July 24, 1962 G. W. KITTREDGE ETAL 3,045,622

SUBMARINE ESCAPE DEVICE

Filed March 26, 1959 3 Sheets-Sheet 1

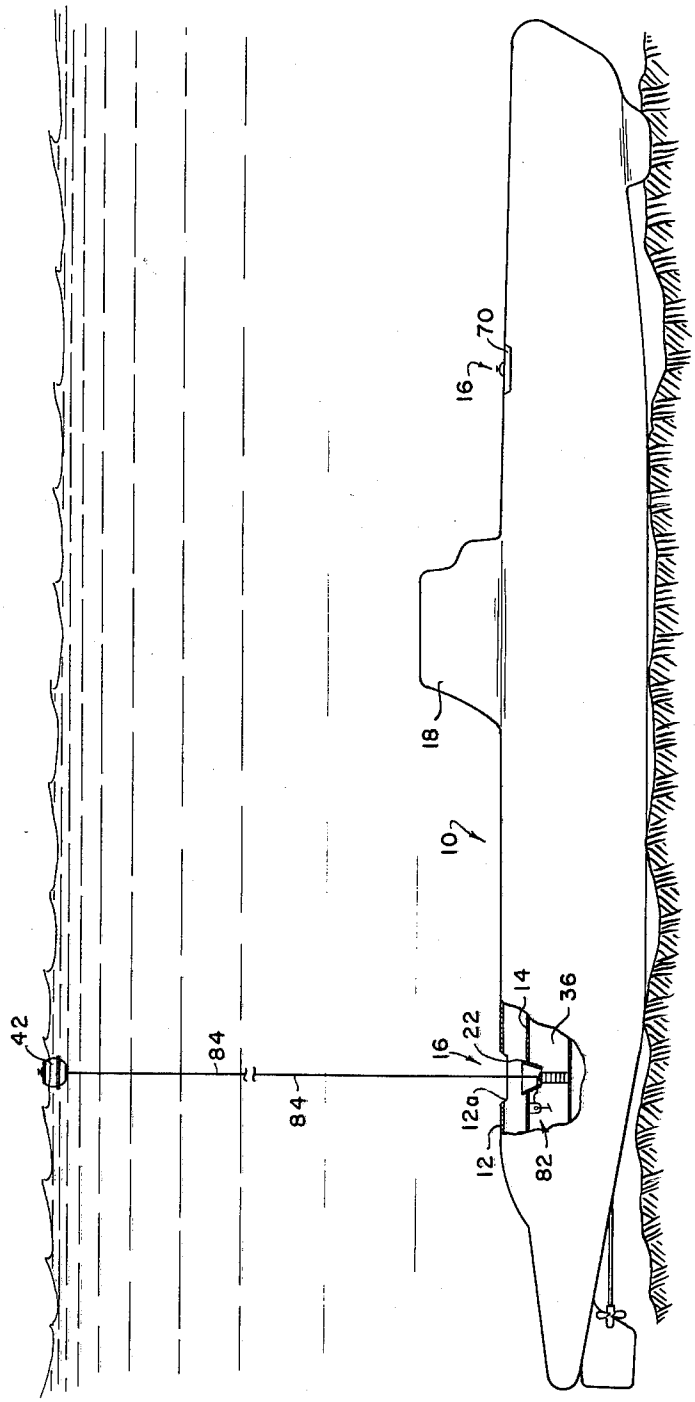

FIG. 1.

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Filed March 26, 1959 3 Sheets-Sheet 2

