

DESCRIPTION

TITLE OF INVENTION: AMMONIA RECEIVING FACILITY

TECHNICAL FIELD

5 [0001]

The present disclosure relates to an ammonia receiving facility.

Priority is claimed on Japanese Patent Application No. 2024-011503, filed January 30, 2024, the content of which is incorporated herein by reference.

BACKGROUND ART

10 [0002]

For example, Patent Document 1 discloses a liquefied gas storage tank. The liquefied gas storage tank disclosed in Patent Document 1 is a double-shell tank having a storage container and an outer shell that surrounds the storage container. In the liquefied gas storage tank disclosed in Patent Document 1, a space between the storage container and the outer shell is provided with a heat insulating layer. In addition, the space is filled with dry gas.

Citation List

Patent Document

[0003]

20 Patent Document 1: Japanese Unexamined Patent Application, First Publication No. 2021-17920

SUMMARY OF INVENTION

Technical Problem

[0004]

25 In a double-shell tank having an inner tank (for example, the storage container of

Patent Document 1) and an outer tank (for example, the outer shell of Patent Document 1), when a liquefied gas leaks from the inner tank because of some cause, the liquefied gas that has leaked from the inner tank is vaporized in a space between the inner tank and the outer tank. As a result, the internal pressure of the outer tank of the tank rises. In a case
5 where the liquefied gas is liquefied natural gas (LNG) or liquefied petroleum gas (LPG), the vaporized gas can be vented to the atmosphere. However, in a case where the liquefied gas is ammonia liquid, it is necessary to suppress venting of the vaporized gas to the atmosphere because the toxicity of the ammonia gas is strong.

[0005]

10 The present disclosure has been made in view of the above-described circumstances, and an object of the present disclosure is to make it possible to suppress venting of ammonia gas to the atmosphere even when the outer tank pressure of an ammonia tank that stores ammonia liquid has risen to a pressure at which the release of the ammonia gas is required.

15 Solution to Problem

[0006]

As a means for solving the above-described problem, the present disclosure adopts the following configurations.

[0007]

20 A first aspect of the present disclosure is an ammonia receiving facility including an ammonia tank configured to store an ammonia liquid, a gas release section configured to open when the outer tank pressure of the ammonia tank exceeds a predetermined release pressure, and an ammonia absorbing liquid contact section configured to bring a released gas released from the gas release section into contact with an ammonia absorbing liquid
25 having an ammonia absorption property.

Advantageous Effects of Invention

[0008]

According to the present disclosure, in a case where the outer tank pressure of the ammonia tank exceeds the release pressure due to some cause such as leakage of the ammonia liquid, the gas release section opens. The released gas released from the gas release section is capable of coming into contact with the ammonia absorbing liquid by the ammonia absorbing liquid contact section. Therefore, it is possible to absorb the ammonia contained in the released gas in the ammonia absorbing liquid and remove the ammonia contained in the released gas that is vented to the atmosphere from the gas release section. The present disclosure makes it possible to suppress venting of ammonia gas to the atmosphere even when the outer tank pressure of an ammonia tank that stores ammonia liquid has risen to a pressure at which the release of the ammonia gas is required.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

[FIG. 1] A flow diagram showing the schematic configuration of an ammonia receiving facility according to one embodiment of the present disclosure.

[FIG. 2] A schematic flow diagram showing a state in which leakage of ammonia liquid X has not occurred in an ammonia receiving facility according to one embodiment of the present disclosure.

[FIG. 3] A schematic flow diagram showing a state in which leakage of ammonia liquid X has occurred in an ammonia receiving facility according to one embodiment of the present disclosure.

DESCRIPTION OF EMBODIMENTS

[0010]

Hereinafter, one embodiment of an ammonia receiving facility according to the

present disclosure will be described with reference to the drawings.

[0011]

FIG. 1 is a flow diagram showing the schematic configuration of an ammonia receiving facility 1 of the present embodiment. The ammonia receiving facility 1 of the present embodiment is a facility that stores ammonia liquid X. For example, the ammonia liquid X stored in the ammonia receiving facility 1 of the present embodiment is vaporized and supplied to a boiler or the like. As shown in FIG. 1, the ammonia receiving facility 1 of the present embodiment includes an ammonia tank 2, a pressure regulating section 3, a pressure regulating release section 4, a gas release section 5, an ammonia absorbing liquid contact section 6, and a gas detector 7.

[0012]

The ammonia tank 2 is a tank that stores the ammonia liquid X, and is, for example, a flat-bottomed cylindrical ammonia tank. The ammonia tank 2 stores the ammonia liquid X supplied from the outside in a state of being kept at a low temperature. As shown in FIG. 1, the ammonia tank 2 is a double-shell tank including an inner tank 2a and an outer tank 2b. The inner tank 2a is a metal container provided inside the outer tank 2b, and retains the ammonia liquid X inside. The outer tank 2b is a metal or concrete container that surrounds the inner tank 2a from the outside, and is disposed to form a gap between the outer tank 2b and the inner tank 2a.

