April 28, 1970 E. G. FRANKEL 3,508,510

LIGHTER HYDROLIFT DEVICE

Filed Aug. 21, 1968 2 Sheets-Sheet 1

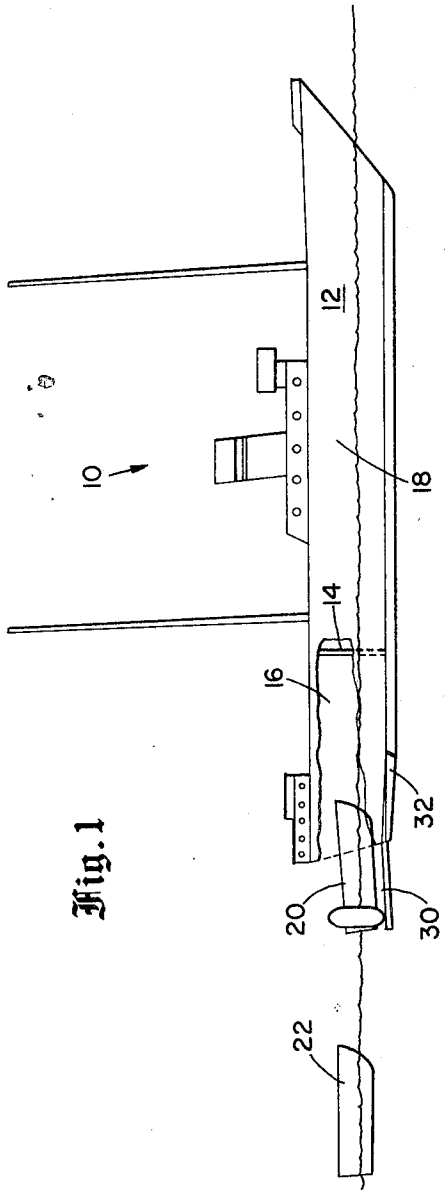


Fig. 1

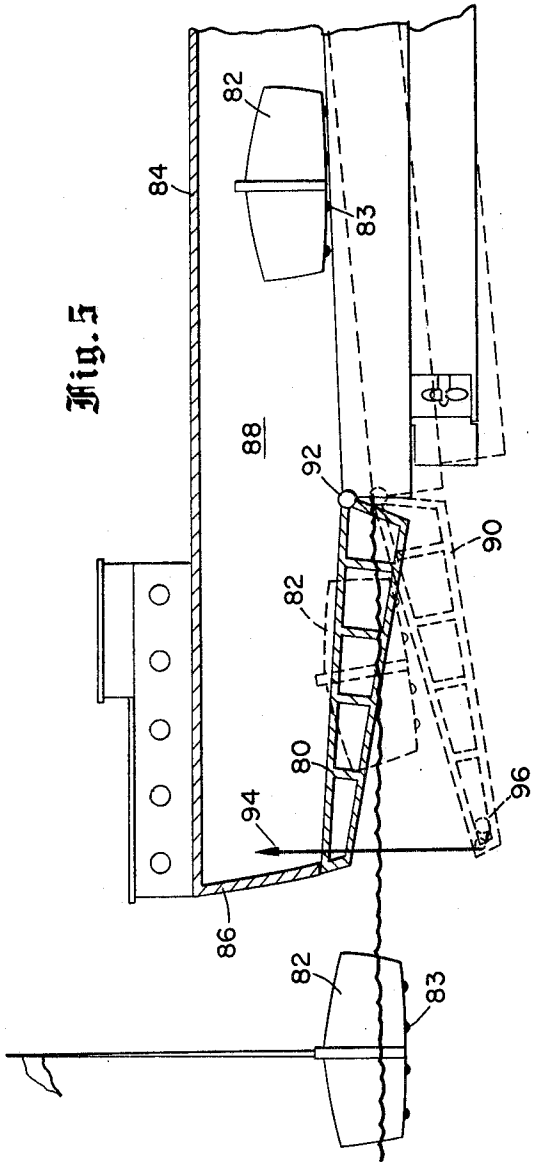


Fig. 5

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Filed Aug. 21, 1968 2 Sheets-Sheet 2

