

DESCRIPTION

TITLE: STORAGE AND TREATMENT FACILITY FOR A GAS PRODUCED BY THE EVAPORATION OF A CRYOGENIC LIQUID

5 [0001] The present invention relates to the field of transport and/or storage of a cryogenic liquid, and more particularly the transport and/or storage of a gas prepared from this cryogenic liquid.

[0002] Gaseous hydrocarbons at ambient temperature and atmospheric
10 pressure are liquefied at cryogenic temperatures, that is, temperatures below -60°C, in order to facilitate their transport and/or storage. The hydrocarbons thus liquefied, also called cryogenic liquids, are then placed in tanks of a structure, particularly a floating structure.

15 [0003] However, such tanks are never perfectly thermally insulated so that natural evaporation of the cryogenic liquid is inevitable. The phenomenon of natural evaporation is called boil-off, and the gas generated by this natural evaporation is called boil-off gas (BOG). The tanks of the structure thus comprise both the cryogenic liquid in liquid form and the gas generated by the
20 boil-off of this cryogenic liquid.

[0004] Part of the gas generated by the boil-off of the cryogenic liquid may be used as fuel to supply at least one consumer, such as an engine, provided to meet the operational energy needs of the floating structure. Thus, it is possible
25 to generate electricity for electrical equipment of this structure.

[0005] The gas circulates to the consumer via a pipe which generally has a significant diameter, such a diameter being adapted to facilitate and accelerate cryogenic liquid loading operations on the floating structure.

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[0006] However, the large diameter of the piping means that the gas resulting from the evaporation of the cryogenic liquid is heated as it is conveyed to the

consumer. The gas resulting from the evaporation of the cryogenic liquid sometimes reaches temperatures that prevent the consumer from being supplied, notably because these temperatures are incompatible with the operation of a compressor located upstream of the consumer and designed to
5 be traversed by the gas resulting from the evaporation of the cryogenic liquid.

[0007] To lower the temperature of the gas evaporating from the cryogenic liquid in the piping, cryogenic liquid is usually sprayed from the floating structure's tanks. However, this solution increases the quantity of fluid to be
10 processed, and also makes the equipment needed to supply the consumer more complex, notably because of the need to use pumps to withdraw the cryogenic liquid from the tanks.

[0008] The aim of the present invention is to overcome this drawback by
15 proposing a facility wherein the gas resulting from the evaporation of the cryogenic liquid is supplied to the consumer, thus limiting its heating during its circulation within the piping of the floating structure.

[0009] The main object of the present invention is a facility for storing and
20 treating a gas resulting from the evaporation of a cryogenic liquid, comprising at least one tank configured to contain both the cryogenic liquid and the gas resulting from the evaporation of the cryogenic liquid, at least one consumer that consumes a fuel prepared at least from the gas resulting from the evaporation of the cryogenic liquid, a high-capacity compressor designed to
25 be connected to a cryogenic liquid storage terminal, and a low-capacity compressor which supplies the fuel to the consumer, the storage and treatment facility comprising a main circuit connecting a tank head to the high-capacity compressor and an accessory circuit at least partly arranged fluidically in parallel with the main circuit, the accessory circuit being configured to supply
30 the gas resulting from the evaporation of the cryogenic liquid directly to the low-capacity compressor.

[0010] The storage and treatment facility described above is integrated into a floating structure, for example. It is configured for the circulation of a cryogenic liquid on the one hand, and for the circulation of a gas resulting from the evaporation of this cryogenic liquid on the other hand, both the cryogenic liquid and the gas being stored within one or more tanks of the storage and treatment facility. In particular, the cryogenic liquid is stored in the bottom of the tank, while the gas resulting from the evaporation of the cryogenic liquid is stored in the top (head) of the tank.

