CLAIMS

1. An impermeable and thermally insulated tank built into a structure that includes a load-bearing wall, said tank having a tank wall attached to said load-bearing wall, the tank wall comprising:

a thermally insulated barrier held on the load-bearing wall and made up of cuboid thermally insulated blocks, juxtaposed in parallel rows separated from one another by gaps,

an impermeable barrier carried by the thermally insulated barrier, said impermeable barrier comprising a metal membrane formed of metal sheets welded together sealingly,

at least some of the insulated blocks of the thermally insulated barrier carrying, on the face of same opposite the load-bearing wall, at least two substantially orthogonal metal connecting strips, arranged parallel to the sides of the insulated block, the sheets of the metal membrane carried by said insulated block being welded to said strips, said connecting strips being rigidly connected to the insulated block bearing same, the adjacent metal sheets of the impermeable barrier being welded in an overlapping manner on top of the connecting strips carried respectively by the thermally insulated barrier;

a plurality of sheets of the metal membrane each having at least two orthogonal folds parallel to the sides of the thermally insulated blocks, said folds being inserted in the gaps formed between the insulating blocks.

2. The tank as claimed in claim 1, wherein the tank wall has a primary element and a secondary element arranged between the load-bearing wall and the primary element, both the primary element and the secondary element including a thermally insulated barrier made up of cuboid thermally insulated blocks, juxtaposed in parallel rows and both the primary and secondary elements including an impermeable barrier arranged on the thermally insulated barrier, the thermally insulated barrier of the secondary element being rigidly connected to the load-bearing wall, the thermally insulated barrier of the primary element being rigidly connected using attachment means connected to the thermally insulated barrier of the secondary element.

3. The tank as claimed in claim 2, wherein the impermeable barrier of the secondary element is formed by the metal membrane comprising a plurality of sheets each having at least two orthogonal folds parallel to the sides of the thermal insulated blocks, inserted in the gaps formed between the insulated blocks of the secondary element.

4. The tank as claimed in claim 3, wherein the sheets of the metal membrane of the secondary element are made of an iron alloy with nickel or manganese, having a coefficient of expansion not exceeding 7×10^{-6} K^{-1}.

5. The tank as claimed in claim 2, wherein the impermeable barrier of the primary element is formed of metal sheets welded together sealingly, with folds oriented towards the inside of the tank.

6. The tank as claimed in claim 2, wherein the insulated block of the thermally insulated barrier has a base plate on which is arranged a foam layer, the base plate overhanging the foam.

7. The tank as claimed in claim 6, wherein the insulated block of the thermally insulated barrier of the secondary element is pressed against the load-bearing wall using fixtures welded to the load-bearing wall and cooperating with the overhanging zones of the base plate of the insulated block.

8. The tank as claimed in claim 2, wherein the insulated block of the thermally insulated barrier of the secondary element is held on the load-bearing wall by bonding.

9. The tank as claimed in claim 2, wherein each insulated block of the thermally insulated barrier of the secondary element carries the two connecting strips that are arranged along the two axes of symmetry of the rectangle defined by a large face of said insulated block.

10. The tank as claimed in claim 9, wherein the attachment means of the thermally insulated barrier of the primary element include a continuous metal plate arranged at the intersection of the two connecting strips at the center of the rectangle of each insulated block of the secondary element such as to form an impermeable zone to which the corners of the four sheets can be welded around said attachment means, and a projecting member crossing the impermeable barrier of the secondary element without reaching the impermeable barrier of the primary element.

11. The tank as claimed in claim 10, wherein the projecting members are studs, the bases of which are attached to the continuous metal plate placed at the intersection of the two

connecting strips of the insulated block of the secondary element, an intermediate part being interposed between firstly a nut cooperating with the thread provided at the free extremity of the stud and secondly the overhanging parts of the plates of the insulated blocks of the thermally insulated barrier of the primary element.

12. The tank as claimed in claim 2, wherein each insulated block of the thermally insulated barrier of the primary element has two connecting strips that are arranged in the vicinity of the edges of a large face of said insulated block.

13. The tank as claimed in claim 1, wherein the connecting strips of the insulated block are seated in recesses formed in the insulated block bearing same so as not to increase the thickness on the corresponding face of the insulated block.

14. The tank as claimed in claim 13, wherein the connecting strip of the insulated block is attached to the recess of same by screwing, riveting, stapling or bonding.

15. The tank as claimed in claim 1, wherein the metal sheets, which form the impermeable barrier, are rectangular and each have two folds formed along the axes of symmetry of the rectangle formed by the edges of the rectangular sheet.

16. The tank as claimed in claim 15, wherein the two folds of the sheet of the impermeable barrier intersect at the center of the rectangular sheet.

