



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.03.2016 Bulletin 2016/11

(51) Int Cl.:
B67D 7/40 (2010.01) B67D 9/00 (2010.01)

(21) Application number: **14382336.7**

(22) Date of filing: **10.09.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
 Designated Extension States:
BA ME

(71) Applicants:
 • **CEPSA QUIMICA , S.A.**
28046 Madrid (ES)
 • **Techflow Marine**
Cramlington, Northumberland NE23 7RY (GB)

(72) Inventors:
 • **Cuadro Saez, José María**
28046 Madrid (ES)
 • **Straker, Jim**
Cramlington, Northumberland NE23 7RY (GB)
 • **Blenkinsop, Brian**
Cramlington, Northumberland NE23 7RY (GB)

(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

(54) **Method and system for transferring fluids between ship and shore**

(57) A method for transferring a fluid between a vessel and an on shore installation, in particular at an industrial harbour, includes the steps of providing at least one fluid transfer hose 11; winding up the fluid transfer hose 11 on a hose reel 10 installed onshore; actuating the reel 10 to unwind the hose 11; displacing a free end 12 of the hose 11 relative to the deck of the vessel; and connecting the free hose end 12 to a mating equipment on the deck of the vessel.

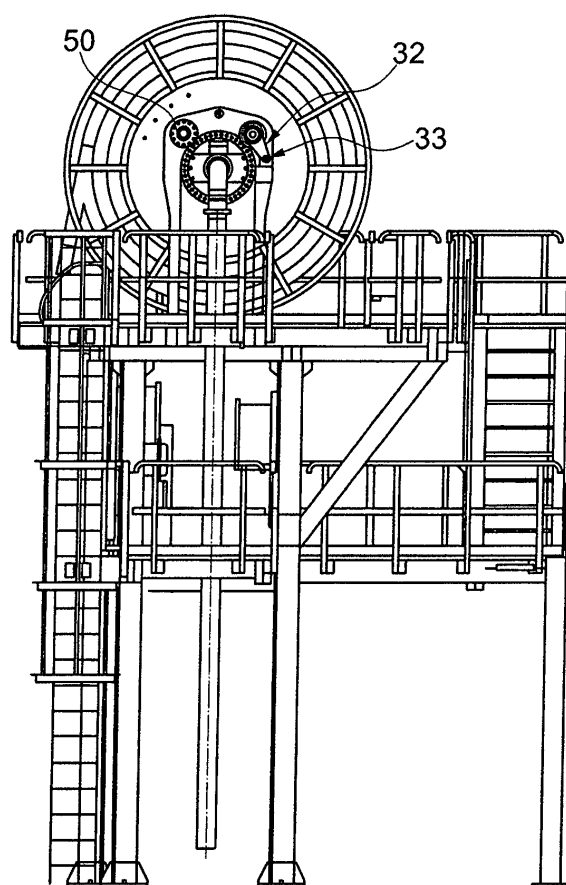


Fig. 8a

Description

Technical Field

[0001] The present invention generally relates to the transfer of fluids at industrial harbours, and more particularly to methods and systems for transferring fluids from ships to the shore and vice versa.

Prior Art

[0002] Different types of fluid transfer systems are in use today. One type of fluid transfer system employs flexible hoses. Different hose types exist for loading and unloading different types of fluids, e.g. diesel, water, chemicals, sewage, mud, or bulk.

[0003] Such hose systems are advantageous insofar as the hoses can be connected to any connection point on the vessel, they can cross each other, and their length can be adapted to the needs in each individual case. The use of hoses also permits the simultaneous loading of several different products.

[0004] WO 2013/096262 A1 discloses a system and method for loading and unloading cryogenic fluids between a free end of a transfer pipeline and a ship. The system includes internal and external hoses as well as a loading arm at the end of the external hose for connection with a ship manifold. An onshore crane is used for lifting the mobile end of the loading arm and moving it towards the deck of the ship.

[0005] When not in use, the loading arm and internal and external hoses are stored inside a shaft to protect them from sea-water, wind and sunlight. Within the shaft, the hoses are freely hung from a convex saddle.

[0006] US 6,886,611 B2 discloses a system for transferring a fluid product between a vessel and a fixed installation, in particular the shore, by means of flexible hoses. The free end of a flexible hose is coupled to a vessel's manifold by means of a connection module. The other end of the flexible hose is permanently fixed at one end to a gantry resting on a main platform. The connection modules and the mobile ends of the hoses are handled by means of a crane and winches.

Technical Problem

[0007] There are industrial harbours in which the use of such hose systems is difficult or even impossible.

[0008] The large hydraulic cranes, which are usually required for manipulating the hoses, take up a large space which is not always easily available.

[0009] An additional difficulty arises in case the loading platforms are located high above the sea level. In such cases, the hoses must be longer than at other ports in order to reach the vessels.

[0010] Another important problem associated with the use of such hose systems is that they are subject to damage: abrasion on the floor, impacts, kicks, crushing by

vehicles, solar irradiation, and so on.

Disclosure of the invention

[0011] In the light of the problems discussed above, it is the object underlying the present invention to provide an improved method for transferring a fluid between a vessel and an on shore installation.

[0012] According to the present invention, this object is achieved by means of a method for transferring a fluid between a ship and an on shore installation, in particular at an industrial harbour, according to claim 1, including the steps of

- providing at least one fluid transfer hose,
- winding up the fluid transfer hose on a hose reel installed onshore,
- actuating the reel to unwind the hose,
- displacing a free end of the hose relative to the deck of a vessel, and
- connecting the free hose end to a mating equipment on the deck of the vessel.

[0013] The present invention also provides a hose reel system for use in this method.

[0014] The solution of the present invention basically resides in the use of reels which are installed onshore and which are used for winding up the fluid transfer hoses if not in use. For using the hoses, the reels are actuated to unwind the hoses so that the free hose ends can be connected to the respective equipment on the decks of the vessels.

[0015] Hose loading stations comprising hose reels have been in use on oil rigs and on board FPSO vessels (FPSO = Floating Production Storage and Offloading Unit). On oil rigs, they have been used for delivering supplies (water, fuel, chemicals, ...) to the oil rig. On FPSOs, the hoses have been larger and have been used for transferring the crude oil from one ship to another. Such hose loading stations or hose reel systems have, however, not been used in an industrial harbour to date. The system and method of the present invention were developed taking into account the particular conditions at the harbour, including the tides as well as the types of ships which are loaded and their dimensions. (Of note, in the present disclosure, the terms "hose reel system" and "hose loading station" are used as synonyms.)

[0016] The hose reel fluid transfer method and system of the present invention provides several advantages over transfer hose solutions which are currently in use at industrial harbours, including the following:

[0017] First of all, when wound up on the reels, the hoses are safely stored and protected. Their lifetime is expanded thereby.

[0018] Secondly, other than with conventional systems, there is no need for a large and cumbersome crane onshore for handling the hoses, the crane on the ship is sufficient.

[0019] Thirdly, the length of the hoses in use can be easily adjusted by winding and unwinding the hoses on the reels, making it possible to easily reach different connection points on the decks of individual vessels and to compensate for different heights at which the vessel decks could be located.

[0020] The solution of the present invention dispenses with the use of onshore cranes in order to displace the free ends of the hoses towards the vessel decks. One possible way of achieving this resides in adding to the hose reels a means for moving the hose end towards the deck of the vessel. For example, an articulated arm could be used, which could e.g. be mounted adjacent to the hose reel. As an alternative, the free end of the hose can be handled by means of a crane installed on board the vessel. Such placement means are not necessary on an oil rig, where the free hose end is basically merely dropped from the hose reel on the oil rig towards the sea where the vessel is located.

[0021] For winding and unwinding the hoses on the reels, a hydraulic system may, for example, be used.

[0022] Irrespective of how exactly the reels are actuated, the operation can be controlled by remote control (e.g. WiFi remote control). The remote control makes it possible for an operator to actuate the reels not only when standing on the shore, but also while standing on the deck of the vessel. Being able to remotely actuate the reels to wind and unwind each individual hose is particularly advantageous at a harbour, since it allows operating the onshore reels while the operator stands on the deck of the vessel. When hose reels are used on an oil rig, the operator is on the oil rig anyway so that there is no actual need to remotely control the hose reels.

[0023] The method of the present invention can further comprise the steps of

- applying a reel brake in order to prevent the hose reel from rotating,
- monitoring a tensile force acting on the hose or a resulting torque acting on the hose reel, respectively, in a state in which the reel brake is applied,
- releasing the reel brake to provide additional hose length by further unwinding the hose in order to reduce the tensile force, and
- re-applying the reel brake.

[0024] The tensile force on the hose could be determined by means of hydraulic pressure sensors detecting a hydraulic pressure related with the torque acting on the reel, or by mechanically measuring the torque acting on the reel.

[0025] In other words, a safety system is employed which detects an excessive tensile force acting on the hose and provides additional hose length by further unwinding the hose. Such tensile forces could result from conditions which are specific at a harbour, in particular the vessel sinking with the sea level due to low tide, or because the vessel's floatation depth increases when

the vessel is being loaded. Conventional hose reels e.g. on oil rigs rather make use of a weakened area of the hose as a predetermined breaking point, so that the hose simply tears when the pulling force is too large.

