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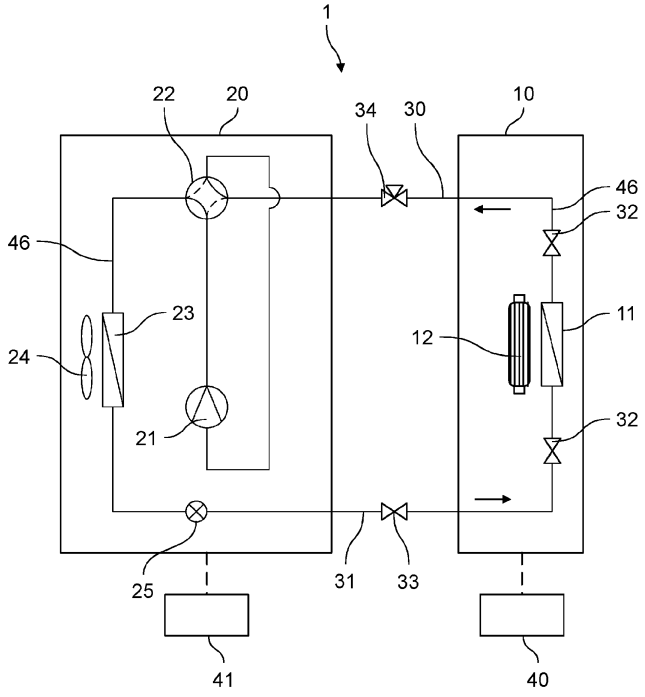
(54) AIR CONDITIONER

(57) An air conditioner includes: an outdoor unit that includes a compressor, an outdoor heat exchanger, an outdoor fan, and an expansion mechanism; and an indoor unit that includes an indoor heat exchanger and an indoor fan. The outdoor unit and the indoor unit together form a refrigeration cycle circuit by being connected by a refrigerant pipe. The refrigeration cycle circuit uses a flammable refrigerant, and the compressor is controlled not to start when a driving rotational frequency of the indoor fan is lower than or equal to a predetermined rotational frequency.

FIG. 1



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Description

BACKGROUND

1. Technical Field

[0001] The present disclosure relates to an air conditioner.

2. Description of the Related Art

[0002] PTL 1 discloses an air conditioner in which electrical components are positioned in an upper part of a casing so that the electrical components are positioned higher than a heat exchanger. In this arrangement, even if the flammable refrigerant leaks from the heat exchanger and accumulates in the lower part of the casing, because the electrical components, which may become an ignition source for the leaking refrigerant, are at a level higher than the heat exchanger, and are separated above the leaking refrigerant, it is possible to prevent the leaking refrigerant from getting into the electric components and catching fire, reliably. In other words, safety against a leakage of a flammable refrigerant is ensured.

Citation List

Patent Literature

[0003] PTL 1: Japanese Patent No. 3807004

SUMMARY

[0004] The present disclosure provides an air conditioner capable of improving safety against a leakage of a flammable refrigerant.

[0005] An air conditioner according to the present disclosure includes: an outdoor unit that includes a compressor, an outdoor heat exchanger, an outdoor fan, and an expansion mechanism; and an indoor unit that includes an indoor heat exchanger and an indoor fan. The outdoor unit and the indoor unit together form a refrigeration cycle circuit by being connected by a refrigerant pipe. The refrigeration cycle circuit uses a flammable refrigerant, and the compressor is controlled not to start when a driving rotational frequency of the indoor fan is lower than or equal to a predetermined rotational frequency.

[0006] The air conditioner according to the present disclosure controls the compressor not to start when the driving rotational frequency of the indoor fan is lower than or equal to a predetermined rotational frequency, and starts the compressor only when the driving rotational frequency of the indoor fan is higher than the predetermined rotational frequency. Therefore, even when a leakage of the flammable refrigerant occurs, a sufficient airflow can be ensured, and the air inside of the air-conditioned space can be sufficiently stirred. Hence, the flammable refrigerant can be prevented from forming a flammable region.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

Fig. 1 is a configuration diagram illustrating a refrigeration cycle circuit of an air conditioner according to a first exemplary embodiment;
Fig. 2 is a block diagram illustrating a control configuration of the air conditioner according to the first exemplary embodiment; and
Fig. 3 is a flowchart illustrating an operation of the air conditioner according to the first exemplary embodiment.

DETAILED DESCRIPTIONS

(Knowledge and the like underlying the present disclosure)

[0008] At the time when the inventors have arrived at the present disclosure, in the technical field of air conditioners, there has been some disclosures for switching the refrigerant to be used, to a refrigerant having low global warming potential, e.g., isobutane or propane, from the viewpoint of decelerating the climate change.

