Title: SYSTEM AND METHOD FOR THE DELIVERY OF LNG

Abstract: The present invention is directed to a system for the delivery of LNG, comprising a main storage for storing supplied LNG, a pressure build-up device for increasing the pressure of the LNG, an intermediate storage for storing the LNG with increased pressure, and a dispenser for dispensing LNG at a pre-conditioned state to a refuelling vehicle, wherein the pressure build-up device and the intermediate storage for storing the LNG with increased pressure are arranged in a pressure build-up loop, and further comprising one or more dispenser storages for storing and/or further pre-conditioning the LNG. Furthermore, the invention is directed to a method for the delivery of LNG, using such system.
SYSTEM AND METHOD FOR THE DELIVERY OF LNG

The present invention is directed to a system and a method for the delivery of Liquefied Natural Gas (LNG).

There is a difference between the conditions (i.e. supply pressure) of LNG supplied by a LNG supply truck, and the conditions required by the engine of a truck using LNG as fuel. Because the engine of a refuelling truck requires LNG at a pressure that is higher than the pressure level at which the LNG is supplied by a LNG supply truck, a time-consuming process of increasing the pressure, i.e. conditioning the LNG, needs to take place before an engine of refuelling truck can run on the LNG.

It is an object of the present invention to at least partially overcome the drawbacks of the state of the art, and more especially to provide a system and method that enable refuelling vehicles to continue their journey shortly or preferably directly after filling up their fuel tanks with LNG. A further object is to provide a system and method to enable this LNG in a substantially continuous delivery.

This object is achieved with the system for the delivery of LNG according to the present invention, said system comprising:

- a main storage for storing supplied LNG;
- a pressure build-up device for increasing the pressure of the LNG;
- an intermediate storage for storing the LNG with increased pressure;
- a dispenser for dispensing LNG at a pre-conditioned state to a refuelling vehicle;
- wherein the pressure build-up device and the intermediate storage for storing the LNG with increased pressure are arranged in a pressure build-up loop; and
- further comprising one or more dispenser storages for storing and/or further pre-conditioning the LNG.

The system brings and maintains the pressure within the desired bandwidth required for delivery to refuelling vehicles. As the pressure is always within this desired bandwidth, the system offers an autonomous and continuous delivery of fuel at the desired pressure.

By pre-conditioning the LNG in the system, it is ready for direct use by the engine of a refuelling vehicle. The system thereby prevents that a time-consuming LNG pressure increasing conditioning process has to be carried out by the refuelling vehicle. The invention provides a system for the continuous delivery of pre-conditioned LNG, especially saturated LNG at a desired pressure.

The pressure build-up device and the intermediate storage for storing the LNG with increased pressure are arranged in a pressure build-up loop. By looping the LNG through the pressure build-up device, the pressure of the LNG contained in the intermediate storage can be maintained within a desired bandwidth. Furthermore, it is possible to obtain an even higher pressure level by gradually increasing the pressure level.

The system comprises one or more dispenser storages for storing and/or further pre-conditioning the LNG. The dispenser storages can be used to store LNG under the conditions (e.g. pressure) obtained in the intermediate storage, but can also be used to further pre-condition the LNG. When more than one dispenser storage is used, different pre-conditioned states, such as different pressures, can be stored in the different dispenser storages. This enables the system to continuously deliver saturated LNG on one or more pressure levels.
In a preferred embodiment, the dispenser storage comprises a heater for heating the LNG contained therein. When the LNG in the dispenser storage cools down, or when the LNG level drops due to dispensing LNG to a refuelling vehicle, the pressure of the LNG in the dispenser storage will decrease. The heater can be applied to heat the LNG in order to maintain the LNG within a preferred bandwidth for the pressure level. It is even possible to use heating to obtain a further increased pressure level which is significantly higher than that available in the intermediate storage. For example a pressure level of 9 bar obtained from the intermediate storage can in the dispenser storage be increased to 18 bar.

The pressure build-up device is a unit that is able to heat-up the LNG to the required pressure in a controlled way.

In a further preferred embodiment, the pressure build-up device is a heater. By heating the LNG, it expands and the pressure increases.

