

Sealed and thermally insulating tank

Technical field

The invention relates to the field of sealed and thermally insulating membrane tanks for storing and/or transporting fluid, such as a cryogenic fluid.

Sealed and thermally insulating membrane tanks are particularly used for storing liquefied natural gas (LNG), which is stored, at atmospheric pressure, at approximately -162°C . These tanks can be installed onshore or on a floating structure. In the case of a floating structure, the tank can be for transporting liquefied natural gas or receiving liquefied natural gas used as a fuel to propel the floating structure.

Technological background

Different techniques are known for constructing a sealed and thermally insulating membrane tank incorporated into a load-bearing structure having a substantially polyhedral inner surface and including consecutively, in a thickness direction, a secondary insulating barrier, a secondary sealing barrier, a primary insulating barrier and a primary sealing barrier.

A tank wall is known, for example from WO-A-2014167214 or WO-A-2017006044, in which the secondary insulating barrier essentially consists of secondary insulating blocks juxtaposed on the polyhedral inner surface of the load-bearing structure, the secondary sealing barrier consists of a corrugated metal membrane arranged on an inner surface of the secondary insulating blocks, the primary insulating barrier essentially consists of primary insulating blocks juxtaposed on the secondary metal membrane and anchored to the secondary insulating barrier by anchoring members held by the secondary insulating blocks, and the primary sealing barrier consists of a corrugated metal membrane arranged on an inner surface of the primary insulating blocks. Along the arrises of the load-bearing structure, the primary and secondary insulating blocks consist of prefabricated corner structures.

Summary

Certain aspects of the invention will now be explained with reference to figure 1. Figure 1 partially illustrates an insulating barrier that essentially consists of insulating blocks juxtaposed on a polyhedral support surface 1 having two flat regions 2 and 3 that form an angle between them and meet at an arris 4. The insulating blocks include a corner structure 5 arranged along the arris that has two faces respectively

parallel to each of the two flat regions 2 and 3, and flat insulating panels 6 arranged on the flat regions of the support surface on either side of the corner structure 5.

As can be seen in figure 1, if the flat insulating panels 6 have been assembled first, a space problem can occur that prevents the corner structure 5 from being positioned along the arris, as indicated by the arrow 7. As a result, it can be preferable to construct the insulating barrier by finishing with a flat region. However, once the corner structure 5 has been positioned along the arris, a whole zone of the support surface near the arris 4 is no longer accessible.

In addition, it is preferable to produce an insulating barrier with insulating blocks that are as standardized as possible in order to reduce manufacturing costs. However, the construction of a large load-bearing structure such as the hull of a vessel is subject to large dimensional tolerances, for example of several centimeters, that prevent the dimensions of a tank being planned in full before its construction. As a result, it can be necessary to construct at least some of the insulating blocks to measure, depending on the actual dimensions of the load-bearing structure.

One idea behind the invention is that of proposing a sealed and thermally insulating multi-layer tank that makes it easier to allow for at least some of the aforementioned constraints. Another idea behind the invention is that of providing a sealed and insulating multi-layer structure that is easy to produce on large surfaces.

To this end, the invention provides a sealed and thermally insulating tank for storing a fluid, the sealed and thermally insulating tank including an insulating barrier and a sealing barrier arranged on an inner surface of the insulating barrier, the insulating barrier being arranged on a support surface, for example substantially polyhedral, holding anchoring members and retained on the support surface by said anchoring members, the support surface having at least two flat regions that form an angle between them and meet at an arris zone,

in which the insulating barrier includes a row of corner structures arranged along said arris zone of the support surface and flat insulating panels arranged on the flat regions of the support surface on either side of the row of corner structures,

in which at least one or each said corner structure includes:

- a dihedral insulating block having two faces respectively parallel to the flat regions and forming an angle between them, said or each face including a flat outer surface pressing against the corresponding flat region of the support surface and a flat inner surface parallel to said corresponding flat region and spaced apart from said flat outer surface in a thickness direction, and

- a metal angle section fastened to the flat inner surfaces of the dihedral insulating block in order to form said sealing barrier in line with the arris zone of the support surface, the metal angle section having a protruding portion that protrudes relative to the dihedral insulating block along the direction of the arris zone, in which two successive corner structures in said row are arranged so that there is a space along the direction of the arris zone between the dihedral insulating blocks, said space being at least partially covered by the protruding portion of the metal angle section of at least one of the two consecutive corner structures, in which the support surface holds one said anchoring member arranged between the dihedral insulating blocks of the two corner structures.

The anchoring member can thus be used to retain an element of the insulating barrier on the support surface, for example a flat insulating panel adjacent to the row of corner structures or a dihedral insulating block of the row of corner structures.

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

According to one embodiment, said at least one of the two consecutive corner structures has a cut-out made in the protruding portion of the metal angle section in line with said anchoring member arranged between the dihedral insulating blocks, to form an access to said anchoring member.

By means of such a cut-out, the anchoring member arranged between the two dihedral insulating blocks remains accessible after the positioning of the row of corner structures, despite the presence of a protruding portion of one or both of the metal angle sections that at least partially covers the space between the two dihedral insulating blocks. This access makes it possible to act on the anchoring member easily from the inner surface of the angle section, for example by means of a screwing tool.

The protruding portion of the metal angle sections makes it possible to limit the space between the metal angle sections of the consecutive corner structures, which facilitates the sealed closure of the sealing barrier by means of closing parts and improves the seating of these closing parts and of the sealing membrane in general. A metal angle section can have the protruding portion at a single end or two protruding portions at its two opposite ends along the direction of the arris zone. The cut-out made in line with the anchoring member can extend in the protruding portion

of a single metal angle section or in the two protruding portions facing one another of the two consecutive metal angle sections.

According to one embodiment, said space is partially covered by two protruding portions facing one another belonging respectively to the metal angle sections of the two consecutive corner structures, each of the two protruding portions facing one another including a cut-out made in line with said anchoring member. By means of these features, an access with a satisfactory size can be made while using a cut-out having a relatively small cross-section in each of the two protruding portions, which limits the influence of these cut-outs on the mechanical strength of the metal angle sections.

According to one embodiment, the metal angle section of a corner structure has two protruding portions that protrude relative to the dihedral insulating block at two opposite ends of the metal angle section along the direction of the arris zone. By means of these features, the corner structures can be constructed identically, which reduces the manufacturing costs.

