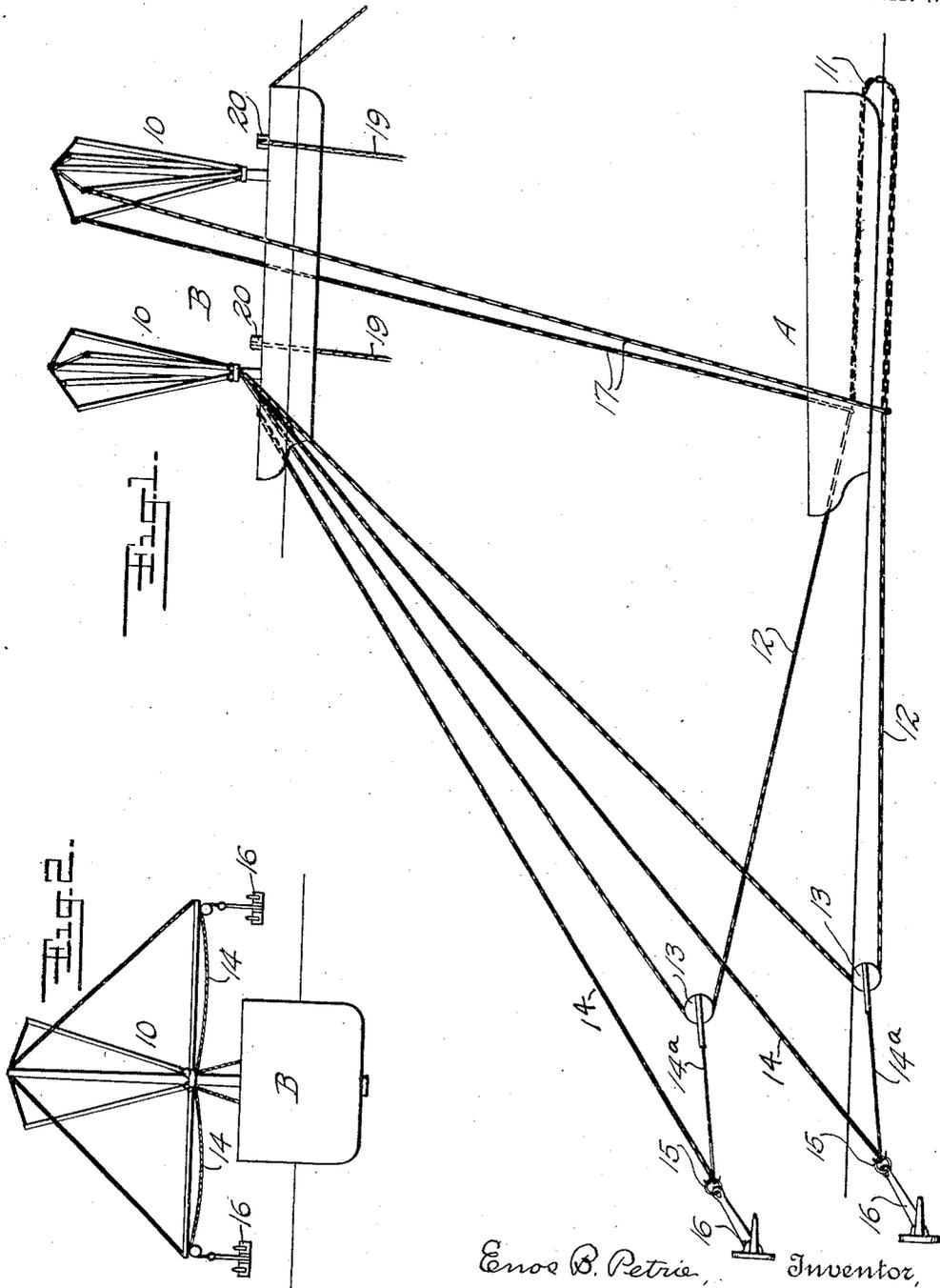


E. B. PETRIE.
SEAGOING APPARATUS FOR RAISING SUNKEN VESSELS.
APPLICATION FILED OCT. 30, 1919.

1,363,266.

Patented Dec. 28, 1920.
5 SHEETS—SHEET 1.



