April 5, 1949. J. T. BEECHLYN 2,465,993

SUBMERSIBLE REFLECTING BODY

Filed May 22, 1943 2 Sheets-Sheet 1

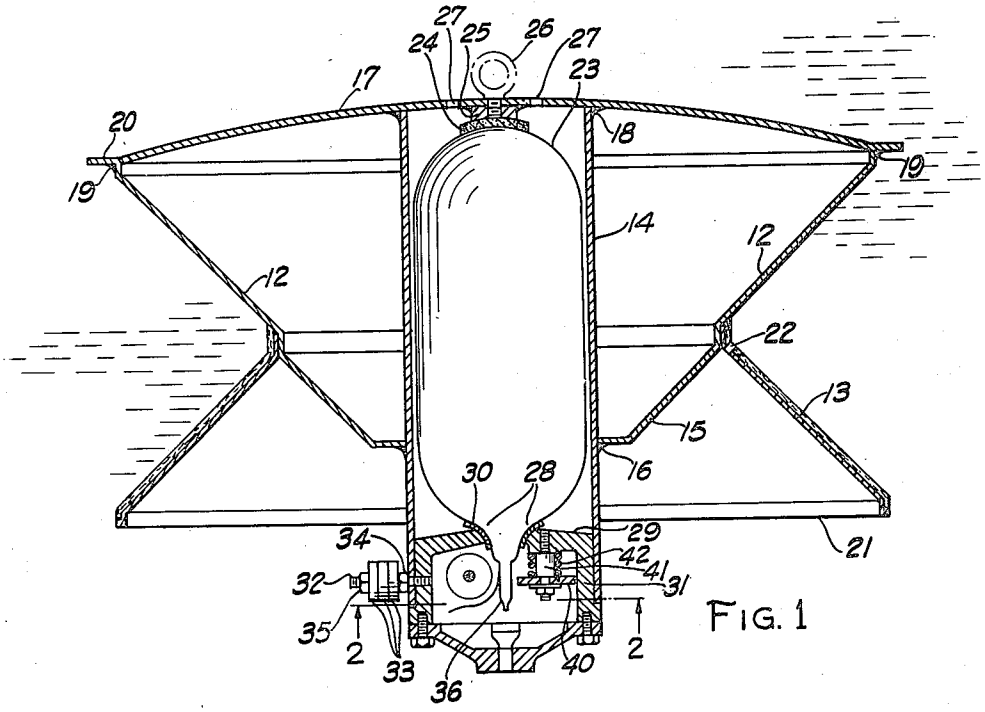

FIG. 1

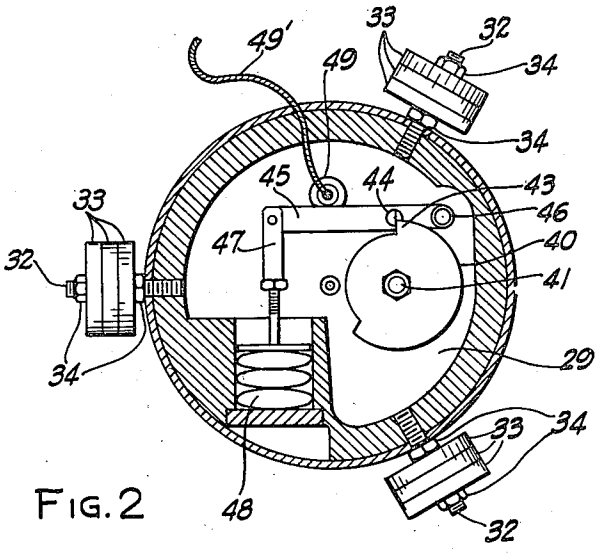

FIG. 2

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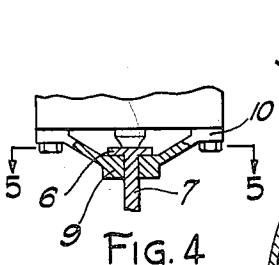


