Jan. 2, 1951 R. G. SOLHEIM 2,536,103

SHIP SALVAGING APPARATUS

Filed March 16, 1946 5 Sheets-Sheet 1

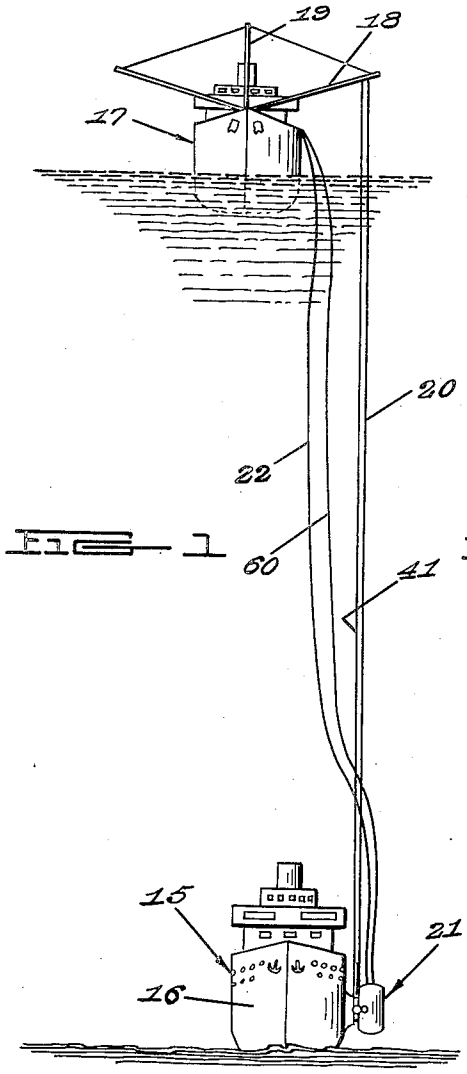


Fig. 1

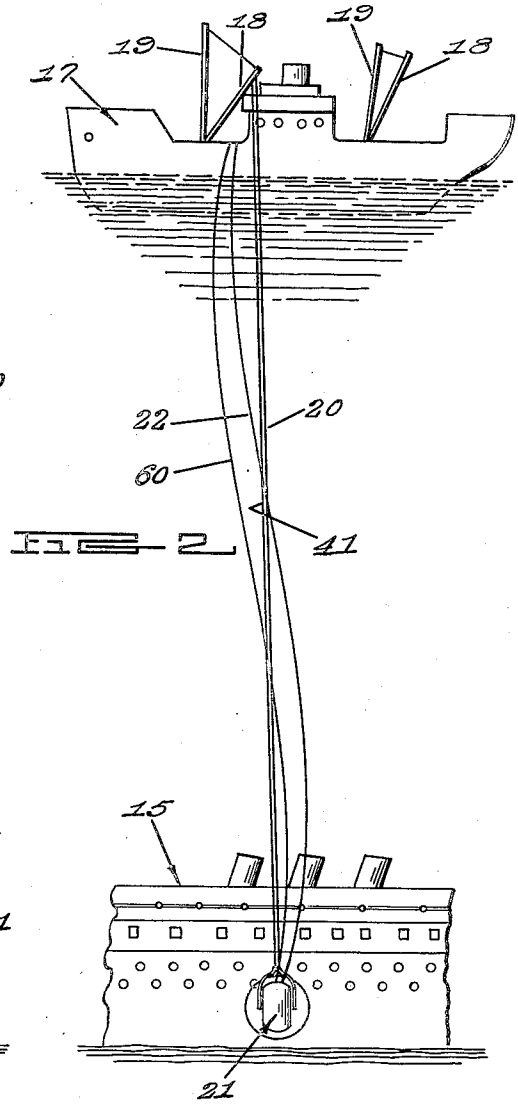


Fig. 2

Inventor

RUSSELL G. SOLHEIM

By Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

Jan. 2, 1951 R. G. SOLHEIM 2,536,103

SHIP SALVAGING APPARATUS

Filed March 16, 1946 5 Sheets-Sheet 2

FIG. 4

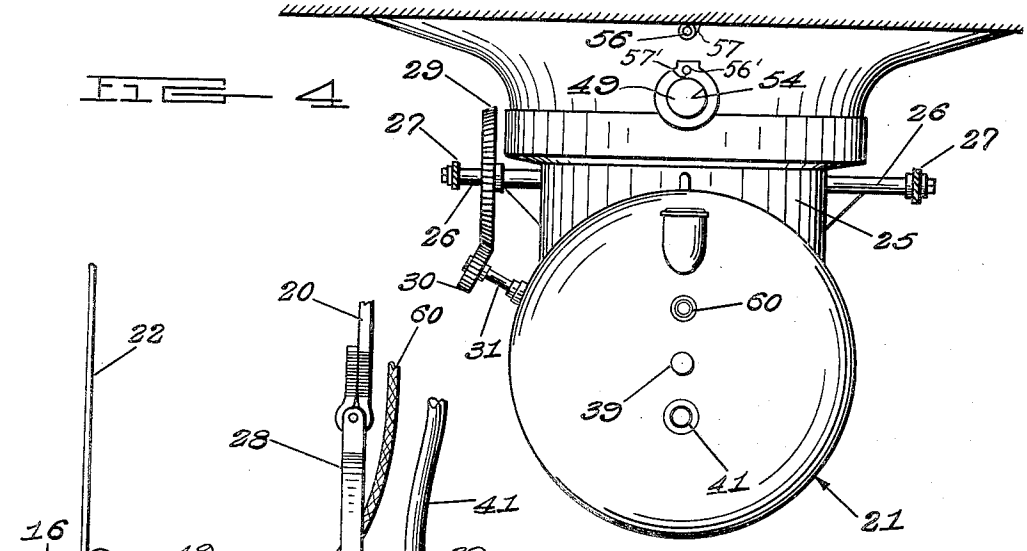
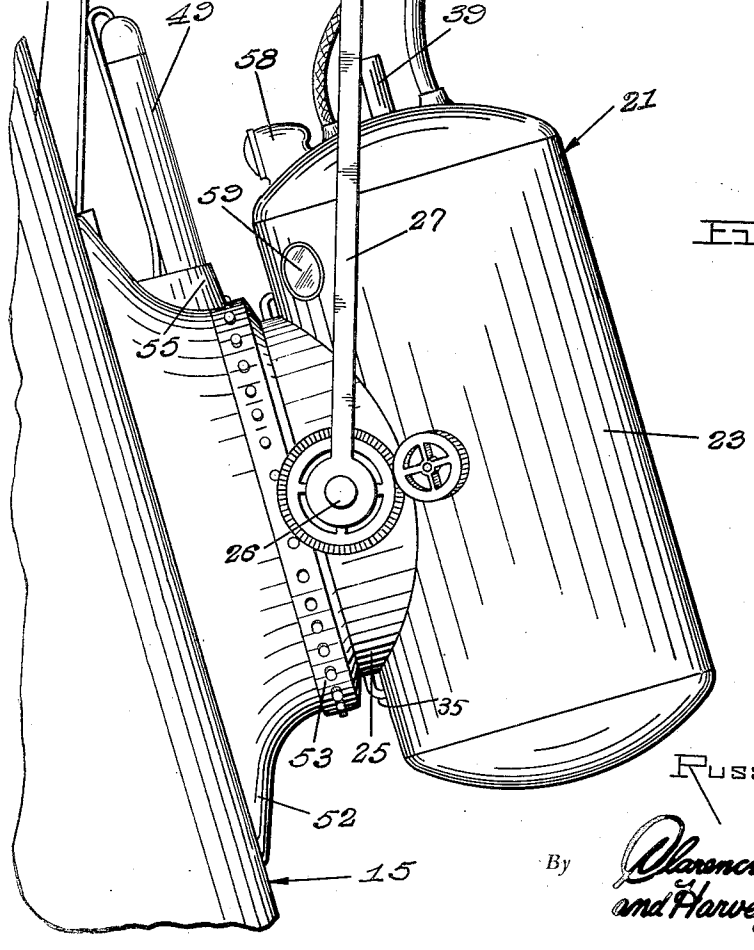