According to one embodiment, said or each cut-out is made in an end edge of said protruding portion oriented transverse to the arris zone. By means of these features, the manufacturing of the cut-outs is facilitated.

According to one embodiment, said metal angle section connects the two faces of the dihedral insulating block to each other.

According to one embodiment, the anchoring member arranged between the dihedral insulating blocks of the two consecutive corner structures engages with the dihedral insulating blocks of the two corner structures in order to retain said dihedral insulating blocks on the support surface.

In this case, the anchoring member can include:

- a stud fastened to the support surface and protruding inwards in the space between the dihedral insulating blocks,
- a pressing bar fitted on said stud and having two lateral portions respectively engaged with the two dihedral insulating blocks, and
- a nut screwed onto the stud in order to push the pressing bar towards the support surface.

According to one embodiment, the pressing bar has a slot through which the stud passes so that, when the nut is not pushing on the pressing bar, the pressing bar can

be slid in a direction transverse to the arris zone between:

- a retracted position in which the pressing bar is housed in the space between the dihedral insulating blocks of the two consecutive corner structures in order to leave the location of said flat isolating panel free, and
- extended positions in which the second portion protrudes beyond the dihedral insulating blocks in an opposite direction to the arris zone in order to engage with said flat insulating panel,

the nut being capable of stopping the sliding of the pressing bar by pushing the pressing bar towards the support surface.

According to one embodiment, the anchoring member arranged between the dihedral insulating blocks of the two consecutive corner structures engages with a flat insulating panel adjacent to the row of corner structures in order to retain said flat insulating panel on the support surface.

By means of these features, it is possible to anchor a flat insulating panel adjacent to the row of corner structures by means of one or more anchoring members situated between the consecutive corner structures. This arrangement simplifies the positioning and implementation of the anchoring members, particularly when the flat insulating panel adjacent to the row of corner structures must be made to measure and cannot therefore be standardized.

If the support surface is provided by a secondary barrier that in turn consists of secondary corner structures and secondary flat insulating panels, this arrangement also has the advantage of making it possible to position these anchoring members relatively close to the arris zone, particularly on the secondary corner structures. Because the secondary flat insulating panels adjacent to the secondary corner structures do not need to hold these anchoring members for the primary flat insulating panels, these secondary flat insulating panels can thus be made to measure more easily.

In this case, the anchoring member can include:

- a stud fastened to the support surface and protruding inwards in the space between the dihedral insulating blocks,
- a pressing bar having a first portion facing towards the arris zone fitted on said stud and a second portion protruding beyond the dihedral insulating blocks in an opposite direction to the arris zone engaged with said flat insulating panel, and

a nut screwed onto the stud in order to push the pressing bar towards the support surface.

According to one embodiment, the flat insulating panel adjacent to the row of corner structures includes a layer of insulating polymer foam sandwiched between a rigid bottom sheet and a rigid cover sheet, the rigid cover sheet and the insulating polymer foam layer having a recess made in the thickness of the insulating panel to uncover a bearing zone on the inner surface of the rigid bottom sheet, said recess emerging on an edge of the flat insulating panel parallel to the arris zone and facing towards the row of corner structures, the anchoring member, particularly the second portion of the pressing bar, being engaged with said bearing zone of the bottom sheet.

According to one embodiment, the recess formed in the thickness of the insulating panel is a notch oriented perpendicular to said edge of the flat insulating panel. Such notches can be formed in different locations, for example at the ends of the edge of the flat insulating panel facing towards the row of corner structures and/or in a central portion of this edge of the flat insulating panel.

According to one embodiment, the flat insulating panel has a rectangular parallelepipedal shape, the recess being made in a corner of the flat insulating panel.

According to one embodiment, the support surface holds a plurality of anchoring members distributed along the arris zone and each arranged between two dihedral insulating blocks of consecutive corner structures and each engaging with a respective zone of the flat insulating panel adjacent to the row of corner structures in order to retain said flat insulating panel on the support surface.

According to one embodiment, the support surface includes a third flat region transverse to the arris zone at one end of the arris zone, and a last corner structure of the row of corner structures includes, in addition to said dihedral insulating block, a third face parallel to the third flat region and forming angles with said two faces of the dihedral insulating block, and the metal angle section of said last corner structure extends on the flat inner surface of said third face to form said sealing barrier in line with the end of the arris zone of the support surface, said metal angle section connecting said third face to the dihedral insulating block, said protruding portion of the metal angle section protruding in the opposite direction to the third face towards a penultimate corner structure of the row of corner structures.

According to one embodiment, said dihedral insulating block of the penultimate corner structure of the row of corner structures has a larger dimension along the direction of the arris zone than corner structures situated along a central portion of the arris zone, the metal angle section of said penultimate corner structure consisting of two angle segments juxtaposed along the direction of the arris zone and fastened to the flat inner surfaces of the dihedral insulating block.

According to one embodiment, a first angle segment of said penultimate corner structure has orifices for the passage of anchoring members that serve to fasten said dihedral insulating block on the support surface and a second angle segment of said penultimate corner structure situated on the side of the end of the arris zone has a continuous surface.

By means of these features, the penultimate corner structure can quite easily be adjusted to the dimension of the support structure along the direction of the arris zone, to allow for the manufacturing tolerances on this support structure.

According to one embodiment, a block of insulating material is arranged in the space between the dihedral insulating blocks, between the protruding portion of the metal angle section and the support surface. According to one embodiment, the block of insulating material has a passage between said cut-out made in the protruding portion of the metal angle section and said anchoring member arranged between the dihedral insulating blocks. By means of such a passage, access to the anchoring member remains possible after the positioning of the block of insulating material, which facilitates the assembly of the tank wall.

According to one embodiment, the sealing barrier includes a closing part arranged straddling the metal angle sections of the two consecutive corner structures so that they provide a sealed connection between the metal angle sections of the two corner structures, said closing part covering a gap situated between the metal angle sections and the cut-out in said or each protruding portion that covers the space between the dihedral insulating blocks.

According to one embodiment, the sealing barrier in line with one or each flat region of the support surface includes a metal membrane having corrugations parallel to the arris zone and corrugations perpendicular to the arris zone, and flat zones situated between said corrugations, one edge of the metal membrane parallel to the arris zone being welded to the metal angle sections of the consecutive corner

structures, said corrugations perpendicular to the arris zone being aligned with gaps situated between the metal angle sections of the consecutive corner structures.