FIG. 4

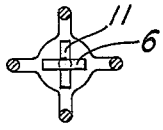


FIG. 5

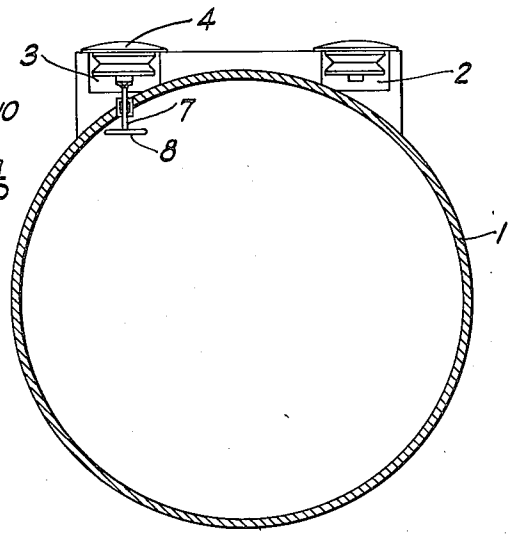


FIG. 3

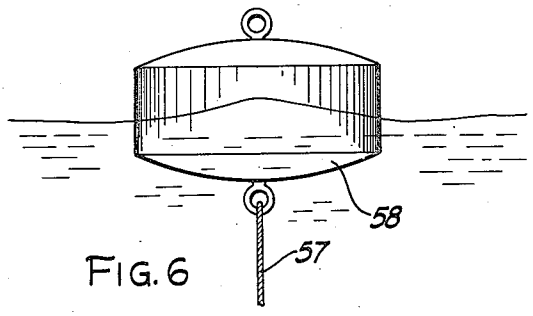


FIG. 6

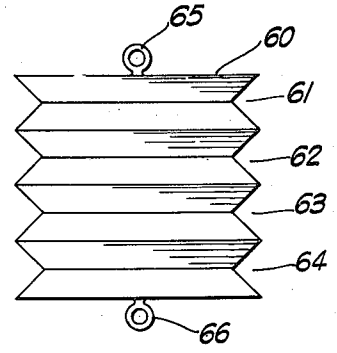
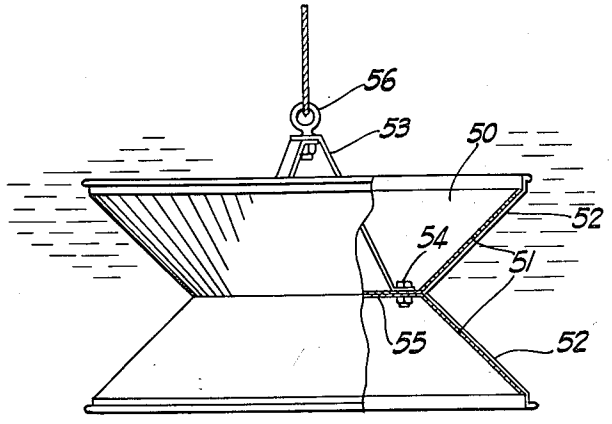


FIG. 7



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Patented Apr. 5, 1949

2,465,993

UNITED STATES PATENT OFFICE

2,465,993

SUBMERSIBLE REFLECTING BODY

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Application May 22, 1943, Serial No. 488,321

9 Claims. (Cl. 35—25)

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The present invention relates to signaling apparatus and more particularly applies to apparatus to be used in a liquid medium such as the ocean but it may also apply in some forms to electromagnetic signaling and radiation in an air medium.

In the application of the present invention in the art of submarine signaling a reflecting body is used providing good reflecting qualities for compressional waves, the body itself simulating to a given extent reflecting conditions of other reflecting bodies such as a submerged submarine or the hulls of surface vessels. The body itself, however, may act as a reflecting means simply to provide in the water medium reflections from desired spots or movable through a desired distance.

In one form of the present invention the reflecting body may be attached to a floating buoy and be temporarily or permanently positioned at a given spot, or the buoy itself may be so constructed that it rises or lowers in a given course during its period of operation.

More particularly the present invention is adaptable to be released from a submarine for the purpose of producing echo reflections simulating the submarine itself so as to provide confusing indications as to the position, course or maneuvering of the submarine vessel.

