

Description

Title of the invention: Storage facility for liquefied gas

Technical field

5 [0001] The invention relates to the field of liquefied gas storage facilities comprising a sealed and thermally insulating tank with a sealed membrane. In particular, the invention relates to the field of sealed and thermally insulating tanks for the storage and/or transport of liquefied gas at low temperature, such as tanks for the transport of Liquefied Petroleum Gas (also known as LPG) with a temperature of, for example, between -50°C and 0°C, or for the transport of Liquefied Natural Gas (LNG) at around -162°C, at atmospheric pressure. These tanks may be installed onshore or on a floating structure. In the case of a floating structure, the tank may be intended for the transport of liquefied gas or to receive liquefied gas serving as fuel for the propulsion of the floating structure.

Prior art

15 [0002] Liquefied gas storage facilities comprising a supporting structure and a sealed and thermally insulating tank arranged in the supporting structure are known for example from document EP3473915.

[0003] The storage facility of this document comprises an upper supporting wall on which a ceiling wall of the tank is carried. This upper supporting wall has a space protruding upward referred to as a liquid dome in the form of a coaming. The liquid dome notably comprises coaming supporting walls extending vertically and protruding upward from the upper supporting wall. Each supporting wall of the dome supports a dome wall or chimney wall of the tank. The liquid dome further comprises a horizontal cover which is intended to cover the opening formed, the cover having a series of pipes passing through it, which are intended in particular for loading and unloading liquefied gas into/from the tank.

[0004] In this document, the tank comprises two sealing membranes which are formed using corrugated metal plates juxtaposed and attached to one another.

30 [0005] The ceiling wall and the dome wall form at their intersection a protruding corner edge, that is to say forming an angle of between 180° and 360°, for example 270°, such that the corner edge is protruding when seen from inside the tank. Thus, at this corner edge, the sealing membrane of the ceiling wall and the sealing membrane of the liquid dome

are connected to one another to maintain the continuity of sealing, by means of a sealing bracket comprising a chamfer.

5 [0006] However, such a document concerns the connection of a corrugated membrane in the region of a protruding corner edge. Due to its design with corrugations for absorbing tensile and compressive forces, it is not necessary to make specific provision for forces to be absorbed at the protruding corner edge.

[0007] Storage facilities are also known for which the sealing membranes used are referred to as “tensioned” membranes, for example the applicant’s NO96® technology with membranes formed of strakes.

10 [0008] In this type of storage facility, the liquid dome is not located on a coaming but is located in alignment with the ceiling wall; this is usually referred to as a “flush” dome. The cover is thus placed in the same plane as the ceiling wall. There is therefore no protruding corner edge in this type of facility.

Summary

15 [0009] The invention is based on the observation that in the case of “tensioned” membranes such as those formed of strakes, it is necessary to absorb in the corners of the tank the tensile and compressive forces resulting from thermal contraction, deformation of the hull linked for example to the bending of the ship’s beam, and the level of filling of the tanks. This is because such sealing membranes do not have, in one of the directions, areas for
20 absorbing tensile and compressive forces, unlike a corrugated membrane. Thus, the connection areas located for example at a protruding corner may be subjected to significant compressive and tensile forces which can lead to a sealing failure in these areas.

25 [0010] An idea forming the basis of the invention is to improve the resistance to forces of the sealing membrane in connection areas such as the protruding corner edges of the storage facility while ensuring continuity of sealing in this area.

30 [0011] According to one embodiment, the invention provides a storage facility for a liquefied gas comprising a supporting structure and a sealed and thermally insulating tank arranged in the supporting structure, the supporting structure comprising an upper supporting wall and the tank comprising a ceiling wall attached to the upper supporting wall, the upper supporting wall and the ceiling wall being interrupted locally in such a way as to delimit an opening, the supporting structure comprising a coaming protruding vertically toward the outside of the tank from the upper supporting wall all around the opening and defining a passage intended to be passed through by at least one pipe

intended for loading or unloading liquefied gas into/from the tank, the coaming comprising at least one coaming supporting wall connected to the upper supporting wall, the tank comprising a chimney wall anchored against the coaming supporting wall, the chimney wall and the ceiling wall being connected to one another at an edge of the opening,

the ceiling wall and the chimney wall each comprising, in a thickness direction from the outside toward the inside of the tank, a thermally insulating barrier anchored to the supporting structure and a metal sealing membrane arranged on the thermally insulating barrier, the metal sealing membrane of the ceiling wall and of the chimney wall each comprising an end portion formed near the edge of the opening,

wherein the sealing membrane of the ceiling wall comprises a plurality of parallel strakes extending perpendicular to the edge of the opening, each strake comprising a flat central portion and two raised edges protruding toward the inside of the tank relative to the central portion, the strakes of the sealing membrane of the ceiling wall being juxtaposed in a direction parallel to the edge of the opening in a repeated pattern and welded together sealingly at the raised edges, at least one of said strakes being interrupted by the opening,

wherein the storage facility comprises a metal connection bracket comprising a first wing and a second wing connected to the first wing, the first wing being connected to the end portion of the sealing membrane of the ceiling wall and the second wing being connected to the end portion of the sealing membrane of the chimney wall,

wherein the storage facility comprises a corner insulating box forming a rectangular parallelepiped, the corner insulating box being located in the extension of the thermally insulating barrier of the ceiling wall and of the thermally insulating barrier of the chimney wall at the edge of the opening, the connection bracket being attached to the corner insulating box.

[0012] By virtue of these features, the connection bracket ensures sealing at a protruding corner edge of the tank between the ceiling wall and the chimney wall. In addition, the support of the corner insulating box makes it possible to at least partially absorb the compressive and tensile forces in the sealing membrane at the protruding corner edge.

[0013] According to some embodiments, such a storage facility may include one or more of the following features.

[0014] According to one embodiment, the first wing of the connection bracket is flat and covers a first flat face of the corner insulating box, the first flat face being parallel to the upper supporting wall, and the second wing of the connection bracket is flat and covers a

second flat face of the corner insulating box, the second flat face being parallel to the coaming supporting wall and being perpendicular to the first flat face.

[0015] According to one embodiment, an anchoring plate is attached to each of the first flat face and the second flat face, the first wing and the second wing being welded to the anchoring plate of the first flat face and of the second flat face, respectively.

