July 17, 1956 W. WIGGINS, JR 2,754,790

UNDERSEA SALVAGE VESSELS

Filed July 6, 1953

4 Sheets-Sheet 1

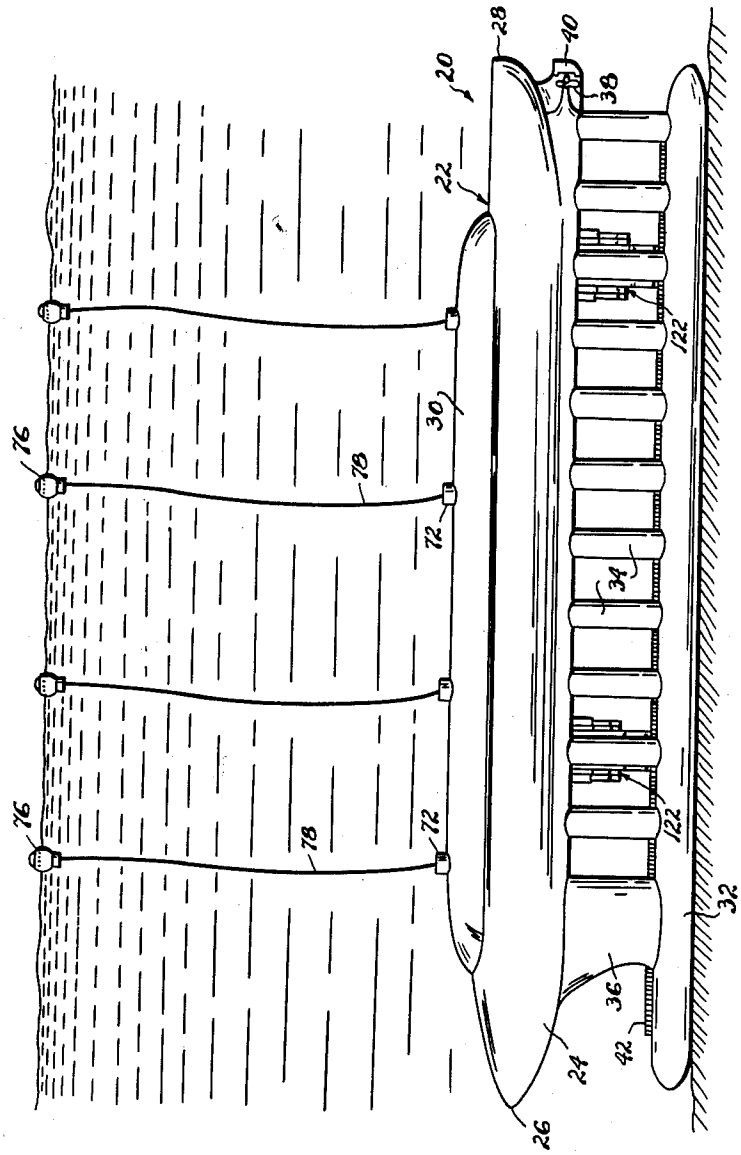


FIG. 1.

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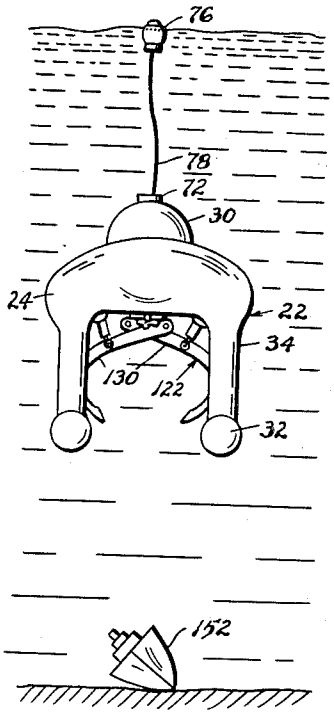


FIG. 2.

