

to a cryogenic temperature in the reliquefaction apparatus including a refrigeration cycle, and the reliquefied BOG is returned to the cargo tank.

In the case of a conventional LNG carrier equipped with a DFDE propulsion system, BOG is consumed in such a manner that it is supplied as fuel to the DFDE after
5 treating BOG by only a BOG compressor and heating, without installing the reliquefaction facility. Therefore, when an amount of fuel necessary for an engine is smaller than a generation amount of BOG, there is a problem that BOG is burnt in a gas combustion unit (GCU) or is vented to atmosphere.

Even though a conventional LNG carrier equipped with a reliquefaction facility
10 and a low-speed diesel engine can treat BOG through the reliquefaction facility, the control of the entire system is complicated due to the operation complexity of the reliquefaction facility using nitrogen gas, and a considerable amount of power is consumed.

Consequently, there is a need for continuous research and development of systems
15 and methods for efficiently treating liquefied gas, including BOG generated naturally from the cargo tank.

DISCLOSURE

TECHNICAL PROBLEM

20 | ~~The Embodiments of the present invention has been made in an effort seek~~ to solve the above problems and is directed to a liquefied gas treatment system for a vessel, which includes a cargo tank storing LNG, and an engine supplied with the LNG stored in the cargo tank and using the LNG as fuel, wherein the BOG generated in the cargo tank and the LNG stored in the cargo tank are used in the engine as fuel, thereby achieving
25 the efficient use of liquefied gas.

TECHNICAL SOLUTION

According to an aspect of the present invention, there is provided a liquefied gas

configured to receive and uses BOG that is compressed while passing through a part of the plurality of compression cylinders included in the compressor.

The BOG supplied to the main engine may be BOG that is compressed while passing through all or part of the plurality of compression cylinders included in the compressor.

The liquefied gas treatment system may further include a forcible vaporizer configured to forcibly vaporize the LNG stored in the cargo tank and supply the forcibly vaporized LNG to the compressor.

The main engine may be an MEGI engine and the sub engine is a DF engine.

The main BOG supply line may include a heat exchanger configured to liquefy BOG, which is not supplied to the main engine and the sub engine among BOG compressed by the compressor, by exchanging heat with BOG that is discharged from the cargo tank and transferred to the compressor.

~~According to another aspect of the present invention~~ the disclosure, there is provided a liquefied gas treatment system for a vessel, which includes a cargo tank storing liquefied natural gas (LNG), and an engine using the LNG stored in the cargo tank as fuel, the liquefied gas treatment system including: a compressor line configured to compress BOG generated in the cargo tank by a compressor and supply the compressed BOG to the engine as fuel; a pump line configured to compress the LNG stored in the cargo tank by a pump and supply the compressed LNG to the engine as fuel; and a gas-liquid separator configured to separate a heavy hydrocarbon component from the LNG so as to adjust a methane number of the LNG to a value necessary for the engine.

According to another aspect of the present invention, there is provided a liquefied gas treatment method for a vessel, which is performed by a liquefied gas treatment system for the vessel including a cargo tank storing LNG, and an engine supplied with the LNG stored in the cargo tank and using the LNG as fuel, the liquefied gas treatment system including a compressor line configured to compress BOG generated in the cargo tank by a compressor and supply the compressed BOG to the engine as fuel, and a pump

line configured to compress the LNG stored in the cargo tank by a pump and supply the compressed LNG to the engine as fuel, the liquefied gas treatment method including adjusting a methane number of the LNG to a value necessary for the engine by separating a heavy hydrocarbon component from the LNG when the LNG is supplied to the engine through the pump line.

ADVANTAGEOUS EFFECTS

According to embodiments of the present invention, all BOG generated during the transportation of cargo (that is, LNG) in the LNG carrier can be used as the fuel of the engine, or may be reliquefied, be returned to the cargo tank and be stored therein. Therefore, an amount of BOG consumed in the GCU or the like can be reduced or removed. Furthermore, BOG can be treated by reliquefaction, without using separate refrigerants such as nitrogen.

Therefore, according to the liquefied gas treatment system in embodiments of the present invention, BOG generated from the cargo tank can be reliquefied without installing a reliquefaction apparatus consuming a large amount of energy and requiring excessive initial installation cost, ~~thereby saving~~ which may save energy consumed in the reliquefaction apparatus.

In addition, according to the liquefied gas treatment system in embodiments of the present invention, a part of compressed BOG after pressurizing BOG discharged from a cargo tank can be supplied to a high pressure gas injection engine (that is, a propulsion system) as fuel. The remaining compressed BOG can be cooled with cold energy of BOG after discharge from the cargo and before compression, and returned to the cargo tank.

In addition, in the liquefied gas treatment system according to embodiments of the present invention, since it is unnecessary to install the reliquefaction apparatuses using separate refrigerants (that is, nitrogen-refrigerant refrigeration cycle, mixed-refrigerant refrigeration cycle, or the like), facilities for supplying and storing the refrigerants need not be separately installed. Consequently, it is possible to save initial installation cost and operation cost for configuring the entire system.

In addition, according to the liquefied gas treatment system in embodiments of the present invention, when BOG cooled and liquefied in the heat exchanger after compression is decompressed by the expander, wasted energy can be reused because energy can be generated during expansion.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic configuration diagram illustrating a liquefied gas treatment system for a vessel according to a first embodiment of the present invention.

FIG. 2 is a schematic configuration diagram illustrating a liquefied gas treatment system for a vessel according to a second embodiment of the present invention.

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FIGS. 3 and 4 are schematic configuration diagrams illustrating liquefied gas treatment systems for a vessel according to modifications of the second embodiment of the present invention.

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FIG. 5 is a schematic configuration diagram illustrating a liquefied gas treatment system for a vessel according to a third embodiment of the present invention.

FIG. 6 is a schematic configuration diagram illustrating a liquefied gas treatment system for a vessel according to a fourth embodiment of the present invention.

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FIGS. 7 and 8 are schematic configuration diagrams illustrating liquefied gas treatment systems for a vessel according to modifications of the fourth embodiment of the present invention.

FIG. 9 is a schematic configuration diagram illustrating a liquefied gas treatment system for a vessel according to a fifth embodiment of the present invention.

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FIGS. 10 to 12 are schematic configuration diagrams illustrating liquefied gas treatment systems for a vessel according to modifications of the fifth embodiment of the present invention.

FIG. 13 is a schematic configuration diagram illustrating a liquefied gas treatment system for a vessel according to a sixth embodiment of the present invention.