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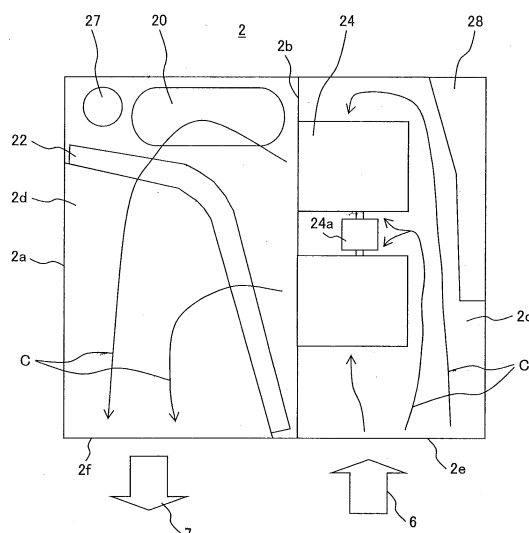
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(54) **AIR CONDITIONER**

(57) An air conditioner able to avoid the risk of fire and able to have a reduced number of refrigerant leakage detectors while using a refrigerant having a low global warming potential (GWP) is obtained. The air conditioner is provided with a heat source unit (2) configured so as to use a flammable refrigerant having a low global warming potential, and configured by housing inside a case (2a) refrigeration cycle components such as a heat exchanger (22) in which the refrigerant flows, an electric part box (28) in which electric parts and the like are housed, and a blower (24) driven by a motor (24a). Also, airflow is formed by the blower in the case, and the refrigeration cycle components in which the refrigerant flows are arranged in the airflow in the case, and the electric part box and electric parts such as the motor of the blower are arranged upstream from the refrigeration cycle components in the airflow.

FIG. 3



Description

TECHNICAL FIELD

[0001] The present invention relates to an air conditioner and particularly to an air conditioner that uses a refrigerant having a low global warming potential (GWP) (Global Warming Potential).

BACKGROUND ART

[0002] Recently, use of the refrigerants having low global warming potentials (GWP) is being considered in terms of stop of global warming. In JP-A-H11-37619 (Patent Literature 1), an air conditioner using a hydrocarbon natural refrigerant has been proposed. Additionally, in Patent Literature 1, refrigerant leakage detection means is provided to detect leakage of a hydrocarbon natural refrigerant, which is flammable. When the refrigerant leakage detection means detects the refrigerant leakage, the leaking refrigerant is stirred and diffused by a fan and the like to prevent the leaking refrigerant from residing and forming a flammable area.

[0003] A conventional air conditioner is described in JP-A-2002-61996 (Patent Literature 2) in consideration of a measure against refrigerant leakage. In Patent literature 2, a gas detector is provided to detect refrigerant leakage in a room in which an indoor unit is arranged. An alert system provided to the indoor unit generates an alert in case of refrigerant leakage. Then, a compressor and an outdoor blower fan are operated, an outdoor expansion valve is closed, a four-way switching valve is switched to a cooling operation, an indoor expansion valve is opened, and an outdoor unit collects refrigerant.

PRIOR ART LITERATURES

PATENT LITERATURES

[0004]

Patent Literature 1: JP-A-H11-37619

Patent Literature 2: JP-A-2002-61996

SUMMARY OF INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0005] In Patent Literature 1, since a hydrocarbon natural refrigerant is used as a refrigerant for the air conditioner, the global warming potential (GWP) is small. However, the hydrocarbon natural refrigerant has a strong flammability, and is therefore difficult to use as a refrigerant for air conditioners.

[0006] In Patent Literature 2, use of a refrigerant having a low global warming potential (GWP) is not taken into consideration.

[0007] As refrigerants having low global warming po-

tentials (GWP), refrigerants such as HFO1234yf (GWP = 4) and HFO1234ze (GWP = 6) are being noted in these days. When using a refrigerant such as HFO1234yf and HFO1234ze as a refrigerant for air conditioners, there is a problem that the refrigerants HFO1234yf and HFO1234ze have low densities and large volumes in vapor condition. For example, in comparison with the refrigerant R410A, the vapor specific volume of HFO1234yf is 180% of R410A and the vapor specific volume of HFO1234ze is 240% of R410A, the vapor specific volumes assuming an inlet portion of a compressor. Thus, there is a problem that the refrigerant pressure loss on the low pressure side of the air conditioner increases (for example, three times or more when compared to R410A under the same condition) to increase power consumption of the compressor of the air conditioner.

[0008] The refrigerant R32 (GWP = 675) also is being considered as a refrigerant having a relatively low global warming potential (GWP). However, each of these refrigerants (HFO1234yf, HFO1234ze, and R32) is flammable while having low flammability (a refrigerant having a lower flammability than those of hydrocarbon refrigerants is hereinafter called a slightly flammable refrigerant).

[0009] Patent Literatures 1 and 2 describe measures against refrigerant leakage when the leakage is detected. A refrigerant leakage detector is needed to be provided to each of the outdoor unit and indoor unit to detect leakage of a flammable or slightly flammable refrigerant and to prevent the fire. There is therefore also a problem that cost increases.

[0010] An object of the present invention is to obtain an air conditioner able to avoid the risk of fire and able to have a reduced number of refrigerant leakage detectors while using a refrigerant having a low global warming potential (GWP).

MEANS FOR SOLVING THE PROBLEM

[0011] To attain the above object, an air conditioner of the present invention is provided with a heat source unit configured so as to use a flammable refrigerant having a low global warming potential, and configured by housing, inside a case, refrigeration cycle components such as a heat exchanger in which the refrigerant flows, an electric part box in which electric parts and the like are housed, and a blower driven by a motor. Airflow is formed by the blower in the case. The refrigeration cycle components in which the refrigerant flows are arranged in the airflow in the case. The electric part box and the electric parts such as the motor of the blower are arranged upstream from the refrigeration cycle components in the airflow.