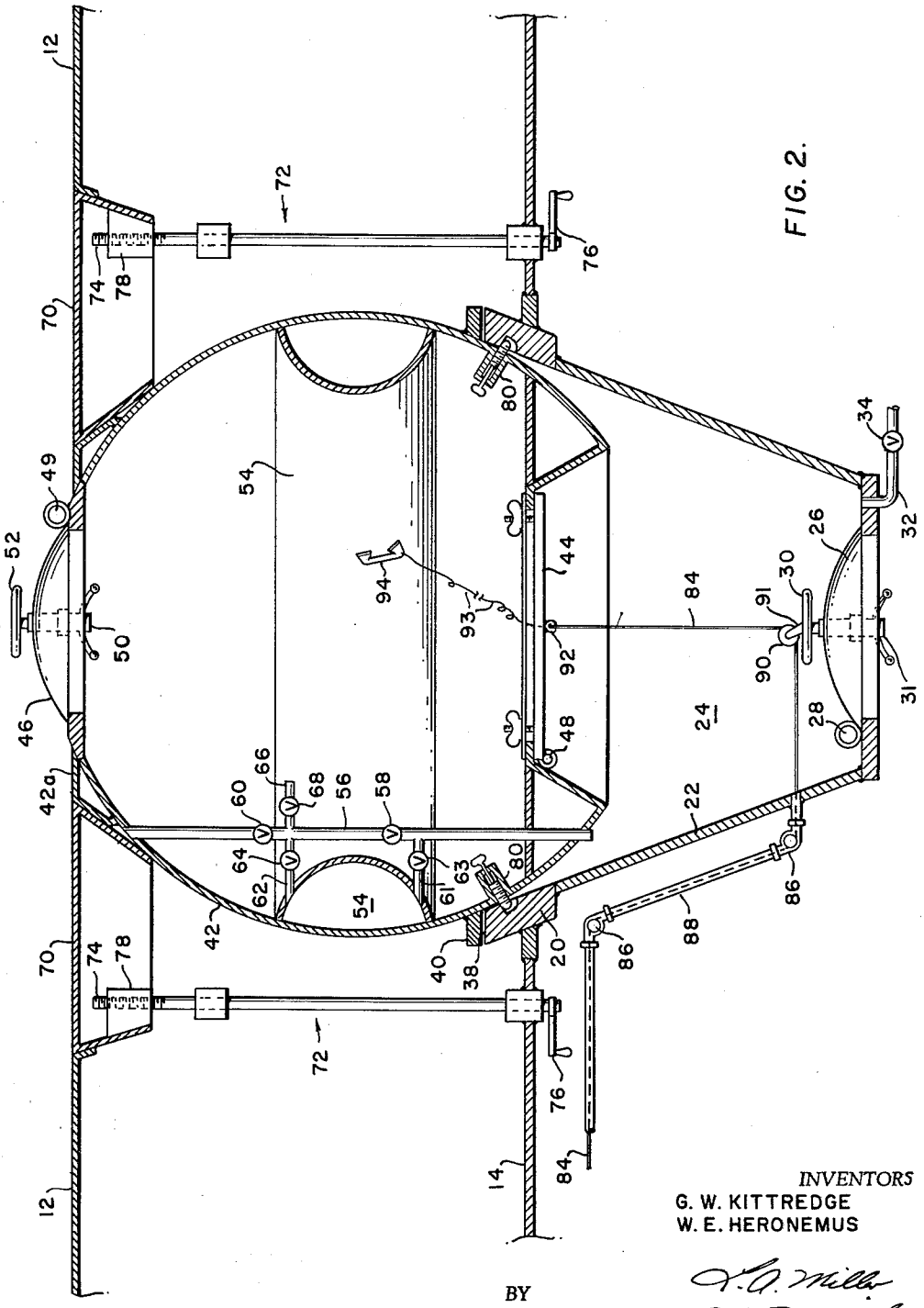

FIG. 2.

