

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. 2024-006133, filed January 18, 2024, the content of which is incorporated herein by reference.

BACKGROUND ART

10 [0002]

For example, Patent Document 1 discloses a flare stack. The flare stack disclosed in Patent Document 1 is provided with an ignition torch at an upper portion.

The ignition torch forms a flame by burning a fuel supplied from the outside. A gas to be treated is burned by being supplied to the flame formed by the ignition torch.

15 Citation List

Patent Document

[0003]

Patent Document 1: Japanese Unexamined Patent Application, First Publication No. 2001-289425

20 SUMMARY OF INVENTION

Technical Problem

[0004]

A flare stack as disclosed in Patent Document 1 is provided in a receiving facility that vaporizes liquefied natural gas (LNG) or liquefied petroleum gas (LPG) and
25 supplies the vaporized gas to a boiler or the like. Such a receiving facility uses a flare

stack to burn an excess gas generated in the receiving facility. Even in a receiving facility that handles ammonia instead of LNG or LPG, excess ammonia gas is burned in the flare stack. However, ammonia gas is less flammable compared to fossil fuels.

Therefore, in the flare stack, it is necessary to use fossil fuels as an assist gas that assists

5 the combustion of the ammonia gas or as a fuel for a pilot burner such as an ignition torch of the flare stack of Patent Document 1. However, in order to meet the social demand for decarbonization, it is preferable to suppress the use of fossil fuels in a flare stack.

[0005]

10 The present disclosure has been made in view of the above-described problems, and an object of the present disclosure is to suppress the use of fossil fuels in a flare stack in an ammonia receiving facility in which an excess gas is burned in the flare stack.

Solution to Problem

[0006]

15 The present disclosure adopts the following configurations to solve the above problems.

[0007]

A first aspect of the present disclosure is an ammonia receiving facility that vaporizes liquid ammonia and delivers vaporized ammonia to a supply destination as
20 ammonia gas, the ammonia receiving facility including a hydrogen gas generation portion that cracks a portion of the ammonia gas to be delivered to the supply destination to generate hydrogen gas, and a hydrogen gas supply portion that supplies the hydrogen gas generated by the hydrogen gas generation portion to a flare stack.

Advantageous Effects of Invention

25 [0008]

According to the present disclosure, the hydrogen gas can be generated by cracking the ammonia gas, and the generated hydrogen gas can be supplied to the flare stack. That is, according to the present disclosure, the combustion in the flare stack can be maintained by supplying the hydrogen gas to the flare stack instead of fossil fuels.

- 5 Therefore, it is possible to reduce or eliminate the use of fossil fuels in the flare stack. In such a present disclosure, in the ammonia receiving facility in which the excess gas is burned in the flare stack, the use of fossil fuels in the flare stack can be suppressed.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

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

[FIG. 2] A flow diagram showing a schematic configuration of an ammonia receiving facility according to a second embodiment of the present disclosure.

- [FIG. 3] A flow diagram showing a schematic configuration of an ammonia
15 receiving facility according to a third embodiment of the present disclosure.

DESCRIPTION OF EMBODIMENTS

[0010]

Hereinafter, embodiments of an ammonia receiving facility according to the present disclosure will be described with reference to the drawings.

- 20 [0011]

(First Embodiment)

- FIG. 1 is a flow diagram showing a schematic configuration of an ammonia receiving facility 1 of the present embodiment. The ammonia receiving facility 1 of the present embodiment stores liquid ammonia X. In addition, the ammonia receiving
25 facility 1 of the present embodiment vaporizes the stored liquid ammonia X to produce

ammonia gas Y. In addition, the ammonia receiving facility 1 of the present embodiment supplies a required amount of the ammonia gas Y to a boiler B (supply destination). The supply destination of the ammonia gas Y of the ammonia receiving facility 1 is not limited to the boiler B.

5 [0012]

As shown in FIG. 1, the ammonia receiving facility 1 of the present embodiment includes an ammonia tank 2, an ammonia gas delivery portion 3, a boil-off gas supply portion 4, a boil-off gas recovery facility 5, an excess gas discharge portion 6, a hydrogen gas generation portion 7, and a hydrogen gas supply portion 8.

