

Container intended to contain a liquid product and equipped with at least one non-return valve, in particular for a liquefied gas carrier vessel

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1. Field of the invention

The present invention relates to the field of non-return valves arranged in containers installed in a tank, in particular of a liquefied gas carrier vessel. It also relates to a container provided with a non-return valve, a tank provided with the container and a vessel provided with said tank.

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2. Prior art

A liquefied gas carrier vessel generally comprises a thermally insulated tank in which liquefied natural gas is stored. This natural gas has a high methane content and is stored at a temperature of the order of -160°C at atmospheric pressure to conserve its liquid state. During the transport of the liquefied gas, it can also be used as a fuel to propel the vessel. To this end, a pump is installed in the tank so as to suck the liquefied gas from the bottom of the tank. The pump has a pump head that is permanently submerged in a container situated near the bottom of the tank so as to prevent the pump from coming into contact with the gaseous phase of the liquefied gas, which leads to a risk of the pump becoming unprimed and/or damaged. The container makes it possible to retain the volume of gas to keep the pump head submerged taking into account the small quantity of liquefied gas necessary for use for propulsion, particularly once the gas is unloaded from the vessel, and any rolling to which the vessel might be subject. The container is in particular provided with non-return valves that are arranged in the bottom thereof.

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In the prior art, each non-return valve comprises a base forming a valve seat and a valve that can move relative to the base via four guide rods. The guide rods are fixed on the base and pass through the wall thereof in a vertical direction. The movable valve translates along the four rods. An example of a

container provided with non-return valves of this type is described in WO2017/055744.

However, the guidance of the valve with four rods is statically indeterminate and leads to a risk of generating the butting or tilting thereof relative to the base. There is a risk that the movable valve will deform during its movements given the competing forces.

3. Aim of the invention

The present invention aims particularly to provide a non-return valve the guidance of which is facilitated while avoiding the risks of deformation of the movable valve during its movement and reducing the footprint thereof.

4. Disclosure of the invention

This aim is achieved, according to the invention, by means of a non-return valve, in particular for a liquefied natural gas carrier vessel, comprising:

- a base having a central opening for the passage of a fluid,
- a valve that can be moved between a first closed position of said central opening and a second open position of said central opening,
- means for guiding the translation of the movable valve between the first position and the second position, in a direction of movement substantially perpendicular to a plane of said central opening,

the guiding means comprising a single central guiding element aligned on an axis of the central opening and rigidly connected to the base, the movable valve being mounted free to translate relative to the central guiding element.

This solution thus makes it possible to achieve the aforementioned aim. In particular, a single central guiding element allows an isostatic assembly and prevents the deformation of the movable valve during its movement between the first and second positions. In addition, such a configuration is easy to implement and does not have a large footprint.

According to one feature of the invention, the guiding means comprise evenly distributed securing members each extending from the base along an axis parallel to the axis of the central opening, the central guiding element being connected to the securing members via a connecting member.

According to another feature of the invention, the connecting member comprises a central portion supporting the central guiding element and arms, for example three in number, spaced apart from each other and each connected to a securing member and to the central portion. Such a configuration is simple and quick to implement. In particular, the spaced arms make it possible to leave a significant free zone of an upper surface of the movable valve so that it can pass easily and without any obstruction from its open position to the closed position under the pressure of the liquid product inside the container. In other words, the pressure can be applied to almost all of the upper surface of the movable valve.

According to another feature, the connecting member is fixed relative to the securing members and the central guiding member.

According to another feature of the invention, the central guiding element has a circular cross-section with a predetermined outer diameter.

According to another feature of the invention, the movable valve moves according to a predetermined guiding length between a first stop and a second stop.

According to another feature of the invention, the first stop is situated in the vicinity of one end of the central guiding element and the second stop is formed by a first beveled surface borne by the base, which complements a second beveled surface borne by the movable valve, the first and second beveled surfaces being capable of coming into contact in a sealed manner around the central opening. The configuration of these stop elements is simple and easy to implement. In addition, the beveled surfaces provide improved sealing of the container when the movable valve obstructs the central opening and at the same time the passage of the container. Furthermore, the beveled shape in the base guides the movement of the movable valve when it moves towards the bottom of the container to obstruct the passage.

