May 2, 1944. W. K. KANNENBERG 2,347,690

SALVAGING APPARATUS FOR SUNKEN VESSELS

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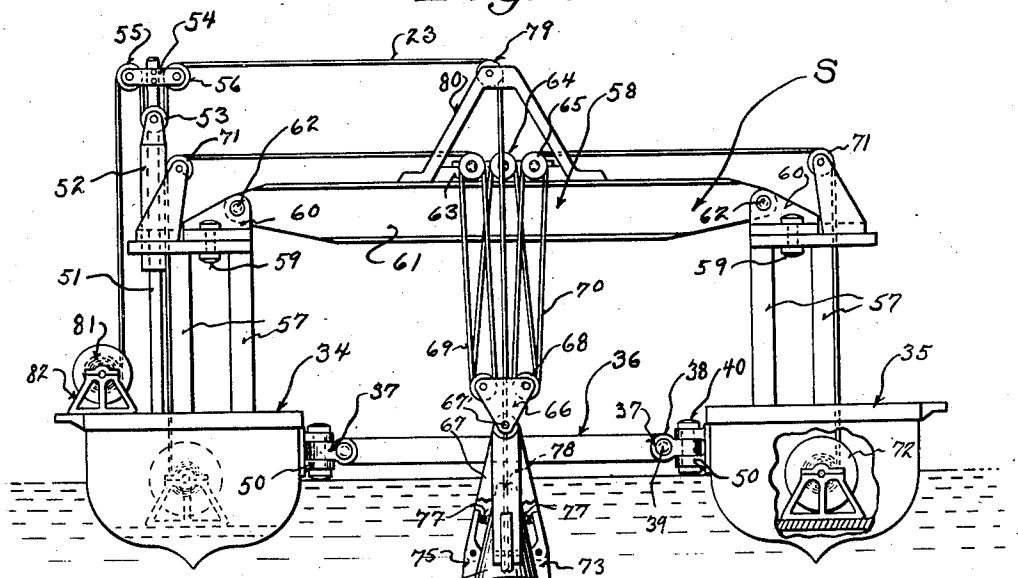
Fig. 2.



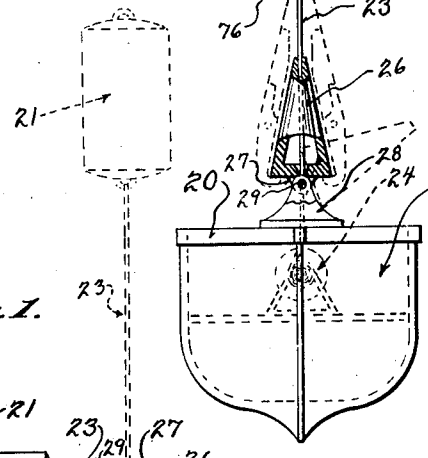


Fig. 1.

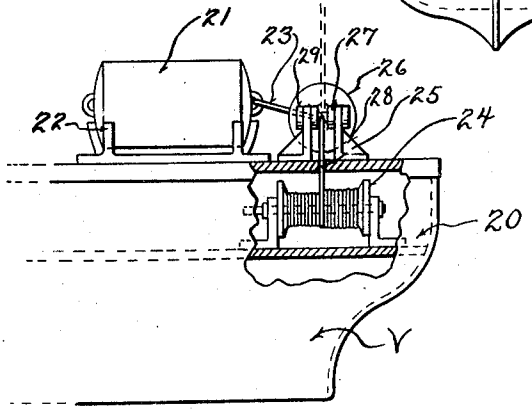
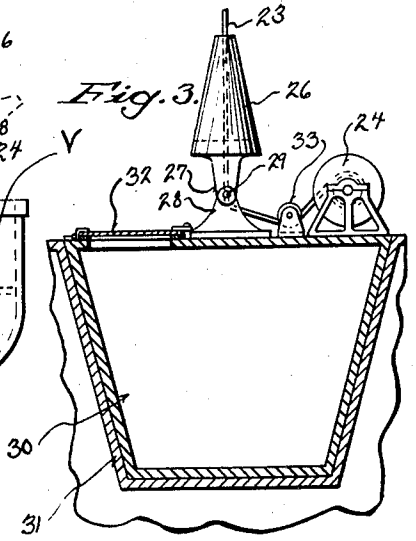


Fig. 3.



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SALVAGING APPARATUS FOR SUNKEN VESSELS

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Fig. 4.

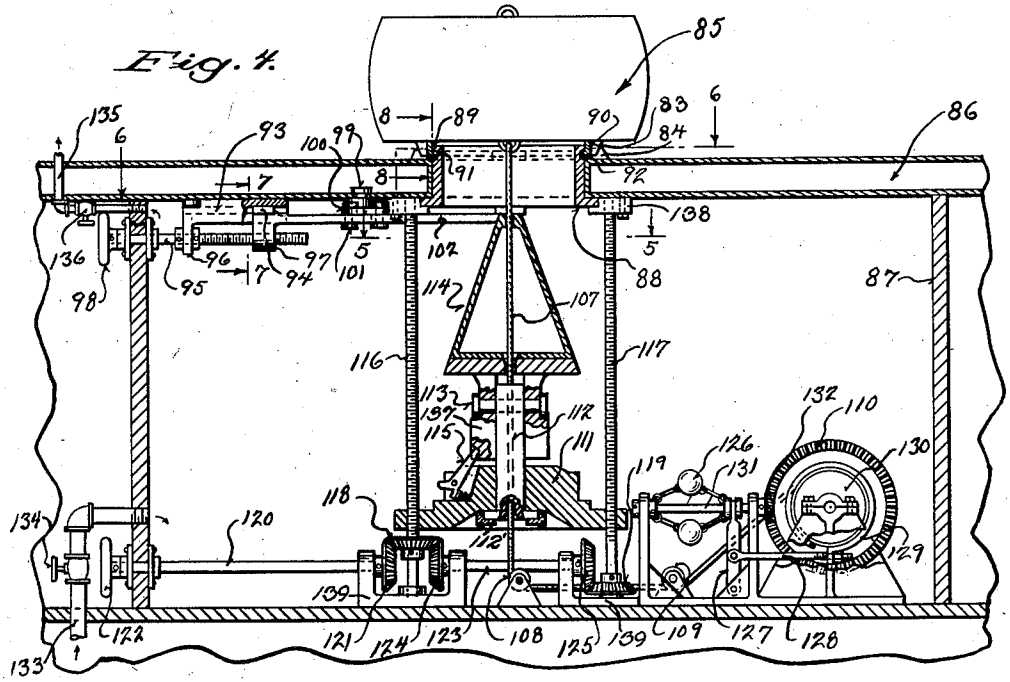

Fig. 5.