ADVANTAGEOUS EFFECT OF THE INVENTION

[0012] According to the present invention, an air conditioner able to avoid the risk of fire and able to have a reduced number of refrigerant leakage detectors while

using a refrigerant having a low global warming potential (GWP) is obtained.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a schematic block diagram explaining Embodiment 1 of an air conditioner of the present invention;

Fig. 2 is a block diagram of a refrigeration cycle of the air conditioner illustrated in Fig. 1;

Fig. 3 is a top view illustrating a ceiling embedded type heat source unit in Embodiment 1 of the present invention;

Fig. 4 is a perspective view explaining an example of a ceiling embedded type heat source unit as a conventional air conditioner; and

Fig. 5 is a top view explaining airflow of in the ceiling embedded type heat source unit illustrated in Fig. 4.

MODE FOR CARRYING OUT THE INVENTION

[0014] Hereafter, a specific embodiment of an air conditioner of the present invention is explained using the drawings. In each figure, the portions having the same reference numerals illustrate the same or corresponding portions.

EMBODIMENT 1

[0015] Embodiment 1 of an air conditioner of the present invention is explained in reference to Figs. 1 to 3. Fig. 1 is a schematic block diagram explaining Embodiment 1 of the air conditioner of the present invention. Fig. 2 is a block diagram of a refrigeration cycle of the air conditioner of Fig. 1. Fig. 3 is a top view of a ceiling embedded type heat source unit in Embodiment 1 of the present invention. An example of a conventional air conditioner also is explained using Figs. 4 and 5 for comparison.

[0016] The present embodiment explains an example of an air conditioner using HFO1234yf or HFO1234ze, which are slightly flammable refrigerants (for example, slightly flammable refrigerants having burning velocity of 10 cm/s or less). The slightly flammable refrigerants are less flammable than hydrocarbon refrigerants such as propane and isobutane, which are flammable refrigerants. Refrigerants having relatively low global warming potentials (GWPs) include R32, as described above. In the present embodiment, an example using HFO1234yf or HFO1234ze as the refrigerant is explained.

[0017] The refrigerants HFO1234yf and HFO1234ze in vapor state have low densities and large volumes, as mentioned above. Therefore, there is a problem that the refrigerant pressure loss is large on the low pressure side to increase power consumption of a compressor of an air conditioner. In the present embodiment, for reduction

of the refrigerant pressure loss on the low pressure side, the heat source unit is a ceiling embedded type heat source unit that is arranged to a ceiling portion and the like in a building to shorten the distance between the heat source unit and an indoor unit (namely, the length of refrigerant piping) and that introduces outside air to perform heat exchange. Hereafter, this specific configuration is explained using Fig. 1.

[0018] Fig. 1 is a schematic block diagram explaining an example of an arrangement of the air conditioner of the present embodiment having the ceiling embedded type heat source unit. Fig. 1 illustrates a building 1 and a heat source unit 2 that includes, inside a case, refrigeration cycle components such as a heat exchanger in which the refrigerant flows, an electric part box in which electric parts and the like are housed, and a blower driven by a motor. In the present embodiment, this heat source unit 2 is the so-called ceiling embedded type heat source unit arranged to a ceiling portion 1a (attic) in the building 1. An indoor unit 3 conditions air in a room 1b. This indoor unit 3 and heat source unit 2 are connected to one another by refrigerant pipes 4 and 5 (4: gas side refrigerant pipe, 5: liquid side refrigerant pipe).

[0019] The heat source unit 2 is configured so as to draw outdoor air as illustrated by an arrow 6, exchange heat between the outdoor air and refrigerant, and blow the air after this heat exchange out of the room as illustrated by an arrow 7.

[0020] The indoor unit 3 draws the air in the room 1b as illustrated by an arrow 8. A heat exchanger provided inside the indoor unit 3 exchanges heat between the indoor air and refrigerant and blows the air cooled (in cooling) or heated (in heating) after the heat exchange into the room as illustrated by an arrow 9 to condition the air in the room 1b in which an occupant 10 is present.

[0021] Generally, the heat source unit 2 is often arranged, e.g., to the rooftop of the building 1 or outside a wall of the building 1 as an outdoor unit, but arranged to a ceiling portion (an attic 1a in the present embodiment) nearer to the indoor unit 3 than to the rooftop and outside the building as the ceiling embedded type heat source unit 2 to enable the refrigerant pipes 4 and 5 that connect the indoor unit 3 and heat source unit 2 to one another to be shorter than those for the heat source unit arranged outside the room. In the present embodiment, the refrigerant pipes 4 and 5 that connect the heat source unit 2 and indoor unit 3 to one another are 10 m or less in length. Thus, the refrigerant pipes 4 and 5 can be made short to enable the refrigerant pressure loss to be reduced on the low pressure side of the compressor of the air conditioner.

[0022] That is, since the refrigerants HFO1234yf and HFO1234ze have low densities and large volumes in vapor state, the refrigerant pressure loss on the low pressure side easily becomes high. With the configuration as in the present embodiment, the refrigerant pressure loss on the low pressure side can be reduced, and power consumption of the compressor can be reduced. Even when using HFO1234yf and HFO1234ze, which are re-

frigerants having low global warming potentials, an efficient air conditioner can be obtained.