[0009] However, the inventors have found out that, when a flammable refrigerant is used in a conventional air conditioner, it is necessary to ensure the safety against a leakage of the refrigerant. In order to address this issue, the inventors have come up with the subject matter of the present disclosure.

[0010] Therefore, the present disclosure provides an air conditioner capable of improving the safety against a leakage of a flammable refrigerant.

[0011] An exemplary embodiment will now be explained in detail with reference to some drawings. However, descriptions more in detail than necessary may be omitted. For example, detailed descriptions of already well-known matters and redundant descriptions of substantially the same configurations are sometimes omitted.

[0012] Note that the accompanying drawings and the following description are provided for those skilled in the art to fully understand the present disclosure, and are not intended to limit the subject matter described in the claims in any way.

(First exemplary embodiment)

[1-1. Configuration]

[1-1-1. Configuration of refrigeration cycle circuit]

[0013] A first exemplary embodiment will now be explained with reference to Figs. 1 to 3.

[0014] Fig. 1 is a configuration diagram illustrating a refrigeration cycle circuit of air conditioner 1 according to the first exemplary embodiment.

[0015] As illustrated in Fig. 1, air conditioner 1 includes indoor unit 10 and outdoor unit 20.

[0016] In the refrigeration cycle circuit in Fig. 1, air conditioner 1 circulates a flammable refrigerant such as isobutane or propane, and performs air conditioning such as heating or cooling inside of an air-conditioned space in which indoor unit 10 is installed. Note that devices that are not used in the descriptions, such as an accumulator, are not illustrated in Fig. 1, but air conditioner 1 may include such other devices not illustrated.

[0017] Indoor unit 10 includes indoor heat exchanger 11 and indoor fan 12. Indoor heat exchanger 11 is, for example, a finned tube heat exchanger, and inside of which is provided with a flow channel through which the refrigerant is passed.

[0018] Indoor fan 12 is, for example, a cross flow fan that blows out the air by using a motor, not illustrated, to rotate an impeller. Indoor fan 12 suctions the air from the air-conditioned space into indoor unit 10, and exchanges the heat between the refrigerant inside of indoor heat exchanger 11 and the suctioned air. The air having the heat exchanged with the refrigerant is returned to the outside of indoor unit 10, and conditions the air inside of the air-conditioned space.

[0019] Outdoor unit 20 includes compressor 21, four-way valve 22, outdoor heat exchanger 23, outdoor fan 24, and expansion mechanism 25.

[0020] Compressor 21 is, for example, sealed compressor 21, and suctions, compresses, and discharges gas refrigerant toward four-way valve 22. Four-way valve 22 is capable of switching a flow path of the refrigerant flowing into compressor 21 and a flow path of the refrigerant discharged from compressor 21.

[0021] By switching the flow path of the refrigerant, four-way valve 22 switches the operation of indoor unit 10 between a cooling operation and a heating operation. For example, when four-way valve 22 causes the refrigerant to flow in the direction of the arrow illustrated in Fig. 1, indoor unit 10 performs the cooling operation. Outdoor heat exchanger 23 is, for example, a finned tube heat exchanger, and inside of which is provided with a flow channel through which the refrigerant is passed.

[0022] The flow channel of outdoor heat exchanger 23 is connected to four-way valve 22 and expansion mechanism 25. Outdoor fan 24 is, for example, an axial blower, and exchanges the heat of the air outside of outdoor unit 20 and of the refrigerant inside of outdoor heat exchanger 23. Expansion mechanism 25 is, for example, a capillary tube or an expansion valve, and decompresses the refrigerant flowing therethrough.

[0023] Indoor unit 10 and outdoor unit 20 are connected to each other by gas-side connection pipe 30 connecting a gas side of indoor unit 10 and a gas side of outdoor unit 20, and liquid-side connection pipe 31 connecting a liquid side of indoor unit 10 and a liquid side of outdoor unit 20.

[0024] Gas-side three-way valve 34 and liquid-side two-way valve 33 are inserted in gas-side connection pipe 30 and in liquid-side connection pipe 31, respectively. Indoor unit 10 and outdoor unit 20 are connected to each other via liquid-side two-way valve 33 and gas-side three-way valve 34.

[0025] Liquid-side two-way valve 33 and gas-side three-way valve 34 are manually opened when the work connecting outdoor unit 20 and indoor unit 10 is finished. It is also possible to configure liquid-side two-way valve 33 and gas-side three-way valve 34 to open and close automatically under the control of outdoor control unit 41 or indoor control unit 40.

