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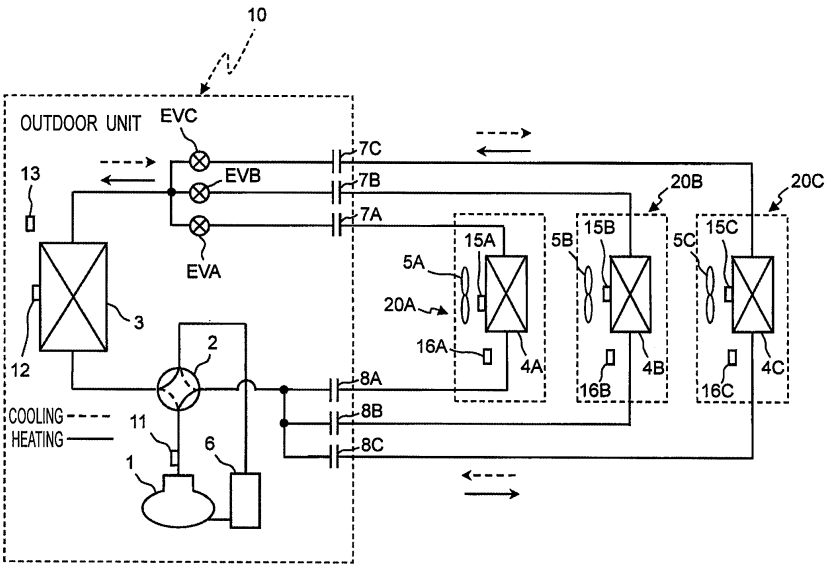
(54) AIR CONDITIONER

(57) An air conditioner includes an outdoor unit (10) to which a plurality of indoor units (20A to 20C) are connectable. One of the plurality of indoor units (20A to 20C) to be connected to the outdoor unit (10) is a low-capacity indoor unit (20C) lower in capacity than the other indoor units (20A, 20B). When the low-capacity indoor unit (20C) is put into powerful operation with a capacity higher than a maximum capacity in normal operation, a compressor (1) of the outdoor unit (10) is started at a rotational speed higher than the maximum rotational speed applied at the start of the normal operation.

Fig.1



EP 3 742 064 A1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to air conditioners.

BACKGROUND ART

[0002] Some conventional air conditioners control, when an outdoor unit is insufficient in air conditioning capacity, the capacity of each indoor unit based on priorities to put a limit on the flow rate of refrigerant supplied to a lower priority indoor unit (for example, refer to JP H8-271017 A (Patent Literature 1)).

CITATION LIST

PATENT LITERATURE

[0003] Patent Literature 1: JP H8-271017 A

SUMMARY OF INVENTION

TECHNICAL PROBLEMS

[0004] Further, such conventional air conditioners maximize, when there is a request for powerful operation from an indoor unit, a capacity request for the indoor unit and lower a capacity request for other lower priority indoor units; however, it takes time to reach a target temperature from the room temperature when the indoor unit is put into operation from an out-of-operation state, and thus quick cooling performance and quick heating performance are not high enough.

[0005] The present disclosure proposes an air conditioner having higher quick cooling performance and/or quick heating performance.

SOLUTIONS TO PROBLEMS

[0006] An air conditioner according to the present disclosure includes
an outdoor unit, and a plurality of indoor units connectable to the outdoor unit.

[0007] At least one of the plurality of indoor units connected to the outdoor unit is a low-capacity indoor unit lower in capacity than the other indoor units, and
when the low-capacity indoor unit is put into powerful operation with a capacity higher than a maximum capacity in normal operation, a compressor of the outdoor unit is started at a rotational speed higher than a maximum rotational speed applied at start of the normal operation.

[0008] According the present disclosure, in order to put the low-capacity indoor unit into powerful operation with a capacity higher than the maximum capacity in normal operation, the compressor of the outdoor unit is put into operation at a rotational speed higher than the maximum rotational speed applied at the start of normal operation, making it possible to increase quick cooling performance and/or quick heating performance.

[0009] Further, in the air conditioner according to one aspect of the present disclosure,
the outdoor unit has a preheating operation capability of preheating the compressor while the outdoor unit is out of operation.

[0010] According to the above-described embodiment, the preheating operation capability of the outdoor unit makes it possible to preheat the compressor while the outdoor unit is out of operation, so that, even when the compressor of the outdoor unit is put into operation, for powerful operation, at a rotational speed higher than the maximum rotational speed applied at the start of normal operation, it is possible to prevent the compressor from running out of oil.

[0011] Further, in the air conditioner according to one aspect of the present disclosure,
the low-capacity indoor unit takes precedence in capacity over the other indoor units during the powerful operation.

[0012] According to the present disclosure, while the low-capacity indoor unit and the other indoor units are in operation, the low-capacity indoor unit takes precedence in capacity over the other indoor units during the powerful operation, thereby allowing the low-capacity indoor unit to quickly cool or heat a small space in which the low-capacity indoor unit is installed.

[0013] Further, in the air conditioner according to one aspect of the present disclosure,
the low-capacity indoor unit has a rated cooling capacity of less than 2.2 kW.

[0014] According to the present disclosure, since the rated cooling capacity is less than 2.2 kW, it is suitable for air conditioning in a small space such as a washroom or a kitchen.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

FIG. 1 is a structure diagram of a multi-type air conditioner including a low-capacity indoor unit according to a first embodiment of the present disclosure.
FIG. 2 is a block diagram of an outdoor control device of an outdoor unit of the multi-type air conditioner.
FIG. 3 is an external view of the low-capacity indoor unit viewed from obliquely below.
FIG. 4 is a block diagram of an indoor control device of the low-capacity indoor unit.
FIG. 5 is a flow chart showing an operation of the multi-type air conditioner.
FIG. 6 is a graph showing changes in indoor temperature while the low-capacity indoor unit of the multi-type air conditioner is in powerful heating operation.
FIG. 7 is a structure diagram of a multi-type air conditioner including a low-capacity indoor unit accord-

ing to a second embodiment of the present disclosure.

DESCRIPTION OF EMBODIMENTS

[0016] Embodiments will be described below.

[First embodiment]

[0017] FIG. 1 is a structure diagram of a multi-type air conditioner including a low-capacity indoor unit according to a first embodiment of the present disclosure.

[0018] The multi-type air conditioner according to the first embodiment includes, as shown in FIG. 1, an indoor unit 20A including an indoor heat exchanger 4A and an indoor fan 5A, an indoor unit 20B including an indoor heat exchanger 4B and an indoor fan 5B, a low-capacity indoor unit 20C including an indoor heat exchanger 4C and an indoor fan 5C, and an outdoor unit 10 connected to the indoor units 20A, 20B and the low-capacity indoor unit 20C via refrigerant pipes.

[0019] The outdoor unit 10 is compatible with a multi-type air conditioner in which a plurality of indoor units are connectable to an outdoor unit, and the low-capacity indoor unit 20C is capable of operating as an indoor unit of the multi-type air conditioner.

