Description

Title: Vessel wall comprising improved insulation around a bushing

The field of the present invention is that of the transport tanks with corrugated sealed membranes, for the storage and/or transportation of a liquid, and in particular the sealed and thermally insulating tanks for transporting a gas in the liquid state.

The invention relates to the field of the sealed and thermally insulating tanks for storing and/or transporting liquid at low temperature, such as tanks for transporting liquefied petroleum gas (LPG), for example having a temperature of between -50°C and 0°C, or for transporting liquefied natural gas (LNG), at approximately -162°C and at atmospheric pressure. These tanks can be installed onshore or on a floating structure. In the case of a floating structure, the tank can be intended for the transportation of liquefied gas or to receive liquefied gas serving as fuel for the propulsion of the floating structure.

Usually, the tanks used for storing liquid at low temperature comprise a number of bushings for the passage of the pipes which can be intended for example for the loading or the offloading of the liquid, or even to capture gases in the vapor space. All of these pipes are surrounded by a coaming, that is to say a vertical structural element which brackets the pipes.

In some situations where the number of pipes or their dimensions are restricted, the use of a coaming can be avoided. It is nevertheless necessary to provide openings which allow the pipes to pass through the wall of the tank.

These openings are nevertheless ill suited for the passage of the pipe for offloading the cargo present in the tank, the latter requiring an opening to be produced in the wall of the tank that is of significant size.

The size of this opening thus generates difficulties in the secondary insulation layer of the tank, because there are significant temperature differences between the secondary insulation layer and the element positioned in the opening and which passes through the wall.

The aim of the present invention is to address the drawbacks cited previously by eliminating the coaming, by combining several pipes of the tank in one and the same

bushing and by managing the temperature differences between the bushing and the secondary insulation layer.

The subject of the invention is therefore a wall of a tank capable of containing a liquid cargo and intended to be installed in a transport ship, the wall comprising at least one primary insulation layer extending mostly in a primary plane and a secondary insulation layer extending mostly in a secondary plane, the primary insulation layer and the secondary insulation layer being superposed in a direction transversal to the planes of insulation of the layers, the tank wall comprising at least one bushing in the form of a hollow cylinder passing through the layers and a pipe which extends in the bushing, characterized in that the primary insulation layer comprises a peripheral zone which extends around the bushing and in the secondary plane of the secondary insulation layer.

It is understood here that a part of the primary insulation layer runs up along the bushing and crosses the general plane of extension of the secondary insulation layer, such a part being defined by the peripheral zone.

According to the invention, the tank can contain liquefied gas, notably liquid natural gas, liquefied petroleum gas and, generally, any liquefied hydrocarbon. The transport ship can then comprise several tanks, capable of storing and transporting gas in the liquid state.

The primary insulation layer and the secondary insulation layer are sets of parts that make it possible to thermally insulate the tank, and they can have distinct thicknesses. The primary plane and the secondary plane are then defined as the planes passing respectively through the middle of the thickness of the primary insulation layer and through the middle of the thickness of the secondary insulation layer.

The bushing has a cylindrical form, notably circular. The bushing takes the form of a duct of circular section which passes right through the wall of the tank that is the subject of the invention. The bushing then makes it possible to run a pipe, the latter being able to be a pipe for offloading the liquid cargo or a pipe for evacuating the gaseous phase of the liquid cargo. In order to offload the maximum of the liquid cargo, the offloading pipe extends from the outside of the tank to the immediate vicinity of a bottom of the tank. The evacuation tube extends, for its part, from the outside of the

tank to the vapor space. The bushing according to the invention can of course comprise an offloading pipe and at least one evacuation pipe.

According to the invention, the peripheral zone is connected with the portion of the primary insulation layer extending in the primary plane, such that they form just one and the same volume. This feature makes it possible to be able to flush, with one and the same inert gas, the portion of the primary insulation layer which is situated in the primary plane and the part of this primary insulation layer which extends in the secondary plane.