[0026] Safety shutoff valves 32 are provided on an inlet side and an outlet side of indoor heat exchanger 11, respectively. Safety shutoff valves 32 shut off gas-side connection pipe 30 and liquid-side connection pipe 31, when indoor heat exchanger 11 is experiencing a leakage of the refrigerant, and prevents the refrigerant inside gas-side connection pipe 30 and liquid-side connection pipe 31 from being sent to indoor heat exchanger 11.

[0027] Safety shutoff valves 32 may also be provided outside of indoor unit 10, or may be provided closer to outdoor unit 20 than liquid-side two-way valve 33 and gas-side three-way valve 34.

[1-1-2. Control configuration]

[0028] A control configuration according to the present exemplary embodiment will now be explained.

[0029] Fig. 2 is a block diagram illustrating the control configuration of the present exemplary embodiment.

[0030] As illustrated in Fig. 2, indoor unit 10 includes indoor control unit 40. Outdoor unit 20 includes outdoor control unit 41. Indoor control unit 40 and outdoor control unit 41 are configured to be able to communicate with each other.

[0031] Indoor control unit 40 includes a processor such as a central processing unit (CPU) or a micro-processing unit (MPU) for executing programs, and a memory such as a read-only memory (ROM) and a random access memory (RAM), and executes various processes through the cooperation of hardware and software so that a control program stored in the memory is read and the processing thereof is executed.

[0032] Indoor control unit 40 controls the rotation of indoor fan 12. Indoor control unit 40 also controls to open and to close safety shutoff valves 32.

[0033] Outdoor control unit 41 includes a processor such as a CPU or a MPU for executing a program and a memory such as a ROM and a RAM, and executes various processes through the cooperation of hardware and software so that a control program stored in the memory is read and the processing thereof is executed.

[0034] Outdoor control unit 41 controls driving of compressor 21 and of outdoor fan 24, and controls to switch four-way valve 22.

[0035] Indoor control unit 40 transmits a driving rotational frequency (driving rotational speed) at which indoor fan 12 is driven to rotate, to outdoor control unit 41. Outdoor control unit 41 controls not to start compressor 21 when the driving rotational frequency of indoor fan 12 is lower than or equal to a predetermined rotational frequency.

[0036] This is because, if the driving rotational frequency of indoor fan 12 is lower than or equal to a predetermined rotational frequency, indoor fan 12 fails to achieve a sufficient airflow and fails to stir the air inside of the air-conditioned space sufficiently in case of a leakage of the flammable refrigerant, so that the flammable refrigerant may form a flammable region.

[0037] In the present exemplary embodiment, the driving rotational frequency of indoor fan 12 is used in making a determination as to whether to start compressor 21. However, it is also possible to use the airflow of indoor fan 12 in making a determination as to whether to start compressor 21, for example.

[0038] In this case, the airflow of indoor fan 12 is calculated based on the following equation.

[0039] In the Enhanced Tightness Refrigerating System (ETRS), the following equation is used.

[Equation 1]

$$Q_{min} = 3600 \frac{5Y\sqrt{A_0}\dot{m}_{leak}^{3/4}}{h_0^{1/4}[LFL \times (1 - CF)]^{5/8}}$$

where

Q_{min}: minimum airflow required (m^3/min)
LFL: flammability limit (kg/m^3)
CF: constant (0.5)
Y: constant (1.5 for outdoor leakage, and 1.0 for indoor leakage)
m_{leak}: refrigerant leakage rate (kg/s)
h_0: set height of indoor unit (m)
A_0: area of airflow outlet (m^2)

[0040] In Non Enhanced Tightness Refrigerating System (Non ETRS), the following equation is used.

[Equation 2]

$$Q_{min} = 3600 \frac{8Y\sqrt{A_0}}{240} \left(\frac{m_c}{LFL}\right)^{3/4} \left(\frac{CF^{1/4}}{1-CF}\right)$$

where:

Q_{min}: minimum airflow required (m^3/min)
LFL: flammability limit (kg/m^3)
CF: constant (0.35)
Y: constant (1.5 for outdoor leakage, and 1.0 for indoor leakage)
A_0: area of airflow outlet (m^2)
m_c: amount of refrigerant charge (kg)

[0041] Both of these equations are based on "ETRS conforming to IEC 60335-2-40".

[0042] As described above, when the airflow of indoor fan 12 is less than or equal to the minimum airflow calculated with the equation above, indoor control unit 40 transmits the calculation result to outdoor control unit 41, and outdoor control unit 41 controls not to start compressor 21.

[0043] Indoor control unit 40 may be configured to, when the driving rotational frequency of indoor fan 12 is lower than or equal to a predetermined rotational frequency, or when the airflow of indoor fan 12 is less than or equal to a predetermined airflow, control not to drive compressor 21 and to close safety shutoff valves 32.

