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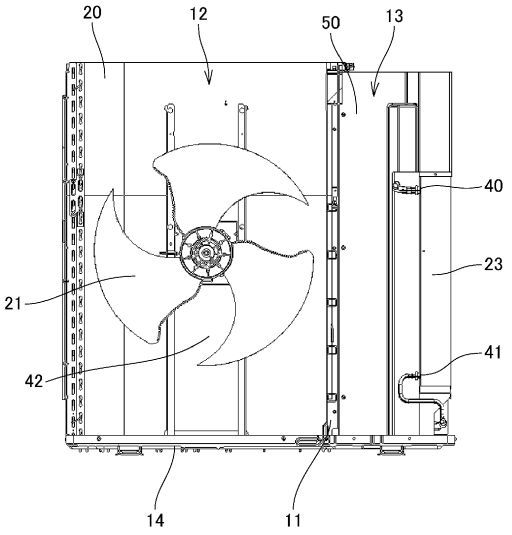
(54) OUTDOOR UNIT AND HEAT PUMP CYCLE DEVICE

(57) The present disclosure provides an outdoor unit that uses a refrigerant, and is capable of improving safety while avoiding electric leakage. The outdoor unit includes: a compressor 22, a use side heat exchanger 23, expansion means 24, and a heat source side heat exchanger 20 stored inside a housing 10; a refrigerant circuit connecting these members annularly and using a flammable refrigerant; a blower device 21 for circulating air through the heat source side heat exchanger 20; and an electrical equipment box 30, wherein the outdoor unit has a cover member 50 covering from an end portion of the heat source side heat exchanger 20 to a portion between a water circuit and the refrigerant circuit of the use side heat exchanger 23.

FIG.2



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an outdoor unit and a heat pump cycle device.

Description of the Related Art

[0002] WO2020-170327 discloses a technology including: a blower chamber in which a fan is stored; a first mechanical chamber in which a compressor is stored; a second mechanical chamber in which a controller is stored; and a third chamber in which a wiring portion connecting the compressor and the controller to each other is stored. The first mechanical chamber and the second mechanical chamber are disposed so that the blower chamber is interposed therebetween, and the third mechanical chamber is disposed between the first mechanical chamber and the second mechanical chamber in a first direction orthogonal to a rotation axis of a fan, and is arranged alongside the fan in a second direction orthogonal to each of the rotation axis and the first direction.

SUMMARY OF THE INVENTION

[0003] The present disclosure provides an outdoor unit and a heat pump cycle device which use a refrigerant and are capable of improving safety while avoiding electric leakage.

[0004] An outdoor unit according to the present disclosure includes: a compressor, a use side heat exchanger, expansion means, and a heat source side heat exchanger stored inside a housing; a refrigerant circuit connecting these members annularly and using a flammable refrigerant; a blower device for circulating air through the heat source side heat exchanger; and an electrical equipment box, wherein the heat pump cycle device has a cover member covering from an end portion of the heat source side heat exchanger to a portion between a refrigerant connection port and a water connection port of the use side heat exchanger.

[0005] The outdoor unit according the present disclosure can prevent water leaked from the use side heat exchanger from hitting contacts of the compressor and a four-way valve in the mechanical chamber by the cover member. Therefore, it is possible to reduce the possibility of explosion, and improve safety.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

FIG. 1 is a perspective view showing an outdoor unit of a heat pump cycle device of Embodiment 1;
FIG. 2 is a front view of the outdoor unit according to Embodiment 1 in which machines such as a compressor are omitted;
FIG. 3 is a perspective view, as viewed from the front side, of the outdoor unit according to Embodiment 1 in which machines such as the compressor are omitted;
FIG. 4 is a perspective view, as viewed from the rear side, showing a state in which panels around the outdoor unit according to Embodiment 1 are removed;
FIG. 5 is a front view showing a schematic structure of the outdoor unit according to Embodiment 1;
FIG. 6 is a plan view showing a schematic structure of the outdoor unit according to Embodiment 1;
FIG. 7 is a perspective view showing a use side heat exchanger of Embodiment 1; and
FIG. 8 is a circuit diagram showing a refrigerant circuit of the heat pump cycle device according to Embodiment 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0007] The present disclosure provides an outdoor unit and a heat pump cycle device which use a refrigerant and are capable of improving safety while avoiding electric leakage.

[0008] Hereinafter, embodiments will be described in detail with reference to the drawings. However, unnecessarily detailed description may be omitted. For example, detailed description of well-known matters, or redundant description of substantially the same configurations may be omitted. This is to avoid the following description from becoming unnecessarily redundant, and to facilitate understanding of those skilled in the art.

[0009] Note that the accompanying drawings and the following description are provided to allow those skilled in the art to fully understand the present disclosure, and are not intended to limit the subject matter recited in the claims.

(Embodiment 1)

[0010] Hereinafter, Embodiment 1 will be described using the drawings.

[1-1. Configuration]

[1-1-1. Configuration of Heat Pump Cycle Device]

[0011] FIG. 1 is a perspective view of an outdoor unit of a heat pump cycle device according to Embodiment 1. FIG. 2 is a front view of the outdoor unit according to Embodiment 1 in which machines such as a compressor are omitted. FIG. 3 is a perspective view, as viewed from the front side, of the outdoor unit according to Embodiment 1 in which machines such as the compressor are omitted. FIG. 4 is a perspective view, as viewed from the

rear side, showing a state in which panels around the outdoor unit according to Embodiment 1 are removed. FIG. 5 is a front view showing a schematic structure of the outdoor unit according to Embodiment 1. FIG. 6 is a plan view showing a schematic structure of the outdoor unit according to Embodiment 1.

