

FLUID-TIGHT, THERMALLY INSULATED TANK

Technical field

The invention relates to the field of fluid-tight, thermally insulated tanks with membranes. In particular, the invention relates to the field of fluid-tight, thermally insulated tanks for the storage and/or transportation of low-temperature liquid, such as tanks for the transportation of liquefied petroleum gas (also called LPG) having, for example, a temperature of between -50°C and 0°C, or for the transportation of liquefied natural gas (LNG) at approximately -162°C at atmospheric pressure. Tanks of this type may be installed on land or on a floating installation. In the case of a floating installation, the tank may be intended for the transportation of liquefied gas or to receive liquefied gas serving as fuel for propulsion of the floating installation.

Technological background

WO-A-2013093262, FR-A-2973098 or WO-A-2016046487, for example, disclose a fluid-tight, thermally-insulated tank comprising a plurality of tank walls delimiting an interior space of the tank, said tank walls including at least one non-horizontal wall, the non-horizontal tank wall comprising:

a non-horizontal support wall,

a plurality of anchoring members arranged on an internal surface of the support wall,

a thermally insulated barrier comprising a plurality of insulating blocks juxtaposed in a repeat pattern over the internal surface of the support wall and anchored to the support wall by means of the anchoring members, and

a fluid-tight membrane carried by said thermally insulated barrier,

wherein each anchoring member comprises:

a projecting element arranged between a plurality of said juxtaposed insulating blocks and projecting toward the interior space of the tank,

a clamping element attached directly or indirectly to the projecting element and extending transversely to the projecting element in order to interact with insulating blocks between which the projecting element is arranged in order to clamp said insulating blocks against the support wall.

5 When anchoring of the insulating block to the support wall is achieved solely by clamping or flanging against the non-horizontal support wall, it is desirable to prevent gravity, possibly in combination with accelerations due to the movements of the vessel at sea, from being able to generate movements of the insulating blocks by sliding over the support wall.

10 Indeed, a number of drawbacks could arise therefrom. For example, the insulating material of the insulating block may be damaged by rubbing against parts of the anchoring members, or the movement of the insulating blocks may create hotspots, promoting convection phenomena in the zones where the insulation is not continuous. Moreover, such movements may give rise locally to supplementary
15 elongations in the fluid-tight membrane if the latter is fastened on the insulating blocks and thus to undesirable stress concentrations.

Summary

One idea underpinning the invention is to provide a membrane tank wall structure that resolves at least some of these drawbacks. A further idea underpinning
20 the invention is to provide a membrane tank wall structure whose manufacture combines reliability and simplicity.

To that end, the invention provides a fluid-tight, thermally insulated tank comprising a plurality of tank walls delimiting an interior space of the tank, said tank walls including at least one non-horizontal tank wall, in particular a tank wall that is
25 vertical or oblique in the terrestrial gravity field, the non-horizontal tank wall comprising:

a non-horizontal support wall,

a plurality of anchoring members arranged on an internal surface of the support wall,

a thermally insulated barrier comprising a plurality of insulating blocks juxtaposed in a repeat pattern over the internal surface of the support wall and anchored to the support wall means of the anchoring members, and

a fluid-tight membrane carried by said thermally insulated barrier, wherein
5 the anchoring members comprise one or more anchoring and positioning members.

Depending on the embodiments, a tank of this type may comprise one or more of the following characteristics.

According to one embodiment, the or each anchoring and positioning member comprises:

10 a projecting element projecting toward the interior space of the tank in an insulating block or beside one or more insulating blocks,

a clamping element attached directly or indirectly to the projecting element and extending transversely to the projecting element in order to interact with an insulating block in or beside which or insulating blocks between which the projecting
15 element is arranged in order to clamp the insulating block or units against the support wall, and

a positioning chock interacting with the projecting element, for example engaged on the projecting element, and arranged above (i.e. toward the interior of the tank) or below (i.e. toward the exterior of the tank) the clamping element in a thickness
20 direction of the tank wall, the positioning chock comprising a stop surface facing an upward direction of the support wall, the upward direction being parallel or oblique to a direction of greater slope of the support wall (i.e. a direction that rises relative to the terrestrial gravity field),

and an internal or external lateral surface of at least one of the insulating
25 blocks in which the projecting element is arranged or beside which the projecting element is arranged abuts against the stop surface of the positioning chock such that the positioning chock maintains the lateral surface of said at least one insulating block at a predetermined distance from the projecting element.

By virtue of these properties, it is possible to position the insulating blocks,
30 or at least some of them, securely relative to the anchoring members arranged in or

beside the insulating blocks, preventing their sliding toward the bottom of the support wall. The repeat pattern formed by the insulating blocks may thus be achieved in a precise manner, in particular taking up a proportion of the discrepancies as compared to a perfectly periodical pattern. Such discrepancies are, in particular, due to the
5 manufacturing tolerances of the support wall, which may be a wall of a carrying structure in which the fluid-tight, thermally insulated tank is constructed or a secondary, thermally insulating barrier covered with a secondary fluid-tight membrane.

The positioning chocks may also serve to position the insulating blocks in a
10 horizontal direction of the support wall in order, also, to take up discrepancies as compared to a perfectly periodical pattern.

The positioning chock may be mounted in different ways on the projecting element. According to one embodiment, the positioning chock is arranged on the projecting element between the support wall and the clamping element, which allows
15 simple, reliable fastening of the positioning chock in the tank wall. It is important, in point of fact, that the positioning chock should not accidentally become detached in the course of the tank service life.

With a view to being able to take up discrepancies of different amplitudes that are likely to arise during the manufacture of a tank of this type, in particular owing
20 to manufacturing tolerances, it is desirable to have in stock a range of positioning chocks having different dimensions.

According to one embodiment, the positioning chock is selected from a predetermined batch of positioning chocks having different dimensions in order to adjust the predetermined distance between the lateral surface of said at least one
25 insulating block and the projecting element. A batch of this type may be manufactured with dimensions progressing systematically along a predetermined scale, for example with graduations of one or several millimeters.

According to one embodiment, the positioning chock has a housing for receiving the projecting element. This housing may, for example, traverse the
30 positioning chock in a thickness direction of the positioning chock.

According to one embodiment, a first stop surface, for example parallel to the thickness and/or width direction of the insulating block, is located at a predetermined first distance from the housing and oriented in a first direction about the housing and a second stop surface is located at a predetermined second distance from the housing and oriented in a second direction about the housing, the positioning chock being configured in order to be able to be engaged on the projecting element in a first position in which the first stop surface faces the upward direction of the support wall and in a second position in which the second stop surface faces the upward direction of the support wall.

Thus, one and the same positioning chock may be used to make two different adjustments depending on the amplitude of the discrepancies to be taken up, which makes it possible to limit a stock of different positioning chocks that have to be used in the manufacture of the tank.

According to one embodiment, the first stop surface and the second stop surface are two parallel opposed surfaces of the positioning chock that are arranged on either side of the housing.

According to one embodiment, the or each anchoring and positioning member comprises at least two projecting elements arranged between a plurality of said juxtaposed insulating blocks and projecting toward the interior space of the tank.

In this case, the positioning chock may have two housings traversing the positioning chock in a thickness direction of the positioning chock in order to receive the two projecting elements, a first stop surface parallel to the thickness direction being located at a predetermined first distance from a first of the housings and a second stop surface parallel to the first stop surface being located at a predetermined second distance from a second of the housings, the positioning chock being configured in order to be able to be engaged on the two projecting elements in a first position in which the first stop surface faces the upward direction of the support wall in order to receive the lateral surface of the insulating block and in a second position in which the second stop surface faces the upward direction of the support wall in order to receive the lateral surface of the insulating block, the second position being changed relative to the first position.

