

This invention relates to articulated fluid transferring apparatus, and more particularly, to an improved offshore loading system having an improved articulated loading arm.

The production of oil and gas from offshore wells has developed into a major endeavour of the petroleum industry, and this growth has led to the development of means for transporting petroleum products from offshore wells to shore-based refineries or storage facilities. Many of the wells are being drilled and completed in deep-water locations where the use of marine tankers of very large capacity constitutes the most practical and efficient method of transporting the petroleum products.

Some of the prior art loading facilities include a fluid handling means such as a fixed mooring buoy or an articulated loading column to which a tanker may be moored while loading. The tanker and the loading column move relative to each other during the loading operation due to winds, tides and the amount of fluid which is loaded into the tanker. The height of the tanker above the waterline changes as the tanker is loaded or unloaded, thus requiring that a flexible or articulated hose be connected between the tanker and the loading column. When flexible hoses are used a tender is normally required to assist the tanker in picking the flexible hoses for connection to the tanker's manifold. Such an arrangement not only requires the use of a tender, but movement of the tanker may cause the flexible hoses to be broken (FR-A-2,330,585).

It is known from French Patent Specification 2,379,473 to provide an offshore loading system for transferring fluid from an articulated column to a manifold on a marine tanker and to provide for relative movement between said tanker and said column, said system comprising a support structure having an inboard end pivotally connected to said articulated column, an inboard conduit member mounted along said support structure with an inboard end of said inboard conduit member pivotally connected to said articulated column for pivotal movement about a first horizontal axis, an outboard conduit member, means for connecting an inboard end of said outboard conduit member to an outboard end of said inboard conduit member for pivotal movement about a second horizontal axis, and universal joint means for pivotally connecting an outboard end of said outboard conduit member to said tanker manifold.

A requirement exists for an improved offshore loading system which is capable of operation without the need of a power supply permanently connected to the column or conduit members.

This is achieved, in accordance with the invention, in that the inboard end of said out-

board conduit member is connected to the outboard end of said inboard conduit member for pivotal movement also about a third axis extending longitudinally of said inboard conduit member, that power-operated means are provided for moving said inboard conduit member pivotally about said first horizontal axis and that, for controlling the operation of said system from said marine tanker, means are provided for coupling power from power supply means on said marine tanker to said support structure to energise said power-operated means.

It is also known from U.S. Patent Specification 2,509,120, to provide a fluid distributor having a distributing arm pivoted at one end about a first horizontal axis, and a discharge spout pivoted to the opposite end of the distributing arm about an axis extending along the arm and about an axis perpendicular thereto.

A tensioner mounted on the articulated column provides lightweight means for raising and balancing the loading arm. The use of the articulated loading arm mounted on the articulated column and the universal joint means between the outboard end of the arm and the tanker manifold compensates for both vertical and horizontal movement between the tanker and the articulated column. The use of a tensioner rather than counterweights reduces the weight of the offshore loading system.

One way of carrying out the invention is described in detail below with reference to drawings which illustrate only one specific embodiment in which:—

Figure 1 is a perspective view of an offshore loading system according to the present invention with the loading arm connected in operating position to a marine tanker;

Figure 2 is an enlarged side elevation of a portion of the offshore loading system shown in Figure 1;

Figure 3 is a plan view of the offshore loading system taken in the direction of the arrows 3—3 of Figure 2;

Figure 4 is an enlarged end elevation of a portion of the offshore loading system taken in the direction of arrows 4—4 of Figures 2;

Figure 5 is an enlarged end elevation of a portion of the offshore loading system shown in Figure 4;

Figure 6 is a perspective view of a portion of the offshore loading system in Figure 2 showing details of the connection between the inboard and outboard conduit members;

Figure 7 is a perspective of a portion of the offshore loading system in Figure 2 showing details of the connection between the outboard end of the outboard conduit member and a marine tanker manifold, and

Figure 8 is a schematic diagram of the hydraulic and electrical control system for

raising, lowering and operating the loading arm of the present invention.