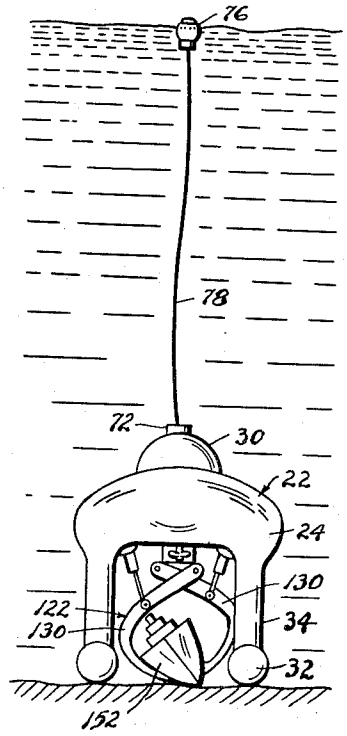


FIG. 3.

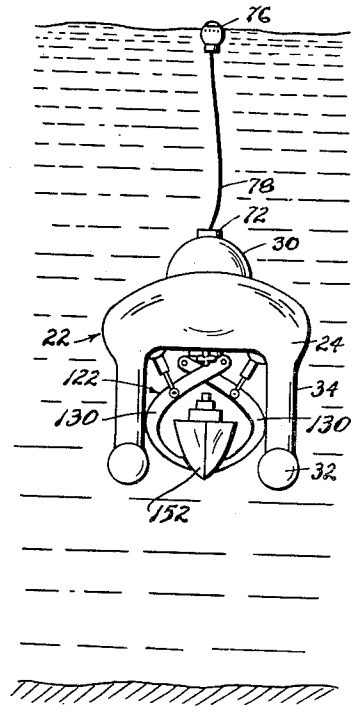


FIG. 4.

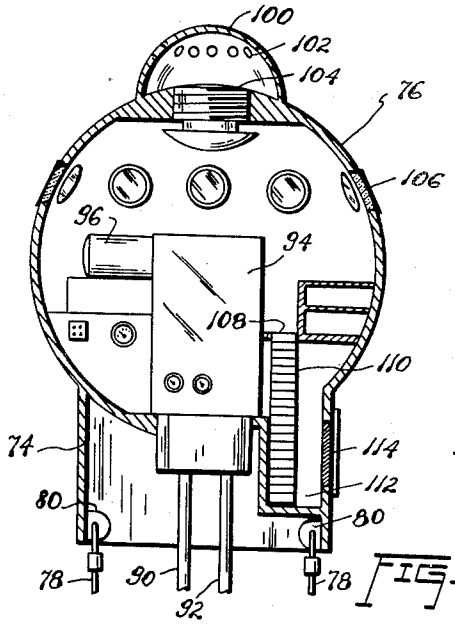


FIG. 8.

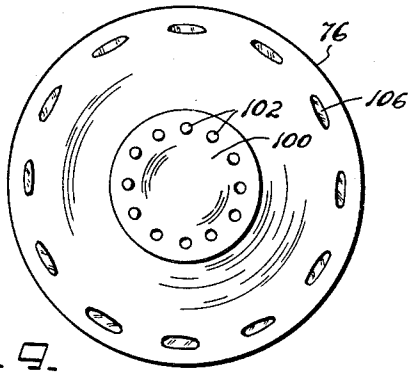


FIG. 9.

