LNG compressed by the high pressure pump into natural gas.

[6] For easy supply, seawater is mainly used as a heat source for gasification of LNG in the vaporizer. Low-temperature seawater having cold heat recovered from LNG through direct or indirect heat exchange with LNG is discharged back to the sea. That is, in the process of regasifying LNG, the cold heat of LNG recovered by the seawater is discarded to sea as is.

[7] LNG has a cold-heat energy of 200 kcal/kg. Thus, in the process of regasifying LNG, the cold heat of LNG recovered by the seawater is discarded from an LNG regasification vessel instead of being effectively used.

【Disclosure】

【Technical Problem】

[8] Embodiments of the present invention provide a liquefied-gas regasification system and method for vessels, which can improve energy efficiency by generating power through recovery of cold heat discarded in regasification of liquefied gas and enable stable operation through pressure regulation.

【Technical Solution】

Summary

[8a] In accordance with an aspect, the present disclosure refers to a liquefied-gas regasification method of a vessel, comprising: gasifying liquefied gas through heat exchange with a first heating medium in a vaporizer; and recovering cold heat from the first heating medium discharged from the vaporizer to recirculate the cold heat to the vaporizer, wherein recovering the cold heat from the first heating medium comprises: gasifying the first heating medium in a first heat exchanger, the first heating medium being condensed into a liquid phase through heat exchange in the

vaporizer; supplying the gasified first heating medium to an expander-generator to generate power through expansion of the gasified first heating medium; and supplying the expanded first heating medium to the vaporizer while controlling a pressure upstream or downstream of the expander-generator to control a pressure downstream of the vaporizer.

[8b] In accordance with an aspect, the present disclosure refers to a liquefied-gas regasification system of a vessel, comprising: a vaporizer gasifying liquefied gas through heat exchange with a first heating medium; a first heat exchanger gasifying the first heating medium condensed into a liquid phase by heat exchange in the vaporizer; an expander-generator expanding the first heating medium gasified in the first heat exchanger to generate power; and a pressure controller controlling a pressure upstream or downstream of the expander-generator, wherein a pressure downstream of the vaporizer is controlled by controlling the pressure upstream or downstream of the expander-generator.

[9] In accordance with one example, there is provided a liquefied-gas regasification method of a vessel, including: gasifying liquefied gas through heat exchange with a first heating medium in a vaporizer; and recovering cold heat from the first heating medium discharged from the vaporizer to recirculate the cold heat to the vaporizer, wherein recovering the cold heat from the first heating medium includes: gasifying the first heating medium in a first heat exchanger, the first heating medium being condensed into a liquid phase through heat exchange in the vaporizer; supplying the gasified first heating medium to an expander-generator to generate power through expansion of the gasified first heating medium, and supplying the expanded first heating medium to the vaporizer while controlling a pressure upstream or downstream of the expander-generator to control a pressure downstream of the vaporizer.

[10] In accordance with another example, there is

provided a liquefied-gas regasification system of a vessel, including: a vaporizer gasifying liquefied gas through heat exchange with a first heating medium; a first heat exchanger gasifying the first heating medium condensed into a liquid phase by heat exchange in the vaporizer; an expander-generator expanding the first heating medium gasified in the first heat exchanger to generate power; and a pressure controller controlling a pressure upstream or downstream of the expander-generator, wherein a pressure downstream of the vaporizer is controlled by controlling the pressure upstream or downstream of the expander-generator.

[11] In accordance with a further example, there is provided a liquefied-gas regasification method of a vessel, including: gasifying liquefied gas through heat exchange with a first heating medium in a vaporizer; and recovering cold heat from the first heating medium discharged from the vaporizer to recirculate the cold heat to the vaporizer, wherein recovering the cold heat from the first heating medium includes: gasifying the first heating medium in a first heat exchanger, the first heating medium being condensed into a liquid phase by heat exchange in the vaporizer; supplying the gasified first heating medium to an expander-generator to generate power through expansion of the gasified first heating medium; and supplying the expanded first heating medium to the vaporizer, wherein a receiver receives the first heating medium discharged from the vaporizer and the first heating medium discharged from the receiver is gasified in order to control a pressure downstream of the expander-generator, and wherein, when a pressure measurement value of the receiver is less than a preset value, a liquefied-gas regasification system is operated in a bypass mode in which the first heating medium expanded in the expander-generator and having a high temperature is supplied to the receiver after bypassing the vaporizer, and, when the pressure measurement value of the receiver is greater than a preset value, the liquefied-gas regasification system is operated in a quenching mode in which the first heating medium discharged from the vaporizer and having a low temperature is supplied into the receiver through a spray nozzle disposed at an upper end of the receiver.

[12] The first heating medium may undergo phase change through heat exchange in the vaporizer and the first heat exchanger.

[13] A flow rate of the liquefied gas supplied to the vaporizer may be regulated to maintain a preset temperature of the first heating medium having a low temperature and discharged from the vaporizer after heat exchange and a preset temperature of the regasified gas discharged from the vaporizer after heat exchange.