A loading system for transferring fluid from an off-shore facility to a tanker manifold comprises an articulated vertical column 10 (Fig. 1) pivotally connected by a universal joint 11 to a concrete or metal base 12 mounted on the ocean floor F. A fluid supply conduit 16, connected to a source of petroleum (not shown), is connected by the universal joint 11 to a vertical supply conduit 17 which extends upward through the interior of the articulated column 10. The lower portion of the column includes a plurality of vertical support rods 18 interconnected by a plurality of braces 22 that provide strength to the column while presenting a relatively small surface to ocean currents flowing through the area about the column. An air-filled buoy 23, connected to the upper end of the vertical support rods 18 and mounted below the surface of the water, holds the articulated column 10 in a generally vertical position. A cylindrical upper portion 24, having a large combination deck and helicopter landing pad 28 at the upper end thereof, is connected to the top of the buoy 23, and additional support for the deck is provided by a plurality of braces 29 connected between the deck 28 and the cylindrical portion 24. The deck includes a narrow extended portion 30 projecting radially outward from the articulated column 24 for supporting a loading arm a distance away from the column 24. A horizontal fluid supply conduit 17a (Figs. 2 and 3) extends from the top of the vertical conduit 17 through the deck supports 29, to the outboard portion of the deck 30.

An articulated loading arm 36 (Figs. 1—3) mounted on the deck extension 30 transfers fluid between the outboard end of the fluid conduit 17a and a tanker manifold M mounted on a tanker T, and compensates for relative movement between the tanker and the deck. The loading arm 36 includes an inboard conduit member 40 having an inboard end pivotally connected between the outboard end of the fluid conduit 17a and an inboard end of an outboard conduit member 41. A horizontal support structure 42, comprising a plurality of tubular rods 46 (Figs. 2 and 3) and braces 47 connected to the inboard conduit member 40, provides support for the inboard conduit member. A walkway 49 (Figs. 2 and 3), connected to the support structure 42 and to the conduit member 40, provides access to the various joints along the loading arm to facilitate maintenance and repair without dismantling the arm.

The tanker T is secured to the articulated column 10 (Fig. 1) by one or more hawsers H which allow the tanker to swing freely according to the dictates of wind and current, and to retain the tanker a proper distance from the deck extension 30 while the tanker is loaded through the articulated loading arm 36. Also connected between the tanker and the articu-

lated column 10 are one or more control lines L, comprising one or more pneumatic and/or electric lines, to couple power from the tanker to the articulated column for controlling connection, operation and disconnection of the loading arm. The hawser H and the control lines L are threaded over a plurality of pulleys P1—P3 and connected to counterweights W1, W2 to facilitate storage of the hawser and lines in the articulated column 10 when they are not in use. The illustrated articulated column 10 does not provide any power for operation of the loading system, all such power being provided through the control lines L by the tanker T. It is also possible to mount power sources on the articulated column 10 and to control these power sources by telemetric means.

A pair of tensioners 48a, 48b (Figs. 1—3), mounted on the deck 28 by a plurality of angle brackets 52 and connected to the support structure 42 by a pair of support chains 53a, 53b, provide power to pivot the articulated loading arm 36 about a horizontal axis A (Figs. 2 and 3) between the "working" position shown in the solid lines of Figure 2 and a "stowed" position shown in the phantom lines. A support structure stop 54 (Figs. 2 and 3) limits the counterclockwise rotation (Fig. 2) of the loading arm 36 to the phantom position shown and prevents the arm from reaching a completely vertical position. This insures that the action of gravity on the loading arm will cause it to pivot clockwise into the working position when the tensioners 48a, 48b relax the tension on the support chains 53a, 53b.

The inboard end of the conduit member 40 is connected to the supporting deck extension 30 by a T-section 58 (Fig. 3) connected between the conduit member 40 and the pair of 90-degree elbows 59a, 59b and by a pair of vertical pipes 60a, 60b best shown in Figure 4. A pair of radial flanges 64a, 64b (Fig. 4) at the lower end of the pipes 60a, 60b are welded or otherwise secured to the deck extension 30 and another pair of radial flanges 65a, 65b at the upper end of the pipes 60a, 60b are connected to a pair of radial flanges 66a, 66b on the elbows 59a, 59b. The lower end of the pipe 60b is connected to the upper end of the supply conduit 17a but the pipe 60a is used only for the support of the articulated loading arm 36, although the pipe 60a could be used to carry fluid in installations where a second supply conduit is available. Additional support of the loading arm 36 is provided by a pair of vertical support beams 70a, 70b (Figs. 4 and 5) connected between the flanges 64a, 64b and a pair of support plates 71a, 71b. At one end the support plates 71a, 71b are each welded to one of the support beams 70a, 70b and to one of the flanges 65a, 65b and at the other end of the plates 71a, 71b are welded to the outer portion of a pair of swivel joints 72a, 72b to provide enough support for the loading arm 36 so that the elbows 59a, 59b can be removed either

