A METHOD AND APPARATUS FOR A REPLENISHMENT AT SEA SYSTEM

FIELD OF INVENTION

The present invention relates to a method and apparatus for a replenishment at sea system and it preferably although not solely of a kind to allow for a ship to ship replenishment of for example fuel, water or other consumable materials to be established.

BACKGROUND

Replenishment at sea systems (RAS systems) are well known. A supply vessel and a recipient vessel are able to position themselves to travel in a substantially parallel path and establish a physical connection in a form of a conduit which is able to displace material from the supply ship to the recipient ship. In existing RAS systems the conduit consists of a plurality of substantially rigid pipe sections. Such pipe sections are assembled to define a single conduit to extend between the two vessels. Normally a cable is provided from which and at appropriate intervals, the conduit is suspended. During set-up, the end of the conduit is progressively extended from a vessel towards the other vessel by the sequential engagement of discrete pipe sections.

The connection of discrete pipe sections takes time as each individual section is required to be securely and sealably engaged to the preceeding pipe section.

During the disassembly of the conduit between the two vessels, individual pipe sections are removed from the chain and are then moved to a storage location. Since the sections are substantially rigid, the sections are stored in a storage rack or compartment but will occupy a significant amount of space since each section will maintain its internal volume.

The manipulation of individual sections and the demand on storage space for storing such sections does present disadvantages to the existing rigid pipe type RAS systems.

Accordingly it is an object of the present invention to reduce such disadvantages or to at least provide users of an RAS system with a useful choice.

BRIEF DESCRIPTION OF THE INVENTION

Accordingly in a first aspect the present invention consists in a hose for use in a replenishment at sea system for the transportation of fluid between a first vessel and a second vessel wherein said hose is flexible and collapsible.

Preferably said hose includes a plurality of means to support said hose spaced at intervals along the length of said hose at which said hose can receive vertical support from an overhead cable extending between said first and second vessels.

Preferably said hose is of a continuous length to, in use, have a first distal end thereof engaged to a coupling member of said first vessel and a second distal end to a coupling member of said second vessel.

Preferably said hose has engaged to one of its two distal ends thereof a floatation means to ensure said one end is has a floatation means of a water displacing volume which allows said hose to be held at least in part above water level at least at the said distal end.

Preferably said hose has engaged at one of said first or second distal ends a rigid pipe which provides a conduit engaged to said hose and which includes a sight glass to allow a user to view inside the conduit, said rigid pipe also including a stopper which provides no significant impedance to the flow of fluid, but is able to stop a hose purging pig, the stopper provided in a location such that when a pig is in a position stopped by said stopper, the pig is visible through said sight glass.

In a second aspect the present invention consists in or for a replenishment at sea system, the use of a flexible and collapsible hose to transport fluid between two vessels.

In a third aspect of the present invention consists in a method of use of a hose as defined in the above in a replenishment at sea system.

Preferably as part of a replenishment at sea operation which utilises a flexible and collapsible hose for delivery of fluid from a first vessel to a second vessel, a method of terminating the operation after the delivery of fluid from said first vessel via said hose is terminated, the method comprising;

firing a pig through the hose to purge at least a significant amount of said fluid from said hose,

applying a suction to said hose, which as a result of at least part of the hose being sealed will collapse said hose thereby reducing the interior volume of said hose and

retracting said hose to one of said first or second vessels.

Preferably said retracting includes the winding of the hose for storage onto a reel.

Preferably said reel is rotatable about an axle.

Preferably said axle includes a conduit which has a first opening through which said fluid is able to be displaced and a second opening through which said fluid is able to be displaced said first opening being engaged for fluid flow to or from said hose and said first and second openings in fluid communication with each other such said second opening engaged to a means for delivery to or receipt of fluid flow from said hose.

Preferably after firing said pig through said hose and before collapsing said hose, air is displaced through said hose, such that any remaining liquid in said hose is at least in part further purged from said hose.

Preferably after firing said pig through said hose, gas is sucked through said hose by a suction means at one end thereof and the other end remains open, to allow gas (preferably air) to be drawn through said hose to thereby allow liquid to be drawn by said suction from said hose.

Preferably said suction is applied to said hose at the end of the hose positioned at said vessel to which said hose is to be retracted to.

In a fourth aspect of the present invention it is a system for replenishment at sea delivery of fluid from a first vessel to a second vessel, said system comprising:

a flexible and collapsible hose to define the conduct for the flow of fluid from said fits vessel to said second vessel, said hose including first distal end engaged to a reel of said first vessel and from which said hose is able to be wound and a second distal end which includes a coupling member for engagement to a complementary coupling member of said second vessel,

said reel including a conduit which at a first end thereof is engaged to the first distal end of said hose and a second distal end which is selectively engagable to being in fluid connection with a supply of fluid to be delivered, a supply of compressed air and a

suction and drainage conduit, said conduit of said reel allowing the displacement of fluid therethrough and to and from said hose when said hose is full dispensed from said reel.

