J. A. DE VITO.

APPARATUS FOR RAISING SUNKEN VESSELS.

APPLICATION FILED DEC. 30, 1920.

1,415,532. Patented May 9, 1922.

4 SHEETS—SHEET 1.

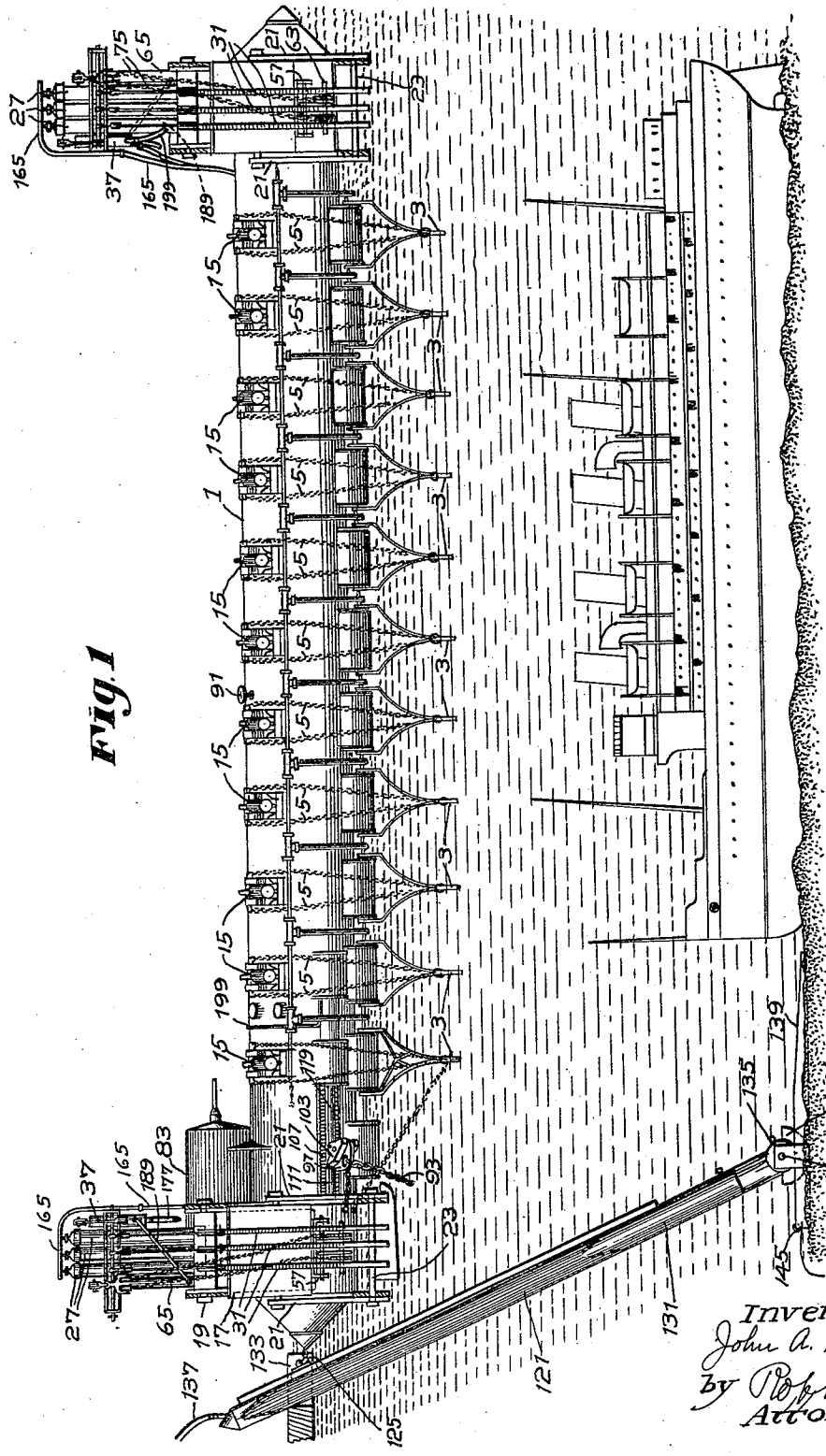


Fig 1

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APPARATUS FOR RAISING SUNKEN VESSELS.

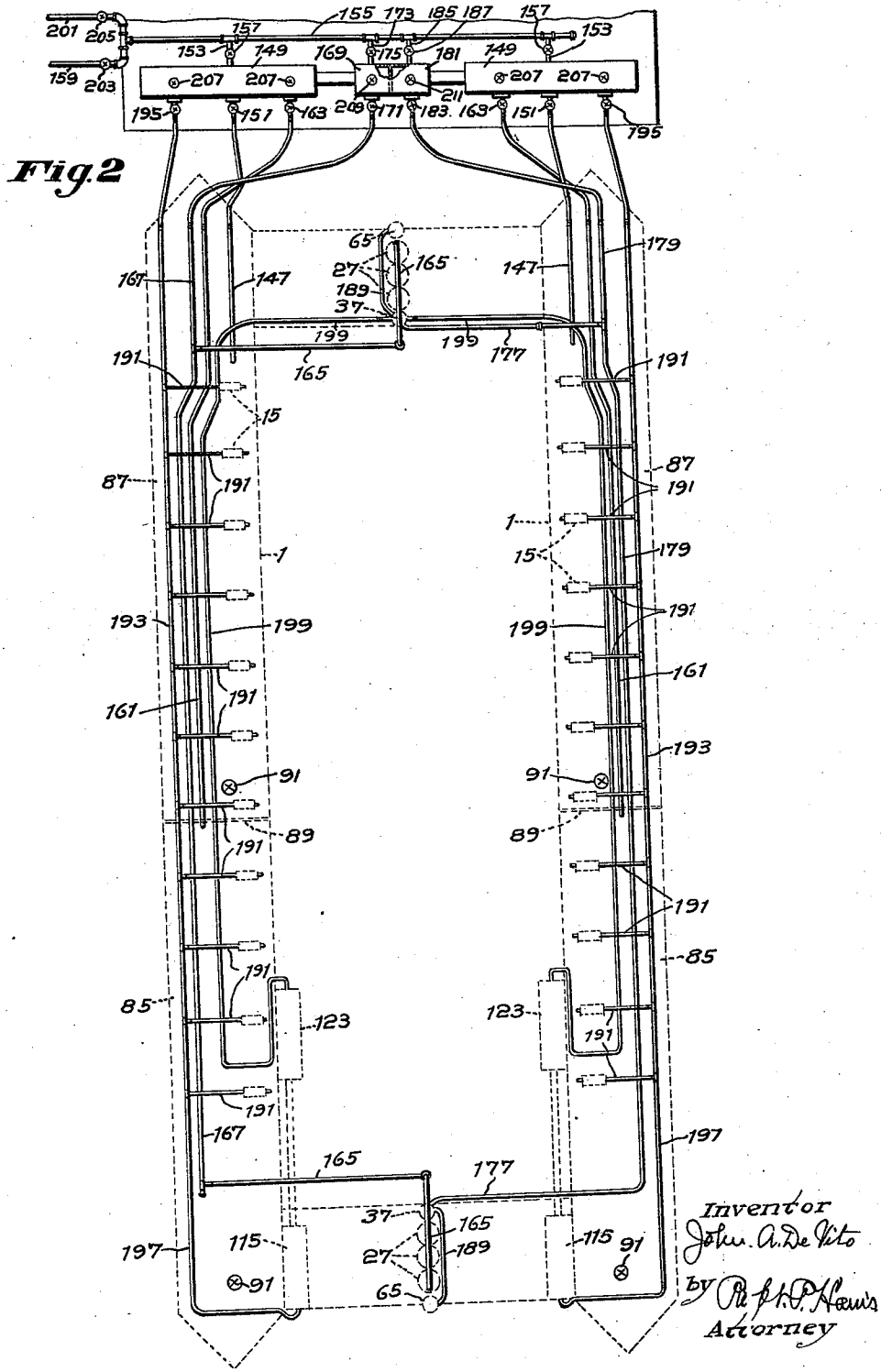
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4 SHEETS—SHEET 2.

