CLAIMS

1. A sealed tank (1) for storing fluid, the tank comprising:
- an outer structure (2) comprising a plurality of tank walls assembled together to form a prismatic structure delimiting an internal space, at least two of the tank walls ~~A sealed tank wall used to form a sealed tank for storing a fluid, the wall~~ comprising:
~~–~~a flat frame (3) including a perimeter (4) and longitudinal stiffening members (5) arranged inside the perimeter (4) in a longitudinal direction such that each longitudinal stiffening member extends from one side of the perimeter (4) to an opposite side of the perimeter (4), the perimeter (4) and the longitudinal stiffening members (5) being designed to form openings (6) in the frame (3),
~~–~~lobed walls fastened to the frame (3) by welding about said openings (6) to close said openings (6), such as to project into a thickness direction orthogonal to the frame (3) and towards the outside of the tank to be formed,
- internal stiffening members (11, 12, 13) positioned in the internal space of the outer structure (2) to form a lattice structure, each internal stiffening member (11, 12, 13) having a first end fastened to the frame (3) of a first of the at least two tank walls and a second end fastened to the frame (3) of a second of the at least two tank walls opposite the first tank wall, the internal stiffening members (11, 12, 13) being fastened to said frames (3) to absorb a force caused by the pressure in said internal space.

2. The sealed tank (1) ~~The tank wall~~ as claimed in claim 1, in which the perimeter (4) has a rectangular shape and comprises a plurality of bars assembled together.

3. The sealed tank (1) ~~The tank wall~~ as claimed in either of claims 1 and 2, in which the frame (3) has complementary stiffening members (14), the complementary stiffening members (14) having a first end fastened to one side of the perimeter (4) and a second end fastened to an opposite side of the perimeter (4) and complementary stiffening members (14) extending in a transverse direction perpendicular to the longitudinal direction of the longitudinal stiffening members (5).

4. The sealed tank (1) ~~The tank wall~~ as claimed in one of claims 1 to 3, in which the wall has a thermally insulating barrier (21) fastened to the frame (3) on the outside of the tank to be formed.

5. The sealed tank (1) ~~The tank wall~~ as claimed in claim 4, in which the thermally insulating barrier (21) has an inner surface shaped to match the lobed walls.

6. The sealed tank (1) ~~The tank wall~~ as claimed in claim 4 or claim 5, in which the thermally insulating barrier (21) has an inner layer (23) made of a flexible deformable insulating material and an outer layer (24) made of a rigid insulating material.

7. The sealed tank (1) ~~The tank wall~~ as claimed in one of claims 1 to 6, in which the lobed walls have curved plates (7) with at least two curved sides (8), and closing plates (10)

positioned on the curved sides (8) of the curved plates (7), the closing plates (10) sealingly linking the curved sides (8) to the frame (3).

8. The sealed tank (1) ~~The tank wall~~ as claimed in claim 7, in which the curved plates (7) are rectangular curved plates (7) with two curved sides (8) and two straight sides (9), the straight sides (9) being welded to the frame (3) on either side of an opening (6).

~~9. A sealed tank (1) for storing fluid, the tank comprising: - an outer structure (2) comprising a plurality of tank walls assembled together to form a prismatic structure delimiting an internal space, at least two of the tank walls being as claimed in claims 1 to 8,~~

~~- internal stiffening members (11, 12, 13) positioned in the internal space of the outer structure (2) to form a lattice structure, each internal stiffening member (11, 12, 13) having a first end fastened to the frame (3) of a first of the at least two tank walls and a second end fastened to the frame (3) of a second of the at least two tank walls opposite the first tank wall, the internal stiffening members (11, 12, 13) being fastened to said frames (3) to absorb a force caused by the pressure in said internal space.~~

~~10.~~9. The sealed tank (1) as claimed in one of claims 1 to 8~~as claimed in claim 9~~, in which an internal stiffening member (11, 12, 13) is positioned level with a longitudinal stiffening member of said frame (3) and extends perpendicular to said tank wall.

~~11.~~10. The sealed tank (1) as claimed in one of claims 1 to 9~~as claimed in claim 9 or claim 10~~, in which each of the tank walls comprises:

a flat frame (3) including a perimeter (4) and longitudinal stiffening members (5) arranged inside the perimeter (4) in a longitudinal direction such that each longitudinal stiffening member extends from one side of the perimeter (4) to an opposite side of the perimeter (4), the perimeter (4) and the longitudinal stiffening members (5) being designed to form openings (6) in the frame (3),

lobed walls fastened to the frame (3) by welding about said openings (6) to close said openings (6), such as to project into a thickness direction orthogonal to the frame (3) and towards the outside of the tank to be formed~~is as claimed in one of claims 1 to 8~~.

~~12.~~11. The sealed tank (1) as claimed in one of claims ~~9~~1 to 10~~1~~, in which the internal stiffening members (11, 12, 13) include first stiffening members (11)

oriented in a first direction, second stiffening members (12) oriented in a second direction different from the first direction, and third stiffening members (13) oriented in a third direction different from the first direction and from the second direction.