In a further preferred embodiment, the system further comprises a main LNG process pump arranged in a main LNG process pump vessel, said pump being adapted to at least pump LNG from the main storage to the intermediate storage. The main LNG process pump in a first step pumps LNG from the main storage to the LNG process pump vessel. In a second step, the main LNG process pump forces the LNG contained in the LNG process pump vessel via the pressure build-up device to the intermediate storage. If desired, the procedure of pressure build-up is repeated by looping the LNG more than once via the pressure build-up device, thereby further increasing the pressure. It is also possible to maintain the desired pressure level by compensating for any pressure losses.
In a further preferred embodiment, the system further comprises a dispenser LNG pump arranged in a dispenser LNG pump vessel, said pump being adapted to at least pump LNG from the dispenser storage to a dispenser.

When a separate main LNG process pump and dispenser LNG pump are used, together with at least one dispenser storage, it is possible to execute a pressure build-up loop for filling the intermediate storage with pre-conditioned LNG, and a dispenser storage refill simultaneously. The main storage can be filled with a new supply of LNG, while simultaneously delivering pre-conditioned LNG to a refuelling vehicle.

In a further preferred embodiment, the main LNG process pump vessel and/or the dispenser LNG pump vessel are arranged in an isolated space within a larger pump vessel.

As NG only exists as a liquid, LNG, in a limited temperature and pressure range that is far below the environmental temperature, LNG will boil and produce inevitable boil-off gas caused by the combined environmental radiative and conductive heat loads, since this boil-off gas is undesirable and should be reduced as far as possible, all embodiments are isolated with an effective thermal isolation using vacuum and/or multilayered isolation and/or vacuum Perlite.

Furthermore, an effective integration and clustering of components within commonly isolated spaces, makes it possible to lower the total radiative area and conductive thermal losses in the system.

The remaining boil-off of all embodiments is collected in a boil-off collecting scheme using thermosyphon connections between all storage vessels and the pump vessel. In this way all boil-off gas is collected in each of the storage vessels that therefore also fulfil the function of
gas/liquid phase separator from which the boil-off gas is transferred to a central boil-off gas collecting embodiment.

In a further preferred embodiment, the isolation of the isolated space comprises a combined vacuum multi-layered isolation and vacuum perlite isolation, which has proven to be a very effective and reliable isolation.

In a further preferred embodiment, the system further comprises:

- a boil-off collecting means for collecting boil-off gasses evaporated from any of the storage tanks; and
- means for cooling down the boil-off gasses. By collecting boil-off gasses and cooling them down, these gasses can be re-condensated, thereby providing a system with zero boil-off.

As a result of all boil-off reducing measures, the remaining quantity of boil-off gas can be processed by cooling-down and re-condensation making it LNG again that is fed back into the process. Re-condensation is done preferably at the highest possible pressure vessel so first in the dispenser storage, then the intermediate storage and ultimately in the main storage. In case the combined re-condensation capacity of all storage is inadequate, an additional internal heat exchanger cooled by Liquid Nitrogen or an active cooling device as a refrigerator can be used.

By re-condensating boil-off gasses, no greenhouse gasses are emitted to the environment. Instead, the gasses remain within the closed loop system, thereby also minimising energy losses.

The invention is further directed to a method for the delivery of LNG, said method comprising the steps of:

- storing supplied LNG in a main storage;
- increasing the pressure of the LNG with a pressure build-up device;
- storing the LNG with increased pressure in an intermediate storage;
- dispensing LNG at a pre-conditioned state with a dispenser to a refuelling vehicle;
- wherein increasing the pressure of the LNG with the pressure build-up device comprises subjecting the LNG to a pressure build-up loop until the desired pressure is reached, after which it is stored in the intermediate storage; and
- further comprising the step of storing and/or further pre-conditioning the LNG in one or more dispenser storages.

According to a preferred embodiment, the method is further comprising the step of pumping LNG from the dispenser storage to a dispenser with a dispenser LNG pump arranged in a dispenser LNG pump vessel.

According to a further preferred embodiment, the method is further comprising the steps of:
- collecting boil-off gasses evaporated from any of the storage tanks with a boil-off collecting means; and
- cooling down the boil-off gasses with cooling means.

According to an even further preferred embodiment, the method is further comprising the step of:
- re-condensating the cooled down boil-off gasses at the storage with highest possible pressure available.