Fig. 2




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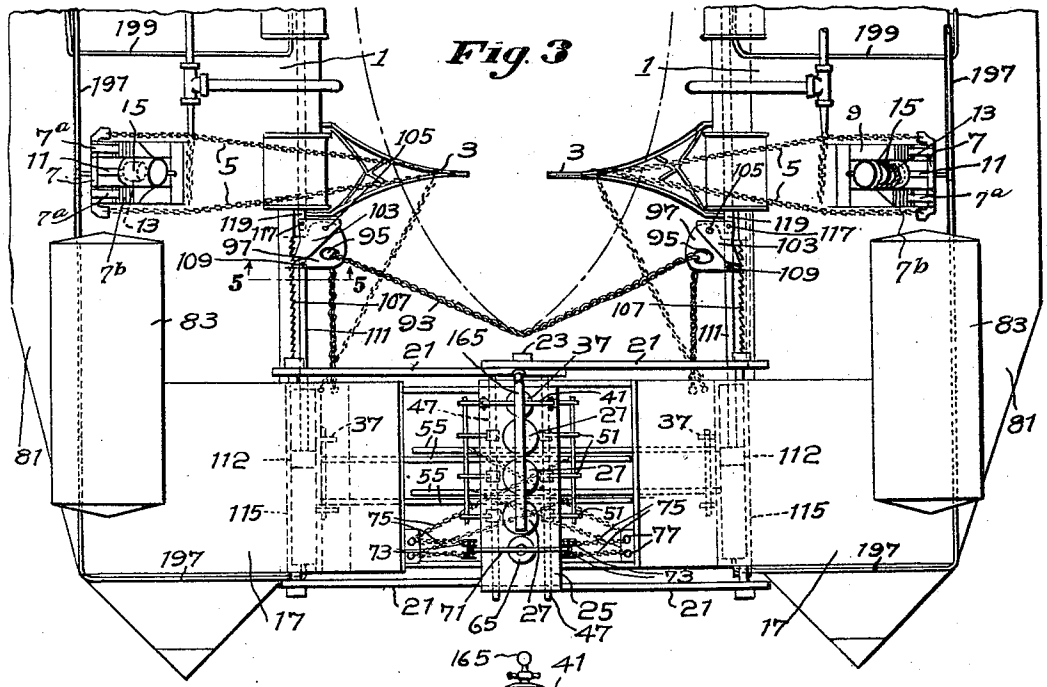
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4 SHEETS—SHEET 3.

Fig. 3



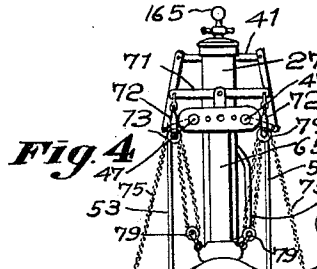
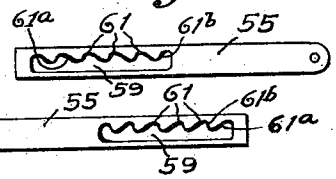
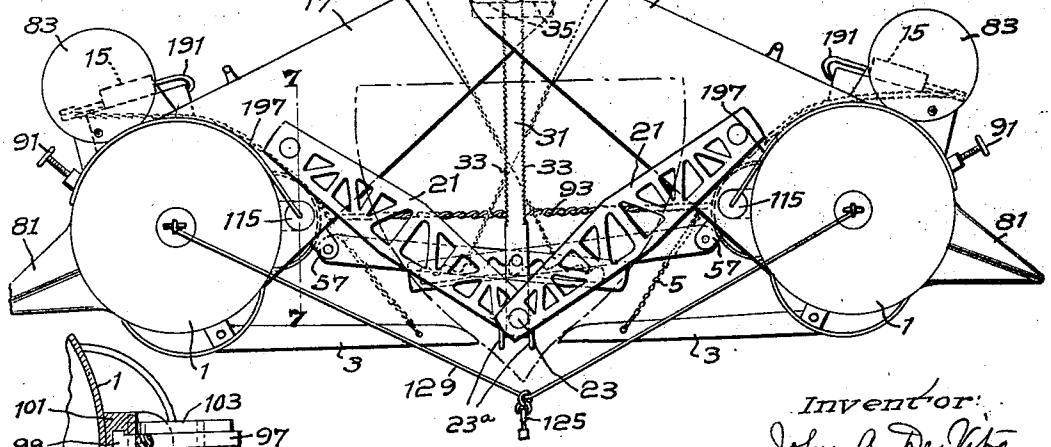


Fig. 4

Fig. 4a





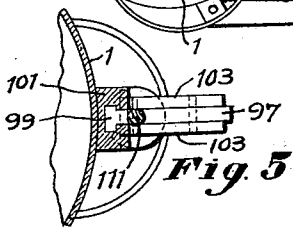


Fig. 5

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4 SHEETS—SHEET 4.