[0013]

A space K is formed between the inner tank 2a and the outer tank 2b. A heat insulating material (not shown) is disposed in the space K. In addition, the space K is filled with a dry gas such as nitrogen gas. Such an ammonia tank 2 stores the ammonia liquid X inside the inner tank 2a in a low temperature state.

[0014]

The pressure regulating section 3 adjusts the pressure of the space K between the inner tank 2a and the outer tank 2b to a constant range. The pressure regulating section 3 regulates the pressure such that the pressure in the space K falls within a predetermined pressure range, for example, even in a case where the atmospheric pressure fluctuates. As shown in FIG. 1, the pressure regulating section 3 includes a pressure regulating pipe 3a, a breathing tank 3b, and a pressure regulating pipe opening/closing valve 3c.

[0015]

The pressure regulating pipe 3a is a pipe connected to the ammonia tank 2. As shown in FIG. 1, the pressure regulating pipe 3a is connected to the space K between the inner tank 2a and the outer tank 2b. In addition, the pressure regulating pipe 3a is connected to the breathing tank 3b. In this way, the pressure regulating pipe 3a connects the space K of the ammonia tank 2 and the breathing tank 3b. Such a pressure regulating pipe 3a allows the dry gas to flow between the space K of the ammonia tank 2 and the breathing tank 3b.

[0016]

The breathing tank 3b is a cushion tank for absorbing a volume change of the dry gas in the space K of the ammonia tank 2, and is connected to the ammonia tank 2 through the pressure regulating pipe 3a. In a case where the pressure of the space K of the ammonia tank 2 decreases, the breathing tank 3b supplies the dry gas to the space K of the ammonia tank 2 through the pressure regulating pipe 3a. In addition, in a case where the pressure of the space K of the ammonia tank 2 rises, the breathing tank 3b recovers the dry gas from the space K of the ammonia tank 2 through the pressure regulating pipe 3a. As a result, the pressure of the space K of the ammonia tank 2 is maintained within a constant pressure range.

[0017]

The pressure regulating pipe opening/closing valve 3c is an opening/closing valve provided at an intermediate portion of the pressure regulating pipe 3a. The pressure regulating pipe 3a is closed by closing the pressure regulating pipe opening/closing valve 3c, and the pressure regulating pipe 3a is opened by opening the pressure regulating pipe opening/closing valve 3c.

[0018]

The pressure regulating release section 4 opens when the outer tank pressure of the ammonia tank 2 (pressure of the space K) exceeds a preset pressure regulation pressure, and releases the gas inside the space K of the ammonia tank 2. It is noted that the pressure regulation pressure is a pressure set to maintain the pressure of the space K in a normal state, and is set to be lower than a release pressure (a pressure at which the pressure of the space K abnormally rises and gas needs to be released from the space K) described later. For example, when the pressure of the space K rises beyond the pressure regulation range of the space K by the pressure regulating section 3, the pressure regulating release section 4 releases or suctions the dry gas in the space K such that the pressure of the space K is within a set range. As shown in FIG. 1, the pressure regulating release section 4 includes a connection pipe 4a, a connection pipe relief valve 4b, and a connection pipe opening/closing valve 4c.

[0019]

The connection pipe 4a is a pipe that connects the ammonia tank 2 and the atmosphere. The connection pipe 4a is connected to the space K of the ammonia tank 2. In addition, the connection pipe 4a is, for example, open to the atmosphere. The connection pipe 4a guides the dry gas from the space K of the ammonia tank 2 to the atmosphere or guides the gas from the atmosphere to the space K. The opening of the pressure regulating release section 4 is not an opening assuming the leakage of the

ammonia liquid X from the inner tank 2a. Therefore, the gas is released or suctioned between the space K and the atmosphere by the pressure regulating release section 4.

[0020]

The connection pipe relief valve 4b is a relief valve provided at an intermediate portion of the connection pipe 4a. The connection pipe relief valve 4b opens the connection pipe 4a when the pressure of the space K of the ammonia tank 2 exceeds the pressure regulation pressure. In addition, the connection pipe relief valve 4b closes the connection pipe 4a when the pressure of the space K of the ammonia tank 2 does not exceed the pressure regulation pressure.

10 [0021]

The connection pipe opening/closing valve 4c is provided at a downstream position of the connection pipe relief valve 4b, which is an intermediate portion of the connection pipe 4a. The connection pipe opening/closing valve 4c can close the connection pipe 4a as necessary. By closing the connection pipe opening/closing valve 4c, the gas can be stopped from being diffused from the connection pipe 4a to the atmosphere regardless of the pressure of the space K of the ammonia tank 2.