[0016] According to one embodiment, the thermally insulating barrier of the ceiling wall comprises an end insulating block adjacent to the edge of the opening and the ceiling wall comprises a plurality of metal longitudinal attachment supports attached to the upper supporting wall along said edge of the opening and located on either side of the end insulating block, each longitudinal attachment support comprising a foot welded to the upper supporting wall and a cap attached to the foot, the thermally insulating barrier comprising a stop plate arranged on the end insulating block, the end portion of the sealing membrane being attached to the stop plate.

[0017] According to one embodiment, the end insulating block or the secondary end insulating block is produced in the form of a box comprising a bottom plate, a cover plate parallel to the bottom plate and supporting spacer plates keeping the cover plate at a distance from the bottom plate, the box being filled with an insulating lining, such as perlite, fumed silica, silica aerogels, glass wool or rock wool.

[0018] According to one embodiment, the corner insulating box is produced in the form of a box comprising a bottom plate, a cover plate parallel to the bottom plate and supporting spacer plates keeping the cover plate at a distance from the bottom plate, the box being filled with insulating filler, for example perlite, fumed silica, silica aerogels or glass or rock wool.

[0019] According to one embodiment, the thermally insulating barrier comprises an insulating panel adjacent to the end insulating block, the insulating panel comprising, successively in the thickness direction, at least one layer of insulating foam and at least one rigid plate. For example, the insulating panel includes a layer of insulating foam placed between a bottom plate and a cover plate.

[0020] According to one embodiment, the insulating foam is a polymer foam, for example a polyurethane foam. According to one embodiment, this insulating foam has a density greater than 100 kg/m^3 , preferably greater than or equal to 120 kg/m^3 , in particular equal to 130, 150 or 210 kg/m^3 .

[0021] According to one embodiment, the structural insulating foam is a reinforced foam, for example reinforced with fibers such as glass fibers.

[0022] According to one embodiment, the bottom panel is a panel of plywood or composite with glass fibers. According to one embodiment, the cover panel is a panel of plywood or composite with glass fibers

5 [0023] According to one embodiment, the thermal contraction coefficient of the end insulating block in said thickness direction is less than the thermal contraction coefficient in said thickness direction of the insulating panel.

10 [0024] According to one embodiment, the foot of the longitudinal attachment support comprises an attachment plate adjacent to the corner insulating box and attached on the one hand to the upper supporting wall and on the other hand to the cap, the attachment plate being formed in a plane parallel to the coaming supporting wall, the corner insulating box being attached to the attachment plate of at least one of the longitudinal attachment supports of the ceiling wall by means of an attachment device.

15 [0025] According to one embodiment, the sealing membrane of the chimney wall comprises a plurality of parallel strakes extending parallel to the edge of the opening, each strake comprising a flat central portion and at least one raised edge protruding toward the inside of the tank relative to the central portion, the strakes being juxtaposed in a direction perpendicular to the edge of the opening in a repeated pattern and welded together sealingly at the raised edges, at least one of said strakes being interrupted by the opening, an end portion of said interrupted strake being welded to the second wing of
20 the connection bracket.

[0026] According to one embodiment, the interrupted strake of the chimney wall comprises a single raised edge located on an end of the strake opposite the end portion.

25 [0027] According to one embodiment, the thermally insulating barrier of the chimney wall comprises an end insulating block adjacent to the edge of the opening and the chimney wall comprises a plurality of metal transverse attachment supports attached to the coaming supporting wall along said edge of the opening and located on either side of the end insulating block, each transverse attachment support comprising a foot welded to the coaming supporting wall and a cap attached to the foot.

30 [0028] According to one embodiment, the foot of the transverse attachment support comprises an attachment plate adjacent to the corner insulating box and attached on the one hand to the coaming supporting wall and on the other hand to the cap, the attachment plate being formed in a plane parallel to the upper supporting wall, the corner insulating box being attached to the attachment plate of at least one of the transverse attachment supports of the chimney wall by means of an attachment device.

[0029] According to one embodiment, the corner insulating box comprises a side face on which a protuberance protrudes, the attachment device comprising a stud attached to the attachment plate and a bearing element engaged on the stud and bearing on a bearing surface of the protuberance.

5 [0030] According to one embodiment, the at least one interrupted strake forms the end portion of the sealing membrane.

[0031] According to one embodiment, the sealing membrane is a secondary sealing membrane and the thermally insulating barrier is a secondary thermally insulating barrier, the ceiling wall and the chimney wall each comprising a primary thermally insulating
10 barrier arranged on the secondary sealing membrane and a metal primary sealing membrane arranged on the primary thermally insulating barrier and intended to be in contact with the liquefied gas.

[0032] According to one embodiment, the end insulating block of the ceiling wall is a secondary end insulating block, and the primary thermally insulating barrier of the ceiling
15 wall comprises a primary insulating panel located in line with the secondary end insulating block, the primary insulating panel being attached to one of the longitudinal attachment supports by means of an anchoring device.

[0033] According to one embodiment, the end insulating block of the chimney wall is a secondary end insulating block, and the primary thermally insulating barrier of the
20 chimney wall comprises a primary insulating panel located in line with the secondary end insulating block, the primary insulating panel being attached to one of the transverse attachment supports by means of an anchoring device.

[0034] According to one embodiment, the storage facility comprises a primary corner insulating assembly, the primary corner insulating assembly being located in the
25 extension of the primary thermally insulating barrier of the ceiling wall and of the primary thermally insulating barrier of the chimney wall at the edge of the opening, the primary corner insulating assembly comprising a chamfered upper face, the primary corner insulating assembly being attached to the corner insulating box by means of at least one anchoring device.

30 [0035] According to one embodiment, the storage facility comprises a primary connection bracket attached to the chamfered upper face of the primary corner insulating assembly, the primary connection bracket being welded on the one hand to the primary sealing membrane of the ceiling wall and on the other hand to the primary sealing membrane of the chimney wall.

[0036] According to one embodiment, the primary connection bracket is welded to a metal part formed on the chamfered upper face of the primary corner insulating assembly.

[0037] According to one embodiment, the thermally insulating barrier of the chimney wall comprises an end insulating block adjacent to the edge of the opening and the chimney wall comprises a plurality of metal transverse attachment supports attached to the coaming supporting wall along said edge of the opening and located on either side of the end insulating block, each transverse attachment support comprising a foot welded to the coaming supporting wall and a cap attached to the foot.