According to a feature of the invention, the peripheral zone houses at least one peripheral piece which extends in the secondary plane of the secondary insulation layer over a radius of between 400 mm and 1000 mm around a bushing axis of the bushing. It is then understood that the portion of the primary insulation layer situated in the primary plane and the peripheral piece are flushed by the same inert gas stream.

The piece or the zone is peripheral in that it surrounds the bushing. It can be a piece or an annular or polygonal zone. Although a constituent part of the primary insulation layer, the peripheral piece is separate from the insulating panels of the primary insulation layer and which extend in the primary plane.

According to a feature of the invention, a thickness of the peripheral zone is identical to a thickness of the secondary insulation layer. This feature guarantees the absence of coaming around the bushing. The thicknesses are measured on a straight line parallel to an axis of revolution of the bushing and the thickness of the peripheral piece is also identical or substantially identical to the thickness of the secondary insulation layer, to within manufacturing and mounting tolerances.

According to a feature of the invention, a partition extends at least around the bushing, between the secondary insulation layer and the peripheral zone. Such a partition separates an inner volume of the secondary insulation layer and an inner volume of the peripheral zone which forms part of the primary insulation layer. The partition can be cylindrical and can be formed by an assembly composed of a circular ring and of an insulating material that can for example be glass wool.

According to a feature of the invention, the partition ensures a seal-tightness between the primary insulation layer and the secondary insulation layer. This partition therefore

separates the primary insulation layer volume from the secondary insulation layer volume, in the vicinity of the peripheral zone.

According to a feature of the invention, at least one gas evacuation tube extends in the bushing and has an outer end which emerges outside of the tank and an inner end which emerges in a vapor space of the tank. The vapor space comprises the gases resulting from the evaporation of the liquid cargo and is therefore close to the top wall of the tank. The gas evacuation tube then makes it possible to suck the gases present in the vapor space so as to supply a heat engine with which the transport ship is equipped or even to adapt the pressure in the vapor space.

According to another aspect, the pipe is a liquid cargo offloading pipe, notably comprising a first end which emerges outside of the internal volume of the tank and a second end which emerges in the tank, in the vicinity of a bottom wall of the tank.

The invention also covers a wall which comprises a number of bushings as described above.

The invention also covers a transport ship, for example a methane tanker, comprising at least one tank wall which comprises the above features.

According to a feature of the transport ship, the latter comprises at least one deck of the transport ship, an edge of the deck being at a non-zero distance from the bushing.

The deck of the transport ship extends at a non-zero distance from the bushing in order to allow movements which result from the thermal expansions between the bushing, which can be in contact with the cargo in the liquid state, and the deck which is insulated from this cargo by at least one primary insulation layer and the secondary insulation layer.

According to one aspect, the non-zero distance which separates the bushing from the edge of the deck is filled by a thermally insulating piece.

According to a feature of the transport ship, the edge of the deck extends at least partly axially in line with the peripheral zone on a straight line parallel to the bushing axis.

According to a feature of the transport ship, a cylinder positioned around the bushing is supported by an outer face of the deck and delimits, with the bushing, a space containing a thermally insulating material, the space being closed by a top. The cylinder

insulation can be composed, for example, of glass wool, of expanded foam or of perlite. It is then understood that the cylinder reinforces the insulation around the bushing and that the top hermetically seals the space of the cylinder.

According to a feature of the transport ship, the edge of the deck is radially positioned between the bushing and an inner face of the cylinder. Such an organization makes it possible to use the deck for it to absorb the axial loads which originate from the pressure internal to the tank around the bushing and to which the primary insulation layer is subjected.

Still according to a feature of the transport ship, a duct passes through the cylinder, the peripheral zone and emerges in the primary insulation layer, the duct being configured to be linked to an inert gas supply device. A first duct opening, a second duct opening and a third duct opening are formed at least respectively in the cylinder, in the deck of the transport ship and through the cylindrical piece, in order to allow the passage of the duct through a cylinder insulation and the primary insulation layer. Preferably, the inert gas is nitrogen.