10 [0013]

The ammonia tank 2 is a tank that stores the liquid ammonia X. The ammonia tank 2 stores the liquid ammonia X supplied from the outside in a state of being held at a low temperature. The ammonia tank 2 is, for example, a PC concrete double-shell tank including a metal inner shell and a PC concrete containment dike. The ammonia tank 2 includes, for example, a heat insulating material filled between the containment dike and the inner shell, and stores the liquid ammonia X inside the inner shell in a low temperature state. However, the structure of the ammonia tank 2 is not particularly limited.

[0014]

20 The ammonia gas delivery portion 3 vaporizes the liquid ammonia X and delivers the vaporized ammonia to the boiler B. As shown in FIG. 1, the ammonia gas delivery portion 3 includes a discharge pump 3a, a discharge pipe 3b, a vaporization facility 3c, and a gas delivery pipe 3d.

[0015]

The discharge pump 3a is disposed inside the ammonia tank 2 and pressure-feeds the liquid ammonia X stored in the ammonia tank 2 to the outside of the ammonia tank 2. The discharge pump 3a is connected to, for example, a control unit (not shown), and discharges a designated amount of the liquid ammonia X to the outside of the ammonia tank 2 based on control of the control unit.

[0016]

The discharge pipe 3b is a pipe that connects the ammonia tank 2 and the vaporization facility 3c. An upstream end of the discharge pipe 3b is connected to the ammonia tank 2, and a downstream end of the discharge pipe 3b is connected to the vaporization facility 3c. The discharge pipe 3b guides the liquid ammonia X discharged by the discharge pump 3a from the ammonia tank 2 to the vaporization facility 3c.

[0017]

The vaporization facility 3c heats and vaporizes the liquid ammonia X. The vaporization facility 3c vaporizes the liquid ammonia X supplied from the ammonia tank 2 via the discharge pipe 3b. For example, a heating fluid supply unit (not shown) is connected to the vaporization facility 3c, and a heating fluid such as seawater is supplied to the vaporization facility 3c. The vaporization facility 3c vaporizes the liquid ammonia X through heat exchange between the liquid ammonia X and the heating fluid such as seawater.

[0018]

The gas delivery pipe 3d is a pipe that connects the vaporization facility 3c and the boiler B. An upstream end of the gas delivery pipe 3d is connected to the vaporization facility 3c, and a downstream end of the gas delivery pipe 3d is connected to the boiler B. The downstream end of the gas delivery pipe 3d may not be directly connected to the boiler B. That is, the downstream end of the gas delivery pipe 3d may

be connected to the boiler B via another device or the like. The gas delivery pipe 3d guides the ammonia gas Y discharged from the vaporization facility 3c to the boiler B.

[0019]

The vaporization facility 3c may include a superheater at an intermediate portion
5 of the gas delivery pipe 3d. The superheater vaporizes the mist-like liquid ammonia X contained in the ammonia gas Y flowing through the gas delivery pipe 3d.

[0020]

The boil-off gas supply portion 4 can supply the boil-off gas G generated in the ammonia tank 2 to the ammonia gas delivery portion 3. As shown in FIG. 1, the boil-
10 off gas supply portion 4 includes a boil-off gas main pipe 4a, a first on-off valve 4b, a boil-off gas treatment facility connection pipe 4c, a second on-off valve 4d, and a boil-off gas compressor 4e.

[0021]

The boil-off gas main pipe 4a is a pipe connected to the ammonia gas delivery
15 portion 3. An upstream end of the boil-off gas main pipe 4a is connected to the ammonia tank 2, and a downstream end of the boil-off gas main pipe 4a is connected to the ammonia gas delivery portion 3. The downstream end of the boil-off gas main pipe 4a is connected to the gas delivery pipe 3d of the ammonia gas delivery portion 3. The boil-off gas main pipe 4a guides the boil-off gas G generated inside the ammonia tank 2
20 from the ammonia tank 2 to the gas delivery pipe 3d.