[0011] A consumer in the storage and treatment system is configured to be supplied from the tank; this consumer is supplied, for example, with a fuel in liquid form and/or with a fuel in gaseous form, that is with the cryogenic liquid and/or with the gas resulting from its evaporation. The storage and treatment facility comprises at least two circuits through which the gas resulting from the evaporation of the cryogenic liquid circulates: a main circuit which conducts it to a high-capacity, low-pressure discharge compressor connected to a storage terminal, and an auxiliary circuit which conducts the gas resulting from the evaporation of the cryogenic liquid to a low-capacity, high-pressure discharge device connected to the consumer. Both circuits are therefore dedicated to supplying gas resulting from cryogenic liquid evaporation to a compressor, with the compressors in each circuit differing in the flow rates and pressures at which they operate. The low-capacity compressor thus operates at higher pressures than the high-capacity compressor. The low-capacity compressor operates, for example, at pressures of between 5 and 7 bar abs and flow rates of 2,000 to 6,000 m³/h, while the high-capacity compressor operates at pressures of between 1.5 and 2.5 bar abs and flow rates of 12,000 to 30,000 m³/h.

[0012] The storage terminal, for example, is located on an onshore coastline, while the consumer is taken on board the floating structure at sea and contributes to its power supply. This storage terminal enables the storage of cryogenic liquid and gas resulting from the evaporation of cryogenic liquid.

[0013] The main circuit and the accessory circuit are at least partly arranged in parallel with each other, that is they are at least partly independent. By "independent" we mean that conduits making up the main circuit are separate from conduits making up the accessory circuit. Preferably, the main circuit and the accessory circuit are mostly independent, that is the majority of the conduits making up the main circuit do not participate in the accessory circuit.

[0014] The main circuit is connected to the tank head, that is the portion of the tank wherein the gas resulting from the evaporation of the cryogenic liquid is stored.

[0015] The accessory circuit is configured to directly supply the gas resulting from the evaporation of the cryogenic liquid to the low-capacity compressor; it is understood that this gas resulting from the evaporation of the cryogenic liquid is routed to the low-capacity compressor by circulating exclusively in pipes. In particular, the accessory circuit has no heat exchanger. The gas resulting from the evaporation of the cryogenic liquid thus benefits from a dedicated circuit for transport to the consumer, limiting its heating during circulation.

[0016] According to an optional feature of the invention, the main circuit and the accessory circuit are thermally independent.

[0017] As a result, there is no exchange of calories between the main circuit and the accessory circuit.

[0018] According to an optional feature of the invention, the accessory circuit is connected to the main circuit at the tank head outlet.

[0019] For example, the accessory circuit is connected to the main circuit outside the tank, in the vicinity of the tank head.

[0020] According to an optional feature of the invention, the storage and treatment facility comprises at least one valve arranged at a separation between the main circuit and the accessory circuit.

5 [0021] The valve, which is either a three-way valve or a combination of two two-way valves, connects the accessory circuit to the main circuit. Upstream of this valve, the gas resulting from the evaporation of the cryogenic liquid flows through a pipe shared by the main circuit and the accessory circuit, which opens into the tank head.

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[0022] According to an optional feature of the invention, the accessory circuit is directly connected to a gas dome of the tank.

15 [0023] The gas dome corresponds to an outward and upward protrusion of the tank, wherein the gas resulting from the evaporation of the cryogenic liquid is present. When the accessory circuit is directly connected to the gas dome, the connections of each of the circuits to the tank are independent; it is understood that the main circuit and the accessory circuit do not share a pipe extending from the tank.

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[0024] According to an optional feature of the invention, a nominal diameter of the conduits forming the main circuit is between 300 and 600 mm.

25 [0025] The size of the main circuit pipes is thus adapted to loading and unloading operations between the storage and treatment facility and the storage terminal.

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[0026] According to an optional feature of the invention, a nominal diameter of the pipes forming the accessory circuit is between 100 and 250 mm.

