

【DESCRIPTION】**【Invention Title】**

GRID-SHAPED PRESSURE TANK HAVING HOLLOW PART THEREIN

【Technical Field】

[0001] The present invention relates to a grid-shaped pressure tank having a hollow part therein, and more particularly, to a grid-shaped pressure tank having a hollow part therein, in which a plurality of grid plates are disposed to be spaced apart from each other in a length direction, a width direction, and a height direction so as to form the hollow part therein.

【Background Art】

[0002] Natural gas is transported from a production site to a consumer site through a pipeline, but when a pipeline is difficult to use or a transport distance is long, the natural gas is transported by a vessel.

[0003] Gas transported in a gaseous state through the pipeline is referred to as pipe gas (PNG), and gas transported in a liquefied state by a dedicated ship is referred to as liquefied natural gas (LNG).

[0004] The reason of liquefying the LNG is to facilitate transportation and storage by liquefying natural gas since a volume of methane that is a main component of natural gas is about 1/600 of a volume of methane in a gaseous state that is a standard state.

[0005] There has been known that the LNG is clean fuel and reserves of the LNG are richer than petroleum, and the use of the LNG is increasing rapidly as mining and transportation technology develops.

[0006] Therefore, a demand for a fixing and floating marine production facility for storing and using the LNG, an offshore production and storage facility, a water transportation using a ship, a fixing and floating offshore introduction terminal and re-gasification facility, a land introduction terminal and re-gasification facility, or the like, has been increased.

[0007] In addition, attempts to directly use the LNG as fuel for a transportation means such as a vessel have been made. Generally, the LNG is stored in a cylindrical pressure tank.

[0008] However, there is a problem in that a large number of cylindrical pressure tanks need to be installed since a volume of one cylindrical pressure tank is small, and therefore a space occupied within the vessel becomes excessive due to a disposition and an interval of the pressure tanks.

[0009] In order to solve the above problems, studies on a tank capable of increasing strength while effectively using a space by manufacturing the tank in a box shape instead of a cylindrical shape and forming an inside of the

tank in a plurality of grid-shaped structures have been conducted.

[0010] In addition, attempts to manufacture a pressure tank in a small size so that the pressure tank may be applied to large-sized vessels and medium-sized vessels have been made. In this case, the small-sized pressure tank has a problem in that the structure of the small-sized pressure tank needs to be improved and a problem of a stress concentration thereof needs to be solved.

[0011] When the grid-shaped tank is manufactured in a large size, an operator may be put between the grids to perform maintenance of the tank, but when the tank is manufactured in a small size, a space into which an operator will be put is narrow and therefore it is difficult to manufacture the tank and perform the maintenance of the tank.

【Disclosure】

【Technical Problem】

[0012] An object of the present invention is to provide a grid-shaped pressure tank having a hollow part therein to have a structure with increased strength while effectively using a space by forming a box-shaped pressure tank having a grid-shaped structure.

[0013] In particular, an object of the present

invention is to provide a grid-shaped pressure tank having a hollow part therein, in which grid plates formed in a length direction, a width direction, and a height direction form a pressure tank having a grid-shaped structure to reduce an omni-directional stress in the height direction, the width direction, and the length direction.

[0014] Another object of the present invention is to provide a grid-shaped pressure tank having a hollow part therein, in which a working space may be separately provided in the pressure tank even if the pressure tank is formed in a small-sized pressure tank by forming a grid-shaped pressure tank having a hollow part therein.

[0015] Still another object of the present invention is to provide a grid-shaped pressure tank having a hollow part therein capable of improving strength of an edge portion by including reinforcing edge plates vertically formed at at least one edge of the grid-shaped pressure tank having a hollow part therein.

[0016] Yet another object of the present invention is to provide a grid-shaped pressure tank having a hollow part therein capable of increasing strength for maintaining a high pressure fluid by forming a reinforcing grid plate at both ends in a length direction of an internal grid part of a grid-shaped pressure tank having a hollow part therein.

[0017] Still yet another object of the present

invention is to provide a grid-shaped pressure tank having a hollow part therein capable of maintaining a uniform stress between the respective grid plates, by including a cut part formed on one surface of a grid plate by cutting.

【Technical Solution】

[0018] In one general aspect, a grid-shaped pressure tank having a hollow part therein includes: an internal grid part having a plurality of grid plates therein to form a hollow part therein, the plurality of grid plates being disposed to be spaced apart from each other in a length direction, a width direction, and a height direction; and a wall surface formed to enclose an outer surface of the internal grid part.