[0022]

The first on-off valve 4b is an on-off valve installed at an intermediate portion of the boil-off gas main pipe 4a. The first on-off valve 4b is opened and closed, for example, under the control of a control unit (not shown). The first on-off valve 4b is
25 disposed at the intermediate portion of the boil-off gas main pipe 4a, near the

downstream end of the boil-off gas main pipe 4a. The first on-off valve 4b is located downstream of a portion of the boil-off gas main pipe 4a to which the boil-off gas treatment facility connection pipe 4c is connected. The boil-off gas G is supplied to the gas delivery pipe 3d in a state where the first on-off valve 4b is open. In addition, the supply of the boil-off gas G to the gas delivery pipe 3d is stopped by closing the first on-off valve 4b.

[0023]

The boil-off gas treatment facility connection pipe 4c is a pipe that connects the boil-off gas main pipe 4a and the boil-off gas recovery facility 5. An upstream end of the boil-off gas treatment facility connection pipe 4c is connected to the boil-off gas main pipe 4a, and a downstream end of the boil-off gas treatment facility connection pipe 4c is connected to the boil-off gas recovery facility 5. The upstream end of the boil-off gas treatment facility connection pipe 4c is connected to the boil-off gas main pipe 4a at an upstream position located upstream of the first on-off valve 4b. That is, the boil-off gas treatment facility connection pipe 4c connects the upstream position of the boil-off gas main pipe 4a located upstream of the first on-off valve 4b and the boil-off gas recovery facility 5. The boil-off gas treatment facility connection pipe 4c guides the boil-off gas G from the boil-off gas main pipe 4a to the boil-off gas recovery facility 5. The downstream end of the boil-off gas treatment facility connection pipe 4c is connected to a condenser 5a of the boil-off gas recovery facility 5, which will be described later.

[0024]

The second on-off valve 4d is an on-off valve installed at an intermediate portion of the boil-off gas treatment facility connection pipe 4c. The second on-off valve 4d is opened and closed, for example, under the control of a control unit (not shown). The boil-off gas G is supplied to the boil-off gas recovery facility 5 in a state

where the second on-off valve 4d is open. In addition, the supply of the boil-off gas G to the boil-off gas recovery facility 5 is stopped by closing the second on-off valve 4d.

[0025]

The boil-off gas compressor 4e is a compressor that increases the pressure of the
5 boil-off gas G flowing through the boil-off gas main pipe 4a, and is installed at an intermediate portion of the boil-off gas main pipe 4a. The boil-off gas compressor 4e is disposed upstream of the portion of the boil-off gas main pipe 4a to which the boil-off gas treatment facility connection pipe 4c is connected. The boil-off gas compressor 4e compresses the boil-off gas G to increase the pressure of the boil-off gas G to a pressure
10 at which the boil-off gas G can be supplied to the gas delivery pipe 3d or the boil-off gas recovery facility 5.

[0026]

The boil-off gas recovery facility 5 can re-liquefy the boil-off gas G. As shown in FIG. 1, the boil-off gas recovery facility 5 includes the condenser 5a. The condenser
15 5a condenses the boil-off gas G in a case where the boil-off gas G is supplied from the boil-off gas supply portion 4. When the second on-off valve 4d is opened, the boil-off gas G is supplied from the boil-off gas supply portion 4 to the condenser 5a. The boil-off gas G is condensed and liquefied inside the condenser 5a to become the liquid ammonia X.

20 [0027]

The excess gas discharge portion 6 discharges excess boil-off gas G from the ammonia tank 2. As shown in FIG. 1, the excess gas discharge portion 6 includes a discharge pipe 6a and a relief valve 6b. The discharge pipe 6a is a pipe that connects the ammonia tank 2 and a flare stack F. An upstream end of the discharge pipe 6a is

connected to the ammonia tank 2, and a downstream end of the discharge pipe 6a is connected to the flare stack F.

[0028]

The relief valve 6b is provided at an intermediate portion of the discharge pipe 6a, and is opened in a case where an internal pressure of the ammonia tank 2 exceeds a predetermined pressure. When the relief valve 6b is open, a part of the boil-off gas G inside the ammonia tank 2 is discharged as excess gas Z (gas to be treated) through the discharge pipe 6a. As shown in FIG. 1, a bypass line for releasing the boil-off gas G to the discharge pipe 6a before the relief valve 6b is operated may be provided.

