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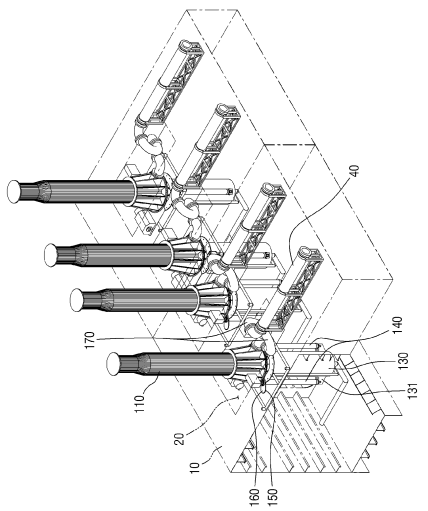
(54) FLOATING TYPE STRUCTURE

(57) Provided herein is a loading structure. The floating type structure includes a loading arm, a plunger connected to the loading arm, a plunger base which is connected to a recess formed in the hull and into which the plunger is inserted, a cylinder which connects the plunger to the plunger base and adjust a height of the loading arm, and a cylinder cover including a first region in which an opening is formed and a second region in which an opening is not formed, connected to the cylinder through the opening, and inserted into a connection groove formed in the recess to couple the cylinder to the recess.

Fig. 2



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Description

[Technical Field]

[0001] The present invention relates to a floating type structure.

[Background Art]

[0002] Liquefied natural gas (LNG) is a colorless transparent liquid obtained by cooling and liquefying natural gas (NG), which contains methane as a main component, at about -162 °C. LNG has a volume which is about 1/600 that of NG. Therefore, when NG is liquefied into LNG, NG may be transported efficiently. For example, an LNG carrier which can transport (carry) LNG by sea is used.

[0003] Recently, an LNG floating, production, storage, and offloading (LNG FPSO) unit has been used to collect, liquefy, and store NG at sea.

[0004] The LNG FPSO is moored at a specific point in the sea, collects NG from a gas well of the ocean bed, liquefies the collected NG, and then stores the LNG in a storage tank. The LNG stored in the LNG FPSO may be moved to the LNG carrier and transported to a destination.

[0005] In this case, the LNG stored in the LNG FPSO is moved to the LNG carrier in a state in which the LNG carrier is moored to the LNG FPSO. To this end, a loading arm may be installed on the LNG FPSO, a manifold corresponding to the loading arm may be installed on the LNG carrier, and the loading arm may be connected to the manifold to transfer the LNG to the LNG carrier.

[0006] However, the transferring of the LNG is carried out in a state in which both of the LNG FPSO and the LNG carrier are floating on the sea. In this case, the LNG FPSO and the LNG carrier move independently according to sea conditions such as winds, waves, and the like. That is, the LNG FPSO and the LNG carrier exhibit different motion responses according to a surrounding environment such that excessive vertical relative movements occur. Consequently, it is very difficult to connect the loading arm of the LNG FPSO to the manifold of the LNG carrier, and there is a problem in that an impact is applied to a connected portion, or a coupling therebetween is loosed.

(Prior Art Document)

[0007] Korean Patent Registration No. 10-1301999 (Issued Date: September 02, 2013)

[Disclosure]

[Technical Problem]

[0008] The present invention is directed to providing a floating type structure which is capable of maintaining a connection of a loading arm while compensating for a height difference between a carrier and the floating type structure using a loading arm ascending and descending device and a connection pipe.

[0009] In addition, the present invention is directed to providing a floating type structure which is capable of facilitating maintenance and repair of a cylinder by releasing a coupling of the cylinder using a cylinder cover.

[0010] Further, the present invention is directed to providing a floating type structure which is capable of performing a function of discharging a fluid accumulated on a hull and a function of controlling a pressure in a plunger base through a single drain pipe.

[0011] The problems to be solved by the present invention are not limited to those described above, and other problems not mentioned above should be clearly understood by those skilled in the art from the following description.

[Technical Solution]

[0012] One aspect of the present invention provides a floating type structure including a loading arm, a plunger connected to the loading arm, a plunger base which is connected to a recess formed in a hull and into which the plunger is inserted, a cylinder which connects the plunger to the plunger base and adjusts a height of the loading arm, and a cylinder cover including a first region in which an opening is formed and a second region in which an opening is not formed, connected to the cylinder through the opening, and inserted into a connection groove formed in the recess to couple the cylinder to the recess.

[0013] The cylinder may be pivoted from one side of the connection groove, into which the first region of the cylinder cover is inserted, to the other side of the connection groove into which the second region of the cylinder cover is inserted such that the coupling between the cylinder and the plunger base may be released.

[0014] The plunger may include a first connector having a U-shaped groove, the plunger base may include a second connector having a U-shaped groove, the first connector may be coupled to a first end of the cylinder, and the second connector is coupled to a second end of the cylinder.

[0015] The floating type structure may further include a cylinder packing disposed on the cylinder cover and configured to block seawater from being introduced into the hull.

[0016] The floating type structure may further include a connection pipe which connects a pipe installed on the hull to the loading arm and which allows a height from the hull to be adjustable.

[0017] The connection pipe may include a first connection pipe connected to the pipe and a second connection pipe which connects the first connection pipe to the loading arm, wherein the first connection pipe may be connected to the pipe by a first joint and rotated around the pipe, the second connection pipe may be connected to the first connection pipe by a second joint and rotated

around the first connection pipe, and the second connection pipe may be connected to the loading arm by a third joint and rotated around the loading arm.

[0018] Another aspect of the present invention provides a floating type structure including a loading arm, a plunger connected to the loading arm, a plunger base which is connected to a recess formed in a hull, into which the plunger is inserted, and which includes a pressure adjusting hole formed below the pressure adjusting hole, a cylinder which connects the plunger to the plunger base and adjusts a height of the loading arm, a drain formed in the recess, a first drain pipe that is connected to the drain and discharges a fluid accumulated in the recess, and a second drain pipe connected to the pressure adjusting hole to allow air to flow in and out the plunger base.

[0019] The first drain pipe may be connected to the second drain pipe, and the second drain pipe may discharge the fluid introduced from the first drain pipe.

[0020] The floating type structure may further include a connection pipe which connects a pipe installed on the hull to the loading arm and which allows a height from the hull to be adjustable.

[0021] The recess may include a first recess in which the loading arm is disposed, and a second recess in which the connection pipe is disposed, wherein a lower surface of the second recess may be formed to be closer to an upper surface of the hull than a lower surface of the first recess, and the drain may be formed in the first recess.

[0022] The recess may include a plurality of drains, and each of the plurality of drains may be formed at an edge of the recess which does not overlap the plunger base.

[0023] Still another aspect of the present invention provides a floating type structure including a first recess formed in a hull and having a first depth, a second recess formed in the hull and having a depth that is smaller than the first depth, a pipe installed on the hull, a loading arm installed in the first recess, a cylinder installed at a lower portion of the first recess and configured to adjust a height of the loading arm, and a connector that is installed in the second recess, connects the pipe to the loading arm, and includes a first connection pipe and a second connection pipe which have a C shape and are connected to each other.

[0024] The connector may include the first connection pipe connected to the pipe, and the second connection pipe which connects the first connection pipe to the loading arm, wherein the first connection pipe may be connected to the pipe by a first joint and rotated around the pipe, the second connection pipe may be connected to the first connection pipe by a second joint and rotated around the first connection pipe, and the second connection pipe may be connected to the loading arm by a third joint and rotated around the loading arm.

[0025] The details of other embodiments are included in the detailed description and the drawings.

[Description of Drawings]

[0026]

FIG. 1 is a schematic diagram illustrating a connection relationship between a floating type structure and a carrier according to one embodiment of the present invention.

FIG. 2 is a perspective view for describing an internal structure of the floating type structure according to one embodiment of the present invention by enlarging a portion E of FIG. 1.

FIG. 3 is a diagram for describing an arrangement of the floating type structure on a recess according to one embodiment of the present invention.

FIG. 4 is a perspective view illustrating a loading arm ascending and descending device of the floating type structure according to one embodiment of the present invention.

FIGS. 5 and 6 are diagrams for describing an operation of a connection pipe according to an operation of the loading arm ascending and descending device of the floating type structure according to one embodiment of the present invention.

FIG. 7 is a diagram for describing a cylinder cover and a cylinder packing of the floating type structure according to one embodiment of the present invention.

FIGS. 8 to 11 are diagrams for describing coupling and decoupling operations of the cylinder in the floating type structure according to one embodiment of the present invention.

FIG. 12 is a perspective view for describing an internal structure of a floating type structure according to another embodiment of the present invention by enlarging the portion E of FIG. 1.

FIG. 13 is a diagram for describing an arrangement of the floating type structure on a recess according to another embodiment of the present invention.

FIG. 14 is a side view for describing an internal structure of the floating type structure according to another embodiment of the present invention.

FIG. 15 is a diagram illustrating a drain pipe of the floating type structure according to another embodiment of the present invention.

FIG. 16 is a diagram for describing a function of the drain pipe of the floating type structure according to another embodiment of the present invention.

FIG. 17 is a perspective view illustrating a loading arm ascending and descending device of the floating type structure according to another embodiment of the present invention.

FIGS. 18 and 19 are diagrams for describing an operation of a connection pipe according to an operation of the loading arm ascending and descending device of the floating type structure according to another embodiment of the present invention.

[Modes of the Invention]

[0027] Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings. The advantages and features of the present invention and the manner of achieving the advantages and features will become apparent with reference to the embodiments described in detail below with the accompanying drawings. The present invention may, however, be implemented in many different forms and should not be construed as being limited to the embodiments set forth herein, and the embodiments are provided such that the present invention will be thorough and complete and will fully convey the scope of the present invention to those skilled in the art, and the present invention is defined by only the scope of the appended claims. The same reference numerals refer to the same components throughout the present invention.

[0028] Although the terms first, second, and the like are used to describe various components, these components are not substantially limited by these terms. These terms are used only to distinguish one component from another component. Therefore, a first component described below may be substantially a second component within the technical spirit of the present invention.

[0029] Terms used herein are intended to describe embodiments and are not intended to limit the present invention. In the present invention, the singular forms include the plural forms unless the context clearly dictates otherwise. It is noted that the terms "comprises" and/or "comprising" used herein do not exclude the presence or addition of one or more other components, steps, operations, and/or elements in addition to stated components, steps, operations, and/or elements.

[0030] Unless defined otherwise, all terms (including technical and scientific terms) used herein may be used in a sense commonly understood by those skilled in the art to which the present invention pertains. Further, terms which are defined in a commonly used dictionary are not ideally or excessively interpreted unless explicitly defined otherwise.

[0031] Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings. The same reference numerals are assigned to the same or corresponding components regardless of reference numerals, and a duplicate description thereof will be omitted.

[0032] Hereinafter, a connection relationship between a floating type structure and a carrier according to one embodiment of the present invention will be described with reference to FIG. 1.

[0033] FIG. 1 is a schematic diagram illustrating a connection relationship between a floating type structure and a carrier according to one embodiment of the present invention.

[0034] Referring to FIG. 1, a floating type structure 100 according to one embodiment of the present invention includes a hull 10, a loading arm 110, a loading arm ascending and descending device E, and a fluid storage tank (not shown).

[0035] For example, the floating type structure 100 may be a floating production storage offloading (FPSO) which produces and stores crude oil. However, the technical spirit of the present invention is not limited thereto.