According to one embodiment, the closing part includes a corrugation perpendicular to the arris zone aligned with a corrugation of the metal membrane and two flat portions situated on either side of the corrugation and respectively welded to the metal angle sections of the two corner structures.

The aforementioned features can be used in the construction of an insulating barrier constructed directly on a load-bearing structure providing the support surface, or in the construction of a primary insulating barrier constructed on a pre-existing secondary barrier providing said support surface.

According to one embodiment, said insulating barrier is a primary insulating barrier and said sealing barrier is a primary sealing barrier, the tank also including a secondary insulating barrier having a substantially polyhedral inner surface covered by a secondary sealing barrier and forming said support surface.

Such a tank can form part of an onshore storage installation, for example for storing LNG, or be installed in an inshore or offshore floating structure, particularly a methane carrier, a floating storage regasification unit (FSRU), a floating production storage and offloading unit (FPSO) or other structure.

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

According to one embodiment, the invention also provides a method for loading or unloading such a vessel, in which a fluid is conveyed through insulated pipes from or to a floating or onshore storage installation from or to the tank of the vessel.

According to one embodiment, the invention also provides a system for transferring a fluid, the system including the aforementioned vessel, insulated pipes arranged so that they connect the tank installed in the hull of the vessel to a floating or onshore storage installation and a pump for conveying a fluid through the insulated pipes from or to the floating or onshore storage installation to or from the tank of the vessel.

According to one embodiment, the invention also provides a method for manufacturing an aforementioned sealed and thermally insulating tank, the method including:

providing a support surface,
 assembling an anchoring member on the support surface,
 assembling a row of corner structures along an arris zone of the support surface, so
 that said anchoring member is arranged between the dihedral insulating blocks of two
 consecutive corner structures in said row,
 accessing said anchoring member through the cut-out made in the protruding portion
 of the metal angle section in line with said anchoring member, in order to place said
 anchoring member in an engaged state in which said anchoring member retains an
 element of the insulating barrier on the support surface.

Brief description of the figures

The invention will be more clearly understood, and further aims, features and advantages thereof will become more apparent from the following description of several specific embodiments of the invention, given by way of non-limitative illustration only, with reference to the attached drawings.

- **Figure 1** is a diagrammatic cross-sectional view of a thermally insulating barrier of modular construction with generally parallelepipedal modules on a polyhedral support surface, at an arris.
- **Figure 2** is a perspective view of a wall of a sealed and thermally insulating tank at a corner zone of the tank, the primary sealing membrane having been omitted.
- **Figure 3** is a similar view to figure 2, in which a primary corner structure is omitted but primary flat insulating panels adjacent to the primary corner structure are shown.
- **Figure 4** is an enlarged perspective view showing a row of primary corner structures, in cross-section along the line IV-IV in figure 3 and for another angle value.
- **Figure 5** is an enlarged perspective view of a detail of the row of primary corner structures.
- **Figure 6** is a top view of a wall of a sealed and thermally insulating tank at a corner zone of the tank, showing the location of a flat insulating panel when the pressing bars are retracted.
- **Figure 7** is a perspective view showing an arrangement of the secondary corner structures at the intersection between three walls of the tank.

- **Figure 8** is a perspective view showing an arrangement of the primary corner structures on the secondary corner structures in figure 7.
- **Figure 9** is a perspective view of the tank at the intersection between three walls of the tank, partially showing the primary sealing membrane and a primary flat insulating panel.
- **Figure 10** is a similar view to figure 9, in which the primary sealing membrane covering the primary flat insulating panel is shown.
- **Figure 11** is a perspective view of a wall of a sealed and thermally insulating tank according to another embodiment, at a corner zone of the tank and in which the sealing membranes have been omitted.
- **Figure 12** is a cut-away diagrammatic representation of a methane carrier tank and a terminal for loading/unloading this tank.

Detailed description of the embodiments

By convention, the terms “outer” and “inner” are used to define the position of one element in relation to another, by reference to the inside and the outside of the tank.

The multi-layer structure of a sealed and thermally insulating tank for storing liquefied natural gas will be described below. Each wall of the tank includes, from the outside towards the inside of the tank, a secondary thermally insulating barrier including juxtaposed secondary insulating elements anchored to a load-bearing structure by secondary anchoring members, a secondary sealing membrane held by the secondary insulating elements, a primary thermally insulating barrier including juxtaposed primary insulating elements anchored to the secondary insulating elements by primary anchorage members 19 and a primary sealing membrane held by the primary insulating elements and suitable for being in contact with the liquefied natural gas contained in the tank.

The load-bearing structure can particularly be made up of self-supporting metal sheets or, more generally, any type of rigid partition having appropriate mechanical properties. The load-bearing structure can particularly be formed by the hull or double hull of a vessel. The load-bearing structure includes a plurality of walls defining the general shape of the tank, which is usually a polyhedral shape.

The flat zones of the tank can be produced in different ways, for example according to WO-A-2016046487 or WO-A-2017006044. A corner zone of the tank along an arris of the load-bearing structure will be described more particularly below.

Figures 2 and 3 show the structure of the walls of the tank at an arris 10 between a first load-bearing wall 11 and a second load-bearing wall 12.

The angle formed between the first load-bearing wall 11 and the second load-bearing wall 12 is approximately 90° in the embodiment shown. The angle can however have any other value, for example of the order of 135°.

The secondary thermally insulating barrier includes a row of secondary corner structures 13 arranged along the arris 10, a single secondary corner structure 13 being shown in figures 2 and 3. The secondary corner structure 13 and the secondary sealing membrane 15 arranged on the inner surface 14 thereof can be made in different ways, for example according to WO-A-2017006044.

The secondary corner structure 13 here includes a sandwich structure consisting of a layer of insulating polymer foam 16 sandwiched between two rigid sheets 17, 18 for example made from plywood. The inner sheet 18 has a network of perpendicular grooves 19 for receiving the corrugations 24 of the secondary sealing membrane 15. The corrugations 24 protrude towards the outside of the tank towards the load-bearing structure and are each received in a groove 19.

In one variant not shown, the orientation of the corrugations of the secondary sealing membrane is towards the inside of the tank.

The inner sheet 18 is also provided with a plurality of metal plates 20, for example made from stainless steel or an alloy with a low thermal expansion coefficient, particularly Invar®, for anchoring edges of the secondary sealing membrane. The metal plates 20 are fastened in recesses made in the inner sheet 18 and fastened thereto, using screws, rivets or clips, for example. Alternatively, the metal plates 20 are fastened directly on the insulating polymer foam layer 16, for example by gluing.

