CLAIMS

1. A vaporization device (4) for cooling a liquefied gas chosen from liquefied natural gas, ethane and liquefied petroleum gas, said vaporization device (1) comprising:
- a vaporization chamber (14) arranged in the interior space of a container (2, 19) intended to be filled with liquefied gas (3), the vaporization chamber (14) comprising heat exchange walls (6) allowing an exchange of heat between an interior space of the vaporization chamber (14) and a liquefied gas (3) present in the interior space of the container (2, 19);
- an inlet circuit (5) comprising an intake emerging in the interior space of the container (2, 19) for withdrawing a flow of liquefied gas in liquid phase from the container (2, 19) and a plurality of head loss members emerging in the interior space of the vaporization chamber (14) in order to expand the withdrawn gas flow and formed from spray nozzles (13) capable of spraying the liquefied gas inside the vaporization chamber (14);
- an outlet circuit (7) arranged to evacuate the withdrawn gas flow, in gaseous phase from the vaporization chamber (14) to a vapor phase gas usage circuit (8); said outlet circuit (7) comprising a vacuum pump (9) capable of sucking the gas flow into the vaporization chamber (14), of discharging it to the vapor phase gas usage circuit (8) and of maintaining an absolute pressure lower than atmospheric pressure in the vaporization chamber (14).

2. The device as claimed in claim 1, in which the vacuum pump (9) is capable of placing the gas flow circulating in the vaporization chamber (14) under an absolute pressure of between 120 and 950 mbar.

3. The device as claimed in claim 1 or 2, in which the inlet circuit (5) comprises a pressure regulator (17) upstream of the head loss member (13).

4. The device as claimed in any one of claims 1 to 3, in which the inlet circuit (5) comprises, upstream of the head loss member (13), an additional pump (33) capable of sucking the flow of liquefied gas in liquid phase and of generating a discharge pressure greater than the maximum hydrostatic pressure likely to be reached in the interior space of the container (2, 19) at the intake of the inlet circuit (5).

5. The device as claimed in claim 4, in which the inlet circuit (5) further comprises a pressure regulator (17) arranged downstream of the additional pump (33) capable of limiting the pressure of the liquefied gas discharged by the additional pump (33) in the inlet duct (5) to a threshold pressure lower than the discharge pressure of the additional pump (33).

6. The device as claimed in any one of claims 1 to 5, in which the heat exchange walls (6) comprise fins (15), intended to augment the exchange surface of the vaporization chamber (14).

7. The device as claimed in any one of claims 1 to 6, comprising a device (24) for recovering and evacuating a heavy fraction of the withdrawn liquefied gas, associated with the vaporization chamber (14).

8. The device as claimed in claim 7, in which the vaporization chamber (14) has a slope and in which the device (24) for recovering and evacuating a heavy fraction of the liquefied gas comprises a receptacle (25) linked to a low point of the vaporization chamber (14) so as to collect the heavy fraction by gravity.

9. The device as claimed in claim 8, in which the receptacle (25) is coupled to the vaporization chamber (14) by a valve, a duct, a non-return value (31) or a trap (29).

10. The device as claimed in claim 8 or 9, in which the device (24) for recovering and evacuating a heavy fraction of the liquefied gas further comprises an evacuation duct (26) linked to the receptacle (25), the evacuation duct (26) extending from the receptacle (25) to the container (2, 19) or to a heavy fraction conditioning device.

11. The device as claimed in claim 10, in which the evacuation duct (26) is equipped with a pump (27) for discharging the heavy fraction in liquid phase through the evacuation duct (26).

12. The device as claimed in claim 10, in which the device (24) for recovering and evacuating a heavy fraction of the liquefied gas further comprises a heating device capable of heating an interior space of the receptacle (25) to vaporize the heavy fraction; the evacuation duct (26) being capable of evacuating the heavy fraction in vapor phase.

13. The device as claimed in one of claims 10, in which the evacuation duct (26) is linked to the receptacle (25) via a valve or a non-return valve (30) and in which the interior space of the receptacle (25) is connected with the outlet circuit (7) of the device, the outlet circuit (7) being coupled to a fluid supply device via a Y-coupling in order to be able to discharge fluid through the outlet circuit (7) to the receptacle (25) so as to discharge the heavy fraction contained in the receptacle (25) to the evacuation duct (26).

14. The device as claimed in any one of claims 1 to 13, further comprising an additional heat exchanger (34) which is coupled upstream to the vaporization chamber (14) and downstream to the outlet circuit (7), said additional exchanger (34) being arranged in an

upper portion of the interior space of the container (2) intended to be filled at least partially with liquefied gas (3).

15. The device as claimed in claim 14, comprising a first bypass line (36), a first three-way coupling coupling the vaporization chamber (14) to the additional heat exchanger (34) and to the first bypass line (36) and a valve (37, 39) capable of selectively allowing or preventing the passage of the gas flow withdrawn from the vaporization chamber (14) to the first bypass line (36).

