CLAIMS:

1. A system for loading and storing CNG onboard of a ship and for unloading it therefrom, the system comprising:

CNG loading facilities for loading CNG on board of the ship;

CNG storage facilities for storing the loaded CNG onboard the ship at storage pressures and temperatures;

CNG unloading facilities for unloading CNG to a delivery point, the delivery point requiring the unloaded CNG to be at delivery pressures and temperatures generally different from the storage pressures and temperatures;

wherein the CNG unloading facilities comprise:

a CNG heater for heating the to-be-unloaded CNG prior to unloading;

a lamination value for allowing the to-be-unloaded CNG to expand from the storage pressure to the delivery pressure prior to unloading; characterized by:

the CNG unloading facilities further comprising a compressor unit for compressing the unloaded CNG prior to unloading.

~~2. A system in accordance with claim 1, wherein the CNG heater is a hot water heater.~~

~~3~~2. A system in accordance with claim ~~2~~1, wherein the CNG heater is configured for being controlled by means of a temperature control valve, the system comprising the temperature control valve~~,~~.

~~4. A system in accordance with claim 3,~~ wherein the temperature control valve is preferably in turn configured for being controlled by a temperature controlled configured for elaborating information provided to it by at least one temperature control unit, the system comprising said temperature controller and temperature control unit.

~~5~~3. A system in accordance with ~~any one of~~ claim~~s~~ 1 or 2~~to 4~~, wherein the opening of the lamination valve can be continuously varied within an interval comprised between a maximum value and a minimum value of said opening~~,~~.

~~6. A system in accordance with claim 5,~~ wherein the lamination valve is preferably configured for being controlled by a lamination valve controller, the system also preferably comprising the lamination valve controller~~,~~.

~~7. A system in accordance with claim 6,~~ wherein the lamination valve controller is preferably configured for elaborating information provided to it by a lamination pressure control unit, the system preferably comprising the lamination pressure control unit~~.~~

~~8 A system in accordance with claim 6 or 7,~~ wherein the lamination valve controller is preferably also configured for elaborating information provided to it by a lamination control unit, the system preferably also comprising the lamination flow control unit.

~~9. A system in accordance with any of the preceding claims, the CNG unloading facilities further comprising a compressor unit for compressing the unloaded CNG prior to unloading.~~

~~10~~4. A system in accordance with claim ~~9~~1, 2 or 3, wherein the compressor unit is located downstream of the CNG heater.

~~11~~5. A system in accordance with any one of claims 1 to ~~4 9 or 10~~, wherein the compressor unit is driven by either electricity or a gas turbine unit.

~~12~~6. A system in accordance with claim ~~11~~5, wherein the gas turbine unit is supplied by a fuel supply unit, and wherein the fuel supply unit is configured for receiving CNG as fuel, the CNG fuel being a portion of the CNG stored on board of the ship, the system comprising the fuel supply unit.

~~13~~7. A system in accordance with any one of the claims 1 to ~~6 9 to 12~~, wherein the CNG unloading facilities further comprise a separator unit for separating liquid from CNG, the separator unit being located downstream of the CNG heater and upstream of the compressor unit~~.~~

~~14. A system in accordance with claim 13,~~ wherein the separator unit is preferably a knock out drum~~.~~

~~15. A system in accordance with claim 13 or 14,~~ wherein the separator unit or knock out drum is preferably connected to a level sensor configured for sensing liquid level inside the separator unit, the system comprising the level sensor,~~.~~

~~16. A system in accordance with claim 15,~~ wherein the level sensor is preferably operably connected to a liquid drainage valve, and the liquid drainage valve is configured for draining the liquid from the separator into a drainage system.

~~17~~8. A system in accordance with any one of claims 1 to 7~~9 to 16~~, wherein the CNG unloading facilities further comprise a compressor unit after cooler, the compressor unit after cooler being located downstream of the compressor unit and being configured for heat to be transferred from the compressed CNG to CNG being transferred from the CNG storage facilities to the CNG unloading facilities.

~~18~~9. A system in accordance with claim ~~17~~8, the CNG unloading facilities further comprising a gas export cooler, the gas export cooler being located downstream of the compressor unit after cooler.