The invention also covers a transport ship comprising a wall of a tank capable of containing a liquid cargo and intended to be installed in a transport ship, the wall comprising at least one primary insulation layer extending mostly in a primary plane and a secondary insulation layer extending mostly in a secondary plane, the primary insulation layer and the secondary insulation layer being superposed in a direction transversal to the planes of insulation of the layers, the tank wall comprising at least one bushing in the form of a hollow cylinder passing through the layers and a pipe which extends in the bushing, the transport ship comprising at least one deck of the transport ship, an edge of the deck being at a non-zero distance from the bushing, the edge of the deck is radially positioned between the bushing and an inner face of a cylinder positioned around the bushing and supported by an outer face of the deck.

According to an aspect of the transport ship, the edge of the deck extends at least partly axially in line with the peripheral zone on a straight line parallel to the bushing axis.

The invention also relates to a method for loading or offloading a liquid natural gas into or from a tank comprising a wall according to the above features or a liquid natural gas transport ship according to one of the above features.

Other features, details and advantages of the invention will emerge more clearly on reading the description given below as an indication in relation to the drawings in which:

[Fig. 1] is a side view of a transport ship showing at least one tank for transporting a liquid cargo and a bushing penetrating the tank;

[Fig. 2] is a cross-sectional view, on a vertical line of the tank, of a top tank wall in which the bushing is formed;

[Fig. 3] is a closer cross-sectional view on a vertical line of the tank of the peripheral zone of penetration of the bushing in the top wall of the tank of figure 2.

It should first of all be noted that the figures display the invention in detail for the implementation of the invention, said figures obviously being able to be better used to define the invention, as necessary.

Figure 1 represents a transport ship 1, for example a methane tanker, which comprises four tanks 2 for transporting or storing liquefied natural gas. At least one of the tanks 2 comprises a tank wall 22 which delimits an internal cavity 20 in which the liquefied gas is stored. The tank wall 22 comprises a tank bottom wall 22a, a tank top wall 22b, opposite the tank bottom wall 22a on a vertical line V of the tank 2, and lateral walls 22c which extend between the tank bottom wall 22a and the tank top wall 22b.

Figure 2 illustrates a cross-sectional view of the tank 2 and of the bushing 3 formed in the tank top wall 22b, on the vertical line V of the tank illustrated in figure 1. This bushing 3 takes the form of a hollow cylinder of which a first end is situated in an environment outside the tank 2 while the other end is positioned in a vapor space 21 of the tank 2 corresponding to a part of the inner cavity 20 close to the top wall 22b of the tank wall 22, that is to say a portion of the tank 2 where the gas in the liquid state is not present in normal conditions of use.

The bushing 3 extends around and along an axis of revolution, called bushing axis R, and comprises a bushing wall which extends peripherally around the bushing axis R of the bushing 3 and which delimits a passage through the tank top wall 22b. The bushing 3 then allows the passage of at least one pipe 31, notably a pipe for offloading liquefied gas and/or of a gas evacuation tube 32. The bushing 3 also comprises a cover 33 covering the part outside the tank 2 and making it possible to tightly close the bushing 3 once the pipe 31 and/or the gas evacuation tube 32 are installed.

The pipe 31, when it is a pipe for offloading gas in the liquid state, extends in the liquid portion of the cargo to the immediate vicinity of the tank bottom wall 22a, for offloading the maximum of the liquefied gas out of the tank 2. The gas evacuation tube 32 extends from the outside of the tank to the interior of the tank 2, and opens in the part of the tank 2 called vapor space 21 of the tank 2, where the natural gas is in the gaseous state. The vapor space 21 of the tank 2 is a space close to the tank top wall 22b which contains a gaseous phase of the liquid cargo which results from the evaporation thereof. The gas evacuation tube 32 then makes it possible to suck the gaseous phase of the liquid cargo to supply a heat engine (not represented) with which the transport ship is equipped, or even to make it possible to adapt the pressure in the vapor space 21 of the tank 2.

The tank top wall 22b is composed of a superposition of insulating and sealed layer, in order to thermally insulate the internal cavity 20 and ensure the seal-tightness thereof. The tank top wall 22b then comprises, respectively from the inner cavity 20 to an environment outside the tank 2, at least a primary insulation layer 224 and a secondary insulation layer 226. The other walls of the tank can also comprise such primary insulation layer 224 and secondary insulation layer 226.