FIG. 2



Inventor

RUSSELL G. SOLHEIM

By Clarence A. O'Brien and Harvey B. Jackson

Attorneys

Jan. 2, 1951 R. G. SOLHEIM 2,536,103

SHIP SALVAGING APPARATUS

Filed March 16, 1946 5 Sheets-Sheet 3

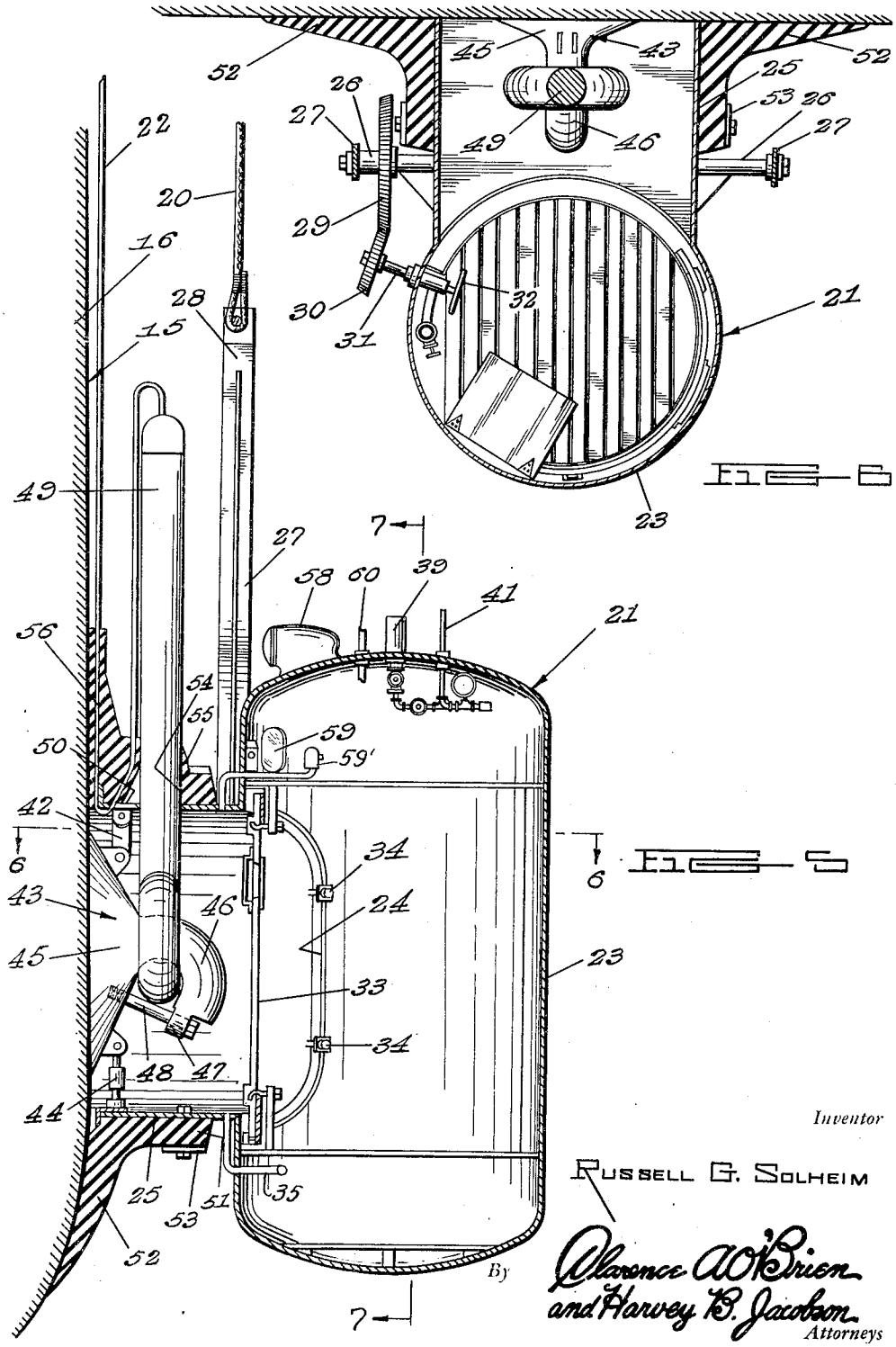


Fig. 6

Fig. 5

Inventor

Russell G. Solheim

Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

Jan. 2, 1951 R. G. SOLHEIM 2,536,103

SHIP SALVAGING APPARATUS

Filed March 16, 1946 5 Sheets-Sheet 4