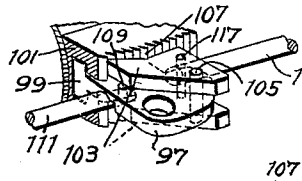



Fig. 6

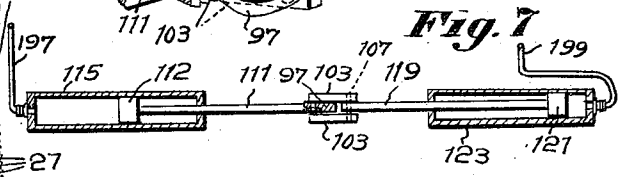



Fig. 7




Fig. 8

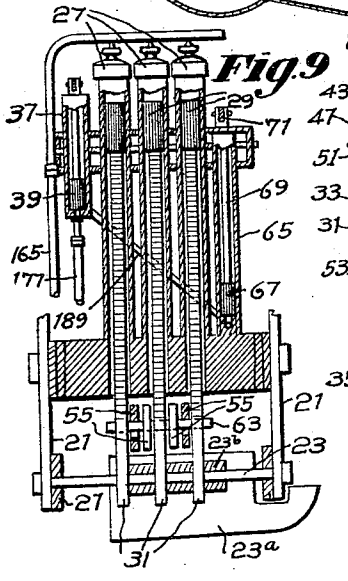



Fig. 9

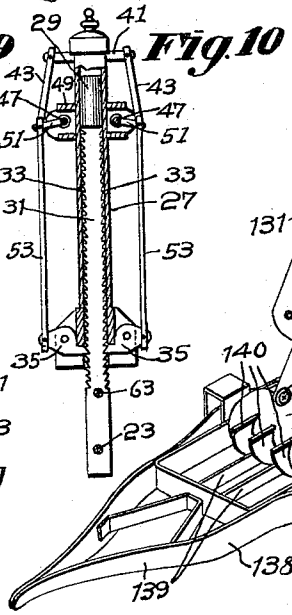



Fig. 10




Fig. 11

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# UNITED STATES PATENT OFFICE.

JOHN A. DE VITO, OF MEDFORD, MASSACHUSETTS.

## APPARATUS FOR RAISING SUNKEN VESSELS.

1,415,532. Specification of Letters Patent. Patented May 9, 1922.

Application filed December 30, 1920. Serial No. 434,122.

*To all whom it may concern:*

Be it known that I, JOHN A. DE VITO, a citizen of the United States, residing at Medford, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Apparatus for Raising Sunken Vessels, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

The invention to be hereinafter described relates to salvaging apparatus for raising sunken vessels of the general type disclosed in my copending application, Serial No. 350,757, filed January 12, 1920.

This apparatus comprises a pair of pontoons connected at their ends and provided with series of jaws or supporting arms distributed along the lengths of the pontoons. The pontoons are movable away from one another to a distance sufficient to enable the apparatus to be lowered downward to the ocean bottom to the opposite sides of the sunken vessel. Then the pontoons are movable toward each other to bring the jaws or supporting arms into position to engage and support the sunken vessel.

The apparatus is preferably moved obliquely toward the sunken vessel, that is, the fore end of the apparatus is first lowered until the fore ends of the pontoons straddle the sunken vessel. A column is provided to guide the fore end of the apparatus toward the sunken vessel, and then the aft end of the apparatus is lowered downward. After the pontoons have been moved toward each other to grasp the sunken vessel, preferably the apparatus together with the sunken vessel is brought to the surface of the water in an oblique path. Preferably the aft end of the apparatus is raised first, and then the fore end of the apparatus is brought upward.

The apparatus is lowered by admitting water into the pontoons, and is raised by driving the water from the pontoons.

One of the purposes of the present invention is to provide improved means for moving the pontoons and the supporting arms toward each other into position to grasp the hull of the sunken vessel.

Devices are provided in the apparatus of said application for locking the pontoons after they have moved toward each other. Another purpose of the present invention is to provide simple and efficient means for controlling the locking devices.

In the apparatus of said application the control of the apparatus is obtained by instrumentalities mounted on pontoons or attending ships located adjacent the fore and aft ends of the apparatus. Another purpose of the present invention is to provide simple and efficient control means whereby the control may be effected largely from a pontoon or attending ship adjacent one end of the apparatus.

Another purpose of the invention is to provide means for so anchoring the lower end of the guide column in the silt or material at the bottom of the ocean, that the column will not shift laterally after being placed adjacent an end of the sunken vessel, and thus the column can be relied upon properly to guide the apparatus toward the sunken vessel.

Since the apparatus preferably is raised obliquely from the bottom of the ocean, there is a tendency for the vessel carried thereby to shift or slide toward the fore end of the apparatus which is preferably raised last. Another purpose of the invention is to provide improved means which may be engaged by the hull of the vessel, and movement of the latter toward the fore end of the apparatus may be limited. As a consequence, the fore end of the apparatus is desirably protected from injury such as might occur if the vessel were allowed to shift into engagement therewith.

With the aforesaid and other purposes in view, the character of the invention will be best understood by reference to the following description of one good form thereof shown in the accompanying drawings, wherein:—

Fig. 1 is a vertical section through the apparatus showing the same at the surface of the water in position in readiness to be lowered to a sunken vessel;

Fig. 2 is a plan showing the arrangement of the control devices mounted on the pontoon or attending ship, and the pipe lead-

ing therefrom co-operating with the instrumentalities of the apparatus controlled thereby;

Fig. 3 is a plan of the fore end portion of the apparatus;

Fig. 4 is an end elevation of the construction shown in Fig. 3;

Fig. 4[a] is a detail of the pontoon lock arms;

Fig. 5 is a sectional detail to be referred to;

Fig. 6 is a perspective view of a detail of the device for controlling the chain for limiting movement of the vessel toward the fore end of the apparatus;

Fig. 7 on an enlarged scale is a vertical section taken on line 7—7 of Fig. 4;

Fig. 8 is a perspective view of a portion of one end of the apparatus, certain parts being shown in section;

Fig. 9 is a vertical section through the control cylinders located at one end of the apparatus;

Fig. 10 is a vertical section through one of the control cylinders shown in Fig. 9, and illustrating the dogs and rack for locking the stem of the piston of the cylinder; and

Fig. 11 on an enlarged scale is a perspective view of the guide column and the anchoring device therefor.

Referring to the drawings, the apparatus shown therein as one good form of the invention, comprises a pair of pontoons 1 of appropriate size to furnish the buoyancy necessary to raise the sunken vessel. Mounted on these pontoons are series of jaws or supporting arms 3. In the present instance, these arms are pivotally connected to the pontoons, and are held by chains 5 or other appropriate flexible connections having their lower ends secured to the arms and their upper ends secured to yokes 7 adapted to slide along chairs 9.

