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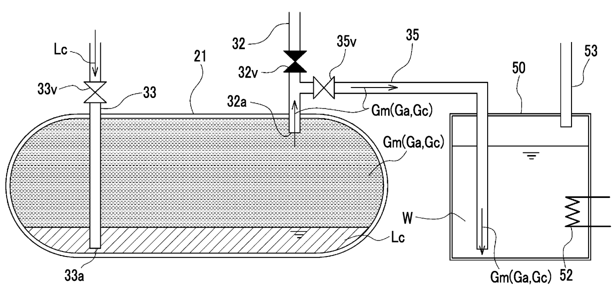
(54) **SHIP**

(57) A ship comprising: a ship body; a tank that is provided in the ship body and stores one of ammonia and carbon dioxide; a supply line through which the other of ammonia and carbon dioxide is supplied into the tank; a discharge line that discharges a gas mixture obtained by mixing one of ammonia and carbon dioxide stored in the tank with the other of ammonia and carbon dioxide supplied into the tank through the supply line when the other of ammonia and carbon dioxide is supplied into the tank through the supply line; and a water tank that is provided in the ship body, that stores water, and into which the gas mixture discharged from the discharge line is introduced.

FIG. 5



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Description

Technical Field

[0001] The present disclosure relates to a ship.

[0002] The present application claims priority with respect to Japanese Patent Application No. 2019-228934 filed in Japan on December 19, 2019, the content of which is incorporated herein by reference.

Background Art

[0003] A liquefied gas carrier or the like is provided with a liquefied gas storage tank. Such a tank may be filled with an inert gas and then the inert gas in the tank may be replaced with air or the like such that the liquefied gas remaining in the tank does not come into contact with oxygen when the tank is opened for maintenance or the like (see, for example, PTL 1).

Citation List

Patent Literature

[0004] [PTL 1] Japanese Unexamined Patent Publication No. 2013-193653

Summary of Invention

Technical Problem

[0005] By the way, the type of gas stored in the tank may be switched in the liquefied gas storage tank. At this time, a problem may arise due to contact between the residual gas of a first gas stored in the tank before the switching and a second gas stored in the tank after the switching. Examples of the problem include solid generation resulting from a chemical reaction between the first gas and the second gas. In addition, the first gas may be mixed with the second gas and the first gas may remain in the tank after the switching. Accordingly, in a case where the type of gas stored in the tank is switched, as in the case of the inert gas of PTL 1, the second gas needs to be loaded into the tank after the first gas in the tank is replaced with the inert gas.

[0006] However, as for the method described above, it is necessary to sequentially execute the steps of discharging the first gas to the outside of the tank, performing replacement with the inert gas or the like in the tank, and loading the second gas into the tank in switching the type of gas loaded into the tank. As a result, it takes time and effort to switch the type of gas loaded into the tank. In addition, depending on the type of the residual gas in the tank, the residual gas cannot be directly released from the tank into the atmosphere, and it may take time and effort to treat the residual gas.

[0007] The present disclosure has been made in view of the above, and an object of the present disclosure is to provide a ship in which the type of gas loaded into a tank can be switched with ease and speed.

Solution to Problem

[0008] In order to achieve the above object, a ship according to the present disclosure includes: a hull; a tank provided in the hull and storing either ammonia or carbon dioxide; a supply line supplying the other of the ammonia and the carbon dioxide into the tank; a discharge line discharging, when the other of the ammonia and the carbon dioxide is supplied into the tank through the supply line, a mixed gas in which one of the ammonia and the carbon dioxide stored in the tank and the other of the ammonia and the carbon dioxide supplied into the tank by the supply line are mixed; and a water tank provided in the hull and storing water, the mixed gas discharged from the discharge line being introduced into the water tank.

Advantageous Effects of Invention

[0009] According to the ship of the present disclosure, it is possible to efficiently switch the type of gas loaded into the tank and work can be facilitated and expedited.

Brief Description of Drawings

[0010]

Fig. 1 is a plan view illustrating a schematic configuration of a ship according to an embodiment of the present disclosure.

Fig. 2 is a side cross-sectional view illustrating a state where liquefied carbon dioxide is loaded in a tank to which the ship according to the embodiment of the present disclosure is applied.

Fig. 3 is a side cross-sectional view illustrating a state where liquefied ammonia is loaded in the tank to which the ship according to the embodiment of the present disclosure is applied.

Fig. 4 is a side cross-sectional view illustrating a state where ammonia gas remains in the tank with the liquefied ammonia discharged in the ship according to the embodiment of the present disclosure.

Fig. 5 is a side cross-sectional view illustrating a state where the liquefied carbon dioxide is supplied to the tank and a mixed gas is sent into a water tank in the ship according to the embodiment of the present disclosure.

Fig. 6 is a side cross-sectional view illustrating a state where carbon dioxide gas remains in the tank with the liquefied carbon dioxide discharged in the ship according to the embodiment of the present disclosure.

Fig. 7 is a side cross-sectional view illustrating a state where the liquefied ammonia is supplied to the tank and the mixed gas is sent into the water tank in the ship according to the embodiment of the present disclosure.

Description of Embodiments

[0011] Hereinafter, a ship according to an embodiment of the present disclosure will be described with reference to Figs. 1 to 7.

(Configuration of Hull of Ship)

[0012] A ship 1 of the embodiment of the present disclosure illustrated in Figs. 1 and 2 is capable of selectively carrying, for example, liquefied carbon dioxide and liquefied ammonia. The ship 1 includes at least a hull 2, a tank 21, an upper supply line 32, a lower supply line 33 as a supply line, a discharge line 35, and a water tank 50.

(Hull Configuration)

[0013] As illustrated in Fig. 1, the hull 2 has a pair of broadsides 3A and 3B, a ship bottom (not illustrated), and a deck 5, which form the outer shell of the hull 2. The broadsides 3A and 3B are provided with a pair of broadside skins respectively forming the left and right broadsides. The ship bottom (not illustrated) is provided with a ship bottom skin connecting the broadsides 3A and 3B. By the pair of broadsides 3A and 3B and the ship bottom (not illustrated), the outer shell of the hull 2 has a U shape in a cross section orthogonal to a ship stern direction Da. The deck 5 exemplified in this embodiment is a whole deck exposed to the outside. In the hull 2, an upper structure 7 having a living quarter is formed on the deck 5 on a stern 2b side.

[0014] In the hull 2, a cargo loading section (hold) 8 is formed closer to a bow 2a side than the upper structure 7. The cargo loading section 8 is recessed toward the ship bottom (not illustrated) below the deck 5 and is open upward.

(Tank Configuration)

[0015] A plurality of the tanks 21 are disposed in the cargo loading section 8. In this embodiment, for example, a total of seven tanks 21 are disposed in the cargo loading section 8. The tank 21 is not limited in any manner in terms of layout and installation number in the cargo loading section 8. In this embodiment, each tank 21 has, for example, a cylindrical shape extending in the horizontal direction (specifically, ship stern direction) . The tank 21 is not limited to a cylindrical tank and may be spherical.

