June 5, 1945. J. W. JUSTUS 2,377,695

APPARATUS FOR DEEP SEA RESCUE AND SALVAGE

Filed Aug. 31, 1944 3 Sheets-Sheet 1

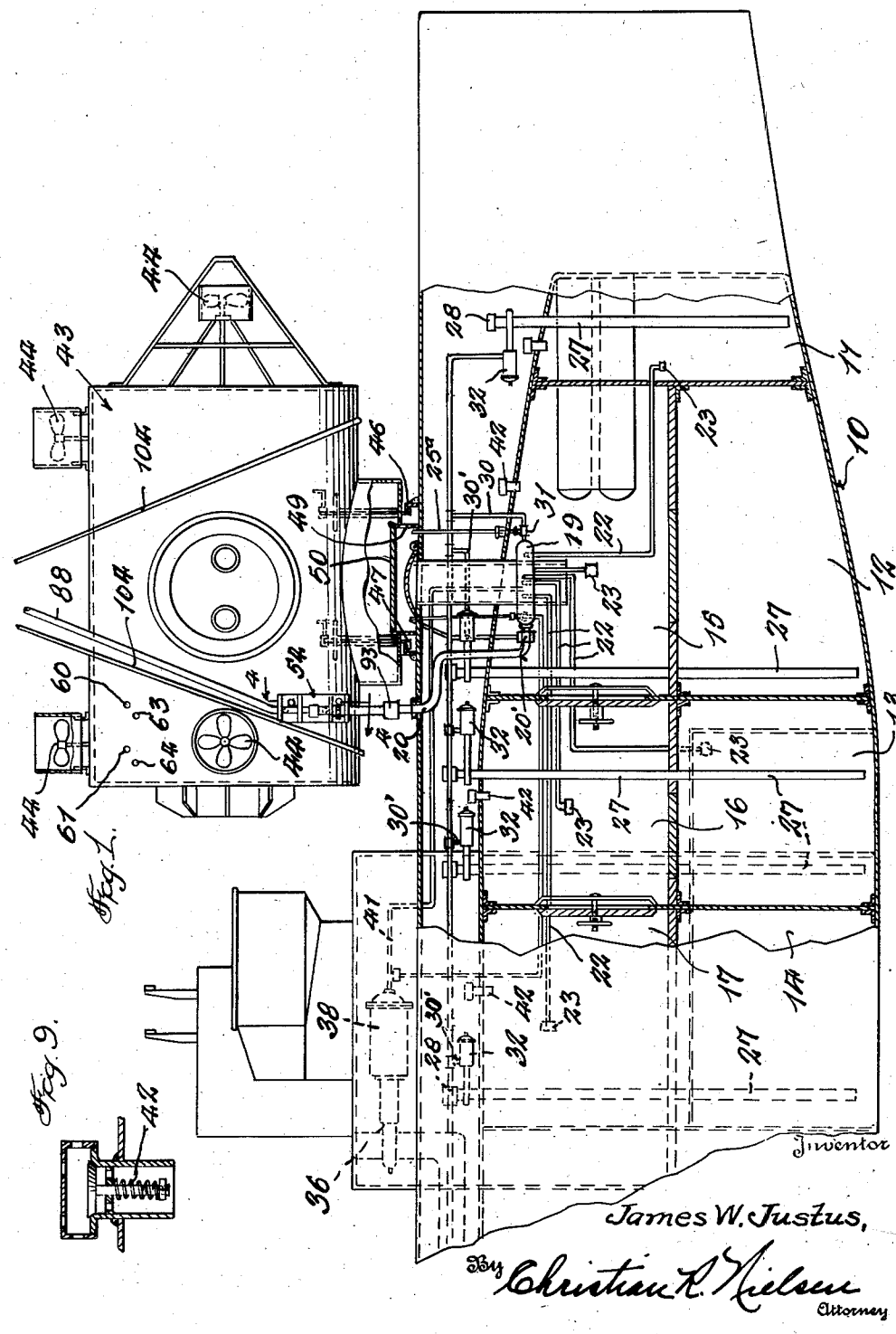


Fig. 1.