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SUBMARINE ESCAPE DEVICE

Filed March 26, 1959 3 Sheets-Sheet 3

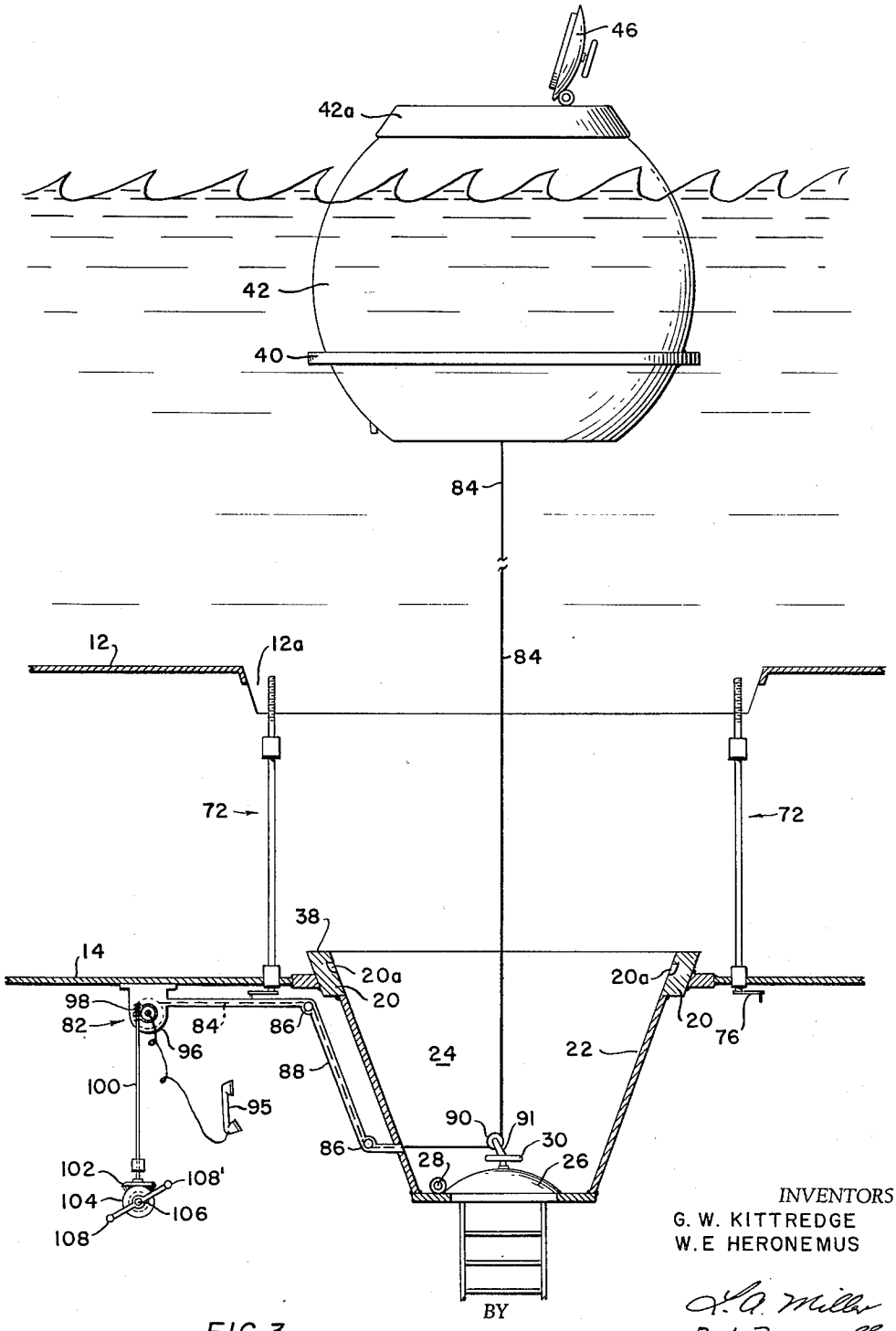

FIG. 3.

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3,045,622

SUBMARINE ESCAPE DEVICE

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6 Claims. (Cl. 114—16.7)
(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to submarines, and more particularly to life saving equipment for submarines.

Ever since the adaption of submarines by the United States Navy, continuing energy has been expended in an effort to develop practical and foolproof equipment and procedures for rescuing and/or permitting the escape of personnel from a sunken submarine.

The existing method of survivor rescue used by the United States Navy in the event of a submarine disaster is the employment of the submarine rescue chamber known as YRC. The latter consists of a pressure proof cylinder 11-feet 6-inches high and 7-feet in diameter. It weighs 21,000 pounds with 3,000 pounds buoyancy when water borne. It is carried to the scene of the disaster by a rescue ship (ASR). Existing submarines are equipped with one or more messenger buoys which when released from a sunken boat carry one end of a steel wire cable to the surface, the opposite end of the cable being secured to the submarine's torpedo room hatch. Upon arrival at the scene of the disaster, crewmen from the rescue ship attach the steel wire cable from the submarine's torpedo room hatch to an air motor-operated reel in the bottom of the rescue chamber. After the rescue ship has lowered the rescue chamber into the water, the operation of the air-motor reels in the wire cable and pulls the rescue chamber down through the water until its lower extremity makes contact with the deck of the disabled submarine at the outer circumference of the submarine's torpedo room hatch. The water in the space between the lower hatch of the rescue chamber and the submarine's hatch is then blown out and the two hatches are opened, permitting survivors (6–8 men) to enter the rescue chamber. The hatches are shut, the space between them is reflooded, and the rescue chamber proceeds to the surface. Subsequent trips down and up are made until all survivors are rescued.