[0026] In addition, an encoder assembly can be provided in order to stipulate a maximum and minimum deployment position of the hose. The safety system may then be operate to further unwind the hose to reduce the tensile force acting on the hose as long as the maximum deployment position has not yet been reached.

[0027] According to the present invention, a hose reel system for use in the fluid transfer method described above includes

- at least one fluid transfer hose, and
- at least one hose reel installed onshore for winding up and unwinding the hose.

[0028] As explained above, the present invention dispenses with the use of onshore cranes for manipulating the free end of the hose relative to the vessel deck. Instead, the system may further comprise means for displacing the free hose end. For example, the means for displacing the free end of the hose may be constituted by a support arm having one end movably supported to a frame of the system and another end configured for supporting the free end of the hose.

[0029] The support arm may be composed of only one joint, but preferably it is configured from at least two joints hingedly connected to each other. For example, a first joint has a first end pivotably coupled to a supporting foundation and a second end hingedly coupled to a first end of a second joint, the second joint having its second end releasably coupled to the free end of the hose.

[0030] There are other conceivable configurations of the support arm. For example, one of the joints or even the entire support arm could be constituted by a telescopic structure so as to allow for a linear translational movement.

[0031] The hose reel system of the invention may further comprise means associated with at least one of the hose reels for determining the torque acting on the hose reel, e.g. in a mechanical manner. The torque determining means include a torque arm which is mounted to a gearbox of the hose reel at or near its one end and anchored to a drive frame of the hose reel at or near its other end via a load pin, so that by measuring the force applied to the load pin, the torque acting on the drum can be determined, considering the radius of the torque arm. The torque determining means can be of use in connection with a safety system which, if an excessive tensile force acts on the hose, provides additional hose length by further unwinding the hose.

[0032] The system of the present invention may include a hose guide chute which is designed to provide a radius for hose deployment and retrieval, eliminating damages suffered from sharp edges. The chute is specifically designed to place the hose end in such a position

that jetty operator would be able to hook the hose end with vessel crane. Standard reels on e.g. oil rigs have rather been designed to deploy the hose vertically down to the vessel. Without this chute, the hook operation within the steel structure would not be possible or the jetty operator would need to work under an extreme fall danger in order to reach the hose end.

[0033] The system may be a modular system so that individual reels can be added or removed as needed.

[0034] The reels may be covered by a housing and/or a roof for protecting the coiled hose(s).

[0035] In order to avoid abrasion and other damages, also where the hoses intercross, the hose(s) may be covered by means of a spiral plastic layer which can be replaced if need be.

Brief Description of the Drawings

[0036] In the attached drawings,

Figure 1 shows a conventional hose loading station;

Figure 2 illustrates a hose loading station according to a first embodiment of the present invention;

Figures 3a through 3h show a hose loading station according to a second embodiment of the present invention, including an articulated arm for use in a hose loading station of the present invention, wherein Figure 3a is a perspective view, Figure 3b is a front elevational view, Figure 3c is a side view along the section C-C in Figure 3b, Figure 3d is a side view along the section B-B in Figure 3b, Figure 3e is a side view along the section A-A in Figure 3b, Figure 3f is a top view with the roof omitted, Figure 3g is a side view, and Figure 3h is a rear elevational view;

Figure 4 illustrates a gearbox 30 for providing rotation to one of the reels of a hose reel system according to the invention;

Figure 5 is a front view of a torque arm and load pin of the system of Figure 4;

Figure 6 shows how the driving coupling between the hose reel and the gearbox 30 would be effected;

Figure 7 shows the mounting of an encoder assembly 50; and

Figures 8a through 8c are overview drawings which illustrate where the arrangements shown in Figures 4 through 7 relative to a hose reel in a hose loading station according to a third embodiment of the present invention, wherein Figure 8a is a side view, Figure 8b is a front view, and Figure 8c is a plan view.

Detailed Description of Embodiments of the Invention

[0037] Figure 1 shows a conventional hose reel system. The conventional system includes a frame 1' which provides rotatable support for a series of hose reels 10'. On each of the reels 10', one or several fluid transfer hoses 11' are wound up. In the case shown in Figure 1', three single reels and one double reel are provided. Adjacent each reel 10', the frame 1' further includes a platform 2' for an operator to stand on, surrounded by a respective rail 3'. Free ends of the hoses 11' are designated 12'.

[0038] Figure 2 shows a hose reel system according to a first embodiment of the present invention. The system is configured for the transfer of fluid from a ship to the shore or vice versa at an industrial harbour. The system includes a frame 1 in the form of a framework of steel struts which provides rotatable support for a series of hose reels 10. On each of the reels 10, one or several fluid transfer hoses (not shown) can be wound up. In the case shown in Figure 2, two double reels and one single reel are provided.

[0039] The system may be a modular system so that individual reels can be added or removed as needed.

Adjacent each reel 10, the frame 1 further includes a platform 2 for an operator to stand on, surrounded by a respective rail 3. Of note, each of the platforms 2 extends by a distance D beyond lower parts of the frame 1 which are located below the platform 2, including e.g. a lower deck 4. This distance D is dimensioned in order to provide sufficient space for the operator to grab and hoist the hose end. The circumstances at the jetty where the hose reel station is placed is also taken into account when dimensioning the distance D; in particular, if the distance D becomes too large, there is a risk of a vessel impacting the platform 2. On the other hand, the vertical location of the platform 2 relative to the associated reel 10 is chosen so as to allow operator to safely hoist the hose end without running the risk of falling down the platform 2.

[0040] The system further includes a hose guide chute 13 for each of the hoses, which is designed to provide a radius for hose deployment and retrieval, eliminating damages suffered from sharp edges. The chutes are specifically designed to place the respective hose end in such a position that the jetty operator would be able to hook the hose end with a vessel crane. The chutes 13 also prevent the hose ends from clashing with the lower parts of the hose reel station, e.g. the lower deck 4, and they may include means for securing the hose ends when not in operation.

[0041] The hose reels 10 are covered by a protective roof 14.

[0042] In order to initiate the fluid transfer, a coupling at the free end of the hose 12 is connected with a manifold on the deck of the vessel (not shown). In order to manipulate the free end of the hose 12 accordingly and to move it to the specific location on the vessel deck, the solution

of the present invention dispenses with the use of on-shore cranes. In accordance with the invention, either a crane on board the vessel is used, or the hose reel system is equipped with a means for moving the hose ends about the deck of the vessel. For example, at least one articulated arm could be used, as it is the case with a second embodiment of the present invention which will now be described with reference to Figures 3a through 3h and is otherwise, i.e. apart from the articulated arm(s), constructed in a similar manner as the first embodiment.

[0043] Figures 3a through 3h illustrate a hose reel system according to a second embodiment of the present invention. In this sequence of Figures, Figures 3c through 3e each illustrate a respective articulated arm of the hose loading station shown in Figures 3a and 3b: Figures 3c, 3d and 3e are side views along the sections C-C, B-B and A-A, respectively, in Figure 3b. Consequently, the arm shown in Figure 3c is the one illustrated in the center of Figure 3b, which is in a stored position or stand-by position. In contrast, the arm shown in Figure 3d has been partly extended by operating the associated telescopic bars 27 and 28, and the arm in Figure 3e has been fully extended by means of its telescopic bars 27 and 28.

[0044] With reference to e.g. Figure 3e, which is a side view along the section A-A in Figure 3b, the hose reel system again includes a frame 1 comprising platforms 2 equipped with rails 3 (only one platform and rail being visible in this sectional view). The frame 1 provides rotatable support for a series of hose reels 10 (one reel being visible) on which respective hoses 11 are wound. The Figure further illustrates a pipe 15 joined to the hose 11 in order to transfer fluids between the shore, where the hose reel is installed, and a vessel, which would be located where the free end 12 of the hose 11 is positioned. In order to move the hose end 12 about the deck of the vessel towards the location where the hose end 12 is coupled with a manifold of the vessel, the hose reel system is provided with an articulated arm 20. The arm 20 is composed of two joints 22 and 23. The first joint 21 has a first end hingedly connected to a supporting foundation 21 of the arm 20, and a second end hingedly connected to a first end of the second joint 23 via a hinge 24. The second end of the second joint 23 is provided with a support bracket 25 for supporting the free end 12 of the hose 11.

[0045] A bridge bar 26 is hingedly connected between the first 21 and second joints 22 of the arm 20, with the opposed ends of the bridge bar 26 being coupled to the joints 21, 22 about halfway between the ends of each joint 21, 22. The bridge bar 26 provides support for the extended length of the hose 11.

[0046] In order to actuate the arm 20 and change the position of the support bracket 25 carrying the free hose end 12, the arm 20 is provided with two telescopic bars 27 and 28. The first telescopic bar 27 is coupled between the supporting foundation 21 and the first joint 22 of the arm 20 in order to pivot the first joint 22 relative to the supporting foundation 21. The second telescopic bar 28

is coupled between the first joint 22 and the hinge 24 in order to pivot the second joint 23 relative to the first joint 22.