The positioning chock is perhaps formed as a single piece or as a plurality of pieces.

According to one embodiment comprising a plurality of pieces, the positioning chock comprises a support body having a lateral surface configured as
 5 first stop surface and an adjustment insert or adjustment band having a predetermined thickness mounted on the first stop surface parallel to the first stop surface, a surface of the adjustment insert or the adjustment band being configured as second stop surface spaced from the first stop surface by the predetermined thickness of the adjustment insert or the adjustment band, the adjustment insert or the adjustment
 10 band being mounted detachably on the support body in order selectively to uncover the first stop surface or to cover the first stop surface with the adjustment insert or the adjustment band such that the lateral surface of said at least one insulating block abuts against, selectively, the first or the second stop surface of the positioning chock.

In this case, the positioning chock may also comprise one or more additional
 15 adjustment bands superposed on the adjustment band detachably in order to allow adjustment of the predetermined distance between the lateral surface of said at least one insulating block and the projecting element.

Thus, one and the same positioning chock may be used to make two or even more different adjustments depending on the amplitude of the discrepancies to be
 20 taken up, which makes it possible to limit a stock of different positioning chocks that have to be used in the manufacture of the tank. The adjustment insert or the adjustment band and the or each additional adjustment band may be mounted on the support body by means of any appropriate method, for example adhesive bonding, screwing, snap-fitting or nesting.

25 According to a further embodiment comprising a plurality of pieces, the support body has a first attachment and the adjustment insert has a lateral surface configured as a second attachment suitable for attaching detachably to the first attachment in order to mount the adjustment insert on the support body, the adjustment insert having the lateral surface configured as second stop surface located
 30 opposite the second attachment.

In this case, the adjustment insert may be selected from a predetermined batch of adjustment inserts having different dimensions in order to adjust the predetermined distance between the lateral surface of said at least one insulating block and the projecting element. A batch of this type may be manufactured with
 5 dimensions progressing systematically along a predetermined scale, for example with graduations of one or several millimeters.

The first and second attachments may be produced in different ways, for example as a tenon and mortise, screw and tapped hole, male engagement and female engagement, etc.

10 The stop surface and the lateral surface of said at least one insulating block may have different geometries. Preferably, the stop surface and the lateral surface of said at least one insulating block are planar and parallel.

The insulating blocks may be produced in different ways. According to one embodiment, one or each parallelepipedal insulating block comprises a caisson
 15 housing the heat-insulating packing, said caisson comprising a bottom panel, a cover panel and, optionally, side panels extending between said bottom panel and the cover panel. According to another embodiment, one or each parallelepipedal insulating block comprises a bottom panel and a cover panel, with an intercalated foam block forming the heat-insulating packing.

20 Preferably, one or each insulating block comprises a bottom panel and the lateral surface of the insulating block abutting against the positioning chock comprises a lateral surface of said bottom panel. Thus, the positioning chock may be simply placed on the support surface at the same level as the bottom panels.

In this case, the bottom panel may have a globally rectangular form with a
 25 re-entrant cut-out at the four corners of the bottom panel, and an external lateral surface of the re-entrant cut-out of the bottom panel abuts against the positioning chock.

According to one embodiment, the re-entrant cut-out of the bottom panel comprises two external lateral surfaces parallel, respectively, to a length direction and
 30 a width direction of the bottom panel and arranged abutting against two mutually perpendicular stop surfaces of the positioning chock.

According to another embodiment, the re-entrant cut-out of the bottom panel comprises an external lateral surface oblique relative to a length direction and a width direction of the bottom panel and arranged abutting against the stop surface of the positioning chock.

- 5 According to one embodiment, the fluid-tight membrane of the or each tank wall comprises a first series of corrugation extending in a first direction and a second series of corrugation extending in a second direction perpendicular to the first direction.

10 The corrugations of the fluid-tight membrane may be formed in different ways. According to embodiments, the corrugations project towards the interior of the tank relative to the planar portions, or the corrugations project toward the exterior of the tank relative to the plane portions and are accommodated in grooves made in the cover panels of the insulating blocks. In the event that there is a plurality of membranes, such embodiments may be combined.

- 15 The anchoring and positioning members may be arranged in different ways relative to the insulating blocks. In particular, the anchoring and positioning member may be positioned in order to anchor or to contribute to anchoring a single insulating block or a plurality of insulating blocks simultaneously, for example two, three or four insulating blocks.

20 According to one embodiment of the anchoring and positioning member, the projecting element is arranged between a plurality of said juxtaposed insulating blocks and one or more of the insulating blocks between which the projecting element is arranged have an external lateral surface abutting against the stop surface of the positioning chock.

- 25 According to one embodiment, the insulating blocks are arranged in the form of a plurality of mutually parallel rows, each row extending, for example, along a horizontal-level line of the tank wall or obliquely, and one anchoring and positioning member is arranged at an interface between at least two insulating blocks in a row. The stop surface of the positioning chock interacts with an external lateral surface of
30 each of the at least two insulating blocks of the row such that the positioning chock

maintains the external lateral surface of each of the at least two insulating blocks of the row at a predetermined distance from the projecting element.

Advantageously, the anchoring and positioning member is arranged between an upper row of the insulating blocks located on the support surface above the
5 anchoring and positioning member and a lower row of the insulating blocks located on the support surface below the anchoring and positioning member, and the stop surface of the positioning chock interacts with an external lateral surface of each of the at least two insulating blocks of the upper row.

According to one embodiment, the anchoring and positioning member is
10 arranged at an interface between at least two insulating blocks of the upper row and at an interface between at least two insulating blocks of the lower row, the clamping element being configured in order to interact with the at least two insulating blocks of the upper row and the at least two insulating blocks of the lower row in order to clamp said insulating blocks against the support wall.

15 Thus, the anchoring and positioning member may contribute to anchoring at least four insulating blocks simultaneously.

According to another embodiment of the anchoring and positioning member, the projecting member is engaged in a housing formed in the thickness of an insulating block at a distance from the edges of the insulating block, the housing being
20 delimited by an internal lateral surface of the insulating block, the internal lateral surface abutting against the stop surface of the positioning chock.

The clamping element and the projecting element may be produced in different ways. According to embodiments, the clamping element has the form of a cross or of a rectangular plate. According to one embodiment, the projecting element
25 comprises a setscrew.

The support wall may be a wall of a carrying structure in which the fluid-tight, thermally insulated tank is constructed.

In this case, the thermally insulated barrier may be a single barrier and the fluid-tight membrane may be a single membrane. Alternately, the thermally insulated
30 barrier may be a secondary thermally insulated barrier and the fluid-tight membrane a secondary fluid-tight membrane,

the tank wall further comprising a primary thermally insulated barrier arranged on the secondary fluid-tight membrane and a primary fluid-tight membrane carried by said primary thermally insulated barrier.

5 A thickness chock is preferably arranged about the projecting element of the anchoring and positioning member and between the carrying structure and the positioning chock in the thickness direction of the tank wall, the thickness chock having an internal surface on which the insulating blocks between which the projecting element is arranged are kept abutting by the clamping element.

10 The support wall may be a secondary thermally insulated barrier covered with a secondary fluid-tight membrane. In this case, the thermally insulated barrier is a primary thermally insulated barrier of the tank wall, the fluid-tight membrane carried by said primary thermally insulated barrier being a primary fluid-tight membrane, the tank wall furthermore comprising a secondary thermally insulated barrier covered with a secondary fluid-tight membrane forming said support wall.