Fig. 2

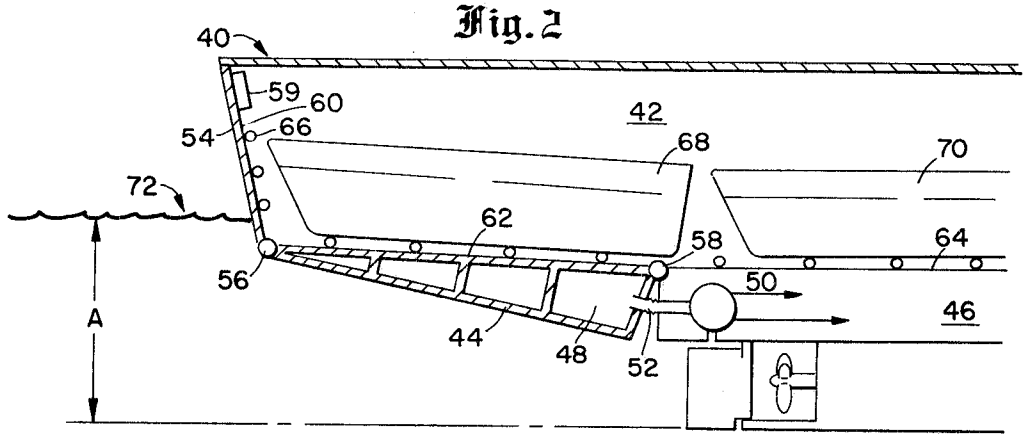


Fig. 3

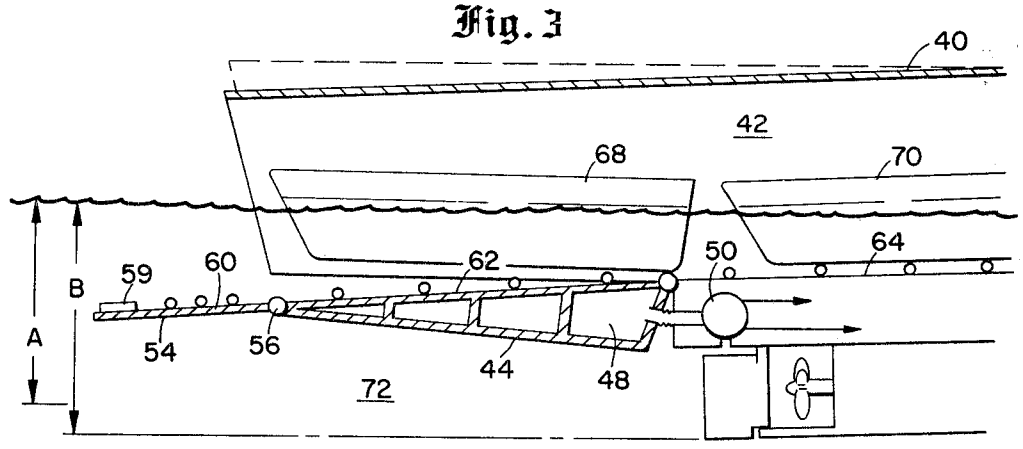
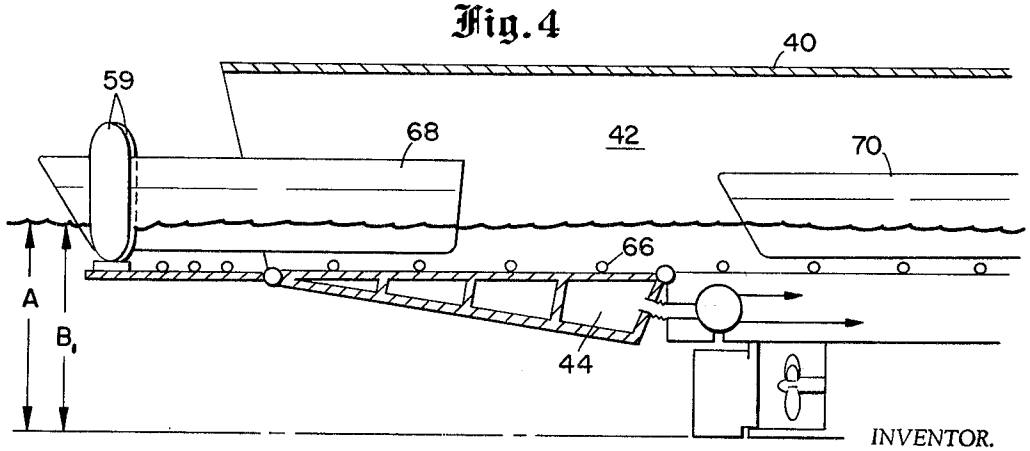