The inner sheet 18 is also provided with anchoring plates 21 for fastening primary corner structures 30 against the secondary corner structure 13. The anchoring plates 21 are for example glued onto the inner sheet 18 and/or fastened thereto, using screws, rivets or clips, for example.

In addition, the secondary sealing membrane 15 has a plurality of orifices through each of which passes an anchoring member making it possible to anchor the primary corner structures 30. A cap nut 22 passes through each of the orifices and has on its outer periphery a thread engaging with a threaded bore 23 formed in one of the anchoring plates 21. In addition, the cap nut 22 has a threaded blind bore for receiving a stud for fastening the primary corner structures 30. The cap nut 22 also includes a collar that makes it possible to sandwich the secondary sealing membrane 15 between said collar and the anchoring plate 21. The periphery of this collar is welded onto the secondary sealing membrane 15 in order to ensure the sealing thereof.

The primary thermally insulating barrier includes, along the arris 10 of the tank, a plurality of primary corner structures 30. The primary corner structure 30 is a pre-assembled assembly comprising a dihedral insulating block 31 and an angle section 32. The dihedral insulating block 31 has an inner face on which rests the angle section 32 and an outer face resting against the secondary sealing membrane 15. The dihedral insulating block 31 has a composite structure in its thickness, including a layer of insulating polymer foam 33 sandwiched between two plywood sheets 34, 35 glued to said polymer foam layer 33.

The angle sections 32 are metal angle sections, for example, made from stainless steel. The angle section 32 has two flanges resting against the inner face of the dihedral insulating block 31. Each flange of an angle section 32 has studs, not shown, that are welded onto the outer face of said flange and protrude towards the inside of the tank in order to fasten the angle section 32 to the dihedral insulating block 31, before the primary corner structure 30 is assembled in the tank.

Each flange of the angle section 32 also has a stud 36 on its inner face, protruding towards the inside of the tank. The studs 36 make it possible to anchor welding equipment during the welding of the primary sealing membrane elements to the angle sections 32.

As described in WO-A-2017006044, the angle section 32 is provided with orifices 37, for example eight in number per angle section 32, making it possible to fit nuts on studs (not shown) held by the plates 21, in order to fasten the primary corner structure 30 to the secondary corner structure 13.

As can be seen more clearly in figures 2 and 4, the primary corner structures 30 are arranged on the secondary corner structures 13 in the form of a row running

along the arris 10. In this row, two consecutive primary corner structures 30 have a space 38 between the two dihedral insulating blocks 31. Generally, insulating joint elements 39 are inserted in the space 38 between the two dihedral insulating blocks 31, so that they provide continuity of the thermal insulation.

In at least some of the spaces 38, the secondary corner structure 13 can hold an anchoring member for engaging with a primary insulating element. This case will be described more specifically with reference to figures 3 to 5. The anchoring element as a whole is cut along its mid-plane of symmetry in figure 4, so that the half-view is sufficient for understanding the structure thereof.

In this embodiment, the anchoring member includes a plate 40 fastened to the inner surface of the secondary corner structure 13 between two plates 21. The plate 40 can be fastened to the secondary corner structure 13 in different ways, as can the plates 21. It has a threaded hole 41 for receiving a cap nut 42 shown in half-view in figure 4. The plate 40 can be present in line with each space 38 or in line with some, for example one in three, of the spaces 38.

The cap nut 42 passes through an orifice in the secondary sealing membrane, not shown, and has on its outer periphery a thread 43 engaging with the threaded hole 41 made in the plate 40. In addition, the cap nut 42 has a blind threaded bore 44 receiving a stud 45. The cap nut 42 also includes a collar 46 that makes it possible to sandwich the secondary sealing membrane between said collar and the plate 40. The periphery of this collar is welded onto the secondary sealing membrane 15 in order to ensure the sealing thereof.

As can be seen in figure 4, the stud 45 protrudes towards the inside in the space 38 between the two dihedral insulating blocks 31 and serves to fasten a pressing bar 50 oriented perpendicular to the arris 10. The pressing bar 50 here has a U-shaped cross-section the base of which is facing towards the load-bearing structure. When assembled as shown, a first portion of the pressing bar 50 extends in the space 38 between the two dihedral insulating blocks 31 and has a slot 58 through which the stud 45 passes. A nut 47 screwed onto the stud 45 makes it possible to push the pressing bar 50 towards the inner surface of the secondary corner structure 13.

A second portion 51 of the pressing bar 50 protrudes beyond the row of primary corner structures 30 in order to press on a flat primary insulating panel 29 adjacent to the row of primary corner structures 30. The length of the slot 58 makes it

possible to adjust the length of the second portion 51 protruding beyond the row of primary corner structures 30.

Preferably, the slot 58 the two ends 58a and 58b of which are shown in the cross-sectional view in figure 4, is long enough to make it possible to fully retract the pressing bar 50 into the space 38 between the two dihedral insulating blocks 31. Before the nut 47 is tightened, it is thus possible to slide the pressing bar 50 between this retracted position (shown in figure 6), which facilitates the installation of the flat primary insulating panel 29 by completely freeing its location shown in chain dotted lines with reference sign 99, and the extended position illustrated in figure 4. The movement to extend the pressing bar 50 is shown by the arrow 98 in figure 6.

In one embodiment, the length of the flat primary insulating panel 29 is equal to nine times the width of the primary corner structure 30, so that four pressing bars spaced apart from each other at an interval three times the width of the primary corner structure 30 engage with the flat primary insulating panel 29 along its edge facing the arris, that is, two pressing bars 50 at the two ends of this edge, i.e. at two corners of the flat primary insulating panel 29, and two pressing bars in a central zone of the edge of the flat primary insulating panel 29. This central zone is shown in figure 3.

As partially shown in figure 3, the flat primary insulating panel 29 has a generally rectangular parallelepipedal shape with a longitudinal edge 26 parallel to the arris 10. The flat primary insulating panel 29 has for example a composite structure consisting of a layer of insulating polymer foam sandwiched between a rigid bottom sheet, an uncovered zone 28 of which is visible, and a rigid cover sheet 25. A notch 27 is formed in the rigid cover sheet 25 and the insulating polymer foam layer, extending perpendicular to the arris 10 in line with the plate 20 and emerging on the longitudinal edge 26 to uncover the uncovered zone 28 of the rigid bottom sheet.