15 Preferably, in this case, the projecting element of the anchoring and positioning member is fastened to the secondary thermally insulated barrier and projects relative to the internal surface of the secondary fluid-tight membrane.

20 Such a tank may form part of a land-based storage installation, for example for storing liquefied gas, or be installed in a floating structure in coastal waters or off-shore, in particular a methane-carrier vessel, an LPG transport vessel, a floating storage and regasification unit (FSRU), a floating production, storage and offloading unit (FPSO), and others.

According to one embodiment, a vessel for transporting a cold liquid product comprises a hull and a tank as described above arranged in the hull.

25 According to one embodiment, the invention also provides a method for loading or unloading a vessel of this type, wherein a cold fluid product is conveyed through insulated pipelines from or to a floating or land-based storage installation to or from the vessel's tank.

30 According to one embodiment, the invention also provides a system for transferring a cold fluid product, the system comprising the aforesaid vessel, insulated

pipelines arranged so as to connect the tank installed in the vessel's hull to a floating or land-based storage installation, and a pump for driving a stream of cold fluid product through insulated pipelines from or to the floating or land-based storage installation to or from the vessel's tank.

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Brief description of the figures

The invention will be better understood and further aims, details, features and advantages thereof will become more clearly apparent during the following description of a plurality of particular embodiments of the invention, given merely for
10 illustration and without limitation, with reference to the attached drawings.

- figure 1 is a cut-away perspective view of a portion of a tank for the transportation and/or the storage of liquefied gas, illustrating a planar tank wall according to a first embodiment.
- 15 • figure 2 is a sectional view of an anchoring member according to one embodiment.
- figure 3 is an expanded perspective view of the anchoring member of figure 2.
- figure 4 is a top view of a detail of the planar tank wall of figure 1.
- 20 • figure 5 is a cut-away perspective view of a portion of a tank for the transportation and/or the storage of liquefied gas, illustrating a planar tank wall according to a second embodiment.
- figure 6 is a perspective view of a clamping member according to one embodiment.
- figure 7 is a top view of a detail of the planar tank wall of figure 5.
- 25 • figure 8 is a top view of a series of positioning chocks having different dimensions according to one embodiment.
- figure 9 is a top view of a series of positioning chocks having different dimensions according to another embodiment.

- figure 10 is a top view of a positioning chock having a peel-off adjustment band.
 - figure 11 is an enlarged perspective view of the positioning chock of figure 10 with the adjustment band partially removed.
- 5
 - figures 12 and 13 are two perspective views of a positioning chock having removable adjustment bands, in a detached state and in an assembled state.
 - figures 14 and 15 are two perspective views of a support body showing two opposite faces of the support body.
- 10
 - figure 16 is a perspective view of a series of adjustment inserts that can be mounted on the support body of figures 14 and 15 and that have different thicknesses.
 - figure 17 is a schematic sectional view on the line XVII-XVII of figure 18 of an insulating block in a planar tank wall according to a third embodiment.
- 15
 - figure 18 is a schematic top view of the insulating caisson of figure 17. Figure 19 is a view similar to figure 7, showing the positioning chock obtained by mounting the insert on the support body.
 - figure 20 is a top view of a planar tank wall according to a fourth embodiment.
- 20
 - figure 21 is a top view of an exchangeable positioning chock in two mutually exchanged positions.
 - figure 22 is a top view of a planar tank wall according to a fifth embodiment.
- 25
 - figure 23 is a top view of a planar tank wall according to a sixth embodiment.
 - figure 24 is a cut-away schematic representation of a tank of methane-carrier vessel or a vessel for transporting LPG and of a terminal for loading/unloading this tank.

Detailed description of embodiments

The figures are described below within the context of a carrying structure constituted by the internal walls of a double hull of a vessel for the transportation of liquefied gas. A carrying structure of this type has a well known polyhedral geometry.

5 Each wall of the carrying structure bears a respective tank wall. According to a first embodiment, each of the tank walls is composed of a single thermally insulated barrier carrying a single fluid-tight membrane in contact with a fluid stored in the tank, such as liquefied petroleum gas, including butane, propane, propene or the like, and having an equilibrium temperature of between -50°C and 0°C .

10 With reference to figures 1 to 4, a description will now be given of further details of a planar wall of the tank. In this regard, it should be noted that the planar wall is produced in accordance with a periodic pattern in the two directions of the plane, and this pattern may thus be repeated over a greater or lesser extent, depending on the dimensions of the surfaces to be covered. Thus, the number of
15 heat-insulating elements 8 represented is not limited and may be modified in one or the other sense, depending on the requirements arising from the geometry of the carrying structure. Moreover, on a planar wall of great extent, there may locally be one or a plurality of singular zones where the pattern has to be modified in order to negotiate an obstacle or to receive a particular item of equipment. Figure 1 illustrates
20 a vertical or oblique wall of the tank according to the first embodiment. The arrow 100 indicates the direction of greatest slope of the tank wall and is oriented upward.

The thermally insulated barrier of the tank wall is constituted from a plurality of parallelepipedal heat-insulating elements 8 anchored over the entire carrying wall 1. The heat-insulating elements 8 together form a planar surface over which a fluid-
25 tight membrane 12, illustrated in cut-away form, is anchored. The heat-insulating elements 8 are juxtaposed as a regular rectangular mesh. The heat-insulating elements 8 are anchored on the carrying wall 1 with the aid of anchoring members 10 arranged at each node of the regular rectangular mesh.

Each heat-insulating element 8 comprises a bottom panel 17, two
30 longitudinal side panels 21, two transverse side panels 22 and a cover panel 19. All these panels are of rectangular form and delimit an internal space of the heat-

insulating element. The bottom panel 17 and the cover panel 19 extend parallel to one another and parallel to the carrying wall 1. The side panels 21, 22 extend perpendicularly to the bottom panel 17 and connect the bottom panel 17 and the cover panel 19 over the entire periphery of the heat-insulating element. Carrying spacers 5 (not shown) may be arranged between the bottom panel 17 and the cover panel 19 in the internal space of the heat-insulating element, parallel to the longitudinal side panels 21. The transverse side panels 22 extending perpendicularly to the longitudinal side panels 21 comprise through-holes 23. These through-holes 23 are designed to allow the circulation of inert gas in the thermally insulated barrier. The panels and the 10 carrying spacers are attached by any appropriate means, for example screws, staples or spikes, and together form a caisson in which a heat-insulating packing (not shown) is arranged. This heat-insulating packing is preferably non-structural, for example perlite or glass wool or low-density polymer foam, for example of the order of 10 to 50 kg/m³.

15 The bottom panel 17 comprises longitudinal borders 11 projecting from the longitudinal side panels 21 and transverse borders 56 projecting from the transverse side panels 22. Ledges 57 are carried by the longitudinal borders 11, at the corners of the heat-insulating element 8, in order to interact with the anchoring members 10.

Figure 1 also shows the beads of mastic 60 on which a heat-insulating 20 element 8 rests. These beads of mastic 60 are preferably non-adhesive in order to allow a sliding clearance for the heat-insulating element 8 relative to the carrying wall 1. The anchoring of the heat-insulating elements 8 to the carrying wall is achieved on each occasion with the aid of four anchoring members 10 arranged at the four corners, wherein an anchoring member 10 interacts on each occasion with four adjacent heat- 25 insulating elements 8.

As illustrated in figure 1, the anchoring members 10 are arranged at the corners of each heat-insulating element 8. Each ledge 57 of the heat-insulating elements 8 interacts with a respective anchoring member 10, one and the same support member 10 interacting with the ledges 57 of four adjacent heat-insulating 30 elements 8. The corners of the adjacent heat-insulating elements 8 comprise a recess forming, concomitantly, a shaft in line with the anchoring member 10. This shaft allows access to the fastening member 10 during mounting. This shaft is filled with a heat-

insulating packing 41 and covered with a closure plate 42 in order to form a planar surface with the cover panels of the heat-insulating elements 8.

