(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 855 089 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
**28.07.2021 Bulletin 2021/30**

(21) Application number: **18934249.6**

(22) Date of filing: **20.09.2018**

(51) Int Cl.:
***F24F 11/86*** *(2018.01)* ***F24F 11/74*** *(2018.01)*
***F25B 13/00*** *(2006.01)*

(86) International application number:
**PCT/JP2018/034819**

(87) International publication number:
**WO 2020/059077 (26.03.2020 Gazette 2020/13)**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA ME**
Designated Validation States:
**KH MA MD TN**

(71) Applicant: **Toshiba Carrier Corporation**
**Kawasaki-Shi,**
**Kanagawa 212-8585 (JP)**

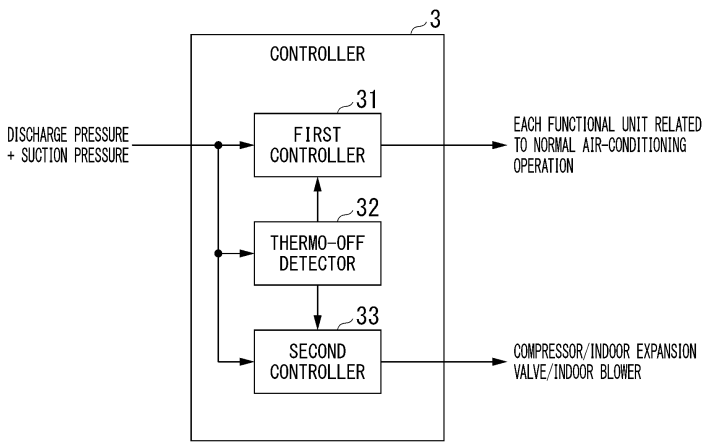
(72) Inventors:
- **IUCHI Akira**
  **Fuji-shi, Shizuoka 416-8521 (JP)**
- **MIURA Ken**
  **Fuji-shi, Shizuoka 416-8521 (JP)**
- **IMATO Naoki**
  **Fuji-shi, Shizuoka 416-8521 (JP)**
- **NAGAI Hiroyuki**
  **Fuji-shi, Shizuoka 416-8521 (JP)**

(74) Representative: **Gramm, Lins & Partner**
**Patent- und Rechtsanwälte PartGmbB**
**Theodor-Heuss-Straße 1**
**38122 Braunschweig (DE)**

# (54) AIR CONDITIONER AND CONTROL METHOD

(57) An air conditioner of the embodiment includes one or a plurality of indoor units, one or a plurality of outdoor units, a thermo-off detector, and a controller. The one or plurality of indoor units include an indoor expansion valve and an indoor blower. The one or plurality of outdoor units include a compressor. The thermo-off detector detects the thermo-off of the one or plurality of indoor units at the time of the heating operation. The controller controls an operation of the compressor and an operation of an indoor expansion valve or an indoor blower of the one or plurality of indoor units, on the basis of a result of the detection of the thermo-off, when there is an indoor unit which does not performing the heating operation, among the one or plurality of indoor units.

FIG. 2




EP 3 855 089 A1

## Description

[Technical Field]

**[0001]** An embodiment of the present invention relates to an air conditioner and a control method.

[Background Art]

**[0002]** As one type of an air conditioner, there is a multi-type air conditioner in which a plurality of indoor units are connected to a single outdoor unit. The multi-type air conditioner can collectively perform air-conditioning in a plurality of spaces, by a plurality of indoor units being installed in the plurality of spaces in a dispersed manner. In such a multi-type air conditioner, in some cases, some of the indoor units may enter a state of not performing a heating operation (hereinafter referred to as a "non-heating state") when an overall heating operation is being performed, and a minute amount of refrigerant circulates in the indoor unit in a non-heating state. In the related art, when an indoor blower is driven in such a case, there is a likelihood that the refrigerant will be condensed by heat exchange due to discharging of warm air, and the required amount of gas refrigerant may be insufficient.

[Citation List]

[Patent Literature]

[Patent Literature 1]

**[0003]** Japanese Patent No. 3778117

[Summary of Invention]

[Technical Problem]

**[0004]** An object of the present invention is to provide an air conditioner and a control method capable of curbing warm air being blown off from an indoor unit that is not performing a heating operation in a multi-type air conditioner that is performing a heating operation.

[Solution to Problem]

**[0005]** An air conditioner of the embodiment includes one or a plurality of indoor units, one or a plurality of outdoor units, a thermo-off detector, and a controller. The one or plurality of indoor units include an indoor expansion valve and an indoor blower. The one or plurality of outdoor units include a compressor. The thermo-off detector detects the thermo-off of the one or plurality of indoor units at the time of a heating operation. The controller controls an operation of the compressor and an operation of an indoor expansion valve or an indoor blower of the one or plurality of indoor units, on the basis of a result of the detection of the thermo-off, when there is an indoor unit which is not performing a heating operation, among the one or plurality of indoor units.

[Brief Description of Drawings]

**[0006]**

Fig. 1 is a diagram showing a configuration example of the multi-type air conditioner (100) of the embodiment.
Fig. 2 is a diagram showing a specific example of a functional configuration of a controller (3) in the embodiment.
Fig. 3 is a flowchart showing a specific example of a process in which the controller (3) controls an intermittent operation of an indoor blower (13) in the multi-type air conditioner (100) of the embodiment.
Fig. 4 is a flowchart showing a specific example of a process in which the controller (3) controls the intermittent operation of the indoor blower (13) in the multi-type air conditioner (100) of the embodiment.
Fig. 5 is a flowchart showing a specific example of a process in which the controller (3) controls the intermittent operation of the indoor blower (13) in the multi-type air conditioner (100) of the embodiment.

[Description of Embodiments]

**[0007]** Hereinafter, an air conditioner and a control method of the embodiment will be described with reference to the drawings.

**[0008]** Fig. 1 is a diagram showing a configuration example of a multi-type air conditioner 100 of the embodiment. As shown in Fig. 1, the multi-type air conditioner 100 of the embodiment includes, for example, a first indoor unit 1A, a second indoor unit 1B, a third indoor unit 1C, and an outdoor unit 2, which are four indoor units, and a controller 3. The first indoor unit 1A, the second indoor unit 1B, and the third indoor unit 1C are connected to the outdoor unit 2 via a crossover pipe.

