

DESCRIPTION

TITLE: LOADING AND/OR UNLOADING TOWER INTENDED TO EQUIP A LIQUEFIED GAS STORAGE TANK

5 [0001] The present invention relates to the field of the storage and/or transport of a cargo of liquefied gas, such as liquefied natural gas, liquid ammonia as well as liquefied petroleum gas. More particularly, the invention relates to a tower for loading and unloading a liquefied gas storage tank.

10 [0002] Liquefied natural gas, commonly known by the acronym "LNG", for "Liquefied Natural Gas," is an important source of energy and is composed of approximately 95% methane. More particularly, LNG is stored in the liquid state in a thermally insulated tank at a temperature near -160°C , at which LNG occupies 1/600 of the volume that it would occupy in the gaseous state, thus
15 making it possible to facilitate transport from one site to another.

[0003] Conventionally, the tank comprises a loading and unloading tower suspended from a cover which closes an opening in the tank. The loading and unloading tower may comprise a tripod type structure, that is, comprising three
20 vertical poles connected to one another by cross members forming a lattice structure, said tower being guided by a support of the tank emerging from a bottom wall. The loading and unloading tower then comprises at least one unloading pipe and a pumping member whose function is to unload the cargo from the tank, said pumping member being connected to a drive device
25 arranged outside the tank. Furthermore, in order to allow optimal suction of the cargo, usually the suction member is arranged at least in part in a sump formed in the bottom wall of the tank which makes it possible to increase the amount of the cargo extracted by the unloading pipe while ensuring the immersion of the suction member in said cargo, thus preserving its integrity.

30 [0004] It is then known to place the unloading pipe in one of the poles of the structure of the loading and unloading tower. One of the drawbacks of such an

arrangement of the loading and unloading tower then lies in the proximity between the support guiding the structure of the tower and the sump formed opposite the unloading pipe. Such a proximity indeed limits the deformation property of the tank wall during storage of the cargo and during cool-down of the tank prior to filling it with the liquefied gas, this deformation property being necessary to limit the deterioration of the tank. Furthermore, such an arrangement of the unloading pipe in one of the poles of the structure of the tower complicates its accessibility for an operator. It is thus understood that such a configuration of the tank and more particularly of the loading and unloading tower reduces the strength of said tank, necessary for the storage of liquefied gas, while limiting the accessibility of the unloading pipe.

[0005] The present invention falls within this context by proposing an arrangement of the pumping member different from the already existing positioning solutions making it possible, firstly, to facilitate access to the pumping member and to the unloading pipe, while also taking into account the mechanical stresses which are exerted on the bottom wall of the storage tank.

[0006] In this context, the main subject matter of the present invention is a tower for loading and/or unloading liquefied gas for a tank intended to contain the liquefied gas, the tower extending along a main direction of extension between an upper end and a lower end and comprising a base at its lower end, the tower comprising at least three poles integral with the base, two poles of which form rear poles and the third pole of which forms a front pole, the tower comprising at least one liquefied gas pumping member arranged at least partially outside a perimeter defined by an outer envelope of the three poles, characterized in that the base comprises at least one support of the pumping member, said support extending outside said perimeter and opposite any one of the two rear poles relative to the front pole.

[0007] The tower thus makes it possible to be able to load or unload liquefied gas into a tank wherein the tower is installed.

[0008] The perimeter delimited by the structure of the tower corresponds to an axial projection of the structure of the tower onto a bottom wall of the storage tank wherein the tower is installed. In addition, the perimeter is delimited by
5 the outer edges of each of the poles, that is, by circular portions of the poles that are positioned outermost of the structure. This is understood to mean that each of the poles has an inner face oriented toward the other poles and an outer face turned toward the outside of the tower, the perimeter tangent to these outer faces forming the outer envelope. Thus, the perimeter of the tower
10 passes through each of the outer faces of the poles.

[0009] Thus, there is an advantage in the arrangement of the pumping member outside the perimeter delimited by the structure in that it makes it possible to separate the pumping member from the base of the tower. This specific
15 arrangement of the pumping member, on the one hand, facilitates the mounting, installation, maintenance or other actions to be carried out on the pumping member, and on the other hand reduces the stiffening of a wall of the tank wherein the tower is installed.

[0010] In addition to being arranged outside this perimeter, the pumping member is advantageously arranged in front of the front pole, this arrangement being assessed relative to the two rear poles. This arrangement in front of the tower further optimizes the mounting, installation, maintenance or other actions to be carried out on the pumping member, while limiting the stiffening
20 of the wall of the tank wherein the tower is installed.