Figures 2 and 3 show one embodiment of the anchoring member 10. A pin 38 extends perpendicularly to the carrying wall 1. An end of the pin 38 opposite the carrying wall 1 comprises a screw thread. A support plate 39 of rectangular form comprises a central hole traversed by the pin 38. A nut 40 is mounted on the threaded end of the pin 38. The support plate 39 of each pin 38 is thus maintained abutting by said nut 40 against a tank-side face of the ledges 57. Figure 1 also shows a stack of Belleville washers 37 inserted between the support plate 39 and the nut 40 for elastically supporting the support plate 39 on the heat-insulating elements 8.

At the external end, the setscrew 38 is screwed into a slotted nut 61 accommodated in a hollow base 62. The hollow base 62 containing the slotted nut 61 has been previously welded to the carrying wall 1. Thus, mounting of the setscrew 38 is simple. Alternately, the setscrew 38 may be welded directly on the carrying wall 1.

A thickness chock 63 is placed on the carrying wall 1 about the hollow base 62 in order to receive the corners of the four adjacent heat-insulating elements 8 that are to rest thereon. The thickness chocks 63 and the beads of mastic 60 serve to take up the unevenness of the carrying wall and thus offer a planar surface on which the heat-insulating elements 8 rest.

Furthermore, a positioning chock 64 projecting above the thickness chock 63 is mounted on the thickness chock 63 about the hollow base 62. The positioning chocks 64 serve as a stop for positioning the corners of the heat-insulating elements 8. More precisely, the longitudinal border in 11 is exactly the length of the longitudinal side panel 21 and the transverse border 56 is exactly the length of the transverse side panel 22 such that the end surfaces of the longitudinal border 11 and of the transverse border 56 at the corner form two orthogonal surfaces that delimit a re-entrant cut-out 9 relative to the rectangular contour of the bottom panel 17 and that may come into contact against two corresponding facets of the positioning chock 64.

The positioning chock 64 and the thickness chock 63 could be manufactured as a single piece, but that would require an extremely large multiplication of the number of chocks in order to cover all dimensional combinations.

Figure 4 is an enlarged top view of the tank wall plumb with an anchoring member 10 and shows more precisely the position of the four heat-insulating elements 8 relative to the positioning chock 64. The thickness chock 63 and the support plate 39 are sketched in broken lines.

5 Relative to the direction of greatest slope 100, the insulating blocks are arranged in the form of a plurality of rows parallel to horizontal-level lines, that is to say, here, an upper row 3 and a lower row 4. The anchoring member 10 is arranged between the upper row 3 and the lower row 4 and at an interface between two heat-insulating elements 8 of the upper row 3 and at an interface between two heat-insulating elements 8 of the lower row 4. Thus, the support plate 39 interacts both with
10 the two heat-insulating elements 8 of the upper row 3 and the two heat-insulating elements 8 of the lower row 4 in order to clamp the four heat-insulating elements 8 against the carrying wall 1.

 The positioning chock 64 is arranged on the top side of the hollow base 62
15 and has a first stop surface 5 facing up the carrying wall that receives, abutting, the end surfaces of the longitudinal border in 11 of the two heat-insulating elements 8 of the upper row 3. This abutting ensures definite, durable positioning of the heat-insulating elements 8 along the direction of greatest slope 100.

 Furthermore, the positioning chock 64 has a second stop surface 6 facing
20 the side that receives, abutting, the end surfaces of the transverse border 56 of the two heat-insulating elements 8 located on the right in figure 4. This abutting ensures definite, durable positioning of the heat-insulating elements 8 along the direction perpendicular to the direction of greatest slope 100. Owing to positioning clearance, a gap then remains between the opposite surface 7 of the positioning chock 64 and
25 the end surfaces of the transverse border 56 of the two heat-insulating elements 8 located on the left in figure 4.

 Naturally, the choice of abutting the heat-insulating elements 8 on the right side or on the left side is technically equivalent if the rows of heat-insulating elements 8 are horizontal. On the other hand, if the rows of heat-insulating elements 8 are
30 oblique, it is preferable to abut on the side of the heat-insulating element 8 where the lowest corner is located. Thus, the stop position of the heat-insulating element 8

against the positioning chock 64 is a position that is stable under the effect of the weight of the heat-insulating element 8.

By abutting the heat-insulating elements 8 against the positioning chocks 64, it can be seen that the anchoring member 10 also fulfils a function of positioning the heat-insulating elements 8. In the embodiment described above, it is preferable for all the anchoring members 10 to be anchoring and positioning members in order that all the heat-insulating elements 8 of the wall are positioned reliably. In one embodiment, the positioning chock 64 could be omitted from certain anchoring members 10, in particular if the anchoring members 10 were even more numerous. The positioning chock 64 comprises interior cutaways facing the two heat-insulating elements 8 of the upper row 3 making it possible to provide flexibility when placing the positioning chock 64 on the base 62 and thus to facilitate the installation thereof.

Returning to figure 1, the fluid-tight membrane 12 is constituted from a plurality of metal plates juxtaposed with one another with covering. These metal plates are preferably of rectangular form. The metal plates are welded together in order to ensure sealing of the fluid-tight membrane. Each heat-insulating element 8 comprises, on a tank-side face, two perpendicular anchoring bands 14 accommodated in respective countersinks and screwed or riveted on the cover panels. The anchoring bands 14 are preferably arranged parallel to the corrugations 13. The anchoring bands 14 extend over a central portion of the countersinks in which they are accommodated. Thermal protections 54 are accommodated in the ends of the countersinks.

The corners and the edges of the metal plates are located in line with anchoring bands 14 of the heat-insulating elements 8 that support the fluid-tight membrane 12. The metal plates of the fluid-tight membrane 12 are welded on the anchoring bands 14 on which they rest. The thermal protections 54 prevent the degradation of the heat-insulating elements 8 upon welding of the metal plates to one another along the borders thereof. The thermal protections 54 are produced from a heat-resistant material, for example from a composite material based on glass fibers. Welding of the metal plates on the anchoring bands 14 allows the fluid-tight membrane 12 to be retained on the insulating barrier.

In order to allow deformation of the fluid-tight membrane in response to the different stresses that the tank undergoes, in particular in response to the thermal contraction resulting from the loading of liquefied gas in the tank, the metal plates comprise a plurality of corrugations 13 oriented toward the interior of the tank. More particularly, the fluid-tight membrane 12 comprises a first series of corrugations 13 and a second series of corrugations 13 forming a regular rectangular pattern.

Figure 1 also shows that each corrugated metal plate comprises a thickness offset in a raised border zone 66 along two out of four edges, the other two edges being flat. The raised border zone 66 serves to cover the flat border zone of an adjacent metal plate and will ultimately be welded thereto in a continuous manner in order to ensure a fluid-tight link between the two metal plates. The raised border zone 66 is obtained by an operation of forming a fold, also called a step portion.

The technique described above for producing a tank having a single fluid-tight membrane may also be used in different types of reservoir, for example for producing a double-membrane tank for liquefied natural gas (LNG) in a land-based installation or in a floating installation, such as a methane-carrier vessel or the like. In this context, it is possible to consider that the fluid-tight membrane illustrated in the above figures is a secondary fluid-tight membrane and that a primary insulating barrier and also a primary fluid-tight membrane (not shown) also have to be added to this secondary fluid-tight membrane. Thus, this technique can also be applied to tanks having a plurality of thermally insulating barriers and superposed fluid-tight membranes.

