

Description

Title of the invention: Method for closing a sealing membrane for a sealed and thermally-insulating tank

Technical field

5 [0001] The invention relates to the field of sealed tanks and more particularly to sealed and thermally-insulating membrane tanks. In particular, the invention relates to the field of sealed and thermally-insulating tanks for the storage of liquefied gas at low temperature, such as tanks for the storage of Liquefied Natural Gas (LNG) at approximately -162°C at atmospheric pressure. These tanks may be installed on land or on a floating structure. In
10 the case of a floating structure the tank may be intended for the transport of liquefied gas or to receive liquefied gas serving as fuel for the propulsion of the floating structure.

Technological background

[0002] There are known from the prior art sealed and thermally-insulating tanks integrated into support structures in order to serve as terrestrial storage installations, comprising a
15 secondary thermally-insulating barrier, a secondary sealing membrane, a primary thermally-insulating barrier and a primary sealing membrane. The tank includes a plurality of tank walls assembled to one another.

[0003] In this type of structure the sealing membranes are closed at the edge of the wall or at the level of an opening in order for example to allow the passage of loading/offloading
20 pipes.

[0004] During these closures, the secondary sealing membrane or the primary sealing membrane is connected in sealed manner to the support structure. These connections are made by means of a part bent at 90° that is generally on the one hand welded to the support structure and on the other hand connected to the sealing membrane.

25 [0005] These welding operations are carried out manually.

Summary

[0006] One idea behind the invention is to simplify the welding operation in a closure zone of the sealing membrane.

[0007] In accordance with one embodiment, the invention provides a method for closing a
30 sealing membrane for a sealed tank, said tank being in particular thermally insulated, the method including the following steps:

- furnishing a tank wall fixed to a support wall, the tank wall including in a direction of thickness a thermally-insulating barrier and a sealing membrane fixed to the thermally-insulating barrier, the thermally-insulating barrier including an edge portion situated at one edge of the thermally-insulating barrier in a first direction,

5 - fixing a metal connecting angle-iron at the level of the edge portion, the metal connecting angle-iron including a first flange and a second flange connected to the first flange, by welding the first flange by means of a weld bead to a metal part on the support wall, and by connecting the second flange to the sealing membrane,

10 in which the step of welding the first flange is carried out using an automatic welding machine moving on a welding support, the welding support including a fixing surface and a support surface perpendicular to the fixing surface, the support surface including a guide means, in particular a guide rail, extending in a second direction perpendicular to the first direction and to the direction of thickness, the welding machine including a displacement system cooperating with the guide means and configured to move the welding machine
15 in a forward movement parallel to the second direction, the welding machine also including a welding torch,

and in which during welding of the first flange the fixing surface of the welding support is fixed to the edge portion of the thermally-insulating barrier so that the support surface is perpendicular to the first direction.

20 [0008] Thanks to these features, it is possible to use an automatic welding machine in a sealing membrane closure zone, thus making it possible to simplify the welding operation and to limit costs. Moreover, the welding support enables the automatic welding machine to be guided and retained by being fixed to elements of the tank already mounted in the latter, namely an edge portion of the thermally-insulating barrier. Because of this, it is not
25 necessary to allocate space to the welding support and to the machine when closing the sealing membrane.

[0009] Embodiments of a method of this kind may include one or more of the following features.

30 [0010] In accordance with one embodiment, the welding machine also includes an attachment bar fixed to the displacement system and having a first end remote from the displacement system and a second end remote from the displacement system, the first end and the second end being situated on respective opposite sides of the displacement system in the direction of thickness, the welding torch being fixed to the first end and a counterweight being fixed to the second end.

[0011] In accordance with one embodiment, the first flange is formed in a plane perpendicular to the first direction and the second flange is formed in a plane perpendicular to the direction of thickness.

5 [0012] In accordance with one embodiment, the metal part on the support wall is an anchor flat projecting from the support wall in the direction of thickness and extending in the second direction, the edge portion of the thermally-insulating barrier being adjacent to the anchor flat.

[0013] The edge portion is thus either situated against the anchor flat or separated from the anchor flat by a sheet of plywood.

10 [0014] In accordance with one embodiment, the metal part on the support wall is a metal portion of the support wall.

[0015] In accordance with one embodiment, the thermally-insulating barrier includes a plurality of insulating blocks juxtaposed to one another and the edge portion of the thermally-insulating barrier includes an edge insulating block.