[0011] It is also understood from the foregoing that the support of the pumping member is integral with the base of the tower, or even forms a protrusion of the latter. This securing of the support with the base facilitates the holding in
30 position of the pumping member relative to the tower, in particular when said tower is at least partially immersed in liquefied gas.

[0012] According to an optional feature of the invention, the support comprises at least one platform bearing the pumping member, as well as an anti-sloshing system for liquefied gas which protects the pumping member from an impact resulting from a movement of said liquefied gas. Arranging the pumping member and the support in front of the tower exposes them to the swell of the liquefied gas wherein the tower can be at least partially immersed, this swell being able to enter violently into contact with the pumping member and the support, and lead to degradation of the latter. The anti-sloshing system then makes it possible to reduce the force of the impact of the liquefied gas against the pumping member and the support, limiting the risk of degradation of the latter. The anti-sloshing system is a protection member, and this protection is local. The anti-sloshing system is thus a local system aiming to reduce the effects of the sloshing.

[0013] According to another optional feature of the invention, the anti-sloshing system comprises at least one protective arm extending between the platform and at least the front pole. The protective arm is exposed to the impact which may be formed by the swell of liquefied gas, limiting the impact undergone by the support and the pumping member.

[0014] According to another optional feature of the invention, the protective arm extends between the platform and one of the poles. Preferably, the protective arm is attached directly to the front pole. The securing of the ends of the protective arm, on the one hand to the platform and on the other hand to one of the poles, reinforces the strength of the support relative to the base.

[0015] According to another optional feature of the invention, the platform comprises two arms extending parallel to one another, the platform having a U-shaped cross section seen in a plane extending perpendicular to the main direction of extension of the tower. The U-shaped cross section may be reinforced against the effects of the sloshing by adding a reinforcement, for

example bolted to be removable, between the ends of the “U,” to handle any more severe hydrodynamic loads.

5 [0016] According to another optional feature of the invention, the branches of the platform are spaced apart from one another in a first dimension measured along a direction perpendicular to the directions along which the branches extend, the pumping member having a second dimension corresponding to the diameter of a circle wherein an outer surface of the pumping member is inscribed, the first dimension being greater than the second dimension.

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[0017] According to another optional feature of the invention, the protective arm comprises at least one orifice configured to allow passage of the liquefied gas. The dimension of the orifice is calculated in order on the one hand to allow liquefied gas to circulate through it and thus limit the forces experienced by the arm and the support, and on the other hand, so that the arm sufficiently reduces the forces experienced by the support and the pumping member generated by the swell of the liquefied gas.

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[0018] According to another optional feature of the invention, the protective arm comprises a strapping member of one of the poles arranged at one of its ends, the strapping member having a shape at least partially complementary to said pole.

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[0019] According to another optional feature of the invention, the strapping member is connected to one of the poles.

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[0020] According to another optional feature of poles, the strapping member is connected to the front pole.

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[0021] According to another optional feature of the invention, the anti-sloshing system comprises two arms extending from the platform to the same pole,

each of the arms participating in forming an orifice configured to allow a displacement of liquefied gas through it.

[0022] According to another optional feature of the invention, the two arms
5 extend from the platform to the front pole.

[0023] According to another optional feature of the invention, each of the arms extends from one of the branches of the platform.

10 [0024] According to another optional feature of the invention, the anti-sloshing system comprises at least one bushing integral with the platform, the pumping member extending at least partially into the bushing. It will be understood here that the term "bushing" refers to an at least partially cylindrical member wherein the pumping member is at least partially housed.

15 [0025] According to another optional feature of the invention, the bushing comprises at least one base body and at least one protective wall, the base body extending in a plane parallel to a plane wherein the platform is inscribed, the protective wall extending from the base body along a direction parallel to
20 the main direction of extension of the tower opposite the upper end of the tower, the base body and the protective wall delimiting a housing of the pumping member.

[0026] According to another optional feature of the invention, the base body is
25 integral with the platform, for example by welding and/or bolting.

[0027] According to another optional feature of the invention, the base body is integral with each of the branches of the platform, for example by welding and/or bolting.

30 [0028] According to another optional feature of the invention, the bushing comprises at least two protective walls, for example extending along the main

direction of extension of the tower from the base body opposite the upper end of the tower, the two protective walls extending radially around the pumping member, the two protective walls being arranged at a distance from one another while delimiting a slot.

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[0029] According to one particular embodiment of the invention, "radially" means that the protective walls extend at least partially circularly around the pumping member.

10 [0030] According to another optional feature of the invention, at least one slot delimited by two protective walls is opposite the front pole. "Facing the pole" is understood to mean the fact that the front pole is arranged in an angular sector centered on the pumping member and passing through the edges of the slot.

15 [0031] According to another optional feature of the invention, the support is bolted to the base. Alternatively or in a complementary manner, the support is welded to the base.