Enos B. Petrie, Inventor,

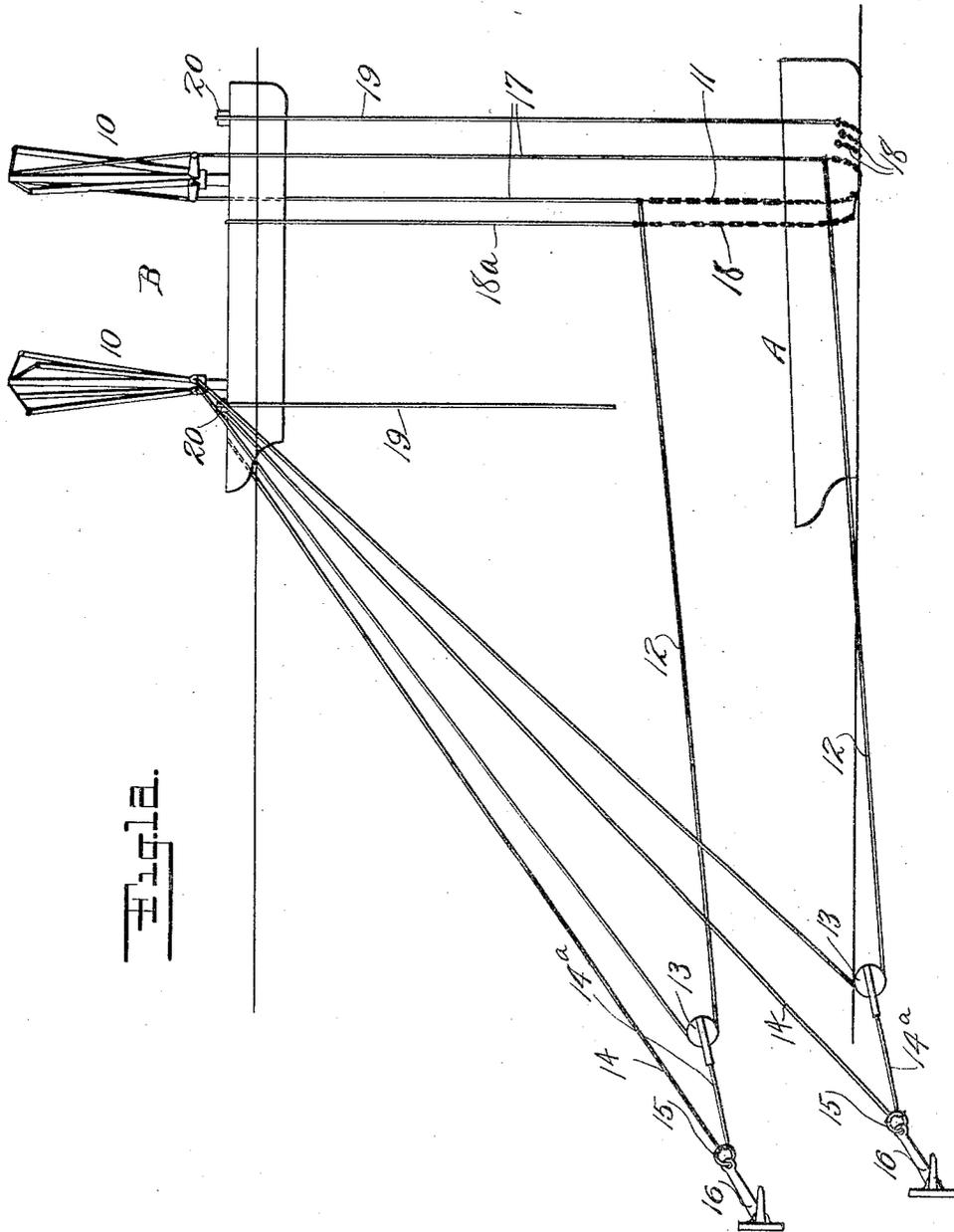
By his Attorney,

W. P. Hutchinson,

E. B. PETRIE,
SEAGOING APPARATUS FOR RAISING SUNKEN VESSELS.
APPLICATION FILED OCT. 30, 1919.

1,363,266.

Patented Dec. 28, 1920.
5 SHEETS—SHEET 2.