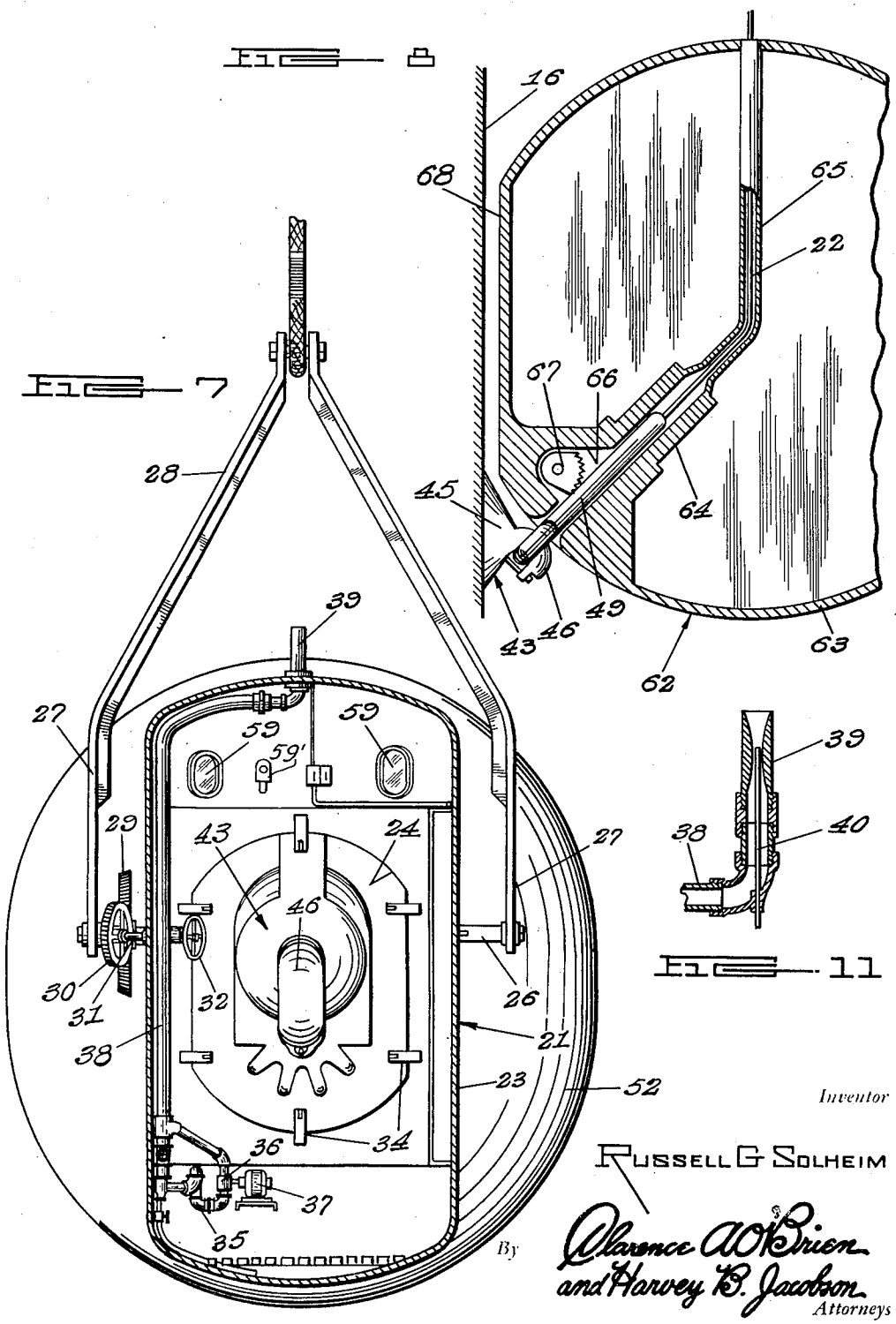


Fig. 11

Inventor

Russell G. Solheim

Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

Jan. 2, 1951 R. G. SOLHEIM 2,536,103

SHIP SALVAGING APPARATUS

Filed March 16, 1946 5 Sheets-Sheet 5

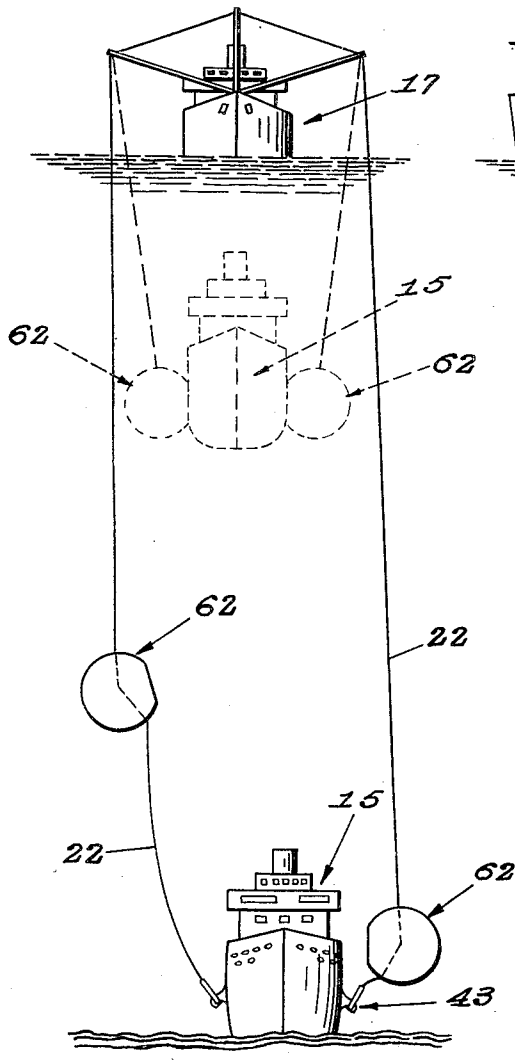


FIG. 9

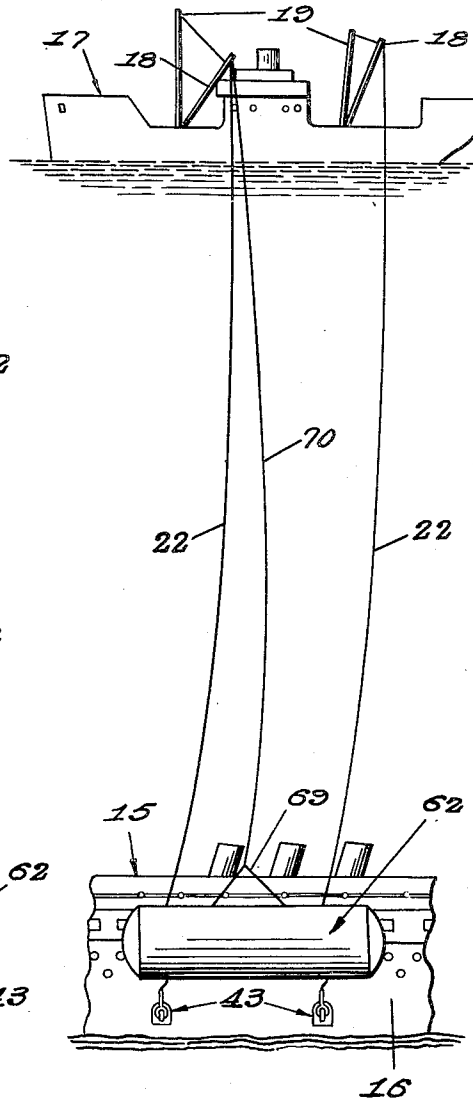


FIG. 10

Inventor

RUSSELL G. SOLHEIM

By Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

Patented Jan. 2, 1951

2,536,103

UNITED STATES PATENT OFFICE

2,536,103

SHIP SALVAGING APPARATUS

Russell G. Solheim, Racine, Wis.

Application March 16, 1946, Serial No. 654,983

1 Claim. (Cl. 114—51)

1

This invention relates to ship salvaging and more particularly to the elevation of sunken vessels to the surface.

The primary object of the invention is to facilitate the attaching of pontoons to the hull of a sunken vessel, and the subsequent elevation of the vessel to the surface by means of the pontoons.

