

Thermally insulating and leaktight tank wall

Technical field

The invention relates to the field of sealed and thermally insulating tanks with
5 membranes. In particular, the invention relates to the field of sealed and thermally
insulating tanks for storing and/or transporting low-temperature liquefied gas, such as
tanks for transporting Liquefied Petroleum Gas (also called LPG) having, for example,
a temperature between -50°C and 0°C , or for transporting Liquefied Natural Gas
(LNG) at approximately -162°C at atmospheric pressure. These tanks can be installed
10 onshore or on a floating structure. In the case of a floating structure, the tank can be
intended for transporting liquefied gas or for receiving liquefied gas used as fuel to
propel the floating structure.

Technological background

Document WO2014/167227 discloses a sealed and thermally insulating tank
15 for storing liquefied gas in a structure that comprises a support wall. The tank
comprises a tank wall attached onto the support wall and comprising a thermally
insulating barrier made up of juxtaposed insulation blocks and a sealing membrane
made up of corrugated sheets sealably welded together.

In order to attach the sealing membrane to the thermally insulating barrier,
20 retention elements in the form of rails are inserted into a groove formed in an insulating
block of the thermally insulating barrier. The sheets forming the sealing membrane
are subsequently welded, via their edges, to the rail inserted into the groove at its
edges. Thus, each sheet of the sealing membrane is attached to the thermally
insulating barrier so as to maintain translation mobility in the lengthwise direction of
25 the rail. Indeed, with the rail being slidably mounted in the groove, the sheets of the
membrane maintain the same mobility as the rails. Thus, the displacements of the
edges of the sheets of the membrane are freed to reduce the stresses in the
membrane.

However, the retention elements of the document of the prior art have several
30 disadvantages. Indeed, these particularly relate to a complex and expensive design.

Furthermore, the mechanical resistance of these elements needs to be improved in order to absorb the stresses experienced by the sealing membrane over the long term.

Summary

5 One idea behind the invention is to improve the sliding attachment of the sealing membrane to the thermal insulating barrier, whilst maintaining sufficient mechanical resistance for withstanding the stresses exerted by the sealing membrane on the attachment.

 According to one embodiment, the invention provides a sealed and thermally
10 insulating tank wall for forming a sealed and thermally insulating tank for storing a liquefied gas, the tank wall comprising:

a sealing membrane intended to be in contact with the liquefied gas contained in the tank, the sealing membrane comprising a corrugated metal plate;
a thermally insulating barrier forming a support surface for the sealing membrane and
15 comprising a groove extending in a longitudinal direction;

at least one welding support borne by the thermally insulating barrier, the welding support comprising a lower part retained in the groove of the thermally insulating barrier in a direction perpendicular to the support surface, an upper part parallel to the support surface, an intermediate part connecting the lower part to the upper part, the
20 intermediate part being disposed in the groove in a thickness direction of the thermally insulating barrier,

wherein the at least one welding support is slidably mounted in said groove in the longitudinal direction, and the corrugated metal plate is welded to the upper part of the welding support,

25 and wherein the upper part of the welding support is accommodated in a counterbore adjacent to the groove, the counterbore being formed in the thermally insulating barrier, so that the upper part of the welding support is located between the sealing membrane and the thermally insulating barrier and in the extension of the support surface.

30 The longitudinal direction is defined as being a direction parallel to one of the edges of the corrugated metal plate.

By virtue of these features, the welding support allows the sealing membrane to be attached to the thermally insulating barrier, whilst maintaining a degree of freedom in the longitudinal direction due to the sliding assembly of the welding support in the groove. This degree of freedom allows small movements of the edges of the metal plate relative to the thermally insulating barrier to occur during temperature variations, which limits the concentrations of stresses and improves the distribution of the forces and movements experienced by the corrugated plate in order to limit the fatigue of the sealing membrane.

Furthermore, the upper part of the welding support rests in a counterbore produced in the thermally insulating barrier, which allows the welding support to be located in the continuity of the support surface of the thermally insulating barrier, and therefore obviates the need for additional machining of the corrugated metal plate in order to limit the manufacturing cost of the assembly. Furthermore, the counterbore allows the upper part of the welding support to be supported by the thermally insulating barrier, which results in the mechanical forces of the upper part of the welding support, in particular the pressure stresses applied to the sealing membrane in the thickness direction of the tank wall, being transferred to the thermally insulating barrier.

According to embodiments, such a tank wall can comprise one or more of the following features.

According to one embodiment, the welding support is an elongated element extending in the same direction as the groove.

According to one embodiment, the tank wall comprises a plurality of welding supports retained in the groove. The welding supports can be spaced apart from each other or can be continuously disposed in the groove.

According to one embodiment, an edge of the corrugated metal plate extending in the longitudinal direction is welded to the upper part of the welding support.

According to one embodiment, the groove is a longitudinal groove, the edge is a first edge, the welding support is a first welding support, and the thermally

insulating barrier comprises a transverse groove extending in a transverse direction perpendicular to the longitudinal direction, wherein the wall comprises a second welding support, the lower part of which is retained in the transverse groove of the thermally insulating barrier, and wherein a second edge of the corrugated metal plate
5 extending in the transverse direction is welded to the upper part of the second welding support.

According to one embodiment, said groove has, in the thermally insulating barrier, an inlet zone, which extends in the thickness direction, the groove comprising a retention zone, which is disposed under the inlet zone and which is established
10 parallel to the support surface over a greater width than the inlet zone, and wherein the lower part of the welding support is accommodated in the retention zone.

Thus, the retention zone enables blocking of the movement of the lower part of the welding support, and therefore of the welding support as a whole, to be improved in the thickness direction of the thermally insulating barrier.

15 According to one embodiment, the retention zone is established parallel to the support surface on either side of the inlet zone, and said welding support comprises a first segment and a second segment, the first segment comprising a lower part retained in the retention zone of the thermally insulating barrier in a direction perpendicular to the support surface, an upper part parallel to the support
20 surface and accommodated in the counterbore adjacent to the groove, so that the upper part of the first segment is located between the sealing membrane and the thermally insulating barrier and in the extension of the support surface, an intermediate part connecting the lower part of the first segment to the upper part of the first segment, the intermediate part being disposed in the groove in a thickness
25 direction of the thermally insulating barrier, and the second segment comprising a lower part retained in the retention zone of the thermally insulating barrier in a direction opposite the direction of the lower part of the first segment, and an intermediate part welded to the intermediate part of the first segment, and wherein the upper part of the first segment is welded to the corrugated metal plate.

