July 8, 1969 L. S. JUE 3,453,834

DEVICE FOR SUPPLY REPLENISHMENT OF AN UNDERWATER HABITAT

Filed Jan. 10, 1968 Sheet 1 of 2

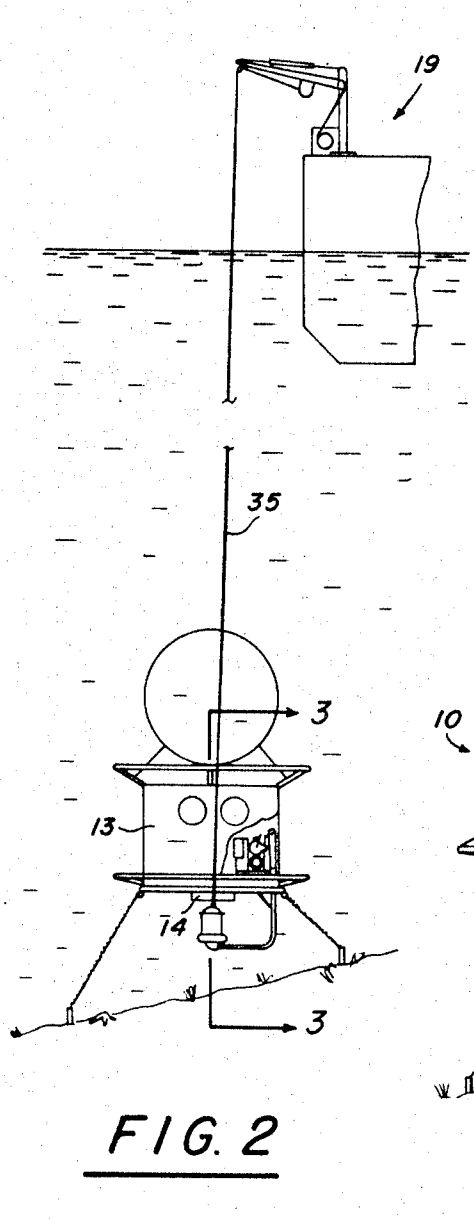


FIG. 2

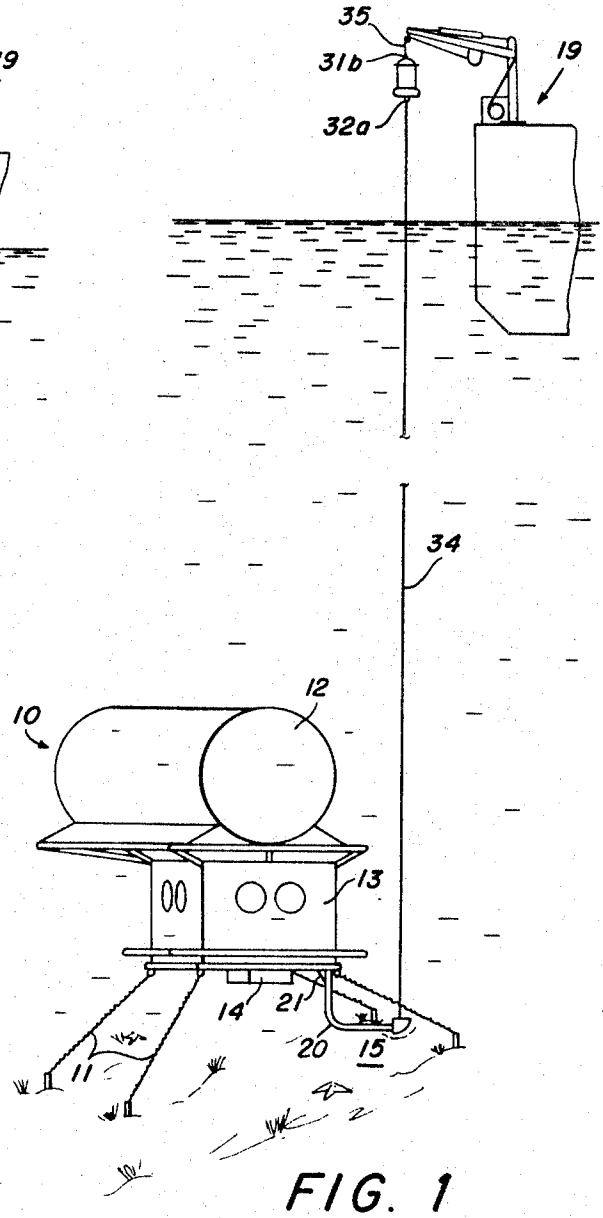


FIG. 1

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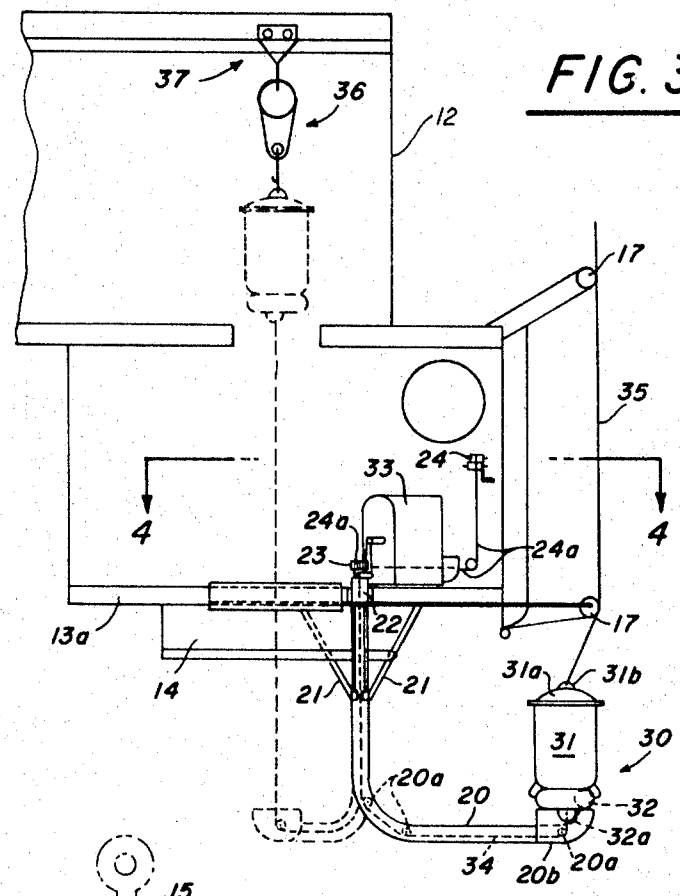


FIG. 3

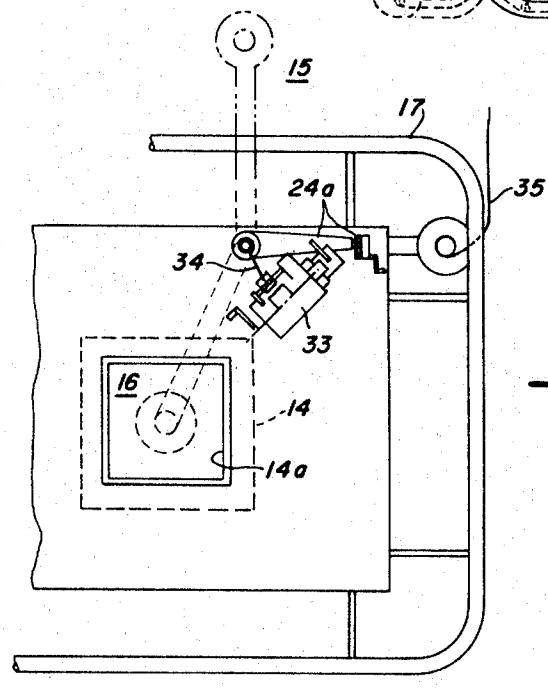


FIG. 4

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DEVICE FOR SUPPLY REPLENISHMENT OF AN UNDERWATER HABITAT

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U.S. Cl. 61—69 2 Claims

ABSTRACT OF THE DISCLOSURE

The disclosure relates to a method and means for transferring materials and supplies between a submerged chamber and the surface of a body of water in which the chamber is submerged. Such a transfer is achieved by controlling the vertical displacement of a buoyant container by selectively reeling in and unreeling a downhaul whip from a winch contained within the chamber. Lateral positioning of the buoyant container for facilitating the transfer is achieved by providing a pivoted davit-like arm or a telescoping boom. Both the arm and the boom are provided with a portion that is selectively positionable immediately adjacent an opening on the bottom of the chamber in the inboard position and laterally beyond the physical limits of the chamber in the outboard position. The invention provides a means for an underwater transfer that does not require that operating personnel get wet, that is to say, a transfer between the chamber and the surface may be readily achieved by personnel controlling the transfer from within the chamber.