[0044] With such control, when the driving rotational frequency of indoor fan 12 is low, it is possible to reduce the amount of refrigerant on the side of the indoor unit. Therefore, when a leakage of the refrigerant occurs, it is possible to reduce the amount of the refrigerant outflow into the air-conditioned space. Hence, the flammable region inside of the air-conditioned space can kept minimum.

[0045] Indoor control unit 40 may also control to keep indoor fan 12 driving while the air conditioner is not operating.

[0046] In this case, when a leakage of the refrigerant occurs while the air conditioner is not operating, by stirring the air inside of the air-conditioned space, it is possible to keep the flammable region formed by the refrigerant minimum.

[0047] The air conditioner may include an auxiliary power supply (not illustrated) such as a battery.

[0048] The auxiliary power supply is installed in an indoor unit, for example, and serves to supply the power for driving indoor fan 12 when the supply of commercial power stops due to a power failure, for example.

[0049] In this manner, it is possible to drive indoor fan 12 even at the time of a power failure. Therefore, when a leakage of the refrigerant occurs, by stirring the air inside of the air-conditioned space, it is possible to keep the flammable region formed by the refrigerant minimum.

[1-3. Operation and action]

[0050] The operation of air conditioner 1 having a configuration described above will now be explained.

[0051] Fig. 3 is a flowchart illustrating the operation of air conditioner 1 according to the first exemplary embodiment.

[0052] As illustrated in Fig. 3, when air conditioner 1 is powered ON (ST1), indoor control unit 40 controls to drive indoor fan 12.

[0053] Indoor control unit 40 detects the driving rotational frequency of indoor fan 12, and determines whether the driving rotational frequency is lower than or equal to a predetermined rotational frequency (ST2).

[0054] If it is determined that the driving rotational frequency of indoor fan 12 is lower than or equal to the predetermined rotational frequency (ST2: YES), indoor control unit 40 transmits information of the driving rotational frequency of indoor fan 12 to outdoor control unit 41. With this information, outdoor control unit 41 controls not to start compressor 21 (ST3).

[0055] At this time, indoor control unit 40 controls to close safety shutoff valves 32 (ST4).

[0056] By contrast, if it is determined that the driving rotational frequency of indoor fan 12 is higher than the predetermined rotational frequency (ST2: NO), indoor control unit 40 transmits the information of the driving rotational frequency to outdoor control unit 41, and causes outdoor control unit 41 to drive compressor 21 and outdoor fan 24 (ST5) and to switch four-way valve 22 for the cooling operation or the heating operation.

[0057] In this manner, air conditioner 1 performs the normal cooling operation or heating operation.

[1-4. Effects and the like]

[0058] As described above, in the present exemplary embodiment, air conditioner 1 includes outdoor unit 20 that includes compressor 21, outdoor heat exchanger 23, outdoor fan 24, and expansion mechanism 25, and the indoor unit that includes indoor heat exchanger 11 and indoor fan 12. Outdoor unit 20 and the indoor unit together form a refrigeration cycle circuit by being connected by a refrigerant pipe, and the refrigeration cycle circuit uses a flammable refrigerant. Compressor 21 is controlled not to start when the driving rotational frequency of indoor fan 12 is lower than or equal to a predetermined rotational frequency.

[0059] In this manner, because compressor 21 is started only when the driving rotational frequency of indoor fan 12 is higher than the predetermined rotational frequency, even when a leakage of the flammable refrigerant occurs, a sufficient airflow can be ensured, and the air inside of the air-conditioned space can be stirred sufficiently. Therefore, it is possible to suppress formation of a flammable region by the flammable refrigerant.

[0060] In the present exemplary embodiment, it is also possible to control not to start compressor 21 if the airflow of indoor fan 12 is less than or equal to a predetermined airflow.

[0061] Because the airflow and the rotational frequency of indoor fan 12 are in a proportional relationship, when the airflow of indoor fan 12 is greater than a predetermined airflow, a sufficient airflow can be ensured. Therefore, even when a leakage of the flammable refrigerant occurs, the air inside of the air-conditioned space can be stirred sufficiently, and formation of a flammable region by the flammable refrigerant can be suppressed.

[0062] In the present exemplary embodiment, safety shutoff valves 32 are installed in the refrigeration cycle circuit, and safety shutoff valves 32 are controlled to close when the driving rotational frequency of indoor fan 12 is lower than or equal to a predetermined rotational frequency.

[0063] In this manner, even when the driving rotational frequency of indoor fan 12 is low, it is possible to reduce the amount of refrigerant on the side of the indoor unit. Therefore, when a leakage of the refrigerant occurs, it is possible to reduce the amount of the refrigerant outflow into the air-conditioned space. Hence, the flammable region inside of the air-conditioned space can kept minimum.