[0020] In FIG. 1, 1 denotes a compressor, 2 denotes a four-way switching valve having one end connected to a discharge side of the compressor 1, 3 denotes an outdoor heat exchanger having one end connected to the other end of the four-way switching valve 2, EVA, EVB, EVC denote electrically powered expansion valves each having one end connected to the other end of the outdoor heat exchanger 3, 4A, 4B, 4C denote the indoor heat exchangers each having one end connected to the other end of a corresponding one of the electrically powered expansion valves EVA, EVB, EVC, and 6 denotes an accumulator having one end connected to the other ends of the indoor heat exchangers 4A, 4B, 4C via the four-way switching valve 2 and having the other end connected to an intake side of the compressor 1. The indoor fans 5A, 5B, 5C are arranged near the indoor heat exchangers 4A, 4B, 4C, respectively.

[0021] Further, the electrically powered expansion valves EVA, EVB, EVC each have the other end connected to a corresponding one of a plurality of refrigerant pipe connection parts 7A, 7B, 7C, and the indoor heat exchangers 4A, 4B, 4C each have one end connected to a corresponding one of the plurality of refrigerant pipe connection parts 7A, 7B, 7C via a connection pipe (refrigerant pipe). Further, the indoor heat exchangers 4A, 4B, 4C have the other ends connected to a plurality of refrigerant pipe connection parts 8A, 8B, 8C, respectively, via respective connection pipes (refrigerant pipes).

[0022] The compressor 1, the four-way switching valve 2, the outdoor heat exchanger 3, the electrically powered expansion valves EVA, EVB, EVC, the indoor heat exchangers 4A, 4B, 4C, and the accumulator 6 constitute a refrigerant circuit. This refrigerant circuit is filled with a slightly flammable R32 refrigerant.

[0023] Further, provided on the discharge side of the compressor 1 is a discharge pipe temperature sensor 11. Further, the outdoor heat exchanger 3 is provided with an outdoor heat exchanger temperature sensor 12 that detects an outdoor heat exchanger temperature, and, in the vicinity of the outdoor heat exchanger 3, an outdoor temperature sensor 13 that detects an outdoor temperature is provided.

[0024] Further, the indoor heat exchanger 4A is provided with an indoor heat exchanger temperature sensor 15A that detects an indoor heat exchanger temperature, and, in the vicinity of the indoor heat exchanger 4A, an indoor temperature sensor 16A that detects an indoor temperature is provided. Further, the indoor heat exchanger 4B is provided with an indoor heat exchanger temperature sensor 15B that detects an indoor heat exchanger temperature, and, in the vicinity of the indoor heat exchanger 4B, an indoor temperature sensor 16B that detects an indoor temperature is provided. Further, the indoor heat exchanger 4C is provided with an indoor heat exchanger temperature sensor 15C that detects an indoor heat exchanger temperature, and, in the vicinity of the indoor heat exchanger 4C, an indoor temperature sensor 16C that detects an indoor temperature is provided.

[0025] The outdoor unit 10 includes an outdoor control device 100 including a microcomputer, an input-output circuit, and the like. The outdoor control device 100 includes an operation control unit 100a that controls the compressor 1, the electrically powered expansion valves EVA, EVB, EVC, and the like, and a communication unit 100b. Further, the indoor units 20A, 20B each include an indoor control device (not shown), and the low-capacity indoor unit 20C includes an indoor control device 200 shown in FIG. 2.

[0026] The indoor control devices of the indoor units 20A, 20B and the indoor control device 200 of the low-capacity indoor unit 20C communicate with the outdoor control device 100 of the outdoor unit 10 over a communication line (not shown) so as to cause the outdoor control device 100, the indoor control devices of the indoor units 20A, 20B, and the indoor control device 200 of the low-capacity indoor unit 20C to operate in cooperation with each other as the multi-type air conditioner.

[0027] When the indoor units 20A, 20B and the low-capacity indoor unit 20C are put into cooling operation in the multi-type air conditioner, the four-way switching valve 2 is switched to a position represented by a dotted line, and then the compressor 1 is put into operation. Then, each of the electrically powered expansion valves EVA, EVB, EVC is opened to a predetermined opening degree. Then, a high-temperature and high-pressure gas refrigerant discharged from the compressor 1 exchanges heat with outdoor air in the outdoor heat exchanger 3 with the help of an outdoor fan (not shown) in operation to be condensed to a liquid refrigerant. Next, a liquid re-

frigerant from the indoor heat exchangers 4A, 4B, 4C is decompressed by the electrically powered expansion valves EVA, EVB, EVC, exchanges heat with indoor air in the indoor heat exchangers 4A, 4B, 4C with the help of the indoor fans 5A, 5B, 5C in operation to be evaporated to become a gas refrigerant, and then returns to the intake side of the compressor 1.

[0028] Here, the indoor units 20A, 20B have a rated cooling capacity of 2.2 kW, and the low-capacity indoor unit 20C has a rated cooling capacity of 0.8 kW. That is, the low-capacity indoor unit 20C is lower in capacity than the indoor units 20A, 20B and is used for heating and cooling a small space such as a washroom or a kitchen.

[0029] On the other hand, when the indoor units 20A, 20B and the low-capacity indoor unit 20C are put into heating operation, the four-way switching valve 2 is switched to a position represented by a solid line, and then the compressor 1 is put into operation. Then, each of the electrically powered expansion valves EVA, EVB, EVC is opened to a predetermined opening degree. Then, a high-temperature and high-pressure gas refrigerant discharged from the compressor 1 exchanges heat with indoor air in the indoor heat exchangers 4A, 4B, 4C with the help of the indoor fans 5A, 5B, 5C in operation to be condensed to a liquid refrigerant. Next, a liquid refrigerant from the indoor heat exchangers 4A, 4B, 4C is decompressed by the electrically powered expansion valves EVA, EVB, EVC, exchanges heat with outdoor air in the outdoor heat exchanger 3 with the help of the outdoor fan (not shown) in operation to be evaporated to become a gas refrigerant, and then returns to the intake side of the compressor 1.

[0030] FIG. 2 is a block diagram of the outdoor control device 100 of the outdoor unit 10 of the multi-type air conditioner.

[0031] As shown in FIG. 2, the outdoor unit 10 includes the outdoor control device 100 including the microcomputer, the input-output circuit, and the like. Connected to the outdoor control device 100 are the discharge pipe temperature sensor 11, the outdoor heat exchanger temperature sensor 12, the outdoor temperature sensor 13, the compressor 1, the four-way switching valve 2, a fan motor 14, and the electrically powered expansion valves EVA, EVB, EVC. Further, the outdoor control device 100 further includes the operation control unit 100a and the communication unit 100b.

[0032] The operation control unit 100a controls the compressor 1, the electrically powered expansion valves EVA, EVB, EVC, and the like based on detection signals from the discharge pipe temperature sensor 11, the outdoor heat exchanger temperature sensor 12, and the outdoor temperature sensor 13.

[0033] The communication unit 100b communicates with the indoor control device 200 (shown in FIG. 4) of the low-capacity indoor unit 20C connected to the outdoor unit 10 via a communication unit 200b.