**[0009]** In the present embodiment, a configuration of the first indoor unit 1A, a configuration of the second indoor unit 1B, and a configuration of the third indoor unit 1C are the same. Therefore, the configurations of these three indoor units 1 will be described by taking the first indoor unit 1A as an example, and a description of the second indoor unit 1B and the third indoor unit 1C will not be provided.

**[0010]** Further, hereinafter, each constituent of the first indoor unit 1A is identified by adding a letter "A" to a common reference numeral. Similarly, each configuration of the second indoor unit 1B is identified by adding a letter "B" to a common reference numeral, and each configuration of the third indoor unit 1C is identified by adding a letter "C". Further, hereinafter, when the first indoor unit 1A, the second indoor unit 1B, and the third indoor unit 1C are not particularly distinguished, the letters "A", "B" and "C" are not added, and each common

configuration is represented by common reference numerals.

**[0011]** The first indoor unit 1A is equipped with an indoor heat exchanger 11A, an indoor expansion valve 12A, an indoor blower 13A, and a room temperature measuring device 14A. The indoor heat exchanger 11A is a device that realizes a heat exchange between the refrigerant and the indoor air. The indoor heat exchanger 11A is connected to the indoor expansion valve 12A by an indoor pipe. For example, the indoor heat exchanger 11A is a fin tube type heat exchanger.

**[0012]** The indoor expansion valve 12A is a device that expands the refrigerant. For example, the indoor expansion valve 12A is an electronic expansion valve (PMV: Pulse Motor Valve) in which an opening degree can be changed. For example, as the opening degree of the indoor expansion valve 12A is increased, the refrigerant flows more easily in the indoor expansion valve 12A, and as the opening degree of the indoor expansion valve 12A is decreased, the refrigerant flows less easily in the indoor expansion valve 12A.

**[0013]** The indoor blower 13A is a blower for promoting heat exchange by the indoor heat exchanger 11A. For example, the indoor blower 13A has a centrifugal fan. The fan of the indoor blower 13A is disposed to face the indoor heat exchanger 11A.

**[0014]** The room temperature measuring device 14A is a device for measuring the room temperature in the vicinity of the indoor heat exchanger 11A. The room temperature measuring device 14A is communicatively connected to the controller 3, and transmits measurement data to the controller 3.

**[0015]** The outdoor unit 2 is equipped with an outdoor heat exchanger 21, a four-way valve 22, a compressor 23, an outdoor expansion valve 24, an outdoor blower 25, a discharge pressure sensor 26, and a suction pressure sensor 27. The outdoor heat exchanger 21 is a device that realizes heat exchange between the refrigerant and the outdoor air. The outdoor heat exchanger 21 is connected to the four-way valve 22 and the outdoor expansion valve 24 by an outdoor pipe. For example, the outdoor heat exchanger 21 is a fin tube type heat exchanger.

**[0016]** The four-way valve 22 is a device that switches a circulation path of the refrigerant inside the multi-type air conditioner 100. Specifically, the four-way valve 22 switches the circulation path of refrigerant to either a heating operation path or a cooling operation or defrosting operation path. For example, Fig. 1 shows a situation in which the circulation path of the refrigerant is switched to the heating operation path by the four-way valve 22. The four-way valve 22 is connected to the indoor heat exchanger 11, the compressor 23, and the outdoor heat exchanger 21 by the outdoor pipe.

**[0017]** The compressor 23 is a device that compresses the refrigerant supplied from the first indoor unit 1A, the second indoor unit 1B or the third indoor unit 1C. The compressor 23 compresses the refrigerant sucked from the suction port SP, and discharges the compressed refrigerant from the discharge port DP. The refrigerant compressed by the compressor 23 is sent to the indoor heat exchanger 11 or the outdoor heat exchanger 21 by the four-way valve 22. An accumulator 231 for storing the liquid refrigerant is attached to the suction port SP of the compressor 23.

**[0018]** The outdoor expansion valve 24 is a device that expands the refrigerant. For example, the outdoor expansion valve 24 may be an electronic expansion valve (PMV) similar to the indoor expansion valve 12A. The outdoor expansion valve 24 is connected to the outdoor heat exchanger 21 and the indoor expansion valve 12 by the outdoor pipe.

**[0019]** The outdoor blower 25 is a blower for promoting the heat exchange by the outdoor heat exchanger 21. For example, the outdoor blower 25 has a centrifugal fan similar to the indoor blower 13, and is disposed to face the outdoor heat exchanger 21.

**[0020]** The discharge pressure sensor 26 is a device that measures the pressure of the refrigerant discharged from the compressor 23 (hereinafter referred to as a "discharge pressure"). Specifically, the discharge pressure sensor 26 measures the discharge pressure of the refrigerant at the discharge port DP of the compressor 23. The discharge pressure sensor 26 is communicably connected to the controller 3 and transmits the measurement data to the controller 3.

**[0021]** The suction pressure sensor 27 is a device that measures the pressure of the refrigerant sucked into the compressor 23 (hereinafter referred to as a "suction pressure"). Specifically, the suction pressure sensor 27 detects the suction pressure of the refrigerant at the suction port SP of the compressor 23. The suction pressure sensor 27 is communicably connected to the controller 3 and transmits the measurement data to the controller 3.

**[0022]** The controller 3 has a function of controlling the operations of the first indoor unit 1A, the second indoor unit 1B, the third indoor unit 1C, and the outdoor unit 2. For example, the controller 3 is equipped with a central processing unit (CPU), a memory, an auxiliary storage device, and the like connected by a bus, and executes a program. The controller 3 functions as a functional unit equipped with a first controller 31, a thermo-off detector 32, and a second controller 33, which will be described later, by executing a program, and controls the operations of the first indoor unit 1A, the second indoor unit 1B, the third indoor unit 1C, and the outdoor unit 2 by communication performed via a bus.

**[0023]** All or a part of each function of the controller 3 may be realized, using hardware such as an application specific integrated circuit (ASIC), a programmable logic device (PLD), or a field programmable gate array (FPGA). The program may be recorded on a computer-readable recording medium. The computer-readable recording medium is, for example, a portable medium such as a flexible disk, a magneto-optical disk, a ROM or a CD-ROM, or a storage device such as a hard disk built into

a computer system. The program may be transmitted via a telecommunication line.