[0064] In the present exemplary embodiment, it is possible to control to drive indoor fan 12 while the air conditioner is not operating.

[0065] In this manner, when a leakage of the refrigerant occurs while the air conditioner is not operating, by stirring the air inside of the air-conditioned space, it is possible to keep the flammable region formed by the refrigerant minimum.

[0066] In the present exemplary embodiment, an auxiliary power supply that supplies power to indoor fan 12 when the air conditioner is not receiving power supply may be provided.

[0067] In this manner, it is possible to drive indoor fan 12 even at the time of a power failure. Therefore, when a leakage of the refrigerant occurs, by stirring the air inside of the air-conditioned space, it is possible to keep the flammable region formed by the refrigerant minimum.

(Note)

[0068] The above description of the exemplary embodiment discloses the following technologies.

[0069] (Technology 1) An air conditioner comprising: an outdoor unit that includes a compressor, an outdoor heat exchanger, an outdoor fan, and an expansion mechanism; and an indoor unit that includes an indoor heat exchanger and an indoor fan, wherein the outdoor unit and the indoor unit together form a refrigeration cycle circuit by being connected by a refrigerant pipe; the refrigeration cycle circuit uses a flammable refrigerant; and the compressor is controlled not to start when a driving rotational frequency of the indoor fan is lower than or equal to a predetermined rotational frequency.

[0070] With this configuration, the compressor is started only when the driving rotational frequency of the indoor fan is higher than the predetermined rotational frequency. In this manner, a sufficient airflow can be ensured. Therefore, even when a leakage of the flammable refrigerant occurs, the air inside of the air-conditioned space can be stirred sufficiently, and formation of a flammable region by the flammable refrigerant can be suppressed.

[0071] (Technology 2) The air conditioner according to Technology 1, in which the compressor is controlled not to start when an airflow of the indoor fan is less than or equal to a predetermined airflow.

[0072] With this configuration, because the airflow and the rotational frequency of the indoor fan are in a proportional relationship, when the airflow of the indoor fan is greater than a predetermined airflow, a sufficient airflow can be ensured. Therefore, even when a leakage of the flammable refrigerant occurs, the air inside of the air-conditioned space can be stirred sufficiently, and formation of a flammable region by the flammable refrigerant can be suppressed.

[0073] (Technology 3) The air conditioner according to Technology 1 or Technology 2, in which a safety shutoff valve is installed in the refrigeration cycle circuit, and the safety shutoff valve is controlled to close when the driving rotational frequency of the indoor fan is lower than or equal to a predetermined rotational frequency.

[0074] With this configuration, even when the driving rotational frequency of the indoor fan is low, it is possible to

reduce the amount of refrigerant on the side of the indoor unit. Therefore, when a leakage of the refrigerant occurs, it is possible to reduce the amount of the refrigerant outflow into the air-conditioned space. Hence, the flammable region inside of the air-conditioned space can kept minimum.

[0075] (Technology 4) The air conditioner according to any one of Technologies 1 to 3, configured to control to drive the indoor fan while the air conditioner is not operating.

[0076] With this configuration, when a leakage of the refrigerant occurs while the air conditioner is not operating, by stirring the air inside of the air-conditioned space, it is possible to keep the flammable region formed by the refrigerant minimum.

[0077] (Technology 5) The air conditioner according to any one of Technologies 1 to 4, further including an auxiliary power supply that supplies power to the indoor fan when the air conditioner is not receiving power supply.

[0078] With this configuration, it is possible to drive the indoor fan even at the time of a power failure. Therefore, when a leakage of the refrigerant occurs, by stirring the air inside of the air-conditioned space, it is possible to keep the flammable region formed by the refrigerant minimum.

[0079] The present disclosure is applicable to an air conditioner capable of suitably improving the safety against a leakage of a flammable refrigerant.

Claims

1. An air conditioner comprising:

an outdoor unit including a compressor, an outdoor heat exchanger, an outdoor fan, and an expansion mechanism; and
an indoor unit including an indoor heat exchanger and an indoor fan,
wherein the outdoor unit and the indoor unit together form a refrigeration cycle circuit by being connected by a refrigerant pipe,
the refrigeration cycle circuit uses a flammable refrigerant, and
the compressor is controlled not to start at least one of when a driving rotational frequency of the indoor fan is lower than or equal to a predetermined rotational frequency and when an airflow of the indoor fan is less than or equal to a predetermined airflow.

2. The air conditioner according to Claim 1, wherein

a safety shutoff valve is installed in the refrigeration cycle circuit, and
the safety shutoff valve is controlled to close when the driving rotational frequency of the indoor fan is lower than or equal to a predetermined rotational frequency.

3. The air conditioner according Claim 1, configured to control to drive the indoor fan while the air conditioner is not operating.