(Supply Line Configuration)

[0016] As illustrated in Fig. 2, the upper supply line 32 and the lower supply line 33 are provided in each tank 21.

[0017] The upper supply line 32 reaches the inside of the tank 21 from the outside of the tank 21. An opening portion 32a opening to the upper portion in the tank 21 is formed at the tip of the upper supply line 32. Here, the upper portion in the tank means the region in the tank 21 that is on the side closer to the upper end of the tank 21 than the center of the tank 21 in the ship height direction (that is, the up-down direction of the tank 21). As an example, the portion can be the top of the tank 21. The upper supply line 32 is provided with an opening-closing valve 32v. In addition, the discharge line 35 is branch-connected to the upper supply line 32.

[0018] The lower supply line 33 reaches the inside of the tank 21 from the outside of the tank 21. An opening portion 33a opening to the lower portion in the tank 21 is formed at the tip of the lower supply line 33. Here, the lower portion in the tank 21 means the region in the tank 21 that is on the side closer to the lower end of the tank 21 than the center of the tank 21 in the ship height direction. As an example, the portion can be the bottom portion of the tank 21. The lower supply line 33 is provided with an opening-closing valve 33v.

(Discharge Line Configuration)

[0019] When the type of gas loaded into the tank 21 is switched, the discharge line 35 discharges the gas stored in the tank 21 and containing at least one of ammonia and carbon dioxide to the outside of the tank 21. One end side of the discharge line 35 branches from the upper supply line 32. The discharge line 35 is provided with an opening-closing valve 35v.

(Water Tank Configuration)

[0020] The water tank 50 is provided in the hull 2 (see Fig. 1). The water tank 50 may be, for example, a ballast tank provided in the hull 2. Water W can be stored in the water tank 50. The water W stored in the water tank 50 may be seawater. The other end of the discharge line 35 is disposed in the water tank 50. As a result, the gas discharged from the tank 21 through the discharge line 35 is introduced into the water W in the water tank 50.

[0021] The water tank 50 exemplified in this embodiment is provided with a heating unit 52. The heating unit 52 is configured to be capable of heating the water W in the water tank 50. For example, the component (carbon dioxide or ammonia) contained in the gas discharged from the tank may cause a chemical reaction via the water W and a substance resulting from the chemical reaction (for example, ammonium carbonate) may be dissolved in the water W in the water tank 50. In this case, it is possible to perform separation into the components before the chemical reaction (carbon dioxide, ammonia, and water) by the heating unit 52 heating the water W in the water tank 50.

[0022] Further, a separated gas discharge line 53 is connected to the water tank 50 exemplified in this embodiment. By the separated gas discharge line 53, the gas containing the above components separated by the heating unit 52 can be discharged to the outside of the ship.

(Liquefied Gas Loading into and Discharge from Tank)

[0023] Either liquefied carbon dioxide Lc or liquefied ammonia La is selectively loaded into the tank 21.

[0024] In a case where the ship 1 repeatedly carries only one of the liquefied carbon dioxide Lc and the liquefied ammonia La, liquefied carbon dioxide loading into the tank 21 or liquefied ammonia loading into the tank 21 is performed as follows.

(Liquefied Carbon Dioxide Loading into Tank)

[0025] As illustrated in Fig. 2, in order to load the liquefied carbon dioxide Lc into the tank 21, a pipe (not illustrated) for supplying the liquefied carbon dioxide Lc from an outboard liquefied carbon dioxide supply facility or the like is connected to the lower supply line 33. The opening-closing valve 33v is opened, and the liquefied carbon dioxide Lc is sent from the outside of the ship into the lower supply line 33. Then, the liquefied carbon dioxide Lc is loaded into the tank 21 from the opening portion 33a. In this manner, the liquefied carbon dioxide Lc is stored in the tank 21. In addition, carbon dioxide gas Gc resulting from partial vaporization of the liquefied carbon dioxide Lc is in the upper portion in the tank 21. The liquefied carbon dioxide Lc may be loaded into the tank 21 through the upper supply line 32 with the opening-closing valve 32v open.

(Liquefied Ammonia Loading into Tank)

[0026] As illustrated in Fig. 3, in order to load the liquefied ammonia La into the tank 21, a pipe (not illustrated) for supplying the liquefied ammonia La from an outboard liquefied ammonia supply facility or the like is connected to the lower supply line 33. The opening-closing valve 33v is opened, and the liquefied ammonia La is sent from the outside of the ship into the lower supply line 33. Then, the liquefied ammonia La is loaded into the tank 21 from the opening portion 33a. In this manner, the liquefied ammonia La is stored in the tank 21. In addition, ammonia gas Ga resulting from partial vaporization of the liquefied ammonia La is in the upper portion in the tank 21. The liquefied ammonia La may be loaded into the tank 21 through the upper supply line 32 with the opening-closing valve 32v open.

(Gas Replacement from Liquefied Ammonia to Liquefied Carbon Dioxide)

[0027] In the case of liquefied ammonia-to-liquefied carbon dioxide replacement of the liquefied gas loaded into the tank 21, first, the liquefied ammonia La in the tank 21 is discharged to an outboard liquefied ammonia recovery facility or the like. In order to discharge the liquefied ammonia La stored in the tank 21, the opening-closing valve 33v is opened and the liquefied ammonia La is suctioned out of the tank 21 through the lower supply line 33 by, for example, a cargo pump (not illustrated). As a result, the liquefied ammonia La in the tank 21 is discharged to the outboard liquefied ammonia recovery facility or the like through the lower supply line 33.

[0028] After the liquefied ammonia La in the tank 21 is discharged, the ammonia gas Ga remains in the tank 21 as illustrated in Fig. 4.

[0029] Subsequently, as illustrated in Fig. 5, the liquefied carbon dioxide Lc is supplied to the lower portion of the tank 21. In order to supply the liquefied carbon dioxide Lc to the tank 21, the opening-closing valve 33v is opened and the liquefied carbon dioxide Lc is sent into the lower supply line 33 from the outside of the ship. The liquefied carbon dioxide Lc is loaded into the tank 21 from the opening portion 33a. The liquefied carbon dioxide Lc is higher in specific gravity than the ammonia gas Ga in the tank 21. Accordingly, the liquefied carbon dioxide Lc sent into the tank 21 is stored in the lower portion of the tank 21. The ammonia gas Ga is stored above the liquefied ammonia La in the tank 21. In addition, the carbon dioxide gas Gc generated by the liquefied carbon dioxide Lc vaporizing also accumulates in the upper portion of the tank 21. In other words, when the liquefied carbon dioxide Lc is supplied into the tank 21, mixed gas Gm of the ammonia gas Ga and the carbon dioxide gas Gc is stored in the upper portion of the tank 21.