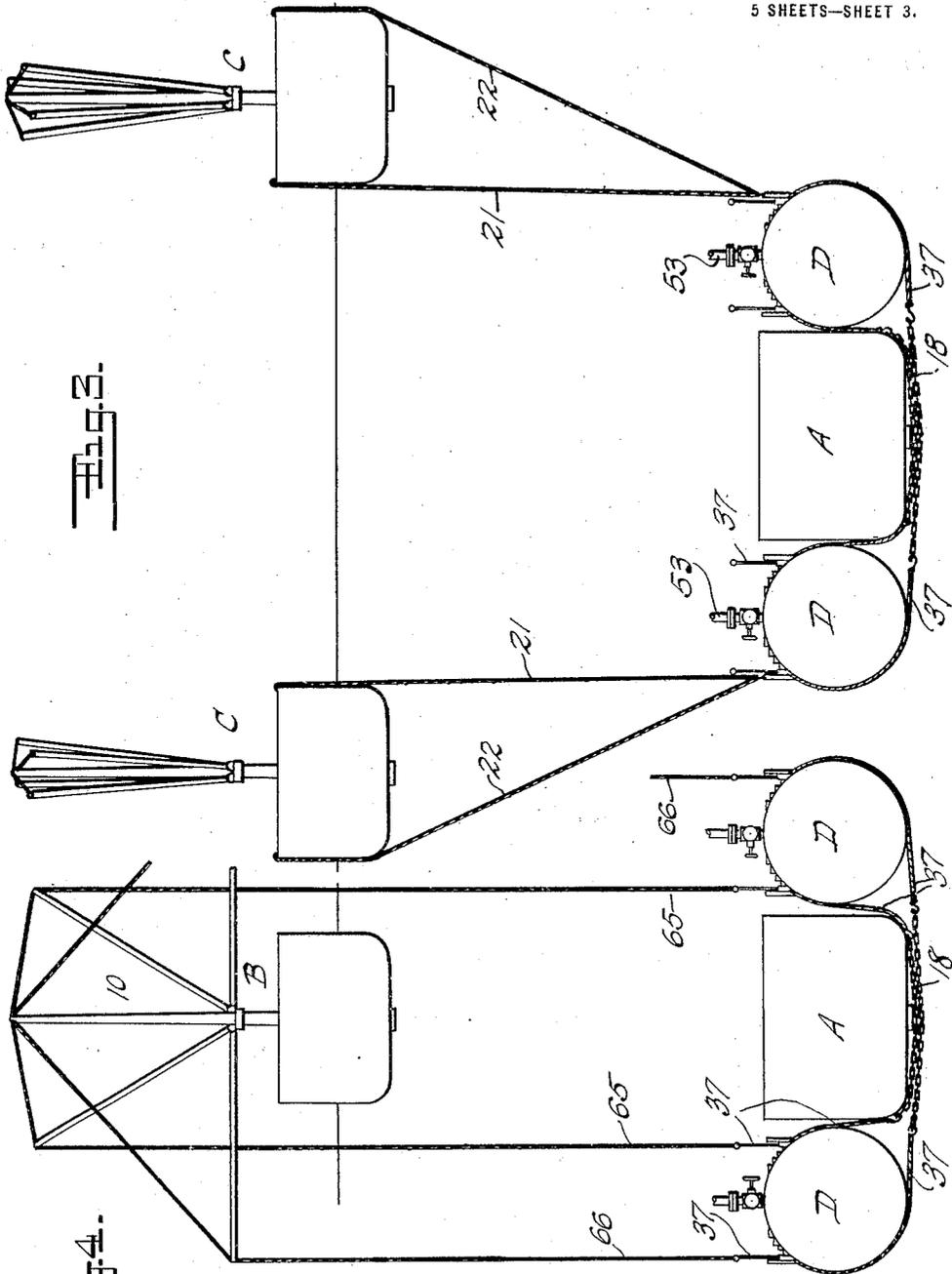
Ernos B. Petrie, Inventor,
By his Attorney,
W. B. Hutchinson,

E. B. PETRIE,
SEAGOING APPARATUS FOR RAISING SUNKEN VESSELS.
APPLICATION FILED OCT. 30, 1919.

1,363,266.

Patented Dec. 28, 1920.