Various advantages and purposes of the present invention will be more fully understood in connection with the description of the invention in the specification below, showing various embodiments of the same when taken in connection with the drawings in which

Fig. 1 is a sectional elevation of the invention;

Fig. 2 is an enlarged view taken substantially on the line 2—2 of Fig. 1;

Fig. 3 shows a detail in fragmentary section of the installation of the device in Fig. 1 on the deck of a submarine;

Fig. 4 shows a section in detail of an element of Fig. 3;

Fig. 5 shows a section on the line 5—5 of Fig. 4;

Fig. 6 shows a modification of the invention illustrated in Fig. 1; and

Fig. 7 shows a modification of a detail shown in Fig. 6.

In the modification shown in Figs. 1 to 5, inclusive, the invention is shown as applied to a submarine, although it may be applied in similar fashion to other types of vessels. In the illustration, 1 represents the submarine which is provided with wells 2 and 3 in the deck in which

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the reflecting body or buoy 4 may be positioned. The reflecting body or buoy 4 may be held in the well in any suitable manner which is desired. In Figs. 3, 4 and 5 the reflecting body 4 is held to the deck of the vessel by means of a locking bar 6 at the end of a shaft 7 which may be turned by means of the handle 8 from within the vessel. The locking bar 6 rests on a plate 9 attached by means of a spider 10 to the bottom of the buoy. This plate 9 is provided with a slot 11 through which the bar 6 may pass when turned from the position shown in Fig. 5 across the slot to a position in alignment with the slot under which conditions the reflecting body or buoy 4 will of its own accord by means of its buoyancy lift itself from the deck of the submarine. If it is desired to put the reflecting body into the water from a surface vessel, it will only have to be lowered overboard with some weighted device to carry the reflecting body down to the depth desired. In such a case some spring-latch mechanism could be employed for releasing the weight so that the buoy would act in the same manner as released from a submarine. This will be more fully discussed later.

In Fig. 1 the reflecting buoy or body 4 comprises two shells 12 and 13 providing surfaces in the shape of frusta of cones which are faced with the smaller diameters together providing thereby a figure of revolution having as an element a V-shaped section formed by the outer shell walls of the frusta 12 and 13.

In the center axis of the body there is positioned a cylindrical shell 14 which is connected to the outer cone elements in the web 15 which extends from the end of the frustum of the cone 12 to the cylinder 14 to which it is joined by a weld 16. The chamber formed between the cylindrical wall 14, the conical wall 12 and the web 15 is sealed at the top by the plate 17 which is welded to the cylinder 14 around the contact edge 18 and to the open edge of the frustum 12 around the periphery by welding as indicated at 19. The plate 17 may have an extending flange 20 covering over the welded periphery 19. The lower conical frustum 13 has an open mouth 21 into which the water may freely flow and it is also provided with vents 22 so that as the body sinks, any trapped air may escape through the vent openings so that the buoyancy of the device is determined solely under known conditions. The inside of the cylinder 14 is occupied by an evacuated vessel 23 which may be made of glass, plastic or other suitable material which may be readily fractured and broken as desired. This

vessel or bottle 23 is preferably held in place against a yielding pad 24 which abuts against a small plate 25 attached to the top plate 17 of the device. An eye member 26 may also be attached at the outside opposite the member 25 to serve as a means for suspending and supporting the whole device when desired. The purpose of making the bottle 23 breakable is that under certain conditions this bottle is broken and the space occupied by it is filled with water which may flow up through the inside of the cylinder 14 and out through the top vents 27 as the device descends in the water. The evacuated vessel 23 is held at its bottom in the shoulders 28 by a supporting collar 29 between which may be inserted a porous cushioning collar pad 30 thus permitting water to flow through to the inside of the cylinder. The collar 29 is mounted by means of its cylindrical wall 31 inside the cylinder 14 in which it snugly fits and is locked by means of studs 32 which carry also the balancing weights 33. Suitable nuts 34 and 35 securely position the studs 32 and lock the balancing weights 33 in the desired position. The balancing weights are used to hold the device in the same balance as indicated by the drawings of Fig. 1 with reference to the water as the device descends or rises in the water.

A mechanism is provided within the cylindrical wall 31 adjacent the neck 36 at the end of the vessel 23 for breaking the end of the vessel off and permitting the evacuated space within the vessel to be filled with water. This action changes the buoyancy of the device from a positive to a negative buoyance, thus causing the device slowly to sink after this action has occurred where previous to the time of the action the motion of the device was in the upward direction. For this purpose there is provided a disc 40 pivoted on a shaft 41 mounted in the collar plate 29.