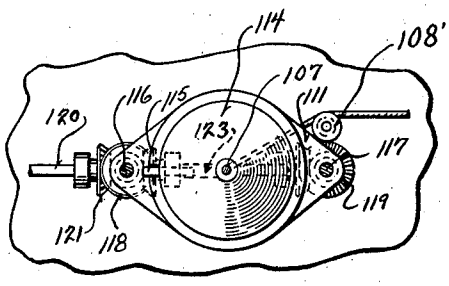

Fig. 8.

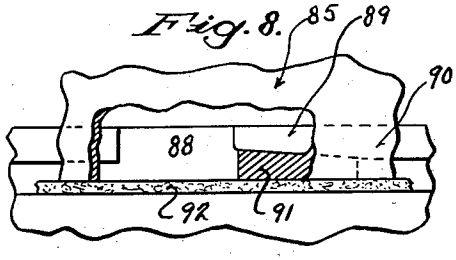

Fig. 7.

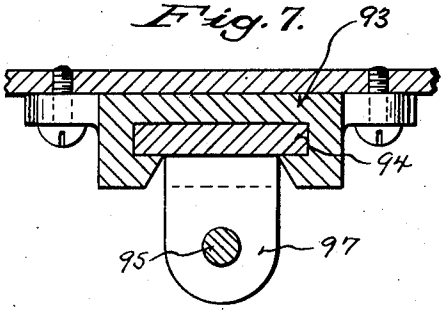

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Fig. 6.

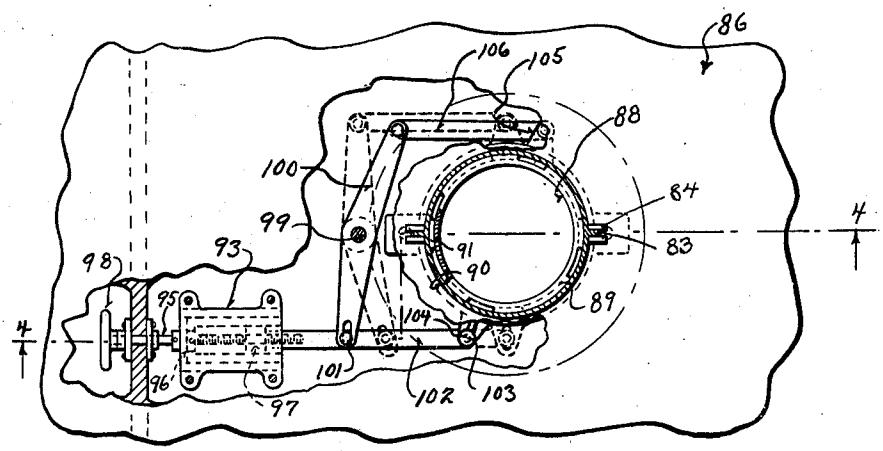

Fig. 9.

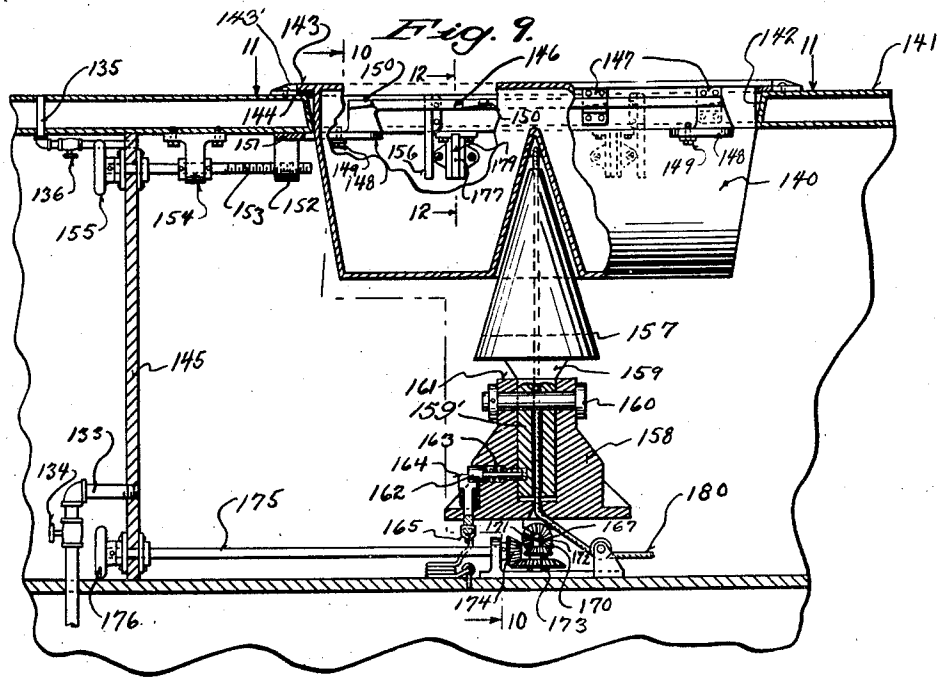

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Fig. 10.

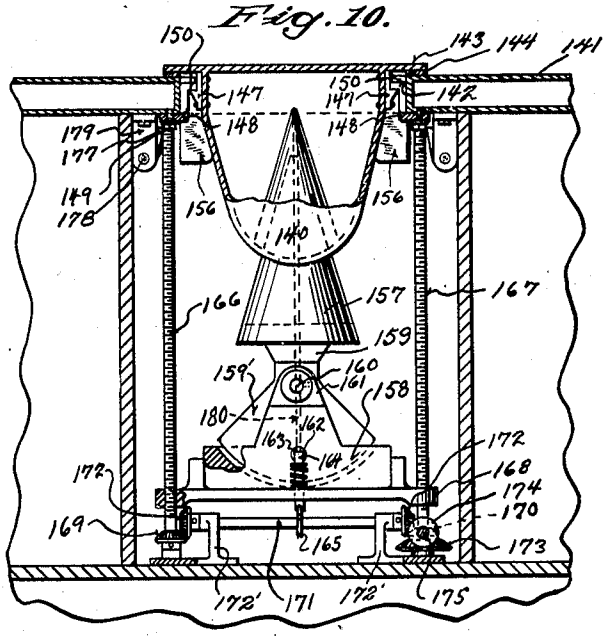
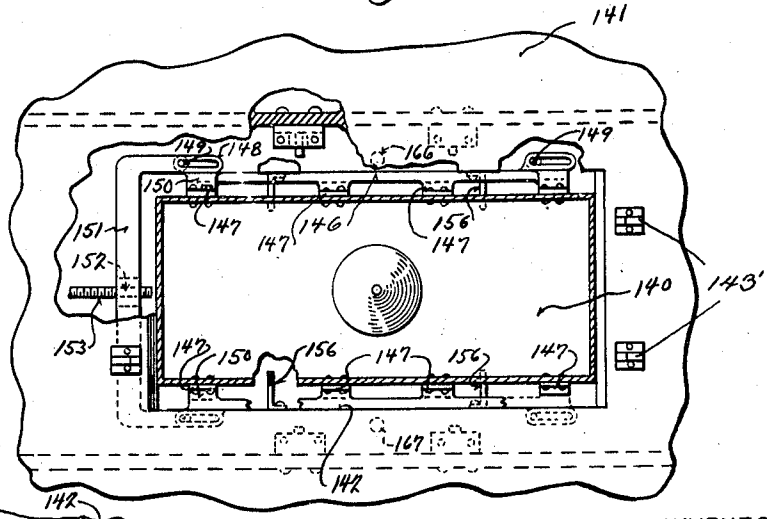


