

[54] **DEVICE FOR SINKING AND RETRIEVING UNDERWATER HEAVY ARTICLE**

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[51] **Int. Cl.**..... **B63c 11/34**

[58] **Field of Search**..... 61/69, 46.5; 114/16, 16.5, 114/50, 51; 166/.5, .6

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[57] **ABSTRACT**

A device for sinking and retrieving an underwater heavy article which has a heavy article used under water, a take-up drum supported axially by the heavy article in connection to an electric motor controlled by the control command from a ship for taking up a guide rope when the motor is normally rotated and for feeding out the guide rope when the motor is reversely rotated, a float removably mounted to the guide rope, a hook attached to the suspension wire rope wound on the winch drum on the ship and replaceable with the float of the guide rope, and a mechanism for locking the hook to the heavy article when the hook is attached to the guide rope to be introduced to a predetermined position with respect to the heavy article. Thus, the heavy article may be simply and safely retrieved at any time even if underwater is turbulent or in any other troubled state.

5 Claims, 3 Drawing Figures

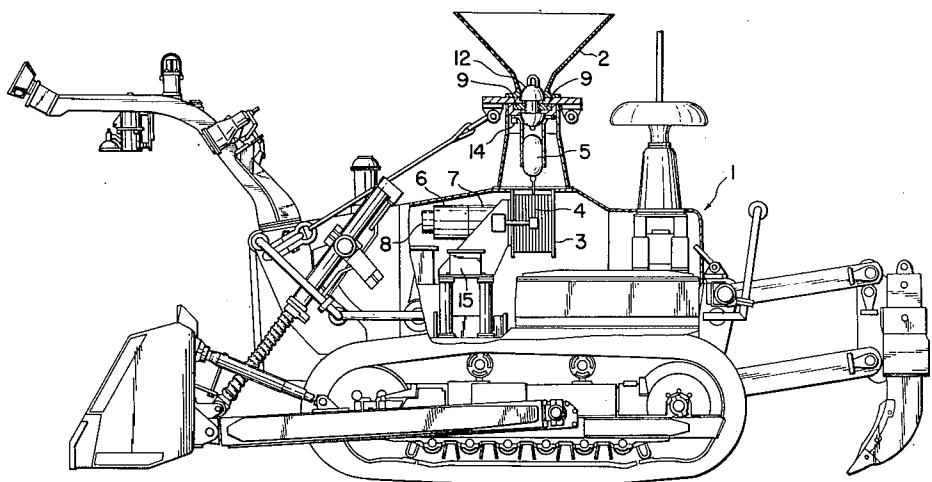
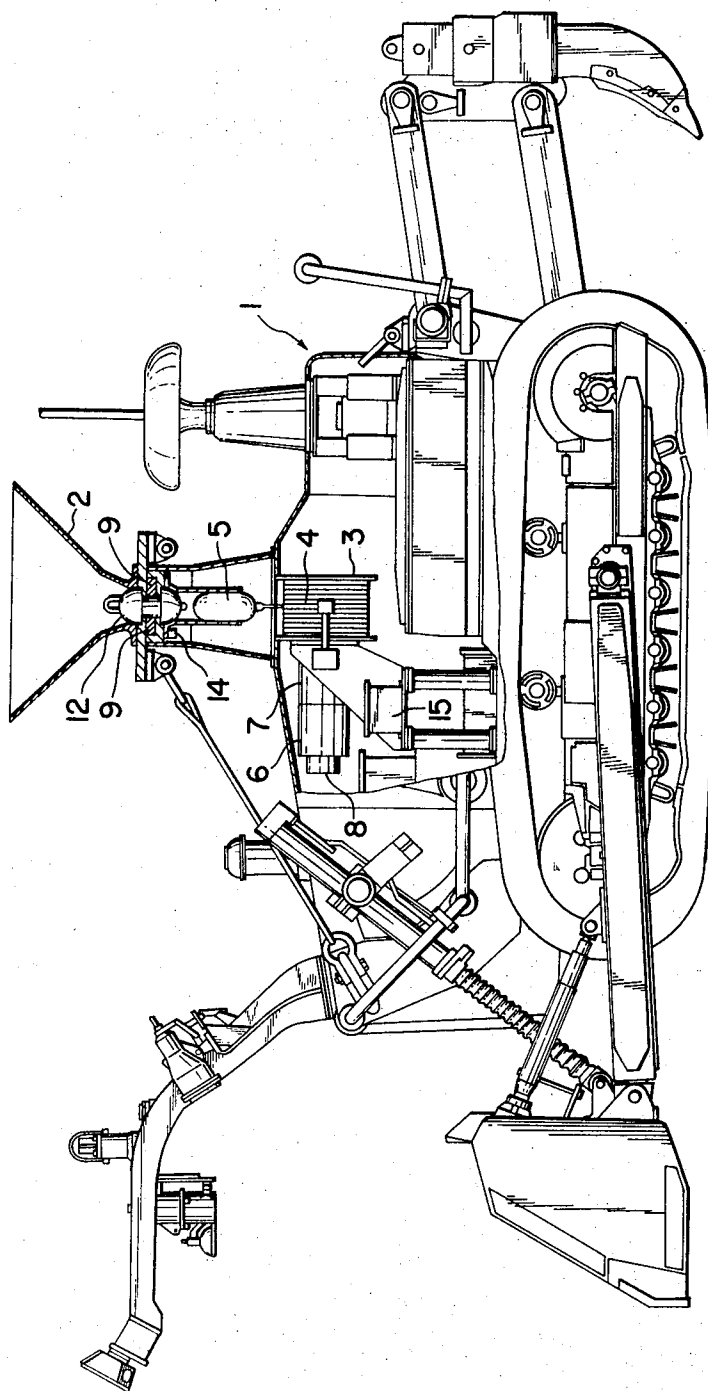