~~13.~~12. The sealed tank (1) as claimed in claim 1~~12~~, in which the first direction, the second direction and the third direction form a three-dimensional orthogonal frame.

~~14.~~13. The sealed tank (1) as claimed in claim 1~~12~~ or claim 1~~23~~, in which the internal stiffening members (11, 12, 13) are made of bars (111, 121, 112, 122) of square section.

~~15.~~14. The sealed tank (1) as claimed in claim 1~~12~~ or claim 1~~23~~, in which one of the first stiffening members (11) has at least one orifice (19) that is designed to enable one of the third stiffening members (13) to pass through the first stiffening member (11).

~~16.~~15. The sealed tank (1) as claimed in one of claims 1~~12~~ to 1~~34~~, in which one of the second stiffening members (12) has at least one orifice (19) that is designed to enable one of the third stiffening members (13) to pass through the second stiffening member (12).

~~17.~~16. The sealed tank (1) as claimed in one of claims ~~19~~ to 1~~45~~, in which each internal stiffening member (11, 12, 13) has at least one elongate sheet (15) and at least one profile (16) including a base (17) fastened to the elongate sheet (15) and two flanges (18) on either side of the base (17), the flanges (18) projecting from the elongate sheet (15).

~~18.~~17. The sealed tank (1) as claimed in one of claims 1~~12~~ to 1~~56~~, in which one of the first stiffening members (11) and/or one of the second stiffening members (12) has two elongate sheets (15) and a plurality of profiles (16) positioned between the two elongate sheets (15), the profiles (16) including a base (17) fastened to one of the elongate sheets (15) and two flanges (18) on either side of the base (17), the flanges (18) projecting from each elongate sheet (15), and in which the profiles (16) are spaced apart regularly on the elongate sheet (15).

~~19.~~18. The sealed tank (1) as claimed in claim 1~~34~~ or claim 1~~45~~, in which the orifice (19) that is designed to enable one of the third stiffening members (13) to pass through one of the first stiffening members (11) or one of the second stiffening members (12) is a space formed between the profiles (16).

~~20.~~19. The sealed tank (1) as claimed in one of claims 1~~12~~ to 1~~34~~, in which each third stiffening member (13) comprises a single elongate stiffening member extending from one tank wall to an opposite tank wall.

~~21.~~20. The sealed tank (1) as claimed in one of claims 1~~12~~ to 1~~34~~, in which each third stiffening member (13) has a plurality of third bars (131, 132), the third bars (131, 132) being aligned with one another in the third direction and being spaced apart from one another.

~~22.~~21. The sealed tank (1) as claimed in claim 19~~20~~ or claim 20~~1~~, in which each first stiffening member (11) and/or each second stiffening member (12) has a plurality of first bars (111, 112) and/or second bars (121, 122) respectively, the first bars (111, 112) or the second bars (121, 122) being aligned with one another in the first direction or the second direction respectively, the first bars (111, 112) or the second bars (121, 122) being spaced apart from one another.

~~23.~~22. The sealed tank (1) as claimed in claim 21~~2~~, in which the first bars include two first end bars (111) positioned at the ends of the first stiffening member (11) and at least one first intermediate bar (112) positioned between the first end bars (111), two adjacent first bars (111, 112) being fastened to one another by means of one of the third stiffening members (13).

~~24.~~23. The sealed tank (1) as claimed in claim 21~~2~~ or claim 22~~3~~, in which the second bars include two second end bars (121) positioned at the ends of the second stiffening member (12) and at least one second intermediate bar (122) positioned between the second end bars (121), two adjacent second bars (121, 122) being fastened to one another by means of one of the third stiffening members (13).

~~25.~~24. The sealed tank (1) as claimed in claims 20~~1~~ and 21~~2~~ taken in combination, in which the tank has connectors (33, 34) formed by at least one connection plate (35, 36), two first adjacent bars (111, 112), two second adjacent bars (121, 122) or two third adjacent bars (131, 132) being fastened to one another by means of one of the connectors (33, 34).

~~26.~~25. The sealed tank as claimed in claim 24~~5~~, in which the internal stiffening members (11, 12, 13) and the connectors (33, 34) are designed to be assembled together with at least two degrees of freedom.

~~27.~~26. The sealed tank as claimed in claim 24~~5~~ or claim 25~~6~~, in which the first bars (111, 112), the second bars (121, 122) and the third bars (131, 132) have a pair of parallel fastening slots (38) at each of the ends thereof, and the first bars (111, 112), the second bars (121, 122) and the third bars (131, 132) are designed to be welded to one of the connection plates (35, 36) by inserting said connection plate (35, 36) into the pair of fastening slots (38).

~~28.~~27. The sealed tank (1) as claimed in one of claims 2~~3~~4 to 2~~6~~7, in which the first end bars (111) or the second end bars (121) have a first end fastened to the outer structure (2) and a second end fastened to one of the third stiffening members (13).