Preferably said conduit of said reel is able to be selectively engaged to said supply of fluid, said supply of compressed air and a suction and drainage conduit, via a valving arrangement.

Preferably said supply of fluid is delivered to said conduit of said reel and to said hose from a holding tank of said first vessel by a pump via a delivery conduit.

Preferably said supply of compressed air is delivered to said conduit of said reel and to said hose from an air compressor via a delivery conduit.

Preferably said suction and drainage conduit includes a suction means to effect a suction pressure to said hose to thereby collapse said hose.

The invention may further be said to consist in any alternative combination of parts or features here mentioned or shown in the accompanying drawings. Known equivalents of these parts or features which are not expressly set out are nevertheless deemed to be included. A preferred form of the present invention will now be explained with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a plan view of equipment which forms part of the RAS system of the present invention,

Figure 2 is a view in direction A of Figure 1,

Figure 3 is a view in direction B of Figure 1,

Figure 4 is a side view of the end of a flexible hose of the present invention for use in an RAS system,

Figure 5 is a view through section C-C of Figure 4,

Figure 6 is a plan view of the end region of the flexible hose, and

Figure 7 is a schematic view of the various sections.

DETAILED DESCRIPTION OF THE INVENTION

The present invention utilises some components which are similar to existing RAS systems and hence such components are not described in detail. The provision of

storage tanks for storing the fluid (usually a liquid fuel or water) pumps, cables to support the conduit extending between the two vessels couplings and other aspects are therefore to be taken as common general knowledge.

The present invention utilises a flexible and collapsible hose which defines the conduit between the two vessels. The hose is flexible both in its longitudinal direction but also flexible to allow for it to collapse and to minimize the interior volume thereof. In a collapsed form, the hose will be substantially planar whereas in its inflated condition the hose is substantially circular in cross section. The hose 1 shown in Figure 7 may be one continuous member or may alternatively be made up of several members which extend end on end from each other to define the conduit of a sufficient length to extend between the two vessels. The hose will have a first distal end 2 and a second distal end 20 each end to be engaged at or approximate to a respective first and second vessel. The first vessel 30 is preferably the recipient vessel and the second vessel 31 is the delivery vessel. At or towards the first distal end 2 there is preferable provided a floatation member 3. The floatation member 3 is engaged or forms part of the distal end 2 of the hose. The floatation member 3 is of a volume which allows for the hose to (at least in part) float on a body of water. The floatation member 3 ensures that the distal end 2 (if this is in contact with the body of water), can remain at least above the surface of the water. The floatation member is preferable made of a durable and rigid material and is of a sufficient size such that its water displacing volume is sufficiently to provide adequate buoyancy to the first distal end 2 of the hose 1. The first distal end 2 preferably also include a coupling section which is a rigid member engaged to the end of the hose 1. The coupling member 4 allows for this first distal end 2 of the hose 1 to become engaged to a complimentary coupling member which is secured to the first vessel.

The flexible and collapsible hose is able to be stored on board one of (preferably the second vessel) said two vessels when not in use. The hose 1 is preferably wound onto a reel 5. With reference to Figure 1 and 7, there is shown a plant room 32 which contains two reels 5. The plant room shown in Figure 1 is adapted to allow for the separate storage of two separate hoses, one for the delivery of water and one for the delivery of fuel.

The reel 5 is supported by an axle 6 about which the reel 5 is able to rotate. The reel 5 includes a drum section which allows for the winding on and off of the hose 1. The

hose 1 is stored on the reel 5 in a condition where it is in a collapsed form. In this manner the volume occupied by the hose 1 is significantly reduced than where the hose 1 is in an expanded condition. A fluid delivery pipe 7 is engaged to the axle 6 and which can deliver a fluid therethrough, to the axle 6 which is preferably hollow, and to a spout 8 which is coupled to the second distal end (not shown) of the hose 1. During operation of the RAS system of the present invention the hose 1 will be completely wound from the reel 5 but remain engaged to the spout 8 and through which fluid can be delivered to the hose 1. In an alternative form, the spout 8, axle 6 and conduit 7 maybe provided for receiving fluid from the hose 1 (i.e. the second vessel is a recipient vessel) fuel can be pumped via a delivery conduit 36 from a storage tank to the hose. It will then be displaced along the hose to the other end 2. During operation, the hose 1 will extend from the reel 5 and be guided to be in the appropriate position for delivering of fluid by a guide means 9. The guide means 9 may be of a curved profile so that the hose 1 can be guided to change their directions so as to appropriately positioned to extend between the two vessels. The guide 9 will ensure that the hose 1 remains in a steady condition relative to the reel 5 so that it can extend therefrom for use when transferring fluid in a non-movable manner. Forming part of or engageable to the first end 2 of the hose 1, there may be provided a pipe section 10 as shown in Figure 4. This pipe section 10 is a rigid section which is engaged or forms part of the distal end 2 of the hose 1. The pipe section 10 may include a fixing portion 11 onto which the flexible hose can be engaged. Alternatively the pipe section 10 may be engaged to the coupling 4. This pipe section 10 may be permanently attached to the distal end 2 of the hose or may be temporarily provided. The pipe section 10 includes a conduit 12 through which the fluid being displaced through the hose 1 can pass. The conduit 12 includes a sight glass region 13 which includes a sight glass which allows for a user to view inside the interior of a pipe 10. Adjacent the sight glass region 13 there is provided a stopper 14 which provides a part obstruction to the conduit 12. The stopper is positioned within the conduit 12 and only provides a limited disruption to the flow of fluid therethrough.