Fig. 4



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LIGHTER HYDROLIFT DEVICE

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U.S. Cl. 114—43.5 11 Claims

ABSTRACT OF THE DISCLOSURE

A marine vessel having a cargo-well construction which is adapted to load and unload buoyant cargo by using a hull section which is pivotally connected to a bottom section which is pivotally connected to the vessel for opening the well whereby the sections act as gates and ramps and, in addition, the bottom section in combination with integral ballast compartments and power means acts as a hydrolift device. The loading and unloading method involves opening the well by turning and submerging the hull section and activating the hydrolift device for raising cargo into, or lowering cargo out of, the well.

SUMMARY OF THE INVENTION

This invention relates to an improved device and method for loading and unloading a marine vessel and, more particularly, to an operable well construction and associated operational method which launches, docks and retrieves buoyant cargo or vehicles, such as lighters, barges, etc., in the hull of the marine vessel.

As by introduction, it might be well to point out that throughout history ships have been built which can load and unload substantial, large objects into their holds without hoisting those objects over the ship's side (or railing). Such ships can be divided into two different types; the first type uses a so-called dry solid ramp or well with an outside gate, and the second type uses a wet-well configuration. As known to stevedores in particular, the use of a dry ramp or well requires powerful mechanical towing or conveying devices while the use of a wet-well requires massive ballasting requirements and associated pumping equipment to stabilize and trim the ship's draught.

The present invention does not use powerful mechanical towing or conveying devices nor does it need the overall ballasting requirements as needed by the dry solid ramp or wet-well configuration, respectively. It achieves the advantages of both types of cargo-handling systems without these noted disadvantages.

Besides being able to dock, launch and retrieve lighters within the hull of a marine vessel by a method comprising a few simple steps, an additional advantage of greater magnitude and importance resides in the potential usefulness and application of the invention. This important advantage can be easily recognized when comparing the invention with the systems mentioned above, wherein it is a known fact that a marine vessel which has a construction employing a wet or dry well classifies the vessel into a distinct minority group of special ships built for particular purposes, i.e., such as floating docks, whale-fishing factory vessels, etc. However, that fact may change soon since the present invention through its uniqueness, simplicity and compactness can be used in almost every existing freighter. As is well-known through the merchant marine industry, one of the largest financial losses occurs when a freighter is delayed through circumstances such as: waiting for pilot services, waiting in line until the harbor is clear, or as is customary in many ports with poor harbor facilities, having to anchor offshore

while waiting to make arrangements with stevedores for loading or unloading purposes. Furthermore, sea conditions and/or weather conditions such as fog and rain can prevent the entering of the port, often causing excessive delays. In addition, the expense and the availability of longshoremen and possible sudden strikes have many times turned a promising profitable cargo haul into a heavy financial loss. As known to people having experience in the merchant marine business, one or more of the above-mentioned delay-causing occurrences do happen quite frequently and do occur on practically every regular freighter voyage. Thus, it will be understood that the present invention, wherein a freighter carries its own lighters or barges for loading and unloading purposes and where the method of launching, docking and retrieval of these lighters can be done by a simple method, offers a very important financial and time-saving advantage which will undoubtedly be attractive to the shipping business of the future.

