

# HEAT-INSULATING STRUCTURE AND HEAT-INSULATING TANK

## DESCRIPTION

### Technical Field

[0001]

The present invention relates to a heat-insulating structure and a heat-insulating tank and, more particularly, to a heat-insulating structure suitable for a thermal insulation panel that is disposed on the side surface of a tank and to a heat-insulating tank that includes the heat-insulating structure.

### Background Art

[0002]

In a liquefied gas tank for storing liquefied gas such as liquefied natural gas (LNG), the liquefied gas stored in the tank easily vaporizes, and hence there is a need to suppress the entry of heat from the tank surface. As such a heat-insulating structure, a panel system for installing a plurality of thermal insulation panels configured from a heat-insulating material on the surface of a tank, as disclosed in Patent Literature 1, for example, is already known.

[0003]

The heat-insulating structure disclosed in Patent Literature 1 is configured such that a protruding portion is formed in a center section of a thermal insulation block

(thermal insulation panel), such that only this protruding portion is brought into contact with the tank surface, and such that the parts of the thermal insulation block other than the protruding portion are formed at a predetermined gap from the tank surface. According to this invention, even when the outer plate of the tank has partially expanded outward, excessive contact between the tank outer plate and the thermal insulation block can be suppressed, and damage to the thermal insulation block and the support members can be suppressed.

#### Citation List

##### Patent Literature

[0004]

Patent Literature 1: Japanese Utility Model No. 4-40078.

##### Summary of Invention

##### Technical Problem

[0005]

For example, when a panel-system heat-insulating structure is applied to the side surface of a liquefied gas tank mounted in a liquefied gas carrying vessel or the like, a load such as the self-weight of the thermal insulation panel and the force of inertia involved in the operation of the carrying vessel is applied to the support members of the thermal insulation panel. When the heat-insulating structure disclosed in Patent Literature 1 is adopted here,

there has been a problem in that only the protruding portion formed in the center section of the thermal insulation panel is in contact with the tank surface, and therefore a rotational moment, the origin of which is the contact section between the protruding portion and the tank surface, is readily produced, thereby extending the damage to the support members.

[0006]

Embodiments of the present invention were conceived in view of these problems, and embodiments of the present invention seek to provide a heat-insulating structure and a heat-insulating tank that may enable support member damage to be suppressed even when a thermal insulation panel is applied to the side surface of the tank.

Solution to Problem

[0006a]

According to an aspect of the present invention, there is provided a heat-insulating structure disposed on the side surface of a tank that has, on the inside thereof, a stiffener which is provided in a horizontal direction and a support member which is disposed on a surface corresponds to the position where the the stiffener is disposed, the heat-insulating structure comprising: a thermal insulation panel that has, in a center section thereof, a fixed section which is fixed to the support member; a first pad that is long in a horizontal direction is disposed between the fixed section and the side surface of the tank; and a second pad that is disposed

in a position vertically below the first pad and between the side surface of the tank and the thermal insulation panel, and has smaller horizontal width than the first pad.

[0007]

According to embodiments of the present invention, there is provided a heat-insulating structure installed on the side surface of a tank on the surface of which a support member is disposed, the heat-insulating structure including : a thermal insulation panel that has, in a center section thereof, a fixed section which is fixed to the support member; a first pad that is disposed between the fixed section and the side surface of the tank; and a second pad that is disposed in a position below the first pad and between the side surface

of the tank and the thermal insulation panel.

[0008]

Furthermore, according to embodiments of the present invention, there is provided a heat-insulating tank over the whole surface of which a heat-insulating structure is formed, the heat-insulating structure being disposed on the side surface of a tank on the surface of which a support member is installed and the heat-insulating tank including: a thermal insulation panel that has, in a center section thereof, a fixed section which is fixed to the support member; a first pad that is disposed between the fixed section and the side surface of the tank; and a second pad that is disposed in a position below the first pad and between the side surface of the tank and the thermal insulation panel.