Fig. 11.



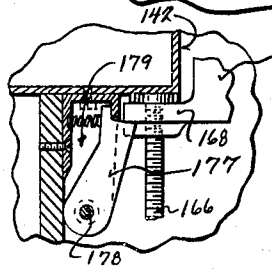


Fig. 12.

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Fig. 13.

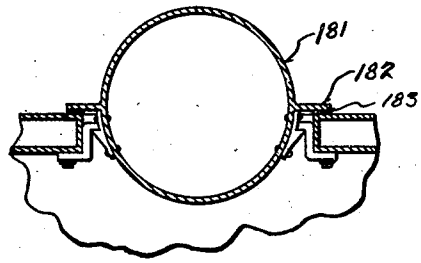


Fig. 14.

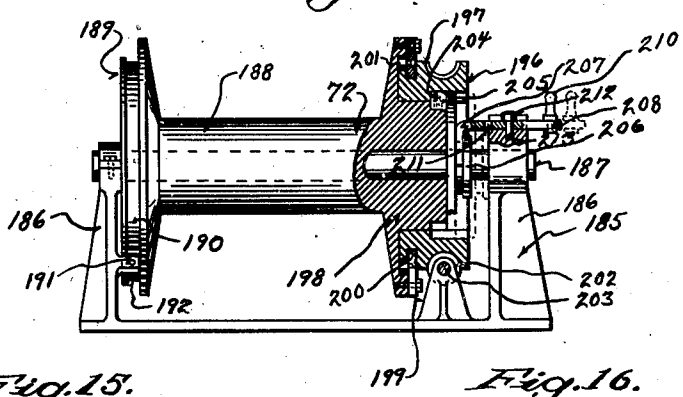


Fig. 15.

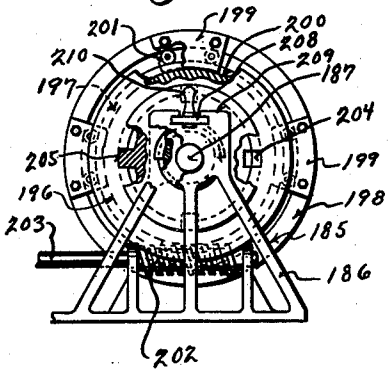
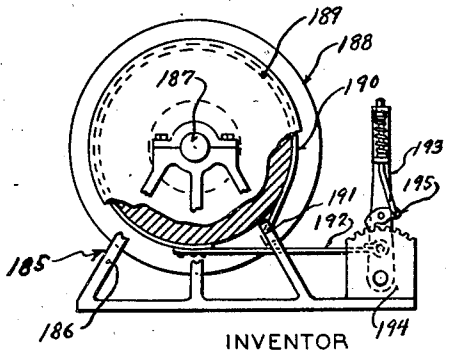


Fig. 16.



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Patented May 2, 1944 2,347,690

UNITED STATES PATENT OFFICE

2,347,690

SALVAGING APPARATUS FOR SUNKEN VESSELS

William K. Kannenberg, Milwaukee, Wis.

Application November 27, 1941, Serial No. 420,658

11 Claims. (Cl. 114—51)

This invention appertains to means for raising and salvaging sunken vessels, and more particularly to means for quickly locating and bringing sunken submarines to the surface without the necessity of employing divers.

One of the primary objects of my invention is to provide means for releasing buoys or floats from a sunken vessel, whereby said buoys can rise to the surface for facilitating the locating of the sunken vessel, and means on the salvaging ships including novel grappling members adapted to be guided by the buoy leader lines to novel cooperating devices on the sunken vessel, whereby said vessel can be raised by hoisting mechanism on the salvaging ships.

Another salient object of my invention is to provide means operable from inside the sunken vessel for raising the contact shoe above the vessel deck after the buoys have risen to the surface, whereby the contact shoe can be conveniently gripped by the grapple from the rescue or salvaging ships, the contact shoe being mounted for swinging movement on the submarine, whereby the same can extend in a horizontal position, even though the submarine is listing to one side.

A further object of my invention is to provide means for guiding the leader buoy line through the axial center of the contact shoe, so that not only will the line hold the contact shoe in proper position, but whereby the grapple will be efficiently guided over the shoe, so that the grapple will effectively and quickly engage the same.

A further important object of my invention is the provision of means for controlling the rotation of the winch or drum for the leader buoy line during the floating of the buoy to the surface, so that a too rapid ascent of the buoy will be checked.

A further important object of my invention is to provide means on the rescuing or salvaging ships for winding up the leader buoy line and for maintaining the leader buoy lines taut at all times, irrespective of the rise or fall of the salvaging ships with the waves, so that the grappling members will be guided directly to the contact shoes.

A still further object of my invention is to provide a novel hoisting mechanism on the salvaging ships, whereby the grapples with the sunken vessel can be gradually and effectively raised without undue strain on the hoisting cables and operating mechanism.

A still further object of my invention is to provide novel means for coupling the salvaging ships in pairs and for hoisting the grappling members by the operating mechanism on each salvaging ship, the means for coupling the ships together allowing independent movement thereof under influence of a rough sea.

With these and other objects in view, the invention consists in the novel construction, arrangement, and formation of parts, as will hereinafter more specifically described, claimed, and illustrated in the accompanying drawings, in which drawings:

Figure 1 is a fragmentary, side, elevational view of a sunken vessel equipped with my novel buoy mechanism.

Figure 2 is a front elevational view, with parts thereof broken away and in section, illustrating the position of the salvaging ships after the locating of the sunken vessel and the winding up of the leader buoy line for guiding the grappling mechanism down to the contact shoe or cone.

