

- [54] **MARINE SALVAGE VESSEL**
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- [52] U.S. Cl. .... **114/51**
- [51] Int. Cl. .... **B63c 7/02, B63b 35/40**
- [58] Field of Search ..... **114/43.5, 45, 46, 51, 66.5 F**

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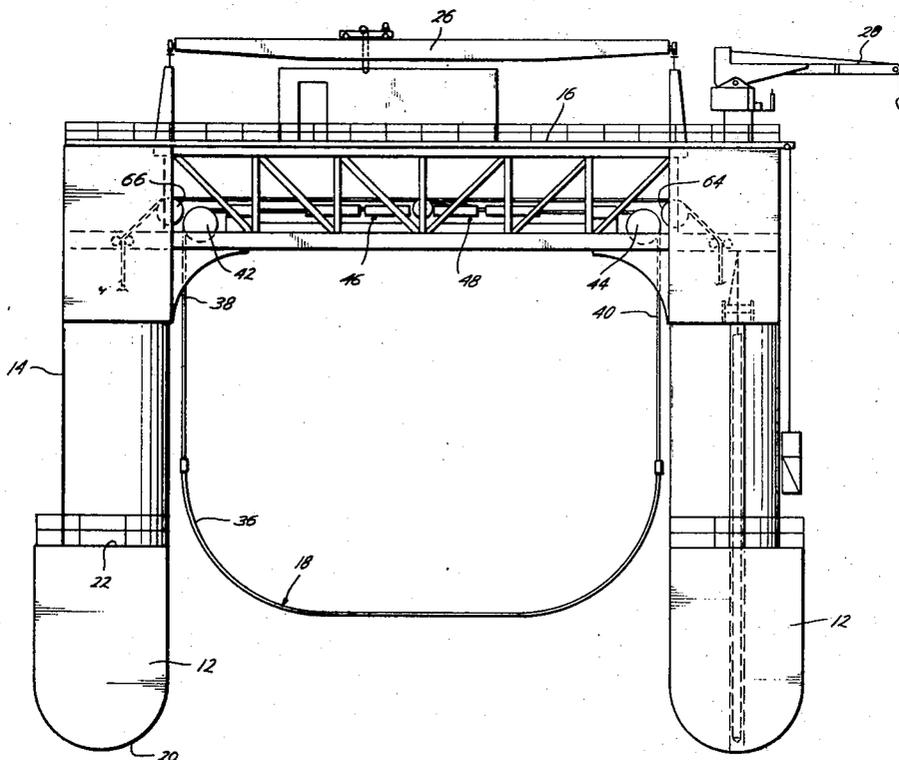
[57] **ABSTRACT**