[0022]

The gas release section 5 opens when the outer tank pressure of the ammonia tank 2 (pressure of the space K) exceeds a predetermined release pressure. As shown in FIG. 1, the gas release section 5 includes a vent pipe 5a, a vent valve 5b, and a vent pipe opening/closing valve 5c.

[0023]

The vent pipe 5a is a pipe connected to the space K between the inner tank 2a and the outer tank 2b. The vent pipe 5a releases the released gas G to, for example, the atmosphere. However, the vent pipe 5a may guide the released gas G to the abatement

25

equipment.

[0024]

The vent valve 5b is a relief valve provided at an intermediate portion of the vent pipe 5a. The vent valve 5b opens the vent pipe 5a when the pressure of the space K of the ammonia tank 2 exceeds the release pressure. In addition, the vent valve 5b closes the vent pipe 5a when the pressure of the space K of the ammonia tank 2 does not exceed the release pressure.

[0025]

The vent pipe opening/closing valve 5c is disposed near a downstream end of the vent pipe 5a. That is, the vent pipe opening/closing valve 5c is disposed at a downstream position of the vent valve 5b in the vent pipe 5a. The vent pipe opening/closing valve 5c can close the vent pipe 5a as necessary. By closing the vent pipe opening/closing valve 5c, the released gas G from the vent pipe 5a to the atmosphere can be stopped regardless of the pressure of the space K of the ammonia tank 2.

[0026]

The ammonia absorbing liquid contact section 6 can bring the ammonia absorbing liquid Y capable of absorbing ammonia into contact with the released gas G released from the gas release section 5. As shown in FIG. 1, the ammonia absorbing liquid contact section 6 includes a gas-liquid contact section 6a, an ammonia absorbing liquid supply pipe 6b, an ammonia absorbing liquid opening/closing valve 6c, and an ammonia absorbing liquid discharge pipe 6d.

[0027]

The gas-liquid contact section 6a is installed at an intermediate portion of the vent pipe 5a. In addition, the gas-liquid contact section 6a is provided at a downstream position of the vent valve 5b in the vent pipe 5a. The gas-liquid contact section 6a brings

the ammonia absorbing liquid Y supplied from the ammonia absorbing liquid supply pipe 6b into contact with the released gas G flowing through the vent pipe 5a. In a case where the released gas G contains ammonia gas, the ammonia gas is absorbed by the ammonia absorbing liquid Y by bringing the released gas G into contact with the ammonia absorbing liquid Y. As a result, the ammonia is removed from the released gas G.

[0028]

For example, the gas-liquid contact section 6a has a filler accommodated inside the container. The filler may be formed of, for example, a plurality of ring members irregularly stacked. In addition, the filler may be formed of, for example, a porous body in which a large number of irregular pores are formed. Such a filler increases the contact time between the ammonia absorbing liquid Y and the released gas G and increases the contact area between the ammonia absorbing liquid Y and the released gas G. According to such a gas-liquid contact section 6a, the ammonia absorbing liquid Y and the released gas G can be efficiently brought into contact with each other.

[0029]

In a case where the ammonia absorbing liquid Y and the released gas G are brought into contact with each other in this way, the ammonia can be sent to the abatement equipment or the like by utilizing gravity to cause the ammonia absorbing liquid Y to absorb the ammonia. Therefore, the ammonia can be sent to the abatement equipment by using a thin pipe (ammonia absorbing liquid discharge pipe 6d described later).

[0030]

However, the gas-liquid contact section 6a is not limited to a structure having a filler. For example, the ammonia absorbing liquid Y may be sprayed, and the released gas G may be allowed to pass through the sprayed ammonia absorbing liquid Y. In addition, a retention tank in which the ammonia absorbing liquid Y is temporarily retained

may be provided, and the ammonia absorbing liquid Y may be allowed to pass through the liquid in the retention tank.

[0031]

5 The ammonia absorbing liquid supply pipe 6b is a pipe that connects a supply source of the ammonia absorbing liquid Y and the gas-liquid contact section 6a. The ammonia absorbing liquid supply pipe 6b is connected to the gas-liquid contact section 6a and guides the ammonia absorbing liquid Y to the gas-liquid contact section 6a.