partially or completely, for service (Fig. 5) without disconnecting the loading arm from the deck extension.

The elbows 59a, 59b are connected to swivel joints 72a, 72b by a pair of hinges 76a, 76b, each connected between a swivel joint and a flange 77a, 77b (Figs. 4 and 5) on the elbows. Power to lift the elbows into position for replacing an annular seal or for other service is provided by a pair of hydraulic jacks 82a, 82b removably connected between an ear 83a, 83b on the elbows and a brace 84 which is welded or otherwise connected to the inboard conduit member 40. The jacks 82a, 82b are connected to the ears 83a, 83b and to the brace 84 by a plurality of removable pins 88, the jacks normally being connected to the ears and brace only during the time that the elbows and the swivel joints are being serviced. When the seal 78b (Fig. 5) is to be replaced, the articulated loading arm 36 (Fig. 4) is lowered into the working position shown in Figures 2 and 4, the hydraulic jack 82b is connected in position by the pins 88 at either end, the flange 66b of the vertical pipe 60b and the jack 82b is retracted to rotate the elbow 59b clockwise about the hinge 76b to expose the seal 78b. The seal 78b is replaced, the elbow 59b lowered into the operating position (Fig. 4), the elbow flange 66b secured to the flange 65b and the hydraulic jack disconnected by removing the pins 88. A brace 89 (Fig. 4) welded or otherwise connected between the swivel joints 72a and 72b provide support for the T-section 58.

An outboard end 40a (Fig. 6) of the inboard conduit member 40 is connected to the inboard end 41a of the outboard conduit member 41 (Figs. 2, 3 and 6) by a pair of elbows 90, 91 and a pair of swivel joints 94, 95 with the conduit member 41 pivoting about the generally horizontal axis B and about the horizontal axis C. The inboard end 41a includes a plurality of elbows 92a—92c interconnected between the swivel joint 95 and the conduit member 41. The joint 94 (Fig. 6) swivels about the end 40a of the conduit 40 and the inboard ends 41a of the conduit 41 swivels inside the joint 95. A support bracket having one end welded to the joint 94 and the other end welded to the joint 95, provides support so that the elbow 90 can be repaired or replaced without disconnecting the outboard conduit member 41 from the inboard conduit member 42. The elbow 90 is connected to the swivel 94 by a hinge 100 and a hydraulic jack 101 is removably connected between an ear 102 on the elbow 90 and a brace 106 which is welded or otherwise connected to the end 40a of the inboard conduit member 40. The hydraulic jack 101 is normally between the ear and brace only during the time that the elbow and swivel joints are being serviced. When either of the joints 94, 95 is to be serviced, the jack 101 is connected to the ear 102 by a pin 107 and to the brace 106 by a pin 109. A flange 91a of the elbow is dis-

connected from the joint 95 and the hydraulic jack 101 is retracted to pivot the elbows about the hinge 100 so that seals can be replaced or other work performed on the joints 94, 95. The jack 101 is disconnected after the service work has been performed.

The lower end 41b (Figs. 2 and 7) of the outboard conduit member 41 is connected to the tanker manifold M by a universal joint means 108 and by a guide assembly 112. The guide assembly 112 includes a double elbow 113 having a flange 114 (Fig. 7) on the upper end connected to a swivel joint 118 on the end 41b of the conduit member and having a radial flange 117 on the lower end of the elbow connected to a butterfly valve 119. A guide probe 120 welded to a centre portion of the elbow 113 is connected to a pull-in cable 124 which is threaded through a guide funnel 125 and connected to a pull-in winch 126. The universal joint means 108 includes a plurality of swivel joints 130a—130d, a pair of triple elbows 131a, 131b and a Tee pipe 132 interconnected between the tanker manifold M and a support pipe S. The swivel joints 130b, 130c allow the guide funnel 125 and a pipe connector 136 to pivot about a horizontal axis E, while the swivel joints 130a, 130d allow the funnel 125 and the pipe connector 136 to pivot about a horizontal axis F.

