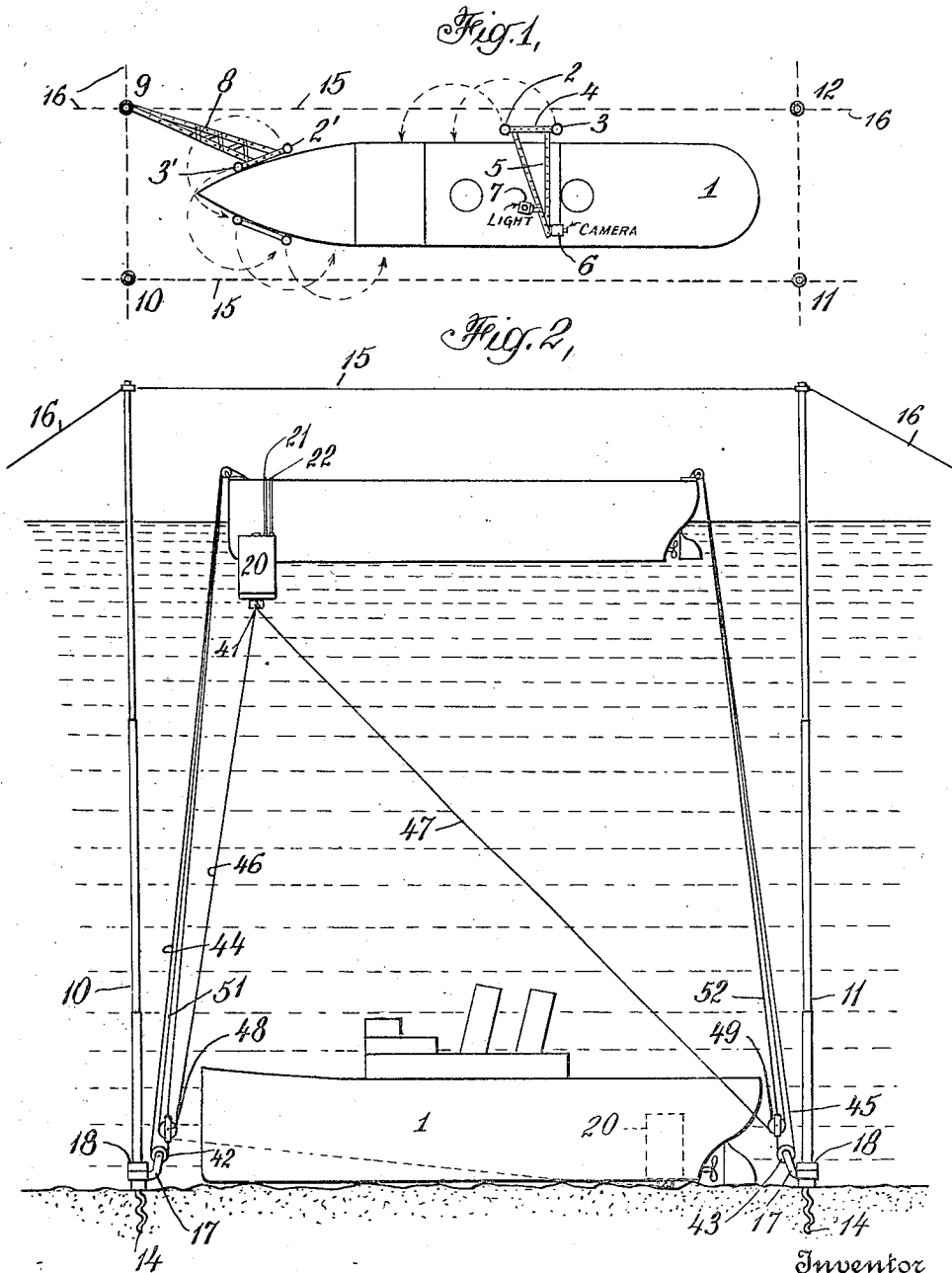


A. ALLAN.  
METHOD OF AND APPARATUS FOR RAISING SUNKEN SHIPS.  
APPLICATION FILED FEB. 7, 1921.

1,421,887.

