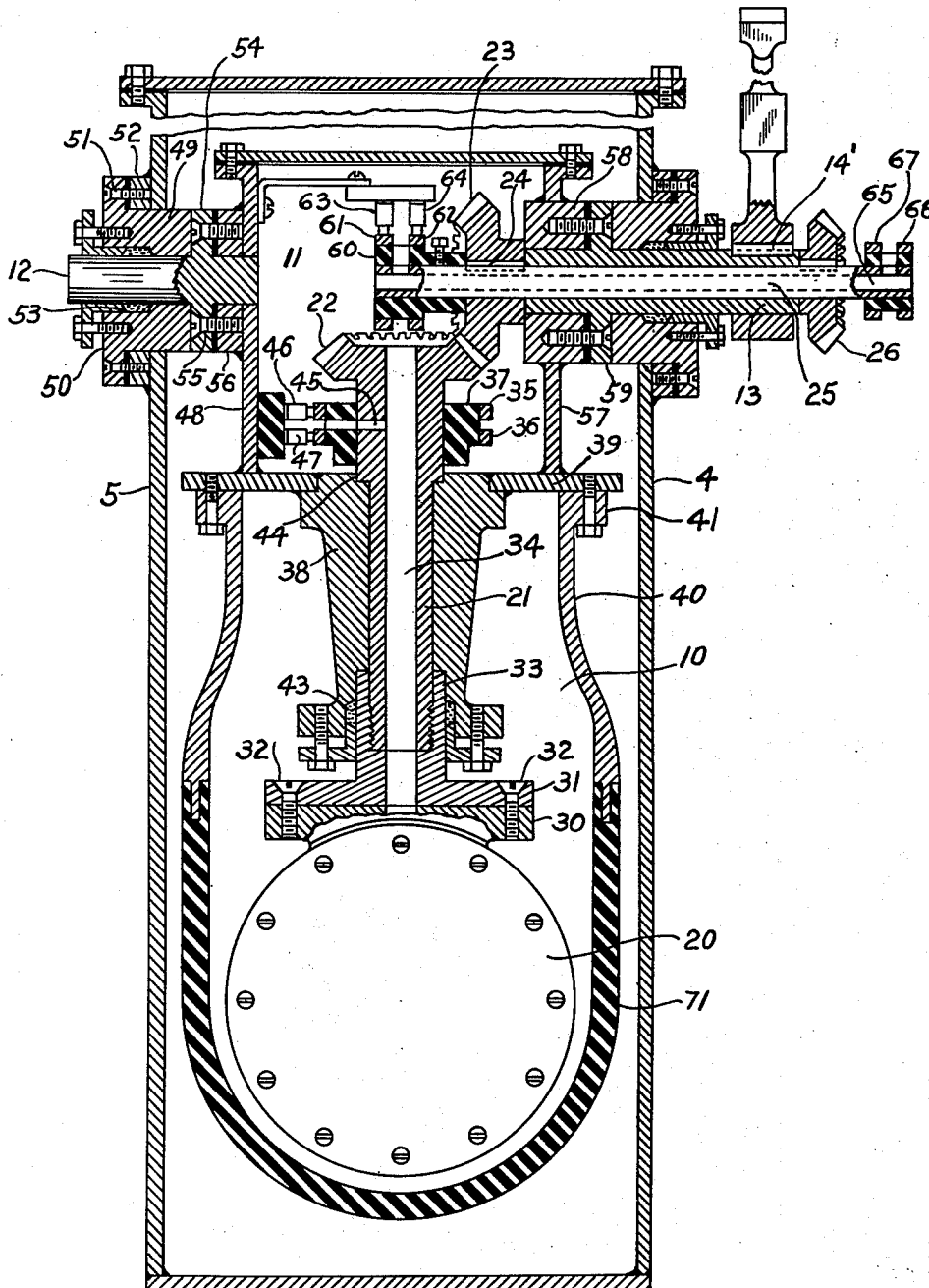


FIG. 2

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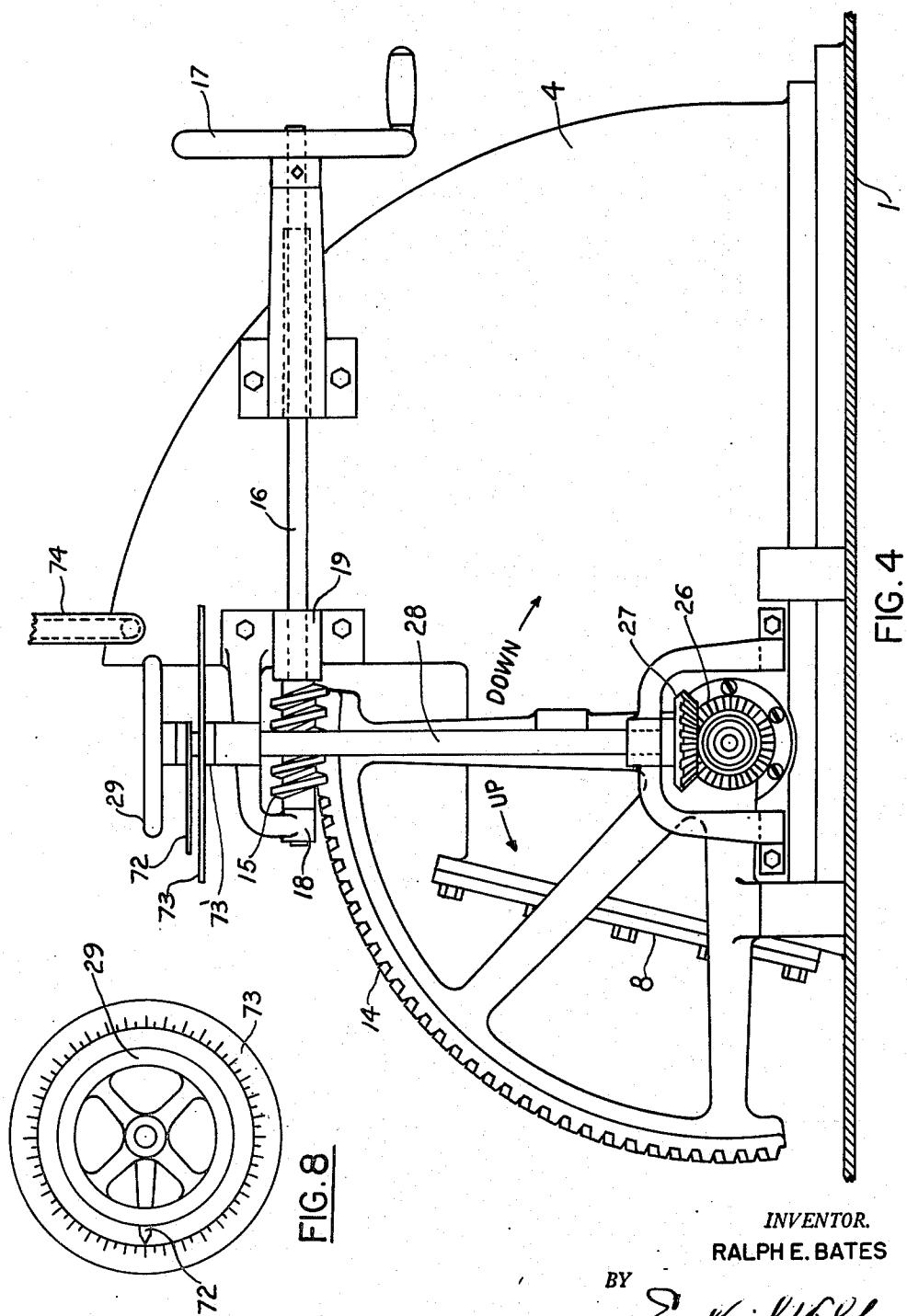
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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

