

SPECIFICATION

Title of Invention: FLOATING-TYPE STRUCTURE

Technical Field

5 **[0001]** The present invention relates to a floating-type structure obtained by converting an existing LNG carrier ship.

Related Art

[0002] Conventionally, there has been a floating-type structure mounted with an LNG tank for storing liquefied natural gas, as well as a natural gas-processing facility for processing natural gas.

10 As a method of constructing such a floating-type structure, it is conceivable to first construct a new structure, but in addition to the method of constructing a new structure, a method of using an existing LNG carrier ship or the like is also conceivable.

[0003] As a method of using an existing LNG carrier ship, for example, a technology has been proposed to construct a new floating-type structure by transferring and reusing a LNG tank from
15 an aged LNG carrier ship (for example, Patent Literature 1). This technology focuses on the property that even if the hull part of an existing LNG carrier ship is aged, the LNG tank is not easily aged because the liquefied natural gas stored inside is not corrosive.

[0004] According to this technology, by reusing the LNG tank of the existing LNG carrier ship, it is not necessary to construct a new LNG tank, which can significantly shorten the construction
20 process of a new floating-type structure and reduce the cost.

Citation List

Patent Literature

[0005] [Patent Literature 1] Japanese Unexamined Patent Publication No. 2012-86768

SUMMARY OF INVENTION

Technical Problem

[0006] However, when the LNG tank of an aged LNG carrier ship is transferred to construct a new floating-type structure as in the above-mentioned technology, it is necessary to newly
5 construct the hull part of the floating-type structure. Therefore, even if the existing LNG tank is reused, the hull part requires the same construction process and cost as before, which is not sufficient for shortening the construction period and reducing the cost.

Solution to Problem

[0007] In this case, the existing LNG carrier ship may be used as it is and converted into a floating-
10 type structure, but there is a problem that the space for mounting a natural gas-processing facility cannot be secured.

[0008] An object of the present invention is to provide a floating-type structure that can be constructed at low cost and in a short delivery time.

[0009] A floating-type structure of the present invention is one converted from a liquefied-gas
15 carrier ship including a hull part in which a membrane-type or self-supporting prismatic-type storage tank is mounted, the floating-type structure including:

the hull part;

a projecting part which is fixed to the hull part and which projects to at least one side in a width direction of the hull part; and

20 a gas-processing facility positioned on the projecting part,

wherein the projecting part and the gas-processing facility are portions that are added during conversion.

Thus, by using the existing liquefied-gas carrier ship as it is and adding the projecting part and the gas-processing facility, it is possible to construct a floating-type structure at low cost and
25 in a short delivery time. Further, by providing the projecting part, a sufficient space for

positioning the gas-processing facility can be secured.

[0010] Further, according to the floating-type structure of the present invention, the gas-processing facility is configured by a module.

Thus, the gas-processing facility can also be configured by a module.

5 [0011] Further, according to the floating-type structure of the present invention, the module includes a protruding part that protrudes toward the hull part.

Thus, by protruding the module toward the hull part, the space above the hull part can be effectively used.

[0012] Further, according to the floating-type structure of the present invention, the hull part
10 includes a lower hull part to which the projecting part is fixed; and

an upper hull part that protrudes above the lower hull part and constitutes an upper part of the storage tank,

wherein the upper hull part includes a hull inclined part that inclines downward toward the lower hull part at an end part in the width direction of the upper hull part;

15 the protruding part protrudes toward the upper hull part; and

a module inclined part that inclines upward along the hull inclined part is formed below the protruding part.

Thus, by forming the module inclined part below the protruding part, the module can be protruded along the hull inclined part of the upper hull part, and the space of the inclined part of
20 the upper hull part can be used without waste.

[0013] Further, the floating-type structure of the present invention includes:

a plurality of stools that support the module,

wherein all the stools are positioned on the projecting part.

That is, the module is positioned on the stools at the projecting part. Therefore, the
25 projecting part can be designed in advance so as to have the strength to support the module, and

the reinforcement work of the hull part for supporting the module becomes unnecessary.

[0014] Further, according to the floating-type structure of the present invention includes:

a plurality of stools that support the module,

wherein a part of the stools are positioned on the hull part and remaining stools are

5 positioned on the projecting part.