The existing method of submarine rescue using the rescue chamber has one primary disadvantage in that the rescue chamber has to be carried to the scene of the disaster by a rescue ship and placed in operation before the air in the sunken submarine is exhausted. This means that the crews of submarines sunk beyond the range of rescue ships e.g. ex USS Bumper rammed by freighter and sunk in the Dardanelles, have very little hope of survival. In addition, some minor disadvantages of the existing rescue method are: (1) Time is lost in search for the sunken submarine before rescue operations can begin. (2) The rescue ship has to position itself exactly over the disabled submarine by means of a fourpoint moor; this becomes more difficult with increasing depth. (3) Use of the rescue chamber (YRC) is dependent upon sea conditions. (4) Submerged operation of the rescue chamber relies on high-pressure air piped by flexible air hoses from the rescue ship. These air hoses have an increasingly great tendency to leak with increases in depth.

Accordingly, a broad object of the present invention

is the provision of a practical and efficient life saving device for submarines.

Another object of this invention is to provide a self-contained escape device for submarines.

A further object of this invention is to provide an escape device that travels with the submarine and is operable by crewmen of the disabled submarine without the need of auxiliary power or external help.

In accordance with this invention the submarine escape device is essentially a buoyant sphere or ball-like envelope, two of which are carried by the submarine and replace the existing escape trunks now constructed integral with the submarine over the forward and after torpedo rooms. The purpose of the existing escape trunks, not hitherto mentioned, is to provide an airlock insuring watertight integrity of the torpedo rooms when the rescue chamber is being used. These buoyant spheres, of the instant invention, hereinafter called escape buoys, are 7 feet in diameter, of steel construction capable of withstanding pressure at the collapse depth of the submarine's pressure hull. The escape buoy has two access hatches, both seating with sea pressure. The lower hatch is a boiler, manhole type hatch and used for access to the escape buoy when the submarine is on the bottom. The upper hatch is a standard submarine torpedo room upper hatch and is used for exist of survivors after the buoy has reached the surface. The buoy is designed to hold six men including an operator. Repeated trips may be made to the surface until all survivors have been evacuated from the submarine. The escape buoy is stable during its trips to and from the surface and while surfaced. It is self-centering with respect to the submarine and is self-sealing; being held in sealed relation to the submarine by ambient sea water pressure. The escape buoy is equipped with a ballast system operable by an operator within the buoy to create excess buoyancy to break the seal and start the buoy upward, to create ample freeboard when surfaced, and to permit achieving minimum positive buoyancy to be overcome on a downward trip.

The invention, together with the above and other objects and advantages, is set forth in more technical detail in the following description and accompanying drawings in which like reference characters designate like parts throughout the several views and wherein:

FIG. 1 is a schematic elevational view of a submarine resting on the ocean floor and incorporating a preferred embodiment of the instant invention;

FIG. 2 is a schematic longitudinal section through a portion of the submarine showing the escape buoy in its normal position attached to the submarine; and

FIG. 3 is a longitudinal section similar to FIG. 2 and showing the escape buoy surfaced and in position to discharge crewmen.

Referring now to the drawings, first to FIG. 1, the submarine **10** is of known construction, formed with an outer deck portion or shell **12** and with a pressure hull **14**, the pressure hull being divided into the usual compartments, ballast tanks, fuel storage tanks, etc.

In accordance with the instant invention the submarine is equipped with two escape buoys **16**, one fore and one aft of the conning tower **18**. The escape buoys are substantially identical, except for location, therefore only the aft escape buoy will be described in detail.

