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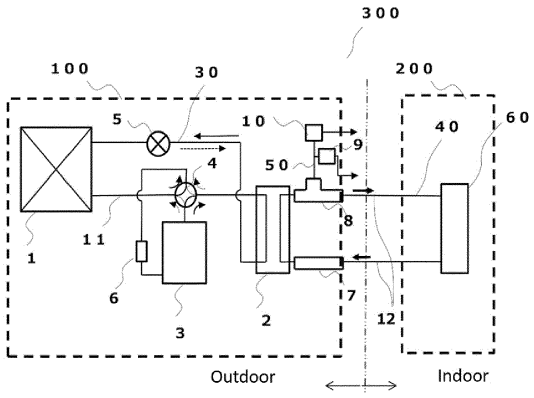
(54) HEAT MEDIUM CIRCULATION DEVICE

(57) [Object] The present invention provides a heat medium circulation device including a pressure relief valve and an air vent valve placed in a pipe of a water circuit in an outdoor unit, the pipe of the water circuit can be shortened, the outdoor unit can be downsized, and maintenance of the heat medium circulation device is easy.

[Solving Means] The heat medium circulation device 300 includes: a refrigerant circuit 30 formed by annularly connecting, to one another, a compressor 3, a heat source-side heat exchanger 1, an expansion device 5 and a use-side heat exchanger 2; and a heat medium circuit 40 through which heat medium cooled or heated in the use-side heat exchanger 2 by refrigerant discharged from the compressor 3 is circulated. The heat medium circuit 40 includes a pressure relief valve 9 which discharges the heat medium in the heat medium circuit 40 and an air vent valve 10 which discharges air in the heat medium circuit 40, and the pressure relief valve 9 and the air vent valve 10 are located downstream of the use-side heat exchanger 2. The pressure relief valve 9 and the air vent valve 10 are connected to a branch pipe 50 which branches off from the heat medium circuit 40 at the downstream of the use-side heat exchanger 2.

[Fig. 1]



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Description

[TECHNICAL FIELD]

[0001] The present invention relates to a heat medium circulation device.

[BACKGROUND TECHNIQUE]

[0002] Patent document 1 discloses a heat medium circulation device having an outdoor unit and an indoor unit in which a pressure relief valve and an air vent valve are provided in a pipe of a water circuit in the outdoor unit.

[PRIOR ART DOCUMENT]

[PATENT DOCUMENT]

[0003] [Patent Document 1] Japanese Patent Application Laid-open No. 2013-167398

[SUMMARY OF THE INVENTION]

[PROBLEM TO BE SOLVED BY THE INVENTION]

[0004] The present invention provides a heat medium circulation device having a pressure relief valve and an air vent valve in a pipe of a heat medium circuit, in which the pipe of the heat medium circuit can be shortened and downsize, and maintenance of the heat medium circulation device is easy.

[MEANS FOR SOLVING THE PROBLEM]

[0005] A heat medium circulation device of the present invention includes: a refrigerant circuit formed by annularly connecting, to one another, a compressor, a heat source-side heat exchanger, an expansion device and a use-side heat exchanger; and a heat medium circuit through which heat medium cooled or heated in the use-side heat exchanger by refrigerant discharged from the compressor is circulated. The heat medium circuit includes a pressure relief valve which discharges the heat medium in the heat medium circuit and an air vent valve which discharges air in the heat medium circuit, and the pressure relief valve and the air vent valve are located downstream of the use-side heat exchanger. The pressure relief valve and the air vent valve are connected to a branch pipe which branches off from the heat medium circuit at the downstream of the use-side heat exchanger.

[EFFECT OF THE INVENTION]

[0006] In the heat medium circulation device of the present invention, a pressure relief valve and an air vent valve are placed in a branch pipe which branched from a heat medium circuit located downstream of a use-side heat exchanger. According to this, the pipe of the heat medium circuit is shortened, and the device can be downsized.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0007]

Fig. 1 is a schematic block diagram of a heat medium circulation device in an embodiment of the present invention; and
Fig. 2 is a detailed diagram of an essential portion of the heat medium circulation device of the embodiment.