[0032]

10 The ammonia absorbing liquid opening/closing valve 6c is provided at an intermediate portion of the ammonia absorbing liquid supply pipe 6b. Such an ammonia absorbing liquid opening/closing valve 6c can open and close the ammonia absorbing liquid supply pipe 6b. That is, when the ammonia absorbing liquid opening/closing valve 6c is opened, the ammonia absorbing liquid Y flows through the ammonia absorbing liquid supply pipe 6b. In addition, when the ammonia absorbing liquid opening/closing valve 15 6c is closed, the flow of the ammonia absorbing liquid Y through the ammonia absorbing liquid supply pipe 6b can be stopped. In addition, the ammonia absorbing liquid opening/closing valve 6c can adjust the flow rate of the ammonia absorbing liquid Y flowing through the ammonia absorbing liquid supply pipe 6b.

[0033]

20 The ammonia absorbing liquid discharge pipe 6d is a pipe that connects the gas-liquid contact section 6a and the dilution tank Z. The ammonia absorbing liquid discharge pipe 6d guides the ammonia absorbing liquid Y discharged from the gas-liquid contact section 6a to the dilution tank Z. The dilution tank Z dilutes and detoxifies the supplied ammonia absorbing liquid Y.

25 [0034]

Here, for example, the fire-extinguishing water used in the fire extinguishing equipment (not shown) installed in the ammonia receiving facility 1 can be used as the ammonia absorbing liquid Y. The fire-extinguishing water is, for example, water that can be released from a sprinkler or the like, and is pressurized. Therefore, by using the fire-extinguishing water as the ammonia absorbing liquid Y, the ammonia absorbing liquid Y can be supplied to the gas-liquid contact section 6a without using a pump or the like.

[0035]

In addition, the gas-liquid contact section 6a is disposed at a position higher than the dilution tank Z. By disposing the gas-liquid contact section 6a at a position higher than the dilution tank Z, the ammonia absorbing liquid Y can be supplied from the gas-liquid contact section 6a to the dilution tank Z by using the hydraulic head. For example, the gas-liquid contact section 6a may be provided in a ceiling portion of the ammonia tank 2.

[0036]

The gas detector 7 is connected to the ammonia tank 2 and detects the ammonia gas in the space K of the ammonia tank 2. When the ammonia gas is detected, the gas detector 7 notifies, for example, the control room or the like of the detection of the ammonia gas.

[0037]

For example, when the ammonia is detected by the gas detector 7, the pressure regulating pipe opening/closing valve 3c and the connection pipe opening/closing valve 4c are closed. The closing of the pressure regulating pipe opening/closing valve 3c and the connection pipe opening/closing valve 4c is manually performed by, for example, a worker. In addition, a control device that controls the opening and closing of the pressure regulating pipe opening/closing valve 3c and the connection pipe opening/closing valve 4c may be

provided, and the control device may automatically close the pressure regulating pipe opening/closing valve 3c and the connection pipe opening/closing valve 4c based on a detection signal input from the gas detector 7.

[0038]

5 Subsequently, an operation of the ammonia receiving facility 1 of the present embodiment will be described with reference to FIGS. 2 and 3.

[0039]

FIG. 2 is a schematic flow diagram showing a state in which the leakage of the ammonia liquid X does not occur in the ammonia tank 2. In a state in which the leakage
10 of the ammonia liquid X does not occur between the inner tank 2a and the outer tank 2b, the ammonia is not detected by the gas detector 7. Therefore, the pressure regulating pipe opening/closing valve 3c and the connection pipe opening/closing valve 4c are held in an open state. In addition, the vent pipe opening/closing valve 5c is also held in an open state.

15 [0040]

In addition, in a state in which the leakage of the ammonia liquid X does not occur between the inner tank 2a and the outer tank 2b, the ammonia absorbing liquid opening/closing valve 6c of the ammonia absorbing liquid contact section 6 is closed. Therefore, the ammonia absorbing liquid Y is not supplied to the gas-liquid contact section
20 6a. That is, in a state in which the leakage of the ammonia liquid X does not occur, the supply of the ammonia absorbing liquid Y to the gas-liquid contact section 6a is stopped as shown in FIG. 2.

[0041]

In a state in which the leakage of the ammonia liquid X does not occur, the dry
25 gas flows through the pressure regulating pipe 3a between the space K of the ammonia

tank 2 and the breathing tank 3b, and the pressure of the space K is adjusted to a certain range lower than the pressure regulation pressure. At this time, the pressure of the space K does not exceed the release pressure set to be higher than the pressure regulation pressure. Therefore, the vent pipe 5a is in a closed state. Therefore, as shown in FIG. 2, the supply
5 of the released gas G to the gas-liquid contact section 6a is stopped.

[0042]

In addition, in a state in which the leakage of the ammonia liquid X does not occur, when the pressure of the space K exceeds the pressure regulation pressure, the connection pipe relief valve 4b is opened, and the dry gas is vented to the atmosphere through the
10 connection pipe 4a. As a result, it is possible to suppress the pressure rise in the space K.