That is, according to the above configuration, the load of the module can be distributed to the hull part and the projecting part, such that the module can be supported in a well-balanced and stable manner. Further, since part of the weight of the module can be supported by the hull part, the strength of the projecting part itself and the fixing strength to the hull part can be lowered, and

10 the construction cost of the projecting part can be reduced.

[0015] Further, according to the floating-type structure of the present invention,

the stools on the hull part are positioned on a ship-side outer plate that constitutes a ship side of the hull part.

As a result, the loads received by the stools are transmitted to the ship-side outer plate

15 having higher strength than other parts, such that the stools can be firmly supported.

[0016] Further, according to the floating-type structure of the present invention,

the module is formed across the storage tank in the width direction of the hull part.

Thus, the hollow on the storage tank can be effectively used.

[0017] Further, the floating-type structure of the present invention is one converted from a liquefied-gas carrier ship including a hull part in which a membrane-type or self-supporting prismatic-type storage tank is mounted, the floating-type structure including:

the hull part; and

a module that constitutes a gas-processing facility,

wherein the module is supported by stools positioned on both sides of the storage tank in

25 a width direction of the hull part and positioned above the storage tank, and

the module is a portion added during conversion.

Thus, by mounting the stools on the hull part and positioning the module on them, the space above the hull part may be used to position the module. Therefore, the cost and man-hours for converting an existing liquefied-gas carrier ship can be significantly reduced.

5 Effects of Invention

[0018] According to the present invention, it is possible to provide a floating-type structure that can be constructed at low cost and in a short delivery time.

BRIEF DESCRIPTION OF DRAWINGS

10 **[0019]**

Figure 1 is a schematic view of a floating-type structure according to an embodiment as viewed from above.

Figure 2 is a schematic view of a floating-type structure according to an embodiment as viewed from the front.

15 Figure 3 is a view illustrating a method of constructing a floating-type structure according to an embodiment.

Figure 4 is a view illustrating a situation in which a module is mounted on an added projecting part in a floating-type structure according to an embodiment.

Figure 5 is a schematic view of a floating-type structure according to another embodiment as
20 viewed from the front.

Figure 6 is a schematic view of a floating-type structure according to another embodiment as viewed from the front.

Figure 7 is a schematic view of a floating-type structure according to another embodiment as viewed from the front.

25

DESCRIPTION OF EMBODIMENTS

[0020] Hereinafter, the floating-type structure according to the embodiment of the present invention will be described with reference to the drawings. Figure 1 is a schematic view of a floating-type structure 2 according to an embodiment as viewed from above, and Figure 2 is a schematic view of the floating-type structure 2 as viewed from the front (direction of an arrow A shown in Figure 1). As shown in Figures 1 and 2, the floating-type structure 2 is a unidirectionally long structure having a hull part 4, which is referred to as a hull, as a main body. The floating-type structure 2 according to the embodiment is a converted LNG carrier ship 26 (see Figure 3) as an existing liquefied-gas carrier ship.

[0021] The floating-type structure 2 is used as an offshore plant. As such equipment, FPSO (floating production storage and offloading unit) that produces, stores, and load oil and natural gas; FSO (floating storage and offloading unit) that does not have production equipment and only stores and offloads; FSU (floating production storage unit) that only stores; and the like are known. Further, as one of the FPSOs, FLNG (floating liquefied natural gas production facility) specialized in the production, storage and offloading of liquefied natural gas (LNG) is known. In the embodiment of the present invention, the case where the floating-type structure 2 is FLNG will be described as an example. The floating-type structure 2 does not have a self-advancing function, and when it moves, it is towed by a power ship.

[0022] In the floating-type structure 2, the hull part 4 of the existing LNG carrier ship 26 (see Figure 3) is used for the hull part 4. Inside a ship side 8 and a ship bottom 9, the hull part 4 includes a ballast tank 10 which is a space for injecting seawater or the like in order to adjust the weight of the hull part 4 and balance the hull part 4. Further, the hull part 4 is equipped with a storage tank 12 for storing liquefied natural gas.