[MODE FOR CARRYING OUT THE INVENTION]

[0008] An embodiment will be described in detail below with reference to the drawings. However, description which is detail more than necessary will be omitted in some cases. For example, detailed description of already well known matters, or redundant description of substantially the same configuration will be omitted in some cases. This is for preventing the following description from becoming redundant more than necessary, and for making it easy for a person skilled in the art to understand the present disclosure.

[0009] The accompanying drawing and the following description are provided so that a person skilled in the art can sufficiently understand the present disclosure, and it is not intended that they limit the subject matter described in claims.

[0010] The embodiment of the present invention will be described below using Figs. 1 and 2.

[1-1. Configuration]

[0011] As shown in Fig. 1, a heat medium circulation device 300 of the embodiment includes an outdoor unit 100 and an indoor unit 200. The outdoor unit 100 is placed outdoors and the indoor unit 200 is placed indoors.

[0012] A refrigerant circuit 30 is formed by connecting an air heat exchanger 1 (also called heat source-side heat exchanger), a water heat exchanger 2 (also called use-side heat exchanger), a compressor 3, a four-way valve 4, an expansion device 5 and a receiver 6 to one another through a refrigerant pipe 11.

[0013] A water circuit 40 is formed by connecting the water heat exchanger 2, an inlet joint 7, an outlet joint 8, a pressure relief valve 9 and an air vent valve 10 to one another through a water pipe 12. The water pipe 12 of the embodiment corresponds to a heat medium pipe, and the water circuit 40 of the embodiment corresponds to a heat medium circuit.

[0014] The refrigerant may be R32, mixture refrigerant including 70 % or more by weight including R32, propane or mixture combustible refrigerant (combustible refrigerant) including propane.

[0015] The compressor 3 compresses sucked refrig-

erant, and discharges the same. The four-way valve 4 switches between a suction side and a discharge side of the compressor 3. With this operation, circulation directions of refrigerant at the time of the heating operation and at the time of the cooling operation are switched.

[0016] The water heat exchanger 2 (also called use-side heat exchanger) exchanges heat between refrigerant flowing through the refrigerant circuit 30 and water flowing through the water circuit 40. The expansion device 5 is located between the air heat exchanger 1 and the water heat exchanger 2, and adjusts pressure and a flow rate of refrigerant.

[0017] The receiver 6 is provided upstream of the compressor 3, and stores redundant refrigerant therein. The inlet joint 7 of the water heat exchanger 2 introduces, to an inlet of the water heat exchanger 2, water supplied from the indoor unit 200.

[0018] The outlet joint 8 of the water heat exchanger 2 includes a flow path through which water passing through the water heat exchanger 2 is returned to the indoor unit 200, and a flow path connected to the pressure relief valve 9 and the air vent valve 10. The pressure relief valve 9 discharges water of the water circuit 40 to outside, thereby adjusting water pressure of the water circuit 40. The air vent valve 10 discharges gas which flows into the water circuit 40 to outside of a room.

[0019] In the embodiment, since the water heat exchanger 2 is incorporated in the outdoor unit 100, refrigerant does not flow into the room unless the refrigerant leaks from the water heat exchanger 2. Also when the refrigerant leaks into the water circuit 40 due to freezing damage or the like of the water heat exchanger 2, the refrigerant can be discharged from the air vent valve 10, and it is possible to prevent the refrigerant from flowing into the indoor unit 200.

[0020] The pressure relief valve 9 and the air vent valve 10 will be described in detail with reference to Figs. 1 and 2.

[0021] In the embodiment, the pressure relief valve 9 and the air vent valve 10 are placed in the outdoor unit 100.

[0022] The pressure relief valve 9 and the air vent valve 10 are connected to a branch pipe 50. The branch pipe 50 branches off from the water circuit 40 at a location downstream of the water heat exchanger 2.

