

LIQUEFIED NATURAL GAS DISTRIBUTION METHOD AND DEVICE

TECHNICAL SCOPE OF THE INVENTION

The present invention concerns a process and a device for the distribution of liquefied natural gas. It is particularly applicable for the supply of liquefied natural gas to small regasification terminals located for example on islands.

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TECHNICAL DESCRIPTION

For the rest of the document, the acronym "LNG" is used to denote "Liquefied Natural Gas".

The LNG is obtained by condensation of natural gas, mainly from methane, condensed to liquid form. The main advantage for the condensation of natural gas is in the reduction of volume obtained from the condensation. The reduction in volume facilitates the transport of LNG when compared to non liquefied natural gas.

In the context of supply to regasification terminals located on lowly populated islands, the supply of gas to the terminal is by means of a methane carrying ship.

15 The terminals supplied by this method comprise mainly:

- a marine infrastructure, consisting of a 'finger pier' type jetty to relay the terminal to the methane reservoir,
- an onshore storage reservoir and
- a unit for the regasification of the stored LNG.

20 This type of infrastructure requires a substantial initial investment and as a consequence is not adapted to locations with a low consumption of LNG. Further, the duration for the construction of a terminal of this type is long when considering alternative energy sources. The high cost tends to favour the selection of more highly 'carbonised' energy sources such as coal or petroleum for example.

25 There are for example the systems as described in the documents US 2002/178988, DE 31 43 457 and WO 2006/130785. In these systems, the mobile reservoirs are positioned on a semi-submersible vessel in order to be transported:

- in the water, from the point of origin to the submerged vessel,
- on the emerged vessel from an initial immersion point on the ship to a second immersion point of the ship then
- in the water from the submerged vessel to a destination point.

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These systems however require supplying LNG to each reservoir before it can be secured onto the vessel.

OBJECTIVE OF THE INVENTION

The present invention is aimed at resolving all or part of these drawbacks.

To this effect, according to an initial aspect, the present invention concerns a
 5 device for the distribution of liquefied natural gas to a regasification unit, which comprises:

- at least one barge comprising:
 - a tank for the storing of liquefied natural gas, said «LNG»,
 - a means of floating the barge in a body of water,
 - 10 – a means of securing the barge to a semi-submersible vessel, the barge being positioned out of the water when the vessel is in the emerged position and
 - a means of transferring the gas contained in the storage tanks to a regasification unit in an onshore gas distribution network,
 - the semi-submersible vessel for transporting each barge, this vessel comprising a
 15 means of supply of at least one storage tank of LNG and
 - at least a means of moving at least one floating barge in water up to the regasification unit.

As a result of these arrangements, the gas terminals constructed in locations of low LNG consumption do not necessarily require to have a storage reservoir as this
 20 function is performed by each mobile barge attached to the regasification terminal. In this way, the cost of initial investment for the construction is reduced as well as the duration of construction of the gas terminal. Further, as a consequence of this device the jetty or mooring step required to be built is of inferior dimensions to other jetties currently in use as the semi-submersible vessel is not moored to the jetty.

25 The implementation of a means of supply allows, by way of the vessel, to supply LNG to the storage tank on each barge in such manner that it is not necessary to fill beforehand each barge prior to the emersion.

In the implementation modes, the means of supply comprises an LNG transfer unit capable of supplying at least one storage tank.

30 In the implementation modes, the vessel comprises a configured means of commanding the transfer unit for controlling the execution of a first method of transfer in which at least two storage tanks are supplied simultaneously with LNG.

In these implementation modes, the vessel comprises at least one LNG storage reservoir provided with LNG by the means of supply.

In the implementation modes, the LNG transfer unit is configured to transfer LNG from at least one reservoir to at least one storage tank or from at least one storage tank to at least one reservoir.

The presence of a reservoir on the vessel allows the vessel to supply LNG to each barge when moving the vessel in the water.

In this way the semi-submersible vessel respects at the same time the methane regulations and the regulations appertaining to semi-submersibles as defined in the international code for the transport of gas (« international gas carrier code », in English).

In the implementation modes, the means of commanding the transfer unit is, additionally, configured to select a method of transferring the LNG from:

- a second method of transfer in which at least one reservoir and at least one storage tank (105) are supplied simultaneously with LNG and
- a third method of transfer in which only one reservoir is supplied with LNG.