When the tanker T (Fig. 1) is moved into loading position adjacent the articulated column 10, the ends of the hawser H and the control lines L are grasped and pulled out for connection to the tanker. The lower end of pull-in cable 124 is grasped and threaded through the guide funnel 125 where it is secured to the winch 126, and the winch energised to pull the guide probe 120 (Fig. 7) toward the funnel 125. A guide member 139 extending radially outward from the probe 120 engages a tapered guide groove 140 in the wall of the guide funnel to pivot the guide assembly 112 about the axis D and align the coupling flange 137 on the butterfly valve with the coupling flange 138 on the connector 136. A plurality of hook-like clamps 142 secured the coupling flanges 137 and 138 together in a fluid-tight connection. The butterfly valve 119 is opened by energising a valve operator 119a to allow the transfer of fluid from the loading arm into the tanker manifold M.

The hydraulic, pneumatic and electric circuitry for controlling the operating of the loading arm and the associated valves (Fig. 8) includes a pneumatic pressurised source 143 connected to a pneumatic supply line L1 through a shutoff valve 144 and monitored by a pair of pressure gauges 149, 150. A pair of check valves 151, 155 and a pair of accumulators 156, 157 stabilise the pneumatic pressure for accurate control of the tensioners and the valve operators. The valve operator 119a and a valve operator 161 are individually controlled by a pair of electrically operated spool valves 163,

167 to open and close the fluid control valves 119 and 162. A regulator 168 controls the gas pressure on a pneumatic line L3, and an electrical control panel 169 provides electrical signals on the cable L2 to control the operation of the spool valves 163, 167 and signal on the cable L4 to control the operation of a spool valve 173. A hydraulic pump 174, a switch 175, a reservoir 179 and the spool valve 173 (Fig. 8) provide power to control a hydraulic coupler operator 180 (Figs. 7 and 8) and to operate the clamps 142. When the spool valve 137 is in the deenergised position shown in Figure 8, a piston 181 is moved upward in the operator 180 to open the clamps 142 and release the flanges 137, 138 so that the loading arm 36 can be disconnected from the tanker T. When the spool valves 163, 167 are in the deenergised position shown in Figure 8, the valves 119, 162 are closed to prevent the flow of fluid through the loading arm 36. A relief valve 185 relieves excessive fluid pressure in the loading arm which can be caused by thermal expansion of the fluid contained in the conduit members 40, 41 while the valves 119 and 162 are closed.

Providing electrical signals to the valves 163, 167, 173 on the electric lines L2, L4 shifts the valves into the energised position to supply hydraulic fluid to the coupler 180 which clamps the flanges 137, 138 together and provides pneumatic pressure to the valve operators 161, 119a to open the butterfly valves 162, 119 and allow fluid transfer from the supply conduit 17 to the tanker manifold M.

The various controls and switches on the control panel 169 can be manually controlled, or positioned sensors, such as potentiometers, can be mounted to sense the orientation of the inboard conduit member 40 relative to the supply conduit 17a and to sense the orientation of the outboard conduit member 41 relative to the inboard conduit member. Electrical circuitry of the type disclosed in the United States Patent No. 4,084,277 can use signals from these sensors to determine the position of the outboard end of the loading arm 36 and to shut the valves 119, 162 and disconnect the loading arm from the tanker when the outboard end of the loading arm reaches an unsafe position.

The present invention provides a lightweight loading arm having a tensioner to maintain a zero relative motion between the tanker and the outboard end of the loading arm except for the effect of the pull-in winch. The lightweight tensioner eliminates the need for a counterweight used in other loading arms. During the connect operation the loading arm is biased away from the tanker by the tensioner to eliminate collision between the arm and the tanker. Seals in the swivel joints of the loading arm can be quickly replaced without dismantling the loading arm and the valve at the outboard end of the loading arm prevents spillage of fluid when the arm is disconnected from the tanker manifold. The service life of the

loading arm is many times longer than the life of flexible hoses which were previously used for transferring fluid from an articulated column to a marine tanker and the articulated loading arm can be disconnected from the tanker faster and safer than the flexible hoses.