[0023] The embodiment illustrated in Fig. 1 has been explained using the heat source unit 2 in direct contact with the air outside the building 1. It can be also considered that the heat source unit 2 is provided inside the building, e.g., to further shorten the distance to the indoor unit 3. In such a case, since the heat source unit 2 is not in direct contact with the air outside the building, the outdoor air may be introduced to the heat source unit 2 via an air duct. In such a configuration, the lengths of the refrigerant pipes 4 and 5 that connect the heat source unit 2 and indoor unit 3 to one another can be easily 10 m or less. Thus, the refrigerant pressure loss on the low pressure side can be reduced easily even when HFO1234yf and HFO1234ze are used as the refrigerant.

[0024] Fig. 2 is a block diagram of the refrigeration cycle of the air conditioner illustrated in Fig. 1, and illustrates the heat source unit 2 and indoor unit 3. These heat source unit 2 and indoor unit 3 are connected by a gas side refrigerant pipe (gas side connection pipe) 4 and a liquid side refrigerant pipe (liquid side connection pipe) 5. In the heat source unit 2, a compressor 20, a four-way switching valve 21, a heat source side heat exchanger 22, and an expansion device 23 are sequentially connected by the refrigerant piping. A blower 24 draws outdoor air from outside the building and blows the air to the heat source side heat exchanger 22. The heat source side heat exchanger 22 exchanges heat between the drawn outdoor air and the refrigerant that flows inside the refrigerant piping of the heat exchanger 22 to condense the refrigerant (in cooling) and evaporate the refrigerant (in heating).

[0025] The indoor unit 3 is configured to connect the indoor heat exchanger 30 and expansion device 31 by the refrigerant piping. A blower 32 draws indoor air and blows the air to the indoor heat exchanger 30. The indoor heat exchanger 30 exchanges heat between the drawn indoor air and the refrigerant flowing in the refrigerant piping of the heat exchanger 30 to evaporate (in cooling) and condense (in heating) the refrigerant. Thus, cool air and warm air can be supplied into the room to condition air in the room.

[0026] The present embodiment describes that a refrigerant leakage detector (refrigerant leakage detection means) 33 is arranged in the indoor unit 3 and can detect refrigerant leakage immediately when the leakage occurs. This refrigerant leakage detector 33 may be arranged outside the indoor unit 3 or in the room in which the indoor unit 3 is arranged.

[0027] The heat source unit 2 and indoor unit 3 are connected to one another by the gas side refrigerant pipe 4 and liquid side refrigerant pipe 5. A gas side prevention valve 25 is provided to the gas side refrigerant pipe 4. A liquid side prevention valve 26 is provided to the liquid side refrigerant pipe 5. Usually, these prevention valves 25 and 26 are provided to the heat source unit 2 side. In the heat source unit 2, an arrow A in the heat source unit

2 illustrates a flow of the refrigerant in heating, and an arrow B illustrates a flow of the refrigerant in cooling.

[0028] Next, a configuration of the heat source unit 2 is explained using Fig. 3. Before that, a configuration of a conventional ceiling embedded type heat source unit is explained using Figs. 4 and 5 for comparison. Fig. 4 is a perspective view explaining an example of a ceiling embedded type heat source unit as the conventional air conditioner. Fig. 5 is a top view explaining airflow in the ceiling embedded type heat source unit illustrated in Fig. 4.

[0029] Fig. 4 illustrates the conventional ceiling embedded type heat source unit 2 corresponding to the ceiling embedded type heat source unit 2 illustrated in Fig. 1, and illustrates a case 2a. The inside of the case 2a is partitioned to an upstream space 2c and a downstream space 2d by a partition plate 2b. An air inlet 2e is to draw outdoor air (open air). An air outlet 2f is to blow the heat-exchanged air out of the downstream space 2d to outside the building.

[0030] The upstream space 2c includes the heat exchanger (heat source side heat exchanger) 22 that exchanges heat between the refrigerant flowing in a heat transfer tube and the outdoor air introduced from the air inlet 2e, a blower 24 that draws the outdoor air to supply the outdoor air to the heat exchanger 22, the compressor 20 that compresses the refrigerant, and a receiver 27 that receives an excess refrigerant condensed by the heat exchanger 22 and the like. A motor 24a is to drive the blower 24.

[0031] On the other hand, the downstream space 2d houses an electric part box 28 that houses electric parts such as a control substrate mounting electronic parts and a terminal base. The conventional the heat source unit 2 uses R407C, R410A, and the like as a refrigerant. In Fig. 4, the compressor 20, heat exchanger 22, and receiver 27 are refrigeration cycle components in which the refrigerant flows. The four-way switching valve 21 and expansion device 23 illustrated in Fig. 2 but not illustrated in Fig. 4 are also refrigeration cycle components in which the refrigerant flows.

[0032] Next, airflow in the conventional ceiling embedded type heat source unit illustrated in Fig. 4 is explained using Fig. 5. In Fig. 5, an arrow C illustrates airflow within the case 2a of the heat source unit 2. In the conventional ceiling embedded type heat source unit 2, the refrigeration cycle components such as the compressor 20, heat exchanger 22, and receiver 27 are arranged upstream from airflow C formed by the blower 24, and the blower 24 and electric part box 28 are arranged downstream from the airflow C. Therefore, when the refrigerant leaks from any of these refrigeration cycle components, the leaking refrigerant flows along the airflow C.

[0033] When a refrigerant such as HFO1234yf and HFO1234ze having low global warming potentials (GWPs) or a refrigerant such as R32 having a relatively small GWP, these refrigerants being slightly flammable refrigerants, is used as the refrigerant, the slightly flam-

mable refrigerant is entrained in the airflow C and contacts the motor 24a of the blower 24 and the electric part box 28. It has been found that there is the risk of combustion of a flammable refrigerant when the refrigerant is present around the electric parts in the event of heat generation and current leakage of the electric parts because the electric parts are housed in the electric part box 28. The same may occur also with respect to the motor 24a of the blower 24.