5 SHEETS—SHEET 3.



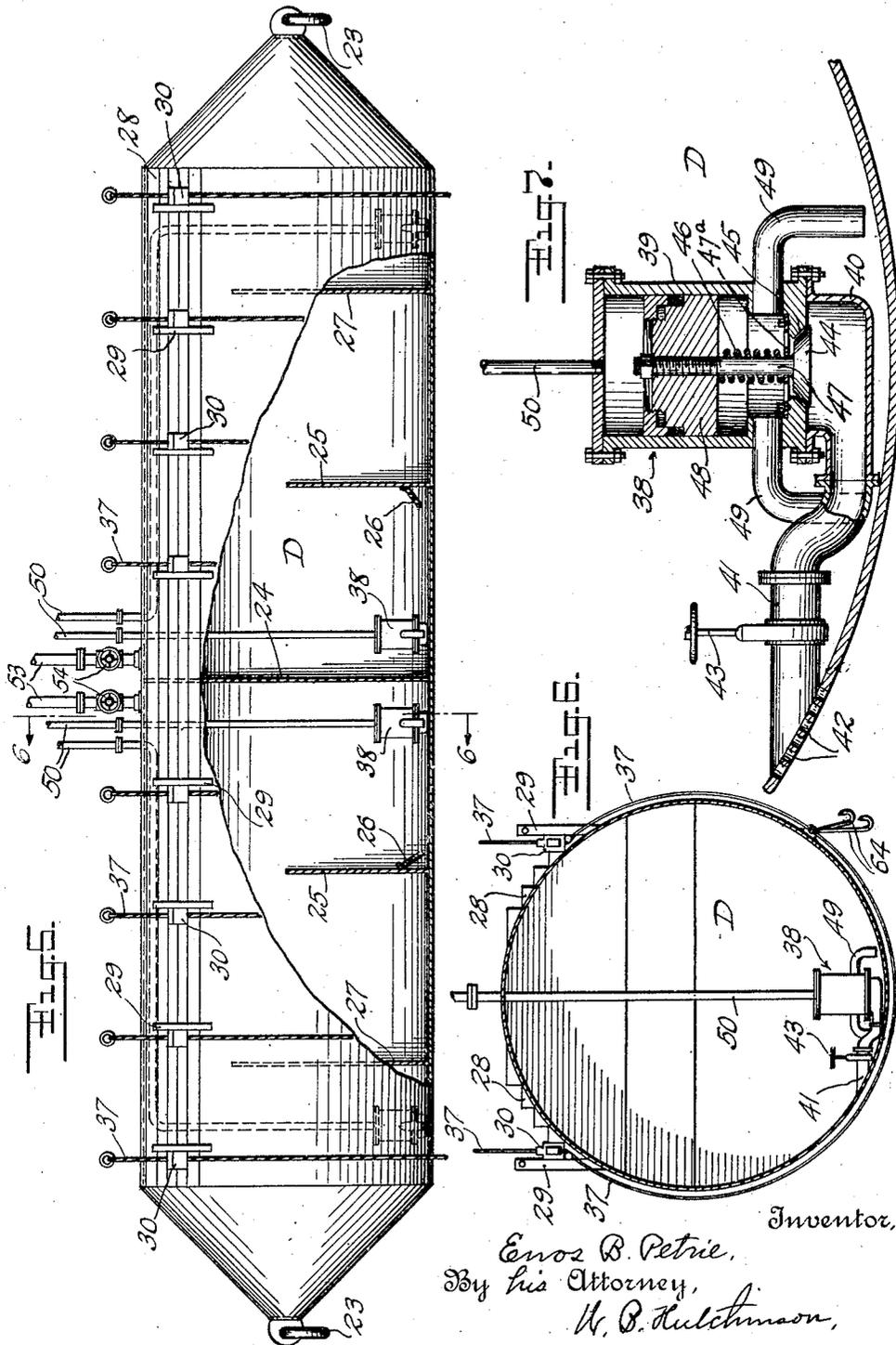
E. B. Petrie, Inventor,
By his Attorney,
W. P. Hutchinson.

E. B. PETRIE.
 SEAGOING APPARATUS FOR RAISING SUNKEN VESSELS,
 APPLICATION FILED OCT. 30, 1919.

1,363,266.

Patented Dec. 28, 1920.

5 SHEETS—SHEET 4.



Inventor,
 Enoch B. Petrie,
 By his Attorney,
 W. B. Hutchinson,

E. B. PETRIE.
 SEAGOING APPARATUS FOR RAISING SUNKEN VESSELS.
 APPLICATION FILED OCT. 30, 1919.

1,363,266.

Patented Dec. 28, 1920.

5 SHEETS—SHEET 5.

Fig. 8.

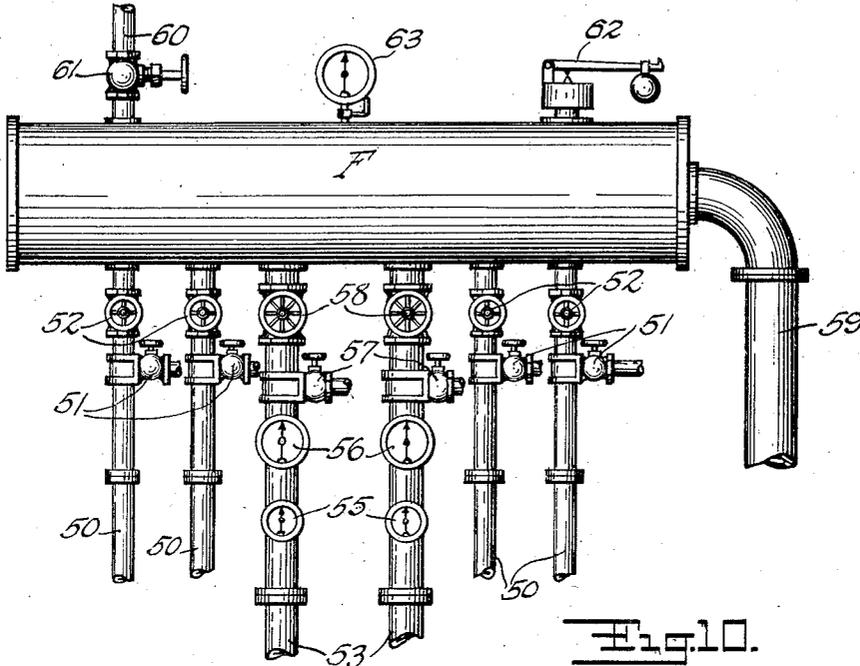


Fig. 10.