~~29.~~28. The sealed tank (1) as claimed in one of claims 1~~9~~ to 2~~7~~8, in which the lattice structure has stiffening-member nodes (28), each stiffening-member node (28) being designed to form an intersection zone in the lattice structure where at least two internal stiffening members cross.

~~30.~~29. The sealed tank (1) as claimed in claim 2~~8~~9, in which the tank has reinforcing stiffening members (29) inclined at an angle of approximately 45° in relation to the first direction, to the second direction or to the third direction, the reinforcing stiffening members (29) being fastened at one of the ends thereof to one of the stiffening-member nodes (28) and at the other of the ends thereof to another of the stiffening-member nodes (28) or one of the tank walls.

~~31.~~30. The sealed tank (1) as claimed in one of claims 1~~9~~ to 29~~30~~, in which a first of said tank walls is fastened to a second of said tank walls by welding the frame of the first tank wall to the frame of the second tank wall.

~~32.~~31. The sealed tank (1) as claimed in one of claims 1~~9~~ to 29~~30~~, in which a first of said tank walls is fastened to a second of said tank walls by means of a lobed corner wall (30), the lobed corner wall (30) having a first straight edge fastened to the perimeter (4) of the first tank wall and a second straight edge fastened to the perimeter (4) of the second tank wall.

~~33.~~32. 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~~9~~ to 3~~1~~2 placed inside the double hull.

~~34.~~33. The ship (70) as claimed in claim 3~~2~~3, in which the sealed tank (1) is fastened to the double hull (72) using cables (25).

~~35.~~34. The ship (70) as claimed in claim 3~~3~~4, in which the sealed tank (1) has a center and edges at the join between the frames (3), the cables (25) being fastened at the edges of the tank and being fastened to the double hull (72) such as

to be oriented orthogonally to the direction linking the center of the tank to the edge where the cable (25) is fastened.

~~36.~~35. A transfer system for a cold liquid product, the system including a ship (70) as claimed in one of claims 3~~2~~3 to 3~~4~~5, 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.

~~37.~~36. A manufacturing method for a prismatic sealed tank (1), in which the method includes the following steps:

- providing several tank walls ~~as claimed in one of claims 1 to 8~~comprising a flat frame (3) including a perimeter (4) and longitudinal stiffening members (5) arranged inside the perimeter (4) in a longitudinal direction such that each longitudinal stiffening member extends from one side of the perimeter (4) to an opposite side of the perimeter (4), the perimeter (4) and the longitudinal stiffening members (5) being designed to form openings (6) in the frame (3), and comprising lobed walls fastened to the frame (3) by welding about said openings (6) to close said openings (6), such as to project into a thickness direction orthogonal to the frame (3) and towards the outside of the tank to be formed,
- assembling the tank walls together sealingly to form an open prismatic outer structure (2),
- providing a plurality of internal stiffening members (11, 12, 13),
- fastening the internal stiffening members (11, 12, 13) to the inside of the outer structure (2) such as to form a lattice structure, each internal stiffening member (11, 12, 13) having a first end fastened to a frame (3) and a second end fastened to an opposing frame (3), the internal stiffening members (11, 12, 13) being fastened to the longitudinal stiffening members (5) or to the perimeters (4) of said frames (3),
- assembling one or more tank walls to the open outer structure (2) such as to sealingly close the prismatic outer structure (2).

~~38.~~37. A manufacturing method for a prismatic sealed tank (1), in which the method includes the following steps:

- providing several tank walls ~~as claimed in one of claims 1 to 8~~comprising a flat frame (3) including a perimeter (4) and longitudinal stiffening members (5) arranged inside

the perimeter (4) in a longitudinal direction such that each longitudinal stiffening member extends from one side of the perimeter (4) to an opposite side of the perimeter (4), the perimeter (4) and the longitudinal stiffening members (5) being designed to form openings (6) in the frame (3), and comprising lobed walls fastened to the frame (3) by welding about said openings (6) to close said openings (6), such as to project into a thickness direction orthogonal to the frame (3) and towards the outside of the tank to be formed,

- arranging one of the tank walls such as to form a bottom wall of the tank (1),
- providing a plurality of internal stiffening members (11, 12, 13),
- fastening the internal stiffening members (11, 12, 13) to the bottom wall of the tank (1) and to one another such as to form a lattice structure,
- sealingly assembling the other tank walls to the bottom wall of the tank (1) and to one another such as to form a closed prismatic outer structure (2), each internal stiffening member (11, 12, 13) having a first end fastened to a frame (3) and a second end fastened to an opposing frame (3), the internal stiffening members (11, 12, 13)

being fastened to the longitudinal stiffening members (5) or to the perimeters (4) of said frames (3).

~~39.~~38. A method for loading or offloading a ship (70) as claimed in one of claims 3~~2~~3 to 3~~4~~5, in which a cold liquid product is channeled through insulated pipes (73, 79, 76, 81) to or from an onshore or floating storage facility (77) to or from the tank on the ship (71).