There is provided a bulk delivery system for moving bulk material from an elevation below the surface of a host to the host surface. The delivery system includes a storage system mounted on the host surface, a device submersible in the bulk material for lifting the bulk material to the host surface, and a flexible conduit connecting the storage system with the lifting device. The device for lifting the bulk material may be a pump or an eductor. When an eductor is used, a motive conduit is attached to the eductor for introducing a motive product, such as air or previously recovered bulk material into the eductor for drawing the bulk material therein and into the flexible conduit leading to the host surface. The storage system is rotatably mounted on the host for rotation between an operating position in which the flexible conduit and lifting device are located over the bulk material and a storage position in which the flexible conduit and lifting device are stored on the host.
BULK DELIVERY SYSTEM
CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Patent Application No. 60/676,142 entitled "Bulk Delivery System," filed on Apr. 29, 2005 in the United States Patent and Trademark Office.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT
Not Applicable.

BACKGROUND OF THE INVENTION

1. Field of the Invention
This present invention relates to a bulk delivery system, and more particularly to a device for delivering liquid or dry bulk loads to an elevated host in a body of water.

2. Background of the Invention
Delivering large amounts of sea water to elevated offshore floating and fixed structures to support day-to-day operations typically require either large bulky structures or high maintenance set-ups. Seawater and bulk material delivery to offshore drilling rigs is critical to the functionality of the work involved with drilling and producing petroleum products. The seawater is used for cooling engines, fire fighting and often for purified drinking, septic and drilling water. The delivery system is not limited to seawater, but encompasses various types of bulk materials, such as fresh water, drilling mud, dry bulk material, etc.

3. Description of the Related Art
U.S. Pat. No. 4,492,514 issued to Dron on Jan. 8, 1985 discloses a method and means for providing a protective environment for submerged pumps. A submerged water pump, a shell, or casing is installed to enclose at least a lower portion of the pump, and a protective fluid medium, typically compressed air, is introduced in the shell to exclude water from contacting the pump operating components or lines when the pump is not in use. Means are provided for quickly removing the protective medium and permitting water to enter the pump when it is desired to put the pump into operation.

U.S. Pat. No. 5,377,763 issued to Pearce et al. on Jun. 3, 1995 discloses a riser pipe assembly for interconnecting a subssea wellhead on an ocean floor with an above-surface platform. The assembly includes at least one cable extending generally between the wellhead and the platform to provide vertical support for the assembly. A plurality of support plates are fixed to the cable at predetermined spaced locations therealong. At least one riser pipe string extends between the wellhead and the platform and includes a plurality of riser pipes engaged end-to-end. In one embodiment of the invention, each riser pipe includes a lower bell-shaped end and an upper spigot-shaped end inserted into the bell-shaped end of the immediately adjacent riser pipe thereabove. The lower bell-shaped end of each riser pipe rests by gravity on and is supported by one of the support plates. In another embodiment of the invention, each riser pipe includes an upper bell-shaped end and a lower spigot-shaped end inserted into the bell-shaped end of the immediately adjacent riser pipe therebelow. The enlarged juncture of the upper bell-shaped end of each riser pipe rests by gravity on and is supported by one of the support plates.

U.S. Pat. No. 5,833,503 issued to Kallio on Nov. 10, 1998 discloses a bottom well and sea water piping system for vessels with which the supply of sea water is provided for a vessel for engine cooling and other uses. The invention has only one bottom well preferably arranged on the vessel's middle line, and that the sea water piping as a whole is on the delivery side of submersible pumps. All the openings and lead-throughs of the bottom well are above the water level, most preferably on a covering plate. The sea water piping system is regulated by a heat regulating valve and a pressure regulating valve. The flow is regulated with an operating speed regulator for the motors of the submersible pumps by means of a frequency converter.

U.S. Pat. No. 5,848,641 issued to Epp on Dec. 15, 1998 discloses an apparatus for raising and lowering a submersible pump in a well. A cylindrical drum for reeling flexible water pipe is mounted for rotation at one side of the well. A cavity is provided in the drum for accommodating connectors or other large items at the top of the well, and a guide is provided at the top of the well for guiding water pipe vertically from the well and substantially horizontally to the cylindrical drum. An electric drive is provided for rotating the drum, the drive being mounted to accommodate sudden stopping of the drum due to jamming of the submersible pump or the water pipe secured to the pump as the pump is being withdrawn from the well.