[0027] The size of the accessory circuit pipes means that the gas produced by the evaporation of the cryogenic liquid can be rapidly conveyed to the low-

capacity compressor and thus to the consumer, thereby limiting heating. The gas resulting from the evaporation of the cryogenic liquid is thus supplied to the low-capacity compressor at suitable pressure and temperature, limiting the need for cooling devices.

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[0028] In some embodiments, a diameter of the pipes and/or ducts is scalable, with this diameter being larger in the vicinity of the compressor than in the vicinity of the tank.

10 [0029] According to an optional feature of the invention, the accessory circuit is thermally insulated.

[0030] Such thermal insulation can be achieved by placing foam around the pipes forming the accessory circuit. Alternatively, it can be achieved by vacuum
15 insulation, placing the accessory circuit pipes in larger pipes and evacuating the space between them.

[0031] According to an optional feature of the invention, the main circuit comprises a divergence point between a first branch dedicated to supplying
20 gas to the high-capacity compressor and a second branch connected to the accessory circuit via at least one valve.

[0032] This point of divergence constitutes a division within the main circuit. When circulating in the main circuit, the gas resulting from the evaporation of
25 the cryogenic liquid is therefore routed either to the high-capacity compressor via the first branch, or to the accessory circuit via the second branch.

[0033] According to an optional feature of the invention, the valve is arranged between the divergence point and the low-capacity compressor.

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[0034] It is understood that when the gas resulting from the evaporation of the cryogenic liquid passes through the second branch of the main circuit, it is intended to feed the low-capacity compressor.

- 5 [0035] According to an optional feature of the invention, the storage and treatment facility comprises a branch configured to cool the second branch from cryogenic liquid taken from the tank.

10 [0036] This branch acts as a cooling device for the second branch upstream of the valve, thereby cooling the gas produced by the evaporation of the liquid that has flowed through the second branch of the main circuit. The branch opens out, for example, between the valve and the low-capacity compressor.

15 [0037] According to an optional feature of the invention, the storage and treatment facility comprises an auxiliary circuit dedicated to filling the tank with cryogenic liquid, this auxiliary circuit being configured to connect the storage terminal to a bottom zone of the tank.

20 [0038] The bottom zone of the tank is the lowest part of the tank, designed to receive and store cryogenic liquid. This bottom zone of the tank corresponds, for example, to a space located between a tank bottom wall and a plane substantially parallel to the bottom wall and extending one meter above it.

25 [0039] The invention also relates to a floating structure for transporting and/or storing cryogenic liquid and gas resulting from the evaporation of cryogenic liquid, comprising a storage and treatment facility as described above.

30 [0040] Other features, details and advantages of the invention will appear more clearly upon reading the following description on the one hand, and from exemplary embodiments given for illustrative purposes and without limitation with reference to the appended drawings on the other hand, wherein:

[Fig. 1] schematically shows a storage and treatment facility according to the invention;

[Fig. 2] shows a cutaway view of a floating structure comprising the storage and treatment facility shown in Figure 1.

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[0041] The features, variants, and the different embodiments of the invention 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 advantage and/or to differentiate the invention from the prior art.

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[0042] In the figures, the members common to several figures retain the same reference.

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[0043] Figure 1 schematically shows a storage and treatment facility 1 according to the invention, such a storage and treatment facility 1 being integrated within a floating structure 2, such a floating structure 2 being shown in Figure 2.

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[0044] The storage and treatment facility 1 is configured to circulate cryogenic liquid LC on the one hand, and gas resulting from the evaporation of cryogenic liquid G on the other. The cryogenic liquid LC is stored in at least one tank 4 of the storage and treatment facility 1. As the thermal insulation of the tank 4 is not perfect, some of the cryogenic liquid LC evaporates naturally, forming the gas resulting from the evaporation of cryogenic liquid G. The tank 4 therefore contains both cryogenic liquid LC and the gas resulting from the evaporation of cryogenic liquid G, a separation between these two fluids being represented in Figure 1 by a dotted horizontal line.