Claims

1. An offshore loading system for transferring fluid from an articulated column (10) to a manifold (M) on a marine tanker (T) and to provide for relative movement between said tanker and said column, said system comprising a support structure (42) having an inboard end pivotally connected to said articulated column (10), an inboard conduit member (40) mounted along said support structure with an inboard end of said inboard conduit member pivotally connected to said articulated column for pivotal movement about a first horizontal axis (A), power-operated means for moving said inboard conduit member (40) pivotally about said first horizontal axis (A), an outboard conduit member (41), means (95) for connecting an inboard end of said outboard conduit member to an outboard end of said inboard conduit member for pivotal movement about a second (C) horizontal axis, and universal joint means (108) for pivotally connecting an outboard end of said outboard conduit member (41) to said tanker manifold, characterised in that the inboard end of said outboard conduit member (41) is connected to the outboard end of said inboard conduit member (40) for pivotal movement also about a third (B) axis extending longitudinally of said inboard conduit member and that, for controlling the operation of said system from said marine tanker, means (L) are provided for coupling power from power supply means on said marine tanker to said support structure to energise said power-operated means.

2. An offshore loading system as claimed in claim 1 characterised in that said means for pivotally moving said inboard conduit member about said first horizontal axis (A), comprise a tensioner (such as 48a) mounted to said articulated column, and means (such as 53a) for connecting said tensioner to said support structure.

3. An offshore loading system as claimed in claim 1 or claim 2 characterised by a swivel joint (72a) connected between said articulated column (10) and said inboard end of said inboard conduit member (40), and piping support means (such as 71a) connected between an outer portion of said swivel joint and said articulated column (10) to facilitate repair of portions of said swivel joint while said inboard conduit remains in an operating position.

4. An offshore loading system as claimed in claim 1 characterised in that said means (95) for connecting said inboard end of said out-

167 to open and close the fluid control valves 119 and 162. A regulator 168 controls the gas pressure on a pneumatic line L3, and an electrical control panel 169 provides electrical signals on the cable L2 to control the operation of the spool valves 163, 167 and signal on the cable L4 to control the operation of a spool valve 173. A hydraulic pump 174, a switch 175, a reservoir 179 and the spool valve 173 (Fig. 8) provide power to control a hydraulic coupler operator 180 (Figs. 7 and 8) and to operate the clamps 142. When the spool valve 137 is in the deenergised position shown in Figure 8, a piston 181 is moved upward in the operator 180 to open the clamps 142 and release the flanges 137, 138 so that the loading arm 36 can be disconnected from the tanker T. When the spool valves 163, 167 are in the deenergised position shown in Figure 8, the valves 119, 162 are closed to prevent the flow of fluid through the loading arm 36. A relief valve 185 relieves excessive fluid pressure in the loading arm which can be caused by thermal expansion of the fluid contained in the conduit members 40, 41 while the valves 119 and 162 are closed.

Providing electrical signals to the valves 163, 167, 173 on the electric lines L2, L4 shifts the valves into the energised position to supply hydraulic fluid to the coupler 180 which clamps the flanges 137, 138 together and provides pneumatic pressure to the valve operators 161, 119a to open the butterfly valves 162, 119 and allow fluid transfer from the supply conduit 17 to the tanker manifold M.

The various controls and switches on the control panel 169 can be manually controlled, or positioned sensors, such as potentiometers, can be mounted to sense the orientation of the inboard conduit member 40 relative to the supply conduit 17a and to sense the orientation of the outboard conduit member 41 relative to the inboard conduit member. Electrical circuitry of the type disclosed in the United States Patent No. 4,084,277 can use signals from these sensors to determine the position of the outboard end of the loading arm 36 and to shut the valves 119, 162 and disconnect the loading arm from the tanker when the outboard end of the loading arm reaches an unsafe position.