The primary insulation layer 224 consists of a primary membrane 222, composed of a plurality of plates welded to one another and comprising corrugations 2221, and a plurality of primary insulation panels 221. The primary membrane 222 constitutes a face in direct contact with the liquefied gas contained in the inner cavity 20.

The secondary insulation layer 226 consists of several secondary insulation panels 220 and a secondary membrane 225, opposite the primary insulation layer 224. The secondary insulation layer 226 of the tank top wall 22b is then topped by a deck 228 in contact with the outside of the tank 2.

According to a feature of the invention, the primary insulation layer 224 defines a volume which is flushed by an inert gas, and is delimited on one side by the primary membrane 222 and on another side by the secondary membrane 225. In an equivalent manner, the secondary insulation layer 226 defines a volume, distinct from the volume of the primary insulation layer 224, which is flushed by an inert gas, and which is delimited on one side by the secondary membrane 225 and on the other side by the deck 228.

The circulation of inert gas in the primary insulation layer 224 and in the secondary insulation layer 226 makes it possible for example to detect leaks of the cargo out of the inner cavity 20 of the tank 2. The leak detection is then performed in a way that is distinct for the primary insulation layer 224 and for the secondary insulation layer 226. Advantageously, the inert gas used is nitrogen.

The tank top wall 22b also comprises a cylinder 233 extending radially around the bushing 3. This cylinder 233 has an axis of revolution which coincides with the bushing axis R.

Figure 3 shows a closer cross-sectional view on the vertical line V of the tank, of the bushing 3 and of its peripheral zone. In the following description, superposition is understood to mean a superposition on the vertical line V of the tank, going from the inner cavity 20 of the tank to the outside of the tank.

The bushing 3 defines a passage in the tank top wall 22b for the pipe 31, notably the pipe for offloading the liquid cargo, and/or for the gas evacuation tube 32, for the suction of the gases from the vapor space 21.

The tank top wall 22b comprises the primary insulation layer 224 composed partly of the primary membrane 222 on which the primary insulation panel 221 is superposed. The primary membrane 222 is in contact with the liquefied gas stored in the inner cavity 20 of the tank. The primary membrane 222 is composed of a plurality of plates comprising corrugations 2221 distributed over its surface and it surrounds the bushing 3, nevertheless remaining at a non-zero distance from this bushing 3. Such a configuration of the primary membrane 222 gives it a greater resistance to the stresses generated on the tank, notably to the thermal shrinkage when the tank is cooled, the hydrostatic pressure due to the loading of the liquid cargo, and the dynamic pressure due to the movement of the cargo, notably because of the swell. The corrugations 2221 on the primary membrane 222 then allow it to be deformed to mitigate these stresses. The primary membrane 222 is preferentially made of stainless steel.

A bracket 236 is placed in the inner cavity 20 of the tank, such that it is in contact with the primary membrane 222 and with the bushing 3. Only the ends of the bracket 236 are welded respectively to the primary membrane 222 and to the bushing 3. Such a configuration of the bracket 236 allows it to both close the space between the primary membrane 222 and the bushing 3, and also give it a flexibility in this zone to absorb the

dynamic stresses of the tank. In fact, the bushing 3 can cut several corrugations 2221 so that it is necessary to restore flexibility in the zone of passage of the bushing 3. This flexibility is for example given by the fact that the bracket 236 is welded only at its ends.

The primary insulation panel 221 is composed of an insulating material and contributes to the thermal insulation of the tank, necessary for the storage of the liquid natural gas at low temperature (-163° Celsius).

The primary insulation layer 224 is defined by a thickness T1 measured on a straight line parallel to the bushing axis R and this thickness extends from the primary membrane to the secondary membrane. The primary insulation layer 224 extends around the bushing 3 to a non-zero distance D1, in order to adapt to the expansion and the shrinkage of the bushing 3 provoked by the temperature variations upon the loading or the offloading of the tank. The function of the primary insulation layer 224 is to form a first thermal insulation barrier of the tank.