[0034] Therefore, in the present embodiment, the device arrangement inside the ceiling embedded type heat source unit 2 is configured as illustrated in Fig. 3. In the ceiling embedded type heat source unit illustrated in Fig. 3, the configuration corresponding to the conventional ceiling embedded type heat source unit illustrated in Figs. 4 and Fig. 5 is given the same reference numerals, the overlapped portions are not explained, and only the different portions are explained.

[0035] In the ceiling embedded type heat source unit 2 of the present embodiment, when the blower 24 is activated, the drawn airflow of the outdoor air illustrated by an outline arrow 6 flows from the air inlet 2e into the case 2a, and flows inside the case 2a and is blown from an air outlet 2f to outside the building as illustrated by the airflow C.

[0036] In the present embodiment, the refrigeration cycle components such as the compressor 20, heat exchanger 22, and receiver 27 in which the refrigerant flows are arranged to the downstream space 2d in the case 2a, and the blower 24 and electric part box 28 are arranged to the upstream space 2c in the case 2a.

[0037] With such a configuration, the refrigeration cycle components are downstream from the airflow and the electric part box 28 and blower 24 are arranged upstream from the refrigeration cycle components in the airflow. Thus, even when refrigerant leakage occurs from any of the refrigeration cycle components, the leaking refrigerant can be entrained in the airflow C and flown out of the building without contacting the electric part box 28 and blower 24. Therefore, even when a slightly flammable or flammable refrigerant leaks from the refrigeration cycle components, this refrigerant can be prevented from contacting the electric components in the electric part box 28 and the electric components such as the motor 24a of the blower 24, the electric components being capable of being ignition sources. Then, the risk of combustion can be avoided.

[0038] Further explanation will be made in detail. In the present embodiment, since HFO1234yf, HF01234ze, and the like, which are slightly flammable refrigerants, are used and the heat source unit is the ceiling embedded type heat source unit, the following risks are present in case of refrigerant leakage of the heat source unit. These include the risk of combustion inside the heat source unit, the risk of combustion in the building when the refrigerant may flow into the building such as the attic in the event of the refrigerant leakage from the heat source unit, and the risk of oxygen deficiency when the leaking refrigerant

enters the room. In the present embodiment, to deal with such problems, the electric part box 28 and blower 24 are arranged upstream from the refrigeration cycle components in the airflow. Thus, even when refrigerant leakage occurs in the ceiling embedded type heat source unit, the leaking refrigerant can be discharged out of the building without contacting the electric part box 28 and blower 24. The advantageous effect that combustion and oxygen deficiency due to refrigerant leakage from the ceiling embedded type heat source unit is preventable can be obtained.

[0039] Since the refrigerant leakage detector 33 is provided to the indoor unit to deal with refrigerant leakage from the indoor unit, the risks of combustion and oxygen deficiency can be avoided. That is, in the present embodiment, as illustrated in Fig. 2, the refrigerant leakage detector 33 is provided to the indoor unit 3. Thus, when refrigerant leakage occurs in the indoor unit 3, the refrigerant leakage detector 33 can detect the leakage, and generate an alert and the like to enable prevention of combustion and oxygen deficiency caused by deposition of the refrigerant in the indoor unit 3 and room 1b.

[0040] The refrigerant detector is expensive. In the present embodiment, the combustion and oxygen deficiency caused by the refrigerant leakage from the heat source unit can be prevented. Therefore, it is not necessary to provide a refrigerant leakage detector in the heat source unit. Therefore, the number of expensive refrigerant detectors can be reduced and an inexpensive air conditioner can be obtained accordingly. That is, in the present embodiment, since the heat source unit 2 is configured as explained in Fig. 3, it is not necessary to arrange a refrigerant leakage detector in the heat source unit 2. Therefore, the number of expensive refrigerant detectors can be reduced, and an inexpensive air conditioner can be realized by suppressing increase in cost.

[0041] In the present embodiment, since HFO1234yf and HF01234ze, which are refrigerants having low global warming potentials (GWPs), are used as a refrigerant of the air conditioner, there is a problem that the refrigerant pressure loss on the low pressure side of the air conditioner becomes large easily. Since the heat source unit 2 is the ceiling embedded type heat source unit in the present embodiment to handle the problem, the length of the refrigerant piping that connects the indoor unit and heat source unit to one another can be short, for example, 10 m or less. Therefore, while using the refrigerant such as HFO1234yf and HF01234ze, having low densities and large volumes in vapor state, the refrigerant pressure loss on the low pressure side of the air conditioner can be reduced. As a result, an efficient air conditioner that can also reduce power consumption can be obtained.

[0042] In the present embodiment, the blower 24 of the ceiling embedded type heat source unit 2 is driven periodically even while the air conditioner does not operate. That is, even during shutdown of the air conditioner, the blower 24 is rotated periodically, for example, for several seconds to several minutes once to several times a day

by use of a timer and the like to generate the airflow C in the case 2a of the heat source unit 2. Thus, even when the refrigerant leakage occurs during shutdown of the air conditioner, the leaking refrigerant can be discharged out of the building periodically. As a result, gradual deposition of the leaking refrigerant in the case 2a to increase the risk of combustion can be prevented.

[0043] When the blower is not operated periodically during shutdown of the air conditioner unlike in the present embodiment, the slightly flammable refrigerant remains in the heat source unit 2 and increases in density in case of the refrigerant leakage to increase the risk of fire. When the leaking refrigerant moves from the heat source unit 2 into the room 1b (see Fig. 1) through the attic and the like, the risks of combustion and oxygen deficiency arise in the room.