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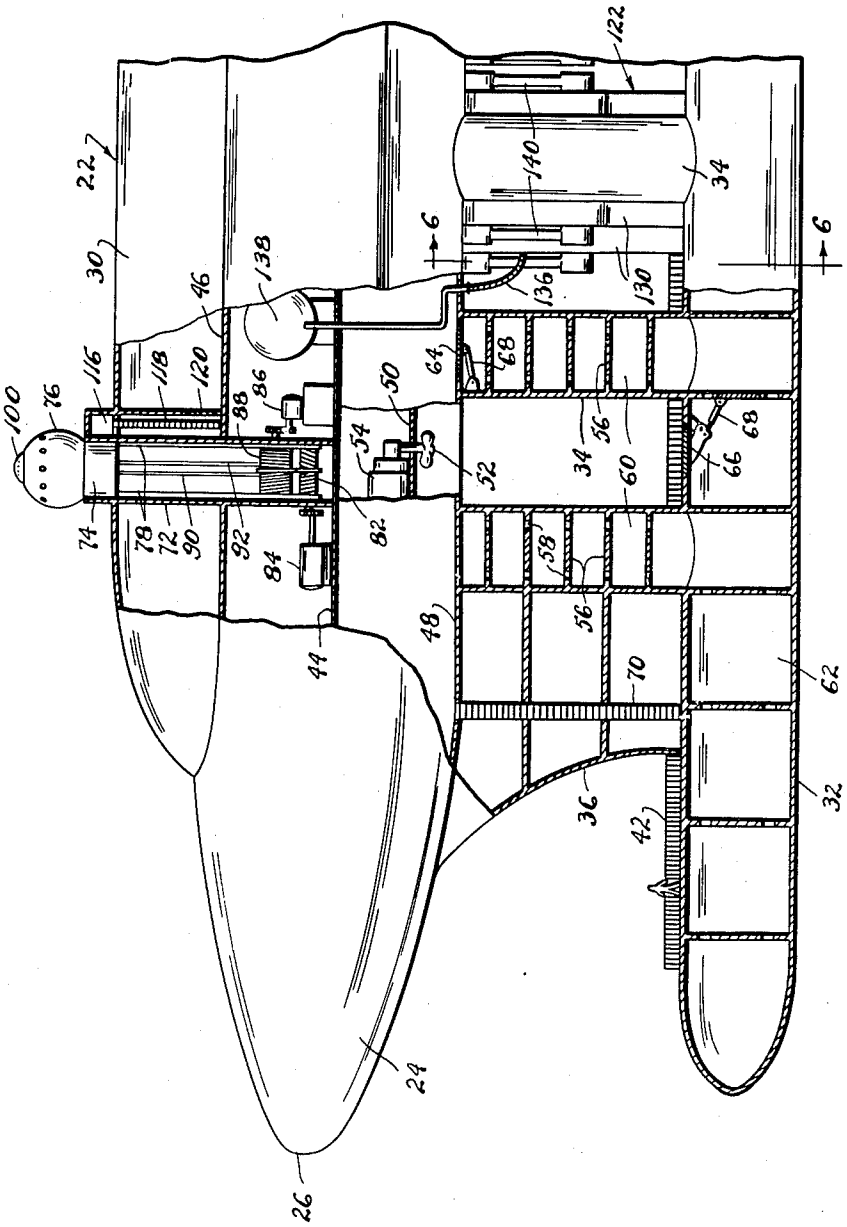


FIG. 5.

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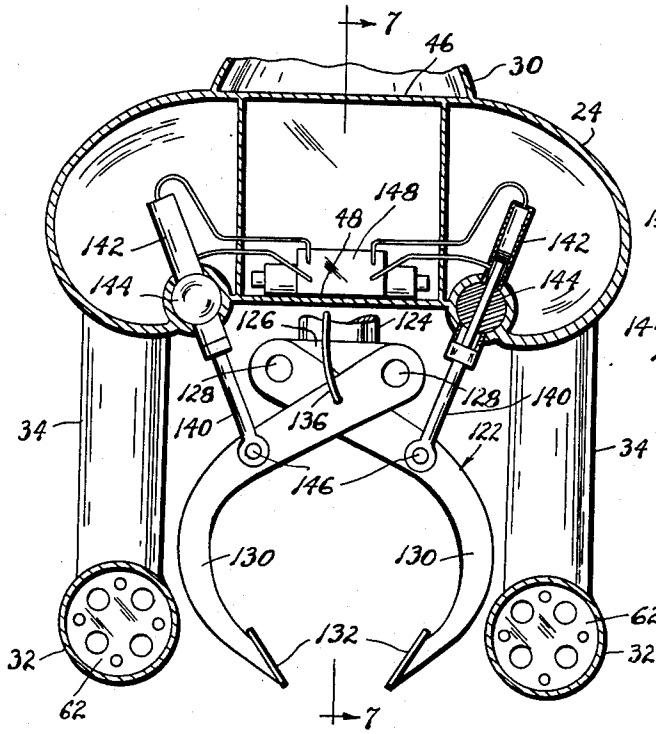


FIG. 6.