**[0024]** Fig. 2 is a diagram showing a specific example of the functional configuration of the controller 3 in the embodiment. The controller 3 is equipped with a first controller 31, a thermo-off detector 32, and a second controller 33. The first controller 31 has a function of controlling an air-conditioning operation during normal operation by the first indoor unit 1A, the second indoor unit 1B, the third indoor unit 1C, and the outdoor unit 2 (hereinafter referred to as a "normal control function"). The normal air-conditioning operation referred to herein means the operations of heating, cooling, blowing, defrosting, and the like, which are provided in a conventional air conditioner, and the normal control function includes a function of stopping the indoor unit 1 in which a room temperature has reached a set temperature at the time of the heating operation. In general, stoppage of the indoor unit 1 in which the room temperature has reached the set temperature at the time of the heating operation is referred to as a "thermo-off".

**[0025]** The thermo-off detector 32 has a function of detecting the thermo-off of the first indoor unit 1A, the second indoor unit 1B, and the third indoor unit 1C on the basis of the discharge pressure of the compressor 23 measured by the discharge pressure sensor 26 and the suction pressure of the compressor 23 measured by the suction pressure sensor 27. The thermo-off detector 32 notifies the first controller 31 and the second controller 33 of the detection result. Further, the thermo-off may be detected when the room temperature measured by the room temperature measuring device 14 reaches the set temperature.

**[0026]** The second controller 33 has a function of controlling the blowing operation of the indoor unit 1 in the multi-type air conditioner 100 that performs the heating operation as a whole. Specifically, the second controller 33 controls the operations of the indoor expansion valve 12, the indoor blower 13, and the compressor 23 of each indoor unit 1 on the basis of a result of the detection of thermo-off of each indoor unit 1.

**[0027]** Figs. 3, 4 and 5 are flowcharts showing a specific example of the process in which the controller 3 controls the intermittent operation of the indoor blower 13 in the multi-type air conditioner 100 of the embodiment. First, a case is assumed in which the first controller 31 causes the first indoor unit 1A, the second indoor unit 1B, the third indoor unit 1C, and the outdoor unit 2 to start the heating operation (step S101), and after that, the blowing operation is set for any of the indoor units 1. Here, it is assumed that the blowing operation is set for the third indoor unit 1C (step S 102). Even if the cooling operation is set in step S102, the indoor fan performs the blowing operation.

**[0028]** In this case, the second controller 33 determines whether the blowing operation at the time of the heating operation is permitted for the third indoor unit 1C (step S103). Here, when the blowing operation at the time of the heating operation is not permitted for the third indoor unit 1C (step S103-NO), the second controller 33 opens the indoor expansion valve 12C of the third indoor unit 1C by a minute amount (step S104: micro-opening), and stops the indoor blower 13C (step S105: OFF). On the other hand, when the blowing operation at the time of the heating operation is permitted for the third indoor unit 1C (step S103-YES), the second controller 33 closes the indoor expansion valve 12C of the third indoor unit 1C (step S106: closing), and operates the indoor blower 13C (step S107: ON).

**[0029]** The reason why the indoor expansion valve 12C is closed in step S106 is to suppress the warm air from being blown off from the third indoor unit 1C by the operation of the indoor blower 13C. However, it is not always necessary to close the indoor expansion valve 12C when allowing the warm air to be blown off at the time of the blowing operation.

**[0030]** Further, whether the blowing operation at the time of the heating operation is permitted for the third indoor unit 1C may be determined by any method. For example, the second controller 33 may store information indicating permission or disapproval of the blowing operation for the third indoor unit 1C in advance, and determine whether the blowing operation is permitted by referring to the information.

**[0031]** Subsequently, the thermo-off detector 32 determines whether the first indoor unit 1A is in the thermo-off state (step S108). Specifically, the thermo-off detector 32 determines the presence or absence of thermo-off on the basis of the suction pressure and the discharge pressure of the compressor 23. When it is determined that the first indoor unit 1A is in the thermo-off state (step S108-YES), the thermo-off detector 32 determines whether the second indoor unit 1B is in the thermo-off state (step S109).

**[0032]** Here, when it is determined that the second indoor unit 1B is in the thermo-off state (step S109-YES), the second controller 33 stops the compressor 23 (step S110: OFF), closes the indoor expansion valve 12A (step S111), and then causes the indoor blower 13A to execute an intermittent blowing operation (step S112: intermittent operation). Subsequently, the second controller 33 closes the indoor expansion valve 12B (step S113), and then causes the indoor blower 13B to intermittently execute the blowing operation (step S114: intermittent operation).

**[0033]** For example, in the intermittent operation, an operation of operating the indoor blower 13 at 300 rpm for 1 minute and then stopping the indoor blower 13 for 1 minute is repeated.

**[0034]** When the first indoor unit 1A and the second indoor unit 1B are in the thermo-off state by the processing so far, the compressor 23 is stopped, the indoor expansion valves 12A and 12B are closed, and then the intermittent operation of the indoor blowers 13A and 13B is performed. By such a process, it is possible to suppress the warm air from being blow off from the first indoor unit 1A and the second indoor unit 1B in the non-heating state.

**[0035]** On the other hand, when it is determined in step S109 that the second indoor unit 1B is not in the thermo-off state (step S109-NO), the second controller 33 operates the compressor 23 (step S115: ON), opens the indoor expansion valve 12B by a minute amount (step S 116: minute opening), and then causes the indoor blower 13A to execute an intermittent blowing operation (step S117: intermittent operation). Subsequently, the first controller 31 controls the indoor expansion valve 12B and the indoor blower 13B by the normal control function (steps S118 and S119).

**[0036]** By the processing so far, when the first indoor unit 1A is in the thermo-off state and the second indoor unit 1B is not in the thermo-off state, in a state in which the compressor 23 is not stopped and the indoor expansion valve 12A is opened by a minute amount (for example, 30 pulse), the intermittent operation of the indoor blower 13A is performed. Further, in this case, the second indoor unit 1B is controlled in the same manner as in the normal state. By such a process, it is possible to suppress the warm air from being blown off from the first indoor unit 1A in the non-heated state.