When assembled, the second portion 51 of the pressing bar 50 is fitted in the notch 27 and presses on the uncovered zone 28 of the rigid bottom sheet, optionally by means of a shim 48. Another shim 49 can be inserted between the other end of the pressing bar 50 and the secondary membrane (not shown). The shims 48 and 49 are sized to ensure that the pressing bar 50 and the bottom sheet of the flat primary insulating panel 29 are parallel to each other. They are made from a sufficiently soft material to prevent the risk of piercing, marking or damaging the secondary sealing membrane 15. For example, they can be made from plywood, plastic or epoxy resin.

The pressing bar 50 assembled in this way offers several advantages: the second portion 51 is a cantilevered length substantially parallel to the flat wall of the tank that presses on the flat primary insulating panel 29, preferably at a distance from the edge of this panel. It therefore makes it possible to retain the flat primary insulating panel 29 on the secondary membrane without requiring any complex arrangements on the flat primary insulating panel 29: a flat portion of the bottom sheet must simply be uncovered.

In addition, the length of the second portion 51 is easily adjustable by sliding the stud 45 in the length of the slot 58. This arrangement can therefore be adjusted easily to flat primary insulating panels having different dimensions or notches 27 of different lengths. The length of the notch 27 can particularly be shortened following the cutting of the edge 26 in order to reduce the width of the insulating panel 29.

In addition, given that the pressing bar 50 is anchored on a stud held by the secondary corner structure 13, its position is not affected by the size of the flat secondary insulating panels (not shown) adjacent to the secondary corner structure 13. This arrangement can therefore be adjusted easily to flat secondary insulating panels with different dimensions.

As can be seen in figure 4, each angle section 32 has two protruding rims 53 that protrude relative to the dihedral insulating block 31 at two opposite ends of the angle section 32 along the direction of the arris 10. The space 38 between the two dihedral insulating blocks 31 is thus partially covered by the two protruding rims 53 on either side thereof.

In order to retain access to the anchoring member arranged in the space 38, at least each of the two protruding rims 53 on either side of the anchoring member is provided with a cut-out 54 that is situated in line with the stud 45 and is formed in the end edge 55 oriented transverse to the arris 10.

Optionally, as shown in figure 2, all of the protruding rims 53 of all of the angle sections 32 can have this cut-out 54 in order to standardize manufacturing.

As can be seen more clearly in figure 5, the cut-outs 54 serve to form sufficient space between the two protruding rims 53 for the passage of a tightening tool 60, for example a socket wrench having a cylindrical head 61, or a screwdriver. The depth of the cut-out 54 in the direction of the arris 10 can therefore be sized in order to form a distance D slightly larger than the diameter of the cylindrical head 61

between the bottoms of the two facing cut-outs 54. The length of the cut-out 54 along the end edge 55 can be substantially equal to this same distance D, for example approximately 30 mm.

The assembly sequence of the corner zone of the tank will now be described briefly:

- assembling the secondary insulating barrier and the secondary sealing membrane 15, including the cap nuts 42,
- positioning the pressing bars 50 in the retracted position, the slot 58 of the pressing bar being positioned in line with the cap nut 42,
- inserting and screwing the stud 45 into the cap nut 42 through the slot 58 of the pressing bar 50, positioning the nut 47 on the stud 45 in the untightened position,
- positioning the insulating joints 39 between the locations of the primary corner structures 30. Where the pressing bar 50 is present, the insulating joint 39 has at its base a post inserted into the hollow U-shaped cross-section of the pressing bar 50. The insulating joint 39 also has a cylindrical well 56 in line with the cap nut 42 in order to receive the stud 45 and the nut 47,
- fastening the primary corner structures 30 onto the secondary corner structures 13, on either side of the insulating joints 39,
- installing the flat primary insulating panels 29 adjacent to the row of primary corner structures 30,
- moving the pressing bars 50 to the extended position, the insulating joint 39 remaining immobilized by the stud 45 fitted in the cylindrical well 56,
- screwing the nut 47 onto the stud 45 through the cut-outs 54 in the angle sections 32 and the cylindrical well 56 in the insulating joint 39, in order to push the pressing bar 50,
- inserting a cylindrical plug 57 into the cylindrical well 56 in order to close it,
- positioning the primary sealing membrane.

The flat portions of the tank wall situated on either side of an arris can be constructed identically or differently, and symmetrically or asymmetrically. In addition, although only one corner of the tank has been described above, the other corners of the tank can be arranged identically or differently.

With reference to figures 7 to 10, the structure of the tank wall at one end of the arris 10, that is, at the intersection between three flat walls, will now be described. The three walls shown here respectively form a bottom wall, an end wall and a lower oblique wall. The lower oblique wall forms an angle of 135° with the bottom wall. The lower oblique wall and the bottom wall are perpendicular to the end wall. Such an arrangement corresponds for example to a tank that has a generally polyhedral shape and includes two octagonal end walls that are connected to each other by eight walls, that is, a horizontal bottom wall and a horizontal ceiling wall, two vertical side walls, two upper oblique walls each connecting one of the side walls to the ceiling wall, and two lower oblique walls each connecting one of the side walls to the bottom wall.

In this zone, as shown in figure 7, the row of secondary corner structures 13 ends in a last secondary corner structure 113 that is made up of a set of three insulating panels that are respectively fastened to the load-bearing structure of each of the three load-bearing walls. The three insulating panels of the last secondary corner structure 113 each have a sandwich structure identical to that of the secondary corner structures 13, that is, consisting of a layer of insulating polymer foam 116 sandwiched between two rigid sheets 117, 118 for example made from plywood.

On each of the three insulating panels of the last secondary corner structure 113, the rigid sheet 118 holds anchoring plates 121 and 140 the structures and functions of which are identical to those of the anchoring plates 21 and 40 described above in relation to the secondary corner structure 13. In particular, the anchoring plates 121 make it possible to fasten a last primary corner structure 130 (figure 7) to the last secondary corner structure 113.

The plate 40 makes it possible to fasten an anchoring member in a space between the last primary corner structure 130 and a penultimate primary corner structure 230 (figure 7) of the row of primary corner structures. This anchoring member includes a stud 145 fitted in a slot 158 of a pressing bar 150 that can be seen in figure 9.

Figure 8 is also a view of the end zone of the arris, additionally showing the primary corner structures assembled on the secondary corner structures in figure 7. The entire secondary sealing membrane has been omitted in order to simplify the drawing.