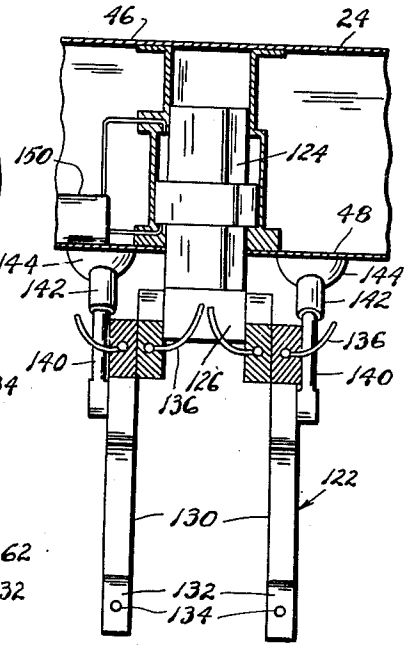


FIG. 7.

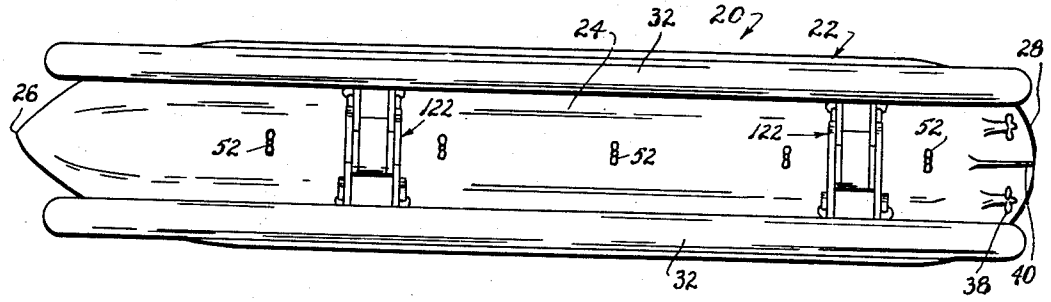


FIG. 10.

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2,754,790

UNDERSEA SALVAGE VESSELS

Walter Wiggins, Jr., Beaver Heights, Md.

Application July 6, 1953, Serial No. 366,267

3 Claims. (Cl. 114—53)

This invention relates to new and useful improvements and structural refinements in undersea salvage vessels, that is to say, marine vessels capable of surface as well as under-surface operations for the purpose of gathering, retrieving and thereby salvaging various types of material from the sea bed.

Specifically, the principal object of the instant invention is to provide an apparatus having such size and facilities of a self-container nature, as to be able to submerge to any required depth; locate and affix itself to any bulk of material which is to be gathered or salvaged; to sustain itself in the undersea strata for an indefinite period of survival so that proper and comparatively leisurely preparations may be made for retrieving or salvage; to bodily lift and bring to the surface the material involved; and finally, to transport under its own power such material to a dock or landing, where such material may be transferred by conventional means to terra firma.

With the above more important objects and features in view, and such other objects and features as may become apparent as this specification proceeds, the invention resides in the construction and arrangement of parts shown in the accompanying drawings wherein like numerals are employed to designate like parts and wherein:

Figure 1 is a side elevational view of the invention in a submerged position.

Figure 2 is a front end view of the invention, shown while descending to retrieve a sunken ship.

Figure 3 is a front end view of the invention, shown while picking up the sunken ship.

Figure 4 is a front end view of the invention, shown while raising the sunken ship to the surface.

Figure 5 is a fragmentary side elevational view of the invention on an enlarged scale and partially broken away to reveal its construction.

Figure 6 is a transverse sectional view, taken substantially in the plane of the line 6—6 of Figure 5.

Figure 7 is a sectional view, taken substantially in the plane of the line 7—7 in Figure 6.

Figure 8 is a vertical sectional view of one of the buoys used in the invention.

Figure 9 is a top plan view of one of the buoys, and Figure 10 is a bottom plan view of the invention as shown in Figure 1.