[0043]

It is noted that in a state in which the leakage of the ammonia liquid X does not occur, when the pressure of the space K further rises to exceed the pressure regulation pressure and exceeds the release pressure, the vent valve 5b is opened, and the dry gas is
15 discharged from the space K as the released gas G through the vent pipe 5a. At this time, since the leakage of the ammonia liquid X does not occur, the released gas G does not contain ammonia. In a state in which the leakage of the ammonia liquid X does not occur, the released gas G released through the vent pipe 5a is vented to the atmosphere through the gas-liquid contact section 6a. However, in a state in which the leakage of the
20 ammonia liquid X does not occur, the ammonia absorbing liquid Y is not supplied to the gas-liquid contact section 6a. Therefore, the released gas G is vented to the atmosphere without coming into contact with the ammonia absorbing liquid Y.

[0044]

FIG. 3 is a schematic flow diagram showing a state in which the leakage of the
25 ammonia liquid X occurs in the ammonia tank 2. In a state in which the leakage of the

ammonia liquid X occurs between the inner tank 2a and the outer tank 2b, the ammonia is detected by the gas detector 7. Therefore, the pressure regulating pipe opening/closing valve 3c and the connection pipe opening/closing valve 4c are held in a closed state. In addition, the vent pipe opening/closing valve 5c is held in an open state.

5 [0045]

In addition, in a state in which the leakage of the ammonia liquid X occurs, the ammonia absorbing liquid opening/closing valve 6c of the ammonia absorbing liquid contact section 6 is opened. Therefore, the ammonia absorbing liquid Y is supplied to the gas-liquid contact section 6a through the ammonia absorbing liquid supply pipe 6b. That is, in a state in which the leakage of the ammonia liquid X occurs, the ammonia absorbing liquid Y is supplied to the gas-liquid contact section 6a as shown in FIG. 3.

[0046]

In a state in which the leakage of the ammonia liquid X occurs, the dry gas does not flow through the pressure regulating pipe 3a between the space K of the ammonia tank 2 and the breathing tank 3b. Therefore, the inflow of the ammonia gas into the breathing tank 3b through the pressure regulating pipe 3a is prevented. In a case where the leakage of the ammonia liquid X continues, the pressure of the space K rises and exceeds the pressure regulation pressure. However, since the connection pipe opening/closing valve 4c is closed in advance, the ammonia gas is not vented to the atmosphere through the pressure regulating release section 4.

[0047]

Furthermore, when the leakage of the ammonia liquid X continues, the pressure of the space K further rises and exceeds the release pressure. In a case where the pressure of the space K further rises to exceed the pressure regulation pressure and exceeds the release pressure, the vent valve 5b is opened, and the released gas G containing the

ammonia gas is discharged from the space K. In a state in which the leakage of the ammonia liquid X occurs, the released gas G released through the vent pipe 5a is vented to the atmosphere through the gas-liquid contact section 6a. In a state in which the leakage of the ammonia liquid X occurs, since the ammonia absorbing liquid Y is supplied
5 to the gas-liquid contact section 6a, the released gas G comes into contact with the ammonia absorbing liquid Y, the ammonia is absorbed, and then the released gas G is vented to the atmosphere.

[0048]

The ammonia absorbing liquid Y that has absorbed the ammonia is supplied from
10 the gas-liquid contact section 6a to the dilution tank Z through the ammonia absorbing liquid discharge pipe 6d. The ammonia absorbing liquid Y supplied to the dilution tank Z is diluted such that the ammonia concentration is equal to or less than a specified value.

[0049]

The ammonia receiving facility 1 of the present embodiment as described above
15 includes the ammonia tank 2 that stores the ammonia liquid X. In addition, the ammonia receiving facility 1 of the present embodiment includes the gas release section 5 and the ammonia absorbing liquid contact section 6. The gas release section 5 opens when the outer tank pressure of the ammonia tank 2 exceeds a predetermined release pressure. In the ammonia absorbing liquid contact section 6, the ammonia absorbing liquid Y capable
20 of absorbing the ammonia can come into contact with the released gas G released from the gas release section 5.

[0050]

In the ammonia receiving facility 1 of the present embodiment, the gas release section 5 is opened when the outer tank pressure of the ammonia tank 2 exceeds the release
25 pressure due to some cause such as the leakage of the ammonia liquid X or the like. The

released gas G released from the gas release section 5 can come into contact with the ammonia absorbing liquid Y in the ammonia absorbing liquid contact section 6. Therefore, the ammonia contained in the released gas G is absorbed by the ammonia absorbing liquid Y, and the ammonia contained in the released gas G vented to the atmosphere from the gas release section 5 is removed. Therefore, the ammonia receiving facility 1 of the present embodiment can suppress the venting of the ammonia gas to the atmosphere even when the outer tank pressure of the ammonia tank 2 that stores the ammonia liquid X rises to a pressure at which the release of the ammonia gas is required.