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[0045] The storage and treatment facility 1 has at least one tank 4 for storing the cryogenic liquid LC and the gas resulting from the evaporation of the cryogenic liquid G, the cryogenic liquid LC being methane, for example. In the embodiment shown here, the storage and treatment facility 1 comprises four
5 tanks 4. It is understood that the description which follows in relation to one of these four tanks 4 is applicable to each of the other tanks 4.

[0046] The tank 4 is delimited by a bottom wall 6, which corresponds to its lowest wall. From this bottom wall 6 extends a bottom zone of the tank, which
10 corresponds, for example, to a zone between this bottom wall 6 and a plane parallel thereto and disposed at a distance of one meter therefrom. At least the bottom zone of the tank is intended for storing the cryogenic liquid LC. Conversely, the gas resulting from the evaporation of cryogenic liquid G is stored in a head of the tank 4, corresponding to its uppermost portion. Here,
15 the roof of the tank 4 is equipped with a gas dome 8, which is a portion of tank 4 through which the gas resulting from the evaporation of cryogenic liquid G is withdrawn.

[0047] The storage and treatment facility 1 is connected to a storage terminal
20 10 located on a coast. Cooperation between the floating structure 2 and this storage terminal 10 will be described in greater detail below in relation to Figure 2. The storage terminal 10 can store both cryogenic liquid LC and gas resulting from the evaporation of cryogenic liquid G. In particular, the gas resulting from the evaporation of cryogenic liquid G can be discharged from the tank 4 of the
25 storage and treatment facility 1 to the storage terminal 10, and the cryogenic liquid LC can be loaded from the storage terminal 10 to the tank 4. Such loading of cryogenic liquid LC from the storage terminal 10 to the tank 4 takes place via an auxiliary circuit 12, this auxiliary circuit 12 connecting the storage terminal 10 to the bottom zone of the tank. It is understood that auxiliary circuit
30 12 is dedicated to filling the tank 4 with cryogenic liquid LC.

[0048] The gas resulting from the evaporation of cryogenic liquid G is discharged from tank 4, for example to fill it with cryogenic liquid LC, via a main circuit 14. This main circuit 14 connects the head of tank 4 to the storage terminal 10.

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[0049] The main circuit 14 opens into tank 4; more specifically, it is connected to the gas dome 8 of tank 4. The main circuit 14 comprises at least one conduit extending from the gas dome 8 to a high-capacity compressor 16, such a high-capacity compressor 16 thus being interposed between the tank 4 and the storage terminal 10. The pipe forming the main circuit 14, through which the gas resulting from the evaporation of cryogenic liquid G flows, has a diameter of between 300 and 600 millimeters. A heat exchanger can be fitted to the main circuit 14 between the tank 4 and the high-capacity compressor 16, to ensure that the pressure and temperature of the gas resulting from the evaporation of cryogenic liquid G are adequate to supply this high-capacity compressor 16.

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[0050] In some embodiments, as shown in Figure 1, the main circuit 14 comprises a divergence point 18, which consists of a separation between a first branch 20 of the main circuit 14 and a second branch 22 of this main circuit 14. The first branch 20 corresponds to the portion of the main circuit 14 designed to supply the high-capacity compressor 16, as described above. Conversely, the second branch 22 is designed to feed a low-capacity compressor 24 of the storage and treatment facility 1, this low-capacity compressor 24 being arranged between the tank 4 and a consumer 26 of the storage and treatment facility 1.

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[0051] The consumer 26 is for example a motor, and more specifically an electric generator of the DFDE (dual fuel diesel electric) type, that is to say, a gas consumer intended to ensure the electrical supply of the floating structure 2. The consumer 26 is configured to be able to use both cryogenic liquid LC and gas resulting from the evaporation of cryogenic liquid G as fuel, alternatively; it is understood that depending on its operating mode, the

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consumer 26 can be supplied either with cryogenic liquid LC or with gas resulting from the evaporation of cryogenic liquid G.

