Claims

[Claim 1] A sealing membrane (1) for a sealed fluid storage tank, in which the sealing membrane (1) comprises at least one metal plate (2), the metal plate (2) comprising a flat portion (3) defining a plane of the plate and a plurality of reliefs (4) protruding from the flat portion (3) in a thickness direction perpendicular to the plane of the plate, the reliefs (4) being spaced apart from one another, the metal plate (2) comprising, in all directions of the plane, at least one relief (4), each relief (4) comprising a base (5) constituting the connection between the relief (4) and the flat portion (3), and comprising at least one vertex (6), the base (5) comprising, in the plane formed by the flat portion (3), a first dimension (7) equal to the diameter of the smallest circle circumscribed around the base (5) and a second dimension (8) equal to the diameter of the largest circle inscribed in the base (5), and the distance between the vertex (6) and the base (5) in the thickness direction forming a height (9) of the relief,
in which the height (9) of the relief (4) is less than 20 mm,
in which each relief (4) is spaced apart from an adjacent relief (4) in all directions of the plane by a distance less than or equal to 2 times the first dimension (7) of the base (5), and the ratio of the height (9) to the first dimension (7) of the base (5) of each relief (4) is between 0.28 and 1.

[Claim 2] The sealing membrane (1) as claimed in claim 1, wherein the reliefs (4) are produced by forming, preferably drawing, or by stamping or die-stamping, or by magnetoforming.

[Claim 3] The sealing membrane (1) as claimed in claim 1 or claim 2, wherein the thickness (11) of the metal plate (2) e_{plaque}, expressed in mm in the flat portion (3), is greater than or equal to $\frac{115}{E}$, where E is the Young's modulus of the material from which the metal plate (2) is made, expressed in GPa.

[Claim 4] The sealing membrane (1) as claimed in one of claims 1 to 3, wherein the metal plates (2) have a thickness (11) of between 0.5 mm and 2 mm.

[Claim 5] The sealing membrane (1) as claimed in one of claims 1 to 4, wherein the metal plates (2) are made of a metal with a Young's modulus of between 130 GPa and 230 GPa.

[Claim 6] The sealing membrane (1) as claimed in one of claims 1 to 5, wherein the metal plates (2) are made of a metal with a yield strength which is greater than 170 MPa at ambient temperature.

[Claim 7] The sealing membrane (1) as claimed in one of claims 1 to 6, wherein the number of reliefs (4) per linear meter of metal plate N_{relief} falls within the following range:

$$\frac{\propto \times \Delta T \times 10^6}{11 \times h} \leq N_{relief} \leq \frac{\propto \times \Delta T \times 10^7}{35 \times h}$$

where α is the coefficient of thermal expansion of the metal plate (2) in K^{-1}, ΔT is the temperature difference between ambient temperature and the temperature of the fluid stored in the tank in K, and h is the height (9) of the relief (4) in mm.

[Claim 8] The sealing membrane (1) as claimed in one of claims 1 to 7, wherein the base (5) has the shape of an ellipse or of a polygon.

[Claim 9] A sealed and thermally insulating tank (71) for storing liquefied gas, integrated in a supporting structure (15), the tank comprising a plurality of tank walls forming an internal space for receiving the liquefied gas, at least one of the tank walls comprising a thermally insulating barrier (12) secured to the supporting structure (15) and a sealing membrane (1) as claimed in one of claims 1 to 8 resting on the thermally insulating barrier (12) and intended to be in contact with the liquefied gas in the tank.

[Claim 10] The tank as claimed in claim 9, wherein the reliefs (4) protrude from the flat portion (3) in the direction of the internal space of the tank.

[Claim 11] The tank as claimed in claim 9, wherein the reliefs (4) protrude from the flat portion (3) in the direction of the supporting structure (15).

[Claim 12] The tank as claimed in one of claims 9 to 11, wherein the sealing membrane is a primary sealing membrane (1), the thermally insulating barrier is a primary thermally insulating barrier (12), and the tank wall (1) comprises, in a thickness direction from the outside to the inside of the tank, a secondary thermally insulating barrier (14) secured to the supporting structure (15), a secondary sealing membrane (13) resting on the secondary thermally insulating barrier (14), the primary thermally insulating barrier (12) resting on the secondary sealing membrane (13) and the primary sealing membrane (1) resting on the primary thermally insulating barrier (12).

[Claim 13] A carrier (70) for the transport of a cold liquid product, the carrier comprising a double hull (72) and a tank (71) as claimed in one of claims 9 to 12 arranged in the double hull, the double hull forming the supporting structure of the tank (71).

[Claim 14] A transfer system for transferring a cold liquid product, the system comprising a carrier (70) as claimed in claim 13, insulated pipelines (73, 79, 76, 81) arranged so as to connect the tank (71) installed in the hull of the carrier to a floating or onshore storage facility (77) and a pump for pumping a flow of cold liquid product through the insulated pipelines from or to the floating or onshore storage facility, to or from the tank of the carrier.

[Claim 15] A method for loading or unloading a carrier (70) as claimed in claim 13, in which a cold liquid product is conveyed through insulated pipelines (73, 79, 76, 81) from or to a floating or onshore storage facility (77), to or from the tank of the carrier (71).