[0038] According to one embodiment, a secondary metal attachment plate is attached to an upper surface of the secondary stop plate, and an end portion of the or each strake interrupted by the loading/unloading opening is welded to the secondary metal attachment plate. The first wing of the connection bracket is for example welded to a first part of the secondary attachment plate while the end portion of the strake is welded to a second part of the secondary attachment plate.

[0039] According to one embodiment, the secondary metal attachment plate is made of an iron alloy with nickel, for example Invar, an iron alloy with manganese, or stainless steel.

[0040] According to one embodiment, the thermally insulating barrier of the ceiling wall or of the chimney wall comprises a primary insulating panel located in line with one of the longitudinal attachment supports or one of the transverse attachment supports respectively and attached by means of an anchoring device to the cap of said attachment support.

[0041] According to one embodiment, the primary insulating panel comprises a bearing surface and the anchoring device comprises a base attached to the cap, a stud attached to said base and extending in the thickness direction and passing sealingly through a hole in the secondary sealing membrane, and a bearing element mounted on the stud and bearing on the bearing surface of the primary insulating panel in such a way as to retain it on the longitudinal or transverse attachment support.

[0042] According to one embodiment, the anchoring device further comprises a sealing washer which is engaged on the stud and comprises a flange sealingly attached to the secondary sealing membrane around the hole in the secondary sealing membrane and a deformable seal sealingly connecting the sealing washer to the stud in such a way as to allow relative movement between the sealing washer and the stud.

[0043] According to one embodiment, the anchoring device further comprises a flange forming an integral part of the stud, the flange protruding radially outward from the stud

and being sealingly attached to the secondary sealing membrane around the hole in the secondary sealing membrane.

[0044] According to one embodiment, the deformable seal comprises a deformable bellows, said deformable bellows being hollow and extending around and axially along the stud.

5 The deformable bellows is for example made of stainless steel.

[0045] According to one embodiment, the anchoring device comprises a bell covering the deformable seal, the bell having a cylindrical shape.

[0046] According to one embodiment, the bearing surface of the primary insulating panel is located in a corner or at a distance from a corner of the primary insulating panel.

10 [0047] The primary sealing membrane may be produced in various ways. According to one embodiment, the primary sealing membrane of the ceiling wall and of the chimney wall comprises a plurality of corrugated metal plates juxtaposed and welded to one another, the primary sealing membrane comprising a first series of corrugations extending in a first direction and a second series of corrugations extending in a second direction.

15 [0048] Such a storage facility may be an onshore storage facility, for example for storing LNG, or may be a floating structure, coastal or deep-water, in particular a liquefied gas carrier, a floating storage and regasification unit (FSRU), a remote floating production and storage unit (FPSO), and the like. Such a facility may also be used as a fuel tank in any type of carrier.

20 [0049] According to one embodiment, the abovementioned storage facility is produced in the form of a floating structure, said supporting structure consisting of a double hull of the floating structure, and the first direction is a longitudinal direction of the floating structure.

[0050] According to one embodiment, the floating structure is a carrier for the transport of a cold liquid product.

25 [0051] According to one embodiment, the invention also provides a system for transferring a cold liquid product, the system comprising a storage facility as mentioned above, insulated pipelines arranged so as to connect the tank installed in the hull of the carrier to an external floating or onshore storage facility, and a pump for pumping a flow of cold liquid product through the insulated pipelines from or to the external floating or onshore storage facility, to or from the tank of the carrier.

30

[0052] According to one embodiment, the invention also provides a method for loading or unloading a storage facility as mentioned above, wherein a cold liquid product is conveyed through insulated pipelines from or to an external floating or onshore storage facility, to or from the tank of the carrier.

Brief description of the figures

[0053] The invention will be better understood, and other objects, details, features and advantages thereof will appear more clearly during the following description of several particular embodiments of the invention, provided solely by way of non-limiting
5 illustration, with reference to the attached drawings.

[0054] [Fig. 1] Figure 1 is a schematic perspective view of a storage facility comprising a supporting structure supporting a sealed and thermally insulating tank for storing a liquefied gas.

10 [0055] [Fig. 2] Figure 2 is a schematic view of the multilayer structure of the walls of the tank.

[0056] [Fig.3] Figure 3 is a schematic sectional view showing in particular the coaming of the storage facility.

15 [0057] [Fig. 4] Figure 4 is a partial perspective view showing the connection of the ceiling wall to the chimney wall at an edge of the opening, before attachment of the secondary sealing membrane.

[0058] [Fig. 5] Figure 5 is a partial perspective view zoomed in on figure 4 and showing the connection of the ceiling wall to the chimney wall at an edge of the opening, after attachment of the secondary sealing membrane.

20 [0059] [Fig. 6] Figure 6 is a partial perspective view showing the connection of the ceiling wall to the chimney wall at an edge of the opening, after attachment of the primary sealing membrane.

[0060] [Fig. 7] Figure 7 is a partial perspective view zoomed in on figure 6 showing in particular the structure of the tank at the protruding corner edge.

25 [0061] [Fig. 8] Figure 8 is a view similar to figure 7, showing an anchoring device according to another embodiment.

[0062] [Fig. 9] Figure 9 schematically depicts, with part cut away, a tank of a liquefied gas carrier and a terminal for loading/unloading this tank.

Description of the embodiments

30 [0063] By convention, “on” or “above” or “upper” refers to a position closer to the interior of the tank, while “under” or “below” or “lower” refers to a position closer to the supporting structure of the carrier, regardless of the orientation of the tank wall relative to the earth's field of gravity.

[0064] Figure 1 schematically depicts a storage facility 1 comprising a supporting structure 2 and a sealed and thermally insulating tank 71 arranged in the supporting structure 2. The sealed and thermally insulating tank 71 will be described more particularly below.

[0065] The supporting structure 2 comprises a plurality of walls connected to one another and in particular an upper supporting wall 4 which is located, as can be seen in figure 1, at the top of the storage facility 1.

[0066] When the storage facility 1 is positioned on a carrier such as a liquefied gas carrier, the supporting structure 2 is formed by the double hull of the carrier and is therefore formed of an inner supporting structure and an outer supporting structure. The inner upper supporting wall 4 is thus called the inner deck 4 of the carrier while the outer upper supporting wall 3 is called the outer deck 3 of the carrier.

[0067] The tank 71 comprises a main structure 5 formed of a bottom wall 6, a ceiling wall 7, two cofferdam walls 8 connecting the bottom wall to the ceiling wall 7 and located at the front and at the rear when the storage facility 1 is located on a carrier, two side walls 9 and optionally two to four chamfer walls 10 connecting the side walls to the bottom wall 6 or to the ceiling wall 7. The walls of the tank 71 are thus connected to one another in such a way as to form a polyhedral structure and to delimit an internal storage space 11.