Fig. 1



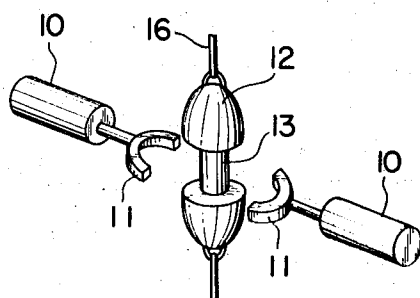
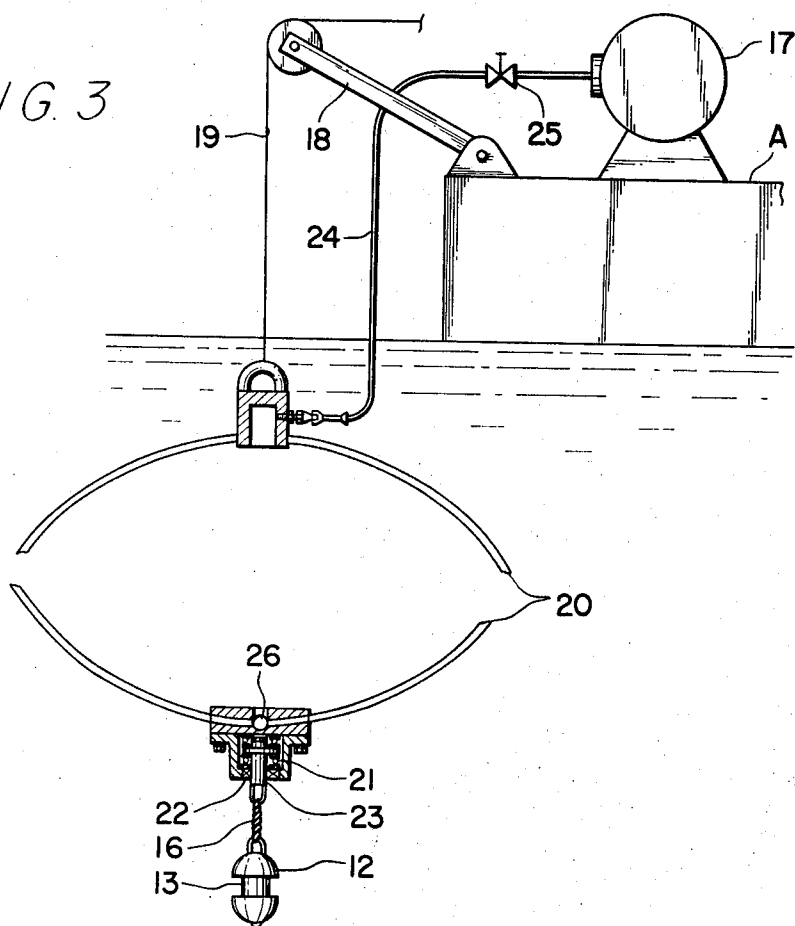


FIG. 2

FIG. 3



DEVICE FOR SINKING AND RETRIEVING UNDERWATER HEAVY ARTICLE

This invention relates to an underwater bulldozer, and more particularly to a device for sinking and retrieving underwater heavy article such as underwater operating machinery used under water such as underwater bulldozer.