[0030] When the liquefied carbon dioxide Lc is sent into the tank 21 as described above, the opening-closing valve 35v provided on the discharge line 35 is opened. When the liquefied carbon dioxide Lc continues to be supplied to the lower portion of the tank 21, the mixed gas Gm of the ammonia gas Ga and the carbon dioxide gas Gc in the upper portion of the tank 21 is pushed upward in the tank 21 as the amount of the liquefied carbon dioxide Lc in the tank 21 increases. After the push, the mixed gas Gm flows into the upper supply line 32 from the opening portion 32a open in the upper portion in the tank 21. After flowing into the upper supply line 32, the mixed gas Gm is introduced into the water W in the water tank 50 through the discharge line 35.

[0031] Then, ammonia (NH_3) and carbon dioxide (CO_2), which are components contained in the mixed gas Gm, are released into the water W and cause a chemical reaction via the water W (H_2O). Then, solid ammonium carbonate ($(NH_4)_2CO_3$) or ammonium bicarbonate (NH_4HCO_3) is generated as a result of the chemical reaction. The generated ammonium carbonate or ammonium bicarbonate is stored in the water tank 50 in a state of being dissolved in the water W.

[0032] If not the mixed gas Gm but only the ammonia gas Ga is discharged from the upper portion of the tank 21 to the upper supply line 32 in the initial stage in which the liquefied carbon dioxide Lc is sent into the tank 21, the ammonia gas Ga may be recovered, without being sent into the water tank 50, through the upper supply line

32 by an ammonia gas recovery facility or the like provided outside the ship.

[0033] The opening-closing valves 33v and 35v are closed when a predetermined amount of the liquefied carbon dioxide Lc is stored in the tank 21. As a result, the work of replacing the liquefied gas loaded into the tank 21 from the liquefied ammonia La to the liquefied carbon dioxide Lc is completed.

(Gas Replacement from Liquefied Carbon Dioxide to Liquefied Ammonia)

[0034] In the case of liquefied carbon dioxide-to-liquefied ammonia replacement of the liquefied gas loaded into the tank 21, first, the liquefied carbon dioxide Lc in the tank 21 is discharged to an outboard liquefied carbon dioxide recovery facility or the like. In order to discharge the liquefied carbon dioxide Lc stored in the tank 21, the opening-closing valve 33v is opened and the liquefied carbon dioxide Lc is suctioned out of the tank 21 through the lower supply line 33 by, for example, a cargo pump (not illustrated). As a result, the liquefied carbon dioxide Lc in the tank 21 is discharged to the outboard liquefied carbon dioxide recovery facility or the like through the lower supply line 33.

[0035] After the liquefied carbon dioxide Lc in the tank 21 is discharged, the carbon dioxide gas Gc remains in the tank 21 as illustrated in Fig. 6.

[0036] Subsequently, as illustrated in Fig. 7, the liquefied ammonia La is supplied to the lower portion of the tank 21. In order to supply the liquefied ammonia La to the tank 21, the opening-closing valve 33v is opened and the liquefied ammonia La is sent into the lower supply line 33 from the outside of the ship. Then, the liquefied ammonia La is loaded into the tank 21 from the opening portion 33a.

[0037] The liquefied ammonia La is higher in specific gravity than the carbon dioxide gas Gc in the tank 21. Accordingly, the liquefied ammonia La sent into the tank 21 is stored in the lower portion of the tank 21. The carbon dioxide gas Gc is stored above the liquefied carbon dioxide Lc in the tank 21. In addition, the ammonia gas Ga generated by the liquefied ammonia La vaporizing also accumulates in the upper portion of the tank 21. In other words, when the liquefied ammonia La is supplied into the tank 21, the mixed gas Gm of the carbon dioxide gas Gc and the ammonia gas Ga is stored in the upper portion of the tank 21.

[0038] When the liquefied ammonia La is sent into the tank 21 as described above, the opening-closing valve 35v provided on the discharge line 35 is opened. When the liquefied ammonia La continues to be supplied to the lower portion of the tank 21, the mixed gas Gm of the carbon dioxide gas Gc and the ammonia gas Ga in the upper portion of the tank 21 is pushed upward in the tank 21 as the amount of the liquefied ammonia La in the tank 21 increases. After the push, the mixed gas Gm flows into the upper supply line 32 from the opening portion 32a open in the upper portion in the tank 21. After flowing into the upper supply line 32, the mixed gas Gm is introduced into the water W in the water tank 50 through the discharge line 35.

[0039] Then, ammonia (NH_3) and carbon dioxide (CO_2), which are components contained in the mixed gas Gm, are released into the water W and cause a chemical reaction via the water W (H_2O). Then, solid ammonium carbonate ($(NH_4)_2CO_3$) or ammonium bicarbonate (NH_4HCO_3) is generated as a result of the chemical reaction. The generated ammonium carbonate or ammonium bicarbonate is stored in the water tank 50 in a state of being dissolved in the water W.

[0040] If not the mixed gas Gm but only the carbon dioxide gas Gc is discharged from the upper portion of the tank 21 to the upper supply line 32 in the initial stage in which the liquefied ammonia La is sent into the tank 21, the carbon dioxide gas Gc may be recovered as it is by, for example, a carbon dioxide recovery facility provided outside the ship or may be released to the outside of the ship without being sent into the water tank 50.

[0041] The opening-closing valves 33v and 35v are closed when a predetermined amount of the liquefied carbon dioxide Lc is stored in the tank 21. As a result, the liquefied gas loaded into the tank 21 can be replaced from the liquefied carbon dioxide Lc to the liquefied ammonia La.

(Pyrolysis Treatment of Water in Water Tank)

[0042] As described above, the water W in the water tank 50 can be pyrolyzed by operating the heating unit 52. The ammonium carbonate- or ammonium bicarbonate-dissolved water W is heated when the heating unit 52 is operated. When the water W in the water tank 50 is heated to, for example, 58°C or higher, the ammonium carbonate or ammonium bicarbonate is pyrolyzed into ammonia, carbon dioxide, and the water W. These pyrolyzed ammonia and carbon dioxide are discharged to, for example, a treatment facility provided outside the ship through the separated gas discharge line 53 or the like.

(Action and Effect)

[0043] The ship 1 of the above embodiment includes the tank 21 where one of the ammonia gas Ga and the carbon dioxide gas Gc remains (is stored), the lower supply line 33 supplying the other of the liquefied ammonia La and the liquefied carbon dioxide Lc into the tank 21, the discharge line 35 discharging the mixed gas of the ammonia gas Ga or the carbon dioxide gas Gc that remains in the tank 21 and the gas vaporized from the other of the liquefied ammonia La and the liquefied carbon dioxide Lc when the other of the liquefied ammonia La and the liquefied carbon dioxide Lc is supplied from the lower supply line 33, and the water tank 50 into which the mixed gas discharged from the discharge line 35 is introduced.