Fig. 9.

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Fig. 2.

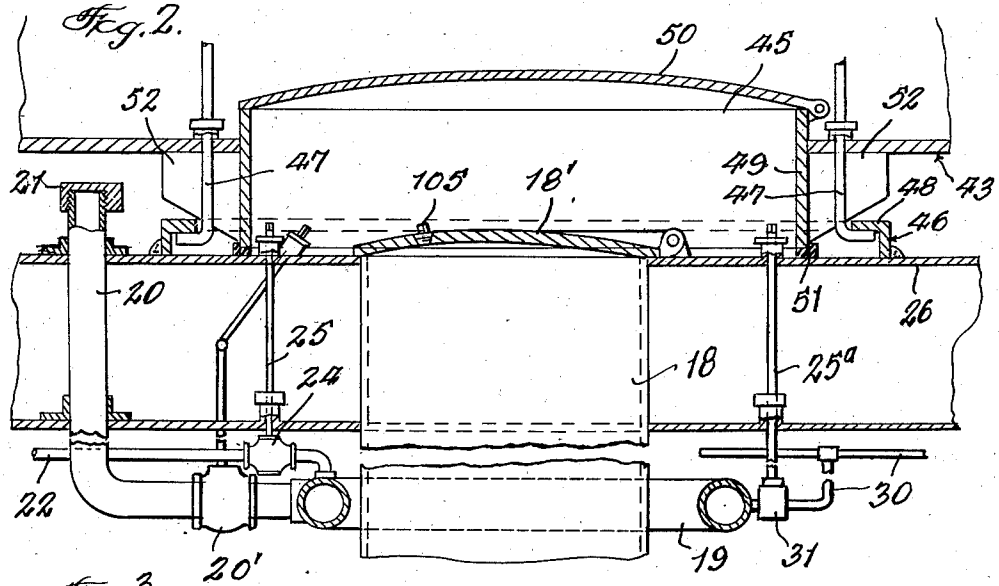
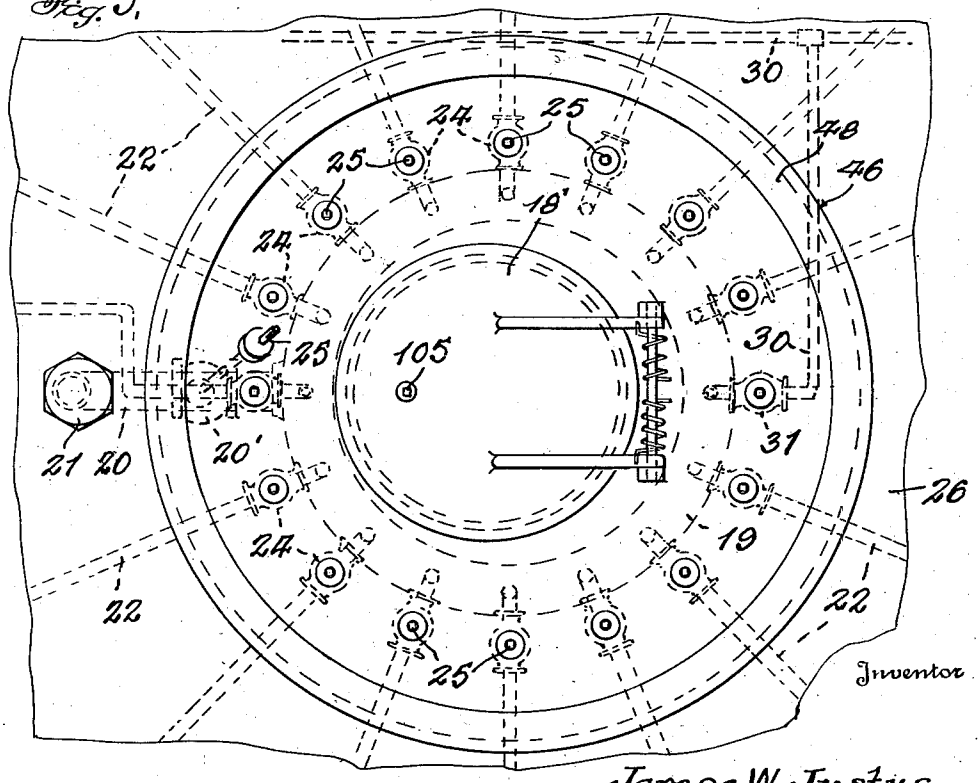