The cooled down boil-off gasses re-condensate within one of the storages of the system, and preferably at the storage with the highest possible pressure, in order to have the most effective re-condensation. This closed loop principle re-condensates boil-off gasses at the LNG supply available within the system, thereby preventing any gas losses to the environment.
By re-condensation at the storage with the highest possible pressure, the most effective re-condensation is obtained.

According to an even further preferred embodiment, the step of re-condensating the cooled down boil-off gasses at the storage with highest possible pressure available, comprises at least the step of: A. re-condensation in the one or more dispenser storages until these one or more dispenser storages are completely filled with LNG. The dispenser storages are the vessels within the system wherein the LNG is at the highest pressure, e.g. 9 and 18 bar respectively, and therefore the system primarily re-condensates boil-off gasses at the dispenser storages.

According to an even further preferred embodiment, the step of re-condensating the cooled down boil-off gasses at the storage with highest possible pressure available, if the one or more dispenser storages are completely filled with LNG and further boil-off gasses are to be re-condensated, further comprises the step of: B. re-condensation in the intermediate storage until the intermediate storage is completely filled with LNG. When the capacity of the dispenser storages is insufficient, the storage vessel with the highest pressure available, is the intermediate storage.

According to an even further preferred embodiment, the step of re-condensating the cooled down boil-off gasses at the storage with highest possible pressure available, if the one or more dispenser storages and intermediate storage are completely filled with LNG and further boil-off gasses are to be re-condensated, further comprises the step of: C. re-condensation in the main storage until the main storage is completely filled with LNG.
According to an even further preferred embodiment, the method is further comprising the step of using a cooling device when the combined re-condensation capacity of the one or more dispenser storages, the intermediate storage and the main storage is inadequate if all storages are pressurized till their maximum operating pressure. Then, a cooling device can be connected to the pump vessel and lower the pressure of any of the storages using an appropriate valve setting. In this mode the total LNG content of the filling station can be stored without boil off loss for any length of time independent from any delivery.

Preferred embodiments of the present invention are further elucidated in the following description with reference to the drawing, in which:

Figure 1 discloses a schematic overview of the present invention;

Figure 2 shows a detailed schematic overview of the system according to the present invention;

Figure 3 shows a detailed schematic figure of the process of pumping LNG from a main storage to a LNG process pump vessel;

Figure 4 shows a detailed schematic figure of the process of pumping LNG from the LNG process pump vessel to an intermediate storage;

Figure 5 shows a detailed schematic figure of the process of pumping LNG from the intermediate storage to a dispenser storage;

Figure 6 shows a detailed schematic figure of the pumping of LNG from the dispenser storage to a dispenser;

Figure 7 shows a detailed schematic figure of boil-off re-condensation;

Figure 8 shows a schematic graph of the LNG level and pressure in the main storage;
Figure 9 shows a schematic graph of the LNG level, pressure and heater power in the intermediate storage;

Figure 10 shows a schematic graph of the LNG level, pressure and heater power in the dispenser storage;

Figure 11 shows a schematic graph of the system; and

Figure 12 shows liquid and boil-off gas flow directions within the system.

As shown in figure 1 the system according to the present invention comprises a main storage 2, an intermediate storage 4 and a dispenser storage 6. An LNG supply truck 8 supplies LNG to the main storage 2, after which it is processed to a preferred preconditioned state in the intermediate storage 4 and/or dispenser storage 6 in order to obtain pre-conditioned LNG that is suitable for supply from a dispenser 12. Due to the pre-conditioned state of the LNG supplied by the dispenser 12, a refuelling vehicle 64 (not shown in figure 1) can drive further directly after refuelling with LNG.

The detailed basic flow diagram of figure 2 discloses a main storage 2 to which a LNG supply truck 8 supplies LNG via a supply pipe 10. The supplied LNG is stored in the main storage 2, from which it is delivered to a main LNG process pump vessel 18 that is arranged in pump vessel 14. The main LNG process pump 16 that is arranged in the main LNG process pump vessel 18 supplies the LNG via a pressure build-up device 30 to the intermediate storage 4, in which the LNG is stored with increased pressure. The LNG with increased pressure in intermediate storage 4 can be supplied to the dispenser storage 6 via a dispenser LNG pump vessel 22 which is also arranged in the pump vessel 14. Both the main LNG process pump 16 and the dispenser LNG pump 20
are arranged in an own vessel, respectively the main LNG process pump vessel 18 and the dispenser LNG vessel 22.