[0034] FIG. 3 is an external view of the low-capacity indoor unit 20C viewed from obliquely below. This indoor unit 20C is designed to be embedded in a ceiling.

[0035] As shown in FIG. 3, the low-capacity indoor unit 20C includes a casing main body 101, a panel 102 having a rectangular shape and mounted to a lower side of the casing main body 101, and a grille 103 detachably mounted to the panel 102.

[0036] The panel 102 has, on its one end in a longitudinal direction, a blow-out port 110 extending along a short side of the panel 102. The panel 102 further has a flap 120 pivotably mounted to the panel 102. In FIG. 3, the flap 120 closes the blow-out port 110.

[0037] A drain socket 107 is further provided protruding from a sidewall of the casing main body 101. The drain socket 107 is connected to an external drain hose (not shown). Pipe connection parts 105, 106 are further provided protruding from the sidewall of the casing main body 101. The pipe connection parts 105, 106 are each connected to a corresponding external refrigerant pipe (not shown).

[0038] Also, in FIG. 3, 108 denotes an electrical components unit, and 111 to 113 denote hanger fittings each protruding sideward from the casing main body 101.

[0039] FIG. 4 is a block diagram of the indoor control device 200 of the low-capacity indoor unit 20C.

[0040] As shown in FIG. 4, the low-capacity indoor unit 20C includes the indoor control device 200 including a microcomputer, an input-output circuit, and the like. Connected to the indoor control device 200 are the indoor heat exchanger temperature sensor 15C, the indoor temperature sensor 16C, a fan motor 21, a flap drive unit 22, and a display unit 23. The indoor control device 200 further includes an operation control unit 200a and the communication unit 200b.

[0041] The operation control unit 200a controls the fan motor 21, the flap drive unit 22, and the like based on detection signals from the indoor heat exchanger temperature sensor 15C and the indoor temperature sensor 16C.

[0042] The communication unit 200b communicates with the outdoor control device 100 (shown in FIG. 2) of the outdoor unit 10 connected to the low-capacity indoor unit 20C via the communication unit 100b.

[0043] FIG. 5 is a flow chart for describing the operation of the multi-type air conditioner.

<One room operation>

[0044] For example, in order to put the low-capacity indoor unit 20C into normal heating operation and put the indoor units 20A, 20B out of operation, first, in step S1, the outdoor control device 100 of the outdoor unit 10 determines, in response to an operation command signal from the indoor control device 200 of the low-capacity indoor unit 20C, whether there is a request for powerful operation.

[0045] Then, when determining that there is no request for powerful operation, the outdoor control device 100 proceeds to step S2 to put the compressor 1 into oper-

ation at a maximum rotational speed A (for example, 55 Hz) applied at the start of normal operation.

[0046] Next, in step S3, the outdoor control device 100 and the indoor control device 200 perform normal heating operation control. Under this normal heating operation control, a capacity request ΔD for the low-capacity indoor unit 20C is determined based on a target set temperature and indoor temperature.

[0047] On the other hand, in order to put the low-capacity indoor unit 20C into powerful heating operation and put the indoor units 20A, 20B out of operation, first, in step S1, the outdoor control device 100 of the outdoor unit 10 determines that, in response to a signal from the indoor control device 200 of the low-capacity indoor unit 20C, there is a request for powerful operation, and then proceeds to step S4 to put the compressor 1 into operation at a rotational speed (for example, 70 Hz) higher than the maximum rotational speed A (for example, 55 Hz) applied at the start of normal operation.

[0048] Next, proceeding to step S5, the outdoor control device 100 of the outdoor unit 10 and the indoor control device 200 of the low-capacity indoor unit 20C perform powerful operation control by controlling the compressor 1 and the electrically powered expansion valves EVA to EVC and the indoor fan 5C. Under this powerful operation control, the capacity request ΔD for the low-capacity indoor unit 20C is maximized, and the indoor fan 5C is rotated at a rotational speed higher than the maximum rotational speed of the indoor fan in normal operation.

<Two room operation>

[0049] For example, in order to put the low-capacity indoor unit 20C and the indoor unit 20A into normal heating operation and put the indoor unit 20B out of operation, first, in step S1, when the outdoor control device 100 determines that there is no request for powerful operation, the outdoor control device 100 proceeds to step S2 to put the compressor 1 into operation at the maximum rotational speed A (for example, 55 Hz) applied at the start of normal operation.

[0050] Next, proceeding to step S3, the outdoor control device 100 of the outdoor unit 10, the indoor control device 200 of the low-capacity indoor unit 20C, and the indoor control device of the indoor unit 20A perform normal heating operation control. Under this normal heating operation control, the capacity request ΔD for the low-capacity indoor unit 20C and the indoor unit 20A is determined based on the target set temperature and the indoor temperature.

[0051] On the other hand, in order to put the low-capacity indoor unit 20C into powerful heating operation, put the indoor unit 20A into normal heating operation, and put the indoor unit 20B out of operation, first, in step S1, the outdoor control device 100 of the outdoor unit 10 determines, in response to signals from the indoor control device 200 of the low-capacity indoor unit 20C and the indoor control device of the indoor unit 20A, whether there is a request for powerful operation.

[0052] Then, when determining that there is a request for powerful operation, the outdoor control device 100 proceeds to step S4 to put the compressor 1 into operation at a rotational speed (for example, 70 Hz) higher than the maximum rotational speed A (for example, 55 Hz) applied at the start of normal operation.

[0053] Next, proceeding to step S5, the outdoor control device 100 of the outdoor unit 10 and the indoor control device 200 of the low-capacity indoor unit 20C perform powerful operation control by controlling the compressor 1 and the electrically powered expansion valves EVA to EVC and the indoor fan 5C. Under this powerful operation control, the capacity request ΔD for the low-capacity indoor unit 20C is maximized, and the indoor fan 5C is rotated at a rotational speed higher than the maximum rotational speed of the indoor fan in normal operation. At this time, the capacity request ΔD for the indoor unit 20A that is put into normal heating operation is determined based on the target set temperature and the indoor temperature.

[0054] Here, when the indoor unit 20A is set as a priority room, the indoor control device of the indoor unit 20A also performs powerful operation control.

[0055] In this multi-type air conditioner, it is possible to set one of the plurality of indoor units as the priority room using a setting unit provided in the outdoor unit 10 at the time of installation.

<Three room operation>

[0056] In order to put the low-capacity indoor unit 20C into powerful heating operation and put the indoor units 20A, 20B into normal heating operation, the capacity request ΔD for the low-capacity indoor unit 20C is maximized, and the indoor fan 5C is rotated at a rotational speed higher than the maximum rotational speed of the indoor fan in normal operation. At this time, the capacity request ΔD for the indoor units 20A, 20B that are put into normal heating operation is determined based on the target set temperature and the indoor temperature.

[0057] Here, when the indoor unit 20A is set as the priority room, the indoor control device of the indoor unit 20A performs powerful operation control. Alternatively, when the indoor unit 20B is set as the priority room, the indoor control device of the indoor unit 20B performs powerful operation control.