Fig. 3.



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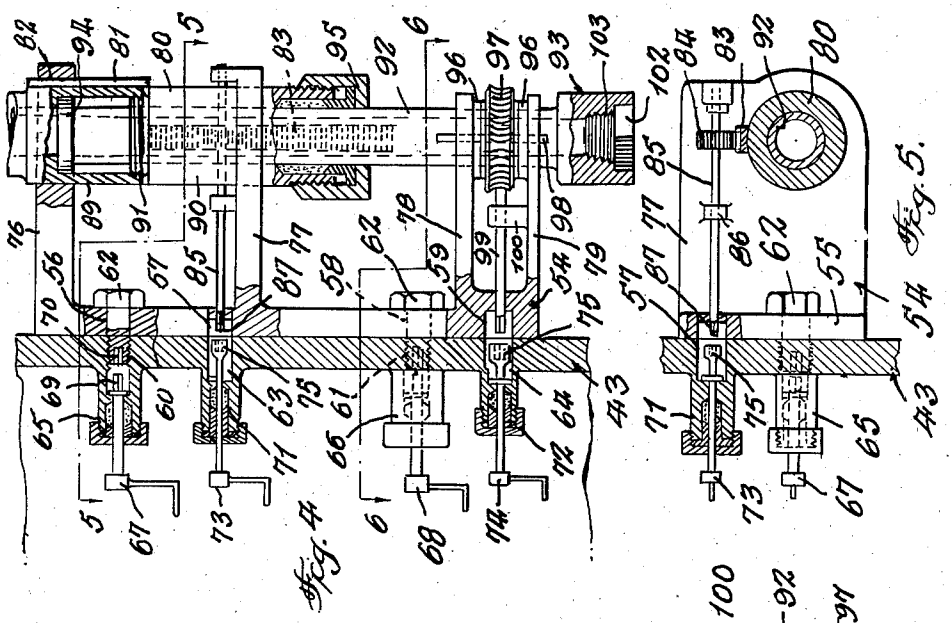


Fig. 4.

Fig. 5.

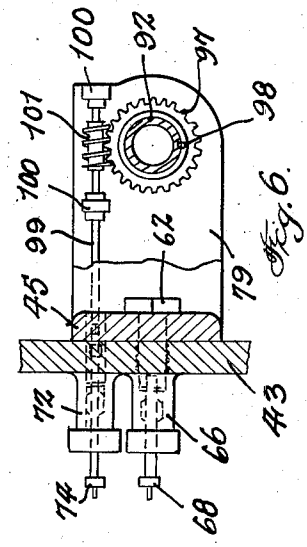


Fig. 6.

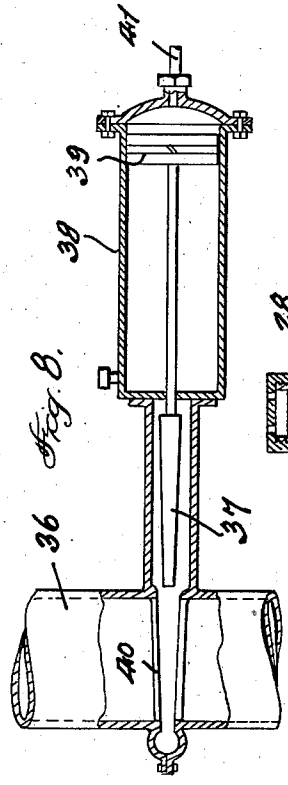


Fig. 8.

