



(12) **EUROPEAN PATENT APPLICATION**  
published in accordance with Art. 153(4) EPC

(43) Date of publication:  
**06.05.2015 Bulletin 2015/19**

(51) Int Cl.:  
**B63B 27/24 (2006.01) B63B 25/08 (2006.01)**

(21) Application number: **12879789.1**

(86) International application number:  
**PCT/KR2012/011683**

(22) Date of filing: **28.12.2012**

(87) International publication number:  
**WO 2014/003272 (03.01.2014 Gazette 2014/01)**

(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**

- **KIM, Seung Hyuk**  
Geoje-si  
Gyeongsangnam-do 656-914 (KR)
- **SONG, Yong Seok**  
Busan 611-760 (KR)
- **CHOI, Jae Woong**  
Geoje-si  
Gyeongsangnam-do 656-707 (KR)

(30) Priority: **27.06.2012 KR 20120069332**

(71) Applicant: **Samsung Heavy Industries Co., Ltd.**  
**Seoul 137-955 (KR)**

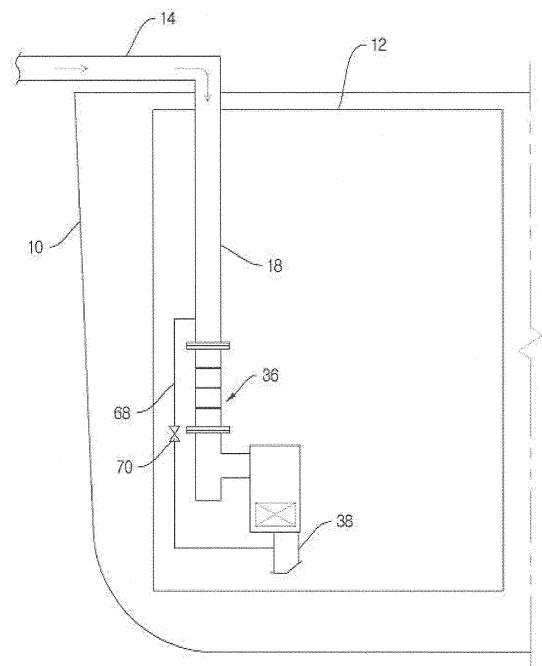
(74) Representative: **Heine, Christian Klaus**  
**KNH Patentanwälte Kahlhöfer Neumann**  
**Röbler Heine PartG mbB**  
**Postfach 10 33 63**  
**40024 Düsseldorf (DE)**

(72) Inventors:  
• **CHOI, Sung Yun**  
Jinju-si  
Gyeongsangnam-do 660-780 (KR)

(54) **OIL-LOADING APPARATUS AND OIL CARRIER INCLUDING SAME**

(57) Provided is an oil loading apparatus which is connected to a supply pipe and loads oil in a storage tank. The oil loading apparatus includes: a loading pipe which is connected to the supply pipe and disposed in a vertical direction in the inside of the storage tank; and a pressure drop module which is connected to a lower end of the loading pipe and induces a pressure drop of the oil discharged from the loading pipe, wherein the pressure drop module includes: a pressure drop pipe which is connected to the lower end of the loading pipe; multi-hole orifices which are disposed in a transverse direction in an inside of the pressure drop pipe; and a T-shaped branch pipe which includes a vertical pipe and a horizontal pipe.

Fig. 8



## Description

### BACKGROUND

#### 1. Field of the Invention

**[0001]** The present invention relates to an oil loading apparatus and an oil carrier including the same, and more particularly, to an oil loading apparatus capable of preventing occurrence of volatile organic compounds (VOC) when loading oil in a storage tank, and an oil carrier including the same.

#### 2. Description of the Related Art

**[0002]** In land or maritime crude oil production facilities, crude oil storage facilities, crude oil carriers, etc., oil such as crude oil, petroleum, liquefied gas, and other mineral liquid cargo is stored in a storage tank, and due to the temperature or pressure change within the storage tank, volatile organic compounds (VOC) which are gaseous elements are filled on the upper part of the storage tank.

**[0003]** Such volatile organic compounds may be generated in the process of loading oil in the storage tank. When loading oil from a supply pipe to the storage tank, an excessive pressure drop may occur in the process where oil drops, and due to such a pressure drop, oil is evaporated, and thereby volatile organic compounds are generated.

**[0004]** Volatile organic compounds contain various organic compounds such as methane, propane, butane, and ethane, and they are harmful to human bodies and when discharged to the air, they become causes of smog, thereby causing air pollution.

**[0005]** Specifically, volatile organic compounds are highly mobile in the air, cause smell, are potentially toxic and carcinogenic, and form ozone by photochemically reacting with nitric oxide and other compounds, and thus environmental pollution by such volatile organic compounds is drawing special attention. Further, when such volatile organic compounds are discharged to the air, such amount of oil is lost. Hence, it is needed to reduce the generation of the volatile organic compounds when loading oil.

**[0006]** As a background technology of the present invention, the method and equipment in the loading column as disclosed in a patent literature has a transverse cross-section of a loading column wider than that of a supply pipe and has a spiral downward flow pattern as crude oil is moved.

**[0007]** According to the conventional technology, a loading column having a transverse cross-section relatively wider than that of the supply pipe is needed, and thus a lot of space for installation is required in order to install the loading column.

## SUMMARY

**[0008]** The present invention provides an oil loading apparatus capable of preventing occurrence of volatile organic compounds (VOC) when loading oil in a storage tank, and an oil carrier including the same.

**[0009]** In accordance with an aspect of the present invention, an oil loading apparatus which is connected to a supply pipe and loads oil in a storage tank includes: a loading pipe which is connected to the supply pipe and disposed in a vertical direction in the inside of the storage tank; and a pressure drop module which is connected to a lower end of the loading pipe and induces a pressure drop of the oil discharged from the loading pipe, wherein the pressure drop module includes: a pressure drop pipe which is connected to the lower end of the loading pipe; multi-hole orifices which are disposed in a transverse direction in an inside of the pressure drop pipe; and a T-shaped branch pipe which includes a vertical pipe, one end of which is communication with the lower end of the pressure drop pipe and the other end of which is closed, and a horizontal pipe, which is in communication with the vertical pipe and which is disposed separately from the other end of the vertical pipe by a predetermined distance, while extending in the transverse direction from one sidewall of the vertical pipe.

**[0010]** A plurality of multi-hole orifices may be disposed separately from each other in the inside of the pressure drop pipe.

**[0011]** The orifices may open and close the inside of the pressure drop pipe according to rotation.

**[0012]** The pressure drop module may be disposed on an upper part of the orifices and may further include a mesh part which is installed in the transverse direction in the inside of the pressure drop pipe, and the mesh part may include a plurality of mesh networks which are stacked in multi layers in the inside of the loading pipe so that meshes are crossed.