[0044] In such a configuration, when the other of the liquefied ammonia La and the liquefied carbon dioxide Lc is supplied through the lower supply line 33 into the tank 21 where one of the ammonia gas Ga and the carbon dioxide gas Gc remains, the mixed gas in which ammonia and carbon dioxide are mixed is discharged from the tank 21. This mixed gas is introduced into the water tank 50 through the discharge line 35 and released into the water W. Then, a chemical reaction occurs as a result of ammonia-carbon dioxide-water contact in the tank 21, and ammonium carbonate or ammonium bicarbonate is generated. The ammonium carbonate or ammonium bicarbonate is dissolved in the water W and stored. Accordingly, there is no need to discharge the gas or product discharged from the tank 21 in the event of gas type switch to the outside of the ship. In other words, gas type switch can be performed even in a case where it is difficult to release the gas discharged from the tank 21 into the atmosphere. As a result, it is possible to efficiently switch the type of gas loaded into the tank 21 and gas type switch can be facilitated and expedited.

[0045] The ship 1 of the above embodiment further includes the heating unit 52 heating the water W in the water tank 50 and the separated gas discharge line 53 discharging the gas separated from the water W by the heating unit 52 heating the water W.

[0046] In such a configuration, in the event of gas type switch, the water W in the water tank 50 in which the product of a mixed gas-water chemical reaction is dissolved can be heated by the heating unit 52. Accordingly, the ammonium carbonate or ammonium bicarbonate dissolved in the water W can be pyrolyzed to separate the gas such as carbon dioxide gas and ammonia gas from the water W. The gas separated from the water W in the water tank 50 can be discharged from the separated gas discharge line 53. Accordingly, the gas separated from the water W can be treated at an appropriate timing regardless of, for example, the situation of gas type switch.

(Other Embodiments)

[0047] Although an embodiment of the present disclosure has been described in detail with reference to the drawings, the specific configuration is not limited to this embodiment and also includes, for example, design changes within the gist of the present disclosure.

[0048] Although the water tank 50 is provided with the heating unit 52 in the above embodiment, the heating unit 52 may be provided in an outboard treatment facility or the like. In that case, the water W in the water tank 50 is discharged to the outside of the ship with the component and product contained in the gas discharged from the discharge line 35 dissolved and is treated at the outboard treatment facility or the like.

[0049] Exemplified in the above embodiment is a case where the discharge line 35 is branch-connected to the upper supply line 32. Alternatively, the discharge line 35 may be directly connected to the tank 21 with the upper supply line 32 omitted.

[0050] Described in the above embodiment is a case where the liquefied ammonia La or the liquefied carbon dioxide Lc is supplied into the tank 21 from the lower portion of the tank 21 by the lower supply line 33. Alternatively, the liquefied ammonia La or the liquefied carbon dioxide Lc may be supplied into the tank 21 from, for example, the upper portion or center of the tank 21 instead of the lower portion.

<Additional Notes>

[0051] The ship 1 described in the embodiment is, for example, grasped as follows.

(1) A ship 1 according to a first aspect includes: a hull 2; a tank 21 provided in the hull 2 and storing either ammonia or carbon dioxide; a supply line 33 supplying the other of the ammonia and the carbon dioxide into the tank 21; a discharge line 35 discharging, when the other of the ammonia and the carbon dioxide is supplied into the tank 21 through the supply line 33, a mixed gas in which one of the ammonia and the carbon dioxide stored in the tank 21 and the other of the ammonia and the carbon dioxide supplied into the tank 21 by the supply line 33 are mixed; and a water tank 50 provided in the hull 2 and storing water W, the mixed gas discharged from the discharge line 35 being introduced into the water tank 50.

[0052] As for the ship 1, in a case where the type of gas loaded into the tank 21 is switched, the other of ammonia and carbon dioxide is supplied through the supply line 33 into the tank 21 in which one of ammonia and carbon dioxide is stored. Then, the mixed gas of ammonia and carbon dioxide is discharged from the discharge line 35. The mixed gas discharged from the tank 21 is sent into the water tank 50 through the discharge line 35. As a result of contact between the mixed gas sent into the tank 21 and the water W, ammonium carbonate or ammonium bicarbonate as an example is generated as a product. This product dissolves in the water W by being introduced into the water tank 50.

[0053] In this manner, when the type of gas loaded into the tank 21 is switched, the mixed gas discharged from the tank 21 is allowed to chemically react with the water W and can be stored in the water tank 50. Accordingly, there is no need to discharge the gas or product discharged from the tank 21 in the event of gas type switch to the outside of the ship. In other words, gas type switch can be performed even in a case where it is difficult to release the gas discharged from the tank 21 into the atmosphere. As a result, it is possible to efficiently switch the type of gas loaded into the tank 21 and gas type switch can be facilitated and expedited.

[0054] (2) The ship 1 according to a second aspect, which is the ship 1 of (1), further includes a heating unit 52 heating the water W in the water tank 50; and a separated gas discharge line 53 discharging a gas separated from the water W by the heating unit 52 heating the water W.

[0055] As a result, the water W in the water tank 50 in which the product is dissolved can be heated. Accordingly, the ammonium carbonate or ammonium bicarbonate dissolved in the water W can be pyrolyzed to separate the gas such as carbon dioxide gas and ammonia gas from the water W. In addition, the gas separated from the water W in the water tank 50 can be discharged from the separated gas discharge line 53. Accordingly, the gas separated from the water W can be treated at an appropriate timing regardless of, for example, the situation of switching the type of gas in the tank 21.

Industrial Applicability

[0056] According to the ship of the present disclosure, it is possible to efficiently switch the type of gas loaded into the tank and work can be facilitated and expedited.

Reference Signs List

[0057]

1: ship
2: hull
2a: bow
2b: stern
3A, 3B: side
5: deck
7: upper structure
8: cargo loading section
21: tank
32: upper supply line
32a: opening portion
32v: opening-closing valve
33: supply line
33: lower supply line (supply line)
33a: opening portion
33v: opening-closing valve
35: discharge line
35v: opening-closing valve
50: water tank
52: heating unit
53: separated gas discharge line
Da: ship stern direction
Ga: ammonia gas
Gc: carbon dioxide gas
Gm: mixed gas
La: liquefied ammonia
Lc: liquefied carbon dioxide
W: water

Claims

1. A ship comprising:

a hull;
a tank provided in the hull and storing either ammonia or carbon dioxide;
a supply line supplying the other of the ammonia and the carbon dioxide into the tank;
a discharge line discharging, when the other of the ammonia and the carbon dioxide is supplied into the tank through the supply line, a mixed gas in which one of the ammonia and the carbon dioxide stored in the tank and the other of the ammonia and the carbon dioxide supplied into the tank by the supply line are mixed; and
a water tank provided in the hull and storing water, the mixed gas discharged from the discharge line being introduced into the water tank.

2. The ship according to Claim 1, further comprising:

a heating unit heating the water in the water tank; and
a separated gas discharge line discharging a gas separated from the water by the heating unit heating the water.