10 [0029]

The hydrogen gas generation portion 7 cracks a portion of the ammonia gas Y to be delivered to the boiler B to generate hydrogen gas H. As shown in FIG. 1, the hydrogen gas generation portion 7 includes a supply pipe 7a, a pressure reducing valve 7b (ammonia gas pressure adjustment portion), a catalyst 7c, a discharge pipe 7d, a mixed gas compressor 7e, and a separation device 7f.

[0030]

The supply pipe 7a is a pipe that connects the boil-off gas main pipe 4a of the boil-off gas supply portion 4 and the catalyst 7c. An upstream end of the supply pipe 7a is connected to the boil-off gas main pipe 4a via the gas delivery pipe 3d of the ammonia gas delivery portion 3, and a downstream end of the supply pipe 7a is connected to the catalyst 7c. The supply pipe 7a supplies the ammonia gas Y to the catalyst 7c.

20 [0031]

The pressure reducing valve 7b is provided at an intermediate portion of the supply pipe 7a. The pressure reducing valve 7b reduces the pressure of the ammonia gas Y flowing through the supply pipe 7a. The pressure reducing valve 7b reduces the

25

pressure of the ammonia gas Y to a pressure at which the ammonia gas Y can be suitably decomposed by the catalyst 7c. That is, the pressure reducing valve 7b is an ammonia gas pressure adjustment portion that adjusts the pressure of the ammonia gas Y to be supplied to the catalyst 7c to a pressure suitable for decomposition. However, in a case
5 where it is not necessary to adjust the pressure of the ammonia gas Y to be supplied to the supply pipe 7a, the pressure reducing valve 7b can be omitted.

[0032]

The catalyst 7c is disposed inside a furnace of the boiler B, which is a heat source. The catalyst 7c is heated by heat (radiation or convection) from the boiler B.
10 For example, the catalyst 7c decomposes the ammonia gas Y into the hydrogen gas H and nitrogen gas N in a state of being heated in this manner. The gas generated by the catalyst 7c is a mixed gas K in which the hydrogen gas H and the nitrogen gas N are mixed. That is, the mixed gas K is a hydrogen-containing gas containing the hydrogen gas H.

15 [0033]

As the catalyst 7c, for example, a catalyst formed of a non-metal-based material and capable of decomposing substantially 100% of the ammonia gas Y into the hydrogen gas H and the nitrogen gas N at a temperature of 600°C or higher and a pressure of 0.1 to 0.6 MPa may be used. However, the material for forming the catalyst 7c is not
20 particularly limited as long as the ammonia gas Y can be decomposed in a heated state.

[0034]

The discharge pipe 7d is a pipe for discharging the mixed gas K generated by the catalyst 7c from the catalyst 7c. An upstream end of the discharge pipe 7d is connected to the catalyst 7c, and a downstream end of the discharge pipe 7d is connected to the

mixed gas compressor 7e. The discharge pipe 7d guides the mixed gas K from the catalyst 7c to the mixed gas compressor 7e.

[0035]

5 The mixed gas compressor 7e compresses the mixed gas K supplied from the discharge pipe 7d. The mixed gas compressor 7e increases the pressure of the mixed gas K to a pressure suitable for the separation device 7f. In a case where the pressure of the mixed gas K in the discharge pipe 7d is a pressure suitable for the separation device 7f, the mixed gas compressor 7e may be omitted.

[0036]

10 The separation device 7f separates the hydrogen gas H from the mixed gas K supplied from the mixed gas compressor 7e. For example, a pressure swing adsorption (PSA) type device may be used as the separation device 7f. The mixed gas K (primarily the nitrogen gas N) after the hydrogen gas H is separated is discharged from the separation device 7f, and is, for example, released to the atmosphere after being treated
15 as necessary.

[0037]

The hydrogen gas supply portion 8 supplies the hydrogen gas H generated by the hydrogen gas generation portion 7 to the flare stack F. As shown in FIG. 1, the hydrogen gas supply portion 8 includes a pilot burner connection pipe 8a and an assist
20 fuel pipe 8b.