[0032] According to another optional feature of the invention, the support is
20 integral with the base.

[0033] The present invention also relates to a tank for storing and/or transporting a liquefied gas comprising at least one top wall, a bottom wall and several side walls extending between the top wall and the bottom wall,
25 the walls of the storage tank defining a liquefied gas storage volume, the storage tank comprising at least one tower characterized according to any one of the preceding features, the tower extending between the top wall and the bottom wall.

30 [0034] In order to echo what has been previously explained, the arrangement of the pumping member in front of the front pole is assessed relative to an orientation of the storage tank. The tower is advantageously arranged behind

the storage tank, the arrangement in front of the support thus makes it possible to limit the stiffening of the bottom wall between the tower and a side wall arranged behind the storage tank.

5 [0035] As was able to be mentioned above, the tower comprises at least three poles, two poles of which form rear poles and one pole of which forms a front pole. The tower is arranged in the tank at a rear portion of said tank; this rear portion is considered relative to the direction of travel of the structure comprising the tank. The front pole of the tower is the pole which, still
10 considering the direction of travel of the structure, is furthest from a rear wall of the tank. The support of the pumping member is arranged at this front pole. More specifically, the support of the pumping member is arranged in a forward position relative to the front pole. As a result, the pumping member is arranged in a free space within which interventions are facilitated by the great
15 accessibility of this space compared to an arrangement of the pumping member which would be constrained, for example, between the tower and the rear wall of the tank.

[0036] According to another optional feature of the invention, the storage tank
20 comprises a sump arranged in the bottom wall and wherein the pumping member of the tower and the bushing of the anti-sloshing system are at least partially housed.

[0037] According to another optional feature of the invention, the storage tank
25 extends mainly along a longitudinal direction, at least two protective walls for protecting the bushing extending facing one another along a transverse direction perpendicular to said longitudinal direction and to the main direction of extension of the tower.

30 [0038] According to another optional feature of the invention, the protective walls participate in forming two slots opposite one another along the longitudinal direction.

[0039] Other features, details and advantages of the invention will emerge more clearly both from the description which follows and from several exemplary embodiments, which are given for illustrative purposes and without
5 limitation with reference to the appended schematic drawings, in which:
[Fig. 1] is a schematic depiction of a ship seen from above and equipped with a liquefied gas storage tank comprising a loading and/or unloading tower according to the invention;
[Fig. 2] is a schematic depiction of the tower shown in Figure 1;
10 [Fig. 3] is a schematic depiction of the lower end of the tower according to Figure 1;
[Fig. 4] is a longitudinal cross section of a lower end of the tower according to Figure 1;
[Fig. 5] is a schematic depiction of a support for a pumping member protected
15 by an anti-sloshing system of the tower according to Figure 1;
[Fig. 6] is an exploded view of a pumping member protected by an anti-sloshing system of the tower according to Figure 1.

[0040] The features, variants, and the different embodiments of the invention
20 can be combined with one another in various combinations as long as they are not incompatible or exclusive of one another. It is possible, in particular, to imagine variants of the invention that comprise only a selection of the features that are described below in isolation from the other features that are described, provided that this selection of features is sufficient to confer a technical
25 advantage and/or to differentiate the invention from the prior art.

[0041] In the figures, the members common to several figures retain the same reference.

30 [0042] In the detailed description that follows, the terms “longitudinal,” “transverse” and “vertical” refer to the orientation of a storage tank equipped with a loading and/or unloading tower according to the invention. A longitudinal

direction corresponds to a main direction of elongation of the storage tank, this longitudinal direction being parallel to a longitudinal axis L of a reference frame L, V, T shown in the figures. A vertical direction corresponds to a direction along which the tower mainly extends, this vertical direction being parallel to a vertical axis V of the reference frame L, V, T and this vertical axis V being perpendicular to the longitudinal axis L. Finally, a transverse direction corresponds to a direction parallel to a transverse axis T of the reference frame L, V, T, this transverse axis T being perpendicular to the longitudinal axis L and the vertical axis V.

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[0043] Figure 1 shows a structure 1 here corresponding to a liquefied gas transport ship. In order to transport the liquefied gas, the ship comprises at least one tank 2 for storing and/or transporting liquefied gas comprising at least one bottom wall 4 and a top wall, in this case not visible, and opposite one another in a vertical direction of the tank 2, said walls being connected to one another by side walls 6. The bottom wall 4, the top wall and the side walls 6 participate, inter alia, in delimiting a storage volume of the liquefied gas.

[0044] In order to guarantee optimal transport and preservation of the liquefied gas in the tank 2, the walls of the of the latter, in particular the bottom wall 4, comprise at least one thermal insulation layer covered by a sealed membrane, visible in Figures 3 and 4, and intended to be in contact with the liquefied gas.