30 By virtue of these features, the first segment allows the sealing membrane to be slidably attached to the thermally insulating barrier. Furthermore, the second segment allows the welding support to be reinforced, in particular at the intermediate

part, and allows the movement of the welding support to be limited in the transverse direction, namely the direction of the lower part of the welding support. The second segment also allows the perpendicular load resistance of the welding support to be increased, by distributing the forces experienced by the corrugated metal plate over
5 twice as much surface area of the thermally insulating barrier, as well as the resistance of the welding support against tearing out of the groove.

According to one embodiment, the counterbore is a first counterbore, the thermally insulating barrier comprising a second counterbore, the first counterbore and the second counterbore being located on either side of said groove, and wherein
10 the second segment comprises an upper part parallel to the support surface and accommodated in the second counterbore, so that the upper part of the second segment is located between the sealing membrane and the thermally insulating barrier and in the extension of the support surface, the intermediate part of the second segment connecting the lower part of the second segment to the upper part of the
15 second segment.

By virtue of these features, the upper part of the second segment rests in a second counterbore produced in the thermally insulating barrier, which allows the welding support to be located in the continuity of the support surface of the thermally insulating barrier, and therefore obviates the need for additional machining of the
20 corrugated metal plate in order to limit the manufacturing cost of the assembly. Furthermore, the second counterbore allows the upper part of the second segment to be supported by the thermally insulating barrier, which improves the resistance of the welding support, in particular in the event of stresses applied to the sealing membrane in the thickness direction of the tank wall.

25 According to one embodiment, said groove has, in the thermally insulating barrier, an inlet zone, which extends in the thickness direction, the inlet zone comprising a fastener attached to a wall of said groove, and wherein the lower part of the welding support is slidably accommodated in the fastener.

Thus, the fastener enables blocking of the movement of the lower part of the
30 welding support, and thus of the welding support, to be improved in its entirety in the thickness direction of the thermally insulating barrier.

According to one embodiment, the lower part comprises a hook and the fastener comprises an opposing hook, the hook being accommodated in the opposing hook.

According to one embodiment, the fastener is a first fastener and the inlet
5 zone comprises a second fastener attached to a wall of said groove opposite the first fastener, said welding support comprises a first segment and a second segment, the first segment comprising a lower part retained in the first fastener of the thermally insulating barrier in a direction perpendicular to the support surface, an upper part parallel to the support surface and accommodated in the counterbore adjacent to the
10 groove, so that the upper part of the first segment is located between the sealing membrane and the thermally insulating barrier and in the extension of the support surface, with an intermediate part of the first segment connecting the lower part to the upper part, the intermediate part being disposed in the inlet zone in a thickness direction of the thermally insulating barrier, and the second segment comprising a
15 lower part retained in the second fastener of the thermally insulating barrier, and an intermediate part of the second segment welded to the intermediate part of the first segment.

By virtue of these features, the first segment allows the sealing membrane to be slidably attached to the thermally insulating barrier. Furthermore, the second
20 segment allows the welding support to be reinforced, in particular at the intermediate part, and also allows the movement of the welding support to be limited in the transverse direction, namely the direction of the lower part of the welding support.

According to one embodiment, the counterbore is a first counterbore, the thermally insulating barrier comprising a second counterbore, the first counterbore
25 and the second counterbore being located on either side of said groove, and wherein the second segment comprises an upper part parallel to the support surface and accommodated in the second counterbore, so that the upper part of the second segment is located between the sealing membrane and the thermally insulating barrier and in the extension of the support surface, the intermediate part of the second
30 segment connecting the lower part of the second segment to the upper part of the second segment.

According to one embodiment, the metal plate welded to the upper part of the welding support is a first metal plate, wherein the sealing membrane comprises a second corrugated metal plate comprising an offset portion welded above the first metal plate to form a sealed overlap between the two metal plates and wherein the
5 weld between the upper part of the welding support and the first metal plate is located below the offset portion of the second metal plate.

According to one embodiment, the thermally insulating barrier comprises a plurality of juxtaposed parallelepiped insulating panels, the upper part of the welding support being retained in an insulating panel of the thermally insulating barrier and
10 the counterbore being formed in said insulating panel.

According to one embodiment, the thermally insulating barrier comprises a plurality of juxtaposed parallelepiped insulating panels and wherein said groove is located between two adjacent insulating panels of the thermally insulating barrier, so that the inlet zone is an inter-panel space.

15 By virtue of these features, the inlet zone does not require the machining of an insulating panel, but simply requires two panels to be placed at a certain distance.

According to one embodiment, the thermally insulating barrier comprises a plurality of juxtaposed parallelepiped insulating panels and wherein said groove is located at the center of an insulating panel of the thermally insulating barrier.

20 According to one embodiment, the thermally insulating barrier comprises a plurality of juxtaposed parallelepiped insulating panels and wherein said groove is located in the vicinity of an edge of an insulating panel.

The expression "in the vicinity of an edge of an insulating panel" means that the element is located at a distance from an edge ranging between 0 and 10% of a
25 transverse dimension of an insulating panel.

According to one embodiment, the groove is a first groove and the thermally insulating barrier comprises a second groove extending in the longitudinal direction at a distance from the first groove, the counterbore extending between the two grooves, the upper part of the welding support being accommodated in the counterbore
30 extending between the two grooves, and wherein the lower part is a first lower part

and the intermediate part is a first intermediate part, the welding support comprising a second lower part and a second intermediate part connecting the second lower part to the upper part of the welding support, so that the first lower part and the first intermediate part are located in the first groove and so that the second lower part and
 5 the second intermediate part are located in the second groove separate from the first groove.

According to one embodiment, at least one of or each lower part is formed by a plurality of lower part portions spaced apart from each other in the longitudinal direction and at least one of or each intermediate part is formed by a plurality of
 10 intermediate part portions spaced apart from each other in the longitudinal direction, so that each intermediate part portion connects one of the lower part portions to the upper part.

According to one embodiment, the upper part is a first upper part and the thermally insulating barrier comprises a third groove extending in the transverse
 15 direction and a fourth groove adjacent to the third groove and extending in the transverse direction, and wherein the welding support comprises a second upper part that is accommodated in a transverse counterbore extending between the third groove and the fourth groove, the third and fourth grooves crossing the first and second grooves.

20 According to one embodiment, a third intermediate part is located in the third groove and is connected to the second upper part, and a fourth intermediate part is located in the fourth groove and is connected to the second upper part.

According to one embodiment, the thermally insulating barrier is a primary thermally insulating barrier and the sealing membrane is a primary sealing membrane,
 25 and wherein the tank wall further comprises a secondary sealing membrane located under the primary thermally insulating barrier and a secondary thermally insulating barrier located under the secondary sealing membrane and comprising a plurality of juxtaposed parallelepiped insulating panels forming a support surface for the secondary sealing membrane.