Patented July 4, 1922.  
2 SHEETS—SHEET 1.



Inventor  
Alexander Allan  
By his Attorneys  
Pennie, Davis, Marwin & Edmund

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Fig. 3,

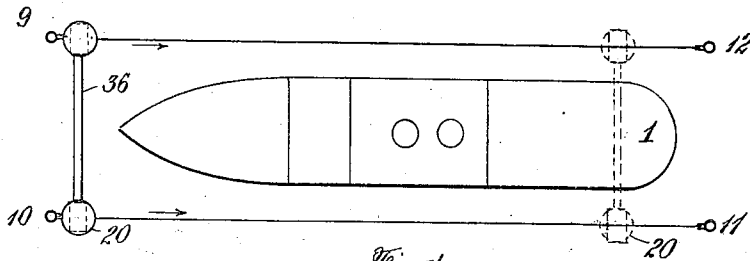


Fig. 4,

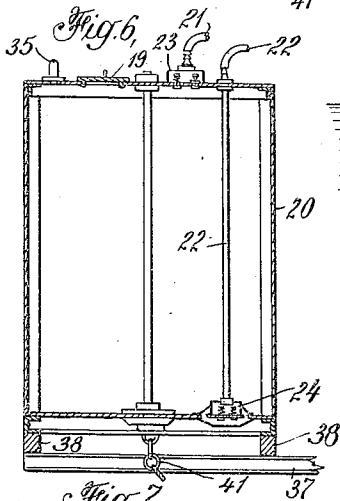
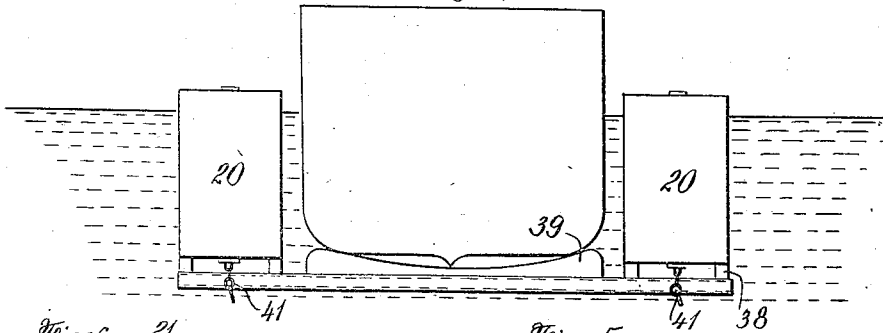


Fig. 5,

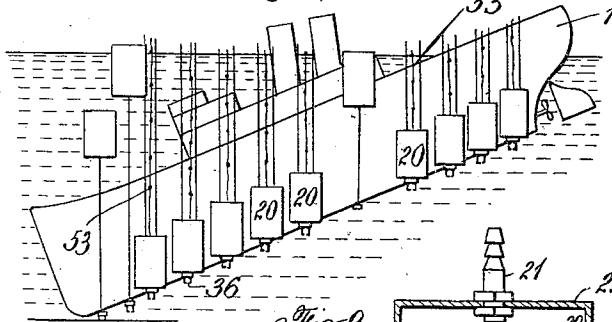


Fig. 9,

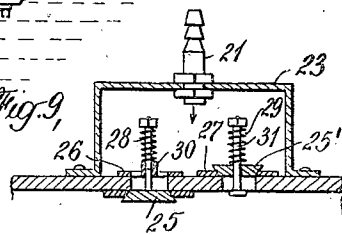


Fig. 7,

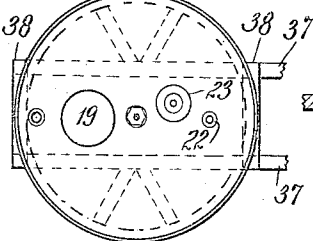
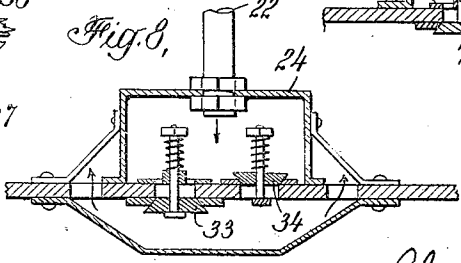


Fig. 8,



Inventor

Alexander Allan

By his Attorneys

Pennie, Davis, Marwin & Edmunds

# UNITED STATES PATENT OFFICE.

ALEXANDER ALLAN, OF MIDDLETOWN, RHODE ISLAND.