In general, the construction of the device comprises at least one well which is a distinct part of the hold of the ship. The hold of the ship is meant herein to comprise the whole interior of the ship below deck. The location of the well could be anywhere in the hold, provided that one side of the well is part of the outboard hull-side of the vessel. The well may have a horizontal or slightly inclined bottom inboard surface, depending on the ship's characteristics and cargo-handling operations, and one section of the bottom is pivotally hinged and connected to a portion of the bottom of the vessel. The hinged bottom section can either form a part of the underwater buoyancy portion of the ship's displacement body when in its retracted position or be designed to partially or completely be above the mean water level and form all or part of the closure of the ship's well. The level of the hinge may be at the mean water level or a few feet above or below the mean water level, depending on the ship's hull characteristics and operating requirements. Preferably, the hinged bottom section is provided with internal ballast compartments divided in an appropriate manner to permit adjusted sinkage of this well bottom section to any degree required. As a result of ballasting this bottom section, not only is it submerged by rotation about the hinge, but the added weight introduced by ballasting will result in parallel sinkage of the ship and cause a positive gradient of the ship's draft towards the well. This declining gradient will effectively aid the unloading of cargo or the launching of lighters.

For retrieval operations the lighter is moved onto the submerged hinged sloping bottom section of the well until the bow touches the inboard surface of the bottom section. Thereafter, the water ballast within the ballast compartments of the bottom section is discharged by the use of a pump, pneumatic pressure or other means causing a positive buoyancy to the bottom section which will lift the lighter into the ship's well. When the bottom section is in its retracted position, the existence of a declining inboard surface and/or anti-frictional devices mounted thereto will greatly assist in properly docking the lighter. In the preferred and most practical design of this invention, one sidewall of the wall being a side-hull section will be pivotally connected to the bottom section and during loading and unloading or launching and retrieval operations will be submerged to form an auxiliary ramp or guiding means.

It is accordingly an object of the present invention to provide an improved well construction in a marine vessel which construction is adapted to accomplish a variety of functions such as loading, transporting and unloading of objects into and out of the well area.

It is another object of the present invention to provide an improved well construction in a marine vessel wherein the construction is adapted to transport cargo in a simple manner without requiring heavy power means or massive balance systems.

It is yet another object of the present invention to provide an improved well construction in a marine vessel which is applicable to most marine freighters and does not require heavy capital investments.

It is yet another object of the present invention to provide an improved well construction for marine vessels which is applicable for installation in most existing freighters and the well construction is used for the launching, docking and retrieval of lighters in order to provide the freighter with independent cargo-handling means.

It is yet another object of the invention to provide an improved well construction in which the construction itself employs a small power means to actuate a hydrolift means which can handle the transporting of large objects.

It is yet another object of the present invention to provide a method for loading and unloading of buoyant lading into or out of the ship's hull mainly through the aid of gravitation and the regulation of buoyancy forces.

It is yet another object of the present invention to provide a method for launching and retrieval of buoyant objects into and out of a marine vessel during almost all weather and sea conditions.

These and other objects and advantages of the present invention will become more apparent as the description proceeds but, in general, the present invention relates to a marine vessel which has as part of its hold a separate cargo-well construction which is adapted to convey lading. A bottom section of the well is provided with integral ballast compartments which are pivotally connected to the vessel. Preferably, a side-hull section is pivotally connected to the bottom section and power means are connected to the ballast compartments of the bottom section for regulating the contents of these compartments. Most likely, a pump for regulating the water contents of the ballast compartments is used so that the pivotally connected bottom section can be submerged and positioned into a predetermined ramp slope. Also, the pivotally connected bottom section in combination with the pump comprises a hydrolift means for raising and lowering cargo positioned on said bottom section. It will be an advantage to have the upper surface of the bottom section declining toward the pivoting arrangement so that when the cargo is within the well the transportation thereof is aided by gravitation. When the well is opened by turning outboard the pivotally connected side-hull section, the latter section may be submerged into a predetermined position with respect to the pivotally connected submerged bottom section and used as an auxiliary ramp. Floating means may be connected to the hull section to serve as guiding or additional lifting components. In the preferred embodiment, the well construction is located at the stern or bow portion of a ship, in which case the stern or bow side acts as a movable side-hull section. This movable side-hull section and a bottom well section are pivotally connected, and the bottom section and the remainder of the vessel are pivotally connected by a first and a second substantially horizontal athwartship-mounted watertight hinge assembly, respectively.