A primary plate 223 extends between the primary membrane 222 and the primary insulation panel 221. The primary plate 223 is a plywood which can include stainless steel strips (not represented) that make it possible to weld the edges of the plates of the primary membrane 222.

The secondary insulation layer 226 comprises the secondary membrane 225, also called triplex, superposed on the primary insulation layer 224 and which extends in the vicinity of the bushing 3, to a non-zero distance D2 and a distance that is strictly greater than the distance D1 mentioned above. The secondary membrane 225 is a material comprising three layers, namely two outer layers of glass fiber fabrics and an intermediate layer of thin metal sheet, for example a sheet of aluminum approximately 0.1 mm thick. The secondary membrane 225 has a flexural flexibility, which allows it to follow the deformations of the tank due to the deformation of the hull by the swell or by the cooling of the tank. Flexural flexibility is understood to mean the capacity of the material to be folded to form curves without breaking.

The secondary insulation panel 220 is superposed on the secondary membrane 225. The secondary insulation panel 220 consists of a thermally insulating material and contributes, together with the primary insulation panel 221, to the thermal insulation of the tank. The secondary insulation layer 226 is then defined by a thickness T2 measured

along a straight line parallel to the bushing axis R between the secondary membrane and a secondary plate 227 glued against the deck.

The secondary insulation layer 226 extends around the bushing 3 to the non-zero distance D2, this distance D2 being strictly greater than the distance referenced D1. The secondary insulation layer 226 comprises a first face 2261, facing the deck 228, and a second face 2262, facing the secondary membrane 225.

A secondary plate 227 extends between the deck 228 and the secondary insulation panel 220. The secondary plate 227 makes it possible to stiffen the secondary insulation panel 220 and can notably be made of plywood.

According to an aspect of the invention, a peripheral piece 240 extends in a peripheral zone 229, that is defined as the zone which extends in the plane of insulation P2 of the secondary insulation layer 226 and radially between the secondary insulation layer 226 and the bushing 3, at least over a radial distance equivalent to the distance D2 mentioned above. The peripheral piece 240 has a thickness T3 measured along a straight line parallel to the bushing axis R which is identical or similar to the thickness T2 of the secondary insulation layer 226, to within manufacturing and/or mounting tolerances. This thickness T3 also defines the part of the primary insulation layer 224 which extends around the bushing 3 and which is in the secondary plane P2 of the secondary insulation layer 226. In the present description, this part is the peripheral zone 229.

The peripheral piece 240 is a piece contributing to the thermal insulation of the tank and can be made of materials identical to the insulating panels of the primary insulation layer 224. The peripheral piece 240 is housed in the peripheral zone 229.

According to the invention, the peripheral piece 240 is connected with the volume of the primary insulation layer 224 at least through a bushing space 242 defined by the distance D1 between the primary insulation layer 224, the peripheral piece 240, and the bushing 3. This bushing space 242 can be filled by thermal insulation 241, preferably glass wool which, by its flexibility, makes it possible to absorb the cold plays of the bushing 3, while allowing a circulation of the inert gas. It is then understood that the peripheral zone 229 is flushed by the inert gas circulating in the volume of the primary insulation layer 224. By this feature, it is considered that the peripheral piece 240 forms part of the primary insulation layer 224.

The secondary insulation layer 226 thus comprises a countersink which surrounds the bushing 3, this countersink being formed by the peripheral zone 229 and filled by the peripheral piece 240.

Preferentially and in a nonlimiting manner, the peripheral piece 240 extends in the secondary plane P2 of the secondary insulation layer 226 over a radius of between 400 mm and 1000 mm around the bushing axis R of the bushing 3.

A first annular plate 2291 extends between the peripheral piece 240 and the deck 228. A second annular plate 2292 can be positioned between the primary insulation panel 221 and the peripheral piece 240. The first annular plate 2291 and the second annular plate 2292 can be, in a nonlimiting manner, made of densified wood or of polyurethane and their function is to stiffen the peripheral piece 240.