16. The device as claimed in claim 14 or 15, comprising a second bypass line (40) which is, on the one hand, coupled to the inlet circuit (5), upstream of the head loss member (13), and, on the other hand, coupled to the additional heat exchanger (34), in order to conduct at least a part of the withdrawn liquefied gas flow from the inlet circuit to the second bypass line (40), the device further comprising regulation means (40, 42, 43, 44) capable of regulating the flow rates of gas flows circulating respectively through the vaporization chamber (14) and through said second bypass line (40).

17. A liquefied gas storage and cooling installation comprising a container (2, 19) having an interior space and a vaporization device as claimed in any one of claims 1 to 16, the vaporization chamber (14) of said vaporization device being arranged in the interior space of said container (2, 19).

18. The installation as claimed in claim 17, in which the container (2, 19) is a tight and thermally insulating tank.

19. The installation as claimed in claim 17 or 18, in which the container is a tight and thermally insulating ancillary tank (19), the installation (1) further comprising a tight and thermally insulating main tank (20), a delivery duct (21) and a return duct (22) linking the main tank (20) and the ancillary tank (19) and a pump (23) capable of circulating liquefied gas between the main tank (20) and the ancillary tank (19) through the delivery duct (21) and the return duct (22).

20. The installation as claimed in any one of claims 17 to 19, in which the container (2, 19) is filled with a liquefied combustible gas chosen from liquefied natural gas, ethane and liquefied petroleum gas.

21. A method for cooling a liquefied gas contained in the interior space of a container (2, 19), the liquefied gas being chosen from liquefied natural gas, ethane and liquefied petroleum gas, the cooling method comprising:

- withdrawing a flow of liquefied gas in the container (2, 19) containing a quantity of liquefied

gas having to be cooled and conducting it to a vaporization chamber (14) arranged in the interior space of the container (2, 19) through a plurality of head loss members emerging in the interior space of the vaporization chamber (14) and formed from spray nozzles (13) capable of spraying the liquefied gas inside the vaporization chamber (14);

- generating an absolute pressure lower than atmospheric pressure inside the vaporization chamber (14);
- effecting a heat exchange through the walls (6) of the vaporization chamber (14) between the gas flow withdrawn and expanded in the vaporization chamber (14) and the liquefied gas (3) contained in the container (2, 19) so as to vaporize the withdrawn gas flow by absorbing calories from the liquefied gas (3) contained in the container (2, 19); and
- conducting the withdrawn gas flow in vapor phase to a vapor phase gas usage circuit (8).

22. The method as claimed in claim 21, in which an absolute pressure lying between 120 and 950 mbar, preferably lying between 650 and 850 mbar, is maintained inside the vaporization chamber (14).

23. The method as claimed in claim 21 or 22, in which the liquefied gas is stored in the interior space of the container (2) in a state of two-phase equilibrium and has a lower liquid phase and an upper gaseous phase (35) and in which the gas flow withdrawn from the vaporization chamber (14) is conducted to an additional exchanger (34) in contact at least partially with the upper gaseous phase (35) in order to effect a heat exchange between the withdrawn gas flow and the upper gaseous phase (35) before conducting the withdrawn gas flow to the vapor phase gas usage circuit (8).

24. The method as claimed in claim 23, in which the vaporization chamber (14) is coupled to the additional heat exchanger (34) and to a bypass line (36) making it possible to circumvent the additional heat exchanger (35) via a first three-way coupling, a valve (37, 39) being capable of selectively allowing or preventing the passage of the withdrawn gas flow to the bypass line (36) and in which said valve (37, 39) is controlled in order to allow or prevent the passage of the withdrawn gas flow to the bypass line (36) as a function of a variable representative of the pressure of the upper gaseous phase (35).

25. The method as claimed in any one of claims 21 to 24, in which the liquefied gas is stored in the interior space of the container (2) in a state of two-phase equilibrium and has a lower liquid phase and an upper gaseous phase (35) and in which a flow of liquefied gas is withdrawn from the container and it is conducted to an additional heat exchanger (34) at least partially in contact with the upper gaseous phase (35) in order to effect a heat exchange between said withdrawn gas flow and the upper gaseous phase (35).

26. A ship (70) comprising an installation (1) as claimed in any one of claims 17 to 20 and in which the vapor phase gas usage circuit (8) is an energy production unit.

27. A method for loading or offloading a ship (70) as claimed in claim 26, in which a fluid is routed through insulated lines (73, 79, 76, 81) from or to a floating or onshore storage installation (77) to or from a tank (71) of the ship.

28. A transfer system for a fluid, the system comprising a ship (70) as claimed in claim 26, insulated lines (73, 79, 76, 81) arranged so as to link the tank (71) installed in the hull of the ship to a floating or onshore storage installation (77) and a pump for driving a fluid through the insulated lines from or to the floating or onshore storage installation to or from the tank of the ship.