[0036] The floating type structure 100 may provide a fluid, e.g., a liquefied natural gas (LNG), stored in a fluid storage tank (not shown) disposed inside the hull 10 to a carrier 1 through the loading arm 110. However, the technical spirit of the present invention is not limited thereto.

[0037] In this case, the loading arm 110 may be connected to a manifold 2 installed on the carrier 1 to provide the fluid to the carrier 1.

[0038] Specifically, the loading arm 110 may be configured with a plurality of arms which are connected to be bendable such that the loading arm 110 may extend in a direction in which the carrier 1 is disposed. The loading arm 110 may be fixedly installed on the loading arm ascending and descending device E which is installed on the hull 10. An angle formed by each of the plurality of arms of the loading arm 110 may be adjusted so as to allow the loading arm 110 to be connected to the manifold 2 installed on the carrier 1.

[0039] A height of the loading arm 110 from a top surface of the hull 10 may be adjusted by the loading arm ascending and descending device E which is disposed below the loading arm 110. Thus, the floating type structure 100 may compensate for a height difference between the floating type structure 100 and the carrier 1 which varies due to sea environmental conditions such as winds, waves, and the like, using the loading arm ascending and descending device E.

[0040] Hereinafter, an internal structure and an operation of the floating type structure according to one embodiment of the present invention will be described with reference to FIGS. 2 to 7.

[0041] FIG. 2 is a perspective view for describing an internal structure of the floating type structure according to one embodiment of the present invention by enlarging a portion E of FIG. 1. FIG. 3 is a diagram for describing an arrangement of the floating type structure on a recess according to one embodiment of the present invention. FIG. 4 is a perspective view illustrating a loading arm ascending and descending device of the floating type structure according to one embodiment of the present invention. FIGS. 5 and 6 are diagrams for describing an operation of a connection pipe according to an operation of the loading arm ascending and descending device of the floating type structure according to one embodiment of the present invention. FIG. 7 is a diagram for describing a cylinder cover and a cylinder packing of the floating type structure according to one embodiment of the present invention.

[0042] Referring to FIGS. 2 to 7, the floating type structure 100 according to one embodiment of the present

invention includes the hull 10, a recess 20, a connection groove 30, a pipe 40, the loading arm 110, a plunger 120, a first connector 121, a plunger base 130, a second connector 131, a cylinder 140, a cylinder cover 150, a cylinder packing 160, a connection pipe 170, a first joint 173, a second joint 174, and a third joint 175.

[0043] The plunger 120 may be connected to the loading arm 110 disposed on the hull 10. Specifically, an upper surface of the plunger 120 may be connected to the loading arm 110, and the plunger 120 may be inserted into the plunger base 130.

[0044] The plunger 120 may include the first connector 121 having a U-shaped groove coupled to a first end of the cylinder 140. The plunger 120 may be easily attached to and detached from the first end of the cylinder 140 using the U-shaped groove formed in the first connector 121.

[0045] The plunger base 130 may be disposed in the hull 10. Specifically, the plunger base 130 may be connected to the recess 20 formed in the hull 10, and the plunger 120 may be inserted into the plunger base 130.

[0046] The plunger base 130 may include the second connector 131 having a U-shaped groove coupled to a second end opposite the first end of the cylinder 140. The plunger base 130 may be easily attached to and detached from the second end of the cylinder 140 using the U-shaped groove formed in the second connector 131.

[0047] The cylinder 140 may connect the plunger 120 to the plunger base 130. Specifically, the first end of the cylinder 140 may be coupled to the first connector 121 installed on the plunger 120, and the second end of the cylinder 140 may be coupled to the second connector 131 installed on the plunger base 130.

[0048] For example, the cylinder 140 may ascend or descend the plunger 120 using a hydraulic pressure. However, the technical spirit of the present invention is not limited thereto. That is, in some other embodiments, the cylinder 140 may be driven using a mechanical device, e.g., a motor.

[0049] The cylinder 140 may ascend or descend the plunger 120 to thereby ascend or descend the loading arm 110 connected to the plunger 120. Consequently, the floating type structure 100 may adjust the height of the loading arm 110 from the upper surface of the hull 10 using the cylinder 140.

[0050] The connection pipe 170 may be connected to the pipe 40 installed on the hull 10 and allow a height from the hull 10 to be adjustable.

[0051] Specifically, the connection pipe 170 may include a first connection pipe 171 connected to the pipe 40 and a second connection pipe 172 for connecting the first connection pipe 171 to the loading arm 110. However, the technical spirit of the present invention is not limited thereto. That is, in some other embodiments, the connection pipe 170 may include three or more connection pipes.

[0052] The first connection pipe 171 may be connected to the pipe 40 by the first joint 173 and rotated around the pipe 40. The second connection pipe 172 may be connected to the first connection pipe 171 by the second joint 174 and rotated around the first connection pipe 171. The second connection pipe 172 may be connected to the loading arm 110 by the third joint 175 and rotated about the loading arm 110.

[0053] Even when the loading arm 110 is ascended from the upper surface of the hull 10, the first connection pipe 171 and the second connection pipe 172 may maintain a connection between the loading arm 110 and the pipe 40 using the first, second, and third joints 173, 174, and 175 which perform an articulating function. To this end, the first connection pipe 171 and the second connection pipe 172 may each have a C shape, and one end of the first connection pipe 171 may be connected to one end of the second connection pipe 172 through the second joint 174.

[0054] The above operations of the first connection pipe 171 and the second connection pipe 172 are shown in FIGS. 5 and 6.

[0055] FIG. 5 illustrates a state in which the plunger 120 is inserted into the plunger base 130 and thus the loading arm 110 is disposed adjacent to the upper surface of the hull 10. In this case, the first and second connection pipes 171 and 172 may be formed at a position closer to sea level than the pipe 40.

[0056] As shown in FIG. 6, the cylinder 140 is operated to ascend the plunger 120 such that the loading arm 110 is ascended from the upper surface of the hull 10.

[0057] In this case, the first connection pipe 171 may be rotated around the first and second joints 173 and 174, and the second connection pipe 172 may be rotated around the second and third joints 174 and 175.

[0058] Consequently, the connection pipe 170 may maintain the connection between the loading arm 110 and the pipe 40.

[0059] As shown in FIG. 3, the connection pipe 170 and the first, second, and third joints 173, 174, and 175 may be disposed in the recess 20 formed in the hull 10.

[0060] Consequently, even though the loading arm 110 is ascended or descended, the connection pipe 170 may maintain the connection between the loading arm 110 and the pipe 40 without interference of the upper surface of the hull 10.

[0061] Referring to FIGS. 2 and 7, the cylinder cover 150 includes a first region R1 in which an opening 151 is formed and a second region R2 in which the opening 151 is not formed.

[0062] In this case, the second region R2 may include an area that is equal to an area of the opening 151. Thus, as described below, when the coupling of the cylinder 140 is released, the cylinder 140 may be moved to the connection groove 30 of FIG. 10 into which the second region R2 of the cylinder cover 150 is inserted.

[0063] The cylinder cover 150 may be connected to the cylinder 140 through the opening 151. Specifically, the cylinder cover 150 may surround a side surface of

the cylinder 140 which is installed to pass through the opening 151, thereby being connected to the cylinder 140.

[0064] The cylinder cover 150 may be inserted into the connection groove 30 of FIG. 10 formed in a lower surface of the recess 20, which is formed in the hull 10, thereby being coupled to the recess 20. Consequently, the cylinder cover 150 may couple the cylinder 140 to the connection groove 30 of FIG. 10 formed in the recess 20.

[0065] Referring to FIG. 7, the cylinder packing 160 may be disposed on the cylinder cover 150. The cylinder packing 160 may surround a side surface of the cylinder 140 to block seawater from being introduced into the hull 10 through a minute space between the cylinder cover 150 and the cylinder 140.

[0066] Hereinafter, coupling and release operations of a cylinder in the floating type structure according to one embodiment of the present invention will be described with reference to FIGS. 7 to 11.

[0067] FIGS. 8 to 11 are diagrams for describing coupling and release operations of the cylinder in the floating type structure according to one embodiment of the present invention.

[0068] Referring to FIGS. 8 and 9 first, when the coupling of the cylinder 140 is released, the plunger 120 is descended to a lowest position.

[0069] Then, the first end of the cylinder 140 coupled to the first connector 121 of the plunger 120 is descended to release the coupling between the first connector 121 and the first end of the cylinder 140. In this case, as described above, since the first connector 121 has a U shape, the first connector 121 may be easily released from the first end of the cylinder 140.

[0070] Referring to FIGS. 9 and 10, the cylinder cover 150 is ascended from the connection groove 30, which is formed in the lower surface of the recess 20 formed in the hull 10 so that the coupling of the cylinder cover 150 to the connection groove 30 is released.

[0071] Referring to FIGS. 7, 10, and 11, the cylinder 140 is pivoted around the second connector 131 of the plunger base 130.

[0072] Specifically, the cylinder 140 is pivoted from one side of the connection groove 30 into which the first region R1 of the cylinder cover 150 is inserted to the other side of the connection groove 30 into which the second region R2 of the cylinder cover 150 is inserted.

[0073] In this case, as shown in FIG. 3, in order to avoid interference between the cylinder cover 150 being moved and a side wall of the recess 20, the connection groove 30 is formed to be spaced apart from the side wall of the recess 20.

[0074] Then, the second end of the cylinder 140 coupled to the second connector 131 of the plunger base 130 is ascended to release the coupling between the second connector 131 and the second end of the cylinder 140.

[0075] In this case, as described above, since the second connector 131 has a U shape, the second connector 131 may be easily released from the second end of the cylinder 140.

[0076] The above-described operations may be performed to release the couplings between the cylinder 140 and the plunger 120 and between the cylinder 140 and the plunger base 130. Further, the above-described operations may be performed reversely to couple the cylinder 140 to the plunger 120 and the plunger base 130.

[0077] The floating type structure 100 according to one embodiment of the present invention may maintain the connection of the loading arm 110 while compensating for the height difference between the carrier 1 and the floating type structure 100 using the loading arm ascending and descending device E and the connection pipe 170.

[0078] Further, the floating type structure 100 according to one embodiment of the present invention is capable of facilitating maintenance and repair of the cylinder 140 by releasing the coupling of the cylinder 140 using the cylinder cover 150.

[0079] Hereinafter, an internal structure and an operation of a floating type structure according to another embodiment of the present invention will be described with reference to FIGS. 12 to 17.

[0080] FIG. 12 is a perspective view for describing an internal structure of a floating type structure according to another embodiment of the present invention by enlarging the portion E of FIG. 1. FIG. 13 is a diagram for describing an arrangement of the floating type structure on a recess according to another embodiment of the present invention. FIG. 14 is a side view for describing an internal structure of the floating type structure according to another embodiment of the present invention. FIG. 15 is a diagram illustrating a drain pipe of the floating type structure according to another embodiment of the present invention. FIG. 16 is a diagram for describing a function of the drain pipe of the floating type structure according to another embodiment of the present invention. FIG. 17 is a perspective view illustrating a loading arm ascending and descending device of the floating type structure according to another embodiment of the present invention.

[0081] Referring to FIGS. 12 to 17, a floating type structure 400 according to another embodiment of the present invention includes a hull 310, a first recess 320, a second recess 330, a pipe 340, a loading arm 410, a plunger 420, a plunger base 430, a pressure adjusting hole 431, a cylinder 440, a drain 450, a first drain pipe 460, a connection pipe 470, a first joint 473, a second joint 474, a third joint 475, and a second drain pipe 480.

