CLAIMS

1. A fuel gas supply system comprising:

a storage unit configured to contain a liquefied gas and a boil-off gas generated from the liquefied gas;

a compression unit configured to compress the boil-off gas generated in the storage unit and transfer the compressed boil-off gas;

a re-condensation unit configured to re-condense the boil-off gas compressed in the compression unit by using a super-cooled liquefied gas of the storage unit;

a high-pressure pump unit installed on a consumer supply line connected from the re-condensation unit to a consumer to pressurize the liquefied gas of the re-condensation unit at a pressure requested by the consumer or more; and

a heat-exchange unit including a vaporizer configured to heat the liquefied gas pressurized in the high-pressure pump unit to re-vaporize the liquefied gas,

wherein the re-condensation unit includes:

a first condensation part configured to mix the liquefied gas transferred from the storage unit and the boil-off gas compressed in the compression unit to re-condense the boil-off gas;

a second condensation part configured to exchange heat between the liquefied gas which is pressurized in and transferred from the high-pressure pump unit and the boil-off gas compressed in the compression unit to re-condense the boil-off gas; and

a minimum flow line branched from a rear end of the high-pressure pump unit and circulated to the first condensation part,

wherein the second condensation part is installed on a condensation line branched from the minimum flow line and connected to the rear end of the high-pressure pump unit such that heat exchange between the liquefied gas passing

through the condensation line and the boil-off gas flowing from the compression unit to the first condensation part is performed.

2. The fuel gas supply system of claim 1,

wherein the compression unit includes:

a first compression part configured to compress the boil-off gas transferred from the storage unit and transfer the compressed boil-off gas to the first condensation part;

a second compression part configured to compress the boil-off gas and transfer the compressed boil-off gas to the second condensation part when the boil-off gas is generated more than a re-condensation capacity of the first condensation part; and

a high-pressure compression part configured to compress a part of the boil-off gas generated in the storage unit to transfer the compressed part of the boil-off gas to the consumer supply line on an rear end of the vaporizer.

3. The fuel gas supply system of claim 1,

wherein the boil-off gas re-condensed in the second condensation part is collected in the first condensation part.

4. The fuel gas supply system of claim 1, wherein the first condensation part mixes the liquefied gas pressurized by a supply pump of the storage unit with the boil-off gas compressed by a first compression part of the compression unit, and re-condenses all or a part of the boil-off gas.

5. A fuel gas supply system comprising:

a liquefied gas supply line configured to transfer a liquefied gas contained in a storage unit to a first condensation part;

a boil-off gas first supply line configured to transfer boil-off gas contained in the storage unit to the first condensation part through a first low-pressure compression part;

a boil-off gas second supply line configured to transfer the boil-off gas contained in the storage unit to the first condensation part through a second low-pressure compression part;

a consumer supply line configured to transfer the liquefied gas stored in the first condensation part to a consumer through a high-pressure pump unit and a vaporizer;

a condensation line branched from a rear end of the high-pressure pump unit of the consumer supply line and rejoined with consumer supply line to bypass the liquefied gas pressurized in the high-pressure pump unit;

a second condensation part configured to exchange heat between the boil-off gas of the boil-off gas second supply line and the liquefied gas of the condensation line to re-condense the boil-off gas of the boil-off gas second supply line; and

a minimum flow line connected from the rear end of the high-pressure pump unit of the consumer supply line to the first condensation part,

wherein the condensation line is branched from the minimum flow line and rejoined with the rear end of the high-pressure pump unit of the consumer supply line.

6. The fuel gas supply system of claim 5, wherein the liquefied gas supply line includes a liquefied gas first supply line and a liquefied gas second supply line, and

wherein the first condensation part is configured to spray the liquefied gas supplied from the liquefied gas second supply line to the boil-off gas stored in the first condensation part to re-condense the boil-off gas.