In the implementation modes, the vessel comprises a device for the transfer of LNG from a storage tank on one barge to the storage tank of a second barge.

In the implementation modes, the vessel comprises a means of tapping evaporated gas from liquefied natural gas present in at least one means of storage of LNG.

In the implementation modes, the vessel comprises:

- a means of compressing any tapped evaporated gas and
- a means of propulsion of the vessel supplied with evaporated gas whether compressed or not by the means of compression.

These implementation modes allow the recuperation of evaporated LNG into recycled LNG.

In the implementation modes, the vessel comprises a pressurisation unit for at least one storage tank.

These implementation modes allow to optimise management of the residues of LNG in the reservoirs and storage tanks.

In the implementation modes the pressurisation unit is configured to pressurize the LNG to a first pressure level in at least one storage tank and to a second pressure level, different to the first, in at least one other storage tank.

These implementation modes allow the use of tugboats to move the detached barges from the semi-submersible vessel.

In the implementation modes, the semi-submersible vessel comprises, additionally:

- at least one ballast reservoir in order to perform a partial immersion and an emersion of the vessel,
- a means of liaison of the vessel with each barge when the craft is submerged.

These implementation modes allow to obtain a standardisation of barges,
 5 achieving an optimised transport of a number of barges per semi-submersible vessel.

In the implementation modes, the device being the object of the present invention includes for the onshore gas network being equipped with a supply pipe to be connected to the means of transfer of at least one barge.

In the implementation modes, the means for the transfer of gas is connected to a
 10 gas network and comprises a regasification unit of liquefied natural gas supplied directly and uniquely by the barge.

These implementation modes allow to restore the liquefied gas in gaseous phase, thus rendering it apt for consumption on the network or for a direct use by an end terminal.

15 According to a second aspect, the present invention aims to provide a process for the distribution of liquefied natural gas to a regasification unit utilising a distribution device being the object of the present invention, which comprises:

- a step of securing of each barge to a semi-submersible vessel in submerged position,
- 20 – a step of supply of a liquefied natural gas storage tank of at least one barge by the deployment of a means of supply from a semi-submersible vessel transporting each said barge.
- a step of movement of the semi-submersible vessel and of each barge transported by the vessel
- 25 – a step of flotation of each barge in a body of water,
- a step of movement of at least one detached barge up to the supply pipe of a gas network and
- a step of regasification of LNG and supply to the supply pipe of the gas network by the LNG of at least one barge.

30 The objectives, advantages and particular characteristics of the process object of the present invention being similar to those of the device object of the present invention, it is not necessary to repeat them here.

In the implementation modes the process object of the present invention comprises additionally:

- before the flotation stage, a step of partial submersion of the semi-submersible vessel,
- following the flotation stage, a step of emersion of the semi-submersible vessel and
- 5 – between the immersion and emersion stages, a step of liaison of a barge to the semi-submersible vessel.

These implementation modes allow to exchange an empty barge of the gas network and a full barge detached from the vessel, in such a way that the empty barge be brought to a distribution station of liquefied natural gas before being transported to
10 another gas network or another terminal.

In the implementation modes, the process object of the present invention comprises, following the flotation stage, a step of securing of at least one barge to a solid surface.

In the implementation modes, the process object of the present invention
15 comprises, during the course of the movement stage, a step of securing to a jetty or mooring step in proximity to the supply pipe.

These implementation modes allow to use a jetty or mooring step of lesser dimensions than those currently applicable for jetties in use for the methane transporting ships otherwise utilised.

20 BRIEF DESCRIPTION OF THE DRAWINGS

Other advantages, aims and particular characteristics of the invention will be revealed from the description non limitative which follows from at least a particular implementation mode of the device and of the process of the distribution of liquefied
25 natural gas object of the present invention, with regard to the attached drawings, in which:

- the figure 1 represents, schematically and in perspective, a particular implementation mode of the device being the object of the present invention,
- the figure 2 represents, schematically and in perspective, a particular
30 implementation mode of the vessel and of the barge of the device object of the present invention and
- the figure 3 represents, schematically, in the form of a flowchart, the stages of a particular implementation mode of the process object of the present invention.