[0045] Such a tank 2 can be installed for example on a structure 1 intended for transporting liquefied gas, such as a ship or a barge, for the processing of the liquefied gas, such as a reliquefaction unit and/or a gasification unit, as well as for storing liquefied gas, such as a land-based structure or a gravity platform.

[0046] As can be seen in Figure 3, the walls of the tank 2 comprise at least one primary space participating in delimiting an internal volume of the tank 2 and a secondary space carrying the primary space, each of the spaces comprising a thermally insulating layer and a sealing membrane. It is understood that the

walls of the tank 2 are thus composed of layers and membranes superimposed on one another.

[0047] More specifically, the walls of the tank 2 comprise, from the outside of the tank 2 to the internal volume of said tank 2, a secondary thermally insulating layer 8, a secondary sealing membrane 10 borne by the secondary thermally insulating layer 8, a primary thermally insulating layer 12 arranged on the secondary sealing membrane 10 and a primary sealing membrane 14 borne by the primary thermally insulating layer 12, the primary sealing membrane 14 participating in defining the internal volume of the tank 2. The thermally insulating layers are formed by blocks, generally composed of two plywood panels between which the thermally insulating material extends.

[0048] In the remainder of the description, the characteristics described in relation to the term "sealing membrane 10, 14" may relate to the primary sealing membrane 14 and/or to the secondary sealing membrane 10, unless otherwise mentioned.

[0049] The sealing membrane 10, 14 itself comprises several metal strips or plates each having an external face in contact with the thermally insulating layer and an internal face facing the internal volume of the tank 2. In addition, the metal strips have two folded edges, the metal strips being connected together via their respective folded edges. In other words, the folded edges of two adjacent metal strips are made integral with one another by welding, for example, thus making the metal strips integral with one another. The attachment of the metal strips to one another by means of their folded edges promote an elasticity of the sealing membrane 10, 14, in particular when the walls of the tank 2 undergo thermal deformations when loading and/or unloading the tank 2 of liquefied gas.

[0050] As shown in Figure 2, the tank 2 comprises at least one loading and/or unloading tower 16 according to the invention making it possible to introduce

or remove the liquefied gas into or outside of the tank 2, the tower 16 advantageously extending between the top wall and the bottom wall 4. More particularly, the top wall comprises an opening wherein a cover 18 constituting the tank 2 is arranged so as to close the storage volume of the tank 2 in a sealed manner. As shown in Figure 2, the cover 18 is at least partially traversed by the tower 16 so as to be able to load and/or unload liquefied gas to or from the storage space of the tank 2.

[0051] The tower 16 comprises a structure which extends mainly along a main direction of extension parallel to the vertical direction, having an upper end 20 and a lower end 22, the upper end 20 being in the immediate vicinity of the top wall while the lower end 22 is facing the bottom wall 4. More particularly, the tower 16 is formed by at least three poles 24, otherwise called tripod, and a base 25 advantageously arranged at its lower end 22 connecting the three poles 24 to one another.

[0052] Additionally, the structure of the tower 16 comprises the at least three poles 24 secured to one another by means of a lattice structure 28. Each of the three poles 24 passes through the cover of the tank 2. A front pole 24a of the structure and two rear poles 24b of the structure are then defined, defined according to a direction of travel of the ship, visible in Figure 1, under normal navigation conditions, the front pole 24a being the pole of the forward-most structure in the tank 2.

[0053] The tower 16 is arranged within the tank 2 toward the rear of the latter, considering the direction of travel of the structure 1, that is, of the ship equipped with said tank 2. The three poles 24 are arranged in a triangle configuration with the two rear poles 24b being the two poles 24 closest to a rear wall of the tank 2 and the front pole 24a being furthest from this rear wall, that is, closest to a front wall of the tank 2 compared to the rear poles.

[0054] Indeed, it is remarkable in Figure 1 that the poles 24 of the tower 16 are, in the embodiment shown, arranged relative to one another so that each pole forms the top of an isosceles triangle. The front pole 24a forming the main vertex of this isosceles triangle. It should be noted that in the embodiment shown, the rear poles 24b are aligned relative to one another along a straight line that is substantially parallel to a main plane of elongation of the rear wall of the tank 2. As a result, the isosceles triangle configuration of the tower 16 makes it possible to position the front pole 24a the furthest possible toward the front wall of the tank 2.

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[0055] Furthermore, and as is particularly visible in Figure 4, the structure of the tower 16 is supported by a support device 30 which at least partially passes through the bottom wall 4 of the tank 2. More specifically, the support device 30 comprises at least one foot 32 that extends from an external structure of the tank 2, not visible and to the base 25, by passing through the bottom wall 4 of said tank 2.