7. The fuel gas supply system of claim 5, further comprising:

a boil-off gas high-pressure supply line configured to shut off a fluid flow from the boil-off gas second supply line, the condensation line and the consumer supply line to the consumer when being driven at a minimum flow rate,

wherein the boil-off gas high-pressure supply line is configured to allow the liquefied gas stored in the first condensation part to circulate through the high-pressure pump unit and the minimum flow line, thereby enabling continuous operation of the high-pressure pump unit,

shut off the fluid flow to the boil-off gas second supply line and the condensation line during normal operation and disable the operation of the second condensation part,

open the fluid flow to the boil-off gas second supply line and the condensation line during loading operation and operate the second condensation part, thereby being operated differently according to an operation mode, and

pressurize an excessive boil-off gas using a high-pressure compression part to directly supply the excessive boil-off gas to a rear end of the vaporizer when an amount of the boil-off gas generated in the storage unit exceeds an amount that is

capable of being re-condensed in the first and second condensation parts during the loading operation.

8. The fuel gas supply system of claim 1, further comprising:

a vaporization reduction module configured to reduce a vaporization amount of the liquefied gas in the storage unit,

wherein the vaporization reduction module includes a cooling unit configured to cool a storage tank of the storage unit.

9. The fuel gas supply system of claim 8,

wherein the cooling unit includes:

a spray member configured to spray the liquefied gas stored in the storage tank into the storage tank;

a spray pump configured to supply the liquefied gas stored in the storage tank to the spray member; and

a spray line configured to connect the spray member and the spray pump.

10. The fuel gas supply system of claim 8, further comprising:

a shipment unit configured to transfer a liquefied gas from a liquefied gas carrier to the storage tank,

wherein the vaporization reduction module further includes a controller configured to control the cooling unit to cool the storage tank before the shipment unit transfers the liquefied gas.

11. The fuel gas supply system of claim 10,

wherein the vaporization reduction module further includes a pressure regulating unit configured to regulate a pressure in the storage tank, and

wherein the controller is configured to:

control the cooling unit to cool the storage tank while the shipment unit transfers the liquefied gas, control the pressure regulating unit to pressurize an inside of the storage tank for a first time before or after the shipment unit starts a liquefied gas transfer and to maintain a pressure inside the storage tank for a second time after the first time, and control the pressure regulating unit to depressurize the inside of the storage tank for a third time after the second time.

12. The fuel gas supply system of claim 11, further comprising:

a boil-off gas supply line through which a boil-off gas is transferred from the storage tank to the re-condensation unit,

wherein the pressure regulating unit includes a pressure regulating valve configured to regulate an opening rate of the boil-off gas supply line,

wherein the consumer includes a gas generating module provided with a gas turbine configured to generate electricity by using a liquefied gas, and

wherein the fuel gas supply system further includes an excess gas supply unit configured to compress a part of the boil-off gas in the boil-off gas supply line and supply the compressed part of the boil-off gas to the gas turbine.

13. The fuel gas supply system of claim 10, further comprising:

a boil-off gas transfer unit configured to transfer a part of the boil-off gas generated in the storage tank to the liquefied gas carrier,

wherein the boil-off gas transfer unit includes:

a transfer line provided to transfer a part of the boil-off gas generated in the storage tank to the liquefied gas carrier;

a transfer gas pressurizer configured to pressurize the boil-off gas in the transfer line toward the liquefied gas carrier;

a bypass line provided to transfer the boil-off gas from the storage tank to the liquefied gas carrier by bypassing the transfer gas pressurizer; and

a pressure regulating member configured to regulate a pressure of a liquefied gas storage tank in which the liquefied gas of the liquefied gas carrier is stored.

14. The fuel gas supply system of claim 1, further comprising:

a circulation module configured to circulate a cooling fluid,

wherein the circulation module includes:

a main circulation module configured to circulate the cooling fluid to cool an cooling object; and

an auxiliary circulation module configured to branch the cooling fluid circulated by the main circulation module to circulate the cooling fluid to flow into the vaporizer, thereby heat-exchanging with the liquefied gas in the vaporizer.