According to another feature of the invention, the ratio between the guiding length and the predetermined outer diameter of the central guiding element is between 1 and 2.

According to one embodiment of the invention, the central guiding element comprises a central rod extending along the axis of the central opening, the movable valve including a through-orifice receiving the central rod.

5 According to another embodiment, the central guiding element comprises a through-hole, the movable valve bearing a rod extending along the axis of the central opening and received by the through-hole.

 The invention also relates to a container intended to contain a liquid product, such as liquefied natural gas, and provided with at least one non-
10 return valve having any one of the previous features, the container comprising a bottom provided with at least one passage connecting the inside and the outside of the container, the base of the non-return valve being borne by the bottom of the container and the movable valve being capable of occupying its first closed position and obstructing the passage when a pressure differential
15 exerted on the movable valve between the outside of the container and the inside of the container is less than a predetermined positive threshold, and occupying its second open position and freeing the passage when the pressure differential is greater than said threshold.

 According to one feature of the container, the base with said central
20 opening is an additional part that is fixed onto the bottom of the container, said central opening communicating with the passage of the container. Such a configuration makes it possible to produce more easily a base with great precision, which is particularly necessary to ensure the sealing of the container when the movable valve obstructs the passage and the central opening.

25 According to another embodiment, the base is formed by a portion of the bottom of the container and defines the central opening.

 The invention also relates to a thermally insulated tank intended to contain a liquid product, such as liquefied natural gas, at least one container having the aforementioned features, and a pump including a pump head
30 intended to suck up the liquid product contained inside the tank, the bottom of the container facing towards a bottom wall of the tank and the pump head being arranged in the container, near the bottom of the container.

The invention further relates to a vessel, in particular a liquefied natural gas carrier vessel, comprising a tank having any one of the features above.

5. Brief description of the figures

The invention will be more clearly understood, and further aims, details, features and advantages thereof will become more apparent on reading the following detailed explanatory description of embodiments of the invention given by way of purely illustrative, non-limitative examples, with reference to the attached diagrammatic drawings.

In these drawings:

Figure 1 is a partial transverse cross-sectional diagrammatic view of a floating structure such as a methane carrier storing and/or transporting liquefied natural gas in a thermally insulated tank;

Figure 2 is a diagrammatic perspective view of an example of a container for retaining a liquid product such as liquefied natural gas and inside which a pump head is accommodated according to the invention;

Figure 3 is a perspective illustration of an example of a non-return valve intended to be provided in a liquid product retention container as illustrated in figure 2;

Figure 4 is a perspective transverse cross-sectional view of the non-return valve illustrated in figure 3;

Figures 5 and 6 show an example of a non-return valve with a movable valve respectively occupying a first closed position and a second open position of a passage of the container;

Figure 7 is a highly diagrammatic illustration of another embodiment of a non-return valve according to the invention; and

Figure 8 illustrates a transverse cross-section of another embodiment of the invention in which the base of the non-return valve, forming the valve seat, comprises a portion of the bottom wall of a liquid retention container.

6. Description of embodiments of the invention

Figure 1 shows a portion of a floating structure 1 for storing and/or transporting a cold liquid product such as liquefied natural gas (LNG). This floating structure is in the present example a methane carrier including a

double hull forming a load-bearing structure 2 and in which a tank 3 is mounted.

The tank 3 is thermally insulated and intended to contain the liquid product, here the LNG. The tank 3 comprises walls each formed from a multi-layer structure. This structure includes in succession a secondary insulating barrier fixed to the load-bearing structure 2, a secondary sealing membrane supported by the secondary insulating barrier, a primary insulating barrier covering the secondary sealing membrane and a primary sealing membrane supported by the primary insulating barrier. In particular, the tank 3 comprises a bottom wall 4 extending along a longitudinal axis X, here in the plane of figure 1. Side walls 5 rise along a vertical axis Z, perpendicular to the longitudinal axis X, from the bottom wall 4 to an upper wall 6 of the tank 3. The terms “upper”, “lower”, “above” and “below” are defined relative to the vertical axis Z. The bottom wall 4 of the tank denotes a preferably generally flat wall. The upper wall 6 is substantially parallel to the bottom wall 4. The general geometry of the tank can also be of different types. Polyhedral geometries are the most common. A cylindrical, spherical or other geometry is also possible.