[0051]

10 In addition, in the ammonia receiving facility 1 of the present embodiment, the ammonia tank 2 is a double-shell tank having the inner tank 2a in which the ammonia liquid X is retained and the outer tank 2b that surrounds the inner tank 2a from the outside. In addition, the outer tank pressure of the ammonia tank 2 is a pressure in the space K between the inner tank 2a and the outer tank 2b. It is noted that the outer tank pressure

15 here is a pressure in a case where the inner tank 2a is damaged.

[0052]

Such an ammonia receiving facility 1 of the present embodiment can suppress the venting of the ammonia gas contained in the released gas G released from the gas release section 5 to the atmosphere even when the ammonia liquid X leaks between the inner tank

20 2a and the outer tank 2b.

[0053]

In addition, in the ammonia receiving facility 1 of the present embodiment, the gas release section 5 includes a vent pipe 5a and a vent valve 5b. The vent pipe 5a is connected to the space K between the inner tank 2a and the outer tank 2b. The vent valve

25 5b is provided at an intermediate portion of the vent pipe 5a and opens when the outer tank

pressure exceeds the release pressure.

[0054]

In such an ammonia receiving facility 1 of the present embodiment, when the ammonia liquid X leaks into the space K between the inner tank 2a and the outer tank 2b, the ammonia liquid X is vaporized, and thus the pressure in the space K rises. In addition, when the pressure in the space K exceeds the preset release pressure, the vent valve 5b is opened, and the released gas G is released through the vent pipe 5a. Therefore, the ammonia receiving facility 1 of the present embodiment can automatically release the released gas G to the outside of the ammonia tank 2 when the ammonia liquid X leaks.

[0055]

In addition, in the ammonia receiving facility 1 of the present embodiment, the ammonia absorbing liquid contact section 6 includes a gas-liquid contact section 6a, an ammonia absorbing liquid supply pipe 6b, and an ammonia absorbing liquid opening/closing valve 6c. The gas-liquid contact section 6a is provided at a downstream position with respect to the vent valve 5b of the vent pipe 5a, and brings the ammonia absorbing liquid Y into contact with the released gas G. The ammonia absorbing liquid supply pipe 6b is connected to the gas-liquid contact section 6a and guides the ammonia absorbing liquid Y to the gas-liquid contact section 6a. The ammonia absorbing liquid opening/closing valve 6c is provided at an intermediate portion of the ammonia absorbing liquid supply pipe 6b.

[0056]

In such an ammonia receiving facility 1 of the present embodiment, the ammonia absorbing liquid Y can be supplied to the gas-liquid contact section 6a by opening the ammonia absorbing liquid opening/closing valve 6c. In addition, the supply of the ammonia absorbing liquid Y to the gas-liquid contact section 6a can be stopped by closing

the ammonia absorbing liquid opening/closing valve 6c. That is, the ammonia receiving facility 1 of the present embodiment can switch between the supply and the stop of the ammonia absorbing liquid Y to the gas-liquid contact section 6a. Therefore, the ammonia receiving facility 1 of the present embodiment can cause the ammonia absorbing liquid Y to flow to the gas-liquid contact section 6a only when the leakage of the ammonia liquid X occurs, and can prevent the ammonia absorbing liquid Y from being wasted.

[0057]

In addition, in the ammonia receiving facility 1 of the present embodiment, the ammonia absorbing liquid contact section 6 includes an ammonia absorbing liquid discharge pipe 6d that connects the gas-liquid contact section 6a and the dilution tank Z. In such an ammonia receiving facility 1 of the present embodiment, the ammonia absorbing liquid Y that has absorbed the ammonia from the released gas G can be guided to the dilution tank Z.

[0058]

In addition, the ammonia receiving facility 1 of the present embodiment includes a gas detector 7 that detects the ammonia gas in the space K between the inner tank 2a and the outer tank 2b. According to the ammonia receiving facility 1 of the present embodiment, it is possible to identify the leakage of the ammonia liquid X from the occurrence of the leakage in a short period of time. For example, it takes time for the pressure of the space K to rise to the release pressure after the leakage of the ammonia liquid X occurs. Therefore, by detecting the ammonia gas with the gas detector 7, it is possible to perform the valve closing operation or the like of the pressure regulating pipe opening/closing valve 3c or the connection pipe opening/closing valve 4c with a margin until the released gas G is released.