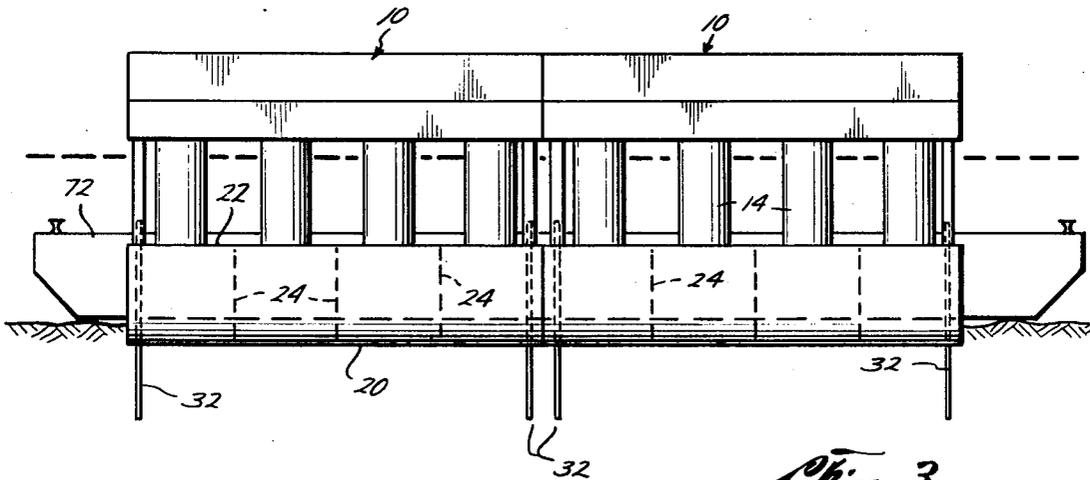
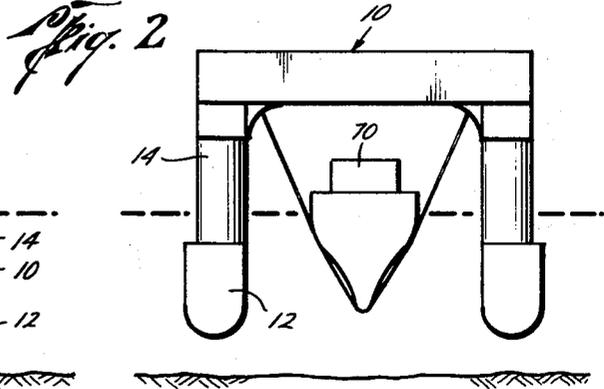
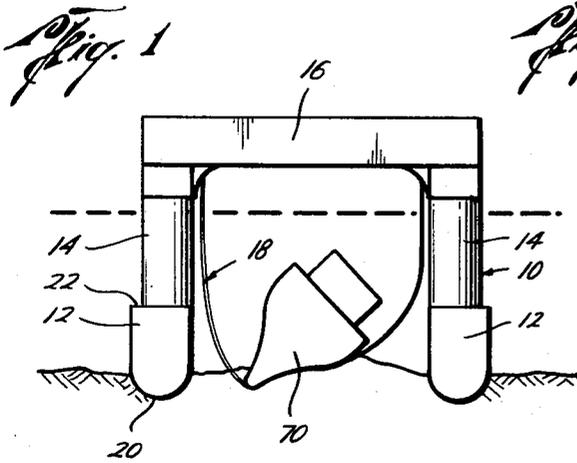
A marine salvage vessel having two elongated parallel horizontal hulls having ballast compartments with the lower portion of the hulls being arcuate and the tops being flat and of sufficient displacement to support the vessel and payload while floating on the water with a plurality of vertically extending buoyant caissons connected to the top of each horizontal hull, and a horizontal superstructure connected between the tops of the vertical caissons. Improved lifting means including a plurality of lifting cables, the ends of the cable leading to opposite sides of the structure around pulleys carried by the superstructure inside of the horizontal hulls and adjacent the vertical caissons with a horizontally positioned hydraulic jack connected to each end of the cable. The jacks at opposing ends of the cable being supported from the superstructure between opposing vertical caissons and connected together whereby the center of gravity is a minimum and the required strength of the superstructure is a minimum.

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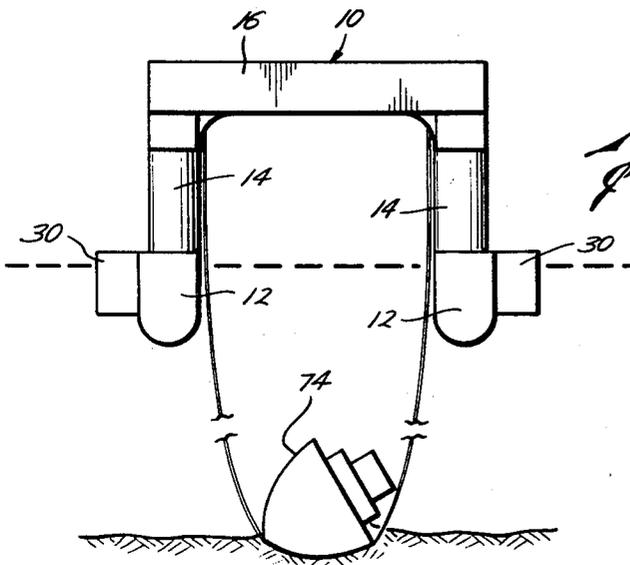
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**2 Claims, 7 Drawing Figures**