[0038]

The pilot burner connection pipe 8a is connected to a pilot burner F1 of the flare stack F. The pilot burner F1 of the flare stack F maintains a flame using the hydrogen gas H supplied from the hydrogen gas supply portion 8 as a fuel.

25 [0039]

The assist fuel pipe 8b is a pipe for mixing the hydrogen gas H as an assist fuel, with the excess gas Z supplied from the discharge pipe 6a to the flare stack F. In a case where combustion is difficult with only the excess gas Z supplied from the discharge pipe 6a to the flare stack F, the hydrogen gas H is supplied to the flare stack F via the assist fuel pipe 8b.

[0040]

However, in a case where the combustion is possible only with the excess gas Z, the hydrogen gas H may not be supplied from the assist fuel pipe 8b to the flare stack F. For example, a flow control valve (not shown) is provided at an intermediate portion of the assist fuel pipe 8b, and a flow rate of the hydrogen gas H supplied from the assist fuel pipe 8b to the flare stack F can be adjusted.

[0041]

The flare stack F incinerates the boil-off gas G supplied from the excess gas discharge portion 6. In addition, the flare stack F uses the hydrogen gas H supplied from the pilot burner connection pipe 8a of the hydrogen gas generation portion 7 as a fuel for the pilot burner F1. In addition, the flare stack F can mix the hydrogen gas H supplied from the assist fuel pipe 8b of the hydrogen gas generation portion 7 with the boil-off gas G, as an assist fuel.

[0042]

As shown in FIG. 1, the pilot burner F1 is disposed at an upper portion of the flare stack F. The pilot burner connection pipe 8a of the hydrogen gas generation portion 7 is connected to the pilot burner F1. In addition, the discharge pipe 6a and the assist fuel pipe 8b are connected to a lower portion of the flare stack F.

[0043]

Subsequently, an operation of the ammonia receiving facility 1 of the present embodiment will be described. As shown in FIG. 1, the liquid ammonia X stored in the ammonia tank 2 is discharged from the ammonia tank 2 by the discharge pump 3a and supplied to the vaporization facility 3c. The liquid ammonia X supplied to the vaporization facility 3c is vaporized to become ammonia gas Y. The ammonia gas Y discharged from the vaporization facility 3c is delivered to the boiler B.

[0044]

On the other hand, the boil-off gas G generated inside the ammonia tank 2 is discharged from the ammonia tank 2 and is then pressurized by being compressed by the boil-off gas compressor 4e. The pressurized boil-off gas G is supplied to the ammonia gas delivery portion 3 and mixed with the ammonia gas Y.

[0045]

For example, in a case where the demand for ammonia in the boiler B is small, the pressurized boil-off gas G is supplied to the boil-off gas recovery facility 5. The boil-off gas G supplied to the boil-off gas recovery facility 5 is condensed by the condenser 5a to become the liquid ammonia X. The liquid ammonia X produced in the condenser 5a is discharged from the condenser 5a and returned to the ammonia tank 2 via, for example, an economizer (not shown).

[0046]

The excess gas Z discharged from the ammonia tank 2 by the excess gas discharge portion 6 is supplied to the flare stack F via the discharge pipe 6a. As shown in FIG. 1, the excess gas Z is supplied to the lower portion of the flare stack F and mixed with the hydrogen gas H inside the flare stack F as necessary.

[0047]

In addition, in the present embodiment, a portion of the ammonia gas Y supplied to the boiler B flows into the supply pipe 7a of the hydrogen gas generation portion 7.

The ammonia gas Y that has flowed into the supply pipe 7a is depressurized by the pressure reducing valve 7b and then is supplied to the catalyst 7c. The catalyst 7c is

5 disposed inside the boiler B and is heated using the boiler B as a heat source.

Therefore, the ammonia gas Y supplied to the catalyst 7c is cracked by the catalyst 7c in a heated state.

[0048]

In this way, the ammonia gas Y is cracked to generate the mixed gas K

10 containing the hydrogen gas H and the nitrogen gas N. The mixed gas K is supplied from the catalyst 7c to the mixed gas compressor 7e via the discharge pipe 7d and is pressurized by the mixed gas compressor 7e. The pressurized mixed gas K is supplied to the separation device 7f. In the separation device 7f, the hydrogen gas H is separated from the mixed gas K. The hydrogen gas H separated from the mixed gas K is supplied
15 to the flare stack F by the hydrogen gas supply portion 8.