[0082] The plunger 420 may be connected to the loading arm 410 disposed on the hull 310. Specifically, an upper surface of the plunger 420 may be connected to the loading arm 410, and the plunger 420 may be inserted into the plunger base 430. The plunger 420 may be coupled to a first end of the cylinder 440.

[0083] The plunger base 430 may be disposed in the hull 310. Specifically, the plunger base 430 may be connected to the first recess 320 formed in the hull 310, and

the plunger 420 may be inserted into the plunger base 430. The plunger base 430 may be coupled to a second end of the cylinder 440 opposite the first end thereof.

[0084] Referring to FIG. 16, the plunger base 430 includes the pressure adjusting hole 431 formed therebelow.

[0085] When the plunger 420 is descended in a direction of sea level inside the plunger base 430, the plunger base 430 may allow air thereinside to flow out through the pressure adjusting hole 431 along the second drain pipe 480 connected to the pressure adjusting hole 431, thereby adjusting an inner pressure of the plunger base 430.

[0086] Further, when the plunger 420 is ascended from inside the plunger base 430 toward a position of an upper surface of the hull 310, the plunger base 430 may allow external air to be introduced through the pressure adjusting hole 431 along the second drain pipe 480 connected to the pressure adjusting hole 431, thereby adjusting the inner pressure of the plunger base 430.

[0087] The cylinder 440 may connect the plunger 420 to the plunger base 430. Specifically, the first end of the cylinder 440 may be coupled to the plunger 420, and the second end of the cylinder 440 may be coupled to the plunger base 430.

[0088] For example, the cylinder 440 may ascend or descend the plunger 420 using a hydraulic pressure. However, the technical spirit of the present invention is not limited thereto. That is, in some other embodiments, the cylinder 440 may be driven using a mechanical device, e.g., a motor.

[0089] The cylinder 440 may ascend or descend the plunger 420 to thereby ascend or descend the loading arm 410 connected to the plunger 420. Consequently, the floating type structure 400 may adjust the height of the loading arm 410 from the upper surface of the hull 310 using the cylinder 440.

[0090] The drain 450 may be formed on a lower surface of the first recess 320 which is formed in the hull 310. A plurality of drains 450 may be formed on the lower surface of the first recess 320.

[0091] As shown in FIG. 13, the plurality of drains 450 may each be formed at an edge of the first recess 320 which does not overlap the plunger base 430 connected to the first recess 320. However, the technical spirit of the present invention is not limited thereto.

[0092] The drains 450 may discharge a fluid, e.g., rainwater or seawater, which is accumulated in the first recess 320 and the second recess 330 adjacent thereto, along the first drain pipe 460 connected to each of the drains 450.

[0093] Referring to FIG. 14, a lower surface of the second recess 330 may be formed to be closer to the upper surface of the hull 310 than the lower surface of the first recess 320.

[0094] Specifically, a second height h2 from the lower surface of the second recess 330 to the upper surface of the hull 310 may be smaller than a first height h1 from the lower surface of the first recess 320 to the upper surface of the hull 310.

[0095] Consequently, even when a separate drain is not installed in the second recess 330, the fluid accumulated in the first and second recesses 320 and 330 may be discharged through the drains 450 formed in the first recess 320.

[0096] However, the technical spirit of the present invention is not limited thereto. That is, in some other embodiments, the drains 450 may also be formed in the second recess 330. Further, in some other embodiments, the drains 450 may be formed in only the second recess 330, and the second height h2 from the lower surface of the second recess 330 to the upper surface of the hull 310 may be greater than the first height h1 from the lower surface of the first recess 320 to the upper surface of the hull 310.

[0097] Referring to FIGS. 14 to 16, the first drain pipe 460 may connect between each of the drains 450 and the second drain pipe 480. The first drain pipe 460 may discharge a fluid, e.g., rainwater or seawater, which is introduced through the drains 450, by providing the fluid to the second drain pipe 480.

[0098] One end of the second drain pipe 480 may be connected to the pressure adjusting hole 431 formed at a lower portion of the plunger base 430, and the first drain pipe 460 may be connected to a side surface of second drain pipe 480.

[0099] The second drain pipe 480 may allow air to flow in and out the plunger base 430 according to an inner pressure of the plunger base 430.

[0100] The second drain pipe 480 may simplify a drain pipe configuration inside the hull 310 by performing a function of discharging the fluid introduced through the first drain pipe 460 and flowing in the second drain pipe 480 and a function of adjusting the inner pressure of the plunger base 430.

[0101] The connection pipe 470 may be disposed on the second recess 320. The connection pipe 470 may be connected to the pipe 340 installed on the hull 310 and allows a height from the hull 310 to be adjustable.

[0102] Specifically, the connection pipe 470 may include a first connection pipe 471 connected to the pipe 340, and a second connection pipe 472 for connecting the first connection pipe 471 to the loading arm 410. However, the technical spirit of the present invention is not limited thereto. That is, in some other embodiments, the connection pipe 470 may include three or more connection pipes.

[0103] The first connection pipe 471 may be connected to the pipe 340 by the first joint 473 and rotated around the pipe 340. The second connection pipe 472 may be connected to the first connection pipe 471 by the second joint 474 and rotated around the first connection pipe 471. The second connection pipe 472 may be connected to the loading arm 410 by the third joint 475 and rotated about the loading arm 410.

[0104] Even when the loading arm 410 is ascended

from the upper surface of the hull 310, the first connection pipe 471 and the second connection pipe 472 may maintain a connection between the loading arm 410 and the pipe 340 using the first, second, and third joints 473, 474, and 475 which perform an articulating function. To this end, the first connection pipe 471 and the second connection pipe 472 may each have a C shape, and one end of the first connection pipe 471 may be connected to one end of the second connection pipe 472 through the second joint 474.

[0105] The above operations of the first connection pipe 471 and the second connection pipe 472 are shown in FIGS. 18 and 19 which will be described below.

[0106] Although not shown in the drawings, lines (e.g., electric lines, hydraulic pressure supply lines, nitrogen lines, and the like) may be installed along the pipe 340 and the connection pipe 470.

[0107] Hereinafter, an operation of a connection pipe according to an ascending or descending operation of a loading arm ascending and descending device of the floating type structure according to another embodiment of the present invention will be described with reference to FIGS. 18 and 19.

[0108] FIGS. 18 and 19 are diagrams for describing an operation of a connection pipe according to an operation of the loading arm ascending and descending device of the floating type structure according to another embodiment of the present invention.

[0109] FIG. 18 illustrates a state in which the plunger 420 is inserted into the plunger base 430 and thus the loading arm 410 is disposed adjacent to the upper surface of the hull 310. In this case, the first and second connection pipes 171 and 172 may be formed at a position closer to sea level than the pipe 340.

[0110] As shown in FIG. 19, the cylinder 440 is operated to ascend the plunger 420 such that the loading arm 410 is ascended from the upper surface of the hull 310.

[0111] In this case, the first connection pipe 471 may be rotated around the first and second joints 473 and 474, and the second connection pipe 472 may be rotated around the second and third joints 474 and 475.

[0112] Consequently, the connection pipe 470 may maintain the connection between the loading arm 410 and the pipe 340.

[0113] As shown in FIG. 13, the connection pipe 470 and the first, second, and third joints 473, 474, and 475 may be disposed in the second recess 330 formed in the hull 310.

[0114] Consequently, even though the loading arm 410 is ascended or descended, the connection pipe 470 may maintain the connection between the loading arm 410 and the pipe 340 without interference of the upper surface of the hull 310.

[0115] The floating type structure 400 according to another embodiment of the present invention may maintain the connection of the loading arm 410 while compensating for the height difference between the carrier 1 and the floating type structure 400 using the loading arm ascending and descending device E and the connection pipe 470.

[0116] Further, the floating type structure 400 according to another embodiment of the present invention may simplify the drain pipe configuration inside the hull 310 by performing a function of discharging the fluid accumulated in the first and second recesses 320 and 330 in the hull 310 and a function of adjusting the inner pressure of the plunger base 430 using the second drain pipe 480 connected to the first drain pipe 460.

[0117] While the embodiments of the present invention have been described with reference to the accompanying drawings, those skilled in the art can understand that the present invention can be implemented in other specific forms without departing from the technical spirit or the necessary features of the present invention. Therefore, it should be understood that the above-described embodiments are not restrictive but illustrative in all aspects.

Claims

1. A floating type structure comprising:

a loading arm;
a plunger connected to the loading arm;
a plunger base which is connected to a recess formed in a hull and into which the plunger is inserted;
a cylinder which connects the plunger to the plunger base and adjusts a height of the loading arm; and
a cylinder cover including a first region in which an opening is formed and a second region in which an opening is not formed, connected to the cylinder through the opening, and inserted into a connection groove formed in the recess to couple the cylinder to the recess.

2. The floating type structure of claim 1, wherein the cylinder is pivoted from one side of the connection groove, into which the first region of the cylinder cover is inserted, to the other side of the connection groove into which the second region of the cylinder cover is inserted such that the coupling between the cylinder and the plunger base is released.

3. The floating type structure of claim 1, wherein:

the plunger includes a first connector having a U-shaped groove;
the plunger base includes a second connector having a U-shaped groove;
the first connector is coupled to a first end of the cylinder; and
the second connector is coupled to a second end of the cylinder.

4. The floating type structure of claim 1, further comprising a cylinder packing disposed on the cylinder cover and configured to block seawater from being introduced into the hull.

5. The floating type structure of claim 1, further comprising a connection pipe which connects a pipe installed on the hull to the loading arm and which allows a height from the hull to be adjustable.

6. The floating type structure of claim 5, wherein the connection pipe includes:

a first connection pipe connected to the pipe; and
a second connection pipe which connects the first connection pipe to the loading arm,
wherein the first connection pipe is connected to the pipe by a first joint and is rotated around the pipe;
the second connection pipe is connected to the first connection pipe by a second joint and rotated around the first connection pipe; and
the second connection pipe is connected to the loading arm by a third joint and rotated around the loading arm.

7. A floating type structure comprising:

a loading arm;
a plunger connected to the loading arm;
a plunger base which is connected to a recess formed in a hull, into which the plunger is inserted, and which includes a pressure adjusting hole formed below the pressure adjusting hole;
a cylinder which connects the plunger to the plunger base and adjusts a height of the loading arm;
a drain formed in the recess;
a first drain pipe that is connected to the drain and discharges a fluid accumulated in the recess; and
a second drain pipe connected to the pressure adjusting hole allow air to flow in and out the plunger base.

8. The floating type structure of claim 7, wherein:

the first drain pipe is connected to the second drain pipe; and
the second drain pipe discharges the fluid introduced from the first drain pipe.

9. The floating type structure of claim 7, further comprising a connection pipe which connects a pipe installed on the hull to the loading arm and which allows a height from the hull to be adjustable.

10. The floating type structure of claim 9, wherein the recess includes:

a first recess in which the loading arm is disposed; and
a second recess in which the connection pipe is disposed,
wherein a lower surface of the second recess is formed to be closer to an upper surface of the hull than a lower surface of the first recess; and
the drain is formed in the first recess.

11. The floating type structure of claim 7, wherein:

the recess includes a plurality of drains; and
each of the plurality of drains is formed at an edge of the recess which does not overlap the plunger base.