A helical spring 42 has one end fixed in the supporting plate 29 and the other end fixed in the disc 40. The disc 40 has a radial projecting portion 43 by means of which the disc is held with the spring in a tension position by means of the projection 44 extending from the arm 45 which is pivoted by the shaft 46 to the collar plate 29. At the end of the arm 45 there is provided a supporting link 47 whose motion is controlled by means of a bellows-pressure device 48 which expands with decreasing pressure in the medium. A safety pin 49 in the wall 29 extends in contact with the arm 45 preventing it from moving until the pin has been removed. For this purpose, the wire 49' may be fastened to the deck of this vessel so that when the buoy is released the pin will be removed.

The operation of this device is such that when the pressure decreases below a certain set or desired amount, the arm 47 as viewed in Fig. 2, will be raised, taking the projection 44 out of engagement with the member 43, thus permitting the spring 42 to drive the disc 40 and its projection 43 against the neck 36, breaking it off. The water will then rush into and fill the vessel 23 thereby changing the buoyancy of the device from a positive to a negative value. Up to the moment that this occurs, the device will rise in the water but when this has occurred, the device will slowly begin to sink, eventually sinking to the bottom of the ocean.

If, for instance, the buoy is released from a submarine at perhaps 400 feet, it will ascend in the water under a positive buoyancy of about 50 pounds due to the evacuated bottle 23 at a rate

of ascent which may perhaps be established in the neighborhood of one foot per second and would bring the buoy within 50 feet of the surface in about six minutes. At or near this level the pressure bellows 48 will have expanded to such a degree that the cam 40 will be released, breaking the neck of the bottle. The filling of the bottle may give a negative buoyancy of one or two pounds, causing the buoy to sink slowly at a rate of a few feet per minute, permitting it to serve as a potential sound-reflecting target for several hours or more.

The device indicated in Fig. 1 is given the form and shape shown in order that by means of a comparatively small device, it might give a reflection comparable to that of a submarine vessel. The angles between the surfaces 12 and 13, are such that sound waves approaching from a given direction laterally will be directively reflected outward in substantially the same direction providing a comparatively large reflecting surface and maintaining the wave with substantially the same form of wave front. Since the top cone 12 of the device is part of an air chamber, practically the total energy impinging upon it from the outside will be reflected back. Since water may come on the inside of the wall 14, it is preferable to line the outside of the wall 13 with a sound-reflecting skin or surface such as "coprene" or cork or some other material having a great number of air cells or composed of materials which have radically different sound transmission characteristics from those of water. The velocity of sound in and density of the air as compared to the corresponding characteristics of water, provide marked reflecting qualities at the boundary surfaces between air and water.

In the structures shown in Figs. 6 and 7 the reflecting body 50 may be open at both top and bottom, permitting water to surround both the inside and the outside of the conical frusta 51, 51. These may be of the same outward contour as the elements 12 and 13 of Fig. 1 but are preferably provided with a sound-reflecting lining or coating of coprene or other suitable material as indicated at 52, 52. The angle of the walls in the radial section, as indicated in Fig. 6, may be 90° or thereabouts which is the theoretical angle for providing parallel reflection irrespective of any moderate divergence from the horizontal plane. The reflecting body 50 is supported by means of a tripod frame 53 which is bolted at 54 to central web 55 of the reflecting body. The tripod frame 53 may be supported by means of a ring member 56 to which the cable 57 is attached connecting to the bottom of the floating buoy 58. The structure shown in Fig. 6 may be used for harbor guides and navigation or landing locations for military purposes.

In Fig. 7 a reflecting body 60 is provided which is made up of a plurality of sections 61, 62, 63, 64 each section being similar in shape to the reflecting body 50 shown in Fig. 6. A ring member 65 may be provided at the top of this reflecting body whereby it is supported from a buoy and the body may also be provided with an eye member 66 at the bottom by means of which it may be anchored at a given point in the water. A similar eye member may also be provided for the device in Fig. 6 to anchor this at a desired point.