METHOD OF AND APPARATUS FOR RAISING SUNKEN SHIPS.

1,421,887.

Specification of Letters Patent.

Patented July 4, 1922.

Application filed February 7, 1921. Serial No. 443,192.

*To all whom it may concern:*

Be it known that I, ALEXANDER ALLAN, a citizen of the United States, residing at Middletown, in the county of Newport, State of Rhode Island, have invented certain new and useful Improvements in Methods of and Apparatus for Raising Sunken Ships; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to salvaging, and particularly to the salvaging of sunken vessels.

Where a vessel has sunk in shallow water divers can accurately determine its position, can locate and remove its cargo and sometimes, if necessary, direct cutting operations for gaining access to the interior of the hull (although this last is almost always difficult). If the cargo is too bulky or heavy for their strength they can make it fast to hoisting means; when the vessel itself is to be raised they can direct the operations of making connections with submerged pontoons, or in other ways guide the movements of those working on the surface. On the other hand, where the wreck lies in more than about 100 feet of water, it is usually impossible for divers to descend and it has therefore been necessary to abandon any attempt to recover either vessel or cargo. Under these circumstances it becomes highly desirable to develop a system by means of which the need for divers can be dispensed with and all operations necessary in locating, securing and raising either ship or cargo directed from the surface of the water.

It is an object of the invention claimed in copending application, Serial No. 443,191 filed on even date herewith to devise ways and means all operable from the surface and, if necessary, without the aid of divers, first, for accurately locating the sunken vessel and, second, for establishing operative connection with it by means of which either the cargo may be salvaged or the vessel raised. It is a further and more specific object of that invention to perfect the method and apparatus for salvaging the cargo.

It is an object of the present invention to devise ways and means for raising a sunken vessel to the surface of the water after it

has been accurately located by any satisfactory means.

This object may, according to the present invention, be attained as follows:

The wreck is first approximately located by any available means, such as by dragging the bottom in the locality where she is known to lie. This done, a pair of vertical, hollow steel tubes, designed to have a slight buoyancy and remain upright of their own accord, and spaced apart a fixed distance by means of spacer eye bars at their upper and lower ends, are lowered in proximity to the wreck and temporarily made fast to the sea bottom. The next step is to locate the sunken vessel accurately with reference to these tubes. This is done by a system of photographic triangulation. A sliding frame is lowered upon the guide tubes and from this frame project two horizontal bars which intersect and form a triangle with the sliding frame as base. At the apex of this triangle a camera is fixed, and nearby upon the triangulation bars, a search light. A picture is taken of the wreck. The frame is then raised, the angular relation of the triangulation bars to the frame changed, the frame again lowered and a second picture taken. In this manner the exact location of two or more recognizable parts of the vessel, such as a mast, funnel, or hatch, can be determined with relation to the two guide tubes. The photographs also disclose the position of the ship relative to the sea bottom. Having accomplished this much, and the plan of the ship being known beforehand, it is a simple matter to draft a layout of the ship as she lies with the two tubes in their proper positions.

This relation once definitely established serves as a basis for succeeding operations. The procedure from this point on is adapted to the particular end sought. If the cargo is to be saved these tubes, or others like them, are stepped into proximity to the particular cargo to be removed and made fast either to the sea bottom or to the ship itself. They then serve as a guideway upon which cutting and grappling mechanisms are successively lowered. If the vessel itself is to be raised (our present concern) the procedure is as follows:

Four semi-permanent tubes secured to the sea bottom are positioned, one off each

quarter of the ship. The location of these tubes is determined directly from the first two which are stepped over to and along the side of the vessel until the ends are reached.