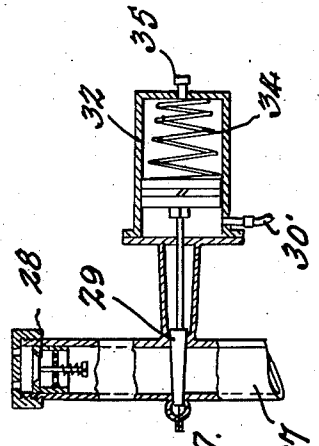


Fig. 7.

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2,377,695

APPARATUS FOR DEEP SEA RESCUE AND SALVAGE

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Application August 31, 1944, Serial No. 552,105

11 Claims. (Cl. 114—16.4)

This invention relates to an apparatus for raising disabled submerged vessels and it consists in the method, constructions and arrangements herein described and claimed.

It is the cardinal object of the invention to provide a propelled rescue chamber constructed and adapted to be secured to hatches of submerged vessels for the purpose of rescuing surviving passengers, and thereafter supplying and maintaining pressure to the compartments of the submerged vessel to displace water confined within the compartments to provide buoyancy to the submerged vessel.

It is also an important object of the invention to provide a new and novel means whereby the rescue apparatus may be readily and quickly secured to the hatch of a submerged vessel, the actual coupling between the two devices being accomplished by the rescue crew within the rescue apparatus, and further effect a coupling of the air hose directly with an air distributing manifold system within the submerged vessel; as well as providing means for detaching the rescue apparatus from the air hose and the submerged vessel.

It is a further important object to provide an apparatus which is of such construction as to permit operation upon submerged vessels in depths not possible by deep sea divers.

It is a still further object of the invention to provide an air distributing manifold system which may be readily installed within old type boats or the new type submarines, thereby insuring refloating of any submerged craft equipped with the apparatus.

A further important object of the invention is the provision of an air manifold system wherein a plurality of valves are employed for controlling the discharge of air at desired points as well as closing the induction line of the submerged vessel, all of which may be accomplished by the crew while in the rescue apparatus.

Additional objects, advantages and features of the invention will be apparent from the following description and accompanying drawings, wherein

Figure 1 is a fragmentary sectional view of a submarine showing the rescue apparatus attached to the hatch of the vessel.

Figure 2 is an enlarged cross section through the hatch of the submarine, illustrating the air manifold and the means for obtaining connection with the rescue apparatus.

Figure 3 is a top plan view thereof.

Figure 4 is a vertical section on the line 4—4 of Figure 1.

Figure 5 is a cross section on the line 5—5 of Figure 4.

Figure 6 is a cross section on the line 6—6 of Figure 4.

Figure 7 is a fragmentary sectional view of a valve associated with the water discharge lines.

Figure 8 is a similar view of a valve installed in the main induction and battery vent.

Figure 9 is a vertical sectional view of an air vent associated with the various compartments of the vessel.

Reference is first made to Figure 1 of the drawings, wherein there is shown a fragmentary portion of a submarine indicated at 10, the hull being divided into compartments 11 to 17, as here shown, although the number of compartments may be increased, it being understood that each compartment of the vessel is to be equipped with water discharge lines and air inlet means, as will be described.

The submarine is constructed with the usual escape hatch 18, including the usual hatch cover 18' and customary locking features for maintaining a watertight connection, these not being illustrated, since they form no part of the present invention. Surrounding the hatch 18, inwardly or ouwardly of the vessel, there is disposed and suitably mounted an annular air manifold 19 having an air inlet pipe 20 leading to the exterior of the vessel where it is closed by a screw threaded cap 21. A valve 20' is installed in the line 20 which is maintained in position, preventing water entering the manifold when the cap 21 is removed. A series of air pipes 22 are connected to the manifold 19, there being a pipe for each compartment of the submarine, each pipe terminating in a discharge valve 23 within respective compartments, preferably at a high point within the compartments.