[0009]

In the heat-insulating structure and the heat-insulating tank, the thickness  $D_b$  of the second pad may be configured with a size equal to or less than the thickness  $D_a$  of the first pad. Furthermore, the thickness  $D_b$  of the second pad may be configured to vary in size according to the separation thereof from the first pad.

[0010]

In addition, the second pad may be disposed so as to be in contact with the first pad or may be configured to be integral with the first pad. Furthermore, the second pad

may be disposed in a position spaced apart from the first pad.

[0011]

Further, the thermal insulation panel may have a mark indicating the orientation thereof when same is installed on the side surface of the tank.

[0012]

In addition, the heat-insulating tank has, on the inside the side surface thereof, a stiffener which is provided so as to extend in a horizontal direction, and the support member may be disposed in alignment with the stiffener.

Advantageous Effects of Invention

[0013]

According to the foregoing heat-insulating structure and heat-insulating tank according to embodiments of the present invention, by installing, in addition to the first pad that supports the thermal insulation panel in a state of being spaced apart from the side surface of the tank, a second pad that is positioned between the thermal insulation panel and the tank and in a position below the first pad, it is possible to draw the lower section of the thermal insulation panel outward using the second pad when the side surface of the tank has expanded outward.

[0014]

Therefore, an external force can be made to act on the lower section of the thermal insulation panel by the second pad, and a drag on the load and the rotational moment that arises in the thermal insulation panel can be formed by this external force, whereby support member damage can be suppressed.

#### Brief Description of Drawings

[0015]

Fig. 1 is a diagram illustrating a heat-insulating tank according to a first embodiment of the present invention, where (A) illustrates a cross-sectional view of a marine vessel in which the heat-insulating tank is installed and (B) illustrates a modification example of the heat-insulating tank.

Fig. 2 is a side view of the heat-insulating tank in which section A in Fig. 1(A) is enlarged.

Fig. 3 is a diagram illustrating a heat-insulating structure according to the first embodiment of the present invention, where (A) illustrates a plan view, (B) illustrates a cross-sectional view along line B-B in Fig. 3(A), (C) is a first modification example of a second pad, and (D) illustrates a second modification example of the second pad.

Fig. 4 is a diagram illustrating the heat-insulating structure illustrated in Figs. 3(A) and 3(B), where (A)

illustrates a comparative view and (B) illustrates the first embodiment.

Fig. 5 is a plan view illustrating modification examples of the heat-insulating structure, where (A) illustrates a first modification example and (B) illustrates a second modification example.

Fig. 6 is a plan view illustrating heat-insulating structures according to other embodiments of the present invention, where (A) illustrates a second embodiment, (B) illustrates a third embodiment, (C) illustrates a fourth embodiment, and (D) illustrates a fifth embodiment.

Fig. 7 is a cross-sectional view illustrating heat-insulating structures according to other embodiments of the present invention, where (A) illustrates a sixth embodiment, (B) illustrates a seventh embodiment, and (C) illustrates an eighth embodiment.

#### Description of Embodiments

[0016]

Embodiments of the present invention will be described hereinbelow using Figs. 1(A) to 7(B). Here, Fig. 1 is a diagram illustrating a heat-insulating tank according to a first embodiment of the present invention, wherein (A) illustrates a cross-sectional view of a marine vessel in which the heat-insulating tank is installed and (B) illustrates a modification example of the heat-insulating

tank. Fig. 2 is a side view of the heat-insulating tank in which section A in Fig. 1(A) is enlarged. Fig. 3 is a diagram illustrating a heat-insulating structure according to the first embodiment of the present invention, where (A) illustrates a plan view, (B) illustrates a cross-sectional view along line B-B in Fig. 3(A), (C) is a first modification example of a second pad, and (D) illustrates a second modification example of the second pad.