[0047] For winding and unwinding the hoses on the reels, the fluid transfer system may employ a hydraulic system which is operated by remote control (e.g. WiFi remote control). The remote control makes it possible for an operator to actuate the reels not only when on the shore, but also while standing on the deck of the vessel. Being able to remotely actuate the reels to wind and unwind each individual hose is particularly advantageous at a harbour, since it allows operating the onshore reels while the operator stands on the deck of the vessel. When hose reels are used on an oil rig, the operator is on the oil rig anyway so that there is no actual need to remotely control the hose reels.

[0048] The remote controller, e.g. WiFi remote controller, would be capable of operating each hose reel 10 and/or the associated hose end displacement means individually, e.g. the respective articulated arm in the second embodiment just described. A selector would be provided to choose the hose reel 10 to be operated. There could be two separate operating means (e.g. joysticks) for winding out the hose and for moving the associated articulated arm, respectively.

[0049] In order to avoid abrasion and other damages, also where the hoses intercross, the hoses may be covered by means of a spiral plastic layer which can be replaced if need be.

[0050] The system may employ a safety system which detects an excessive tensile force acting on the hose and provides additional hose length by further unwinding the hose. Such tensile forces could result from conditions which are specific at a harbour, in particular the vessel sinking with the sea level due to low tide, or because the vessel's floatation depth increases when the vessel is being loaded.

[0051] The mode of operation of one embodiment of such a safety system will be described with reference to Figures 4 through 7.

[0052] Figure 4 illustrates a gearbox 30 for providing rotation to one of the reels of a hose reel system, e.g. the system shown in Figure 2 (first embodiment of the present invention), the one shown in Figures 3a through 3h (second embodiment of the present invention) or the one shown in Figures 8a through 8c described further below (third embodiment of the present invention). Each reel of the hose reel system would be equipped with a gearbox 30 as shown in Figure 4. The frame 1 of the system is illustrated in Figure 4. The hose reel as such would be located on the left hand side in this drawing and coupled to the gearbox 30 and the drive shaft, a free end of which is illustrated at 34, in a manner described further below with reference to Figure 6.

[0053] A torque arm 32 is mounted to the gearbox 30 at its one end. At its other end, the torque arm 32 is anchored to the drive frame 1 via a load pin 33. Any pull on the drum equates to a torque on the drum, and this torque

is transferred through the gearbox 30 to the torque arm 32 and further to the load pin 33. In the present embodiment, the load pin 33 has an axis which is parallel to a longitudinal axis of the drive shaft. By measuring the force applied to the load pin 33, the torque acting on the drum can be determined, considering the radius of the torque arm. The load pin 33 could, for example, send an electrical signal of e.g. 4 to 20 mA to a PLC (programmable logic controller) which in turn determines the force acting upon it and then if necessary releases the reel brakes.

[0054] Figure 5 is a front view of the torque arm 32 and load pin 33. Figure 6 shows how the driving coupling between the hose reel and the gearbox 30 would be effected. Reference numeral 40 designates a reel side frame, which is coupled to the free end 34 of the drive shaft via a slew ring 41 and pinion 42.

[0055] In order to observe the maximum and minimum deployment positions of the hose, the system further includes an encoder assembly 50 which engages with the slew ring 41 via a pinion 52 (cf. Figure 7). The hose is wrapped around the drum in single turn in multilayers so that end points can be set. The encoder assembly 50 essentially counts the number of revolutions of the hose reel from a set datum. This information is interpreted via the PLC so that the hose paid out is monitored at all times. The reel will stop when the hose is almost completely paid out, and at that point an operator will take over to make final adjustments if necessary.

[0056] If an overload situation occurs during operation of one of the hose reels, as measured by the associated load pin 33, the system will automatically release the associated reel brake (shown at 35 in Figure 4) to further unwind the hose. Once the load is reduced, the reel brake 35 will re-apply. This can continue until maximum deployment position of the hose is reached, as measured by the encoder assembly 50.

[0057] Finally, Figures 8a through 8c are overview drawings which illustrate a safety system as shown in Figures 4 through 7 relative to a hose reel in a hose loading station according to a third embodiment of the present invention. Figure 8a is a side view, Figure 8b is a front view, and Figure 8c is a plan view of the third embodiment. Of note, in Figures 8a through 8c, the safety system shown in Figures 4 through 7 is shown in connection with the third embodiment of the present invention, but the safety system could as well be provided in the first or the second embodiment of the present invention.

[0058] In the side view of Figure 8a, the location of the encoder assembly 50, torque arm 32 and load pin 33 of the safety system are shown, as explained further above with reference to Figures 4 to 7. Figure 8b shows that each of the hose reels (six in this embodiment) is equipped with a gearbox 30 and reel brake 35 as described further above. Figure 8c illustrates the location of the gearbox 30, brake 35 and encoder assembly 50 once again in plan view.

Claims

1. A method for transferring a fluid between a vessel and an on shore installation, in particular at an industrial harbour, the method including the steps of
 - providing at least one fluid transfer hose (11),
 - winding up the fluid transfer hose (11) on a hose reel (10) installed onshore,
 - actuating the reel (10) to unwind the hose (11),
 - displacing a free end (12) of the hose (11) relative to the deck of the vessel, and
 - connecting the free hose end (12) to a mating equipment on the deck of the vessel.
2. The method of claim 1, in which the displacing of the free end (12) of the hose (11) is performed without the use of onshore cranes.
3. The method of claim 1 or 2, in which the displacing of the free end (12) of the hose (11) is performed by means of a crane installed on the vessel.
4. The method of any one of the preceding claims, in which the displacing of the free end (12) of the hose (11) is performed by means of an articulated arm (20), the arm (20) preferably being provided adjacent to the hose reel (10).
5. The method of any one of the preceding claims, in which the winding and unwinding of the hose (11) is controlled by means of a remote control system, e.g. a WiFi remote control system.
6. The method of any one of the preceding claims, further comprising the steps of
 - applying a reel brake (35) in order to prevent the hose reel (10) from rotating,
 - monitoring a tensile force acting on the hose (11) or a resulting torque acting on the hose reel (10), respectively, in a state in which the reel brake (35) is applied,
 - releasing the reel brake (35) to provide additional hose length by further unwinding the hose (11) in order to reduce the tensile force, and
 - re-applying the reel brake (35).
7. The method of claim 6, in which the tensile force on the hose (11) is determined by means of hydraulic pressure sensors detecting a hydraulic pressure related with the torque acting on the reel (10).
8. The method of claim 6, in which the tensile force on the hose (11) is determined by mechanically determining the torque acting on the reel (10).
9. The method of any one of claims 6 to 8, in which the

provision of the additional hose length is only effected between a maximum and a minimum deployment position of the hose (11), as determined by means of an encoder assembly (50).

5

- 10.** A hose reel system for use in the method of any one of claims 1 to 9 for transferring a fluid between a vessel and an on shore installation, the system including

10

- at least one fluid transfer hose (11), and
- at least one hose reel (10) installed onshore for winding up and unwinding the hose (11).

- 11.** The hose reel system of claim 10, further comprising means for displacing a free end (12) of the hose (11) relative to the deck of a vessel.

15

- 12.** The hose reel system of claim 11, in which the means for displacing the free end (12) of the hose (11) are constituted by a support arm (20) having one end movably supported to a frame (1) of the hose reel system and another end configured for supporting the free end (12) of the hose (11).

20

25

- 13.** The hose reel system of claim 12, wherein the support arm (20) is configured from at least two joints (22, 23) hingedly connected to each other, in particular from a first joint (22) which has a first end pivotably coupled to a supporting foundation (21) of the arm (20) and a second end hingedly coupled to a first end of a second joint (23) of the arm (20), the second joint (23) having its second end releasably coupled to the free end (12) of the hose (11).

30

35

- 14.** The hose reel system of any one of claims 10 to 13, further comprising means associated with at least one of the hose reels (10) for determining the torque acting on the hose reel (10), e.g. in a mechanical manner.

40

- 15.** The hose reel system of claim 14, wherein the torque determining means include a torque arm (32) which is mounted to a gearbox (30) of the hose reel (10) and anchored to a drive frame (1) of the hose reel (10) via a load pin 33, so that by measuring the force applied to the load pin (33), the torque acting on the drum can be determined, considering the radius of the torque arm (32).