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

Background of the invention

Recent widespread developments in adapting man to an undersea environment have focused scientists' and designers' attention on the problem of supply and materials replenishment to the submerged habitats. Since mental and physical strains attendant undersea operations are relatively great, every effort is being made to minimize these strains to make undersea operations more bearable. Current methods of supply replenishment require that the habitat occupants leave the habitat and go outside to effect the materials transfer via a single anchored cable or an endless belt, clothesline-like arrangement. Obviously, putting on a wet suit, leaving the habitat, carrying the supplies back to the habitat, and unsuiting involve a great deal of activity that preferably should be eliminated.

Summary of the invention

The present invention is directed to providing a device for transferring a buoyant container between a submerged chamber and the surface of a body of water. The chamber is provided with an opening on the bottom in communication with the surrounding environment. Since

the chamber is pressurized, the surrounding water is prevented from entering and filling the chamber. An extensible means in the form of a telescoping rod section or a pivoted, underwater upside-down davit is mounted on the chamber and has a portion which is selectively positionable in an inboard position and an outboard position. This portion is formed to releasably secure the buoyant container and to hold the container when the portion is being laterally displaced. When combined with a means for controlling the vertical displacement of the container, preferably in the form of a winch having an uphaul whip connected to the container, a transfer of the container between the opening and the surface of the body of the water is achieved without requiring that the operating personnel leave the submerged chamber.

It is an object of the present invention to provide a device for effecting the transfer of supplies between the surface and a submerged chamber.

Another object of the invention is to provide a device for effecting a transfer of materials between the surface and a submerged habitat in which habitat personnel control the transfer from within the habitat.

Another object of the invention is to provide a device that enables an underwater transfer of relatively heavy objects.

Still another object is to provide an apparatus for underwater supply replenishment that involves no undue physical or mental strain on the committed personnel.

An additional object is to provide a means for effecting an underwater supply and materials transfer that is rugged and extremely reliable thereby being ideal in deep submergence work.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Brief description of the drawings

FIG. 1 is a perspective view of the habitat on the ocean floor showing an underwater upside-down davit in the outboard position and a buoyant container hoisted from the water by the surface support vessel;

FIG. 2 shows an end view of the view of FIG. 1 with an underwater upside-down davit approaching the inboard position;

FIG. 3 shows a sectional view of the underwater habitat taken along lines **3—3** of FIG. 2;

FIG. 4 shows a sectional view taken along lines **4—4** of FIG. 3.

Preferred embodiments of the invention

Referring now to the drawings, FIG. **1** shows a chamber **10** submerged in a body of water and moored on the bottom by a plurality of chains **11** connected to embedded stanchions or similar mooring devices. Here, for purposes of the immediate disclosure, the chamber is separated into a habitat portion **12** and an observation-supply transfer portion **13** having a dependent rectangularly shaped passageway **14** terminating in an opening **14***a*. Since the interior of the chamber is directly exposed to the surrounding water, it is necessary to pressurize the chamber to equal the surrounding water pressure to prevent flooding of the

chamber interior. Pressurization from compressed air bottles or from a line extending to a compressor on the surface keeps the level of the surrounding water at the opening or at a desired level within the rectangularly shaped passageway.

A container **30** includes a supply and materials compartment **31** having a lid **31***a* provided with an uphaul pad eye **31***b* and a float compartment **32** provided with a downhaul pad eye **32***a*. The load capacity and the displacement of the materials' compartment and the float compartment must be such that even when the materials' compartment is fully loaded, the float compartment will render the entire container buoyant. It can be readily seen that heavy loads can be transported easily by merely increasing the size of the float compartment. Since the container is subjected to substantial variations in pressure as it passes from the habitat to the surface, suitable seals and lid securing means, well known within the art, must be provided. To facilitate ease in opening and safety, a valve for the supply-material compartment can be provided to equalize the pressure in the compartment to the pressure of the surroundings when a transfer between the chamber and the surface has been made.

A hollow L-shaped, underwater upside-down davit **20** is pivotally mounted on the bottom of the supply transfer portion of the chamber and is provided with a plurality of internal guide rollers **20***a*. The davit is secured by several braces **21** and well known seal bearing support **22** mounted in the floor **13***a* both being suitably constructed to bear the forces involved when transferring the container. A rotation pulley **23** is secured to the inner end of the davit and is operatively connected to a rotation crank assembly **24** by an endless cable **24***a*. By manually turning the crank assembly, the davit can be made to transverse a 360° arc. On the outward end of the davit a shaped portion **20***b* is formed to releasably support the container.