It is desirable that these arms may be adjusted to conform to the contour of the hull of the sunken vessel. To accomplish this, the yokes 7 may be connected to stems 11 of pistons 13 mounted in cylinders 15 supported by the chairs 9 referred to. Fluid for operating these pistons is admitted to the cylinders, as more fully hereinafter described. The construction is such that when the fluid is admitted to these cylinders, the pistons and yokes will be moved upward, thereby drawing the chains 5 and arms 3 upward until further movement of the latter is limited by engagement with the hull of the vessel. As a consequence, the work of supporting the hull is desirably distributed to and borne by the supporting arms. Suitable means may be provided to hold the arms in their positions of adjustment. To accomplish this, the yokes may be provided with lock dogs 7[a] adapted to engage racks 7[b] on the chairs at opposite sides of the cylinders 15.

When the apparatus is at the surface of the water, and is moved down toward the sunken vessel, it is desirable that the pontoons shall be a sufficient distance apart to enable the same to be located at opposite sides of the hull of the sunken vessel. Then it is desirable that the pontoons shall be moved toward each other to bring the arms 3 in supporting relation with respect to the hull of the sunken vessel. To accomplish this, suitable means may be provided enabling the movement of the pontoons toward and from each other. This means, in the present instance, comprises arms 17 having their outer ends rigidly secured to the pontoons, and their inner ends pivotally connected by shafts 19. These arms may be desirably secured to the pontoons at or adjacent to the ends thereof, in order that they may clear the fore and aft ends of the sunken vessel when the apparatus is lowered down over the same.

Suitable means may be provided for moving the pontoons toward each other to bring the arms 3 in position to support the sunken vessel. This means, in the present instance, comprises pairs of links 21 having their outer ends pivotally connected to the arms 17, and their inner ends pivotally connected by a shaft 23. Mounted on each of the shafts 19 referred to, is a block or support 25 on which are mounted a group of cylinders 27 (Figs. 4 and 9), in the present instance, three in number. These cylinders are provided with pistons 29 having rods 31 connected to the link shaft 23.

The construction is such that when fluid is admitted to the cylinders 27 by means to be described, the pistons 29 and their rods 31 are thrust downward, thereby moving the links 21 from straightened to buckled condition. As a consequence, the pontoons are drawn toward each other and toward opposite sides of the hull of the sunken vessel to bring the arms 3 into positions adjacent the hull. Then the supporting arms may be adjusted to conform to the contour of the hull, as already described.

The provision of groups of cylinders for moving the pontoons toward each other is a desirable feature, since smaller cylinders can be employed than if this work were to be accomplished by one cylinder at each end of the apparatus, and more efficient control over the pontoons may be maintained.

It is desirable that after the pontoons have been adjusted toward each other, they shall be held in this position without moving away from and releasing the hull of the sunken vessel. If the fluid pressure is maintained on the pistons of the cylinders 27, it will be impossible for the pistons to move upward, and this will serve as one means

for holding the pistons. However, it is desirable positively to lock the pontoons after they have been moved toward each other, in order that in case the fluid pressure on the pistons should be released for any reason, the pontoons will be prevented from moving away from each other and prevent release of the vessel. To accomplish this, the piston stems 31 referred to, may be provided with racks 33 at opposite edges thereof, and dogs 35 may be pivotally mounted on the blocks 25 and co-operate with these racks. The weight of the dogs and their relation is such with respect to the pivotal points of the dogs that the latter will automatically move into locking relation with the racks, in case the latter tend to move upward.

It is desirable to provide means for releasing the dogs from the racks to permit the pontoons to move away from each other after the apparatus has been raised to the surface of the water. To accomplish this, a cylinder 37 (Figs. 8 and 9) may be provided at each end of the apparatus, and may be conveniently mounted on the block 25 adjacent the cylinders 27. This cylinder contains a piston 39 connected by a stem 40 to a cross head 41, having its opposite ends connected by links 43 with arms 45 (Figs. 8 and 10) on rock shafts 47 journalled in bearings in a support 49 conveniently mounted on and secured to the cylinders 27. Fast on the rock shafts are arms 51 connected by links 53 with the dogs 35.

The construction is such that when pressure is admitted to the cylinders 37 by means to be described, the pistons 39, their stems 40 and the cross heads 41 will be moved upward, thereby operating through the links 43 and arms 45 to rock the shafts 47 and through the arms 51 and links 53 withdraw the dogs from engagement with the racks.

In some instances it may be desirable to provide further means for locking the pontoons after they have been adjusted toward each other. For example, in rough weather there may be a tendency to move the pontoons or the connections to the dogs so as to release the dogs. The locking means about to be described will prevent such occurrence. This means, in the present instance, comprises groups of locking arms 55 located at opposite ends of the apparatus, and having their outer ends pivotally connected to brackets 57 on the pontoons. These locking arms are provided with elongated slots 59 having a series of notches 61 in the upper edges thereof adapted for locking engagement with shafts 63 (Fig. 9) extending through the piston stems 31.

The notched edges 61 of the lock arms have portions $61^a$ of a pitch sufficient to allow the notches to slide over the shaft 63 when the pontoons are moved toward each other, and said notched edges have portions $61^b$ of steeper pitch to engage the shafts 63 and lock the pontoons against outward movement from each other.

Suitable means may be provided for rocking the lock arms upward to release their lock notches from the shafts 63 when it is desired that the pontoons shall move outward away from each other. This means, in the present instance, comprises a cylinder 65 provided at each end of the apparatus, and may be conveniently mounted on the supporting block 25 adjacent the cylinders 27. Mounted in the cylinder 65 is a piston 67 connected by a stem 69 with a cross head 71 having carriers 72 for pulleys 73. Chains 75 or other suitable flexible members may have ends connected to certain of the lock arms 55, and may be extended upward through guide eyes 77 mounted on the arms 17 (see Figs. 3 and 4). The chains may be extended thence over the pulleys 73 and down around pulleys 79 secured to the lower end of the cylinder 65. The chains may be extended thence upward over other pulleys, down through other guide eyes, and their opposite ends may be secured to other lock arms.

The construction is such that the lock arms will tend to gravitate downward and bring their lock notches into locking engagement with the shafts 63. When fluid pressure is admitted to the cylinders 65 by means to be described, the lock arms will be pulled upward, thereby bringing the lock notches thereof up out of engagement with the shafts 63 so as to permit the arms to slide relatively to said shafts. When the pressure in said cylinders is released, the lock arms will rock downward and cause certain of the notches thereof to engage the shafts 63 and securely lock the pontoons against movement away from each other.