45

50

55

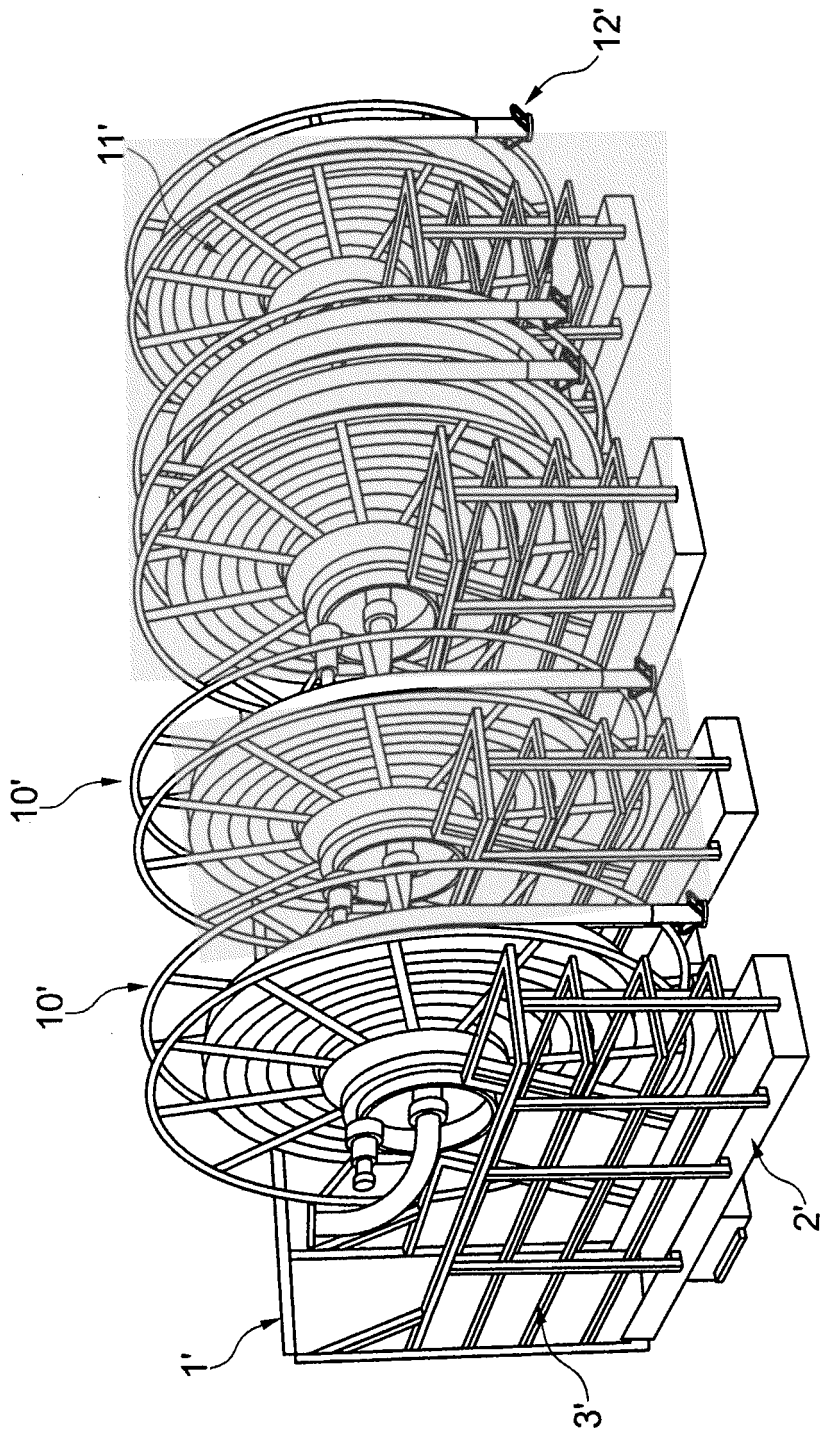


Fig. 1 (prior art)