[0068] In order to load and unload the tank 71 with liquefied gas, the storage facility 1 comprises a loading/unloading opening 12 locally interrupting the upper supporting wall 4 and the ceiling wall 7 of the tank 71 in such a way as to allow loading/unloading pipes 13 to reach the bottom of the tank 71 by passing through this opening 12.

[0069] The storage facility 1 also includes a loading/unloading tower 14 located in line with the opening 12 and inside the tank 71 forming a support structure for the loading/unloading pipes 13 over the entire height of the tank 71 as well as for the pumps (not shown).

[0070] In addition, the storage facility 1 comprises a cover 15 placed in the loading/unloading opening 12 in order to close off the internal storage space 11 at said opening 12. The cover 15 includes holes allowing the loading/unloading pipes 13 to pass through the cover 15.

[0071] The tank 71 also includes a chimney 16 located on the main structure 5 at the opening 12 and allowing the tank walls to extend continuously from the inner deck 4 to the outer deck 3, where these decks are interrupted by the opening 12. For liquefied gas storage tanks, such a chimney 16 provided with said cover 15 is called the liquid dome.

[0072] The present invention is illustrated herein with reference to the area of the liquid dome but this invention could also be applicable to another chimney of a tank 71, such as conventionally the gas dome.

[0073] The chimney 16 comprises a plurality of chimney walls 17 connected to one another and extending vertically. The chimney walls 17 are for example four in number in the case of a rectangular opening 12. These chimney walls 17 are attached to a coaming 18 of the supporting structure, specifically the coaming supporting walls 19, connecting the inner upper supporting wall 4 to the outer upper supporting wall 3.

[0074] The chimney 16 is, in the embodiment shown in figures 1 and 2, formed in the extension of the rear cofferdam wall 8 such that three of the edges 20 of the opening 12 form a protruding corner edge at the intersection between the ceiling wall 7 and one of the chimney walls 17. In another embodiment not shown, the chimney may be placed at a distance from the rear cofferdam wall 8 such that the four edges 20 of the opening 12 form a protruding corner edge.

[0075] In the remainder of the description, only the front longitudinal end edge 20 formed between the opening 12 and the front cofferdam wall will be described in detail subsequently. The other edges 20 forming a protruding corner edge may be formed in a similar or different way.

[0076] As shown in figure 2, each tank wall, and in particular the ceiling wall 7 and the chimney wall 17 successively have, from the outside toward the inside, in the thickness direction of the wall, a secondary thermally insulating barrier 21 comprising secondary insulating elements attached to the supporting structure 2, a secondary sealing membrane 22 anchored to the secondary insulating elements of the secondary thermally insulating barrier 21, a primary thermally insulating barrier 23 comprising primary insulating elements attached to the secondary insulating elements of the secondary thermally insulating barrier 21 or to the supporting structure 2 and resting against the secondary sealing membrane 22, and a primary sealing membrane 24 anchored to the primary insulating elements of the primary thermally insulating barrier 23 and intended to be in contact with the liquefied gas contained in the tank.

[0077] Figures 4 to 8 show more particularly the connection of the ceiling wall 7 to the chimney wall 17 at the edge 20 of the opening 12.

[0078] As shown in figure 4, the secondary thermally insulating barrier 21 of the ceiling wall 7 comprises a plurality of secondary insulating panels 25 which are anchored to the upper supporting wall 4 by means of anchoring devices (not shown). The secondary insulating panels 25 have a generally parallelepiped shape and are for example

arranged in parallel rows in the longitudinal direction L and in the transverse direction T perpendicular to the longitudinal direction L.

[0079] The secondary thermally insulating barrier 21 of the chimney wall 17 also comprises a plurality of secondary insulating panels 25 which are anchored to the coaming supporting wall 19 by means of anchoring devices (not shown).

[0080] As shown in figure 5, the secondary sealing membrane 22 of the ceiling wall 7 and of the chimney wall 17 comprises a continuous layer of metal strakes 26, with raised edges. The strakes 26 comprise a flat central portion 27 resting on the secondary insulating panels 25 of the secondary thermally insulating barrier 21 and also comprise two raised edges 28 arranged on either side of the flat central portion 27 and protruding toward the inside of the tank relative to the central portion. As regards the ceiling wall 7, the strakes 26 extend in the longitudinal direction L of the carrier while the raised edges 28 are arranged on either side of the flat central portion 27 in the transverse direction T of the carrier. As regards the chimney wall 17, the strakes 26 extend in a circumferential direction of the opening 12, substantially horizontal during normal use of the storage facility, while the raised edges are arranged on either side of the flat central portion 27 in a height direction H of the carrier, substantially vertical during normal use of the storage facility.

[0081] The strakes 26 are welded via their raised edges 28 on parallel welding supports which are attached in grooves formed on the upper surface of the secondary insulating panels 25 in contact with the secondary sealing membrane 22. The strakes 26 are for example made of Invar®, which is an alloy of iron and nickel with a coefficient of expansion typically between 1.2×10^{-6} and $2 \times 10^{-6} \text{ K}^{-1}$.

[0082] In figures 6 and 7 it can be seen that the primary thermally insulating barrier 23 of the ceiling wall 7 and of the chimney wall 17 comprises a plurality of primary insulating panels 29 which are anchored to the secondary thermally insulating barrier 21 by means of anchoring devices 52. The primary insulating panels 29 have a generally parallelepiped shape. Furthermore, they may have dimensions substantially identical to or different from those of the secondary insulating panels 25. In the embodiment shown in figure 5, the primary insulating panels 29 are positioned such that they are offset relative to the secondary insulating panels 25 in the longitudinal direction L, and optionally also in the transverse direction T.

[0083] The secondary insulating panels 25 and the primary insulating panels 29 comprise a bottom plate, a cover plate and one or more layers of insulating polymer foam sandwiched between the bottom plate, the cover plate and adhesively bonded thereto.

The insulating polymer foam may in particular be a polyurethane-based foam, optionally reinforced with fibers, in particular glass fibers.

[0084] The primary sealing membrane 24 comprises a plurality of corrugated metal plates juxtaposed and welded to one another. The primary sealing membrane 24 comprises a first series of corrugations extending in a first direction and a second series of corrugations extending in a second transverse direction.