Referring now to FIG. 2, in accordance with this invention, the pressure hull **14** is formed with a reinforcing ring **20** to which is attached a funnel-shaped casing **22** forming a compartment or chamber **24**. The casing, which is in the form of a hollow, downwardly directed truncated cone, is made of steel and capable of withstanding ocean pressure at the collapse depth of the submarine's pressure hull. The compartment **24** is open at the top and is closed at the bottom by a hatch **26**. The

hatch 26, which is a standard submarine torpedo room hatch, is hinged at 28 and is provided with conventional inner and outer securing mechanism indicated generally at 30 and 31. A drain conduit 32 equipped with a manually operated valve 34 drains the compartment 24 into the aft torpedo room 36, as described hereinafter. The upper surface 38 of the reinforcing ring 20 is machined flat and forms a seat for an annular ring 40, which annular ring is integrally attached to an escape buoy 42. The purpose of the annular ring 40 and of the flat surface 38 of the reinforcing ring 20 is to hold the escape buoy in sealed engagement with the submarine, as described in detail hereinafter.

The escape buoy is generally spherical in shape and is equipped with a lower hatch 44 and an upper hatch 46. The lower hatch 44, which is of a boiler-manhole type, is hinged at 48 for outward movement relative to the escape buoy. The upper hatch 46, which is of a standard submarine torpedo room type, is hinged at 49 for outward movement and is equipped with inner and outer securing mechanisms 50 and 52 respectively. The escape buoy is formed with an annular ballast tank 54. A conduit 56, equipped with valves 58 and 60, passes through the escape buoy and has its upper end open to the ambient sea and its lower end open to the compartment 24. A pair of branch conduits 61 and 62, equipped with valves 63 and 64, respectively, connect intermediate portions of conduit 56 to lower and upper portions of the ballast tank 54, and a third branch conduit 66, equipped with a valve 68, opens into the escape buoy.

The outer deck portion 12 of the submarine is formed with a relatively large opening 12*a* (FIGS. 1 and 3), which opening is fitted with an annular fairing ring 70 (FIG. 2). The fairing ring, which forms a part of the outer deck, is streamlined to the exterior contour of the submarine shell and is releasably held in place by a pair of screw jacks 72. The screw jacks have an upper threaded portion 74 and a lower crank portion 76. The threaded portion of the jack is adapted to engage a nut 78 secured to an under portion of the fairing ring. The arrangement of the screw jacks is such that rotation of the cranks in one direction pulls the fairing ring into engagement with the shell of the submarine and with an annular flange 42*a* formed on an upper portion of the escape buoy, whereas, rotation of the cranks in an opposite direction releases the fairing ring and forces it upward relative to the submarine whereby ambient sea water floats the fairing ring away, as described hereinafter. Three equally spaced securing devices 80, only two of which are shown, are mounted on the lower portion of the escape buoy and are adapted to be screwed into and out of companion bores 20*a* formed in the reinforcing ring for releasably securing the buoy to the reinforcing ring.

The principal purpose of the securing devices 80 is to secure the escape buoy to the submarine during normal maneuver. As pointed out hereinbefore, the exterior of the buoy above the ring 40 is exposed to ambient sea water when the submarine is submerged, so that the pressure of the seawater acting on the buoy forces and holds the ring 40 into sealing engagement with the upper surface 38 of the reinforcing ring 20. Thus the buoy is self sealing with respect to the submarine. Also as shown in FIG. 2, the casing 22 is so shaped and sized as to guide (self-center) the lower portion of the spherical buoy into the compartment 24 during a return movement of the buoy to the submarine in a rescue operation, as described hereinafter.

Referring now to FIG. 3, a pressure proof reel, indicated generally by numeral 82, is secured to the interior of the pressure hull 14 and is equipped with a wire cable 84. The wire cable passes from the reel over a pair of idler pulleys 86 encased in a conduit 88 and into the compartment 24. In the compartment, the cable passes over a third idler pulley 90, pivotally attached to hatch 26 by a swivel connector 91, and the outer end of the cable is secured to the center of hatch 44 (FIG. 2) by a releasable swivel connector 92. A rubber-covered, sound-powered telephone cable is located in the center of the wire cable 84 and has one end 93 thereof attached to a telephone receiver-transmitter set 94 within the escape buoy and the opposite end connected to a telephone receiver-transmitter set 95 within the aft torpedo room 36 of the submarine. The reel 82 is equipped with a gear 96 that meshes with a worm 98 formed on one end of a shaft 100. The opposite end of shaft 100 is provided with a bevel gear 102 that meshes with a second bevel gear 104, which second bevel gear is secured to a second shaft 106, and the second shaft has a pair of oppositely directed cranks 108, 108′ secured thereto. The shafts 100 and 106 are mounted on the interior of the pressure hull by suitable means, not shown. The arrangement of the reel and operating mechanism is such that rotation of the cranks 108, 108′ in one direction releases or unwinds the wire cable, whereas, rotation in the opposite direction reels in or winds the cable.