[0049]

The hydrogen gas H supplied to the pilot burner F1 of the flare stack F via the pilot burner connection pipe 8a of the hydrogen gas supply portion 8 is used as a fuel in the pilot burner F1. In addition, the hydrogen gas H supplied to the flare stack F via the
20 assist fuel pipe 8b of the hydrogen gas supply portion 8 is mixed with the excess gas Z as an assist fuel. The excess gas Z and the hydrogen gas H are ignited and burned by the flame formed by the pilot burner F1.

[0050]

The ammonia receiving facility 1 of the present embodiment as described above
25 vaporizes the liquid ammonia X and delivers the vaporized ammonia to the boiler B as

the ammonia gas Y. In addition, the ammonia receiving facility 1 includes the hydrogen gas generation portion 7 and the hydrogen gas supply portion 8. The hydrogen gas generation portion 7 cracks a portion of the ammonia gas Y to be delivered to the boiler B to generate the hydrogen gas H. The hydrogen gas supply portion 8 supplies the hydrogen gas H generated by the hydrogen gas generation portion 7 to the flare stack F. [0051]

According to the ammonia receiving facility 1 of the present embodiment, the hydrogen gas H can be generated by cracking the ammonia gas Y, and the generated hydrogen gas H can be supplied to the flare stack F. That is, according to the ammonia receiving facility 1 of the present embodiment, the combustion in the flare stack F can be maintained by supplying the hydrogen gas H to the flare stack F instead of fossil fuels. Therefore, the ammonia receiving facility 1 of the present embodiment can reduce or eliminate the use of fossil fuels in the flare stack F. In the ammonia receiving facility 1 of the present embodiment, the use of fossil fuels in the flare stack F can be suppressed in the ammonia receiving facility in which the excess gas Z is burned in the flare stack F. [0052]

In addition, in the ammonia receiving facility 1 of the present embodiment, the hydrogen gas generation portion 7 includes the catalyst 7c, the supply pipe 7a, and the discharge pipe 7d. The catalyst 7c is heated by the heat from the boiler B and cracks the ammonia gas Y. The supply pipe 7a supplies the ammonia gas Y to the catalyst 7c. The discharge pipe 7d discharges the mixed gas K containing the hydrogen gas H from the catalyst 7c. [0053]

According to the ammonia receiving facility 1 of the present embodiment, the mixed gas K containing the hydrogen gas H can be generated by using the catalyst 7c.

Therefore, it is possible to obtain the hydrogen gas H without using energy such as electric power.

[0054]

In addition, in the present embodiment, the heat source for heating the catalyst
5 7c is the boiler B that burns the ammonia gas Y. The catalyst 7c is disposed inside the boiler B and is heated by the boiler B as the heat source.

[0055]

According to the ammonia receiving facility 1 of the present embodiment, it is not necessary to separately provide a heat source that is used only for heating the catalyst
10 7c. Therefore, it is possible to simplify and miniaturize the ammonia receiving facility 1.

[0056]

In addition, in the ammonia receiving facility 1 of the present embodiment, the hydrogen gas generation portion 7 includes the separation device 7f that separates the
15 hydrogen gas H from the mixed gas K. According to the ammonia receiving facility 1 of the present embodiment, it is possible to supply the hydrogen gas H having a high purity to the flare stack F. In addition, for example, in a case where the amount of the hydrogen gas H generated exceeds the required amount of the flare stack F, it is also possible to take out the hydrogen gas H having a high purity from the ammonia receiving
20 facility 1 and use the hydrogen gas H for other purposes.

[0057]

In addition, in the ammonia receiving facility 1 of the present embodiment, the hydrogen gas generation portion 7 includes the pressure reducing valve 7b that adjusts the pressure of the ammonia gas Y supplied to the catalyst 7c. According to the

ammonia receiving facility 1 of the present embodiment, it is possible to adjust the pressure of the excess gas Z supplied to the catalyst 7c to a pressure suitable for cracking.