30 According to one embodiment, the secondary sealing membrane comprises a plurality of strakes parallel to the longitudinal direction, a strake comprising a flat

central portion resting on an upper surface of the insulating panels of the secondary thermally insulating barrier and two raised edges projecting toward the primary sealing membrane relative to the central portion, the strakes being juxtaposed in a transverse direction perpendicular to the longitudinal direction following a repeated pattern and sealably welded together at the raised edges, with anchoring wings anchored to the insulating panels of the secondary thermally insulating barrier and parallel to the longitudinal direction being arranged between the juxtaposed strakes in order to retain the secondary sealing membrane on the secondary thermally insulating barrier.

According to one embodiment, the secondary thermally insulating barrier comprises a plurality of secondary rows parallel to the longitudinal direction, with a secondary row comprising a plurality of juxtaposed parallelepiped secondary insulating panels, the secondary rows being juxtaposed in the transverse direction following a repeated pattern, wherein the dimension of the repeated pattern of secondary rows is an integer multiple of the dimension of a strake in the transverse direction.

According to one embodiment, the primary insulating barrier comprises a plurality of primary rows parallel to the longitudinal direction, with a primary row comprising a plurality of juxtaposed parallelepiped primary insulating panels and being stacked on a secondary row, the primary rows being juxtaposed in the transverse direction following a repeated pattern, the dimension of the repeated pattern of the primary rows being equal to the dimension of the repeated pattern of the secondary rows in the transverse direction.

According to one embodiment, the primary sealing membrane has first corrugations parallel to the longitudinal direction and disposed following a repeated pattern in the transverse direction and flat portions located between the first corrugations and resting on an upper surface of the primary insulating panels, wherein the dimension of the repeated pattern of the primary rows is an integer multiple of the dimension of the repeated pattern of the first corrugations; the primary sealing membrane comprising a plurality of rows of metal sheets parallel to the longitudinal direction, with a row of metal sheets comprising a plurality of rectangular metal sheets sealably welded together via edge zones, the rows of metal sheets being juxtaposed in the transverse direction and sealably welded together, the

dimension of a row of metal sheets in the transverse direction being equal to an integer multiple of the dimension of the repeated pattern of the primary rows; the rows of metal sheets being offset in the transverse direction relative to the primary rows, so that the welded junctions between the rows of metal sheets are located at a distance from the interfaces between the primary rows.

According to one embodiment, the invention also provides a sealed and thermally insulating tank disposed in a support structure, the tank comprising a plurality of walls sealably attached together so as to form an internal space for receiving a liquefied gas, wherein at least one of the walls is an aforementioned wall.

Such a tank can form part of an onshore storage installation, for example, for storing LNG, or can be installed in a floating, coastal or deep sea structure, in particular an LNG tanker vessel, a floating storage and regasification unit (FSRU), an offshore floating production and storage unit (FPSO) and others. Such a tank also can be used as a fuel tank in any type of vessel.

According to one embodiment, a vessel for transporting a cold liquid product comprises a double hull and an aforementioned tank disposed in the double hull.

According to one embodiment, the invention also provides a method for loading or offloading such a vessel, wherein a cold liquid product is routed through insulated pipelines, from or to a floating or onshore storage installation, to or from the tank of the vessel.

According to one embodiment, the invention also provides a transfer system for a cold liquid product, the system comprising the aforementioned vessel, insulated pipelines arranged so as to connect the tank installed in the hull of the vessel to a floating or onshore storage installation and a pump for conveying a flow of cold liquid product through the insulated pipelines, from or to the floating or onshore storage installation, to or from the tank of the vessel.

Brief description of the figures

The invention will be better understood, and further aims, details, features and advantages thereof will become more clearly apparent throughout the following description of a plurality of particular embodiments of the invention, which are

provided solely by way of a non-limiting illustration, with reference to the accompanying drawings, in which:

- **figure 1** is a perspective cutaway view of a tank wall according to one embodiment;
- 5 - **figure 2** is an exploded view of zone II of figure 1;
- **figure 3** is a section view along line III-III of figure 1;
- **figure 4** is an exploded view of zone IV of figure 3 showing a welding support attaching the primary sealing membrane to the primary thermally insulating barrier according to a first embodiment;
- 10 - **figure 5** is an exploded view of zone IV of figure 3 showing a welding support according to a second embodiment;
- **figure 6** is an exploded view of zone IV of figure 3 showing a welding support according to a third embodiment;
- **figure 7** is an exploded view of zone IV of figure 3 showing a welding
15 support according to a fourth embodiment;
- **figure 8** is an exploded view of zone IV of figure 3 showing a welding support according to a fifth embodiment;
- **figure 9** is an exploded view of zone IV of figure 3 showing a welding support according to a sixth embodiment;
- 20 - **figure 10** is a perspective view of a welding support according to a seventh embodiment;
- **figure 11** is a perspective view of a welding support according to an eighth embodiment;
- **figure 12** is a cutaway schematic representation of a tank of an LNG
25 tanker vessel and of a terminal for loading/offloading this tank.

Detailed description of embodiments

Figure 1 shows the multilayer structure of a wall 1 of a sealed and thermally insulating tank for storing a liquefied fluid, such as liquefied natural gas (LNG). Each

wall 1 of the tank successively comprises, in the thickness direction, from the outside to the inside of the tank, a secondary thermally insulating barrier 3 retained on a support structure 2, a secondary sealing membrane 4 resting against the secondary thermally insulating barrier 2, a primary thermally insulating barrier 5 resting against the secondary sealing membrane 4, and a primary sealing membrane 6 intended to be in contact with the liquefied natural gas contained in the tank.

The support structure particularly can be formed by the hull or the double hull of a vessel. The support structure comprises a plurality of support walls 2 defining the general shape of the tank, commonly a polyhedral shape.

10 The secondary thermally insulating barrier 3 comprises a plurality of secondary insulating panels 7 that are anchored onto the support wall 2 by means of retention devices. The secondary insulating panels 7 have a general parallelepiped shape and are disposed in parallel rows. Three rows are indicated by the letters A, B and C. Sealant beads 99 are inserted between the secondary insulating panels 7 and
15 the support wall 2 in order to close the gaps in the support wall 2 relative to a flat reference surface. A kraft paper is inserted between the sealant beads 99 and the support wall 2 to prevent the sealant beads 99 from adhering on the support wall 2.