[0023] The outlet joint 8 is connected to one end of the branch pipe 50, and the air vent valve 10 is connected to the other end (downstream side) of the branch pipe 50. The pressure relief valve 9 is connected between the outlet joint 8 and the air vent valve 10. Water is discharged from the pressure relief valve 9 downwardly.

[0024] The air vent valve 10 is placed upward (downstream side) from the pressure relief valve 9.

[0025] A height difference may be provided between an inlet and an outlet of water of the outlet joint 8. More specifically, the outlet may be provided at a location higher than the inlet.

[1-2. Action]

[0026] Action and effect of the heat medium circulation device 300 of the embodiment having the above-described configuration will be described below.

[0027] The outdoor unit 100 carries out the heating operation and the cooling operation. In the heating operation, water flowing through the water circuit 40 is heated by the water heat exchanger 2. In the cooling operation, the flowing direction of the refrigerant is opposite from that at the time of the heating operation. In the heating operation, water heated in the water heat exchanger 2 is circulated through the water circuit 40, and is supplied to a use-side terminal 60 located in the room. In the cooling operation, water cooled in the water heat exchanger 2 is circulated through the water circuit 40, and is supplied to the heat exchanger use-side terminal 60 in the room.

[0028] In Fig. 1, a solid arrow of the refrigerant circuit 30 represents a circulating direction of the refrigerant at the time of the heating operation, and a broken arrow of the refrigerant circuit 30 represents the circulating direction of the refrigerant at the time of the cooling operation. Arrows of the water circuit 40 represents a flowing direction of water which circulates through the water circuit 40.

[0029] Action and effect of the heat medium circulation device 300 at the time of the heating operation will be described below.

[0030] The refrigerant which flows into the compressor 3 is compressed and becomes high temperature and high pressure gas, and flows into the water heat exchanger 2 through the four-way valve 4. The refrigerant which flows into the water heat exchanger 2 exchanges heat with water which flows into the water heat exchanger 2 from the indoor unit 200 through the inlet joint 7, and the refrigerant is condensed. Thereafter, the refrigerant is decompressed by the expansion device 5, exchanges heat with air in the air heat exchanger 1, and is evaporated. Further, the refrigerant is circulated into the compressor 3 through the four-way valve 4 and the receiver 6.

[0031] On the other hand, water which flows into the water heat exchanger 2 exchanges heat with refrigerant which flows into the water heat exchanger 2 as described above, and the water is heated and is supplied to the use-side terminal 60 of the indoor unit 200 through the outlet joint 8. When the water pressure of the water circuit 40 is increased, the water is discharged to outside of the room from the pressure relief valve 9. If gas is generated due to influence of heated water during operation, the gas can be discharged from the air vent valve 10.

[0032] At the time of the cooling operation, the refrigerant which flows into the compressor 3 is compressed and becomes high temperature and high pressure gas, and the refrigerant exchanges heat with air in the air heat exchanger 1 and is condensed through the four-way valve 4. Thereafter, the refrigerant is decompressed in the expansion device 5, and flows into the water heat exchanger 2. The refrigerant which flows into the water heat exchanger 2 exchanges heat with water which flows

into the water heat exchanger 2 from the indoor unit 200 through the inlet joint 7, and the refrigerant is evaporated. The refrigerant is circulated into the compressor 3 through the four-way valve 4 and the receiver 6.

[1-3. Effect and the like]

[0033] As described above, the heat medium circulation device 300 of the embodiment includes the outdoor unit 100 placed outdoors and the indoor unit 200 placed indoors. In the outdoor unit 100, the air heat exchanger 1, the water heat exchanger 2, the compressor 3, the four-way valve 4, the expansion device 5 and the receiver 6 are connected to one another through the refrigerant pipe 11, and the refrigerant circuit 30 is formed. The water heat exchanger 2, the inlet joint 7, the outlet joint 8, the pressure relief valve 9 and the air vent valve 10 are connected to one another through the water pipe 12, and the water circuit 40 is formed.