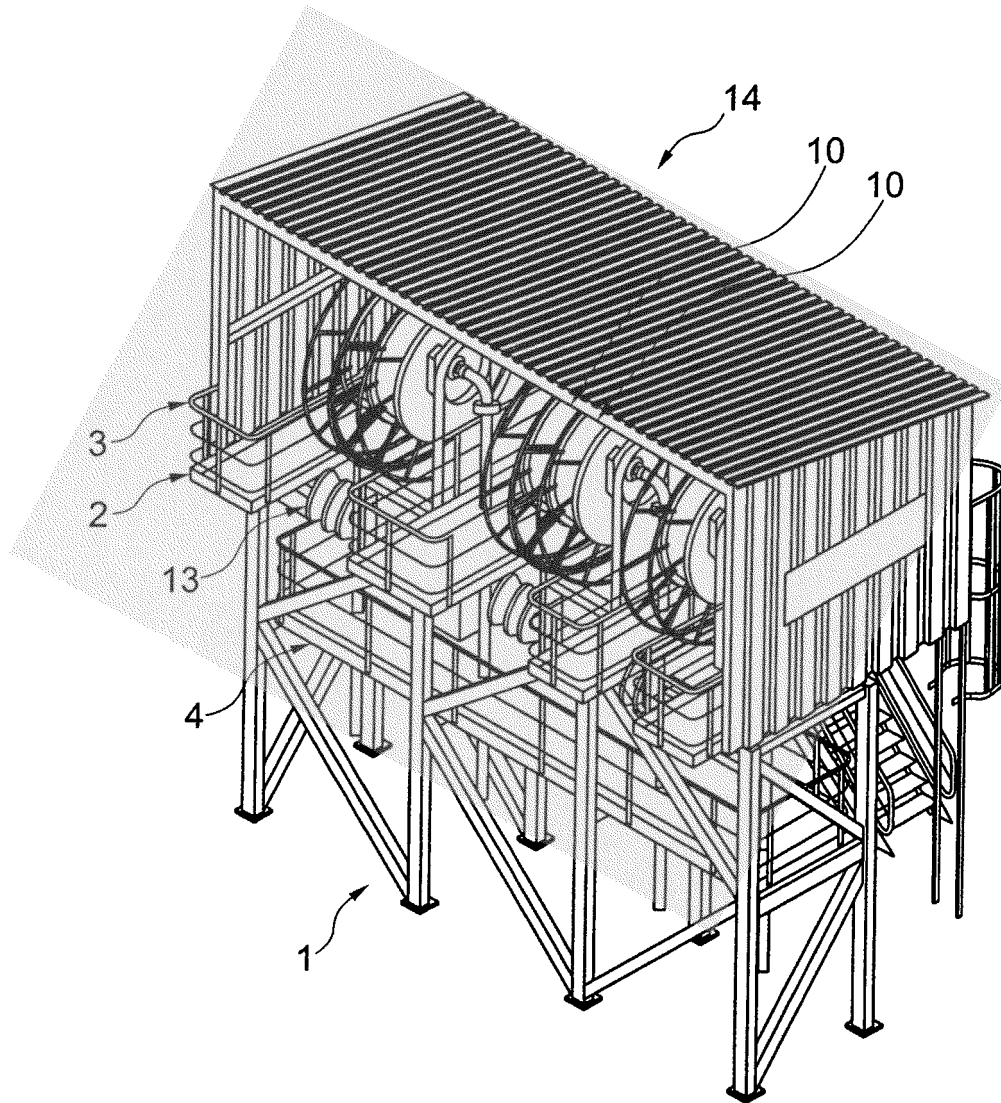


Fig. 2

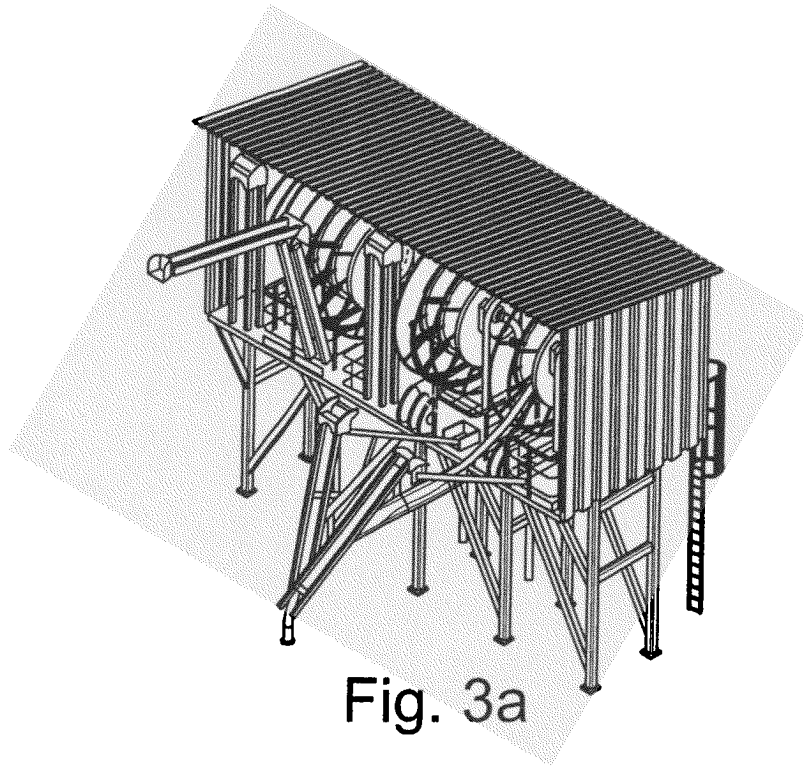


Fig. 3a

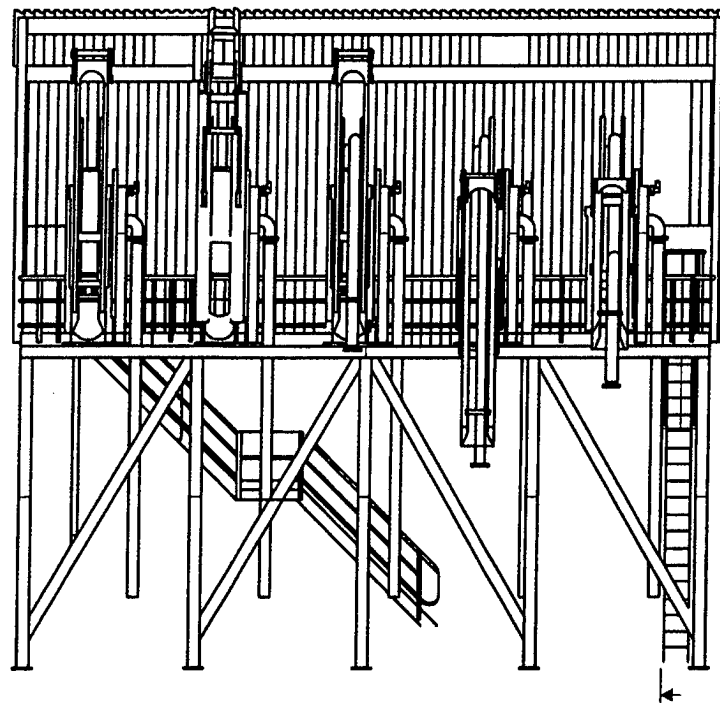


Fig. 3b

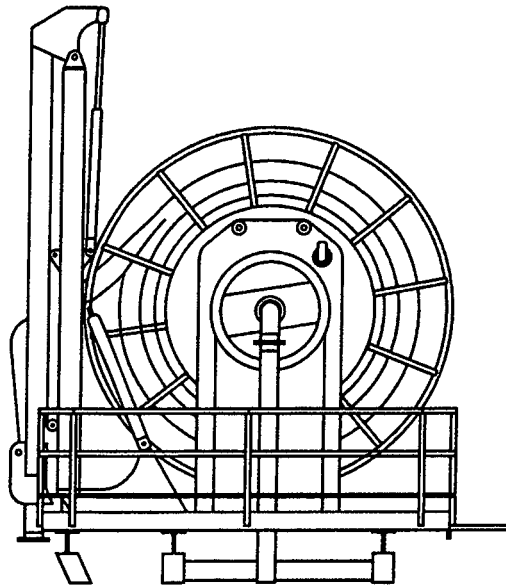


Fig. 3c

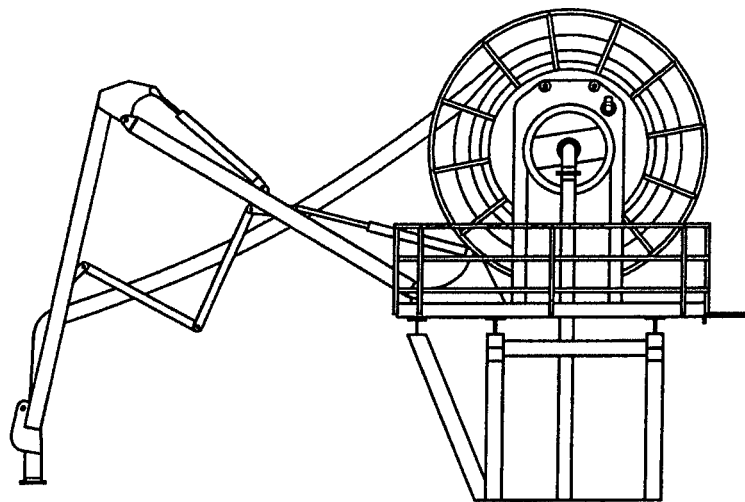


Fig. 3d

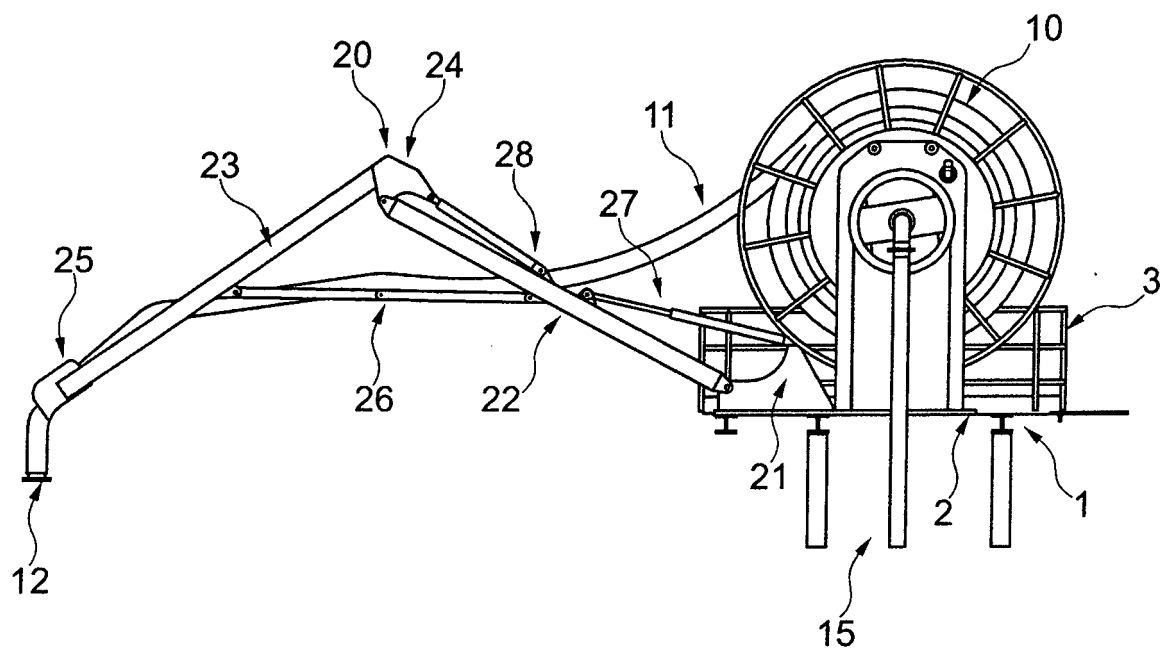


Fig. 3e

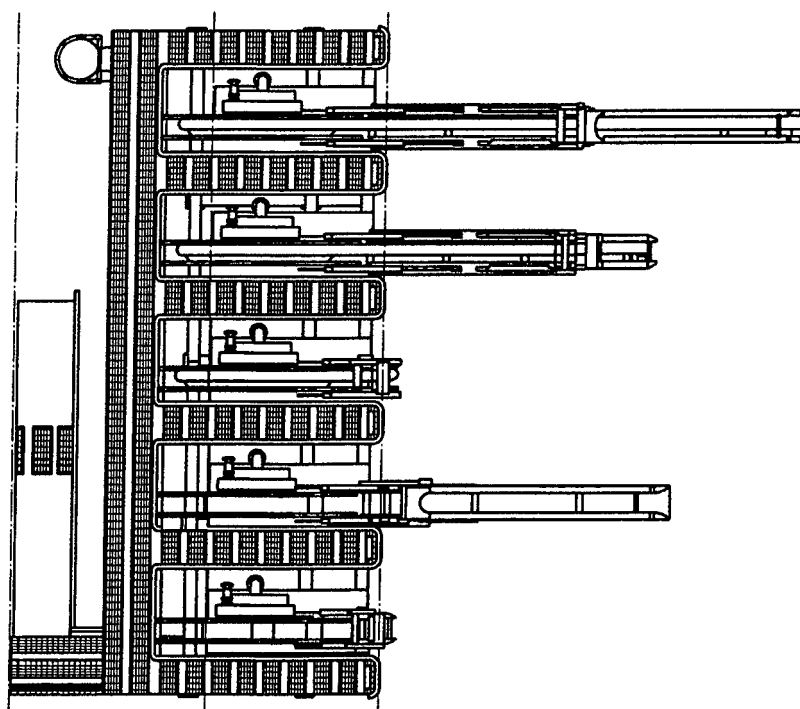


Fig. 3f

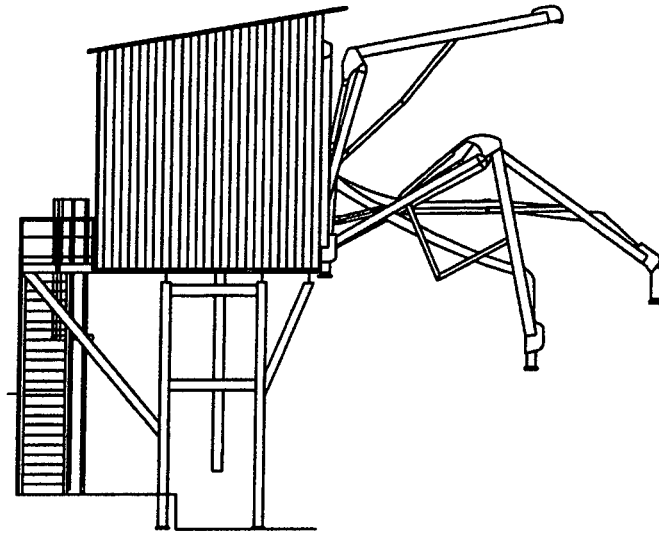


Fig. 3g

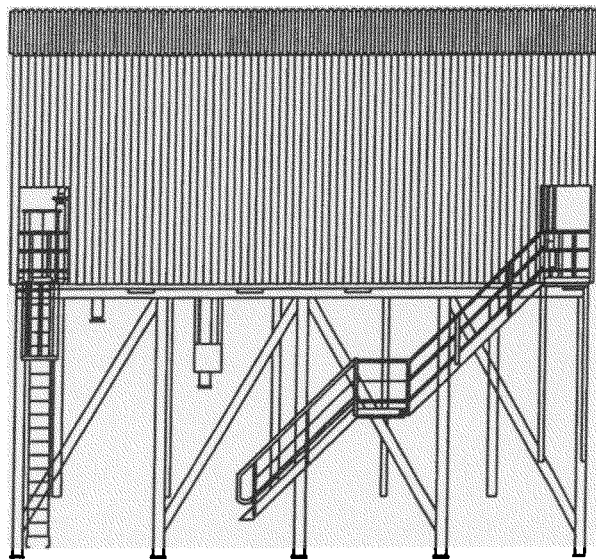


Fig. 3h

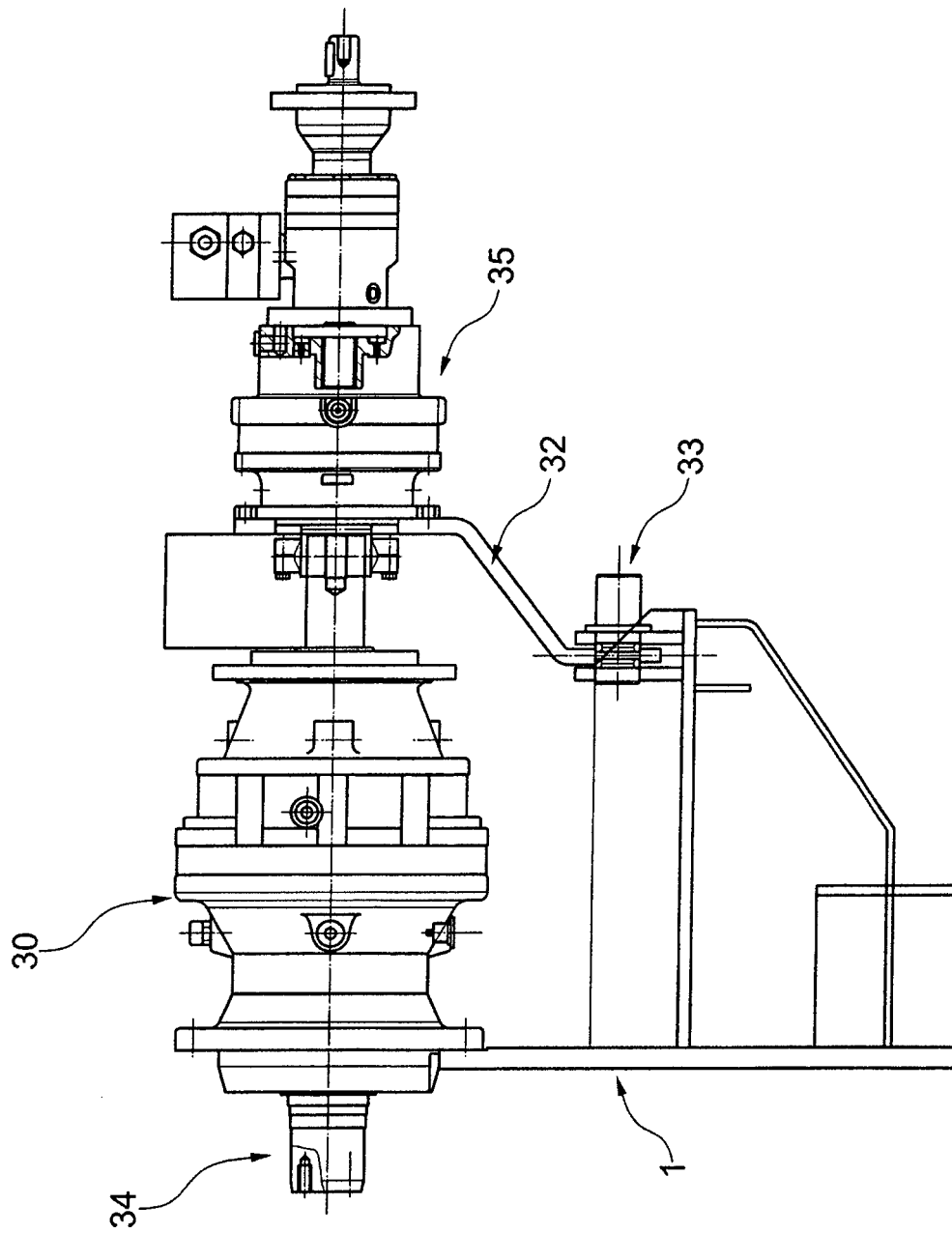


Fig. 4

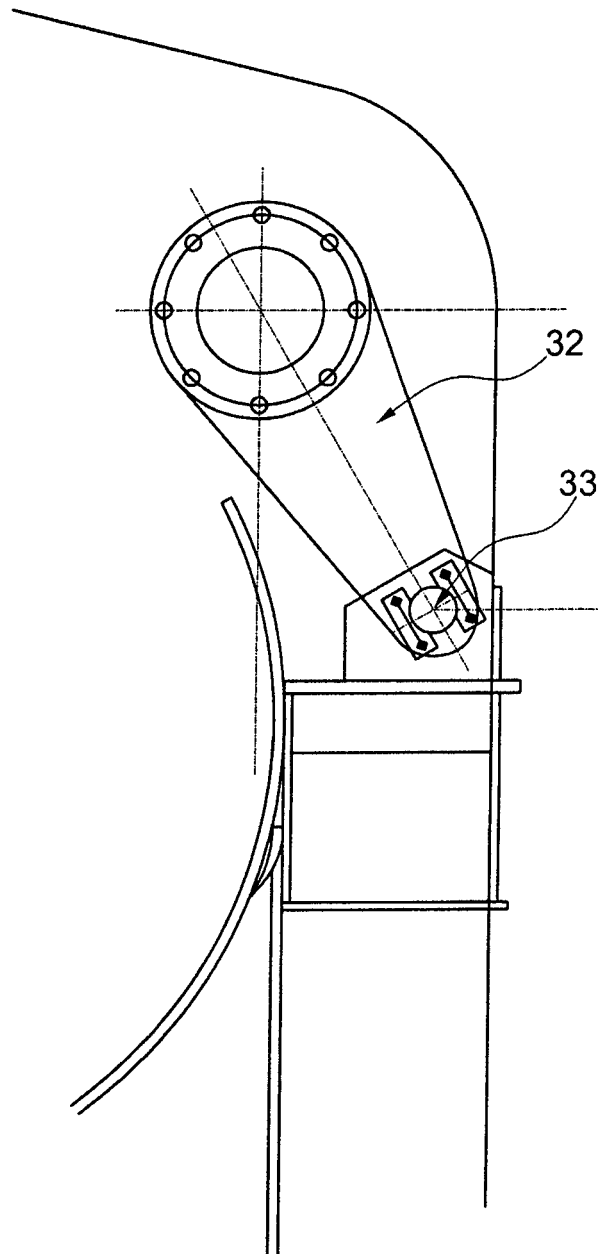


Fig. 5

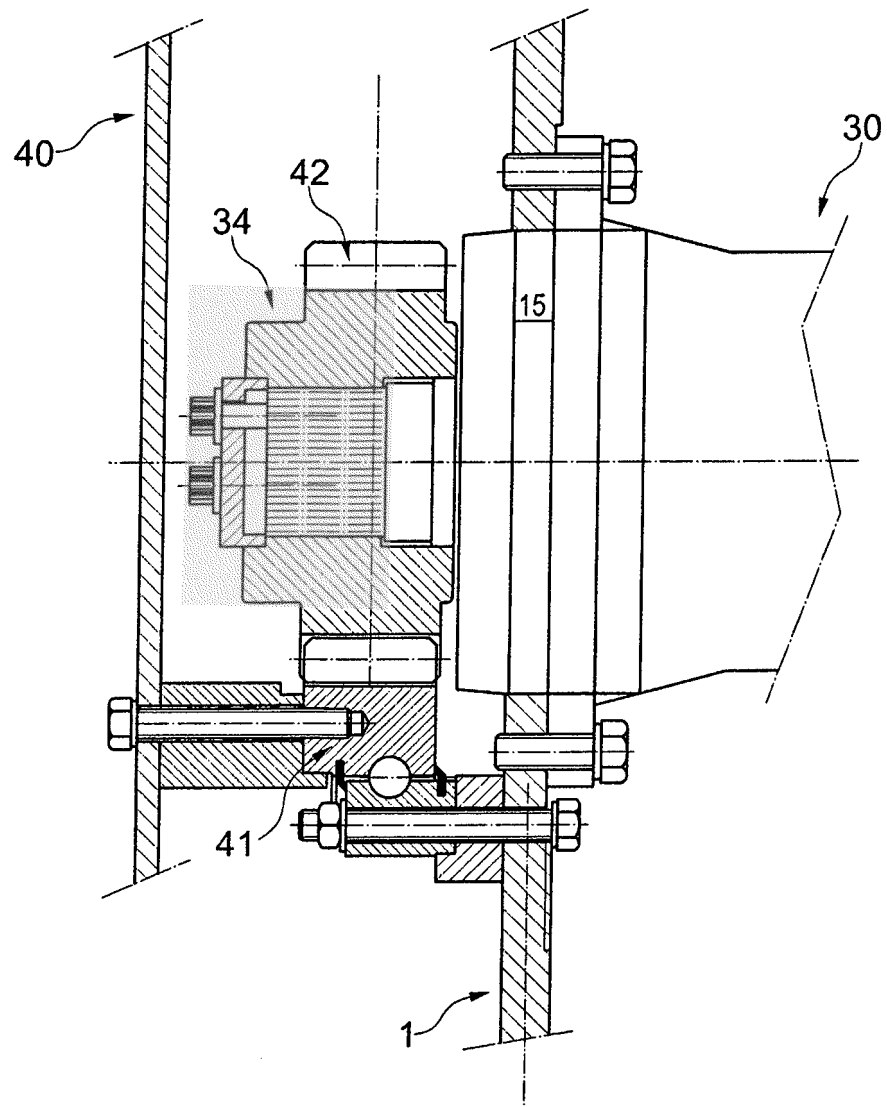


Fig. 6

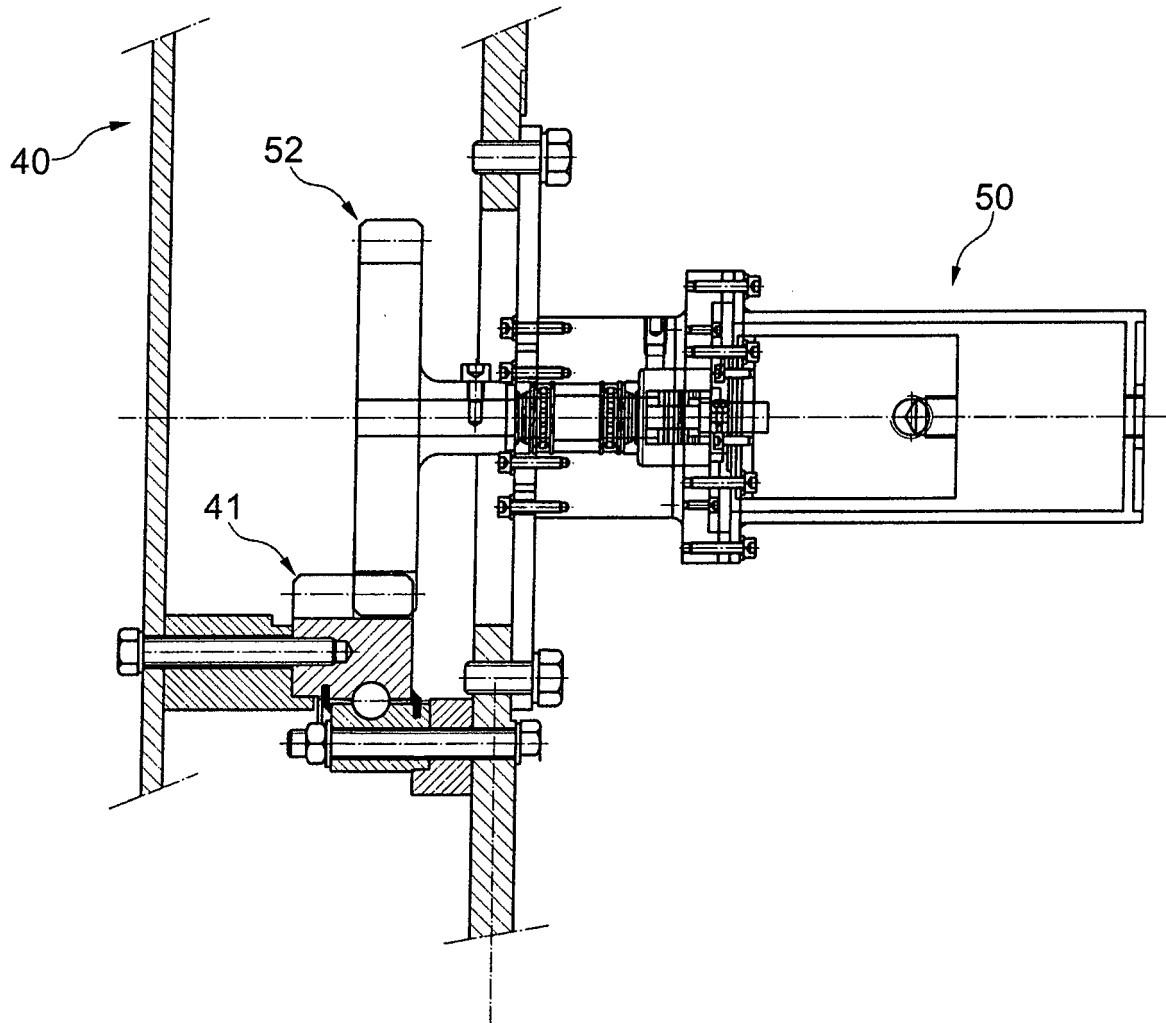


Fig. 7

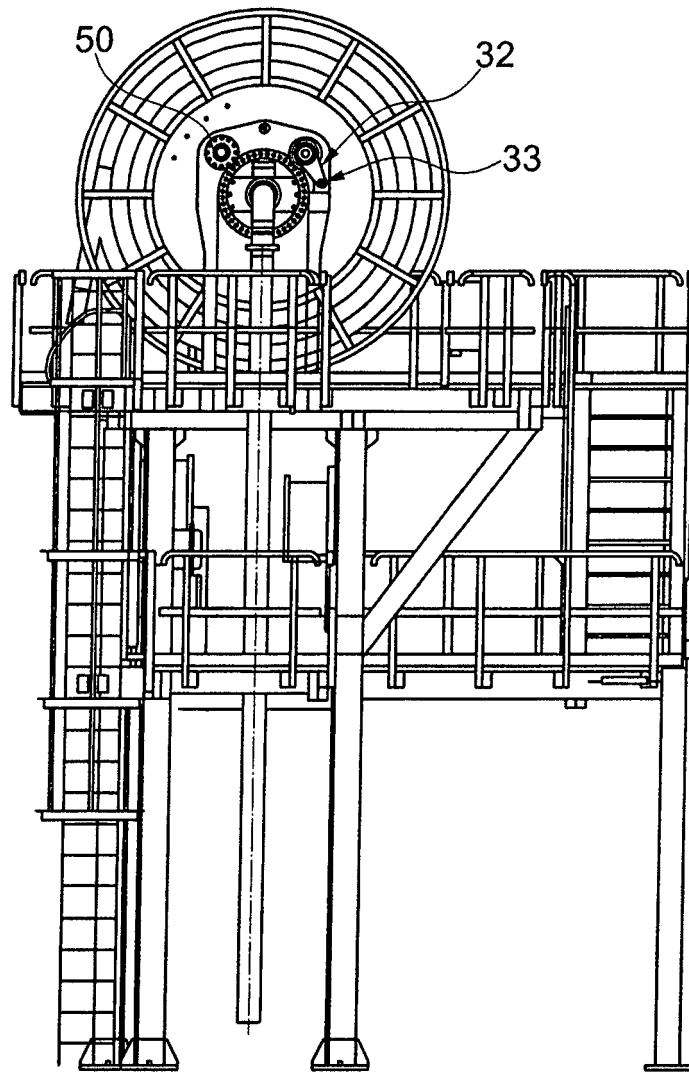