[0017]

A heat-insulating tank 1 according to the first embodiment of the present invention is a heat-insulating tank over the whole surface of which a heat-insulating structure 2 is formed, the heat-insulating structure 2 being installed on a side surface 1s of the heat-insulating tank 1 on the surface of which a support member 11 is disposed, the heat-insulating tank 1 including: a thermal insulation panel 3 that has, in a center section thereof, a fixed section 31 which is fixed to the support member 11; a first pad 4 that is disposed between the fixed section 31 and the side surface 1s (an outer plate 15) of the heat-insulating tank 1; and a second pad 5 that is disposed in a position below the first pad 4 and between the side surface 1s (the outer plate 15) of the heat-insulating tank 1 and the thermal insulation panel 3.

[0018]

The heat-insulating tank 1 illustrated in Fig. 1(A) is a standalone tank-type liquefied gas tank that is mounted in a marine vessel 6 (a liquefied gas carrying vessel) for carrying liquefied gas such as liquefied natural gas (LNG) or liquefied petroleum gas (LPG). The marine vessel 6 (liquefied gas carrying vessel) includes a hull 61 disposed on the water and a storage section 62 in which the heat-insulating tank 1 can be mounted, for example. The hull 61 has a dual hull structure, for example. The storage section 62 is constituted by a space surrounded by the hull 61, and the upper section of the storage section 62 is hermetically covered by a tank cover 63. Furthermore, a support member 64 that supports a bottom section 1b of the heat-insulating tank 1 may also be disposed on the bottom section of the storage section 62.

[0019]

Note that the heat-insulating tank 1 is not limited to a tank mounted in a liquefied gas carrying vessel and may, for example, be a tank mounted in a floating body storage system that stores liquefied gas such as liquefied natural gas (LNG) or liquefied petroleum gas (LPG) on water, or a liquefied gas tank that is installed above ground.

[0020]

In addition, the heat-insulating tank 1 has a substantially rectangular parallelepiped shape configured

from the outer plate 15 in which the bottom section 1b, an apex section 1t, and a plurality of side surfaces 1s are formed, and includes a transverse material 12 (large support) disposed on the inside of the outer plate 15; a plurality of stiffeners 13 (small supports) disposed on the inside of the outer plate 15; and a tank dome 14 into which piping or the like for supplying or extracting liquefied gas is inserted. Note that the heat-insulating tank 1 is not limited to a rectangular parallelepiped and may have a spherical shape or a cylindrical shape.

[0021]

Furthermore, in the heat-insulating tank 1 illustrated in Fig. 1(A), the side surface 1s is also assumed to include an inclined surface which is formed on the bottom section 1b side. Further, as illustrated in Fig. 1(B), the heat-insulating tank 1 may also have an inclined surface on the apex section 1t side. In this case, the side surface 1s is also assumed to include an inclined surface which is formed on the apex section 1t side. In other words, in the present embodiment, the side surface 1s signifies not only a vertical surface but also includes a surface which is inclined to the vertical direction. Note that, for the sake of expediency, the heat-insulating tank 1 illustrated in Fig. 1(B) is illustrated with only its outline showing, and the support members 11, the transverse material 12, the

stiffeners 13, and the tank dome 14 are omitted from the illustration.

[0022]

The support members 11 whereon the thermal insulation panel 3 is installed are arranged on the surface of the outer plate 15 in correspondence with the positions in which the stiffeners 13 are arranged, for example. As illustrated in Fig. 3(B), for example, the support members 11 are configured from a stud bolt 11a which is welded to the surface of the heat-insulating tank 1; a washer 11b which is inserted into the stud bolt 11a; and a nut 11c which is screwed onto the stud bolt 11a.

[0023]

As illustrated in Figs. 3(A) and 3(B), for example, the thermal insulation panel 3 is a thermal insulating material that is in a state of being disposed on the outer plate 15 of the side surface 1s of the heat-insulating tank 1 (a usage state) and has a rectangular parallelepiped shape with a vertical height  $H_p$ , a horizontal width  $W_p$ , and a thickness  $D_p$ . The vertical height  $H_p$  and horizontal width  $W_p$  are configured to be substantially the same size but the thermal insulation panel 3 is not limited to such a shape.