12. A floating type structure comprising:

a first recess formed in a hull and having a first depth;
a second recess formed in the hull and having a depth that is smaller than the first depth;
a pipe installed on the hull;
a loading arm installed in the first recess;
a cylinder installed at a lower portion of the first recess and configured to adjust a height of the loading arm; and
a connector that is installed in the second recess, connects the pipe to the loading arm, and includes a first connection pipe and a second connection pipe which have a C shape and are connected to each other.

13. The floating type structure of claim 12, wherein the connector includes:

the first connection pipe connected to the pipe; and
the second connection pipe which connects the first connection pipe to the loading arm,
wherein the first connection pipe is connected to the pipe by a first joint and is rotated around the pipe;
the second connection pipe is connected to the first connection pipe by a second joint and is rotated around the first connection pipe; and
the second connection pipe is connected to the loading arm by a third joint and is rotated around the loading arm.

Fig. 1

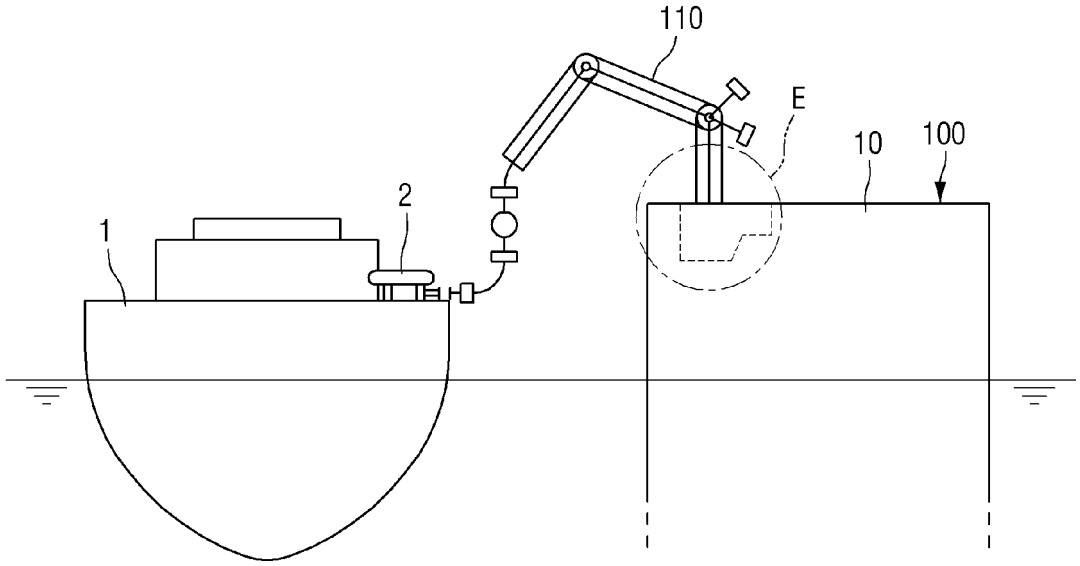


Fig. 2

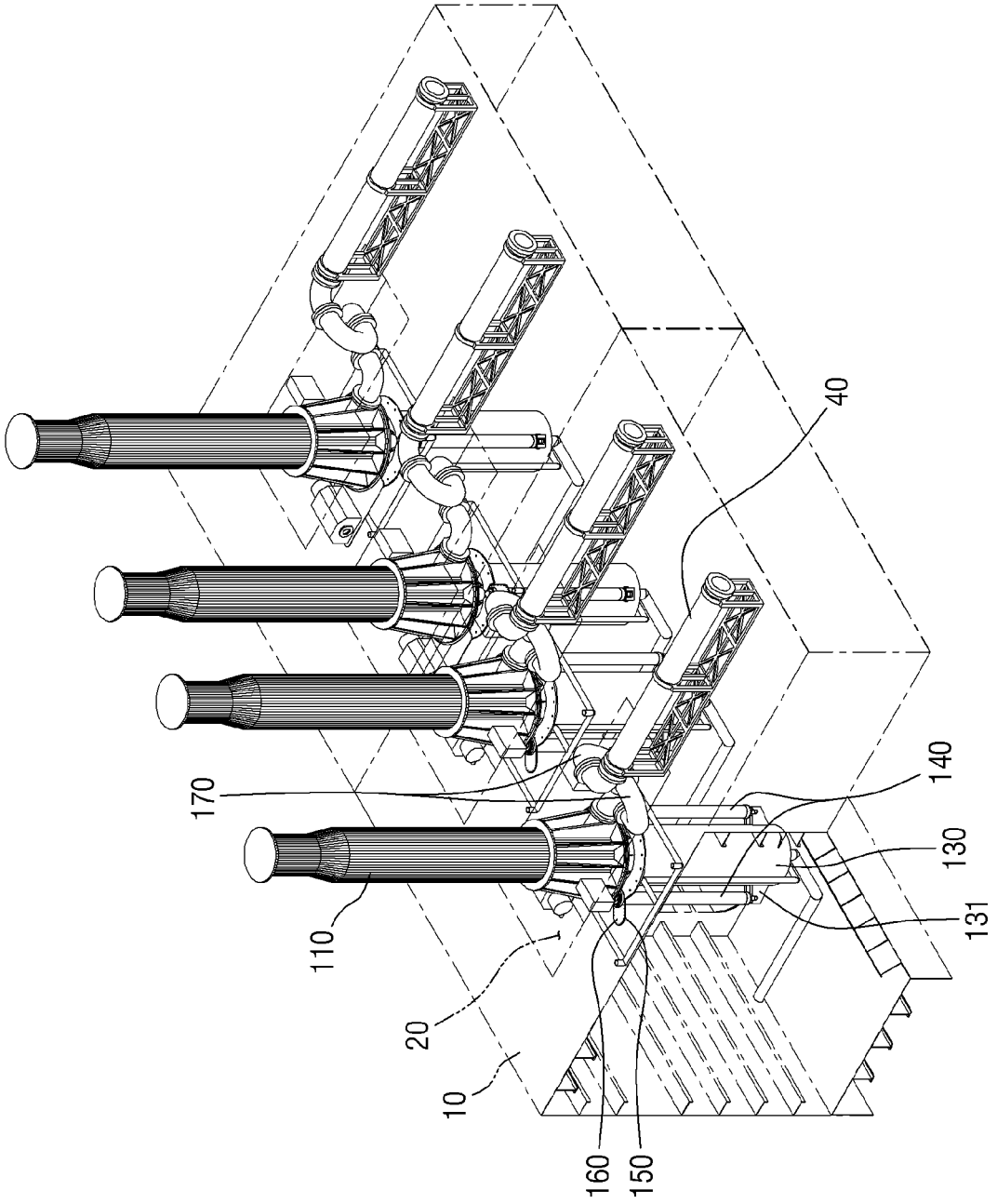


Fig. 3

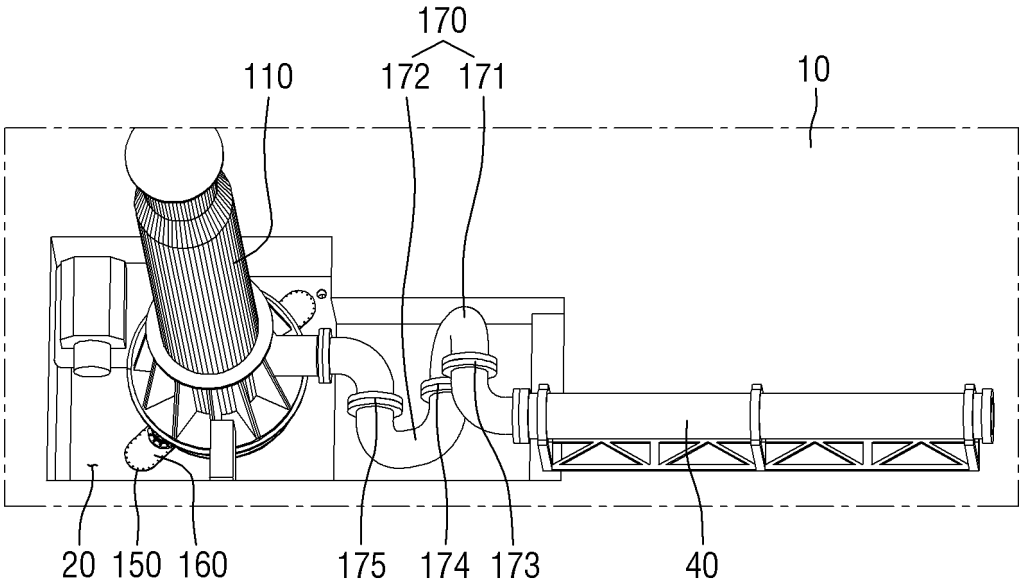


Fig. 4

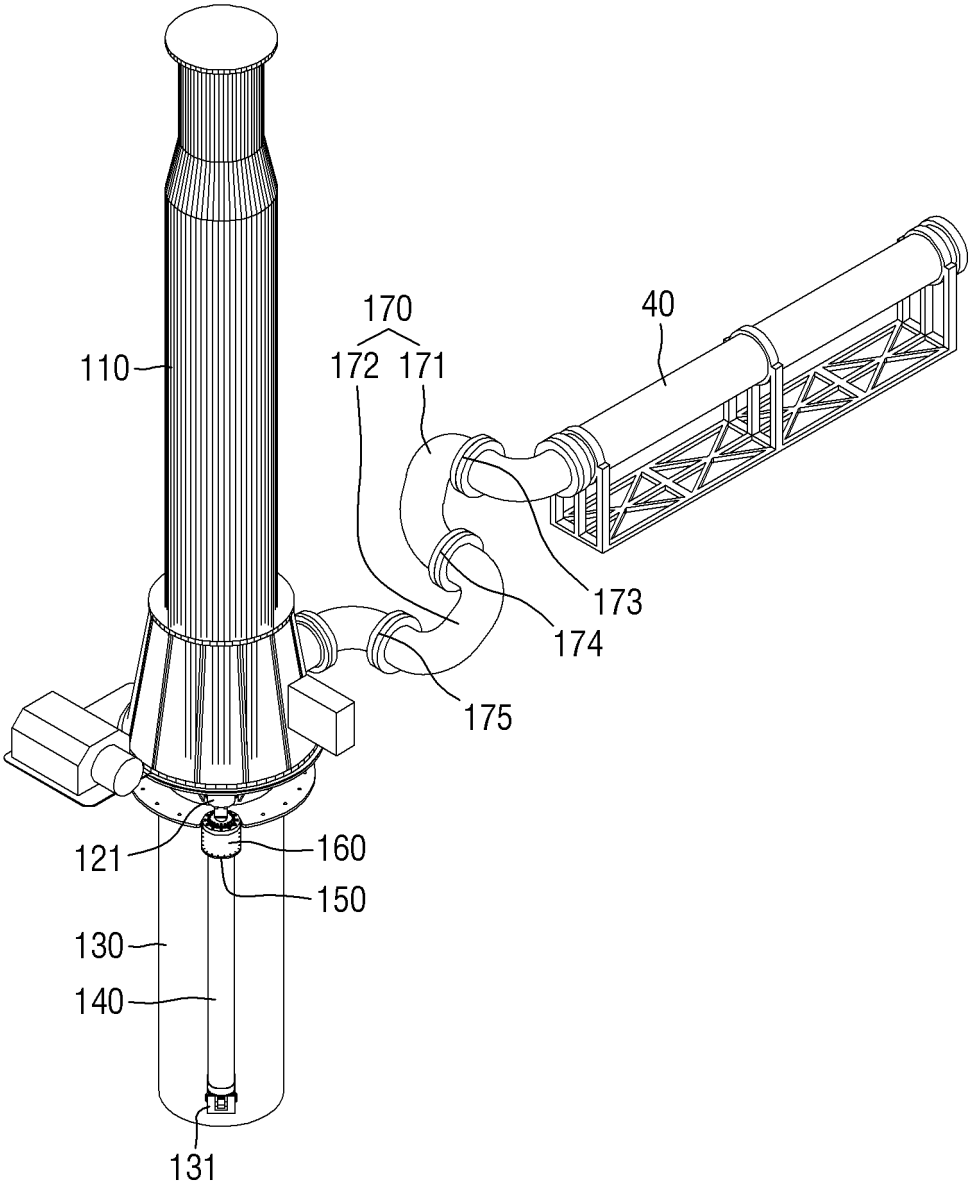


Fig. 5

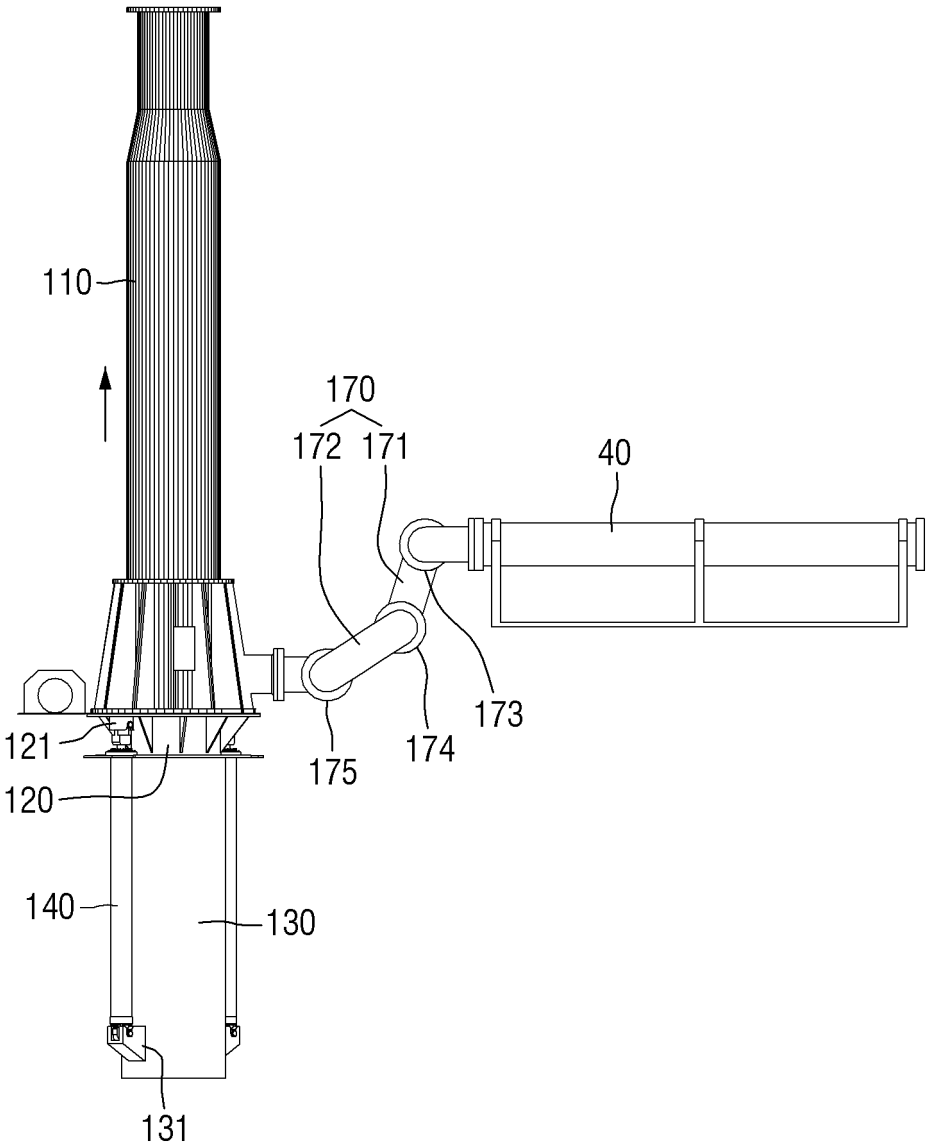


Fig. 6

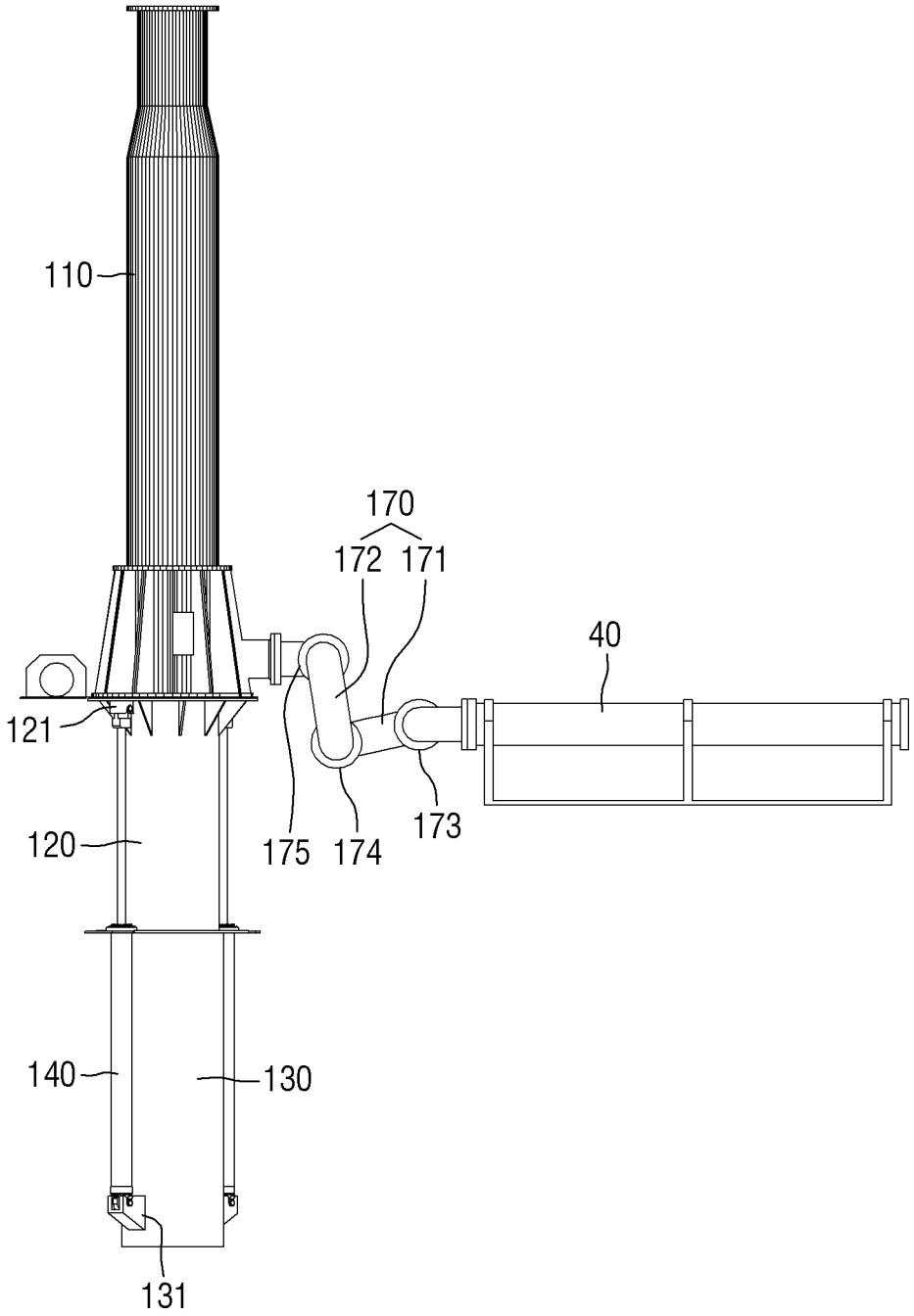


Fig. 7

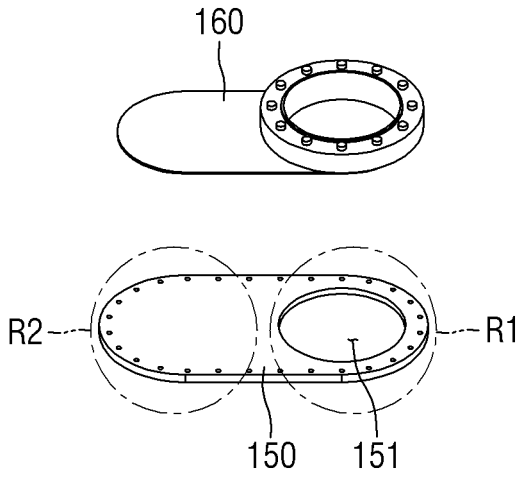


Fig. 8

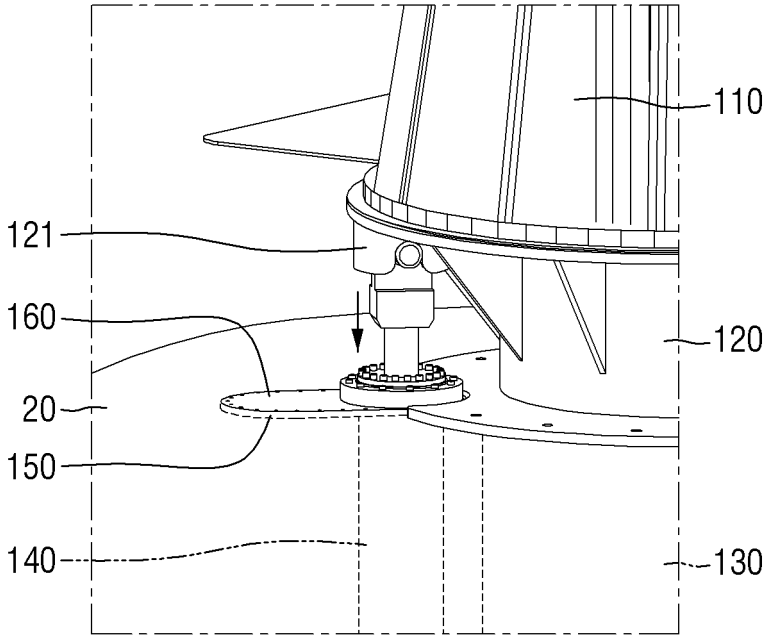


Fig. 9

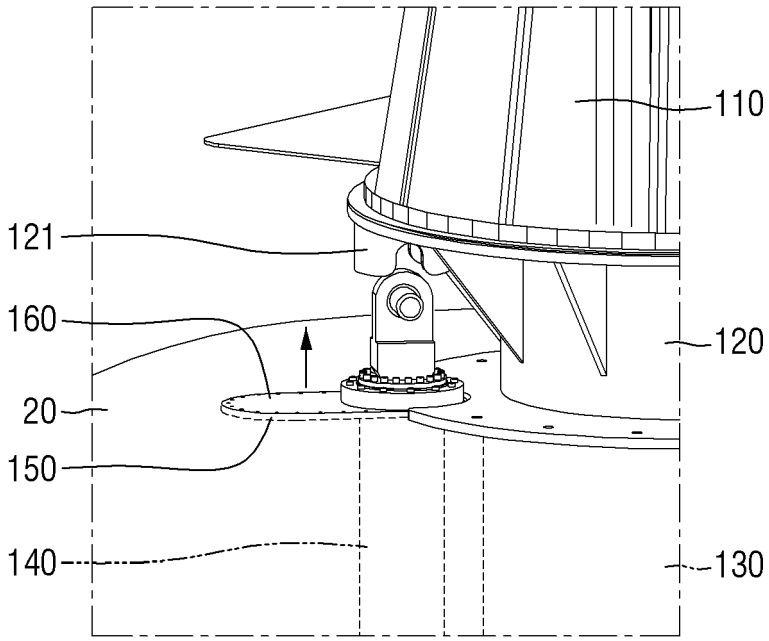


Fig. 10

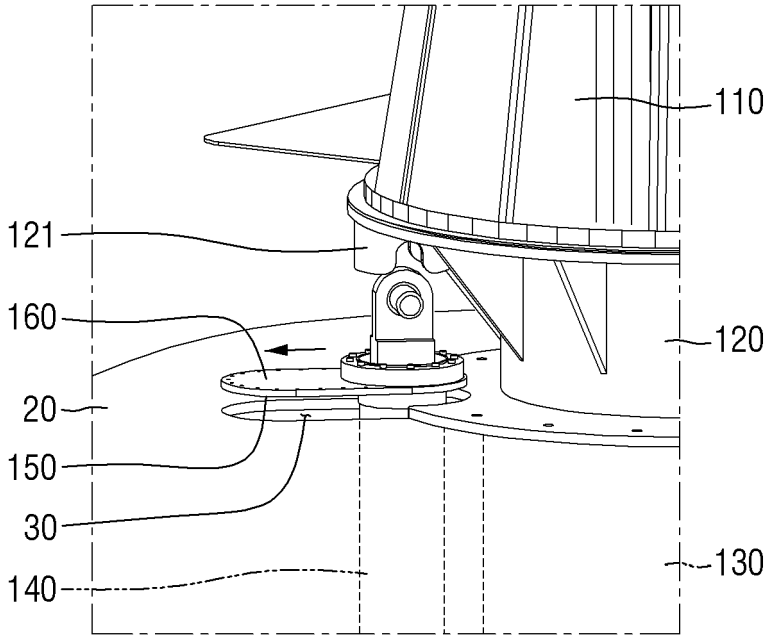


Fig. 11

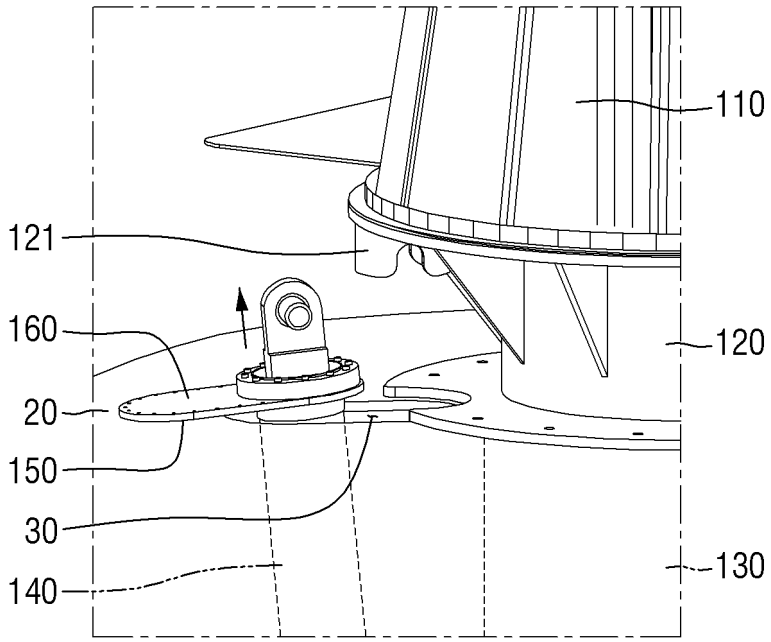


Fig. 12

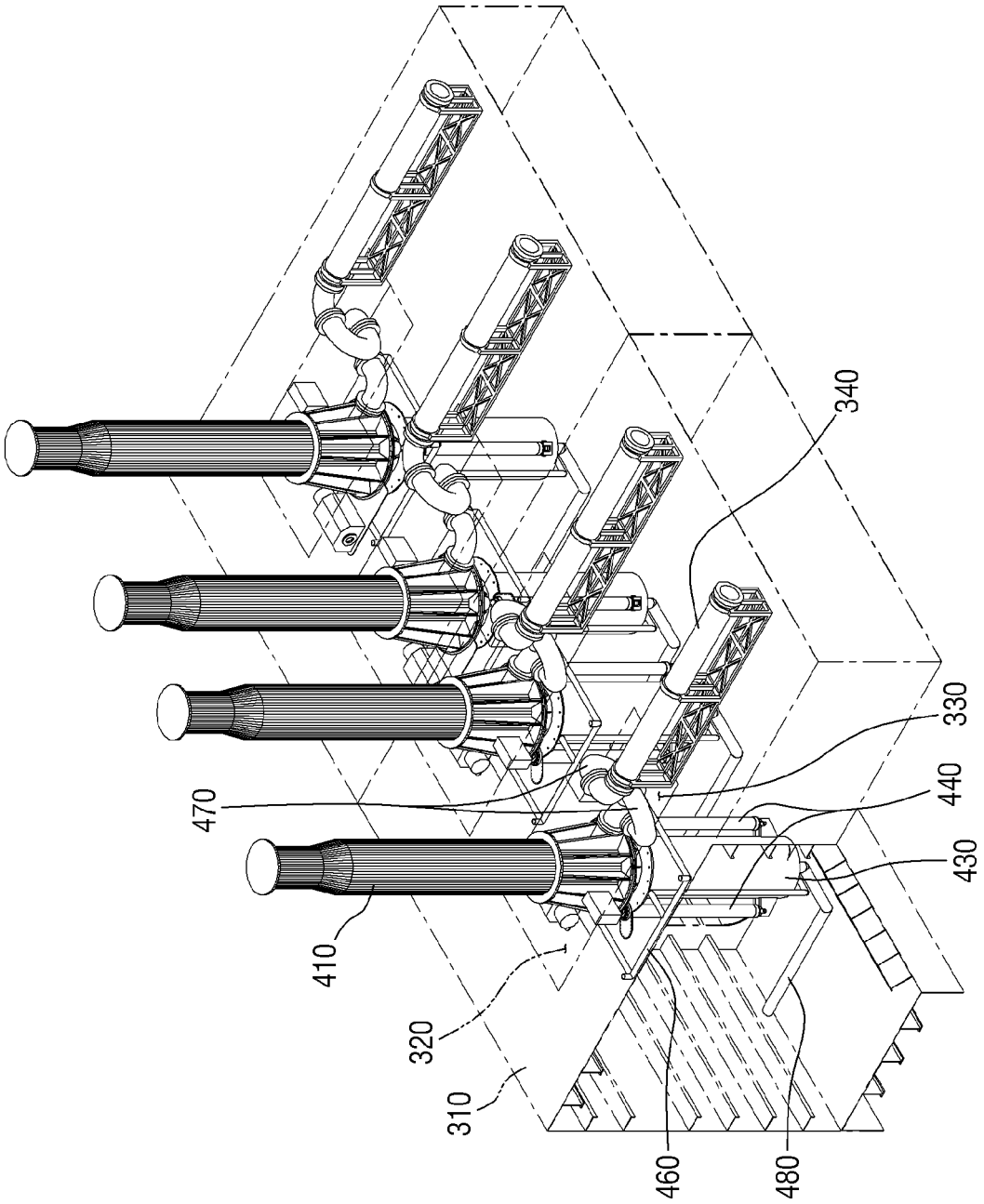


Fig. 13

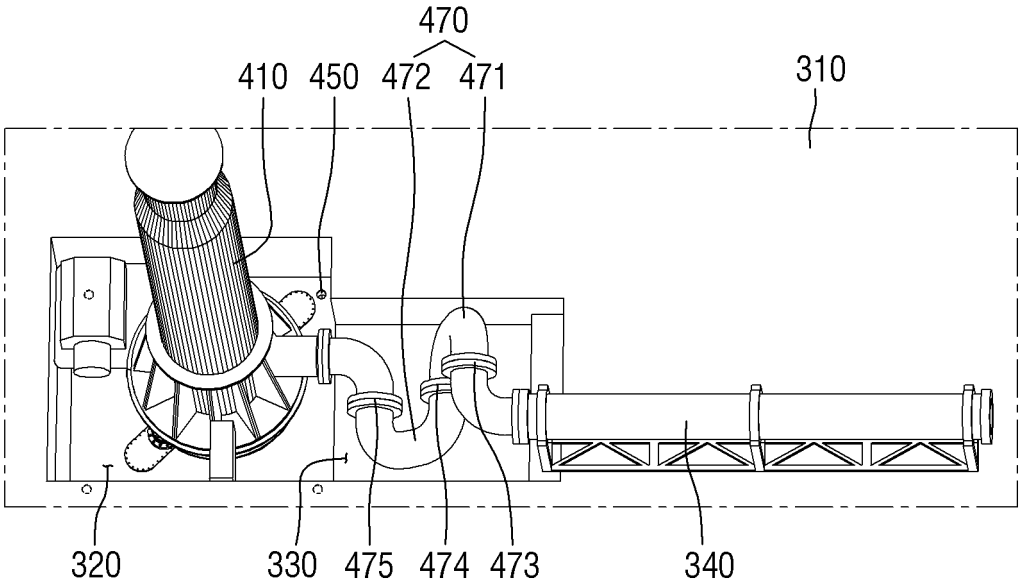


Fig. 14