U.S. Pat. No. 6,248,242 issued to Martin on Jun. 19, 2001 discloses a system for bulk delivery of potable spring water to a customer's home. This system includes a bulk water supply truck equipped with a pumping system and an onboard ozone generator for delivery of potable tank water to a customer's supply tank. The supply tank is not
pressurized, but uses an electric pump to deliver potable water to the individual faucets in the customer’s home.

BRIEF SUMMARY OF THE INVENTION

[0014] Accordingly, it is an object of the present invention to provide a device for delivering liquid or dry bulk loads to an elevated host in a body of water. Other features and advantages of the invention will be apparent from the following description, the accompanying drawing and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a front view of the preferred embodiment of the bulk delivery system.

[0016] FIG. 2A is a front view of an embodiment of the operating bulk delivery system using an electric pump.

[0017] FIG. 2B is a front view of an embodiment of the operating bulk delivery system using an eductor.

[0018] FIG. 3 is a side view of the conduit

[0019] FIG. 4 is an isometric view of the mounted reel system.

[0020] FIG. 5 is an isometric view of the stored reel system

[0021] FIG. 6 is an isometric view of the reel system mounted on an alternative host.

[0022] FIG. 7A is an alternative embodiment of the bulk delivery system.

[0023] FIG. 7B is a detail view of the eductor portion of the bulk delivery system of FIG. 7A.

[0024] FIG. 8 is an alternative embodiment, providing a pump for delivering bulk or water through the reel system.

DESCRIPTION OF THE INVENTION

[0025] The bulk delivery system is attached to the host in a body of water. A method of delivering the fluid or bulk material to the host is by either a submerged pump on the end of the conduit or an eductor motivating the fluid to the host by a pump stationed on the host. The materials delivered by this device are not stored on the host, cost effectively reducing variable loads that would otherwise be supported by the offshore host. The variable loads stored off the host and delivered by the delivery system are products used by the host to perform their day-to-day operations. These stored materials (or variable loads) are not limited to, but include: seawater, drillwater, potable water, drilling muds, completion fluids, diesel fuel, pre-load fluids, chemicals used in drilling muds and chemicals used to treat wells.

[0026] The delivery system is a conduit with a conduit storage device and a tool to move or motivate bulk material from a low level to a higher level. The conduit varies in length and diameter, depending on the application. The conduit is made up of a flexible material, which is stored on the conduit storage device. The conduit storage device can be a spool driven by a motor or gear. The tool used to drive the bulk material from a low level to a higher level can be a submerged eductor or a submerged pump.

[0027] The delivery system may take on various forms, depending on the application. This example is described in the next paragraph and demonstrated in FIGS. 1-2. The method of moving the material up to the host can be by a pump attached to the end of the conduit.

[0028] The pump can be driven either by electricity, hydraulics or air. The pump is submerged in the material and in turn drives the material to a higher elevation through the conduit. The material is dispersed to the host when it reaches the conduit storage system. Another method to move the material up to the host is by using an eductor as shown in FIG. 2. The eductor is attached to the end of the return conduit. A fluid or bulk material is pumped from the host down a smaller motive conduit through the eductor on the end of the larger return conduit. The jetting force of the conduit creates a vacuum in the eductor and forces the bulk material up the larger return conduit. A single motive line and eductor or a series of eductors and motive lines may accomplish this. Air may also be pumped down to the lower section of the return line to help motivate the fluid up the return line. The combination of the eductor system as just described will depend on the bulk material, the elevation of the host above the bulk to the bulk material and the rate of return flow desired.

[0029] The configuration of the conduit can take on various forms as shown in FIG. 3. The conduit is made of a flexible material to allow easy retrieval of the pump and conduit system onto a storage device. The flexible material is a lightweight material that reduces loads to the host and allows for a smaller storage device, further reducing the load on the offshore host. The conduit may be made up of several components, depending on the application. If the pump is a submerged electrical pump, the conduit may have been driven in it a cable to provide electrically. If the pump is hydraulically driven, the conduit may have a hydraulic line within the flexible conduit. An aircraft may be run in the conduit to run a pneumatic submerged pump or provide motive to the bulk material returning to the host. The flexible conduit may also have cables running the length of the conduit to support the weight of the pump, bulk and conduit. This may enhance the integrity of the conduit in harsh environments and prevent stretching of the conduit. Another characteristic to the conduit is the flexibility of its make-up. Flexibility of the conduit allows easy storage if it flattens out when rolled up in the storage device. The embedded cables or auxiliary hoses will roll up with the conduit in a compact bundle. This bundle gives the system the benefit of being lightweight and small requiring the offshore host by removing weight and using less space than other delivery systems. The conduit bundle is also easily plugged into the storage system on one end and the pump or eductor on the opposite end. A cover (or covers) made of flame resistant or flameproof material protects the hose and cable. The cover jackets the hose and contains the cabling to make one hose bundle.