[0034] In this embodiment, since the water heat exchanger 2 is incorporated in the outdoor unit 100, the refrigerant does not flows into the room unless the refrigerant leaks from the water heat exchanger 2. Also when the refrigerant leaks into the water circuit 40 due to freezing damage or the like of the water heat exchanger 2, the refrigerant can be discharged from the air vent valve 10, and it is possible to prevent the refrigerant from flowing into the indoor unit 200.

[0035] The outdoor unit 100 is provided therein with the outlet joint 8 having flow path which is connected to the pressure relief valve 9 and the air vent valve 10. The pressure relief valve 9 adjusts water pressure of the water circuit 40. The air vent valve 10 discharges gas generated in the water circuit 40 to outside of the room. According to this, the pipe of the water circuit 40 of the outdoor unit 100 can be shortened, and the outdoor unit 100 can be downsized.

[0036] The pressure relief valve 9 and the air vent valve 10 are placed in the outdoor unit 100. As compared with a case where the pressure relief valve 9 and the air vent valve 10 are provided in the water circuit 40 located outside of the outdoor unit 100, it is possible to alleviate labor of maintenance.

[0037] The pressure relief valve 9 and the air vent valve 10 are connected to the branch pipe 50 which branches off from the water circuit 40 at location downstream of the water heat exchanger 2. According to this, the pipe of the water circuit 40 of the outdoor unit 100 can be shortened, and the outdoor unit 100 can be downsized.

[0038] The outlet joint 8 is connected to one end of the branch pipe 50, and the air vent valve 10 is connected to the other end of the branch pipe 50. The pressure relief valve 9 is connected between the outlet joint 8 and the air vent valve 10. The pressure relief valve 9 is configured such that water is discharged downwardly. According to this, water can be discharged to outside of the room without splashing the water.

[0039] The air vent valve 10 is placed at a location higher than the pressure relief valve 9. According to this, water can easily be discharged. Further, it is possible to reduce a possibility that the air vent valve 10 becomes clogged due to influence of material which is included in water discharged from the air vent valve 10.

[0040] A height difference may be provided between an inlet and an outlet of water of the outlet joint 8. More specifically, the outlet may be provided at a location higher than the inlet. According to this, gas discharged from the water heat exchanger 2 easily flows into the air vent valve 10, and separating efficiency between gas and liquid can be enhanced.

[0041] As described above, the branch pipe 50 is connected to the outlet joint 8 which connects the water heat exchanger 2 and the water circuit 40 to each other. According to this, the pipe of the water circuit 40 of the outdoor unit 100 can be shortened, and the outdoor unit 100 can be downsized.

[0042] Although the water heat exchanger 2 is provided in the outdoor unit 100 in the embodiment, the configuration is not limited to this. The water heat exchanger 2 may be provided in a space outside of the outdoor unit 100 existing outdoors. In this case, spaces for placing the outdoor unit 100 and the water heat exchanger 2 are required, but when installation space of the outdoor unit 100 is limited, the water heat exchanger 2 can be placed in the outdoor unit 100.

[0043] The present embodiment has been described as an example of the technique disclosed in the present application. However, the technique of the invention is not limited to another embodiment which is changed, displaced, added or omitted. Further, the constituent elements described in the embodiment may be combined to form a new embodiment.

[INDUSTRIAL APPLICABILITY]

[0044] According to the heat medium circulation device of the present invention, since the heat medium circuit can be shortened, the heat medium circulation device can be applied to a device which exchanges heat between refrigerant and heat medium.