Figure 3 is a transverse sectional view illustrating a slightly modified form of my invention.

Figure 4 is an enlarged, fragmentary, longitudinal, sectional view taken on the line 4—4 of Figure 6, looking in the direction of the arrows, through a submarine, illustrating one means of attaching a buoy thereto and for releasing the buoy from the interior of the vessel, and one form of means for raising the contact shoe above the vessel deck.

Figure 5 is a detail, horizontal, sectional view taken on the line 5—5 of Figure 4, looking in the direction of the arrows, showing the contact shoe in top plan and a part of the mechanism for raising the contact shoe above the vessel deck.

Figure 6 is a detail, horizontal, sectional view taken on the line 6—6 of Figure 4, looking in the direction of the arrows, illustrating in detail one form of means for permitting the release of the buoy from the inside of the submarine.

Figure 7 is a detail, vertical, sectional view taken on the line 7—7 of Figure 4, looking in the direction of the arrows, illustrating the slide bar and guide therefor, which forms a part of the buoy-releasing mechanism.

Figure 8 is a detail, vertical, sectional view taken on the line 8—8 of Figure 4, looking in the direction of the arrows, illustrating a part of the latching mechanism for the buoy.

Figure 9 is a view similar to Figure 4, but showing a modified form of means for mounting the buoy within the submarine and flush with the deck thereof.

Figure 10 is a vertical sectional view taken on

the line 10—10 of Figure 9, looking in the direction of the arrows, illustrating my novel means employed for raising the contact shoe above the deck of the vessel after the release of the buoy.

Figure 11 is a horizontal sectional view taken on the line 11—11 of Figure 9, looking in the direction of the arrows, illustrating the latching and releasing means for the buoy.

Figure 12 is a detail, transverse, sectional view taken on the line 12—12 of Figure 9, looking in the direction of the arrows, illustrating a part of the latching mechanism for the riser arch.

Figure 13 is a fragmentary, detail, sectional view taken through a vessel, illustrating another modified form of associating a buoy therewith.

Figure 14 is a detail, side, elevational view, partly in section, illustrating one of the hoisting drums or winches utilized for raising the sunken vessel.

Figure 15 is an end elevational view of the same.

Figure 16 is a view similar to Figure 15, but showing the opposite end of the hoisting drum or winch and illustrating the brake mechanism therefor.

Referring to the drawings in detail, wherein similar reference characters designate corresponding parts throughout the several views, the letter S generally indicates the salvaging apparatus, and V a sunken vessel to be raised.

In Figures 1 and 2, the vessel V can be considered as of the surface type, but, obviously, my invention can be applied to submarines, as will be more clearly understood as the description proceeds.

The vessel V includes a hull 20 of any preferred character and size, and the hull has arranged thereon at appropriate points buoys or floats 21. As the vessel V is of the surface type, the buoys 21 can be arranged on the deck of the hull and carried in suitable cradles 22. Attached to each buoy is a leader line 23, and the line can be wound around a suitable rotatable drum 24. The drum 24 can be mounted on the deck or inside the vessel, as desired.

In Figures 1 and 2, I have shown the drum arranged within the hull, and the line is led through a guide opening 25 in the hull and through the axial center of a contact or grip cone 26. This cone is provided at its base with pivot ears 27, which are received between brackets 28 securely fastened to the deck of the vessel. A pivot pin 29 extends through the pivot ears and the brackets 28, whereby the contact cone can swing from one side to the other.

If the vessel V sinks through any cause, the buoys 21 will float away from the cradles 22 and rise to the surface, and as the end of the line is securely fastened to the drum, the leader line 23 remains attached to the sunken vessel. As the buoy floats to the surface, the contact cone 26 will be raised to a vertical position, as is clearly shown in Figure 2, the purpose of which will be more fully described. As the buoy reaches the surface, the same will function as a marker for indicating the position of the sunken vessel, and this buoy can be of any desired size or character best suited for the purpose intended.

In Figure 3, the contact cone 26 and the drum 24 are mounted on the top of a vault or chamber 30, which can be used for housing valuables. This vault 30 can be received within an enclosure 31 built into the vessel, and the top of the vault can be flush with the deck of the vessel. A suitable manhole and cover 32 can be provided for the vault. One or more idle guide pulleys 33 can be arranged between the drum 24 and the contact cone 26.

Referring more particularly to the salvaging apparatus S shown in Figure 2, it will be noted that salvaging ships 34 and 35 can be used in tandem. The ships 34 and 35 can be connected at spaced points by lower connecting beams 36. The beams 36 are secured at their ends by universal couplings 37 with the ships 34 and 35. As illustrated, each coupling 37 includes a link 38 connected by a cross pivot pin 39 to the adjacent end of the beam, and each link 38 is, in turn, connected by a vertically extending pivot pin 40 to a bracket 50 connected with the hull of the ship.

One ship 34 has mounted thereon, at spaced points, tension masts 51, and these masts 51 have slidably mounted thereon tension weights 52. The upper ends of the weights 52 carry an idle guide pulley wheel 53. The upper end of the mast has mounted thereon a pulley block 54, and the ends of the block carry guide pulley wheels 55 and 56.

Each of the ships 34 and 35 has mounted thereon, at spaced points, towers 57, which form a part of a hoisting apparatus or crane 58. The upper end of each tower 57 has swivelly mounted thereon by means of a pivot pin 59 a rotatable head 60. The heads 60, which are in transverse alinement on the ships 34 and 35 are connected by an overhead cross beam 61. The ends of the cross beam are connected to the heads 60 by means of transversely extending pivot pins 62. Hence, the ships 34 and 35 are connected together by upper and lower beams, and these beams are free to rock in two directions, whereby to allow the vessels 34 and 35 to rise and fall with the waves.

The hoisting apparatus 58 includes a large cap plate 63 on which is mounted a center balance pulley 64 and a series of side pulleys 65.

Below the cap plate 63 is a swinging block 66 carrying a series of side sheaves 68. The hoisting cable has side stretches 69 and 70, which are trained about the side sheaves 68 and over the side pulleys 65, and the ends of the cable then extend over guide pulley wheels 71 carried by the tops of the towers 57, down to the drums 72. The ends of the cable are then wound about and are secured to the drums 72 which are rotatably mounted in the ships 34 and 35. These drums 72 are preferably power-driven, as will be later described. It will be noted that the center runs of the cable are trained over the center balance pulley 64 carried by the upper cross beam 61. This arrangement of the pulleys, the sheaves and the cable gives the desired great lifting power. Pivotally connected to the lower end of the swinging block 66 is a grapple device 73.