17. The tank as claimed in claim 15, wherein one of the folds of the sheet of the impermeable barrier is continuous and the other is interrupted in the central portion of same.

18. The tank as claimed in claim 17, wherein the impermeable barrier includes sheets of a first type that have a continuous fold along the major axis of same and sheets of a second type that have a continuous fold along the minor axis of same, the first and second types of sheet alternating regularly on a tank wall so that one sheet of one of the types is always surrounded by four sheets of the other type arranged along the four sides of same.

19. The tank as claimed in claim 1, wherein each insulated block of the thermally insulated barrier has two series of orthogonal slots, each of said series having slots arranged parallel to

two opposing sides of the insulated block, and in that the sheets of the metal membrane each have two series of supplementary folds, each of said series of supplementary folds having folds orthogonal to the folds in the other series, parallel to one of the two folds inserted in the gaps, and inserted into the slots of one of the series of slots formed in the insulated block.

20. The tank as claimed in claim 1, wherein the metal membrane has a second plurality of sheets, each of the sheets in the second plurality having a single fold parallel to two opposing sides of the insulated blocks, said fold being inserted into a gap formed between two insulated blocks.

21. The tank as claimed in claim 1, wherein each insulated block of the thermally insulated barrier has a slot parallel to two opposing sides of the insulated blocks and in which the metal membrane has a second plurality of sheets, each of the sheets in the second plurality having a fold inserted in a slot formed in an insulated block and a fold inserted in a gap formed between two insulated blocks.

22. A ship used to transport a liquid product, the ship having a double hull and a tank as claimed in claim 1 placed inside the double hull.

23. A method of using a ship as claimed in claim 22 for loading or offloading a liquid product, comprising the step of channeling a liquid product through insulated pipes to or from an onshore or floating storage facility to or from the tank on the ship.

24. A transfer system for a liquid product, the system including a ship as claimed in claim 22, insulated pipes arranged to connect the tank installed in the hull of the ship to an onshore or floating storage facility and a pump for driving a flow of liquid product through the insulated pipes to or from the onshore or floating storage facility to or from the tank on the ship.

25. The tank as claimed in claim 2, wherein the attachment means of the thermally insulated barrier of the primary element include a continuous metal plate arranged at the intersection of the two connecting strips to form an impermeable zone to which the corners of the four sheets can be welded around said attachment means, and a projecting member crossing the impermeable barrier of the secondary element without reaching the impermeable barrier of the primary element.

26. The tank as claimed in claim 1, wherein the plurality of sheets of the metal membrane each having at least two orthogonal folds inserted in the gaps formed between the insulating blocks are welded to the connecting strips.

27. The tank as claimed in claim 1, wherein the plurality of sheets of the metal membrane each having at least two orthogonal folds inserted in the gaps formed between the insulating blocks are juxtaposed and are welded together sealingly.

28. The tank as claimed in claim 1, wherein each insulating block of the thermally insulated barrier is covered by at least four sheets of the plurality of sheets of the metal membrane each having at least two orthogonal folds inserted in the gaps formed between the insulating blocks.

29. The tank as claimed in claim 1, wherein the two metal connecting strips that are carried by each insulating block of the thermally insulated barrier are arranged along the two axes of symmetry of a rectangle defined by a large face of said insulating block;
wherein the plurality of sheets of the metal membrane each having at least two orthogonal folds inserted in the gaps formed between the insulating blocks are welded to the connecting strip and are rectangular, the orthogonal folds being formed along the axes of symmetry of the rectangle formed by the edges of the rectangular sheet.

30. An impermeable and thermally insulated tank built into a structure that includes a load-bearing wall, said tank having a tank wall attached to said load-bearing wall, the tank wall comprising:

a thermally insulated barrier held on the load-bearing wall and made up of cuboid thermally insulated blocks, juxtaposed in parallel rows separated from one another by gaps,

an impermeable barrier carried by the thermally insulated barrier, said impermeable barrier comprising a metal membrane formed of metal sheets welded together sealingly,

at least some of the insulating blocks of the thermally insulated barrier carrying, on the face of same opposite the load-bearing wall at least two substantially orthogonal metal connecting strips, arranged parallel to the sides of the insulating block, the sheets of the metal membrane carried by said insulating block being welded to said strips, said connecting strips being rigidly connected to the insulating block bearing same,

a plurality of sheets of the metal membrane each having at least two orthogonal folds parallel to the sides of the thermal insulating blocks, said folds being inserted in the gaps formed between the insulating blocks;

wherein each insulating block of the thermally insulated barrier has two series of orthogonal slots, each of said series having slots arranged parallel to two opposing sides of the insulating block, and in that the sheets of the metal membrane each have two series of supplementary folds, each of said series of supplementary folds having folds orthogonal to the folds in the other series, parallel to one of the two folds inserted in the gaps, and inserted into the slots of one of the series of slots formed in the insulating block.