35 DESCRIPTION OF EXAMPLES OF IMPLEMENTATION OF THE INVENTION

The present description is non-limitative, each characteristic of an implementation mode being capable of advantageous combination with any other characteristic of any other implementation mode.

Please note for further reference that the drawings are not to scale.

5 It is also to be noted that:

- the term « storage tank » is a reference to a volume of storage on a barge 20 and
- the term « storage reservoir » is a reference to a volume of storage on a vessel 30.

10 Further it is noted that the term « fastening » used hereafter is not limited to fastenings in the sense of joining two objects but is utilised in the sense of a mechanical liaison, detachable or not, linking an object to another in a way that there exists a mechanical constraint between the two objects. Such a 'fastening' is for example formed by ties or guides during the movement of one of the two objects.

15 Finally it is to be noted that the succession of stages appertaining to the process object of the present invention is not described in a limited way, the stages of the process being able to be advantageously and successively combined in all manner of ways.

It is to be observed on figure 1, which is not to scale, schematically and viewed from above, an implementation mode of device 10 object of the present invention. This device 10 for distribution of liquefied natural gas to a unit of regasification, comprises:

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- at least a barge 20 comprising:
 - a storage tank 105 of liquefied natural gas, said « LNG »,
 - a means 110 of flotation of the barge 20 in a body of water,
 - a means 115 of fastening (securing) the barge 20 to a semi-submersible vessel 30, the barge 20 being positioned out of the water when the craft 30 is
- 25
- in emerged position and
 - a means 120 of transfer of gas contained in the storage tank 105 to a regasification unit 405 of an onshore gas network 40,
 - the semi-submersible vessel 30 to transport each barge, this vessel comprising a means of supply 325 of at least one storage tank in LNG and
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- at least a means 50 of moving at least one barge 20 in flotation in the water up to the regasification unit.

Each barge 20 comprises a storage tank 105 of LNG. This storage tank 105 is, for example, a volume presented in the form of a revolving cylindrical trunk. This storage tank 105 can be formed of several independent volumes (compartmentalised) or

interconnected. The storage tank 105 can be of type A or C, respectively a tank of membrane type and at atmospheric pressure or a pressurised rigid tank.

Each storage tank 105 is positioned, for example, on the means of flotation 110. This means of flotation 110 is, for example, a floating surface of rectangular form on which is aligned each barge 20.

Each barge 20 comprises, additionally, a means of fastening (securing) 115 to a semi-submersible vessel 30. This means of fastening (securing) 115 is, for example, formed by an ensemble of chains or ropes linked through the rings fitted to the means of flotation 110. This means of fastening (securing) 115 has for objective to maintain in position the barge 20 during the transport of this barge 20 by the semi-submersible vessel 30. More precisely, the barges are carried by the semi-submersible vessel 30.

Preferably the means of fastening (securing) 115 is formed from an ensemble of guides allowing a vertical displacement of each barge 20 once the barge is attached to the vessel 30. In this way when the vessel 30 is submerged, each barge 20 floats in the body of water and, when the craft 30 emerges, the guides allow to constrain the movement of each barge 20 in relation to the vessel 30.

Preferably, the means of fastening (securing) 115 comprises equally a means of interlocking each barge 20 to the vessel 30 once the vessel 30 is emerged. Such a means of interlocking can function, for example, by magnetic attraction of each barge 20 to a surface of the vessel 30. In the variations, the means of interlocking is formed by chains linking the vessel 30 to each barge 20.

Finally, each barge 20 comprises a means of transfer 120 of gas contained in the storage volume 105 to a regasification unit 405 of the onshore gas network 40. This means of transfer 120 is, for example, a pipe of which the opening (not represented) is connected to the interior of the storage tank 105. This pipe is, for example, a cryogenic tubing or hose.

In another implementation mode, the means of transfer 120 comprises a pipe (not represented) and a pump (not represented) for the transfer of the LNG from the barge 20 to an onshore buffer tank.

This buffer tank is, for example, a barge 20 installed permanently onshore. It allows for the supply of the regasification units in LNG if the ship is delayed and to ensure the continuity of supply during the periods of disconnection of the empty tanks and reconnections to full tanks.

In the variations, at least one barge 20 comprises a means 125 of fastening (securing) to a tugboat, acting as means 50 of movement, towing or pushing the floating barge 20 in the body of water.