[0012] As shown in FIG. 1, an outdoor unit 2 of a heat pump cycle device 1 has a box-shaped housing 10. In the present embodiment, each part of the housing 10 is made of a steel plate.

[0013] As shown in FIG. 2, FIG. 3 and FIG. 5, a partition plate 11 extending in the up-down direction is provided inside the housing 10. The inside space of the housing 10 is partitioned into a blower chamber 12 and a mechanical chamber 13 by the partition plate 11.

[0014] The housing 10 has a bottom plate 14 forming a bottom surface of the housing 10, a right-side front panel 15a and a right-side rear panel 15b covering the mechanical chamber 13 of the housing 10 from the front and rear thereof, a front panel 16 covering a front side of the blower chamber 12, and a top plate 17 covering a top side of the housing 10.

[0015] The front panel 16 is provided with a ventilation part 18 formed in a mesh shape to allow passage of air.

[0016] A heat source side heat exchanger 20 and a blower device 21 are installed in the blower chamber 12.

[0017] The heat source side heat exchanger 20 of the present embodiment extends along a height direction of the housing 10, and is formed in a substantially L shape in plan view of the housing 10 so as to face a side surface and a back surface of the housing 10.

[0018] For the heat source side heat exchanger 20, for example, a fin-tube heat exchanger is used.

[0019] For the blower device 21, for example, an axial fan with a propeller-shaped impeller is used. The blower device 21 is disposed such that an axial flow direction is directed to the ventilation part 18.

[0020] Stored in the mechanical chamber 13 are various pieces of equipment, such as a compressor 22, a use side heat exchanger 23, and expansion means 24 (see FIG. 8), forming a refrigerant circuit, and refrigerant piping 25 (see FIG. 8) connecting these pieces of equipment to each other. For the use side heat exchanger 23, for example, a plate heat exchanger is used. An upper portion of the partition plate 11 is cut out to enable installation of an electrical equipment box 30. The electrical equipment box 30 is installed in the cut-out part of the upper portion of the partition plate 11. The electrical equipment box 30 is disposed across the mechanical chamber 13 and the blower chamber 12.

[0021] FIG. 7 is a perspective view showing the use side heat exchanger 23. A plate heat exchanger is shown as the use side heat exchanger 23. In the present embodiment, a refrigerant and water are used as a heat medium.

[0022] In an upper portion and a lower portion of the use side heat exchanger 23, refrigerant connection ports 40, 41, and water connection ports 42, 43 are provided side by side in the left-right direction.

[0023] For example, in a case in which hot water is supplied from the heat pump cycle device 1, the refrigerant connection port 40 functions as a refrigerant inlet, the refrigerant connection port 41 functions as a refrigerant outlet, the water connection port 43 functions as a water inlet, and the water connection port 42 functions as a water outlet.

[0024] Moreover, as shown in FIG. 2 to FIG. 4 and FIG. 6, in the present embodiment, the housing 10 has a cover member 50. The cover member 50 is mounted such that the cover member 50 is in contact with an end portion of the heat source side heat exchanger 20 at one end, extends in the left-right direction of the housing 10, and is in contact with the portion between the refrigerant connection ports 40, 41 and the water connection ports 42, 43 of the use side heat exchanger 23 at another end.

[0025] In other words, the refrigerant connection ports 40, 41 of the use side heat exchanger 23 are located on the front side of the cover member 50, and the water connection ports 42, 43 are located on the rear side of the cover member 50.

[0026] As shown in FIG. 2, an upper end of the cover member 50 is formed to be slightly lower than an upper end of the heat source side heat exchanger 20. Consequently, a ventilable space is formed between the upper end of the cover member 50 and a lower surface of the top plate 17.

[0027] Further, a space allowing discharge of water is formed between a lower end of the cover member 50 and the bottom plate 14 of the housing 10.

[1-1-2. Configuration of Refrigerant Circuit]

[0028] FIG. 8 is a circuit diagram showing the refrigerant circuit of the heat pump cycle device 1 according to Embodiment 1.

[0029] As shown in FIG. 8, in the heat pump cycle device 1, the compressor 22, a four-way valve 27, the use side heat exchanger 23, the expansion means 24, and the heat source side heat exchanger 20 are annularly connected through the predetermined refrigerant piping 25 so as to form the refrigerant circuit.

[0030] Predetermined water supply piping 28 is connected to the use side heat exchanger 23, and heat exchange is performed between the refrigerant circulating in the refrigerant circuit and water in the use side heat exchanger 23.

[0031] Here, in the present embodiment, a flammable refrigerant is used as the refrigerant. The flammable refrigerant is R32 or a mixed refrigerant containing 70 weight percent or more of R32, or propane or a mixed refrigerant containing propane.

[0032] Note that an inflammable refrigerant may be used as the refrigerant, instead of the flammable refrigerant.

[1-2. Operation]

[0033] Next, an operation of the heat pump cycle device 1 configured as described above will be described.

[0034] When the heat pump cycle device 1 is driven, the compressor 22 and the blower device 21 are operated.

[0035] Consequently, in a case in which hot water is used, the refrigerant compressed to high temperature and high pressure by the compressor 22 flows as shown by the solid-line arrows in FIG. 8, is sent to the use side heat exchanger 23, and is cooled by heat exchange with the water flowing through the water supply piping 28, and the water becomes hot water by receiving the heat of the refrigerant, and is supplied to a predetermined location.