To strengthen or stiffen the pontoons and prevent them from arching out under the load of the sunken vessel, they may be provided with longitudinal ribs or projections 81 (Fig. 4), in the present instance, wedge-shaped in section and projecting outwardly from the pontoons.

To contribute to the lateral stability of the apparatus, cylinders 83 may be provided on the pontoons, preferably adjacent the fore end of the apparatus. These cylinders may be filled with air and maintained in closed condition, so that they not only serve to contribute to the lateral stability of the apparatus, but also may assist raising of the fore end of the apparatus up from the bottom of the ocean. Since the fore end of the apparatus is moved down before the aft end and up after the aft end, it may be more difficult to raise the fore end than the aft end. These cylinders desirably facilitate raising of the fore end of the apparatus.

To sink the apparatus, water is admitted

into the pontoons, and to raise the apparatus, compressed air is forced into the pontoons to drive the water therefrom. To enable the lowering and raising of the apparatus in oblique position and facilitate control thereof, the apparatus may be divided into fore compartments 85 (Fig. 2) and aft compartments 87 separated by partition walls 89. Valves 91 may be provided for controlling the entranec of water into the compartments through the lower walls of the pontoons, and the discharge of water therefrom. Since these valves may be similar to the valve for a similar purpose shown in Fig. 8 of my copending application above referred to, it is unnecessary to show and describe the same in detail herein. The air for forcing the water from the compartments is admitted thereto by means to be described.

As stated, after the apparatus has been moved downward into position to take the sunken vessel, it is preferably moved upward while maintained in oblique position, and since the aft end is raised first, there would be a tendency for the vessel carried by the apparatus to shift toward the fore end thereof. Therefore, it is desirable to provide means for limiting such movement of the vessel, in order that it may not jam against and injure parts adjacent the fore end of the apparatus. This limiting means, in the present instance, comprises a chain 93 (Figs. 3 and 4) or other suitable flexible member bridging the space between the pontoons and having ends secured to the arms 17. The chain intermediate its ends is extended through and guided by eyes 95 on slides 97 (Figs. 3 and 6) having T-shaped edges 99 adapted to slide in guides 101 secured to the pontoons. Pairs of dogs 103 are pivotally connected to the slides 97 by pins 105, and said dogs are adapted to cooperate with pairs of racks 107 on the inner faces of the guides 101.

To move the slides toward the aft end of the apparatus, they may have pins 109 pivotally connected to stems 111 of pistons 112 working in cylinders 115 mounted on the pontoons.

To move the slides toward the fore end of the apparatus, the dogs may have pins 117 pivotally connected to stems 119 of pistons 121 working in cylinders 123. Fluid may be admitted to these cylinders by means to be described.

When the pistons 112 are moved in an aft direction, the slides 97 will be moved in an aft direction and take up on the cross chain 93 and tighten the same against one end of the vessel. The pull on the chain rocks the slides slightly about the pins 109 in a clockwise direction (Figs. 3 and 6), thereby operating through the dog pins 105 to rock the dogs 103 on the pins 117 toward the racks. The slides have sufficient play in their guides to allow the slight rocking movement of the slides described. When the chain has been sufficiently tightened, the dogs will interlock with the rack and prevent relaxing of the chain, and thereby limit the movement of the vessel toward the fore end of the apparatus. As a consequence, the vessel cannot jam against and injure parts adjacent the fore end of the apparatus.

When it is desired to relax the chain, fluid is admitted into the cylinders 123 to move the pistons 121 toward the fore end of the apparatus. The rods 119 operating through the pins 117 rock the dogs about the pins 105 in a contra-clockwise direction, thereby moving the same, so as to relax the cross chain.

To prevent the cross chain 93 when slack from interference with parts at the fore end of the apparatus, shields $23^a$ (Figs. 4 and 9) may be provided secured to sleeves $23^b$ on the shaft 23 and located between the piston rods 31.

As stated, means is provided for guiding the fore end of the apparatus toward the sunken vessel. This means, in the present instance, comprises a column 122 provided with a guideway $122^a$ receiving a slide 125 having an eye 127 adapted to be connected to the fore ends of the pontoons by a cross cable 129. This column may have a pair of cylinders or compartments 131 adjacent the lower end thereof, and adapted to have air confined therein to contribute to the lateral stability of the column.

The upper end of the column may be supported by a scow 133 or a ship attending the apparatus. The column may have a valve 135 adjacent the lower end thereof which may be opened to cause the lower end of the column to sink to the bottom of the ocean, and air may be forced into the column through a pipe 137 to drive the water from the column to enable elevation thereof to the surface of the water as required.

The water control valve and the means for forcing air thereinto may be similar to the means for these purposes shown in my copending application referred to, and therefore, it is unnecessary to show and describe the same in detail herein.

The lower end of the column should be lowered to a point adjacent one end of the sunken vessel, and it is desirable that it should be anchored in position, and not shift laterally away from this position. To accomplish this, the lower end of the column may have an anchor 138 which may be desirably formed so as to have a series of vertical ribs 139 which may sink into the silt or material at the bottom of the ocean, and thereby prevent lateral movement of the anchor. The lower end of the column may also be provided with kedge anchors 140, further to contribute to the secure anchorage

of the lower end of the column. Preferably this anchor is fulcrumed on a shaft 141 carried by the lower end of the column, and a heel 143 is provided projecting beyond said shaft, and having a buffer 145 for engagement with the lower end of the column to limit the downward rocking movement of the anchor.

The construction is such that when the column is lowered, the buffer 145 will engage the column, and the anchor will point downward in the general direction of the length of the column. When the point of the anchor engages the bottom of the ocean, the column will continue to rock downward until the anchor rests in a substantially horizontal position on the bottom of the ocean, as shown in Fig. 1. The anchor will sink into the soil, and its size and construction is such that it will securely hold the lower end of the column in the position in which it is placed.

When the apparatus is moved downward, the slide 125 connected to the bow will slide along the guide 123 of the column and guide the bow end of the apparatus to the sunken vessel, and cause the pontoons to straddle the vessel.

It will be noted that the guide 123 for the slide terminates short of the end of the column. As a consequence, after it has served the purpose of guiding the fore end of the apparatus to the sunken vessel, the slide may escape from the guide and not interfere with the raising of the apparatus and the sunken vessel to the surface of the water.

In my copending application, the apparatus is controlled from attending vessels at opposite ends of the apparatus. As stated, another purpose of the present invention is to provide means whereby the control may be obtained principally from an attending vessel at one end of the apparatus.