15 [0016] In accordance with one embodiment, the weld bead is a first weld bead, a metal closing plate being fixed to at least a portion of a surface of the edge portion of the thermally-insulating barrier opposite the support wall, an edge of the sealing membrane being fixed to the metal closing plate, and during the step of fixing the connecting angle-iron the second flange is welded by means of a second weld bead to the metal closing plate.

20 [0017] In accordance with one embodiment, the weld bead is a first weld bead, a metal closing plate being fixed to at least a part of a surface of the edge portion of the thermally-insulating barrier opposite the support wall, and during the step of fixing the connecting angle-iron the second flange is welded to the metal closing plate, an edge of the sealing membrane being also welded to the second flange.

25 [0018] Preferably, only the welding of the edge of the sealing membrane to the second flange of the connecting angle-iron is carried out by means of the automatic welding machine and thus constitutes a second weld bead. The welding of the second flange to the metal closing plate is manual welding.

30 [0019] In accordance with one embodiment, the closing plate includes fixing orifices, the closing plate being fixed to the edge portion of the thermally-insulating barrier by means of an anchoring device coming to be inserted in the fixing orifices, and during the production of the first weld bead the fixing surface of the welding support is fixed by means

of anchor devices that come to be inserted in the fixing orifices left free by the devices anchoring the closing plate.

[0020] In accordance with one embodiment, the fixing surface of the welding support is a first fixing surface and the welding support includes a second fixing surface perpendicular to the first fixing surface and parallel to the support surface, and during the production of the second weld bead the second fixing surface of the welding support is fixed against the support wall so that the support surface is parallel to, preferably coplanar with, the sealing membrane, the second weld bead being produced by means of said automatic welding machine moving on the guide means of the welding support, said welding support being used to produce both the first weld bead and the second weld bead.

[0021] The same welding support and the same welding machine can therefore be used both to weld the first flange of the connecting angle-iron to the support wall and to weld the second flange of the connecting angle-iron to the closing plate or to the sealing membrane.

[0022] In accordance with one embodiment, the support wall includes fixing orifices, the insulating blocks being anchored to the support wall by means of anchor devices that come to be inserted in the fixing orifices, and during the production of the second weld bead the second fixing surface of the welding support is fixed by means of anchor devices that come to be inserted in the fixing orifices of the support wall left free by the devices anchoring the insulating blocks.

[0023] In accordance with one embodiment, the tank wall is inclined relative to the horizontal and the tank wall is preferably a vertical wall.

[0024] In accordance with one embodiment, the second end of the attachment bar is equipped with a wheel provided with a spring so that the wheel is pressed at all times against the support surface of the welding support during the production of the weld bead.

[0025] In accordance with one embodiment, the welding torch is an electric arc welding torch, advantageously with no addition of material and with a flow of inert gas, such as for example a tungsten electrode torch with flow of argon.

[0026] In accordance with one embodiment, the thermally-insulating barrier is a secondary thermally-insulating barrier and the sealing membrane is a secondary sealing membrane and the tank wall includes in the direction of thickness a primary thermally-insulating barrier disposed at least partly on the secondary sealing membrane and a primary sealing membrane fixed to the primary thermally-insulating barrier and intended to be in contact with a liquefied gas.

[0027] In accordance with one embodiment, the secondary sealing membrane is made of a composite material including a sheet of aluminium sandwiched between two glass fibre sheets.

5 [0028] In accordance with one embodiment, an edge of the secondary sealing membrane is glued to the metal closing plate or to the second flange.

[0029] In accordance with one embodiment, the thermally-insulating barrier is a primary thermally-insulating barrier and the sealing membrane is a primary sealing membrane and the tank wall includes in the direction of thickness a secondary thermally-insulating barrier arranged between the primary thermally-insulating barrier and the support wall and a secondary sealing membrane arranged between the secondary thermally-insulating barrier and the primary thermally-insulating barrier, a first part of the primary thermally-insulating barrier being disposed on the secondary sealing membrane and a second part being disposed against the support wall, said edge portion of the primary thermally-insulating barrier being situated in the second part of the primary thermally-insulating barrier, the first part and the second part of the primary thermally-insulating barrier being adjacent to one another in line with an edge portion of the secondary thermally-insulating barrier.