[0019] The internal grid part may include a reinforcing edge plate formed at at least one edge thereof.

[0020] The reinforcing edge plate may have a cross section of an 'L'-letter shape.

[0021] The reinforcing edge plate may have a cross section of a '-'-letter shape.

[0022] The internal grid part may further include a reinforcing grid plate formed at both ends in a length direction in a width direction and a height direction.

[0023] The reinforcing grid plate may include: a side reinforcing grid plate formed along a side surface of the internal grid part; and an end surface reinforcing grid

plate formed along an end surface of the internal grid part.

[0024] The reinforcing grid plate may further include: a first side reinforcing grid plate bent at both ends of the side reinforcing grid plate to extend in a length direction of the internal grid part; and a first end surface reinforcing grid plate extending at both ends of the end surface reinforcing grid plate to be connected to both ends of the first side reinforcing grid plate.

[0025] The internal grid part may include the grid plate having cut part formed by cutting.

[0026] The grid plate may include: a gas passing part for a gas flow; and a liquid passing part for a liquid flow.

[0027] The grid-shaped pressure tank may further include: a secondary wall surface formed at an outside of the wall surface.

【Advantageous Effects】

[0028] According to the grid-shaped pressure tank having a hollow part therein in accordance with the exemplary embodiments of the present invention, it is possible to have the structure with the increased strength while effectively using the space by forming the box-shaped pressure tank having the grid-shaped structure.

[0029] In particular, according to the grid-shaped pressure tank having a hollow part therein in accordance with the exemplary embodiments of the present invention,

the grid plates formed in the length direction, the width direction, and the height direction may form the pressure tank having the grid-shaped structure to reduce the omnidirectional stress in the height direction, the width direction, and the length direction.

[0030] Further, according to the grid-shaped pressure tank having a hollow part therein in accordance with the exemplary embodiments of the present invention, the grid-shaped pressure tank may be formed and thus the working space may be separately provided in the pressure tank even if the pressure tank is formed in the small-sized pressure tank.

[0031] Further, according to the grid-shaped pressure tank having a hollow part therein in accordance with the exemplary embodiments of the present invention, the grid-shaped pressure tank having a hollow part therein may include the reinforcing edge plates vertically formed at at least one edge of the grid-shaped pressure tank having a hollow part therein, thereby improving the strength of the edge portion.

[0032] Further, according to the grid-shaped pressure tank having a hollow part therein in accordance with the exemplary embodiments of the present invention, the reinforcing grid plate may be formed at both ends in the length direction of the internal grid part to increase the

strength for maintaining the high pressure fluid.

[0033] Further, the grid-shaped pressure tank having a hollow part therein in accordance with the exemplary embodiments of the present invention may include the cut part formed on one surface of the grid plate by cutting, thereby maintaining the uniform stress between the respective grid plates.

【Description of Drawings】

[0034] FIG. 1 is a diagram illustrating a grid plate of a grid-shaped pressure tank having a hollow part therein according to an exemplary embodiment of the present invention.

[0035] FIG. 2 is another diagram illustrating the grid plate of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0036] FIG. 3 is a diagram illustrating cross sections in a height direction and a width direction of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0037] FIG. 4 is a diagram illustrating a cross section in a length direction of the grid-shaped pressure tank having a hollow part therein according to an exemplary embodiment of the present invention.

[0038] FIG. 5 is a diagram illustrating a reinforcing

edge plate of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0039] FIG. 6 is a diagram illustrating a grid-shaped pressure tank having a hollow part therein according to an exemplary embodiment of the present invention.

[0040] FIG. 7 is a diagram illustrating a part of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0041] FIG. 8 is another diagram illustrating the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0042] FIG. 9 is a diagram illustrating Example 1 of the reinforcing grid plate provided in the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0043] FIG. 10 is another diagram illustrating Example 1 of the reinforcing grid plate provided in the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0044] FIG. 11 is a diagram illustrating Example 2 of the reinforcing grid plate provided in the grid-shaped pressure tank having a hollow part therein according to the

exemplary embodiment of the present invention.