As shown, the last primary corner structure 130 in the row consists of three insulating blocks respectively resting against each of the three insulating panels of

the last secondary corner structure 113. In addition, the insulating blocks of the last primary corner structure 130 each include an inner face on which rests a three-faced angle section 132, the general structure of which is similar to the metal angle section 32 of the primary corner structure 30, apart from the presence of a third flange 100 parallel to the lower oblique wall. The three-faced angle section 132 particularly includes studs 136, orifices 137 and rims 153 the structures and functions of which are similar to those of the studs 36, orifices 37 and rims 53 described above.

The penultimate primary corner structure 230 is shown using reference signs increased by 200 for elements that are similar or identical to those of the primary corner structure 30. The dihedral insulating block 231 is longer than the dihedral insulating block 31 and holds on its inner surface two consecutive metal angle sections in the direction of the arris. The metal angle section 232 is substantially identical to the metal angle section 32 of the primary corner structure 30 but, because the dihedral insulating block 231 is elongated towards the last primary corner structure 130, it can have a longer dimension along the arris 10 and it only extends on one side (not shown) of the dihedral insulating block 231.

The metal angle section 65 is placed next to the metal angle section 232 with a small gap between them, and fastened to the dihedral insulating block 231 in the same way as the metal angle section 32 of the primary corner structure 30. The metal angle section 65 has a protruding rim 253 that protrudes relative to the dihedral insulating block 231 along the direction of the arris 10 above the space 138. The space 138 is partially covered by the two protruding rims 153 and 253 on either side thereof.

The protruding rim 153 and/or the protruding rim 253 can include a cut-out in order to facilitate access to the anchoring member situated in the space 138. Here, a cut-out 254 is only present in the protruding rim 253.

In addition, the penultimate primary corner structure 230 is only fastened to the secondary insulating barrier on the portion furthest from the last primary corner structure 130, that is, the portion holding the metal angle section 232 that is fastened to an underlying penultimate secondary corner structure 13 in the same way as described previously. To this end, the metal angle section 232 also has the orifices 237.

Conversely, the metal angle section 65 does not include any orifices and can be continuous, since the portion of the dihedral insulating block 231 facing towards

the last primary corner structure 130 straddles the gap 66 between the penultimate secondary corner structure 13 and the last secondary corner structure 113 and extends on the last secondary corner structure 113 without being fastened thereto.

This arrangement has the advantage of being independent of the precise dimension of the gap 66 in the secondary insulating barrier, which can be adjusted easily to compensate for the manufacturing tolerances.

In addition, in order to adjust the primary insulating barrier to the dimensional manufacturing tolerances of the load-bearing structure, it is possible to cut the penultimate primary corner structure 230 to measure, that is, to cut the end of the dihedral insulating block 231 and the end of the metal angle section 65 facing towards the last primary corner structure 130. Given the absence of fastening of this end portion to the secondary insulating barrier, this cutting does not result in any complications. In this case, the cut-out 254 is added after the metal angle section 65 has been cut to the desired length.

Figure 9 shows the same zone of the tank as figure 8, but with the addition of a last flat primary insulating panel 129 adjacent to the penultimate primary corner structure 230. This flat primary insulating panel 129 has, in a similar way to the notch 27 in figure 3, a recess 127 made in line with a corner zone of the rigid bottom sheet (not shown) in order to uncover said corner zone. Figure 9 also shows the pressing bar 150, which is fitted in the recess 127 and presses on the uncovered zone as described previously.

With reference to figures 9 and 10, the structure of the primary sealing membrane at the corners of the tank will now be described.

The primary sealing membrane is for example a membrane having two series of corrugations that are perpendicular to each other. It can be made essentially as described in WO-A-2017006044. Metal sheets 67 of the primary sealing membrane bordering an arris are welded along their edge facing towards the arris to the metal angle sections 32, 232, 65, 132. In addition, metal corner pieces 68, 168, 268 are welded straddling each interface between two consecutive metal angle sections 32, 232, 65, 132.

The corner pieces 68, 168, 268 cover the orifices 37, 137, 237 and the cut-outs 54, 254 of the metal angle sections produce the continuity of the corrugations of the primary sealing membrane oriented perpendicular to the arris 10.

Figure 11 shows another embodiment of the tank wall along the arris 10. The primary and secondary sealing membranes have been omitted in order to simplify the drawing. Similar or identical elements to those in figures 2 to 4 have the same reference sign increased by 300 and will only be described insofar as they differ from those in figures 2 to 4.

In this embodiment, the primary corner structure 330 is fastened to the secondary corner structure 313 by means of studs 345 arranged in each space 338 between two dihedral insulating blocks 331. To this end, the rigid sheet 334 is slightly wider than the polymer foam layer 333 so that two lateral rims of the rigid sheet 334 are uncovered.

A pressing bar 350 has a bore, which can be oblong, through which the stud 345 passes, and presses on the lateral rims of the rigid sheet 334 of the two primary corner structures 330 between which the stud 345 is arranged. Each primary corner structure 330 is thus retained by two pressing bars 350 engaging with the two lateral rims of its rigid sheet 334. A nut, not shown, is screwed onto each stud 345 in order to push the pressing bar 350 towards the load-bearing structure. The cut-outs 354 in the edges of the metal angle sections 332 facilitate the assembly of the stud 345 and then the positioning of the nut as described previously.

Due to this method of fastening the primary corner structures 330, the orifices are not present on the metal angle section 332, which can therefore be continuous.

In order to anchor the flat primary insulating panel 329 adjacent to the row of primary corner structures 330 on the secondary barrier, a row of studs 69 can be provided on each side of the row of primary corner structures 330. This can make it necessary to provide a wider secondary corner structure 313, as shown.

In one embodiment, the secondary insulating barrier and the secondary sealing membrane are not present and the studs that anchor the primary insulating barrier are held directly by the load-bearing walls 11, 12.

The technique described above for producing a sealed and thermally insulating tank for storing a fluid can be used in different types of reservoir, for example to form an LNG reservoir in an onshore installation or in a floating structure such as a methane carrier or other vessel.

The technique illustrated above in the context of a support surface that is actually polyhedral, in which flat portions meet at arrises, is also applicable to an

approximately polyhedral support surface which, instead of arrises, has rounded portions forming a connection between flat portions. The term arris zone is used to denote the connection between two flat portions in both contexts and can correspond to an actual arris or to a rounded portion between the two flat portions.