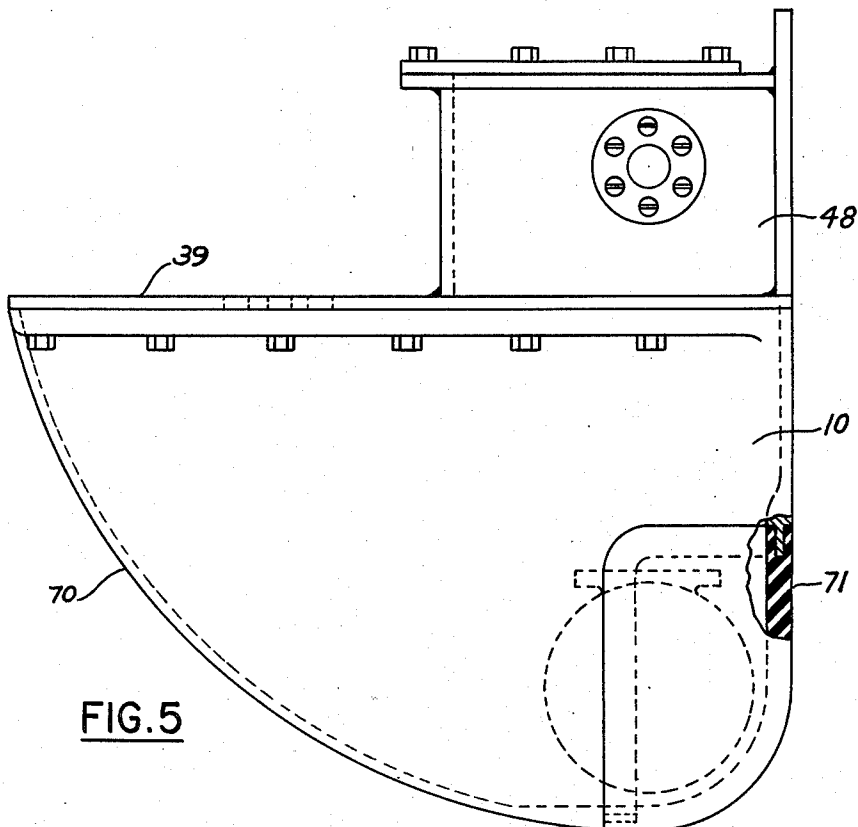


FIG. 5

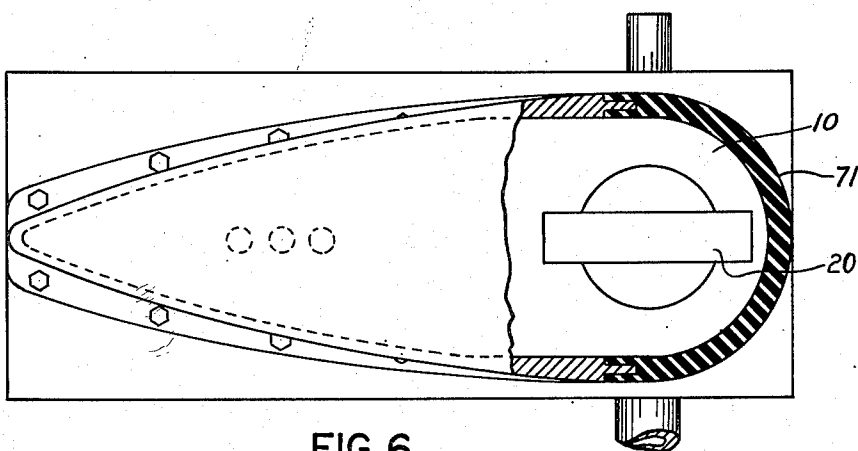


FIG. 6

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UNITED STATES PATENT OFFICE

2,400,870

SUBMARINE SIGNALING APPARATUS

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Application December 7, 1942, Serial No. 468,302

10 Claims. (Cl. 116—27)

The present invention relates to the art of submarine signaling and particularly to a device which may be projected into the water from the bottom of the vessel in such a manner that the apparatus so projected may be positioned in good acoustic arrangement with the sound-propagating medium.

The present invention is particularly useful on small boats such, for instance, as submarine chasers and so-called P. T. boats, and provides a unit which may be swung into the water from a sea chest in the boat, the unit itself having a stream-line body such that the water noise which is usually present may be substantially eliminated. In the present invention the unit may take a shape something like that of a center board, except that it is streamlined at the front, hollow inside and filled with liquid, making good acoustic coupling between the outer propagating medium and the sound-transmitting and receiving unit which may be freely rotated within the hollow housing.

The sound-receiving and transmitting unit used in the housing may be of the directive type, sending a beam of supersonic sound energy or receiving sound from a direction substantially at right angles to the surface of the sound unit itself.

The invention also includes special means for directing or training the sound-receiving or transmitting unit or projector as well as special means for swinging the unit out from the sea chest within the vessel. While these operations may be accomplished through a motor drive, the device preferably may be operated by handwheels and thereby may be simply controlled and operated on a small boat without the use of electric or hydraulic power. The device finds utility in this manner particularly for sound ranging for military purposes in the detection of enemy submarines and also listening and determining the direction of surface vessels.