The present invention provides a lightweight loading arm having a tensioner to maintain a zero relative motion between the tanker and the outboard end of the loading arm except for the effect of the pull-in winch. The lightweight tensioner eliminates the need for a counterweight used in other loading arms. During the connect operation the loading arm is biased away from the tanker by the tensioner to eliminate collision between the arm and the tanker. Seals in the swivel joints of the loading arm can be quickly replaced without dismantling the loading arm and the valve at the outboard end of the loading arm prevents spillage of fluid when the arm is disconnected from the tanker manifold. The service life of the

loading arm is many times longer than the life of flexible hoses which were previously used for transferring fluid from an articulated column to a marine tanker and the articulated loading arm can be disconnected from the tanker faster and safer than the flexible hoses.

Claims

1. An offshore loading system for transferring fluid from an articulated column (10) to a manifold (M) on a marine tanker (T) and to provide for relative movement between said tanker and said column, said system comprising a support structure (42) having an inboard end pivotally connected to said articulated column (10), an inboard conduit member (40) mounted along said support structure with an inboard end of said inboard conduit member pivotally connected to said articulated column for pivotal movement about a first horizontal axis (A), power-operated means for moving said inboard conduit member (40) pivotally about said first horizontal axis (A), an outboard conduit member (41), means (95) for connecting an inboard end of said outboard conduit member to an outboard end of said inboard conduit member for pivotal movement about a second (C) horizontal axis, and universal joint means (108) for pivotally connecting an outboard end of said outboard conduit member (41) to said tanker manifold, characterised in that the inboard end of said outboard conduit member (41) is connected to the outboard end of said inboard conduit member (40) for pivotal movement also about a third (B) axis extending longitudinally of said inboard conduit member and that, for controlling the operation of said system from said marine tanker, means (L) are provided for coupling power from power supply means on said marine tanker to said support structure to energise said power-operated means.

2. An offshore loading system as claimed in claim 1 characterised in that said means for pivotally moving said inboard conduit member about said first horizontal axis (A), comprise a tensioner (such as 48a) mounted to said articulated column, and means (such as 53a) for connecting said tensioner to said support structure.

3. An offshore loading system as claimed in claim 1 or claim 2 characterised by a swivel joint (72a) connected between said articulated column (10) and said inboard end of said inboard conduit member (40), and piping support means (such as 71a) connected between an outer portion of said swivel joint and said articulated column (10) to facilitate repair of portions of said swivel joint while said inboard conduit remains in an operating position.

4. An offshore loading system as claimed in claim 1 characterised in that said means (95) for connecting said inboard end of said out-



board conduit member (41) to said outboard end of said inboard conduit member (40), is a swivel joint.

5. An offshore loading system as claimed in claim 1 characterised in that a fluid control valve (119) is provided and that the inboard end connecting means (95) is a swivel joint connected between said fluid control valve and said outboard end of said outboard conduit member (47).

6. An offshore loading system as claimed in claim 5 characterised in that said universal joint means (108) is pivotally mounted for movement about a pair of horizontal axes (E, F) one of said pair of horizontal axes being positioned at substantially 90 degrees to the other of said pair of horizontal axes.

7. An offshore loading system as claimed in claim 5 characterised by a generally S-shaped elbow (92a—92c) connected between said swivel joint (95) and said fluid control valve (119) to facilitate rotational movement of said fluid control valve in an arc about the axis of said outboard conduit member.

8. An offshore loading system as claimed in claim 1 characterised by a plurality of valves connected to said inboard end and said outboard conduit members, and means for connecting said valves to said power coupling means (L) to selectively control the flow of fluid through said conduit members by controlling said valves.

9. An offshore loading system as claimed in claim 5 characterised in that said control valve (119) is responsive to signals from said power supply means.