[0036] The refrigerant discharged from the use side heat exchanger 23 is decompressed by the expansion means 24, is heat-exchanged by the heat source side heat exchanger 20 to be a gas refrigerant, and is returned again to the compressor 22.

[0037] Moreover, in a case in which cool water is used, by switching the four-way valve 27, the refrigerant flows as shown by the broken-line arrows in FIG. 8, is heat-exchanged with outside air by the heat source side heat exchanger 20, is decompressed by the expansion means 24, is sent to the use side heat exchanger 23 so as to cool the water flowing through the water supply piping 28, and is then returned again to the compressor 22.

[0038] Here, the plate heat exchanger which is used as the use side heat exchanger 23 performs heat exchange between the water and the compressed refrigerant to produce hot water or cool water, and uses O-rings or the like to seal against water.

[0039] However, water leakage may occur due to deterioration of the seal over time. In the heat pump cycle device using the flammable refrigerant, if the leaked water hits contacts of electronic parts such as the compressor 22 and the four-way valve 27 in the mechanical chamber 13, there is a high possibility of occurrence of sparks and explosion.

[0040] In the present embodiment, since the cover member 50 partitioning from the end portion of the heat source side heat exchanger 20 to the water circuit of the use side heat exchanger 23 is provided, it is possible to prevent the water leaked from the use side heat exchanger 23 from hitting the contacts of the compressor 22 and the four-way valve 27 in the mechanical chamber 13. Consequently, it is possible to reduce the possibility of explosion, and improve safety.

[0041] Moreover, since the space is formed between the upper end of the cover member 50 and the lower surface of the top plate 17, it is possible to ensure ventilation between the mechanical chamber 13 and the top plate 17.

[0042] Further, since the space allowing discharge of water is formed between the lower end of the cover member 50 and the bottom plate 14 of the housing 10, water leaked from the use side heat exchanger 23 can be discharged together with condensed water produced in the mechanical chamber 13.

[0043] Furthermore, since the spaces are provided above and below the cover member 50, it is possible to prevent the concentration of flammable gas inside the mechanical chamber 13 from increasing locally when the refrigerant leaks.

[1-3. Effects]

[0044] As described above, in the present embodiment, the outdoor unit 2 includes: the compressor 22, the use side heat exchanger 23, the expansion means 24, and the heat source side heat exchanger 20 stored inside the housing 10; the refrigerant circuit connecting these members annularly through the refrigerant piping 25, and using a flammable refrigerant; the blower device 21 for circulating air through the heat source side heat exchanger 20; and the electrical equipment box 30, wherein the outdoor unit 2 has the cover member 50 covering from an end portion of the heat source side heat exchanger 20 to a portion between the refrigerant connection ports 40, 41 and the water connection ports 42, 43 of the use side heat exchanger 23.

[0045] Consequently, it is possible to prevent water leaked from the use side heat exchanger 23 from hitting the contacts of the compressor 22 and the four-way valve 27 in the mechanical chamber 13 by the cover member 50. Therefore, it is possible to reduce the possibility of explosion, and improve safety.

[0046] Moreover, in the present embodiment, the outdoor unit 2 has a ventilable space between the upper end of the cover member 50 and the top plate 17 of the housing 10.

[0047] Consequently, it is possible to ensure ventilation between the mechanical chamber 13 and the top plate 17.

[0048] Further, in the present embodiment, the outdoor unit 2 has a space allowing discharge of water below the cover member 50.

[0049] Consequently, water leaked from the use side heat exchanger 23 can be discharged together with condensed water produced in the mechanical chamber 13.

[0050] Furthermore, in the present embodiment, a flammable refrigerant to be used in the outdoor unit 2 is R32 or a mixed refrigerant containing 70 weight percent or more of R32, or propane or a mixed refrigerant containing propane.

[0051] Consequently, even when a particularly combustible flammable refrigerant is used, it is possible to prevent water leaked from the use side heat exchanger 23 from hitting the contacts of the compressor 22 and the four-way valve 27 in the mechanical chamber 13 by the cover member 50, and it is possible to reduce the possibility of explosion, and improve safety.

(Other Embodiments)

[0052] As described above, Embodiment 1 is described as an example of the technology disclosed in the present application. However, the technology in the present disclosure is not limited to this, and can also be applied to embodiments in which modifications, replacements, additions, omissions, etc. are made.

[Configurations Supported by the Embodiments]

[0053] The above-described embodiments support the following configurations.

(Configuration 1)

[0054] An outdoor unit including: a compressor, a use side heat exchanger, expansion means, and a heat source side heat exchanger stored inside a housing; a refrigerant circuit connecting these members annularly and using a flammable refrigerant; a blower device for circulating air through the heat source side heat exchanger; and an electrical equipment box, wherein the outdoor unit has a cover member covering from an end portion of the heat source side heat exchanger to a portion between a refrigerant connection port and a water connection port of the use side heat exchanger.

[0055] According to this configuration, it is possible to prevent water leaked from the use side heat exchanger from hitting contacts of the compressor and a four-way valve in a mechanical chamber by the cover member. Therefore, it is possible to reduce the possibility of explosion, and improve safety.

(Configuration 2)

[0056] The outdoor unit according to configuration 1, wherein a ventilable space is provided between an upper end of the cover member and a top plate of the housing.

[0057] According to this configuration, it is possible to ensure ventilation between the mechanical chamber and the top plate.

(Configuration 3)

[0058] The outdoor unit according to configuration 1 or configuration 2, wherein a space allowing discharge of water is provided under the cover member.

[0059] According to this configuration, water leaked in the use side heat exchanger can be discharged together with condensed water produced in the mechanical chamber.