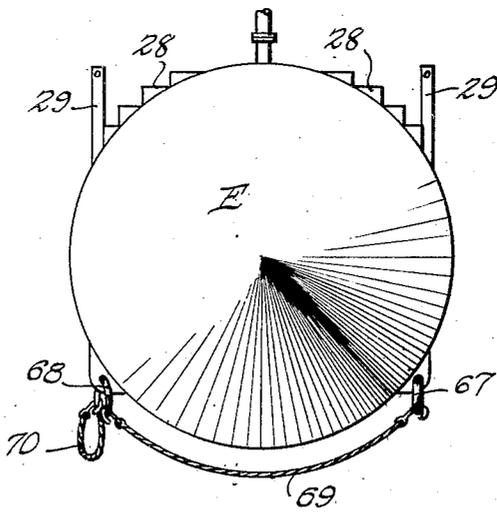
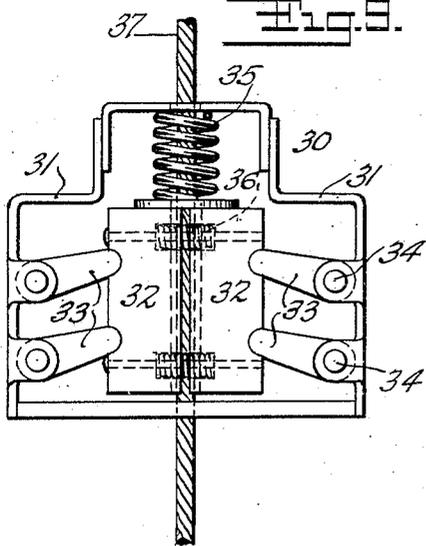


Fig. 9.



Enos B. Petrie, Inventor,
 By his Attorney,
 W. B. Hutchinson.

UNITED STATES PATENT OFFICE.

ENOS B. PETRIE, OF BROOKLYN, NEW YORK.

SEAGOING APPARATUS FOR RAISING SUNKEN VESSELS.

1,363,266.

Specification of Letters Patent. Patented Dec. 28, 1920.

Application filed October 30, 1919. Serial No. 334,456.

To all whom it may concern:

Be it known that I, ENOS B. PETRIE, a citizen of the United States, and a resident of the borough of Brooklyn, city of New York, county of Kings, and State of New York, have invented a new and useful Improvement in Seagoing Apparatus for Raising Sunken Vessels, of which the following is a full, clear, and exact description.

My invention relates to improvements in apparatus for raising sunken vessels, and the general object of my invention is to produce an apparatus and a system for using it, by means of which sunken vessels can be safely and efficiently raised and salvaged. More particularly my invention is intended to provide means for placing a series of lifting chains at desired points beneath the keel of a sunken vessel, arranging a series of tanks with controlling apparatus so that the tanks can be sunk alongside the vessel to be raised and connected with the lifting chains in such a manner that an even draft may be had at regular intervals all along the vessel, and further provide means for removing the water from the tanks and by their buoyancy lifting the vessel. Further my invention comprises means for regulating the pressure in the tanks, and thus controlling their buoyancy, and for controlling and guiding the tanks so that they will rise together on an even keel, and distribute the load of the vessel to be raised in such a way that there will be no overstrain on any particular chain, but the vessel and tanks will rise smoothly and evenly. My invention also comprises means for controlling the above operations very nicely, and various details which will be clearly understood from the description which follows.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar reference characters indicate corresponding parts in all the views.

Figure 1 is a diagrammatic side elevation showing the position of a sunken vessel and the wrecking boat above it, and the means for forcing the lifting cable beneath the vessel to be raised.

Fig. 1^A is a view similar to Fig. 1 but showing the progressive arrangement of the cross-chains.

Fig. 2 is an end view of the wrecking boat, this also being diagrammatic.

Fig. 3 is a diagrammatic sectional view of

the sunken vessel, the tanks alongside, and the means for guiding the tanks.

Fig. 4 is a view similar to Fig. 3 but with the tanks connected with the wrecking boat in position to get the apparatus ready for lifting.

Fig. 5 is an enlarged broken side elevation partly in detail, of one of the lifting tanks.

Fig. 6 is a cross section on the line 6—6 of Fig. 5.

Fig. 7 is an enlarged detail sectional view showing the valve arrangement for letting water into and forcing water out of the tank.

Fig. 8 is a detail elevation of the apparatus for controlling the air connections with the tank.

Fig. 9 is a detail of a form of clutch which can be used to advantage in the operation of the invention, and

Fig. 10 is an end view of a form of tank which can be used to advantage near the bow of the vessel.

In the diagrammatic views shown in Figs. 1 to 4 inclusive, A represents the vessel to be raised; B a wrecking boat; C additional wrecking boats which can be used in connection with the wrecking boat; D the large tanks which are placed alongside the sunken vessel to lift it, and E a modified form of the tank.

In the first four figures of the drawings the views are diagrammatic simply to show the general arrangement of the apparatus when the sunken vessel is to be raised. It will be understood that the wrecking boats B and C are provided with all usual or preferred appliances for use in salvaging operations, such as a derrick 10, and an assortment of air compressors, hoisting engines, hydraulic jacks, pumps, and other necessary devices.

