CLAIMS

1. A floating structure comprising a hull including bearing walls defining a polyhedral space inside the hull, the floating structure comprising a sealed and thermally insulated tank housed in the polyhedral space to store a low-temperature liquefied gas,

in which an upper bearing wall of the hull has an opening and bears a turret-like cargo tank dome projecting from an exterior surface of the upper bearing wall around the opening, the opening and the turret-like cargo tank dome being intended for the passage of cargo handling equipment for handling a liquid phase and/or a vapor phase of the liquefied gas contained in the tank,

in which the tank comprises a plurality of tank walls fixed to the bearing walls of the hull,

in which an upper tank wall comprises a multilayer structure fixed to an interior surface of the upper bearing wall, the multilayer structure being formed of a primary sealing membrane intended to be in contact with the liquefied gas contained in the tank, a secondary sealing membrane arranged between the primary sealing membrane and the upper bearing wall, a secondary insulating barrier positioned between the secondary sealing membrane and the upper bearing wall, and a primary insulating barrier positioned between the secondary sealing membrane and the primary sealing membrane,

in which the turret-like cargo tank dome comprises:

an internal fluidtight wall forming a sheath engaged through the opening of the upper bearing wall and connected in a fluidtight manner to the primary sealing membrane of the upper tank wall all around the sheath,

an external fluidtight wall arranged around the sheath some distance from the sheath parallel to the sheath, the external fluidtight wall being connected in fluidtight manner to the upper bearing wall around the opening,

a dividing wall arranged between the external fluidtight wall and the internal fluidtight wall of the turret-like cargo tank dome and dividing the space defined between the external fluidtight wall and the internal fluidtight wall of the turret-like cargo tank dome into, on the one hand, a secondary

space communicating through the opening of the upper bearing wall with the secondary insulating barrier of the upper tank wall arranged around the opening and, on the other hand, a primary space communicating through the opening of the upper bearing wall with the primary insulating barrier of the upper tank wall positioned around the opening, a primary venting device comprising a primary overpressure relief valve and a primary venting pipe communicating directly with the primary space of the turret-like cargo tank dome and passing through the external fluidtight wall of the turret-like cargo tank dome in order to allow gas to be vented from the primary space in response to an opening of the primary overpressure relief valve, a secondary venting device comprising a secondary overpressure relief valve and a secondary venting pipe communicating directly with the secondary space of the turret-like cargo tank dome and passing through the external fluidtight wall of the turret-like cargo tank dome to allow gas to be vented from the secondary space in response to an opening of the secondary overpressure relief valve,

the floating structure further comprising:

a gas reservoir containing a tracer gas that is non-condensable or that has a condensation temperature below the low temperature of the liquefied gas contained in the tank, the gas reservoir being connected via a control valve to one of the venting devices that are the primary venting device and the secondary venting device, and

a gas detector able to detect the tracer gas, the gas detector being in communication with the other of the venting devices that are the primary venting device, notably the primary venting pipe, and the secondary venting device, notably the secondary venting pipe.

2. The floating structure as claimed in claim 1, in which the primary or secondary venting device further comprises a primary or secondary control line which communicates directly with the primary or secondary space of the turret-like cargo tank dome and which passes through the external fluidtight wall of the turret-like cargo tank dome to control the primary or secondary overpressure relief valve according to the pressure prevailing in the primary or secondary space, and in which the gas reservoir is in direct communication with the primary or secondary control line.

3. The floating structure as claimed in claim 1 or 2, in which the primary or secondary venting device further comprises a primary or secondary control line which communicates directly with the primary or secondary space of the turret-like cargo tank dome and which passes through the external fluidtight wall of the turret-like cargo tank dome to control the primary or secondary overpressure relief valve according to the pressure prevailing in the primary or secondary space, and in which the gas detector is in direct communication with the primary or secondary control line.

4. The floating structure as claimed in one of claims 1 to 3, in which the turret-like cargo tank dome is a vapor dome of the tank, the sheath engaged through the opening of the upper bearing wall being a collecting pipe connected to a main vapor manifold of the floating structure,
and in which the dividing wall of the turret-like cargo tank dome forms a primary withdrawing pipe running parallel to the collecting pipe in the space defined between the external fluidtight wall and the internal fluidtight wall of the turret-like cargo tank dome and having an interior end opening into the primary insulating barrier of the upper tank wall and an exterior end opening directly into the primary venting device, the primary space of the turret-like cargo tank dome comprising the interior space of the primary withdrawing pipe.