Revendications

1. Système de chargement en mer pour transporter un fluide d'une colonne articulée (10) vers un manifold (M) situé sur un navire-citerne (T) et pour permettre un mouvement relatif entre ledit navire-citerne et ladite colonne, ledit système comprenant une structure de support (42) ayant une extrémité intérieure reliée de façon à pouvoir pivoter à ladite colonne articulée (10), un élément de conduit intérieur (40) monté le long de ladite structure de support, une extrémité intérieure dudit élément de conduit intérieur étant reliée de façon à pouvoir pivoter à ladite colonne articulée pour effectuer un mouvement de pivotement autour d'un premier axes horizontal (A), des moyens à commande mécanique pour faire pivoter ledit élément de conduit intérieur (40) autour dudit axe horizontal (1), un élément de conduit extérieur (41), des moyens (95) pour relier une extrémité intérieure dudit élément de conduit extérieur à une extrémité extérieure dudit élément de conduit intérieur afin de permettre un mouvement de pivotement autour d'un second axe horizontal (C), et un moyen à joints universels (108) pour relier de façon à pouvoir pivoter une extrémité extérieure dudit élément de conduit extérieur (41) audit mani-

fold du navire-citerne, caractérisé en ce que l'extrémité intérieure dudit élément de conduit extérieur (41) est reliée à l'extrémité extérieure dudit élément de conduit intérieur (40) pour pouvoir pivoter également autour d'un troisième axe (B) s'étendant longitudinalement audit élément de conduit intérieur, et en ce que pour commander le fonctionnement dudit système à partir dudit navire-citerne, des moyens (L) sont prévus pour transmettre de l'énergie de moyens d'alimentation en énergie situés sur le navire-citerne à ladite structure de support afin d'actionner lesdits moyens de commande mécanisée.

2. Système de chargement en mer selon la revendication 1, caractérisé en ce que lesdits moyens pour faire pivoter ledit élément de conduit intérieur autour dudit premier axe horizontal (A) comprennent un tendeur (tel que 48) monté sur ladite colonne articulée, et des moyens (tels que 53a) pour relier ledit tendeur ladite structure de support.

3. Système de chargement en mer selon la revendication 1 ou la revendication 2, caractérisé par une joint articulée (72a) monté entre ladite colonne articulée (10) et ladite extrémité intérieure dudit élément de conduit intérieur (40); et des moyens de support de tube (tels que 71a) montés entre une partie extérieure dudit joint articulé et ladite colonne articulée et ladite colonne articulée (10) pour faciliter la réparation de parties dudit joint articulé tandis que ledit conduit intérieur reste dans une position de travail.

4. Système de chargement en mer selon la revendication 1, caractérisé en ce que lesdits moyens (95) pour relier ladite extrémité intérieure dudit élément de conduit extérieur (41) à ladite extrémité extérieure dudit élément de conduit intérieur (40) comprennent un joint articulé.

5. Système de chargement en mer selon la revendication 1, caractérisé en ce qu'une vanne (119) de commande de fluide est prévue entre ce que les moyens (95) de liaison de l'extrémité intérieure comprennent un joint articulé entre ladite vanne de commande de fluide et ladite extrémité extérieure dudit élément de conduit extérieur (41).

6. Système de chargement en mer selon la revendication 5, caractérisé en ce que lesdits moyens à joints universels (108) sont de manière à pouvoir pivoter autour de deux axes horizontaux (E, F), l'un desdits deux axes horizontaux étant positionné sensiblement à 90° par rapport à l'autre desdits deux axes horizontaux.

7. Système de chargement en mer selon la revendication 5, caractérisé par un élément (92a—92c) de forme sensiblement en S entre ledit joint articulé (95) et ladite vanne (119) de commande de fluide pour faciliter le mouvement de rotation de ladite vanne de commande de fluide sur un arc autour de l'axe dudit élément de conduit extérieur.



8. Système de chargement en mer selon la revendication 1, caractérisé par plusieurs vannes reliées auxdits éléments de conduits intérieur et extérieur, et des moyens pour relier lesdites vannes auxdits moyens (L) de transmission d'énergie afin de commander sélectivement l'écoulement d'un fluide dans lesdits éléments de conduits par commande desdites vannes.

9. Système de chargement en mer selon la revendication 5, caractérisé en ce que ladite vanne de commande (119) réagit à des signaux provenant desdits moyens d'alimentation en énergie.