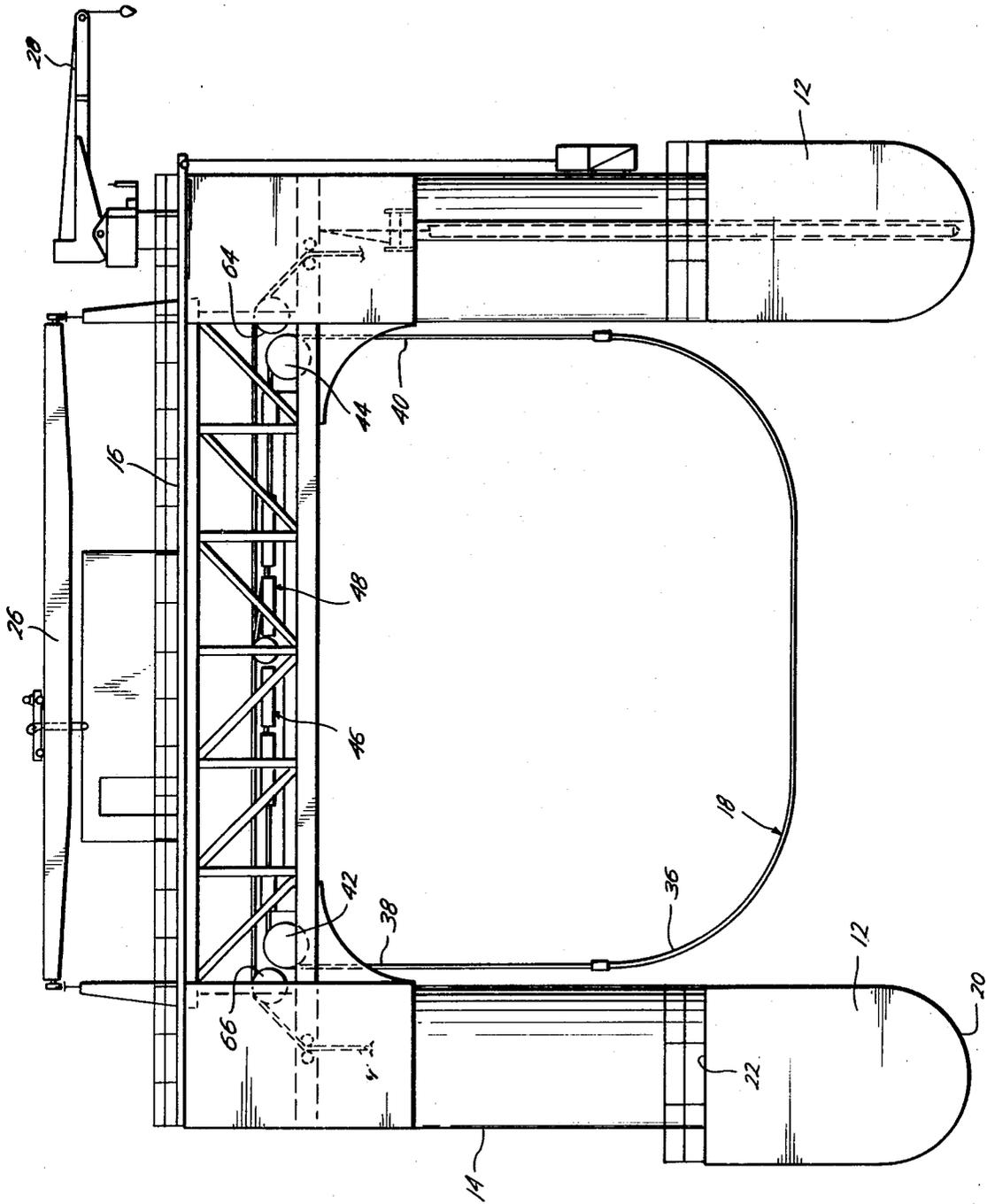
*Fig. 3*