As can be seen in figure 3, the secondary insulating panels 7 comprise, for example, three plates, namely a base plate 8, an intermediate plate 9 and a cover
20 plate 10. The base 8, intermediate 9 and cover 10 plates are made of plywood, for example. The secondary insulating panel 7 also comprises a first insulating polymer foam layer 11 sandwiched between the base plate 8 and the intermediate plate 9 and a second insulating polymer foam layer 12 sandwiched between the intermediate plate 9 and the cover plate 10. The secondary insulating panels 7 are liable to have
25 another general structure, for example, that described in document WO 2012/127141. The secondary insulating panels 7 are then produced in the form of a casing comprising a base plate, a cover plate and support webs extending, in the thickness direction of the tank wall 1, between the base plate and the cover plate and delimiting a plurality of compartments filled with an insulating lining, such as perlite, glass wool
30 or rock wool.

The secondary sealing membrane 4 comprises a continuous layer of metal strakes 13 with raised edges. The strakes 13 are welded, via their raised edges 14,

onto parallel welding supports, which are attached in grooves provided on the cover plates 10 of the secondary insulating panels 7. The strakes 13 are, for example, made of Invar®: i.e. an iron and nickel alloy, the expansion coefficient of which is typically between $1.2 \cdot 10^{-6}$ and $2 \cdot 10^{-6} \text{ K}^{-1}$. It is also possible to use iron and manganese alloys, the expansion coefficient of which is typically of the order of $7 \cdot 10^{-6} \text{ K}^{-1}$.

The primary thermally insulating barrier 5 comprises a plurality of primary insulating panels 15 that are anchored onto the support wall 2 by means of retention devices. The primary insulating panels 15 have a general parallelepiped shape. Furthermore, as shown in figure 1, they have identical dimensions to those of the secondary insulating panels 7, with the exception of their thickness in the thickness direction of the tank wall 1, which is liable to be different, and particularly lower. Each of the primary insulating panels 15 is positioned to the right of one of the secondary insulating panels 7, aligned therewith in the thickness direction of the tank wall 1.

As can be seen in figure 3, the primary insulating panel 15 has a multilayer structure similar to that of the secondary insulating panel 7. Furthermore, the primary insulating panel 15 successively comprises a base plate 16, a first insulating polymer foam layer 17, an intermediate plate 18, a second insulating polymer foam layer 19 and a cover plate 20. The insulating polymer foam particularly can be a polyurethane-based foam, optionally reinforced with fibers.

The base plate 16 comprises grooves intended to accommodate the raised edges 14 of the strakes 13 of the secondary sealing membrane 4. The structure of the primary insulating panel 15 is described above by way of an example. Furthermore, in another embodiment, the primary insulating panels 15 are liable to have another general structure, for example, that described in document WO 2012/127141.

The tank wall 1 comprises welding supports 26 for anchoring the primary sealing membrane 6 to the primary thermally insulating barrier 5. The welding supports 26 will be described hereafter.

Figure 1 also shows that the primary sealing membrane 6 comprises a continuous layer of rectangular shaped corrugated metal plates 21 that have two series of mutually perpendicular corrugations. The first series of corrugations

extends to the rows of insulating panels A, B, C and therefore perpendicular to the raised edges 14 of the strakes 13 and has an even spacing 40. The second series of corrugations 23 extends parallel to the rows of insulating panels A, B, C and therefore parallel to the raised edges 14 of the strakes 13 and has an even spacing 41.

5 Preferably, the first series of corrugations 22 is higher than the second series of corrugations 23.

The corrugated metal plates 21 are welded together by forming overlaps 24 along their visible edges shown in figures 4 to 9, in accordance with the known technique. Indeed, at an overlap between two adjacent corrugated metal plates 21,

10 one of the corrugated metal plates 21 comprises an offset portion 25 that is placed above the other one of the corrugated metal plates 21.

A corrugated metal plate 21 preferably has width and length dimensions that equal integer multiples of the spacing of the corresponding corrugations and also of the integer multiples of the dimensions of the primary insulating panels 15. Figure 1

15 shows a corrugated metal plate 21 that measures 4 times the spacing 40 by 12 times the spacing 41. Preferably, the spacings 40 and 41 are equal. Thus, the orientation of the corrugations 22 and 23 in the tank can be easily adapted to the requirements of the application without causing significant modifications with respect to the production of the insulating barriers.

20 For example, in an alternative embodiment, the primary sealing membrane 6 is rotated by 90° so that the second series of corrugations 23 extends parallel to the rows of insulating panels A, B, C, and therefore parallel to the raised edges 14 of the strakes 13.

The primary insulating panels 15 and the secondary insulating panels 7 have

25 the same dimension in the widthwise direction of the rows A, B, C. This dimension will be called length of the insulating panels by convention. This row width is an integer multiple of the spacing of the corrugations in the same direction, in this case the spacing 41, and an integer multiple of the width of the strakes 13, in order to facilitate the manufacture of the tank wall in a modular manner by forming repeated patterns a

30 significant number of times over substantially the whole of the support wall 2.

Preferably, the width of a strake 13 is an integer multiple of the spacing of the corrugations in the same direction, for example, double.

In the lengthwise direction of the rows A, B, C, a primary insulating panel 15 can have the same dimension as a secondary insulating panel 7 or an integer multiple of this dimension. This dimension is an integer multiple of the spacing of the corrugations in the same direction, in this case the spacing 40, for facilitating the manufacture of the tank wall in a modular manner by forming repeated patterns a significant number of times over the whole of the support wall 2.

Preferably, the primary insulating panels 15 and the secondary insulating panels 7 are square shaped. Thus, it is easier to adapt the relative orientation of the strakes and of the corrugations in the tank without requiring significant modifications to the design of the insulating panels.

Preferred dimensional example

Spacing of the corrugations 40, 41: PO.

Width of the primary insulating panel 15 and of the secondary insulating panel 7: 4PO.

Length of the primary insulating panel 15 and of the secondary insulating panel 7: 4PO (square shape).

Width of a strake 13: 2PO.

Length of a corrugated metal plate 21: 12PO (Fig. 1) or 8PO (not shown).

Width of a corrugated metal plate: 4PO.

PO = 300 mm.

With these dimensions, a good compromise is achieved between the ease of handling the parts forming the tank wall and the number of parts that must be assembled. This arrangement also simplifies the connection of the corrugations between two walls of a tank.

Dimensional example 2

Spacing of the corrugations 40: PO.

Spacing of the corrugations 41: GO.

Width of the primary insulating panel 15 and of the secondary insulating panel 7: 3GO.

Length of the primary insulating panel 15 and of the secondary insulating panel 7: 4PO (rectangular shape).

Width of a strake 13: 2PO.

- 5 Length of a corrugated metal plate 21: 12PO.

Width of a corrugated metal plate 21: 3GO.

PO = 300 mm.

GO = 340 mm.