The means of fastening (securing) 125 is, for example, an ensemble formed by chains or ropes linked through rings fitted to the means of flotation 110 of the barge 20. These chains or ropes are linked at another extremity, to the tugboat.

In the variations, the means of fastening (securing) 115 to a semi-submersible vessel 30 and the means of fastening (securing) 125 to a tugboat are the same.

In the variations, at least one barge 20 comprises a means of movement, such as a motor and a propeller for example, allowing the independent movement of the barge 20 without recourse to an external device.

The semi-submersible vessel 30 is for example, a transport ship comprising at least a ballast reservoir 305 of sufficient dimension in order that, when each ballast is filled with water, a storage surface is submerged in the body of water. This partial immersion of the vessel allows a movement of the storage surface. This storage surface is moved beneath a device to be transported, such as the barges 20 for example, before the ballasts are emptied. In this way, the semi-submersible vessel 30 undergoes an emersion and the storage surface emerges from the water and supports the device placed on top of the submerged surface.

In the variations, the semi-submersible vessel 30 comprises, additionally, a means of liaison 310 of the vessel 30 with each barge 20 for the interlocking of each barge 20 with the vessel 30 when the vessel 30 is submerged. This means of liaison 310 is, for example, formed by an ensemble of chains and or ropes attached through at least a ring positioned on the barge 20 or the vessel 30.

The means of supply 325 allow to provide the barges 20 with LNG, at least partially empty, secured on the semi-submersible vessel 30. The vessel 30 comprises a supply pipe equipped for connection to a source of LNG such as a liquefaction plant or a methane terminal. The vessel 30 comprises equally pumps to selectively supply one or several barges 20 in order to fill them with LNG either simultaneously or selectively. In this way, all of the empty storage tanks 105 of a semi-submersible vessel can be filled by a single source while the corresponding barges 20 are already attached to the vessel.

The means of supply 325 is, for example, a network of pipes pouring LNG supplied to the supply pipe in at least one storage tank 105.

In the implementation modes, the means of supply 325 comprises a unit 320 for the transfer of LNG to at least one storage tank 105.

This transfer unit 320 is, for example, a network of pipes allowing the transfer of LNG to and from at least one storage tank 105. The transfer unit 320 is, for example, a pump attached to the pipes 335 linking an entry of LNG from the vessel to at least one storage tank 105.

In the implementation modes the vessel 30 comprises at least a reservoir 315 for the storage of LNG provided with LNG by the means of supply 325.

In the implementation modes, the LNG transfer unit is configured to transfer LNG from at least one reservoir to at least one storage tank or from at least one storage tank
5 to at least one reservoir.

In the variations, the transfer unit 320 and the supply means 325 are the joined, all or part of the LNG entering a storage tank 105 having firstly passed through a reservoir 315.

In the variations, the transfer unit 320 is configured to draw off LNG stored in at
10 least one storage tank 105 in a way to optimise the distribution of LNG between the different storage tanks 105.

In this way, for example, a storage tank 105 partially empty is attached to the vessel 30, the contained LNG is drawn off for accumulation in another unique storage tank 105 equally having initially contained LNG. All of the LNG is located from this point
15 on in one single storage tank 105.

Each reservoir 315 is, for example, a container of normal dimensions.

All the reservoirs 315 are either linked up or independent.

These reservoirs allow the transport in bulk of LNG.

In the implementation modes, the vessel 30 comprises a means of command 330
20 of the transfer unit 320 configured to control the execution of a first transfer method in which at least two storage tanks 105 are supplied simultaneously with LNG.

The means of command 330 is, for example, an electronic control circuit of the transfer unit 320.

In the implementation modes, such as that represented in figure 1, the means of
25 command 330 of the transfer unit 320 is, additionally, configured to select a method of transferring the LNG, from:

- a second transfer method in which at least one reservoir 315 and at least one storage tank 105 are supplied simultaneously in LNG and
- a third transfer method in which at least one reservoir 315 is supplied with LNG.

In the implementation modes, such as that represented in figure 1, the craft 30
30 comprises a device 335 for the transfer of LNG from a storage tank 105 of a first barge 10 to a storage tank of a second barge.

The device 335 for the transfer of LNG is, for example, a pipe connecting two storage tanks 105, an increase in the pressure of one of the storage tanks 105 activating
35 the transfer of LNG to the other storage tank.