5 The distance separating the guide tubes being fixed and known their position relative to the sunken vessel is always known and can be traced on the lay-out. When the movable pair has been stepped, say to the  
10 starboard bow, the position of the permanent tube off that quarter can be accurately determined by means of triangulation bars or approximately by the eye. In a similar manner all four tubes are located, then secured to  
15 the sea bottom and anchored firmly by means of stay ropes extending from their upper ends. A sheave block is fixed to the bottom of each tube, a rope or chain running through the block with its ends retained at the sur-  
20 face.

This much accomplished, pairs of submersible pontoons, the pontoons of each pair being connected by girders or chains attached to their lower parts, are lowered to  
25 the bottom and drawn along the bottom in such a manner that the connecting chains or girders are positioned beneath the hull of the wreck. After a sufficient number of such pontoons have been moved into position, they  
30 are slowly filled with air by means of pumps on the salvaging vessel and the wreck slowly raised. Once at the surface, permanent pontoons may be attached to the vessel, or the holes in its hull repaired and the water  
35 pumped from it.

In order that the invention may be more clearly understood, reference is had to the accompanying drawings, disclosing one embodiment of means whereby it may be carried out and in which Fig. 1 is a plan view  
40 of the sunken vessel showing the locating rods in various positions and the four guideways established in relation to the vessel; Fig. 2 is an elevation showing the salvaging  
45 vessel, the wreck and the means for lowering the pontoons into operative position with relation to the wreck; Fig. 3 is a plan view of the sunken vessel similar to Fig. 1, showing the relation of the pontoons to the guide-  
50 ways and the sunken vessel; Fig. 4 is an enlarged end view of the vessel showing it raised to the surface and supported upon the cradle of a pair of pontoons; Fig. 5 is an elevation showing the pontoons in position and the vessel partly raised; Fig. 6 is a  
55 vertical section through one of the pontoons; Fig. 7 is a plan of one of the pontoons. Fig. 8 is a section on an enlarged scale through the housing of the water valves of the pontoon, and Fig. 9 is a similar section showing  
60 the air valves.

Referring first to Fig. 1, 1 represents the sunken vessel which is to be raised by the method and apparatus of this invention. As  
65 described in a preceding paragraph of this

application, this sunken vessel is accurately located by means of tubes 2 and 3, which are temporarily secured to the sea bottom in the immediate vicinity of the wreck. On these tubes, as guideways, a frame 4 is lowered  
70 and to this frame are adjustably secured a pair of triangulation bars carrying a camera 6 and a search light 7 operated from the surface of the water. By means of this apparatus a series of photographs of the wreck  
75 are taken, and this photographic survey determines accurately the position of the vessel with relation to tubes 2 and 3.

This much being determined, the permanent guide-tubes, which are to serve as means  
80 for positioning the pontoons, or buoyancy chambers to be employed in raising the wreck, may be established. The preferred method is as follows:

The tubes 2 and 3, which are spaced apart  
85 a fixed distance by means of spacer bars not shown, are stepped over to and along the side of the vessel, as indicated in Fig. 1 until they reach a position, say at the starboard bow and shown on Fig. 1 as 2' and 3'.  
90 The position of the first permanent guideway 9 with relation to these tubes is preferably determined by means of triangulation bars 8 in the manner indicated, but as  
95 this position need not be determined with any great accuracy, it being only necessary that the tube be about 20 feet beyond and to one side of the bow of the wreck, this position may be determined by other means. The other guideways 10, 11 and 12 may be  
100 similarly positioned by continuing to step tubes 2 and 3 along the side of the vessel.

These guide tubes are made up of a series of hollow steel tubes, the lowest section having the thickest walls, in order to withstand  
105 the greater pressure, and the walls of the succeeding sections diminishing in thickness. The bottom of each tube is provided with a screw point 14, adapted to be deeply imbedded in the sea bottom and hold the tube  
110 firmly in position. In order to prevent the upper ends of the tubes from being swayed out of position they are connected to one another by means of stay ropes 15 and are  
115 anchored to the sea bottom by means of anchor ropes 16. The bottom of each tube is provided with a sheave block 17 which loosely encircles the tube and is held against longitudinal movement by means of collars  
120 18. These relatively fixed sheave blocks are provided with ropes or cables, the ends of which extend to the salvaging vessel before the tubes are positioned. These four guide tubes being now placed and firmly anchored  
125 are ready to serve as guides whereby the pontoons may be submerged and guided into position.