[0044] On the other hand, in the present embodiment, the blower 24 is periodically driven even during shutdown of the air conditioner as mentioned above. Thus, since the leaking refrigerant can be prevented from remaining in the heat source unit 2 to increase in density and from entering the room 1b, the combustion and oxygen deficiency due to the leakage of the slightly flammable refrigerant can be prevented certainly.

[0045] As described above, according to the present embodiment, the risk of fire can be avoided while using the slightly flammable refrigerant having a low global warming potential (GWP), and cost reduction can be achieved because the number of the refrigerant leakage detectors can be reduced. Since the refrigerant pressure loss on the low pressure side of the air conditioner can also be reduced, an advantageous effect that the efficient air conditioner can be obtained is also obtained.

[0046] The present invention is not limited to the above embodiment, but includes various modifications. For example, the above embodiment explains the example using HF01234yf and HFO1234ze, which have low global warming potentials (GWP) and are slightly flammable, as the refrigerant, but is applicable also when R32, which has a relatively small GWP and is slightly flammable, is used or when other refrigerants and mixed refrigerants having a similar property are used. The heat source unit has been explained as the ceiling embedded type heat source unit. The heat source unit is not limited to a ceiling embedded type. The technical concept of the present invention is also applicable to an outdoor unit arranged outside a building. Further, the above embodiment has been explained in detail for understanding the present invention, but is not necessarily limited to having all the explained configurations.

REFERENCE SIGNS LIST

[0047]

- 1: building
- 1a: ceiling portion (attic)
- 1b: room

- 2: ceiling embedded type heat source unit
- 2a: case
- 2b: partition plate
- 2c: upstream space
- 5 2d: downstream space
- 2e: air inlet
- 2f: air outlet
- 3: indoor unit
- 4: gas side refrigerant pipe
- 10 5: liquid side refrigerant pipe
- 6: airflow drawn into heat source unit
- 7: airflow blown out of heat source unit
- 8: airflow drawn into indoor unit
- 9: airflow blown out of indoor unit
- 15 10: occupant
- 20: compressor
- 21: four-way switching valve
- 22: heat source side heat exchanger
- 23: expansion device
- 20 24: blower
- 24a: motor
- 25: gas side prevention valve
- 26: liquid side prevention valve
- 27: receiver
- 25 28: electric part box
- 30: indoor heat exchanger
- 31: indoor expansion device
- 32: blower
- 33: refrigerant leakage detector (refrigerant leakage detection means)
- 30 A: refrigerant flow in heating
- B: refrigerant flow in cooling

35 Claims

1. An air conditioner comprising a heat source unit, the heat source unit using a flammable refrigerant having a low global warming potential, the heat source unit housing inside a case:

refrigeration cycle components such as a heat exchanger in which the refrigerant flows; an electric part box housing electric parts and the like; and a blower driven by a motor,

wherein airflow is formed in the case by the blower, the refrigeration cycle components in which the refrigerant flows are arranged in the airflow in the case, and the electric part box and the electric parts such as a motor of the blower are arranged upstream from the refrigeration cycle components in the airflow.

2. The air conditioner according to claim 1 wherein the refrigerant has a smaller flammability than a hydrocarbon natural refrigerant and is slightly flammable.

3. The air conditioner according to claim 2 wherein the slightly flammable refrigerant is at least any one of HFO1234yf, HFO1234ze, and R32.
4. The air conditioner according to claim 3 wherein the slightly flammable refrigerant is at least any one of HFO1234yf and HFO1234ze, and the heat source unit is a ceiling embedded type heat source unit arranged to a ceiling portion and the like in a building, and introduces outside air to perform heat exchange.
5. The air conditioner according to claim 4 wherein the ceiling embedded type heat source unit is connected, by refrigerant piping, to an indoor unit that conditions air in a room, and a length of the refrigerant piping that connects between the heat source unit and the indoor unit is 10 m or less.
6. The air conditioner according to claim 5 wherein refrigerant leakage detection means is provided to the indoor unit or in a room in which the indoor unit is arranged.
7. The air conditioner according to any one of claims 1 to 6 wherein the blower of the heat source unit is periodically driven even during shutdown of the air conditioner.