By choosing an appropriate circulation speed of the main LNG process pump 16, the pressure increase rate of the intermediate storage 4 pressure can match the dispenser storage 4 pressure at the precise moment the dispenser storage 4 needs to be refilled, thereby creating a zero boil-off storage.

The intermediate storage 4 is heated to bring it to a higher pressure. It therefore is required that the boil-off gas remains inside the storage taking care of the pressure buildup, otherwise the intermediate storage 4 would simply boil at the vent-line pressure. During filling of the dispenser storage 6 the intermediate storage 4 drops in pressure which restart the chain of events. Only if the set-pressure of the intermediate storage 4 is reached before a refill of the dispenser storage(s) 6 is required, the intermediate storage 4 will generate build-off gas which then is fed back to the main storage 2 for re-condensation.

Both the main LNG process pump vessel 18 and dispenser LNG pump vessel 22 are isolated by an isolated space 24 which preferably comprises a combined vacuum multi-layered isolation and vacuum perlite isolation. Typical flow rates are 350 l/min for the main LNG process pump 16, and 130 l/min for the dispenser LNG pump 20.

A valve box 26, which comprises a vacuum isolated space 28, is located in the upper part of pump vessel 14. The pre-conditioned LNG can be delivered from the dispenser storage 6, via the dispenser LNG vessel 22, to the dispenser 12, where it is ready to be dispensed to a refuelling vehicle. The valve box 26 is located below the minimum filling levels of the main storage 2, the intermediate storage 4 and the one or more dispenser storages 6 to ensure
a sub-cooled LNG feed to the LNG main process pump 16 and
the one or more dispenser LNG pumps 20 located in separate
pump vessels, respectively the main LNG process pump vessel
18 and the dispenser LNG pump vessel 22. Pump vessels 18 and
22 are both arranged in the lower part of the pump vessel
14.

All process open/close cryogenic valves are
located in the upper part of the valve box 26. Furthermore,
all interconnecting LNG transfer pipes from all storage
vessels to the valve box 26 are mounted pointing downwards,
so that any LNG gas will flow back to the storage vessels
which therefore also act as a phase separator.

In the following figures 3-7 the separate circuits
will be described in more detail.

The LNG supplied by the LNG supply truck 8 is
stored in the main storage 2 from where it is delivered to
the main LNG process pump vessel 18 via supply pipes 38, 40.
The main LNG process pump 16, which drives the flow of this
circuit, is located in the main LNG process pump vessel 18
(figure 3).

In a preferred embodiment the supply pipe 40 can
also be used as a return pipe for emptying the main LNG
process pump vessel 18 by delivering the LNG in the LNG
process pump vessel 18 via the supply pipe 40 to the main
storage 2. Once the main LNG process pump vessel 18 is
empty, it is available for e.g. maintenance of the main LNG
process pump 16 located in the pump vessel 18.

As shown in figure 4, the LNG that has been pumped
from the main storage 2 to the main LNG process pump vessel
18 will be subjected to a main LNG process pump 16 pressure
build-up loop via pipes 42, 44 and 46. The LNG in the pump
vessel 18 is delivered from the pump vessel 18 to a pressure
build-up device 30 via a pipe 42. The LNG is heated by the
heater which forms the pressure build-up device 30, after which it is transported via a pipe 44 to the intermediate storage 4. The LNG can be delivered back to the pump vessel 18 via pipe 46 to be subjected to a further build-up loop in order to further increase the pressure, if desired. Finally, the intermediate storage 4 will comprise LNG at an elevated pressure of e.g. 9 bar.

Typically, the main storage 2 capacity to the intermediate storage 4 capacity ratio is in the order of 5:1, but can also vary depending on the main LNG process pump 16 capacity and/or bulk LNG delivery logistics.

