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Description

[0001] The invention concerns an arrangement for emergency release of a hose end valve from its connected position with a connector valve and a method for carrying out the same emergency release.

[0002] The hose end valve is provided at a hose end of a hose which carries fluid. The fluid to be transferred by the invention may be any kind of fluid. The invention may be employed for the transfer of hydrocarbons, including the transfer of LNG, and vaporized LNG, LPG and other fluid in gaseous and liquid form. In one application the invention may be used when transferring fluid such as LNG from a floating LNG production facility (FLNG) to an LNG carrier. The transfer system may then comprise three separate hose end suspension lines, two for the transfer of LNG to the LNG carrier and one for the return of vaporized LNG to the FLNG.

[0003] The transfer of fluid in between two structures is a demanding and risky operation. Especially when the transfer is carried out in the open sea, and when the fluid is both a cryogenic fluid and a hydrocarbon which is highly flammable and explosive, the transfer operation is especially risky and special care needs to be taken.

[0004] As mentioned above the fluid may be transferred between structures where both are located in water. Alternatively the fluid transfer may occur between structures where one of these is located in water and the other one is a land based structure. The structures located in water may comprise different kinds of vessels, barges, ships and platforms or other structures suitable for loading or offloading. The structures or vessels may be floating, submersible, semisubmersible or resting on the seabed. Various systems may be employed for holding the structures in position, for instance mooring arrangements such as a turret system, anchor positioning or a dynamic positioning system may be used. Prior art solutions for transfer of fluid between structures include the arrangement of a tandem position, stern offloading or a side by side configuration.

[0005] Various rigid systems for the transfer of fluid in between structures have been proposed using fixed arms and rigid articulated pipes. The rigid systems are relatively complex and heavy, and high loads are working on systems when wave motions cause the structures to move relative to each other.

[0006] Prior art solutions include the systems disclosed in US 2004/0011424, US 3249121, JP 2012158337, US 2818891, US 2914080, US 2922446 and US 3228421 and "The All Metal LNG Offloading System for the Adriatic LNG Terminal" by Charles Hughes and Renaud Le Devehat presented at the Gastech conference, Abu Dhabi 2006.

[0007] As an alternative to the rigid pipe system for transfer of fluid such as LNG, the use of flexible hoses have been suggested and tried out.

[0008] However, the flexible lines are more cumbersome to handle during connection to a manifold on a

receiving structure, and prior art systems have not presented satisfactory solutions for the control of the flexible hoses when connection is carried out in open sea.

[0009] When one of the structures or both, involved in the transfer of fluid is located in water it is a concern to provide a solution which is capable of handling the movements occurring due to wave movements. Further, even if the invention should be able to handle the transfer of all kind of fluid, the wish to also be able to transfer LNG, challenges the functional features as the transfer of LNG involves high risk operations due to special concern which needs to be shown when handling cryogenic fluid.

[0010] Due to high risk when transferring LNG and the strict safety restrictions needed to apply to these systems, one certified solution for transfer of LNG satisfying these restrictions has been favorable in the market.

[0011] This solution is a rigid loading arm which is positioned on a first structure for instance a FLNG, for connection to a manifold structure on a second structure for instance a LNG carrier. The arm is balanced by a counter weight and makes use of rigid pipes for the transfer of fluid from one structure to the other. The system also employs a swivel system to be able to compensate for relative movement between the two structures. The large masses of the system made of rigid pipes and heavy counterweight may in some situations result in high dynamic forces and considerable impact on the manifold as a function of the relative movements between the structures. This may occur during connection to the second structure, and also during use when the system is installed and the fluid is transferred from one structure to the other. The manifolds on the LNG carrier are especially vulnerable in these given circumstances. And the resulting forces working on the system set requirements to the wave height and thus restrictions to when the loading arm may be used for transfer of fluid.

[0012] If an emergency situation arises it is necessary to pull back the complete rigid loading arm for disconnection of the pipe transferring the fluid. A need has evoked within the technical field to provide solutions which utilize safe handling of flexible hoses together with a reliable emergency return system. It is a critical factor for the operators to be able to disconnect in emergency situations with a system that is simple, reliable and easy to use.

[0013] Hence it is an object of the invention to provide a reliable disconnection arrangement with low masses and easy handling of the suspension lines without exposure to large forces.

[0014] The invention is defined in the independent claims and embodiments of the invention are defined in the dependent claims.

[0015] In accordance with the invention a method and an arrangement have been provided with the basis in providing a solution which is self sufficient and based on passive working principles capable of simple and easy disconnection without the need of involving complicated and heavy equipment.

[0016] In accordance with the invention it is provided an arrangement for emergency release of a hose end valve from its connected position with a connector valve which is connected to a receiving assembly on a first structure located in water. The structure may be an LNG carrier, a barge, a fixed structure or some kind of vessel. The hose end valve is provided at a hose end of a hose which carries fluid especially LNG and/or vaporized LNG. A hose end suspension line is provided for pulling the hose end with the hose end valve away from the receiving assembly in the case of emergency. The hose end suspension line is suspended in a support structure by at least one line guiding element, for instance sheaves or other line leading and supporting elements. A first end portion of the hose end suspension line is attached to the hose end valve and a second end portion of the hose end suspension line is attached to a counter weight.

[0017] The attachment of the hose end suspension line to the counterweight may be provided in various ways such as passing the hose end suspension line around a sheave or a pulley in a looped shaped manner and then into attachment with a winch, or by attaching the hose end suspension line directly to the counterweight in a fixed manner after the winch.

[0018] Alternatively the hose end suspension line may be attached directly to the counterweight without a winch involved. The at least one line guiding element is arranged in an elevated position in the support structure compared to the position of the counterweight and the position of the hose end and the hose end valve.

[0019] The positions of the counterweight and the hose end with the hose end valve, as well as the at least one line guiding element in the comparatively elevated position acting as balancing points provides for a weight balancing relationship. Thus the impact of the weight provided at the two end portions of the hose end suspension line is utilized for the controlled lifting or lowering of the hose end with the hose end valve.

[0020] The arrangement for emergency release and method for emergency release is independent of the chosen arrangement and method for connection of the hose end to the receiving assembly.

[0021] However, in one aspect or use of the invention the equipment for connection to the receiving assembly may be rearranged to the working arrangement of the emergency release. In this situation the hose end is arranged with the hose end valve and a connector valve connected to the hose end valve. The hose end valve is to be connected to the receiving assembly. The hose end suspension line is attached to the hose end valve and a hose end guiding line may be attached to the connector valve. The hose end with the hose end valve and the connector valve is initially positioned elevated above the receiving assembly. The weight of the hose end with the combination of the hose end valve and connector valve exceeds the counterweight, and when using the arrangement as described above utilizing the weight balancing principles, the larger weight of the hose end with the com-

bination of the hose end valve and connector valve causes the lowering of the hose end with the hose end valve and connector valve into a connection position with a receiving pipe coupler included in the receiving assembly.