[0058] FIG. 6 is a graph showing changes in room temperature while the low-capacity indoor unit 20C is in powerful heating operation. Here, the room temperature is an average value of room temperatures at a plurality of measurement points in a room space measured. In FIG. 6, the horizontal axis represents time [min], and the vertical axis represents operating frequency [Hz] of the compressor 1, indoor temperature [°C], and rotational speed [/10 rpm] of the indoor fan 5C.

[0059] As shown in FIG. 6, when starting powerful heating operation of the low-capacity indoor unit 20C,

the capacity request ΔD for the low-capacity indoor unit 20C was maximized, the rotational speed of the indoor fan 5C was set to 1670 rpm, and the compressor 1 was put into operation at 70 Hz, resulting in the room temperature increasing from 10°C to 20°C within 10 minutes with the outside temperature of 2°C.

[0060] According to the multi-type air conditioner configured as described above, when starting powerful operation of the low-capacity indoor unit 20C with a capacity higher than the maximum capacity in normal operation, the compressor 1 of the outdoor unit 10 is put into operation at a rotational speed higher than the maximum rotational speed applied at the start of normal operation, making it possible to increase quick cooling performance and/or quick heating performance.

[0061] Further, while the low-capacity indoor unit 20C and the other indoor units 20A, 20B are in cooling operation or heating operation, the low-capacity indoor unit 20C takes precedence in capacity over the other indoor units 20A, 20B during powerful operation, thereby allowing the low-capacity indoor unit 20C to quickly cool or heat a small space in which the low-capacity indoor unit 20C is installed.

[0062] The operation in which the low-capacity indoor unit 20C takes precedence in capacity means an operation in which a thermo-off determination temperature applied when the other indoor units 0A, 20B reach the set temperature is set higher in cooling operation than in normal operation and is set lower in heating operation than in normal operation, so that the capacity concentrates on the low-capacity indoor unit 20C.

[0063] Further, since the low-capacity indoor unit 20C has a rated cooling capacity of 0.8 kW, the low-capacity indoor unit 20C is suitable for air conditioning in a small space such as a washroom or a kitchen.

[0064] Further, as for the multi-type air conditioner according to the first embodiment, the powerful operation control during heating operation has been described, but, for example, the same powerful operation control may be applied to cooling operation.

[Second embodiment]

[0065] FIG. 7 is a structure diagram of a multi-type air conditioner including a low-capacity indoor unit 20C according to a second embodiment of the present disclosure. The multi-type air conditioner according to the second embodiment is the same in structure as the multi-type air conditioner according to the first embodiment, except for a preheating capability of preheating the compressor 1 of the outdoor unit 10.

[0066] The preheating capability is a capability of preheating the compressor 1 with a preheating unit 1a (a coil of a motor) provided in the compressor 1. Interrupting a phase of a motor drive signal from the outdoor control device 100 causes the coil itself to generate heat without rotating the motor. The preheating operation capability of the outdoor unit 10 preheats the compressor 1 when the outside temperature is equal to or lower than a predetermined temperature, for example.

[0067] According to the multi-type air conditioner configured as described above, the preheating operation capability of the outdoor unit 10 makes it possible to preheat the compressor 1 while the outdoor unit 10 is out of operation, so that, even when the compressor 1 of the outdoor unit 10 is put into operation, for powerful operation, at a rotational speed higher than the maximum rotational speed applied at the start of normal operation, preheating a lubricating oil in the compressor 1 to increase lubricating performance makes it possible to prevent the compressor 1 from running out of oil.

[0068] Note that, according to the second embodiment, the preheating unit 1a that preheats the compressor 1 is the coil of the motor in the compressor 1, or alternatively, the preheating unit may include a heater provided in the compressor 1 or the like.

[0069] According to the first and second embodiments, the multi-type air conditioner including the low-capacity indoor unit 20C and the other indoor units 20A, 20B has been described, but, for example, the present invention may be applied to a multi-type air conditioner including a plurality of low-capacity indoor units or a multi-type air conditioner including one other indoor unit, or three or more other indoor units.

[0070] The foregoing description concerns specific embodiments of the present disclosure; however, the present disclosure is not limited to the first and second embodiments, and various modifications and variations may be made within the scope of the present disclosure. For example, an appropriate combination of the configurations described in the first and second embodiments may be regarded as an embodiment of the present disclosure.

REFERENCE SIGNS LIST

[0071]

1	compressor
1a	preheating unit
2	four-way switching valve
3	outdoor heat exchanger
4A, 4B, 4C	indoor heat exchanger
5A, 5B, 5C	indoor fan
6	accumulator
7A, 7B, 7C	refrigerant pipe connection part
8A, 8B, 8C	refrigerant pipe connection part
10	outdoor unit
11	discharge pipe temperature sensor
12	outdoor heat exchanger temperature sensor
13	outdoor temperature sensor
15A, 15B, 15C	indoor heat exchanger temperature sensor
16A, 16B, 16C	indoor temperature sensor
20A, 20B	indoor unit

20C	low-capacity indoor unit
100	outdoor control device
100a	operation control unit
100b	communication unit
200	indoor control device
200a	operation control unit
200b	communication unit
EVA, EVB, EVC	electrically powered expansion valve

Claims

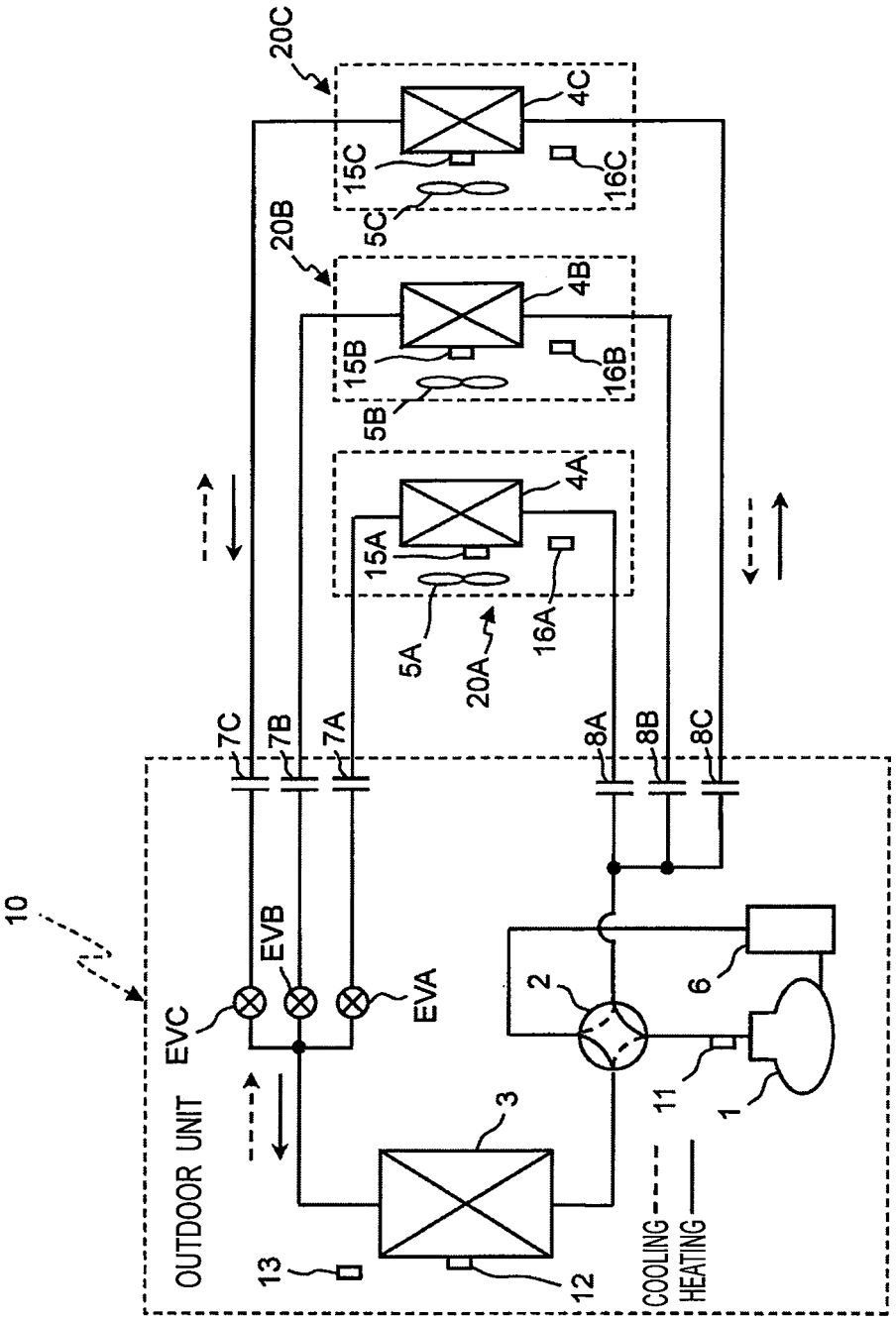
1. An air conditioner comprising:

an outdoor unit (10) to which a plurality of indoor units (20A to 20C) are connectable,
wherein at least one of the plurality of indoor units (20A to 20C) to be connected to the outdoor unit (10) is a low-capacity indoor unit (20C) lower in capacity than the other indoor units (20A, 20B), and
when the low-capacity indoor unit (20C) is put into powerful operation with a capacity higher than a maximum capacity in normal operation, a compressor (1) of the outdoor unit (10) is started at a rotational speed higher than a maximum rotational speed applied at start of the normal operation.

2. The air conditioner according to claim 1, wherein the outdoor unit (10) has a preheating operation capability of preheating the compressor (1) while the outdoor unit (10) is out of operation.

3. The air conditioner according to claim 1 or 2, wherein the low-capacity indoor unit (20C) takes precedence in capacity over the other indoor units (20A, 20B) during the powerful operation.

4. The air conditioner according to any one of claims 1 to 3, wherein the low-capacity indoor unit (20C) has a rated cooling capacity of less than 2.2 kW.


20C
4C
15C
16C
5C
20B
4B
15B
16B
5B
4A
15A
5A
20A
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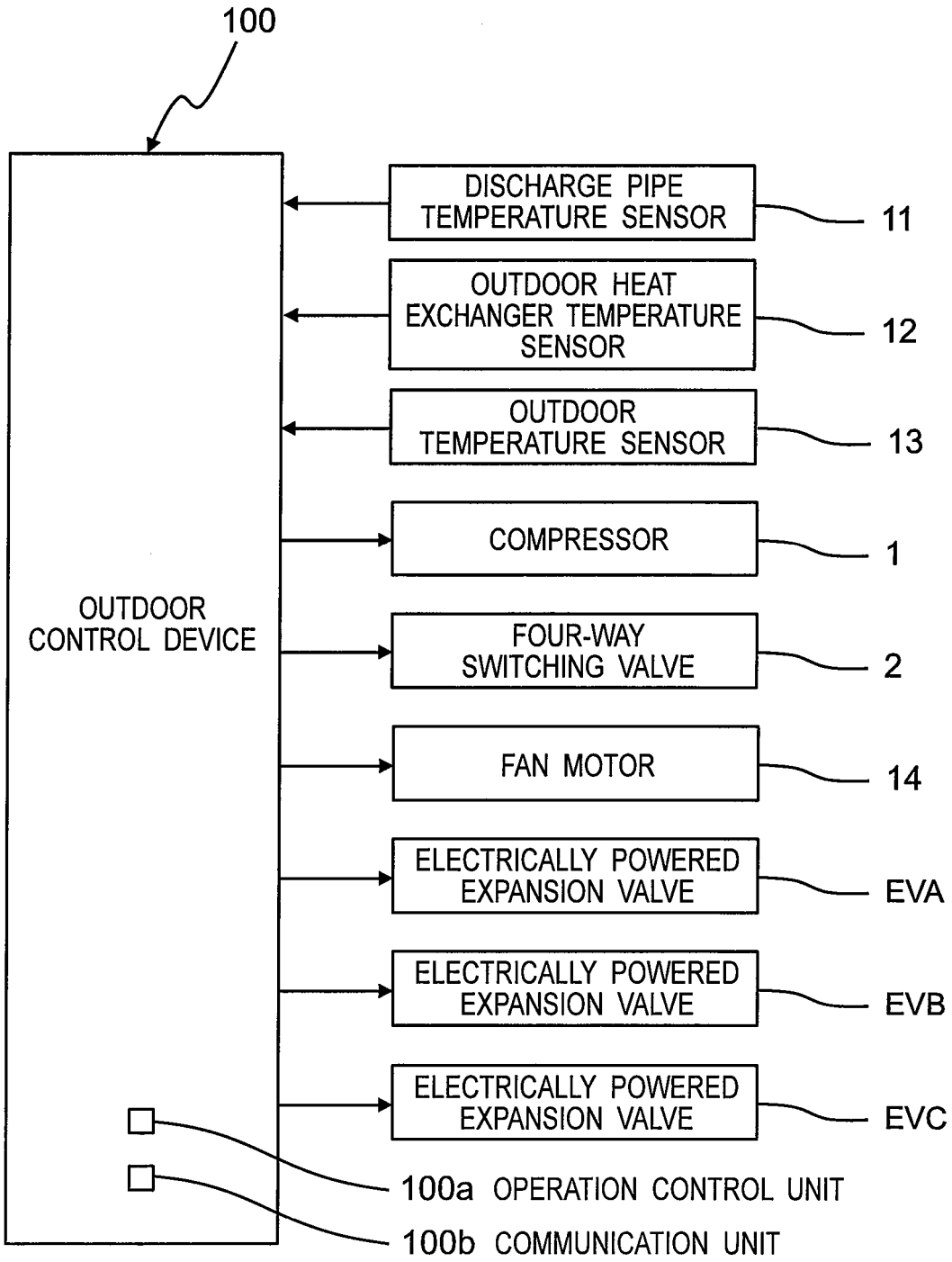
7C
7B
7A
8A
8B
8C
10
EVB
EVC
EVA
2
6
3
11
1
13
12
OUTDOOR UNIT
COOLING
HEATING