The hose 1 and pipe section 10 are able to allow for a pig to pass therethrough. A pig which is commonly used for cleaning the interior of a conduit can be used in this application to purge any fluid which remains within the hose 1 from the hose 1. The

stopper 14 will stop the pig from passing out through the conduit 10. The pig will be of a size which allows for it to make at least in part a significant contact with the interior wall of the conduit of the hose 1 and pipe section 10. By reducing the amount of available space between the exterior surface of the pig and the interior surface of the hose 1 a sufficiently large quantity of fluid which remains within the hose can be purged. To operate the RAS system of the present invention, the first distal end 2 of the hose I is moved from a second vessel to a first vessel. As it is moved, the collapsible and flexible hose will be dispensed from the reel 5. A connection is made by the coupling 4 of the first distal end 2, to the first vessel whereupon a fluid can be displaced from the second vessel to the first vessel. The displacement of fluid into the hose will expand the hose from a collapsed state, the state in which it is stored on the reel 5, to an expanded state. The fluid which is preferably of a liquid such as water or fuel, can flow from the second vessel to the first vessel via the hose 1. The hose may for example be 200m long and of a 3inch diameter with a 3 mm wall thickness. The hose may be a rubber hose with a composite frame inside for re-enforcement. Once replenishment has been completed the flow of fluid is discontinued. The liquid which remains in the hose 1 and once positive displacement of the liquid has ceased, can be purged from the hose 1 prior to the hose being retracted. Such a purging can firstly occur by the displacement of a gas such as air down the hose 1 (whether it is from the first vessel to the second vessel or vice versa) using a compressed air source 35. Some liquid will remain and this can be purged from the hose by firing, with the use of compressed air, a pig from one end of the hose 1 to the other. In the most preferred form the pig is fired from the second vessel to the first vessel. The pig will scrape with it most of the liquid that remains within the hose 1. The pig will reach the stopper and be prevented from further movement. The liquid travelling ahead of the pig will be removed from the hose. The pig can then be seen through the sight glass and can then be removed by hand from the hose/pipe. Once most of the liquid has been removed from the hose 1, the hose I may be collapsed. A collapsing of a hose preferable occurs by the provision of suction. The hose 1 at its first distal end is sealed by the use of a cap or plug or similar and a suction is applied to the hose 1 from the second vessel. Suction can occur via an air eductor 33 through a suction line 34. Such a suction may also carry with it some liquid and a gas/liquid separator 15 is preferably provided in the plant

room as shown in Figure 1 and 7. Suction may alternatively be provided from the first vessel but this is less preferred. The suction (because the hose is sealed at one end), will collapse the hose I to a substantially planar condition. The hose I may then be wound onto the reel 5 or storage. The cap or plug provided at the end of the hose will prevent any fuel from spilling from the hose as it is being retracted. Where water is the fluid which is displaced via the hose, the firing of a pig and the suction of the hose via to the winding of the hose onto the reel is or may not be necessary. The first end of the hose may remain open as it is being retracted back towards the first vessel and water which remains within the hose can spill out through the opening of the first distal end and into the ocean. Such water is not going to create any pollution. A non return valve 16 may be provided to prevent sea water from entering the hose.

CLAIMS

1. A system for replenishment at sea delivery of fluid from a first vessel to a second vessel, said system comprising:
a flexible and collapsible hose to define the conduct for the flow of fluid from said fits vessel to said second vessel, said hose including first distal end engaged to a reel of said first vessel and from which said hose is able to be wound and a second distal end which includes a coupling member for engagement to a complementary coupling member of said second vessel,
said reel including a conduit which at a first end thereof is engaged to the first distal end of said hose and a second distal end which is selectively engagable to being in fluid connection with a supply of fluid to be delivered, a supply of compressed air and a suction and drainage conduit, said conduit of said reel allowing the displacement of fluid therethrough and to and from said hose when said hose is full dispensed from said reel.

2. A system as claimed in claim 1 wherein said conduit of said reel is able to be selectively engaged to said supply of fluid, said supply of compressed air and a suction and drainage conduit, via a valving arrangement.

3. A system as claimed in claim 1 or 2 said supply of fluid is delivered to said conduit of said reel and to said hose from a holding tank of said first vessel by a pump via a delivery conduit.

4. A system as claimed in any one of claims 1 to 3 said supply of compressed air is delivered to said conduit of said reel and to said hose from an air compressor via a delivery conduit.

5. A system as claimed in claim 1or 2 said suction and drainage conduit includes a suction means to effect a suction pressure to said hose to thereby collapse said hose.