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[0056] The tower 16 comprises at least one pumping member 34 for the liquefied gas arranged at least partially outside a perimeter P defined by an outer envelope of the three poles 24, as shown in Figure 1. "Perimeter P defined by an outer envelope of the three poles 24" is understood to mean an axial projection of the structure of the tower 16 onto the bottom wall of the tank 2. The perimeter P is delimited here by the outer edges of each of the poles 24, that is, by circular portions of the poles 24 that are positioned outermost of the structure. The perimeter P thus forms a triangle, each side of which is tangent to two poles.

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[0057] In addition to being arranged outside this perimeter P, the pumping member 34 is advantageously arranged in front of the front pole 24a, this arrangement being assessed relative to the two rear poles 24b. The position of the pumping member 34 is considered, like the poles 24, relative to the direction of travel of the structure 1. The pumping member 34 is thus arranged

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relative to the front pole 24a so as to be in front of the front pole 24a, that is, closer to the front wall of the tank 2 than the front pole. Such an arrangement of the pumping member 34 promotes interventions within the tank 2 on this pumping member 34 by maximizing a working space adjoining the pumping member 34.

[0058] The tank 2 comprises at least one sump 26 installed at least partially through the bottom wall 4 of the tank 2, and wherein the pumping member 34 is at least partially arranged. The main function of the sump 26 is to collect part of the liquefied gas contained in the bottom of the tank 2, the pumping member 34 installed at least partially in the sump 26 then suctioning the liquefied gas contained in the sump 26. According to one aspect, the pumping member 34 is configured to supply fuel to at least one consumer of the structure. According to another solution, the pumping member 34 is configured to pump the cargo from the tank, in particular in order to unload it.

[0059] Advantageously, and as shown in Figures 3 and 4, the tower 16 comprises at least one liquefied gas unloading member 36 configured to suction a majority part of the cargo of liquefied gas contained in the tank 2, and at least one pumping member 34 configured to collect a minority part of the cargo that flows in the sump 26, this minority part corresponding to liquefied gas pumped by the unloading member 36. According to the invention, and preferentially, it is the pumping member 34 which is arranged outside the perimeter P defined by the three poles 24 and at the front of the front pole 24a, the unloading member 36 being either in the perimeter P or secant thereto.

[0060] According to the invention, and as can be seen more particularly in Figures 3 to 5, the base 25 comprises at least one support 38 of the pumping member 34, said support 38 extending outside said perimeter P and opposite any one of the two rear poles 24b relative to the front pole 24a. It will be understood here that the arrangement of the pumping member 34 in front of

the front pole 24a outside the perimeter P defined by the three poles 24 is permitted by the specific arrangement of the support 38 of the base 25.

[0061] More specifically, the support 38 of the pumping member 34 is integral with the base 25 of the tower 16, or even forms a protrusion of the latter, as shown in Figures 3 to 5. This securing of the support 38 with the base 25 facilitates the holding in position of the pumping member 34 relative to the tower 16, in particular when said tower 16 is at least partially immersed in liquefied gas. According to the example shown here in Figures 3 to 5, the support 38 advantageously forms a single-piece element with the base 25, that is, the separation of the support 38 and the base 25 would result in the destruction of the support 38 and/or of the base 25. In such a case, the support 38 is integral with the base 25, but this support can also be welded and/or bolted to this base.

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[0062] As shown in Figures 3 to 5, the support 38 comprises at least one platform 40 bearing the pumping member 34, the platform 40 extending mainly in a plane coincident with a plane wherein the base 25 of the tower 16 extends. More specifically, the platform 40 comprises two branches 42, particularly visible in Figure 5, extending parallel to one another from an edge of the base 25, the platform 40 having a U-shaped cross section seen in a plane extending perpendicularly relative to the main direction of extension of the tower 16, each of the branches 42 forming the arms of the "U" shape.

[0063] The branches 42 of the platform 40 are arranged relative to one another by defining a space within which the pumping member 34 at least partially extends. According to one example, these branches 42 each comprise a free end that can be connected to one another, or may not have a link.

[0064] The branches 42 of the platform 40 are spaced apart from one another in a first dimension measured along a direction perpendicular to the directions along which the branches 42 extend, the pumping member 34 having a second

dimension corresponding to the diameter of a circle wherein an outer surface of the pumping member 34 is inscribed, the first dimension being greater than the second dimension so as to allow the arrangement of the pumping member.