[0045] FIG. 12 is another diagram illustrating Example 2 of the reinforcing grid plate provided in the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0046] FIG. 13 is a diagram illustrating Example 3 of the reinforcing grid plate provided in the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0047] FIG. 14 is another diagram illustrating Example 3 of the reinforcing grid plate provided in the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0048] FIG. 15 is a diagram illustrating a cut part cut to prevent an unbalance of stress applied to the grid plate of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0049] FIG. 16 is another diagram illustrating the cut part cut to prevent the unbalance of stress applied to the grid plate of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0050] FIG. 17 is a diagram illustrating a wall surface formed to enclose an outside of an internal grid

part of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0051] FIG. 18 is a diagram illustrating a gas entrance part and a liquid entrance part provided on the grid plate of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

[0052] FIG. 19 is a diagram conceptually illustrating a secondary wall surface formed at an outside of a wall surface of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention.

【Best Mode】

[0053] Hereinafter, a grid-shaped pressure tank having a hollow part therein according to an exemplary embodiment of the present invention as described above will be described in more detail with reference to the accompanying drawings.

[0054] A grid-shaped pressure tank having a hollow part therein according to an exemplary embodiment of the present invention may be used for various purposes such as a transportation fuel tank of a vessel, or the like using liquefied natural gas as power source, a liquefied natural gas tank equipped in a transportation truck or train, or

the like.

[0055] A main object of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention is to manufacture the grid-shaped pressure tank in a small size and allow a worker to easily perform manufacturing and maintenance of an inside of the tank by disposing a hollow part 110 in a wall surface 200.

[0056] That is, when the pressure tank is formed in a small size, the existing grid-shaped pressure tank has a trouble in performing the manufacturing and maintenance of the inside of the tank, whereas the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention may facilitate the manufacturing and maintenance of the inside of the tank.

[0057] As illustrated in FIGS. 1 to 8, the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention is formed in a grid-shaped structure in which a plurality of grid plates 10 are disposed to be spaced apart from each other in a length direction, a width direction, and a height direction.

[0058] At this point, the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention in which the plurality

of grid plates 10 are disposed to be spaced apart from each other by a predetermined distance in the length direction, the width direction and the height direction includes an internal grid part 100 having the hollow part 110 therein.

[0059] That is, as described above, the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention includes the plurality of grid plates 10 disposed therein and including the hollow part 110 formed therein, in which the hollow part 110 may be provided with a space for manufacturing and maintenance even if the pressure tank is formed in a small size.

[0060] That is, the internal grid part 100 includes the hollow part 110, thereby reducing time and cost consumed for manufacturing and maintenance.

[0061] At this point, a fluid stored in the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention, especially liquefied natural gas is stored at a low temperature with high pressure, and therefore the internal grid part 100 may be made of metals for cryogenic temperature such as high Mn steel, 9% nickel steel, SUS 304L or 316L, aluminum and the like.

[0062] The internal grid part 100 of the grid-shaped pressure tank having a hollow part therein according to the

exemplary embodiment of the present invention has a reinforcing edge plate 12 provided at at least one edge thereof in order to improve strength of edges of the tank and the entire tank.

[0063] That is, each edge is formed as a triangle as illustrated in FIG. 1 or the grid plates 10 formed to have a fan shape as illustrated in FIG. 2 are disposed to be spaced apart from each other by at a predetermined distance in a height direction, a width direction, and a length direction and each edge portion of the internal grid part 100 is formed in a triangular shape or a fan shape (smoothly curved shape).

[0064] Here, the reinforcing edge plate 12 is additionally installed thereon.

[0065] In other words, it is possible to lower the stress applied to the edge portion of the pressure tank and increase the entire structure stability of the pressure tank, by additionally forming the reinforcing edge plate 12 at an edge portion that is more vulnerable to stress than other portions of the pressure tank.

[0066] At this time, it is recommended that the reinforcing edge plate 12 has an 'L'-letter shape open to the outside.

[0067] However, the reinforcing edge plate 12 is not limited to the above-described 'L'-letter shape, but it

goes without saying that the embodiment of the reinforcing edge plate having shapes having various angles such as a '-'-letter shape (straight shape) in consideration of a size of the tank, the surrounding environment, or the like may be possible.

[0068] For example, the embodiment of the reinforcing edge plate 12 having the '-'-letter shape (straight shape) in addition to the 'L'-letter shape described above is possible, and it goes without saying that as the embodiment of the angle of the reinforcing edge plate 12, the embodiments of various angles from 0° (straight shape) to 90° (L-letter shape) are possible and the reinforcing edge plate 12 may be formed to have both of the L-letter shape and the '-'-letter shape.