[0024]

The fixed section 31 of the thermal insulation panel 3 is provided with a long and narrow insertion hole 31a into

which the stud bolt 11a can be inserted; an open section 31b that forms a cylindrical-shaped space into which the washer 11b can be inserted; and a lid member 31c that closes the open section 31b. The open section 31b has a larger diameter than the insertion hole 31a, and a step section is formed between the insertion hole 31a and the open section 31b. The washer 11b is formed with a size enabling contact with the step section.

[0025]

Furthermore, as illustrated in Fig. 3(A), the open section 31b has a vertical height  $H_f$  and a horizontal width  $W_f$ . When the open section 31b is a cylindrical-shaped space, the vertical height  $H_f$  and the horizontal width  $W_f$  are configured with the same size.

[0026]

As illustrated in Figs. 3(A) and 3(B), for example, the first pad 4 is a thermal insulating material and having a long rectangular parallelepiped shape in a horizontal direction in a used state. A long and narrow insertion hole 41 into which the stud bolt 11a can be inserted is formed in the center section of the first pad 4. Furthermore, the first pad 4 has a vertical height  $H_a$ , a horizontal width  $W_a$ , and a thickness  $D_a$ .

[0027]

For example, the vertical height  $H_a$  is configured to be

on the order of 20% of the vertical height  $H_p$  of the thermal insulation panel 3 or to be substantially the same size as the vertical height  $H_f$  of the open section 31b but is not limited to this number and size.

[0028]

When the thermal insulation panel 3 is fixed to the support member 11, first the first pad 4 is threaded onto the stud bolt 11a, and then the thermal insulation panel 3 is threaded onto the stud bolt 11a. Thereafter, the washer 11b is threaded onto the stud bolt 11a from the open section 31b, and the nut 11c is screwed onto the stud bolt 11a. Finally, the open section 31b is sealed by the lid member 31c. The method for securing the thermal insulation panel 3 is the same as a conventional fixing method. The present embodiment is characterized in that a second pad 5 is installed.

[0029]

As illustrated in Figs. 3(A) and 3(B), for example, the second pad 5 is a thermal insulating material and having a long rectangular parallelepiped shape in a horizontal direction in a used state. In the present embodiment, the second pad 5 is disposed so as to be in contact with the lower surface of the first pad 4. Note that the second pad 5 is fixed to the thermal insulation panel 3 using adhesive or the like but could also be fixed to the surface of the

heat-insulating tank 1.

[0030]

Furthermore, the second pad 5 has a vertical height  $H_b$ , a horizontal width  $W_b$ , and a thickness  $D_b$ . The vertical height  $H_b$  is, for example, configured larger than about half the vertical height  $H_a$  of the first pad 4 or smaller than about half the horizontal width  $W_a$  of the first pad 4. In addition, the horizontal width  $W_b$  is, for example, configured larger than the horizontal width  $W_f$  of the open section 31b and smaller than the horizontal width  $W_a$  of the first pad 4. Further, the thickness  $D_b$  is configured to be substantially the same size as the thickness  $D_a$  of the first pad 4, for example.

[0031]

Note that the second pad 5 is not limited to the shapes illustrated in Figs. 3(A) and 3(B). For example, the second pad 5 may be a cube shape subject to a vertical height  $H_b =$  horizontal width  $W_b$  relationship, as illustrated in Fig. 3(C), or may be a rectangular parallelepiped shape which is long in the vertical direction and subject to a vertical height  $H_b >$  horizontal width  $W_b$  relationship, as illustrated in Fig. 3(D). Note that a state where the thermal insulation panel 3 is omitted for the sake of expediency is illustrated in Figs. 3(C) and 3(D).

[0032]

The heat-insulating structure 2 according to the present embodiment is configured from the foregoing thermal insulation panel 3, first pad 4, and second pad 5 and, as illustrated in Fig. 2, is made to cover the side surfaces 1s of the heat-insulating tank 1 at a predetermined gap therefrom. Thermal insulating material having an elastic force such as glass wool is disposed in the gap between the thermal insulation panels 3 (in the sections shaded gray in the drawing).