Detailed operation of the escape buoy is as follows:

Assuming the submarine is lying disabled on the bottom, survivors in the aft torpedo room 36 clear the movable section or fairing ring 70 of the superstructure from the escape buoy by means of the hand operated screw jacks 72 which force the fairing ring upwards relative to the escape buoy, whereupon ambient sea water rushes in and floats the fairing ring free of the submarine. Hatches 26 and 44 are opened and five survivors plus a buoy operator take their places in the buoy. Before closing the hatch 44, the swivel 91 is fixed in place so that the wire cable 84 which is fastened to hatch 44 will run free and be centered over hatch 26. As soon as the survivors have taken their positions in the escape buoy and hatches 26 and 44 are secured shut, the operator opens valves 58 and 60 allowing sea water to fill space 24. After space 24 is flooded and equalized with sea pressure, the securing devices 80 are withdrawn by their worm screws, allowing the buoyancy of the escape buoy to take effect. The operator, by the use of the sound-powered telephone 94, instructs the remaining personnel within the submarine to commence unwinding the hand operated reel 82 allowing the rescue buoy to float to the surface. Upon arrival at surface, hatch 46 is opened, a rubber boat is pushed out and the five survivors disembark through the hatch and into the rubber boat. The operator now closes hatch 46 and opens valve 63, allowing the ballast tank 54 to flood sufficiently to compensate for the weight of the five disembarked survivors. Valves 64 and 60 may be temporarily opened to vent the ballast tank. As soon as flooding of the ballast tank is completed all valves are closed. Pressure in ballast tank is now approximately 15 p.s.i. The operator now instructs the remaining personnel in the submarine to reel in on reel 82 and pull the escape buoy back down to the sunken submarine. In coming down on seat 38, chamber 24 being filled with water, the escape buoy's seal ring 40 is temporarily prevented from seating by a wedge of such water, so valves 58, 60 are opened allowing water to flow from space 24 and permitting sealing ring 40 to rest on seat 38. Valves 58 and 60 are then closed and valve 63 opened. The escape buoy is immediately forced on seat 38 by a force equal to:

$$(\text{Sea pressure} - 15)\ \text{p.s.i.} \times \frac{\pi x (\text{Diameter of the sealing ring})^2}{4}$$

Petcock 68 is now opened momentarily to make sure the seal is not leaking. Securing devices 80 are screwed out clamping the escape buoy in place. The operator within the buoy now instructs the survivors in the submarine to open valve 34 and drain space 24 into the torpedo room. Hatches 44 and 26 are opened and the escape buoy is ready to take another five survivors to

the surface. On the last trip to the surface, the cable 84 is unfastened from hatch 44 and the escape buoy floats freely to the surface.

Thus it is seen in accordance with the instant invention, there is provided a rescue system for disabled submarines that permits surviving personnel entrapped in a submarine sunk at any depth not exceeding the collapse depth of the submarine's hull, to effect their own rescue without being dependent upon any outside agency such as a submarine rescue ship, deep sea divers, or the like.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and the scope of the invention as set forth in the appended claims.