This grapple device 73 includes a hollow cone 74 shaped to conform to the configuration of the contact cone 26, so that the hollow cone 74 can ride over the contact cone 26. Mounted upon the hollow cone 74, at spaced points, are reinforcing ribs 67 and these ribs 67 carry pivoted grappling arms 75. The ribs 67 merge at their upper ends and are connected by a pivot pin or bolt 67' with the swinging block 66. These arms 75 are provided at their lower ends with inwardly directed grappling jaws 76. Expansion springs 77 engage the upper ends of the grappling arms 75 and normally urge the hooked jaws 76 inwardly for engaging the base of the

contact cone 26 when the hollow cone 74 slides thereover.

As stated, upon the sinking of the vessel V, the buoys 21 will float to the surface of the water, and upon the location thereof, the buoys are taken aboard the ship 34, and the leader lines 23 are uncoupled from the buoys and each line is threaded through an axial guide opening 78 formed in the apex of the hollow cone 74. Each leader line is then led over a guide pulley wheel 79 carried by the top of a bracket 80 mounted on the cross beam 61. Each leader line is now placed over the guide pulley wheel 56 under the guide pulley wheel 53 on the tension weight 52 and over the guide pulley wheel 55. The leader line is now attached to the drum 81 of winch 82. These winches can either be hand- or power-manipulated. The drums 81 are employed for drawing the leader lines tight and for pulling the contact cones 26 to an upright position.

While I have merely described the heads 60 as being connected by one beam 61, it is to be understood that two or more beams can be utilized.

When the leader lines 23 are taut, the grappling devices 73 can be lowered on the leader cables until the cones 74 ride over the contact cones 26 and until the jaws 76 firmly grip the contact cones. The swinging movement of the grappling arms is permitted due to their pivotal connection with the reinforcing ribs 67. The drums 72 can now be manipulated for winding up the hoisting cable, which will effectively raise the sunken vessel.

It is to be understood that the vessel V is provided with buoys fore and aft and as many intermediate buoys as may be desired. The salvaging apparatus S is provided at spaced points with the same number of hoisting devices 58 as there are buoys.

Where it is impractical to salvage an entire ship of great size, the ship can be provided with one or more vaults 30, as shown and described in Figure 3, and in this instance only the vaults are raised, as can be readily understood.

Emphasis is placed on the importance of the leader line 23, as the same forms an effective guide for the grappling apparatus and insures the proper engagement of said apparatus with the cone 26.

Likewise, emphasis is placed on the importance of the sliding tension weights 52, as these weights maintain the leader lines 23 in a taut condition, irrespective of the rise and fall of the ships 34 and 35 with the waves.

In Figures 4 to 8, inclusive, I have illustrated one preferred form of means for associating a buoy or float 85 with a submarine 86, and, obviously, the submarine can be equipped with as many of the buoys as may be desired. Each buoy 85 can be mounted on the deck of the submarine, if desired, and where the buoys are mounted on the submarine deck, the same are firmly clamped in position to prevent accidental displacement. Below each buoy 85, the submarine has built therein a watertight compartment 87, and leading from the compartment through the deck of the submarine is a collar 88. This collar is mounted for turning movement on the submarine, and the upper end thereof, which extends above the deck, is provided at spaced points with outwardly directed wedges 89. Carried by the lower surface of the buoy 85 is a depending ring 90 for surrounding the collar 88, and the lowed edge of the ring 90 is provided at spaced points with wedges 91. A gasket 92 can be placed around the collar, and this gasket is adapted to be engaged by the lower surface of the ring 90, when the collar is turned in one direction for moving the wedges 89 into contact with the wedges 91. When the wedges 89 engage the wedges 91, the buoy will be firmly clamped to the submarine. When the collar is turned in a retrograde direction, the wedges 89 on the collar will ride off the wedges 91 of the ring 90 and permit the release of the buoy from the submarine. The buoy 85 and its ring 90 carry radially extending guide fins 83, which are received between pairs of locating lugs 84 fastened to the deck of the submarine. These fins 83 and the lugs 84 hold the buoy 85 in position against turning or twisting incident to the maneuvering of the submarine.

The means for turning the collar can include the following mechanism. Arranged within the compartment 87 is a guide track 93, and this guide track 93 carries a slide block 94. The slide block 94 can be moved back and forth by means of a hand screw 95. This hand screw 95 is rotatably carried by a bearing ear 96 formed on the track, and the screw is threaded into an internally threaded nut 97 formed on the slide block. The hand scew 95 also rotatably extends through one end wall of the compartment 87, so that the screw can extend into the body of the submarine. A suitable hand wheel 98 can be connected to the screw to permit the manual turning thereof. Obviously, by rotating the screw, the slide block can be fed back and forth in its track 93.

Rockably mounted intermediate its ends in said compartment by a pivot pin 99 is a double-armed lever 100. One arm of the lever 100 is connected by means of a slot and pin 101 with a forwardly projecting operating bar 102 formed on the slide block 94. The extreme forward end of the bar 102 is pivotally connected, as at 103, to an outwardly extending slotted ear 104 formed on the collar 88. The collar, at a point diametrically opposite the ear 104, has formed thereon a similar ear 105, and this ear is pivotally connected to the lever 100 by means of a link 106. Consequently, upon the rocking of the lever 100 by the slide block 94, the collar 88 can be rotated in the desired direction for either releasing the buoy or for latching the buoy.

The buoy 85 has firmly attached thereto a leader buoy line 107, and this line extends into the compartment and is trained about guide pulleys 108, 108' and 109, carried by the floor of the compartment. The line is led from the guide pulley 109 to a rotatable drum or windlass 110, and the cable is wound thereabout and fastened thereto.

Arranged within the compartment is a riser arch 111, and this arch carries at its axial center a guide sleeve 112. The lower end of the guide sleeve is flanged and is held in place by a ring 112' which is secured to the riser arch 111. The upper face of the flange abuts the lower face of the riser arch. Rockably mounted on the upper end of the guide sleeve 112 by means of a cross pivot pin 113 is a contact or grip cone 114. In order to prevent swinging movement of the cone 114, the same is engaged by a spring-pressed latch dog 115 rockably mounted upon the riser arch 111.

Upon the sinking of the submarine and upon the release of the buoy 85 by the occupants of the submarine, the riser arch 111 is raised so that the contact cone 114 can be disposed ex-

teriorly of the deck of the submarine. Upon the raising of the cone by means which will be later described, the lower end of the dog 115 strikes the collar 88 and is moved away from a keeper notch formed in the balance weight 137, which depends from the cone 114 below the pivot pin 113 and when the latch is actuated this allows free swinging movement of the cone on the pivot pin. The balance weight 137 tends to hold the cone 114 upright. At this point it is to be noted that the leader line 107 extends through the guide sleeve 112 and axially through the contact cone 114.