31. An impermeable and thermally insulated tank built into a structure that includes a load-bearing wall, said tank having a tank wall attached to said load-bearing wall, the tank wall comprising:

a thermally insulated barrier held on the load-bearing wall and made up of cuboid insulating blocks, juxtaposed in parallel rows separated from one another by gaps,

an impermeable barrier carried by the thermally insulated barrier, said impermeable barrier comprising a metal membrane formed of metal sheets welded together sealingly,

at least some of the insulating blocks of the thermally insulated barrier carrying, on the face of same opposite the load-bearing wall at least two substantially orthogonal metal connecting strips, arranged parallel to the sides of the insulating block, the sheets of the metal membrane carried by said insulating block being welded to said strips, said connecting strips being rigidly connected to the insulating block bearing same,

a plurality of sheets of the metal membrane each having at least two orthogonal folds parallel to the sides of the thermal insulating blocks, said folds being inserted in the gaps formed between the insulating blocks ;

wherein each insulating block of the thermally insulated barrier has a slot parallel to two opposing sides of the insulating blocks and in which the metal membrane has a second plurality of sheets, each of the sheets in the second plurality having a fold inserted in a slot formed in an insulating block and a fold inserted in a gap formed between two insulating blocks.

CLAIMS

1. A fluidtight and thermally insulated tank built into a structure that includes a load-bearing wall, said tank having a tank wall attached to said load-bearing wall (3), the tank wall comprising:

- a thermal insulation barrier held on the load-bearing wall (3) and made up of right-angled parallelepiped insulating blocks (1), juxtaposed in parallel rows separated from one another by gaps (10),

- a fluidtight barrier carried by the thermal insulation barrier, said fluidtight barrier comprising a metal membrane formed of metal sheets (11) welded together sealingly,

- each insulating block of the thermal insulation barrier carrying, on the face of same opposite the load-bearing wall (3), at least two substantially orthogonal metal connecting strips (5, 6), arranged parallel to the sides of the insulating block, the sheets (11) of the metal membrane carried by said insulating block being welded to said strips, said connecting strips being rigidly connected to the insulating block bearing same,

- a plurality of sheets (11) of the metal membrane each having at least two orthogonal folds (12a, 12b) parallel to the sides of the thermal insulating blocks (1), said folds being inserted in the gaps (10) formed between the insulating blocks.

2. The tank as claimed in claim 1, characterized in that the tank wall has a primary element and a secondary element arranged between the load-bearing wall and the primary element, both the primary element and the secondary element including a thermal insulation barrier made up of right-angle parallelopiped insulating

blocks (1, 13), juxtaposed in parallel rows and both the primary and secondary elements including a fluidtight barrier arranged on the thermal insulation barrier, the thermal insulation barrier of the secondary element being rigidly connected to the load-bearing wall (3), the thermal insulation barrier of the primary element being rigidly connected using attachment means (8, 18) connected to the thermal insulation barrier of the secondary element.

3. The tank as claimed in claim 2, characterized in that the fluidtight barrier of the secondary element is formed by the metal membrane comprising a plurality of sheets (11) each having at least two orthogonal folds (12a, 12b) parallel to the sides of the thermal insulating blocks (1), inserted in the gaps (10) formed between the insulating blocks of the secondary element.

4. The tank as claimed in claim 3, characterized in that the sheets (11) of the metal membrane of the secondary element are made of an alloy of iron with nickel or manganese, having a coefficient of expansion not exceeding 7×10^{-6} K^{-1}.

5. The tank as claimed in any one of claims 2 to 4, characterized in that the fluidtight barrier of the primary element is formed of metal sheets (15) welded together sealingly, with folds (16a, 16b) oriented towards the inside of the tank.

6. The tank as claimed in one of claims 2 to 5, characterized in that an insulating block (1, 13) of the thermal insulation barrier has a base plate (2a, 13a) on which is arranged a foam layer, the base plate overhanging the foam.

7. The tank as claimed in claim 6, characterized in that an insulating block (1) of the thermal insulation barrier of the secondary element is pressed against the load-bearing wall (3) using fixtures (9) welded to the load-bearing wall and cooperating with the overhanging zones of the base plates (2a) of the insulating block.

8. The tank as claimed in one of claims 2 to 7, characterized in that an insulating block (1) of the thermal insulation barrier of the secondary element is held on the load-bearing wall by bonding.

9. The tank as claimed in one of claims 2 to 8, characterized in that each insulating block (1) of the thermal insulation barrier of the secondary element carries said two connecting strips (5, 6) that are arranged along the two axes of symmetry of the rectangle defined by a large face of said insulating block (1).