This allows to make a transfer of LNG from the barge 20 to another barge 20 even though the two barges 20 are attached to the same vessel 30.

In the implementation modes, such as represented in figure 1, the vessel 30 comprises a means 340 for the tapping of evaporated gas from the liquefied natural gas present in a storage tank 105.

The means for tapping the gas 340 is, for example, similar to a hood extracting evaporated gas more volatile than LNG.

In the implementation modes, such as that represented in figure 1, the vessel 30 comprises:

- a means 345 for the compression of the tapped evaporated gas and
- a means 360 for the propulsion of the vessel supplied with tapped evaporated gas whether compressed or not by the means of compression.

The means of compression 345 is, for example, a compressor.

In the variations, the compressed evaporated gas is supplied to a reservoir of the means of propulsion 360 in complement to the carburant already stored. The evaporated gas can be supplied to the means of propulsion 360 with or without an intermediate reservoir. In other variations, the evaporated gas is directly supplied to the means of propulsion 360.

In the implementation modes, such as that represented in figure 1, the vessel 30 comprises a pressurisation unit 350 of at least a storage tank 105.

This pressurisation unit 350 is, for example, a pump. This pressurisation unit 350 allows to optimise the liquid residues by overpressure of the headspace in each said storage tank 105.

In the implementation modes, such as that represented in figure 1, the pressurisation unit 350 is configured to pressurise the LNG to a first pressure in at least one storage tank 105 and at a second pressure, superior to the first pressure, in at least one other storage tank 105.

In the variations, the second pressure is at least three times superior to the first pressure. In the variations, the second pressure is at least seven times superior to the first pressure. In the variations, the second pressure is at least twenty times superior to the first pressure. In the variations the first pressure corresponds to the atmospheric pressure.

In the implementation modes the pressurisation unit 350 is configured to draw off the gas in the headspace of each storage tank and to store it in a dedicated storage volume.

Each means of movement 50 is, for example, a towing vessel capable of moving each barge 20 from a mooring stage to the semi-submersible vessel 30 or from this semi-submersible vessel 30 to a mooring stage or jetty.

The reduced dimensions of the towing craft 50 and of each barge 20 makes it possible for the required mooring stages or jetties (not represented) to be equally of reduced dimensions relative to the jetties, mooring stages otherwise necessary to accommodate the methane transporting ships.

In the variations, the means for the transfer of gas 120 is connected to an onshore gas network 40 comprising a supply pipe 410 for connection to the means of transfer 120 of at least one barge 20. This gas network 40 does not comprise a dedicated storage reservoir for liquefied natural gas, which allows for the more rapid and economic construction of the gas network. To be supplied with gas, an onshore network 40 is connected to at least one barge 20 transported from a location for the filling of the storage tanks 105 by the semi-submersible vessel 30.

The gas network 40 comprises preferably at least two supply pipes 410. In this way, a barge 20 filled with LNG is connected to one of the pipes 410 while an empty barge 20 is disconnected from a second supply pipe 410 by this manner effecting a transition between the supply of different barges 20. Further, the number of supply pipes 410 allow a modularity in the dimensions of the LNG storage reservoirs formed by the barges 20.

This gas network 40 comprises a regasification unit 405 of liquefied natural gas supplied directly and uniquely by the barge 20. This regasification unit 405 increases the pressure of the LNG and heats up the LNG with the result that the LNG undergoes a phase change. The natural gas thus obtained is transmitted to the pipes for utilisation on the gas network 40.

In the implementation modes, the vessel 30 is configured in order that, during partial submersion of this vessel 30, the reservoirs 315 are not submerged.

Such a configuration is attained, for example, by immersion of the front of the vessel 30, the barges 20 being positioned forward of the submersible part of the vessel 30.

Such a configuration is attained, in the variations, by an elevated position of each reservoir 315.

Such a configuration is attained, in the variations, by the addition of floats to a surface supporting each reservoir 315.

Such a configuration is attained, in the variations, by the utilisation of a mechanical means of elevation of each reservoir 315 configured, during the submersion of vessel 30, for the elevation of each reservoir 315 above the water level.