A tripod mast 7 is arranged in the tank 3, extending along the vertical axis Z, i.e. perpendicular to the load-bearing structure 2. The tripod mast 7 is fixed near a side wall 5 of the tank 3. This tripod mast 7 is preferably, but not limitatively, substantially centered on the middle of the width of the vessel. It extends from the bottom wall 4 of the tank to the upper wall 6 of the tank 3. In the present example, the tripod mast 7 is also fixed to the load-bearing structure via a support (not shown). The tripod mast 7 supports one or more pump(s) 8, the pump head 9 of which is situated near the bottom wall 4 of the tank 3. Pipes connect the pump head 9 to a cargo handling system (not illustrated) through the upper wall 6 of the tank 3. This cargo handling system makes it possible to load/unload the LNG contained in the tank 3 via the pump 8.

During the unloading of the LNG tank or if the LNG contained in the tank is used to supply gas to the vessel's engines, the pump 8 is activated in order to suck up the LNG contained in the tank 3 via the pump head 9. In vessels

with engines powered by LNG coming from the tank, during a return voyage, only a liquid heel of LNG is retained in the tank 3 in order to power the vessel's engines.

With reference to figure 2, a liquid retention container 10 is installed in the tank 3 in order to keep the pump head 9 continuously submerged in liquid product, here LNG, regardless of the vessel's movements. The pump head 9 is accommodated in the container 10, which contains a quantity of LNG. This pump head 9 is fixed to the container 10, which is rigidly connected to the support (not shown) of the tripod mast 7, which in turn is fixed to the load-bearing structure 2. The container 10 includes a bottom 11 arranged above the bottom wall 4 of the tank. The bottom 11 extends parallel to the bottom wall 4. Preferably, the distance between the bottom 11 of the container and the bottom wall 4 of the tank 3 is between 25 and 150 mm, and the maximum value can reach 250 mm. The container 10 comprises a wall 12 extending from the bottom 11 along the vertical axis Z. In the present example, the container 10 has a circular cylindrical shape. Of course, the container can have another shape such as trapezoid, parallelepipedal, etc. The upper part of the container 10 is open. In other words, the container 10 comprises an opening 13 opposite the bottom 11 relative to the vertical axis Z and defined by a rim 14 of the wall 12. Thus, when the level of LNG in the tank 3 is higher than the container 10, the container 10 is filled with LNG via the opening 13.

As can be seen in figure 2, the wall 12 has an inner face 15 provided with two lugs 16. These lugs 16 protrude radially towards the inside of the container 10. These lugs 16 extend from diametrically opposite zones of the inner face 15. The pump head 9 includes two fins 17 protruding radially outwards, i.e. in the direction of the inner face 15 of the container 10. The lugs 16 of the container 10 are fixed to the fins 17 of the pump head 9 by any suitable means such as using screws and nuts, a weld, or other means. The pump is thus fixed to the container 10 and is accommodated inside said container 10. Preferably, the pump head 9 is centered in the container 10. A free end of the pump head 9, through which LNG is sucked up when the tank 3 is unloaded, is preferably situated near the bottom of the container 10 in

order to be kept submerged in the LNG contained in the container 10. The container 10 also comprises two securing fins 19 that protrude radially from an outer face 18 of the wall 12 of the container. The securing fins 19 are also diametrically opposite each other from diametrically opposite zones of the outer face 18. The outer face 18 is radially opposite the inner face 15 of the wall 12. These securing fins 19 are fixed via fixing means (not shown) to the support of the tripod mast 7.

With reference to figures 3 and 4, the container 10 is provided with at least one non-return valve 20 as illustrated in the cut-away part of figure 2. The non-return valve 20 allows the LNG contained in the tank 3 to enter the container 10 to keep the pump head submerged in a volume of LNG, in particular when the level of LNG in the tank 3 is below a plane in which the rim 14 of the wall 12 is defined. To this end, the bottom 11 of the container 10 is provided with at least one passage 24 (cf. figures 5 and 6) connecting the inside and the outside of the container. The passage 24 passes through the bottom 11 from one side to the other along the vertical axis Z. In the present example, the container 10 is provided with three passages 24. These passages 24 are evenly distributed around the pump head 9. The non-return valve 20 is arranged on the bottom 11 of the container as can be seen in figure 2. Each passage 24 engages with a non-return valve 20 that respectively frees or closes the passage as a function of the pressure exerted by the LNG stored in the tank 3 as explained below.