Finally, the tank top wall 22b comprises the deck 228 of the transport ship which covers the secondary plate 227 and which extends at least partly axially in line with the peripheral piece 240, that is to say along a straight line parallel to the bushing axis R.

The deck 228 therefore at least partly covers the first annular plate 2291. Furthermore, the deck 228 extends to a non-zero distance from the bushing 3 and comprises an edge 2280 radially positioned between the bushing 3 and an inner face 2334 of the cylinder 233. The edge 2280 thus defines a passage 2332 between the deck 228 and the bushing 3. Such a configuration of the deck 228 makes it possible to allow the thermal expansions due to the loading or offloading of the liquid cargo. The passage 2332 can be filled by a thermal insulator, the latter then being positioned between the edge 2280 and the bushing 3.

The deck 228 comprises an outer face 2281, facing the environment outside the tank, and an inner face 2282, facing the secondary plate 227 and the first annular plate 2291. An adhesive 230 can be positioned between the inner face 2282 of the deck 228, the first annular plate 2291 and the secondary plate 227. The adhesive 230 can for example be in the form of blobs of glue and makes it possible to secure the first annular plate 2291 and the secondary plate 227 to the deck 228.

A partition 232 extends parallel to the bushing axis R, radially at least between the peripheral piece 240 and the secondary insulation layer 226. The partition 232 emerges at right angles from the inner face 2282 of the deck 228 to be in contact with the

secondary membrane 225. The partition 232 is composed of a ring 2321 and of an insulating material 2322, for example glass wool. According to the invention, the ring 2321 of the partition 232 has a straight circular cylinder profile. It is then understood that the function of the partition 232 is to thermally insulate and tightly separate the peripheral piece 240 from the secondary insulation layer 226, in order for the inert gas circulating respectively in each of the volumes not to mix. According to this feature, the junction between the ring 2321 and the secondary membrane 225 can for example be the subject of welding in order to make this junction tight. Generally, it is considered that the partition 232 separates the volume of the secondary layer 226 from the volume of the peripheral zone 229.

The tank top wall 22b comprises the cylinder 233 positioned bearing on the outer face 2281 of the deck 228. The cylinder 233 extends radially around the bushing 3 and axially in line with the peripheral piece 240. The cylinder 233 comprises a space 2331 filled with a thermally insulating material called cylinder insulating layer 242 and which can for example be glass wool, expanded foam or perlite. The function of the cylinder 233 is to augment the thermal insulation around the bushing 3. The space 2331 of the cylinder 233 is delimited by the bushing 3, the cylinder 233, a part of the deck 228 with its edge 2280 and a circular top 234. The circular top 234 covers the space 2331, opposite the deck 228, and extends at right angles to the bushing axis R and from the bushing 3 to the cylinder 233. The space 2331 of the cylinder 233 is therefore connected with the volume of the primary insulation layer 224 and the volume occupied by the peripheral piece 240, by means of the passage 2332 formed between the edge 2280 of the deck 228 and the bushing 3.

It is understood from the above feature that the primary insulation layer 224, the peripheral piece 240 and the cylinder insulating layer 242 are connected and form a single volume, flushed by the same inert gas stream.

A duct 235, in the form of a tube, extends partly in the primary insulation layer 224. To this end, a number of openings are formed in the tank top wall 22b, including a first duct opening 2351 formed through the cylinder 233, a second duct opening 2352 formed through the deck 228, close to its edge 2280, and a third duct opening 2353 formed through the second annular plate 2292. It is then understood that the duct 235 circulates from the outside of the tank to the primary insulation layer 224, notably by

passing through the cylinder insulating layer 242 and the peripheral piece 240, by means of the duct openings 2351, 2352, 2353 described above.

The duct 235 is configured to be linked to an inert gas supply device (not represented) and its function is to contribute to a gaseous flushing of the primary insulation layer 224. The injection of inert gas in the primary insulation layer 224 makes it possible, by means of an external analysis device (not represented), to check for the absence of flooding of the primary insulation layer 224. The same goes for the secondary insulation layer 226 which is also connected to an inert gas supply device and to an external analysis device checking for the flooding of the secondary insulation layer 226.