Referring now to Figs. 6, 7, 8 and 9, the pontoons, which are preferably employed, are large metallic cylindrical vessels 20, 130

properly reinforced to be able to withstand the necessary hydraulic pressure of the sea and of such capacity as to be able to raise the particular vessel in question. These pontoons are provided with manholes 19. It is necessary that the buoyancy of such pontoons be under accurate control, and to this end means are provided for simultaneously increasing their air and decreasing their water contents. The salvaging vessel is provided with air and water pumps, both of which are operatively connected to the pontoons by means of tubes 21 and 22 respectively. Each of these tubes makes connection with the pontoon through housing 23 and 24 respectively, each containing a pair of valves.

The air valves are situated at the upper end of the pontoon in housing 23. These valves comprise frusto-conical valve members proper 25 and 25', held normally seated upon seats 26 and 27 respectively by means of compression coil springs 28 and 29 which surround valve stems 30 and 31. Valve 25 is the inlet valve for air and valve 25' the exit valve.

A pair of water valves 33 and 34 situated in housing 24 at the lower end of the pontoon (see Fig. 8) are constructed very much like the air valves above described and operate in precisely the same manner.

The buoyancy of the pontoons is controlled through these valves as follows:

When it is desired to decrease the buoyancy, water is pumped through tube 22 and into housing 24. If the pressure of this water be sufficient to overcome the coil spring which normally holds valve 33 seated, this valve will open and allow the water to enter the pontoon. The air within the pontoon is compressed and when its pressure rises to such a point that it overcomes the opposing force of coil spring 29, valve 25' opens and allows it to escape through tube 21. In an analogous manner the buoyancy may be increased by forcing air through tube 21 and into the pontoon. As neither water nor air can enter or leave the pontoon unless under pressure great enough to overcome the opposing force of the coil springs of the valves, the pressure exerted by these springs predetermines the minimum pressure which can exist within the pontoon. Thus, if these springs be made to exert a pressure of 30 pounds per square inch, the pressure within the pontoon will during operations always be at least equal to two atmospheres. This materially assists the pontoon in withstanding the hydraulic pressure of the sea water and makes possible the construction of lighter pontoons, than would be possible if reliance were placed upon the metallic structure alone. Each pontoon is also provided with a safety valve 35, designed to open when a predetermined maximum pressure is attained.

These pontoons are designed to be used in pairs, the members of which are connected at their lower ends, either by means of chains or cables, or preferably by means of rigid cradles 36. These cradles are preferably constructed of two channel irons 37, bolted to stools 38 at the lower end of the pontoon. Each cradle is provided on its upper side with wooden packing 39 upon which the vessel is designed to rest.

The bottom of each pontoon is provided with a ring 41, to which the ropes or chains are connected, which are used in drawing the pontoon into position relative to the wreck.

The method of submerging the pontoons and ranging them into position along the sides of the vessel with their cradles extending beneath it is shown in Fig. 2, and will now be described. (In connection with this description it must be borne in mind that although only guide tubes 10 and 11 and their corresponding mechanism are described, and in connection with only one pontoon of a pair, it is, of course, to be understood that tubes 9 and 12 are employed similarly and simultaneously and that the pontoons are operated in pairs.) The lower sheave blocks 17 of tubes 10 and 11 are provided with sheaves or pulleys 42 and 43, about which run ropes or cables 44 and 45 respectively, these ropes being positioned before their respective tubes were secured to the sea bottom. Attached to ring 41 of the pontoon are a pair of ropes 46 and 47. These ropes are passed through movable sheave blocks 48 and 49 respectively, and these movable sheave blocks in turn secured one to the end of rope 44 and the other to the end of rope 45, as shown. Both movable sheave blocks are then lowered to the bottom by pulling on ropes 44 and 45 and paying out ropes 51 and 52, which are respectively secured to these blocks. When these sheave blocks have been drawn down as far as possible, the position of the parts is that indicated in full lines in Fig. 2.