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FIG. 1

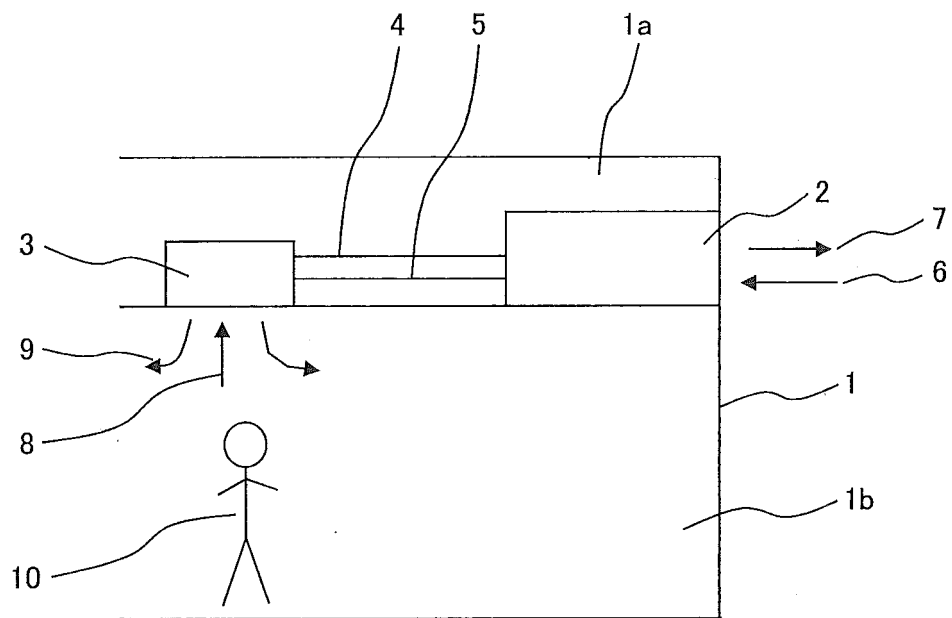


FIG. 2

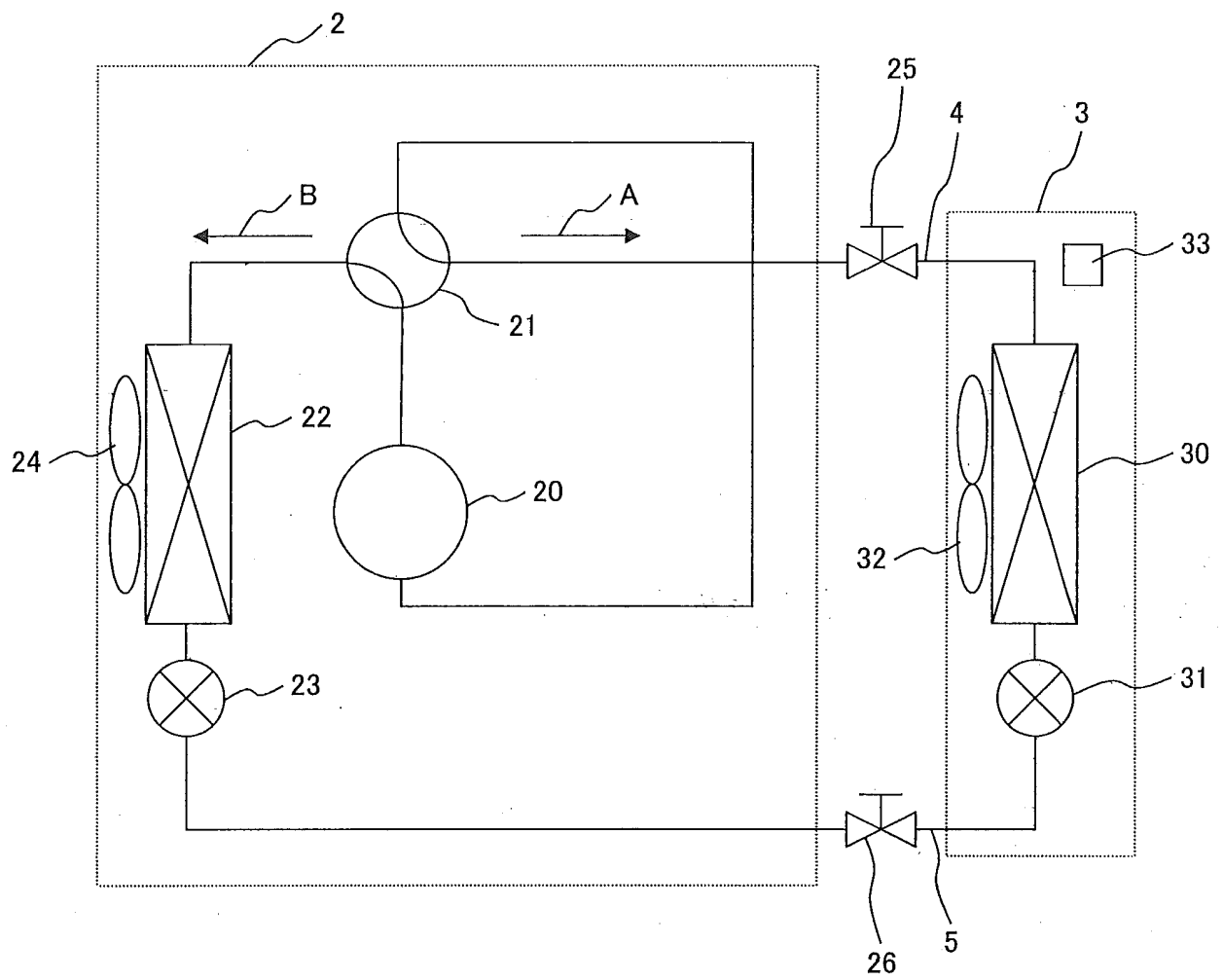


FIG. 3

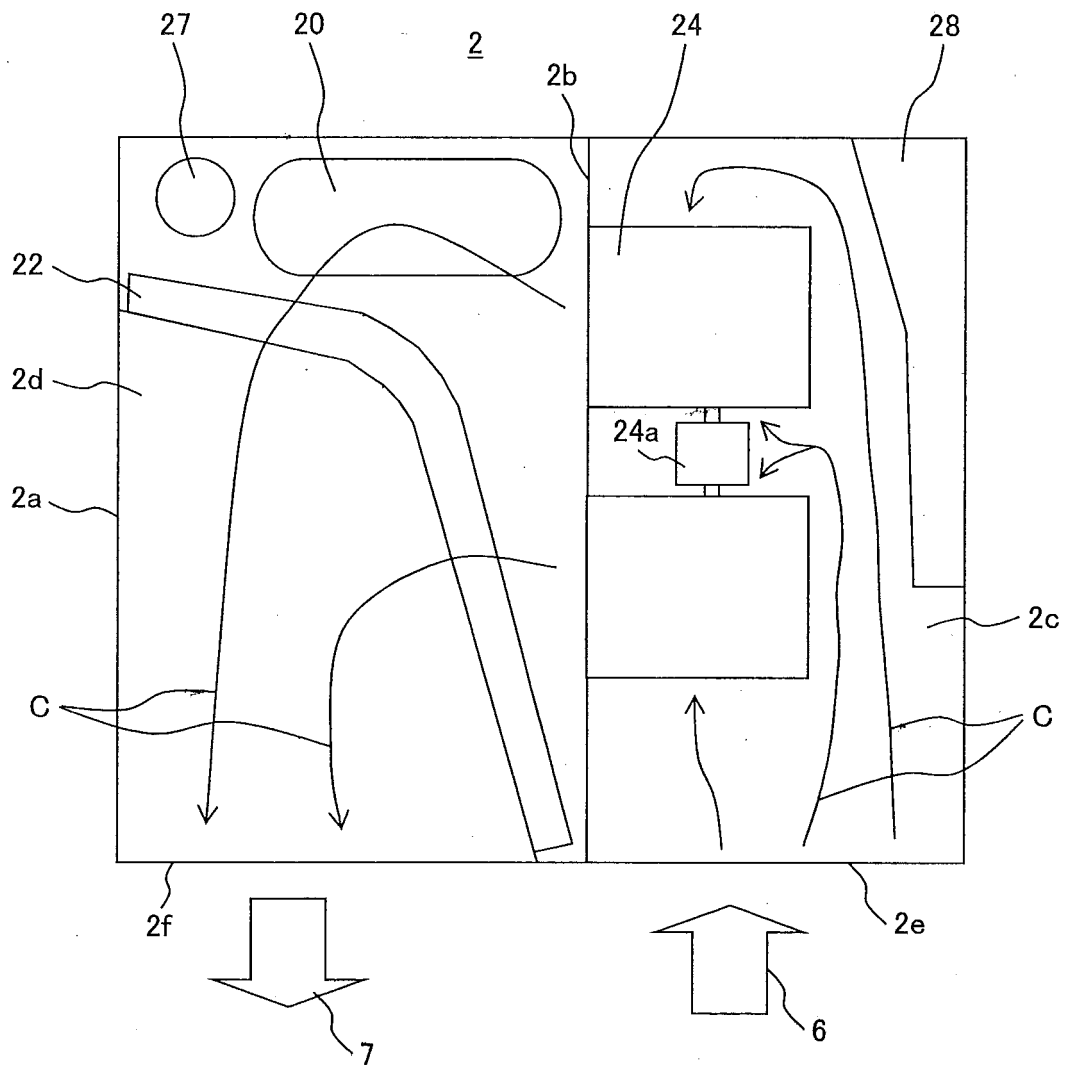


FIG. 4

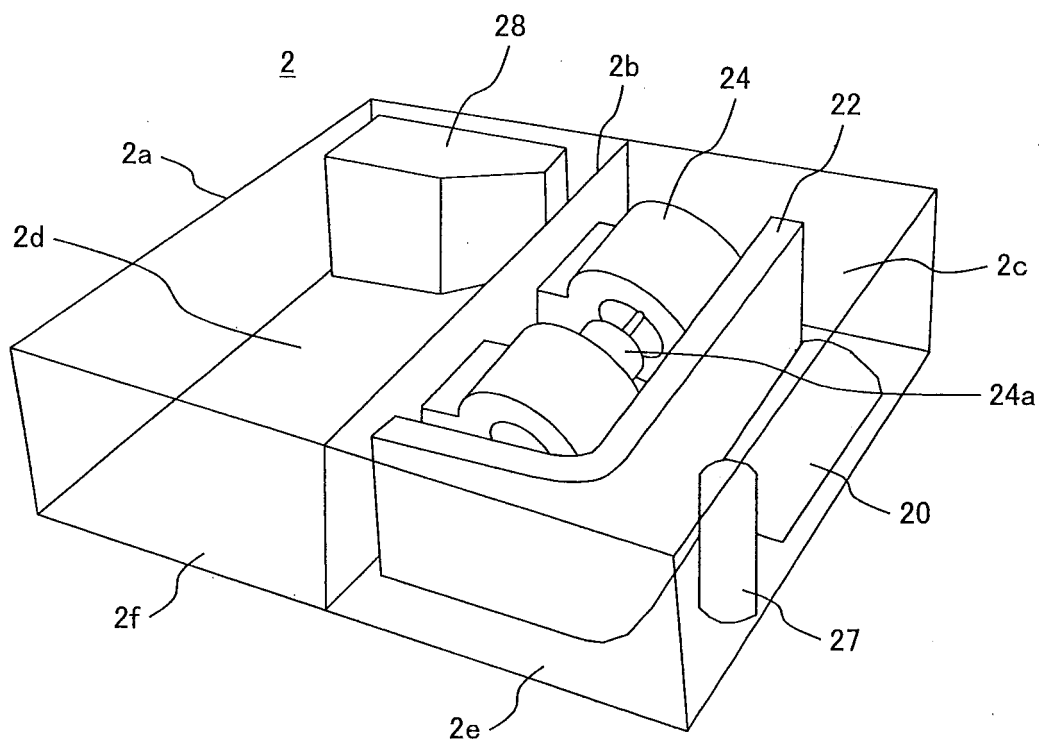
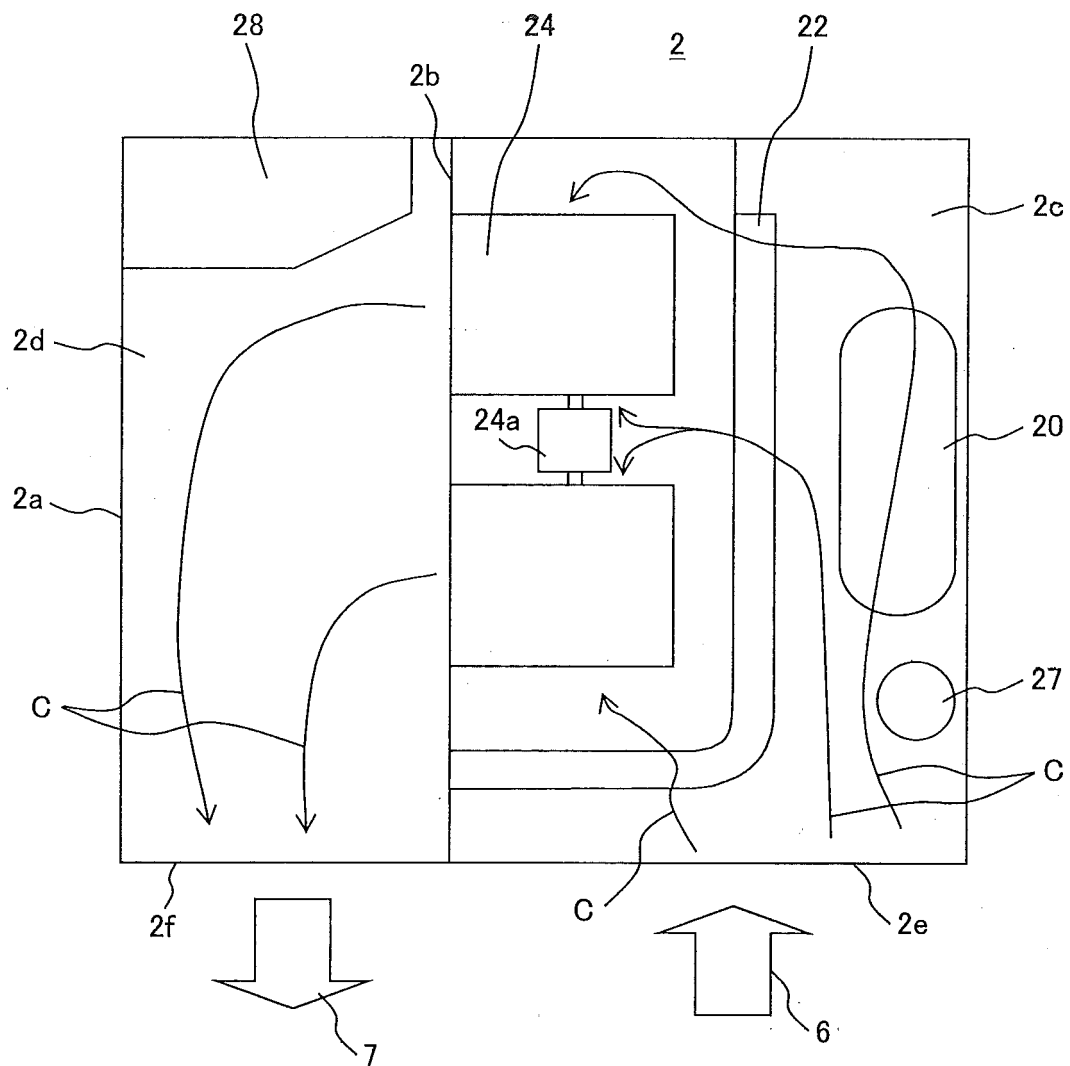


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/078436

A. CLASSIFICATION OF SUBJECT MATTER

F24F1/22(2011.01)i, F24F1/24(2011.01)i, F24F1/32(2011.01)i, F24F1/60
(2011.01)i, F24F7/007(2006.01)i, F24F11/02(2006.01)i, F24F11/04(2006.01)i,
F25B1/00(2006.01)i, F25B49/02(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)

F24F1/22, F24F1/24, F24F1/32, F24F1/60, F24F7/007, F24F11/02, F24F11/04,
F25B1/00, F25B49/02

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015
Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

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.