[0022] If an emergency situation arises or it is necessary to release the hose quickly from the receiving assembly, it is possible to carry out an emergency release by the use of the same counterweight previously used for installation purposes. In a release mode, the hose end valve is separated from the connector valve, and by this separation the weight impact on the hose end is redistributed. The weight of the hose end with the hose end valve is smaller than the counterweight, and by the use of the weight balancing principles provided by the suspension of the hose suspension line in the support structure and the arrangement of the two end portions of the hose end suspension line as explained above, the counterweight causes the hose end with the hose end valve to be pulled away from the receiving assembly.

[0023] In accordance with an embodiment of the invention a suspension arrangement connects the hose end suspension line to the hose end for instance at the hose end valve. The suspension arrangement is provided to balance the weight of the hose end valve with the hose end so that the hose end valve is tilted downwards in direction of the receiving assembly, when the hose end valve is pulled away from the receiving assembly.

[0024] The suspension arrangement may comprise a pulling line, a lifting line and a suspension bracket. In this aspect, the lifting line is attached to an attachment point of the hose end suspension line and to a first end portion of the suspension bracket. The second end portion of the suspension bracket is connected to the hose end. The pulling line is connected to the second end portion of the suspension bracket and to the attachment point of the hose end suspension line. The configuration of the suspension arrangement positions the hose end valve tilted when being pulled away with the hose end suspension line.

[0025] In accordance with the method as defined in the independent method claim an emergency release of the hose end with the hose end valve from the connector valve connected to the receiving assembly comprises: separating the hose end valve from the connector valve and thereby enabling pulling the hose end suspension line and moving or pulling the hose end with the hose end valve away from the receiving assembly by the pulling force contributed by the counterweight.

[0026] When using a suspension arrangement as the one described above; the moving of the hose end with the hose end valve away from the receiving assembly causes first the tightening of the lifting line, and thereafter the tightening of the pulling line. By this arrangement the hose end valve is tilted downwards in direction of the receiving assembly.

[0027] Thus the dual function of the counterweight fulfills two purposes, installation of a hose to a receiving

assembly and release from the receiving assembly, wherein the function of the counterweight depends on the working conditions determined by the separation or combination of the hose end valve and the connector valve as provided by activating the emergency release and/or the installation procedure respectively.

[0028] The counter weight could be positioned enabling a downward movement of the counter weight in order to carry out the lifting of the hose end with the hose end valve. In one embodiment the counter weight is arranged to move in a counter weight guide path. The counter weight guide path may be provided with an upper end stop and a lower end stop. The counter weight may be placed in an upper end stop position, or in a position somewhere in between the upper end stop and the lower end stop, as a result of the installation of the hose end with the hose end valve and the connector valve as described above, in a sufficient height above the lower end stop to be able to carry out the emergency function. Usually, the counterweight may be positioned in a middle position in between the upper and lower end stop. When separating the hose end valve from the connector valve, the counter weight moves downward from its position in the counter weight guide path, thereby pulling the hose end suspension line and the hose end valve away from the receiving assembly.

[0029] It may usually be necessary to close the hose end valve and the connector valve from fluid flow prior to separation of the hose end valve from the connector valve.

In one embodiment of the invention plural hoses are included in the arrangement, and the hoses are provided to be released sequentially or essentially at the same time.

[0030] It should be noted that the support structure may be located on a structure such as a FLNG and that the receiving assembly is located on a structure such as an LNG carrier.

[0031] An embodiment of the invention will be described in the following, by way of an example as shown in the figs, where

Fig 1 shows the hose end connected to a receiving assembly on a structure.

Figs 2a-2b show the procedure for emergency release of the hose end valve from the connector valve connected to a receiving assembly.

[0032] As shown in fig 1, a hose end 63 with a hose end valve 13 is connected to a connector valve 14 by a releasable coupling 20. The connector valve 14 is connected to a receiving coupling pipe 15 of a manifold 16 included in a receiving assembly 90 arranged on board a structure for instance a LNG- carrier 80. As shown in fig 1, a hose end suspension line 27 is connected to the hose end valve 13 and a hose end guiding line 35 is connected to the connector valve 14. In one embodiment

of the invention the hose end guiding line 35 is connected to a support structure 200 by line guiding means 38, 34 such as sheaves, and is provided with lifting and lowering means such as a winch 33 for paying out and retrieving the hose end guiding line 35.

[0033] The hose end suspension line 27 is connected to the hose end valve 13 by a suspension arrangement 120. The suspension arrangement 120 comprises a pulling line 116 and a lifting line 117. The lifting line 117 is connected to an attachment point 121 of the hose end suspension line 27 and to a first end portion of a suspension bracket 118. The second end portion of the suspension bracket 118 is connected to the hose end 63 and in the embodiment the suspension bracket 118 is shown attached to the hose end valve 13. The suspension bracket 118 is composed of linear and angular portions in order to obtain a correct tilting of the hose valve when lifting the hose end 63 away from the receiving assembly. The pulling line 116 is connected to the second end portion of the suspension bracket 118 and to the attachment point 121. In the embodiment shown in fig 1, the lifting line 117 is provided as a separate line, but the lifting line 117 may alternatively be provided as a portion of the hose end suspension line. The pulling line 116 is longer than the lifting line 117.

[0034] As shown in fig 1 the lifting line 117 is tightened in preparation for starting the emergency release.

[0035] The support structure 200 comprises a vertical structure 1 and an arm 106 which is oriented essentially in a direction transverse to the vertical structure 1. The support structure 200 may be located on board a FLNG 70 as shown in the figs. The hose end suspension line 27 is shown connected to the support structure 200 by line guiding means 28, 31 such as sheaves, and is provided with lifting and lowering means such as a counter weight 22 which is arranged movable in the counterweight guiding path 110. The hose end suspension line runs through a sheave 23 and into engagement with a winch 24. The counterweight guiding path 110 has upper end stops 25 and lower end stops 26, and in fig 1, the counterweight 22 is shown in a position below and close to the upper end stops 25.

[0036] The hose end suspension line 27 in fig 1 is also shown arranged with a winch 24 for paying out and retrieving the hose end suspension line 27. The hose end suspension line 27 runs through a sheave 23 in a looped shape manner and into engagement with a winch 24. Even if the sheave 23 here is shown as a single movable pulley it is also possible to provide solutions of various ways of rigging with several pulleys mounted on the fixed and moving axles.

[0037] The arrangement of the hose end suspension line 27 being supported by the elevated line guiding means 28, 31 and the hose end suspension line 27 having a first end portion attached to the hose end valve 13 and a second end portion arranged with a counterweight 22 provides a weight balancing relationship. Under given working conditions, such as an emergency situation

when the hose end valve 13 is separated from the hose connector 14, the pulling force contributed by the counterweight to the hose end line 27, is effectuated into movement of the hose end 63 with the hose end valve 13, as will be explained more detailed in the following. The positioning of the counterweight 22 may be a result of an installation procedure, where the hose end 63 with the hose end valve 13 and the connector valve 14 is lowered from an elevated position and into the installed position as shown in fig 1. During this installment procedure, the weight of the combination of the hose end valve 13 and the connector valve 14 exceeds the weight of the counterweight, thereby lowering the hose end suspension line 27 and guiding the hose end 63 with the hose end valve 13 and the connector valve 14 along the hose end guide line 35 into the installation position. As a result of this installation procedure the counterweight 22 is brought to a position at the upper end stop, and when the installation is completed, the counterweight 22 is lowered until reaching the position between the upper end stop 25 and lower end stop 26, for instance a middle position, as the one shown in fig 1.