**[0013]** The pressure drop module may further include a cylindrical chamber to which the horizontal pipe is connected and which has a diameter larger than the diameter of the pressure drop pipe, in which the horizontal pipe may be connected to the upper end of the cylindrical chamber in a tangential direction so that the oil, which flows out of the horizontal pipe, spirally flows along the inner wall of the chamber.

**[0014]** The pressure drop module may be prepared in the lower part of the inside of the chamber and may further include a static mixer which mixes oil which is filled in the lower part of the inside of the chamber.

**[0015]** The chamber may include: an upper plate of a round shape; a cylindrical body part which has a size corresponding to an outline of the upper plate so that the upper plate is coupled to the upper end, in which a coupling hole to which the horizontal plate is connected is formed in the sidewall, and which has a diameter larger than the diameter of the loading pipe; and a lower plate which has a size corresponding to the lower outline of

the cylindrical body part, which is connected to the lower outline of the cylindrical body part, and which has a discharge hole to which the oil is discharged.

[0016] A plurality of pressure drop modules may be connected to the lower part.

[0017] The oil loading apparatus may further include: a discharge pipe which is connected to the connected to the discharge hole; a bypass line which connected the discharge pipe with the loading pipe in order to bypass the pressure drop module; and a valve installed in the bypass line.

[0018] In accordance with another aspect of the present invention, an oil carrier includes: a ship body; a storage tank which is prepared inside the ship body and where oil, which flows in from a supply pipe, is loaded; and the oil loading apparatus described above.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The above and other features and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG. 1 illustrates an oil loading apparatus according to a first embodiment of the present invention.

FIG. 2 is a sectional view taken along A-A line of FIG. 1.

FIG. 3 is a sectional view taken along B-B line of FIG. 1.

FIG. 4 is a sectional view taken along C-C line of FIG. 1.

FIG. 5 is an exploded perspective view of a pressure drop module of FIG. 1.

FIG. 6 illustrates an opening and closing structure of an orifice of an oil loading apparatus according to a first embodiment of the present invention.

FIG. 7 illustrates an oil loading apparatus according to a second embodiment of the present invention.

FIG. 8 illustrates an oil loading apparatus according to a third embodiment of the present invention.

## DETAILED DESCRIPTION OF THE EMBODIMENTS

[0020] The present invention can be modified in various manners and may have various embodiments, and in this specification, some embodiments will be described with reference to drawings. However, the present invention is not limited to the embodiments described here and may include all conversions, equivalents and substitutes within the scope of the ideas and technologies of the present invention. When it appears that the specification description on already known related technologies, the detailed description will be omitted here.

[0021] Hereinafter, embodiments of an oil loading apparatus according to the present invention will be described in detail with reference to the attached drawings. Here, the same reference numerals refer to the same

elements, and thus redundant description for the same elements is omitted.

[0022] FIG. 1 illustrates an oil loading apparatus according to a first embodiment of the present invention, FIG. 2 is a sectional view taken along A-A line of FIG. 1, FIG. 3 is a sectional view taken along B-B line of FIG. 1, FIG. 4 is a sectional view taken along C-C line of FIG. 1, FIG. 5 is an exploded perspective view of a pressure drop module of FIG. 1, and FIG. 6 illustrates an opening and closing structure of an orifice of an oil loading apparatus according to a first embodiment of the present invention.

[0023] FIGS. 1 to 5 illustrate a ship body 10, a storage tank 12, a supply pipe 14, a loading pipe 18, a pressure drop pipe 20, a flange 22, a mesh part 24, a first orifice 26, a second orifice 27, a chamber 28, a third orifice 29, a vertical pipe 30, a horizontal pipe 32, a T-shaped branch pipe 34, a pressure drop module 36, a discharge pipe 38, mesh networks 40 and 42, holes 46 and 50, an upper plate 52, a cylindrical body part 54, a coupling hole 55, a lower plate 56, a discharge hole 58, a static mixer 60, a vapor process line 64, and a spiral flow 66.

[0024] The oil loading apparatus according to the present embodiment is connected to the supply pipe 14 and loads oil in the storage tank 12. The oil loading apparatus includes: a loading pipe 18 which is connected to the supply pipe 14 and disposed in the vertical direction in the inside of the storage tank 12; and a pressure drop module 36 which is connected to the lower end of the loading pipe 18 and induces a pressure drop of the oil discharged from the loading pipe 18, in which the pressure drop module 36 includes: a pressure drop pipe 20 which is connected to the lower end of the loading pipe 18; multi-hole orifices 26, 27, and 29 which are disposed in the transverse direction in the inside of the pressure drop pipe 20; and a T-shaped branch pipe 34 which includes a vertical pipe 30, one end of which is communication with the lower end of the pressure drop pipe 20 and the other end of which is closed, and a horizontal pipe 32, which is in communication with the vertical pipe 30 and which is disposed separately from the other end of the vertical pipe 30 by a predetermined distance, while extending in the transverse direction from one sidewall of the vertical pipe 30.

[0025] Here, oil includes crude oil, petroleum, liquefied gas, and other mineral liquid cargo from which volatile organic compounds may be generated due to a temperature or pressure change.

[0026] The oil loading apparatus according to the present embodiment may be installed in the storage tank 12 which is prepared in the ship body 10 of the oil carrier and prevent generation of volatile organic compounds when loading oil in the storage tank 12.

[0027] The storage tank may be included in land or maritime crude oil production facilities, crude oil storage facilities, crude oil carriers, etc., and in the present embodiment, the storage tank prepared in the ship body 10 of the oil carrier will be described.

[0028] The supply pipe 14 may be disposed on the

upper part of the storage tank 12 in the horizontal direction, and through which oil flows into the storage tank 12 from the outside. When the storage tank 12 is prepared in the ship body 10 of the oil carrier, the supply pipe 14 is connected to the oil storage tank 12 of the oil producing area so that the oil may be supplied to the storage tank 12 of the oil carrier.

**[0029]** The loading pipe 18 is connected to the supply pipe 14 and is vertically disposed in the insider of the storage tank 12. The upper end of the loading pipe 18 may be connected to the supply pipe 14 so as to be supplied oil.

**[0030]** The pressure drop module 36 is connected to the lower end of the loading pipe 18 and includes a pressure drop of oil which is discharged from the loading pipe 18. The pressure drop module 36 may include the following configuration which increases resisting force against the oil flow so as to cause a pressure drop.

**[0031]** The oil, which passes through the loading pipe 18 and the pressure drop module 36, may flow into the storage tank 12 through the discharge pipe 38.

**[0032]** Here, the pressure drop may mean a pressure difference between one point of a pipe where a fluid like oil flows and one point of another flow.