Patentansprüche

1. Ablandiges Ladesystem zum Transport einer Flüssigkeit von einer angelenkten Säule zu einem Leitungsrohr an einem Tankschiff und zum Ermöglichen einer relativen Bewegung zwischen diesem Tankschiff und dieser Säule, wobei dieses System einen Auslegearm, dessen innenbordiges Ende drehbar zu dieser angelenkten Säule angebracht ist, eine inneren Leitung, mit einem innenbordigen Ende, welche drehbar zu dieser Säule angeordnet ist, besitzt, wobei die innere Leitung entlang dem Auslegearm montiert ist und zur Drehbewegung über eine erste horizontale Achse, Antriebsmittel für die Drehbewegung dieser inneren Leitung über die erste horizontale Achse, ferner eine äußere Leitung, Bauteile zur Verbindung des innenbordigen Endes auf dieser äußeren Leitung und dem außenbordigen Ende der inneren Leitung für die Drehbewegung über eine zweite horizontale Achse und ein Universalgelenkteil zur Drehbewegung eines außenbordigen Endes auf dieser äußeren Leitung zu diesem Tankschiff besitzt, dadurch gekennzeichnet, daß das innenbordige Ende von der äußeren Leitung (41) verbunden ist mit dem außenbordigen Ende von der inneren Leitung (40) um eine Drehbewegung auch über eine dritte Achse zur Längserweiterung von der inneren Leitung (40) zu ermöglichen und daß zur Kontrolle der Funktion in diesem System Einrichtungen von Kraftübertragungsteilen an diesem Tankschiff zu dem Auslegearm (42) und zur Energieversorgung dieser Kraftübertragungsteile vorgesehen sind.

2. Ablandiges Ladesystem nach Anspruch 1, dadurch gekennzeichnet, daß die Vorrichtung zur Drehbewegung dieser inneren Leitung über eine erste horizontale Achse (A), einem Spanner

(48a), angebracht an der drehbaren Säule (10) und Einrichtungen (53a) zur Verbindung dieses Spanners mit dem Auslegearm umfaßt.

3. Ablandiges Ladesystem nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß ein Drehgelenk (72a) mit einer drehbaren Säule (10) verbunden ist und das innenbordige Ende der inneren Leitung (40) und Rohrstützteile (71), mit einem äußeren Teil von dem Drehgelenk (72) und der angelenkten Säule (10) zur leichteren Reparatur auf Teilen dieses Drehgelenkes verbunden sind, während diese innere Leitung (40) in einer Arbeitsposition verbleibt.

4. Ablandiges Ladesystem nach Anspruch 1, dadurch gekennzeichnet, daß Verbindungsbauteile (95) des innenbordigen Endes von der äußeren Leitung (41) mit dem außenbordigen Ende dieser inneren Leitung (40) ein Drehgelenk sind.

5. Ablandiges Ladesystem nach Anspruch 1, dadurch gekennzeichnet, daß ein Kontrollventil (119) vorgesehen ist, und daß die beiden Verbindungsbauteile (95) ein Drehgelenk sind, das mit diesem Flüssigkeitskontrollventil und dem außenbordigen Ende von dieser äußeren Leitung (41) verbunden ist.

6. Ablandiges Ladesystem nach Anspruch 5, dadurch gekennzeichnet, daß ein Universalgelenkteil (108) zur Bewegung über einem Paar von horizontalen Achsen (E, F) drehbar angebracht ist, wobei eine dieser horizontalen Achsen in etwa in einem Winkel von 90° zu den anderen beiden horizontalen Achsen sich befindet.

7. Ablandiges Ladesystem nach Anspruch 5, dadurch gekennzeichnet, daß ein s-förmiger Rohrkrümmer (92a—92c) zwischen diesem Drehgelenk (95) und dem Flüssigkeitskontrollventil (119) zur leichteren Drehbewegung von dem Kontrollventil in einem Bogen über die Achse der äußeren Leitung (41) angeordnet ist.

8. Ablandiges Ladesystem nach Anspruch 1, dadurch gekennzeichnet, daß mehrere Ventile der inneren Leitung (40) und der äußeren Leitung (41) zugeordnet sind, und daß Teile zur Verbindung des Kontrollventils (119) mit Kraftkupplungsteilen (I) zur selektiven Kontrolle des Stromes des Flüssigkeit durch die Rohrleitungen (40, 41) durch die Kontrollventile (119) verbunden sind.

9. Ablandiges Ladesystem nach Anspruch 5, dadurch gekennzeichnet, daß das Kontrollventil (119) durch Signale von den Kraftverbindungsbauteilen gesteuert wird.