Fig. 8a

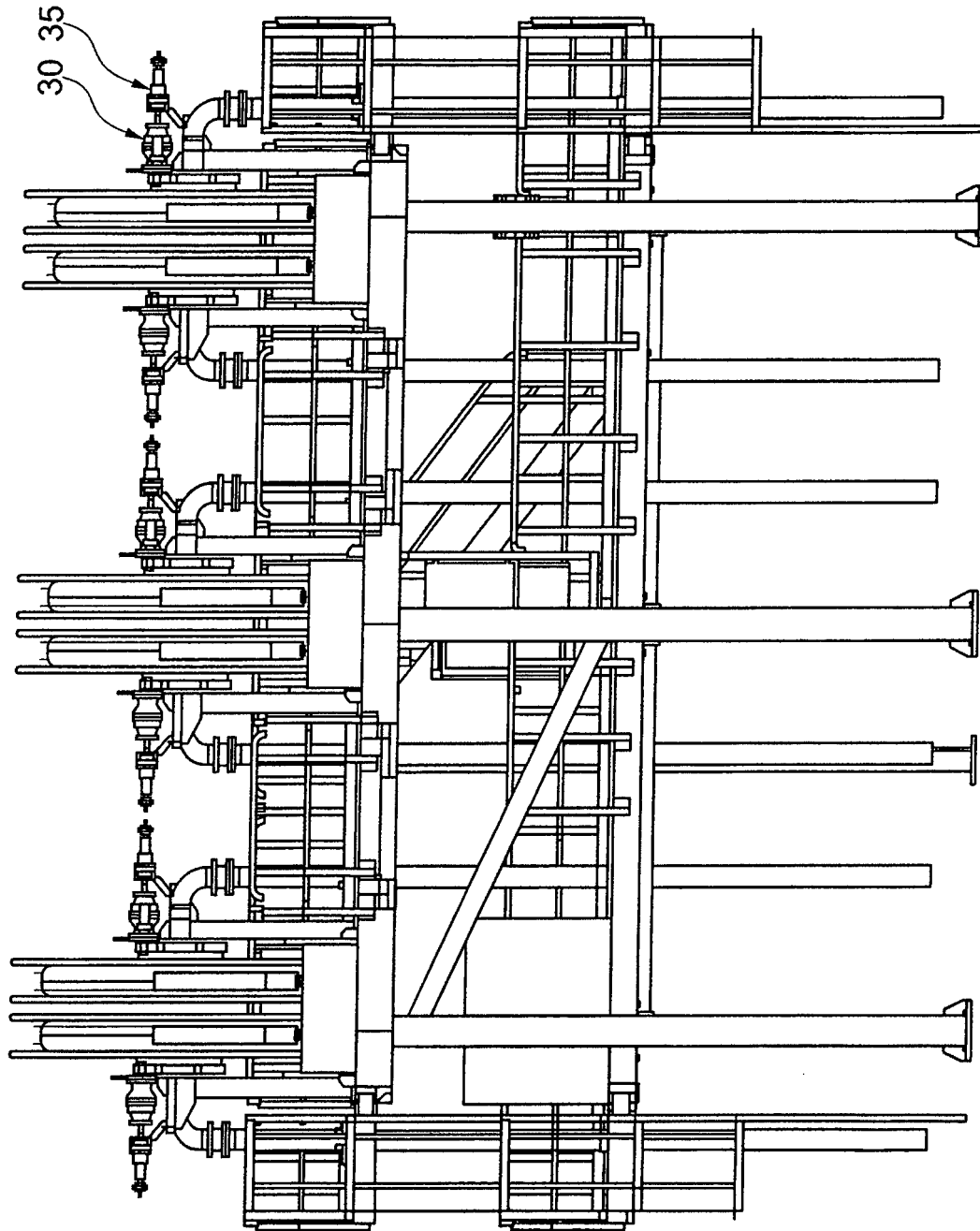


Fig. 8b

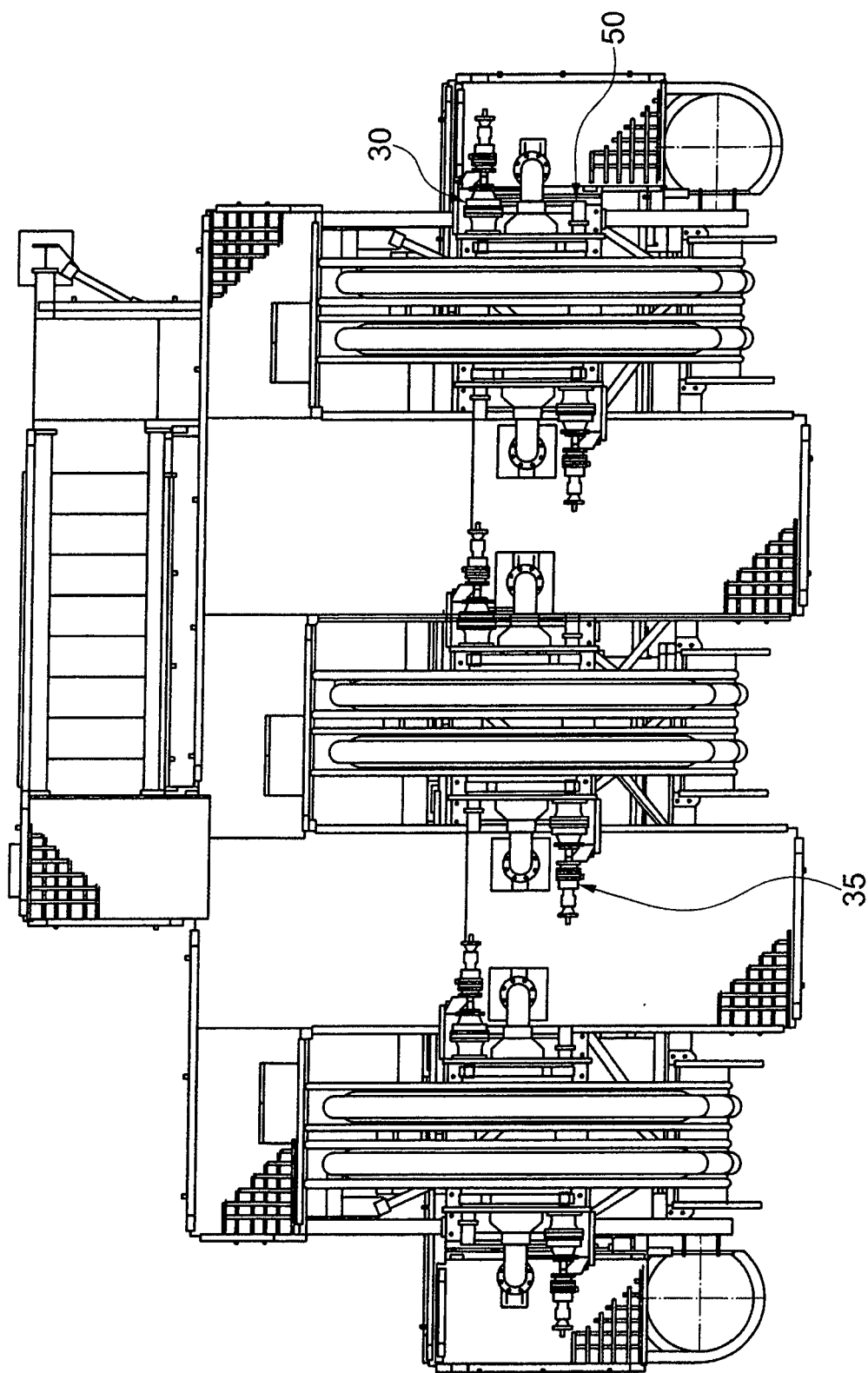


Fig. 8c



EUROPEAN SEARCH REPORT

Application Number
EP 14 38 2336

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2011/040855 A1 (HERRSTROEM ROLF [SE]; KAELLMARK TORE [SE]) 7 April 2011 (2011-04-07)	1,2,10	INV. B67D7/40 B67D9/00
Y	* page 3, line 25 - page 4, line 3 *	5	
X	US 2005/051237 A1 (DUPONT BERNARD [FR] ET AL) 10 March 2005 (2005-03-10) * paragraph [0018] *	1,2,10	
X	WO 01/87703 A1 (BLUEWATER TERMINAL SYSTEMS NV [NL]; BAAN JACOB DE [NL]) 22 November 2001 (2001-11-22) * page 3, line 13 - line 19 *	1,4, 10-13	
Y	US 4 190 090 A (TUSON SAMUEL [FR]) 26 February 1980 (1980-02-26) * column 4, line 30 - line 36 *	5	