[0023] Here, the type of the storage tank 12 is specified in "The International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk" (IGC Code) issued by

IMO (International Maritime Organization). As specific types, various types are known: the spherical type called Moss type; the square type called Membrane type, which is integrated with the hull by attaching a thin film tank material inside the hull; the self-supporting prismatic-type in which the hull and the square tank are separated; and others.

5 [0024] In the present embodiment, the membrane type storage tank 12 will be described as an example, but the storage tank 12 may be a self-supporting prismatic-type. In the present embodiment, the storage tank 12 having an octagonal cross section is exemplified, but the storage tank 12 is not limited to the octagonal shape as long as it has an aspherical shape.

[0025] The hull part 4 includes a lower hull part 41 that accommodates the storage tank 12, and
10 an upper hull part 18 that protrudes above the lower hull part 41 and constitutes the upper part of the storage tank 12. Further, the lower hull part 41 includes a ship-side outer plate 40 constituting the outer shell of the ship side 8 and a ship-bottom outer plate 42 constituting the outer shell of the ship bottom 9. The upper hull part 18 includes a hull inclined part 18a that inclines downward toward the lower hull part 41 at both end parts of the upper hull part 18 in the width direction.
15 That is, the peripheral edge of the upper hull part 18 inclines downward corresponding to the inclined part of the upper end part of the storage tank 12. The width direction of the upper hull part 18 coincides with the width direction of the hull part 4.

[0026] A projecting part 14 projecting to the outside of the hull part 4, called pontoon, sponson, or the like, is fixed to both sides of the hull part 4 in the width direction. In the present
20 embodiment, the projecting part 14 is fixed to the lower hull part 41. Waste oil tank, additional ballast tank, and the like are provided inside the projecting part 14. Further, the space on the projecting part 14 where no module 16 (to be described later) is positioned is used as a storage place for equipment and the like.

[0027] Further, a gas-processing facility for processing gas is positioned on the projecting part
25 In the present embodiment, a natural gas-processing facility is positioned on the projecting part

14 as a gas-processing facility. Specifically, the module 16 used as a natural gas-processing facility is positioned on the projecting part 14. The module 16 is a structure equipped with equipment or piping for processing natural gas. After the module 16 is mounted on the projecting part 14, the equipment or piping in the adjacent modules 16 are connected to each other as needed to form a natural gas-processing facility.

[0028] Further, the module 16 is supported by stools 17, which are referred to as stools, positioned on the projecting part 14. The stools 17 include a first stool 17a located on the hull part 4 side in the width direction of the hull part 4 and a second stool 17b located on the opposite side of the hull part 4 side. The first stool 17a and the second stool 17b are both lined up in a row at predetermined intervals along the longitudinal direction of the hull part 4. In the present embodiment, the projecting part 14, the module 16 serving as a natural gas-processing facility, and the stools 17 (first stool 17a, second stool 17b) are included in the added portions to be described later.

[0029] Here, the module 16 includes a protruding part 16a protruding toward the hull part 4. A module inclined part 16b that inclines upward toward the hull part 4 side is formed below the protruding part 16a. In the present embodiment, the protruding part 16a protrudes toward the upper hull part 18, and the module inclined part 16b inclines upward along the hull inclined part 18a of the upper hull part 18.

[0030] Thus, by protruding the module 16 toward the hull part 4, the space above the hull part 4 can be effectively used. Further, by forming the module inclined part 16b below the module 16, the module 16 may be protruded in accordance with the hull inclined part 18a of the upper hull part 18, and the inclined space of the hull inclined part 18a of the upper hull part 18 can be used without waste.

[0031] In addition, a living area 20 having sailors' room, kitchen, and the like is positioned on the floating-type structure 2.

[0032] Next, an example of the construction method of the floating-type structure 2 according to the embodiment will be described. First, the LNG carrier ship 26 mounted with the membrane type or self-supporting prismatic-type storage tank 12 is towed by a towing vessel such as a tugboat and comes in a dock 24 as shown in (a) of Figure 3. Next, as shown in (b) of Figure 3, the seawater in the dock 24 is drained and the LNG carrier ship 26 is landed on the bottom of the dock. Then, the projecting part 14 is moved to both sides of the hull part 4 of the LNG carrier ship 26 in the width direction. Next, by welding the projecting part 14 to the hull part 4, as shown in (c) of Figure 3, the projecting part 14 is added to the hull part 4.