[0085] In order to ensure continuity of sealing and insulation at the opening 12 between the ceiling wall 7 and the chimney wall 17, the sealing membranes 22, 24 and the thermally insulating barriers 21, 23 of the ceiling wall 7 are connected respectively to the sealing membranes 22, 24 and to the thermally insulating barriers 21, 23 of the chimney wall 17.

[0086] Thus, at the edge 20 of the opening 12, the secondary sealing membrane 22 of the ceiling wall 7 is connected to the secondary sealing membrane 22 of the chimney wall 17 using a secondary connection bracket 31. The secondary connection bracket 31 comprises a first secondary wing 32 and a second secondary wing 33 connected to the first secondary wing 32, the first secondary wing 32 being connected to the secondary sealing membrane 22 of the ceiling wall 7 and the second secondary wing 33 being connected to the secondary sealing membrane 22 of the chimney wall 17, as shown in figure 5.

[0087] At this connection, the secondary sealing membrane 22 is capable of transmitting to the secondary connection bracket 31 compressive and tensile forces linked to the operation of the secondary sealing membrane 22. These forces are particularly great at the front longitudinal end edge 20 of the opening 12, which is the edge of the opening 12 located between the chimney 16 and the front cofferdam wall in the longitudinal direction L. To be specific, owing to the position of the chimney 16 close to the rear cofferdam wall 8, the longitudinal dimension of the secondary sealing membrane 22 of the ceiling wall 7 between the chimney 16 and the front cofferdam wall is much greater than the longitudinal dimension of the secondary sealing membrane 22 between the chimney 16 and the rear cofferdam wall 8 which results in greater forces at the front longitudinal end edge 20 upon deformation of the hull or thermal contraction. In addition, these forces on the front longitudinal end edge 20 are particularly great owing to the orientation of the secondary sealing membrane 22. To be specific, the secondary sealing membrane 22 is oriented such that the flat central portion 27 of the strakes extends in the longitudinal direction L of the carrier 70. There is therefore no area for absorbing tensile and compressive forces in this direction.

[0088] In order to relieve the secondary connection bracket 31, a particular support structure is provided along the front longitudinal end edge 20 extending in the transverse direction T, which will be described in detail below. This particular support structure is formed of a corner insulating box 34, a longitudinal attachment support 35 anchored to the upper supporting wall 4 and a transverse attachment support 36 anchored to the coaming supporting wall 19.

[0089] The ceiling wall 7 comprises a plurality of metal longitudinal attachment supports 35 juxtaposed in the transverse direction T, extending at a distance from one another preferably at a regular interval, along the edge 20 of the opening 12.

[0090] Likewise, as shown in figure 4, the chimney wall 17 comprises a plurality of metal transverse attachment supports 36 juxtaposed in the transverse direction T, extending at a distance from one another preferably at a regular interval, along the edge 20 of the opening 12.

[0091] The storage facility lastly comprises a corner insulating box 34 forming a rectangular parallelepiped and being located in the extension of the secondary thermally insulating barrier 21 of the ceiling wall 7 and of the secondary thermally insulating barrier 21 of the chimney wall 17 at the edge 20 of the opening 12 such that the corner insulating box 34 is juxtaposed on the one hand with a longitudinal attachment support 35 and on the other hand with a transverse attachment support 36, as can be seen in figure 5 in particular.

[0092] Each longitudinal attachment support 35 comprises a cap 37 extending in the longitudinal direction L and welded to a foot 38. The foot 38 is anchored to the upper supporting wall 4, for example by welding or screwing. The longitudinal attachment support 35 thus has a seat length extending in the longitudinal direction L, measured at the attachment of the foot 38 to the supporting structure, and making it possible to oppose tilting and bending in this direction.

[0093] In the same way, each transverse attachment support 36 comprises a cap 37 extending in the height direction H and welded to a foot 38. The foot 38 is anchored to the coaming supporting wall 19, for example by welding or screwing.

[0094] Thus, in the areas where the secondary sealing membrane 22 is most likely to stress the secondary connection bracket 31, that is to say when the strakes 26 extend perpendicular to an edge of the opening 12, longitudinal attachment supports 35 are arranged, and in the other areas, that is to say when the strakes 26 extend parallel to an edge of the opening 12, transverse attachment supports 36 are arranged. This is why, at the front longitudinal end edge 20, longitudinal attachment supports 35 are arranged on

the upper supporting wall 4 while at a transverse end edge, transverse attachment supports 36 are arranged on the upper supporting wall 4.

[0095] Furthermore, as the strakes 26 of the secondary sealing membrane 22 of each chimney wall 17 extend perpendicular to the edge of the corresponding opening 12,
5 transverse attachment supports 36 are arranged on each coaming supporting wall 19.

[0096] The foot 38 of the longitudinal attachment support 35 is produced in the form of an H-beam (H-shaped section in a plane orthogonal to the thickness direction) comprising a first plate 39, referred to below as the attachment plate 39, adjacent to the corner insulating box 34 and a second plate spaced apart from the first plate 39 in the
10 longitudinal direction L by a connecting plate. The spacing in the longitudinal direction L between the first plate 39 and the second plate at the upper supporting wall 4 corresponds to the seat length.

[0097] The foot 38 of the transverse attachment support 36 for its part has a shorter seat length than the foot 38 of the longitudinal attachment support 35, as can be seen in
15 figure 5, and may be formed from a support plate supporting the cap 37 and an attachment plate 39 adjacent to the corner insulating box 34.

[0098] Other section shapes for the foot 38 may also be used as long as they offer a sufficient moment of inertia.

[0099] The secondary thermally insulating barrier 21 of the ceiling wall 7 and of the chimney
20 wall 17 comprises secondary end insulating blocks 40. Each secondary end insulating block 40 is inserted between two attachment supports 35, 36 adjacent in the transverse direction T.

[0100] As regards the ceiling wall 7 and in order to absorb the forces of the secondary sealing membrane 22, a secondary stop plate 41 is attached, for example using mastic,
25 not shown, to the upper surface of each secondary end insulating block 40. The secondary sealing membrane 22 of the ceiling wall 7 also has a secondary metal attachment plate 42 which is attached to the upper surface of the secondary stop plate 41. Thus, the first secondary wing 32 of the secondary connection bracket 31 is welded to a first portion of the secondary metal attachment plate 42 while the strakes 26
30 interrupted by the opening 12 are welded to a second portion of the secondary metal attachment plate 42, as shown in particular in figure 5. The secondary stop plate 41 is for its part attached at each of its transverse ends to a cap 37 for example by two studs.