In figures 3 and 4, the non-return valve 20 comprises a base 21 forming a valve seat and a valve 22 that can move relative to the base 21. All of the non-return valves mounted in the container are similar. Just one of them is described below in detail, in an installed state in the container.

The base 21 in the example illustrated is an additional part on the bottom of the container. It comprises a central opening 23 for the passage of a fluid having a central axis A and passing through the wall of the base 21 from one side to the other along the vertical axis Z. The central axis A is perpendicular to the plane in which the base is defined, and parallel to the vertical axis Z. In particular, the base 21 is fixed to the bottom 11 of the

container by any suitable means, for example using screws and nuts or by welding. As can be seen in figure 3, the base 21 comprises notches 29 in its periphery in which are accommodated the screws used to fix the base 21 to the bottom 11. In the present description, the base 21 has a circular transverse cross-section. It is of course possible for the base to have a rectangular or other cross-section. Each base 21 surrounds a passage 24 formed in the container. Each central opening 23 is coaxial with the axis of the passage 24 of the container 10. In other words, the central opening 23 delimited by the base 21 communicates with the passage 24 of the container 10. The central opening 23 has a substantially larger diameter than the diameter of the passage 24 with which it engages.

The movable valve 22 can be moved between a first closed position of the central opening 23 and a second open position of the central opening 23. To this end, the non-return valve 20 comprises means 25 for guiding the movable valve 22 between the first and second positions. These guiding means 25 more specifically make it possible to guide and limit the movement of the movable valve 22. Here, the movable valve 22 translates in a direction of movement substantially perpendicular to a plane of the central opening 23. In the present case, the direction of movement is parallel to the vertical axis Z. In other words, the movement of the movable valve is parallel to the central axis A of the central opening 23. The movable valve is also defined in a plane substantially parallel to the plane of the central opening. The guiding means 25 comprise a single central guiding element 26 aligned on the axis of the central opening 23 and rigidly connected to the base 21. The movable valve 22 is mounted free to translate relative to the central guiding element 26.

In particular, the guiding means 25 comprise securing members 27 that are fixed to the base 21. These securing members 27 each extend from the base 21, from an outer surface 28 thereof. This outer surface 28 is opposite, along the vertical axis Z, an inner surface facing towards the bottom of the container. The securing members each have an axis parallel to the axis of the central opening. In the example shown, the securing members 27 are three in number, as can be seen in figures 3 and 4. They are evenly distributed on

the base 21. The securing members 27 are fixed to the base 21 by welds, screws or any other suitable means.

A connecting member 30 makes it possible to connect the central guiding element 26 to the base 21. More specifically, this connecting member 30 is connected to the securing members 27 and to the central guiding element 26. The connecting member 30 is fixed relative to the securing members 27 and the central guiding member 26. To this end, the connecting member 30 comprises a central portion 31 defined in a plane perpendicular to the axis A of the central opening. This central portion 31 supports the central guiding element 26. Arms extend from this central portion 31, here three arms 32 that are evenly distributed around the periphery of the central portion 31. In other words, the arms 32 are spaced apart from each other. This promotes the movement of the moving valve and particularly makes it possible for the pressure of the liquid in the container to be applied without obstruction to an upper surface 33 of the moving valve 22. Each arm 32 is connected to a securing member 27. Each arm 32 comprises a free end 34 that widens substantially in the same plane as the central portion 31. Each free end 34 has a cylindrical ring shape. Each securing member 27 comprises a distal end 35 that is received through the cylindrical ring of the corresponding free end 34. The free end 34 of each arm is fixed to a securing member via fixing elements 36. These fixing elements 36 comprise a threaded part with a reduced cross-section arranged at the distal end 35 of the securing members. A nut is screwed onto each threaded part to fix the free end 34 of the arms to the securing member. Other differently arranged fixing elements can of course be envisaged. Furthermore, the central portion 31 has a circular transverse cross-section. The arms 32 extend radially from its periphery. The connecting member 30, with its central portion 31 and the arms 32, are integrally formed.