5 [0052] When the consumer 26 uses gas resulting from the evaporation of cryogenic liquid G as fuel, this gas from the evaporation of cryogenic liquid G can be supplied to him via an accessory circuit 28 of the storage and treatment facility 1. The consumer 26 is thus supplied with gas from the evaporation of cryogenic liquid G either solely via accessory circuit 28, or via both accessory circuit 28 and the second branch 22 of main circuit 14 when main circuit 14
10 has a divergence point 18, or solely via this second branch 22.

[0053] The accessory circuit 28 consists of at least one pipe. This pipe is smaller than the pipe in the main circuit 14, so that the gas evaporating from the cryogenic liquid G can be conveyed more quickly to the low-capacity
15 compressor 24 and the consumer 26 than would be the case if the gas evaporating from the cryogenic liquid G were conveyed via the main circuit 14. Faster routing of the gas resulting from evaporation of the cryogenic liquid G makes it possible to limit pressure losses and its cooling, and therefore to supply it to the low-capacity compressor 24 at a temperature and pressure that
20 are both suitable for operation of this low-capacity compressor 24. For this purpose, the accessory circuit 28 pipe has a diameter of between 100 and 250 millimeters, for example.

[0054] The accessory circuit 28 is also thermally insulated. Such thermal
25 insulation of the accessory circuit 28 consists, for example, of a foam tube placed around its pipe. Alternatively, thermal insulation can be achieved by vacuum insulation, with the pipe of the accessory circuit 28 arranged in a larger-diameter pipe wherein a vacuum is applied. In this case, the accessory circuit pipe 28 and the larger-diameter pipe are arranged concentrically, with
30 the larger-diameter pipe surrounding the accessory circuit pipe 28 through which the gas from the evaporation of cryogenic liquid G flows.

[0055] As shown in the variant shown in Figure 1, the accessory circuit 28 is connected to the main circuit 14 at the outlet of the tank 4 head. In particular, the main circuit 14 is connected to the gas dome 8, with the accessory circuit 28 connected to main circuit 14 in the vicinity of this gas dome 8. It is thus understood that the gas resulting from the evaporation of the cryogenic liquid G intended for delivery to the low-capacity compressor 24 and to the consumer 24 circulates in a pipe of the main circuit 14 before passing through the accessory circuit 28. The gas resulting from the evaporation of cryogenic liquid G, whether destined for the low-capacity compressor 24 or the high-capacity compressor 16, circulates at least partially within the main circuit 14. In other words, the gas resulting from the evaporation of cryogenic liquid G passes through the same pipe 30 connected to gas dome 8 independently of its destination compressor 16, 24. The connection between the main circuit 14 and the accessory circuit 28 is made via a valve, in this case a three-way valve 32, which is arranged at a separation between these two circuits 14, 28. The three-way valve 32 is thus located on the common pipe 30. Alternatively, the three-way valve 32 could be replaced by two two-way valves.

[0056] However, without departing from the scope of the invention and although not shown in the figures, it is possible to envisage variants wherein the accessory circuit 28 is directly connected to the gas dome 8, that is this accessory circuit 28 is independent of the main circuit 16 in the vicinity of the outlet of the tank 4 head. In these variants, the gas resulting from the evaporation of cryogenic liquid G does not pass through a common pipe 30 in the main circuit 14 and the accessory circuit 16.

[0057] As a result of the above, the main circuit 14 and the accessory circuit 28 are, at least in part, arranged in parallel with each other. It is understood that the main circuit pipes 14 are separate from the accessory circuit pipes 28 over at least a portion of the storage and treatment facility 1 between the tank 4 and one of the compressors 16, 24. The main circuit 14 and the accessory circuit 28 are connected in parallel either from the gas dome 8 of the tank 4,

for the variants where each of the two circuits 14, 28 is connected directly to this gas dome 8, or from the three-way valve 32 when the circuits 14, 28 have the common pipe 30 as is the case in Figure 1. Similarly, the main circuit 14 and the accessory circuit 28 run in parallel either for the rest of the storage and treatment facility 1, or up to the divergence point 18 when the main circuit 14 has the first branch 20 and the second branch 22.