The preconditioned LNG with an elevated pressure of e.g. 9 bar that is contained in the intermediate storage 4, can now be delivered via a pipe 46 to the main LNG process pump vessel 18 and via a pipe 48 to the dispenser storage 6 where it is stored for later use by the dispenser 12.

Typically, the intermediate storage 4 capacity to the dispenser storage 6 ratio is also in the order of 5:1, but can also vary depending on the dispenser LNG pump 20 capacity. Furthermore, a typical delivery rate is 130 l/min, while a typical storage capacity is in the order of 2 m³.

The LNG that is contained in the dispenser storage 6 comprises preconditioned LNG at an elevated pressure of e.g. 9 bar. Due to factors such as partially emptying the dispenser storage 6, heat loss, et cetera, the pressure of the LNG in the dispenser storage 6 may be lowered, which can be compensated by heating the LNG with a heater 50, thereby increasing the pressure contained in the dispenser storage 6 (figure 5). The electrical heater 50 comprises an energy supply 52, and can also be activated to maintain the pressure within a desired bandwidth during LNG delivery.
If a higher pressure than the pressure of the intermediate storage 4 is desired, the heater 50 can also be used to increase the pressure of the LNG in the dispenser storage 6, for example from 9 bar up to 18 bar.

In a further preferred embodiment (not shown) the system comprises two or more separate dispenser storages 6, so that preconditioned LNG at different pressure levels can be readily available to be delivered to a dispenser 12. When for example two dispenser storages 6 are applied, one dispenser storage can be conditioned to provide an LNG pressure of 9 bar, while the other dispenser storage 6 can be conditioned to deliver LNG preconditioned at 18 bar.

In the embodiment shown in figure 6, the preconditioned LNG is transported via a supply pipe 54 to the dispenser LNG pump vessel 22. Vessels 22 and 6 are interconnected by pipe 56 thus creating a thermosyphon loop between both vessels 22, 6. This thermosyphon loop assures an uninterrupted LNG flow from the dispenser storage 6 to the pump vessel 14 under transient and steady state conditions.

The LNG is transported via a delivery pipe 58 to the dispenser 12, where it is available for a truck 64 that is refuelling. The dispenser 12 furthermore comprises a back flow pipe 60 which allows the gas contained in the dispenser LNG pump vessel 22 to be pumped around continuously, thereby preventing gas build-up. The dispenser 12 comprises a delivery hose connected to delivery pipe 58, and a return hose connected to back flow pipe 60, enabling a continuous backflow of LNG to keep the system saturated and cold up to the nozzle. The balance between the LNG supply flow and LNG return flow is for example set at 10:1 and is fixed by calibrated restrictions interconnecting the supply and return LNG lines.
The dispenser LNG pump 20 maintains a low flow circulation to keep the dispenser circuit cold and filled with LNG in the periods wherein there is no LNG delivery.

Furthermore, the difference of the measured values between a flow gas meter (not shown) in the delivery pipe 58 and a back flow gas meter (not shown) in the back flow pipe 60 is equal to the mass delivered to the refuelling truck 64. Integrated software can be provided to calculate the delivery volume of LNG, i.e. by calculating the difference of the existing delivery flow and the back flow. If desired, this software can be linked to a fuel station payment system.

Optionally, a further gas return flow pipe 62 can be provided to allow equalization between the fuel tank of the refuelling truck 64 and LNG dispenser storage 6.

Figure 7 shows the re-condensation of boil-off gasses. Boil-off gasses from the different storages are directed via pipes to a boil-off pipe 36. All expected sources of CNG gas production (which are under normal operation, intermediate storage, dispenser storage(s), pump vessel(s), dispensers, LCNG pump) are venting CNG on the boil-off pipe 36 via overpressure valves. Pipe 36 is connected to a CNG buffer (e.g. low pressure buffer 32 as shown in figure 2 via heater 30) that is typically at ambient temperature. The pressure of the low pressure buffer 32 varies with the main storage 2 pressure to which the CNG is fed for re-condensation. The low pressure buffer 32 can also be connected to an external refrigerator 34 which re-liquefies the CNG to LNG in case the recondensation capacity of the main storage is not enough (for instance if the facility is operated far outside its specification for delivery) or in case the main storage has reached its maximum pressure. The external refrigerator 34 produces LNG
into pump vessel 18 from which it is returned to the main storage 2. The pressure in the main storage 2 is deliberately kept low enough to enable gas to recondensate in this main storage 2.