The invention thus achieves the aim that was set for it by eliminating the coaming and by combining a number of pipes of the tank in one and the same volume, while improving the thermal insulation and the seal-tightness of this bushing, by means of the peripheral zone and of the cylinder extending radially around the bushing.

The invention should not however be limited to the means and configurations exclusively described and illustrated, and applies equally to all the equivalent means or configurations and to any combination of such means or configurations. In particular, it goes without saying that it applies to any bushing form and/or dimension.

CLAIMS

1. A wall (22) of a tank (2) capable of containing a liquid cargo and intended to be installed in a transport ship (1), the wall (22) comprising at least one primary insulation layer (224) extending mostly in a primary plane (P1) and a secondary insulation layer (226) extending mostly in a secondary plane (P2), the primary insulation layer (224) and the secondary insulation layer (226) being superposed in a direction transversal to the planes of insulation (P1, P2) of the layers (224, 226), the tank wall (22) comprising at least one bushing (3) in the form of a hollow cylinder passing through the layers (224, 226) and a pipe (31) which extends in the bushing (3), characterized in that the primary insulation layer (224) comprises a peripheral zone (229) which extends around the bushing (3) and in the secondary plane (P2) of the secondary insulation layer (226).

2. The wall (22) of a tank (2) as claimed in the preceding claim, wherein the peripheral zone (229) houses at least one peripheral piece (240) which extends in the secondary plane (P2) of the secondary insulation layer (226) over a radius of between 400 mm and 1000 mm around a bushing axis (R) of the bushing (3).

3. The wall (22) of a tank (2) as claimed in either one of the preceding claims, wherein a thickness (T3) of the peripheral zone (229) is identical to a thickness (T2) of the secondary insulation layer (226).

4. The wall (22) of a tank (2) as claimed in any one of the preceding claims, wherein a partition (232) extends at least around the bushing (3) between the secondary insulation layer (226) and the peripheral zone (229).

5. The wall (22) of a tank (2) as claimed in the preceding claim, wherein the partition (232) ensures a seal-tightness between the primary insulation layer (224) and the secondary insulation layer (226).

6. The wall (22) of a tank (2) as claimed in any one of the preceding claims, wherein at least one gas evacuation tube (32) extends in the bushing (3) and has an outer end (322) which emerges outside of the tank (2) and an inner end (321) which emerges in a vapor space (21) of the tank (2).

7. The wall (22) of a tank (2) as claimed in any one of the preceding claims, wherein the pipe (31) is a liquid cargo offloading pipe.

8. A transport ship (1) comprising at least one wall (22) of a tank (2) as claimed in any one of the preceding claims.

9. The transport ship (1) as claimed in the preceding claim, comprising at least one deck (228) of the transport ship (1), one edge (2280) of the deck (228) being at a non-zero distance from the bushing (3).

10. The transport ship (1) as claimed in the preceding claim, wherein the edge (2280) of the deck (228) extends at least partially axially in line with the peripheral zone (229) on a straight line parallel to the bushing axis (R).

11. The transport ship (1) as claimed in claim 9 or 10, wherein a cylinder (233) positioned around the bushing (3) is supported by an outer face (2281) of the deck (228) and delimits, with the bushing (3), a space (2331) containing a thermally insulating material, the space (2331) being closed by a top (234).

12. The transport ship (1) as claimed in the preceding claim, wherein the edge (2280) of the deck (228) is radially positioned between the bushing (3) and an inner face (2334) of the cylinder (233).

13. The transport ship (1) as claimed in claim 10, wherein a duct (235) passes through the cylinder (233), the peripheral zone (229) and emerges in the primary insulation layer (224), the duct (235) being configured to be linked to an inert gas supply device.

14. A method to be used to load or offload a liquid natural gas into or from a tank (2) comprising a wall (22) as claimed in one of claims 1 to 7 or a liquid natural gas transport ship (1) as claimed in one of claims 8 to 12.