4. The air conditioner according to Claim 1, further comprising an auxiliary power supply that supplies power to the indoor fan when the air conditioner is not receiving power supply.

FIG. 1

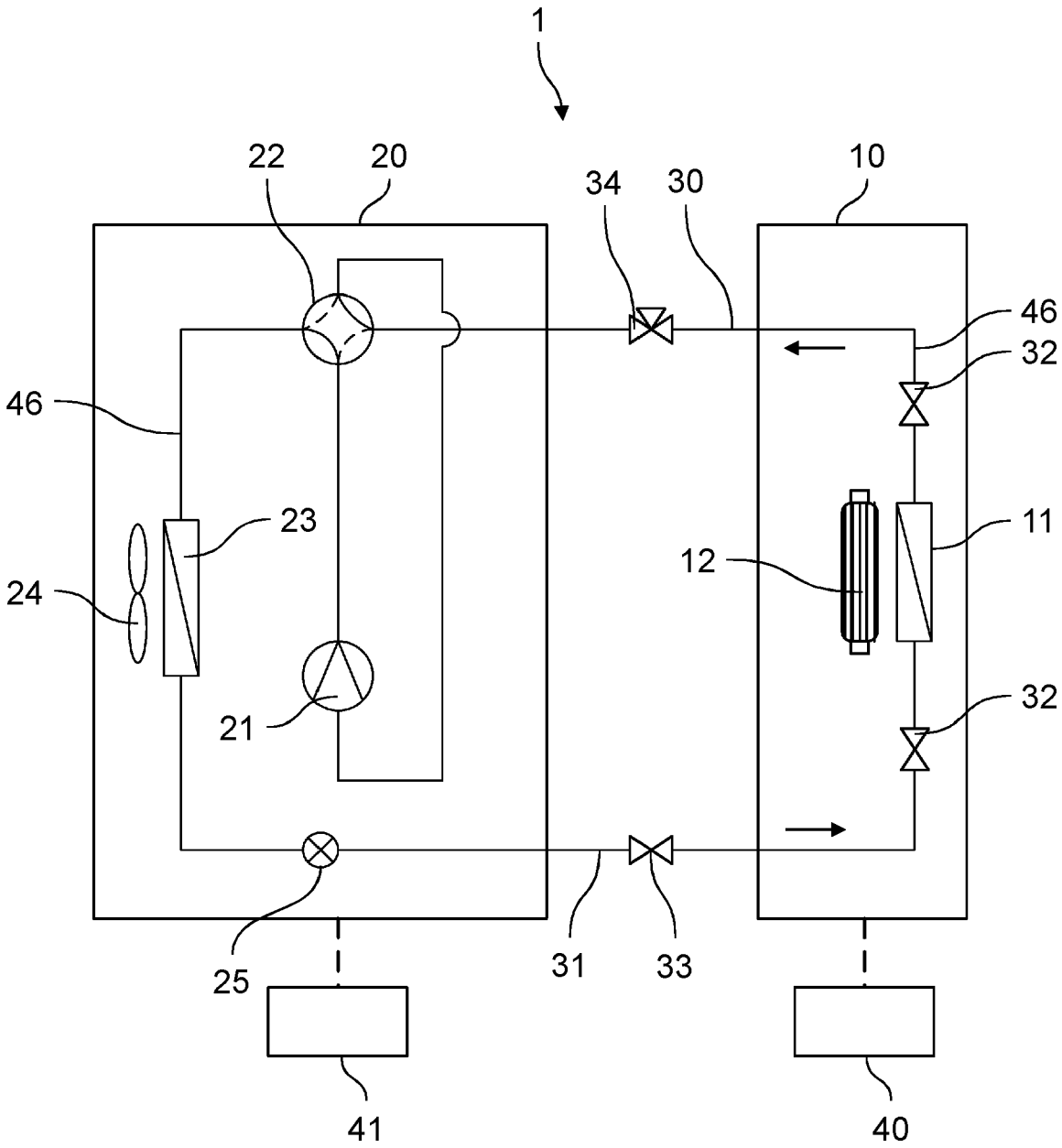


FIG. 2

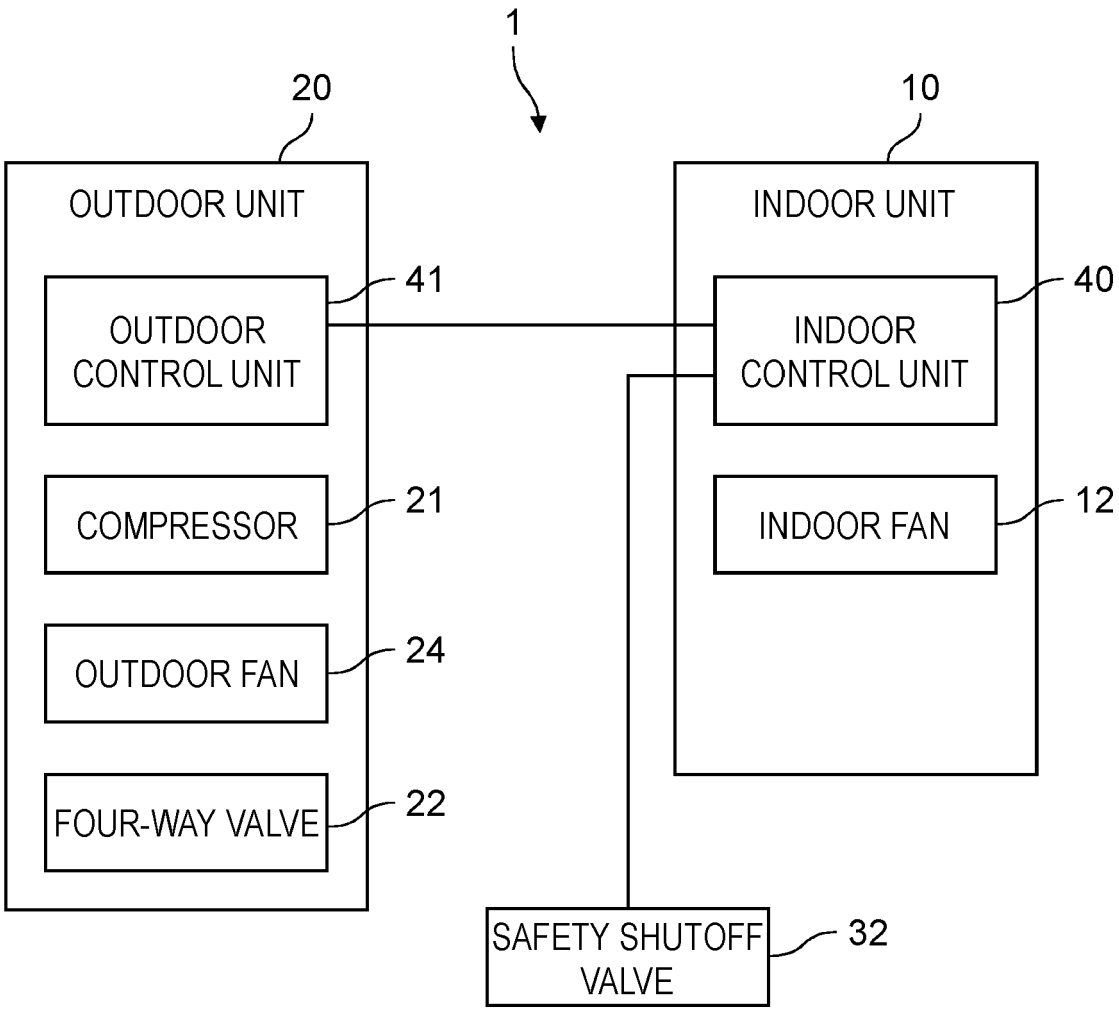
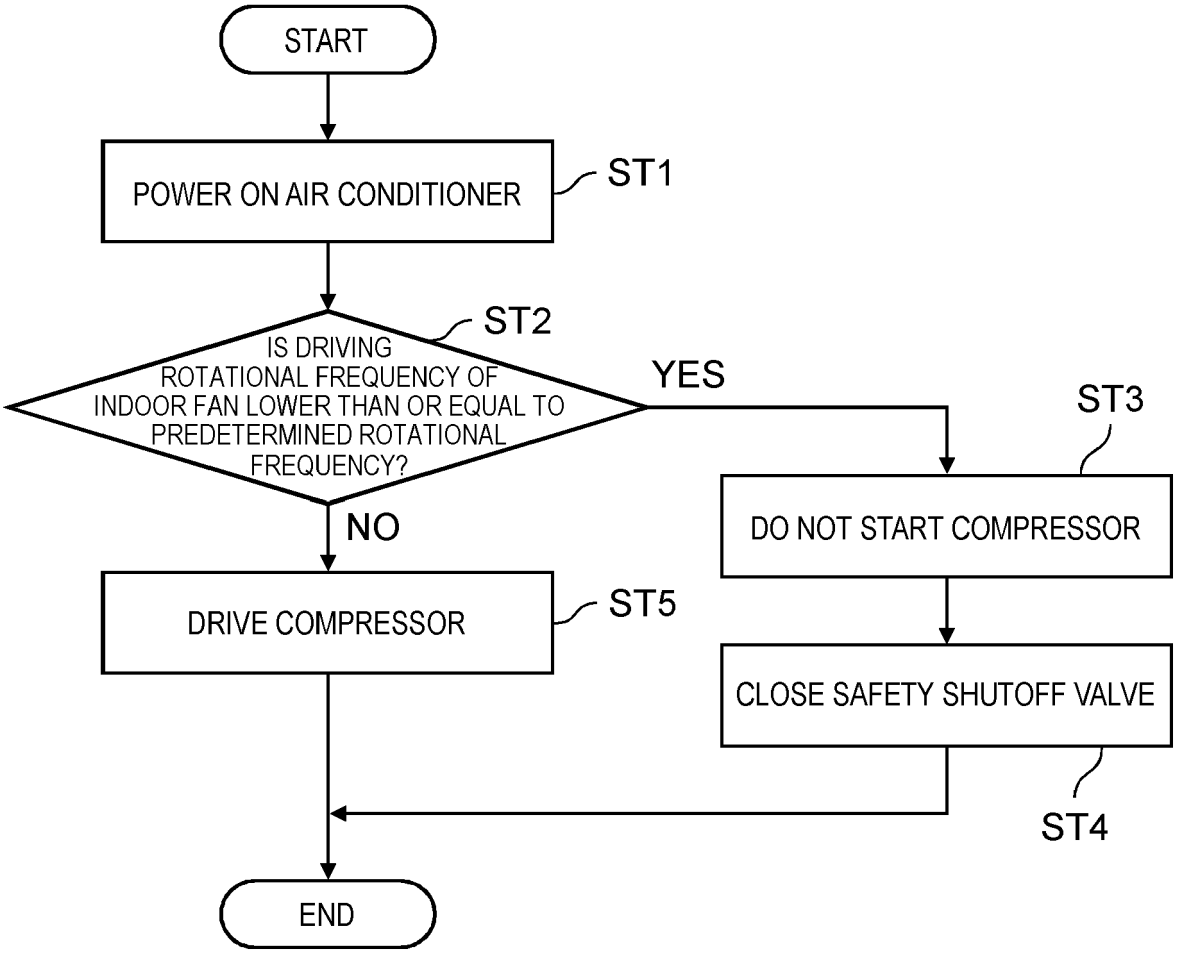