Another object is to guide the pontoons to the sunken hull and avoid the use of divers for the connecting of the pontoons to the hull of the sunken vessel.

Among its features my invention embodies a hook adapted to be secured to the hull of a sunken vessel, a link pivotally fixed at one end to the hook, a guide cable attached to the opposite end of the link leading to the surface of the body of water on the bottom of which the sunken vessel lies, a pontoon having a guide passage through which the guide cable is adapted to be threaded and means carried by the pontoon for engaging the link and automatically locking the pontoon against upward movement independently of the hook.

Other features include means for admitting water to the interior of the pontoon for sinking the same after the guide cable has been threaded therethrough, and means for expelling the water from the pontoon after it has attached itself to the link in order to reestablish its buoyancy and create a lifting effort on the hull.

Still other features include a diving bell which is adapted to be lowered in a position to contact the hull of the sunken vessel, means to engage the side of the sunken vessel and seal the diving bell thereto, a hook carried by the diving bell, a link pivotally attached at one end to the hook, a cable attached to the opposite end of the link and leading to the surface, means in the diving bell through which access may be had to the hook after the bell has become sealed to the hull of the sunken vessel, to facilitate the attaching of the hook to the hull, means to seal the opening giving access to the hook after it has been welded to the hull of the vessel whereby the bell may be unsealed from contact with the hull and elevated to the surface.

Still other features include a diving bell and working bay in which the occupant of the diving bell may work at normal atmospheric pressure.

In the drawings:

Figure 1 is a diagrammatic view showing a diving bell lowered from a tender and contacting the side of the hull of a sunken vessel,

Figure 2 is a side view of Figure 1,

2

Figure 3 is an enlarged side view of the diving bell showing a portion of the hull of the vessel with the diving bell attached thereto,

Figure 4 is a top plan view of a diving bell embodying the features of this invention,

Figure 5 is a longitudinal sectional view through a diving bell showing the hook in position to be attached to the hull of a sunken vessel,

Figure 6 is a transverse sectional view taken substantially along the line 6—6 of Figure 5,

Figure 7 is a longitudinal sectional view taken substantially along the line 7—7 of Figure 5,

Figure 8 is a fragmentary enlarged sectional view through a pontoon showing the manner in which it is locked to the side of a sunken vessel,

Figure 9 is a diagrammatic view similar to Figure 1 showing a pontoon lowered along one of the guide cables and about to engage the links carried by a hook which has been previously attached to the hull of the sunken vessel,

Figure 10 is a side view of Figure 9, and

Figure 11 is a fragmentary enlarged sectional view through the discharge nozzle used in emptying the working bay.

Referring to the drawings in detail the vessel to be salvaged is designated generally 15, the hull of which is designated 16. A salvage vessel designated generally 17 is equipped with the customary winches, electrical power generators, air compressors and like equipment as well as booms 18 and masts 19.

Suspended from a boom 18 is a cable 20 which is connected to the lifting yoke of a diving bell designated generally 21 which will be more fully hereinafter described. A guide cable 22 is led from a winch over the side of the salvage vessel 17 and is attached to one end of the link carried by the diving bell as will be more fully hereinafter explained.

The diving bell 21 comprises a hollow substantially cylindrical chamber or capsule 23 provided in its side with a port or opening 24 which is surrounded by a laterally extending collar 25 from diametric opposite points of which extend trunnions 26 to the outer ends of which are attached the legs 27 of an inverted U-shaped yoke 28 to which the suspension cable 20 is attached. The trunnions are pivotally mounted in the yoke 28 so that the angular position of the bell 21 may be altered with relation to the yoke for a purpose to be more fully hereinafter described. Fixed to the yoke 28 is a gear 29 which meshes with a pinion 30 carried at the outer end of a shaft 31 which enters the side of the capsule 23 through a suitable water tight packing and is provided at

its inner end with a hand wheel 32 by means of which the pinion 30 may be rotated from the interior of the diving bell 21.