[0058] In embodiments wherein the main circuit 14 is divided between the first branch 20 and the second branch 22, a valve, e.g. a three-way valve 34, is arranged between the second branch 22 and the accessory circuit 28. It is understood that this three-way valve 34 constitutes a junction point between the second branch 22 and the accessory circuit 28, which enables the main circuit 14 to supply the consumer 26 with gas from the evaporation of cryogenic liquid G. To this end, the three-way valve 34 is located between the divergence point 18 and the low-capacity compressor 24. Alternatively, the valve could comprise two two-way valves.

[0059] As previously mentioned, the main circuit 14 is formed by at least one pipe with a larger diameter than a pipe involved in forming the accessory circuit 28. In order to ensure that the gas resulting from the evaporation of the cryogenic liquid G conveyed by the main circuit 14 is supplied to the low-capacity compressor 24 at a suitable temperature and pressure, the storage and treatment facility 1 comprises a branch 36 which cools the second branch 22 using the cryogenic liquid LC upstream of the three-way valve 34. More precisely, this branch 36 extends between a first end connected to the second branch 22 in the vicinity of the three-way valve 34, and a second end opening into the tank 4. The end that opens out into the tank 4 is located, for example, in the vicinity of the bottom wall 6, within the bottom zone of the tank. This second end is equipped with a pump 38, which sucks up the cryogenic liquid LC and delivers it to the second branch 22. The purpose of the branch 36 is to cool, by means of this cryogenic liquid LC, the gas resulting from the evaporation of cryogenic liquid G having circulated within the main circuit 14

and its second branch 22. For this purpose, a heat exchanger is positioned between the second branch 22 and the branch 36, each of these branches 22, 36 constituting a heat exchanger pass.

5 [0060] Although not shown in the figures, the main circuit 14 may, as mentioned above, comprise a heat exchanger separate from the heat exchanger. This heat exchanger is then designed to adapt the temperature of the gas resulting from the evaporation of the cryogenic liquid G circulating within the main circuit 14 to supply it to the high-capacity compressor 16 at a
10 temperature and pressure required for proper operation of this high-capacity compressor 16. Such a heat exchanger is thus arranged between the tank 4 and the high-capacity compressor 16, or between the three-way valve 32 and the high-capacity compressor 16.

15 [0061] Conversely, the accessory circuit 24 has no heat exchanger. It is thus connected directly to the low-capacity compressor 24, either from the gas dome 8 or from the three-way valve 32. Thus, the gas resulting from the evaporation of cryogenic liquid G circulating within accessory circuit 24 is not intended to gain calories other than those which would possibly result from its
20 circulation within the accessory circuit pipe 28, such a gain of calories being furthermore limited by the aforementioned thermal insulation of the accessory circuit 28. It is understood here that no heat exchange device is arranged on the accessory circuit 28. In particular, the main circuit 14 and the accessory circuit 28 are thermally independent. There are no heat exchanges between
25 these two circuits 14, 28; for example, the main circuit 14 and the accessory circuit 28 do not constitute the passes of a heat exchanger that would be arranged between these two circuits 14, 18.

[0062] The use of the high-capacity compressor 16 and the low-capacity
30 compressor 24 depends on the operation performed by the storage and treatment facility 1. For example, both the high-capacity compressor 16 and

the low-capacity compressor 24 are located in the same area of the floating structure 2, such as a compressor room of the floating structure 2.

5 [0063] When a loading and/or unloading operation carried out within the storage and treatment facility 1 consists of unloading gas from the evaporation of cryogenic liquid G to the storage terminal 10, the high-capacity compressor 16 is in operation. In other words, the gas resulting from the evaporation of cryogenic liquid G contained in tank 4 is routed to the storage terminal 10 via the main circuit 14 and thus via the high-capacity compressor 16.