**[0033]** The pressure drop module 36 may include: a pressure drop pipe 20 which is connected to the lower end of the loading pipe 18; multi-hole orifices 26, 27, and 29 which are disposed in the transverse direction in the inside of the pressure drop pipe 20; and a T-shaped branch pipe 34 which includes a vertical pipe 30, one end of which is communication with the lower end of the pressure drop pipe 20 and the other end of which is closed, and a horizontal pipe 32, which is in communication with the vertical pipe 30 and which is disposed separately from the other end of the vertical pipe 30 by a predetermined distance, while extending in the transverse direction from one sidewall of the vertical pipe 30.

**[0034]** Further, the pressure drop module 36 may be disposed on the upper part of the orifices 26, 27, and 29, and may further include the mesh part 24 which is installed in the inside of the pressure drop pipe 20 in the transverse direction. The mesh part 24 may include a plurality of mesh networks 40 and 42 which are multi-stacked in the inside of the loading pipe 18 so that meshes are crossed.

**[0035]** The pressure drop pipe 20 may have substantially the same inside diameter and may be connected to the lower end of the loading pipe 18 by the flange 22. The orifices 26, 27, and 29 and the mesh networks 40 and 42 are combined in the transverse direction so as to induce a pressure drop of oil which flows in from the loading pipe 18. For example, the generation of the volatile organic compounds in the loading pipe 18 may be reduced by maintaining the pressure inside the loading pipe 18 higher than the saturated pressure of oil by adjusting the amount of the pressure drop in the pressure drop module 36.

**[0036]** Referring to FIG. 2, the mesh part 42 includes

mesh networks 40 and 42 which are multi-stacked inside the pressure drop pipe 20. The mesh networks 40 and 42 may be disposed away along the longitudinal direction of the pressure drop pipe 20 so as to be multi-stacked.

The mesh networks 40 and 42 may be arranged in a single layer according to the amount of pressure drop induction. The external outline of the mesh networks 40 and 42 is formed and fixed according to the inner circumference of the pressure drop pipe 20.

Here, the stacked number or the mesh size of the mesh networks 40 and 42 may be determined in consideration of the influence according to the amount of flow in the rated driving operation condition and the level change of the oil of the storage tank.

The flow may be accelerated by the gravity when the oil flows downward along the loading pipe 18, but the pressure drop may be induced as the speed is reduced by the mesh networks 40 and 42 of the mesh part 24.

Hence, the flow section of the pressure drop pipe 20 in the installation location in the mesh networks 40 and 42 is relatively smaller than the flow section of the loading pipe 18 due to the mesh networks 40 and 42, and thus the pressure drop may be partly induced as the oil passes through the mesh networks 40 and 42.

The pressure inside the loading pipe may be maintained constant by adjusting the amount of the pressure drop in the pressure drop module 36.

The orifices 26, 27, and 29 have a plate shape having a plurality of holes 46 and 50. The number, size, and shape of the holes 46 and 50 may be determined according to the amount of the pressure drop. Further, the orifices 26, 27, and 29 may be disposed away along the longitudinal direction inside the pressure drop pipe 20 and a plurality of orifices 26, 27, and 29 may be installed. The present embodiment presents a form where three orifices, which are the first orifice 26, the second orifice 27, and the third orifice 29, are installed in the pressure drop pipe 20.

The first orifice 26 and the second orifice 27 are disposed away by a predetermined distance and are arranged in the horizontal direction toward the longitudinal direction of the pressure drop pipe 20. Further, the third orifice 29, which is arranged to be slant in the transverse direction toward the longitudinal direction of the pressure drop pipe 20, may be interposed between the first orifice 26 and the second orifice 27. The outlines of the first orifice 26, the second orifice 27, and third orifice 29 may be configured to fixed at the inner wall of the pressure drop pipe 20 or to open and close the inside of the pressure drop pipe 20 according to the rotation. The third orifice 29, which is arranged to be slant, may enhance the pressure drop efficiency by increasing the contact area of oil which passes through the orifice.

The design parameters of the orifices such as the number of orifices, the distance between orifices, the number, shape, and size of holes 46 and 50 may be determined in consideration of the amount of the flow in the

rated operation condition and the level change of the oil of the storage tank 12.

**[0044]** In particular, if the type or size of the oil carrier is determined, the time and amount, which is needed in loading oil, may be determined, and accordingly, the design parameters of the orifices may be determined within the scope of expecting the reduction of the volatile organic compounds.

**[0045]** That is, when the time and amount, which is needed in loading oil, is changed according to the change of the oil carrier, the existing design parameters may be changed so that the existing orifices may be substituted by the orifices having the changed design parameters, thereby easily adjusting the reduction performance of the volatile organic compounds. Further, when the Reid vapor pressure (RVP) is changed, the design parameters of the orifices may be changed so as to reduce the generation of the volatile organic compounds.

**[0046]** Further, the orifices 26, 27, and 29 may be configured to open or close the inside of the pressure drop pipe 20 according to the rotation. Referring to FIG. 5, in the state where the orifice 26 of a round plate shape is arranged in a horizontal direction in the inside of the pressure drop pipe 20, the inside of the pressure drop pipe 20 may be opened or closed as the round plate is rotated on the central line of the round plate. That is, if the orifice 26 of the round plate shape is rotated in a horizontal direction toward the longitudinal direction of the pressure drop pipe 20, the inside of the pressure drop pipe 20 is closed, and if the orifice 26 of the round plate shape is rotated in the same direction as the longitudinal direction of the pressure drop pipe 20, the inside of the pressure drop pipe 20 is opened. Further, even in the state the pressure drop pipe 20 is closed by the orifice 26, oil is moved through the hole 46 of the orifice.

**[0047]** In the case of the third orifice 29, the orifice 29 of an oval shape is arranged in the pressure drop pipe 20, and in this case, the pressure drop pipe 20 may be opened or closed by rotating the third orifice 29.

**[0048]** If the oil flows into the storage tank 12 and is filled up to a certain height, the pressure inside the loading pipe 18 may increase, and if the pressure of the loading pipe 18 increases, the total head of the pump at the land side for supplying oil to the storage tank 12 increases, and thus the pumping efficiency may be lowered, and thus the pressure drop may be decreased by opening the inside of the pressure drop pipe 20 by rotating the orifices 26, 27, and 29.