It is observed on the figure 2, schematically and viewed in perspective, a particular implementation mode of the semi-submersible vessel 30, of identical barges 20 and a means of movement 50 of the barge. These three elements, 20, 30 and 50, are represented here in a body of water.

It is observed, on the figure 3, schematically, a flowchart of particular stages of process 60 object of the present invention. This process 60 for the distribution of liquefied natural gas to a regasification unit comprises:

- an optional step 602 of storage of liquefied natural gas, said « LNG », in at least one storage reservoir of one vessel.
- a step 610 of flotation of each barge in a body of water,
- a step 615 of securing of each barge to the semi-submersible vessel in immersed position,
- a step 605 of supplying a storage tank with liquefied natural gas from at least one barge 20 by the deployment of a means of supply from a semi-submersible vessel transporting each said barge,
- a step 620 of movement of the semi-submersible vessel and of each barge attached to the vessel.
- a step 630 of detachment of at least one barge secured to the semi-submersible vessel in submerged position,
- a step 645 of flotation of each barge in a body of water,
- a step 650 of movement of at least one detached barge 20 up to the supply pipe of a gas network and
- a step 665 of regasification of LNG and the supply to the supply pipe of the gas network of the LNG of at least one barge 20.

The step of storage of gas 602 is effected, for example, at a station for the distribution of liquefied natural gas. This station for the distribution of gas is capable of filling at least one reservoir on the vessel. This station for the distribution of gas is normally utilised for the filling of reservoirs on methane transporting ships, these ships supplying the storage depots of gas networks distant from the distribution station.

The flotation step 610 is implemented, for example, by the use of floats or means of flotation fitted to the storage volume of LNG. In the variations, the means of flotation is a barge type structure, ie; a flat bottomed vessel.

In the variations where the gas storage step 610 is effected even though at least one barge is already floating in the body of water, the process 605 comprises a step of detachment of the LNG pipe, each barge being left free to float.

The process 60 comprises a step (not represented) of movement of at least one barge from the place of flotation to a semi-submersible vessel. The semi-submersible vessel is generally anchored offshore from the shore where the distribution station is situated.

This movement step is implemented, for example, with the utilisation of a crane, a towing vessel or an independent means of movement such as a motor and propeller for example.

The step 615 of securing of each moved barge to a semi-submersible vessel is implemented by:

- the partial immersion of the semi-submersible vessel in order that a surface of the support is submerged,
- the movement of the vessel until so far as the surface of the support is positioned under at least one barge to be transported and
- the emersion of the vessel in order that each barge lifted by the emersion is in contact with the supporting surface.

In the variations, this step 615 of securing of the barge is complemented by a step for the locking of the attachment. This locking step is implemented, for example, by the utilisation of chains, ropes, and rings capable of attaching at least one barge to the semi-submersible vessel.

The step of gas storage 605 is implemented, for example, by the utilisation of a means of supply or an LNG transfer unit such as described with regard to the figure 1.

The transport step 620 is implemented, for example, by the movement of the semi-submersible vessel in order to transport each secured barge in the direction of a distant onshore gas network.

The onshore gas network possesses its own characteristics in terms of LNG consumption. For this reason, this gas network comprises a predetermined number of supply pipes to be fitted to the connection points on a corresponding number of barges. The number of barges utilised depends on the consumption of the gas network and on the frequency of the re-supply in LNG by a semi-submersible vessel as described above.

Once the semi-submersible vessel arrives in proximity to the onshore gas network, at least one barge is detached from the vessel. This step of detachment 630 is implemented, for example, by:

- the detachment of the fastenings attaching each barge to the vessel and

- the partial submersion of the vessel in order that the support surface is submerged.

The partial immersion step 625 of the semi-submersible vessel is implemented, for example, by the filling of the ballast tanks with water from the body of water. In this way,
5 the waterline of the vessel is displaced to the upper part of the vessel.

Each barge thus detached floats in the body of water during the flotation step 645 implemented, for example, in a similar manner to the flotation step 610.

Each floating barge is moved, during the movement step 650, in the direction of the onshore gas network. This movement step 650 is implemented, for example, by the
10 utilisation of a crane, a towing vessel, or by means for the independent movement of at least one barge.

In a variation the LNG is transferred from the barge to a buffer tank which allows to ensure the continuity of supplies to the network or to the customer when the barge is empty.