**[0037]** On the other hand, in step S 108, when it is determined that the first indoor unit 1A is not in the thermo-off state (step S 108-NO), the second controller 33 operates the compressor 23 (step S120), and then the first controller 31 controls the indoor expansion valve 12A and the indoor blower 13A by a normal control function (steps S121 and S122).

**[0038]** Subsequently, the thermo-off detector 32 determines whether the second indoor unit 1B is in the thermo-off state (step S123). Here, when it is determined that the second indoor unit 1B is in the thermo-off state (step S123-YES), the second controller 33 opens the indoor expansion valve 12B by a minute amount (step S 124: minute opening), and causes the indoor blower 13B to execute an intermittent blowing operation (step S125: intermittent operation).

**[0039]** By the processing so far, when the first indoor unit 1A is not in the thermo-off state and the second indoor unit 1B is in the thermo-off state, the compressor 23 is not stopped and the first indoor unit 1A is controlled in the same manner as in the normal state. Further, in this case, the intermittent operation of the indoor blower 13B is performed in the state in which the indoor expansion valve 12B is opened by a minute amount (for example, 30 pulses). By such a process, it is possible to prevent the warm air from being blown off from the second indoor unit 1B in the non-heated state.

**[0040]** On the other hand, in step S 123, when it is determined that the second indoor unit 1B is not in the thermo-off state (step S123-NO), the first controller 31 controls the indoor expansion valve 12B and the indoor blower 13B by the normal control function (steps S126, and S127).

**[0041]** When the first indoor unit 1A and the second indoor unit 1B are not in the thermo-off state by the processing so far, the compressor 23 is not stopped, and the first indoor unit 1A and the second indoor unit 1B are controlled in the same manner as in the normal state.

**[0042]** Further, the second controller 33 determines whether all the indoor units 1 are in the non-heating state (step S 128), and when it is determined that any of the indoor units 1 is not in the non-heating state (step S128-NO), the process returns to step S103, and when it is determined that all the indoor units 1 are in the non-heated state, the process is terminated.

**[0043]** The multi-type air conditioner 100 of the embodiment configured in this way the can suppress the warm wind from being blown off from the indoor unit 1 which is in the non-heated state at the time of the heating operation, by intermittently operating the indoor blower 13 depending on the thermo-off state of the indoor unit 1.

**[0044]** In general, a multi-type air conditioner can collectively perform air-conditioning of a plurality of spaces, by installing a plurality of indoor units in a plurality of spaces in a dispersed manner. In such a multi-type air conditioner, all connected indoor units are not always in operation. For example, in some cases, some indoor units may stop the operation by manipulation of the user, or may be temporarily stopped by the thermo-off. In this case, it is not necessary to circulate the refrigerant in the indoor unit which is originally in the non-heated state or the thermo-off state. However, in the non-heating state or the thermo-off state at the time of the heating operation, in some cases, a minute amount of refrigerant may be circulated in the indoor unit to suppress an occurrence of problems due to liquid accumulation.

**[0045]** On the other hand, the air conditioner is generally equipped with a room temperature sensor. Therefore, in general, the air conditioner can control the space to be air-conditioned to a comfortable temperature, by controlling each component to be provided on the basis of the room temperature. When trying to measure the room temperature for the purpose of such a control, in order to prevent the room temperature sensor of the indoor unit of the thermo-off state from being affected by the temperature of the indoor heat exchanger, the indoor air may be taken into the indoor unit to detect the room temperature. Therefore, even in the indoor unit of the thermo-off state, the indoor blower is often driven when measuring the room temperature.

**[0046]** Further, in such a multi-type air conditioner, the indoor blower may be driven at the same time in a plurality of indoor units which is in the thermo-off state. Further, in this case, a minute amount of refrigerant may be circulated in the plurality of indoor units which is in the thermo-off state, due to the above-mentioned reason or the like, and in such a case, when the indoor blower is driven, the refrigerant is condensed. When this occurs in the plurality of indoor units at the same time, when a rotation speed of the indoor blower is high and an air volume is large, or when a large amount of refrigerant is flowing, the condensation amount of refrigerant increases, and a sudden drop of the pressure, refrigerant shortage or the like is likely to occur.

**[0047]** Further, in such a multi-type air conditioner, when any indoor unit is performing the heating operation, the cooling operation or the blowing operation may be set in another indoor unit. In such a case, since the flow of the refrigerant differs between the cooling operation and the heating operation, even if such a setting is made, the cooling operation and the heating operation cannot be performed at the same time.

**[0048]** In this way, in the multi-type air conditioner, when the heating operation is performed as a whole, the cooling operation or the blowing operation may be set in the indoor unit that is not performing the heating operation, and in such a case, a minute amount of refrigerant may be circulated to the indoor units. Further, in such a case, when the indoor blower is driven in the indoor units, there is a likelihood that the condensation amount of refrigerant in the indoor unit may increase, and the refrigerant shortage may be likely to occur.

**[0049]** According to at least one embodiment described above, by including the thermo-off detector which detects the thermo-off of one or a plurality of indoor units at the time of the heating operation, and the controller which controls the operation of the compressor and the operation of the indoor expansion valve or the indoor blower of the one or plurality of indoor units, on the basis of a result of the detection of the thermo-off, when there is an indoor unit which does not performing the heating operation, among the one or plurality of indoor units, it is possible to suppress the warm air from being blow off from the indoor unit that does not perform the heating operation, in the multi-type air conditioner at the time of the heating operation.

**[0050]** The number of indoor units 1 included in the multi-type air conditioner 100 may be one or more, and does not necessarily need to be three. The number of outdoor units 2 included in the multi-type air conditioner 100 may be two or more, and does not necessarily need to be one.

**[0051]** Although some embodiments of the present invention have been described, these embodiments are presented as examples and are not intended to limit the scope of the invention. These embodiments can be implemented in various other forms, and various omissions, replacements, and changes can be made without departing from the gist of the invention. These embodiments and modifications thereof are included in the scope and gist of the invention as well as in the scope of the invention described in the claims and the equivalent scope thereof.

## Claims

**1.** An air conditioner comprising:

one or a plurality of indoor units including an indoor expansion valve and an indoor blower;
one or a plurality of outdoor units including a compressor;
a thermo-off detector which detects thermo-off of the one or plurality of indoor units at the time of a heating operation; and
a controller which controls an operation of the compressor and an operation of the indoor expansion valve or the indoor blower of the one or plurality of indoor units, on the basis of a result of the detection of the thermo-off, when there is an indoor unit which is not performing the heating operation, among the one or plurality of indoor units.