When the work field of an underwater operating machinery such as underwater bulldozer is moved or the underwater bulldozer is damaged, the bulldozer must once be retrieved from underwater, and, in such case, a diver is heretofore submerged so that the hook of a wire rope fed from a crane ship is engaged with the retainer of the hook fixed to the operating machinery, but such wiring work of the diver becomes remarkably difficult, particularly when the depth of the sea is deep and the crane ship is rolling and pitching by the wave, and when the water is dirty.

The present invention contemplates to eliminate the aforementioned disadvantages of the conventional underwater bulldozer, and to provide a novel and improved device for sinking and retrieving underwater heavy article such as underwater bulldozer.

It is an object of the present invention to provide a device for sinking and retrieving underwater heavy article such as underwater bulldozer which may simply and smoothly retrieve the underwater bulldozer without necessity of wiring work of a diver.

It is another object of the present invention to provide a device for sinking and retrieving underwater heavy article such as underwater bulldozer which may simply sink and retrieve the underwater bulldozer under water only by the take-up and feed-out of the suspension wire rope by a winch drum provided on a ship.

It is a further object of the present invention to provide a device for sinking and retrieving underwater heavy article such as underwater bulldozer which may easily presume the position of the underwater bulldozer.

It is still another object of the present invention to provide a device for sinking and retrieving underwater heavy article such as underwater bulldozer which may automatically retrieve the underwater bulldozer even in any underwater state with simplicity and safety at any time.

According to one aspect of the present invention, there is provided a device for sinking and retrieving an underwater heavy article which comprises a heavy article used under water, a take-up drum supported axially by the heavy article in connection to an electric motor controlled by the control command from a ship for taking up a guide rope when the motor is normally rotated and for feeding out the guide rope when the motor is reversely rotated, a float removably mounted to the guide rope, a hook attached to the suspension wire rope wound on the winch drum on the ship and replaceable with the float of the guide rope, and a mechanism for locking the hook to the heavy article when the hook is attached to the guide rope to be introduced to a predetermined position with respect to the heavy article. Thus, the heavy article may be simply and safely retrieved at any time even if underwater is in any state without necessity of wiring work of a diver by automatically introducing the hook of the suspension wire rope fed from the crane ship to the locking mechanism of

the underwater bulldozer so as to automatically lock the hook by the locking mechanism.

According to another aspect of the present invention, there is provided a device for sinking and retrieving an underwater heavy article such as underwater bulldozer which comprises a heavy article used under water, a take-up drum supported reversely rotatably to the heavy article in connection to an electric motor controlled by the control command from a ship for introducing a guide rope connected to the motor, a rope take-up float removably attached to the guide rope wound on the take-up drum, a second float for sinking and retrieving the heavy article in connection to a compressor board on the ship through a transfer valve having an inlet and outlet port provided at a predetermined position, a hook attached to the second float and replaceable with the rope take-up float on the guide rope, and a mechanism for locking the hook to the heavy article when the hook mounted to the heavy article is introduced to a predetermined position of the heavy article. Thus, the underwater heavy article such as underwater bulldozer operated under water is sunken or retrieved by the float, and particularly upon retrieving of the underwater bulldozer, the above float is automatically docked to the underwater bulldozer so as to simply retrieve the underwater bulldozer by the buoyancy of the float produced by feeding compressed air into the float after docking of the float to the bulldozer. Thus, the wiring work of the diver, usage of crane ship having large suspension capacity and of towing boat for loading the underwater bulldozer are not necessary so as to simply and safely retrieve the underwater bulldozer at any time.

These and other objects, features and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawing, in which:

FIG. 1 is a side view partly in section of underwater bulldozer applied with one embodiment of the device of the present invention;

FIG. 2 is an enlarged perspective view of the locking mechanism of the device of the present invention; and

FIG. 3 is a view of another embodiment of the device of the present invention.