~~19~~10. A system in accordance with ~~any one of~~ claim~~s 13 to 18~~ 7, 8 or 9, wherein the unloading facilities further comprise a compressor pressure control unit located downstream of the compressor unit, a separator flow control unit located downstream of the separator unit and upstream of the compressor unit, and a feedback flow valve located downstream of the compressor pressure control unit, wherein the separator flow control unit and the compressor pressure unit are each configured to provide information to a compressor controller, also comprised in the system, the compressor controller being programmed for operating the feedback flow valve so that unloaded CNG can be re-injected into the compressor unit before it is unloaded by the CNG unloading facilities.

~~20. A system in accordance with any one of the preceding claims, the system further comprising a blow down unit for allowing CNG to be ejected from the system for safety reasons.~~

~~21~~11. A system in accordance with any one of the preceding claims, wherein the compressor unit is designed for providing a maximum pressure gradient of approximately 90 barg or in excess of 90 barg.

~~22~~12. A CNG carrier ship comprising a system in accordance with any one of the preceding claims.

~~23~~13. A method for loading and storing CNG onboard of a ship and for unloading CNG therefrom, the method comprising the sequential steps of:

loading CNG onboard a ship;

storing the loaded CNG onboard the ship for transportation purposes at a range of storage pressures and temperatures; and

unloading the to-be-unloaded CNG from the ship to a delivery point, the delivery pressures and temperatures of the unloaded CNG being a range that is generally different from the range of storage pressures and temperatures, wherein the step of unloading the to-be-unloaded CNG from the ship comprises the steps of:

heating the to-be-unloaded CNG prior to unloading; and

allowing the then heated, to-be-unloaded to CNG to expand freely through a lamination valve whereby the to-be-unloaded CNG can be delivered at the delivery point at the delivery pressure and temperature, characterized by the method further comprising:

compressing the to-be-unloaded CNG using a compressor unit.

~~24. A method according to claim 23, wherein the step of heating the to-be-unloaded CNG prior to unloading is carried out using a hot water heat exchanger.~~

~~25. A method according to claim 24, wherein the step of heating the to-be-unloaded CNG prior to unloading comprises the further steps of:~~

~~sensing the temperature of to-be-unloaded CNG in exit from the hot water heat exchanger; by means of a temperature control unit;~~

~~sending temperature information on the to-be-unloaded CNG to a temperature controller;~~

~~controlling the hot water heat exchange by means of a temperature control valve, the temperature control valve being operably connected to the temperature controller.~~

~~26. A method according to claim 23, 24 or 25, wherein the step of allowing the then heated, to be unloaded CNG to expand freely through a lamination valve further comprises the steps of:~~

~~using a lamination pressure control unit and/or a lamination flow control unit to sense respectively pressure and/or flow rate information about the to be unloaded CNG downstream of the lamination valve;~~

~~sending the sensed pressure and/or flow rate information to a lamination valve controller;~~

~~controlling the opening of the lamination valve by means of the lamination controller.~~

~~27. A method according to any one of claims 23 to 27, wherein the step of unloading the to be unloaded CNG from the ship further comprises the step of:~~

~~compressing the to be unloaded CNG using a compressor unit.~~

~~28~~14. A method according to claim ~~27~~13, wherein the step of compressing the to-be-unloaded CNG using a compressor unit is performed between the steps of:

heating the to-be-unloaded CNG prior to unloading; and

allowing the then heated, to-be-unloaded CNG to expand freely through a lamination valve whereby the to-be-unloaded CNG can be delivered at the delivery point at the delivery pressure and temperature.

~~29~~15. A method according to claims ~~27~~13 or ~~28~~14, wherein the step of unloading the to-be-unloaded CNG from the ship further comprises the step of:

separating liquid from the to-be-unloaded CNG using a separator unit~~.~~.

~~30. A method according to claim 29,~~ wherein the step of separating liquid from the to-be-unloaded CNG using a separator unit is preferably performed between the steps of heating the to-be-unloaded CNG prior to unloading and compressing the to-be-unloaded CNG using a compressor unit~~.~~.