The central guiding element 26 comprises an elongated central rod 38 that is borne by the central portion 31. The elongated central rod 38 is coaxial with the central opening 23. Here, the central rod 38 has a circular transverse cross-section. The central portion 31 of the connecting member 30 comprises a through-slot 39 in which a first end 40 of the central rod 38 is received. This

first end 40 comprises a bore 41 receiving fixing means 42 rigidly connecting the central rod 38 to the central portion 31 of the connecting member. Here, the fixing means 42 comprise a screw and a washer as illustrated in figure 4. Of course, other similar means can be envisaged. The movable valve 22 comprises a through-orifice 43 allowing the passage of the central rod 38. The movable valve 22 moves along the rod 38 between its first and second positions.

Figures 5 and 6 illustrate the operation of a non-return valve 20 as illustrated in figures 3 and 4. The movable valve 22 can move in the container 10 in the direction of movement perpendicular to the bottom 11 of the container 10 and, preferably, parallel to the Earth's gravity. In figure 5, the movable valve 22 is shown in its first closed position in which the central opening 23 and the passage 24 are closed. The movable valve is located on the lower part of the central rod 38 forming the central guiding element. The upper part of the central opening 23 is delimited by a first beveled surface 44 that engages with and complements a second beveled surface 45 of the movable valve to form a first stop. In particular, the first beveled surface 44 connects the outer surface 28 of the base and an inner cylindrical face 46 of the central opening. The second beveled surface 45 is formed on a peripheral edge 47 of the movable valve 22. In addition, the first and second beveled surfaces come into contact in a sealed manner around the central opening 23. Advantageously, but not limitatively, the first and second beveled surfaces 44, 45 each have an angle of 45° relative to the plane of the movable valve.

In figure 6, the movable valve 22 is shown in its second open position in which the central opening 23 and the passage 24 are open. In this position, the movable valve 22 is on the upper part of the central rod. The central rod comprises a shoulder 48 forming a second stop. This shoulder 48 is situated in the vicinity of the first end 40 of the central rod 38 and the movable valve 22 presses against it at the end of its travel. In the present example, the movable valve 22 comprises an annular seating 49 surrounding the through-orifice 43 and coming up against the shoulder 48 likewise at the end of its travel. The movable valve 22 moves along the central rod according to a predetermined

guiding length between the base and the connecting member. Preferably, the guiding length is determined between the first stop formed by the first and second beveled surfaces 44, 45 and the second stop formed by the shoulder 48. Advantageously, but not limitatively, the ratio between the guiding length and the outer diameter of the central rod is between 1 and 2. Preferably, the ratio is of the order of 1.5. The guiding takes place with very little clearance to avoid leaks. Advantageously, the clearance is of the order of 0.1 mm.

The movable valve 22 moves from the first position to the second position in the container 10 under the effect of a pressure differential exerted on the movable valve 22 between the inside and the outside of the container 10, greater than a predetermined positive threshold. In particular, when the container 10 is surrounded by LNG present in the tank 3, without the LNG being higher than the rim 14 of the container 10 and therefore flowing into the container 10 through the opening 13 of the container, the movable valve 22 is subject to an internal pressure caused by the LNG present in the container 10, and to an external pressure caused by the LNG stored in the tank 3, surrounding the container 10 and in contact with the movable valve 22. The movable valve 22 is therefore subject to a pressure differential that makes it possible to push the movable valve 22, moving it away from the base 21 and therefore from the valve seat.

The pressure differential allows the movable valve 22 to switch from its closed position to its open position when the following equation is true:

$$P_{\text{tank}} \times S_{\text{lower}} + F_{\text{buoyant}} > P_{\text{container}} \times S_{\text{upper}} + \text{Weight}_{\text{valve}}.$$

Where P_{tank} represents the pressure exerted by the LNG contained in the tank 3 outside the container 10 on the movable valve 22, S_{lower} represents the lower surface of the valve 22 in contact with the LNG contained in the tank 3 outside the container 10, F_{buoyant} represents the buoyancy exerted on the valve 22 by the LNG contained in the tank 3 outside the container 10, $P_{\text{container}}$ represents the pressure exerted by the LNG contained in the container 10 on the movable valve 22, S_{upper} represents the upper surface of the movable valve 22 on which the pressure of the LNG contained in the container 10 is exerted, and $\text{Weight}_{\text{valve}}$ represents the weight of the movable valve 22.