A second embodiment of the planar tank wall, adapted more particularly to a double-membrane tank, will now be described with reference to figures 5 to 7.

Figure 5 shows a cut-away view of the multi-layer structure of a fluid-tight, thermally insulated tank for the storage of a fluid.

The wall of the tank comprises, from the exterior toward the interior of the tank, a secondary thermal insulation barrier 201 comprising juxtaposed insulating blocks 202 fastened to the carrying structure 203, a secondary fluid-tight membrane 204 carried by the insulating blocks 202 of the secondary thermal insulation barrier 201, a primary thermal insulation barrier 205 comprising juxtaposed insulating blocks

206 anchored to the insulating blocks 202 of the secondary thermal insulation barrier 201 by primary retention members and a primary fluid-tight membrane 207 carried by the insulating blocks 206 of the primary thermal insulation barrier 205 and designed to be in contact with the cryogenic fluid contained in the tank.

5 The supporting structure 203 may in particular be a self-supporting metal plate, or more generally any type of rigid partition with suitable mechanical properties. The supporting structure 203 may in particular be formed by the hull or double hull of a vessel. The supporting structure 203 comprises a plurality of walls defining the general form of the tank, which is customarily a polyhedral form.

10 The secondary thermal insulation barrier 201 comprises a plurality of insulating blocks 202 adhesively bonded to the carrying structure 203 by means of adhesive resin beads (not illustrated). The resin beads must be sufficiently adhesive in order by themselves to ensure the anchoring of the insulating blocks 202. Alternately, or in combination, the insulating blocks 202 may be anchored by means
15 of the aforesaid anchoring members 10 or similar mechanical devices placed at the periphery of the insulating blocks 202 or in the interior of the insulating blocks 202. The insulating blocks 202 have substantially a rectangular parallelepipedal form.

 As illustrated in figure 5, the insulating blocks 202 are juxtaposed in parallel rows separated from one another by gaps guaranteeing a functional mounting
20 clearance.

 The insulating blocks 202 of the secondary thermally insulated barrier carry primary anchoring members 219, for example setscrews or metal rods, and the primary thermally insulated barrier comprises a plurality of juxtaposed rectangular parallelepipedal insulating blocks 206 anchored to the primary anchoring members.

25 The secondary fluid-tight membrane 204 comprises, for example, a plurality of corrugated metal plates each having a substantially rectangular form. The corrugated metal plates are arranged in an offset manner relative to the insulating blocks 202 of the secondary thermal insulation barrier 201 such that each of said corrugated metal plates extends concomitantly over at least four adjacent insulating
30 blocks 202.

The secondary fluid-tight membrane 204 comprises cut-outs in order to allow the primary anchoring members 219 project above the secondary fluid-tight membrane 204 and the edges of the cut-outs of the secondary fluid-tight membrane 204 are welded sealingly on metal anchoring pieces of the insulating blocks 202 of the secondary thermally insulated barrier right around the primary anchoring members 219. Preferably, these cut-outs are made on the edges of the rectangular plates, but they may also be made in a planar portion located within a rectangular plate.

For example, the insulating blocks 202 each comprise a layer of insulating polymer foam sandwiched between an rigid internal plate that constitutes a cover panel and rigid external plate that constitutes a bottom panel. The rigid internal and external plates are, for example, plywood plates adhesively bonded to said layer of insulating polymer foam. The insulating polymer foam may, in particular, be a polyurethane-based foam. The polymer foam is advantageously reinforced with glass fibers which contribute to reducing its thermal contraction.

The internal plate 210 has two series of two grooves, perpendicular to one another, so as to form a network of grooves. Each of the series of grooves is parallel to two opposite sides of the insulating blocks 202. The grooves are intended to receive corrugations 13, projecting toward the exterior of the tank, formed on the metal sheets of the secondary fluid-tight barrier 204.

Each corrugated metal sheet has a first series of parallel corrugations 13 extending in a first direction and a second series of parallel corrugations 13 extending in a second direction. The directions of the series of corrugations 13 are perpendicular. Each of the series of corrugations 13 is parallel to two opposite edges of the corrugated metal plate. The corrugations 13 project, here, toward the exterior of tank, i.e. toward the carrying structure 203. The corrugated metal plate comprises a plurality of planar portions between the corrugations 13. At each intersection between two corrugations 13, the metal sheet comprises a node zone. The node zone comprises a central portion having a summit projecting toward the exterior of the tank.

The secondary fluid-tight membrane 204 is, for example, made from Invar®, i.e. an alloy of iron and nickel, the coefficient of expansion of which is typically

between $1.2 \cdot 10^{-6}$ and $2 \cdot 10^{-6} \text{ K}^{-1}$, or an alloy of iron with a high manganese content, the coefficient of expansion of which is typically of the order of $7 \cdot 10^{-6} \text{ K}^{-1}$. Alternately, the secondary fluid-tight membrane 204 may also be made from stainless steel or aluminum.

5 Different known techniques may be employed for producing the primary thermal insulation barrier 205 and the primary fluid-tight membrane 207, for example as taught in WO-A-2016046487.

As shown in figure 5, the primary thermal insulation barrier 205 comprises, here, a plurality of insulating blocks 206 of substantially rectangular parallelepipedal
 10 form. The insulating blocks 206 are offset relative to the insulating blocks 202 of the secondary thermal insulation barrier 201 such that each insulating block 206 extends over a plurality of insulating blocks 202 of the secondary thermal insulation barrier 201, for example over four or eight insulating blocks 202.

Just like the heat-insulating elements 8 of the first embodiment, the insulating
 15 blocks 206 are likely to move by sliding over the secondary fluid-tight membrane 204 if they are retained only by flanging. In order to prevent this, at least on a non-horizontal wall or over all the walls, at least some of the primary anchoring members 219, for example those located at the corners located at the bottom of the insulating blocks 206, are configured as primary anchoring and positioning members in order
 20 that the insulating blocks 206 of the wall are positioned reliably. To that end, a positioning chock may be arranged in a similar way to the positioning chock 64 of the first embodiment.

The fastening of an insulating block 206 of the primary thermal insulation barrier 205 on a primary anchoring and positioning member carried by the secondary
 25 thermal insulation barrier 201 may be achieved, in one embodiment, in the manner illustrated in figure 7. Figure 7 is a top view of the primary thermal insulation barrier 205 plumb with the zone VII of figure 5, showing an embodiment of the primary anchoring and positioning member.

The primary anchoring and positioning member comprises a pin 15 that
 30 projects relative to the secondary fluid-tight membrane 204 in a recess 30 of square form formed between the adjacent corners of four of the insulating blocks 206. The

recess 30 is formed by means of a re-entrant cut-out 7 formed in each corner of each insulating block 206. The insulating block 206 comprises a diagonal groove 18 that uncovers a zone 29 of the external rigid plate adjacent to the re-entrant cut-out 7.

A clamping element 65 in the form of a cross, sketched in figure 7, comprises
 5 tabs 68 accommodated inside the diagonal grooves 18 and bearing against the zone 29 of the uncovered external plate inside the groove so as to sandwich the external plate between a tab 68 and an insulating block 202 of the secondary thermal insulation barrier 201. The clamping element 65 is engaged on the pin 15. Furthermore, a nut (not shown) interacts with the screw thread of the pin 15 so as to fasten the clamping
 10 element 65.