10. The tank as claimed in claim 9, characterized in that the attachment means of the thermal insulation barrier of the primary element include a continuous metal plate arranged at the crossing of the two connecting strips (5, 6) at the center of the rectangle of each insulating block (1) of the secondary element such as to form a fluidtight zone (39) to which the corners of the four sheets (11) can be welded about said attachment means, and a projecting member (8, 18) crossing the fluidtight barrier of the secondary element without reaching the fluidtight barrier of the primary element.

11. The tank as claimed in claim 10 combined with claim 6, characterized in that the projecting members are studs (8, 18), the bases of which are attached to the continuous metal plate placed at the crossing of two connecting strips of the insulating block of the secondary element, an intermediate part being interposed between firstly a nut (19, 22) cooperating with the thread provided at the free extremity of the stud and secondly the overhanging parts of the plates of the insulating blocks of the thermal insulation barrier of the primary element.

12. The tank as claimed in one of claims 2 to 11, characterized in that each insulating block (13) of the thermal insulation barrier of the primary element has two connecting strips (14a,

14b) that are arranged in the vicinity of the edges of a large face of said insulating block.

13. The tank as claimed in one of claims 1 to 12, characterized in that the connecting strips (5, 6, 14a, 14b) of an insulating block (1, 13) are seated in recesses formed in the insulating block bearing same so as not to increase the thickness on the corresponding face of the insulating block.

14. The tank as claimed in claim 13, characterized in that a connecting strip (5, 6, 14a, 14b) of an insulating block is attached to the recess of same by screwing, riveting, stapling or bonding.

15. The tank as claimed in one of claims 1 to 14, characterized in that the adjacent metal sheets (11, 15) of the fluidtight barrier are lap-welded level with the connecting strips (5, 6, 14a, 14b) carried respectively by the thermal insulation barrier.

16. The tank as claimed in one of claims 1 to 15, characterized in that the metal sheets (11), which form the fluidtight barrier, are rectangular and each have two folds formed along the axes of symmetry of the rectangle formed by the edges of the rectangular sheet.

17. The tank as claimed in claim 16, characterized in that the two folds of a sheet (11) of the fluidtight barrier are secant at the center of the rectangular sheet.

18. The tank as claimed in claim 16, characterized in that one of the folds of a sheet (11) of the fluidtight barrier is continuous and the other is interrupted in the central portion of same.

19. The tank as claimed in claim 18, characterized in that the fluidtight barrier includes sheets (31) of a first type that have a continuous fold along the major axis of same and sheets (32) of a second type have a continuous fold along the minor axis of same, the first and second types of sheet (31, 32) alternating regularly on a tank

wall so that one sheet of one of the types is always surrounded by four sheets of the other type arranged along the four sides of same.

20. The tank as claimed in one of claims 1 to 19, characterized in that each insulating block (1) of the thermal insulation barrier has two series of orthogonal slots (53a, 53b), each of said series having slots (53a, 53b) arranged parallel to two opposing sides of the insulating block (1), and in that the sheets (11) of the metal membrane each have two series of supplementary folds (12c, 12d), each of said series of supplementary folds having folds (12c, 12d) orthogonal to the folds (12d, 12c) in the other series, parallel to one of the two folds (12a, 12b) inserted in the gaps (10), and inserted into the slots (53a, 53b) of one of the series of slots (53a, 53b) formed in the insulating block (1).

21. The tank as claimed in one of claims 1 to 19, characterized in that the metal membrane has a second plurality of sheets (11), each of the sheets in the second plurality having a single fold (12a) parallel to two opposing sides of the insulating blocks (1), said fold being inserted into a gap (10) formed between two insulating blocks.

22. The tank as claimed in one of claims 1 to 19, characterized in that each insulating block (1) of the thermal insulation barrier has a slot parallel to two opposing sides of the insulating blocks and in which the metal membrane has a second plurality of sheets, each of the sheets in the second plurality having a fold (12a) inserted in a slot (53e) formed in an insulating block (1) and a fold (12b) inserted in a gap (10) formed between two insulating blocks.

23. A ship (70) used to transport a cold liquid product, the ship having a double hull (72) and a tank (71) as claimed in one of claims 1 to 22 placed inside the double hull.

24. Use of a ship (70) as claimed in claim 23 for loading or offloading a cold liquid product, in which a cold liquid product is

channeled through insulated pipes (73, 79, 76, 81) to or from a onshore or floating storage facility (77) to or from the tank on the ship (71).

25. A transfer system for a cold liquid product, the system including a ship (70) as claimed in claim 23, insulated pipes (73, 79, 76, 81) arranged to connect the tank (71) installed in the hull of the ship to an onshore or floating storage facility (77) and a pump for driving a flow of cold liquid product through the insulated pipes to or from the onshore or floating storage facility to or from the tank on the ship.