The side-hull and the bottom sections are substantially rectangular shaped and their upper surfaces are substantially level shaped at the inboard side and, depending on the operational requirements, could be provided with antifrictional means for transporting cargo.

Thus, in accordance with the above-described well construction, it will be obvious that the loading and unloading procedures comprise a few simple steps such as: opening the cargo well by turning outwardly the side-hull section, submerging the bottom section, and activating pumping means to regulate the buoyancy of that section for hydrolift purposes.

The above-mentioned objects, features and advantages will become more apparent from the following description taken in conjunction with the accompanying drawings, wherein like character references are used to indicate like parts for each embodiment, and wherein:

FIG. 1 is a schematic side view of a freighter which has a partly broken-away section showing, in the stern portion of the vessel, a well constructed in accordance with the present invention;

FIGS. 2, 3, and 4 are enlarged schematic views of the well shown in FIG. 1 wherein the figures sequentially illustrate the steps for launching or retrieving a lighter;

FIG. 5 is a schematic view of a bow or stern section which illustrates a slightly different embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings, there is shown in FIG. 1 a marine vessel **10** having holds **12** in which, if required by bulkhead deck requirements, is mounted a vertically closed bulkhead **14** which extends substantially athwartship and separates the holds **12** in a specially constructed well area **16** and a remander area **18**. This separation, if required, can be penetrated by watertight doors (not shown).

As illustrated in FIG. 1, a lighter **20** is shown in the position of being launched or retrieved while another lighter **22** is floating independently. Both lighters **20** and **22** were stored side by side in the well area **16** in such a way that their longitudinal axes extended parallel to the longitudinal axis of the vessel. However, it should be understood that the manner of storing the lighters or cargo is not part of the invention and also that efficient storing could be accomplished by positioning the lighters with their longitudinal axes perpendicular to the longitudinal axis of the vessel. Similarly depending on the width of the well, a single lighter may be stored only in the athwartship direction.

The lighter **20** is partly positioned on an auxiliary submerged ramp **30** and a submerged bottom section **32**, which are both part of the construction of the well **16** and which operate in a special way which is more clearly illustrated in the embodiment in FIG. 2.

Referring to FIG. 2, there is shown an enlarged stern portion **40** of a marine vessel. Part of the stern portion **40** comprises a well **42**, which is part of a hold of a marine vessel similarly described in FIG. 1. The bottom of the well area comprises a pivotally connected bottom section **44** and a permanently stationary mounted bottom portion **46**. The bottom section **44** comprises a plurality of integrally mounted ballast compartments **48** which capacity is divided in an appropriate manner to permit adjusted draft sinkage, or submergence, of the movable bottom section **44** to any degree required. In order to regulate the water contents of the ballast compartments **48**, a regulating means **50**, such as a pump operating on a hydraulic, pneumatic pressure, electric or on any other well-known system, is installed in the vessel and connected with a flexible coupling **52** to the ballast compartments **48** for adding or removing water ballast to or from the ballast compartments **48** upon activation of the regulating means **50**.

The stern closure, or side-hull section **54**, is pivotally connected to the bottom section **44**. The pivoting connection with the side-hull section **54** and the bottom section **44** comprises a substantially horizontally athwartship watertight mounted hinge assembly **56**, which is more or less similar to the hinge assembly **58**, mounted between the movable bottom section **44** and the stationary bottom section **46**. In addition, the side-hull section **54** is equipped with an optionally mounted, deflated floating means **59**, which use will be explained below. Furthermore, the inboard surface **60** of the side-hull section **54**, the inboard surface **62** of the bottom section **44** and the inboard section **64** of the bottom section **46** are provided

with anti-frictional means **66** to aid in the launching and retrieval of lighters **68** and **70**. In FIG. 2 the lighters **68** and **70** are illustrated to be docked in the well **42**, as during a regular voyage of the marine vessel having a predetermined draft A at the stern portion, as indicated.