The means for raising and lowering the riser arch 111 and the cone 114 includes rotatable screws 116 and 117. The upper ends of the feed screws 116 and 117 are rotatably mounted in bearing blocks 138 and the lower ends of the feed screws are rotatably mounted in suitable bearing brackets 139, and the ends of the riser arch 111 have formed thereon feed nuts, which receive the feed screws. The bearing blocks 138 are also employed for holding the collar 88 in position and the brackets 139 also support other parts, as will be later described. The feed screws adjacent their lower ends have keyed or otherwise fastened thereto oppositely directed beveled gears 118 and 119.

An operating shaft 120 extends into the compartment 87 through one end wall thereof, and this operating shaft is rotatably mounted in suitable bearings, and the inner end thereof has keyed or otherwise secured thereto a beveled gear 121, which meshes with one side of the beveled gear 118. One end of the shaft 120 extends exteriorly of the compartment and is provided with a handwheel 122, so as to permit the manual turning of the shaft by the occupants of the submarine. Disposed between the feed screws 116 and 117 is a rotatable jack shaft 123, and this jack shaft has keyed to the inner end thereof a beveled gear 124, which meshes with the beveled gear 118, and, hence, the jack shaft is turned simultaneously with the operating shaft. The outer end of the jack shaft 123 has keyed or otherwise secured thereto a beveled gear 125, which meshes with the beveled gear 119, carried by the feed screw 117. The bearings for the shafts 120 and 123 can be formed on or carried by the brackets 139 previously mentioned. Upon the release of the buoy, the hand wheel 122 can be turned, which will rotate the feed screws 116 and 117, and the turning of these screws in the proper direction will raise the riser arch 111, so that the contact cone will be pushed out of the vessel. The arch is preferably raised until the same strikes the top of the compartment.

In order to prevent the too rapid rise of the buoy to the surface, I can provide an automatic brake mechanism for the drum or windlass 110. This mechanism includes a ball governor 126. The movable section of the governor operates a pivoted lever 127, and this lever has, in turn, pivotally connected thereto a pull rod 128. The outer end of the pull rod is, in turn, fastened to one end of a brake band 129, which extends about a brake drum 130 fastened to the rotatable spool of the windlass. The other end of the brake band can be fastened to the frame of the windlass. The shaft 131 of the ball governor 126 is operated from the windlass by a gear and pinion connection 132. Hence, as the speed of the windlass increases, the speed of the governor will increase, and as the movable section of the governor controls the brake band 129, the frictional contact of the brake band on the drum will be in direct proportion to the speed of the governor.

In order to insure the disengaging of the buoy from the submarine, the compartment 87 can be flooded by means of a sea pipe 133. The flow of water through the sea pipe 133 can be controlled by a hand valve 134. To permit the escape of air from the compartment as the water rushes in, a vent pipe 135 can be provided. This pipe can also be controlled by a hand valve 136, and this valve is actuated after the opening of the sea pipe 133. When the compartment has been flooded by the opening of the sea pipe and the vent pipe, the next operation is to actuate the latching mechanism to release the buoy, after which the riser arch is operated to raise the contact cone 114. The other operations are carried out by the crews of the salvaging ships.

The same type of salvaging apparatus S as shown in Figure 2 can be utilized for lifting the submarine, and hence, the buoys 85 are taken on the salvaging ships in the same manner as heretofore described, and the grapples 73 are lowered on the guide leader lines 107.

In Figures 9 to 12, inclusive, I have shown a float or buoy 140, which can be arranged flush with the deck of a submarine 141. The deck of the submarine is provided with an opening 142 into which the buoy or float extends, and the upper edge of the buoy can be provided with an outstanding marginal flange 143. This flange can extend over the deck of the submarine and can fit tightly on a sealing gasket 144. Holding blocks 143' are secured to the deck and engage the edge of the flange 143 at spaced points to prevent accidental shifting of the buoy. A watertight compartment 145 is arranged within the submarine for receiving the buoy 140, and the buoy is releasably connected to the submarine by a latch mechanism 146, which will now be described.

Fastened to the sides of the buoy at spaced points are keeper brackets 147. Latch bars 148 are slidably connected to the submarine on each side of the opening 142 by means of guide pins 149. Latch arms 150 are formed on the latch bars, and these arms can be of a wedge shape, if so desired. Upon the sliding of the latch bars, the arms 150 can be moved into and out of the latching engagement with the keepers 147.

The latch bars 148 at one end are connected by a cross bar 151, and this cross bar has connected therewith a feed nut 152, which receives a feed screw 153. This feed screw 153 is rotatably mounted in a suitable bearing 154 and extends through one wall of the compartment 145 into the body of the submarine. A hand wheel 155 can be connected to the feed screw, and, obviously, upon the turning of the feed screw by the hand wheel, the latch bars can be moved back and forth for releasing the float from the submarine, or for latching the float onto the submarine.

If desired, laterally extending guide fins 156 can be carried by the side walls of the opening 142 for engaging the sides of the float or buoy to facilitate the movement of the float or buoy from the submarine.

Inside the compartment 145 is a contact cone 157 and a riser arch 158. The base of the cone is provided with a shank 159, and this shank is pivotally connected by means of a cross pivot pin 160 to pivot ears 161 formed on the central part

of the riser arch 158. The lower end of the shank 159 has formed thereon a balance weight 159'. In order to prevent accidental swinging movement of the cone during the raising thereof with the riser arch from the compartment 145, a latch 162 is provided. The inner end of the latch normally engages a keeper opening in the balance weight 159', and a spring 163 is provided for urging the latch out of the keeper opening. To retain the latch in said keeper, a spring-pressed holding arm 164 is provided. This holder 164 is connected by a short rope, chain or the like 165, with the floor of the compartment. Consequently, when the riser arch is raised to a predetermined position, the holder 164 will be pulled out of the path of the spring-pressed latch, and said latch will then move away from the balance weight. By referring to Figures 9 and 10, it will be noted that the bottom of the float can be struck in to receive the upper end of the contact cone.