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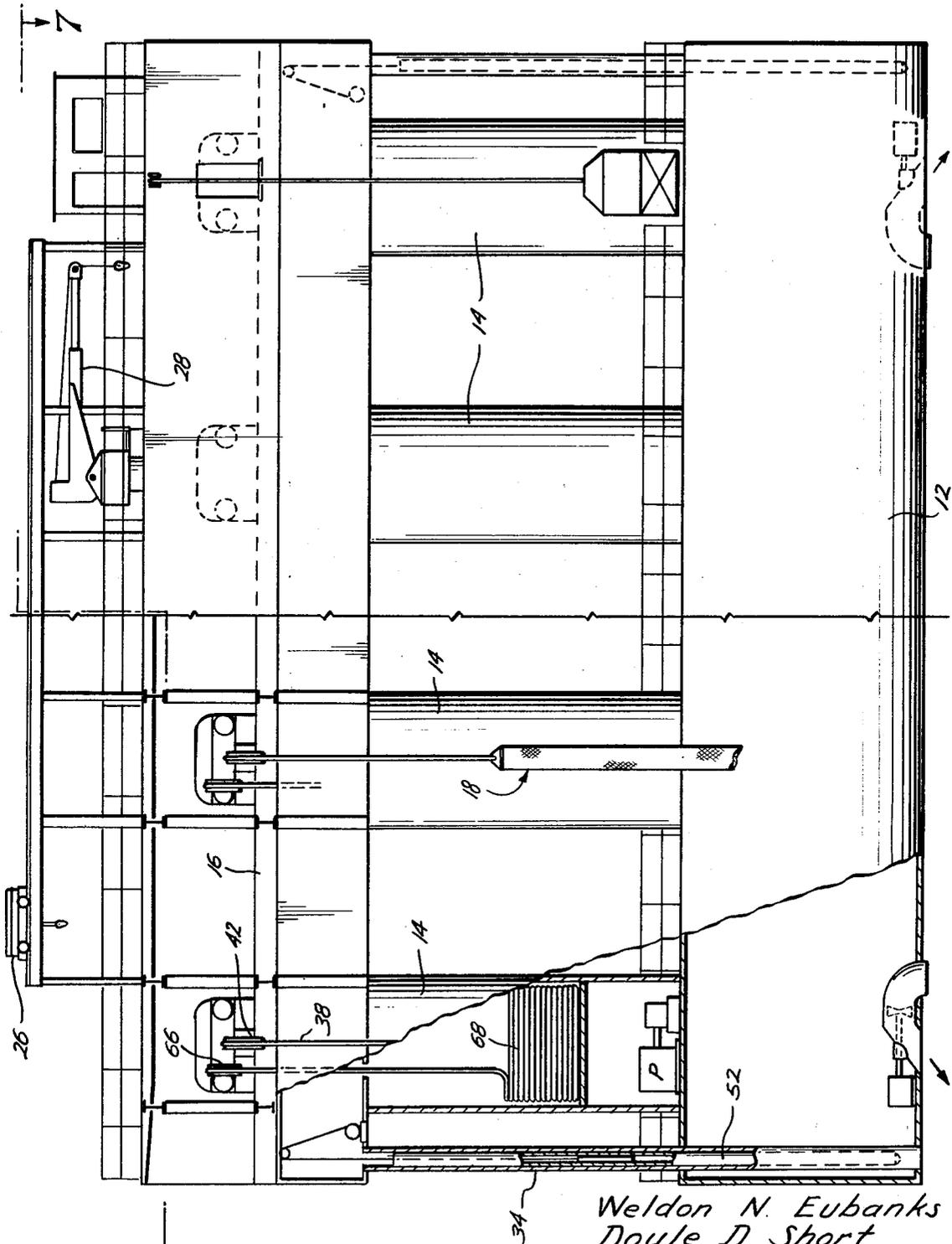