[0069] As described above, the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention has an advantage in that the internal grid part 100 having the strength increased by plurality of grid plates 10 formed in the width direction, the length direction and the height direction and the reinforcing edge plate 12 does not have to be formed thick like the existing pressure tank, thereby reducing manufacturing cost and a weight and a volume.

[0070] As illustrated in FIGS. 9 to 14, the internal grid part 100 of the grid-shaped pressure tank having a

hollow part therein according to the exemplary embodiment of the present invention further includes a reinforcing grid plate 20 formed at both ends in a length direction in a width direction and a height direction.

[0071] The reinforcing grid plate 20 is formed at both ends in the length direction of the internal grid unit 100 in at least any one of the height direction and the width direction to be able to increase strength for maintaining a high pressure fluid.

[0072] Further, the reinforcing grid plate 20 includes a side reinforcing grid plate 21 formed along a side surface of the internal grid part 100 and an end surface reinforcing grid plate 22 formed along an end surface of the internal grid part 100.

[0073] At this point, the side surface refers to an outer surface of the internal grid part 100 in which the grid plates 10 are formed in a grid shape with respect to each other, and the end surface refers to a surface of a first outermost grid plate 10 at both ends in the length direction of the internal grid part 100.

[0074] FIGS. 9 and 10 illustrate Example 1 of the reinforcing grid plate 20, in which the reinforcing grid plate 20 including the side reinforcing grid plate 21 and the end surface reinforcing grid plate 22 is formed on the first outermost grid plate 10 at both ends of the internal

grid part 100 in the length direction.

[0075] Further, FIGS. 11 and 12 are diagrams illustrating Example 2 of the reinforcing grid plate 20. As illustrated in FIGS. 11 to 12, the reinforcing grid plate 20 includes a first side reinforcing grid plate 21-1 that extends in a length direction of the internal grid part 100 while being bent at both ends of the side reinforcing grid plate 21 and a first end surface reinforcing grid plate 22-1 that extends from both ends of the end surface reinforcing grid plate 22 to be connected to both ends of the first side reinforcing grid plate 21-1.

[0076] FIGS. 13 and 14 illustrate Example 3 of the reinforcing grid plate 20, in which the side reinforcing grid plate 21 includes a first side reinforcing grid plate 21-1 that passes through the outermost grid plate 10 at both ends in the length direction of the internal grid part 100 and extends in the length direction of the internal grid part 100 while being bent at both ends of the side reinforcing grid plate 21 to be formed on a third grid plate 10 formed inwardly from both ends of the internal grid part 100 and a first end surface reinforcing grid plate 22-1 that extends from both ends of the end surface reinforcing grid plate 22 to be connected to both ends of the first side reinforcing grid plate 21-1.

[0077] The present applicant derived the result that

Example 3 of the reinforcing grid plate has a lower stress than Example 1 of the reinforcing grid plate, as the experiment result of the reinforcing grid plate 20.

[0078] However, in the case of Example 3 of the reinforcing grid plate 20, the stress is reduced but the weight of the entire tank is increased, and therefore the Example of the reinforcing grid plate 20 is not limited to the method described above.

[0079] As illustrated in FIG. 15, the grid plate 10 of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention may include a cut part 1 formed by cutting.

[0080] However, it goes without saying that the cut part 1 is not limited to the one illustrated in FIG. 15, but may have various shapes such as a camel back shape, an irregular shape, and a shape cut to be keenly angled.

[0081] Describing in more detail it with reference to FIG. 16, according to the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention having a grid shape, the grid plates 10 may be formed in various lengths to form a hollow part 110 having a desired shape, as illustrated in FIG. 12.

[0082] For example, in the grid structure, a part having a length of L1 may be formed longer than a portion having a length of L2.

[0083] This has the problem that L1 having a longer length is subjected to more stress (any point for helping understanding of the hatched portion) than L2, such that the pressure tank is under an unbalanced stress.

[0084] In order to solve the above problem, the portion having the length of L1 can be formed thicker, but this causes a problem of increasing the weight and volume.

[0085] Therefore, the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention may be formed so as to be evenly subjected to the stress regardless of the difference in the lengths of L1 and L2 by forming the cut part 1 by cutting L1 that is subjected to a less stress than L2.