The main storage 2 also provides refrigeration power to the return LNG boil-off gas from all components of the system, thereby creating an effective zero boil-off system. The enthalpy difference between the main storage 2 pressure after refill and the upper main storage 2 pressure setting, which is typically around 3.5 bar, can be used as refrigeration capacity for re-condensation of evaporated LNG from the system.

Each delivery from the main storage 2 to the intermediate storage 4 lowers the pressure in the main storage 2 through the expansion occurring by this delivery, thereby increasing the refrigeration power.

Buffer 32 accumulates all CNG, from boil-off or other sources, that is released during normal operation of the plant. As the CNG flow in pipe 36 is not constant buffer 32 damps the pressure fluctuations that otherwise would occur and might have a negative effect on the recondensation in main storage 2 which in basis is a steady state process. Furthermore, buffer 32 allows the proper operation of the refrigerator 34.

Figures 8-10 together show an operational timeline of the main storage 2 (figure 8), the intermediate storage 4 (figure 9) and the dispenser storage 6 (figure 10). Please note that the X access of the graphs shown in figures 8-10 represent the timescale, which is different for the separate figures 8 to 10.

When a truck 64 starts refuelling at time T, the LNG level 80 in the dispenser storage 6 will decrease during the time span T' of the refuelling (figure 10). Together
with this decrease in LNG level 80, also the pressure 82 of the LNG in the dispenser storage 6 will decrease. In order to obtain the pressure within the desired bandwidth 84 for LNG delivery, the heater power 86 of heater 50 is temporarily increased until the pressure 82 is increased to stay within the bandwidth 84.

After a number of trucks 64 have refuelled, four refills are shown in figure 10, the LNG level 80 in the dispenser storage 6 has been reduced significantly and is refilled at time D during time span D’ by transporting LNG from the intermediate storage 4 to the dispenser storage 6.

As shown in figure 9, the LNG level 74 in the intermediate storage 4 lowers when the dispenser storage refill D’ takes place. Also the pressure 76 in the intermediate storage 4 reduces, which pressure is increased again to the desired pressure level by turning on the heater 30. The heater 30 functions as a pressure build-up device and the power delivered to the heater 30 is shown in figure 9 as line 78. When the LNG level 74 in the intermediate storage 4 has been lowered by one or more dispenser storage 6 refills D’, there are four refills shown in figure 9, an intermediate storage 4 refill is executed at time I during time span I’.

As shown in figure 8, the LNG level 70 in the main storage 2 lowers during time span I’ when an intermediate storage refill takes place at time I.

The pressure in the main storage is regulated by three mechanisms:

1) Due to the thermal heat loads (due to normal isolation losses and recondensation), the pressure in the main storage 2 steadily increases to its maximum allowed pressure;
2) During filling of the intermediate storage 4 the pressure in the main storage 2 drops – see line 72 dropping in figure 8 during delivery in interval I'; and

3) During refill of the main storage 2 the LNG is delivered at typically 1 bar pressure so after refill, the pressure in the main storage 2 is approximately 1 bar and the level is full (starting point in figure 8).

When the LNG level 70 in the main storage 2 is lowered by a number of intermediate storage 4 refills I’, the main storage 2 can be refilled by the delivery of LNG by a LNG supply truck 8.

Figure 11 shows that it is also possible to deliver LCNG via delivery pipe 90, by using a high pressure LNG pump 88, which is arranged between the main storage 2 and heater 50. The delivery pipe 90 delivers high pressure CNG at ambient temperature for direct CNG filling of vehicle tanks or as close-in to an all ambient CNG filling station. The ambient high pressure CNG station is no part of the patent description.

As shown in figure 12, liquid L flows from the main storage 2 to the intermediate storage 4, and finally to the dispenser storage 6. Boil-off gasses follow the opposite direction, preferably being introduced to the storage 6, 4, 2, with the highest pressure, being in successive order: the dispenser storage 6, the intermediate storage 4, and finally the main storage 2. Hence, in the step of re-condensing the cooled down boil-off gasses at the storage with highest possible pressure available, these boil-off gasses are added to the dispenser storage 6 until it is completely filled.