With reference to figure 12, a cut-away view of a methane carrier 70 shows a sealed and insulated tank 71 with a generally prismatic shape assembled in the double hull 72 of the vessel. The wall of the tank 71 includes a primary sealing barrier suitable for being in contact with the LNG contained in the tank, a secondary sealing barrier arranged between the primary sealing barrier and the double hull 72 of the vessel, and two insulating barriers respectively arranged between the primary sealing barrier and the secondary sealing barrier and between the secondary sealing barrier and the double hull 72.

In a manner known *per se*, loading/unloading pipes 73 arranged on the upper deck of the vessel can be connected, by means of appropriate connectors, to a marine or harbor terminal in order to transfer a cargo of LNG from or to the tank 71.

Figure 12 shows an example of a marine terminal including a loading and unloading station 75, a subsea pipeline 76 and an onshore installation 77. The loading and unloading station 75 is a fixed offshore installation including a mobile arm 74 and a tower 78 that supports the mobile arm 74. The mobile arm 74 holds a bundle of insulated flexible hoses 79 that can be connected to the loading/unloading pipes 73. The orientable mobile arm 74 is suitable for all sizes of methane carrier. A connecting pipeline, not shown, extends inside the tower 78. The loading and unloading station 75 makes it possible to load and unload the methane carrier 70 from or to the onshore installation 77. The latter includes liquefied gas storage tanks 80 and connecting pipelines 81 connected by the subsea pipeline 76 to the loading or unloading station 75. The subsea pipeline 76 makes it possible to transfer liquefied gas between the loading or unloading station 75 and the onshore installation 77 over a long distance, for example 5 km, which makes it possible to keep the methane carrier 70 a long distance from the coast during the loading and unloading operations.

In order to generate the pressure necessary for transferring the liquefied gas, pumps on board the vessel 70 and/or pumps provided at the onshore installation 77 and/or pumps provided on the loading and unloading station 75 are implemented.

Although the invention has been described with reference to several specific embodiments, it is obvious that it is in no way limited thereto and that it comprises all

technical equivalents of the means described and any combinations thereof if these fall within the scope of the invention.

The use of the verb “include” or “comprise” and its conjugated forms does not rule out the presence of elements or steps other than those set out in a claim. The use of the indefinite article “one” for an element or a step does not rule out, unless otherwise stated, the presence of a plurality of such elements or steps.

In the claims, any reference sign in brackets cannot be interpreted as limiting the claim.

CLAIMS

1. A sealed and thermally insulating tank for storing a fluid, the sealed and thermally insulating tank including an insulating barrier and a sealing barrier arranged on an inner surface of the insulating barrier, the insulating barrier being arranged on a support surface holding anchoring members and retained on the support surface by said anchoring members, the support surface having at least two flat regions that form an angle between them and meet at an arris zone (10), in which the insulating barrier includes a row of corner structures (30, 130, 230, 330) arranged along said arris zone of the support surface and flat insulating panels (29, 129, 329) arranged on the flat regions of the support surface on either side of the row of corner structures,

in which at least one said corner structure includes:

- a dihedral insulating block (31, 231, 331) having two faces respectively parallel to the flat regions and forming an angle between them, said face including a flat outer surface pressing against the corresponding flat region of the support surface and a flat inner surface parallel to said corresponding flat region and spaced apart from said flat outer surface in a thickness direction, and
- a metal angle section (32, 65, 132, 232, 332) fastened to the flat inner surfaces of the dihedral insulating block in order to form said sealing barrier in line with the arris zone of the support surface, the metal angle section having a protruding portion (53, 153, 253, 353) that protrudes relative to the dihedral insulating block along the direction of the arris zone,

in which two successive corner structures in said row are arranged so that there is a space (38, 138, 338) along the direction of the arris zone between the dihedral insulating blocks, said space being at least partially covered by the protruding portion (53, 153, 253, 353) of the metal angle section of at least one of the two consecutive corner structures,

in which the support surface holds one said anchoring member (45, 145, 345) arranged between the dihedral insulating blocks of the two corner structures, said at least one of the two consecutive corner structures having a cut-out (54, 254, 354) made in the protruding portion of the metal angle section in line with said anchoring member arranged between the dihedral insulating blocks, to form an access to said anchoring member (45, 145, 345).

2. The tank as claimed in claim 1, in which said space is partially covered by two protruding portions (53, 153, 253, 353) facing one another belonging respectively to the metal angle sections of the two consecutive corner structures, each of the two protruding portions facing one another including a cut-out (54, 254, 354) made in line with said anchoring member.

3. The tank as claimed in either one of claims 1 and 2, in which said cut-out (54, 254, 354) is formed in an end edge of said protruding portion oriented transverse to the arris zone.

4. The tank as claimed in any one of claims 1 to 3, in which the anchoring member (345, 350) arranged between the dihedral insulating blocks (331) of the two consecutive corner structures (330) engages with the dihedral insulating blocks of the two corner structures in order to retain said dihedral insulating blocks (331) on the support surface.

5. The tank as claimed in claim 4, in which the anchoring member includes:

a stud (345) fastened to the support surface and protruding inwards in the space between the dihedral insulating blocks,
a pressing bar (350) fitted on said stud and having two lateral portions respectively engaged with the two dihedral insulating blocks (331), and
a nut screwed onto the stud (345) in order to push the pressing bar (350) towards the support surface.

6. The tank as claimed in any one of claims 1 to 5, in which the anchoring member arranged between the dihedral insulating blocks (31, 231) of the two consecutive corner structures engages with a flat insulating panel (29, 129) adjacent to the row of corner structures in order to retain said flat insulating panel on the support surface.

7. The tank as claimed in claim 6, in which the anchoring member includes:

a stud (45, 145) fastened to the support surface and protruding inwards in the space between the dihedral insulating blocks,
a pressing bar (50, 150) having a first portion facing towards the arris zone fitted on said stud and a second portion (51) protruding beyond the dihedral insulating blocks (31, 231) in an opposite direction to the arris zone engaged with said flat insulating panel (29, 129), and

a nut (47) screwed onto the stud and capable of pushing the pressing bar (50, 150) towards the support surface.