[0038] The emergency release to be described in the following may occur with the counterweight in a position at or below the upper end stop 25 and a distance away from the lower end stop 26, such as the middle position as shown in fig 1. It should be noted that also other positions of the counterweight 22 than the one shown in fig 1, is possible when initiating the emergency release. For instance it may be necessary to activate the emergency release during the lowering of the counterweight 22 from upper end stop position 25 to the middle position, as the one shown in fig 1. Or in a situation where the transfer of fluid is completed and the counterweight is above the middle position moving upwards in the direction of the upper end stop 25.

[0039] Fig 2a and 2b show the procedure for retrieving a hose end 63 with the hose end valve 13 by the use of the counterweight 22. This is a procedure especially suitable for an emergency situation when the hose end 63 with the hose end valve 13 needs to be evacuated quickly and in this circumstance the use of a counterweight offers a simple and reliable method.

[0040] In preparation for emergency release the valve devices included in hose end valve 13 and connector valve 14 should be closed for fluid flow. And also the hose end guiding line 35 is disconnected from the receiving assembly 90 and pulled back as illustrated by the arrow B. When the fluid flow is closed off, the releasable coupling 20 separates the hose end valve 13 from the connector valve 14 as shown in fig 2a, thereby preparing for pulling the hose end 63 with the hose end valve 13 away from the connector valve 14. To make sure that the hose end valve 13 and the connector valve 14 is separated correctly and also kept separated during the emergency release, it may be necessary to provide either the connector valve 14, the hose end valve 13 or both valves 13, 14 with a distance and guiding arrangement. The

distance arrangement may be provided by equipping the valve flanges with contact point's extremities at a sufficient distance to the sealing area ensuring axial distance between sealing surfaces when the angle between the two valve units is increased.

[0041] The guiding arrangement may be provided with a bracket 30 which guides the hose end valve 13 away from the connector valve 14 in a predetermined manner when lifting the hose end valve 13 away from the connector valve 14 by the use of the hose end suspension line 27. As the skilled person will realize also other devices than the shown bracket 30 may be used to ensure a correct separation of the hose end valve 13 from the connector valve 14. For instance a distance element may be attached to the hose end valve 13. One end of the distance element may fit into a recess provided at the connector valve 14. With the end of the distance element arranged to follow the outline of the recess during lifting by the hose end suspension line 27, a controlled separation of the hose end valve 13 from the connector valve 14 is obtained. Another possible alternative is to combine the bracket 30 with the distance element and the recess.

[0042] With the hose end valve 13 separated from the connector valve 14, the counterweight which is larger than the combined weight of the hose end 63 and the hose end valve 13, is allowed to start its downward movement as illustrated with arrow A in the counter weight guide path 110 as shown in fig 2.

[0043] The moving of the counterweight 22 downwards in the counterweight guiding path 110 away from the upper end stops 25, see fig 2b, causes the upward pulling of the hose end suspension line 27 which is connected to the hose end valve 13. The upward movement of the hose end suspension line 27 is illustrated by arrow B. Consequently, the continued downward movement of the counterweight 22 away from the upper end stop 25, causes the lifting of the hose end 63 with the hose end valve 13 away from the receiving assembly 90 and the LNG-carrier 80, see fig 2b.

[0044] When pulling the hose end suspension line 27 away from the receiving assembly 90, both the lifting line 117 and the pulling line 116 is tightened as shown in fig 2a. The triangular configuration of the suspension arrangement 120 then tilts the hose end valve 13 downward and balances the hose end valve 13 with the hose end 63. As seen in fig 2b, where the continued pulling of the hose end suspension line 27 is carried out in a more vertical direction than the one shown in fig 2a, the lifting line 117 is held tightened whereas the pulling line 116 is slackened, still with the hose end valve 13 tilted downward and the hose end 63 in balance with the hose end valve.

[0045] In the case where plural hoses are connected to the receiving assembly 90, the arrangement with respective counterweights connected to each hose ensures that the disconnection of each hose end with the hose end valve may be controlled individually. The disconnection procedure for the individual hose end with

the hose end valve will follow the procedure as described above and the disconnection of each hose end with hose end valve may be carried out at the same time or sequentially.

Claims

1. Arrangement comprising a hose end (63), a hose end valve (13), a suspension line (27), a support structure (200), at least one line guiding element (31, 28), a counterweight (22) and a receiving assembly (90), wherein the arrangement is prepared for emergency release of the hose end valve (13) from its connected position with a connector valve (14) which is connected to the receiving assembly (90) arranged on a first structure (80) located in water, wherein the hose end valve (13) is provided at the hose end (63) of a hose which carries fluid especially LNG and/or vaporized LNG, and a first end portion of the hose end suspension line (27) is attached to the hose end valve (13), and is suspended in a support structure (200) by the at least one line guiding element (31, 28), **characterized in that** a second end portion of the hose end suspension line (27) is attached to the counterweight (22), wherein the at least one line guiding element (31, 28) is arranged in an elevated position compared to the position of the hose end (63) with the hose end valve (13) and the position of the counterweight (22), thereby providing for a weight balancing relationship and in an emergency release mode the hose end valve (13) is separated from the connector valve (14), and as the weight of the hose end (63) and the hose end valve (13) without the connector valve (14) is smaller than the counterweight (22), the counterweight (22) causes the hose end (63) with the hose end valve (13) to be pulled away from the receiving assembly (90).
2. Arrangement for emergency release in accordance with claim 1, **characterized that** a suspension arrangement (120) connecting the hose end suspension line (27) to the hose end (63), is provided to balance the weight of the hose end valve (13) with the hose end (63) so that the hose end valve (13) is tilted downwards in direction of the receiving assembly (90), when the hose end valve (13) is pulled away from the receiving assembly (90).
3. Arrangement for emergency release in accordance with claim 1 or 2, **characterized in that** the suspension arrangement (120) comprises a pulling line (116), a lifting line (117), and a suspension bracket (118), wherein the lifting line (117) is attached to an attachment point (121) of the hose end suspension line (27) and to a first end portion of the suspension bracket, further the second end portion of the suspension bracket (118) is connected to the hose end (63), and the pulling line (116) is connected to the second end portion of the suspension bracket (118) and to the attachment point (121) of the hose end suspension line (27), wherein the configuration of the suspension arrangement (102) positions the hose end valve (13) tilted when being pulled away with the hose end suspension line (27).
4. Arrangement for emergency release in accordance with one of the claims 1-3, **characterized in that** the counterweight (22) is arranged to move in a counterweight guide path (110).
5. Arrangement for emergency release, in accordance with claim 4, **characterized in that** the counterweight guide path (110) has upper end stop (25) and lower end stop (26) and the counterweight (22) is positioned at or below the upper end stop (25) and a distance away from the lower end stop (26), when separating the hose end valve (13) from the connector valve (14).
6. Arrangement for emergency release in accordance with one of the claims 1-5, **characterized in that** plural hoses are included in the arrangement, and the hoses are provided to be released sequentially or essentially at the same time.
7. Arrangement for emergency release in accordance with one of the claims 1-6, **characterized in that** providing either the connector valve 14, the hose end valve 13 or both valves 13, 14 with a distance and guiding arrangement.
8. Arrangement for emergency release in accordance with claim 7, **characterized in that** the guiding arrangement is provided with a bracket (30) which guides the hose end valve (13) away from the connector valve (14) in a predetermined manner when lifting the hose end valve (13) away from the connector valve (14) by the use of the hose end suspension line (27).
9. Arrangement for emergency release in accordance with one with one of the claims 1-8, **characterized in that** a distance element is attached to the hose end valve (13), wherein one end of the distance element is arranged to fit into a recess provided at the connector valve (14).
10. Arrangement for emergency release in accordance with claim 9, **characterized in that** the end of the distance element is arranged to follow the outline of the recess during lifting by the hose end suspension line (27) for a controlled separation of the hose end valve (13)