A cable or chain 11 is in the first operation drawn beneath the vessel A to be raised, and to facilitate this operation it is connected at the ends with lines or cables 12 which run over pulleys 13 connected to the anchors by the short lines 14^a. The lines 14 are connected to anchors 16 as shown at 15. The lines 12 are also connected to suitable hoisting apparatus such as the derrick 10 or other equivalent hoisting means, and the lines 14 connect with a suitable windlass. The ends of the cables are also connected with lines 17, and these connect with a forward derrick 10 or equivalent hoisting apparatus,

and the draft cable 11 is used to fix the position of the cross-chains 18 which are used as lifting chains.

When the vessel is located the wrecking boat B steams up behind and in line with it at some distance from the vessel to be raised, and the anchors 16 with the connected lines 14 and 12 are lowered, and the lines 17 are used to hold the draft cable 11 at the right height. It will be understood that the anchors 16 are spaced apart so as to be well aft of the vessel A and some distance from opposite sides thereof. The vessel B then steams ahead until it is forward of the vessel A, which is suitably marked so that the wreckers will know how far forward to go. The draft cable or chain 11 is then lowered so as to come forward of the vessel A, and the lines 17 and also the lines 12 slack so that the chain 11 is lowered well in advance of the bow of the vessel A. The lines 12 are then by means of the hoisting apparatus tightened up, and the lines 12 are moved backward and forward so as to saw the cable under the vessel A to the desired distance. This distance can be located by the divers. When it is at the proper position for attaching the first cross lifting chains 18, the lines 17 are drawn up taut, and one of the cross lifting chains 18 is attached and the draft cable and the attached line 18 pulled through beneath the vessel until the cross-chain is in the desired position beneath the keel, as shown in Fig. 1^A, when a similar cross-chain is attached by divers to a line 18^a on the other side and the operation reversed, and a second cross-chain 18 extended beneath the vessel A so as to connect with the lifting tanks as hereinafter described. This position has to be accurately determined, and it can be done by being properly plumbed with suitable marks on the wrecking vessel so that the lines connecting the cross-chains will be vertical, as hereinafter described.

When the first set of cross-chains 18 are placed, the cable 11 is then drawn back to the position where the second set of cross-chains are to be placed, and the above operation is repeated, and so on until the cross-chains 18 are in position beneath the vessel's hull. After the chains 18 are placed beneath the vessel's hull the forward chain is connected by means of lines 19 with hydraulic jacks on the wrecking boat above, and the after-chain that is the one farthest aft is also connected with jacks on the wrecking boat so as to fix the relative position of the boat to be raised and the wrecking boat, and subsequently the other chains 18 are connected with the tanks as presently described. The intervening chains 18 are then plumbed by means of the lines 17 so that they will be regular distances apart as indicated by measured lines on the

boat B above, so that when the tanks D are brought into place the several chains 18 and lines 37 will be in accurate position to connect with the lines 65 and 66, and all the lines will thus be accurately spaced and so that an even strain will be had on them all.

After the cross-chains are positioned and the lines 12 removed, the tanks D are then lowered to position to be connected with the cross-chains 18 as presently described. The additional wrecking boat C is equipped with apparatus like the boat B and can be connected by lines 21 and 22 with the tanks D for the purpose of lifting a definite amount on the tanks as hereinafter described, but before going into the operation further it is necessary to describe the tanks.

Each tank D is preferably provided with end rings 23 to facilitate handling it, and each tank is divided transversely by an air tight partition 24 placed in the center thereof. There are also baffles 25 rising from the bottom of the tank, and spaced apart from the partition 24, these having flap valves 26 therein so that the water in the tank can run through from the end portions toward the center but cannot return, and there are other baffles 27 placed between the baffles 25 and the ends of the tank. These baffles are necessary because the tanks are very large and they prevent the water from surging too rapidly backward and forward in the tank and thus assist in regulating it so that it will rise on an even keel.

The tank is also preferably provided on the top and on opposite sides with steps 28 so that the divers may handle themselves better on the tank while working thereon, and the tank is also preferably provided with lugs 29 which can be readily connected with the lines 21 and 22 hereinabove referred to, or with other lines for properly guiding the tank and connecting it with the vessel above. The tank has also on opposite sides and at intervals, clutches through which the lines 37 may be passed as presently described. The object of these clutches is to enable the lines and the chains with which they connect to be drawn perfectly taut under a hundred and fifty tons strain more or less on each line, so that they will all have an even lifting action on the adjoining vessel, and the clutches while permitting the lines to be drawn taut, prevent them from slacking up. Any desirable clutches can be used for this purpose, and the clutch shown in Fig. 9 is suitable. As here shown the clutch has a casing 31 in which are arranged shoes 32 adapted to grip the cable 37, and the shoes are engaged by levers 33 which have normally an upward inclination, and are pivoted as shown at 34. The shoes are pressed down by a spring 35, and are normally separated slightly by lighter springs 36. It will be seen that

with a clutch of this character the cable or line 37 can be pulled upward through the clutch, but they cannot slack back, as the downward strain causes the levers 33 to act
5 against the shoes 32 and set them firmly against the line or cable so as to prevent any slipping.