15 The process 60 comprises as an option a stowage step 660 which is implemented, for example, by the utilisation of a device for traction of the barge on the shore in proximity to the body of water.

In the variations, the process 60 comprises a step 655 of mooring to a jetty in proximity to the supply pipe.

20 At least one moved barge is connected to a supply pipe of the gas network in order to supply the gas network in LNG contained in the barge.

A supply step is implemented, for example, by the utilisation of a pump to draw off from a barge connected to the onshore gas network, at least a part of the LNG contained in the interior of the storage volume of LNG. The LNG can equally be transferred by a
25 pressure differential.

In the variations, the process 60 comprises a step 635 of securing to the vessel of a floating barge with LNG emptied to the semi-submersible vessel. This securing step 635 is implemented, for example, in the same way as the securing effected in the course of the securing step 615. Each floating empty barge is initially connected to the onshore
30 gas network where the supply of the network has drawn off all of the LNG contained in storage volume of this barge. Each barge detached from the semi-submersible vessel is intended to replace at least one barge in position at the time of the vessel's arrival in proximity to the gas network.

Following the detachment of the barges to be delivered to the onshore gas
35 network and, if required, the securing of the empty barges to the semi-submersible vessel, the process 60 comprises a step 640 of emersion of the vessel.

In this way, the semi-submersible vessel can transport the barges still filled with LNG up to another distant onshore gas network, collect the empty barges from these networks then return to the distribution station to fill again the barges.

In these particular implementation modes, the semi-submersible vessel comprises the means of loading the LNG and the means of supplying with LNG the empty barges stowed on the semi-submersible vessel. The vessel comprises a supply pipe equipped for connection to a source of LNG such as a liquefaction plant or a methane terminal. The vessel comprises equally the pumps for the selective supply to one or more barges in order to fill them with LNG either simultaneously or selectively. In this way, all of the empty storage tanks of a semi-submersible vessel can be filled by a single source.

As can be understood from the reading of the preceding description, the device and the process objects of the present invention allow the construction of onshore gas networks at locations having a low gas consumption. On these locations, gas networks comprising permanent storage reservoirs cannot be built for economic reasons due to the cost of the reservoirs and the jetties and mooring stages necessary for the accommodation of methane transporting ships. The barges, filled at an LNG distribution station, are transported to incomplete gas networks without storage reservoirs, and connected directly to the network. In this way, the LNG container and the contents are supplied simultaneously to incomplete gas networks, which thus allows:

- to not require the construction of gas storage reservoirs in these networks and
- to favour the smaller jetties of reduced dimensions for the mooring of the barges.

The onshore gas networks present therefore a capacity for a modular consumption of gas and a reduced fabrication cost by comparison with existing systems.

The regasification step 665 is implemented, for example, by a regasification terminal.

Further, the present invention allows to optimise the delivery rotation achieved by the vessel in several ways as a function of the nature, the size, and the capacity of the locations for delivery with LNG.

This optimisation can be obtained by adjustment of the geometry of each storage tank 105 in order that each barge 20 corresponds to a particular site, or a type of site, to be supplied with LNG.

This optimisation can be obtained by adjustment of the number of barges as a function of the number of sites for delivery in a round trip.

The optimisation can equally be obtained by the management, in the course of a round trip of the filled volume of each storage tank 105.

For example, the contents of a storage tank 105 partially empty, coming from a delivery site, could be transferred to another tank 105 or to a storage reservoir 315 when the tank 105 is secured to the vessel 30 or maintained in the tank 105 as a function of the known capacity of the next site for delivery and / or the presence of a buffer tank at the location.

As a general rule, all of the storage tanks 105 form a modular storage unit, the distribution of LNG between the different tanks 105 being capable of adjustment by transfer of LNG from one tank 105 to another 105. In the variations, this storage unit is complemented by the reservoirs 315.

This optimisation allows to deliver to a location the adequate quantity of LNG, this quantity being determined before the arrival on site of the vessel 30, via the transfer of LNG from reservoir 315 to storage tank 105, from storage tank 105 to storage tank 105 or from storage tank 105 to reservoir 315.