Then, further boil-off gasses are fed back into the intermediate storage 4. Only if also the capacity of the intermediate storage 4 is completely filled with LNG, further boil-off gasses are fed back into the main storage
2. By re-condensation at the storage with the highest possible pressure, the most effective re-condensation is obtained.

Although they show preferred embodiments of the invention, the above described embodiments are intended only to illustrate the present invention and not to limit the scope of the invention in any way. It is particularly noted that the skilled person can combine technical measures of the different embodiments. The scope of the invention is therefore defined solely by the following claims.
CLAIMS

1. System for the delivery of LNG, comprising:
   - a main storage (2) for storing supplied LNG;
   - a pressure build-up device (30) for increasing the pressure of the LNG;
   - an intermediate storage (4) for storing the LNG with increased pressure;
   - a dispenser (12) for dispensing LNG at a pre-conditioned state to a refuelling vehicle;
   wherein the pressure build-up device (30) and the intermediate storage (4) for storing the LNG with increased pressure are arranged in a pressure build-up loop; and
   - further comprising one or more dispenser storages (6) for storing and/or further pre-conditioning the LNG.

2. System according to claim 1, further comprising:
   - a boil-off collecting means (36) for collecting boil-off gasses evaporated from any of the storage tanks; and
   - means (34) for cooling down the boil-off gasses.

3. Method for the delivery of LNG, comprising the steps of:
   - storing supplied LNG in a main storage (2);
   - increasing the pressure of the LNG with a pressure build-up device (30);
   - storing the LNG with increased pressure in an intermediate storage (4);
- dispensing LNG at a pre-conditioned state with a dispenser (12) to a refuelling vehicle;
  - wherein increasing the pressure of the LNG with the pressure build-up device (30) comprises subjecting the LNG to a pressure build-up loop until the desired pressure is reached, after which it is stored in the intermediate storage (4); and
  - further comprising the step of storing and/or further pre-conditioning the LNG in one or more dispenser storages (6).

4. Method according to claim 3, further comprising the step of pumping LNG from the dispenser storage (6) to a dispenser (12) with a dispenser LNG pump (20) arranged in a dispenser LNG pump vessel (22).

5. Method according to claim 3 or 4, further comprising the steps of:
  - collecting boil-off gasses evaporated from any of the storage tanks with a boil-off collecting means (36); and
  - cooling down the boil-off gasses with cooling means (34).

6. Method according to claim 5, further comprising the step of:
  - re-condensating the cooled down boil-off gasses at the storage (6, 4, 2) with highest possible pressure available.

7. Method according to claim 6, wherein the step of re-condensating the cooled down boil-off gasses at the
storage (6, 4, 2) with highest possible pressure available, comprises at least the step of:

A. re-condensation in the one or more dispenser storages (6) until these one or more dispenser storages (6) are completely filled with LNG.

8. Method according to claim 7, wherein the step of re-condensating the cooled down boil-off gasses at the storage (6, 4, 2) with highest possible pressure available, if the one or more dispenser storages (6) are completely filled with LNG and further boil-off gasses are to be re-condensated, further comprises the step of:

B. re-condensation in the intermediate storage (4) until the intermediate storage is completely filled with LNG.

9. Method according to claim 8, wherein the step of re-condensating the cooled down boil-off gasses at the storage (6, 4, 2) with highest possible pressure available, if the one or more dispenser storages (6) and intermediate storage (4) are completely filled with LNG and further boil-off gasses are to be re-condensated, further comprises the step of:

C. re-condensation in the main storage (2) until the main storage (2) is completely filled with LNG.

10. Method according to any of claims 6-9, further comprising the step of:

- using a cooling device when the combined re-condensation capacity of the one or more dispenser storages (6), the intermediate storage (4) and the main storage (2) is inadequate, i.e. when all storages (6, 4, 2) are completely filled with LNG.
11. Method according to any of claims 3-10, wherein a system according to any of claims 1 or 2 is applied.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. F17C5/02 F17C9/00

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F17C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>A</td>
<td>EP 1 308 667 A2 (CHART INC [US]) 7 May 2003 (2003-05-07) the whole document</td>
<td>1,3</td>
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