CLAIMS

1. A superconducting current limiter, comprising:

a superconducting current limiting element;

a refrigerant tank storing a first refrigerant for cooling the superconducting current limiting element;

a condenser disposed in a gas phase portion of the refrigerant tank or a space communicating with the gas phase portion; and

a liquid return channel for returning a condensate liquid liquefied by the condenser to a liquid phase portion of the refrigerant tank,

wherein the condenser includes a heat exchanger disposed on a branch passage which branches from a circulation passage of a second refrigerant for cooling a superconducting cable on an upstream side of the superconducting cable to bypass the superconducting cable, the heat exchanger being configured to exchange heat between the first refrigerant in the space and the second refrigerant flowing in the branch passage so as to condense the first refrigerant.

2. The superconducting current limiter according to claim 1,

wherein the condenser is disposed above the refrigerant tank, and

wherein the liquid return channel is configured to drop the condensate liquid in the liquid phase portion of the refrigerant tank.

3. The superconducting current limiter according to claim 2,

wherein the condenser includes:

a housing disposed above the refrigerant tank; and

a communicating tube causing the housing and the refrigerant tank to communicate with each other, and

wherein the condenser is configured such that a lower end of the communicating tube protrudes downward relative to a ceiling surface of the refrigerant tank.

4. A cooling system for a superconducting current limiter, comprising:

a condenser disposed in a gas phase portion of a refrigerant tank or a space communicating

with the gas phase portion, the refrigerant tank storing a first refrigerant for cooling a superconducting current limiting element; and

a liquid return channel for returning a condensate liquid liquefied by the condenser to a liquid phase portion of the refrigerant tank,

wherein the condenser includes:

a heat exchanger for exchanging heat between the first refrigerant and the second refrigerant; and

a flow regulating valve for controlling a flow rate of the second refrigerant supplied to the heat exchanger.

5. The cooling system for the superconducting current limiter according to claim 4, comprising:

a pressure sensor for detecting a pressure of the gas phase portion or the space communicating with the gas phase portion; and

a control part for controlling an opening degree of the flow regulating valve based on a detected value of the pressure sensor.

6. The cooling system for the superconducting current limiter according to claim 5,

wherein the control part is configured to control a temperature of the first refrigerant to a temperature close to a transition temperature of the superconducting current limiter.

7. A superconducting current limiter, comprising:

a superconducting current limiting element;

a refrigerant tank storing a first refrigerant for cooling the superconducting current limiting element; and

the cooling system for the superconducting current limiter according to any one of claims 4 to 6.

8. A control method for a cooling system for a superconducting current limiter, the cooling system including:

a condenser disposed in a gas phase portion of a refrigerant tank or a space communicating

with the gas phase portion, the refrigerant tank storing a first refrigerant for cooling a superconducting current limiting element; and

a liquid return channel for returning a condensate liquid liquefied by the condenser to a liquid phase portion of the refrigerant tank,

the control method comprising:

a pressure detection step of detecting a pressure value in the gas phase portion of the refrigerant tank or the space communicating with the gas phase portion; and

a flow rate control step of controlling a flow rate of the second refrigerant flowing into the condenser, in accordance with the pressure value.

9. The control method for the cooling system for the superconducting current limiter according to claim 8,

wherein the refrigerant tank is configured to internally maintain the first refrigerant in a saturated condition, and

wherein the flow rate control step includes controlling the flow rate of the second refrigerant flowing into the condenser, such that the first refrigerant in the refrigerant tank has a target pressure Pg uniquely corresponding to a cooling target temperature Tg.