The buoyancy of the pontoons is decreased by introducing water through the manhole 19 until the pontoon just barely floats. The manhole cover is then secured in position and the water pump on the salvaging vessel operated to pump water through tube 22 past valve 33 and into the pontoon. When a buoyancy of approximately zero has been reached by this method, the pontoon is lowered by pulling upwardly on rope 46. Rope 47 is also drawn upwardly at the same time in order to keep the length of that rope between the pontoon and sheave block 49 as small as possible. As the pontoon sinks care must be taken to increase the air pressure in proportion to the depth. In this manner the pontoon reaches the sea bottom. The

next step is to draw it along the side of the vessel with its cradle bar beneath it. This is now accomplished by drawing on rope 47 and paying-out rope 46 until finally the pontoon occupies the position near the stern of the vessel, indicated in dotted lines. Blocks 48 and 49 are then drawn to the surface and ropes 46 and 47 withdrawn from them. These ropes are cast away and allowed to sink or may be attached to a float on the surface. The apparatus is then in readiness for another pair of pontoons.

In this manner any number of pontoons are positioned alongside the vessel. As it may be difficult in some instances to draw the cradles beneath the hull of the vessel for the entire length of the keel, it may be desirable in some instances to work from both ends. The principle in any event is the same. The vessel is now slowly raised by proper manipulation of the air and water pumps which control the buoyancy of the pontoons. In order to maintain the vessel on even keel, it is desirable to have some of the pontoons at the surface at all times for such pontoons have no tendency to move upwardly. Where the vessel is of great length and lies in water the depth of which is less than this length, is it desirable to raise one end at a time, as shown in Fig. 5. In such a case some of the pontoons should be arranged to reach the surface at different times and thus tend to stabilize the operation.

In order to be aware at all times of the position of the wreck during the time it is being raised, each pontoon is provided with a rope 53, carrying at fixed intervals of 10 or 20 feet, colored floats so arranged that the colors vary, according to a prearranged scheme, the greater the distance from the pontoon. In this manner the workers in the salvaging vessel can tell at a glance not only how far the vessel has been raised, but also whether she is being maintained on an even keel and whether or not there is a list to one side. Knowing this, the buoyancy of the pontoons may be varied to correct the trouble and straighten the vessel. By having the buoyancy of the pontoons under accurate and ready control, the wreck may be slowly and carefully raised. Without such control there is the danger that the whole system may rise too rapidly and throw the vessel out of the water. In such event it is highly probable that the ship will slip from the supporting pontoons and sink once more.

The entire operation may be briefly reviewed as follows:

The sunken vessel is first accurately located. This being done, four guide tubes are secured to the sea bottom, one off each quarter of the vessel. These tubes are provided with sheave blocks and serve as guides whereby pairs of connected pontoons may be lowered and drawn along the side of the

vessel with the connecting chains or cradles beneath the keel. The buoyancy of these pontoons is under control from the salvaging vessel and by slowly increasing their buoyancy, the wreck may be raised.

The entire operation not only of locating the vessel and positioning the guide tubes, but of placing the pontoons in operative relation to the vessel, is controlled from the surface of the water and without the necessity for employing divers. In this manner vessels may be salvaged which lie at depths too great for divers to operate.

I claim:

1. The method of salvaging a sunken vessel which comprises accurately locating the vessel, establishing guideways relative thereto, lowering pontoons upon said guideways, positioning them in operative relation to the vessel and raising the vessel by controlling the buoyancy of the pontoons, all operations being controlled from the surface of the water.

2. The method of salvaging a sunken vessel which comprises submerging a pair of connected pontoons, drawing the pontoons along the side of the vessel with the connecting means beneath it, and increasing the buoyancy of the pontoons to raise the vessel.