**2.** The air conditioner according to claim 1, wherein the controller causes the indoor blower of the indoor unit, which is in a thermo-off state, to perform an intermittent blow operation.

**3.** The air conditioner according to claim 2, wherein the controller closes the indoor expansion valve of the indoor unit, which is in the thermo-off state, before executing the intermittent blowing operation.

**4.** The air conditioner according to any one of claims 1 to 3, wherein when indoor units in a thermo-off state and indoor units in a non-thermo-off state are mixed in the indoor units other than an indoor unit which is not performing a heating operation, the indoor expansion valve of the indoor unit which is in the thermo-off state is opened by a minute amount.

**5.** The air conditioner according to any one of claims 1 to 4, wherein the controller stops the operation of the compressor, when all the indoor units other than the indoor unit which is not performing the heating operation are in the thermo-off state.

**6.** The air conditioner according to any one of claims 1 to 5, wherein when the blowing operation has been made not to be permitted in advance for the indoor unit which is not performing the heating operation, the controller causes the indoor blower of the indoor unit to execute the blowing operation.

**7.** The air conditioner according to claim 6, wherein the controller closes the indoor expansion valve of the indoor unit, before causing the indoor unit which is not performing the heating operation to execute the blowing operation.

**8.** The air conditioner according to any one of claims 1 to 7, wherein when the blowing operation is not permitted in advance for the indoor unit which is not performing the heating operation, the controller stops the indoor blower of the indoor unit.

**9.** The air conditioner according to claim 8, wherein the controller opens the indoor expansion valve of the indoor unit by a minute amount, before stopping the

indoor blower of the indoor unit which is not performing the heating operation.

**10.** The air conditioner according to any one of claims 1 to 9, wherein the indoor unit which is not in the heating operation is an indoor unit in which the cooling operation or the blowing operation is set at the time of the heating operation of the air conditioner.

**11.** A control method of an air conditioner equipped with one or a plurality of indoor units including an indoor expansion valve and an indoor blower, and one or a plurality of outdoor units including a compressor, the control method comprising:

detecting thermo-off of the one or plurality of indoor units at the time of a heating operation; and controlling an operation of the compressor and an operation of the indoor expansion valve or the indoor blower of the one or plurality of indoor units, on the basis of a result of the detection of the thermo-off, when there is an indoor unit which does not performing the heating operation, among the one or plurality of indoor units.