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[0030] In accordance with one embodiment, the invention also provides a welding system including a welding support and an automatic welding machine, in which the welding support includes a plane fixing surface and a plane support surface perpendicular to the fixing surface, the support surface carrying a guide means, for example a guide rail, extending in a direction, the welding machine including a displacement system cooperating with the guide means and configured to move the welding machine in the direction of the guide rail, the welding machine also including an attachment bar fixed to the displacement system and having a first end remote from the displacement system and a second end remote from the displacement system, the first end and the second end being situated on respective opposite sides of the displacement system in a direction parallel to the support surface and perpendicular to the direction of the guide means, a welding torch being fixed to the first end and a counterweight being fixed to the second end to cooperate with the support surface at a distance from the guide means.

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[0031] In accordance with one embodiment, the fixing surface of the welding support is a first fixing surface and the welding support further includes a second fixing surface perpendicular to the first fixing surface and parallel to the support surface.

Brief description of the figures

[0032] The invention will be better understood and other aims, details, features and advantages thereof will become more clearly apparent in the course of the following description with reference to the appended drawings of particular embodiments of the invention provided by way of non-limiting illustration only.

5 [0033] [Fig. 1] Figure 1 is a diagrammatic cutaway representation of a terrestrial storage installation.

[0034] [Fig. 2] Figure 2 is an exploded view of the detail II in figure 1.

[0035] [Fig. 3] Figure 3 is an exploded view of the detail III in figure 1.

10 [0036] [Fig. 4] Figure 4 is a diagrammatic side view of a secondary membrane closure zone in accordance with a first embodiment during a first welding operation.

[0037] [Fig. 5] Figure 5 is a diagrammatic side view of a secondary membrane closure zone in accordance with a second embodiment during a first welding operation.

[0038] [Fig. 6] Figure 6 is a diagrammatic side view of a primary membrane closure zone in accordance with the first embodiment during a first welding operation.

15 [0039] [Fig. 7] Figure 7 is a diagrammatic side view of a secondary membrane closure zone during a second welding operation.

Description of the embodiments

20 [0040] The invention will be described hereinafter with reference to a liquefied gas storage installation that bears the reference 1 in the following description. The installation 1 is adapted to store a liquefied gas, in particular liquefied natural gas (LNG) at a temperature of approximately -162°C and at atmospheric pressure or other liquefied gases. The installation 1 may equally be adapted to store other types of liquid, in particular at ambient temperature.

25 [0041] The installation 1 mainly includes a support structure 10 and a sealed and thermally-insulating tank 20 installed in the internal space of the support structure 10.

[0042] The support structure 10 comprises a bottom support wall 11 and a vertical support wall 12.

30 [0043] The installation 1 may be intended to be situated on land. The bottom support wall 11 is then typically horizontal, that is to say situated in a plane perpendicular to the direction of the acceleration due to gravity to within dimensional tolerances. The bottom support wall 11 may be situated at ground level or possibly below ground level. The support structure 10 is for example made of concrete.

[0044] Alternatively, the installation 1 may be intended to be installed onboard a floating structure, such as a ship. In this case, the support structure 10 is a portion of a double hull that is part of the floating structure. When the floating structure is at rest the bottom support wall 11 may not be horizontal, and even situated in a plane parallel to the direction of the acceleration due to gravity to within the dimensional tolerances.

[0045] The remainder of the description will refer more particularly to a terrestrial storage installation 1. The contour of the bottom support wall 11 is intended to have the shape of a regular polygon with N sides, where N is an integer greater than or equal to 3. N is preferably even. An installation 1 in which N is equal to 8 or 56 is of more particular interest.

[0046] As can be seen better in figure 1, the vertical support wall 12 forms a polygonal cylindrical surface with as its directrix the polygonal contour of the bottom support wall 11. The vertical support wall 12 extends in a vertical direction, that is to say in a direction perpendicular to the plane of the bottom support wall 11 to within the dimensional tolerances.

[0047] At the edge of the vertical support wall 12 opposite the bottom support wall 11 the support structure 10 comprises a cover support wall 13 closing the internal space delimited by the bottom support wall 11 and the vertical support wall 12. This cover support wall can support various types of equipment usable to route liquefied gas from or to this internal space.

[0048] The sealed and thermally-insulating tank 20 is installed in the internal space of the support structure 10. The tank 20 includes a bottom wall 21 disposed on the bottom support wall 11 and a vertical wall 22 disposed on the vertical support wall 12.