Example 3

- 10 The corrugations are not equidistant, but are arranged following a repeated pattern of four corrugations, the successive spacings of which are:

340; 340; 340; 180 mm.

Preferably, the gap of 180 mm is divided into two 90 mm portions located on two opposite edges of the corrugated metal plate 21.

- 15 Therefore, the dimension of the repeated pattern is 1,200 mm. For the rest, the dimensions of the first example are maintained.

Example 4

The corrugations are not equidistant, but are arranged following a repeated pattern of four corrugations, the successive spacings of which are:

- 20 300; 400; 300; 200 mm.

Preferably, the gap of 200 mm is divided into two 100 mm portions located on two opposite edges of the corrugated metal plate.

Therefore, the dimension of the repeated pattern is 1,200 mm. For the rest, the dimensions of the first example are maintained.

- 25 Figure 2 shows a detailed view of the attachment of a metal plate 21 of the primary sealing membrane 6 to the primary thermally insulating barrier using welding supports 26.

Each primary insulating panel 15 comprises grooves 27 on the cover plate 20. The grooves 27 can be produced continuously, by generating intersections between the grooves 27, as illustrated in figures 1 and 2. At an intersection between two grooves 27, a groove can contain one anchoring support 26, which continuously
 5 crosses the intersection, whereas the other groove can contain two anchoring supports 26 disposed on either side of the intersection.

In order to attach a metal plate 21 of the primary sealing membrane 6 to the primary thermally insulating barrier 5, at least one edge of the metal plate 21 extending in the longitudinal direction is welded to a welding support 26 located in a
 10 groove 27 directed in the longitudinal direction, and at least one edge of the metal plate 21 extending in the transverse direction is welded to a welding support 26 located in a groove 27 directed in the transverse direction.

The welding supports 26, which are metal, for example, are slidably accommodated in the grooves 27 hollowed out of the cover plates 20 of the primary
 15 thermally insulating barrier 5. This degree of freedom allows small movements of the edges of the metal plates 21 relative to the primary insulating panels 15 to occur during temperature variations, which limits the concentrations of stresses and therefore the fatigue of the primary sealing membrane 6.

As can be seen in the embodiment illustrated in figure 2, the welding supports
 20 26 are spaced apart in the grooves 27. These spaces formed between two welding supports 26 can vary from a few millimeters to a spacing that is slightly more than a corrugation of the corrugated metal plate 21. The spaces formed between two welding supports 26 in a groove 27 can be filled with an insulating material.

Figure 3 shows a tank wall 1 as a section view where the various layers
 25 forming said tank wall can be distinguished. Figures 4 to 9 are a detailed representation of the zone for attaching the primary sealing membrane 6 to the primary thermally insulating barrier 5 in a plurality of embodiments.

A first embodiment for attaching the primary sealing membrane 6 to the primary thermally insulating barrier 5 is illustrated in figure 4.

30 In this embodiment, the welding support 26 comprises a lower part 28 retained in the groove 27 of the primary thermally insulating barrier 5, in a direction

perpendicular to the support surface 31, an upper part 30 parallel to the support surface 31 and located on the thermally insulating barrier 5, an intermediate part 29 connecting the lower part 28 to the upper part 30, the intermediate part 29 being disposed in the groove 27 in a thickness direction of the primary thermally insulating barrier 5.

The upper part 30 of the welding support 26 is accommodated in a counterbore 32 adjacent to the groove 27, the counterbore 32 being formed in a primary insulating panel 15 of the primary thermally insulating barrier 5, so that the upper part 30 of the welding support 26 is located between the primary sealing membrane 6 and the primary thermally insulating barrier 5 and in the extension of the support surface 31.

The groove 27 has an inlet zone 33 that extends in the thickness direction and a retention zone 34, which is disposed under the inlet zone 33 and which is established parallel to the support surface 31 over a greater width than the inlet zone 33. The lower part 28 of the welding support 26 is accommodated in the retention zone 34, so that the welding support is retained in the groove 27. The retention zone 34 is formed in one or more cover plates 20 of the primary thermally insulating barrier 5.

The primary sealing membrane 6 is attached to the primary thermally insulating barrier 5 by means of the overlapping attachment of two adjacent metal plates 21 of the primary sealing membrane 6. Indeed, a first metal plate 21 that does not comprise an offset portion 25 on this edge is welded to the upper part 30 of the welding support 26, then a second metal plate 21 comprising an offset portion 25 on the edge to be welded covers the welding support 26, as well as the edge of the first metal plate 21. The offset portion 25 is then welded to the first metal plate so as to produce a sealed overlap, i.e. with a continuous weld bead over the entire length of the edge of the metal plate 21, completely covering the welding support.

Figure 5 shows a second embodiment of the welding support 26 for attaching the primary sealing membrane 6 to the primary thermally insulating barrier 5.

In this embodiment, the welding support 26 is inserted into two adjacent grooves 27 extending in the same direction. The counterbore 32 in this case is

produced on the part of the cover plate 20 that is located between the two grooves 27. The upper part 30 of the welding support 26 is accommodated in the counterbore 32 extending between the two grooves. The welding support 26 comprises a first lower part 28 inserted into the retention zone 34 of the first groove 27 and a second lower part 28 inserted into the retention zone 34 of the second groove 27. The welding support 26 also comprises a first intermediate part 29 located in the inlet zone 33 of the first groove 27 and connecting the first lower part 28 to one end of the upper part 30 and a second intermediate part located in the inlet zone 33 of the second groove 27 and connecting the second lower part 28 to the other end of the upper part 30 of the welding support 26. The lower part 28 and the intermediate part 29 are continuously formed in the longitudinal direction.

The cover plate 20 can be made of plywood or of a composite material and can be between 9 and 24 mm thick.

Figure 6 shows a third embodiment of the welding support 26 for attaching the primary sealing membrane 6 to the primary thermally insulating barrier 5.

In this embodiment, the retention zone 34 is established parallel to the support surface 31 on either side of the inlet zone 33. The welding support 26 comprises a first segment 35 and a second segment 36. The first segment 35 comprises a lower part 28 accommodated in the retention zone 34 of the groove 27, an upper part 30 parallel to the support surface and accommodated in the counterbore 32 adjacent to the groove 27, so that the upper part 30 of the first segment 35 is located between the primary sealing membrane 6 and the primary thermally insulating barrier 5 and in the extension of the support surface 31, as in the first embodiment. The first segment 35 also comprises an intermediate part 29 connecting the lower part 28 of the first segment 35 to the upper part 30 of the first segment 35, the intermediate part 29 being disposed in the inlet zone 33 of the groove 27. The second segment 36 comprises a lower part 28 accommodated in the retention zone 34 of the groove 27, in a direction opposite the direction of the lower part 28 of the first segment 35, and an intermediate part 29 welded by a weld 98 to the intermediate part 29 of the first segment 35.