5. The floating structure as claimed in one of claims 1 to 3, in which the turret-like cargo tank dome is a liquid dome of the tank, further comprising a top wall positioned over an upper end of the external fluidtight wall of the liquid dome and having an opening aligned with a central zone of the opening of the upper bearing wall, the sheath formed by the internal fluidtight wall of the liquid dome being a primary sealing membrane having an upper edge attached in fluidtight manner to an edge of the top wall all around the opening of the top wall,
and in which the dividing wall comprises a secondary sealing membrane extending all around the sheath between the external fluidtight wall and the sheath and having an interior end connected in fluidtight manner to the secondary sealing membrane of the upper tank wall all around the sheath and an exterior end connected in fluidtight manner to the top wall all around the opening of the top wall of the liquid dome.

6. The floating structure as claimed in claim 5, in which the wall of the liquid dome comprises a multilayer structure fixed to an interior surface of the

external fluidtight wall, the multilayer structure being formed of the primary sealing membrane of the liquid dome, the secondary sealing membrane of the liquid dome, a secondary insulating barrier of the liquid dome positioned between the secondary sealing membrane and the external fluidtight wall and a primary insulating barrier positioned between the secondary sealing membrane and the primary sealing membrane of the liquid dome.

7. The floating structure as claimed in claim 6, further comprising a connecting plate positioned between the exterior end of the secondary sealing membrane of the liquid dome and the top wall, the connecting plate comprising a main leg running parallel to the external fluidtight wall between the external fluidtight wall and the sheath formed by the internal fluidtight wall of the liquid dome, the main leg comprising an upper end attached to the top plate and a lower end extended by a flange bent over toward the inside of the liquid dome with respect to the main leg, the exterior end of the secondary sealing membrane being attached in a fluidtight manner to the flange,

in which the secondary insulating barrier of the liquid dome comprises a fibrous filling placed between the main leg of the connecting plate and the external fluidtight wall, and

in which the secondary venting pipe opens into the fibrous filling.

8. The floating structure as claimed in claim 7, in which the primary venting pipe passes through the main leg of the connecting plate and opens into the primary insulating barrier between the main leg of the connecting plate and the primary sealing membrane of the liquid dome.

9. The floating structure as claimed in one of claims 5 to 8, further comprising a nitrogen distribution system including a gaseous-nitrogen reservoir and a distribution network, the distribution network comprising a primary distribution pipe extending from an upper deck of the floating structure through the primary space of the liquid dome and through the primary insulating barrier of a transverse wall of the tank as far as a bottom zone of the tank, and a secondary distribution pipe extending from the upper deck of the floating structure through the secondary space of the liquid dome and through the secondary insulating barrier of the transverse wall of the tank as far as the bottom zone of the tank, and

in which the nitrogen distribution system further comprises pressure regulating

means for regulating the pressure prevailing in the primary insulating barrier and the secondary insulating barrier of the walls of the tank by means of the primary and secondary distribution pipes.

10. The floating structure as claimed in one of claims 1 to 9, in which the tracer gas is selected from argon, helium and mixtures thereof.

11. The floating structure as claimed in one of claims 1 to 10, in which the tracer gas reservoir is fixed removably to the primary or secondary venting device.

12. A method for operating a floating structure as claimed in one of claims 1 to 11, involving:

injecting the tracer gas through one of the primary and secondary venting devices into the primary or secondary space of the turret-like cargo tank dome of the floating structure as claimed in one of claims 1 to 11 without exceeding the pressure at which the primary or secondary overpressure relief valve opens,

detecting the tracer gas through the other of the primary and secondary venting devices in the primary or secondary space of the turret-like cargo tank dome and diagnosing a leak in the secondary sealing barrier of the tank upper wall and/or in the turret-like cargo tank dome dividing wall in response to the detection of the tracer gas.

13. The method as claimed in claim 12, in which the tracer gas is injected into the secondary space through the secondary venting device and is detected in the primary space through the primary venting device, the method further involving:

maintaining a higher total pressure in the secondary space than in the primary space by injecting gaseous nitrogen into the secondary space, without exceeding the pressure at which the secondary overpressure relief valve opens.

14. The method as claimed in claim 12 or 13, in which the step of diagnosing a leak comprises one of the measures selected from the group involving logging the presence of a leak, measuring a quantity or concentration of the tracer gas in order to determine a flow rate of the leak, and measuring a time delay

between the injection and detection of the tracer gas in order to determine a position of the leak.

15. A method for the loading of, or offloading from, a floating structure as claimed in one of claims 1 to 11, in which liquefied gas is brought through insulated pipelines from or to a floating or on-shore storage facility to or from the sealed and thermally insulated tank of the floating structure as claimed in one of claims 1 to 11.

16. A transfer system for low-temperature liquefied gas, the system comprising a floating structure as claimed in one of claims 1 to 11, insulated pipelines designed to connect the sealed and thermally insulated tank to a floating or on-shore storage facility and a pump for driving a flow of cold liquid product through the insulated pipelines from or to the floating or on-shore storage facility to or from the tank of the carrier ship.