[0049] In the direction from the support structure toward the interior space of the tank 20 the bottom wall 21 and the vertical wall 22 include a secondary thermally-insulating barrier 23, a secondary sealing membrane 24, a primary thermally-insulating barrier 25 and a primary sealing membrane 26 intended to be in contact with the liquefied gas contained in the tank 20.

[0050] The bottom wall 21 and the vertical wall 22 can be produced from modular elements. In the embodiment described here, these modular elements correspond to the GST® technology marketed by the applicant, for example. See also the document US 6,035,795 for the description of certain modular elements.

[0051] Also by way of example, membrane tanks of this kind are described in particular in the patent applications WO2019239048, WO14057221, FR2691520 and FR2877638.

[0052] There will be described more particularly hereinafter two particular zones of the vertical wall 22, namely the closure zone of the secondary sealing membrane 24 and the closure zone of the primary sealing membrane 26. On the vertical wall 22 of the terrestrial storage installation 1 represented in figure 1 the secondary sealing membrane 24 and the secondary thermally-insulating barrier 23 are intended to extend only from a lower edge of the vertical wall to a predetermined height of the vertical wall 22 at a distance from the upper edge of the vertical wall. This predetermined height is for example of the order of 5 m.

[0053] The secondary sealing membrane 24 is therefore closed at the predetermined height so as to be connected to the vertical support wall 12. Beyond this predetermined height of the vertical wall 22 and as far as the vicinity of the cover support wall 13 the vertical wall 22 includes only the primary thermally-insulating barrier 25 that is fixed directly to the vertical support wall 12 and the primary sealing membrane 26. Because of this, in the vicinity of the cover support wall 13 there is also provision for closing the primary sealing membrane so as to connect it to the vertical support wall 12.

[0054] Figure 2 shows more particularly the closure zone of the secondary sealing membrane 24 while figure 3 represents more particularly the closure zone of the primary sealing membrane 26.

[0055] As partially represented in figure 2, the secondary thermally-insulating barrier 23 includes a plurality of secondary insulating blocks 231 juxtaposed to one another and an edge secondary insulating block 232 situated at an edge of the secondary thermally-insulating barrier 23 formed at the level of the predetermined height of the vertical wall 22. As represented in figure 2, in this embodiment the secondary insulating blocks 231 are pre-assembled with a portion of the secondary sealing membrane 24 as well as one or more primary insulating blocks 251. These portions of the secondary sealing membrane 24 are then connected to one another by means of flexible tapes (not represented).

[0056] The secondary sealing membrane 24 is closed at the level of the edge secondary insulating block 232. Closure is effected by means of a metal connecting angle-iron 30 including a first flange 31 that comes to be welded to a part of the vertical support wall 12 and a second flange 32 connected to the secondary sealing membrane 24. As represented in figure 2, the first flange 31 and the second flange 32 form a right-angle part that comes to be positioned at the level of an edge of the edge secondary insulating block 232. In the first embodiment represented in figures 2 to 4 in particular said vertical support wall portion 12 is an anchor flat 14 projecting from the vertical support wall 12 in the direction of

thickness of the vertical wall 22 and extending parallel to a lateral edge of the edge secondary insulating block 232.

[0057] A metal secondary closing plate 27 is fixed to a surface of the edge secondary insulating block 232 opposite the vertical support wall 12 by means of fixing devices (not represented) passing through orifices 29 formed in the secondary closing plate 27. Depending on the type of sealing membrane used one edge of the secondary sealing membrane 24 is fixed to the metal secondary closing plate 27 by gluing or welding.

[0058] The second flange 32 of the connecting angle-iron 30 thus comes to be welded to the secondary closing plate 27 so as to connect the connecting angle-iron 30 and the secondary sealing membrane 24 in sealed manner.

[0059] The first flange 31 is welded to the anchor plate 14 by means of a first weld bead 33 the step of welding whereof is explained hereinafter with reference to figure 4. The second flange 32 is welded to the secondary closing plate 27 by means of a second weld bead 34 the step of welding whereof is explained hereinafter with reference to figure 7.

[0060] As partially represented in figure 3, the primary thermally-insulating barrier 25 includes a plurality of primary insulating blocks juxtaposed to one another and an edge primary insulating block 252 situated at one edge of the primary thermally-insulating barrier 25 formed in the vicinity of the cover support wall 13.

