removing, more power is required to compress and recondense the gas in the head to return to the rectification tower as a stationary reflux liquid.

In view of this situation, an objective of the present disclosure is to provide a BOG recondenser for recondensing BOG of LNG with high heat exchange efficiency while removing nitrogen in the BOG of LNG and without using a compressor, and an LNG storage system using the same.

In a first aspect, the present disclosure provides a BOG recondenser for recondensing boil-off gas (BOG) vaporised from LNG in an LNG buffer tank without using a compressor, characterized in that: a BOG draw-off pipe for drawing BOG from the LNG buffer tank, a first condenser for condensing at least some of the BOG delivered by the BOG draw-off pipe, a first gas supply section for supplying at least some of the gas in the first condenser from the first condenser to a second condenser, a first return pipe for returning at least some of the recondensed BOG in the first condenser from the first condenser to the LNG buffer tank, a second return pipe for returning the recondensed BOG in the second condenser from the second condenser to the LNG buffer tank, and a second exhaust pipe for expelling at least some of the gas in the second condenser from the second condenser, are provided; the first condenser has a first heat exchanger; the second condenser has a second heat exchanger; and at least some of the coolant exchanging heat with the BOG in the second condenser in the second heat exchanger is made to also exchange heat with the BOG in the first condenser in the first heat exchanger, characterized in that the second heat exchanger is a latent heat exchanger for exchanging heat between the latent heat of the coolant and the heat quantity of the BOG in the second condenser, and the first heat exchanger is a sensible heat exchanger for exchanging heat between the sensible heat of the coolant and the heat quantity of the BOG in the first condenser.

In a second aspect, the present disclosure provides a BOG storage system, provided with the BOG recondenser according to the first aspect, an LNG tank for storing LNG, an LNG tank BOG exhaust pipe for introducing BOG in the LNG tank to the LNG buffer tank, and an LNG buffer tank LNG exhaust pipe for delivering at least some of the liquid phase of the LNG in the LNG buffer tank into the LNG tank.

Disclosure1

The BOG recondenser according to an embodiment of the present disclosure is

- a BOG recondenser for recondensing boil-off gas (BOG) vaporised from LNG in an LNG buffer tank, characterized in that:

- a BOG draw-off pipe for drawing BOG from the LNG buffer tank,

- a first condenser for condensing at least some of the BOG delivered by the BOG draw-off pipe,
- a first gas supply section for supplying at least some of the gas in the first condenser from the first condenser to a second condenser,
- a first return pipe for returning at least some of the recondensed BOG in the first condenser from the first condenser to the LNG buffer tank,
- a second return pipe for returning the recondensed BOG in the second condenser from the second condenser to the LNG buffer tank, and
- a second exhaust pipe for expelling at least some of the gas in the second condenser from the second condenser, are provided;
- the first condenser has a first heat exchanger;
- the second condenser has a second heat exchanger; and
- at least some of the coolant exchanging heat with the BOG in the second condenser in the second heat exchanger is made to also exchange heat with the BOG in the first condenser in the first heat exchanger.

The BOG recondenser according to the present disclosure does not require the expensive rotating machine of a compressor and requires no troublesome compressor maintenance. The BOG recondenser according to the present disclosure can use the cold of the coolant effectively and obtain high heat exchange efficiency because the coolant used in the second heat exchanger isalso used in the first heat exchanger.

Claims

1. BOG recondenser for recondensing boil-off gas (BOG) vaporised from LNG in an LNG buffer tank without using a compressor, characterized in that:

- a BOG draw-off pipe for drawing BOG from the LNG buffer tank,
- a first condenser for condensing at least some of the BOG delivered by the BOG draw-off pipe,
- a first gas supply section for supplying at least some of the gas in the first condenser from the first condenser to a second condenser,
- a first return pipe for returning at least some of the recondensed BOG in the first condenser from the first condenser to the LNG buffer tank,
- a second return pipe for returning the recondensed BOG in the second condenser from the second condenser to the LNG buffer tank, and
- a second exhaust pipe for expelling at least some of the gas in the second condenser from the second condenser,

are provided;

the first condenser has a first heat exchanger;

the second condenser has a second heat exchanger; and

at least some of the coolant exchanging heat with the BOG in the second condenser in the second heat exchanger is made to also exchange heat with the BOG in the first condenser in the first heat exchanger,

characterized in that the second heat exchanger is a latent heat exchanger for exchanging heat between the latent heat of the coolant and the heat quantity of the BOG in the second condenser, and

the first heat exchanger is a sensible heat exchanger for exchanging heat between the sensible heat of the coolant and the heat quantity of the BOG in the first condenser.

~~2. BOG recondenser according to Claim 1, characterized in that the second heat exchanger is a latent heat exchanger for exchanging heat between the latent heat of the coolant and the heat quantity of the BOG in the second condenser, and~~

~~the first heat exchanger is a sensible heat exchanger for exchanging heat between the sensible heat of the coolant and the heat quantity of the BOG in the first condenser.~~

~~3.~~2. BOG recondenser according to Claim 1 or Claim 2, characterized in that an opposite end of the BOG draw-off pipe from the first condenser is disposed lower than the first heat exchanger;

an opposite end of the first return pipe from the first condenser is disposed lower than the opposite end of the BOG draw-off pipe from the first condenser;

~~the~~ an opposite end of the first gas supply section from the first condenser is disposed higher than the first heat exchanger;

~~the~~ an opposite end of the first gas supply section from the second condenser is disposed lower than the second heat exchanger; and

~~the~~ an opposite end of the second return pipe from the second condenser is disposed lower than the opposite end of the first gas supply section from the second condenser.

~~4.~~3. BOG recondenser according to any one of Claims 1 to ~~3~~2, characterized in that the second condenser is provided with ~~a~~ the second exhaust pipe for drawing gas in the second condenser, and an exhaust pressure control valve for exercising control such that the pressure in the second exhaust pipe is a predetermined value or lower; and the second exhaust pipe is disposed higher than the second heat exchanger.

~~5.~~4. BOG recondenser according to Claim 1 ~~or Claim 2~~, characterized in that the second heat exchanger is provided with:

- a second coolant delivery channel for drawing the coolant from the second heat exchanger,
- a coolant buffer tank for collecting a coolant delivered via the second coolant delivery channel,
- a second coolant return channel for returning at least some of the liquid phase of the coolant in the coolant buffer tank to the second heat exchanger,
- and a second coolant flow rate control valve for controlling the circulation amount of the coolant.

~~6.~~5. BOG recondenser according to ~~any one of~~ Claim~~s 1 to 3~~4, characterized in that a first coolant return channel for drawing at least some of the gas phase of the coolant in the coolant buffer tank to the first heat exchanger, is also provided.

~~7.~~6. BOG recondenser according to any one of Claims 1-~~4~~3, characterized in that the coolant is liquid nitrogen and/or liquid air.

~~8.~~7. LNG storage system, provided with the BOG recondenser according to any one of ~~Inventions~~ Claims 1 to ~~7~~6, an LNG tank for storing LNG,an LNG tank BOG exhaust pipe for introducing BOG in the LNG tank to the LNG buffer tank, and an LNG buffer tank LNG exhaust pipe for delivering at least some of the liquid phase of the LNG in the LNG buffer tank into the LNG tank.