To admit air to the aft compartments of the pontoons, pipes 147 (Fig. 2) may be provided having ends communicating with the aft compartments, and ends communicating with control boxes 149 mounted on the attending vessel, said pipes being provided with valves 151. To admit fluid to these boxes, branch pipes 153 are provided communicating with said boxes and with a main pipe 155, said branch pipes being provided with valves 157. Compressed air may be supplied to the main pipe 155 from an air compressor connected by a pipe 159 with the main pipe 155. This air compressor is carried by the attending vessel, and since any suitable well known form of air compressor may be provided for the purpose, it is unnecessary to show the same herein.

To admit fluid to the fore compartments 85, pipes 161 may be provided having ends communicating with the fore compartments, and ends communicating with the control boxes 149, said pipes being provided with valves 163.

To admit fluid to the cylinders 27 for moving the pontoons toward each other, branch pipes 165 may be provided communicating with said cylinders, and communicating with a pipe 167 leading to a control box 169, said pipe 167 being provided with a control valve 171. Fluid may be supplied to the control box 169 from the main pipe 155 through a branch pipe 173 provided with a valve 175. Thus, the groups of cylinders 27 at both ends of the apparatus are controlled from the control box 169 at one end of the apparatus.

To control the cylinders 37 for releasing the dogs which co-operate with the piston racks, said cylinders are connected by branch pipes 177 with a main pipe 179 leading to a control box 181, said pipe 179 being provided with a valve 183. Fluid may be supplied from the main pipe 155 to the box 181 through a branch pipe 185 provided with a valve 187.

The construction is such that the cylinders for effecting the release of the rack dogs may be controlled from a control box at one end of the apparatus.

To supply fluid to the cylinders 65 for releasing the lock arms 55, branch pipes 189 may be provided leading from the lower ends of the cylinders 37 to the lower ends of the cylinders 65. Thus, when fluid is admitted to the cylinders 37 to release the dogs 35 from the piston racks 33, fluid will also be admitted to the cylinders 65 to release the lock arms 55 from the shafts 63.

To admit fluid to the cylinders 15 for moving the supporting arms 3 into positions to conform to the contour of the hull of the vessel, branch pipes 191 may lead from the cylinders 15 to pipes 193 extending longitudinally of the pontoons and communicating with the control boxes 149, said pipes 193 being provided with valves 195.

To admit fluid to the cylinders 115 for moving the slides 97 in an aft direction to tighten the cross chain 93, the pipes 193 may have extensions 197 communicating with the fore ends of said cylinders 115.

Thus, when the fluid is admitted to the cylinders for rocking the supporting arms inward to conform to the contour of the hull of the vessel, fluid will be admitted into the cylinders for moving the slides 197 in an aft direction to tighten the cross chain 93 into engagement with an end of the vessel, so as to prevent the latter from jamming into and injuring parts at the fore end of the apparatus.

To admit fluid to the cylinders 123 for shifting the slides 97 in a fore direction to relax the cross chain 93, pipes 199 may be provided leading from the lower end of the

cylinder 37 located at the aft end of the apparatus for controlling the release of the dogs 35 from the piston racks 33.

The construction is such that fluid will be admitted to the cylinders 37 for releasing the dogs 35 from the piston racks 33, and will pass thence to the cylinders 65 for releasing the lock arms 55, and pass to the cylinders 123 for releasing the dogs 103 from the racks 107, thereby to allow slackening of the cross chain 93.

The fluid operated instrumentalities of the apparatus may be controlled by compressed air or by hydraulic pressure, with the exception of the raising and submerging of the apparatus which must be pneumatically controlled. It is desirable to control the other instrumentalities by hydraulic pressure, since it is more positive and efficient than pneumatic pressure.

To enable the control to be effected by hydraulic pressure, a pipe 201 may be provided leading from a suitable hydraulic apparatus to the main pipe 155. Since this hydraulic apparatus may be of any suitable well known construction, it is unnecessary to show and describe the same herein. The pipe 159 leading from the air compressor, and the pipe 201 leading from the hydraulic apparatus may be provided with valves 203 and 205 respectively, so that the control may be effected pneumatically or hydraulically at will.

The control boxes 149 may be provided with vent valves 207, and the control boxes 169 and 181 may be provided with vent valves 209 and 211 respectively.

In operation, when it is desired to submerge the apparatus, the valves 163 in the pipes 161 leading to the fore compartments 85 are opened, the valves 157 leading to the control boxes 149 are closed, and the vent valves 207 are opened. This will allow air to escape from the fore compartments and allow water to enter the same, thereby causing the fore end of the apparatus to move downward.

Then the valves 151 in the pipes 147 leading to the aft compartments are opened, thereby allowing the air to escape from and water to enter said compartments and cause the same to lower. By manipulation of the valves 151 and 163, the inclination of the apparatus and the lowering thereof may be controlled as desired.

After the apparatus has been lowered to bring the pontoons at opposite sides of the hull of the sunken vessel, the pontoons should be moved toward one another and toward the hull of the sunken vessel. To accomplish this, the valve 171 is opened in the pipe 167 leading to the branch pipes 165 leading in turn to the cylinders 27. The vent valve 209 is closed, and the valve 175 is opened in the branch pipe 173 leading to the control boxes 169. The valve 203 in the pipe 159 leading from the air compressor is closed, and the valve 205 in the pipe 201 leading from the hydraulic apparatus is opened. This will admit hydraulic pressure to the main pipe 155, branch pipe 173, control box 169, and thence through the pipes 167 and 165 to the cylinders 27. This will cause the pistons in said cylinders to move downward and buckle the toggle links 21, and thereby move the pontoons toward each other and toward the hull of the vessel. Thereupon, the dogs 35 will automatically lock the piston racks 33 and prevent movement of the pontoons away from each other.

The notches 61 of the lock arms 55 have inclined portions $61^a$ of less pitch than the inclined portions $61^b$, the construction being such that the notched edges of the lock arms will slide over the shafts 63 when the pontoons are moved toward each other, but the notched edges will automatically prevent movement of the pontoons away from each other by the engagement of their steep pitched portions $61^b$ with the shafts 63.

Thus, the hydraulic pressure standing in the cylinders 37, the dogs 35 co-operating with the piston racks 33, and the lock arms 55 co-operating with the shafts 63 will reliably prevent movement of the pontoons away from each other, and prevent release of the vessel.