With reference now to the accompanying drawings in detail, it will be noted that the invention as a whole is designated generally by the reference character 20 and embodies in its construction a submersible body structure 22 which includes an elongated hull 24 having a bow 26 and a stern 28. The upper portion of the hull 24 is formed with a longitudinally extending protuberance or bulge 30 and the body structure 22 also includes a pair of transversely spaced, elongated and substantially tubular base or keel members 32 which depend from the hull 24 and are connected thereto by a plurality of vertical, substantially tubular members 34. These last mentioned members are arranged in two rows, one row for each of the base members 32 and the forward of the vertical

members in each row is of an increased width so that it is substantially oval-shaped in horizontal section, as indicated at 36.

For purposes of forward or rearward propulsion, the hull 24 is provided at the stern thereof with conventional propellers 38 and with a conventional rudder 40 to facilitate steering. It will be also observed that the base members 32 are provided at the top thereof with cat-walks 42, to which access may be had from the interior of the vessel, as will be hereinafter described.

Referring now to the accompanying Figure 5, it will be noted that the interior of the hull 24 contains a main deck 44, an upper deck 46 disposed at the base of the protuberance 30, and a lower deck 48 disposed at the upper ends of the vertical members 34, 36. Moreover, an intermediate deck strip 50 extends longitudinally of the center portion of the hull, in vertically spaced relation from the main and lower decks 44, 48, respectively, it being understood, of course, that the lower deck 48 does not extend the full width of the hull, but is provided only at the upper ends of the vertical members 34, 36, so that the intermediate deck strip 50, in effect, constitutes the bottom of the center portion of the hull, as is best shown in Figure 10. Under this bottom or intermediate deck strip there are disposed a plurality of longitudinally spaced lift propellers 52 which are rotatable on vertical axes for the purpose of raising or assisting to raise the vessel to the surface, the propellers 52 being rotated by suitable motors 54 mounted on the intermediate deck 50.

The aforementioned vertical members 34, 36 are provided inside thereof with sets of vertically spaced baffles 56 having passages 58 formed therein, and the interior of these vertical members as well as of the base members 32 affords a series of compartments which, like those of a submarine, may be flooded with water so as to cause the entire vessel to submerge. Conversely, these compartments, indicated at 60, 62, may be "blown out" by compressed air to facilitate surfacing. As already mentioned, the surfacing operation may be assisted by the use of the lift propellers 52 and it will be noted that the compartments 60, 62 are provided with suitable hatches 64, 66 to permit ingress or egress of water, as the case may be. The hatches 64, 66 are operated by conventional hydraulic cylinders 68.

The two front vertical members 36 also contain vertical ladders 70 which extend from the lower deck 48 of the hull 24 to the top of the base members 32, whereby access may be gained to the cat-walks 42.

The hull 24 is provided at longitudinally spaced points therein with a plurality of vertical tubes 72 which extend upwardly from the main deck 44 through the upper deck 46 and project somewhat through the top of the hull. These projecting portions of the tubes 72 constitute receptacles or seats for cylindrical lower portions or bases 74 of substantially spherical buoys 76. These buoys are adapted to be released to the surface when the vessel is submerged and thereby maintain contact with the atmosphere for the purpose of furnishing the machinery as well as the crew of the submerged vessel the necessary air required for submarine activity of indefinite duration.

As is best shown in Figure 8, the base 74 of each of the buoys 76 is open and a pair of anchoring cables 78, secured to lugs 80 in the base 74, extend downwardly from each buoy into the associated tube 72, where the cables 78 are windable on a winch 82 located at the bottom of the tube. This winch is rotated by a suitable motor 84 mounted on the main deck 44, while another motor 86 actuates a second winch 88 mounted in the tube 72 above the winch 82.

An air line 90 and an electric power line 92 extend from each buoy 76 and are windable on the winch 88, it

being understood, of course, that the operation of the winches **82**, **88** is controlled so that the cables **78** and the lines **90**, **92** are hauled in or paid out simultaneously.