Figure 7 shows a fourth embodiment of the welding support 26 for attaching the primary sealing membrane 6 to the primary thermally insulating barrier 5.

This embodiment is very similar to the second embodiment. Indeed, the major difference between these two embodiments resides in the second segment 36. As can be seen in figure 7, the thermally insulating barrier 5 in this case comprises two counterbores 32 on either side of the groove 27, with one of the counterbores 5 accommodating the upper part 30 of the first segment 35. The second segment 36 comprises, in addition to the lower part 28 and the intermediate part 29, an upper part 30 parallel to the support surface 31 and accommodated in the other one of the counterbores 32, so as to be oriented in a direction opposite the direction of the upper part 30 of the first segment 35. The upper part 30 of the second segment 36 thus is 10 also located between the primary sealing membrane 6 and the primary thermally insulating barrier 5. The intermediate part 29 of the second segment 36 connects, like that of the first segment 35, the lower part 28 of the second segment 36 to the upper part 30 of the second segment 36.

The groove 27 of each of the previously described embodiments can be 15 located at the center of a primary insulating panel 15, as illustrated in figure 1, or in the vicinity of an edge of a primary insulating panel 15.

Figure 8 shows a fifth embodiment of the welding support 26 for attaching the primary sealing membrane 6 to the primary thermally insulating barrier 5.

The fifth embodiment of figure 8 is very similar to the first embodiment of 20 figure 4. This embodiment of figure 8 nevertheless differs through the location of the groove 27. Indeed, as can be seen in figure 8, the inlet zone 33 of the groove 27 corresponds, in this embodiment, to an inter-panel space, i.e. the groove 27 is located between two adjacent primary insulating panels 15 of the primary thermally insulating barrier 5. Therefore, the retention zone 34 is produced in one direction in a first 25 primary insulating panel 15 and in the opposite direction in a second primary insulating panel 15.

Figure 9 shows a sixth embodiment of the welding support 26 for attaching the primary sealing membrane 6 to the primary thermally insulating barrier 5.

The sixth embodiment of figure 9 is very similar to the embodiment of figure 30 8. Indeed, the inlet zone 33 of the groove 27 also corresponds to an inter-panel space. However, in this embodiment, the retention zone 34 has been replaced by a fastener

37. The fastener 37 is attached to a wall of the inlet zone 33 corresponding to a side of a primary insulating panel 15. The lower part 28 of the welding support 26 is then slidably accommodated in the fastener 36, in order to be particularly retained in the thickness direction of the tank wall 1 and in the transverse direction for a groove 27
 5 extending in the longitudinal direction. To this end, the lower part 28 comprises, at the end thereof, a hook 38, the shape of which matches an opposing hook 39 located on the fastener 37. Thus, the hook 38 of the lower part 28 is accommodated in the opposing hook 39 of the fastener 37 in order to implement the sliding attachment. This embodiment also can be used at the center of a primary insulating panel 15 or in the
 10 vicinity of an edge of a primary insulating panel 15.

Figure 10 shows a seventh embodiment of the welding support 26 for attaching the primary sealing membrane 6 to the primary thermally insulating barrier 5.

The seventh embodiment of figure 10 is very similar to the embodiment of
 15 figure 5. However, in this embodiment, the lower part 28 and the intermediate part 29 of the welding support are formed in the longitudinal direction in a discontinuous manner, so as to form lugs connected to the upper part 30 and spaced apart from each other in the longitudinal direction.

Figure 11 shows an eighth embodiment of the welding support 26 for
 20 attaching the primary sealing membrane 6 to the primary thermally insulating barrier 5.

In this embodiment, the welding support 26 is inserted at the center of a primary insulating panel 15 in two adjacent grooves 27 extending in the longitudinal direction and in two adjacent grooves 97 (sketched as a dashed line in figure 11)
 25 extending in the transverse direction crossing the two longitudinal grooves 27. Indeed, the welding support 26 of this embodiment is produced by a portion 26A formed in the longitudinal direction and a portion 26B formed in the transverse direction, the portions 26A, 26B cross so as to form a cross. Thus, the upper part 30 extends into a first counterbore 32 formed between the two longitudinal grooves 27 and also into a
 30 second counterbore 32 formed between the two transverse grooves 97.

Therefore, the portion 26A comprises the portion of the upper part 30 extending in the longitudinal direction and also comprises a first lower part 28 inserted into the retention zone 34 of the first groove 27 and a second lower part 28 inserted into the retention zone 34 of the second longitudinal groove 27. The portion 26A also
5 comprises a first intermediate part 29 located in the inlet zone 33 of the first longitudinal groove 27 and connecting the first lower part 28 to the upper part 30 and a second intermediate part 29 located in the inlet zone 33 of the second transverse groove 27 and connecting the second lower part 28 to the upper part 30.

Contrary to the portion 26A, the portion 26B does not comprise a lower part
10 28. The portion 26B is formed from the portion of the upper part 30 extending in the transverse direction and also comprises a first intermediate part 29 located in the first transverse groove 97 and connected to the upper part 30 and a second intermediate part 29 located in the inlet zone 33 of the second transverse groove 97 and connected to the upper part 30. The transverse grooves 97 have a significant opening so as to
15 provide a sufficient clearance for the welding support 26 in the longitudinal direction. Thus, the welding support 26 maintains a sufficient degree of freedom in the longitudinal direction. In the same way, the longitudinal grooves 27 also can have a significant opening in this embodiment in order to allow a clearance to be provided in the transverse direction.

20 Furthermore, in order to be able to accommodate the lower parts 28 and the intermediate parts 29 in the longitudinal 27 and transverse 97 grooves, the welding support 26 is forcibly inserted into the intersection of the longitudinal 27 and transverse 97 grooves.

In other embodiments, not shown, the embodiments described in figures 4
25 to 11 can be combined when the features of these embodiments are mutually compatible.

For example, the embodiment described in figure 5 can comprise fasteners
36 in each of the grooves 27 instead of the retention zone 34. The two lower parts 28 of the welding support 26 are then provided with hooks 38, which are accommodated
30 in the opposing hooks 39 of the fasteners 36.

In another embodiment, not shown, the embodiment described in figure 7 can comprise fasteners 36 instead of the retention zone 34, a first fastener 36 attached on the wall of the groove 27 close to the first segment 35 and a second fastener 36 attached on the wall of the groove 27 close to the second segment 36.