An electrically or manually operated downhaul winch **33** is adapted to store a downhaul whip **34**. The whip extends from the winch through the davit, passes over the guide rollers, and is attached to downhaul pad eye **32***a* on the container. The whip is of sufficient length to permit the buoyant container to make a controlled ascension and descent the entire distance between the habitat and the surface. The whip is either a treated wire rope or a polyethylene line, both of which are noted for their strength and ability to resist the effects of salt water corrosion and chafing. A line of similar material, an uphaul whip **35**, is connected to the uphaul pad eye **31***b* and extends to a surface winch and crane assembly **36**.

The davit is selectively pivotable about a 360° arc to freely position the container supporting shaped portion **20***b* laterally from the chamber as shown in phantom by the reference character **15** or directly adjacent the opening **14***a* as shown by the reference character **16**. When the shaped portion is radially displaced to position the container adjacent the opening, an overhead hoist **36** is extended to connect to uhaul pad eye **31***b* and the entire container can be raised through the transfer portion and into the habitat portion of the submerged chamber. A wheel and track assembly **37** supporting the hoist permits a selective transverse positioning of the container within the habitat. To prevent damage to the container and to the chamber during raising and lowering operations, the supply transfer portion is provided with a pair of girdling fairing extensions **17**.

In operation of the invention, communications between the chamber and the surface are essential. Telephone communications or an acoustic code must be established to insure that efficient transfer occurs.

To send supplies from the surface to the habitat the uphaul winch and crane operator lowers the container to the surface of the water, and while so doing, signals to the subferged chamber that the lowering operation is beginning. Upon receiving an additional signal from the surface, the downhaul winch operator commences to reel in the downhaul whip and, in so doing, pulls the container beneath the surface of the water and toward the submerged chamber.

In order to insure stability of transfer, that is, to resist the effects of current and tide, the uphaul crane operator maintains tension on the uphaul whip. When the downhaul winch operator observes that the container is close to shaped portion **20***b*, he signals the uphaul crane operator to relieve tension on the uphaul whip. Additional rotation of the downhaul winch places the container on the shaped portion and circumferential rotation of the davit via crank assembly **24** positions the container immediately adjacent opening **14***a*. The overhead hoist operator connects the overhead hoist **36** to the uphaul whip pad eye **31***b* and hoists the container **30** into the habitat. Since there is no tension in the uphaul whip **35**, the whip follows this operation effortlessly. During the hoisting operation, the downhaul winch operator will play out a sufficient length of downhaul whip **34** to enable the container to be raised into the habitat.

To effect a chamber-to-surface transfer, the container is placed on the shaped portion and the davit is cranked to a position lateral of the chamber. Upon signaling the surface, tension is brought to bear on the uphaul whip and a slight amount of drag is maintained on the downhaul whip as it is unreeled from the downhaul winch. When the container reaches the surface, a signal from the surface to the chamber indicates that additional downhaul line should be released to permit the uphaul crane operator to raise the container from the water onto the surface support vessel.

While what has been described has been a pivotal davit, it is readily understood that a telescoping extension could be used to selectively position the container adjacent the opening and laterally from the chamber. Additionally, an arrangement of weights and pulleys within the observation chamber can be provided to take up slack or fluctuations in the length of the whips caused by wave and tide action on the surface vessel.

It should be understood that the foregoing disclosure relates only to a preferred embodiment of the invention. Numerous modifications or alterations may be made therein without departing from the spirit and scope of the invention as set forth.

What is claimed is:

1. A device for transferring a container having a watertight supply compartment and a float compartment between a submersed chamber and the surface of a body in which said chamber is submerged comprising:

access means disposed in the bottom in said chamber having an opening sized for permitting the passage of said container therethrough;

means for pressurizing said chamber to expel water from said access means;

extensible means mounted in said chamber having a portion selectively positionable adjacent to said access means and lateral from said chamber, said portion adapted to releasably secure said container thereto;

means for controlling the vertical displacement of said container when said portion is disposed adjacent said access means and when laterally disposed from said chamber to permit the transfer of said container between said chamber and said surface including a downhaul winch disposed within said chamber and a dawnhaul whip extending along said extensible means and being connected to said container for controlling said vertical displacement;

means disposed on said surface for stabilizing said container having an uphaul whip connected to said container for stabilization thereof during said transfer; and

means for hoisting said container from said access means into said chamber being adapted to traverse said chamber.

2. A device according to claim 1 in which said extensible means includes;

an upside-down davit pivotally mounted on the botton of said chamber and

a rotation crank assembly disposed within said chamber mechanically cooperating with said davit for positioning said portion adjacent said opening and lateral from said chamber, said davit having means for guiding said downhaul whip.

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U.S. Cl. X.R.

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