from the connector valve (14).

11. Arrangement for emergency release in accordance with claim 9 or 10,

characterized in that the distance element is arranged ensuring axial distance between the sealing surfaces of the hose end valve (13) and the connector valve (14) when the angle between the hose end valve (13) and the connector valve (14) is increased.

12. Method for emergency release of a hose end valve (13) from its connected position with a connector valve (14) connected to a receiving assembly (90) arranged on a first structure (80) located in water, wherein the hose end valve (13) is provided at a hose end (63) of a hose which carries fluid especially LNG and/or vaporized LNG, and the hose end valve (13) is attached to a first end portion of a hose end suspension line (27) which is suspended in a support structure (200) by at least one line guiding element (31, 28),

characterized in that

a second end portion of the hose end suspension line (27) is attached to a counterweight (22), wherein the at least one line guiding element (31, 28) is arranged in an elevated position compared to the position of the hose end (63) with the hose end valve (13) and the position of the counterweight (22) thereby providing for a weight balancing relationship wherein the weight of the hose end (63) with the hose end valve (13) is smaller than the counterweight (22), wherein the method comprises the following steps,

- separating the hose end valve (13) from the connector valve (14) and thereby enabling
- pulling the hose end suspension line (27) and moving the hose end (63) with the hose end valve (13) away from the receiving assembly (90) by the pulling force contributed by the counter weight.

13. Method for emergency release in accordance with claim 12,

characterized in that a suspension arrangement (120) connects the hose end suspension line (27) to the hose end valve (13) and the suspension arrangement (120) comprises a lifting line (117), an pulling line (116) and a suspension bracket (118), the lifting line (117) being attached to an attachment point (121) of the hose end suspension line (27) and to a first end portion of the suspension bracket (118), further the second end portion of the suspension bracket (118) is connected to the hose end valve (13) and the pulling line (116) is connected to the second end portion of the suspension bracket (118) and to the attachment point (121) of the hose end suspension line (27), wherein when pulling the hose end suspension line (27) and moving the hose end (63) with

the hose end valve (13) away from the receiving assembly (90), the pulling of the hose end suspension line (27) first causes the tightening of the lifting line (117), thereafter the tightening of the pulling line (116) resulting in a positioning of the hose end valve (13) tilted downwards in direction of the receiving assembly (90).

14. Method for emergency release in accordance with one of the claims 12-13 ,

characterized in that plural hoses are included in the receiving assembly (90), and releasing the hoses sequentially or essentially at the same time.

Patentansprüche

1. Anordnung, umfassend ein Schlauchende (63), ein Schlauchendeventil (13), eine Aufhängeleine (27), eine Haltestruktur (200), wenigstens ein Leinenführungselement (31, 28), ein Gegengewicht (22) und eine Aufnahmeeinheit (90), wobei die Anordnung für eine Notentkopplung des Schlauchendeventils (13) von seiner mit einem Verbindungsventil (14) verbundenen Position vorbereitet ist, das mit der Aufnahmeeinheit (90) verbunden ist, die an einer ersten Struktur (80) angeordnet ist, die sich im Wasser befindet, wobei das Schlauchendeventil (13) am Schlauchende (63) eines Schlauchs vorgesehen ist, der Fluid, insbesondere Flüssigerdgas und/oder verdampftes Flüssigerdgas, trägt, und wobei ein erster Endabschnitt der Schlauchende-Aufhängeleine (27) an dem Schlauchendeventil (13) befestigt ist und durch das wenigstens eine Leinenführungselement (31, 28) in einer Haltestruktur (200) aufgehängt ist, **dadurch gekennzeichnet, dass** ein zweiter Endabschnitt der Schlauchende-Aufhängeleine (27) an dem Gegengewicht (22) befestigt ist, wobei das wenigstens eine Leinenführungselement (31, 28) in einer im Vergleich zu der Position des Schlauchendes (63) mit dem Schlauchendeventil (13) und der Position des Gegengewichts (22) erhöhten Position angeordnet ist, wodurch eine gewichtsausgleichende Beziehung geschaffen wird, und wobei in einem Notentkopplungsmodus das Schlauchendeventil (13) von dem Verbindungsventil (14) getrennt wird, und wobei das Gegengewicht (22) bewirkt, dass das Schlauchende (63) mit dem Schlauchendeventil (13) von der Aufnahmeeinheit (90) weggezogen wird, da das Gewicht des Schlauchendes (63) und des Schlauchendeventils (13) ohne das Verbindungsventil (14) geringer ist als das Gegengewicht (22).
2. Anordnung zur Notentkopplung nach Anspruch 1, **dadurch gekennzeichnet, dass** eine Aufhängeanordnung (120), welche die Schlauchende-Aufhängeleine (27) mit dem Schlauchende (63) verbindet, vorgesehen ist, um das Gewicht des Schlauchende-

ventils (13) mit dem Schlauchende (63) auszugleichen, so dass das Schlauchendeventil (13) in Richtung auf die Aufnahmeeinheit (90) nach unten gekippt wird, wenn das Schlauchendeventil (13) von der Aufnahmeeinheit (90) weggezogen wird.

3. Anordnung zur Notentkopplung nach Anspruch 1 oder 2,

dadurch gekennzeichnet, dass die Aufhängeanordnung (120) eine Zugleine (116), eine Hubleine (117) und einen Aufhängebügel (118) umfasst, wobei die Hubleine (117) an einem Befestigungspunkt (121) der Schlauchende-Aufhängeleine (27) und an einem ersten Endabschnitt des Aufhängebügels befestigt ist, wobei ferner der zweite Endabschnitt des Aufhängebügels (118) mit dem Schlauchende (63) verbunden ist und die Zugleine (116) mit dem zweiten Endabschnitt des Aufhängebügels (118) und dem Befestigungspunkt (121) der Schlauchende-Aufhängeleine (27) verbunden ist, wobei die Ausgestaltung der Aufhängeanordnung (102) das Schlauchendeventil (13) gekippt positioniert, wenn es mit der Schlauchende-Aufhängeleine (27) weggezogen wird.