The features and advantages of the present invention will be more fully and readily understood from the description in the specification below when taken in connection with the drawings in which Fig. 1 shows an elevation of the device as installed in a vessel with parts in section and with a dotted portion illustrating a portion of the apparatus in a second position swung out from the vessel; Fig. 2 shows a section substantially on the line Y—Y of Fig. 1; Fig. 3 shows a section substantially on the line X—X of Fig. 1; Fig. 4 shows an elevation of the device substantially in the position of Fig. 1 but viewed from the back side with reference to Fig. 1; Fig. 5 shows an

elevation of the pivoted unit projecting into the water with a part in fragmentary section; Fig. 6 is a plan view looking upward with reference to Fig. 5 with portions in fragmentary sections; Fig. 7 shows a detail of the wiring of the transmitting and receiving unit; and Fig. 8 shows a further detail.

In the drawings 1, Figs. 1 and 4, shows the skin of the vessel in which there is built a sea chest 2 which has an arcuate back wall 3, side enclosures 4 and 5 and a front enclosing wall 6 with an outward projecting wall 7 at its lower portion which is enclosed by a cover plate 8 completing the enclosure of the sea chest whose base, or bottom face, 9 is open to the water. Within the sea chest there is pivoted a second housing 10 having in section the contour substantially of a center board. This second housing has a top projecting chamber 11 with projecting shafts 12 on one side and 13 on the other side which are journaled in bearings in the side walls 5 and 4 of the outside housing. The inside housing 10 is swung downward and outward on these bearings. For this purpose the shaft 13 carries externally of the wall 4, of the outer housing, a sector gear 14 to which the shaft 13 is secured by means of the key 14'. This sector gear meshes with a gear worm 15 at the end of a horizontal shaft 16 in the vessel which may be turned by means of the handwheel 17. The shaft 16 is supported by two bearings 18 and 19 carried by the outer housing and positioned in such a fashion that the gear worm 15 meshes with the large sector gear 14. By rotating the handwheel 17 the worm 15 and the sector gear 14 are turned and the interior housing 10 swung outward or inward, to or from, the water.

The mechanism within the housing 10 comprises the sound-transmitting and receiving unit 20 which is supported and rotated by means of the hollow shaft 21 at the top of which is a horizontally positioned bevel gear 22 meshing with a second bevel gear 23 which, in turn, is keyed by means of the key 24 to the shaft 25 which is turned by the bevel gear 26. The bevel gear 26 is controlled and rotated by the bevel gear 27 meshing with it which, in turn, is operated at the end of the shaft. The rotation of this handwheel 29 will rotate the sound-transmitting and receiving unit 20. This briefly traces through the driving mechanism for rotating the oscillator or sound projector-receiver 20.

The sound projector 20, positioned within the chamber 10, may be of the supersonic type, magnetostriction, piezoelectric or other type of oscil-

lator driven electrically for converting sound pick-up by its radiating face into electric energy. This unit, as shown more clearly in Figs. 1 and 2, has a mounting flange 30 to which a second flange 31 is attached by means of bolts 32 or in any other suitable manner. The flange 31 is provided with a collar or sleeve 33 which is threaded to the upright shaft 21 and turns with it in both directions. The sleeve 33 and the shaft 21 are both hollow at the center as indicated by 34 to receive the electrical conductors which are led up through the hollow shaft to the collar rings 35 and 36 mounted on an insulating collar or member 37 at the top of the shaft 21. The sleeve 33 and the shaft 21 rotate in a long bearing 38 which is fixed to the supporting plate 39 by welding, as indicated in Fig. 2, or by any other suitable manner. This plate 39 forms the top supporting member for the inner housing 10. The streamline casing 40 is bolted to this by a flange 41 extending outward from the housing 40.

The plate 39 is provided with openings 42, 42, to permit water, if desired, to enter freely within the chamber 10 but not within the extension chamber, or section 11, from which the water or sound-conducting liquid is excluded at all times. For this purpose the end of the sleeve 38 is provided with a stuffing gland 43 so that no liquid can come up through the shaft bearing and around the shoulder 44 upon which the top of the shaft 21 rests. The conductors for the oscillator are led through the opening 45 from the hollow shaft to the conducting rings 35 and 36 against which the brushes 46 and 47 bear, which brushes are insulatingly supported from the side wall 48 of the chamber 11. The shaft 12, which is journaled in the wall 5 of the outer chamber, is held in a bearing 49 which has an outwardly extending flange 50 by which the bearing is attached by bolts 51 to a ring 52 welded to the wall of the casing. This shaft is made watertight by means of the packing gland 53 so that no water will enter the ship from within the chamber 3 which is open at the bottom to the sea. The shaft 12 is supported by a flange 54 and is held by the bolts 55 to a ring 56 which, as indicated in Fig. 2, is welded to the wall 48 of the chamber 11.