[0033]

Furthermore, as will be described subsequently, the heat-insulating structure 2 according to the present embodiment eliminates the effect of the self-weight of the thermal insulation panel 3, and therefore the first pad 4 and second pad 5 are preferably used side by side in a vertical direction. Therefore, a conventional heat-insulating structure which does not use the second pad 5 can be used as the heat-insulating structure 2 that is disposed on the bottom section 1b and the apex section 1t of the heat-insulating tank 1.

[0034]

Note that the heat-insulating structure 2 according to the present embodiment can be used as long as a state is assumed enabling a gravitational force, however slight, to

act on the thermal insulation panel 3, in a direction from the first pad 4 toward the second pad 5. In other words, the side surface 1s of the heat-insulating tank 1, which uses the heat-insulating structure 2 according to the present embodiment, may also include a surface that is inclined relative to the vertical direction illustrated in Figs. 1(A) and 1(B).

[0035]

Here, Fig. 4 is a diagram illustrating the action of the heat-insulating structure illustrated in Figs. 3(A) and 3(B), where (A) illustrates a comparative view and (B) illustrates the first embodiment. Here, the comparative example illustrated in Fig. 4(A) includes a thermal insulation panel 3' and a first pad 4' and illustrates a conventional heat-insulating structure 2' which does not have a second pad. Furthermore, in Figs. 4(A) and 4(B), only one thermal insulation panel 3, 3' is illustrated for the sake of expediency, other thermal insulation panels being omitted from the illustration.

[0036]

As illustrated in Fig. 4(A), the heat-insulating tank 1' of the comparative example has an outer plate 15' that forms a vertical surface, and a plurality of stiffeners 13' are arranged at fixed intervals on the inside of the outer plate 15'. Furthermore, support members 11' are arranged

on the surface of the outer plate 15' in positions corresponding to the stiffeners 13'. The first pad 4' and the thermal insulation panel 3' are fixed to the support members 11'. When a liquid such as liquefied natural gas (LNG) is supplied to the heat-insulating tank 1', the section of the outer plate 15' where the stiffeners 13' are not arranged expands outward due to the fluid pressure, as illustrated by the dash-dot-dash line in the drawing.

[0037]

The expansion of the outer plate 15' is absorbed by the gap formed between the thermal insulation panel 3' and the outer plate 15', and hence excessive contact between the outer plate 15' and the thermal insulation panel 3' can be suppressed, and damage to the thermal insulation panel 3' and the support members 11' can be suppressed.

[0038]

However, in the case of the thermal insulation panel 3', because only the first pad 4' is in contact with the outer plate 15', a load (a rotational moment  $M$ ) due to the self-weight  $F$  and force of inertia of the thermal insulation panel 3' acts on the support members 11'. Hence, there is a problem in that the self-weight  $F$  and rotational moment  $M$  extend the damage to the support members 11'.

[0039]

In contrast, with the heat-insulating structure 2

according to the present embodiment illustrated in Fig. 4(B), when a liquid such as liquefied natural gas (LNG) is supplied to the heat-insulating tank 1, if the section of the outer plate 15 where the stiffeners 13 are not arranged expands outward due to the fluid pressure as illustrated by the dash-dot-dash line in the drawing, the second pad 5 is then pushed outward. The lower section of the thermal insulation panel 3 can be pushed outward by the movement of the second pad 5.

[0040]

Therefore, an external force can be made to act on the lower section of the thermal insulation panel 3 by the second pad 5, drag (a load  $F_p$  and a rotational moment  $M_p$ ) on the self-weight  $F$  and rotational moment  $M$  which are produced in the thermal insulation panel 3 by the external force can be formed, and damage to the support members 11 can be suppressed.