15. The fuel gas supply system of claim 14,

wherein the consumer includes a gas generating module provided with a gas turbine configured to generate electricity by using the liquefied gas,

wherein the gas generating module includes an air cooler configured to cool an outside air flowing into the gas turbine, and

wherein the auxiliary circulation module is configured to circulate the cooling fluid such that the cooling fluid after heat exchange with the liquefied gas in the vaporizer flows into the air cooler to exchange heat with the outside air.

16. The fuel gas supply system of claim 15,

wherein the main circulation module includes:

a cooling unit configured to cool the cooling fluid;

a main circulation pipe through which the cooling fluid flows to circulate between the cooling unit and the cooling object; and

a main pump configured to pressurize the cooling fluid such that the cooling fluid flows through the main circulation pipe.

17. The fuel gas supply system of claim 16,

wherein the auxiliary circulation module includes:

a temperature regulating unit for regulating a temperature of the cooling fluid flowing into the vaporizer; and

a bypass flow path provided to allow the cooling fluid to flow and bypass the air cooler, and

wherein the temperature regulating unit includes:

a mixing member in which a first fluid as the cooling fluid flowing from the cooling unit to the cooling object is mixed with a second fluid as the cooling fluid flowing from the cooling object to the cooling unit; and

a controller configured to control the mixing member to adjust a mixing ratio between the first fluid and the second fluid according to a temperature of the outside air and the temperature of the cooling fluid flowing into the vaporizer.

18. The fuel gas supply system of claim 17,

wherein a third fluid, which is a cooling fluid having completed heat exchange with the liquefied gas in the vaporizer, is mixed with the first fluid and the second fluid in the mixing member,

wherein the auxiliary circulation module is configured to circulate the cooling fluid such that the cooling fluid passing through the air cooler or the bypass flow path is mixed with the first fluid and supplied to the cooling object, and

wherein the controller is configured to control the mixing member to adjust a mixing ratio between the first fluid, the second fluid and the third fluid according to the temperature of the outside air and the temperature of the cooling fluid flowing into the vaporizer, and to adjust a flow rate of the cooling fluid flowing into the vaporizer according to the temperature of the outside air and the temperature of the cooling fluid flowing into the vaporizer.

19. The fuel gas supply system of claim 1, further comprising:

a circulation module configured to circulate a cooling fluid and an intermediate heat medium,

wherein the circulation module includes:

a main circulation module configured to circulate the cooling fluid to cool a cooling object;

an auxiliary circulation module configured to circulate the intermediate heat medium to vaporize the liquefied gas in the vaporizer; and

a heater configured to heat the intermediate heat medium by exchanging heat between the cooling fluid circulated by the main circulation module and the intermediate heat medium circulated by the auxiliary circulation module.

20. The fuel gas supply system of claim 19,

wherein the consumer includes a gas generating module provided with a gas turbine configured to generate electricity by using the liquefied gas,

wherein the gas generating module includes an air cooler configured to cool an outside air introduced into the gas turbine, and

wherein the auxiliary circulation module is configured to circulate the intermediate heat medium such that the intermediate heat medium flows into the air cooler to exchange heat with the outside air after exchanging heat with the liquefied gas in the vaporizer.

21. The fuel gas supply system of claim 19,

wherein the auxiliary circulation module includes a temperature regulating unit configured to regulate a temperature of the intermediate heat medium flowing into the vaporizer,

wherein the temperature regulating unit includes:

a bypass pipe provided to allow the intermediate heat medium to bypass the heater;

a regulating valve configured to control a flow of the intermediate heat medium bypassed to the bypass pipe; and

a controller configured to control the flow of the intermediate heat medium by controlling the regulating valve according to a temperature of an outside air and a

temperature of the intermediate heat medium heated by the heater and flowing into the vaporizer.