[0061] In a manner analogous to the secondary sealing membrane 24, the primary sealing membrane (not represented) is closed at the level of the edge primary insulating block 252. The closure is also effected by means of a metal connecting angle-iron 30 including a first flange 31 that comes to be welded to an anchor flat 14 of the vertical support wall 12 and a second flange 32 welded to a metal primary closing plate 28. The primary closing plate 28 is fixed to a surface of the edge primary insulating block 252 opposite the vertical support wall 12.

[0062] As represented in figure 3, but as is equally valid at the level of the secondary sealing membrane 24, connecting angle-irons 30 are welded to one another so as to form a continuous closure on the vertical wall 22 all around the bottom wall 21.

[0063] Figures 4 and 5 represent the step in accordance with two embodiments of producing the first weld bead 33 between the first flange 31 and the portion of the vertical support wall 12 in such a manner as to effect the closing of the second sealing membrane 24.

[0064] A welding support 50 and an automatic welding machine 40 are used to perform the welding. The welding support 50 includes a plane first fixing surface 51, a plane second

fixing surface 52 that is connected perpendicularly to the first fixing surface 51 and a plane support surface 53 that is connected perpendicularly to the first fixing surface 51 so as to be parallel to the second fixing surface 52. In accordance with the first embodiment represented in figure 4, the support surface 53 is equipped with a guide rail 54 extending parallel to the anchor flat 14.

[0065] The automatic welding machine 40 includes a displacement system 41 cooperating with the guide rail 54 that is configured to move the welding machine 40 in a forward movement parallel to the direction of the guide rail 54. The welding machine 40 also includes an attachment bar 42 fixed to the displacement system 41 and having a first end remote from the displacement system 41 and a second end remote from the displacement system 41. The first end and the second end are situated on respective opposite sides of the displacement system 41. A welding torch 43 is fixed to the first end of the attachment bar 42 while a counterweight 44 is fixed to the second end. The second end of the attachment bar 42 is also equipped a wheel 45 provided with a spring so that the wheel 45 is pressed at all times against the support surface 53 of the welding support 50.

[0066] During the production of the first weld bead 33 the first fixing surface 51 of the welding support 50 is fixed to the edge secondary insulating block 232 so that the support surface 53 is perpendicular to the vertical support wall 12. As represented in figures 4 and 5, one or more anchor devices 60 come to fix the first fixing surface 51 to the edge secondary insulating block 232, passing through the orifices 29 in the secondary closing plate 27. The welding machine 40 therefore moves on the support surface 53 so that the welding torch 43 is situated in the vicinity of the zone to be welded between the first flange 31 and the anchor flat 14.

[0067] The second embodiment illustrated in figure 5 differs from the embodiment from figure 4 in that the first flange 31 is not welded to an anchor flat but to a fixed metal portion 15 parallel to the vertical support wall 12. In the situation where the vertical support wall 12 is made of metal, this metal portion 15 is simply a portion of the vertical support wall 12. In this embodiment the first flange 31 therefore includes a bent end, the end remote from the second flange 32, so as to extend parallel to the metal portion 15. The bent end and the metal portion 15 are thus welded to one another by the first weld bead 33.

[0068] This welding step is carried out in an analogous manner to that for the primary sealing membrane whether that be in the first embodiment, represented in figure 6 or in the second embodiment (not represented). In fact, the welding machine 40 is also used to weld a first flange 31 of a connecting angle-iron 30 to an anchor flat 14 by means of a second weld

bead 33 at the level of the edge primary insulating block 252 of the primary thermally-insulating barrier 25. The welding support 50 is also fixed at the level of the first fixing surface 51 to a surface of the edge primary insulating block 252 opposite the vertical support wall 12 by means of one or more anchor devices 60. For its part the second flange 32 is welded to a primary closing plate 28. An edge of the primary sealing membrane thereafter comes to be welded to the second flange 32 or alternatively to the primary closing plate 28.

[0069] Figure 7 shows the step of producing the second weld bead 34 between the second flange 32 and the secondary closing plate 27 so as to close the secondary sealing membrane 24.