*Fig. 5*

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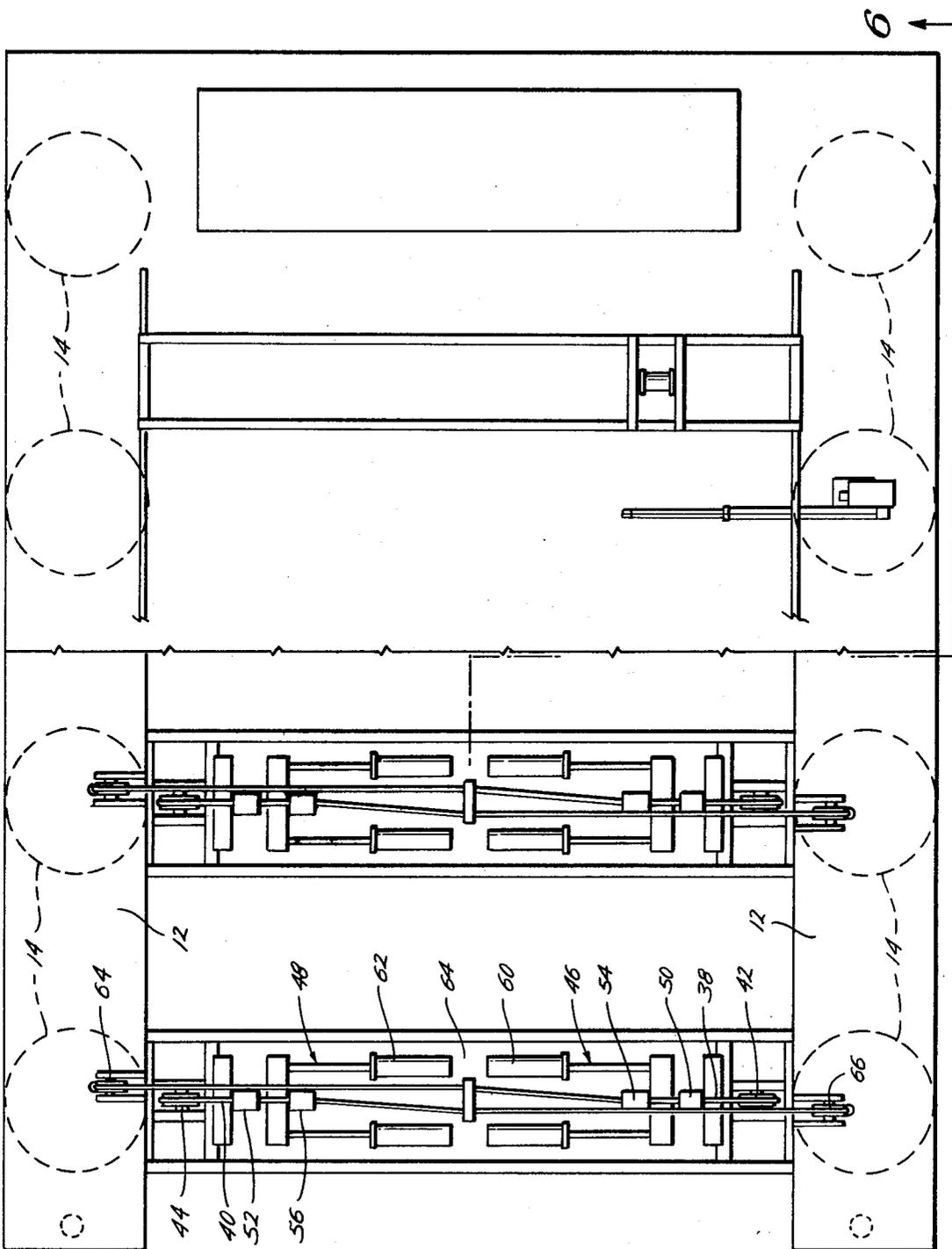


*Fig. 6*

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## MARINE SALVAGE VESSEL

## BACKGROUND OF THE INVENTION

Generally, the use of floating structures for use in marine salvage work such as shown in U.S. Pat. No. 2,375,286 is old. However, the prior art structures were lacking somewhat in flexibility of operation, stability, and ease of operation.

The present invention is directed to a marine salvage structure or vessel which may be operated on top of the water or submerged for salvaging operations and is stable both in a floating and a submerged position and includes an improved lifting system which allows the structure to have a minimum center of gravity as well as minimum superstructure strength thereby further increasing the stability of the structure.

## SUMMARY

The present invention is directed to a marine salvage structure having two elongated parallel horizontal hulls having ballast compartments with the hulls having a sufficient displacement to entirely support the structure and the salvage while floating on the water, the bottom of the hulls being arcuate and the tops being flat with a plurality of vertically extending buoyant caissons connected to the top of each horizontal hull and a horizontal superstructure connected between the tops of the vertical caissons for supporting the lifting means.

The present invention is further directed to an improved lifting means connected to the superstructure including a plurality of lifting cables one each of each cable leading upwardly to the superstructure on each side of the structure with a pulley supporting each end of the cable and the pulleys being carried by the superstructure adjacent one of the vertical caissons at a point inside the horizontal hull with a horizontally positioned jack connected to each end of the cable and the jacks at the opposing ends of each cable being supported from the superstructure between opposing vertical caissons and connected together thereby providing a minimum center of gravity and requiring a minimum superstructure strength.