Each of the buoys **76** is large enough to accommodate one or more crew members therein as well as suitable pumping machinery **94** actuated by a motor **96**. The motor **96** receives its supply of power from the vessel itself through the power line **92**, while the pumping mechanism **94** delivers air from the atmosphere through the air line **90** to the vessel. To this end, each buoy is provided at the top thereof with a dome **100** having air inlet openings **102** formed therein, while a manually removable closure **104** is interposed between the dome and the interior of the buoy, for use in instances when the buoy is submerged together with the vessel. It will be also noted that the buoys are provided with a plurality of port holes **106**.

The interior of each buoy is equipped with a platform **108** from which a ladder **110** extends downwardly into a well **112** which is disposed within and at one side of the buoy base **74**. This well is equipped with an exit closure **114** so that, as is best shown in Figure 5, when the base of the buoy is seated in the upper end of the associated tube **72**, the closure **114** may be removed and communication established between the interior of the buoy and a vertically elongated transfer chamber **116** which extends through the top of the hull **24** to the upper deck **46** of the vessel. The transfer chamber **116** may be flooded with water or "blown out" in conventional manner as desired, and apart from being provided with a vertical ladder **118**, the transfer chamber is also equipped at the lower end thereof with a removable closure or door **120**, leading to the interior of the hull.

With particular reference now to the accompanying Figures 6, 7 and 10, it will be observed that the hull **24** is provided at the underside thereof with a plurality of longitudinally spaced grapple units or mechanisms designated generally by the reference character **122**. These units are disposed between the base members **32** and since they are similar in construction, it is believed that a description of one will suffice for all.

Each of the grapple units comprises a hydraulic ram **124** which is mounted in the hull between the lower deck **48** and the top deck **46**, the lower end portion of this ram projecting below the hull and being provided with a mounting plate **126** to which are pivotally attached by means of the pins **128** two pairs of coacting jaws **130**. The opposing lower extremities of the jaws in each pair are equipped with pads **132** to engage the work, these pads preferably being of a permanent magnetic or electromagnetic character, so that they may adhere to magnetically-responsive metals, or the like, with which the pads may come in contact when the apparatus is in use. Also, the pads **132** are provided with orifices **134** for discharging compressed air, whereby undersea deposits or other foreign matter may be dislodged from the work immediately prior to the engagement of the pads therewith, so that more effective adhesion and gripping action of the pads to the work is facilitated. Compressed air is delivered to the orifices **134** through the medium of flexible lines or conduits **136** which extend through the jaws **130** and are connected to a suitable compressed air tank within the hull, as shown at **138** in Figure 5.

The jaws **130**, although coacting in character, are actuated independently in each pair, this being achieved by connecting to each jaw a piston rod **140** of a hydraulic cylinder **142**. This cylinder is mounted by means of a ball and socket unit **144** in the hull **24** adjacent the lower deck **48**, the connection between the piston rod **140** and the associated jaw being made by a pivot pin **146**. The ball and socket unit **144** permits the piston rod and piston to adjust themselves, automatically, to different positions of the associated jaw, as the jaws in each pair are brought together or spread apart. The cylinders **142** are double-acting and, in each pair, are connected to a

suitable valve unit **148**, whereby their operation may be independently controlled.

The aforementioned hydraulic rams **124** are also double-acting, each being connected to a suitable valve unit **150** for controlling its operation, as illustrated in Figure 7.

It may be explained at this point that apart from the components already described, the hull **24** also contains, at suitable locations therein, conventional electric generators for furnishing electric current for purposes of illumination, power for the motors **54**, **84**, **86**, etc., and power for the magnetic pads **132**; hydraulic pumps for furnishing fluid under pressure to the rams **124** and cylinders **142**; air compressors for supplying air under pressure to the tank **138** and orifices **134**; as well as fuel supplies and machinery for propelling, steering and otherwise sustaining the entire vessel in a navigable condition. In addition, the customary facilities are provided for the benefit of the crew and it is also contemplated that suitable equipment, mechanical, electronic or otherwise, be provided for viewing, directly or indirectly, from a control point within the hull, the areas of operation generally adjacent the grapple units **122**.