Fig.1

Fig.2


100
OUTDOOR CONTROL DEVICE
DISCHARGE PIPE TEMPERATURE SENSOR
11
OUTDOOR HEAT EXCHANGER TEMPERATURE SENSOR
12
OUTDOOR TEMPERATURE SENSOR
13
COMPRESSOR
1
FOUR-WAY SWITCHING VALVE
2
FAN MOTOR
14
ELECTRICALLY POWERED EXPANSION VALVE
EVA
ELECTRICALLY POWERED EXPANSION VALVE
EVB
ELECTRICALLY POWERED EXPANSION VALVE
EVC
100a OPERATION CONTROL UNIT
100b COMMUNICATION UNIT

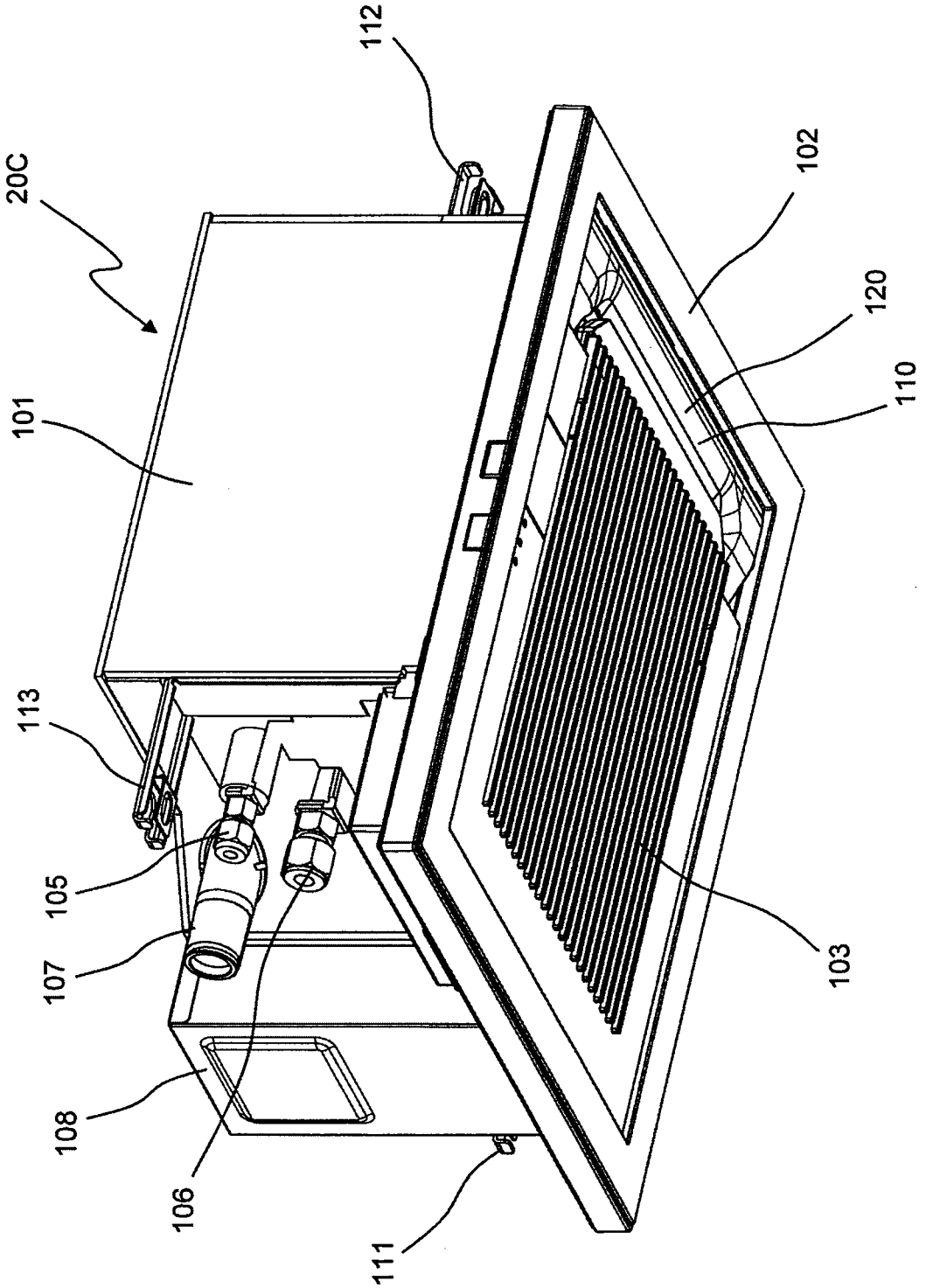


Fig.3

Fig.4

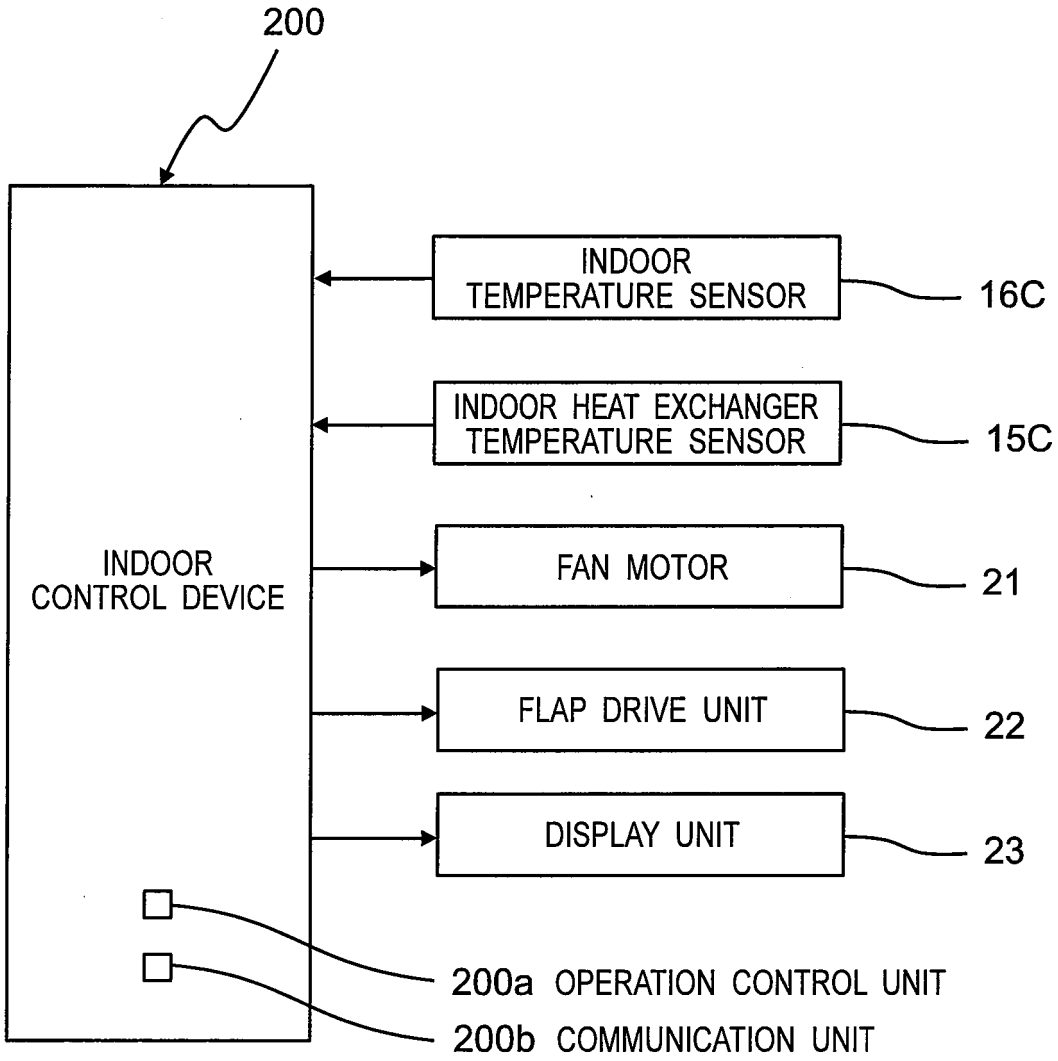

200
INDOOR CONTROL DEVICE
INDOOR TEMPERATURE SENSOR
16C
INDOOR HEAT EXCHANGER TEMPERATURE SENSOR
15C
FAN MOTOR
21
FLAP DRIVE UNIT
22
DISPLAY UNIT
23
200a OPERATION CONTROL UNIT
200b COMMUNICATION UNIT

Fig.5

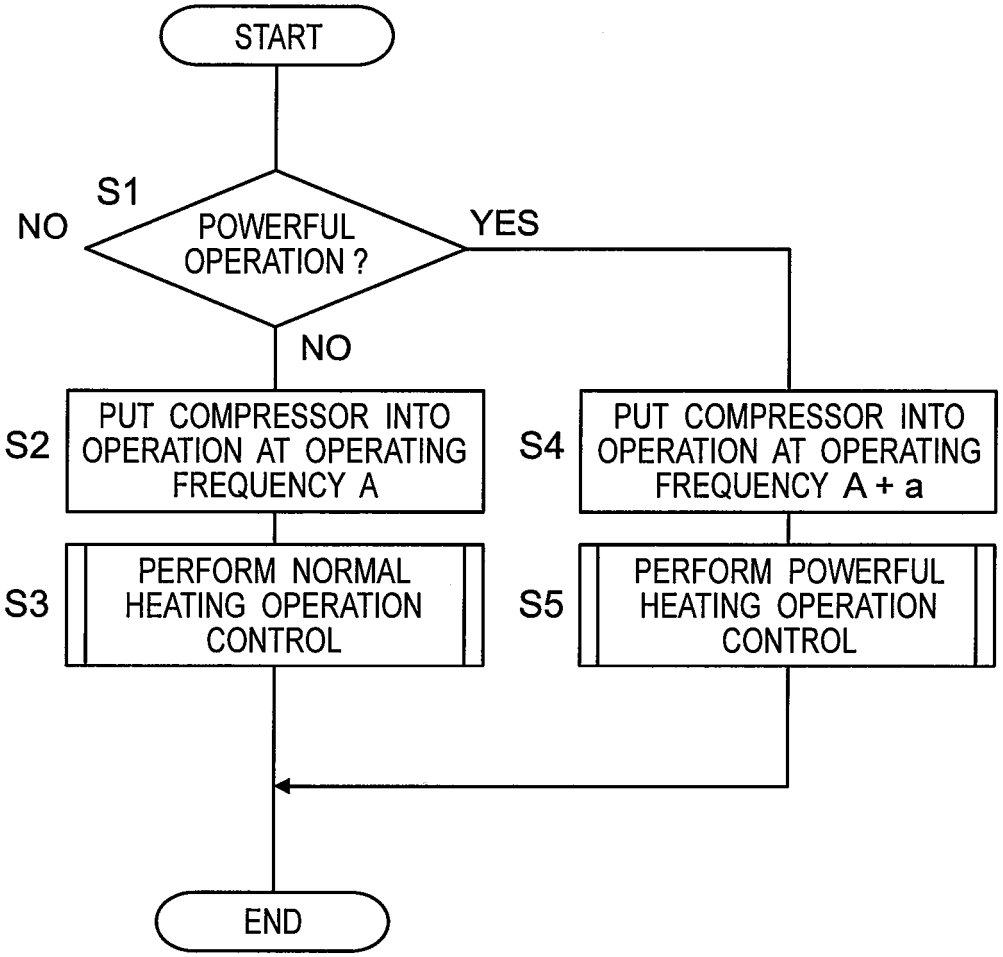
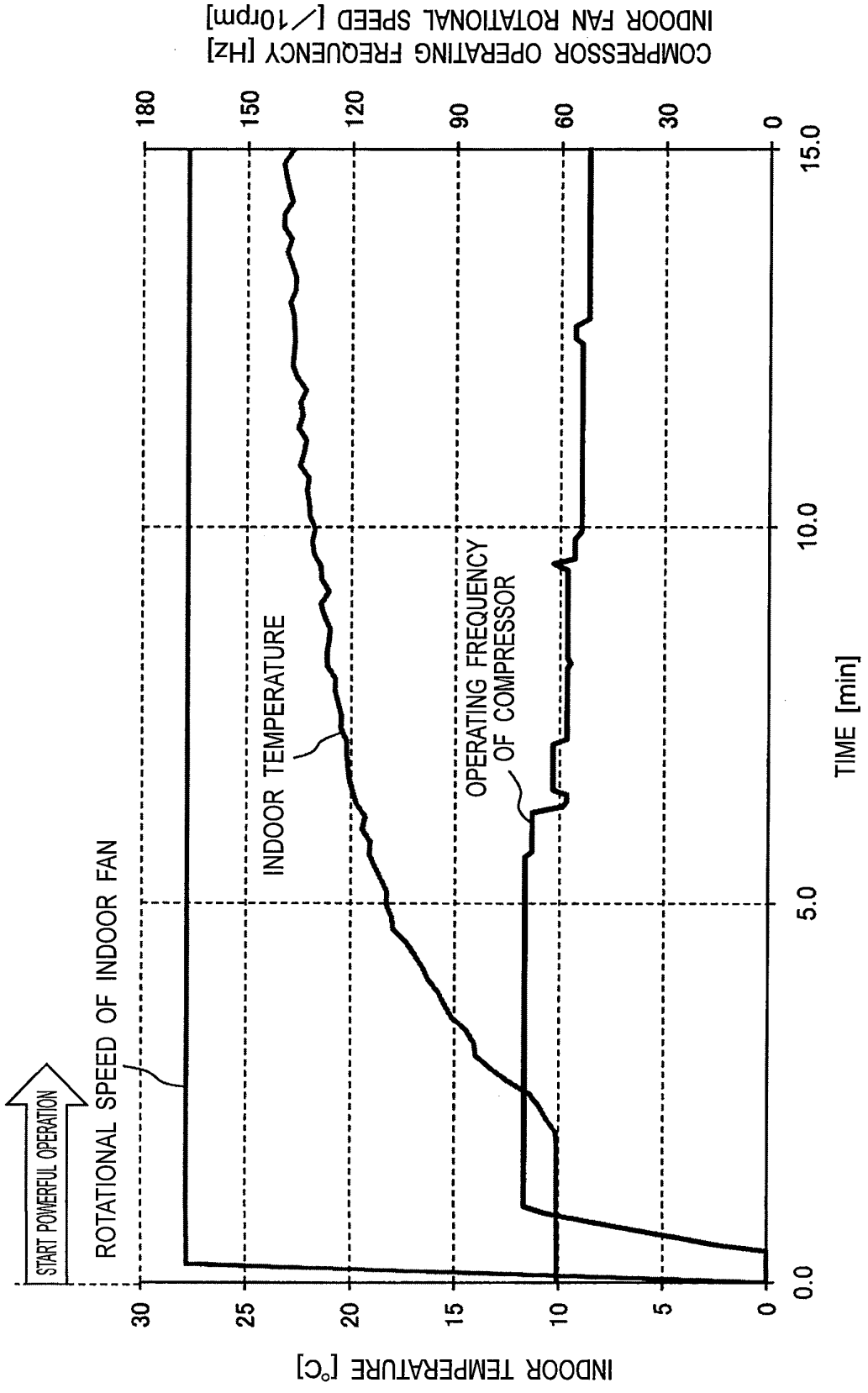