[0033] When the projecting part 14 is added, the stools 17 are positioned on the projecting part 14, and the module 16 is usually mounted thereon by a crane. As an alternative to the mounting method, as shown in (a) of Figure 4, a rail 29 for transferring the module 16 is provided on the stools 17. During this time, the module 16 is appropriately moved into the dock 24. The module 16 is transferred to a lift 30 positioned in the vicinity of the dock 24, and then the lift 30 rises to the same level as the rail 29, as shown in (b) of Figure 4.

[0034] Next, by moving the module 16 from the lift 30 to the rail 29, the module 16 is installed on the projecting part 14 as shown in (c) of Figure 4. Such a transferring process is called jack-up and skidding, and may be adopted as one of the module mounting methods. As a result, the conversion of the LNG carrier ship 26 is completed, and the floating-type structure 2 obtained by converting the LNG carrier ship 26 is completed. Next, the dock 24 is injected with water, and the floating-type structure 2 is launched and comes out of the dock, and is towed to the destination by a towing vessel. Natural gas processing takes place at the destination.

[0035] In the floating-type structure 2 constructed as described above, a known pre-processing for removing impurities from natural gas and a known liquefaction processing for liquefying the preprocessed natural gas are carried out in the natural gas-processing facility.

[0036] According to the invention according to the present embodiment, the floating-type

structure 2 can be constructed at low cost and in a short delivery time by adding the projecting part 14, the module 16, and the like by using the existing LNG carrier ship as it is. Further, by providing the projecting part 14, a sufficient space for positioning the module 16 can be secured.

[0037] Further, since all the stools 17 (the first stool 17a and the second stool 17b) are positioned on the projecting part 14, the projecting part 14 can be designed in advance so as to have the strength to support the module 16, and the reinforcement work of the hull part 4 for supporting the module 16 becomes unnecessary. Further, even if reinforcement work on the hull part 4 side of the projecting part 14 is required, the stool 17 (the first stool 17a) does not get in the way. Therefore, the reinforcement work can be easily performed.

[0038] In the above-described embodiment, the case where the first stool 17a and the second stool 17b are both positioned on the projecting part 14 in the width direction of the hull part 4 has been described as an example, but it is also possible to position the first stool 17a on the hull part 4, as shown in Figure 5. That is, it is possible to position a part of the stools 17 on the hull part 4. As a result, the load of the module 16 can be distributed to the hull part 4 and the projecting part 14, such that the module 16 can be supported in a well-balanced and stable manner. Further, since part of the weight of the module 16 can be supported by the hull part 4, the strength of the projecting part 14 itself and the fixing strength to the hull part 4 can be lowered, and the construction cost of the projecting part 14 can be reduced. Further, since the distance between the stools 17 in the width direction of the hull part 4 is widened, the module 16 can be stably supported.

[0039] Further, in this case, the first stool 17a may be positioned on the ship-side outer plate 40 constituting the ship side 8 of the hull part 4. The ship-side outer plate 40 has higher strength than the portion where the storage tank 12 is mounted. Therefore, the load received by the first stool 17a is directly transmitted to the ship-side outer plate 40, and the first stool 17a can be firmly supported.

[0040] Further, in the above-described embodiment, as shown in Figure 2, the module 16 is positioned above the projecting part 14 on both sides of the hull part 4 in the width direction. However, the module 16 may also be formed across the storage tank 12 in the width direction of the hull part 4. For example, as shown in Figure 6, the modules 16 positioned above the projecting part 14 may be connected above the storage tank 12. As a result, the hollow above the storage tank 12 can also be effectively used.

[0041] Further, when the module 16 is positioned above the storage tank 12 in this way, the stools 17 may be positioned on both sides of the storage tank 12 in the width direction of the hull part 4 as shown in Figure 7, and the projecting part may not need to be provided. In this case, the stools 17 are preferably mounted on the ship-side outer plate 40, and the module 16 is supported by the stools 17 positioned on both sides of the storage tank 12.