[0041]

Note that the thermal deformation of the heat-insulating tank 1 which accompanies the supplying and extraction of a liquid such as liquefied natural gas (LNG) causes the whole of the outer plate 15 to expand or contract, and hence the effect on the foregoing heat-insulating structure 2 is minimal. In other words, the heat-insulating structure 2 according to the present

embodiment is configured to accommodate the deformation involved in partial expansion of the outer plate 15 when liquid is contained in the heat-insulating tank 1.

[0042]

Next, modification examples of the foregoing heat-insulating structure 2 will be described with reference to Figs. 5(A) and 5(B). Here, Fig. 5 is a plan view illustrating modification examples of the heat-insulating structure, where (A) illustrates a first modification example and (B) illustrates a second modification example.

[0043]

With the heat-insulating structure 2, because the first pad 4 and second pad 5 are connected to the back face of the thermal insulation panel 3 in the form of a block by means of adhesive or the like, the thermal insulation panel 3 in block form has a shape that is asymmetric in a vertical direction. Hence, there is a risk that the top, bottom, left and right sides of the thermal insulation panel 3 will be positioned erroneously when the heat-insulating structure 2 is implemented.

[0044]

Thus, a mark 32 indicating the orientation of the thermal insulation panel 3 when same is disposed on the side surface of the heat-insulating tank 1 may be placed on the surface of the thermal insulation panel 3. The mark 32

may be provided through printing, stamping, or by attaching a seal.

[0045]

Furthermore, downward positioning may be indicated by an arrow as per the first modification example illustrated in Fig. 5(A), or upward positioning and downward positioning may be indicated by text as per the second modification example illustrated in Fig. 5(B). Note that, although not illustrated, the mark 32 may be another mark other than an arrow (a circle or the like), may be displayed in English, or may represent all the orientations top, bottom, left, and right.

[0046]

Next, heat-insulating structures 2 according to other embodiments of the present invention will be described with reference to Figs. 6(A) to 7(C). Here, Fig. 6 is a plan view illustrating heat-insulating structures according to other embodiments of the present invention, where (A) illustrates a second embodiment, (B) illustrates a third embodiment, (C) illustrates a fourth embodiment, and (D) illustrates a fifth embodiment. Fig. 7 is a cross-sectional view illustrating heat-insulating structures according to other embodiments of the present invention, where (A) illustrates a sixth embodiment, (B) illustrates a seventh embodiment, and (C) illustrates an eighth

embodiment.

[0047]

The heat-insulating structure 2 according to the second embodiment illustrated in Fig. 6(A) is configured such that the second pad 5 is disposed in a position spaced apart from the first pad 4. The heat-insulating structure 2 according to the third embodiment illustrated in Fig. 6(B) is configured such that the second pad 5 is configured to be integral with the first pad 4. In this third embodiment, the horizontal width of the second pad 5 is configured to be of the same size as the horizontal width of the first pad 4. The heat-insulating structure 2 according to the fourth embodiment illustrated in Fig. 6(C) is configured such that the second pad 5 is divided into two and arranged in the respective lower corners of the thermal insulation panel 3. The heat-insulating structure 2 according to the fifth embodiment illustrated in Fig. 6(D) is configured by shortening the horizontal width of the first pad 4 illustrated in the fourth embodiment and by forming the vertical surface cross-section of the first pad 4 as a substantially square shape.

[0048]

The heat-insulating structure 2 according to the sixth embodiment illustrated in Fig. 7(A) is configured by forming the thickness of the second pad 5 such that same

grows thinner as its separation from the first pad 4 increases. Specifically, the second pad 5 has a tapered surface 51, and the tapered surface 51 is disposed so as to not be in contact with the outer plate 15. Thus, by adjusting the thickness of the second pad 5 according to the distance from the first pad 4, the load  $F_p$  and rotational moment  $M_p$ , which are generated when the outer plate 15 expands, can be optionally adjusted.