FIG. 1

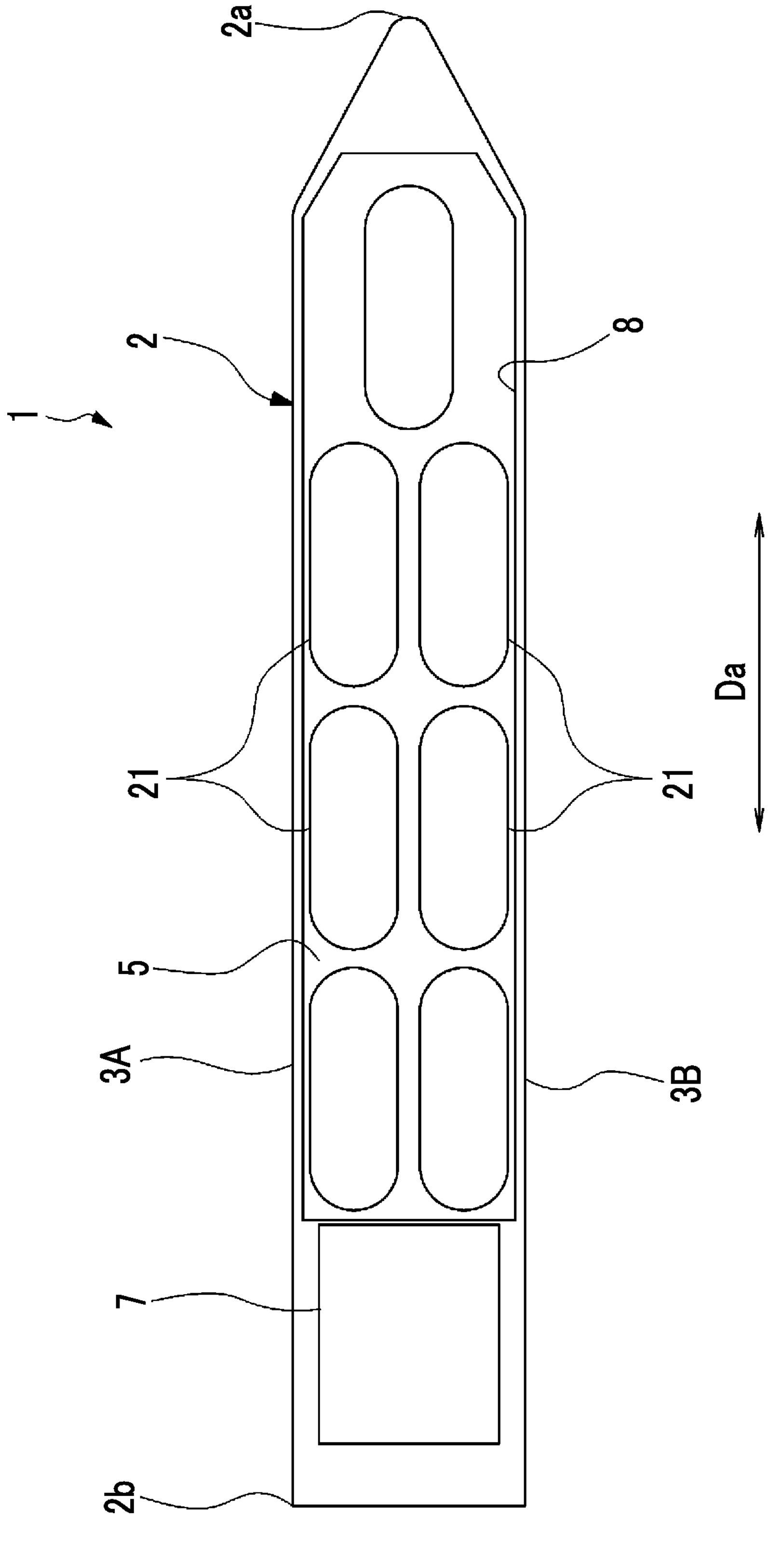


FIG. 2

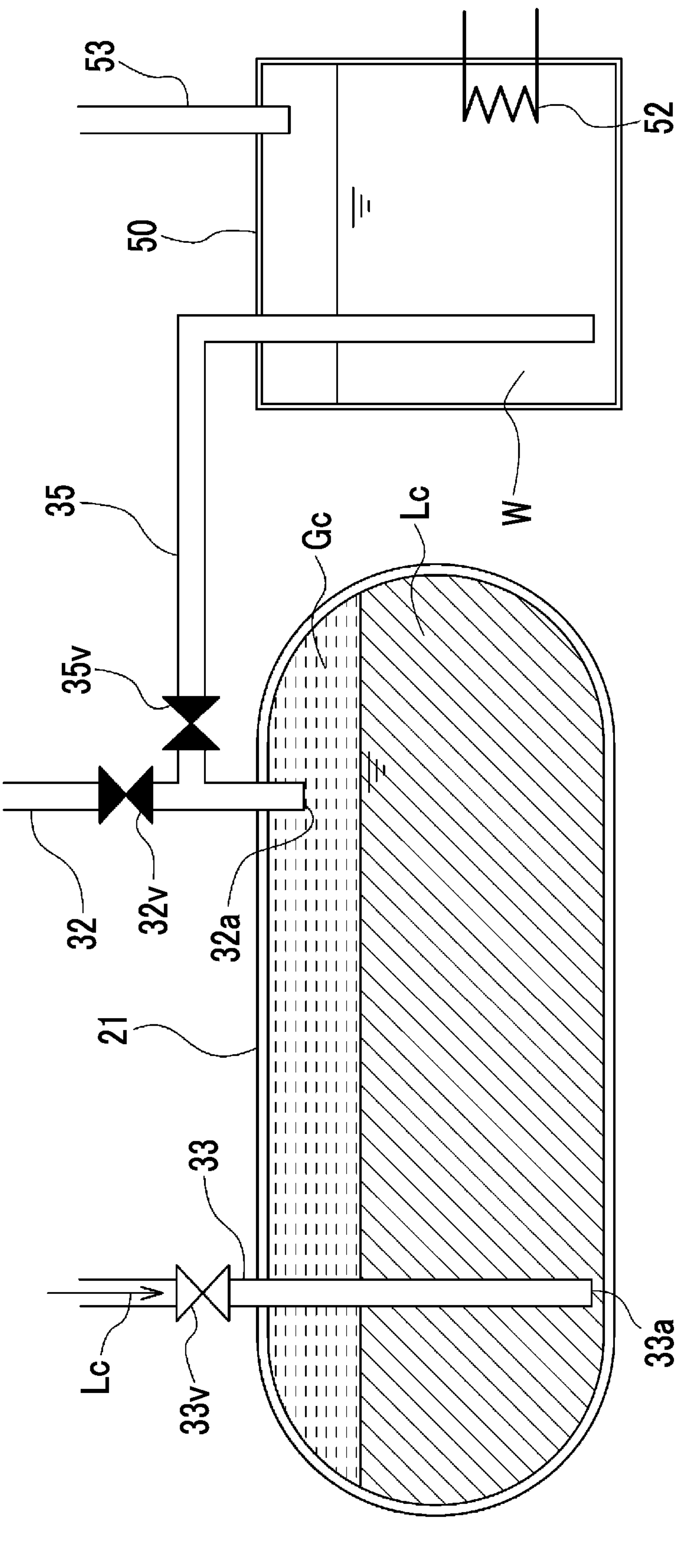


FIG. 3

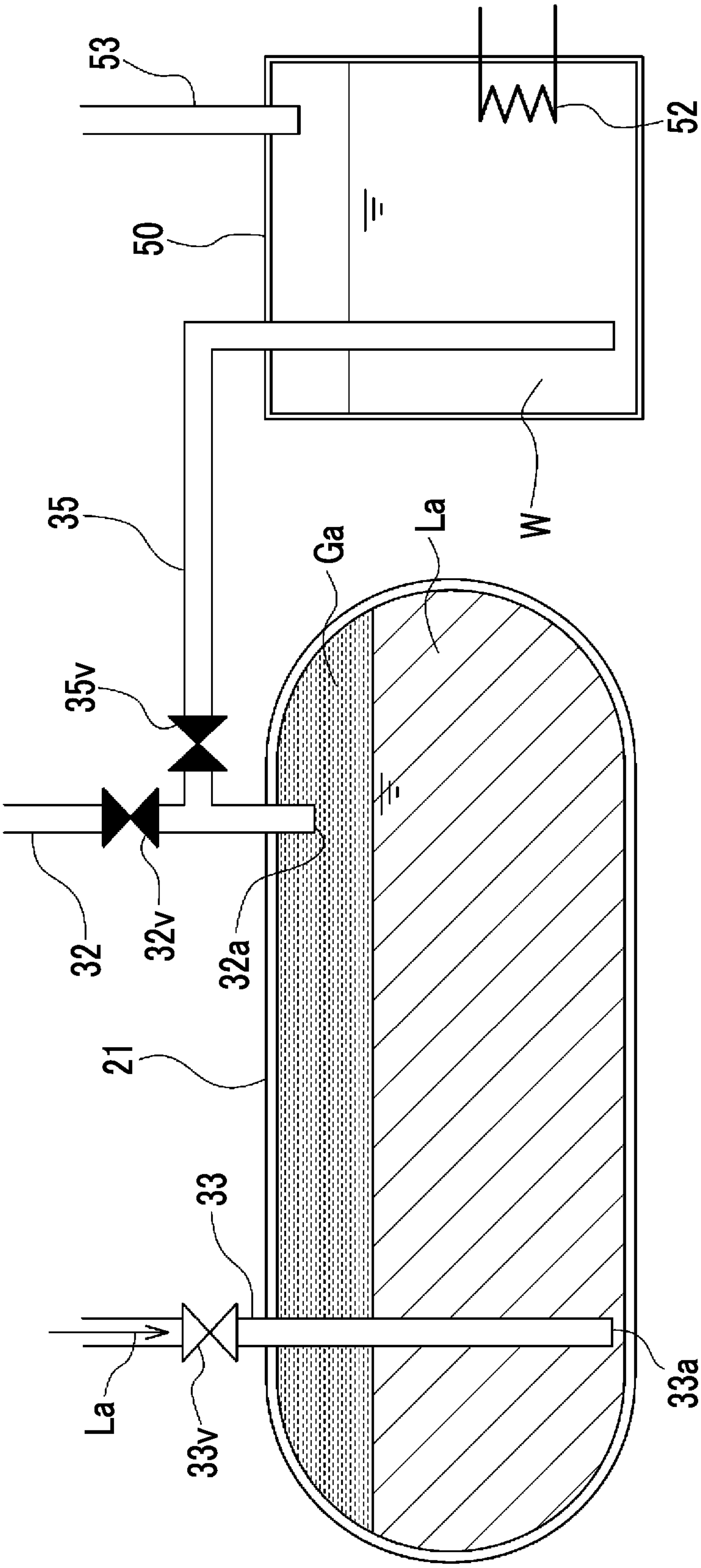


FIG. 4

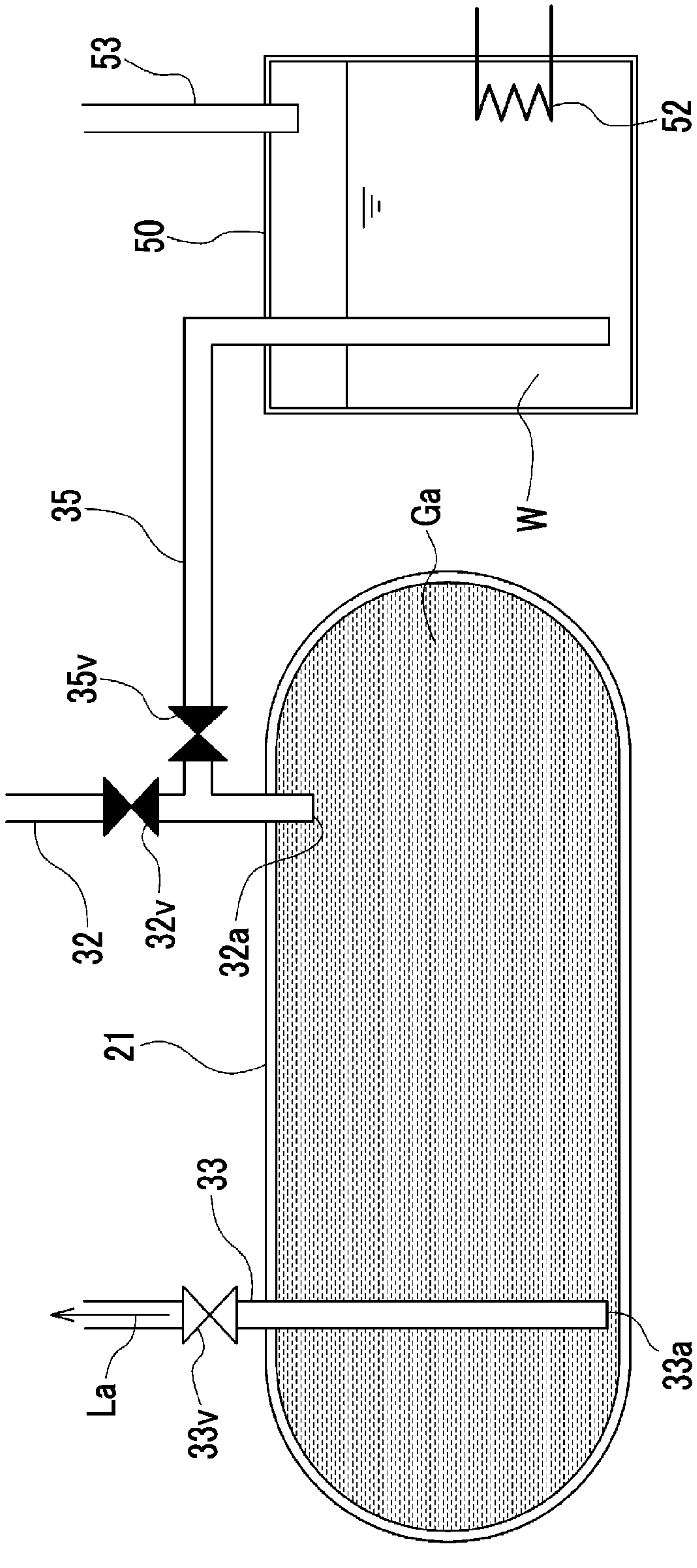


FIG. 5

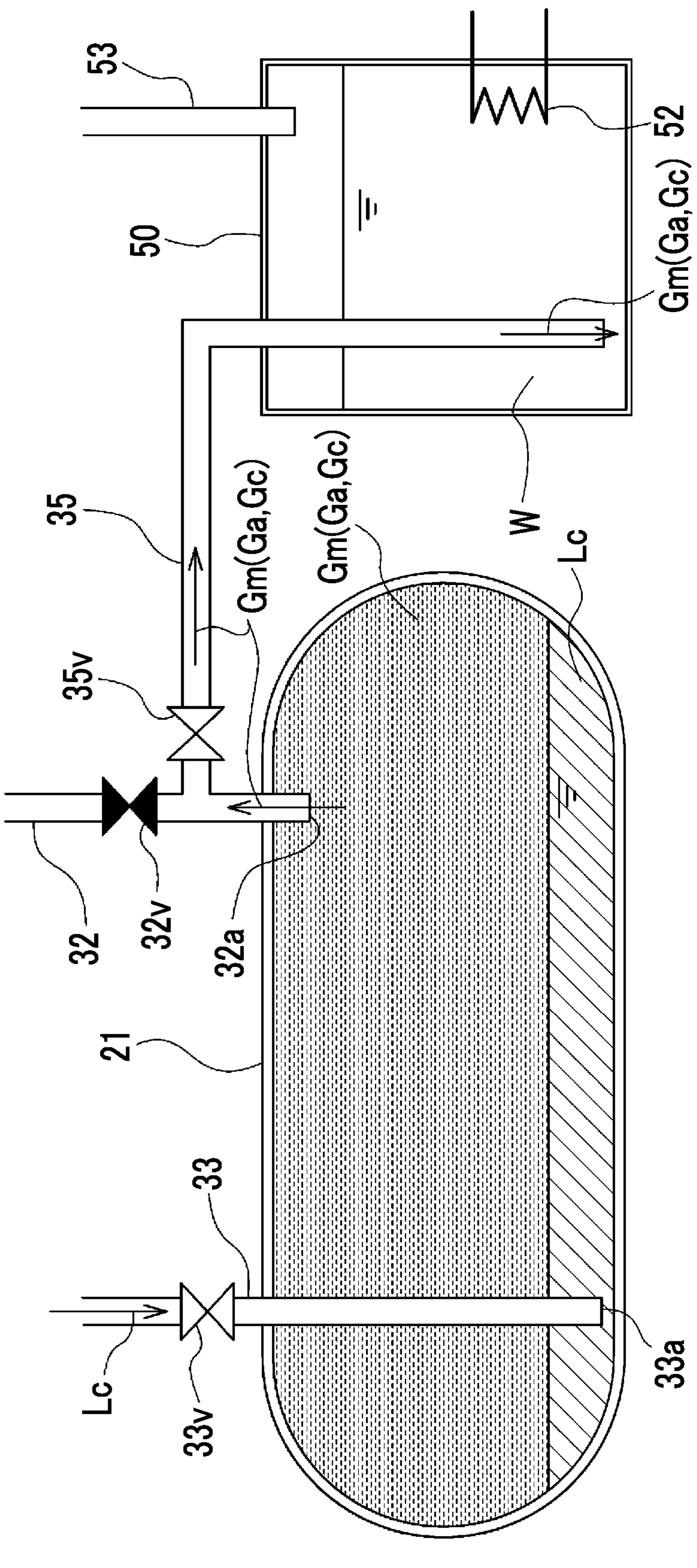

53
50
52
Gm(Ga,Gc)
W
Lc
35
Gm(Ga,Gc)
Gm(Ga,Gc)
35v
32
32v
32a
21
33
33a
Lc
33v

FIG. 6

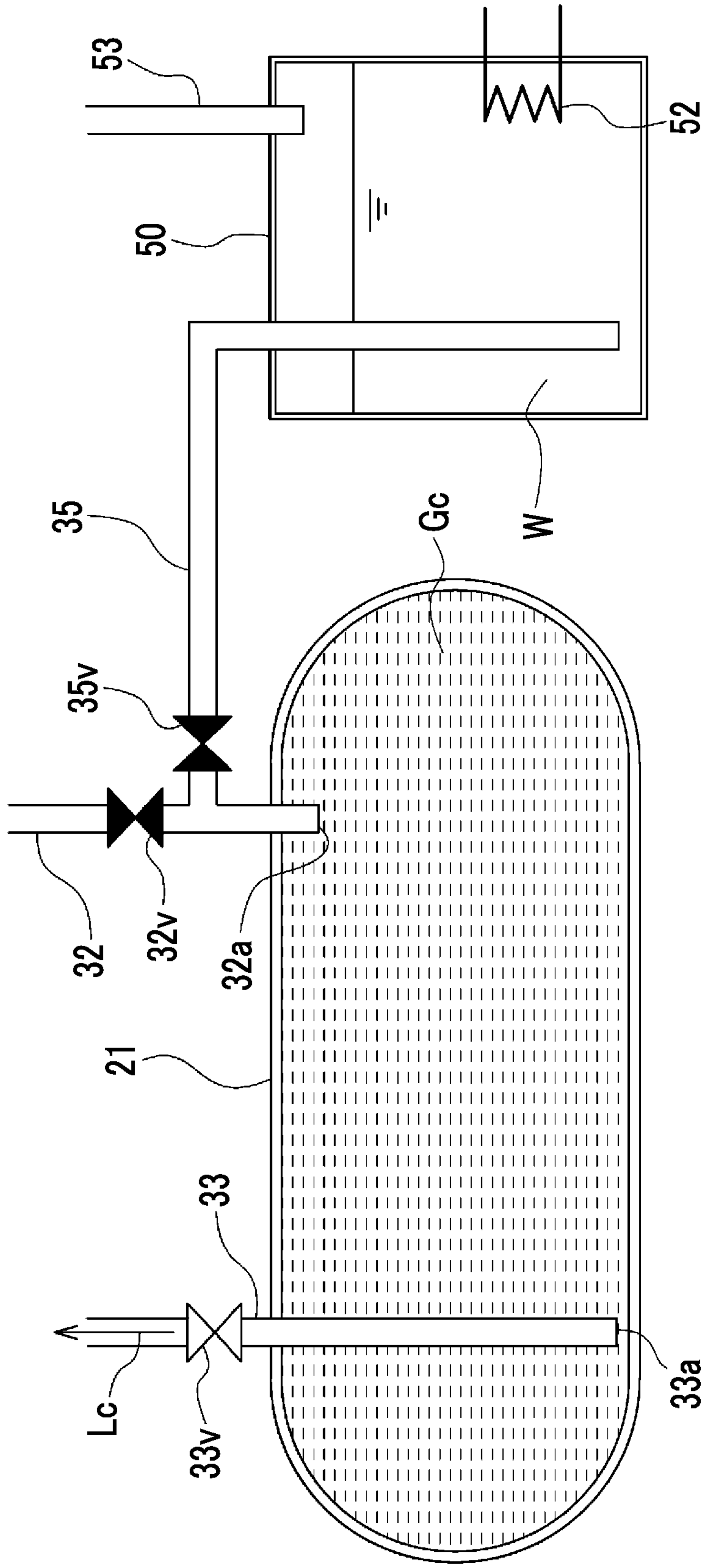
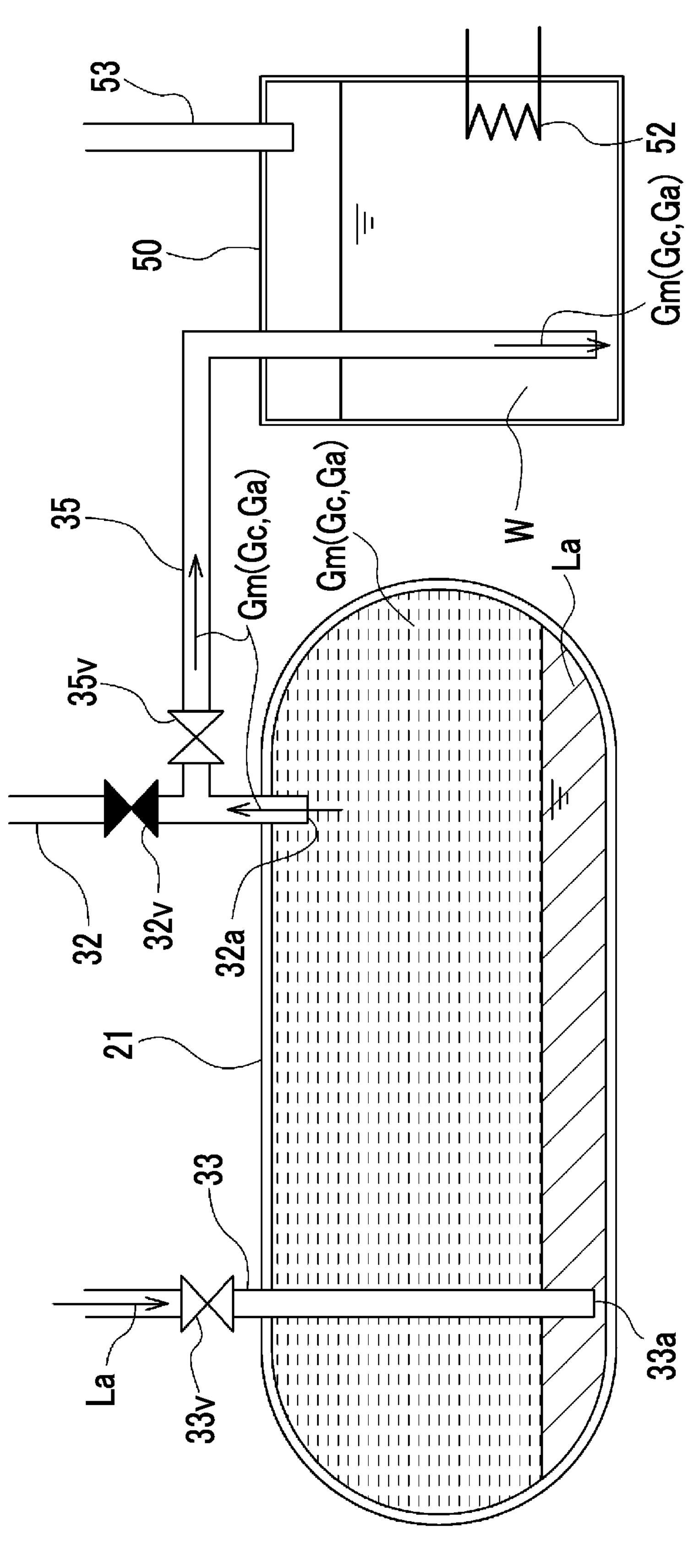


FIG. 7


53
50
52
Gm(Gc,Ga)
W
35
Gm(Gc,Ga)
Gm(Gc,Ga)
La
35v
32
32v
32a
21
33
La
33v
33a

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/033961

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. B63B25/08(2006.01)i, F17C6/00(2006.01)i, F17C13/00(2006.01)i
