J. W. RENO.

ART OF RAISING SUBMERGED VESSELS.

APPLICATION FILED JUNE 15, 1921.

1,400,316.

Patented Dec. 13, 1921.

2 SHEETS—SHEET 1.

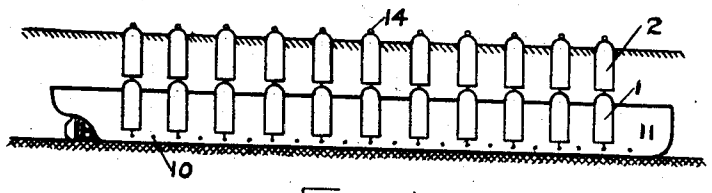


Fig. 1

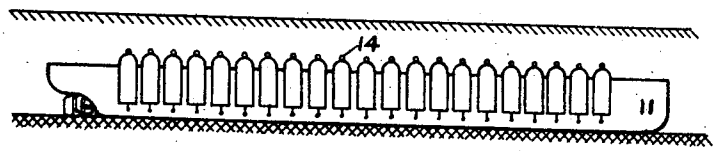


Fig. 2

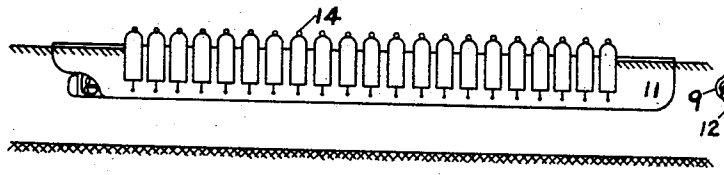


Fig. 3

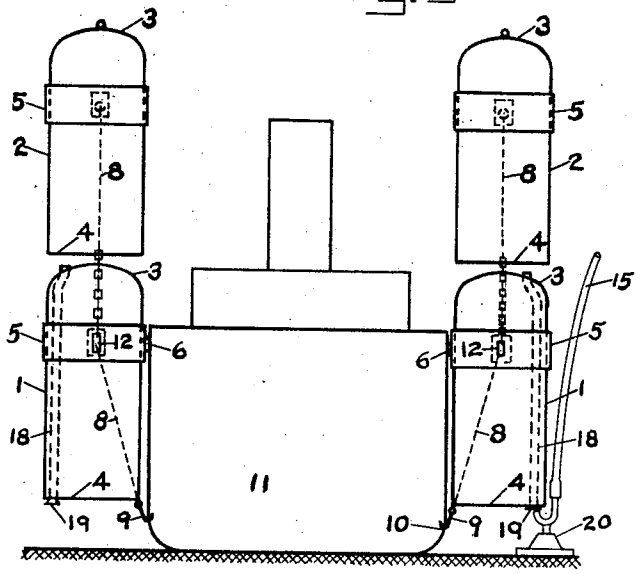


Fig. 4

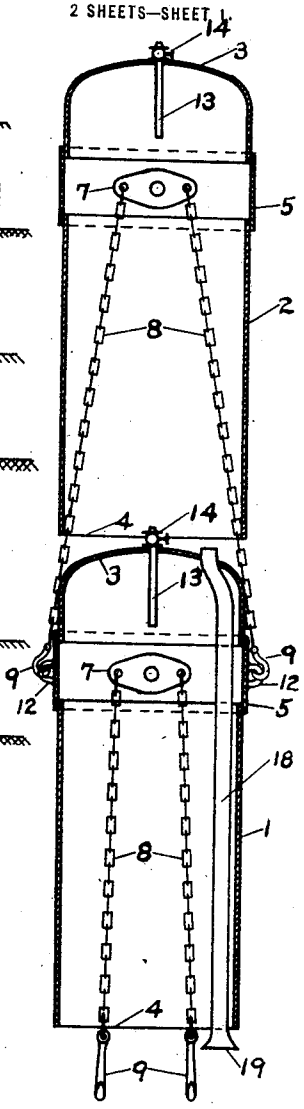


Fig. 5

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ART OF RAISING SUBMERGED VESSELS.

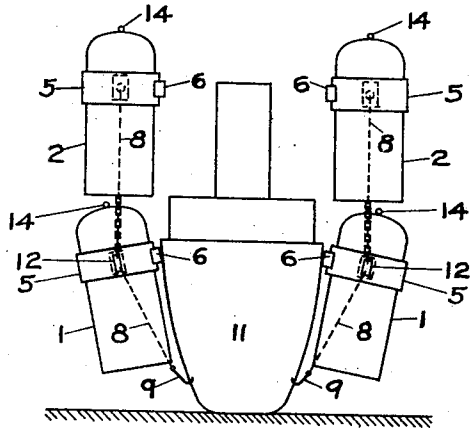
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2 SHEETS—SHEET 2.