[0030] The delivery system for the conduit and pump is a compact system as shown in FIG. 1. It is a smaller system than other delivery systems as a result of the all the contributing components of the total system. The storage system rolls the conduit and associated cables or hoses onto a drum designed specifically for the application. The storage system provides plug-ins to the conduit, cables or hoses, allowing removal of the conduit as a bundle in case the conduit is damaged.
As shown in FIG. 1, the bulk delivery system is generally made up of a flexible conduit 3 made of material such as rubber based product, rubber-coated fabric or similar material, but is not restricted to these types of materials. The conduit 3 is retrieved, deployed and stored in a storage system 2 composed of a reel 13, base 18 and drive mechanism 12. A pump 4 or eductor 5 is attached to the end of the conduit 3. Conduit 3 is provided with a cover or jacket 9. Jacket 9 is omitted in some embodiments of the invention. Conduit 3 wraps around drum 14 of reel 13 when it is stored on storage system 2.

As shown in FIG. 2, the bulk delivery system draws the bulk material 11 from a lower elevation 23 by either means of an electrical pump 4 attached to the end of the conduit 3 or an eductor 5. The eductor set-up 5 is configured according to the material moved and the elevation of lift required. There may be a series of eductors staged at different elevations or there may be additional motive products introduced to the motive line 17, such as air 16. In FIG. 2B, the educting method is demonstrated in simple form where a return line 6 from a motive reel 20 allows the bulk material 21 to be pumped down and into the eductor 5. The bulk material 21 causes a vacuum across the entry port 24 of the eductor 5 and motivates an additional volume of bulk from the bulk material 11 up the flexible conduit 3. More volume of bulk material 11 travels up the flexible conduit 3 than is pumped down the return line 6. The net result is a flow of bulk 11 to the host from the bulk source 11. The electric pump method has an electrical power source (not shown) and power cable 8 to the electrically driven pump 4 attached to the conduit 3. The pump pushes bulk from the bulk source 11 up the conduit 3 to the host.

As shown in FIG. 3, flexible conduit 3 can take on various shapes and construction depending on factors such as bulk product, host height, environment and desired flow rate. The conduit 3 may also be a single flexible hose made of various materials, depending on the environment and bulk product. The conduit may be several hoses or several hoses and cables, depending on the application. Conduit 3 includes a hose portion 30 that lies flat when empty. Hose portion 30 is omitted in some embodiments of the invention. There will be a motive line (not shown) in the conduit if an eductor 5 is used (see FIG. 7). Cables in the conduit may be electrical or tension supporting cables. The combination of these cables and hoses make up a bundle used to conduct bulk from the source to the host. The bundle may also be built to plug into the delivery station (not shown) and the pump 4.

As shown in FIG. 4, the reel system 13 can be in either an operating position 29 and cantilevered so that the conduit 3 and pump 4 will be over the bulk material, such as water. This allows the bulk to be delivered to the host 1. As shown in FIG. 5, the reel system 13 can also be hinged or slid over on the host 1 in a storage position 28.

As shown in FIG. 6, the reel system 13 can be easily up-pinned and relocated to another host or tank hatch 27 of host 1 to allow bulk material to be delivered at that location.

FIGS. 7A and 7B show an optional method of delivering bulk material 11 or water to the host 1. An eductor 5 is fixed to the conduit 3 with associated motive lines 17 to jet or draw bulk or water 11 up to the host 1. An additional eductor stage 34 can be added to assist in boosting the bulk material 11 to the host 1. An additional air pump 40 and air line 42 may be added to assist in boosting the bulk 11 to the host 1 through the return line 7. The eductor is made up of a fluid jet 25 and diffuser 26 that jets the bulk 11 to the host 1. The motive line 17 provides the source of motive fluid to jet the bulk material 11 through the jet 25 and diffuser 26 to the return line(s) 7. Bulk 11 is drawn through the eductor 5 through suction ports 35 to the return line(s) 7. Return bulk is stored in a temporary holding tank 36 and is pumped back down to the eductor 5 by a surface pump 46. The additional bulk material 11 pumped to the holding tank is pumped to the host tank 44 to be used by the host 1.