4. Anordnung zur Notentkopplung nach einem der Ansprüche 1 bis 3,

dadurch gekennzeichnet, dass das Gegengewicht (22) derart angeordnet ist, dass es sich in einem Gegengewichtsführungsweg (110) bewegt.

5. Anordnung zur Notentkopplung nach Anspruch 4, **dadurch gekennzeichnet, dass** der Gegengewichtsführungsweg (110) einen oberen Endanschlag (25) und einen unteren Endanschlag (26) aufweist und das Gegengewicht (22) an oder unter dem oberen Endanschlag (25) und eine Strecke von dem unteren Endanschlag (26) beabstandet positioniert wird, wenn das Schlauchendeventil (13) vom Verbindungsventil (14) getrennt wird.

6. Anordnung zur Notentkopplung nach einem der Ansprüche 1 bis 5,

dadurch gekennzeichnet, dass mehrere Schläuche in der Anordnung enthalten sind und die Schläuche dafür vorgesehen sind, nacheinander oder im Wesentlichen gleichzeitig entkoppelt zu werden.

7. Anordnung zur Notentkopplung nach einem der Ansprüche 1 bis 6,

dadurch gekennzeichnet, dass entweder das Verbindungsventil 14, das Schlauchendeventil 13 oder beide Ventile 13, 14 mit einer Abstands- und Führungsanordnung versehen sind.

8. Anordnung zur Notentkopplung nach Anspruch 7, **dadurch gekennzeichnet, dass** die Führungsanordnung mit einem Bügel (30) versehen ist, der das

Schlauchendeventil (13) auf eine vorbestimmte Weise von dem Verbindungsventil (14) wegführt, wenn das Schlauchendeventil (13) mittels der Schlauchende-Aufhängeleine (27) vom Verbindungsventil (14) weggehoben wird.

9. Anordnung zur Notentkopplung nach einem der Ansprüche 1 bis 8,

dadurch gekennzeichnet, dass ein Abstandselement an dem Schlauchendeventil (13) befestigt ist, wobei ein Ende des Abstandselements derart angeordnet ist, dass es in eine Vertiefung passt, die am Verbindungsventil (14) vorgesehen ist.

10. Anordnung zur Notentkopplung nach Anspruch 9, **dadurch gekennzeichnet, dass** das Ende des Abstandselements derart angeordnet ist, dass es für eine kontrollierte Trennung des Schlauchendeventils (13) vom Verbindungsventil (14) während des Anhebens durch die Schlauchende-Aufhängeleine (27) der Kontur der Vertiefung folgt.

11. Anordnung zur Notentkopplung nach Anspruch 9 oder 10,

dadurch gekennzeichnet, dass das Abstandselement derart angeordnet ist, dass es einen axialen Abstand zwischen den Dichtflächen des Schlauchendeventils (13) und des Verbindungsventils (14) gewährleistet, wenn der Winkel zwischen dem Schlauchendeventil (13) und dem Verbindungsventil (14) zunimmt.

12. Verfahren zur Notentkopplung eines Schlauchendeventils (13) von seiner mit einem Verbindungsventil (14) verbundenen Position, das mit einer Aufnahmeeinheit (90) verbunden ist, die an einer ersten Struktur (80) angeordnet ist, die sich im Wasser befindet, wobei das Schlauchendeventil (13) an einem Schlauchende (63) eines Schlauchs vorgesehen ist, der Fluid, insbesondere Flüssigerdgas und/oder verdampftes Flüssigerdgas, trägt, und wobei das Schlauchendeventil (13) an einem ersten Endabschnitt einer Schlauchende-Aufhängeleine (27) befestigt ist, die durch wenigstens ein Leinenführungselement (31, 28) in einer Haltestruktur (200) aufgehängt ist,

dadurch gekennzeichnet, dass ein zweiter Endabschnitt der Schlauchende-Aufhängeleine (27) an einem Gegengewicht (22) befestigt ist, wobei das wenigstens eine Leinenführungselement (31, 28) in einer im Vergleich zu der Position des Schlauchendes (63) mit dem Schlauchendeventil (13) und der Position des Gegengewichts (22) erhöhten Position angeordnet ist, wodurch eine gewichtsausgleichende Beziehung geschaffen wird, wobei das Gewicht des Schlauchendes (63) mit dem Schlauchendeventil (13) geringer ist als das Gegengewicht (22), wobei das Verfahren die folgenden Schritte umfasst:

- Trennen des Schlaucheventils (13) vom Verbindungsventil (14), wodurch Folgendes ermöglicht wird:

- Ziehen der Schlauchende-Aufhängeleine (27) und Bewegen des Schlauchendes (63) mit dem Schlaucheventil (13) weg von der Aufnahmeeinheit (90) durch die vom Gegengewicht beigetragene Zugkraft.

13. Verfahren zur Notentkopplung nach Anspruch 12, **dadurch gekennzeichnet, dass** eine Aufhängeanordnung (120) die Schlauchende-Aufhängeleine (27) mit dem Schlaucheventil (13) verbindet und die Aufhängeanordnung (120) eine Hubleine (117), eine Zugleine (116) und einen Aufhängebügel (118) umfasst, wobei die Hubleine (117) an einem Befestigungspunkt (121) der Schlauchende-Aufhängeleine (27) und an einem ersten Endabschnitt des Aufhängebügels (118) befestigt ist, wobei ferner der zweite Endabschnitt des Aufhängebügels (118) mit dem Schlaucheventil (13) verbunden ist und die Zugleine (116) mit dem zweiten Endabschnitt des Aufhängebügels (118) und mit dem Befestigungspunkt (121) der Schlauchende-Aufhängeleine (27) verbunden ist, wobei, wenn die Schlauchende-Aufhängeleine (27) gezogen wird und das Schlauchende (63) mit dem Schlaucheventil (13) von der Aufnahmeeinheit (90) wegbewegt wird, das Ziehen der Schlauchende-Aufhängeleine (27) zuerst das Straffen der Hubleine (117) bewirkt, wobei anschließend das Straffen der Zugleine (116) zu einer Positionierung des Schlaucheventils (13) führt, die in Richtung auf die Aufnahmeeinheit (90) nach unten gekippt ist.

14. Verfahren zur Notentkopplung nach einem der Ansprüche 12 bis 13, **dadurch gekennzeichnet, dass** mehrere Schläuche in der Aufnahmeeinheit (90) enthalten sind und dass die Schläuche nacheinander oder im Wesentlichen gleichzeitig entkoppelt werden.