Fig. 6



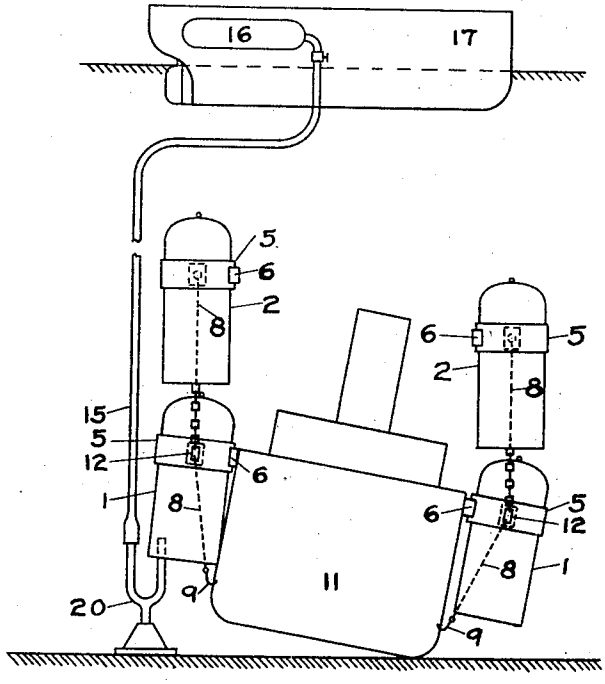


Fig. 7

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UNITED STATES PATENT OFFICE.

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ART OF RAISING SUBMERGED VESSELS.

1,400,316. Specification of Letters Patent. Patented Dec. 13, 1921.

Application filed June 15, 1921. Serial No. 477,653.

To all whom it may concern:

Be it known that I, JESSE W. RENO, a citizen of the United States, residing in New York, in the county of New York and State of New York, have invented a new and useful Improvement in the Art of Raising Submerged Vessels, of which the following is a specification.

My invention relates to the art of raising sunken vessels, and has for its object, among others, to devise what I may properly term, a vertical double tandem pontoon, which when properly attached to the side of the sunken vessel and suitably inflated for the purpose will raise the ship from off of the bottom of the sea sufficiently to allow its deck to be well above the surface of the water without the use of additional pontoons, to the end that the subsequent operations of reclaiming the sunken vessel from the sea can be conveniently and adequately carried on; all of which will more fully appear hereinafter.

In my patents, numbered, 1,364,142, patented January 4, 1921; 1,364,143, patented January 4, 1921; and 1,373,672, patented April 5, 1921, I disclose a vertical pontoon, disposed upright in the sea, adapted to be attached to the sides of a sunken vessel, and capable of raising a sunken vessel under the buoyant force of air contained in the pontoon. In order to raise a sunken vessel from off of the bottom of the sea by the use of the buoyant force of air in a vertical pontoon attached to the sides of the sunken vessel, it is imperative, in order to obtain sufficient buoyancy, to provide pontoons of long length, comparatively speaking, say for instance, sixty feet. The long pontoon also places the center of buoyancy well above the center of gravity of the vessel, so that as the vessel rises to the surface there will be no tendency to turn turtle. The long pontoon, however, in case the vessel rises with one side lower than the other, may be subjected to severe bending strains, which may be sufficient to cause it to rupture. Furthermore, when the vessel is raised, the long pontoon leaves the deck of the vessel a considerable distance below the surface of the water, and too deep in the majority of cases to permit the ship to be towed into a harbor. I have suggested one form of apparatus and method to bring the deck of the ship above the water, in my application for a patent, Serial Number 453,108, filed March 17, 1921, entitled, Devices for raising sunken vessels, by the use of box-shaped buoyant devices, placed under the ship to which the vertical pontoons at the sides of the ship can be attached.