[0058]

In addition, in the present embodiment, the flare stack F includes the pilot burner F1. In addition, the hydrogen gas supply portion 8 includes the pilot burner connection pipe 8a and the assist fuel pipe 8b. The pilot burner connection pipe 8a is capable of supplying the hydrogen gas H to the pilot burner F1. The assist fuel pipe 8b is capable of mixing the hydrogen gas H with the excess gas Z supplied to the flare stack F.

[0059]

According to the ammonia receiving facility 1 of the present embodiment, the hydrogen gas H generated by the hydrogen gas generation portion 7 can be used as both the fuel for the pilot burner F1 and the assist fuel to be mixed with the excess gas Z.

[0060]

(Second Embodiment)

Next, a second embodiment of the present disclosure will be described. In the description of the present embodiment, the description of the same parts as in the first embodiment will be omitted or simplified.

[0061]

FIG. 2 is a flow diagram showing a schematic configuration of an ammonia receiving facility 1A of the present embodiment. As shown in FIG. 2, in the ammonia receiving facility 1A of the present embodiment, the hydrogen gas generation portion 7 does not include the mixed gas compressor 7e and the separation device 7f.

[0062]

According to the ammonia receiving facility 1A of the present embodiment, the mixed gas K containing the hydrogen gas H is supplied to the flare stack F. The mixed

gas K contains the hydrogen gas H and the nitrogen gas N as primary components.

Therefore, in a case where the excess gas Z can be stably burned even when the nitrogen gas N is supplied to the flare stack F, it is not necessary to separate the hydrogen gas H from the mixed gas K.

5 [0063]

According to the ammonia receiving facility 1A of the present embodiment, since the mixed gas compressor 7e and the separation device 7f are not provided, the hydrogen gas generation portion 7 can be simplified and miniaturized.

[0064]

10 (Third Embodiment)

Next, a third embodiment of the present disclosure will be described. In the description of the present embodiment, the description of the same parts as in the second embodiment will be omitted or simplified.

[0065]

15 FIG. 3 is a flow diagram showing a schematic configuration of an ammonia receiving facility 1B of the present embodiment. As shown in FIG. 3, in the ammonia receiving facility 1B of the present embodiment, the hydrogen gas generation portion 7 does not include the pressure reducing valve 7b.

[0066]

20 For example, in a case where the pressure of the ammonia gas Y is suitable for the cracking of the ammonia gas Y by the catalyst 7c, it is not necessary to provide the pressure reducing valve 7b. Even in the ammonia receiving facility 1B of the present embodiment, the hydrogen gas H can be generated by cracking the ammonia gas Y, and the generated hydrogen gas H can be supplied to the flare stack F. Therefore, in the
25 ammonia receiving facility 1B of the present embodiment, it is possible to suppress the

use of fossil fuels in the flare stack F in the ammonia receiving facility in which the excess gas Z is burned in the flare stack F.

[0067]

Although the preferred embodiments of the present disclosure have been
5 described above with reference to the accompanying drawings, it goes without saying that 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 embodiments described above are merely examples, and can be variously changed on the basis of design requirements and the like without departing from the gist of the present
10 disclosure.

[0068]

Meanwhile, the embodiments described above can also be described as, for example, the following supplementary notes.

[0069]

15 (Supplementary Note 1)

An ammonia receiving facility that vaporizes liquid ammonia and delivers vaporized ammonia to a supply destination as ammonia gas, the ammonia receiving facility including:

a hydrogen gas generation portion that cracks a portion of the ammonia gas to be
20 delivered to the supply destination to generate hydrogen gas; and

a hydrogen gas supply portion that supplies the hydrogen gas generated by the hydrogen gas generation portion to a flare stack.

[0070]

(Supplementary Note 2)

25 The ammonia receiving facility according to Supplementary Note 1,

in which the hydrogen gas generation portion includes:

a catalyst that is heated by heat from a heat source and that cracks the ammonia gas;

a supply pipe that supplies the ammonia gas to the catalyst; and

5 a discharge pipe that discharges a hydrogen-containing gas containing the hydrogen gas from the catalyst.