Revendications

1. Agencement comprenant une extrémité de tuyau flexible (63), une valve d'extrémité de tuyau flexible (13), une ligne de suspension (27), une structure de support (200), au moins un élément de guidage de ligne (31, 28), un contrepoids (22) et un ensemble de réception (90), dans lequel l'agencement est préparé pour le dégagement d'urgence de la valve d'extrémité de tuyau flexible (13) de sa position raccordée avec une valve de connecteur (14) qui est raccordée à l'ensemble de réception (90) agencé sur une première structure (80) positionnée dans l'eau, dans lequel la valve d'extrémité de tuyau flexible (13) est prévue au niveau de l'extrémité de tuyau flexible

(63) d'un tuyau flexible qui transporte du fluide, en particulier du gaz naturel liquéfié (GNL) et/ou du GNL vaporisé, et une première partie d'extrémité de la ligne de suspension d'extrémité de tuyau flexible (27) est fixée sur la valve d'extrémité de tuyau flexible (13), et est suspendue dans une structure de support (200) par le au moins un élément de guidage de ligne (31, 28),

caractérisé en ce qu'une seconde partie d'extrémité de la ligne de suspension d'extrémité de tuyau flexible (27) est fixée au contrepoids (22), dans lequel le au moins un élément de guidage de ligne (31, 28) est agencé dans une position élevée par rapport à la position de l'extrémité de tuyau flexible (63) avec la valve d'extrémité de tuyau flexible (13) et à la position du contrepoids (22), fournissant ainsi une relation d'équilibrage de poids et dans un mode de dégagement d'urgence, la valve d'extrémité de tuyau flexible (13) est séparée de la valve de connecteur (14), et étant donné que le poids de l'extrémité de tuyau flexible (63) et de la valve d'extrémité de tuyau flexible (13) sans la valve de connecteur (14) est inférieur au contrepoids (22), le contrepoids (22) amène l'extrémité de tuyau flexible (63) avec la valve d'extrémité de tuyau flexible (13) à être retirée de l'ensemble de réception (90).

2. Agencement pour dégagement d'urgence selon la revendication 1,

caractérisé en ce qu'un agencement de suspension (120) raccordant la ligne de suspension d'extrémité de tuyau flexible (27) à l'extrémité de tuyau flexible (63), est prévu pour équilibrer le poids de la valve d'extrémité de tuyau flexible (13) avec l'extrémité de tuyau flexible (63) de sorte que la valve d'extrémité de tuyau flexible (13) est inclinée vers le bas dans la direction de l'ensemble de réception (90), lorsque la valve d'extrémité de tuyau flexible (13) est retirée de l'ensemble de réception (90).

3. Agencement pour dégagement d'urgence selon la revendication 1 ou 2,

caractérisé en ce que l'agencement de suspension (120) comprend une ligne de traction (116), une ligne de levage (117), et un support de suspension (118), dans lequel la ligne de levage (117) est fixée à un point de fixation (121) de la ligne de suspension d'extrémité de tuyau flexible (27) et à une première partie d'extrémité du support de suspension, en outre la seconde partie d'extrémité du support de suspension (118) est raccordée à l'extrémité de tuyau flexible (63), et la ligne de traction (116) est raccordée à la seconde partie d'extrémité du support de suspension (118) et au point de fixation (121) de la ligne de suspension d'extrémité de tuyau flexible (27), dans lequel la configuration de l'agencement de suspension (102) positionne la valve d'extrémité de tuyau flexible (13) inclinée lorsqu'elle est retirée avec la

ligne de suspension d'extrémité de tuyau flexible (27).

4. Agencement pour dégagement d'urgence selon l'une des revendications 1 à 3, **caractérisé en ce que** le contrepoids (22) est agencé pour se déplacer dans une trajectoire de guidage de contrepoids (110). 5
5. Agencement pour dégagement d'urgence selon la revendication 4, **caractérisé en ce que** la trajectoire de guidage de contrepoids (110) a une butée d'extrémité supérieure (25) et une butée d'extrémité inférieure (26) et le contrepoids (22) est positionné au niveau de ou au-dessous de la butée d'extrémité supérieure (25) et à une distance de la butée d'extrémité inférieure (26) lors de la séparation de la valve d'extrémité de tuyau flexible (13) de la valve de connecteur (14). 10 15 20
6. Agencement pour dégagement d'urgence selon l'une des revendications 1 à 5, **caractérisé en ce que** plusieurs tuyaux flexibles sont inclus dans l'agencement et les tuyaux flexibles sont prévus pour être dégagés de manière séquentielle ou essentiellement en même temps. 25
7. Agencement pour dégagement d'urgence selon l'une des revendications 1 à 6, **caractérisé en ce que** l'on fournit soit à la valve de connecteur (14), à la valve d'extrémité de tuyau flexible (13) ou aux deux valves (13, 14) un agencement d'espacement et de guidage. 30
8. Agencement pour dégagement d'urgence selon la revendication 7, **caractérisé en ce que** l'agencement de guidage est prévu avec un support (30) qui guide la valve d'extrémité de tuyau flexible (13) à distance de la valve de connecteur (14) d'une manière prédéterminée lors du levage de la valve d'extrémité de tuyau flexible (13) à distance de la valve de connecteur (14) à l'aide de la ligne de suspension d'extrémité de tuyau flexible (27). 35 40
9. Agencement pour dégagement d'urgence selon l'une des revendications 1 à 8, **caractérisé en ce qu'un** élément d'espacement est fixé à la valve d'extrémité de tuyau flexible (13), dans lequel une extrémité de l'élément d'espacement est agencée pour se monter dans un évidement prévu au niveau de la valve de connecteur (14). 45 50
10. Agencement pour dégagement d'urgence selon la revendication 9, **caractérisé en ce que** l'extrémité de l'élément d'espacement est agencée pour suivre le contour de l'évidement pendant le levage par la ligne de suspension d'extrémité de tuyau flexible (27) pour une séparation contrôlée de la valve d'ex- 55

trémité de tuyau flexible (13) de la valve de connecteur (14).

11. Agencement pour dégagement d'urgence selon la revendication 9 ou 10, **caractérisé en ce qu'un** élément d'espacement est agencé en garantissant la distance axiale entre les surfaces d'étanchéité de la valve d'extrémité de tuyau flexible (13) et la valve de connecteur (14) lorsque l'angle entre la valve d'extrémité de tuyau flexible (13) et la valve de connecteur (14) est augmenté.
12. Procédé pour le dégagement d'urgence d'une valve d'extrémité de tuyau flexible (13) de sa position raccordée avec une valve de connecteur (14) raccordée à un ensemble de réception (90) agencé sur une première structure (80) positionnée dans l'eau, dans lequel la valve d'extrémité de tuyau flexible (13) est prévue au niveau d'une extrémité de tuyau flexible (63) d'un tuyau flexible qui transporte du fluide en particulier du GNL et/ou du GNL vaporisé, et la valve d'extrémité de tuyau flexible (13) est fixée à une première partie d'extrémité d'une ligne de suspension d'extrémité de tuyau flexible (27) qui est suspendue dans une structure de support (200) par au moins un élément de guidage de ligne (31, 28), **caractérisé en ce que :**

une seconde partie d'extrémité de la ligne de suspension d'extrémité de tuyau flexible (27) est fixée sur un contrepoids (22), dans lequel le au moins un élément de guidage de ligne (31, 28) est agencé dans une position élevée par rapport à la position de l'extrémité de tuyau flexible (63) avec la valve d'extrémité de tuyau flexible (13) et à la position du contrepoids (22), fournissant ainsi une relation d'équilibrage de poids, dans lequel le poids de l'extrémité de tuyau flexible (63) avec la valve d'extrémité de tuyau flexible (13) est inférieur au contrepoids (22), dans lequel le procédé comprend les étapes suivantes :

séparer la valve d'extrémité de tuyau flexible (13) de la valve de connecteur (14) et permettre ainsi de :

tirer la ligne de suspension d'extrémité de tuyau flexible (27) et déplacer l'extrémité de tuyau flexible (63) avec la valve d'extrémité de tuyau flexible (13) à distance de l'ensemble de réception (90) par la force de traction fournie par le contrepoids.