In FIG. 3 the launching operation of the lighter **68** from the well **42** is illustrated. The side-hull section **54** has been turned outwardly about the hinge assembly **56**, as shown by the arrow, thus, opening the well **42**. The bottom section **44** has been submerged, by adding water to the ballast compartments **48**, into a sloping position. The outside water **72** will partly flood the well area **42**, making it a wet-well configuration. Launching of the lighters **68** and **70** can be easily accomplished by moving same along the declining sloping surfaces **64**, **62** and **60**, respectively.

For retrieval operations, the lighter **68** or **70** is moved onto the submerged sloping surfaces **62** and **64**, then the water within the ballast compartments **48** is discharged by the pump **50** which causes a positive buoyancy to the bottom section **44** which, in turn, will retract itself into its former position, thereby lifting the lighter **68** into the well area **42**. Thus, the pivotally connected bottom section **44** in combination with the pump **50** comprises a hydrolift means for raising and lowering cargo or lighters positioned on the bottom section **44** into and out of the well, respectively.

As shown in FIG. 2, the surface **62** of the bottom section **44** has a declining slope toward the hinge assembly **58** when the bottom section is in a retracted or closed position, which aids in the stowing and docking of the lighter into the well as gravitational force.

As shown in FIG. 3, the normal draft A of the marine vessel has been increased to a certain depth B, as indicated, as a result of the flooded well and the ballasted bottom section **44**. Depending on the size of the marine vessel and other characteristics, it might be objectionable in some cases to increase the draft at the stern section. In particular, in cases where the movable bottom section comprises part of the underwater buoyancy of the vessel, this variation of draft may become disturbing to certain hull stress limits.

In instances where the well is a relatively small section of a hold, i.e., in a large marine vessel, the increase in draft at the stern section will be practically insignificant.

In FIG. 4, the ship's draft increase B has been eliminated by the adjusted inflation of the deflated flooding means **59** so that draft B_1 is substantially equal to the normal draft A. As shown in the preferred embodiment, two vertical inflated buoyant surface-piercing cylinders are attached at the port and starboard aft corners of the submerged side-hull section, forming the auxiliary ramp **54**, which both provide a controlled uplift and simultaneously a fendering or guidance to the lighterage. It is, of course, obvious that various retractable guides or floating means can be installed at various locations along the movable ramp **54** and the bottom section **44**.

The slightly different embodiment of the invention shown in FIG. 5 has a bottom section **80** which raises partly above the mean water level when in its retracted or closed position. A customary flat-bottom type lighter **82**, having low frictional means **83** mounted underneath its bottom as a preferred but optional means for handling, is shown in three different positions. The three positions shown are from left to right, a free-floating, a retrieving or launching, and a docking position. The lighter **82** is docked, launched and/or retrieved with its longitudinal axis perpendicular to the longitudinal axis of the marine vessel **84**. The side-hull section **86** is mounted to the vessel **84**, since the well **88** opens through the submerging of bottom section **90** providing sufficient height for the passing of the lighter **82**. The well **88** will not be flooded during launching or retrieval periods since the mean water level is kept below the hinge assembly **92**. As an additional or optional feature, a mechanical lift-damper or buoyancy adjusting means (not shown) is attached to the cable **94**, which cable also operates a pumping means **96** mounted with the bottom section **90**.

Accordingly, the pivotally connected bottom section **90** acts as a door for said well, and the side-hull section **86** is adapted to be engaged by the bottom section for closing of the well and to be disengaged for opening of the well **88** upon activation of the regulating or pumping means **96**.

Thus, a slightly different well construction with hydrolift means, substantially similar in operation as explained above in the preferred embodiments shown in FIGS. 1 through 4, has been presented in FIG. 5.

Various configurations of the ballast compartments within the bottom section can be designed to assure proper distribution of forces and movements to obtain the required damping of lighter impact forces, and lifting forces for the retrieval of various lighters which can be loaded in a multitude of fashions.

Thus, the invention presents a device capable of safely handling a multitude of buoyant cargo or lighter sizes and configurations which can be equipped with low friction means, such as rubber rollers or other devices, for easy handling.