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[0064] During the unloading of the gas resulting from evaporation of the cryogenic liquid G to the storage terminal 10, the low-capacity compressor 24 can also be used, for example to supply the consumer 26 in order to maintain the electrical functions of the floating structure 2. For this purpose, the low-capacity compressor 24 and the consumer 26 are supplied either from the
15 main circuit 14 or from the accessory circuit 28, or from both circuits 14, 28 in the case where the main circuit 14 comprises the second branch 22, which joins the accessory circuit 28.

20 [0065] Such an unloading operation of the gas resulting from the evaporation of cryogenic liquid G can be simultaneous or prior to an operation of loading the cryogenic liquid LC from the storage terminal 10 to the tank 4 of the storage and treatment facility 1, this loading operation then involving the auxiliary circuit 12.

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[0066] Outside of loading and/or unloading operations, that is in particular when the floating structure 2 is on a sea voyage, the high-capacity compressor 16 is shut off, as it is no longer in fluid communication with the storage terminal 10. During such a sea voyage, only the low-capacity compressor 24 is used.
30 This low-capacity compressor 24 is preferably supplied by the accessory circuit 28, but in some embodiments both the main circuit 14 and the accessory circuit 28 supply the consumer 26 via the low-capacity compressor 24.

[0067] Figure 2 shows the floating structure 2 comprising the tank 4, which is leakproof and thermally insulated. It has a generally prismatic shape and is mounted in a double hull 40 of the floating structure 2, which may be a ship or a floating platform. A wall of the tank 4 comprises a primary sealed barrier that is intended to be in contact with the cryogenic liquid LC contained in the tank 4, a secondary sealed barrier that is arranged between the primary sealed barrier and the double hull 40 of the tank, and two thermally insulating barriers that are arranged between the primary sealed barrier and the secondary sealed barrier and between the secondary sealed barrier and the double hull 40, respectively. In a simplified version, the floating structure 2 comprises a single hull.

[0068] Loading/unloading pipes 42 that are arranged on an upper deck of the floating structure 2 may be connected by means of suitable connectors to the storage terminal 10 in order to transfer a cargo of cryogenic liquid LC and/or gas from the evaporation of the cryogenic liquid G from or to the tank 4. It is understood that in the case of loading cryogenic liquid LC from the storage terminal 10 to the tank 4 of floating structure 2, these loading/unloading pipes 42 correspond to auxiliary circuit 12, whereas in the case of unloading gas resulting from the evaporation of cryogenic liquid G from floating structure 2 to the storage terminal 10, the loading/unloading pipes 42 correspond to the main circuit 14.

[0069] Figure 2 also shows the storage terminal 10 comprising a loading and/or unloading station 44, an underwater duct 46 and an onshore facility 48. The loading and/or unloading station 44 is a fixed offshore facility having a moving arm 50 and a tower 52 that supports the moving arm 50. The moving arm 50 carries a bundle of insulated flexible hoses 54 that can be connected to the loading/unloading pipes 42. The moving arm 50 is adjustable and adapts to all floating structure templates 2. A connecting pipe, not shown, extends inside the tower 52. The loading and/or unloading station 44 enables the

floating structure 2 to be loaded and/or unloaded from or to the storage terminal 10, which comprises storage tanks 56 for the cryogenic liquid LC and/or the gas resulting from the evaporation of the cryogenic liquid G, as well as connecting pipes 58 connected by the underwater duct 46 to the loading and/or unloading station 44. The underwater duct 46 allows the transfer of the cryogenic liquid LC and/or the gas resulting from the evaporation of the cryogenic liquid G between the loading or unloading station 44 and the floating structure 2 over a great distance, for example five kilometers, which allows the floating structure 2 to be kept at a great distance from the coast during loading and/or unloading operations.