My present invention, which, as I have already said, may be termed, a double tandem pontoon, is designed to permit raising the ship with its deck well above the surface without the use of additional buoyant devices placed under its bottom; and also permit the use of vertical pontoons of materially less length than the long integral vertical pontoons referred to above, and yet provide in effect a buoyant lifting force substantially equal to that obtained in the use of the long, single pontoon. And, again, the double tandem vertical pontoon is adapted to be manipulated more easily than the long pontoon, and by reason of its flexibility lend itself to the different positions of the ship and pontoon, both absolutely, and relatively to each other, in the operation of raising the ship, and finally reclaiming her by towing her into a harbor or other suitable site.

I attain these objects, and still others which may appear hereinafter, by the apparatus or device and method illustrated in the accompanying drawings, in which,

Figure 1 is a side view of a sunken vessel on the bottom of the sea, with my double tandem vertical pontoons attached to her side.

Fig. 2 is a side view of a sunken vessel on the bottom of the sea with the upper pontoons of my double tandem pontoons unhooked from the lower pontoons, and attached to the sides of the sunken vessel.

Fig. 3 is a side view of a sunken vessel, raised by the pontoons, which constituted the double tandem pontoons, with the deck above the surface of the water and the vessel in position to be towed to a harbor.

Fig. 4 is a diagrammatic end view of the sunken vessel with the double tandem pontoons attached thereto; and a section shown of my siphon, claimed in my Patent Number 1,364,142.

Fig. 5 is a view in vertical section of my double tandem pontoon, with equalizer bar, lifting cables and hooks attached thereto, patented in my Patent Number 1,364,142.

Fig. 6 is a diagrammatic view of the bow of a sunken vessel, with my double tandem pontoon attached thereto, showing the flexi-

bility of the double tandem pontoon to adapt itself to the contour of the vessel.

Fig. 7 is a diagrammatic end view of a sunken vessel with my double tandem pontoon attached thereto, and my said siphon, to deliver air from a compressor to the lower pontoon or to be lowered away from the pontoon or have the pontoon rise from it.

Similar numerals refer to similar parts throughout the several views.

Referring more particularly to my double tandem pontoon, I have shown it embodied in the form of two, separate hollow cylinders, of comparatively short length, attached together by cables, one above the other, each having a closed upper end, and an open lower end, the double tandem pontoon being adapted to constitute a vertical pontoon. In the figures of the drawings, the lower cylinder is designated by the numeral, 1, and the upper cylinder by the numeral, 2, the closed end by the numeral, 3, and the open, lower end by the numeral, 4. Of course, the form of the cylinders may not be necessarily round. Around their circumference at a suitable point in their length is a reinforcement of the wall of the cylinder of a band or belt, 5, and a thrust block or shoe, 6, as disclosed in my Patent Number 1,373,672, and my equalizer bar, 7, and cables, 8, and hooks, 9, at their lower end, adapted to be hooked into the holes, 10, formed for that purpose in the hull of the sunken vessel, 11, disclosed in my Patent Number 1,364,142. On the belt, 5, of the lower cylinder, 1, eyes, 12, are fixed, adapted to receive the hooks, 9, on the cables, 8, of the upper cylinder, 2, and by those means attach the two cylinders together, and yet, permit them to be conveniently and readily detached and separated from each other. In the closed end of the cylinders, constituting my double tandem pontoon, is a pipe, 13, with a cock, 14, adapted to close or open the pipe. The length of the pipe within the cylinder is such that its end normally reaches the right height above the water level in the closed end of the cylinder when the extent of the area of air space between the closed end of the cylinder and water level is sufficient to buoy the cylinder or double tandem pontoon with the closed end of the upper cylinder at or about the surface of the sea or adequately thereabove to cause the pontoon to float at that height, ready to be further handled, manipulated and maneuvered in the several operations of raising the sunken vessel. When desired, the cock may be opened to allow the air confined in the head of the cylinder to escape therefrom until the water in the cylinder rises to the end of the pipe, 13, and seals it or as much air as otherwise desired may be allowed to escape through the pipe, and the cock be thereupon closed. The length of the pipe and the sealing of it by the rising of the water in the cylinder insures that there will always remain sufficient air occluded in the head of the pontoon to preserve sufficient buoyancy of it to prevent it from sinking, even if the cock in the pipe be left open. On the other hand, a tubing, 15, leading from an air compressor, 16, on a supply vessel, 17, standing by, may be coupled to the pipe, 18, and, thereupon, air be forced by the compressor through the tubing, 15, and pipe, 18, to the air space in the head of the upper cylinder, and thereby increase the buoyancy of the pontoon or cause it to rise in the sea. In Fig. 5, I have shown an open ended conduit pipe, 18, fixed upright along the wall of and within the lower cylinder, 1, with its lower end, 19, free to be coupled to the nozzle of an air-supply tubing or pipe, say for example, the tubing, 15, and thereupon, the conduit, 18, conducts air and from its upper end discharges air in the water opposite to the open, lower end of the upper cylinder, 2; the air so discharged will rise through the water in the cylinder to the air space in the closed end of the upper cylinder, 2. By that means, the buoyancy of the upper cylinder of my double tandem pontoon and therefore, the pontoon as a whole may be increased by adding air to the amount of air confined in the air space in the end of the upper cylinder. I find that the plan will be very convenient for that purpose, especially as it is desirable that the work of supplying air to the pontoon shall be expedited as much as possible in the operation as a whole of raising the vessel to the end that no time will be lost, which is possible to avoid by suitable design of apparatus and its ready and easy manipulation in the sea.