A positioning chock 16 is engaged on the pin 15 between the clamping element 65 and the portion of secondary fluid-tight membrane 204 uncovered at the bottom of the recess 30. To that end, the clamping element 65 may be formed as illustrated in figure 6, with a domed general form comprising a central part 67 under
 15 which the positioning chock 16 may be received and tabs 68 elbowed toward the external side of the tank relative to the central part 67. The end of each tab 68 comprises a portion parallel to the central part 67 in order to bear flat on the zone 29 of the external plate. The central part 67 comprises a bore 66 for the passage of the pin 15.

20 The positioning chock may be produced in different ways. In the embodiment illustrated in figures 7 and 8, the positioning chock 16 has a bore 20 with a slot 21 in order to achieve an elastic clearance enabling the positioning chock 16 to be snap-fitted on a suitable portion of the pin 15. A planar stop surface 22 is arranged at a predetermined distance from the bore 20 and facing the upward direction of the tank
 25 wall during operation. A lateral surface of the external plate of the two insulating blocks 206 located higher than the positioning chock abuts against the planar stop surface 22. This lateral surface is located, here, in the re-entrant cut-out 7 formed in the corner of the insulating block 206.

Figure 8 shows a batch of positioning chocks 16 having different dimensions
 30 in order to adjust the predetermined distance between the lateral surface of the insulating block 206 and the pin 15. This batch is manufactured, here, with dimensions progressing systematically along a predetermined scale, for example with graduations

of three millimeters. A mark 24 indicating the dimension of the positioning chock 16 may be printed or engraved thereon in order to facilitate assembly operations. The mark 24 indicates, here, the dimension as separation relative to a marked nominal dimension "0". A color code may be used alternately or in combination with the mark

5 24.

In the embodiment illustrated in figure 9, the positioning chock 25 is not symmetrical and has a bore 26 for receiving the pin 15, a first stop surface 27 located at a predetermined first distance from the bore 26 and oriented in a first direction and a second stop surface 28 located at a predetermined second distance from the bore

10 26 and oriented in a second direction opposite the first stop surface 27.

The positioning chock 25 may be engaged on the pin 15 in two positions turned through 180° relative to one another in order that the first stop surface 27 or the second stop surface 28 faces upward and receives the lateral surface of the insulating blocks 206 located higher. Alternately, the stop surfaces 27 and 28 could

15 be oriented at 90° relative to one another or at another angle. A greater number of stop surfaces could be envisaged.

Figure 9 shows a batch of positioning chocks 25 having different dimensions, it being known that each instance already provides two dimensions corresponding to two adjustments. Marks 24 indicating the two dimensions may be used as in the

20 positioning chock 16.

Figures 10 and 11 illustrate a positioning chock 31 comprising a support body 32 having a lateral surface 33 configured as first stop surface and an adjustment band 34 having a predetermined thickness mounted on the first stop surface. A surface 35 of the adjustment band 34 is configured as second stop surface spaced from the first

25 stop surface by the predetermined thickness of the adjustment band. The adjustment band 34 is mounted removably on the support body 32. Thus, depending on whether the adjustment band 34 is present or absent, the positioning chock 31 also supplies two dimensions corresponding to two adjustments. Marks 24 indicating the two dimensions may be used as in the positioning chock 16.

30 In the embodiment of figures 12 and 13, the positioning chock 44 comprises a support body 45 provided with a bore 46 and a plurality of adjustment bands 47

superposed removably on the support body 45 in order to allow adjustment of the distance between the stop surface 48 and the bore 46. The adjustment bands 47 are, here, mounted with screws 49, but other assembly techniques are possible.

In the embodiment illustrated in figures 14 to 16 and 19, the positioning chock 50 comprises a support body 51 having two opposite lateral surfaces configured as dovetail tenons 52. Alternately, more than or fewer than two dovetailed tenons could be provided. An adjustment insert 53 has a lateral surface configured as a dovetail groove 54 is suitable for engaging on one or other of the dovetail tenons 52 in order to removably attach the adjustment insert 53 on the support body 51. The adjustment insert 53 has a lateral surface 55 configured as stop surface located opposite the dovetail groove 54.

Figures 14 and 15 show two faces of the support body 51. Figures 16 to 18 show a predetermined batch of three adjustment inserts 53 having different dimensions. Figure 19 is a view similar to figure 7, showing the use of the positioning chock 5 to position the insulating blocks 206 relative to the pin 15.

Figure 21 schematically illustrates, in two different positions, an anchoring and positioning member 82 that may be used in the tank walls described above. The anchoring and positioning member 82 comprises two projecting elements 83, 84 arranged between a plurality of said juxtaposed insulating blocks and projecting toward the interior space of the tank.

The positioning chock 85 has two housings 86, 87 traversing the positioning chock 85 through the thickness in order to receive the two projecting elements 83, 84. A first stop surface 88 is located at a first distance b from the center of the housing 86 and a second stop surface 89 parallel to the first stop surface 88 is located at a second distance B from the center of the housing 87.

The positioning chock 85 may be engaged on the two projecting elements 83, 84 in the two positions represented, the second position being exchangeable with the first position.

Figure 20 schematically illustrates another tank wall using anchoring and positioning members 90 arranged at the corners of the insulating blocks 91. The fluid-tight membrane is omitted.

Here, the insulating blocks 91 have an octagonal contour generated by a rectangle in which the corners have been obliquely cut. The oblique surfaces 92 located under the insulating blocks 91 interact with the likewise oblique stop surfaces 95 of two positioning chocks 93.

5 In order to hold the positioning chocks 93 and the clamping element (not shown), the anchoring and positioning member 90 comprises, here, five projecting rods 94 and each positioning chock 93 is engaged on two thereof. A greater or lesser number of projecting rods could, however, be envisaged. For the rest, implementation may be similar to the embodiments described above.

10 The periodic pattern whereby the insulating blocks are arranged is not necessarily a regular rectangular mesh. Figures 22 and 23 illustrate a different pattern, in which the insulating blocks have a rectangular contour and comprise insulating blocks 96 of which the length is oriented in the direction of greatest slope 100 and insulating blocks 97 of which the width is oriented in the direction of greatest
15 slope 100, alternating with one another.

In figure 22 and figure 23, the lateral surface 98 located under an insulating block 97 interacts with two positioning chocks 99 located at two longitudinal ends of the insulating block 97. In order to hold the positioning chocks 99 and the clamping element (not shown), the anchoring and positioning member 101 comprises, here,
20 five or seven projecting rods 102 and each positioning chock 99 is engaged on two thereof. A greater or lesser number of projecting rods could, however, be envisaged. For the rest, implementation may be similar to the embodiments described above.

The positioning chocks 99 are rectangular plates that are used in two different orientations in figure 22 and figure 23. In figure 22, the stop surface is parallel
25 to the width of the positioning chock 99. A longitudinal dimension of the positioning chock 99 thus serves to adjust the positioning of the insulating block 97 relative to the anchoring and positioning member 101.

In figure 23, the stop surface is parallel to the length of the positioning chock 99. A transverse dimension of the positioning chock 99 thus serves to adjust the
30 positioning of the insulating block 97 relative to the anchoring and positioning member 101.

The positioning chocks described above may be used in a similar way with anchoring members produced differently, for example the anchoring members taught in FR-A-2887010, FR-A-2973098 or WO-A-2013093262.

Figures 17 and 18 show, further, another embodiment of the tank wall in which, unlike the preceding embodiments, the positioning chock 364 interacts with an internal lateral surface of an insulating block 308. The elements that are similar or identical to those of figure 1 bear the same numerical reference, increased by 300.

More precisely, the insulating block 308 forms part of a repeat series of insulating blocks that covers a support surface 301 on which rods 338 serving to anchor the insulating blocks 308 are fastened in a projecting manner. In order to receive the rod 338 and a clamping member 339 that will then be fastened thereon, the insulating block 308 comprises on each occasion a housing formed at a distance from the edges, for example in a mid-zone of the insulating block 308, in the thickness of the insulating block 308.