[0101] Provision is also made to block the translation of the secondary stop plates 41 in the longitudinal direction L. To this end, the longitudinal attachment support 35 comprises a

stop device 43 attached to the cap 37. The secondary stop plate 41 is thus held in position in the longitudinal direction L on the one hand by the stop device 43 and on the other hand by the attachment plate 39 of the foot 38. Thus, the secondary stop plate 41 is rigidly supported by the longitudinal attachment supports 35 in the longitudinal direction L and in the thickness direction, which makes it possible to absorb any tensile or compressive force exerted by the secondary sealing membrane 22 of the ceiling wall 7 in operation.

[0102] As shown in figure 5, the corner insulating box 34 is on the one hand anchored to the attachment plate 39 of a longitudinal attachment support 35 by means of a first attachment device 44 and on the other hand anchored to the attachment plate 39 of a transverse attachment support 36 by means of a second attachment device 48.

[0103] To be specific, a side face 45 of the corner insulating box 34 comprises a first protuberance 46 and a second protuberance 47. The first attachment device 44 comprises a stud 49 attached to the attachment plate 39 of the longitudinal attachment support 35 and a bearing element 50 mounted on the stud 49 and bearing on a bearing surface of the first protuberance 46. The second attachment device 48 comprises a stud 49 attached to the attachment plate 39 of the transverse attachment support 36 and a bearing element 50 mounted on the stud 49 and bearing on a bearing surface of the second protuberance 47. Thus, the corner insulating box 34 is solidly anchored to the supporting structure 2 via the attachment supports 35, 36.

[0104] The secondary connection bracket 31 is placed against the corner insulating box 34, as can be seen in figure 5, such that the first secondary wing 32 is against one of the faces of the corner insulating box 34 and the second secondary wing 33 is against another of the faces of the corner insulating box 34. The first secondary wing 32 and the second secondary wing 33 are each attached to the corner insulating box 34 by means of an anchoring plate 51 shown in figure 5.

[0105] As shown in figures 6 and 7, the primary thermally insulating barrier 23 of the ceiling wall 7 and of the chimney wall 17 comprises a primary insulating panel 29 located in line with the secondary end insulating block 40.

[0106] The primary insulating panel 29 of the ceiling wall 7 in line with the secondary end insulating block 40 is attached to one of the longitudinal attachment supports 35 by means of an anchoring device 52, as can be seen in particular in figure 7. To be specific, the primary insulating panel 29 has a hole made at a distance from a corner of the primary insulating panel 29 in the foam, the bottom plate and the cover plate, the corner being located in line with the corner insulating box 34. A batten is attached to the bottom

plate and the anchoring device 52 is arranged in the hole in such a way as to bear on the batten and be attached to the cap 37 of said longitudinal attachment support 35.

[0107] The anchoring device 52 comprises a base attached to the cap 37, a stud attached to said base and extending in the thickness direction and passing sealingly through a hole in the secondary sealing membrane 22, and a bearing element mounted on the stud and bearing on a bearing surface of the batten in such a way as to retain the primary insulating panel 29 on the longitudinal attachment support 35. The bearing element is for example made in the form of a plate retained on the stud using a nut. The hole in the secondary sealing membrane 22 is made through the secondary metal attachment plate 42.

[0108] The anchoring device 52 further comprises a sealing washer which is engaged on the stud and comprises a flange sealingly attached to the secondary sealing membrane 22 around the hole in the secondary sealing membrane 22 and a deformable seal sealingly connecting the sealing washer to the stud in such a way as to allow relative movement between the sealing washer and the stud.

[0109] Furthermore, the stud has an anchoring shoulder protruding radially outward from the stud. In addition, the deformable seal is sealingly welded, on the one hand, to the sealing washer and, on the other hand, to the anchoring shoulder of the stud, which makes it possible to ensure sealed passage of the stud through the secondary sealing membrane 22. Thus, the sealed connection between the secondary sealing membrane 22 and the stud is flexible, which allows relative movements of the primary insulating panel 29 and the secondary end insulating block 40 relative to the secondary sealing membrane 22 and thus makes it possible to limit the risk of deterioration of the sealing of said secondary sealing membrane 22. In order to protect the deformable seal, the anchoring device 52 is also equipped with a bell which has a hole into which the stud is passed and which covers said deformable seal.

[0110] The primary insulating panel 29 of the chimney wall 17 in line with the secondary end insulating block 40 is also attached to the cap 37 of one of the transverse attachment supports 36 by means of the same anchoring device 52, as can be seen in figure 6.

[0111] The storage facility also includes a primary corner insulating assembly 53 which is located in the extension of the primary thermally insulating barrier 23 of the ceiling wall 7 and of the primary thermally insulating barrier 23 of the chimney wall 17 at the edge 20 of the opening 12, as shown in figure 7.

[0112] The primary corner insulating assembly 53 is located against the secondary connection bracket 31 in such a way as to be attached to the corner insulating box 34. To be specific, the primary corner insulating assembly 53 comprises a lower face 54

forming an angle of 90° so as to match the shape of the secondary connection bracket 31, the lower face 54 being attached to the corner insulating box 34 by means of an anchoring device 52 in line with the first secondary wing 32 and by means of an anchoring device 52 in line with the second secondary wing 33.

5 [0113] The primary corner insulating assembly 53 also includes a chamfered upper face 55 forming an angle of 135°. The storage facility also includes a primary connection bracket 56, visible in figures 6 and 7, attached to the chamfered upper face 55 of the primary corner insulating assembly 53. The primary connection bracket 56 is welded on the one hand to the primary sealing membrane 24 of the ceiling wall 7 and on the other hand to
10 the primary sealing membrane 24 of the chimney wall 17. The primary corner insulating assembly 53 may be formed of two insulating elements assembled together as shown in figure 7 or formed of three insulating elements assembled together as shown in figure 6.

[0114] Figure 8 illustrates another embodiment for the anchoring device 52.

[0115] Unlike the embodiment of figure 7, in this embodiment, the anchoring device 52 here
15 comprises a flange forming an integral part of the stud, that is to say that the flange is made in the mass at the same time as the rest of the stud and they thus form a single piece. The flange thus protrudes radially outward from the stud and is sealingly welded to the secondary sealing membrane 22 around the hole in the secondary sealing membrane 22. In this embodiment, the anchoring device 52 does not include any
20 deformable seal, or bell or anchoring shoulder.