Having thus described the construction of the invention, its manner of operation will now be explained, reference being had particularly to Figures 1, 2, 3 and 4 of the accompanying drawings.

Under the assumption that the vessel is intended to salvage, for example, a sunken ship **152** from the bottom of the sea, the vessel, fully equipped, is first maneuvered to the location of the sinking, this of course, being accomplished on the surface of the water.

When the vessel is disposed generally in the vicinity of the sunken ship, it is caused to submerge by simply flooding the ballast tanks or compartments **60**, **62**, during which phase of the operation the vessel is maneuvered forwardly, rearwardly or laterally as required, so that it is disposed immediately above the sunken ship, as shown in Figure 2. At the same time, the winches **82**, **88** are actuated so as to release and sustain one or more of the buoys **76** at the surface and crew members occupying the buoys thus released open the closures **104** and energize the pumping machinery **94** so that air from the atmosphere may be pumped to the submerged vessel as already mentioned.

The vessel is ultimately brought to a position where it rests on the bottom of the sea with the base members **32** thereof straddling the sunken ship, as indicated in Figure 3. The sunken ship is usually found to be listing to either port or starboard and the grapple units **122** are particularly adapted to engage the ship in this listing position, to set the same on an even keel and to firmly hold the same while bringing it to the surface. This is facilitated by the independent action of the grappling jaws **130** in each pair, which may be controlled so as to raise the sunken ship from either side to an even keel, as will be readily apparent. Thereupon, or simultaneously with this operational phase, the hydraulic rams **124** may be energized so as to impart, through the medium of the jaws **130**, an initial lift to the ship, so as to dislodge or break away its adhesion to the sea bed.

When the ship is firmly and properly held by the grapple units **122**, the ballast compartments **60**, **62** are "blown" and the lift propellers **52** are energized whereby the entire vessel, together with its load, rises to the surface. Then, when surface strata are reached, the vessel with its load is navigated under its own power to a suitable port where the salvaged ship may be deposited in a dry dock, or the like.

It will be observed from the foregoing that by virtue of the buoys **76** which maintain communication with the atmosphere while the vessel is submerged, and by virtue of the overall, self-contained and self-sustaining characteristics of the vessel itself, leisurely and satisfactory submarine operations, lasting over periods of many hours or days will be possible without any need for re-surfacing

the vessel and thereby causing it to lose, more-or-less, whatever it may have achieved during its period of submersion.

As a practical matter, it is intended that the vessel be sufficiently large so as to straddle and otherwise accommodate various types of ships or other material such as it may be called upon to gather or retrieve, the motive equipment of the vessel being powered accordingly. It is preferred that the main body structure 22 of the vessel be made from as few components as possible, perhaps integrally moulded in one piece, so as to substantially reduce the number of seams or joints in the body structure and thereby enable it to better withstand the water pressures to which it is subjected.

Although in the foregoing there has been shown and described the preferred embodiment of this invention, it is to be understood that various changes and modifications may be resorted to, such as may lie within the spirit and scope of the accompanying claims.

What is claimed as new is:

1. In an undersea salvage vessel, the combination of a hull, a grapple unit provided at the underside of said hull and comprising a mounting plate connected to the hull, a pair of opposing jaws pivoted to said mounting plate, a pair of hydraulic cylinders swingably attached to the hull and including piston rods pivoted to the respective jaws, whereby the jaws may be actuated independently of each other, and means for raising and lowering said mounting plate relative to the hull.

2. In an undersea salvage vessel, the combination of a hull, a hydraulic ram disposed vertically in said hull and projecting downwardly therefrom, a mounting plate secured to the lower end of said ram and movable upwardly and downwardly relative to the hull, a pair of opposing jaws pivoted to said mounting plate, and a pair of hydraulic cylinders swingably attached to the hull and including piston rods pivotally connected to the respective jaws, whereby the jaws may be actuated independently of each other.

3. The structure as set forth in claim 2 together with a pair of ball and socket joints provided in the bottom of said hull at opposite sides of said ram, said cylinders being secured in and extending through the respective joints.

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