[14] The flow rate of the liquefied gas supplied to the vaporizer may be regulated based on a smaller value among an output value for maintaining a preset temperature of the first heating medium having a low temperature and discharged from the vaporizer after heat exchange and an output value for maintaining a preset temperature of the regasified gas discharged from the vaporizer after heat exchange.

[15] The preset temperature of the first heating medium may be a saturation temperature of the first heating medium and the pressure downstream of the expander-generator may be controlled by changing the preset temperature of the first heating medium depending upon a saturation pressure of the first heating medium.

[16] The regasified gas gasified in the vaporizer may be heated to a temperature required for a gas consumer through heat exchange with a second heating medium in a trim heater.

[17] When the pressure downstream of the expander-generator is less than a preset value or a power generation load is low, the first heating medium having a gas phase may be regulated to flow downstream of the expander-generator after bypassing the expander-generator.

[18] In accordance with still another example, there is provided a liquefied-gas regasification system of a vessel, including: a vaporizer gasifying liquefied gas through heat exchange with a first heating medium; a receiver receiving the first heating medium having a low temperature and discharged from the vaporizer after heat exchange; a first heat exchanger gasifying the first heating medium supplied from the receiver and having a liquid phase; an expander-generator expanding the first heating medium gasified in the first heat exchanger to generate power; a first heating medium line along which the first heating medium expanded by the expander-generator is delivered from the expander-generator to the vaporizer and the first heating medium recovering cold heat of the liquefied gas is delivered from the vaporizer to the receiver; a second valve disposed downstream of

[26] In accordance with still another example, there is provided a liquefied-gas regasification method of a vessel, including: gasifying liquefied gas through heat exchange with a first heating medium in a vaporizer; and recovering cold heat from the first heating medium discharged from the vaporizer to recirculate the cold heat to the vaporizer, wherein recovering the cold heat from the first heating medium includes: gasifying the first heating medium in a first heat exchanger, the first heating medium being condensed into a liquid phase by heat exchange in the vaporizer; supplying the gasified first heating medium to an expander-generator to generate power through expansion of the gasified first heating medium; and supplying the expanded first heating medium to the vaporizer, and wherein a knock-out drum receives the first heating medium gasified in the first heat exchanger before the gasified first heating medium is supplied to the expander-generator, and, when a pressure measurement value of the knock-out drum is greater than a preset value, a pressure upstream of the expander-generator is controlled by increasing an output of the expander-generator.

[27] Increasing the output of the expander-generator may increase an open degree of a second flow rate valve allowing the first heating medium to flow from the knock-out drum to the expander-generator and may be performed corresponding to the opening degree of the second flow rate valve.

[28] A rotational speed of the expander-generator may be controlled by a sixth controller and the opening degree of the second flow rate valve may be regulated by the sixth controller in response to a control signal sent from a fifth controller depending upon the pressure measurement value.

[29] When the opening degree of the second flow rate valve reaches a maximum degree or the output of the expander-generator reaches a maximum output, the fifth controller may open a third flow rate valve to allow the first heating medium to flow downstream of the expander-generator from the knock-out drum after bypassing the expander-generator.

[30] Increasing the output of the expander-generator may include opening the third flow rate valve to allow the first heating medium to flow downstream of the expander-generator from the knock-out drum after bypassing the expander-generator,

increasing the output of the expander-generator within an allowable output range of the expander-generator while decreasing the opening degree of the third flow rate valve, and increasing the opening degree of the second flow rate valve to allow the first heating medium to flow from the knock-out drum to the expander-generator.

[31] The rotational speed of the expander-generator may be controlled by a sixth controller and a seventh controller managing a variation of the third flow rate valve may send a signal to the sixth controller to increase the rotational speed of the expander-generator until the opening degree of the third flow rate valve reaches 0%.

[32] A circulation flow rate of the first heating medium may be determined based on a heating duty of the vaporizer.

[33] In accordance with still another example, there is provided a liquefied-gas regasification system of a vessel, including: a vaporizer gasifying liquefied gas through heat exchange with a first heating medium; a first heat exchanger gasifying the first heating medium condensed into a liquid phase by heat exchange in the vaporizer; an expander-generator expanding the first heating medium gasified in the first heat exchanger to generate power; a knock-out drum receiving the first heating medium gasified in the vaporizer; a second flow rate valve allowing the first heating medium discharged in a gas phase from the knock-out drum to be supplied to the expander-generator through regulation of an opening degree thereof; a third flow rate valve allowing the first heating medium discharged in a gas phase from the knock-out drum to bypass the expander-generator through regulation of an opening degree thereof; and a sixth controller controlling an output of the expander-generator depending upon a pressure of the knock-out drum and regulating the opening degree of the second flow rate valve depending upon the output of the expander-generator to control a pressure upstream of the expander-generator.

[34] The liquefied-gas regasification system may further include: a fifth controller sending a signal for increasing the output of the expander-generator to the sixth controller depending upon the pressure measurement value of the knock-out drum and opening the third flow rate valve when the output of the expander-generator reaches a maximum output.