1
20
10
OUTDOOR UNIT
INDOOR UNIT
41
40
OUTDOOR CONTROL UNIT
INDOOR CONTROL UNIT
COMPRESSOR
21
INDOOR FAN
12
OUTDOOR FAN
24
FOUR-WAY VALVE
22
SAFETY SHUTOFF VALVE
32

FIG. 3


START
POWER ON AIR CONDITIONER
ST1
ST2
IS DRIVING ROTATIONAL FREQUENCY OF INDOOR FAN LOWER THAN OR EQUAL TO PREDETERMINED ROTATIONAL FREQUENCY?
YES
NO
ST3
DO NOT START COMPRESSOR
CLOSE SAFETY SHUTOFF VALVE
ST4
DRIVE COMPRESSOR
ST5
END

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EUROPEAN SEARCH REPORT

Application Number
EP 23 17 8681

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 633 282 A1 (MITSUBISHI ELECTRIC CORP [JP]) 8 April 2020 (2020-04-08) * the whole document *	1,2,4	INV. F24F11/36 F24F11/77 F25B1/00
X	EP 3 150 943 A1 (MITSUBISHI ELECTRIC CORP [JP]) 5 April 2017 (2017-04-05) * the whole document *	1,3	
X	EP 3 396 261 A1 (MITSUBISHI ELECTRIC CORP [JP]) 31 October 2018 (2018-10-31) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			F24F F25B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 November 2023	Decking, Oliver

CATEGORY OF CITED DOCUMENTS

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14-11-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3633282 A1	08-04-2020	EP 3633282 A1	08-04-2020
		JP 6847213 B2	24-03-2021
		JP WO2018220810 A1	12-12-2019
		WO 2018220810 A1	06-12-2018
EP 3150943 A1	05-04-2017	CN 106352400 A	25-01-2017
		CN 205825233 U	21-12-2016
		EP 3150943 A1	05-04-2017
		JP 6463478 B2	06-02-2019
		JP WO2017013715 A1	01-02-2018
		WO 2017013715 A1	26-01-2017
EP 3396261 A1	31-10-2018	CN 108369022 A	03-08-2018
		EP 3396261 A1	31-10-2018
		JP 6388735 B2	12-09-2018
		JP WO2017110904 A1	15-03-2018
		US 2018313591 A1	01-11-2018
		WO 2017109847 A1	29-06-2017
		WO 2017110904 A1	29-06-2017

EPO FORM P0459

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

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Patent documents cited in the description

- JP 3807004 B **[0003]**