[0071]

(Supplementary Note 3)

The ammonia receiving facility according to Supplementary Note 2,

10 in which the supply destination is a boiler that burns the ammonia gas, and

the catalyst is disposed inside a furnace of the boiler and is heated by the boiler as the heat source.

[0072]

(Supplementary Note 4)

15 The ammonia receiving facility according to Supplementary Note 2 or 3, in which the hydrogen gas generation portion includes a separation device that separates the hydrogen gas from the hydrogen-containing gas.

[0073]

(Supplementary Note 5)

20 The ammonia receiving facility according to any one of Supplementary Notes 1 to 4, in which the hydrogen gas generation portion includes an ammonia gas pressure adjustment portion that adjusts a pressure of the ammonia gas supplied to the catalyst.

[0074]

(Supplementary Note 6)

The ammonia receiving facility according to any one of Supplementary Notes 1 to 5,

in which the flare stack includes a pilot burner, and

the hydrogen gas supply portion includes:

5 a pilot burner connection pipe that is capable of supplying the hydrogen gas to the pilot burner; and

an assist fuel pipe that is capable of mixing the hydrogen gas with a gas to be treated that is supplied to the flare stack.

INDUSTRIAL APPLICABILITY

10 [0075]

According to the present disclosure, in an ammonia receiving facility in which an excess gas is burned in a flare stack, it is possible to suppress the use of fossil fuels in the flare stack.

REFERENCE SIGNS LIST

15 [0076]

1 Ammonia receiving facility

1A Ammonia receiving facility

1B Ammonia receiving facility

2 Ammonia tank

20 3 Ammonia gas delivery portion

4 Boil-off gas supply portion

5 Boil-off gas recovery facility

6 Excess gas discharge portion

6a Discharge pipe

25 6b Relief valve

	7 Hydrogen gas generation portion
	7a Supply pipe
	7b Pressure reducing valve (ammonia gas pressure adjustment portion)
	7c Catalyst
5	7d Discharge pipe
	7e Mixed gas compressor
	7f Separation device
	8 Hydrogen gas supply portion
	8a Pilot burner connection pipe
10	8b Assist fuel pipe
	B Boiler (supply destination, heat source)
	F Flare stack
	F1 Pilot burner
	G Boil-off gas
15	H Hydrogen gas
	K Mixed gas (hydrogen-containing gas)
	N Nitrogen gas
	X Liquid ammonia
	Y Ammonia gas
20	Z Excess gas (gas to be treated)

CLAIMS

[Claim 1] An ammonia receiving facility that vaporizes liquid ammonia and delivers vaporized ammonia to a supply destination as ammonia gas, the ammonia receiving facility comprising:

5 a hydrogen gas generation portion that cracks a portion of the ammonia gas to be delivered to the supply destination to generate hydrogen gas; and

a hydrogen gas supply portion that supplies the hydrogen gas generated by the hydrogen gas generation portion to a flare stack.

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

10 wherein the hydrogen gas generation portion includes:

a catalyst that is heated by heat from a heat source and that cracks the ammonia gas;

a supply pipe that supplies the ammonia gas to the catalyst; and

15 a discharge pipe that discharges a hydrogen-containing gas containing the hydrogen gas from the catalyst.

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

wherein the supply destination is a boiler that burns the ammonia gas, and

the catalyst is disposed inside a furnace of the boiler and is heated by the boiler as the heat source.

20 [Claim 4] The ammonia receiving facility according to Claim 2 or 3,

wherein the hydrogen gas generation portion includes a separation device that separates the hydrogen gas from the hydrogen-containing gas.

[Claim 5] The ammonia receiving facility according to Claim 2 or 3,

25 wherein the hydrogen gas generation portion includes an ammonia gas pressure adjustment portion that adjusts a pressure of the ammonia gas supplied to the catalyst.

[Claim 6] The ammonia receiving facility according to any one of Claims 1 to 3,

wherein the flare stack includes a pilot burner, and

the hydrogen gas supply portion includes:

a pilot burner connection pipe that is capable of supplying the hydrogen gas to

5 the pilot burner; and

an assist fuel pipe that is capable of mixing the hydrogen gas with a gas to be treated that is supplied to the flare stack.