[0049]

The heat-insulating structure 2 according to the seventh embodiment illustrated in Fig. 7(B) is configured by forming the thickness  $Db$  of the second pad 5 to be thinner than the thickness  $Da$  of the first pad 4. When the position in which the second pad 5 is disposed is spaced apart from the first pad 4, because the expansion amount of the outer plate 15 is large, the load  $F_p$  and rotational moment  $M_p$ , which are generated by the second pad 5, are then also large. Therefore, by adjusting the thickness  $Db$  of the second pad 5, the load  $F_p$  and rotational moment  $M_p$ , which are generated when the outer plate 15 expands, can be optionally adjusted.

[0050]

The heat-insulating structure 2 according to the eighth embodiment illustrated in Fig. 7(C) is configured by forming the thickness of the second pad 5 such that same

grows thicker as its separation from the first pad 4 increases. For example, when the section of the outer plate 15 where the support members 11 are arranged protrudes and the sections surrounding this section are recessed, the thickness of the second pad 5 may be configured to grow thicker as its separation from the first pad 4 increases. Specifically, the second pad 5 has a tapered surface 51 which is in contact with the inclined surface of the outer plate 15. Thus, by adjusting the thickness of the second pad 5 according to the distance from the first pad 4, the load  $F_p$  and rotational moment  $M_p$  can be optionally adjusted according to the shape of the outer plate 15.

[0051]

As described hereinabove, various shapes and placement can be selected according to requirements as long as the second pad 5 is disposed in a position below the center section of the thermal insulation panel 3. Note that the respective shape and disposition of the second pad 5 illustrated in the foregoing first to eighth embodiments are merely an example, and the heat-insulating structure 2 according to the present invention is not limited to the illustrated configurations.

[0052]

It goes without saying that the present invention is

not limited to the foregoing embodiments and that various modifications can be made without departing from the spirit of the present invention.

#### Reference Signs List

[0053]

- 1 Heat-insulating tank
- 1b Bottom section
- 1s Side surface
- 1t Apex section
- 2 Heat-insulating structure
- 3 Thermal insulation panel
- 4 First pad
- 5 Second pad
- 6 Liquefied gas carrying vessel
- 11 Support member
- 11a Stud bolt
- 11b Washer
- 11c Nut
- 12 Transverse material
- 13 Stiffeners
- 14 Tank dome
- 15 Outer plate
- 31 Fixed section
- 31a Insertion hole
- 31b Open section

31c Lid member  
32 Mark  
41 Insertion hole  
51 Tapered surface  
61 Hull  
62 Storage section  
63 Tank cover  
64 Support member

## CLAIMS

1. A heat-insulating structure disposed on the side surface of a tank that has, on the inside thereof, a stiffener which is provided in a horizontal direction and a support member which is disposed on a surface corresponds to the position where the the stiffener is disposed, the heat-insulating structure comprising:

a thermal insulation panel that has, in a center section thereof, a fixed section which is fixed to the support member;

a first pad that is long in a horizontal direction is disposed

between the fixed section and the side surface of the tank; and

a second pad that is disposed in a position vertically below the first pad and between the side surface of the tank and the thermal insulation panel, and has smaller horizontal width than the first pad.

2. The heat-insulating structure according to claim 1, wherein a thickness  $D_b$  of the second pad is configured with a size equal to or less than a thickness  $D_a$  of the first pad.

3. The heat-insulating structure according to claim 2, wherein the thickness  $D_b$  of the second pad is configured to vary in size according to the separation thereof from the first pad.

4. The heat-insulating structure according to claim 1, wherein the second pad is disposed so as to be in contact with the first pad or is configured to be integral with the first pad.

5. The heat-insulating structure according to claim 1, wherein the second pad is disposed in a position spaced apart from the first pad.

6. The heat-insulating structure according to claim 1, wherein the thermal insulation panel has a mark indicating the orientation thereof when same is installed on the side surface of the tank.

7. A heat-insulating tank over the whole surface of which a heat-insulating structure is formed, wherein the heat-insulating structure is the heat-insulating structure according to any one of claims 1 to 6.