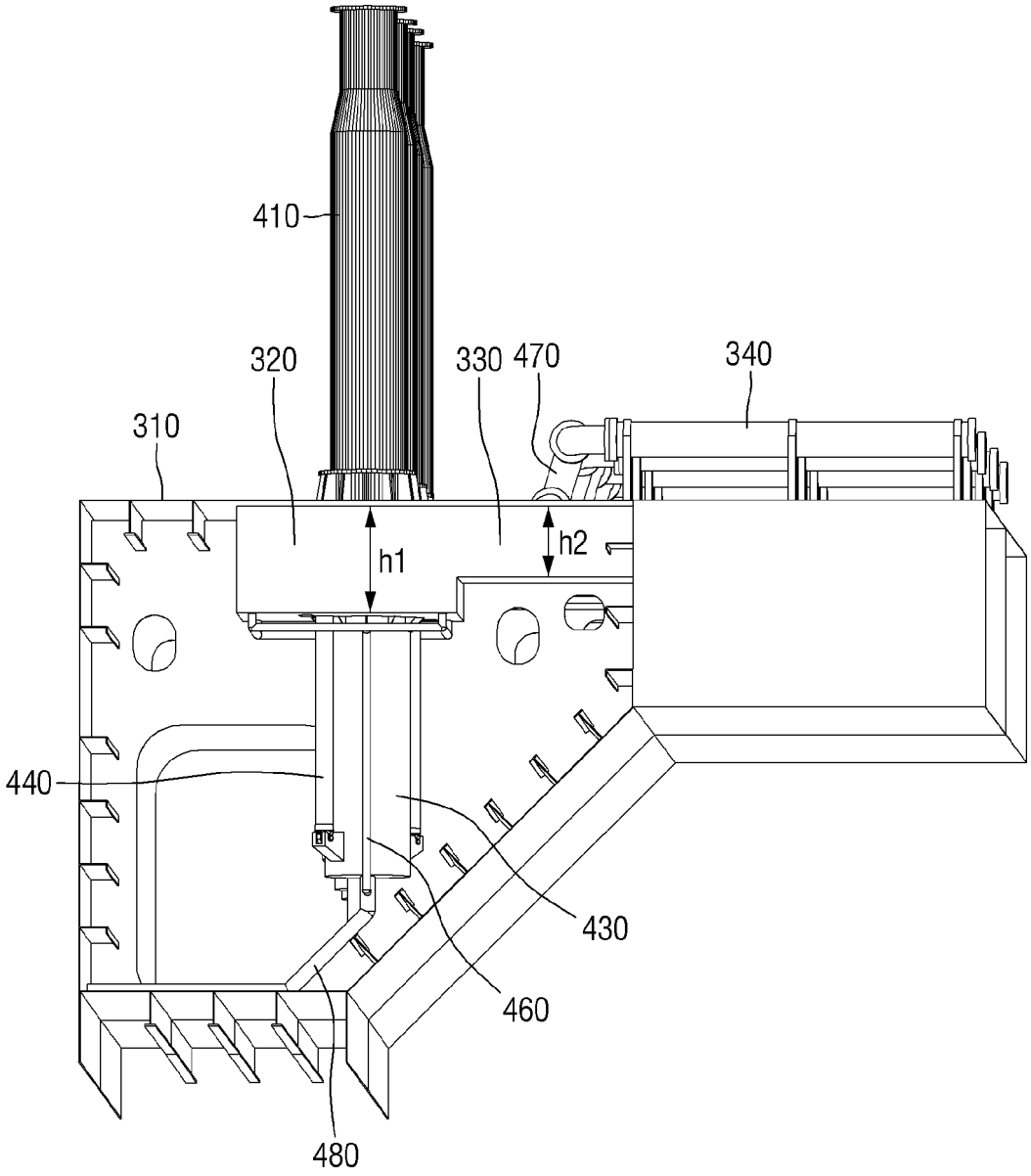


Fig. 15

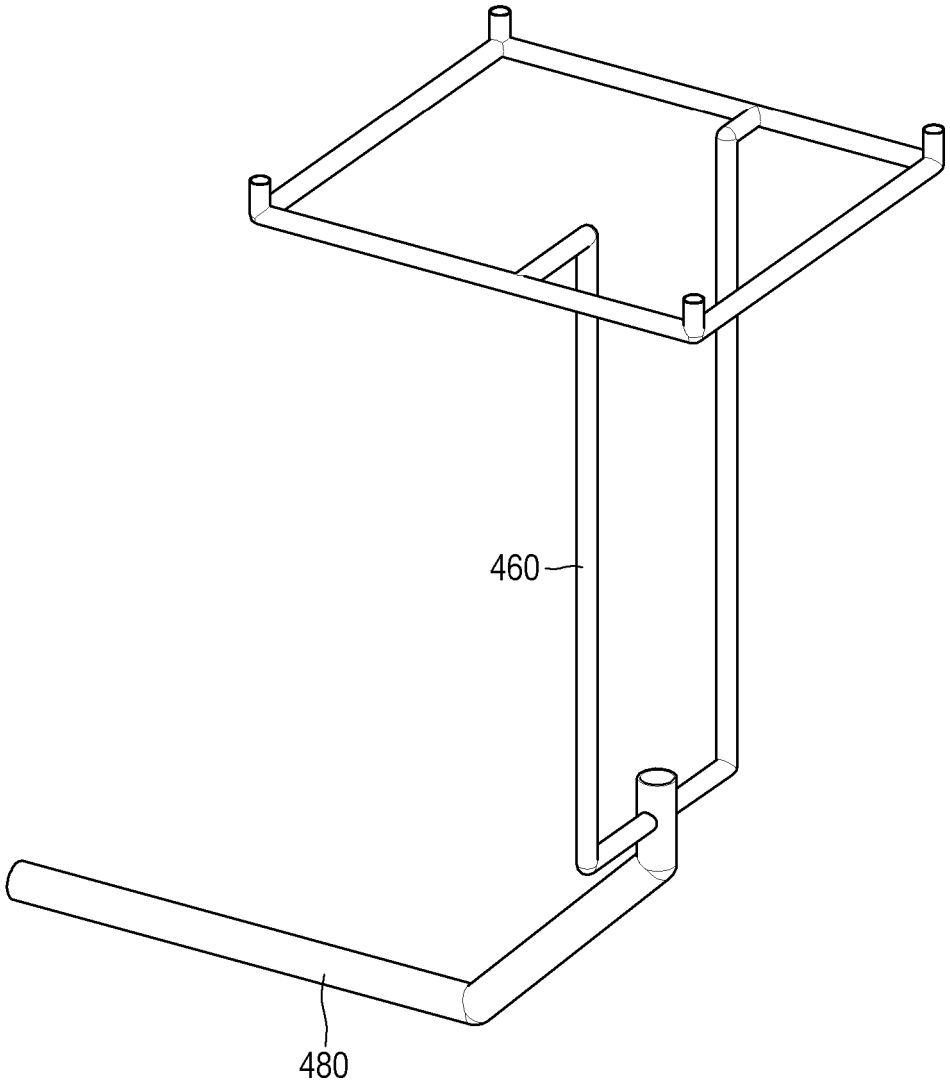


Fig. 16

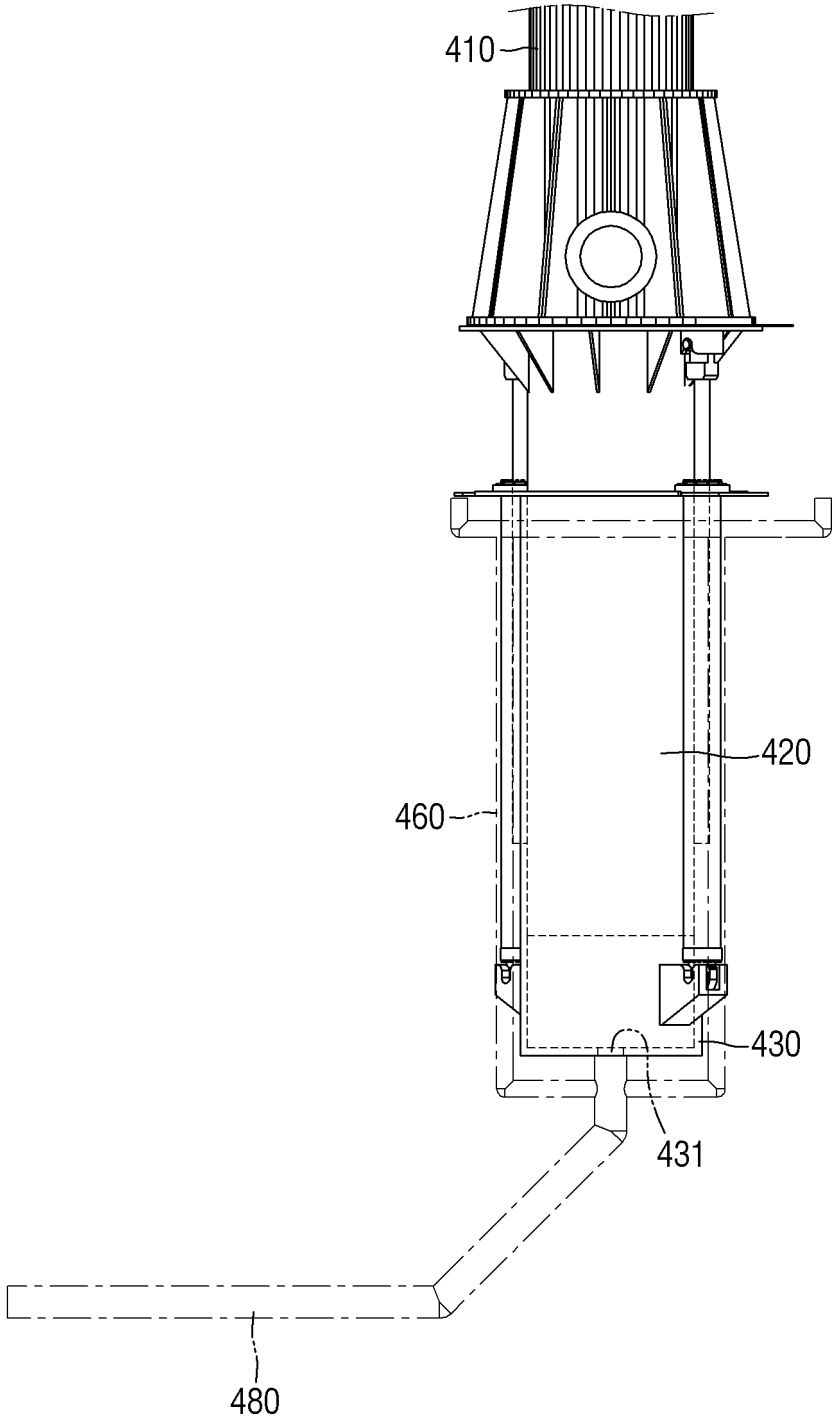


Fig. 17

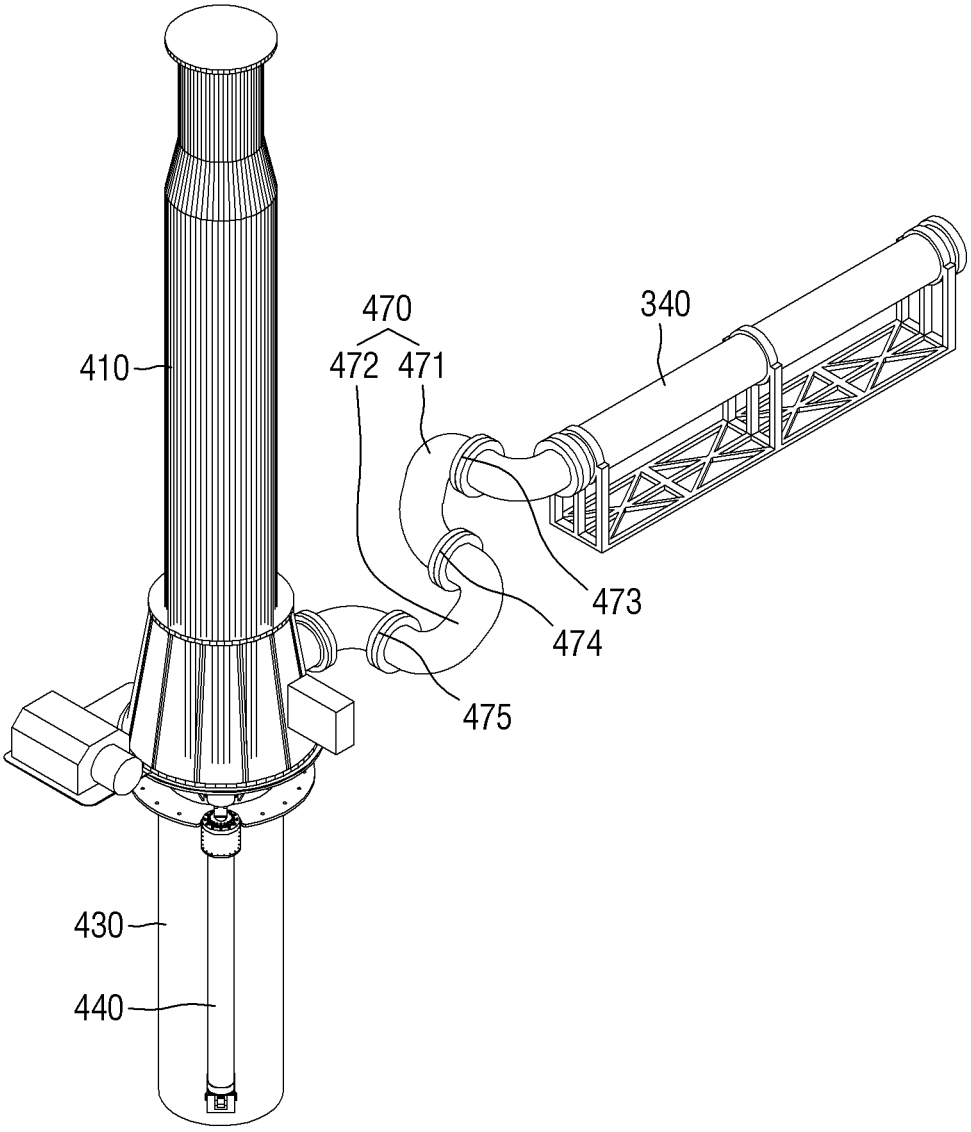


Fig. 18

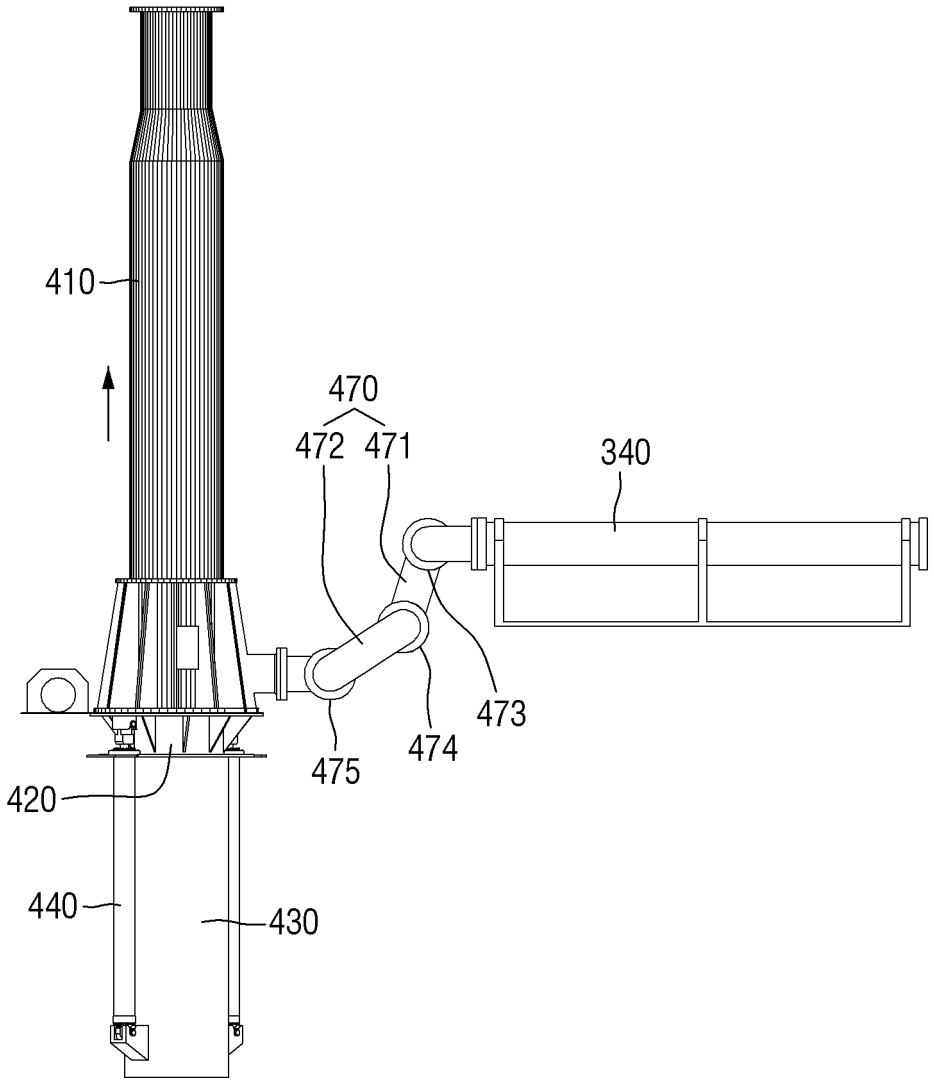
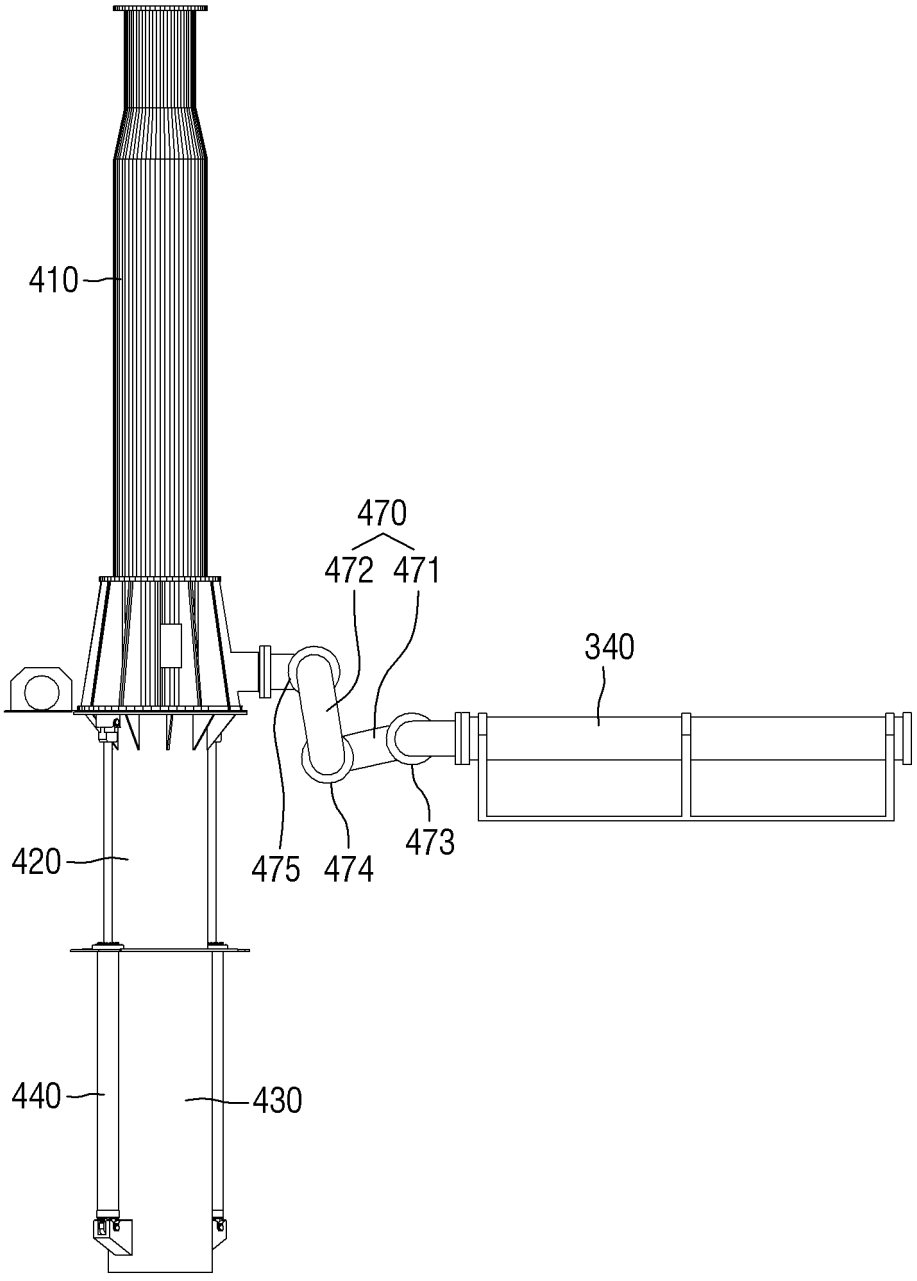


Fig. 19



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2017/008431

A. CLASSIFICATION OF SUBJECT MATTER
B63B 27/34(2006.01)i, B63B 27/24(2006.01)i, B67D 9/02(2010.01)i, B63B 13/00(2006.01)i, F16L 55/00(2006.01)i, F16J 15/02(2006.01)i
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B63B 27/34; B63B 9/00; B63B 3/48; H02G 1/08; B63B 13/00; B25B 11/02; E04H 12/08; B25B 11/00; B67D 9/02; F16F 9/02; B63B 27/24; F16L 55/00; F16J 15/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS (KIPO internal) & Keywords: height, adjustment, cylinder, rotating, coupling