What is claimed is:

1. In combination, a submarine and an escape device therefor, the submarine having an outer deck portion, a casing having an open upper end and a hatch in the lower end, said casing being fixed in said submarine with its upper end spaced inwardly from said deck portion, a rescue buoy of hollow ball form having a lower portion releasably mounted in the upper end of said casing, said buoy having a minor exterior surface area thereof at an opening in said deck portion exposed to ambient sea water when the submarine is submerged, said upper end of said casing and said lower portion of said buoy having means thereof juxtaposed for holding the buoy in sealing engagement with the casing, ingress and egress hatches formed in the lower and upper portions respectively of the buoy, said buoy having a sectional area which is larger than said surface area and which lies inwardly of said deck portion when the buoy is mounted in said upper end of said casing, said opening in the deck portion being larger than said sectional area, ring means for air-tightly closing the space of said opening between the deck portion and said minor buoy surface, and means optionally operable from inside the submarine for tightening said ring, so that the ring is also a bar to movement of the buoy through said opening in said deck portion, and for releasing the ring so as to remove the bar.

2. A combination as defined in claim 1 but further characterized by a fluid ballast tank in said buoy, a first fluid conduit in said buoy having one end thereof in open communication with ambient sea water when the submarine is submerged and an opposite end thereof in open communication with the interior of said casing, a second conduit connecting an intermediate portion of the first fluid conduit with the ballast tank, and manually-operated valve means in said first and second conduits, said valve means being operable to selectively place the ballast tank in open communication with the ambient sea water and with the interior of the casing and to place the interior of the casing in open communication with the ambient sea water.

3. In combination, a submarine and an escape device therefor, the submarine having a pressure hull and deck portion outwardly of said hull, said escape device comprising a casing air-tightly fixed in an opening in said hull, said casing having an open upper end and a hatch in the lower end for ingress of persons, a rescue buoy of hollow ball form releasably mounted in the upper end of the casing with the lower part of said ball form resting in said upper end of said casing, said buoy having a minor exterior surface thereof exposed to ambient sea water when the submarine is submerged, said buoy having a maximum sectional area between said hull and deck portion when the buoy is mounted on said casing, said deck portion having an opening larger than said maximum area, a ring means for air-tightly closing the space between the deck portion and said minor buoy surface, means operably from inside the submarine optionally operable for tightening said ring, so that the ring is also a bar to movement of the buoy through said opening in said deck portion, and for releasing the ring so as to remove the bar, said casing and said buoy having companion surfaces thereof juxtapositioned for holding the buoy in sealing engagement with the casing, ingress and egress hatches formed in the lower and upper portions respectively of the buoy, a fluid ballast tank in said buoy, a first fluid conduit in said buoy having one end thereof in open communication with ambient sea water when the submarine is submerged and an opposite end thereof in open communication with the interior of said casing, a second conduit connecting an intermediate portion of the first fluid conduit with the ballast tank, and manually-operated valve means in said first and second conduits, said valve means being operable to selectively place the ballast tank in open communication with the ambient sea water and with the interior of the casing and to place the interior of the casing in open communication with the ambient sea water.

4. A submarine escape device as set forth in claim 1 wherein said companion surfaces for holding the buoy in sealing engagement with the casing includes an annular flange encircling a lower portion of the buoy and having a flat lower surface thereof facing the casing, and wherein the casing is formed with an upwardly facing flat annular surface forming a seat for the lower surface of the annular flange.

5. A submarine escape device as set forth in claim 1 which additionally includes a reel rotatably secured within the submarine, a reel cable having one end thereof secured to the reel and an opposite end thereof secured to the rescue buoy at a lower central portion thereof, means in the casing for guiding the said opposite end of the cable for substantially vertical movement thereof into and out of the casing and means for unwinding and winding the reel whereby during the unwinding of the reel the buoy in floating to the surface carries the said opposite end of the cable, whereas during winding of the reel the buoy is returned to the casing by the cable.

6. A submarine rescue device as set forth in claim 5 wherein the upper portion of the casing, the lower portion of the buoy, the attachment of the reel cable to the buoy and the reel cable guide means are so constructed and arranged as to center the buoy in predetermined position relative to the casing upon reeling in of the reel cable.

References Cited in the file of this patent

UNITED STATES PATENTS

1,076,496	Grossich	Oct. 21, 1913
1,184,981	Morrison	May 30, 1916
1,188,179	Keampfer	June 20, 1916
1,207,115	Willison	Dec. 5, 1916
1,215,905	Burke et al.	Feb. 13, 1917
1,844,763	Honig	Feb. 9, 1932
1,853,898	Grieshaber	Apr. 12, 1932