13. Procédé pour le dégagement d'urgence selon la revendication 12, **caractérisé en ce qu'un** agencement de suspension (120) raccorde la ligne de suspension d'extré-

mité de tuyau flexible (27) à la valve d'extrémité de tuyau flexible (13) et l'agencement de suspension (120) comprend une ligne de levage (117), une ligne de traction (116) et un support de suspension (118), la ligne de levage (117) étant fixée à un point de fixation (121) de la ligne de suspension d'extrémité de tuyau flexible (27) et à une première partie d'extrémité du support de suspension (118), en outre la seconde partie d'extrémité du support de suspension (118) est raccordée à la valve d'extrémité de tuyau flexible (13) et la ligne de traction (116) est raccordée à la seconde partie d'extrémité du support de suspension (118) et au point de fixation (121) de la ligne de suspension d'extrémité de tuyau flexible (27), dans lequel lors de la traction de la ligne de suspension d'extrémité de tuyau flexible (27) et du déplacement de l'extrémité de tuyau flexible (63) avec la valve d'extrémité de tuyau flexible (13) à distance de l'ensemble de réception (90), la traction de la ligne de suspension d'extrémité de tuyau flexible (27) provoque tout d'abord le serrage de la ligne de levage (117), ensuite le serrage de la ligne de traction (116) se traduit par un positionnement de la valve d'extrémité de tuyau flexible (13) inclinée vers le bas dans la direction de l'ensemble de réception (90).

14. Procédé pour le dégagement d'urgence selon l'une des revendications 12 à 13, **caractérisé en ce que** plusieurs tuyaux flexibles sont inclus dans l'ensemble de réception (90), et la libération des tuyaux flexibles a lieu de manière séquentielle ou essentiellement en même temps.

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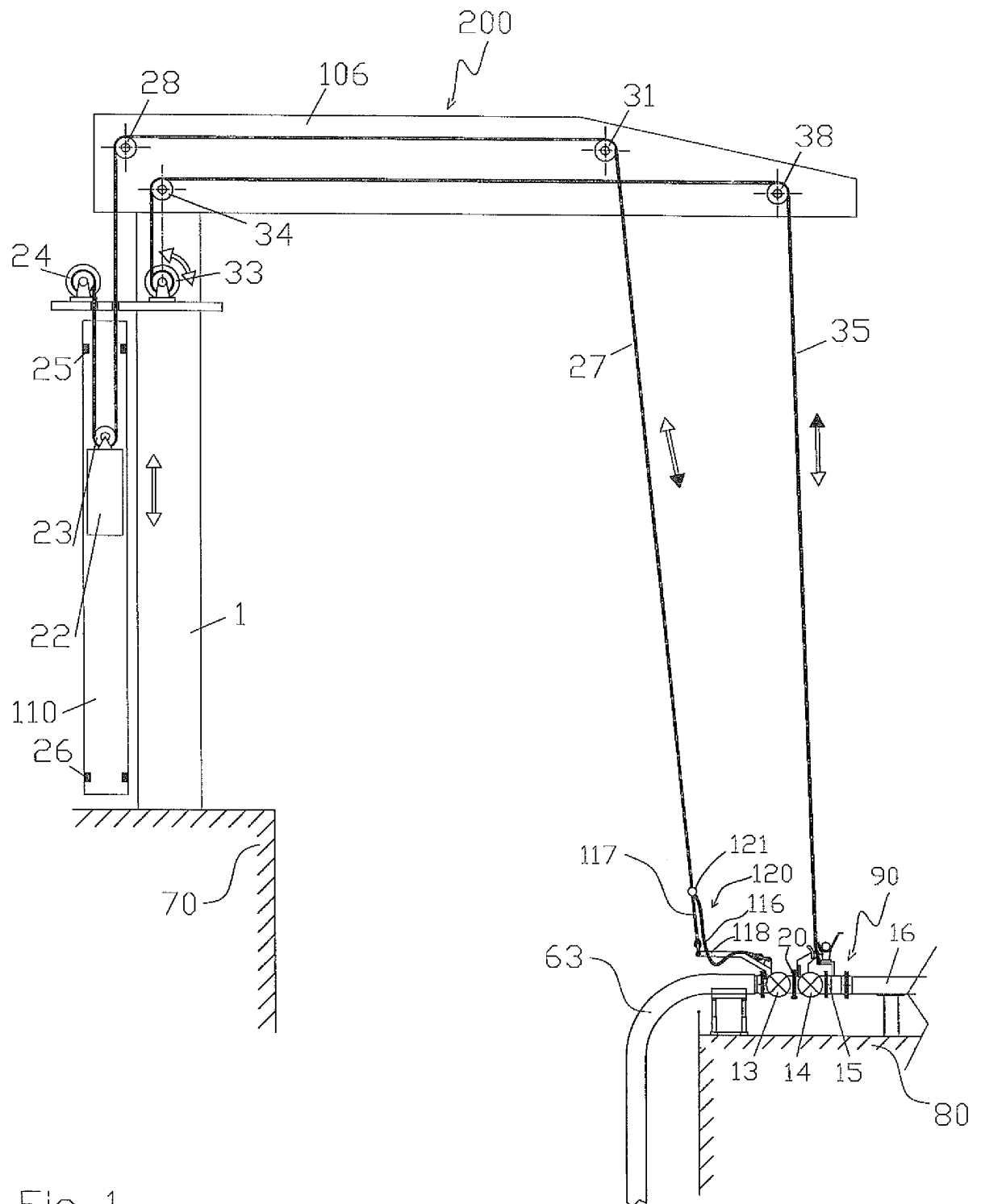