**[0049]** The T-shaped branch pipe 34 includes a vertical pipe 30, one end of which is communication with the lower end of the pressure drop pipe 20 and the other end of which is closed, and a horizontal pipe 32, which is in communication with the vertical pipe 30 and which is disposed separately from the other end of the vertical pipe 30 by a predetermined distance. The flowing direction of the oil, which passes through the pressure drop pipe 20, may be changed from the vertical flow to the horizontal flow through the T-shaped branch pipe 34. At this time,

the horizontal pipe 32 is disposed away from the closed other end of the vertical pipe 30 by a predetermined distance to be connected to the vertical pipe 30, and thus oil is filled up to the height of the lower end of the horizontal pipe 32 at the lower end inside the vertical pipe 30. The oil, which fills the inner lower end of the vertical pipe 30, absorbs the impact of the oil which vertically drops after passing through the pressure drop pipe 20. As such, the wear and vibration noise of the pipe, which may be generated due to the oil's direct impact on the inner wall of the pipe, may be reduced, the vertically dropping oil and the oil's gaseous elements may be mixed so as to absorb the gaseous elements.

**[0050]** The distance between the other end of the vertical pipe 30 and the horizontal pipe 32 determines the amount of oil which is filled in the lower part of the vertical pipe 30, and thus the distance may be variously changed according to the amount of impact of the falling oil.

**[0051]** The pressure drop module 36 may include a cylindrical chamber 38 to which the vertical pipe 32 is connected and which has a diameter larger than the diameter of the pressure drop pipe 20. Further, the horizontal pipe 32 may be connected to the upper end of the cylindrical chamber 28 in the tangential direction so that the oil, which flows out of the horizontal pipe 32, contacts the inner wall of the chamber 28 and spirally flows 66. In detail, the chamber 28 has a cylindrical upper plate 52 and a lower plate 56 which includes a coupling hole 55 which has a size corresponding to the outline of the upper plate 52, the sidewall of which the horizontal pipe 32 is connected to, has a cylindrical body part 54 having a diameter larger than the diameter of the loading pipe 18 and a discharge hole 58 which has the size corresponding to the outline of the lower part of the cylindrical body part 54, is connected to the outline of the lower part of the cylindrical body part 54, and has a discharge hole 58 to which oil is discharged.

**[0052]** The chamber 28 is made of materials which can resist the vapor pressure of the volatile organic compounds which are generated in the inside of the chamber 28, all parts except the coupling hole 55 and the discharge hole 58 are closed, and a safety valve and a vapor process line 64 may be provided.

**[0053]** The installation location of the vapor process line 64 may vary depending on the ship, and thus FIG. 6 merely illustrates an example.

**[0054]** The horizontal pipe 32 of the T-shaped branch pipe 34 is connected to the upper end of the chamber 28 in the tangential direction. As such, the oil, which flows out through the horizontal pipe 32, flows along the inner wall of the chamber 28, and the oil, which flows in in the influence of the inertial force and gravity, spirally flows 66, and the vapor of the volatile organic compounds, which are generated at this time, may be collected at the central part of the chamber 28.

**[0055]** When the amount of gaseous elements or vapor of oil, which is collected in the chamber 28, increases, the pressure of the chamber 28 further increases, and

thereby the generation of vapor may be further prevented or the vapor may be melted in the flowing oil.

**[0056]** Further, the pressure drop module 36 is prepared in the lower part of the inside of the chamber 28, and may further include a static mixer 60, which mixes oil which is being filled in the lower part of the inside of the chamber 28.

**[0057]** The static mixer 60 mixes the oil which flows down along the inner wall of the chamber 28, thereby reducing the size of the bubbles of the gaseous elements contained in the oil. Anything having a structure capable of reducing the size of the vapor of the gaseous elements contained in the oil by mixing the oil which flows down along the inner wall of the chamber 28 may be a static mixer 60.

**[0058]** A discharge pipe 38 is connected to the discharge hole 58 of the chamber 28, and oil is discharged to the outside of the chamber 28 through the discharge pipe 38. The discharge pipe 38 may be disposed close to the floor of the storage tank 12 or may be connected to the distribution pipe of the oil within the storage tank 12.

**[0059]** Further, the loading pipe 18, the pressure drop pipe 20, and the T-shaped branch pipe 34 may be integrally formed according to a design.

**[0060]** Hereinafter, a method of operating an oil loading apparatus according to the present embodiment will be described.

**[0061]** Referring to FIG. 1, the oil, which is flown through the supply pipe 14 and the loading pipe 18, passes through the mesh part 24 and multi-hole orifices 26, 27, and 29. At this time, the pressure drop may occur while passing through the mesh part 24 or the multi-hole orifices 26, 27, and 29, and the flowing direction may be changed through the T-shaped branch pipe 34, thereby reaching up to the coupling hole 55 of the chamber 28.

**[0062]** The oil, which flows into the chamber 28 through the coupling hole 55 by the pressure drop, spirally flows 66 along the inner wall of the chamber 28 in the influence of the inertial force and gravity. Further, the gaseous elements of oil, which may be generated in the process of passing through the multi-hole orifices, may be collected in the center of the chamber 28. Likewise, the gaseous elements of the oil, which is collected in the center of the chamber 28, may increase the inner pressure of the chamber 28.

**[0063]** When the inner pressure of the chamber 28 increases, the back pressure of the loading pipe 18 increases, and thereby the total pressure at the inside of the oil loading apparatus according to the present embodiment increases, and thus the generation of volatile organic compounds in the oil may be further reduced.

**[0064]** FIG. 7 illustrates an oil loading apparatus according to a second embodiment of the present invention. FIG. 7 illustrates a ship body 10, a storage tank 12, a supply pipe 14, a loading pipe 18, a pressure drop module 36, and a discharge pipe 38.

**[0065]** The oil loading apparatus according to the present embodiment is the same as that in the first em-

bodiment except that a plurality pressure drop modules 36 are arranged in order.

**[0066]** The pressure drop module 36, which is arranged at the uppermost part, is connected to the lower end of the loading pipe 18, and a plurality of pressure drop modules 36 may be arranged in order by connecting the discharge pipe 38 of the pressure drop module 36 which is arranged at the upper part with the pressure drop pipe of the pressure drop module 36 which is arranged at the lower part.

**[0067]** According to this installation, negative influences which may occur when rapidly reducing the pressure drop in one pressure drop module and negative influences that the hydrostatic head of the land pump may increase in proportion to the increase of the accumulated height of oil in the storage tank 12 may be reduced.

**[0068]** FIG. 8 illustrates an oil loading apparatus according to a third embodiment of the present invention. FIG. 8 illustrates a ship body 10, a storage tank 12, a supply pipe 14, a loading pipe 18, a pressure drop module 36, a discharge pipe 38, a bypass line 68, and a valve 70.

**[0069]** The oil loading apparatus according to the present embodiment may be the same as that in the first and second embodiments except the bypass line 68 and the valve 70 which are installed around the pressure drop module 36.

**[0070]** In the third embodiment, the bypass line 68, which connects the discharge pipe 38 with the loading pipe 18, may be installed in order to bypass the pressure drop module 36, and the valve 70, which opens and closes the bypass line 68, may be installed in the middle of the bypass line 68.