In operating the tank it is necessary to control the amount of water therein, as well as the amount of water in the several parts thereof, and also to know the pressure of air in each air tight compartment which must be equal at all times. To this end I have provided a series of valves 38 through which
15 water may be admitted to the tank to sink it, and which can also be used to control the ejection of water under force of air admitted to the tank. This valve is shown best in Fig. 7, and there can be as many of them as desired. Each valve is located near the bottom
20 of the tank as shown in Fig. 5, and it has a casing 39, an extension 40, and pipe 41 connecting with the perforated part 42 of the shell of the tank. Of course there might be
25 a wide opening, but a perforated wall is better as this would prevent foreign substances from being drawn in. The pipe 41 is controlled by a valve 43 which can be set to close the pipe when the tank is not in use for
30 lifting purposes. In the bottom of the valve casing is a valve 44 fitting against a suitable seat 45, and normally raised by a spring 46 arranged around the valve stem 47 and between the spider 47^a and the piston 48 which
35 slides in the casing 39 and is suitably packed as shown. The valve is also provided with pipes 49 opening into the lower part of the tank, and the several valves connect at the top with air pipes 50 which lead to the compressed air accumulator F located on the
40 wrecking boat B.

It will of course be understood that the several pipes 50 and the pipes 53 presently referred to, are hose pipes or flexible pipes.
45 The pipes 50 have relief valves 51 near their upper ends so that any excess pressure may be quickly relieved if desired, and they have also valves 52 which control the amount of air passing through the pipes. The tank mechanism also comprises larger air pipes
50 53 which lead from the accumulator F to the tank, and these are provided with valves 54 near their connection with the tank D, which are not necessary in operating the tank.
55 They are also provided with pressure indicators 55 in which the pressure in the pipe and tank will be constantly shown, and with meters 56 showing the rate of flow of air through the pipes. The pipes 53 are also
60 provided with relief valves 57 and with controlling valves 58. The accumulator F has a suitable intake pipe 59 connecting with the receiver of an air compressor so that an adequate head can always be had, and a relief
65 pipe 60 controlled by a valve 61, a safety

valve 62, and a pressure indicator 63. It will be understood, of course, that there is a set of this controlling mechanism shown in Fig. 8 for each tank D. In operation if the tank is to be sunk, the gate valve 43 is fixed
70 so as to open the pipe 41, and after this the tank is controlled by the mechanism shown in Fig. 8 and just described. The air is admitted through the several pipes 50 to the upper part of the several valve casings 39,
75 and in each casing the piston 48 would be pushed down and the valve 44 opened so that the water will rush in through the pipe 41, then through the opening of the valve and out through the pipes 49 to the interior
80 of the tank. When, however, it is desired to eject the water so as to give the tank the desired buoyancy, the pipes 53 are opened so as to admit air from the accumulator F into the tank under pressure which exceeds the
85 water pressure at the level in which the tank happens to be. The air pressure in the tank will then force the water out through the several pipes 49, valves 38 and pipes 41, and the tank will begin to be buoyant, and by
90 properly manipulating the several valves 52 and 58, the amount of buoyancy can be accurately regulated.

It will be seen that by reference to the pressure indicators 55 the pressure in the tank can be accurately determined, and as
95 the water pressure can be quickly determined by the known depth of the tank which can be ascertained by having measuring lines attached to the fore and aft
100 portions of the tank, the desired pressure is obviously easily attained, and a further record of the amount of air in the tank and of the water which it displaces, can be had by reference to the meters 56 which
105 will show just the amount of air under a given pressure which is admitted to the tank, that is to say, for every cubic foot of air under the desired pressure admitted to the tank, a cubic foot of water will be displaced.
110 Attention is called to the fact that this tank control is very important, and that as the tank is divided into compartments and is arranged by baffles so that the water cannot surge readily from end to
115 end, and as the valves 38 are located at various points along the tank bottom, the tank can be controlled so that just the desired amount of water can be kept in it and the pressure in the several parts can be regulated
120 so that the tank will have a substantially even keel, it being understood, of course, that this action will be assisted by lifting on the cables or lines 21 and 22, to each of which a definite lifting power is
125 attached. It will be further understood that the valves 38 can be operated so that the water will all be pumped out of the forward and aft compartments in the tank, and the water between the remaining baf-
130

fles and the partition 24 can be easily controlled. This makes it easy to raise a vessel safely because it will be understood that with the tanks alongside the vessel connected up as described, it is necessary to keep the tanks level and to keep a substantially even strain on all the many chains, or else some of the chains would part and the vessel would sink and release the several tanks; but with the controlling arrangement specified, with the cross-chains connected as described, and with the lifting action on the lines 21 and 22, all the danger referred to is avoided.