5 [0065] According to the invention, the support 38 comprises an anti-sloshing system 44 for liquefied gas which protects the pumping member 34 from an impact resulting from a movement of said liquefied gas. The anti-sloshing system 44 reduces the force of the impact of the liquefied gas against the pumping member 34 and the support 38, limiting the risk of degradation of the
10 latter, in particular when the ship is navigating at sea and the pitching of the ship leads to the formation of a swell of liquefied gas in the tank 2.

[0066] As shown in Figures 3 to 5, the anti-sloshing system 44 comprises, without limiting the invention, at least one protective arm 46 extending between
15 the platform 40 and at least one of the poles 24, for example the front pole 24a. The protective arm 46 is exposed to impacts generated by the swell of liquefied gas, such a protective arm 46 limiting the impacts experienced by the support 38 and the pumping member 34.

20 [0067] The protective arm 46 takes the overall shape of an advantageously metal rod 48 extending along a direction secant to the plane wherein the platform 40 of the support 38 is inscribed. In addition, the protective arm 46 for example has a T-shaped cross section seen in a plane perpendicular to the direction along which the protective arm 46 extends.

25 [0068] The protective arm 46 also comprises a beam 50 extending between a main rod 48 of the protective arm 46 and the platform 40. Here, the beam 50 extends more precisely along the vertical direction V, while being integral with the edge of the base 25 which protrudes from the platform 40. The beam 50 is
30 configured to reinforce the strength of the support 38 and of the anti-sloshing system 44.

[0069] As particularly visible in Figures 3 to 5, the protective arm 46 participates in forming, with the platform 40, at least one orifice 52 configured to allow a displacement of liquefied gas through it. The orifice 52 extends in particular along a transverse direction T and assumes an overall triangular shape, at least one of the sides of which is defined by the protective arm 46 and another side of which is defined by one of the branches 42 of the platform 40. According to the example shown, one of the sides is delimited by the main rod 48 of the protective arm 46, another side being delimited by the beam 50 while a last side is delimited by one of the branches 42 of the platform 40.

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[0070] The orifice 52 is sized firstly so as to allow liquefied gas to pass through the orifice, and thus to limit the forces experienced by the arm, the support 38 and the pumping member 34.

15 [0071] Advantageously, the protective arm 46 extends between the platform 40 and the front pole 24a. Even more advantageously, the protective arm 46 extends from a free end of the platform 40 to the front pole 24a. By extending in this way, the protective arm 46 contributes to breaking the swell of liquefied gas at least at the support 38, limiting the forces exerted by said swell of
20 liquefied gas against the support 38 and/or the pumping member 34.

[0072] The protective arm 46 is also connected to one of the poles 24 and to the platform 40, by welding or bolting. This securing between the protective arm 46 and, on the one hand, the platform 40 and on the other hand, one of the poles 24
25 increases the resistance of the arm and the support 38 faced with the forces exerted against them by the swell of liquefied gas. In the example shown in Figures 3 to 5, the protective arm 46 is connected to the front pole 24a.

[0073] As particularly visible in Figure 5, the protective arm 46 comprises a
30 strapping member 54 of one of the poles 24 arranged at one of its ends, the strapping member 54 having a shape at least partially complementary to said pole. "Strapping member 54" is understood to mean the fact that the member

extends at least partially around said pole. The strapping member 54 can thus be formed by a closed hoop for example, that is, which goes all the way around the pole, a circular arc hoop, that is, which is open on at least one edge and does go all the way around the pole, or several circular arc hoops forming portions partially surrounding the pole. In the example shown here, the strapping member 54 is a hoop forming an arc of a circle.

[0074] Advantageously, the strapping member 54 is connected to one of the poles 24. Even more advantageously, the strapping member 54 is connected to the front pole 24a.

[0075] According to the example shown in Figures 3 and 5, the anti-sloshing system 44 comprises two protective arms 46 extending from the platform 40 to the same pole 24, each of the protective arms 46 delimiting an orifice 52 configured to allow a passage of liquefied gas. It will be understood here that the anti-sloshing system 44 comprises a first protective arm 46 integral with a first branch 42 of the platform 40, the first protective arm 46 and the first branch 42 at least partially delimiting a first orifice 52, and a second protective arm 46 integral with a second branch 42 of the platform 40, the second protective arm 46 and the second branch 42 of the platform 40 at least partially delimiting a second orifice 52.

[0076] It will be understood from the foregoing that the features described above with respect to the protective arm 46 can apply to the first protective arm 46 and/or to the second protective arm 46.

[0077] The two protective arms 46 advantageously extend from the platform 40 to the front pole 24a. It will be understood that each of the arms extends from one of the branches 42 of the platform 40 to the same pole, which here is the front pole 24a. This particular arrangement of each of the arms thus makes it possible to reinforce the mechanical strength of the platform 40.