3. Apparatus for salvaging sunken vessels comprising guideways extending from the sea bottom adjacent the vessel to the surface of the water, and means by which pontoons can be lowered upon said guideways and moved into operative relation to the vessel.

4. Apparatus for salvaging sunken vessels comprising guides extending from the sea bottom adjacent the vessel to the surface of the water, a pulley near the bottom of each guide, a submersible pontoon, cables fastened to said pontoon, each passing around one of said pulleys and back to the surface, the arrangement being such that the pontoon can be moved vertically and horizontally.

5. Apparatus for salvaging sunken vessels comprising guides extending from the sea bottom adjacent the vessel to the surface, a relatively fixed pulley near the bottom of each guide, a movable pulley, a cable attached to said movable pulley and passing around one of said fixed pulleys, a submersible pontoon, cables secured to the pontoon, one of said cables passing around the movable pulley.

6. Apparatus for salvaging sunken vessels comprising a pair of connected submersible pontoons, the length of the connecting means being greater than the width of the vessel, means for submerging the pontoons and positioning them, one on either side of the vessel with the connecting means beneath it and means for increasing the buoyancy of the pontoons to raise the vessel.

properly reinforced to be able to withstand the necessary hydraulic pressure of the sea and of such capacity as to be able to raise the particular vessel in question. These pontoons are provided with manholes 19. It is necessary that the buoyancy of such pontoons be under accurate control, and to this end means are provided for simultaneously increasing their air and decreasing their water contents. The salvaging vessel is provided with air and water pumps, both of which are operatively connected to the pontoons by means of tubes 21 and 22 respectively. Each of these tubes makes connection with the pontoon through housing 23 and 24 respectively, each containing a pair of valves.

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These pontoons are designed to be used in pairs, the members of which are connected at their lower ends, either by means of chains or cables, or preferably by means of rigid cradles 36. These cradles are preferably constructed of two channel irons 37, bolted to stools 38 at the lower end of the pontoon. Each cradle is provided on its upper side with wooden packing 39 upon which the vessel is designed to rest.

The bottom of each pontoon is provided with a ring 41, to which the ropes or chains are connected, which are used in drawing the pontoon into position relative to the wreck.

The method of submerging the pontoons and ranging them into position along the sides of the vessel with their cradles extending beneath it is shown in Fig. 2, and will now be described. (In connection with this description it must be borne in mind that although only guide tubes 10 and 11 and their corresponding mechanism are described, and in connection with only one pontoon of a pair, it is, of course, to be understood that tubes 9 and 12 are employed similarly and simultaneously and that the pontoons are operated in pairs.) The lower sheave blocks 17 of tubes 10 and 11 are provided with sheaves or pulleys 42 and 43, about which run ropes or cables 44 and 45 respectively, these ropes being positioned before their respective tubes were secured to the sea bottom. Attached to ring 41 of the pontoon are a pair of ropes 46 and 47. These ropes are passed through movable sheave blocks 48 and 49 respectively, and these movable sheave blocks in turn secured one to the end of rope 44 and the other to the end of rope 45, as shown. Both movable sheave blocks are then lowered to the bottom by pulling on ropes 44 and 45 and paying out ropes 51 and 52, which are respectively secured to these blocks. When these sheave blocks have been drawn down as far as possible, the position of the parts is that indicated in full lines in Fig. 2.

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next step is to draw it along the side of the vessel with its cradle bar beneath it. This is now accomplished by drawing on rope 47 and paying-out rope 46 until finally the pontoon occupies the position near the stern of the vessel, indicated in dotted lines. Blocks 48 and 49 are then drawn to the surface and ropes 46 and 47 withdrawn from them. These ropes are cast away and allowed to sink or may be attached to a float on the surface. The apparatus is then in readiness for another pair of pontoons.