[EXPLANATION OF SYMBOLS]

[0045]

1	air heat exchanger (heat source-side heat exchanger)
2	water heat exchanger (use-side heat exchanger)
3	compressor
4	four-way valve
5	expansion device
6	receiver
7	inlet joint
8	outlet joint
9	pressure relief valve
10	air vent valve

11 refrigerant pipe
12 water pipe (heat medium pipe)
30 refrigerant circuit
40 water circuit (heat medium circuit)
50 branch pipe
60 use-side terminal
100 outdoor unit
200 indoor unit
300 heat medium circulation device

Claims

1. A heat medium circulation device (300) comprising:

a refrigerant circuit (30) formed by annularly connecting, to one another, a compressor (3), a heat source-side heat exchanger (1), an expansion device (5) and a use-side heat exchanger (2); and
a heat medium circuit (40) through which heat medium cooled or heated in the use-side heat exchanger (2) by refrigerant discharged from the compressor (3) is circulated; wherein
the heat medium circuit (40) includes a pressure relief valve (9) which discharges the heat medium in the heat medium circuit (40) and an air vent valve (10) which discharges air in the heat medium circuit (40), the pressure relief valve (9) and the air vent valve (10) are located downstream of the use-side heat exchanger (2), and the pressure relief valve (9) and the air vent valve (10) are connected to a branch pipe which branches off from the heat medium circuit (40) at the downstream of the use-side heat exchanger (2).

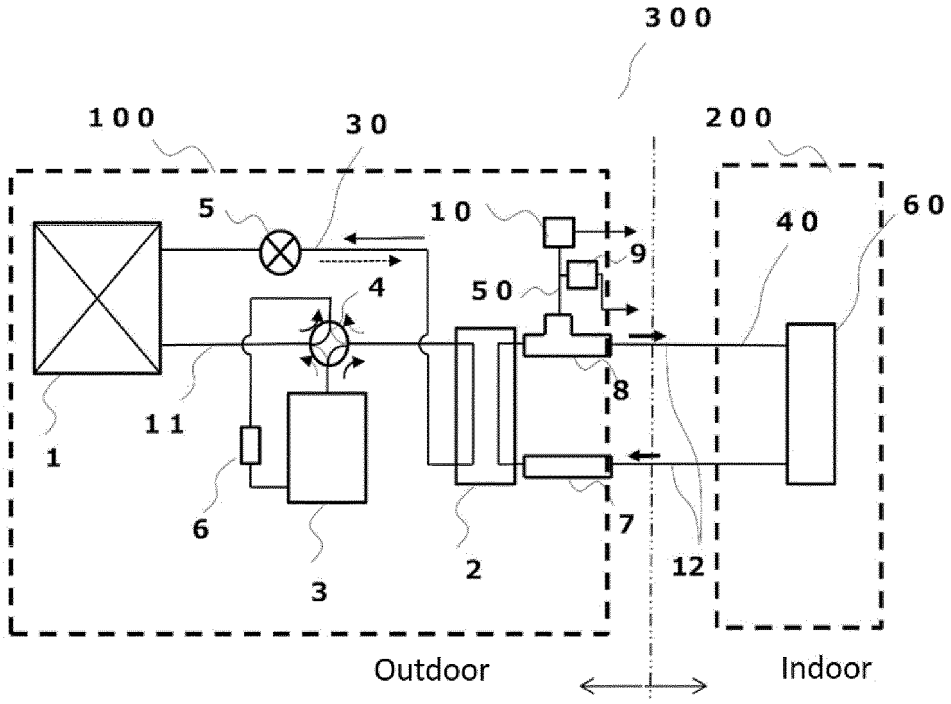
2. The heat medium circulation device (300) according to claim 1, wherein the branch pipe (50) is connected to a joint (8) which connects the use-side heat exchanger (2) and the heat medium circuit (40) to each other.

3. The heat medium circulation device (300) according to claim 2, wherein the joint (8) includes an inlet and an outlet of the heat medium, and the outlet is placed at a location higher than the inlet.