As is generally known, marine vessels are equipped with lifeboats or floats which are mandatory and in accordance with the international safety regulations for merchant marine vessels. The present invention which enables a marine vessel to carry its own lighters which can be launched in a minimum of time may be an added safety system and, if regarded as such, may reduce the financial burden by incorporating the safety provisions with the lighter-handling system, as disclosed.

This completes the description of the embodiments of the invention illustrated herein. However, many modifications thereof will be apparent to persons skilled in the art without departing from the spirit and scope of this invention. Therefore, Applicant does not wish to be limited to the particular details of the modifications of the invention illustrated herein.

What is claimed is:

1. A marine vessel having as part of its hull, a well adapted to receive and discharge cargo, comprising:

(a) a bottom section designed to act as a door for said well and including integral ballast compartments;

(b) regulating means connected to said ballast compartments for regulating the contents thereof to cause pivoting of said bottom section; and

(c) a side-hull section pivotally connected to said bottom section and adapted to be engaged by said bottom section for closing said well and to be disengaged for opening said well upon activation of said regulating means.

2. A marine vessel having a well construction, as claimed in claim **1**, wherein said means connected to said ballast compartments comprises a pump for regulating the water contents in said compartments so that said pivotally connected bottom section can be submerged and positioned into a predetermined slope.

3. A marine vessel having a well construction, as claimed in claim **2**, wherein said pivotally connected bottom section in combination with said pump comprises a hydrolift means for raising and lowering cargo positioned on said bottom section.

4. A marine vessel having a well construction as claimed in claim **2**, wherein said bottom section has an upper surface which slopes toward said pivoting connection located between said bottom section and said vessel when said bottom section is in a closed position with respect to said cargo well so that transportation of said cargo from said surface into said cargo well is aided by gravitation.

5. A marine vessel having a well construction, as claimed in claim **4**, wherein said side-hull section comprises:

adjustable floating means for stabilizing said side-hull section when in a submerged state into the required position with respect to said pivotally connected bottom section; and

wherein said floating means are adapted to serve as guiding means during loading and unloading activities.

6. A marine vessel having a well construction, as claimed in claim 5, wherein said pivoting connection, between said-hull section and said bottom section and said pivoting connection between said bottom section and said vessel comprises a first and second substantially horizontally athwartship mounted watertight hinge assembly, respectively.

7. A marine vessel having a well construction, as claimed in claim 6, wherein said side-hull section and said bottom section each includes a substantially flat surface inboard of said marine vessel having anti-frictional means associated therewith for facilitating the movement of cargo in contact with said surfaces.

8. A method for handling cargo in a marine vessel for loading and unloading purposes, comprising the steps of:

(a) opening a cargo well of said vessel by turning outwardly a side-hull section about a first pivitally arranged junction located between the side-hull section and a bottom section;

(b) submerging the bottom hull section about a second pivotally arranged junction located between the bottom section and the remainder of the bottom of said vessel into a sloping position;

(c) submerging the turned side-hull section;

(d) rendering positive buoyancy to buoyancy means connected to the hull section;

(e) adjusting the buoyancy of the buoyancy means for stabilizing the position of the submerged hull section at a pre-determined angle with respect to the sloping of the bottom section; and

(f) moving cargo on and off the sloping bottom section for loading and unloading purposes, respectively.

9. A method for handling cargo in a marine vessel, as claimed in claim 8, wherein the step of submerging the bottom section comprises:

rendering the bottom section heavier than the weight of the water displaced by adding water to ballast compartments in said bottom section; and

monitoring the quantity of added water in order to obtain a required sloping position of said bottom section.

10. A method for handling cargo in a vessel, as claimed in claim 8, wherein said step of moving cargo on the sloping bottom section comprises:

positioning the cargo on the sloping bottom section in a predetermined location;

activating pumping means for removing the water from the ballast compartments of the bottom section, thereby increasing the buoyancy of said bottom section for lifting the cargo into said well during loading activities.

11. A method for handling cargo in a marine vessel, as claimed in claim 8, wherein said step of moving cargo on the sloping bottom section comprises:

positioning the cargo on the bottom section in a predetermined location;

moving said cargo from said sloping bottom section over said hull section toward a predetermined destination during unloading purposes.

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