Y	JP 62-218745 A (Mitsubishi Electric Corp.), 26 September 1987 (26.09.1987), page 2, lower left column, line 19 to page 3, upper right column, line 7; fig. 1 to 3 (Family: none)	1-7
Y	WO 2013/145013 A1 (Mitsubishi Electric Corp.), 03 October 2013 (03.10.2013), claims; paragraph [0004] (Family: none)	1-7
Y	JP 2013-064525 A (Panasonic Corp.), 11 April 2013 (11.04.2013), paragraph [0027] (Family: none)	1-7

☒ Further documents are listed in the continuation of Box C.
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Date of the actual completion of the international search
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Date of mailing of the international search report
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Name and mailing address of the ISA/
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3-4-3, Kasumigaseki, Chiyoda-ku,
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C (Continuation).	DOCUMENTS CONSIDERED TO BE RELEVANT	
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 053883/1989 (Laid-open No. 144334/1990) (Daikin Industries, Ltd.), 07 December 1990 (07.12.1990), page 2, line 18 to page 16, line 18; page 1, left column, line 19 to page 2, right column, line 5; fig. 1 to 6 (Family: none)	4-7
Y	JP 09-318208 A (Daikin Industries, Ltd.), 12 December 1997 (12.12.1997), claims; fig. 1 to 3 (Family: none)	6-7
Y	JP 3291407 B2 (Sanyo Electric Co., Ltd.), 10 June 2002 (10.06.2002), claims; fig. 1 (Family: none)	6-7
Y	WO 2013/038703 A1 (Panasonic Corp.), 21 March 2013 (21.03.2013), claims; paragraph [0024]; fig. 1 (Family: none)	7

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REFERENCES CITED IN THE DESCRIPTION

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- JP 2002061996 A [0003] [0004]