Typically, this equation reflects the fact that the opening of the movable valve 22, i.e. its separation from the base 21, depends on the height difference between the LNG contained in the tank 3 and the LNG contained in the container 10.

5 As the pressure exerted by this LNG contained in the tank 3 on the movable valve 22 pushes it out of the valve seat, the passage 24 is no longer obstructed and the LNG present in the tank 3 enters the container 10 through the passage 24 situated in the bottom 11 of the container.

10 Conversely, the movable valve moves from the second position to the first position in the container 10 under the effect of its own weight and, if applicable, a pressure differential less than said threshold. In particular, when the LNG contained in the tank 3 does not surround the container, the only pressure exerted on the movable valve 22 is that exerted by the LNG contained in the container 10. Under the effect of gravity and the pressure exerted by the
15 LNG contained in the container 10, the movable valve 22 is therefore pushed towards the bottom 11 of the container 10 and engages with the valve seat in order to obstruct the passage in the bottom 11 of the container 10. If the LNG stored in the tank 3 does not exert sufficient pressure on the movable valve 22 to push it out of the valve seat, the LNG contained in the container 10 is kept
20 in said container.

 The movable valve 22 is made from a material with a lower density than metals of the stainless steel type in order to limit the opening pressure, and compatible with LNG. By way of example, preference will be given to aluminum as the material of the movable valve as aluminum offers an improved weight
25 to strength ratio. Alternatively, polymer materials, preferably a polytetrafluoroethylene, abbreviated to "PTFE", can be used to make the movable valve 22. In this last case, the movable valve can be made from PTFE or provided with a PTFE coating. The movable valve 22 is thus light and its weight only slightly interferes with its opening under the effect of the pressure
30 exerted by the LNG contained in the tank 3. Moreover, the PTFE coating offers good sliding properties for the movable valve 22, facilitating its movement in the container 10. Furthermore, the other members that make up the non-return

valve (connecting member, base, securing members, and central guiding member) are made from stainless steel.

In another embodiment illustrated in figure 7, the central guiding element 26 comprises a through-hole 50 borne by the central portion 31. This through-hole 50 has a circular cross-section. In this scenario, the movable valve 22 comprises the central rod 38' extending along an axis parallel to the axis A of the central opening. The central rod 38' can be fixed to the movable valve 22, here via a screw 51 accommodated in a blind hole in the central rod at its second end 52. Alternatively, the central rod 38' is integrally formed with the movable valve 22. When the movable valve 22 moves in its direction of movement, and under the effect of a pressure differential, the central rod 38' simultaneously translates through the through-hole 50 in the connecting member. Preferably, but not limitatively, the second stop is formed by an annular boss 53 surrounding the through-hole 50 and against which part of the upper surface 33 of the movable valve 22 presses when it occupies its second position. Advantageously, the central rod 38' comprises a shoulder 54 situated in the vicinity of its second end 52 to abut against the annular boss 53.

In another embodiment illustrated in figure 8, the non-return valve 20 has the same configuration as illustrated in figures 5 and 6 with the exception of the base 21 attached to the bottom 11 of the container. More specifically, in this example, the base 21', forming the seat for the movable valve 22, comprises a portion of the bottom wall 11 of the container. In other words, the base 21 and the bottom wall 11 of the container 10 are integrally formed. In this case, the base 21' defines the central opening 23. The movable valve 22 moves relative to the portion of the bottom wall 11 of the container 10, here the base 21', between its first closed position and its second open position. The securing members 27 each extend from the base 21' formed by a portion of the bottom 11 and each have an axis parallel to the axis of the central opening 23. The securing members 27 are fixed to the base 21' by welds, screws or any other suitable means as in the previous embodiments. The three arms 32 of the connecting member 30 are each connected to a securing member 27. The central guiding element 26 is connected to the base 21' via

the connecting member 30. The central guiding element 26 can comprise the through-hole 50 receiving the central rod 38' rigidly connected to the movable valve 22 or the central rod 38 rigidly connected to the connecting member 30.