[0086] FIG. 17 illustrates that the wall surface 200 is formed so as to enclose the outer surface of the internal grid part 100 of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention, in which the wall surface 200 may be formed on the outer surface of the internal grid part 100 to prevent a fluid from being leaked.

[0087] Further, as illustrated in FIG. 18, the grid plate 10 of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention may include a liquid passing part 3 for a liquid flow and a gas passing part 2 for a gas flow.

[0088] This is for passing liquid and gas between the grid plates 10, for example, when the liquid rises, the gases have to move to one side through the gas passing part 2 and be discharged to the outside through a pipe.

[0089] Therefore, the grid plate 10 of the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention is configured to include the liquid passing part 3 and the gas passing part 2.

[0090] However, it goes without saying that the liquid passing part 3 and the gas passing part 2 are not limited to positions illustrated in FIG. 18, but may be variously disposed according to the size of the tank or the surrounding environment.

[0091] As illustrated in FIG. 19, the grid-shaped pressure tank having a hollow part therein according to the exemplary embodiment of the present invention may further include a secondary wall surface 300 that is formed to be spaced apart from the outside of the wall surface 200 by a predetermined distance.

[0092] A heat insulating layer (not illustrated) may be between the secondary wall surface 300 the wall surfaces 200 or on the outside of the secondary wall surface 300 and the secondary wall surface 300 may serve to protect the wall surface 200 from an external impact or force and

secondarily prevent the stored materials such as liquefied natural gas leaked due to the damage of the wall surface 200 from being discharged to the outside.

[0093] At this point, the secondary wall surface 300 may further include a spacing part 310 formed to be spaced apart from the wall surface 200 by a predetermined distance, but is not limited the configuration or shape illustrated in FIG. 19.

[0094] Hereinabove, although the present invention has been described with reference to exemplary embodiments and the accompanying drawings, the present invention is not limited thereto, but may be variously modified and altered by those skilled in the art to which the present invention pertains without departing from the spirit and scope of the present invention claimed in the claims.

[0095] [Detailed Description of Main Elements]

[0096] 10: Grid plate

[0097] 12: Reinforcing edge plate

[0098] 20: Reinforcing grid plate

[0099] 21: Side reinforcing grid plate

[00100] 21-1: First side reinforcing grid plate

[00101] 22: End surface reinforcing grid plate

[00102] 22-1: First end surface reinforcing grid plate

[00103] 100: Internal grid plate

[00104] 110: Hollow part

[00105]	200: Wall surface
[00106]	300: Secondary wall surface
[00107]	310: Spacing part
[00108]	1: Cut part
[00109]	2: Gas passing part
[00110]	3: Liquid passing part

【CLAIMS】**【Claim 1】**

A grid-shaped pressure tank having a hollow part therein, comprising:

an internal grid part 100 having a plurality of grid plates 10 therein to form a hollow part 110 therein, the plurality of grid plates being disposed to be spaced apart from each other in a length direction, a width direction, and a height direction; and

a wall surface 200 formed to enclose an outer surface of the internal grid part 100,

wherein the internal grid part 100 further includes a reinforcing grid plate 20 formed at both ends in a length direction in a width direction and a height direction, and

wherein the reinforcing grid plate 20 includes a side reinforcing grid plate 21 formed along a side surface of the internal grid part 100; and an end surface reinforcing grid plate 22 formed along an end surface of the internal grid part 100.

【Claim 2】

The grid-shaped pressure tank of claim 1, wherein the reinforcing grid plate 20 further includes:

a first side reinforcing grid plate 21-1 bent at both ends of the side reinforcing grid plate 21 to extend in the length direction of the internal grid part 100; and

a first end surface reinforcing grid plate 22-1 extending at both ends of the end surface reinforcing grid plate 22 to be connected to both ends of the first side reinforcing grid plate 21-1.

【Claim 3】

The grid-shaped pressure tank of claim 1, wherein the

internal grid part 100 includes the grid plate 10 having a cut part 1 formed by cutting.

【Claim 4】

The grid-shaped pressure tank of claim of claim 1, wherein the grid plate 10 includes:

- a gas passing part 2 for a gas flow; and
- a liquid passing part 3 for a liquid flow.

【Claim 5】

The grid-shaped pressure tank of claim of claim 1, further comprising:

- a secondary wall surface 300 formed at an outside of the wall surface 200.