8. The tank as claimed in claim 7, in which the pressing bar has a slot through which the stud passes so that, when the nut is not pushing on the pressing bar, the pressing bar can be slid in a direction transverse to the arris zone between:

- a retracted position in which the pressing bar is housed in the space between the dihedral insulating blocks (31, 231) of the two consecutive corner structures in order to leave the location of said flat insulating panel (29, 129) free, and
- extended positions in which the second portion (51) protrudes beyond the dihedral insulating blocks (31, 231) in an opposite direction to the arris zone in order to engage with said flat insulating panel (29, 129).

9. The tank as claimed in any one of claims 6 to 8, in which the flat insulating panel (29, 129) adjacent to the row of corner structures includes a layer of insulating polymer foam sandwiched between a rigid bottom sheet and a rigid cover sheet (25), the rigid cover sheet and the insulating polymer foam layer having a recess (27, 127) made in the thickness of the insulating panel to uncover a bearing zone (28) on the inner surface of the rigid bottom sheet, said recess emerging on an edge (26) of the flat insulating panel parallel to the arris zone and facing towards the row of corner structures, the anchoring member being engaged with said bearing zone (28) of the bottom sheet.

10. The tank as claimed in claim 9, in which the recess formed in the thickness of the insulating panel is a notch (27) oriented perpendicular to said edge (26) of the flat insulating panel.

11. The tank as claimed in claim 9 or 10, in which the flat insulating panel has a rectangular parallelepipedal shape, the recess (127) being made in a corner of the flat insulating panel.

12. The tank as claimed in any one of claims 6 to 11, in which the support surface holds a plurality of anchoring members (45, 145) distributed along the arris zone (10) and each arranged between two dihedral insulating blocks of consecutive corner structures (30, 130, 230) and each engaging with a respective zone of the flat insulating panel (29, 129) adjacent to the row of corner structures in order to retain said flat insulating panel on the support surface.

13. The tank as claimed in any one of claims 1 to 12, in which the support surface includes a third flat region transverse to the arris zone at one end of the arris zone (10), in which a last corner structure (130) of the row of corner structures includes, in addition to said dihedral insulating block, a third face (100) parallel to the third flat region and forming angles with said two faces of the dihedral insulating block (130), and

in which the metal angle section (132) of said last corner structure (130) extends on the flat inner surface of said third face to form said sealing barrier in line with the end of the arris zone of the support surface, said metal angle section connecting said third face to the dihedral insulating block, said protruding portion (153) of the metal angle section (132) protruding in the opposite direction to the third face (100) towards a penultimate corner structure (230) of the row of corner structures.

14. The tank as claimed in claim 13, in which said dihedral insulating block (231) of the penultimate corner structure (230) of the row of corner structures has a larger dimension along the direction of the arris zone than corner structures situated along a central portion of the arris zone, the metal angle section of said penultimate corner structure consisting of two angle segments (232, 65) juxtaposed along the direction of the arris zone and fastened to the flat inner surfaces of the dihedral insulating block (231).

15. The tank as claimed in claim 14, in which a first angle segment (232) of said penultimate corner structure has orifices (237) for the passage of anchoring members that serve to fasten said dihedral insulating block (231) on the support surface, and a second angle segment (65) of said penultimate corner structure situated on the side of the end of the arris zone has a continuous surface.

16. The tank as claimed in any one of claims 1 to 15, in which a block of insulating material (39) is arranged in the space (38, 138, 338) between the dihedral insulating blocks between the protruding portion (53, 153, 253, 353) of the metal angle section and the support surface, the block of insulating material (39) having a passage (56) between said cut-out (54, 254, 354) formed in the protruding portion of the metal angle section and said anchoring member arranged between the dihedral insulating blocks.

17. The tank as claimed in any one of claims 1 to 16, in which the sealing barrier includes a closing part (68) arranged straddling the metal angle sections (32, 132, 232, 65) of the two consecutive corner structures so that they

provide a sealed connection between the metal angle sections of the two corner structures,

said closing part (68) covering a gap situated between the metal angle sections and the cut-out (54, 254, 354) of said or each protruding portion that covers the space between the dihedral insulating blocks.

18. The tank as claimed in any one of claims 1 to 17, in which the sealing barrier in line with one or each flat region of the support surface includes a metal membrane (67) having corrugations parallel to the arris zone and corrugations perpendicular to the arris zone, and flat zones situated between said corrugations, one edge of the metal membrane (67) parallel to the arris zone being welded to the metal angle sections (32, 232, 65) of the consecutive corner structures, said corrugations perpendicular to the arris zone being aligned with gaps situated between the metal angle sections of the consecutive corner structures.

19. The tank as claimed in claims 18 and 17 taken in combination, in which the closing part (68, 168) includes a corrugation perpendicular to the arris zone aligned with a corrugation of the metal membrane and two flat portions situated on either side of the corrugation and respectively welded to the metal angle sections of the two corner structures.

20. The tank as claimed in any one of claims 1 to 19, in which said insulating barrier is a primary insulating barrier and said sealing barrier is a primary sealing barrier, the tank also including a secondary insulating barrier (13, 113, 213) having a substantially polyhedral inner surface covered by a secondary sealing barrier (15) and forming said support surface.

21. A vessel (70) for transporting a fluid, the vessel including a double hull (72) and a tank (71) as claimed in any one of claims 1 to 20 arranged in the double hull.

22. A system for transferring a fluid, the system including a vessel (70) as claimed in claim 21, insulated pipes (73, 79, 76, 81) arranged so that they connect the tank (71) installed in the hull of the vessel to a floating or onshore storage installation (77) and a pump for conveying a fluid through the insulated pipes from or to the floating or onshore storage installation to or from the tank of the vessel.

23. A method for loading or unloading a vessel (70) as claimed in claim 21, in which a fluid is conveyed through insulated pipes (73, 79, 76, 81) from or to a floating or onshore storage installation (77) to or from the tank (71) of the vessel.

24. A method for manufacturing a sealed and thermally insulating tank as claimed in one of claims 1 to 20, the method including:

providing a support surface,

assembling an anchoring member (45, 145, 345) on the support surface,

assembling a row of corner structures (30, 130, 230, 330) along an arris zone of the support surface, so that said anchoring member (45, 145, 345) is arranged between the dihedral insulating blocks of two consecutive corner structures in said row,

accessing said anchoring member (45, 145, 345) through the cut-out (54, 254, 354) made in the protruding portion of the metal angle section in line with said anchoring member, in order to place said anchoring member in an engaged state in which said anchoring member retains an element of the insulating barrier on the support surface.