The chamber 11 at its other side is provided with a wall 57, having a bearing at 58. To this sleeve is secured, by means of the flange 59, the hollow shaft 13 whereby the whole top housing 11 and the lower housing 10, united with it by the plate 39, are turned. Within the hollow shaft 13 the shaft 25 rotates. This shaft 25 extends through the hollow shaft 13 into the housing 11 and, as is stated above, carries the bevel gear 23 which is pinned to the shaft by means of the key 24. Mounted on this shaft 25 is an insulating collar 60 carrying conductor rings 61 and 62 upon which the brushes 63 and 64 bear respectively. Brushes 46 and 47 are electrically connected with brushes 63 and 64. The current from the brushes 63 and 64 is led to the collar rings 61 and 62, or vice versa, and then is conducted through the hollow shaft 65 to the conductor rings 66 and 67 connecting with the outside source of power. The shaft 25 is rotated by means of the bevel gear 26.

When the sound-transmitting and receiving member 20 is projected into the water, sound is received or transmitted by the unit, particularly freely from the forward port and starboard directions. The rear of the housing in the direction of the propeller may substantially shield the unit by constructing the rear wall of the housing, namely 70, Figs. 1 and 5, of sound-re-

fecting material. The front of the housing, however, as indicated in Figs. 1, 2, 5 and 6, is made of sound transparent material such as a rubber or synthetic-rubber sheet having density and velocity values equal to those of water, as, for instance, 71, which permits the sound to pass through the wall of the housing to act upon the sound-producing or receiving member 20.

In the operation of the device the handwheels 17 and 29 may be operated in the usual manner. An indicator 72 may be provided on the handwheel 29 together with an indicating plate 73, mounted on the collar 73' and secured to bearing 18, so that the position of the projector may be known at all times. In the operation of the device the unit is first swung down into the water by rotating the handwheel 17. When this is accomplished, the plate 39 will extend over the sea chest opening and the unit will project vertically from the boat. Training of the sound projector is then accomplished by turning the handwheel 29 which can be turned so that the projector will face in any direction of 360 degrees around its vertical axis position. In order to insure that the whole sea chest be filled with water, an air vent may be provided as indicated at 74 at the top of the casing, which air vent may go up beyond the outside water level so that it may always be kept open.

Having now described my invention, I claim:

1. In combination with a vessel, a sea chest built therein at the bottom of the vessel, a housing having sound receiving and transmitting means contained within said sea chest, said housing having means pivoting the same in said sea chest on an axis extending across one lower corner section of said housing, means rotating said housing in an arc from a position within the sea chest into the water beneath the vessel, and means for rotating said sound receiver and transmitter in its normally operated position when the housing is projected below the water about a vertical axis.

2. In combination with a vessel, a sea chest built in said vessel having an opening at the bottom thereof, a housing positioned in said sea chest, means pivoting said housing at a lower corner thereof on an axis transversely across the lower end of said housing, a sound receiving and transmitting means, means rotatably mounting said transmitting and receiving means within said housing and means operative externally of said housing for rotating said sound receiving and transmitting means about a vertical axis at right angles to the axis above mentioned when said housing is projected into the water and means for projecting said housing into the water, said means being adapted to rotate the housing about one-quarter of a turn on its pivoted axis.

3. In combination with a vessel, a sea chest built in said vessel having an opening to the water, a housing adapted to fit within said sea chest and pivoted transversely thereto at one corner of said housing, said pivoting means comprising shaft means having journaled bearings supporting said housing, a spur gear and pinion connected to said shaft and means for rotating said shaft and thereby rotating the housing into the water, a sound receiving and transmitting device, means rotatably supporting said transmitting and receiving device within said casing and gear means having a right-angle drive with one section thereof concentric with the axis of said housing and means operative through the axis of said housing for rotating said sound transmitting and receiving means about a vertical axis at right angles to

the axis of said housing when the housing is in operating position in the water below the vessel.