As the pontoons are moved toward each other, the supporting arms 3 will be moved toward each other. Then it is desirable that these arms shall be adjusted into conformity with the contour of the hull of the vessel. To accomplish this, the valves 195 are opened in the pipes 193, thereby admitting hydraulic pressure from the control boxes 149 through the pipes 193 and the branch pipes 191 to the cylinders 15. The latter will slide the yokes 7 upward, and through the chains connecting the same with the supporting arms 3 will move the latter inward into conformity with the contour of the hull of the vessel. Reverse movement of the supporting arms will be prevented automatically by the engagement of the yoke dogs with the racks on the chairs 9.

At the same time that fluid is admitted to the arm controlling cylinders 15, fluid is admitted through the pipes 197 to the cylinders 115, thereby adjusting the slides 97 toward the aft end of the apparatus and tightening the cross chain 93 into engagement with the hull of the vessel.

Now the apparatus has taken hold of the sunken vessel and is in condition to be raised to the surface of the water. To accomplish this, the valve 205 in the pipe 201 leading from the hydraulic apparatus is closed, the valve 203 in the pipe 159 leading from the air compressor is opened, and the valves 151 in the pipes 147 leading to the aft

compartments are opened, thereby admitting compressed air to these compartments and forcing the water therefrom. As a consequence, the aft end of the apparatus will rise.

Then the valves 163 in the pipes 161 leading to the fore compartments are opened, thereby admitting compressed air into these compartments and forcing the water therefrom. Thereupon, the fore end of the apparatus will rise. After the water has been driven from the fore and aft compartments, the valves 151 and 163 are closed so as to hold the air therein.

Then such repairs as may be necessary may be made on the vessel, and it may be floated from the apparatus by lowering one end of the apparatus from the vessel so as to allow the latter to pass out over the same.

When it is desired to allow the pontoons to move away from each other, the valves 183 and 187 may be opened, thereby admitting hydraulic pressure through the pipe 179 and the branch pipes 171 to the cylinders 37. This will cause the pistons in said cylinders to move upward and through the connections described rock the dogs 35 out of engagement with the piston stem racks 33.

Fluid pressure will pass from the cylinders 37 through the pipes 189 to the cylinders 65, and thereby draw the chains upward for raising the lock arms so as to release their notched edges from the shafts 63, and allow the arms to slide outward relatively to said shafts.

Fluid will also pass from the cylinder 37 at the aft end of the apparatus through the pipes 199 to the cylinders 123 and release the dogs 103 from the racks 107. This will allow slackening of the cross chain 95.

Then the apparatus is in readiness to be submerged again.

It will be understood that the invention is not limited to the specific embodiment shown, and that various deviations may be made therefrom without departing from the spirit and scope of the appended claims.

What is claimed is:—

1. An apparatus for raising sunken vessels, comprising, in combination, pontoons having series of supporting arms projecting therefrom, means connecting the ends of said pontoons having provision permitting movement of the pontoons toward or away from each other, a group of cylinders at each end of the pontoons having pistons and rods for relatively moving the pontoons, means to supply fluid to said cylinders to operate said pistons, racks for said rods, lock dogs co-operating with said racks, cylinders having pistons therein, and connections including links and levers between said dogs and last-named pistons for releasing the dogs from the racks.

2. An apparatus for raising sunken vessels, comprising, in combination, pontoons having series of supporting arms projecting therefrom, means connecting the ends of the pontoons having provision permitting movement of the pontoons toward or from each other, means including fore and aft cylinders having pistons and rods for relatively moving the pontoons, racks for said rods, dogs co-operating with said racks, cylinders having pistons therein, connections between said pistons and dogs for releasing the same, locking members for preventing movement of the pontoons away from each other, cylinders having pistons therein, and connections between the pistons and locking members to release the latter.

3. An apparatus for raising sunken vessels, comprising, in combination, connected pontoons movable as a unit to positions at opposite sides of the hull of a sunken vessel, a flexible cross member extending from one relatively movable pontoon to the other for limiting movement of a sunken vessel toward one end of the apparatus, and means for tightening or relaxing said cross member.

4. An apparatus for raising sunken vessels, comprising, in combination, connected pontoons movable as a unit to positions at opposite sides of the hull of a sunken vessel, a flexible cross member connected to the relatively movable pontoons and arranged to limit movement of a sunken vessel toward one end of the apparatus, means for tightening said cross member upon positioning the pontoons at opposite sides of the hull, and means controllable from the surface of the water above the apparatus for operating the tightening means.

5. An apparatus for raising sunken vessels, comprising, in combination, connected pontoons movable as a unit to positions at opposite sides of the hull of a sunken vessel, a flexible cross member arranged to limit movement of a sunken vessel toward one end of the apparatus, means for tightening said cross member upon positioning the pontoons at opposite sides of the hull, means controlled from the surface of the water above the apparatus for operating the tightening means, and means automatically to secure the cross member in tightened condition.

6. An apparatus for raising sunken vessels, comprising, in combination, pontoons having series of supporting arms projecting therefrom to engage the hull of a sunken vessel, a flexible member for limiting movement of a vessel toward one end of the apparatus, slides co-operating with said member, fluid pressure means for moving said slides to shorten the effective length of said member, racks adjacent said slides, and dogs on said slides co-operating with said racks to hold the slides in their positions of adjustment.

7. An apparatus for raising sunken vessels, comprising, in combination, connected pontoons movable as a unit to positions at opposite sides of the hull of a sunken vessel, means to adjust said pontoons toward or from each other, a flexible member for limiting movement of a vessel toward one end of the apparatus, slides for taking up slack in said member, means to operate said slides, and means to lock said slides.

8. An apparatus for raising sunken vessels, comprising, in combination, pontoons, means for moving said pontoons toward or from each other, a flexible cross member for limiting movement of a vessel toward one end of the apparatus, slides for taking up slack in the cross member, guides for the slides, fluid pressure means for moving the slides along their guides to take up slack in the flexible member, and fluid pressure means for moving the slides to relax the same.

9. An apparatus for raising sunken vessels, comprising, in combination, pontoons, means to move said pontoons toward or away from each other, a flexible member for limiting movement of a vessel toward one end of the apparatus, slides for taking up slack in said member, guides for said slides, racks, dogs on said slides for engagement with said racks, means to move said slides to take up slack in said flexible member and rock the dogs into engagement with the racks, and means to rock the dogs out of engagement with the racks and relax the flexible member.

10. An apparatus for raising sunken vessels, comprising, in combination, pontoons, means for moving said pontoons towards or from each other, a flexible member for limiting movement of a vessel toward one end of the apparatus, slides for taking up slack in said member, guides for said slides mounted on the pontoons, racks, dogs pivotally mounted on the slides for engagement with said racks, rods pivotally connected to said slides, pistons on said rods, and cylinders for said pistons adapted to be subjected to fluid pressure for moving the slides to take up slack in the flexible member and urge the dogs toward their racks.