[0078] In addition, the two protective arms 46 here are integral with the same strapping member 54, as can be seen in Figure 5.

5 [0079] Alternatively or additionally and as shown in Figures 4 to 6, the anti-sloshing system 44 comprises at least one bushing 56 of the pumping member 34 integral with the platform 40, the pumping member 34 extending at least partially into the bushing 56. It will be understood here that the term “bushing 56” refers to an at least partially cylindrical member wherein the pumping 34 member is at least partially housed.

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[0080] The bushing 56 comprises at least one base body 58 and at least one protective wall 60, the base body 58 extending in a plane parallel to a plane wherein the platform 40 is inscribed, the protective wall 60 extending from the base body 58 along a direction parallel to the main direction of extension of the tower 16 and opposite the upper end of this tower 16, the base body 58 and the protective wall 60 delimiting a housing of the pumping member 34. In other words, the base body 58 is a wall extending parallel to the platform 40, the protective wall 60 extending perpendicularly to the base body 58 in the direction of the bottom wall of the tank. In this configuration, the protective wall 20 60 in particular contributes to protecting the pumping member 34 from impacts produced by the swell of liquefied gas.

[0081] Advantageously, the base body 58 is secured to the platform 40, in particular by bolting and/or welding. More specifically, the base body 58 is 25 integral with each of the branches 42 of the platform 40, which optimizes the securing of the bushing 56 with the platform 40. As is more particularly visible in Figure 5, the base body 58 here takes the form of a discoid wall having two protuberances 62 extending opposite one another, each of the protuberances 62 being secured to one of the branches 42 of the platform 40.

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[0082] In addition, the pumping member 34 is secured by one of its ends to the base body 58 of the bushing 56. As can be seen in Figure 4, the pumping

member 34 comprises an unloading pipe 64 extending between the pumping member 34 and the outside of the tank 2, the unloading pipe 64 being configured to convey the liquefied gas pumped by the pumping member 34 toward the outside of the tank 2. To this end, the base body 58 comprises a
5 hole 66, visible in Figure 6, through which the unloading pipe 64 passes.

[0083] As can be seen in Figures 5 and 6, the bushing 56 comprises at least two protective walls 60 each extending along the main direction of extension of the tower 16 from the base body 58 opposite the upper end of the tower 16,
10 the two protective walls 60 extending radially around the pumping member 34, the two protective walls 60 being arranged at a distance from one another while delimiting a slot 68. The two protective walls 60 protect the pumping member 34 from the swell of liquefied gas, while the slot(s) 68 allow a certain circulation of the liquefied gas around the pumping member 34.

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[0084] In addition, the term “radially” in particular refers to protective walls 60 extending circularly around the pumping member 34. However, protective walls 60 extending radially around the pumping member 34 without, however, being inscribed in a circle, and therefore without being circularly arranged
20 around the pumping member 34, would not be outside the scope of the invention.

[0085] It should be noted that the anti-sloshing system 44 may have no protective arm 46. It will be understood that the anti-sloshing system 44 is in
25 this case in accordance with what has been described above. It should also be noted that in such a configuration of the anti-sloshing system 44, the platform 40 and/or the support 38 provide protection for the pumping member 34 making it possible to limit the force exerted by the swell of the liquefied gas on the pumping member 34.

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[0086] As can be seen in Figure 6, the two protective walls 60 participate in delimiting two slots 68 each extending along the vertical direction V.

Advantageously, the two protective walls 60 are arranged facing one another, while the two slots 68 are opposite one another. Advantageously, the two protective walls 60 extend facing one another along the transverse direction T, the two slots 68 being arranged opposite one another along the longitudinal direction L. This arrangement of the protective walls 60 makes it possible to protect the pumping member 34 from the swell of liquefied gas, this swell generally moving in the tank 2 along the transverse direction T. The slots 68 in turn allow the liquefied gas to continue to circulate around the pumping member 34, despite the presence of the protective walls 60.

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[0087] Advantageously, at least one slot 68 delimited by two protective walls 60 is opposite the front pole 24a. "Opposite the pole" is understood to mean the fact that the front pole 24a is arranged in an angular sector centered on the pumping member 34 and passing through the edges of the slot 68, the edges of the slot 68 here referring to the edges of the protective walls 60.

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[0088] In addition, as can be seen in Figure 6, the bushing 56 comprises a ring 70 connecting the ends of the protective walls 60. The ring 70 here assumes an annular shape through which the pumping member 34 extends. It is understood that a portion of the pumping member 34 extends outside the bushing 56 and below it, as can be seen in Figure 4.

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[0089] Furthermore, the bushing 56 extends at least partially into the sump 26 formed in the bottom wall 4 of the tank 2. More particularly, the base body 58 is arranged outside the sump 26, while the ends opposite the base body 58 of the protective walls and the ring 70 are arranged in the sump 26.