In the example shown, the insulating block comprises a block of insulating material 58, for example polyurethane foam, sandwiched between a cover panel 319 and a bottom panel 317, for example made from plywood. The housing comprises, here, a shaft 59 that traverses the entire thickness of the cover panel 319 and of the block of insulating material 58 in order to uncover a zone 69 of the bottom panel on which the clamping element 339 exerts a pressure in the mounted position.

The housing comprises, further, a bore 309 made through the bottom panel 317, in the extension of the shaft 59 in order to receive the rod 338. In order to position the insulating block 308 relative to the rod 338, the positioning chock 364 is engaged on the rod 338 and interacts with the internal lateral surface of the bore 309. Thus, it is an internal lateral surface of the bottom panel 317 that, here, comes into contact with the positioning chock 364.

In a variant, the positioning chock 364 could be positioned higher in the shaft 59, above or below the clamping element 339, in particular by providing a protective covering over the zone of insulating material where the positioning chock comes into contact. The shaft 59 is filled with a heat-insulating packing 341 after placing of the clamping element 339.

The positioning chock 364 may have different forms, designed in order to come into contact with one or more zones of the internal lateral surface of the bore 309. In the example of figure 18, the elliptical form of the positioning chock 364 has two stop zones oriented obliquely relative to the direction of greatest slope 100. In the example, the elliptical form is not symmetrical in order to allow use of the chock in order to position the panel in two different cases by pivoting the chock through 180°. The section line XVII-XVII passes through one of the two stop zones. Other forms may be envisaged, in particular regular or irregular polygonal forms.

For simplicity, the positioning chocks described above are preferably manufactured from injection-molded plastics, for example high-density polyethylene. Other materials, in particular metals, may also be used. Furthermore, the mounting of the positioning chocks by engagement on a rod, pin or other projecting element of the anchoring member may be achieved very rapidly.

With reference to figure 24, a cut-away view of a methane-carrier vessel 70 shows a fluid-tight and insulated tank 71 of prismatic general form, mounted in the double hull 72 of the vessel. The wall of the tank 71 comprises a primary fluid-tight barrier intended to come into contact with the liquefied gas contained in the tank, a secondary fluid-tight barrier arranged between the primary fluid-tight barrier and the double hull 72 of the vessel, and two insulating barriers arranged respectively between the primary fluid-tight barrier and the secondary fluid-tight barrier, and between the secondary fluid-tight barrier and the double hull 72. In a simplified version, the vessel comprises a single hull.

In a manner known per se, loading/unloading pipelines 73 arranged on the top deck of the vessel may be connected, by means of suitable connectors, to an offshore or port terminal, for transferring a cargo of liquefied gas from or to the tank 71.

Figure 24 shows an example of an offshore terminal comprising a loading and unloading station 75, an underwater pipeline 76, and a land-based installation 77. The loading and unloading station 75 is a fixed offshore installation comprising a mobile arm 74 and a tower 78 that supports the mobile arm 74. The mobile arm 74 carries a bundle of insulated flexible hoses 79 that can connect to the

loading/unloading pipelines 73. The orientable mobile arm 74 can be adapted to all sizes of methane carrier. A connecting pipe (not shown) extends inside the tower 78. The loading and unloading station 75 allows the methane carrier 70 to be loaded and unloaded from or to the land-based installation 77. This comprises liquefied gas
5 storage tanks 80 and connecting pipes 81 connected by the underwater pipeline 76 to the loading or unloading station 75. The underwater pipeline 76 allows the transfer of liquefied gas between the loading or unloading station 75 and the land-based installation 77 over a great distance, for example 5 km, which allows the methane carrier 70 to remain at a great distance from the coast during the loading and
10 unloading operations.

To create the pressure necessary for the transfer of liquefied gas, use is made of on-board pumps in the vessel 70 and/or pumps provided in the land-based installation 77 and/or pumps provided in the loading and unloading station 75.

Although the invention has been described in connection with several
15 specific embodiments, it is very obvious that it is in no way limited thereto and that it comprises all the technical equivalents of the means described and also their combinations, if the latter come within the scope of the invention.

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

In the claims, any reference sign in brackets should not be interpreted as a limitation of the claim.

CLAIMS

1 A fluid-tight, thermally-insulated tank comprising a plurality of tank walls delimiting an interior space of the tank, said tank walls including at least one non-horizontal tank wall, the non-horizontal tank wall comprising:

5 a non-horizontal support wall (1, 204),

 a plurality of anchoring members (10, 219) arranged on an internal surface of the support wall,

 a thermally insulated barrier comprising a plurality of insulating blocks (8, 206, 91, 96, 97, 308) juxtaposed in a repeat pattern over the internal surface of the support wall and anchored to the support wall by means of the anchoring members, and

 a fluid-tight membrane (12, 207) carried by said thermally insulated barrier,

 wherein the anchoring members comprise an anchoring and positioning member, said anchoring and positioning member comprising:

15 A projecting element (62, 38, 15, 94, 102, 338) projecting toward the interior space of the vessel in or beside an insulating block,

 a clamping element (39, 65) attached directly or indirectly to the projecting element and extending transversely to the projecting element in order to interact with the insulating block (8, 206, 91, 96, 97, 308) in or beside which the projecting element is arranged in order to clamp said insulating block against the support wall, and

 a positioning chock (64, 16, 25, 31, 44, 50, 93, 85, 99, 364) interacting with the projecting element (62, 38, 15, 94, 102) and arranged above or below the clamping element (39, 65, 339) in a thickness direction of the tank wall, the positioning chock comprising a stop surface (5, 22, 27, 28, 33, 35, 48, 55, 88, 89, 95) facing an upward direction of the support wall, the upward direction being parallel or oblique to a direction of greatest slope (100) of the support wall,

 wherein a lateral surface (11, 7, 92, 98, 309) of the insulating block (8, 206, 91, 96, 97, 308) in or beside which the projecting element is arranged abuts against

the stop surface of the positioning chock such that the positioning chock maintains the lateral surface of said insulating block at a predetermined distance from the projecting element (62, 38, 15, 94, 102, 338).

2 The tank as claimed in claim 1, wherein the projecting element (62,
5 38, 15, 94, 102) of an anchoring and positioning member is arranged between a plurality of said juxtaposed insulating blocks, and at least one of the insulating blocks between which the projecting element (62, 38, 15, 94, 102) is arranged has an external lateral surface (11, 7, 92, 98) abutting against the stop surface of the positioning chock.

10 3 The tank as claimed in claim 1 or 2, wherein the projecting element (338) of an anchoring and positioning member is engaged in a housing (309, 59) formed in the thickness of the insulating block (308) at a distance from the edges of the insulating block, the housing (309, 59) being delimited by an internal lateral surface of the insulating block, the internal lateral surface abutting against the stop
15 surface of the positioning chock (364).

4 The tank as claimed in one of claims 1 to 3, wherein the stop surface and the lateral surface of said at least one insulating block are planar and parallel.

5 The tank as claimed in one of claims 1 to 4, wherein the positioning chock (25) has a housing (26) for receiving the projecting element, a first stop surface
20 (27) located at a predetermined first distance from the housing and oriented in a first direction about the housing and a second stop surface (28) located at a predetermined second distance from the housing and oriented in a second direction about the housing, the positioning chock being configured in order to be able to be engaged on the projecting element in a first position in which the first stop surface faces the upward
25 direction of the support wall and in a second position in which the second stop surface faces the upward direction of the support wall.