[0070] During the production of the second weld bead 34 the second fixing surface 52 of the welding support 50 is fixed to the vertical support wall 12 so that the support surface 53 is parallel to the surface of the edge secondary insulating block 232 opposite the vertical support wall 12. As shown in figure 7, one or more anchor devices 60 come to fix the second fixing surface 52 to the vertical support wall 12, passing through orifices 16 formed in the vertical support wall 12. In addition, the welding support 50 may include a fixing leg 55 fixed on the one hand to the support surface 53 and on the other hand to the vertical support wall 12 at the level of other orifices 16 in order to increase the number of anchor points. The welding machine 40 therefore moves on the support surface 53 so that the welding torch 43 is located close to the area to be welded between the second wing 32 and the secondary closing plate 27.

[0071] Although the invention has been described with reference to particular embodiments, it is obvious that it is in no way limited thereto and that it includes all technical equivalents of the means described and combinations thereof if they fall within the scope of the invention.

[0072] The use of the verb "to comprise" or "to include" and its conjugate forms does not exclude the presence of elements or steps other than those set out in a claim.

[0073] In the claims, any reference sign between parentheses should not be interpreted as a limitation of the claim.

Claims

[Claim 1] Method of closing a sealing membrane (24, 26) for a sealed tank, said tank

being in particular thermally insulative, the method including the following steps:

5 - furnishing a tank wall (22) fixed to a support wall (12), the tank wall including in a direction of thickness a thermally-insulating barrier (23, 25) and a sealing membrane (24, 26) fixed to the thermally-insulating barrier (23, 25), the thermally-insulating barrier (23, 25) including an edge portion (232, 252) situated at one edge of the thermally-insulating barrier (23, 25) in a first direction,

10 - fixing a metal connecting angle-iron (30) at the level of the edge portion (232, 252), the metal connecting angle-iron (30) including a first flange (31) and a second flange (32) connected to the first flange (31), by welding the first flange (31) by means of a weld bead (33, 34) to a metal part (14, 15) on the support wall, and by connecting the second flange (32) to the sealing membrane (24, 26),

15 in which the step of welding the first flange is carried out using an automatic welding machine (40) moving on a welding support (50), the welding support (50) including a fixing surface (51) and a support surface (53) perpendicular to the fixing surface (51), the support surface (53) including a guide means (54), in particular a guide rail, extending in a second direction perpendicular to the first direction and to the direction of thickness, the welding machine (40) including a displacement system (41)

20 cooperating with the guide means (54) and configured to move the welding machine (40) in a forward movement parallel to the second direction, the welding machine (40) also including a welding torch (43),

25 and in which during welding of the first flange the fixing surface (51) of the welding support (50) is fixed to the edge portion (232, 252) of the thermally-insulating barrier so that the support surface (53) is perpendicular to the first direction.

[Claim 2] Closing method according to claim 1, in which the welding machine also includes an attachment bar (42) fixed to the displacement system (41) and having a first end remote from the displacement system (41) and a second end remote from the displacement system (41), the first end and the second end being situated on

30 respective opposite sides of the displacement system in the direction of thickness, the welding torch (43) being fixed to the first end and a counterweight (44) being fixed to the second end.

[Claim 3] Closing method according to claim 1 or claim 2, in which the first flange (31) is formed in a plane perpendicular to the first direction and the second flange (32) is formed in a plane perpendicular to the direction of thickness.

5 [Claim 4] Closing method according to any one of claims 1 to 3, in which the metal part on the support wall (12) is an anchor flat (14) projecting from the support wall in the direction of thickness and extending in the second direction, the edge portion (232, 252) of the thermally-insulating barrier being adjacent to the anchor flat.

[Claim 5] Closing method according to any one of claims 1 to 3, in which the metal part on the support wall is a metal portion (15) of the support wall (12).

10 [Claim 6] Closing method according to any one of claims 1 to 5, in which the thermally-insulating barrier (23, 25) includes a plurality of insulating blocks (231) juxtaposed to one another and the edge portion of the thermally-insulating barrier includes an edge insulating block (232, 252).

15 [Claim 7] Closing method according to any one of claims 1 to 6, in which the weld bead is a first weld bead (33), a metal closing plate (27, 28) being fixed to at least a portion of a surface of the edge portion (232, 252) of the thermally-insulating barrier opposite the support wall (12), an edge of the sealing membrane (24, 26) being fixed to the metal closing plate (27, 28), and in which during the step of fixing the connecting angle-iron (30) the second flange (32) is welded by means of a second weld bead (34) to the
20 metal closing plate (27, 28).