Reference is now made to the drawings, and particularly to FIG. 1, which shows one embodiment of the device for sinking and retrieving the underwater heavy article such as underwater bulldozer of the present invention.

Reference numeral 1 represents an underwater heavy article such as underwater bulldozer, on the upper portion of the body of which is mounted a hook guide cylinder 2 which is preferably formed gradually larger in diameter at the upper opening side. A take-up drum 3 is reversely rotatably mounted axially generally immediately under the hook guide cylinder 2.

This take-up drum 3 takes up the guide rope 4 wound on the drum 3 for guiding the hook upon normal rotation, and feeds out the guide rope 4 upon reverse rotation, and the float 5 is removably attached to the free end of the guide rope 4.

The take-up drum 3 is connected to a torque motor 6 as a prime mover through a reduction gear 7, and the torque motor 6 has an electromagnetic brake 8 so as to be controlled by the command from the control desk on the ship. The electromagnetic brake 8 is deenergized when the torque motor 6 receives the command

for normal and reverse rotation, and is energized when no command is dispatched or upon no energization.

On the other hand, mechanism 9 and 9 mounted instead of the float 5 to the free ends of the guide rope 4 at proper position in the hook guide cylinder 2 are mounted for removably locking the hook 12 introduced to the hook guide cylinder 2.

Referring now to FIG. 2, which shows one embodiment of the locking mechanism 9 and 9, the mechanism 9 comprises a pair of cylinder devices 10 and 10 disposed laterally symmetrically, a pair of engaging blocks 11 and 11 provided at the ends of the cylinder devices 10 and 10 and bent in semi-circular shape. An engaging groove 13 is formed on the hook 12.

When both the cylinder devices 10 and 10 move to extend in opposite direction relatively, the engaging blocks 11 and 11 are engaged with the engaging groove 13 of the hook 12 so as to lock the hook 12.

A limit switch 14 is mounted under the locking mechanism 9 in the hook guide cylinder 2.

This limit switch 14 is urged by the hook 12 introduced between the locking mechanism 9 and 9 so as to light the confirmation lamp on the control desk on the ship by the switching of the limit switch 14 by the hook 12. Further, the locking mechanism 9 is controlled by the opening and closing of the electromagnetic valve 15 mounted to the underwater bulldozer 1 based on the command from the ship.

In order to retrieve the underwater bulldozer 1 on the sea, the electromagnetic brake 8 is deenergized, when the reverse command is transmitted from the control desk on the ship to the torque motor 6. Then, the take-up drum 3 is reversely driven through the reduction gear 7 by the torque motor 6, and the guide rope 4 is fed out from the take-up drum 3 with the result that the float 5 mounted thereto is floated on the sea.

When the float 5 is floated on the sea, it is retrieved on the crane ship, and the float 5 is then removed from the guide rope 4, and is then replaced with the hook 12 mounted to suspension wire rope (not shown) wound on a winch drum (not shown) of a winch (not shown) on the crane ship to the guide rope 4.

Thus, in the state that the hook 12 is exchanged on the guide rope 4, when the torque motor 6 is normally rotated by the command transmitted from the control desk on the crane ship, the guide rope 4 is wound by the take-up drum 3 connected thereto so that the hook 12 is introduced to the hook guide cylinder 2 side, and when the hook 12 is drawn to a predetermined position of the hook guide cylinder 2, the hook 12 switches the limit switch 14 so as to light the confirmation lamp on the control desk on the crane ship.

When the electromagnetic valve 14 is transferred by the command transmitted from the crane ship upon confirmation of the energization of the confirmation lamp, the cylinder devices 10 and 10 of the locking mechanism 9 and 9 are extended, respectively so that the engaging blocks 11 and 11 are engaged with the engaging groove 13 of the hook 12 with the result that the hook 12 is locked to the hook guide cylinder 2.

When the suspension wire rope (not shown) is taken up by the winch drum on the ship in such state, the underwater bulldozer 1 is retrieved from the underwater. When the electromagnetic valve 15 of the retrieved underwater bulldozer 1 is switched so as to shorten the cylinder devices 10 and 10 of the locking mechanism 9 and 9, the hook 12 is released from the engaging

blocks 11 and 11, and is drawn from the hook guide cylinder 2 so as to remove the hook 12 from the guide rope 4. Then, the float 5 is replaced to the guide rope 4, and the torque motor 6 is rotated normally so as to take up the guide rope 4 by the take-up drum 3 so that the float 5 is reset to a predetermined position in the hook guide cylinder 2.