5 The lower part 28 of the first segment 35 and the lower part 28 of the second segment 36 are provided with hooks 38 accommodated in an opposing hook 38 of each of the fasteners 36.

The technique described above for producing a sealed tank wall can be used in various types of tanks, for example, in order to form the tank wall of a tank for LNG

10 in an onshore installation or in a floating structure, such as an LNG tanker vessel or other.

With reference to figure 12, a cutaway view of an LNG tanker vessel 70 shows a sealed and insulated tank 71 of general prismatic shape mounted in the double hull 72 of the vessel. The wall of the tank 71 comprises a primary sealed barrier

15 intended to be in contact with the LNG contained in the tank, a secondary sealed barrier arranged between the primary sealed barrier and the double hull 72 of the vessel, and two insulating barriers respectively arranged between the primary sealed barrier and the secondary sealed barrier and between the secondary sealed barrier and the double hull 72.

20 In a manner per se known, loading/offloading pipelines 73 disposed on the upper deck of the vessel can be connected, by means of suitable connectors, to a maritime or harbor terminal for transferring an LNG cargo from or to the tank 71.

Figure 12 shows an example of a maritime terminal comprising a loading and offloading station 75, an underwater pipe 76 and an onshore installation 77. The

25 loading and offloading station 75 is a fixed offshore installation comprising a movable arm 74 and a turret 78, which supports the movable arm 74. The movable arm 74 supports a bundle of insulated flexible hoses 79 that can be connected to the loading/offloading pipelines 73. The orientable movable arm 74 adapts to all forms of LNG tankers. A connection pipe, not shown, extends inside the turret 78. The loading

30 and offloading station 75 allows the LNG tanker 70 to be loaded and offloaded from or to the onshore installation 77, which comprises liquefied gas storage tanks 80 and

connection pipes 81 connected by the underwater pipe 76 to the loading or offloading station 75. The underwater pipe 76 allows the liquefied gas to be transferred between the loading or offloading station 75 and the onshore installation 77 over a considerable distance, for example, 5 km, which enables the LNG tanker 70 to be kept at a
5 considerable distance from the shore during the loading and offloading operations.

In order to generate the pressure required to transfer the liquefied gas, pumps on board the vessel 70 and/or pumps equipping the onshore installation 77 and/or pumps equipping the loading and offloading station 75 are used.

Even though the invention has been described in relation to a plurality of
10 specific embodiments, it is obvious that it is by no means limited thereto and that it comprises all the technical equivalents of the means described, as well as their combinations if they fall within the scope of the invention.

The use of the verb “comprise” or “include” and of its conjugated forms does not exclude the presence of other elements or other steps than those stated in a claim.

15 In the claims, any reference sign between brackets cannot be interpreted as a limitation of the claim.

CLAIMS

1. A sealed and thermally insulating tank wall (1) for forming a sealed and thermally insulating tank for storing a liquefied gas, the tank wall (1) comprising: a sealing membrane (6) intended to be in contact with the liquefied gas contained in
5 the tank, the sealing membrane (6) comprising a corrugated metal plate (21); a thermally insulating barrier (5) forming a support surface (31) for the sealing membrane (6) and comprising a groove (27) extending in a longitudinal direction; at least one welding support (26) borne by the thermally insulating barrier (5), the welding support (26) comprising a lower part (28) retained in the groove (27) of the
10 thermally insulating barrier (5) in a direction perpendicular to the support surface (31), an upper part (30) parallel to the support surface (31), an intermediate part (29) connecting the lower part (28) to the upper part (30), the intermediate part (29) being disposed in the groove (27) in a thickness direction of the thermally insulating barrier (5),
15 wherein the at least one welding support (26) is slidably mounted in said groove (27) in the longitudinal direction, and the corrugated metal plate (21) is welded to the upper part (30) of the welding support (26), and wherein the upper part (30) of the welding support (26) is accommodated in a counterbore (32) adjacent to the groove (27), the counterbore (32) being formed in
20 the thermally insulating barrier (5), so that the upper part (30) of the welding support (26) is located between the sealing membrane (6) and the thermally insulating barrier (5) and in the extension of the support surface (31).

2. The tank wall (1) as claimed in claim 1, wherein the groove is a longitudinal groove, the edge is a first edge, the welding support is a first welding
25 support, and the thermally insulating barrier comprises a transverse groove extending in a transverse direction perpendicular to the longitudinal direction, wherein the wall comprises a second welding support, the lower part of which is retained in the transverse groove of the thermally insulating barrier, and wherein a second edge of the corrugated metal plate extending in the transverse direction is welded to the upper
30 part of the second welding support.

3. The tank wall (1) as claimed in claim 1 or claim 2, wherein said groove (27) has, in the thermally insulating barrier (5), an inlet zone (33), which extends in the thickness direction, the groove (27) comprising a retention zone (34), which is disposed under the inlet zone (33) and which is established parallel to the support surface (31) over a greater width than the inlet zone (33), and wherein the lower part (28) of the welding support (26) is accommodated in the retention zone (34).

4. The tank wall (1) as claimed in claim 3, wherein the retention zone (34) is established parallel to the support surface (31) on either side of the inlet zone (33), and said welding support (26) comprises a first segment (35) and a second segment (36), the first segment (35) comprising a lower part (28) retained in the retention zone (34) of the thermally insulating barrier (5) in a direction perpendicular to the support surface (31), an upper part (30) parallel to the support surface (31) and accommodated in the counterbore (32) adjacent to the groove (27), so that the upper part (30) of the first segment (35) is located between the sealing membrane (6) and the thermally insulating barrier (5) and in the extension of the support surface (31), an intermediate part (29) connecting the lower part (28) of the first segment (35) to the upper part (30) of the first segment (35), the intermediate part (29) being disposed in the groove (27) in a thickness direction of the thermally insulating barrier (5), and the second segment (36) comprising a lower part (28) retained in the retention zone (34) of the thermally insulating barrier (5) in a direction opposite the direction of the lower part (28) of the first segment (35), and an intermediate part (29) welded to the intermediate part (29) of the first segment (35), and wherein the upper part (30) of the first segment (35) is welded to the corrugated metal plate (21).

5. The tank wall (1) as claimed in claim 4, wherein the counterbore (32) is a first counterbore (32), the thermally insulating barrier (5) comprising a second counterbore (32), the first counterbore (32) and the second counterbore (32) being located on either side of said groove (27), and wherein the second segment (36) comprises an upper part (30) parallel to the support surface (31) and accommodated in the second counterbore (32), so that the upper part (30) of the second segment (36) is located between the sealing membrane (6) and the thermally insulating barrier (5) and in the extension of the support surface (31), the intermediate part (29) of the

second segment (36) connecting the lower part (28) of the second segment (36) to the upper part (30) of the second segment (36).