Fig 1

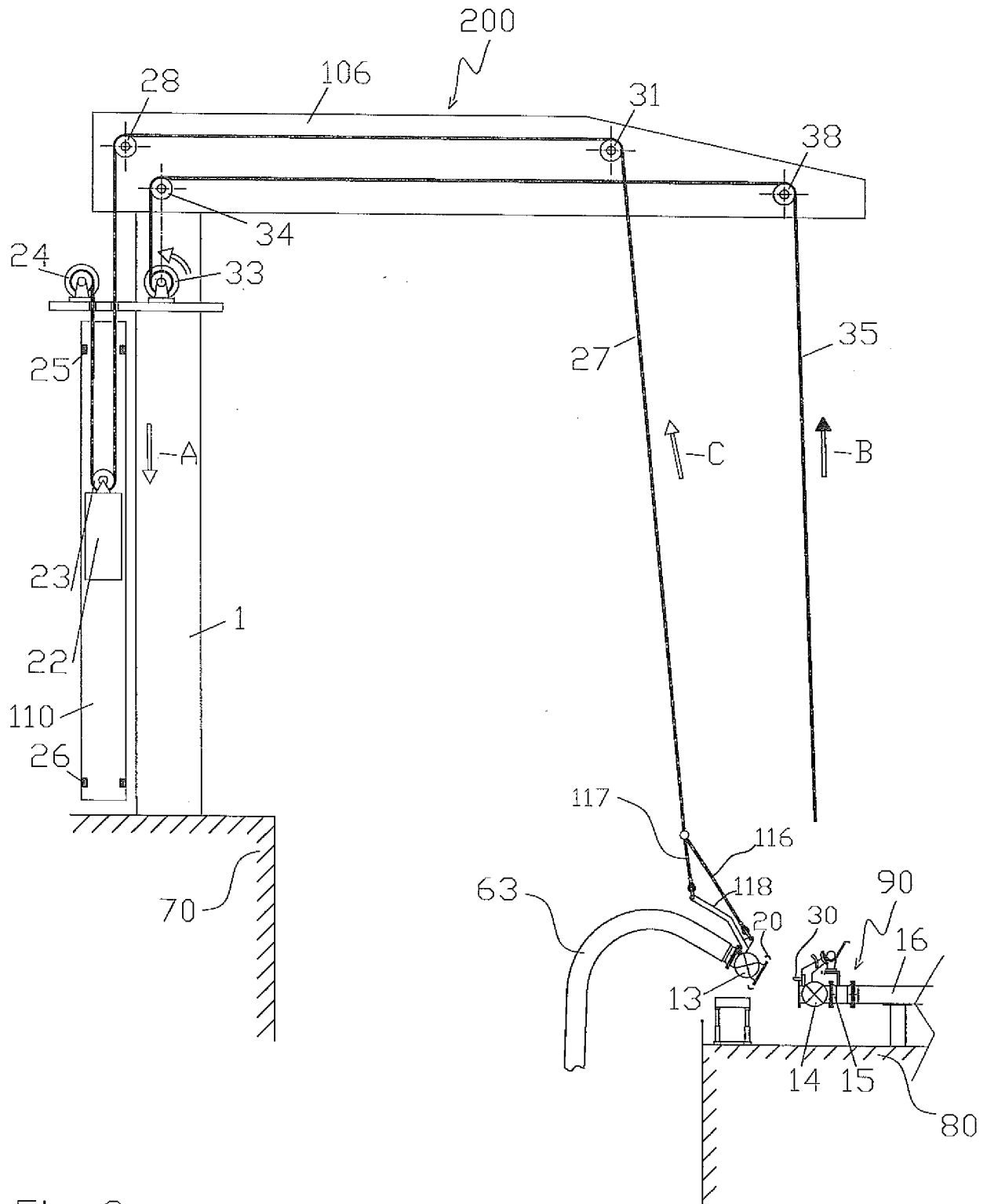


Fig 2a

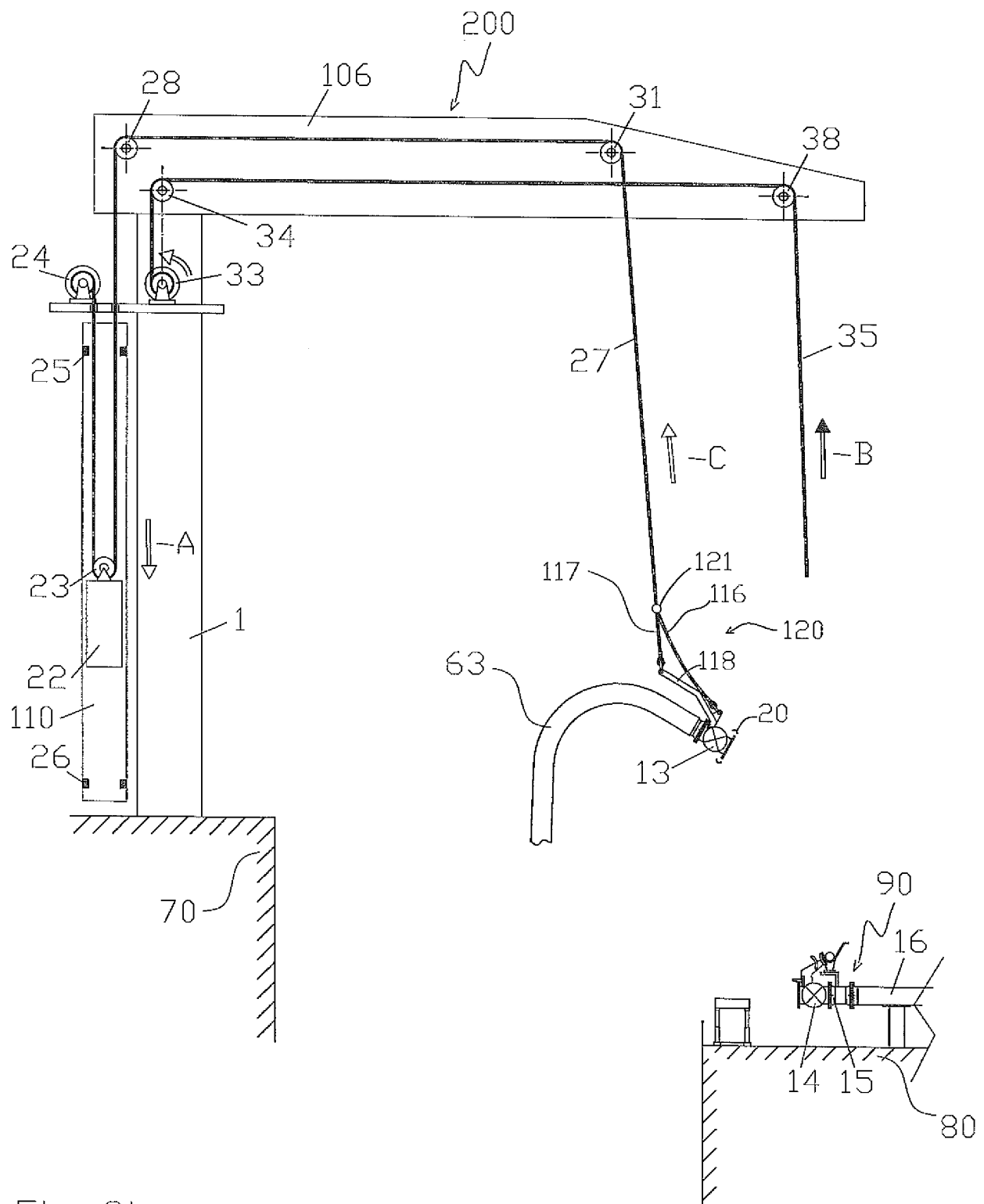


Fig 2b

REFERENCES CITED IN THE DESCRIPTION

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