4. In combination with a vessel, a housing having a substantially horizontally journaled axis for rotating the housing about the same, a sound receiving and transmitting means rotatably supported within the housing and means for rotating said sound receiving and transmitting means comprising driving means operative concentric with the axis of said housing and gear means associated therewith for rotating said sound receiving and transmitting means.

5. In combination with a vessel, a housing having a substantially horizontally journaled axis for rotating the housing about the same, a sound receiving and transmitting means, a shaft supporting said sound receiving and transmitting means, rotatable about its axis, a gear carried by said shaft for rotating the same, gear means meshing with said first-mentioned gear for driving the same, said gear means having a shaft concentric with the axis of said housing and independently operated means positioned externally of said housing, one for rotating said housing into the water below the vessel and the other for rotating the shaft of said sound transmitting and receiving means about its axis.

6. In combination with a vessel, a housing having a substantially horizontally journaled axis for rotating the housing about the same, a sound receiving and transmitting means, a shaft supporting said sound receiving and transmitting means rotatable about its axis, a gear carried by said shaft for rotating the same, gear means meshing with said first-mentioned gear for driving the same, said gear means having a shaft concentric with the axis of said housing and independently operated means positioned externally of said housing, one for rotating said housing into the water below the vessel and the other for rotating the shaft of said sound transmitting and receiving means about its axis, and means within the vessel indicating the position of said sound receiving and transmitting means.

7. In combination with a vessel, a housing having a substantially horizontally journaled axis for rotating the housing about the same, a sound receiving and transmitting means, a shaft supporting said sound receiving and transmitting means rotatable about its axis, a gear carried by said shaft for rotating the same, gear means meshing with said first-mentioned gear for driving the same, said gear means having a shaft concentric with the axis of said housing and independently operated means positioned externally of said housing, one for rotating said housing into the water below the vessel and the other for rotating the shaft of said sound transmitting and receiving means about its axis, said housing being streamlined in the fore and aft direction of the vessel and being supported at the front end of the same with acoustic transparent material at the front of said housing substantially extending around the vicinity of the sound transmitting and receiving means.

8. In combination with a vessel, a housing having a substantially horizontally journaled axis

for rotating the housing about the same, a sound receiving and transmitting means, a shaft supporting said sound receiving and transmitting means rotatable about its axis, a gear carried by said shaft for rotating the same, gear means meshing with said first-mentioned gear for driving the same, said gear means having a shaft concentric with the axis of said housing and independently operated means positioned externally of said housing, one for rotating said housing into the water below the vessel and the other for rotating the shaft of said sound transmitting and receiving means about its axis, said housing being streamlined in the fore and aft direction of the vessel and being supported at the front end of the same, the rear portion of said housing being curved upward in an arc to the vessel.

9. In combination with a vessel, a housing having a substantially horizontally journaled axis for rotating the housing about the same, a sound receiving and transmitting means, a shaft supporting said sound receiving and transmitting means rotatable about its axis, a gear carried by said shaft for rotating the same, gear means meshing with said first-mentioned gear for driving the same, said gear means having a shaft concentric with the axis of said housing and independently operated means positioned externally of said housing, one for rotating said housing into the water below the vessel and the other for rotating the shaft of said sound transmitting and receiving means about its axis, said housing being streamlined in the fore and aft direction of the vessel and being supported at the front end of the same, the rear portion of said housing being curved upward in an arc to the vessel, and means for permitting the outer water to come into the housing and surround the sound transmitting and receiving device.

10. In combination with a vessel, a housing having a substantially horizontally journaled axis for rotating the housing about the same, a sound receiving and transmitting means, a shaft supporting said sound receiving and transmitting means rotatable about its axis, a gear carried by said shaft for rotating the same, gear means meshing with said first-mentioned gear for driving the same, said gear means having a shaft concentric with the axis of said housing and independently operated means positioned externally of said housing, one for rotating said housing into the water below the vessel and the other for rotating the shaft of said sound transmitting and receiving means about its axis, said housing being streamlined in the fore and aft direction of the vessel and being supported at the front end of the same, the rear portion of said housing being curved upward in an arc to the vessel, means sealing a portion of said housing having said gears from the rest of the housing and means permitting the outer water to come into the said rest of the housing and surround said sound transmitting and receiving device.

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