(Configuration 4)

[0060] The outdoor unit according to any one of configuration 1 to configuration 3, wherein the flammable refrigerant is R32 or a mixed refrigerant containing 70 weight percent or more of R32, or propane or a mixed refrigerant containing propane.

[0061] According to this configuration, even when a particularly combustible flammable refrigerant is used, it is possible to prevent water leaked from the use side heat exchanger from hitting the contacts of the compressor and the four-way valve in the mechanical chamber by the cover member, and it is possible to reduce the possibility of explosion, and improve safety.

(Configuration 5)

[0062] A heat pump cycle device including the outdoor unit according to any one of configuration 1 to configuration 4.

[0063] According to this configuration, since the heat pump cycle device has the outdoor unit, it is possible to obtain the heat pump cycle device that can prevent water leaked from the use side heat exchanger from hitting the contacts of the compressor and the four-way valve in the mechanical chamber by the cover member, reduce the possibility of explosion, and improve safety.

[0064] The present disclosure can be suitably used for a heat pump cycle device that can prevent water leaked from a use side heat exchanger from hitting contacts of a compressor and a four-way valve in a mechanical chamber, reduce the possibility of explosion, and improve safety.

Reference Signs List

[0065]

1	heat pump cycle device
10	housing
11	partition plate
12	blower chamber
13	mechanical chamber
14	bottom plate
15a	right-side front panel
15b	right-side rear panel
16	front panel
17	top plate
18	ventilation part
20	heat source side heat exchanger
21	blower device
22	compressor
23	use side heat exchanger
24	expansion means
25	refrigerant piping
27	four-way valve
28	water supply piping
30	electrical equipment box
40, 41	refrigerant connection port
42, 43	water connection port
50	cover member

Claims

1. An outdoor unit (2) **characterized by** comprising: a compressor(22), a use side heat exchanger (23), expansion means (24), and a heat source side heat exchanger (20) stored inside a housing (10); a refrigerant circuit connecting these members annularly and using a flammable refrigerant; a blower device for circulating air through the heat source side heat exchanger; and an electrical equipment box, wherein
the outdoor unit has a cover member covering (50) from an end portion of the heat source side heat exchanger to a portion between a refrigerant connection port (40, 41) and a water connection port (42, 43) of the use side heat exchanger.

2. The outdoor unit according to claim 1, wherein a ventilable space is provided between an upper end of the cover member and a top plate (17) of the housing.

3. The outdoor unit according to claim 1, wherein a space allowing discharge of water is provided under the cover member.

4. The outdoor unit according to any one of claim 1 to claim 3, wherein the flammable refrigerant is R32 or a mixed refrigerant containing 70 weight percent or more of R32, or propane or a mixed refrigerant containing propane.