FIG. 1

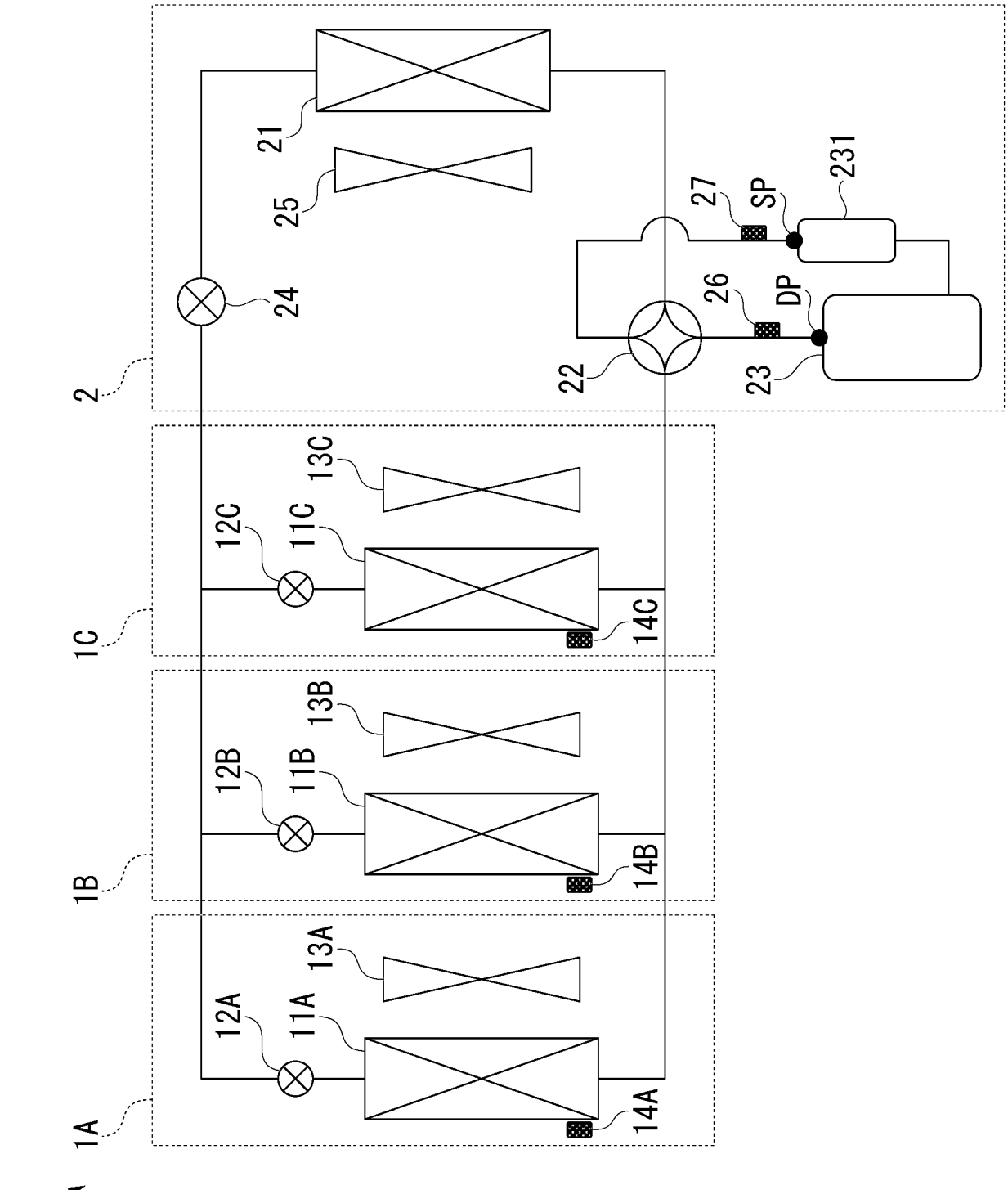

100
1A
1B
1C
2
11A
11B
11C
12A
12B
12C
13A
13B
13C
14A
14B
14C
21
22
23
24
25
26
27
231
SP
DP

FIG. 2

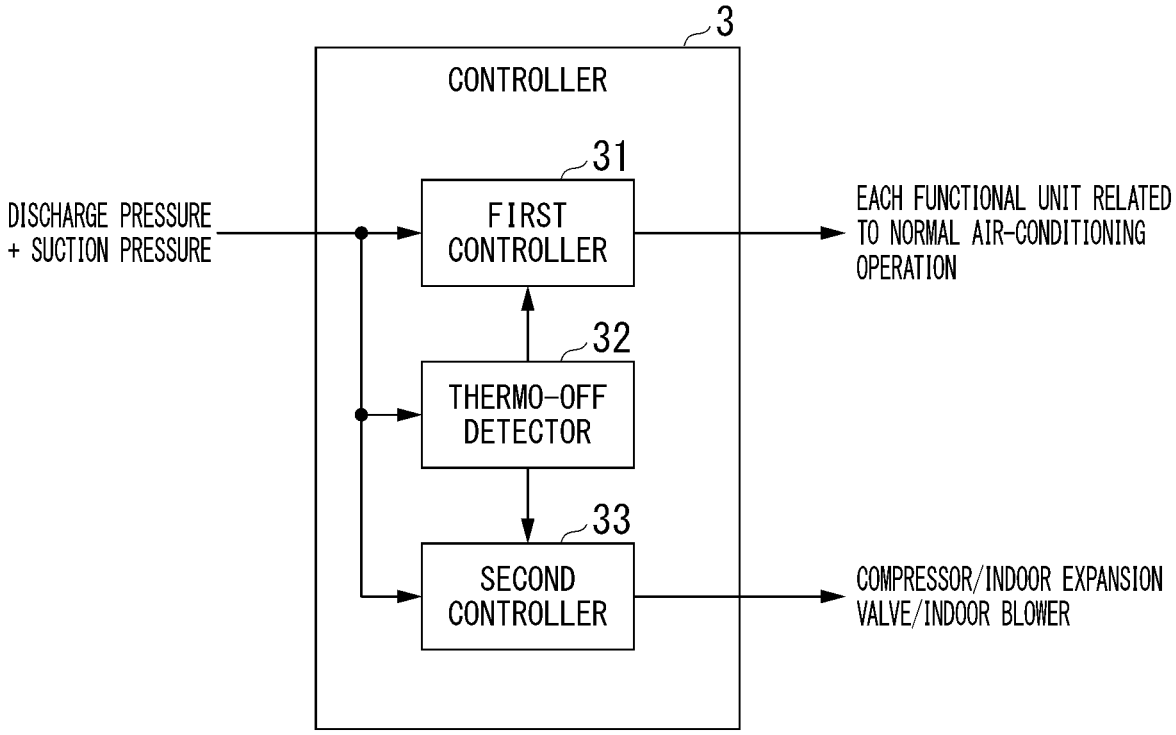

3
CONTROLLER
31
FIRST CONTROLLER
32
THERMO-OFF DETECTOR
33
SECOND CONTROLLER
DISCHARGE PRESSURE + SUCTION PRESSURE
EACH FUNCTIONAL UNIT RELATED TO NORMAL AIR-CONDITIONING OPERATION
COMPRESSOR/INDOOR EXPANSION VALVE/INDOOR BLOWER