**[0071]** When the bypass line 68 and the valve 70 are applied to the second embodiment, the bypass line 68 and the valve 70 may be respectively installed to bypass each pressure drop module 36.

**[0072]** The bypass line 68 may prevent an excessive hydrostatic head increase of the land pump by allowing the whole or part of the oil to bypass the pressure drop module 36 when the pressure of the loading pipe excessively increase as the orifice included in the pressure drop module 36 is not opened.

**[0073]** Further, when the hydrostatic head of the land pump excessively increases as the pressure drop module 36 in the first and second embodiments is installed, the bypass line 68 may prevent the excessive increase of the hydrostatic head of the land pump by allowing the whole or part of the oil to bypass the pressure drop module 36.

**[0074]** An oil loading apparatus and an oil carrier including the same according to an embodiment of the present invention may prevent generation of volatile organic compounds when loading oil in a storage tank.

**[0075]** The embodiments of the present invention have been described with reference to the attached drawings, but it will be understood by one of ordinary skill in the art that the present invention can be performed in other specific forms without changing the technical ideas and es-

sential features of the present invention. For example, one of ordinary skill in the art can execute the present invention in a form which is not clearly disclosed in the embodiments of the present application by changing the material or size of each component or combining or substituting embodiments, but this is still within the scope of the present invention. Hence, all embodiments described above are examples and should not be understood as limitative, and it should be understood that such modified embodiments are included in the technical ideas disclosed in the claims of the present invention.

## Claims

1. An oil loading apparatus which is connected to a supply pipe and loads oil in a storage tank, the oil loading apparatus comprising:

a loading pipe which is connected to the supply pipe and disposed in a vertical direction in the inside of the storage tank; and

a pressure drop module which is connected to a lower end of the loading pipe and induces a pressure drop of the oil discharged from the loading pipe,

wherein the pressure drop module comprises:

a pressure drop pipe which is connected to the lower end of the loading pipe;

multi-hole orifices which are disposed in a transverse direction in an inside of the pressure drop pipe; and

a T-shaped branch pipe which includes a vertical pipe, one end of which is communication with the lower end of the pressure drop pipe and the other end of which is closed, and a horizontal pipe, which is in communication with the vertical pipe and which is disposed separately from the other end of the vertical pipe by a predetermined distance, while extending in the transverse direction from one sidewall of the vertical pipe.

2. The oil loading apparatus of claim 1, wherein a plurality of multi-hole orifices are disposed separately from each other in the inside of the pressure drop pipe.
3. The oil loading apparatus of claim 1, wherein the orifices open and close the inside of the pressure drop pipe according to rotation.
4. The oil loading apparatus of claim 1, wherein the pressure drop module is disposed on an upper part of the orifices and further includes a mesh part which is installed in the transverse direction in the inside

of the pressure drop pipe, wherein the mesh part includes a plurality of mesh networks which are stacked in multi layers in the inside of the loading pipe so that meshes are crossed.

5. The oil loading apparatus of claim 1, wherein the pressure drop module further comprises a cylindrical chamber to which the horizontal pipe is connected and which has a diameter larger than the diameter of the pressure drop pipe, wherein the horizontal pipe is connected to the upper end of the cylindrical chamber in a tangential direction so that the oil, which flows out of the horizontal pipe, spirally flows along the inner wall of the chamber.

6. The oil loading apparatus of claim 5, wherein the pressure drop module is prepared in the lower part of the inside of the chamber and further includes a static mixer which mixes oil which is filled in the lower part of the inside of the chamber.

7. The oil loading apparatus of claim 5, wherein the chamber comprises:

an upper plate of a round shape;

a cylindrical body part which has a size corresponding to an outline of the upper plate so that the upper plate is coupled to the upper end, in which a coupling hole to which the horizontal pipe is connected is formed in the sidewall, and which has a diameter larger than the diameter of the loading pipe; and

a lower plate which has a size corresponding to the lower outline of the cylindrical body part, which is connected to the lower outline of the cylindrical body part, and which has a discharge hole to which the oil is discharged.

8. The oil loading apparatus of claim 7, further comprising:

a discharge pipe which is connected to the connected to the discharge hole;

a bypass line which connected the discharge pipe with the loading pipe in order to bypass the pressure drop module; and

a valve installed in the bypass line.

9. An oil carrier comprising:

a ship body;

a storage tank which is prepared inside the ship body and where oil, which flows in from a supply pipe, is loaded; and

an oil loading apparatus according to one of claims 1 to 8.