11. An apparatus for raising sunken vessels, comprising, in combination, pontoons, means for moving said pontoons towards or from each other, a flexible member for limiting movement of a vessel toward one end of the apparatus, slides for taking up slack in said member, guides for said slides mounted on the pontoons, racks, dogs pivotally mounted on the slides for engagement with said racks, rods pivotally connected to said slides, pistons on said rods, cylinders for said pistons adapted to be subjected to fluid pressure for moving the slides to take up slack in the flexible member and urge the dogs toward their racks, rods pivotally connected to said dogs, pistons on said rods, and cylinders for said pistons adapted to be subjected to fluid pressure for moving the dogs away from the racks and relaxing the flexible member.

12. An apparatus for raising sunken vessels, comprising, in combination, pontoons, means to move said pontoons toward or away from each other, supporting arms projecting from said pontoons, means to adjust said supporting arms into positions to conform with the contour of the hull of a vessel, and fluid pressure operated means for controlling the movement of the pontoons toward or from each other, and for controlling movements of the arms in conformity with the contour of the hull of the vessel, and means to operate all of said control means from one end of the apparatus.

13. An apparatus for raising sunken vessels, comprising, in combination, pontoons, means at the ends of the pontoons to adjust said pontoons toward or from each other, means at the ends of the pontoons to lock said pontoons after they have been moved toward each other, fluid pressure means controlled at one end of the apparatus for operating each means for moving the pontoons, and fluid pressure means controlled at one end of the apparatus for releasing the means for locking the same after they have been moved toward each other.

14. An apparatus for raising sunken vessels, comprising, in combination, pontoons, arms projecting inward from said pontoons and having their ends pivotally connected, links having their outer ends pivotally connected to said arms and their inner ends pivotally connected, cylinders having pistons and rods for buckling said links to move the pontoons toward each other, racks for said rods, dogs for engagement with said racks, cylinders having pistons and connections for releasing said dogs, and fluid pressure controlled from one end of the apparatus for admitting fluid to all the cylinders for moving the pontoons toward each other, and to all the cylinders for releasing the dogs from the racks.

15. An apparatus for raising sunken vessels, comprising, in combination, pontoons having arms projecting inward therefrom with their inner ends pivotally connected, links connected to said arms and having their inner ends pivotally connected, means including cylinders having pistons for buckling said links to move the pontoons toward each other, racks and dogs for locking the pontoons after they have been moved toward each other, means including cylinders and pistons for releasing the dogs from the racks, supporting arms projecting from the pontoons, means including cylinders and pistons for moving the supporting arms into positions to conform to the contour of the hull of a vessel, and fluid pressure operating

means for admitting fluid to all of said cylinders under control from one end of the apparatus.

16, An apparatus for raising sunken vessels, comprising, in combination, pontoons, means connecting said pontoons having provision permitting movement of said pontoons toward or from each other, a column, a slide for connection with one end of the apparatus and having sliding engagement with the column to guide the apparatus toward the bottom of the ocean, and an anchor swingingly connected to the lower end of the column having provision to prevent lateral shifting of the column on the ocean bottom.

17. An apparatus for raising sunken vessels, comprising, in combination, pontoons, means connecting said pontoons that they may move downward as a unit toward a sunken vessel, a guide column, an anchor pivotally connected to the lower end of the column and having provision to prevent lateral shifting of the lower end of the column, a guideway on the column, and a slide connected to one end of the apparatus adapted to move along said guideway to direct the apparatus toward the sunken vessel.

18. An apparatus for raising sunken vessels, comprising, in combination, pontoons, means connecting said pontoons that they may submerge as a unit toward a sunken vessel, a guide column, an anchor pivoted to the lower end of the column and having means to limit rocking movement of the anchor with respect to the column, a guideway on the column, and a slide connected to the apparatus adapted to move along the guideway to direct the apparatus toward the sunken vessel.

19. An apparatus for raising sunken vessels, comprising, in combination, pontoons, means connecting said pontoons that they may submerge as a unit toward a sunken vessel, a hull guide column adapted to receive water to cause the lower end of the column to move toward the bottom of the ocean, compartments adjacent the lower end of the column for balancing the column laterally, an anchor at the lower end of the column to prevent lateral shifting thereof, a guideway extending along the column, and a slide connected to one side of the apparatus adapted to move along the guide way to direct the apparatus toward the sunken vessel.

20. An apparatus for raising sunken vessels, comprising, in combination, pontoons, means connecting the same that they may submerge as a unit toward a sunken vessel, means to adjust said pontoons toward or from each other, supporting arms projecting inward from said pontoons for engagement with the hull of a vessel, and stiffening members projecting outward from a lateral wall of each pontoon and extending along the length thereof to strengthen the pontoons.

21. An apparatus for raising sunken vessels, comprising, in combination, connected pontoons movable as a unit to positions at opposite sides of the hull of a sunken vessel, means for moving the pontoons toward each other, a flexible cross member extending from one pontoon to the other for limiting movement of a sunken vessel toward one end of the apparatus, and means for advancing said cross member toward an end of the sunken vessel as the pontoons move toward each other.

22. An apparatus for raising sunken vessels, comprising, in combination, connected pontoons movable as a unit to positions at opposite sides of the hull of a sunken vessel, a column for guiding the pontoons downwardly toward the sunken vessel, a sliding connection between the column and pontoons, and an anchor connected to the lower end of the column and having an extended skeleton frame for sinking into the material at the bottom of the sea.

23. An apparatus for raising sunken vessels, comprising, in combination, connected pontoons movable as a unit to positions at opposite sides of the hull of a sunken vessel, a column for guiding the pontoons downwardly toward the sunken vessel, a sliding connection between the column on pontoons, and an anchor connected to the lower end of the column and having a relatively flat frame provided with ribs adapted to sink into the material at the bottom of the sea.

24. An apparatus for raising sunken vessels, comprising, in combination, connected pontoons movable as a unit to positions at opposite sides of the hull of a sunken vessel, fluid operated means for moving the pontoons toward each other, arms pivoted to the pontoons, fluid operated means for moving the arm into engagement with the hull of the vessel, means for delivering air to the interior of the pontoons, control boxes communicating with said fluid operated means and air means, and valve means for admitting either air or liquid to the control boxes.

In testimony whereof, I have signed my name to this specification.

JOHN A. DE VITO.