FIG. 3

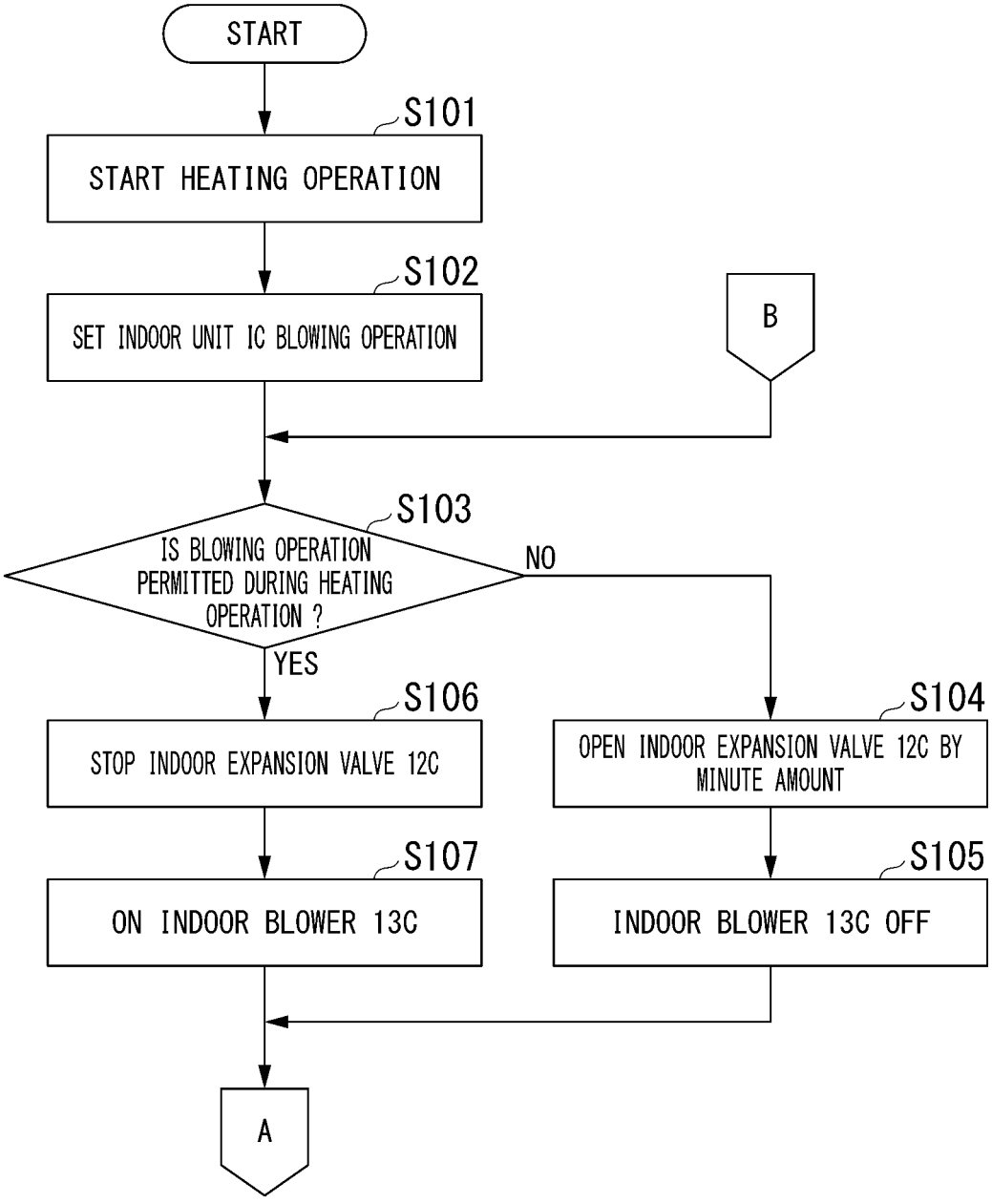

START
S101
START HEATING OPERATION
S102
SET INDOOR UNIT IC BLOWING OPERATION
B
S103
IS BLOWING OPERATION PERMITTED DURING HEATING OPERATION ?
NO
YES
S106
STOP INDOOR EXPANSION VALVE 12C
S104
OPEN INDOOR EXPANSION VALVE 12C BY MINUTE AMOUNT
S107
ON INDOOR BLOWER 13C
S105
INDOOR BLOWER 13C OFF
A

FIG. 4

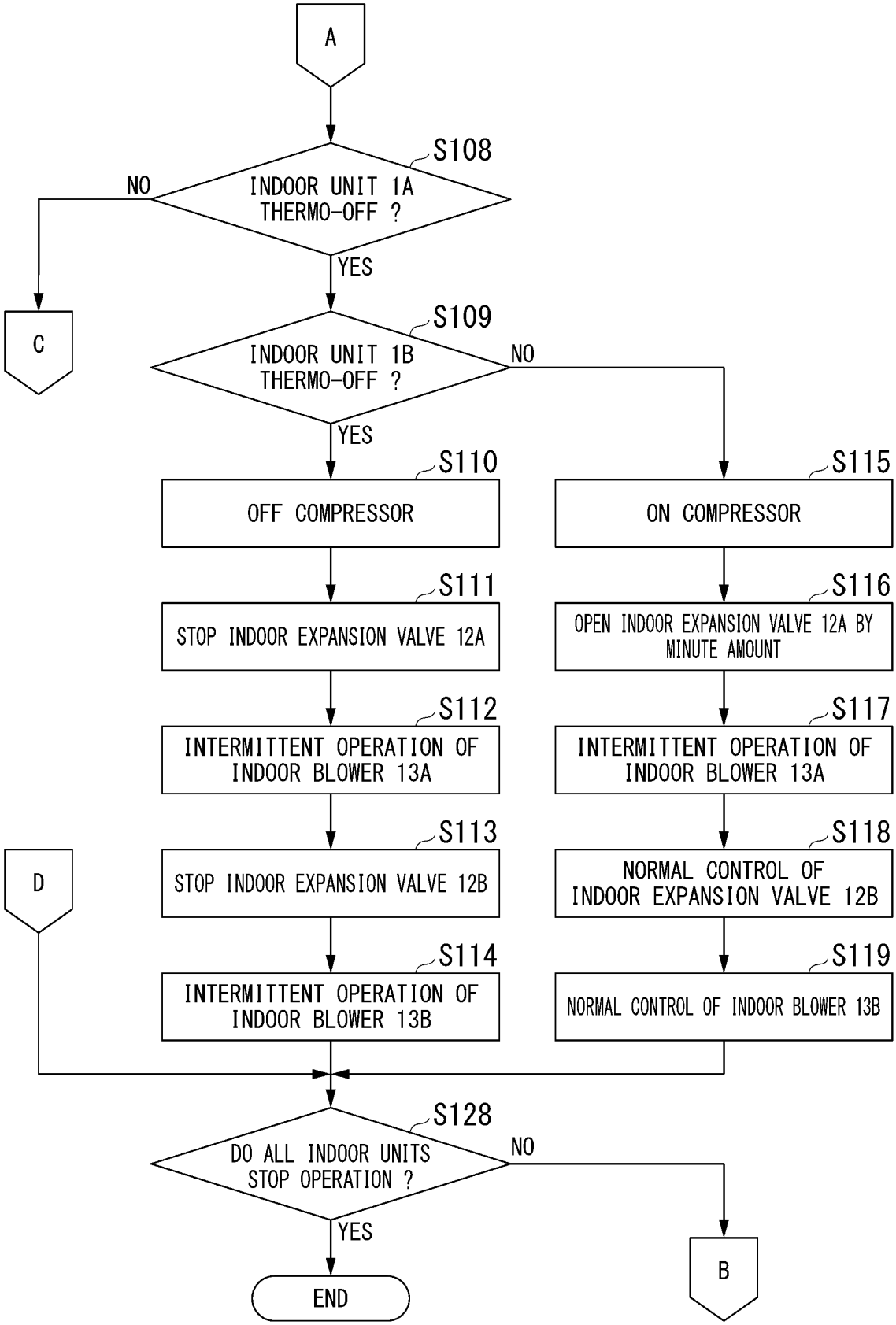
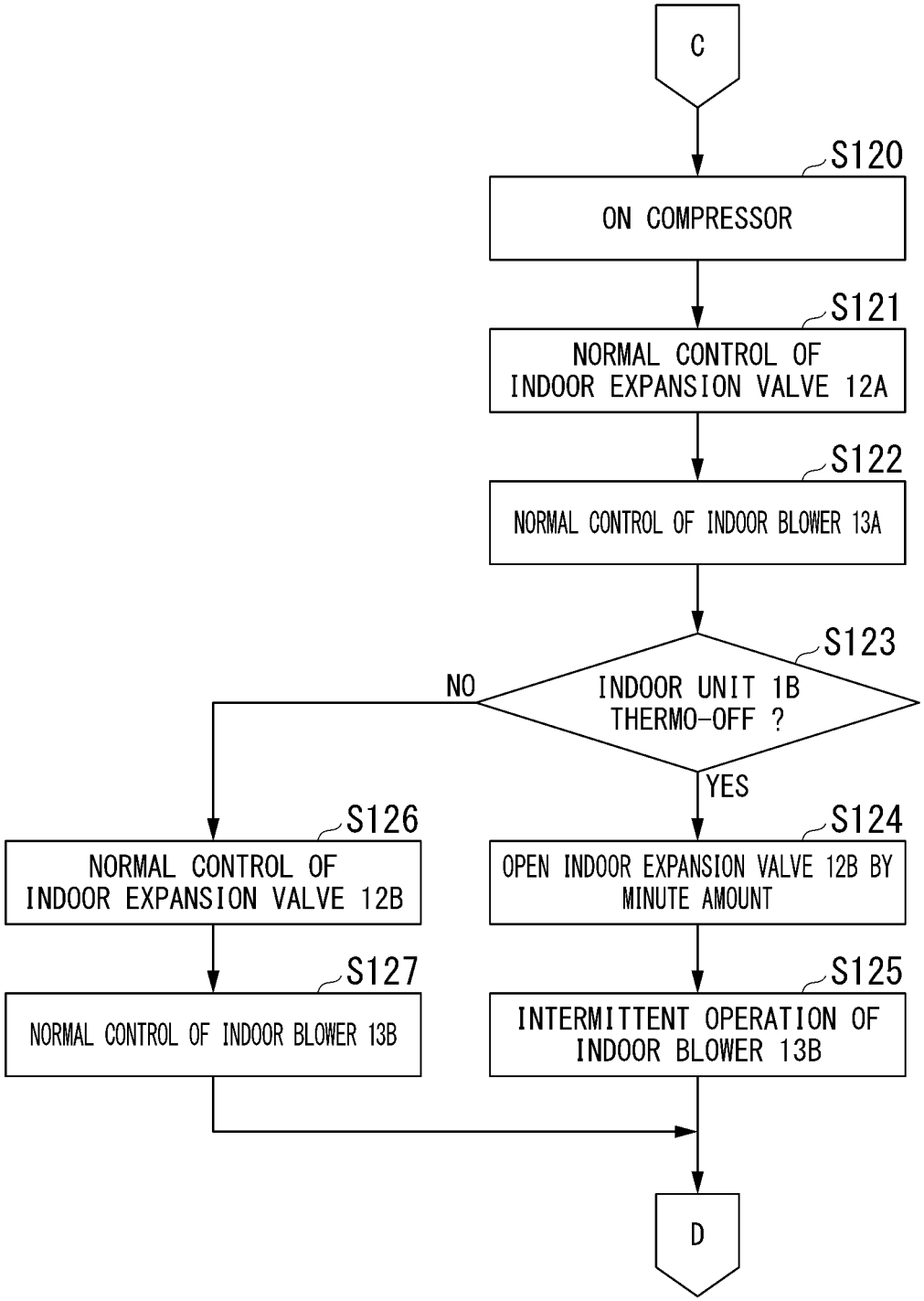