In the beginning, with the sunken vessel resting on the bottom of the sea, I proceed to attach my vertical double tandem pontoons to it, and when they are suitably inflated with air, as already explained in describing them as constituting my double tandem pontoon, will, by the buoyant force of the air confined in them, raise the vessel from off of its sea bed, to the height attainable by the lifting force of the double tandem pontoon. This being accomplished, that is to say, the ship having been raised from deep water, it is then towed with the pontoons attached and grounded in comparatively shallow water to a position, as indicated in Fig. 1, with the closed end of the upper cylinders of the double tandem pontoon protruding above the surface of the sea, but with the deck of the ship below the surface. The vessel at that height may be too deep in the water to tow it into a harbor on account of insufficient depth of chan-

nel or water at the site where it is desired to dock the ship or the deck of the ship may be too deep in the water conveniently to allow the further work of reclaiming the ship to be proceeded with, or the vessel may then be too deep in the water for any other reason present or arising in the cicumstances. Consequently, I may desire to cause the ship to be still further raised. In order to accomplish that end, I proceed to draw the upper cylinders, 2, down from their then position; unhook the hooks of their cables from the eyes, 12, of the lower cylinders, 1, interspace them between the lower cylinders, and hook their hooks into the holes, 10, in the hull of the sustained vessel, as depicted in Figs. 2 and 3. The upper cylinders may be drawn down by any suitable and convenient means: I prefer, however, to use for that purpose my mobile tractor working chamber, and power driven drum and cable, disclosed in my above-recited patents. It is thought to be unnecessary to show that apparatus in the present application for a patent or describe the operation of drawing down the cylinders to a position in which the hooks of their cables become in a position to be hooked into the holes, 10, in the vessel. In order to direct and manipulate the hooks to hook them into the holes, 10, I prefer to resort to my mobile tractor working chamber and rod therein mounted, and more particularly disclosed in my Patent Number 1,373,672, above recited. It is obvious, however, that, in the case where the water is more or less shallow, divers may be employed, if preferred, to hook the hooks into the holes in the vessel. If in the operation of drawing down the cylinders, it is observed that they have a tendency to sink lower than is desired, on account of any decrease of their buoyancy by reason of the further compression of the air confined in the air space in their closed end, a tubing can be connected to the pipe, 13, and air be forced therethrough to within the confined space in the head of the cylinder, and, thereby, the desired buoyancy of the cylinder be regulated and controlled. Or instead of forcing air into the cylinder through the pipe, 13, I can accomplish the same result by employing my siphon, 20, disclosed in my Patent Number 1,364,142, above-recited, which is indicated in Fig. 7 of the application for a patent.

When the ship has been towed into a harbor or to any other site desired, the cock, 14, in the pipe, 13, can be opened, and the cylinder be thereby deflated. In Fig. 4, I have shown the vessel as being on a more or less level keel, and the upper and lower cylinders of my double tandem pontoon in substantially one and the same vertical plane with each other, the upper cylinder being directly above the lower one, and the pressure shoe, 6, of the lower cylinder against the side of the vessel, and its hooks attached in the holes in the vessel in position to apply its lifting force thereto, and the hooks of the upper cylinder attached to the lower cylinder, the latter also in position to add its lifting force to the vessel. Even with the vessel on a level keel, my double tandem pontoon will be found to be of striking importance in the operations of handling, manipulating, and attaching them to the vessel, and raising it. Because of the short length of each of the two cylinders as compared with a long, integral vertical pontoon,—though nevertheless the two short cylinders may constitute in lifting effect one long, integral pontoon,—they are each adapted to be separately and jointly manipulated with great freedom and ease, and raise a sunken vessel to the height that a long, integral pontoon will raise it; but with the important advantage that the upper cylinders of the double tandem pontoon can be conveniently detached from the lower cylinders, and re-attached to the holes, 10, in the vessel, and the raising of the vessel from that position be proceeded with until the desired elevation is attained. The advantage of my double tandem pontoon is notable particularly in comparatively shallow water.