FIG. 8 shows an optional method of pumping bulk material 11 or water though the reel system 13 while the reel is turned by drive mechanism 12. An electrical slip ring 31 is attached to the reel system 13 so that the electric submerged pump 4 can be powered by the host 1. Electrical cables 33 enter in the slip ring at the fixed electrical contacts and exit the slip ring attached to the rotating reel 13. Bulk 11 is pumped to the reel system 13 from the submerged pump 4 and through the swivel 32. The swivel 32 allows the reel and pipe to turn while water is pumped to the manifold 15 and to the host.

The foregoing description of the invention illustrates a preferred embodiment thereof. Various changes may be made in the details of the illustrated construction within the scope of the appended claims without departing from the true spirit of the invention. The present invention should only be limited by the claims and their equivalents.

I claim:

1. A bulk delivery system for moving bulk material from an elevation below the surface of a host to the host surface, which comprises:

a storage system mounted on the host surface;

a device submersible in the bulk material for lifting the bulk material to the host surface;

a flexible conduit connected at an upper end to the storage system and at a lower end to the lifting device.

2. The bulk delivery system of claim 1, wherein the storage system comprises:

a base mounted on the host;

a reel attached to the base;

a drive mechanism associated with the reel for rotating the reel for lowering the lifting device into the bulk material and for raising the lifting device to the host surface.

3. The bulk delivery system of claim 2, wherein the reel includes a drum for storing the flexible conduit when the lifting device is not in use.

4. The bulk delivery system of claim 1, further including a tension bearing cable attached to the flexible conduit for supporting the weight of the lifting device, the flexible conduit, and the bulk material contained in the flexible conduit.

5. The bulk delivery system of claim 1, wherein the device for lifting the bulk material comprises an electric pump, and further including a power cable associated with the flexible conduit for providing power to the pump.

6. The bulk delivery system of claim 1, wherein the device for lifting the bulk material comprises a hydraulic pump, and
further including a hydraulic conduit associated with the flexible conduit for providing hydraulic force to the pump.

7. The bulk delivery system of claim 1, wherein the device for lifting the bulk material comprises a pneumatic pump, and further including an air conduit associated with the flexible conduit for providing pneumatic force to the pump.

8. The bulk delivery system of claim 1, wherein the device for lifting the bulk material comprises an eductor.

9. The bulk delivery system of claim 8, wherein the eductor comprises:

a device for providing at least one fluid jet in the bulk material;

at least one diffuser associated with each fluid jet; and

at least one suction port associated with the fluid jet for receiving the bulk material into the eductor.

10. The bulk delivery system of claim 9, further including a motive conduit attached to the eductor for introducing a motive product into the eductor for drawing the bulk material into the eductor and the flexible conduit.

11. The bulk delivery system of claim 10, wherein the motive product comprises air.

12. The bulk delivery system of claim 10, wherein the motive product comprises bulk material.

13. The bulk delivery system of claim 1, wherein the device for lifting the bulk material comprises a plurality of eductors spaced at intervals along the flexible conduit for boosting the bulk material to the host surface.

14. The bulk delivery system of claim 1, wherein the storage system is rotatably mounted on the host for rotation between an operating position in which the flexible conduit and lifting device are located over the bulk material and a storage position in which the flexible conduit and lifting device are stored on the host.

15. The bulk delivery system of claim 1, wherein the storage system is detachably mounted to the host and is portable for relocation with respect to the host.

16. A method for moving bulk material from an elevation below the surface of a host to the host surface, which comprises:

rotating a reel on the host for lowering a flexible conduit stored on the reel and an electric pump connected to the flexible conduit into the bulk material;

energizing the electric pump for moving the bulk material into the flexible conduit and therethrough to the host surface; and

conveying the bulk material into a holding tank on the host surface.

17. The method of claim 16, wherein the step of energizing the electric pump includes operating an electric slip ring attached to the reel so that the electric pump is energized through power cables attached to the flexible conduit.

18. The method of claim 17, further including the step, after sufficient bulk material has been moved to the host surface, of rotating the reel on the host for winding the flexible conduit thereon and for raising the electric pump to the host surface for storage thereon.

19. A method for moving bulk material from an elevation below the surface of a host to the host surface, which comprises:

rotating a reel on the host for lowering a flexible conduit stored on the reel and an eductor connected to the flexible conduit into the bulk material;

pumping a motive product into the eductor for providing a fluid jet and thereby drawing the bulk material into the eductor and the flexible conduit and therethrough to the host surface; and

conveying the bulk material into a holding tank on the host surface.

20. The method of claim 19, wherein the motive product is bulk material temporarily stored in the holding tank.

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