A still further object is the provision of means for leading each end of the lifting cables across the superstructure for storage out of the way in the interior of an opposite caisson.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic elevational view showing the present invention in position in the water bottom astraddle a vessel to be salvaged,

FIG. 2 is a view similar to FIG. 1 showing the present invention lifting and salvaging the vessel,

FIG. 3 is a side schematic elevational view showing two of the structures of the present invention locked together for lifting a large barge from the water bottom,

FIG. 4 is a schematic elevational view of the present invention in position floating on the water surface and salvaging a vessel from the water bottom,

FIG. 5 is an enlarged elevational view of the marine salvage structure of the present invention,

FIG. 6 is a cross-sectional view taken along the line 6-6 of FIG. 7, and

FIG. 7 is a cross-sectional view taken along the line 7-7 of FIG. 6.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, the reference numeral 10 generally indicates the marine salvage structure or vessel of the present invention and generally includes two elongated parallel horizontally positioned hulls 12, a plurality of vertically extending caissons 14 connected to the top of each horizontal hull 12, a superstructure 16 connected between the tops of the vertical caissons 14 and lifting means generally indicated by the reference numeral 18.

The horizontally disposed hulls 12 preferably include an arcuate bottom 20 for providing a suitable contour for riding on the water, but includes a flat top 22 for providing a suitable work area. In addition, the hulls are of a sufficient displacement to entirely support the structure 10 as well as the item salvaged while floating on the water. The hulls 12 are preferably compartmented as illustrated by dotted lines 24 whereby a ballast may be added and removed during submergence of the structure 10 by any suitable ballast control means (not shown) as is conventional. Thus by ballasting the hulls 12 the marine salvage structure 10 may be lowered, raised or floated on the water as desired.

The vertically extending caissons 14 are secured to the horizontal hulls 12 at spaced intervals thereby providing a vertical support for the superstructure 16 which in turn provides a deck for carrying out the various types of operations. It is noted that the vertically extending caissons 14 may be used to house various operating components and are buoyant and thus will stabilize the vessel 10 when it is in a submerged or semi-submerged position as shown in FIG. 1. For purpose of illustration only, the apparatus 10 may be 100 feet long, have a beam of 85 feet, 55 feet between the hulls 12, and have a 50 foot clearance under the superstructure 16 when the salvage vessel is floating.

The superstructure 16 includes suitable bracing and truss and other connecting members for supporting the various operational components which may include, as best seen in FIG. 5, a traveling crane 26, and a hoisting crane 28 and the other usual facilities for power, crews, etc.

As best seen in FIG. 4, additional side pontoons 30 may be provided for additional buoyancy when required, and as best seen in FIGS. 3 and 6, spuds 32 may be provided to be lowered into the bottom to aid in securely positioning the vessel 10 when it is in a submerged position for holding it against wave forces while the lifting means 18 is secured to the salvaged item. The spuds 32 are slidably mounted in a guide and support tube 34.

Another feature of the present invention is the provision of suitable lifting means to lift a submerged vessel or object off of the bottom in a water covered area without making the superstructure or supporting structure top heavy and unstable. Thus the lifting means 18 includes a plurality of lifting slings or cables 36 wherein the first end 38 leads upwardly to one side of the superstructure 16 and the second end 40 leads upwardly to the other side of the superstructure 16. The end 38 runs over a pulley 42 and the end 40 runs over a pulley 44, the pulleys being carried by the superstructure adjacent one of the vertical caissons 14 at a position inside of the horizontal hulls 12. Thus, the vertical caissons 14 are able to support the vertical load on the pulleys 42

and 44 instead of requiring a great stress on the superstructure and thus requiring a top heavy structure. A horizontally positioned hydraulic jack generally indicated by the reference numeral 46 lifts cable end 38 and a horizontally positioned jack generally indicated by the numeral 48 lifts cable end 40. The hydraulic jacks 46 and 48 are conventional type two step jacks which include a stationary cable gripper 50 and 52, respectively, and a releasable movable cable gripper 54 and 56, respectively, each of the grippers 52, 54 and 56 and 50 include faces which grip the cable ends, as is conventional. Thus, the stationary cable grippers 50 and 52 normally hold the cable ends 38 and 40, but when the movable grippers 54 and 56 are actuated by the hydraulic piston and cylinder assemblies 60 and 62, respectively, the cable ends 38 and 40 are drawn through the stationary cable grippers 50 and 52 while the movable grippers 54 and 56 are pulling on the cable ends 38 and 40, respectively. At the end of the stroke of the hydraulic piston and cylinder assemblies 60 and 62, the stationary cable grippers 50 and 52 again grip and hold the cable ends 38 and 40, respectively, while the movable cable grippers 54 and 56 move outwardly to take another "bite" on the cable ends for again lifting the cable 36.