Fig. 1

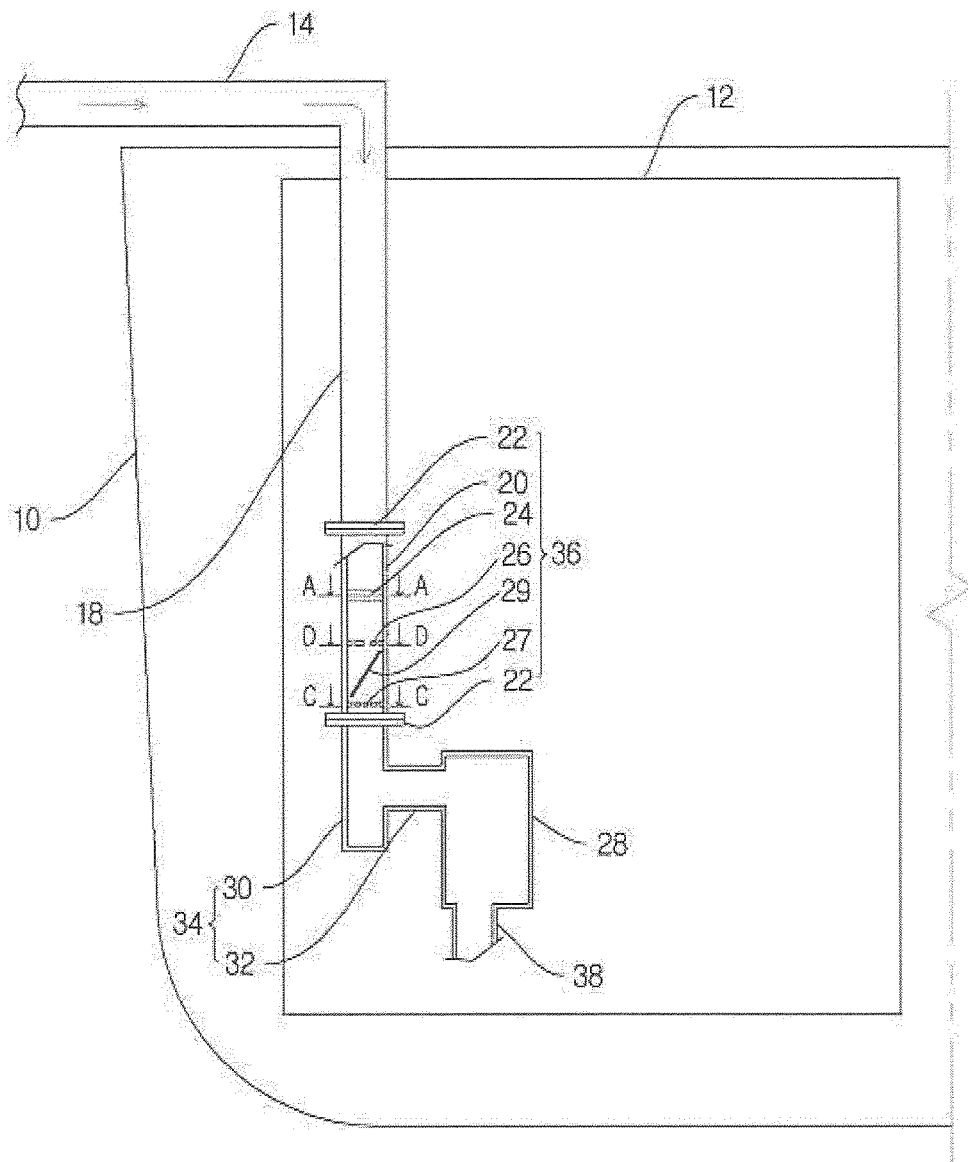


Fig. 2

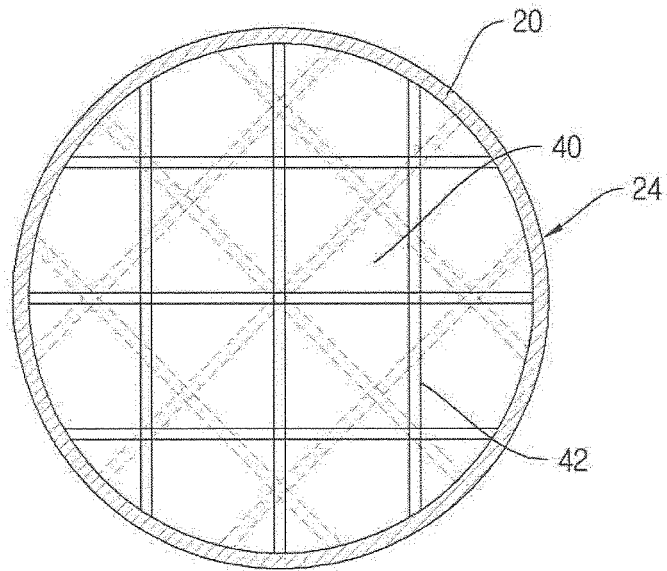


Fig. 3

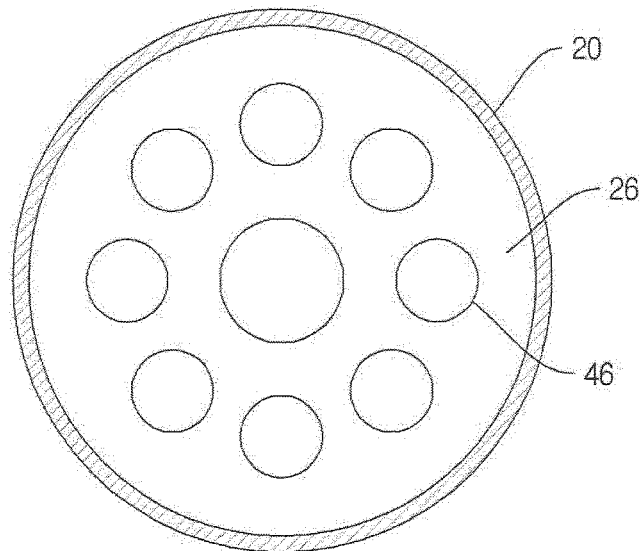


Fig. 4

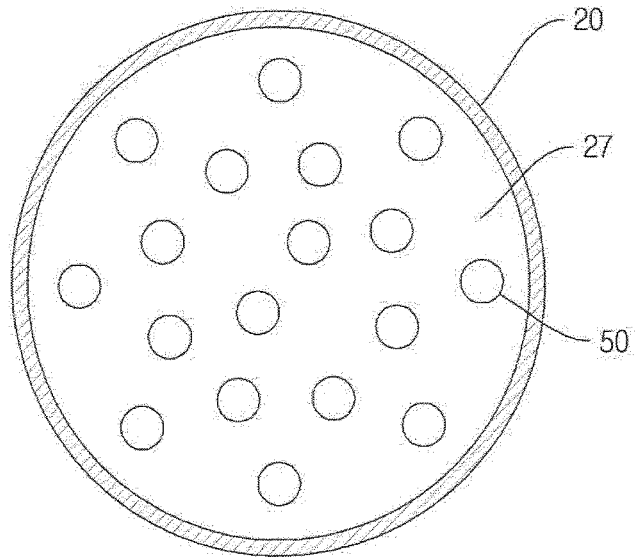


Fig. 5

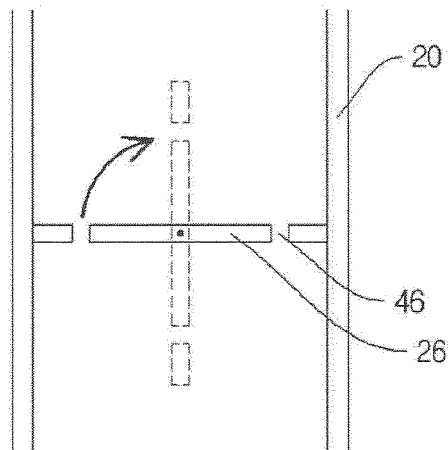


Fig. 6

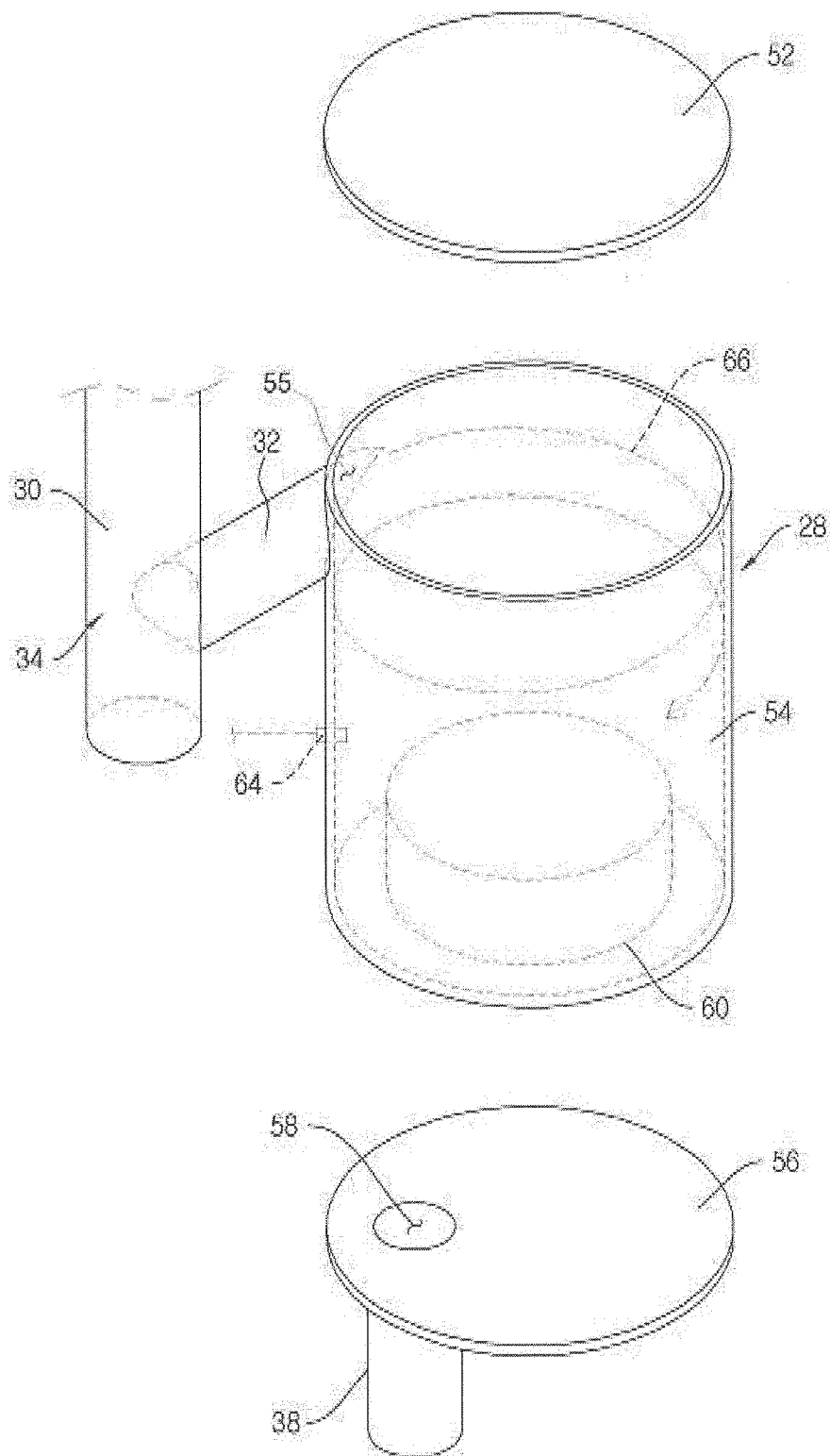


Fig. 7

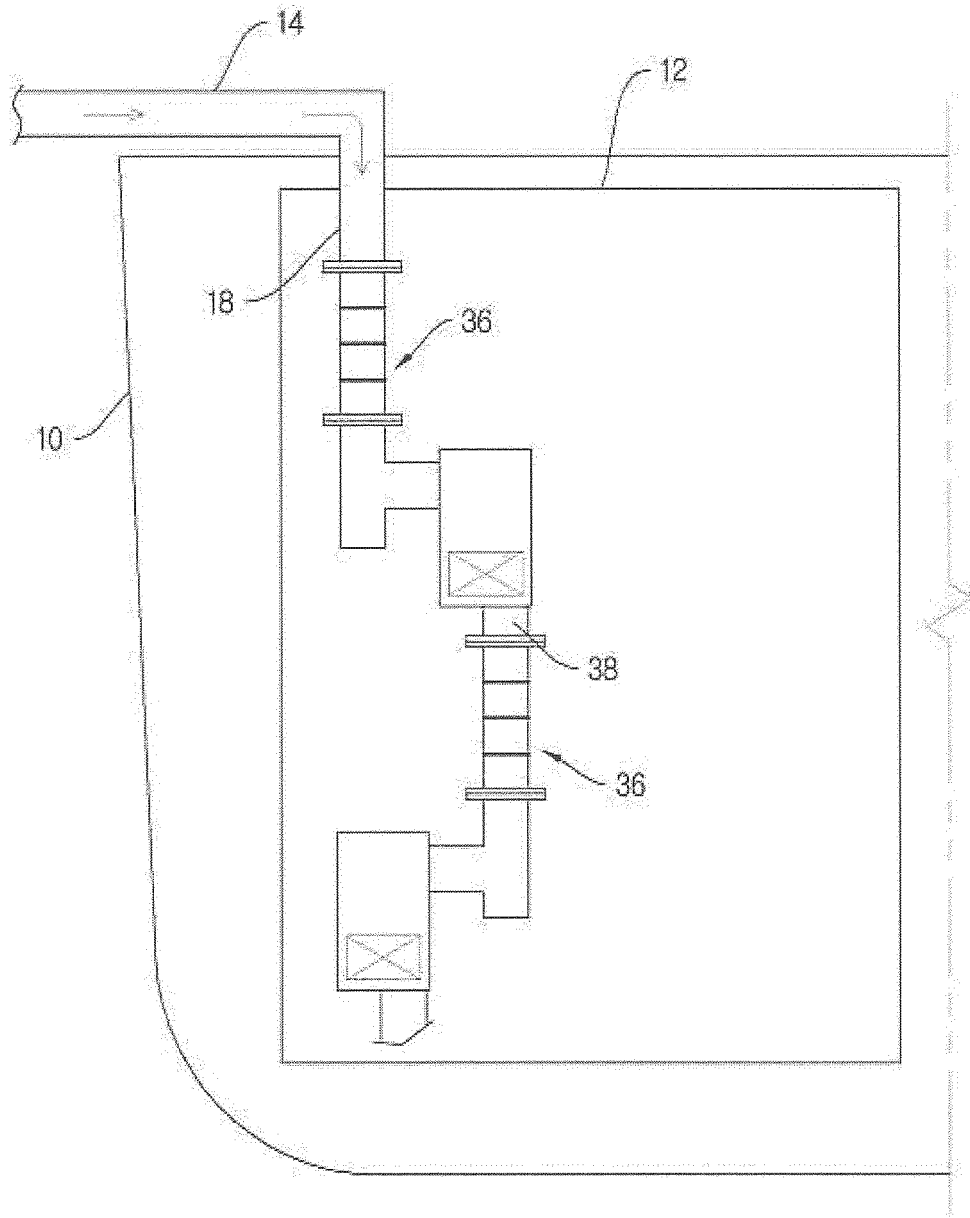
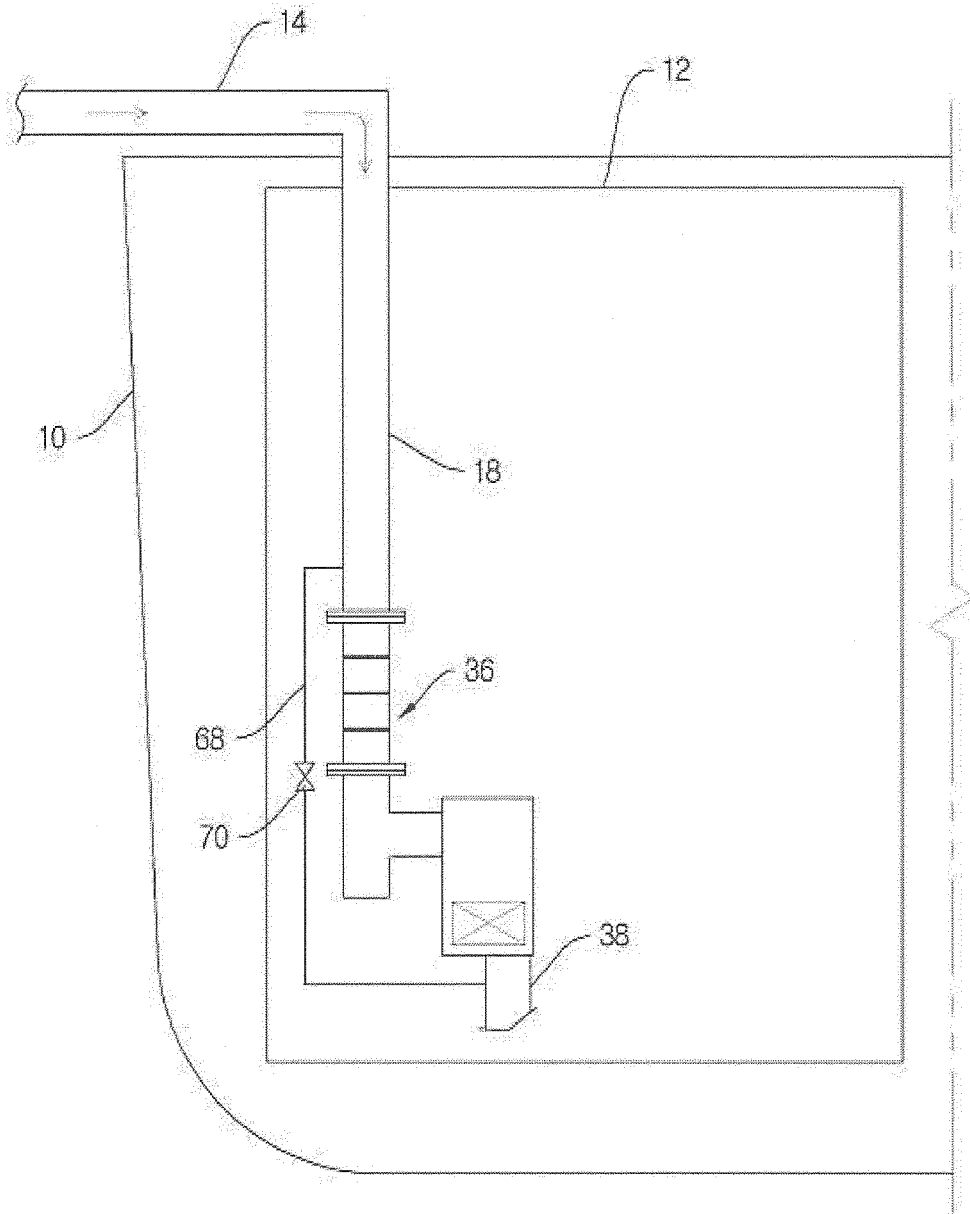


Fig. 8



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2012/011683

## A. CLASSIFICATION OF SUBJECT MATTER

**B63B 27/24(2006.01)i, B63B 25/08(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 27/24; B63B 25/14; B63B 25/08; B65D 90/28; B67D 7/04; B63B 25/16; B63B 25/02

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) &amp; Keywords: organic compound, reduction, decrease, load, loading, volatile organic components, voc, reduce, remove, load

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                | Relevant to claim No. |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | KR 10-2011-0139890 A (DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.) 30 December 2011<br>See abstract, paragraphs [23]-[39] and figures 2,3. | 1-9                   |
| A         | KR 10-2005-0044687 A (KNUTSEN OAS SHIPPING AS) 12 May 2005<br>See claims 1-7 and figure 1.                                                        | 1-9                   |