I have already mentioned that the lifting and other strains entailed on a long, integral vertical pontoon might be enough to rupture it, where the ship is found to be sunk on an uneven keel; whereas, my double tandem vertical pontoon readily and automatically tends to adapt its position to the position of the ship, whatever it may be, and more or less also to the outline of its hull. In Figs. 6 and 7, I have indicated the flexural adaptiveness of my double tandem pontoon. In Fig. 6 the lower cylinder is depicted as conforming its vertical position substantially to the lines of the bow of the ship, while the upper cylinder maintains its major axis virtually vertically. The flexibility inherent in my double tandem pontoon is a highly important characteristic and feature; in that, among other advantages, it may serve to reduce in effect the application of strains, which in the case of a long integral vertical pontoon, might tend to rupture it. My double tandem vertical pontoon also allows the lifting cables of the upper cylinder to pull vertically in substantially the same line in which the buoyant force of the cylinder is lifting the vessel.

Having described and shown my invention, what I desire to secure by a patent is:—

1. In the art of raising submerged sunken vessels by vertical pontoons, containing air,

adapted to raise a sunken vessel, a vertical double tandem pontoon, comprised of several comparatively short-length hollow cylinders, with an open lower end and a closed upper end, flexibly connected together, one substantially over the other, the vertical double tandem pontoon being adapted to be atttached to the said vessel and by the buoyant force of air raise the vessel from off of the bed of the sea.

2. In the art of raising submerged sunken vessels by vertical pontoons, containing air, adapted to be attached to the sunken vessels by means of holes formed in the hull of the vessels for that purpose, a vertical double tandem pontoon, comprised of several comparatively short-length hollow cylinders, with an open lower end and a closed upper end, the said closed end being adapted to contain air, a pipe in the said end, its orifice within the cylinder being adapted to be normally above the water in the cylinder, but abnormally be sealed thereby, the cylinders being flexibly connected together, one over the other, and the said vertical double tandem pontoon being adapted to be attached to the holes in the vessel, and raise it.

3. In the art of raising submerged sunken vessels by vertical pontoons, containing air, adapted to be attached to the sunken vessels by means of holes formed in the hull of the vessels for that purpose, a vertical double tandem pontoon, comprised of several comparatively short-length hollow cylinders, with an open lower end and a closed upper end, the closed end serving to constitute a chamber, the cylinders being flexibly connected together, one over the other, an air conduit or pipe, on the lower cylinder, adapted to discharge air beneath the open end of the upper cylinder, the vertical double tandem pontoon being adapted to be attached to the said holes, and by the buoyant force of air raise the vessel from off of the bottom of the sea.

4. In the art of raising submerged sunken vessels by vertical pontoons, containing air, adapted to be attached to the sunken vessels by means of holes formed in the hull of the vessels for that purpose, a vertical double tandem pontoon, comprised of several comparatively short-length hollow cylinders, with an open lower end and a closed upper end, eyes provided in the lower cylinder, adapted to receive hooks; cables, one end secured to the cylinders, and the other end provided with the said hooks, adapted to connect the cylinders together, one above the other, and to the said holes, and by the buoyant force confined in the pontoon raise the vessel from off of the bottom of the sea.

5. In the art of raising submerged sunken vessels by vertical pontoons, containing air, adapted to be attached to the sunken vessel by means of holes formed in the hull of the vessel for that purpose, a method comprised of the following steps; attaching to the said holes double tandem vertical pontoons comprised of two hollow cylinders, connected together one above the other, with their upper ends closed to form chambers to receive air to enable the pontoons to raise the vessel from off of its sea bed to the height in the water attainable by the buoyant force of the confined air in the double tandem pontoons; thereupon, disconnecting the upper cylinder from the lower cylinder; and attaching it to the holes in the suspended vessel; and inflating with additional air, the pontoons attached to the vessel; and whereupon, the vessel be caused to be raised from its said suspended position to the further height desired.

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

JESSE W. RENO.