

COMPRESSION CHILLER

SPECIFICATION

Detailed Description of the Invention

Technical Field of the Invention

The present invention relates to an improved compression chiller, and particularly relates to a compression chiller which can stably and effectively take advantage of the waste heat energy.

Prior Art

As this type of compression chiller, a compression chiller as shown in Fig. 3 is already known, for example. This conventional chiller has a compressor 1, a condenser 3 and an evaporator 4 disposed in a circle via coolant pipes 5 in the cooler cycle system and the coolant which has passed the compressor 1 is directly sent to the condenser 3.

Problems to be solved by the Invention

In a conventional chiller as described above, however, the coolant which has passed the compressor 1 is directly sent to the condenser 3 and is susceptible to change in the cooling load. This causes the supply of the waste heat energy to be unstable. Besides, stable and effective



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utilization of the waste heat energy is desired recently from the viewpoint of shortage in the energy resources.

The present invention has been made considering such conventional problems and desire. It
5 is an object of the present invention to provide a compression chiller which achieves stable and effective utilization of the waste heat energy by adding a heat exchanger between the compressor and the condenser and by exchanging the heat at the heat storage tank or, in other words, once storing unstable waste heat energy in the heat storage tank.

10 Means for Solving the Problems

In accordance with the present invention, there is provided a compression chiller comprising at least:

- a compressor;
- 15 a condenser;
- a heat exchanger disposed in series between said compressor and said condenser,
- a three-way valve provided intermediate the compressor and the condenser, and the heat exchanger and the condenser, wherein the valve is arranged such that when coolant temperature detected by a temperature sensor on or after the compressor outlet is lower than
20 the temperature of heat storage water detected by a temperature sensor in the heat storage tank, the three-way valve is switched to prevent the coolant from flowing to the heat exchanger so that the coolant flows directly from the compressor to the condenser.

Further, when the temperature sensor between the switching valve and the condenser detects that the coolant temperature reaches a certain temperature, such detection is preferably used for control of the air blow from the fan on the condenser so that the blow is turned on and off or is adjusted to be stronger or weaker.

A compression chiller according to the present invention with the configuration as described above can take out the waste heat energy from the high temperature coolant after passing the compressor and effectively store the heat at the heat exchanger (specifically in the heat storage tank) by disposing a heat exchanger in series between the compressor and the condenser.

In addition, the above heat exchanger can once store unstable waste heat energy in the heat storage tank by exchanging the heat at the heat storage tank for storing the waste heat energy.

Further, when the temperature of the coolant detected by the temperature sensor on or after the compressor outlet is lower than the temperature of the heat storage water detected by the temperature sensor in the heat storage tank, the three-way valve or other switching valve is switched to prevent the coolant from flowing to the heat

exchanger on the heat storage tank side. With such control to have the coolant flow directly from the compressor to the condenser, the temperature of the water once kept for heat storage can be maintained.

Further, when the temperature sensor between the switching valve and the condenser detects that the coolant reaches a certain temperature, this can be utilized for controlling turning on/off or strength of the air blow of the fan on the condenser. Thus, the air blow power of the condenser can be reduced.

In particular, when the heat exchanger for the heat storage tank can be deemed as a condenser in the stage where the coolant is heated, the above control of the fan on the condenser can help saving the energy.

Embodiment

Referring to the attached figures, preferred embodiments of a compression chiller according to the present invention will be described below. Fig. 1 is an explanative view to show the cooler cycle system of a chiller according to the present invention. In the figure, a compressor 1, a heat exchanger 2, a condenser 3 and an evaporator 4 are disposed via coolant tubes 5.

Disposed in series between the compressor 1 and the condenser 3 is the heat exchanger 2. The heat exchanger 2 is provided with a heat storage tank 2a to store unstable waste heat energy and with piping arranged so that it can store the waste heat energy from the high temperature coolant which has passed the compressor 1.

In the figure, reference numeral 6 indicates a three-way valve (Switching valve). It switches the coolant flow corresponding to the preset temperature so as to prevent the coolant from flowing to the heat exchanger 2 on the side of the heat storage tank 2a. It controls the coolant so that it flows directly from the compressor 1 to the condenser 3.

More specifically, as shown in Fig. 2, when the temperature of the coolant detected by a temperature sensor 9 on or after the outlet of the compressor 1 is lower than the temperature of the heat storage water detected by the temperature sensor 7 in the heat storage tank 2a, the three-way valve 6 is automatically switched so that the coolant does not flow to the heat exchanger 2 on the side of the heat storage tank 2a.