[0070] In order to generate the pressure necessary for the transfer of the cryogenic liquid LC and/or the gas resulting from the evaporation of the cryogenic liquid G, pumps on board the floating structure 2 and/or pumps fitted to the onshore facility 48 and/or pumps fitted to the loading and unloading station 44 are used.

[0071] The examples have been described for a floating structure 2; however, they are also applicable to an onshore structure.

[0072] The present invention thus proposes a storage and treatment facility wherein gas resulting from the evaporation of a cryogenic liquid is conveyed to a consumer of the storage and treatment facility by a dedicated circuit, thus limiting the pressure losses of this gas resulting from the evaporation of the cryogenic liquid.

[0073] The present invention cannot, however, be limited to the means and configurations described and shown here, and it also extends to any equivalent means or configuration as well as to any combination technically using such means.

Claims

1. A facility for storing and treating a gas resulting from the evaporation of a cryogenic liquid (G), comprising at least one tank (4) configured to contain
5 both the cryogenic liquid (LC) and the gas resulting from the evaporation of the cryogenic liquid (G), at least one consumer (26) that consumes a fuel prepared at least from the gas resulting from the evaporation of the cryogenic liquid (G), a high-capacity compressor (16) designed to be connected to a cryogenic liquid (LC) storage terminal (10), and a low-capacity compressor (24) which
10 supplies the fuel to the consumer (26), the storage and treatment facility comprising a main circuit (14) connecting a tank (4) head to the high-capacity compressor (16) and an accessory circuit (28) at least partly arranged fluidically in parallel with the main circuit (14), the accessory circuit (28) being configured to supply the gas resulting from the evaporation of the cryogenic
15 liquid (G) directly to the low-capacity compressor (24).
2. The storage and treatment facility according to the preceding claim, wherein the main circuit (14) and the accessory circuit (28) are thermally independent.
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3. The storage and treatment facility according to any of the preceding claims, wherein the accessory circuit (28) is connected to the main circuit (14) at the outlet of the tank (4) head.
- 25 4. The storage and treatment facility according to the preceding claim, comprising at least one valve (32) arranged at a separation between the main circuit (14) and the accessory circuit (28).
5. The storage and treatment facility according to any of claims 1 and 2,
30 wherein the accessory circuit (28) is directly connected to a gas dome (8) of the tank (4).

6. The storage and treatment facility according to any of the preceding claims, wherein a nominal diameter of the pipes forming the main circuit (14) is between 300 and 600 mm.
- 5 7. The storage and treatment facility according to any of the preceding claims, wherein a nominal diameter of the pipes forming the accessory circuit (28) is between 100 and 250 mm.
8. The storage and treatment facility according to any of the preceding
10 claims, wherein the accessory circuit (28) is thermally insulated.
9. The storage and treatment facility according to any of the preceding claims, wherein the main circuit (14) comprises a divergence point (18) between a first branch (20) dedicated to the supply of gas resulting from the
15 evaporation of the cryogenic liquid (G) of the high-capacity compressor (16) and a second branch (22) connected to the accessory circuit (28) via at least one valve (34).
10. The storage and treatment facility according to the preceding claim,
20 wherein the valve (34) is arranged between the divergence point (18) and the low-capacity compressor (24).
11. The storage and treatment facility according to any of the preceding claims in combination with claim 9, comprising a branch (36) configured to cool
25 the second branch (22) from cryogenic liquid (LC) taken from the tank (4).
12. The storage and treatment facility according to any of the preceding claims, comprising an auxiliary circuit (12) dedicated to filling the tank (4) with cryogenic liquid (LC), this auxiliary circuit (12) being configured to connect the
30 storage terminal (10) to a bottom zone of the tank (4).

13. A floating structure (2) for transporting and/or storing cryogenic liquid (LC) and gas resulting from the evaporation of cryogenic liquid (G), comprising a storage and treatment facility (1) according to any of the preceding claims.