[0116] With reference to figure 9, a view of a liquefied gas carrier 70 with part cut away shows a sealed and insulated tank 71 of generally prismatic shape mounted in the double hull 72 of the carrier. The wall of the tank 71 comprises a primary sealed barrier intended to be in contact with the LNG contained in the tank, a secondary sealed barrier
25 arranged between the primary sealed barrier and the double hull 72 of the carrier, and two insulating barriers arranged respectively between the primary sealed barrier and the secondary sealed barrier and between the secondary sealed barrier and the double hull 72.

[0117] In a manner known per se, loading/unloading pipelines 73 arranged on the upper
30 deck of the carrier may be connected, by means of appropriate connectors, to a maritime or port terminal for transferring a cargo of LNG from or to the tank 71.

[0118] Figure 9 shows an example of a maritime terminal comprising a loading and unloading station 75, an underwater pipe 76 and an onshore facility 77. The loading and unloading station 75 is a fixed offshore facility comprising a movable arm 74 and a tower
35 78 which supports the movable arm 74. The movable arm 74 carries a bundle of

insulated flexible pipes 79 which may be connected to the loading/unloading pipelines 73. The orientable movable arm 74 may be adjusted to suit all sizes of liquefied gas carrier. A connecting pipe (not shown) extends inside the tower 78. The loading and unloading station 75 allows loading and unloading of the liquefied gas carrier 70 from or
5 to the onshore facility 77. This facility comprises tanks 80 for storing liquefied gas and connection pipes 81 connected by the underwater pipe 76 to the loading or unloading station 75. The underwater pipe 76 allows the transfer of the liquefied gas between the loading or unloading station 75 and the onshore facility 77 over a long distance, for example 5 km, which makes it possible to keep the liquefied gas carrier 70 at a long
10 distance from the shore during loading and unloading operations.

[0119] To generate the pressure necessary to transfer the liquefied gas, use is made of pumps on board the carrier 70 and/or pumps fitted to the onshore facility 77 and/or pumps fitted to the loading and unloading station 75.

[0120] Although the invention has been described in connection with several particular
15 embodiments, it is obvious that it is in no way limited thereto and that it includes all technical equivalents of the means described as well as combinations thereof, if these fall within the scope of the invention.

[0121] The use of the verb “comprise” or “include” and conjugated forms thereof does not
20 rule out the presence of other elements or other steps in addition to those stated in a claim.

[0122] In the claims, any reference sign in parentheses should not be interpreted as a limitation of the claim.

Claims

[Claim 1] A storage facility (1) for a liquefied gas comprising a supporting structure (2) and a sealed and thermally insulating tank arranged in the supporting structure (2), the supporting structure (2) comprising an upper supporting wall (4) and the tank comprising a ceiling wall (7) attached to the upper supporting wall (4), the upper supporting wall (4) and the ceiling wall (7) being interrupted locally in such a way as to delimit an opening (12), the supporting structure (2) comprising a coaming (18) protruding vertically toward the outside of the tank from the upper supporting wall (4) all around the opening (12) and defining a passage intended to be passed through by at least one pipe (13) intended for loading or unloading liquefied gas into/from the tank, the coaming (18) comprising at least one coaming supporting wall (19) connected to the upper supporting wall (4), the tank comprising a chimney wall (17) anchored against the coaming supporting wall (19), the chimney wall (17) and the ceiling wall (7) being connected to one another at an edge (20) of the opening (12), the ceiling wall (7) and the chimney wall (17) each comprising, in a thickness direction from the outside toward the inside of the tank, a thermally insulating barrier (21) anchored to the supporting structure and a metal sealing membrane (22) arranged on the thermally insulating barrier (21), the metal sealing membrane (22) of the ceiling wall (7) and of the chimney wall (17) each comprising an end portion formed near the edge (20) of the opening (12), wherein the sealing membrane (22) of the ceiling wall (7) comprises a plurality of parallel strakes extending perpendicular to the edge (20) of the opening (12), each strake comprising a flat central portion and two raised edges protruding toward the inside of the tank relative to the central portion, the strakes of the sealing membrane (22) of the ceiling wall (7) being juxtaposed in a direction parallel to the edge (20) of the opening (12) in a repeated pattern and welded together sealingly at the raised edges, at least one of said strakes (26) being interrupted by the opening (12), wherein the storage facility (1) comprises a metal connection bracket (31) comprising a first wing (32) and a second wing (33) connected to the first wing, the first wing being connected to the end portion of the sealing membrane (22) of the ceiling wall (7) and the second wing being connected to the end portion of the sealing membrane (22) of the chimney wall (17), wherein the storage facility comprises a corner insulating box (34) forming a rectangular parallelepiped, the corner insulating box (34) being located in the extension of the thermally insulating barrier (21) of the ceiling wall (7) and of the thermally insulating

barrier (21) of the chimney wall (17) at the edge (20) of the opening (12), the connection bracket (31) being attached to the corner insulating box (34).

[Claim 2] The storage facility (1) as claimed in claim 1, wherein the first wing (32) of the connection bracket (31) is flat and covers a first flat face of the corner insulating box (34), the first flat face being parallel to the upper supporting wall (4), and wherein the second wing (33) of the connection bracket (31) is flat and covers a second flat face of the corner insulating box (34), the second flat face being parallel to the coaming supporting wall (19) and being perpendicular to the first flat face.

[Claim 3] The storage facility (1) as claimed in claim 2, wherein an anchoring plate (51) is attached to each of the first flat face and the second flat face, the first wing (32) and the second wing (33) being welded to the anchoring plate (51) of the first flat face and of the second flat face, respectively.

[Claim 4] The storage facility (1) as claimed in one of claims 1 to 3, wherein the corner insulating box (34) is produced in the form of a box comprising a bottom plate, a cover plate parallel to the bottom plate and supporting spacer plates keeping the cover plate at a distance from the bottom plate, the box being filled with insulating filler.