CLAIMS

5 1. A container (10) intended to contain a liquid product, such as liquefied natural gas, and provided with at least one non-return valve (20), in particular for a liquefied natural gas carrier vessel (1), the non-return valve (20) comprising:

- a base (21) having a central opening (23) for the passage of a fluid,
- 10 - a valve (22) that can be moved between a first closed position of said central opening and a second open position of said central opening (23),
- means (25) for guiding the translation of the movable valve between the first position and the second position, in a direction of movement substantially perpendicular to a plane of said central opening (23), the
- 15 guiding means (25) comprising a single central guiding element (26) aligned on an axis (A) of the central opening and rigidly connected to the base (21), the movable valve (22) being mounted free to translate relative to the central guiding element (26),

the container (10) comprising a bottom (11) provided with at least one

20 passage (24) connecting the inside and the outside of the container, the base (21) of the non-return valve being borne by the bottom (11) of the container and the movable valve (22) being capable of occupying its first closed position and obstructing the passage (24) when a pressure differential exerted on the movable valve (22) between the outside of the container and

25 the inside of the container is less than a predetermined positive threshold, and occupying its second open position and freeing the passage (24) when the pressure differential is greater than said threshold.

2. The container (10) as claimed in the previous claim,

30 characterized in that the guiding means (25) comprise evenly distributed securing members (27) each extending from the base (21) along an axis parallel to the axis (A) of the central opening (23), the central guiding element

(26) being connected to the securing members (27) via a connecting member (30).

3. The container (10) as claimed in the previous claim,
5 characterized in that the connecting member (30) comprises a central portion (31) supporting the central guiding element (26) and arms (32) spaced apart from each other and each connected to a securing member (27) and to the central portion (31).

10 4. The container (10) as claimed in either one of claims 2 and 3, characterized in that the connecting member (30) is fixed relative to the securing members (27) and the central guiding member (26).

15 5. The container (10) as claimed in any one of the previous claims, characterized in that the central guiding element (26) has a circular cross-section with a predetermined outer diameter.

6. The container (10) as claimed in any one of the previous claims,
20 characterized in that the movable valve (22) moves according to a predetermined guiding length between a first stop (44, 45) and a second stop (48, 53).

7. The container (10) as claimed in the previous claim,
25 characterized in that the second stop (48, 53) is situated in the vicinity of one end of the central guiding element (26) and the first stop is formed by a first beveled surface (44) borne by the base (21), which complements a second beveled surface (45) borne by the movable valve (22), the first and second beveled surfaces (44, 45) being capable of coming into contact in a sealed manner around the central opening (23).

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8. The container (10) as claimed in claim 6 or 7, characterized in that the ratio between the guiding length and the predetermined outer diameter of the central guiding element (26) is between 1 and 2.

5 9. The container (10) as claimed in any one of the previous claims, characterized in that the central guiding element (26) comprises a central rod (38) extending along the axis (A) of the central opening, the movable valve (22) including a through-orifice (43) receiving the central rod (38).

10 10. The container (10) as claimed in any one of claims 1 to 8, characterized in that the central guiding element (26) comprises a through-hole (50), the movable valve (22) bearing a rod (38') extending along the axis (A) of the central opening (23) and received in the through-hole (50).

15 11. The container (10) as claimed in any one of the previous claims, characterized in that the base (21) with said central opening (23) is an additional part that is fixed onto the base (11) of the container, said central opening (23) communicating with the passage (24) of the container (10) in
20 which the base is formed by a portion of the bottom (11) of the container (10) and defines the central opening (23).

25 12. A thermally insulated tank (3) intended to contain a liquid product, such as liquefied natural gas, at least one container (10) as claimed in one of claims 1 to 11, and a pump (8) including a pump head (9) intended to suck up the liquid product contained inside the tank, the bottom (11) of the container (10) facing towards a bottom wall of the tank (3) and the pump head (9) being arranged in the container (10), near the bottom of the container (10).

30 13. A vessel (1), in particular a liquefied natural gas carrier vessel, comprising a tank (3) as claimed in claim 12.