[0042] That is, when there is a small amount of space in the hull part 4 where the storage tank 12 is not positioned, by positioning the stools 17 directly on the hull part 4 in this way, the module 16 can be positioned without providing the projecting part 14. Therefore, the module 16 can be mounted by using the space above the hull part 4, and the cost and man-hours for converting the existing LNG carrier ship 26 can be significantly reduced.

[0043] Further, in the above-described embodiment, the case where the projecting part 14 is provided on both sides of the hull part 4 is described as an example, but the projecting part 14 may be provided on only one side of the hull part 4.

[0044] Further, in the above-described embodiment, the case where both the first stool 17a and the second stool 17b are lined up in a row at predetermined intervals along the longitudinal direction of the hull part 4 is illustrated, but the stools 17 do not necessarily have to be positioned in this way. For example, the stools 17 may be positioned without distinction between the first stool 17a and the second stool 17b.

[0045] Further, in the above-described embodiment, the case where the module 16 is a natural

gas-processing facility is illustrated, but the module 16 may include those used other than the natural gas-processing facility.

[0046] Further, in the above-described embodiment, the floating-type structure 2 having no self-advancing function has been described as an example, but the moving means of the floating-type structure 2 is not particularly limited, and the floating-type structure 2 may have a self-advancing function.

[0047] Further, although not particularly mentioned in the above-described embodiments, the module 16 may include a high temperature module in which a device for pre-processing natural gas before liquefaction is mounted and a low temperature module in which a device for liquefying natural gas is mounted. In this case, the high temperature module may be positioned on one side in the width direction of the hull part 4, and the low temperature module may be positioned on the other side. Further, two systems of low temperature modules may be provided, and one system may be positioned on each of the both sides of the storage tank 12.

[0048] Further, although not particularly mentioned in the above-described embodiment, the module inclined part 16b may have a shape inclined as a whole due to a step, for example, as long as it may be positioned along the hull inclined part 18a. In short, the module inclined part 16b may just be a shape positioned along the hull inclined part 18a and capable of effective use of the dead space.

Reference Signs List

[0049]

2 Floating-type structure

4 Hull part

8 Ship side

10 Ballast tank

12 Storage tank

	14	Projecting part
	16	module
	16a	Protruding part
	16b	Module inclined part
5	17	Stool
	17a	First stool
	17b	Second stool
	18	Upper hull part
	18a	Hull inclined part
10	20	Living area
	24	Dock
	26	Carrier ship
	29	Rail
	30	Lift
15	40	Ship-side outer plate
	41	Lower hull part
	42	Ship-bottom outer plate

WHAT IS CLAIMED IS:

1. A floating-type structure converted from a liquefied-gas carrier ship comprising a hull part in which a membrane-type or self-supporting prismatic-type storage tank is mounted, the floating-type structure comprising:

5 the hull part;

 a projecting part which is fixed to the hull part and which projects to at least one side in a width direction of the hull part, and which is configured such that a bottom thereof is submerged in water in a state where the floating-type structure floats on water;

 a gas-processing facility configured by a module and positioned on the projecting part; and

10 a plurality of stools that support the module, comprising a first stool positioned on a hull part side in the width direction and a second stool positioned on a side opposite to the hull part side in the width direction;

 wherein the first stool is positioned on the projecting part or on a ship-side outer plate that constitutes a ship side of the hull part,

15 wherein the second stool is positioned on the projecting part,

 wherein a ballast tank is provided inside the projecting part,

 wherein the projecting part and the gas-processing facility are portions that are added during conversion.

20 2. The floating-type structure according to claim 1, wherein the module comprises a protruding part that protrudes toward the hull part.

 3. The floating-type structure according to claim 2,

 wherein the hull part comprises a lower hull part to which the projecting part is fixed; and

 an upper hull part that protrudes above the lower hull part and constitutes an upper part of the storage tank,

25 wherein the upper hull part comprises a hull inclined part that inclines downward toward the

lower hull part at an end part in the width direction of the upper hull part;

the protruding part protrudes toward the upper hull part; and

a module inclined part that inclines upward along the hull inclined part is formed below the protruding part.

- 5 4. The floating-type structure according to claim 2 or claim 3, wherein the module is formed across the storage tank in the width direction of the hull part.