As may be seen from Figures 2 and 3, each pipe 22 has installed therein a valve 24 for individual control of air through the pipes 22, and since these valves are to be operated exteriorly of the submarine, reach rods 25 are extended upwardly through the top wall 26 of the vessel where the rods are angularly shaped to permit application of a wrench or otherwise, to effect operation of the valves. The valve 20' is also provided with a reach rod.

The compartments 11, 12, 13 and 14 in the present instance, will be considered as ballast compartments, and from each of these compartments, there is suitably mounted a water discharge tube 27, the lower open end of which is spaced slightly above the bottom of the hull

of the ship, the upper end terminating exteriorly of the vessel in the form of a check valve 28 (see Figure 7). Installed in each tube 27, there is a valve 29 which is normally held in closed position across the tube 27, and operable through air pressure to an open position, as will now be described. An air tube 30 is connected to the manifold 19, including a control valve 31 actuated through a reach rod 25—*a*, the tube 30 having air lines 30' connected to respective cylinders 32. The cylinders 32 are of identical construction and attention is invited to Figure 7, wherein a piston 33 is reciprocably mounted and operatively connected to the valve 29, a spring 34 in advance of the piston maintaining the valve in closed position. The air line 30' enters the cylinder rearwardly of the piston and air discharged into the cylinder causes the piston to move forwardly, compressing the spring 34 and at the same time draw the valve to open position. The cylinder includes a vent 34 permitting free movement of the piston. The valve 28 may be of any suitable construction permitting outward passage of water, as will be explained hereinafter.

The main induction and battery vent 36 is controlled by means of a valve 37, shown in detail in Figure 8, in which a cylinder 38 is connected to the vent 36 and includes a piston 39 operatively connected to the valve to move the latter into the valve seat 40 upon entrance of air into the cylinder through an air line 41, the latter being also connected to the manifold 19, and controlled by means of a valve 24.

The compartments 11, 15, 16 and 17 are each provided with equalizing valves 42 opening to the exterior of the vessel, which function to relieve air pressure within the vessel, which will be required as the submerged vessel is being raised, as will be further explained.

The rescue apparatus is indicated at 43 and comprises a submarine vessel adapted to be propelled and guided by means of propeller units 44, as is well understood, and exemplified in my prior patent issued December 21, 1937, Patent No. 2,102,626. The rescue apparatus will include any number of passageways 45 adapted to telescope with the hatches 18 of the submerged and secured to said hatches in watertight relation. In the present instance, the structure of my prior patent will be employed, attention being invited to said patent. Briefly, however, the connection between the rescue apparatus and submerged vessel is made by manipulating the rescue apparatus 43 so as to align the passageway 45 with an annular flanged collar 46 fixed on the submerged vessel and surrounding the hatch 18. Thus aligned, lugs 47 are actuated so as to engage beneath the flange 48 of the collar 46. As may be seen in Figure 2, the passageway is defined by an annular body 49 closed at the end disposed within the apparatus 43 by a cover 50. The other end being planiform, and including a packing 51 for effecting a watertight connection with the submerged vessel when drawn thereagainst by the lugs 47. The exterior of the body 49 has a plurality of radially extended fins 52, the lower edges are tapered as at 53. These fins functioning as centering means between the rescue apparatus and the collar on the submerged vessel.