[0059]

In addition, the ammonia receiving facility 1 of the present embodiment includes a pressure regulating section 3 that adjusts the pressure of the space K between the inner tank 2a and the outer tank 2b. In addition, the pressure regulating section 3 includes a pressure regulating pipe 3a, a breathing tank 3b, and a pressure regulating pipe opening/closing valve 3c. The pressure regulating pipe 3a is connected to the space K between the inner tank 2a and the outer tank 2b. The breathing tank 3b is connected to the ammonia tank 2 through the pressure regulating pipe 3a. The pressure regulating pipe opening/closing valve 3c is provided at an intermediate portion of the pressure regulating pipe 3a.

10 [0060]

According to the ammonia receiving facility 1 of the present embodiment, it is possible to keep the pressure of the space K between the inner tank 2a and the outer tank 2b constant. In addition, the pressure regulating pipe 3a is provided with the pressure regulating pipe opening/closing valve 3c. Therefore, even when the ammonia liquid X leaks into the space K, it is possible to prevent the ammonia gas from flowing into the breathing tank 3b by closing the pressure regulating pipe opening/closing valve 3c.

[0061]

In addition, the ammonia receiving facility 1 of the present embodiment includes a pressure regulating release section 4 that opens when the pressure exceeds a pressure regulation pressure set to be lower than the release pressure. In addition, the pressure regulating release section 4 includes a connection pipe 4a and a connection pipe opening/closing valve 4c. The connection pipe 4a is connected to the space K between the inner tank 2a and the outer tank 2b. The connection pipe opening/closing valve 4c is provided at an intermediate portion of the connection pipe 4a.

25 [0062]

According to the ammonia receiving facility 1 of the present embodiment, even in a case where the ammonia liquid does not leak, when the pressure of the space K rises above the pressure regulation pressure, it is possible to discharge the dry gas in the space K to reduce the pressure of the space K. In addition, the connection pipe 4a is provided with the connection pipe opening/closing valve 4c. Therefore, even when the ammonia liquid X leaks into the space K, it is possible to prevent the ammonia gas from being released to the atmosphere through the connection pipe 4a by closing the connection pipe opening/closing valve 4c.

[0063]

Although preferred embodiments of the present disclosure have been described with reference to the accompanying drawings, the present disclosure is not limited to the above-described embodiments. The various shapes, combinations, and the like of each constituent member shown in the above-described embodiment are merely examples, and can be variously changed based on design requirements and the like within the scope of the present disclosure defined by the claims.

[0064]

It is noted that the embodiments described above can also be described as, for example, the following supplementary notes.

[0065]

(Supplementary Note 1)

An ammonia receiving facility including:

an ammonia tank configured to store an ammonia liquid;

a gas release section configured to open when an outer tank pressure of the ammonia tank exceeds a predetermined release pressure; and

an ammonia absorbing liquid contact section configured to bring a released gas

released from the gas release section into contact with an ammonia absorbing liquid having an ammonia absorption property.

[0066]

(Supplementary Note 2)

5 The ammonia receiving facility according to Supplementary Note 1,
 wherein the ammonia tank is a double-shell tank having an inner tank in which
 the ammonia liquid is stored and an outer tank that surrounds the inner tank from outside,
 and

 the outer tank pressure of the ammonia tank is a pressure in a space between the
10 inner tank and the outer tank.

[0067]

(Supplementary Note 3)

 The ammonia receiving facility according to Supplementary Note 2,
 wherein the gas release section includes
15 a vent pipe connected to the space between the inner tank and the outer tank, and
 a vent valve provided at an intermediate portion of the vent pipe and configured
 to open when the outer tank pressure exceeds the release pressure.

[0068]

(Supplementary Note 4)

20 The ammonia receiving facility according to Supplementary Note 3,
 wherein the ammonia absorbing liquid contact section includes
 a gas-liquid contact section provided at a position downstream of the vent valve
 in the vent pipe, and configured to bring the ammonia absorbing liquid into contact with
 the released gas,

25 an ammonia absorbing liquid supply pipe connected to the gas-liquid contact

section and configured to guide the ammonia absorbing liquid to the gas-liquid contact section, and

an ammonia absorbing liquid opening/closing valve provided at an intermediate portion of the ammonia absorbing liquid supply pipe.

5 [0069]

(Supplementary Note 5)

The ammonia receiving facility according to Supplementary Note 4,

wherein the ammonia absorbing liquid contact section includes an ammonia absorbing liquid discharge pipe connecting the gas-liquid contact section and a dilution

10 tank.

[0070]

(Supplementary Note 6)

The ammonia receiving facility according to any one of Supplementary Notes 2 to 5, further including:

15 a gas detector configured to detect an ammonia gas in the space between the inner tank and the outer tank.