6. The tank wall (1) as claimed in claim 1 or claim 2, wherein said groove (27) has, in the thermally insulating barrier (5), an inlet zone (33), which
5 extends in the thickness direction, the inlet zone (33) comprising a fastener (37) attached to a wall of said groove (27), and wherein the lower part (28) of the welding support (26) is slidably accommodated in the fastener (37).

7. The tank wall (1) as claimed in claim 6, wherein the lower part (28) comprises a hook (38) and the fastener (37) comprises an opposing hook (39), the
10 hook (38) being accommodated in the opposing hook (39).

8. The tank wall (1) as claimed in one of claims 1 to 7, wherein the metal plate (21) welded to the upper part (30) of the welding support (26) is a first metal plate (21), wherein the sealing membrane (6) comprises a second corrugated metal plate (21) comprising an offset portion (25) welded above the first metal plate
15 (21) to form a sealed overlap (24) between the two metal plates (21) and wherein the weld (98) between the upper part (30) of the welding support (26) and the first metal plate (21) is located below the offset portion (25) of the second metal plate (21).

9. The tank wall (1) as claimed in one of claims 1 to 8, wherein the thermally insulating barrier (5) comprises a plurality of juxtaposed parallelepiped
20 insulating panels (15), the lower part (28) of the welding support (26) being retained in an insulating panel (15) of the thermally insulating barrier (5) and the counterbore (32) being formed in said insulating panel (15).

10. The tank wall (1) as claimed in one of claims 1 to 9, wherein the thermally insulating barrier (5) comprises a plurality of juxtaposed parallelepiped
25 insulating panels (15) and wherein said groove (27) is located between two adjacent insulating panels (15) of the thermally insulating barrier (5), so that the inlet zone (33) is an inter-panel space.

11. The tank wall (1) as claimed in one of claims 1 to 9, wherein the thermally insulating barrier (5) comprises a plurality of juxtaposed parallelepiped
30 insulating panels (15) and wherein said groove (27) is located at the center of an insulating panel (15) of the thermally insulating barrier (5).

12. The tank wall (1) as claimed in one of claims 1 to 9, wherein the thermally insulating barrier (5) comprises a plurality of juxtaposed parallelepiped insulating panels (15) and wherein said groove (27) is located in the vicinity of an edge of an insulating panel (15).

5 13. The tank wall (1) as claimed in one of claims 1 to 7, wherein the groove (27) is a first groove (27) and the thermally insulating barrier (5) comprises a second groove (27) extending in the longitudinal direction at a distance from the first groove (27), the counterbore (32) extending between the two grooves (27), the upper part (30) of the welding support (26) being accommodated in the counterbore (32)
10 extending between the two grooves (27), and wherein the lower part (28) is a first lower part (28) and the intermediate part (29) is a first intermediate part (29), the welding support (26) comprising a second lower part (28) and a second intermediate part (29) connecting the second lower part (28) to the upper part (30) of the welding support (26), so that the first lower part (28) and the first intermediate part (29) are
15 located in the first groove (27) and so that the second lower part (28) and the second intermediate part (29) are located in the second groove (27) separate from the first groove (27).

14. The tank wall (1) as claimed in claim 13, wherein each lower part (28) is formed by a plurality of lower part portions spaced apart from each other in the
20 longitudinal direction and each intermediate part (29) is formed by a plurality of intermediate part portions spaced apart from each other in the longitudinal direction, so that each intermediate part portion connects one of the lower part portions to the upper part (30).

15. The tank wall (1) as claimed in claim 13 or claim 14, wherein the
25 upper part (30) is a first upper part (30) and the thermally insulating barrier (5) comprises a third groove (27) extending in the transverse direction and a fourth groove (27) adjacent to the third groove (27) and extending in the transverse direction, and wherein the welding support (26) comprises a second upper part (30) that is accommodated in a transverse counterbore (32) extending between the third groove
30 (27) and the fourth groove (27), the third and fourth grooves (27) crossing the first and second grooves (27).

16. The tank wall (1) as claimed in claim 15, wherein a third intermediate part (29) is located in an inlet zone (33) of the third groove (27) and is connected to the second upper part (30), and a fourth intermediate part (29) is located in an inlet zone (33) of the fourth groove (27) and is connected to the second upper part (30).

5 17. The tank wall (1) as claimed in one of claims 1 to 16, wherein the thermally insulating barrier (5) is a primary thermally insulating barrier (5) and the sealing membrane (6) is a primary sealing membrane (6), and wherein the tank wall (1) further comprises a secondary sealing membrane (4) located under the primary thermally insulating barrier (5) and a secondary thermally insulating barrier (3) located
10 under the secondary sealing membrane (4) and comprising a plurality of juxtaposed parallelepiped insulating panels (7) forming a support surface (31) for the secondary sealing membrane (4).

18. The tank wall (1) as claimed in claim 17, wherein the secondary sealing membrane (4) comprises a plurality of strakes (13) parallel to the longitudinal
15 direction, a strake (13) comprising a flat central portion resting on an upper surface of the insulating panels (7) of the secondary thermally insulating barrier (3) and two raised edges (14) projecting toward the primary sealing membrane (6) relative to the central portion, the strakes (13) being juxtaposed in a transverse direction perpendicular to the longitudinal direction following a repeated pattern and being
20 sealably welded together at the raised edges (14), with anchoring wings anchored to the insulating panels of the secondary thermally insulating barrier (3) and parallel to the longitudinal direction being arranged between the juxtaposed strakes (13) in order to retain the secondary sealing membrane (4) on the secondary thermally insulating barrier (3).

25 19. A sealed and thermally insulating tank (71) disposed in a support structure, the tank comprising a plurality of walls sealably attached together so as to form an internal space for receiving a liquefied gas, wherein at least one of the tank walls (1) is a tank wall according to one of claims 1 to 18.

20. A vessel (70) for transporting a cold liquid product, the vessel
30 comprising a double hull (72) and a tank (71) as claimed in claim 19 disposed in the double hull.

21. A transfer system for a cold liquid product, the system comprising a vessel (70) as claimed in claim 20, insulated pipelines (73, 79, 76, 81) arranged so as to connect the tank (71) installed in the hull of the vessel to a floating or onshore storage installation (77), and a pump for conveying a flow of cold liquid product
5 through the insulated pipelines, from or to the floating or onshore storage installation, to or from the tank of the vessel.

22. A method for loading or offloading a vessel (70) as claimed in claim 20, wherein a cold liquid product is routed through insulated pipelines (73, 79, 76, 81), from or to a floating or onshore storage installation (77), to or from the tank of the
10 vessel (71).