Slidably mounted on the tubular body or capsule 23 is a door 33 which in one position is adapted to close the port 24 and have sealing engagement with the inner wall 23' of the cylindrical body 23 adjacent the port opening, it being understood that the door 33 is held in such sealing contact by means of suitable bolts 34 which are accessible from the interior of the diving bell for manipulation by the occupant thereof. A liquid discharge pipe 35 has communication with the interior of the collar 25 and is connected through the medium of a pump 36 driven by a prime mover such as an electric motor 37 with an outlet pipe 38 leading upwardly and outwardly through the interior of the diving bell to a discharge nozzle 39 in the top thereof. The discharge nozzle 39 is made in the form of a venturi and leading through one of the fittings connecting it to the pipe 38 is a high pressure air pipe 40 which is connected through the medium of an air pressure line 41 to a pump carried by the surface vessel or tender 17.

Suspended on suitable detachable links 42 at the mouth of the collar 25 opposite that which is attached to the cylinder 23 is a hook designated generally 43, and cooperating with the links 42 is a turnbuckle 44 by means of which tension may be released from the links to permit dismounting of the hook 43 from its position in the mouth of the collar 25 as will be readily understood upon reference to Figure 5. The hook 43 comprises a base member 45 of substantially cone-shaped configuration from the apex of which extends an arcuate arm or hook member 46 provided with a depending ear 47 which is pierced to receive a bolt 48, the threaded end of which is received in the cone-shaped body 45 in order to secure in place a link 49 the lower end of which is provided with an eye to receive the hook 46 while the upper end has attached thereto the guide cable 22. As shown in Figure 5 the link projects upwardly through an opening 50 formed in the collar 25 in such a position that the link 49 lies parallel with the longitudinal axis of the diving bell 21.

Surrounding the collar 25 and yieldingly engaging it is a collar or sleeve 51 formed of a soft pliable waterproof material such as rubber. Formed at the end of the sleeve 51 adjacent the mouth of the collar 25 is an outstanding annular flange 52 the edge of which is feathered to form in effect a suction cup as will be more fully hereinafter explained. The collar 51 is attached permanently to the collar 25 by means of an attaching ring 53, and is provided with a passage 54 for the accommodation of the link 49. An upstanding feathered collar 55 surrounds the opening 54 in order effectively to seal the link 49 in said sleeve 51 against the entrance of water. Spaced openings 56 and 56' are formed in the flange 52 parallel with the opening 54 and connecting the opening 56 with the base of the flange opposite that facing the diving bell 21 is a slit 57. A like slit 57' establishes communication between the openings 54 and 56'. Formed in the collar or sleeve 51 adjacent the opening 50 is a parallel passage 58' the wall of which is formed with a longitudinal slit 57' which extends to the passage 54.

The diving bell 21 is provided with convenient lamps 58 and ports 59 which are sealed against the entrance of water in order to aid in visibility when working at great depth, and leading from the tender or surface vessel 17 to the diving bell is an electrical conduit 60 by means of which power may be supplied from a generator aboard the tender to light the lamps and supply power to electrical welding equipment by which the hook 43 may be welded to the hull 16 of the sunken vessel 15.

The operation of the diving bell is as follows: When it is desired to raise a sunken ship the tender 17 is maneuvered to a position as nearly directly above the sunken vessel as is possible after which the bell 21 is lowered by the cable 20 to a position adjacent the side of the hull 16 of the vessel to be salvaged. The bell 21 is then tilted by manipulation of the hand wheel 32 so that its axis lies parallel to the side of the sunken vessel. Upon approaching the hull 16 the occupant of the bell 21 opens the necessary valves and starts the pump 36 into operation and at the same time opens the high pressure line 41 to cause the air which is being fed thereinto from the pump aboard the tender to pass out through the pipe 40 and the Venturi pipe 39 to be discharged into the surrounding water. By reason of the action of the pump 36 it will be evident that the water in the collar or working bay 25 will flow through the pipes 35 and 38 so as to cause a definite flow through the collar 25 or working bay which tends to draw the diving bell toward the hull 16. As the flange 52 of the collar 51 contacts the hull, an effective seal will be produced which will prevent further entrance of water into the collar or working bay 25 with the result that all of the water contained therein may be discharged through the discharge pipe 39.