| A         | KR 10-2010-0115545 A (DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.) 28 October 2010<br>See claims 1-10 and figures 2,4 and 5.               | 1-9                   |
| A         | KR 10-0785587 B1 (TANK TECH CO.,LTD) 13 December 2007<br>See claim 2 and figures 1,2.                                                             | 1-9                   |
| A         | JP 61-012491 A (NIPPON KOKAN KK) 20 January 1986<br>See claim 1 and figures 1,2.                                                                  | 1-9                   |

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

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

29 MARCH 2013 (29.03.2013)

Date of mailing of the international search report

01 APRIL 2013 (01.04.2013)

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. 82-42-472-7140

Authorized officer

Telephone No.

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.

**PCT/KR2012/011683**

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member | Publication<br>date |
|-------------------------------------------|---------------------|-------------------------|---------------------|
| KR 10-2011-0139890 A                      | 30.12.2011          | NONE                    |                     |
| KR 10-2005-0044687 A                      | 12.05.2005          | AU 2002-348542 A1       | 17.06.2003          |
|                                           |                     | CN 1599694 A            | 23.03.2005          |
|                                           |                     | CN 1599694 C0           | 18.04.2007          |
|                                           |                     | EP 1463683 A1           | 06.10.2004          |
|                                           |                     | EP 1463683 B1           | 13.02.2013          |
|                                           |                     | JP 04-219813 B2         | 04.02.2009          |
|                                           |                     | JP 2005-511425 A        | 28.04.2005          |
|                                           |                     | US 2005-0039800 A1      | 24.02.2005          |
|                                           |                     | US 7597115 B2           | 06.10.2009          |
|                                           |                     | WO 03-048028 A1         | 12.06.2003          |
| KR 10-2010-0115545 A                      | 28.10.2010          | NONE                    |                     |
| KR 10-0785587 B1                          | 13.12.2007          | NONE                    |                     |
| JP 61-012491 A                            | 20.01.1986          | NONE                    |                     |

Form PCT/ISA/210 (patent family annex) (July 2009)