[Claim 5] The storage facility (1) as claimed in one of claims 1 to 4, wherein the thermally insulating barrier (21) of the ceiling wall (7) comprises an end insulating block (40) adjacent to the edge (20) of the opening (12) and wherein the ceiling wall (7) comprises a plurality of metal longitudinal attachment supports (35) attached to the upper supporting wall (4) along said edge (20) of the opening (12) and located on either side of the end insulating block (40), each longitudinal attachment support (35) comprising a foot (38) welded to the upper supporting wall (4) and a cap (37) attached to the foot, the thermally insulating barrier (21) comprising a stop plate (41) arranged on the end insulating block, the end portion of the sealing membrane (22) comprising a metal attachment plate (42) which is attached to the stop plate, the first wing (32) of the connection bracket (31) being welded to a first portion of the metal attachment plate (42), said at least one interrupted strake (26) being welded to a second portion of the metal attachment plate (42).

[Claim 6] The storage facility (1) as claimed in claim 5, wherein the foot (38) of the longitudinal attachment support (35) comprises an attachment plate (39) adjacent to the corner insulating box (34) and attached on the one hand to the upper supporting wall (4) and on the other hand to the cap, the attachment plate being formed in a plane parallel to the coaming supporting wall (19), the corner insulating box being attached to the attachment plate of at least one of the longitudinal attachment supports of the ceiling wall (7) by means of an attachment device (44, 48).

- [Claim 7] The storage facility (1) as claimed in claim 6, wherein the corner insulating box (34) comprises a side face on which a protuberance (46) protrudes, the attachment device (44, 48) comprising a stud (49) attached to the attachment plate (39) of the longitudinal attachment support (35) and a bearing element (50) engaged on the stud (49) and bearing on a bearing surface of the protuberance (46).
- [Claim 8] The storage facility (1) as claimed in one of claims 1 to 4, wherein said at least one interrupted strake (26) forms said end portion of the sealing membrane (22).
- [Claim 9] The storage facility (1) as claimed in one of claims 1 to 8, wherein the sealing membrane (22) of the chimney wall (17) comprises a plurality of parallel strakes extending parallel to the edge (20) of the opening (12), each strake comprising a flat central portion (27) and at least one raised edge (28) protruding toward the inside of the tank relative to the central portion, the strakes being juxtaposed in a direction perpendicular to the edge (20) of the opening (12) in a repeated pattern and welded together sealingly at the raised edges, at least one of said strakes being interrupted by the opening (12), an end portion of said interrupted strake being welded to the second wing of the connection bracket.
- [Claim 10] The storage facility (1) as claimed in claim 9, wherein the interrupted strake of the chimney wall (17) comprises a single raised edge (28) located on an end of the strake opposite the end portion.
- [Claim 11] The storage facility (1) as claimed in one of claims 1 to 10, wherein the thermally insulating barrier (21) of the chimney wall (17) comprises an end insulating block (40) adjacent to the edge (20) of the opening (12) and wherein the chimney wall (17) comprises a plurality of metal transverse attachment supports (36) attached to the coaming supporting wall (19) along said edge (20) of the opening (12) and located on either side of the end insulating block, each transverse attachment support (36) comprising a foot (38) welded to the coaming supporting wall (19) and a cap (37) attached to the foot (38).
- [Claim 12] The storage facility (1) as claimed in claim 11, wherein the foot (38) of the transverse attachment support (36) comprises an attachment plate (39) adjacent to the corner insulating box (34) and attached on the one hand to the coaming supporting wall (19) and on the other hand to the cap, the attachment plate being formed in a plane parallel to the upper supporting wall (4), the corner insulating box being attached to the attachment plate of at least one of the transverse attachment supports of the chimney wall (17) by means of an attachment device (44, 48).
- [Claim 13] The storage facility (1) as claimed in one of claims 1 to 12, wherein the sealing membrane (22) is a secondary sealing membrane and the thermally insulating barrier (21) is a secondary thermally insulating barrier, the ceiling wall (7) and the

chimney wall (17) each comprising a primary thermally insulating barrier (23) arranged on the secondary sealing membrane and a metal primary sealing membrane (24) arranged on the primary thermally insulating barrier and intended to be in contact with the liquefied gas.

5 [Claim 14] The storage facility (1) as claimed in claims 5 and 13 combined, wherein the end insulating block of the ceiling wall (7) is a secondary end insulating block, and wherein the primary thermally insulating barrier of the ceiling wall (7) comprises a primary insulating panel (29) located in line with the secondary end insulating block, the primary insulating panel (29) being attached to one of the longitudinal attachment
10 supports by means of an anchoring device (52).

[Claim 15] The storage facility (1) as claimed in claims 11 and 13 combined, wherein the end insulating block of the chimney wall (17) is a secondary end insulating block, and wherein the primary thermally insulating barrier of the chimney wall (17) comprises a primary insulating panel (29) located in line with the secondary end insulating block, the
15 primary insulating panel (29) being attached to one of the transverse attachment supports by means of an anchoring device (52).

[Claim 16] The storage facility (1) as claimed in one of claims 13 to 15, wherein the storage facility comprises a primary corner insulating assembly (53), the primary corner insulating assembly being located in the extension of the primary thermally insulating
20 barrier of the ceiling wall (7) and of the primary thermally insulating barrier of the chimney wall (17) at the edge (20) of the opening (12), the primary corner insulating assembly comprising a chamfered upper face (55), the primary corner insulating assembly (53) being attached to the corner insulating box (34) by means of at least one anchoring device (52).

25 [Claim 17] The storage facility (1) as claimed in claim 16, wherein the storage facility comprises a primary connection bracket (56) attached to the chamfered upper face of the primary corner insulating assembly, the primary connection bracket being welded on the one hand to the primary sealing membrane (24) of the ceiling wall (7) and on the other hand to the primary sealing membrane (24) of the chimney wall (17).

30 [Claim 18] The storage facility (1) as claimed in one of claims 1 to 17 produced in the form of a floating structure, wherein said supporting structure consists of a double hull (72) of the floating structure, and wherein the first direction (L) is a longitudinal direction (L) of the floating structure.

[Claim 19] A system for transferring a cold liquid product, the system comprising a
35 storage facility as claimed in claim 18, insulated pipelines (73, 79, 76, 81) arranged so as to connect the tank (71) installed in the hull of the floating structure to an external floating or onshore storage facility (77), and a pump for pumping a flow of cold liquid product

through the insulated pipelines from or to the external floating or onshore storage facility, to or from the tank of the floating structure.

[Claim 20] A method for loading or unloading a storage facility as claimed in claim 18,
wherein a cold liquid product is conveyed through insulated pipelines (73, 79, 76, 81)
5 from or to an external floating or onshore storage facility (77), to or from the tank (71) of
the floating structure.