START
S1
POWERFUL OPERATION ?
NO
YES
NO
S2
PUT COMPRESSOR INTO OPERATION AT OPERATING FREQUENCY A
S3
PERFORM NORMAL HEATING OPERATION CONTROL
S4
PUT COMPRESSOR INTO OPERATION AT OPERATING FREQUENCY A + a
S5
PERFORM POWERFUL HEATING OPERATION CONTROL
END

Fig.6


INDOOR TEMPERATURE [°C]
COMPRESSOR OPERATING FREQUENCY [Hz]
INDOOR FAN ROTATIONAL SPEED [/10rpm]
TIME [min]
START POWERFUL OPERATION
ROTATIONAL SPEED OF INDOOR FAN
INDOOR TEMPERATURE
OPERATING FREQUENCY OF COMPRESSOR
0
5
10
15
20
25
30
0
30
60
90
120
150
180
0.0
5.0
10.0
15.0

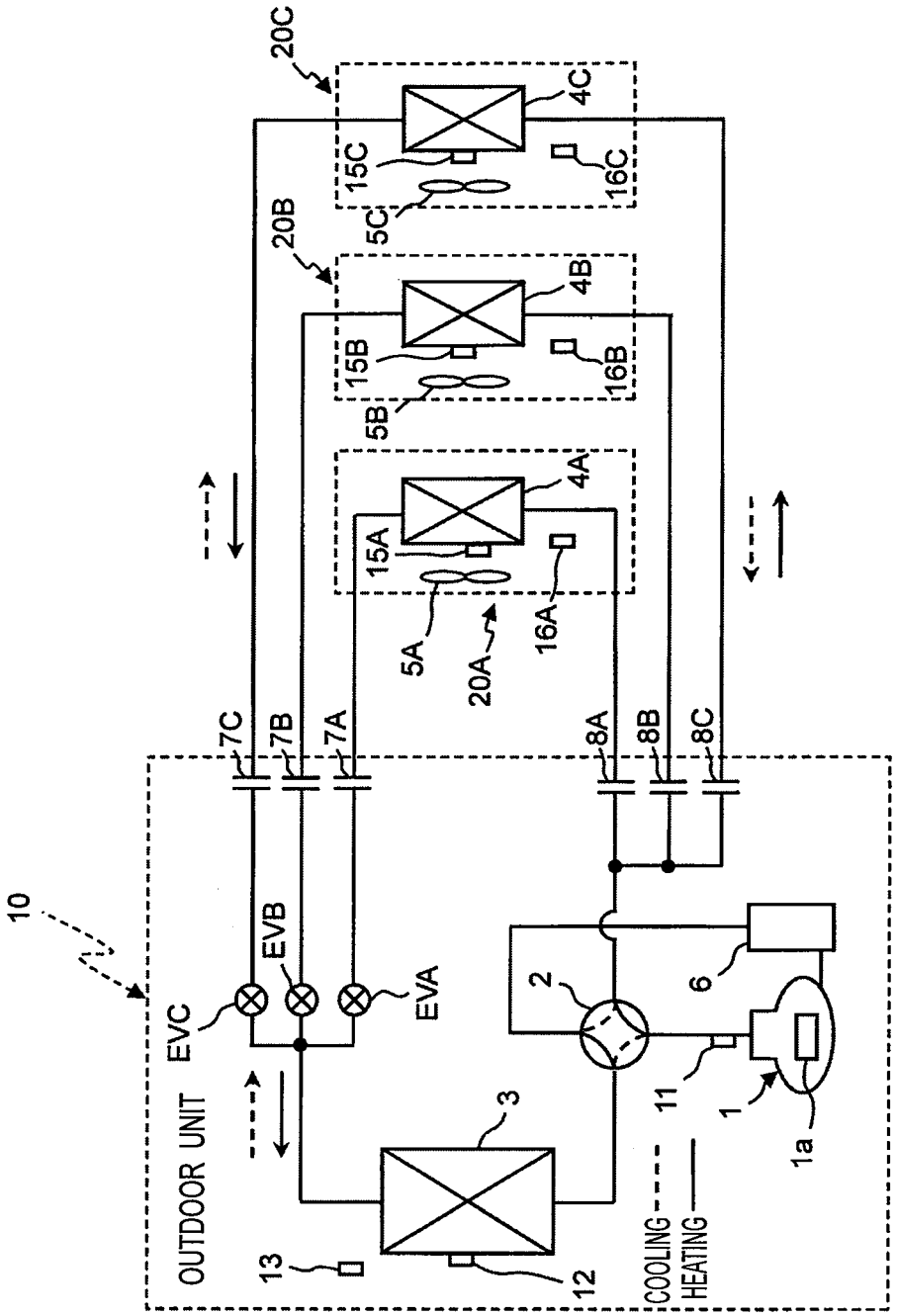

20C
4C
15C
16C
5C
20B
4B
15B
16B
5B
4A
15A
5A
20A
16A
7C
7B
7A
8A
8B
8C
10
EVB
EVC
EVA
2
6
3
11
1
1a
13
12
OUTDOOR UNIT
COOLING
HEATING

Fig.7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/000444

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. F24F11/86(2018.01)i, F24F11/88(2018.01)i, F25B1/00(2006.01)i, F25B13/00(2006.01)i, F24F140/00(2018.01)n

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. F24F11/00-11/89, F25B13/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 9-145130 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 06 June 1997, paragraphs [0037]-[0055], [0063]-[0067], fig. 1, 2 (Family: none)	1 2-4
Y	JP 2001-248877 A (DAIKIN INDUSTRIES, LTD.) 14 September 2001, paragraphs [0002]-[0019] (Family: none)	2-4

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search 29.01.2019	Date of mailing of the international search report 12.02.2019
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H8271017 A **[0002] [0003]**