The rescue apparatus is provided with means for removing the cap 21 from the air line system of the submerged vessel as well as connecting an air supply line to said air line system, all of which must be accomplished within the rescue apparatus. As shown in Figures 1, 4, 5 and 6, a bracket 54 is secured to the exterior of the rescue apparatus 43 adjacent the passageway of the apparatus. The bracket 54 comprises a base portion 55 provided with openings 56, 57, 58 and 59 spaced vertically of the base. The wall of the rescue apparatus 43 is provided with threaded openings 60 and 61 aligned respectively with openings 56 and 58 for receiving mounting bolts 62 for securing the bracket to the apparatus. The wall of the apparatus is also provided with openings 63 and 64 aligned respectively with the openings 57 and 59 of the bracket. A packing gland 65 and 66 is provided for the openings 60 and 61, respectively, and rotatably mount a wrench 67 and 68. The wrenches are formed with a squared end 69 complemental to a similarly shaped opening 70 formed in the end of bolts 62. By sliding the shank of the wrench longitudinally of the packing gland, the squared end 69 will engage in the opening 70 of the bolt, and then by rotating the wrench in the proper direction, the bolts 62 may be quickly removed to release the bracket as will be required in operation of the device. The openings 63 and 64 are provided with glands 71 and 72, respectively, and these glands likewise mount respective wrenches 73 and 74; these wrenches, however, including a socket 75 for a purpose to be explained.

Upon the base 54 vertically spaced right-angularly extended arms 76, 77, 78 and 79 are formed, arranged in pairs, the arms 76 and 77 having openings adjacent their ends through which a metallic tubular sheath 80 is reciprocably mounted. In order that the sheath may be held against rotation, a longitudinal key 81 is formed on the exterior surface of the sheave complemental to a keyway 82 formed in the bracket 76.

A rack bar 83 is fixed upon the exterior of the sheath 80 extending longitudinally thereof of substantial length in mesh with a gear 84 fixed upon a shaft 85 rotatably supported between bearings 86 on the plate 77. The shaft 85 is aligned with and enters the opening 57 of the base where it is provided with a squared end 87 complemental to the socket 75 of the wrench 73. It will be apparent that the wrench may be actuated to move the sheath longitudinally of the bracket, as will be required in operation of the device. The sheath 80 will include any suitable means for connection with an air line 88.

The sheath 80 is made in two sections 89 and 90, threadedly connected as at 91, the bore of the section 89 being of a diameter greater than the section 90. A shank 92 of a combined wrench and die 93 is reciprocably mounted within the sheath 80, the shank including a head 94. The head 94 is of a diameter to freely fit within the bore of the section 89 and will function as a stop means between limits of movements of the shank 92. For instance, as shown in Figure 4, the head 94 is contacting the terminal end of the bore of the section 89, and downward movement of the sheath 80 through operation of the wrench 73 will cause downward movement of the wrench and die 93.

The shank 92 projects outwardly from the sheath 80, the terminal end of the sheath including a gland packing 95, the shank 92 being rotatably mounted between bearings 96 on the bracket arms 78 and 79. A ring gear 97 is se-

cured to the shank 92 positioned between the bearings 96. A longitudinally extending key is formed on the shank 92 complemental to a keyway formed in the bracket arms 78 and 79. The key and keyway permits longitudinal movement of the wrench and die.

A shaft 99 is journalled in bearings 100 formed on the bracket arm 79 and fixed to the shaft there is a worm gear 101 in mesh with the gear 97. This shaft 99 is aligned with and projects into the opening 59 of the base 54, the terminal end being angular shaped for reception of the socket 75 of the wrench 74.

The combined wrench and die 93 is employed in removing the closure cap 21, and to this end a socket wrench 102 is formed at the terminal end of the shank 92 and inwardly of the socket a threaded die 103 is provided, the latter being employed to re-form the threads of the pipe 20 in the event that these may have become distorted or damaged during removal of the nut 21, and also to effect an air and watertight connection with the pipe 20. It will be readily apparent that the socket and die may be rotated by the wrench 74.

The bracket 54 and the associated parts may be mounted adjacent any of the hatch passage ways of the rescue apparatus, it only being necessary to provide the necessary openings 60, 61, 63 and 64.