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[0090] As a reminder, the invention relates to a tower 16 comprising at least three poles 24, including a front pole 24a and two rear poles 24b participating in defining a perimeter P of the tower 16, the three poles 24 being made integral with each other in particular by a base 25, the tower 16 comprising a pumping member 34 for pumping a liquefied gas, the base 25 comprising a

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support 38 of the pumping member 34, said support 38 extending outside the perimeter P defined by the at least three poles 24 in front of the front pole 24a relative to the two rear poles 24b. This particular arrangement of the pumping member 34 and the support 38 of the latter facilitates the mounting of the tower 16, and in particular the installation of the pumping member 34 on the tower 16, as well as the maintenance of said pumping member 34 once the tower 16 is installed.

[0091] The present invention cannot, however, be limited to the means and configurations described and illustrated here, and it also extends to any equivalent means or configuration and to any technical combination using such means. In particular, the shape of the constituent elements of the anti-sloshing system 44 described previously is not limiting with respect to the invention, and an anti-sloshing system 44 comprising substantially structurally different and/or additional elements would not be outside the scope of the invention.

Claims

1. A liquefied gas storage and/or transport tank (2) comprising at least one top wall, a bottom wall (4) and several side walls (6) extending between the top wall and the bottom wall (4), the walls (4, 6) of the tank (2) defining a liquefied gas storage volume, the tank (2) comprising at least one liquefied gas loading and/or unloading tower (16) for a tank (2) intended to contain the liquefied gas, the tower (16) extending between the top wall and the bottom wall (4) along a main direction of extension between an upper end (20) and a lower end (22) and comprising a base (25) at its lower end (22), the tower (16) comprising at least three poles (24) integral with the base (25), two poles (24) of which form rear poles (24b) and the third pole (24) of which forms a front pole (24a), the tower (16) comprising at least one pumping member (34) for pumping liquefied gas arranged at least partially outside a perimeter (P) defined by an outer envelope of the three poles (24), characterized in that the base (25) comprises at least one support (38) of the pumping member (34), said support (38) extending outside said perimeter (P) and opposite any one of the two rear poles (24b) with respect to the front pole (24a), said front pole (24a) being the forward-most pole (16) of the loading and/or unloading tower (2).
2. The tank (2) according to claim 1, wherein the support (38) comprises at least one platform (40) bearing the pumping member (34), as well as an anti-sloshing system (44) for liquefied gas which protects the pumping member (34) from an impact resulting from a movement of said liquefied gas.
3. The tank (2) according to claim 2, wherein the anti-sloshing system (44) comprises at least one protective arm (46) extending between the platform (40) and at least the front pole (24a).
4. The tank (2) according to claim 3, wherein the protective arm (46) comprises at least one orifice (52) configured to allow passage of the liquefied gas.

5. The tank (2) according to any one of claims 2 to 4, wherein the anti-sloshing system (44) comprises at least one bushing (56) integral with the platform (40), the pumping member (34) extending at least partially into the bushing (56).
6. The tank (2) according to claim 5, wherein the bushing (56) comprises at least one base body (58) and at least one protective wall (60), the base body (58) extending in a plane parallel to a plane wherein the platform (40) is inscribed, the protective wall (60) extending from the base body (58) along a direction parallel to the main direction of extension of the tower (16) opposite the upper end (20) of the tower (16), the base body (58) and the protective wall (60) delimiting a housing of the pumping member (34).
7. The tank (2) according to claim 6, wherein the bushing (56) comprises at least two protective walls (60) extending radially around (16) the pumping member (34), the two protective walls (60) being arranged at a distance from one another while delimiting a slot (68).
8. The tank (2) according to claim 7, wherein at least one slot (68) delimited by two protective walls (60) is opposite the front pole (24a).
9. The tank (2) according to any one of claims 1 to 8, wherein the support (38) is bolted to the base (25).
10. The tank (2) according to any one of claims 1 to 9, wherein the support (38) is welded to the base (25).
11. The tank (2) according to any one of claims 1 to 10, wherein the support (38) is integral with the base (25).

12. The tank (2) according to any one of claims 5 to 8, comprising a sump (26) arranged in the bottom wall (4) and wherein the pumping member (34) of the tower (16) and the bushing (56) of the anti-sloshing system (44) are at least partially housed.

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13. The tank (2) according to claim 13 in combination with claim 7, extending mainly along a longitudinal direction (L), at least two protective walls (60) for protecting the bushing (56) extending facing one another along a transverse direction (T) perpendicular to said longitudinal direction (L) and to
10 the main direction of extension of the tower (16).