CLAIMS

1. Device (10) for the distribution of liquefied natural gas to a regasification unit, characterised by what it comprises:

- at least one barge (20) comprising:
 - a tank (105) for the storage of liquefied natural gas, said «LNG»,
 - a means (110) of flotation of the barge (20) in a body of water,
 - a means (115) of securing the barge (20) to a semi-submersible vessel (30), the barge (20) being positioned out of the water when the vessel (30) is in the emerged position and
 - a means (120) of transferring the gas contained in the storage tank (105) to a regasification unit (405) of an onshore gas network (40),
- the semi-submersible vessel to transport each barge, this vessel comprising a means (325) of supplying at least one tank in LNG and
- at least a means (50) of moving at least one barge (20) floating in the water up to the regasification unit.

2. Device (10) according to the claim 1, in which the means of supply (325) comprises an LNG transfer unit (320) for the transfer of LNG to at least one storage tank (105).

3. Device (10) according to the claim 2, in which the vessel (30) comprises a means (330) of command for the transfer unit (320) configured to control the execution of a first method of transfer in which at least two storage tanks (105) are supplied simultaneously with LNG.

4. Device (10) according to one of the claims 1 to 3, in which the vessel (30) comprises at least one LNG storage reservoir (315) supplied with LNG by the means of supply (325).

5. Device (10) according to the claim 4, in which the LNG transfer unit (320) is configured for the transfer of LNG from at least one reservoir (315) to at least one storage tank (105) or from at least one tank to at least one reservoir.

6. Device (10) according to one of the claims 2 or 3, in which the means of command (330) for the transfer unit (320) is, additionally, configured to select a method of transfer of the LNG, from:

- a second method of transfer in which at least one reservoir (315) and at least one storage tank (105) are supplied simultaneously with LNG and
- a third method of transfer in which only one reservoir is supplied with LNG.

5 7. Device (10) according to one of claims 1 to 6, in which the vessel (30) comprises a device (335) for the transfer of LNG from a storage tank of a first barge to the storage tank of a second barge.

10 8. Device (10) according to one of the claims 1 to 7, in which the vessel (30) comprises a means (340) for the tapping of evaporated gas from the liquefied natural gas present in at least one means of storage of LNG (105, 315).

9. Device (10) according to the claim 8, in which the vessel (30) comprises:

- a means (345) for the compression of tapped evaporated gas and
- 15 – a means (360) for the propulsion of the vessel powered by harnessed evaporated gas whether or not compressed by the means of compression.

10. Device (10) according to one of the claims 7 to 9, in which the vessel (30) comprises a unit (350) for the pressurisation of at least one storage tank (105).

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11. Device (10) according to the claim 10, in which the pressurisation unit (350) is configured to pressurise the LNG to a first pressure in at least one storage tank (105) and to a second pressure, different to the first pressure, in at least one other tank.

25 12. Device (10) according to one of the claims 1 to 11, in which the means for the transfer of gas (120) is connected to a gas network (40) which comprises a regasification unit (405) for the liquefied natural gas supplied directly and uniquely by the barge (20).

30 13. Process (60) for the distribution of liquefied natural gas to a regasification unit utilising a device (10) for distribution according to one of the claims 1 to 12, characterised in so far as it comprises:

- a step (615) of securing of each barge to a semi-submersible vessel in submerged position,
- a step (605) of supply to a storage tank for liquefied natural gas of at least one
- 35 barge (20) by the implementation of a means of supply of a semi-submersible vessel transporting each said barge,

- a step (620) of the movement of the semi-submersible vessel and of each barge transported by the vessel,
- a step (645) of the flotation of each barge in a body of water,
- a step (650) of the movement of at least one detached barge (20) up to the supply pipe of a gas network and
- a step (665) of the regasification of LNG and the supply to the supply pipe of a gas network by the LNG of at least one barge (20).

14. Process (60) according to the claim 13, which comprises:

- preceding the flotation step (645) a step (625) of partial immersion of the semi-submersible vessel,
- following the flotation stage, a step (640) of emersion of the semi-submersible vessel and
- between the immersion step (625) and the emersion step (640), a step (635) of securing of a barge to the semi-submersible vessel.

15. Process (60) according to one of the claims 13 or 14, which comprise, following on from the flotation step (645), a step (660) of stowage of at least one barge (20) to a solid surface.

16. Process (60) according to one of the claims 13 to 15, which comprises, in the course of movement step (650), a step (655) of mooring to a jetty or pier in proximity to the supply pipe.