It is to be noted that the hydraulic jack assemblies 46 and 48 are both mounted on a base 64 and thus operate against each other since the cable 36 is simultaneously engaged by both jacks 46 and 48. Thus, when the lifting means 18 is lifting a salvage item less stress is placed on the superstructure 16 except at the pulleys 42 and 44 thereby allowing the strength and thus the weight of the superstructure 16 to be a minimum thereby reducing the possibility of the vessel 10 being top heavy and unstable. Furthermore, it is noted that the jacks 46 and 48 are placed in a horizontal position thereby keeping the center of gravity of the lifting mechanism as low as possible to maintain stability.

In order to keep the free ends of the cable 36 from cluttering up the vessel 10, the end 38 and the end 44 after passing through the hydraulic jacks 46 and 48, respectively, continue to the opposite side of the vessel and the cable end 38 passes over a pulley 64 so that it can be coiled and kept in the opposite caison 14. Similarly, the end 44 extends across the vessel, passes over pulley 66, and as best seen in FIG. 6 forms a coil 68 in the opposite caison. The other lifting cables 36 are similar in structure and operation.

Thus, in referring to FIG. 1, assuming a fishing vessel 70 in a water depth which would permit a bottom support approach, the hulls 12 would be ballasted until they came to rest on the bottom astraddle the vessel 70. With the structure on the bottom, divers can work in stronger current and place the lifting straps in place. After the lifting straps 36 are in place, tension or slack can be applied to any strap or a series of straps or any one end of a strap in order to right the vessel 70, and the vessel 10 may then deballast the hulls 12, either partially or entirely, as shown in FIG. 2, for carrying the salvage vessel 70 to the desired location.

Referring now to FIG. 3, it is noted that in the event of a sunken vessel, such as a barge 72, of a greater length than can be raised safely with a single marine salvage vessel 10, it is possible to connect two or more of the salvage vessels 10 together by conventional

locking devices (not shown) to form a suitably long enough unit with sufficient buoyancy to lift the heavier barge 72. It is noted in FIG. 3 that the salvage vessels 10 are kept in position astraddle the barge 72 by dropping the spuds 32 into the bottom.

And in some installations, as best seen in FIG. 4, it is not necessary that the marine salvage vessel 10 of the present invention 10 be lowered to the bottom of the water, but merely that divers be sent down to run and place the lifting cables 36 under the sunken vessel 74 and the vessel is raised from the bottom and supported entirely by the buoyancy of the vessel 10. Of course, the auxiliary pontoons 30 may be utilized if necessary to supply additional buoyancy.

The present invention, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned as well as others inherent therein.

What is claimed is:

1. A marine salvage structure comprising, two elongated parallel horizontal hulls having ballast compartments, the lower portion of the hulls being arcuate and the tops being flat, said hulls being of sufficient displacement to entirely support said structure and the item to be salvaged while floating on the water,

a plurality of vertically extending buoyant caisons connected to the top of each horizontal hull,

a horizontal superstructure connected between the tops of said vertical caisons,

lifting means comprising,

a plurality of lifting cables, one end of each cable leading upwardly to one side of the superstructure and the other end of each cable leading upwardly to the other side of the superstructure,

a pulley supporting each end of the cable, the pulleys being carried by the superstructure adjacent to one of the vertical caisons for support at a point inside of the horizontal hulls,

a horizontally positioned hydraulic jack connected to each end of said cable for pulling said cable, the jacks at the opposing ends of each cable being supported from the center of the superstructure and between opposing vertical caisons, but being connected together horizontally and back to back whereby the jacking structure center of gravity is a minimum.

2. In a marine salvage structure having two elongated parallel horizontal hulls having ballast compartments and a plurality of vertically extending caisons connected to the top of each horizontal hull a horizontal superstructure connected between the tops of said vertical caisons, the improvement in lifting means comprising,

a plurality of lifting cables, one end of each cable leading upwardly to one side of the superstructure and the other end of each cable leading upwardly to the other side of the superstructure,

a pulley supporting each end of the cable, the pulleys being carried by the superstructure adjacent to one of the vertical caisons for support at a point inside of the horizontal hulls,

a horizontally positioned hydraulic jack connected to each end of said cable for pulling said cable, the jacks at the opposing ends of each cable being supported from the superstructure between oppos-

ing vertical caissons, but being connected together horizontally whereby the jacking structure center of gravity is a minimum, means for leading such end of the cable across the superstructure for storage in the interior of the opposite caisson.

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