In this manner any number of pontoons are positioned alongside the vessel. As it may be difficult in some instances to draw the cradles beneath the hull of the vessel for the entire length of the keel, it may be desirable in some instances to work from both ends. The principle in any event is the same. The vessel is now slowly raised by proper manipulation of the air and water pumps which control the buoyancy of the pontoons. In order to maintain the vessel on even keel, it is desirable to have some of the pontoons at the surface at all times for such pontoons have no tendency to move upwardly. Where the vessel is of great length and lies in water the depth of which is less than this length, it is desirable to raise one end at a time, as shown in Fig. 5. In such a case some of the pontoons should be arranged to reach the surface at different times and thus tend to stabilize the operation.

In order to be aware at all times of the position of the wreck during the time it is being raised, each pontoon is provided with a rope 53, carrying at fixed intervals of 10 or 20 feet, colored floats so arranged that the colors vary, according to a prearranged scheme, the greater the distance from the pontoon. In this manner the workers in the salvaging vessel can tell at a glance not only how far the vessel has been raised, but also whether she is being maintained on an even keel and whether or not there is a list to one side. Knowing this, the buoyancy of the pontoons may be varied to correct the trouble and straighten the vessel. By having the buoyancy of the pontoons under accurate and ready control, the wreck may be slowly and carefully raised. Without such control there is the danger that the whole system may rise too rapidly and throw the vessel out of the water. In such event it is highly probable that the ship will slip from the supporting pontoons and sink once more.

The entire operation may be briefly reviewed as follows:

The sunken vessel is first accurately located. This being done, four guide tubes are secured to the sea bottom, one off each quarter of the vessel. These tubes are provided with sheave blocks and serve as guides whereby pairs of connected pontoons may be lowered and drawn along the side of the

vessel with the connecting chains or cradles beneath the keel. The buoyancy of these pontoons is under control from the salvaging vessel and by slowly increasing their buoyancy, the wreck may be raised.

The entire operation not only of locating the vessel and positioning the guide tubes, but of placing the pontoons in operative relation to the vessel, is controlled from the surface of the water and without the necessity for employing divers. In this manner vessels may be salvaged which lie at depths too great for divers to operate.

I claim:

1. The method of salvaging a sunken vessel which comprises accurately locating the vessel, establishing guideways relative thereto, lowering pontoons upon said guideways, positioning them in operative relation to the vessel and raising the vessel by controlling the buoyancy of the pontoons, all operations being controlled from the surface of the water.

2. The method of salvaging a sunken vessel which comprises submerging a pair of connected pontoons, drawing the pontoons along the side of the vessel with the connecting means beneath it, and increasing the buoyancy of the pontoons to raise the vessel.

3. Apparatus for salvaging sunken vessels comprising guideways extending from the sea bottom adjacent the vessel to the surface of the water, and means by which pontoons can be lowered upon said guideways and moved into operative relation to the vessel.

4. Apparatus for salvaging sunken vessels comprising guides extending from the sea bottom adjacent the vessel to the surface of the water, a pulley near the bottom of each guide, a submersible pontoon, cables fastened to said pontoon, each passing around one of said pulleys and back to the surface, the arrangement being such that the pontoon can be moved vertically and horizontally.

5. Apparatus for salvaging sunken vessels comprising guides extending from the sea bottom adjacent the vessel to the surface, a relatively fixed pulley near the bottom of each guide, a movable pulley, a cable attached to said movable pulley and passing around one of said fixed pulleys, a submersible pontoon, cables secured to the pontoon, one of said cables passing around the movable pulley.

6. Apparatus for salvaging sunken vessels comprising a pair of connected submersible pontoons, the length of the connecting means being greater than the width of the vessel, means for submerging the pontoons and positioning them, one on either side of the vessel with the connecting means beneath it and means for increasing the buoyancy of the pontoons to raise the vessel.



7. Apparatus for salvaging sunken vessels comprising four guides extending from the sea bottom to the surface, two at each side of the vessel, a pulley near the bottom of each guide, a pair of connected submersible  
5 pontoons, the length of the connecting means being greater than the width of the vessel, two cables secured to each of said pontoons,

each cable passing around one of the guide pulleys and back to the surface, the arrange- 10 ment being such that the pontoons may be drawn down vertically and then moved horizontally along the sides of the vessel with the connecting means beneath it.

In testimony whereof I affix my signature. 15  
ALEXANDER ALLAN.