X	GB 2 049 610 A (HUMPHREYS & GLASGOW LTD) 31 December 1980 (1980-12-31) * page 2, line 15 - line 94 *	1,2,10, 12	TECHNICAL FIELDS SEARCHED (IPC)
			B67D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 February 2015	Examiner Desittere, Michiel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 14 38 2336

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-02-2015

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011040855 A1	07-04-2011	EP 2483191 A1	08-08-2012
		SE 0901260 A1	27-07-2010
		WO 2011040855 A1	07-04-2011
US 2005051237 A1	10-03-2005	AT 506248 T	15-05-2011
		DK 1439999 T3	08-08-2011
		EP 1439999 A1	28-07-2004
		ES 2366247 T3	18-10-2011
		FR 2831514 A1	02-05-2003
		PT 1439999 E	26-07-2011
		US 2005051237 A1	10-03-2005
		WO 03037704 A1	08-05-2003
WO 0187703 A1	22-11-2001	AU 5686901 A	26-11-2001
		EP 1286881 A1	05-03-2003
		NL 1015208 C2	19-11-2001
		US 2003172991 A1	18-09-2003
		WO 0187703 A1	22-11-2001
US 4190090 A	26-02-1980	AR 223309 A1	14-08-1981
		BR 7706955 A	04-07-1978
		CA 1077801 A1	20-05-1980
		DE 2746658 A1	20-04-1978
		ES 463376 A1	16-07-1978
		FR 2368434 A1	19-05-1978
		GB 1590972 A	10-06-1981
		JP S5350522 A	09-05-1978
		NL 7711410 A	21-04-1978
		NO 773566 A	20-04-1978
		US 4190090 A	26-02-1980
GB 2049610 A	31-12-1980	NONE	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2013096262 A1 [0004]
- US 6886611 B2 [0006]