~~31. A method according to claim 29 or 30,~~ wherein the step of unloading the to-be-unloaded CNG from the ship preferably further comprises the steps of:

sensing the level of liquid in the separator using a level sensor;

sending information about the level of liquid in the liquid separator to a level control unit; and

using the level control unit, controlling a drainage unit in order to drain liquid from the liquid separator when required.

~~32. A method in accordance with any one of claims 27 to 31,~~ wherein the step of unloading the to-be-unloaded CNG from the ship further preferably comprises the step of:

cooling the compressed, to-be-unloaded CNG via a cooler unit downstream of the compressor unit.

~~33. A method in accordance with any one of claims 29 to 32,~~ wherein the step of unloading the to-be-unloaded CNG from the ship further preferably comprises the steps of:

sensing pressure information about the to-be-unloaded CNG using a pressure control unit downstream of the compressor unit;

sensing flow rate information about the to-be-unloaded CNG using a flow control unit downstream of the separator unit and upstream of the compressor unit;

sending the pressure and the flow rate information to a compressor controller;

controlling via the compressor controller a feedback flow valve located downstream of the compressor pressure control unit so that to-be-unloaded CNG can be re-injected into the compressor unit before the same is unloaded to the delivery point if required.

~~34. A method in accordance with any one of claims 23 to 33, wherein the method further comprises the step of:~~

~~providing a blow down system so that CNG can be ejected into the atmosphere for safety reasons.~~

CLAIMS

1. A system for loading and storing CNG onboard of a ship and for unloading it therefrom, the system comprising:

CNG loading facilities for loading CNG on board of the ship;

CNG storage facilities for storing the loaded CNG onboard the ship at storage pressures and temperatures;

CNG unloading facilities for unloading CNG to a delivery point, the delivery point requiring the unloaded CNG to be at delivery pressures and temperatures generally different from the storage pressures and temperatures;

wherein the CNG unloading facilities comprise:

a CNG heater for heating the to-be-unloaded CNG prior to unloading;

a lamination value for allowing the to-be-unloaded CNG to expand from the storage pressure to the delivery pressure prior to unloading; characterized by:

the CNG unloading facilities further comprising a compressor unit for compressing the unloaded CNG prior to unloading.

2. A system in accordance with claim 1, wherein the CNG heater is configured for being controlled by means of a temperature control valve, the system comprising the temperature control valve,

wherein the temperature control valve is preferably in turn configured for being controlled by a temperature controlled configured for elaborating information provided to it by at least one temperature control unit, the system comprising said temperature controller and temperature control unit.

3. A system in accordance with claims 1 or 2, wherein the opening of the lamination valve can be continuously varied within an interval comprised between a maximum value and a minimum value of said opening,.

wherein the lamination valve is preferably configured for being controlled by a lamination valve controller, the system also preferably comprising the lamination valve controller,

wherein the lamination valve controller is preferably configured for elaborating information provided to it by a lamination pressure control unit, the system preferably comprising the lamination pressure control unit,

wherein the lamination valve controller is preferably also configured for elaborating information provided to it by a lamination control unit, the system preferably also comprising the lamination flow control unit.

4. A system in accordance with claim 1, 2 or 3, wherein the compressor unit is located downstream of the CNG heater.

5. A system in accordance with any one of claims 1 to 4, wherein the compressor unit is driven by either electricity or a gas turbine unit.

6. A system in accordance with claim 5, wherein the gas turbine unit is supplied by a fuel supply unit, and wherein the fuel supply unit is configured for receiving CNG as fuel, the CNG fuel being a portion of the CNG stored on board of the ship, the system comprising the fuel supply unit.

7. A system in accordance with any one of the claims 1 to 6, wherein the CNG unloading facilities further comprise a separator unit for separating liquid from CNG, the separator unit being located downstream of the CNG heater and upstream of the compressor unit,.

wherein the separator unit is preferably a knock out drum,

wherein the separator unit or knock out drum is preferably connected to a level sensor configured for sensing liquid level inside the separator unit, the system comprising the level sensor,

wherein the level sensor is preferably operably connected to a liquid drainage valve, and the liquid drainage valve is configured for draining the liquid from the separator into a drainage system.