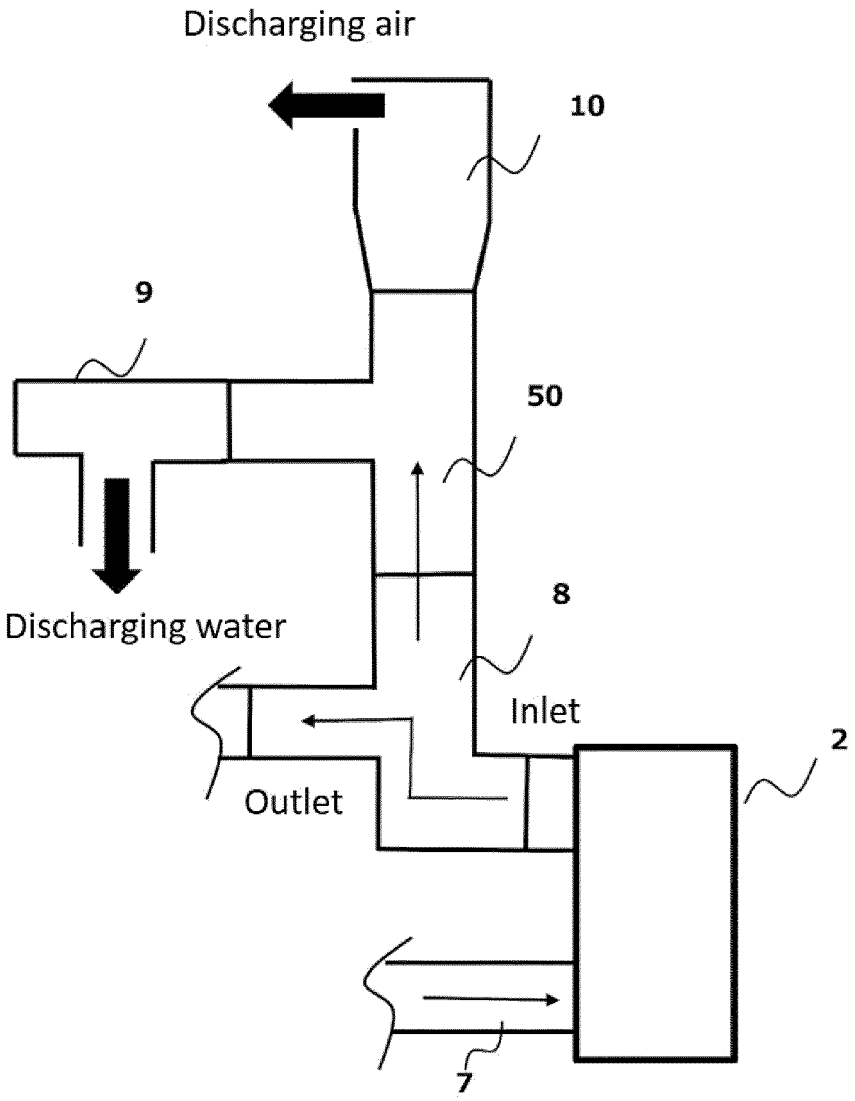
4. The heat medium circulation device (300) according to any one of claims 1 to 3, wherein the pressure relief valve (9) discharges the heat medium in the heat medium circuit (40) downwardly.

5. The heat medium circulation device (300) according to any one of claims 1 to 4, wherein the air vent valve (10) is placed at a location higher than the pressure relief valve (9).

[Fig. 1]



[Fig. 2]



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EUROPEAN SEARCH REPORT

Application Number
EP 22 16 8291

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 933 580 A1 (PANASONIC IP MAN CO LTD [JP]) 21 October 2015 (2015-10-21) * paragraphs [0008], [0044]; claim 1; figure 1 *	1-5	INV. F24H4/02 F24H9/13 F24H9/14 F24H9/20
X	WO 2018/047265 A1 (MITSUBISHI ELECTRIC CORP [JP]) 15 March 2018 (2018-03-15)	1	F24D3/18 F24D19/10
A	* paragraphs [0032], [0033]; claim 1; figures 1,5 *	2-5	F24F5/00
X	JP 2013 167395 A (MITSUBISHI ELECTRIC CORP) 29 August 2013 (2013-08-29)	1-3	
A	* paragraph [0026]; figure 1 *	4,5	

TECHNICAL FIELDS SEARCHED (IPC)

F24H
F24D
F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 August 2022	Degen, Marcello

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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