When the float is released, the riser arch 158 can be raised by the rotatable screws 166 and 167. These screws are rotatably mounted in suitable top and bottom bearings, and the ends of the riser arch 158 carry nuts 168, which are mounted on the screws 166 and 167. The lower ends of the screws have fixed thereto beveled pinions 169 and 170, and these beveled pinions are operatively connected by a cross shaft 171, the terminals of which carry beveled pinions 172 which mesh with the beveled pinions 169 and 170. The shaft 171 is rotatably mounted in suitable bearings 172' carried by the floor of the compartment. The screw 167 also has fastened thereto a second beveled pinion 173, and this pinion has meshing therewith a beveled pinion 174 fixed to an operating shaft 175. The operating shaft 175 is suitably mounted in supporting bearings, and this shaft extends through one wall of the compartment 145 into the body of the submarine. A hand wheel 176 is secured to the extended end of the shaft, and by turning the hand wheel, the screws 166 and 167 can be turned for raising the riser arch. The riser arch is adapted to be moved to a completely raised position into engagement with the inner face of the deck of the submarine, and spring-pressed latches 177 can be rockably mounted at their lower ends on pivot pins 178 carried by brackets 179 fastened to the sides of the compartment 145. These latches engage the ends of the riser arch 158 when the riser arch reaches its extreme raised position, and the latches prevent retrograde movement of the riser arch. Obviously, the spring-pressed latches 177 are forced inwardly by the ends of the arch during the raising of said arch, and when the arch rides past the latches, the said latches can swing under the arch.

A leader cable 180 is fastened to the center of the buoy 140 and extends through the axial center of the contact cone 157 and the arch 158, and this leader line 180 can lead to a windlass of the same type as shown in Figure 4.

Upon the release of the buoy 140, the contact cone 157 is raised above the deck of the submarine, and upon the locating of the buoys by the salvaging ships, the buoys are removed from the leader lines, and the grapples are lowered thereon, as previously described.

The compartment 145 can be flooded in the same manner as the compartment 87.

In Figure 13, I have shown a buoy 181, and this buoy can be of a streamlined type and can extend partly within a watertight compartment. The buoy 181, intermediate its ends, is provided with an outstanding marginal flange 182, which is adapted to overlie the deck of a submarine, and a sealing gasket 183 can be interposed between the flange and the deck of the submarine. This buoy can be latched in place in the same manner as the buoy 140.

While I have shown the contact members in all of the views of the drawings as being of a conical shape, it is to be understood that the specific configuration of the contact members can be changed to suit varying conditions. For instance, I can construct the contact members of an elongated form to extend transversely across a vessel, and where the contact member is of an elongated form, the same is obviously of a wedge shape in cross section.

In actual practice, provision is made for lubricating and preserving all of the operating parts, and a preserving grease or lubricant can be used for the cables, drums, etc.

In Figures 14, 15, and 16, I have illustrated one preferred form of winch or windlass 72, which can be utilized on the salvaging ships 34 and 35 for hoisting the grappling mechanism. As illustrated, the winch or windlass 72 can comprise a supporting bracket 185, which is firmly bolted to the ship. This bracket includes spaced upstanding bearing posts 186, which support the shaft 187 for the hoisting drum or spool 188. One end of the spool or drum 188 has formed thereon a brake drum 189, and a friction brake band 190 is provided therefor. One end of the brake band 190 is secured, as at 191, to one standard 186, and the other end of the band is connected, by means of a strap 192, to an operating hand lever 193. The hand lever is latched in an adjusted position to a segment rack 194 by means of a manually operable dog 195.

The opposite end of the spool has connected therewith a drive and clutch mechanism 196. This drive and clutch mechanism includes a worm wheel 197, which is rotatably mounted on an extended hub portion 198 formed on the spool 188. The worm wheel 196 is connected to the spool by means of inwardly directed guide plates 199 carried by one end wall of the spool. The inner ends of the plates are received within an annular guide groove 200 formed in the periphery of the worm wheel, and these plates 199 can carry anti-friction rollers 201 for engaging the said worm wheel. Meshing with the worm wheel 197 is a worm 202, and this worm is keyed or otherwise secured to a power shaft 203, which can be operated from any suitable source of power. The extended hub portion 198 of the spool and the inner periphery of the worm wheel 196 are provided with mating clutch notches 204, and clutch fingers 205 are adapted to ride into and out of said notches for connecting the worm wheel with the spool. These clutch fingers 205 are formed on one end of a sliding hub 206 mounted upon the windlass shaft 187. This clutch hub 206 can be provided with a rider 207 formed on the inner end of a manipulating lever 208. This manipulating lever is slidably mounted in a guide track 209 formed on the upper end of the adjacent standard 186. A hand grip 210 is carried by the manipulating lever 208, whereby the lever can be slid back and forth in the guide track 209 for connecting or disconnecting the worm wheel with the spool of the windlass.

Any desired means can be provided for holding the manipulating lever 208 in a selected adjusted position, and, as shown, the lever is pro-

vided at spaced points with openings 211, and the latching pin 212 can be placed in the selected opening 211 and into a holding socket 213 formed in said adjacent standard 186.

During the hoisting of the grappling mechanism 73, the clutch is manipulated so as to connect the worm wheel 196 with the spool 188 of the windlass, and, consequently, the spool or drum 188 will be power-driven. This will permit the effective raising of a sunken vessel.

During the lowering of the grappling mechanism 73 the clutch can be manipulated so as to disconnect the worm wheel 196 from the spool, and, consequently, the spool or drum 188 is free to rotate under the weight of the grappling mechanism. The brake mechanism can be operated to prevent the too rapid rotation of said drum or spool 188.

As shown in Figure 3, all of the contact cones are preferably provided with elongated shanks on their bases, so as to insure the engagement of the grapples therewith without the danger of the grapples engaging the sunken vessel.

It is to be understood that the lifting power of the apparatus can be increased according to the weight or size of the vessel being lifted. This can be easily accomplished by modifying the arrangement and number of the pulleys, pulley blocks, cables, etc.

From the foregoing description, it can be seen that I have provided an exceptionally efficient mechanism and apparatus for locating and raising sunken vessels.

Changes in details may be made which do not depart from the spirit and scope of my claims, and what I claim as new is:

1. In an apparatus for locating and raising sunken vessels, a drum and a buoy on the vessel, a leader guide line wound upon said drum and connected to the buoy, the buoy being adapted to float to the surface upon the sinking of the vessel and to pay out the line from said drum, means on a surface vessel including a windlass for pulling said leader guide line taut, a tension mechanism for maintaining the leader guide line taut, irrespective of the rise and fall of the surface vessel under influence of a sea, a grappling member slidable on said taut line for engaging the sunken vessel, and a hoisting equipment for raising said grappling mechanism, said means for maintaining the leader guide line taut including an elevated mast on the surface vessel arranged at one side of the windlass, a sliding weight on the mast, spaced guide pulleys on the mast over which the leader guide line is trained, and an idle pulley on the weight engaging the leader guide line between the pulleys on the mast.