[Claim 8] Closing method according to claim 7, in which the closing plate (27, 28) includes fixing orifices (29), the closing plate (27, 28) being fixed to the edge portion (232, 252) of the thermally-insulating barrier by means of an anchoring device coming to be inserted in the fixing orifices, and in which during the production of the first weld bead (33) the fixing surface (51) of the welding support (50) is fixed by means of anchor devices (60) that come to be inserted in the fixing orifices (29) left free by the devices anchoring the closing plate (27, 28).
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[Claim 9] Closing method according to claim 7 or claim 8, in which the fixing surface of the welding support (50) is a first fixing surface (51) and the welding support (50) includes a second fixing surface (52) perpendicular to the first fixing surface and parallel to the support surface (53), and in which during the production of the second weld bead (34) the second fixing surface (52) of the welding support (50) is fixed against the support wall (12) so that the support surface (53) is parallel to, preferably coplanar with, the sealing membrane (24, 26), the second weld bead being produced
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by means of said automatic welding machine (40) moving on the guide means of the welding support (50), said welding support (50) being used to produce both the first weld bead and the second weld bead.

5 [Claim 10] Closing method according to claim 9 in combination with claim 6, in which the support wall (12) includes fixing orifices (16), the insulating blocks (231) being anchored to the support wall by means of anchor devices that come to be inserted in the fixing orifices (16), and in which during the production of the second weld bead (34) the second fixing surface (52) of the welding support (50) is fixed by means of anchor devices (60) that come to be inserted in the fixing orifices (16) of the support wall (12)
10 left free by the devices anchoring the insulating blocks (231).

[Claim 11] Closing method according to any one of claims 1 to 10, in which the tank wall is inclined relative to the horizontal and the tank wall is preferably a vertical wall (22).

[Claim 12] Closing method according to any one of claims 1 to 11, in which the welding torch (43) is an electric arc welding torch, advantageously with no addition of material
15 and with a flow of inert gas, such as for example a tungsten electrode torch with flow of argon.

[Claim 13] Closing method according to any one of claims 1 to 12, in which the thermally-insulating barrier is a secondary thermally-insulating barrier (23) and the sealing membrane is a secondary sealing membrane (24) and in which the tank wall (22)
20 includes in the direction of thickness a primary thermally-insulating barrier (25) disposed at least partly on the secondary sealing membrane and a primary sealing membrane fixed to the primary thermally-insulating barrier (25) and intended to be in contact with a liquefied gas.

[Claim 14] Closing method according to claim 13, in which the secondary sealing
25 membrane (24) is made of a composite material including a sheet of aluminium sandwiched between two glass fibre sheets.

[Claim 15] Closing method according to any one of claims 1 to 12, in which the thermally-insulating barrier is a primary thermally-insulating barrier (25) and the sealing membrane is a primary sealing membrane and in which the tank wall (22) includes in
30 the direction of thickness a secondary thermally-insulating barrier (23) arranged between the primary thermally-insulating barrier and the support wall and a secondary sealing membrane (24) arranged between the secondary thermally-insulating barrier and the primary thermally-insulating barrier, a first part of the primary thermally-insulating barrier (25) being disposed on the secondary sealing membrane (24) and a

second part being disposed against the support wall (12), said edge portion (252) of the primary thermally-insulating barrier (25) being situated in the second part of the primary thermally-insulating barrier (25), the first part and the second part of the primary thermally-insulating barrier (25) being adjacent to one another in line with an edge portion (232) of the secondary thermally-insulating barrier (23).

[Claim 16] Welding system including a welding support (50) and an automatic welding machine (40), in which the welding support (50) includes a plane fixing surface (51) and a plane support surface (53) perpendicular to the fixing surface, the support surface (53) carrying a guide means (54) extending in a direction, the welding machine (40) including a displacement system (41) cooperating with the guide means (54) and configured to move the welding machine (40) in the direction of the guide means (54), the welding machine (40) also including an attachment bar (42) fixed to the displacement system (41) and having a first end remote from the displacement system (41) and a second end remote from the displacement system, the first end and the second end being situated on respective opposite sides of the displacement system (41) in a direction parallel to the support surface and perpendicular to the direction of the guide means, a welding torch (43) being fixed to the first end and a counterweight (44) being fixed to the second end to cooperate with the support surface at a distance from the guide means.

[Claim 17] System according to claim 16, in which the fixing surface of the welding support (50) is a first fixing surface (51) and the welding support (50) further includes a second fixing surface (52) perpendicular to the first fixing surface and parallel to the support surface (53).