Having now described my invention, I claim:

1. A device having a sound reflecting body adapted to be immersed in water normally having a positive buoyancy providing a slow upward motion in the water, means actuated when the body

has reached a desired distance from the surface for admitting water to a portion thereof to change the device from a positive to a negative buoyancy, said negative buoyancy being sufficiently small so that the device will sink slowly thereafter.

2. A device adapted to be immersed in water having a sound-reflecting body comprising two conical frusta with the small ends abutting each other providing a reflecting surface of revolution having a V-shaped form, said body normally having a positive buoyancy providing a slow upward motion in the water, means actuated when the body has reached a desired distance from the surface for admitting water to a portion thereof to change the body to a negative buoyancy, said negative buoyancy being sufficiently small so that the device will sink slowly thereafter.

3. A device having a sound-reflecting body for submersion in water, means contained within the body providing a variable buoyancy for causing the device to remain near the surface of the water, said body having a surface of revolution conforming to the rotation of a V-shaped element about an axis perpendicular to the bisector of the angle with the vertex and spaced away from the vertex outside of the V.

4. A device having a sound-reflecting body for submersion in water, means contained within the body providing a variable buoyancy for causing the device to remain near the surface of the water, said body having a surface of revolution conforming to the rotation of a V-shaped element about an axis perpendicular to the bisector of the angle with the vertex and spaced away from the vertex outside of the V, said V having an angle substantially of 90°.

5. A device adapted to be used in water having the sound-reflecting body having a surface of revolution conforming to the rotation of a V-shaped element about an axis perpendicular to the bisector of the angle with the vertex and spaced away from the vertex outside of the V, said body having closed-off portions positioned symmetrically within the same from which the water is excluded, a centrally located chamber symmetrically positioned with said body having an evacuated vessel therein, means provided at one end of the chamber for permitting said vessel to be filled with water when the device has travelled upward to a region of desired pressure whereby the buoyancy of the device is changed from a positive to a negative value, said negative buoyancy being sufficiently small so that the device will sink slowly thereafter.

6. A device having a sound-reflecting body in water normally having a positive buoyancy providing a slow upward motion in the water, means actuated when the body has reached a desired distance from the surface for admitting water to a portion thereof to change the device from a positive to a negative buoyancy, said means comprising an evacuated vessel positioned within the body having a projecting neck, means having an impact element tensioned against the action of the spring positioned adjacent the neck of said vessel and means normally holding said impact element in tension and adapted to be released when the pressure in the surrounding water has decreased to the desired magnitude, and means responsive to the pressure in the surrounding water for releasing said holding means whereby the impact element will fracture the neck of said vessel and permit water to enter therein changing the buoyancy.

7. A device adapted to be used in water having a sound-reflecting body comprising a reflecting wall formed as a surface of revolution in which the element of the surface is in the shape of a V positioned outward of the axis of revolution, said body being thereby substantially symmetrically formed about said axis, an air-sealed chamber formed with said surface of revolution forming in part, at least, the outer wall thereof providing a sound-reflecting body comprising said outer wall and the air sealed chamber and means provided on the surface of the rest of the reflecting wall formed as a surface of revolution for reflecting the sound waves impinging therein.

8. A device having a sound-reflecting body adapted to be immersed in water, said reflecting body comprising a surface of revolution whose element is in the form of an outwardly opening V rotated about an axis in an extension of the plane of the V, an air-sealed chamber immediately adjacent the inside of a portion of the sound-reflecting surface symmetrically positioned with the axis of revolution permanently sealed from the water, a cylindrical chamber surrounding the axis of revolution and concentric therewith, said chamber having at least a portion thereof evacuated and means actuated when the device has reached the desired distance from the surface for admitting water to said cylindrical chamber, said actuation changing the device from a positive to a negative buoyancy, said device being so proportioned in volume and weight and water resistance that with the change in buoyancy it will sink slowly in the water.

9. A device providing a sound-reflecting body adapted to be immersed in water normally having a positive buoyancy providing a slow upward motion in the water, means attaching the same to the deck of a submarine, means for releasing the same from within the vessel when desired and means operated upon the release of the device for releasing the actuating mechanism, said actuating mechanism comprising an impact member, means operated to release the impact member when the device has reached a desired distance from the surface and means operated by the release of the impact member for changing the device from a positive to a negative buoyancy whereby the device will slowly sink in the water.

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