2. In a salvaging apparatus for sunken vessels, a pair of spaced surface ships, towers on said ships rising above the hulls thereof, a cross beam arranged between the hulls of the ships, means connecting the ends of the cross beam to the ships for swinging movement both on a vertical and horizontal pivot, rotatable heads carried by the towers, an overhead cross beam pivotally connected at its ends to said heads, a grappling device, and a hoisting apparatus connected with said grappling device and said overhead beam, said hoisting mechanism including cables, and windlasses on said ships for winding up the cables.

3. In an apparatus for locating and raising sunken vessels, a watertight compartment in said vessel, a releasable buoy closing said compartment, latch mechanism manually actuatable exteriorly of said compartment for releasing the buoy from the vessel, a drum in said compartment, a leader guide line connected to and wound upon said drum and secured to the buoy, and means for automatically regulating the speed of rotation of the drum during the floating of the buoy to the surface from the sunken vessel.

4. In an apparatus for raising and locating sunken vessels, a vessel having a watertight compartment therein provided with an opening, a releasable buoy sealing said opening, latch means normally holding the buoy connected with the vessel, manual means arranged exteriorly of the compartment for operating said latch means to release the buoy, a drum in said compartment, a leader guide line connected to and wound upon said drum and secured to the buoy, a riser arch disposed in the compartment, a contact anchor member rockably connected to the riser arch and normally disposed in said compartment, said arch and contact anchor having a guideway therethrough for the cable, and means operable from the exterior of the compartment for raising said arch to move the contact anchor out of said compartment after the release of the buoy.

5. In an apparatus for locating and raising sunken vessels, a vessel having a watertight compartment therein provided with an opening, a releasable buoy sealing said opening, latch means normally holding the buoy connected with the vessel, manual means arranged exteriorly of the compartment for operating said latch means to release the buoy, a drum in said compartment, a leader guide line connected to and wound upon said drum and secured to the buoy, a riser arch disposed in the compartment, a contact anchor member rockably connected to the riser arch and normally disposed in said compartment, said arch and contact anchor having a guideway therethrough for the cable, means operable from the exterior of the compartment for raising said arch to move the contact anchor out of said compartment after the release of the buoy, and means for normally preventing rocking movement of the contact anchor on the arch until the contact anchor is lifted out of the compartment.

6. In an apparatus for locating and raising sunken vessels, a vessel having a watertight compartment therein provided with an opening, a releasable buoy sealing said opening, latch means normally holding the buoy connected with the vessel, manual means arranged exteriorly of the compartment for operating said latch means to release the buoy, a drum in said compartment, a leader guide line connected to and wound upon said drum and secured to the buoy, a riser arch disposed in the compartment, a contact anchor member rockably connected to the riser arch and normally disposed in said compartment, said arch and contact anchor having a guideway therethrough for the cable, means operable from the exterior of the compartment for raising said arch to move the contact anchor out of said compartment after the release of the buoy, means for normally preventing rocking movement of the contact anchor on the arch until the contact anchor is lifted out of the compartment, and means for automatically engaging said arch to prevent downward movement thereof after said arch reaches an extreme raised position.

7. In a salvaging apparatus for sunken vessels, a pair of spaced surface ships, towers on said ships rising above the hulls thereof, a cross beam arranged between the hulls of the ships, means connecting the ends of the cross beam to the ships

for swinging movement both on a vertical and horizontal pivot, rotatable heads carried by the towers, an overhead cross beam pivotally connected at its ends to said heads, a grappling device, and a hoisting apparatus connected with said grappling device and said overhead beam, said hoisting mechanism including cables, and windlasses on said ships for winding up the cables, each of said windlasses including manually operable brake mechanism for regulating the speed thereof during the lowering of the grapple, means for rotating the windless including a gear member, and a clutch mechanism for connecting and disconnecting the gear with the windlass.

8. In an apparatus for raising and locating sunken submarines, a submarine having a watertight compartment therein provided with an opening, a releasable buoy sealing said opening, latch means normally holding the buoy connected with the submarine, means for flooding the compartment from the interior of the submarine, means for venting the compartment from the interior of the submarine, manual means arranged exteriorly of the compartment and within the submarine for operating said latch means to release the buoy, a drum in said compartment, a leader guide line connected to and wound upon said drum and secured to the buoy, a riser arch disposed in the compartment, a contact anchor member rockably connected to the riser arch and normally disposed in said compartment below the buoy, said arch and contact anchor having a guide way there through for the leader guide line, and means operable from the exterior of the compartment and within the submarine for raising said arch to move the contact anchor out of said compartment after the releasing of the buoy.

9. In an apparatus for locating and raising sunken vessels, a buoy and a drum on said sunken vessel, a leader line wound upon the drum and connected with the buoy, the buoy being adapted to rise to the surface from the sunken vessel, a contact anchor member pivotally carried by the sunken vessel having a guideway extending there through for the leader line, means for holding the leader line taut from a surface vessel, a balance weight on the lower end of said contact anchor member for normally holding same in a vertical position, and a grappling mechanism slidably mounted on said leader line and adapted to be guided thereby over the contact anchor member for gripping engagement with said contact anchor member.

10. In an apparatus for raising and locating sunken vessels, a vessel having a watertight compartment therein provided with an opening, a releasable buoy sealing said opening, latch means normally holding the buoy connected with the vessel, manual means arranged exteriorly of the compartment for operating said latch means to release the buoy, a drum in said compartment, a leader guide line connected to and wound upon said drum and secured to the buoy, a riser arch disposed in the compartment, a contact anchor member rockably connected to the riser arch and normally disposed in said compartment, said arch and contact member having a guideway there through for the cable, means operable from the exterior of the compartment for raising said arch to move the contact anchor out of the compartment after the release of the buoy, and a counterbalancing weight on the lower end of said contact anchor member for normally holding said anchor member in a vertical position.

11. In an apparatus for raising and locating sunken vessels, a vessel having a watertight compartment therein provided with an opening, a releasable buoy sealing said opening, latch means normally holding the buoy connected with the vessel, manual means arranged exteriorly of the compartment for operating said latch means to release the buoy, a drum in said compartment, a leader guide line connected to and wound upon said drum and secured to the buoy, a riser arch disposed in the compartment, a contact anchor member rockably connected to the riser arch and normally disposed in said compartment, said arch and contact member having a guideway there through for the cable, means operable from the exterior of the compartment for raising said arch to move the contact anchor out of the compartment after the release of the buoy, and a counterbalancing weight on the lower end of said contact anchor member for normally holding said anchor member in a vertical position, and releasable latch means normally holding the contact anchor member against swinging movement until the contact anchor has been moved out of said compartment.

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