In use, when a disabled submerged submarine has been located, the crew enters the rescue apparatus and it is properly closed and sealed. The apparatus is lowered from the mother ship by means of the suspension cables 104, after which the crew takes over in manipulation of the power units 44 to effect guidance and positioning of the hatch passage over the hatch of the submarine and with these telescoped the lugs 47 are rotated so as to secure the apparatus to the submarine. The rescue crew may now open the hatch cover 50 and make a preliminary inspection by removing the test plug 105 in the cover 18'. In the event that gases or water are present it is obvious that the crew of the submarine would not be alive, and it would then only remain to couple the air line 88 to the line 20. However, should the crew of the submarine be alive a rescue of the entrapped men would be in order and this would be effected prior to the coupling of the air line 88 with the submarine. The rescue would be effected by opening the hatch door 18'' and passing the crew into the rescue apparatus. When the capacity of the rescue apparatus has been attained, the hatch door 18' is closed and sealed, as is the door 50. The lugs 47 are now rotated so as to free the submarine and the crew of the mother-ship is signalled to hoist the rescue apparatus. Then, when all of the crew of the submarine have been removed, the raising thereof will be accomplished, the rescue apparatus being again anchored to the hatch of the submarine, as previously described. At the time of centering the apparatus upon the hatch of the submarine care was taken to also center the wrench and die 93 above the closure cap 21 of the air line 20. The wrench and die 93 is normally in elevated position, and by engaging the wrench with the shaft 85, and rotating it in the proper direction, the sheath 80 and the wrench 102 will be moved into position upon the closure cap 21. The gear 101 and ring gear 97 are now rotated by means of a wrench 74 removing the nut 21 from the air line, which will be permitted by reason of the fact that the combined wrench and die may move upwardly along the key 98. It will be noted from Figures 2 and 3 that the closure cap 21 is of greater weight upon one side, tending to readily topple from the pipe and the wrench when released from the pipe. With the cap 21 removed, the wrench and die 93 is again lowered into position upon the open threaded end of the pipe 20. The die threads 103 are now engaged with the threads of the pipe 20 through operation of the wrench 74, so as to securely connect the air line 88 with the pipe 20. The valve 20' is now opened so as to admit air to the manifold 19. The valve controlling air line 41 is also opened so as to permit passage of air to the cylinder 38 to effect closure of the valve 37 of the induction line 36. After opening of these valves, the valves associated with air lines 22 are opened to admit air to the several compartments of the submerged vessel, and the valve 31 is then opened to effect unseating of the valve 29 controlling the water discharge pipes 27. The air admitted into the compartments of the vessel will be under high pressure and as this builds up, water will be forced upwardly through the tubes 27 for discharge exteriorly of the vessel. After operation of the valves as described further work on the part of the rescue crew is not necessary, and, in fact, it is highly desirable that the rescue apparatus be freed from the submerged vessel, since there is a likelihood of unbalanced movements of the submarine during rising thereof. Thus, the hatch 18 is sealed, as is the hatch passageway 45 of the rescue apparatus. The wrenches 67 and 68 are now engaged with the bolts 62 to effect their removal, freeing the bracket 54. The rescue apparatus is finally released from the submarine by actuating the lugs 47.

As the submarine rises, water pressure surrounding the vessel is reduced and in order to equalize pressure in the submarine, air may escape through relief valves 42.

Any suitable lighting system may be provided on the rescue apparatus so as to illuminate the submarine sufficient to make for good working conditions.

From the foregoing it will be seen that the whole operation is effected from the interior of the rescue apparatus, and while I have specifically shown and described the apparatus, this is by way of illustration only, and I consider as my own all such modifications in construction as fairly fall within the scope of the appended claims.