Each tank is provided at necessary intervals with lines or cables 37 as already described, connecting with the clutches 30, and these cables have hooks or other attachments 64 by which they can connect with the cross-chains 18 hereinbefore referred to. When a vessel is to be raised, the tanks D are arranged in pairs on opposite sides of the vessel as shown in Fig. 4, as many tanks being used as are necessary, this depending on the size of the tanks and the size of the vessel, but the tanks are very large and have great lifting power. The divers, after the tanks are arranged as shown, go down and connect the hooks 64 of opposite tanks with the cross-chains 18 so that the lines 37 will connect with one cross-chain and will run over the inner sides of the tanks to which they are attached while the outer lines 37 are connected also with cross-chains 18 so that the tanks will rise vertically without rolling, as the strain will be applied to both their inner and outer sides in an equal degree. To assure this, after the connection has been made as described, a heavy strain is put on the lines 37 by means of lines 65 which connect with the upper ends of the lines 37 as shown, and which connect with suitable hoisting means above, such as derricks as shown in Fig. 4, or hoisting jacks or the like, and when the draft on the several chains 18 and lines 37 is substantially even, then the operators connect the lines 21 and 22 of the additional wrecking boat C to the outer lugs 29 of the tank D at the forward and aft ends, and a heavy and even strain is applied to all the lines 21 and 22. Then by means of the control shown in Fig. 8, the water is expelled from the tanks and air admitted until they have the desired buoyancy. It is not necessary to have the large tanks D with the connections described for the chains 18 and lines 37 at the extremities of the boat, and especially at the bow, and here smaller tanks, or at least shorter ones E are used which are like the others except for the connections stated. As here shown the tank E is provided near the bottom and on opposite sides with hooks 67 and 68 or equivalent

connections to which lines 69 and 70 are attached, and these are connected with chains 18 near them, and when thus connected there will be more or less of a rolling connection, but it answers the purpose of lifting sufficiently on the bow or extremities of the vessel, and of assisting the main tanks D in raising the same.

It will of course be understood that the wrecking boat can have different line connections with the tanks from that described without affecting the invention, the important thing being to provide such line connections as will enable the tanks to be readily placed alongside the vessel to be raised and to hold the wrecking boat B and the tanks D and E in the right relative position, and my invention is not limited to any particular apparatus for this purpose, but the construction of tanks and tank control shown is important as serving its purpose of making an efficient and strong connection between the tanks and the vessel to be raised, and of controlling accurately the buoyancy of the several tanks so that the vessel can be raised at a desired rate of speed and kept substantially level.

It will be understood that this apparatus is a sea-going wrecking apparatus, and that it will operate in heavy weather and at depths beyond the reach of ordinary diving suits, but that special metal diving suits may be necessary where the vessel to be raised lies deep. It will also be understood that the tanks D and E must be made substantially so as to stand heavy strains in usage, and that the interior partition and baffles must be thoroughly braced to this end.

It will also be understood that in some cases the tanks E may be used instead of the tanks D, without affecting the invention.

Attention is also called to the fact that this apparatus is particularly adapted for use in heavy weather, as sometimes violent squalls or storms arise suddenly and the salvaging work is all lost; but with this invention, in such case, the whole apparatus can be safely, quickly, and easily lowered so that when the storm abates operations may be resumed.

I claim:—

1. In an apparatus of the kind described, the tank having lines on opposite sides thereof, and clutches through which the lines pass, whereby the lines may be efficiently tightened and slack prevented.

2. In an apparatus of the kind described, the tank having clutches spaced apart on opposite sides thereof, and lines connected with the clutches and adapted to pass beneath a vessel to clutches of an opposite tank.

3. In an apparatus of the kind described, the tank having clutches spaced apart on

opposite sides to engage lifting lines, lugs projecting upward from the tank adjacent to the clutches, and steps adjacent to the lugs and clutches.

5 4. An apparatus of the kind described comprising tanks divided into compartments, separately controlled means for each compartment by which the air pressure in
10 tanks kept substantially level, lines connected with the tanks and adapted to extend beneath a vessel to be raised, means for
15 of the tanks for raising them and the connected vessel.

5. An apparatus of the kind described comprising a tank divided by a transverse partition near the center and provided with

baffles transversely arranged in the end portions, valve mechanism controlling the inlet and expulsion of water to and from the tank, and above water control for the valves, clutches spaced apart on the outer walls and upper part of the tank, and means for
25 connecting lifting lines to the tank.

6. An apparatus of the kind described comprising the tank having lines on opposite sides thereof, means for tightening the lines and holding them taut, means for
30 controlling the air pressure in the tank, and means for connecting lifting lines to the tank.

ENOS B. PETRIE.

Witnesses:

WARREN B. HUTCHINSON,
M. G. O'DONNELL.