In order to sink the underwater bulldozer 1, the hook 12 is locked to the vehicle body side by the locking mechanism 9 and a, and the suspension wire rope (not shown) is, in turn, fed out by the winch on the ship in such state.

The above locking mechanism 9 and 9 may not always be limited to the above embodiment, and the underwater bulldozer 1 may be any of heavy articles used under water such as underwater operating machinery et al.

It should be understood from the foregoing description that since the hook attached to the suspension wire rope wound on the winch drum on the ship is locked to the underwater operating machinery or the other heavy article used under water by the locking mechanism, the sinking and retrieving operation of the heavy article under water may be conducted by taking up and feeding out the suspension wire rope by the winch drum on the ship.

It should also be understood that since the take-up drum connected to the motor controlled by the command from the control desk on the ship is supported axially on the heavy article in the present invention and the guide rope of the take-up drum is taken up and feed out by the normal and reverse rotation of the motor in such a manner that the float is removably attached to the guide rope, the guide rope is wound on the take-up drum so that the float is set to a predetermined position of the heavy article when the article is sunken under water, while the take-up drum is driven by the motor by the command of the control desk on the ship to feed out the guide rope when the heavy article is retrieved, and accordingly the position of the underwater heavy article may be easily presumed by the float floated on the sea, and when the float is removed from the guide rope so as to retrieve it, and the hook is replaced to the guide rope, in which state the take-up drum is reversely rotated so as to take up the guide rope, the hook may be introduced to a predetermined position of the heavy article, and then the hook introduced to a predetermined position of the heavy article may be locked to the article by the locking mechanism. Therefore, it is not necessary to conduct the wiring work by the diver when the underwater heavy article is retrieved, but the retrieving of the article may be automatically conducted in any underwater state simply and safely at any time.

Reference is now made to FIG. 3, which shows another embodiment of the device for sinking and retrieving the underwater heavy article such as underwater bulldozer of the present invention.

A crane ship A comprises the aforementioned control desk (not shown), an air compressor 17, and a derrick crane 18 having a suspension wire rope 19, and float 20 for sinking and retrieving the underwater heavy article such as underwater bulldozer mounted to the suspended end of the wire rope 19.

The hook 12 is mounted to the lower end of the float 20 through a thrust bearing 13, oil seal 22 and suspension fittings 23 and wire rope 16. The float 20 is con-

nected through a transfer valve 25 to the air compressor 17 by a hose 24, and an outlet port 26 is formed at the lower peripheral wall. The hook 12 thus mounted to the float 20 is enabled to be replaced with the rope drawing or guide float 5 to the guide rope 4.

The locking mechanism 9 and 9 are mounted to a predetermined position of the hook guide cylinder 2 of the underwater bulldozer 1 similar to the first embodiment of the device of the present invention, and are operated similarly thereto.

In order to retrieve the underwater bulldozer 1 sunken under water, the take-up drum 3 is reversely driven similar to the operation of the above first embodiment so that the float 5 is floated on the sea. Then, the float 5 floated on the sea is retrieved on the crane ship A and is then removed from the guide rope 4, and the hook 12 of the float 20 for sinking and retrieving the heavy article is replaced to the guide rope 4. Then, when the torque motor 6 is normally rotated by the command from the control desk on the crane ship A, the guide rope 4 is taken up by the take-up drum 3 interlocked to the motor 6 so that the hook 12 is introduced to the hook guide cylinder 2 at the same time the float 20 is submerged under water. In this case, water is flown into the float 20 through the outlet port 26 thereinto to fill it. Then, when the hook 20 is introduced to a predetermined position of the hook guide cylinder 2, it pushes the limit switch 14, whereby the confirmation lamp on the control desk is put on the crane ship A. Upon confirmation of the confirmation lamp, the float 20 is docked to the underwater bulldozer 1 similar to the operation of the above first embodiment.

Thus, when the float 20 is docked to the underwater bulldozer 1, the float 20 and the air compressor 17 are communicated by handling the transfer valve 25, and the air compressor 17 is operated so that the compressed air is fed into the float 20 with the result that the water in the float 20 is discharged from the outlet port 26. Then, the buoyancy of the float 20 is increased as the water therein is discharged, and then the underwater bulldozer 1 is floated by the float 20, and is then retrieved. The retrieved underwater bulldozer 1 is similarly reset to the above first embodiment.