8. A system in accordance with any one of claims 1 to 7, wherein the CNG unloading facilities further comprise a compressor unit after cooler, the compressor unit after cooler being located downstream of the compressor unit and being configured for heat to be transferred from the compressed CNG to CNG being transferred from the CNG storage facilities to the CNG unloading facilities.

9. A system in accordance with claim 8, the CNG unloading facilities further comprising a gas export cooler, the gas export cooler being located downstream of the compressor unit after cooler.

10. A system in accordance with claim 7, 8 or 9, wherein the unloading facilities further comprise a compressor pressure control unit located downstream of the compressor unit, a separator flow control unit located downstream of the separator unit and upstream of the compressor unit, and a feedback flow valve located downstream of the compressor pressure control unit, wherein the separator flow control unit and the compressor pressure unit are each configured to provide information to a compressor controller, also comprised in the system, the compressor controller being programmed for operating the feedback flow valve so that unloaded CNG can be re-injected into the compressor unit before it is unloaded by the CNG unloading facilities.

11. A system in accordance with any one of the preceding claims, wherein the compressor unit is designed for providing a maximum pressure gradient of approximately 90 barg or in excess of 90 barg.

12. A CNG carrier ship comprising a system in accordance with any one of the preceding claims.

13. A method for loading and storing CNG onboard of a ship and for unloading CNG therefrom, the method comprising the sequential steps of:

loading CNG onboard a ship;

storing the loaded CNG onboard the ship for transportation purposes at a range of storage pressures and temperatures; and

unloading the to-be-unloaded CNG from the ship to a delivery point, the delivery pressures and temperatures of the unloaded CNG being a range that is generally different from the range of storage pressures and temperatures, wherein the step of unloading the to-be-unloaded CNG from the ship comprises the steps of:

heating the to-be-unloaded CNG prior to unloading; and

allowing the then heated, to-be-unloaded to CNG to expand freely through a lamination valve whereby the to-be-unloaded CNG can be delivered at the delivery point at the delivery pressure and temperature, characterized by the method further comprising:

compressing the to-be-unloaded CNG using a compressor unit.

14. A method according to claim 13, wherein the step of compressing the to-be-unloaded CNG using a compressor unit is performed between the steps of:

heating the to-be-unloaded CNG prior to unloading; and

allowing the then heated, to-be-unloaded CNG to expand freely through a lamination valve whereby the to-be-unloaded CNG can be delivered at the delivery point at the delivery pressure and temperature.

15. A method according to claims 13 or 14, wherein the step of unloading the to-be-unloaded CNG from the ship further comprises the step of:

separating liquid from the to-be-unloaded CNG using a separator unit,

wherein the step of separating liquid from the to-be-unloaded CNG using a separator unit is preferably performed between the steps of heating the to-be-unloaded CNG prior to unloading and compressing the to-be-unloaded CNG using a compressor unit,

wherein the step of unloading the to-be-unloaded CNG from the ship preferably further comprises the steps of:

sensing the level of liquid in the separator using a level sensor;

sending information about the level of liquid in the liquid separator to a level control unit; and

using the level control unit, controlling a drainage unit in order to drain liquid from the liquid separator when required,

wherein the step of unloading the to-be-unloaded CNG from the ship further preferably comprises the step of:

cooling the compressed, to-be-unloaded CNG via a cooler unit downstream of the compressor unit,

wherein the step of unloading the to-be-unloaded CNG from the ship further preferably comprises the steps of:

sensing pressure information about the to-be-unloaded CNG using a pressure control unit downstream of the compressor unit;

sensing flow rate information about the to-be-unloaded CNG using a flow control unit downstream of the separator unit and upstream of the compressor unit;

sending the pressure and the flow rate information to a compressor controller;

controlling via the compressor controller a feedback flow valve located downstream of the compressor pressure control unit so that to-be-unloaded CNG can be re-injected into the compressor unit before the same is unloaded to the delivery point if required.