A
S108
INDOOR UNIT 1A THERMO-OFF ?
NO
YES
C
S109
INDOOR UNIT 1B THERMO-OFF ?
NO
YES
S110
OFF COMPRESSOR
S111
STOP INDOOR EXPANSION VALVE 12A
S112
INTERMITTENT OPERATION OF INDOOR BLOWER 13A
S113
STOP INDOOR EXPANSION VALVE 12B
S114
INTERMITTENT OPERATION OF INDOOR BLOWER 13B
S115
ON COMPRESSOR
S116
OPEN INDOOR EXPANSION VALVE 12A BY MINUTE AMOUNT
S117
INTERMITTENT OPERATION OF INDOOR BLOWER 13A
S118
NORMAL CONTROL OF INDOOR EXPANSION VALVE 12B
S119
NORMAL CONTROL OF INDOOR BLOWER 13B
D
S128
DO ALL INDOOR UNITS STOP OPERATION ?
NO
YES
END
B

FIG. 5


C
S120
ON COMPRESSOR
S121
NORMAL CONTROL OF INDOOR EXPANSION VALVE 12A
S122
NORMAL CONTROL OF INDOOR BLOWER 13A
S123
INDOOR UNIT 1B THERMO-OFF ?
NO
YES
S126
NORMAL CONTROL OF INDOOR EXPANSION VALVE 12B
S124
OPEN INDOOR EXPANSION VALVE 12B BY MINUTE AMOUNT
S127
NORMAL CONTROL OF INDOOR BLOWER 13B
S125
INTERMITTENT OPERATION OF INDOOR BLOWER 13B
D

## INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/034819

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. F24F11/86(2018.01)i, F24F11/74(2018.01)i, F25B13/00(2006.01)i

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. F24F11/86, F24F11/74, 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 | 1971-2018 |
| Registered utility model specifications of Japan | 1996-2018 |
| Published registered utility model applications of Japan | 1994-2018 |

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<br>Y | JP 2014-163607 A (FUJITSU GENERAL LTD.) 08 September 2014, paragraphs [0013]-[0055], [0070], fig. 1-4 (Family: none) | 1-3, 11<br>4-10 |
| Y | JP 2003-287257 A (DAIKIN INDUSTRIES, LTD.) 10 October 2003, paragraphs [0002]-[0004], [0022]-[0048], fig. 1-6 (Family: none) | 4-10 |
| Y | JP 07-145986 A (MITSUBISHI ELECTRIC CORP.) 06 June 1995, paragraph [0011] (Family: none) | 7-10 |
| A | CN 104896621 A (GUANDONG MIDEA HVAC EQUIPMENT) 09 September 2015, paragraphs [0038]-[0162], fig. 1-6 (Family: none) | 1-11 |

☐ 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
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"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
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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 | Date of mailing of the international search report |
|---|---|
| 28.11.2018 | 11.12.2018 |
| Name and mailing address of the ISA/<br>Japan Patent Office<br>3-4-3, Kasumigaseki, Chiyoda-ku,<br>Tokyo 100-8915, Japan | Authorized officer<br><br>Telephone No. |

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

## REFERENCES CITED IN THE DESCRIPTION

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

### Patent documents cited in the description


- JP 3778117 B **[0003]**