5. A heat pump cycle device comprising the outdoor unit according to any one of claim 1 to claim 4.

FIG.1

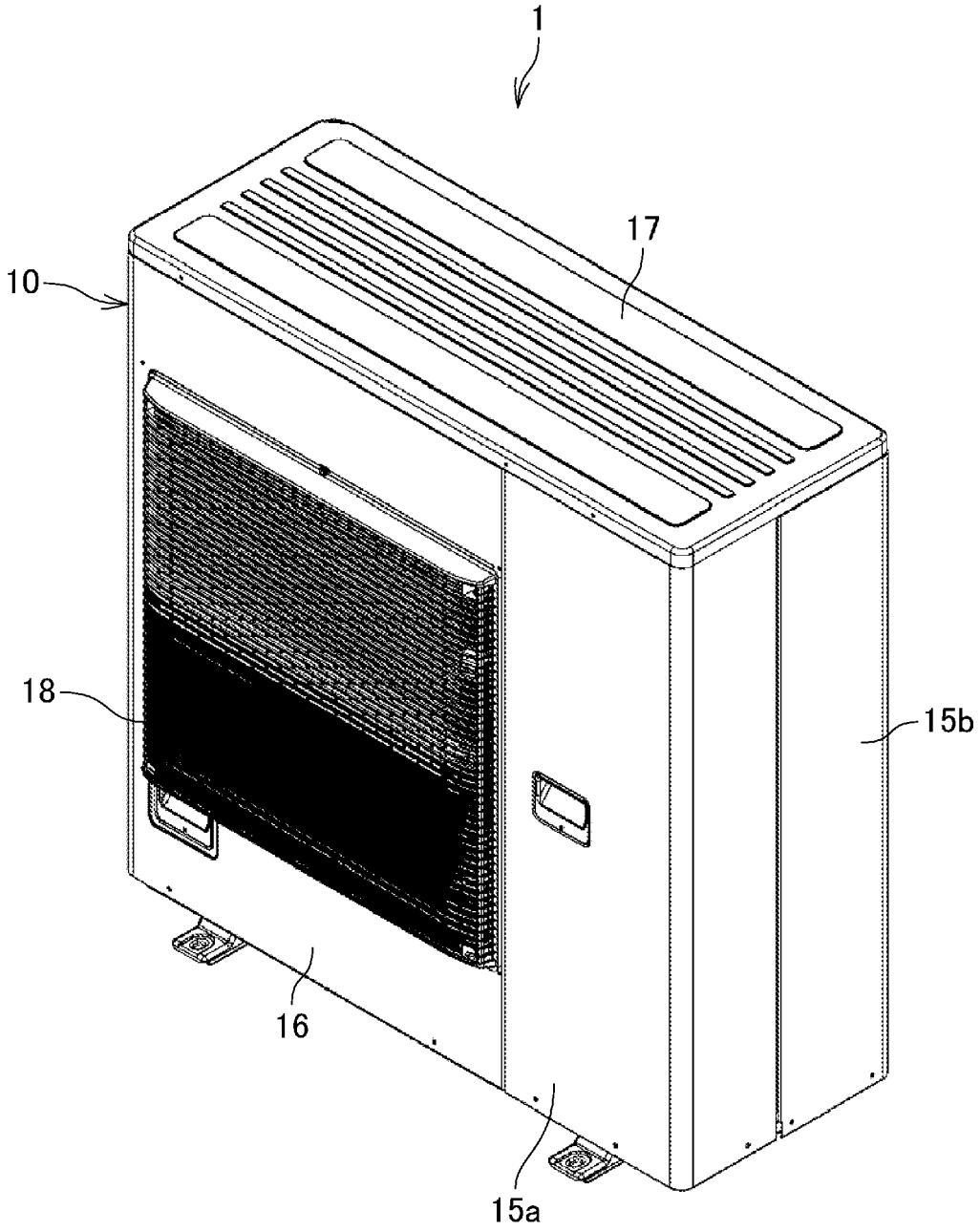


FIG.2

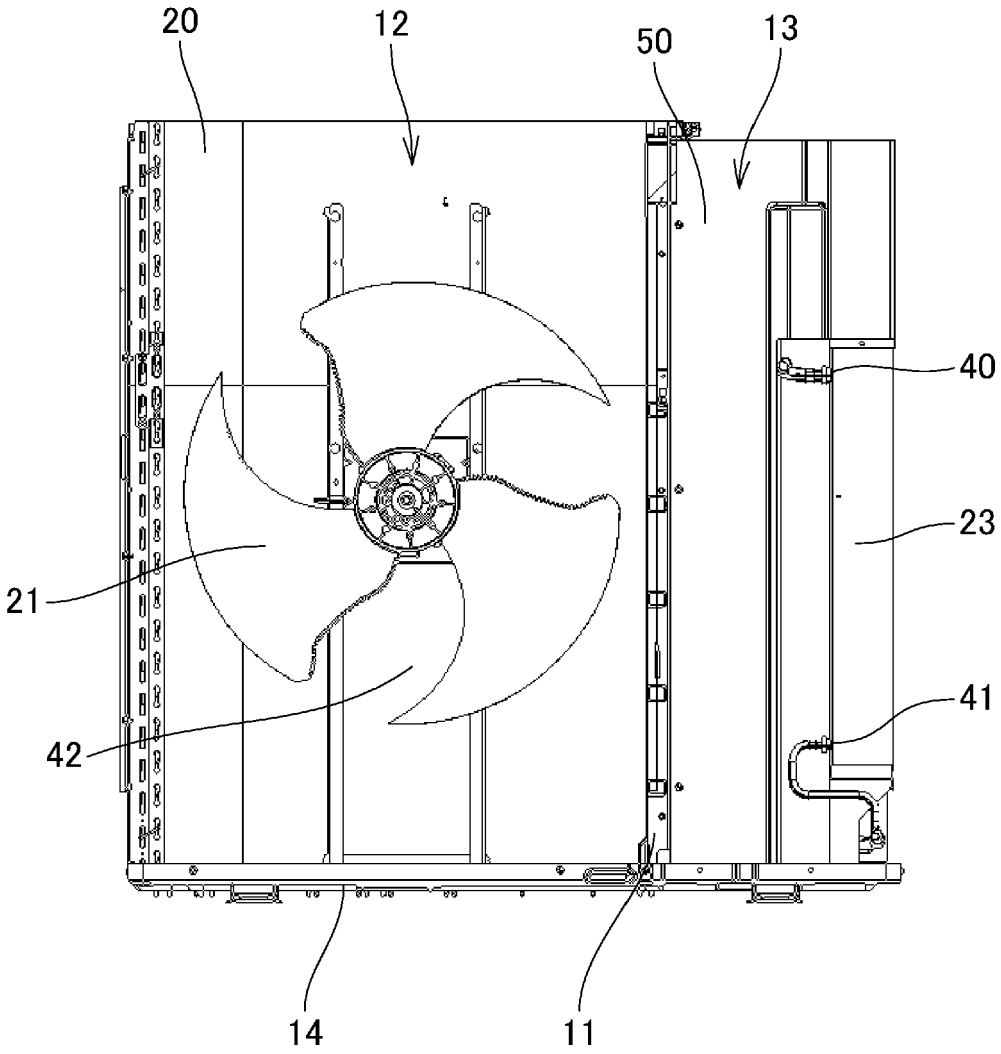


FIG.3

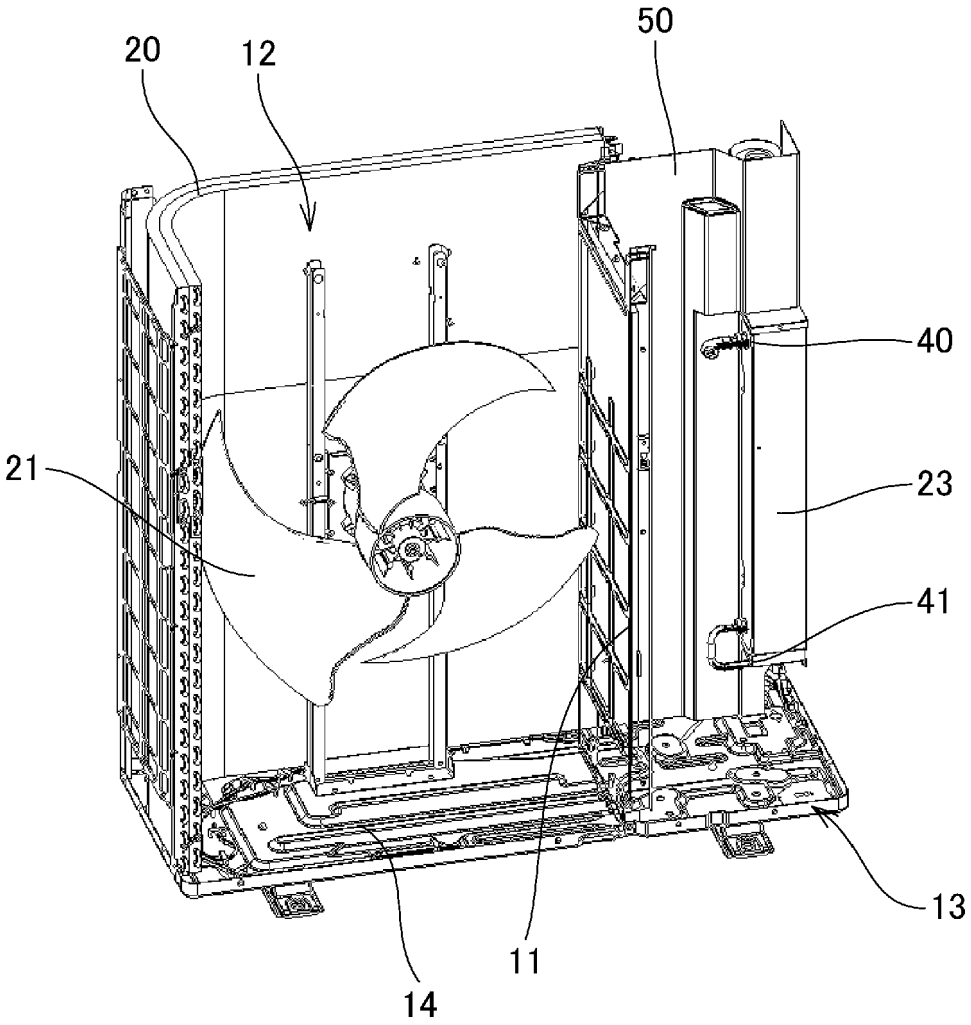


FIG.4

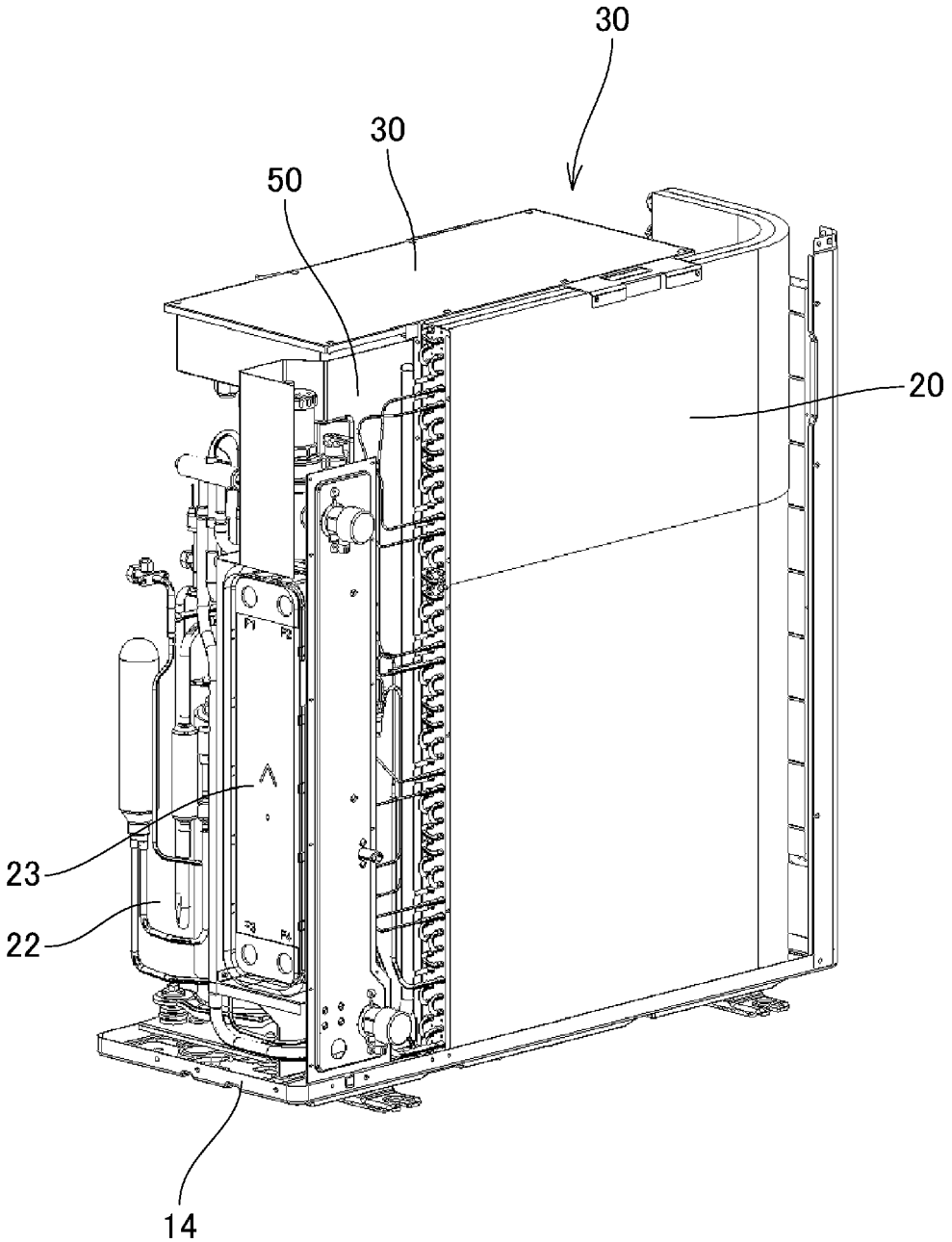


FIG.5

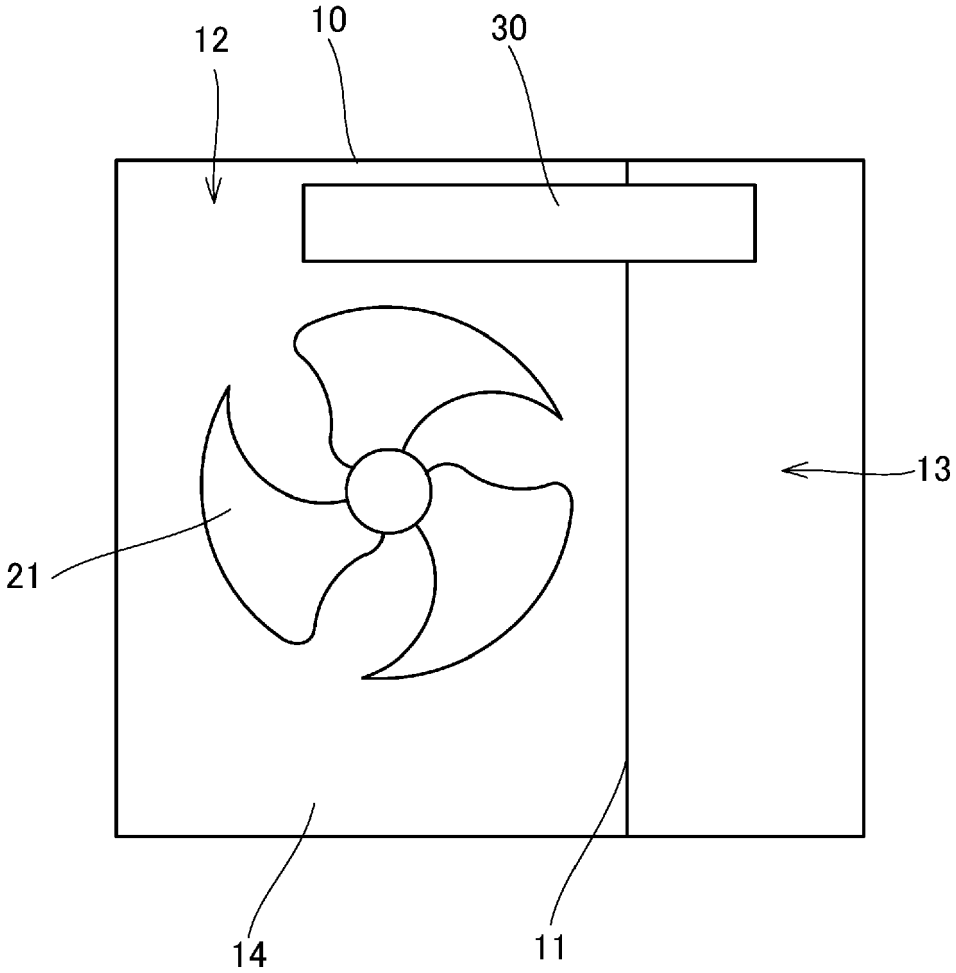