[0071]

(Supplementary Note 7)

20 The ammonia receiving facility according to Supplementary Note 6, further including:

a pressure regulating section configured to regulate the pressure in the space between the inner tank and the outer tank,

wherein the pressure regulating section includes

25 a pressure regulating pipe connected to the space between the inner tank and the outer tank,

a breathing tank connected to the ammonia tank through the pressure regulating pipe, and

a pressure regulating pipe opening/closing valve provided at an intermediate portion of the pressure regulating pipe.

5 [0072]

(Supplementary Note 8)

The ammonia receiving facility according to Supplementary Note 6, further including:

a pressure regulating release section configured to open when a pressure
10 regulation pressure set lower than the release pressure is exceeded,

wherein the pressure regulating release section includes

a connection pipe connected to the space between the inner tank and the outer tank, and

a connection pipe opening/closing valve provided at an intermediate portion of the connection pipe.

15 INDUSTRIAL APPLICABILITY

[0073]

It is possible to provide an ammonia receiving facility capable of suppressing the release of an ammonia gas into the atmosphere even in a case where an outer tank pressure of an ammonia tank that stores an ammonia liquid rises to a pressure at which the release
20 of the ammonia gas is required.

REFERENCE SIGNS LIST

[0074]

1 Ammonia receiving facility

2 Ammonia tank

25 2a Inner tank

	2b Outer tank
	3 Pressure regulating section
	3a Pressure regulating pipe
	3b Breathing tank
5	3c Pressure regulating pipe opening/closing valve
	4 Pressure regulating release section
	4a Connection pipe
	4b Connection pipe relief valve
	4c Connection pipe opening/closing valve
10	5 Gas release section
	5a Vent pipe
	5b Vent valve
	5c Vent pipe opening/closing valve
	6 Ammonia absorbing liquid contact section
15	6a Gas-liquid contact section
	6b Ammonia absorbing liquid supply pipe
	6c Ammonia absorbing liquid opening/closing valve
	6d Ammonia absorbing liquid discharge pipe
	7 Gas detector
20	G Released gas
	K Space
	X Ammonia liquid
	Y Ammonia absorbing liquid
	Z Dilution tank

CLAIMS

[Claim 1] An ammonia receiving facility comprising:

an ammonia tank configured to store an ammonia liquid;

5 a gas release section configured to open when an outer tank pressure of the ammonia tank exceeds a predetermined release pressure; and

an ammonia absorbing liquid contact section configured to bring a released gas released from the gas release section into contact with an ammonia absorbing liquid having an ammonia absorption property.

[Claim 2] The ammonia receiving facility according to Claim 1,

10 wherein the ammonia tank is a double-shell tank having an inner tank in which the ammonia liquid is stored and an outer tank that surrounds the inner tank from outside, and

the outer tank pressure of the ammonia tank is a pressure in a space between the inner tank and the outer tank.

15 [Claim 3] The ammonia receiving facility according to Claim 2,

wherein the gas release section includes

a vent pipe connected to the space between the inner tank and the outer tank, and

a vent valve provided at an intermediate portion of the vent pipe and configured to open when the outer tank pressure exceeds the release pressure.

20 [Claim 4] The ammonia receiving facility according to Claim 3,

wherein the ammonia absorbing liquid contact section includes

a gas-liquid contact section provided at a position downstream of the vent valve in the vent pipe, and configured to bring the ammonia absorbing liquid into contact with the released gas,

25 an ammonia absorbing liquid supply pipe connected to the gas-liquid contact

section and configured to guide the ammonia absorbing liquid to the gas-liquid contact section, and

an ammonia absorbing liquid opening/closing valve provided at an intermediate portion of the ammonia absorbing liquid supply pipe.

5 [Claim 5] The ammonia receiving facility according to Claim 4,

wherein the ammonia absorbing liquid contact section includes an ammonia absorbing liquid discharge pipe connecting the gas-liquid contact section and a dilution tank.

[Claim 6] The ammonia receiving facility according to any one of Claims 2 to 5, further

10 comprising:

a gas detector configured to detect an ammonia gas in the space between the inner tank and the outer tank.

[Claim 7] The ammonia receiving facility according to Claim 6, further comprising:

a pressure regulating section configured to regulate the pressure in the space
15 between the inner tank and the outer tank,

wherein the pressure regulating section includes

a pressure regulating pipe connected to the space between the inner tank and the
outer tank,

a breathing tank connected to the ammonia tank through the pressure regulating
20 pipe, and

a pressure regulating pipe opening/closing valve provided at an intermediate portion of the pressure regulating pipe.

[Claim 8] The ammonia receiving facility according to Claim 6, further comprising:

a pressure regulating release section configured to open when a pressure
25 regulation pressure set lower than the release pressure is exceeded,

wherein the pressure regulating release section includes

a connection pipe connected to the space between the inner tank and the outer tank, and

a connection pipe opening/closing valve provided at an intermediate portion of
5 the connection pipe.

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