In order to sink the underwater bulldozer 1 on the sea bottom, the hook 12 of the float 20 is locked to the vehicle body by the locking mechanism 9 and 9, in which state the float 20 is floated on the sea, and then the float 20 is opened to the atmosphere by the transfer valve 25 so as to gradually introduce the water from the inlet port 26 thereinto.

In the above embodiment, the transfer valve 25 may preferably be three-way valve, and the locking mechanism 9 may not always be limited only to that shown in the drawing, and the underwater bulldozer 1 may be any of the heavy article used under water such as underwater operating machinery.

It should be understood from the foregoing description that since the take-up drum connected to the torque motor controlled by the command of the control desk on the ship is reversely rotatably supported axially to the heavy article used under water in the embodiment, and the rope drawing float is removably mounted to the guide rope wound on the take-up drum, the guide rope is taken up on the take-up drum so that the rope drawing float is set to a predetermined position of the heavy article when the underwater heavy ar-

ticle is sunken, and the take-up drum is driven by the motor by the command of the control desk on the ship so that the guide rope is fed out from the take-up drum when the heavy article is retrieved, so that the rope drawing float is floated on the sea with the result that the position of the heavy article is at first confirmed easily.

It should also be understood that since the float for sinking and retrieving the underwater heavy article is connected through the transfer valve to the air compressor on board and the inlet and outlet port is provided to proper position of the float simultaneously the hook replaceable with the rope drawing float is attached to the guide rope, when the rope drawing float floated on the sea is retrieved to be removed from the guide rope, and the hook is replaced to the guide rope, in which state the guide rope is wound on the take-up drum, the float for sinking and retrieving the underwater heavy article may automatically be submerged under water, and yet since the hook introduced to the predetermined position of the heavy article is locked by the locking mechanism, when the transfer valve is operated so that compressed air is fed from the air compressor into the float docked through the hook to the heavy article by the transfer valve, the flown water is discharged from the float through the inlet and outlet port so that the buoyancy of the float is increased with the result that the heavy article is floated on the sea therewith. Thus, in order to retrieve the underwater heavy article, the device of the present invention does not necessitate the wiring work of the diver, usage of the crane ship having large suspension capacity, and towing boat for loading the heavy article, and accordingly the retrieving operation of the underwater heavy article may be simply and safely conducted at any time.

I claim:

1. A device for sinking and retrieving an underwater heavy article comprising a heavy article used under water, a take-up drum supported axially by said heavy article in connection to a prime mover controlled by the control command from a control desk on a ship for taking up a guide rope when the prime mover is normally rotated and for feeding out the guide rope when the prime mover is reversely rotated, a float removably mounted to the guide rope, a hook attached to the suspension wire rope wound on a winch drum on the ship and replaceable with the float of the guide rope, and a mechanism for locking the hook to the heavy article when the hook is attached to the guide rope to be introduced to a predetermined position with respect to the heavy article.

2. A device as set forth in claim 1, wherein said locking mechanism comprises a pair of cylinder means disposed laterally symmetrically, a pair of engaging blocks provided at the ends of said cylinder means and bent in semi-circular shape.

3. A device as set forth in claim 1, further comprising a limit switch mounted under the locking mechanism for energizing confirmation lamp on the control desk on the ship.

4. A device as set forth in claim 1, wherein further comprising an electromagnetic valve mounted to said underwater heavy article controlled by the command from the control desk on the ship for operating the locking mechanism.

5. A device for sinking and retrieving an underwater heavy article comprising a heavy article used under wa-

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ter, a take-up drum supported reversely rotatably to said heavy article in connection to a prime mover controlled by the control command from a control desk on the ship for introducing a guide rope connected to said prime mover, a rope take-up float removably attached to the guide rope wound on the take-up drum, a second float for sinking and retrieving the heavy article in connection to a compressor board on the ship through a

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transfer valve having an inlet and outlet port provided at a predetermined position, a hook attached to the second float and replacable with the rope take-up float on the guide rope, and a mechanism for locking the hook to the heavy article when the hook mounted to the heavy article is introduced to a predetermined position of the heavy article.

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