In order to facilitate the complete discharge of the water from the working bay 25 I provide a vacuum relief valve 59' which when the pressure in the bay 25 falls below a predetermined value opens and allows air to flow from the interior of the bell 21 into the working bay 25 to equalize the pressure between the two. Having in this fashion sealed the diving bell 21 to the hull 16 and cleared the working bay of any water, the bolts 34 may be released to permit the door 33 to be opened so that the occupant of the diving bell may have access to the working bay through the port 24. Having thus gained access to the working bay it is only necessary to weld the conical base 45 of the hook 43 to the hull of the sunken vessel after which the turnbuckle 44 may be released to relieve the strain on the links 42, and permit the hook 43 to be released from its position in the mouth of the working bay. Having thus fastened the hook to the hull and disengaged the diving bell from the hook, the door 33 is closed and sealed in place by means of the bolts 34 after which the valves are opened to permit water to reenter the working bay or collar 25 and the signal is given by the occupant of the bell to elevate the bell to the surface. The entrance of the water into the working bay relieves all external pressure thereon and when so filled, the lower portion of the bell will swing away from and clear of the hook, thus allowing the bay and bell to move upwardly and away from the vessel causing the link 49 to be withdrawn from the openings 50 and 54 and cable 22 to leave its respective openings 56 and 56' through the slits 57 and 57'. Having attached the necessary number of hooks and their respective links to the hull of the sunken vessel and elevated the diving bell 21 to the surface it is next only necessary to thread the upper ends of the cables 22 attached to the links 49

through the pontoons and to lower the latter into position to lift the sunken vessel.

The pontoons previously referred to comprise hollow cylindrical chambers designated generally **62** each of which comprises a hollow cylindrical body **63** closed at opposite ends and provided with a pair of inwardly extending radially disposed sockets **64**, the inner end of each of which is connected to a tube **65** leading out through the wall of the pontoon at a point remote from the point through which its respective socket **64** extends. Formed in each socket **64** is a radial chamber **66** in which a toothed dog **67** is pivotally supported. This dog is so arranged that when a link **49** enters the socket its withdrawal will be prevented. Having fixed the hooks **43** to the hull **16** the guide cables **22** are threaded through the sockets **64** and tubes **65** of their respective pontoons **62** and the latter are then flooded to cause them to settle downwardly along the guide cables **22** until the links **49** enter the sockets **64** at which time they are guided against the hull **16** with a flattened seat **68** formed on the pontoon engaging the side of the hull. As the pontoon settles into place the latch dogs **67** will engage their respective links **49** so that the links **49** will be securely locked in the sockets **64** and any movement of the pontoon away from the vessel will be resisted. Upon settling of the pontoons **62** into place against the side of the hull **16**, and the locking of the pontoons in place by the latch dogs **67**, the water may be expelled from the pontoons, thus restoring their buoyancy and causing them to exert a lifting force on the sunken vessel **15** as suggested by the dotted lines in Figure 9. It will be understood of course that each pontoon may be equipped with a suitable attaching yoke **69** to which a cable **70** leading to the surface vessel or tender **17** may be connected in order to govern the rapidity with which the pontoon may be sunk.

While in the foregoing there has been shown and described the preferred embodiment of this invention it is to be understood that minor

changes in the details of construction, combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as claimed.

What I claim is:

Ship salvaging apparatus which includes a hook adapted to be secured to the hull of a sunken vessel, a link pivotally fixed at one end to the hook, a guide cable connected to the opposite end of the link and leading to the surface of a body of water on the bottom of which the sunken vessel lies, a pontoon having a guide passage through which the guide cable is adapted to be threaded, said pontoon also having a tubular socket communicating with the passage, said socket being adapted to receive the end of the link which is attached to the guide cable, said socket having a radially extending chamber near its mouth, a latch dog rockably mounted in said chamber and adapted to engage the link and hold it against withdrawal from the socket, and said pontoon having a flat side adjacent the mouth of the socket for cooperation with the link in holding the pontoon from rocking motion about the hook.

RUSSELL G. SOLHEIM.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
865,130	Ximenez	Sept. 3, 1907
1,068,433	Karamanos	July 29, 1913
1,373,672	Reno	Apr. 15, 1921
1,388,363	Miller	Aug. 23, 1921
1,393,894	McGill	Oct. 18, 1921
1,838,566	Merritt	Dec. 29, 1931
1,865,663	White	July 5, 1932

FOREIGN PATENTS

Number	Country	Date
124,236	Great Britain	Mar. 21, 1918