FIG.6

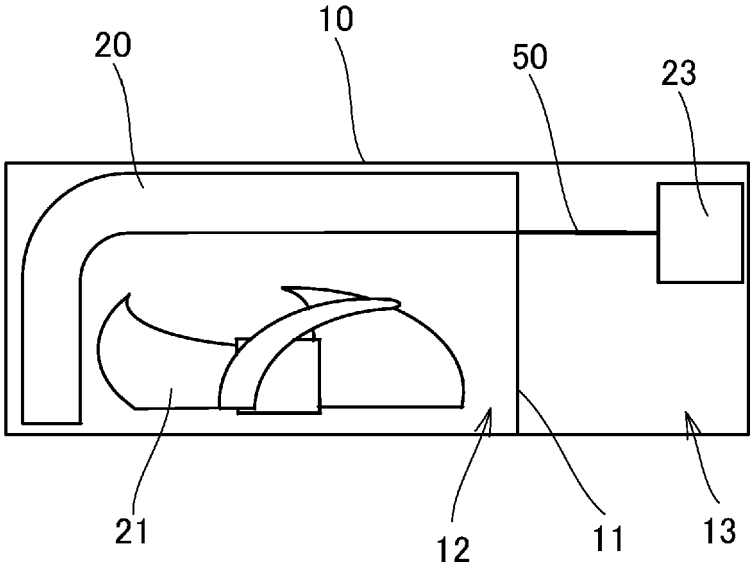


FIG.7

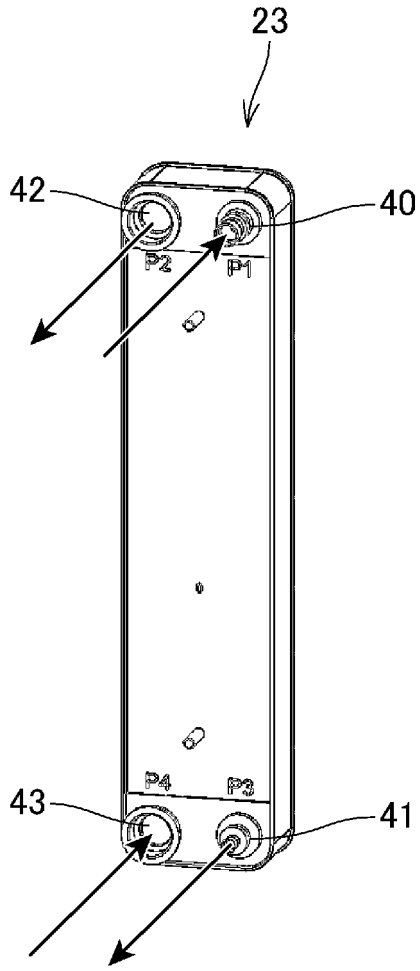
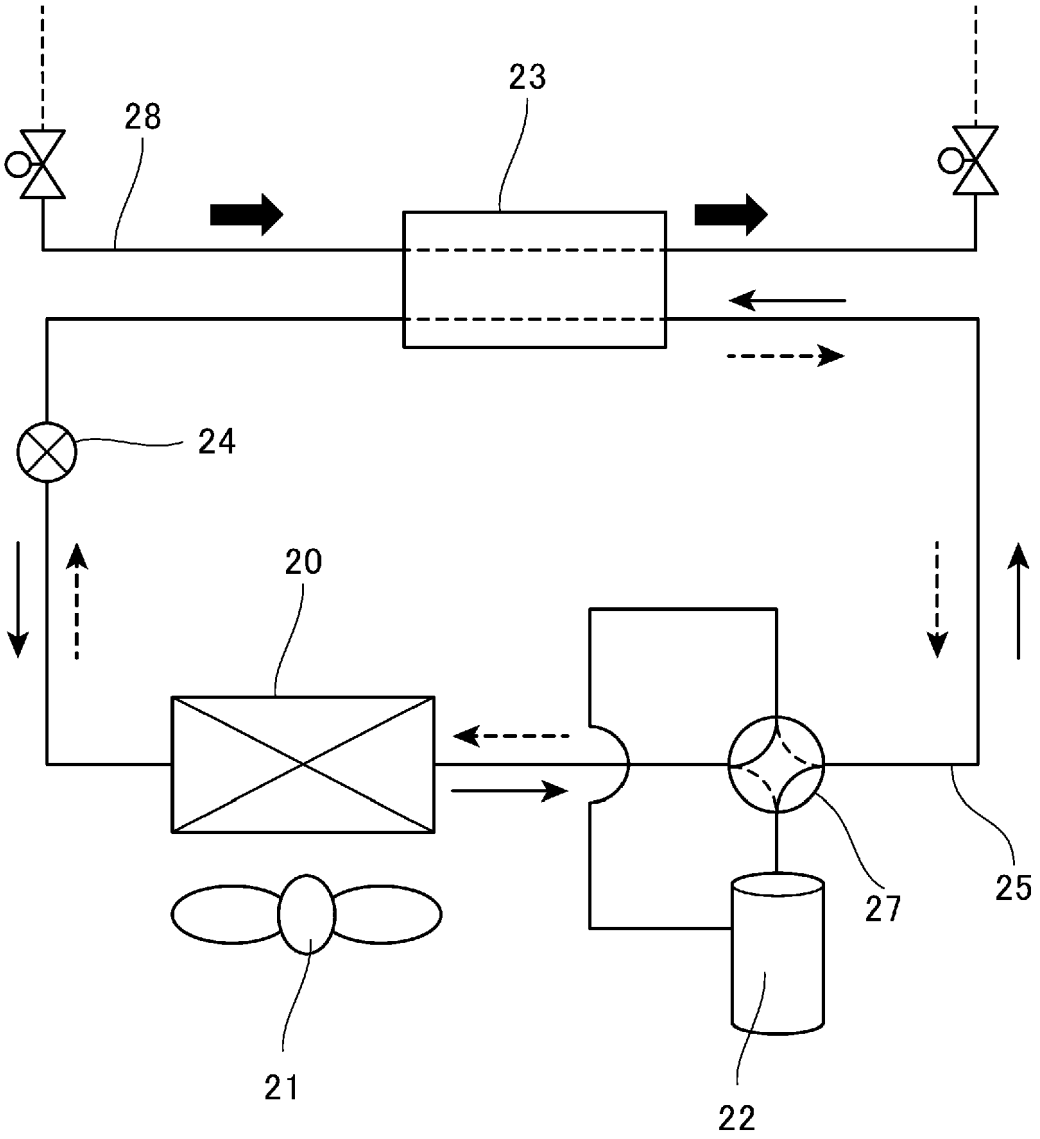


FIG.8



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EUROPEAN SEARCH REPORT

Application Number
EP 23 17 7517

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	JP 2012 037162 A (CHOFU SEISAKUSHO CO LTD) 23 February 2012 (2012-02-23) * paragraphs [0001] - [0052]; figures 1-4 *	1-5	INV. F24F1/46 F24F1/56 F24F13/20 F24H4/02
A	JP 2021 188808 A (HITACHI GLOBAL LIFE SOLUTIONS INC) 13 December 2021 (2021-12-13) * figures 1-6 *	1-5	F24F1/14
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TECHNICAL FIELDS SEARCHED (IPC)

F24F
F24H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 October 2023	Ismail, Youssef

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 17 7517

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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26-10-2023

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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