I claim:

1. A submarine raising apparatus comprising in combination with a submarine having an escape hatch and air pipe lines associated with compartments of the submarine and including an exterior pipe connection, a rescue apparatus having means for attachment to the escape hatch of the submarine, an air supply line carried upon the exterior of the rescue apparatus, means interiorly of the rescue apparatus for coupling said air supply line to the exterior pipe connection on said submarine, valve means for controlling discharge of air into the compartments of the submarine, and water discharge ducts associated with each compartment opening exteriorly of the submarine.

2. A submarine raising apparatus comprising in combination with a submarine having an escape hatch and an air manifold having a hose connection exteriorly of the submarine, air lines connected with said manifold and opening within respective compartments of the submarine, valve

means associated with each of said air lines, each valve including a rod disposed within said escape hatch, a water discharge duct for each compartment opening exteriorly of the submarine, a valve in each duct adjacent the discharge end thereof, an air line between each valve and said air manifold, a main control valve between the manifold and said last named air line, said main control valve including an operating rod disposed within the escape hatch; a rescue apparatus having means for attachment to the escape hatch of the submarine to permit access therein, an air supply hose carried upon the exterior of the rescue apparatus, means interiorly of the rescue apparatus and connected with said air supply hose for coupling said hose to the hose connection exteriorly of the submarine.

3. The structure of claim 2 wherein the hose connection exteriorly of the submarine includes a valve and operating rod, the latter being disposed within the escape hatch.

4. The structure of claim 2 wherein certain compartments of the submarine are provided with an air equalizing valve.

5. The structure of claim 2 wherein the valve associated with each water duct is normally closed and operable to open position under air pressure, and each duct further having a valve opening under water pressure within the duct.

6. A submarine comprising a plurality of compartments and a rescue hatch, an air manifold encircling said hatch, an air intake hose connected to said manifold and having a connecting means exteriorly of said submarine, valve means for controlling passage of air to said manifold, air lines connected with the manifold, each having a discharge end within a respective compartment, water discharge ducts associated with certain of the compartments, each duct having a valve discharge end exteriorly of the submarine, and an air actuated valve in each duct normally in closed position, an air line connected with each of said last named lines and with said manifold, and an air control valve in each air line connected with the manifold, each air control valve having a reach rod within and accessible through said rescue hatch.

7. The structure of claim 6, wherein certain of said compartments have an equalizing valve operable upon reduction of exterior pressure on the submarine.

8. A submarine rescue and raising apparatus comprising in combination with a submarine having an escape hatch and air discharge pipe lines associated with compartments of the submarine and including an exterior air pipe connection having a screw-threaded closure cap, a rescue apparatus having means for centering and attachment to the rescue hatch, a bracket mounted upon the exterior of the rescue apparatus, a sheath carried by said bracket and vertically adjustable therethrough, means interiorly of the rescue apparatus for moving the sheath vertically, said sheath being hollow and including an air hose line, a combined wrench and die rotatably mounted within said sheath having a passage in communication with said sheath, means interiorly of the rescue apparatus for rotating said wrench for removing said closure cap and thereafter engaging said die upon the threaded portion of the exterior pipe connection, and means interiorly of the rescue apparatus for releasing said bracket from the rescue apparatus after connection has been made between said die and said exterior pipe.

9. The structure of claim 8 in which the means for adjusting the sheath consists of a rack bar on the sheath, a shaft rotatably carried by said bracket having an end disposed within an opening accessible from the interior of the rescue apparatus, a gear on the shaft in mesh with the rack bar, and wrench means for rotating the shaft.

10. The structure of claim 8, in which the means for rotating the wrench and die consists of a ring gear fixed upon the shank of the wrench and die, a shaft rotatably carried by said bracket having an end disposed within an opening accessible from the interior of the rescue apparatus, a worm gear on the shaft in mesh with the ring gear and wrench means for rotating the shaft.

11. The structure of claim 8 in which the means for releasing the bracket consists of exterior bolts having their threaded terminal ends presented within an opening accessible from the interior of the rescue apparatus, each bolt having a wrench engaging member, and wrench means cooperable with the wrench engaging member.

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