A temperature sensor 10 between the three-way valve 6 and the condenser 3 is utilized to forcibly turn on or off of a fan 3a of the condenser 3 when the coolant temperature reaches a certain temperature or to gradually or relatively increase or decrease the air blow corresponding to the temperature.

The chiller of the present invention configured as above has the heat exchanger 2 between the compressor 1 and the condenser 3 and can once store the waste heat energy in the heat storage tank 2a so as to stabilize the fluctuating waste heat energy. It can stably take out the hot water from the heat storage tank 2a, which can be utilized for supply of the hot water and air conditioning. Thus, the waste heat energy can be effectively utilized. Note that numeral 4a in the figures indicates a fan of the evaporator 4, 8 indicates a temperature sensor and 11 indicates an expansion valve in the figure.

The chiller according to the present invention is not limited to the above embodiment. It can be freely modified in design in the scope of objects of the present invention and the present invention comprises all such modifications.

Effect of the Invention

The present invention has the configuration as described above and, with a heat exchanger connected in series between the compressor and the condenser, the waste heat energy can be obtained from the coolant at a high temperature after passing through the compressor and can be stored at the heat exchanger. Thus, it has an effect that it can stabilize the fluctuating waste heat energy.

The above heat exchanger can once store unstable waste heat energy to the heat storage tank by heat exchange at the heat storage tank for storing the waste heat energy and can take out the hot water from the heat storage tank stably. Thus, the waste heat energy can be effectively utilized for various applications such as supply of the hot water and air conditioning.

Further, when the temperature of the coolant detected by the temperature sensor on or after the outlet of compressor is lower than the temperature of the heat storage water detected by the temperature sensor in the heat storage tank, the three-way valve or other switching valve is switched to prevent the coolant from flowing to the heat exchanger on the heat storage tank side so as to control the coolant to flow directly from the compressor to the condenser. Thus, the temperature of the water once kept for heat storage can be maintained.

Further, when the temperature sensor between the switching valve and the condenser detects that the coolant reaches a certain temperature, the air blow of the fan on the condenser can be turned on and off and can be controlled to be stronger or weaker. Thus, the air blow power of the condenser can be reduced. In particular, when the heat exchanger for the heat storage tank can be deemed as a condenser in the stage where the coolant is heated, the above control can help saving the energy.

Thus, the present invention adds a heat exchanger between the compressor and a condenser and conducts heat exchange at the heat storage tank (in other words, stores unstable waste heat energy) so that it can stably and effectively utilize the waste heat energy. It can be also applied to compression chillers such as the heat pump chiller and the heat pump air conditioner, for example. Implementation of the present invention has quite a large practical meaning.

Brief Description of the Drawings

Fig. 1 is a schematic explanatory view to show a compression chiller according to the present invention;

Fig. 2 is a schematic explanatory view to show an example of the coolant temperature in the cooler cycle of the compression chiller.

Fig. 3 is a schematic explanatory view to show a conventional compression chiller.

Explanation for Marks

- 1 Compressor
- 2 Heat Exchanger
- 2a Heat Storage Tank
- 3 Condenser
- 3a Fun
- 4 Evaporator
- 4a Fun
- 5 Coolant Tubes
- 6 Three-way Valve

15 April 2002

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- 7 Temperature Sensor
- 8 Temperature Sensor
- 9 Temperature Sensor
- 10 Temperature Sensor
- 11 Expansion Valve

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CLAIMS

1. A compression chiller comprising at least:
a compressor;
5 a condenser;
a heat exchanger disposed in series between said compressor and said condenser,
a three-way valve provided intermediate the compressor and the condenser, and the
heat exchanger and the condenser, wherein the valve is arranged such that when coolant
temperature detected by a temperature sensor on or after the compressor outlet is lower than
10 the temperature of heat storage water detected by a temperature sensor in the heat storage
tank, the three-way valve is switched to prevent the coolant from flowing to the heat
exchanger so that the coolant flows directly from the compressor to the condenser.

2. A compression chiller according to claim 1 wherein the temperature sensor between
15 the valve and the condenser is, when the coolant temperature reaches a certain temperature,
utilized for turning on/off or for strength control of the air blow function of a fan on the
condenser.