6 The tank as claimed in claim 5, wherein the first stop surface (27) and the second stop surface (28) are two parallel opposed surfaces of the positioning chock that are arranged on either side of the housing.

30 7 The tank as claimed in one of claims 1 to 4, wherein said anchoring and positioning member comprises at least two projecting elements (83, 84) arranged

between a plurality of said juxtaposed insulating blocks and projecting toward the interior space of the tank,

the positioning chock (85) having two housings (86, 87) traversing the positioning chock in a thickness direction of the positioning chock in order to receive the two projecting elements, a first stop surface (88) located at a predetermined first distance (b) from a first of the housings and a second stop surface (89) parallel to the first stop surface located at a predetermined second distance (B) from a second of the housings, the positioning chock being configured in order to be able to be engaged on the two projecting elements in a first position in which the first stop surface faces the upward direction of the support wall in order to receive the lateral surface of the insulating block and in a second position in which the second stop surface faces the upward direction of the support wall in order to receive the lateral surface of the insulating block, the second position being changed relative to the first position.

8 The tank as claimed in one of claims 1 to 7, wherein the positioning chock (31) comprises a support body (32, 45, 51) having a lateral surface configured as first stop surface (33, 52) and an adjustment insert (34, 47, 53) having a predetermined thickness mounted on the first stop surface parallel to the first stop surface, a surface of the adjustment insert being configured as second stop surface (35, 55) spaced from the first stop surface by the predetermined thickness of the adjustment insert, the adjustment insert (34, 47, 53) being mounted detachably on the support body in order selectively to uncover the first stop surface or to cover the first stop surface with the adjustment insert such that the lateral surface of said at least one insulating block abuts against, selectively, the first or the second stop surface of the positioning chock.

25 9 The tank as claimed in claim 8, wherein the adjustment insert (34, 47, 53) is mounted on the support body by adhesive bonding, screwing, snap-fitting or nesting.

10 The tank as claimed in claim 8 or 9, wherein the adjustment insert (34, 47) is configured as an adjustment band and the positioning chock (44) furthermore comprises one or more additional adjustment bands (47) superposed on the adjustment band detachably in order to allow adjustment of the predetermined

distance between the lateral surface of said at least one insulating block and the projecting element.

11 The tank as claimed in claim 10, wherein the or each additional adjustment band (47) is mounted on an underlying adjustment band by adhesive
5 bonding, screwing, snap-fitting or nesting.

12 The tank as claimed in one of claims 8 to 9, wherein the adjustment insert (53) is selected from a predetermined batch of adjustment inserts having different dimensions in order to adjust the predetermined distance between the lateral surface of said at least one insulating block and the projecting element.

10 13 The tank as claimed in one of claims 1 to 7, wherein the positioning chock (16, 25) is formed as a single piece.

14 The tank as claimed in claim 13, wherein the positioning chock (16, 25) is selected from a predetermined batch of positioning chocks having different dimensions in order to adjust the predetermined distance between the lateral surface
15 of said at least one insulating block and the projecting element.

15 15 The tank as claimed in one of claims 1 to 14, wherein the insulating blocks (8, 206, 91) are arranged in the form of a plurality of mutually parallel rows (3, 4) in which an anchoring and positioning member (10, 15) is arranged at an interface between at least two insulating blocks (8, 206) of a row and in which the stop surface
20 (5, 22, 27, 28, 33, 35, 48, 55, 88, 89) of the positioning chock (64, 16, 25, 31, 44, 50) interacts with an external lateral surface of each of the at least two insulating blocks of the row such that the positioning chock maintains the external lateral surface of each of the at least two insulating blocks of the row at a predetermined distance from the projecting element.

25 16 The tank as claimed in claim 15, wherein the anchoring and positioning member (10, 15) is arranged between an upper row (3) of the insulating blocks located on the support surface above the anchoring and positioning member and a lower row (4) of the insulating blocks located on the support surface below the anchoring and positioning member, wherein the stop surface (5, 22, 27, 28, 33, 35,
30 48, 55, 88, 89) of the positioning chock (64, 16, 25, 31, 44, 50) interacts with an external lateral surface of each of the at least two insulating blocks of the upper row.

17 The tank as claimed in claim 16, wherein the anchoring and positioning member (10, 15) is arranged at an interface between at least two insulating blocks (8, 206) of the upper row (3) and at an interface between at least two insulating blocks (8, 206) of the lower row (4), the clamping element (39, 65) being configured
 5 in order to interact with the at least two insulating blocks of the upper row and the at least two insulating blocks of the lower row in order to clamp said insulating blocks against the support wall.

18 The tank as claimed in claim 17, wherein the clamping element (65) has the form of a cross.

10 19 The tank as claimed in one of claims 1 to 18, wherein the support wall is a wall (1) of a carrying structure in which the fluid-tight, thermally insulated tank is constructed.

20 The tank as claimed in claim 19, wherein a thickness chock (63) is arranged about the projecting element (62, 38) of the anchoring and positioning
 15 member (10) and between the carrying structure and the positioning chock (64) in the thickness direction of the tank wall, the thickness chock (63) having an internal surface on which the insulating blocks (8) between which the projecting element is arranged are kept abutting by the clamping element.

21 The tank as claimed in one of claims 1 to 20, wherein said thermally
 20 insulated barrier is a primary thermally insulated barrier (205) of the tank wall, the fluid-tight membrane carried by said primary thermally insulated barrier being a primary fluid-tight membrane (207), the tank wall furthermore comprising a secondary thermally insulated barrier (201) covered with a secondary fluid-tight membrane (204) and forming said support wall.

25 22 The tank as claimed in claim 21, wherein the projecting element (15) of the anchoring and positioning member is fastened to the secondary thermally insulated barrier (201) and projects relative to the internal surface of the secondary fluid-tight membrane (204).

23 The tank as claimed in one of claims 1 to 22, wherein each insulating
 30 block (8, 206) comprises a bottom panel (17, 29) and the lateral surface (11, 7) of the

insulating block abutting against the positioning chock comprises a lateral surface of said bottom panel.

24 The tank as claimed in claim 23, wherein the bottom panel (17, 29) has a globally rectangular form with a re-entrant cut-out (9, 7) at the four corners of the bottom panel, wherein an external lateral surface of the re-entrant cut-out of the
5 bottom panel abuts against the positioning chock (64, 16, 25, 31, 44, 50).

25 The tank as claimed in claim 24, wherein the re-entrant cut-out (9) of the bottom panel comprises two external lateral surfaces (11, 56) parallel, respectively, to a length direction and a width direction of the bottom panel (17) and
10 arranged abutting against two mutually perpendicular stop surfaces (5, 6) of the positioning chock (64).

26 The tank as claimed in claim 24, wherein the re-entrant cut-out of the bottom panel comprises an external lateral surface (92) oblique relative to a length direction and a width direction of the bottom panel and arranged abutting against the
15 stop surface (95) of the positioning chock (93).

27 A vessel (70) for the transportation of a cold fluid product, the vessel comprising a hull (72) and a tank as claimed in one of claims 1 to 26, arranged in the hull.

28 A method for loading or unloading a vessel (70) as claimed in claim
20 27, wherein a cold fluid product is conveyed through insulated pipelines (73, 79, 76, 81) from or to a floating or land-based storage installation (77) to or from the vessel's tank (71).

29 A system for transferring a cold fluid product, the system comprising a vessel (70) as claimed in claim 27, insulated pipelines (73, 79, 76, 81) arranged so
25 as to connect the tank (71) installed in the vessel's hull to a floating or land-based storage installation (77), and a pump for driving a stream of cold fluid product through the insulated pipelines from or to the floating or land-based storage installation to or from the vessel's tank.