FI: B63B25/08G, F17C6/00, B63B25/08A, F17C13/00302D

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)
Int.Cl. B63B25/08, F17C6/00, F17C13/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2020
Registered utility model specifications of Japan	1996-2020
Published registered utility model applications of Japan	1994-2020

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2004-125039 A (MITSUBISHI HEAVY INDUSTRIES, LTD.) 22 April 2004 (2004-04-22), entire text, all drawings	1-2
A	JP 8-310482 A (HITACHI ZOSEN CORPORATION) 26 November 1996 (1996-11-26), entire text, all drawings	1-2
A	WO 2008/009930 A2 (NTNU TECHNOLOGY TRANSFER AS) 24 January 2008 (2008-01-24), entire text, all drawings	1-2
A	WO 03/066423 A1 (STATOIL ASA) 14 August 2003 (2003-08-14), entire text, all drawings	1-2
A	JP 2001-32998 A (ISHIKAWAJIMA-HARIMA HEAVY INDUSTRIES CO., LTD.) 06 February 2001 (2001-02-06), entire text, all drawings	1-2

☒ 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
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"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
"&" 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 2020	08 December 2020

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/033961

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	飯嶋正樹, 洲崎誠, 古市裕之, 米川隆仁, 仙波範明, 長安弘貢, CO2を排出しないエネルギー(アンモニア), 三菱重工技報, January 2019, vol. 56, no. 1, ISSN 0387-2432, entire text, all drawings, (IIJIMA, Masaki, SUSAKI, Makoto, FURUICHI, Hiroyuki, YONEKAWA, Takahito, SEMBA, Noriaki, NAGAYASU, Hiromitsu, CO2 free energy (Ammonia), Mitsubishi Heavy Industries Technical Review)	1-2

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2020/033961

JP 2004-125039 A	22 April 2004	(Family: none)
JP 8-310482 A	26 November 1996	(Family: none)
WO 2008/009930 A2	24 January 2008	US 2010/0251763 A1 EP 2041505 A2 NO 20090754 L
WO 03/066423 A1	14 August 2003	AU 2002367607 A1 NO 20015889 L
JP 2001-32998 A	06 February 2001	(Family: none)

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

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- JP 2019228934 A **[0002]**
- JP 2013193653 A **[0004]**