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2012-0050791 A (SAMSUNG HEAVY IND. CO., LTD.) 21 May 2012 See paragraphs [0026], [0039], [0075].	1,4-13
A		2-3
Y	KR 10-2005-0052806 A (SONG, Byong Mog) 07 June 2005 See paragraph [0053] and figure 2.	1,4-13
Y	KR 10-2013-0074177 A (HYUNDAI HEAVY INDUSTRIES CO., LTD.) 04 July 2013 See paragraph [0025].	1,4-6
Y	KR 20-2014-0003208 U (DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.) 30 May 2014 See paragraph [0030].	4
Y	KR 10-2014-0144827 A (SAMSUNG HEAVY IND. CO., LTD.) 22 December 2014 See paragraphs [0023], [0039].	5-6,9-10,12-13
Y	KR 10-2012-0033825 A (SAMSUNG HEAVY IND. CO., LTD.) 09 April 2012 See paragraph [0024].	6,12-13
Y	KR 10-2012-0036029 A (HYUNDAI SAMHO HEAVY INDUSTRIES CO., LTD.) 17 April 2012 See paragraph [0021].	7-13

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 NOVEMBER 2017 (24.11.2017)	**24 NOVEMBER 2017 (24.11.2017)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701, Republic of Korea Facsimile No. +82-42-481-8578	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2017/008431

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2003-0094983 A (RA, Kuen Pal et al.) 18 December 2003 See page 3, line 40-page 4, line 12.	7-11

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2017/008431

Patent document cited in search report	Publication date	Patent family member	Publication date
KR 10-2012-0050791 A	21/05/2012	KR 10-1185528 B1	24/09/2012
KR 10-2005-0052806 A	07/06/2005	KR 20-0344216 Y1	11/03/2004
KR 10-2013-0074177 A	04/07/2013	KR 10-1464135 B1	21/11/2014
KR 20-2014-0003208 U	30/05/2014	NONE	
KR 10-2014-0144827 A	22/12/2014	KR 10-1505458 B1	25/03/2015
KR 10-2012-0033825 A	09/04/2012	KR 10-1259628 B1	29/04/2013
KR 10-2012-0036029 A	17/04/2012	KR 10-1188810 B1	09/10/2012
KR 10-2003-0094983 A	18/12/2003	KR 20-0287903 Y1	09/09/2002

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 101301999 **[0007]**