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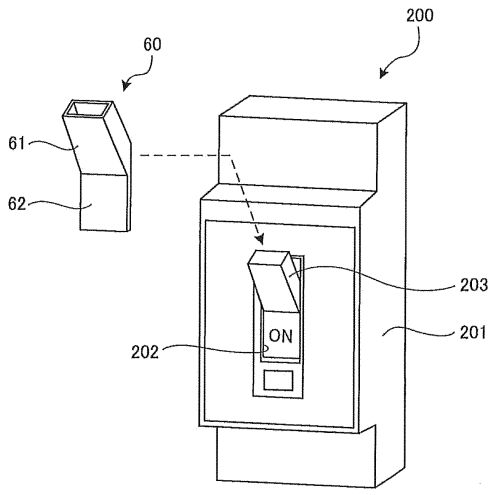
(54) REFRIGERATION CYCLE APPARATUS AND METHOD FOR POSITIONING SAME

(57) Provided is a refrigeration cycle apparatus including a refrigerant circuit configured to circulate refrigerant, a heat source unit accommodating a heat source-side heat exchanger of the refrigerant circuit, an indoor unit to be installed indoors and accommodating a load-side heat exchanger of the refrigerant circuit, a refrigerant detection unit configured to receive supply of power from the heat source unit or the indoor unit, and a cap to be mounted to a lever of a power feed switch configured to switch between an on state in which the power is supplied from a main power supply to the heat source unit or the indoor unit and an off state in which the supply of the power from the main power supply to the heat source unit or the indoor unit is interrupted.

FIG. 9



EP 3 346 211 A1

Description

Technical Field

[0001] The present invention relates to a refrigeration cycle apparatus that includes a refrigerant detection unit, and a method of installing the refrigeration cycle apparatus.

Background Art

[0002] In Patent Literature 1, there is disclosed an air-conditioning apparatus. The air-conditioning apparatus includes a refrigerant detection unit provided on an outer surface of an indoor unit and configured to detect refrigerant, and a controller configured to control an indoor air-sending fan to rotate when the refrigerant detection unit detects the refrigerant. The air-conditioning apparatus can detect leaked refrigerant by the refrigerant detection unit when the refrigerant leaks to an indoor space through an extension pipe connected to the indoor unit or when refrigerant leaked inside the indoor unit passes through a gap of a casing of the indoor unit to flow outside of the indoor unit. Further, when the leakage of the refrigerant is detected by the refrigerant detection unit, the indoor air-sending fan is rotated. With this action, indoor air is sucked through an air inlet formed in the casing of the indoor unit, and air is blown off to the indoor space through an air outlet. In this manner, the leaked refrigerant can be diffused. Further, the controller is backed up by a storage battery. Consequently, even during a period in which an operation of the air-conditioning apparatus is stopped (period in a power supply switch off state), the refrigerant can be detected by the refrigerant detection unit.

Citation List

Patent Literature

[0003] Patent Literature 1: Japanese Patent No. 4599699

Summary of Invention

Technical Problem

[0004] In Patent Literature 1, however, prevention of the power supply switch off state is not mentioned. Consequently, even when the storage battery for backup is mounted, after the power supply switch off state is continued for a long period of time, power feeding becomes impossible sooner or later. Consequently, there is a problem in that the leakage of the refrigerant may not be detected by the refrigerant detection unit.

[0005] The present invention has been made to solve the problem described above, and has an object to provide a refrigeration cycle apparatus capable of more reliably detecting leakage of refrigerant and a method of installing the refrigeration cycle apparatus.

Solution to Problem

[0006] According to one embodiment of the present invention, there is provided a refrigeration cycle apparatus including a refrigerant circuit configured to circulate refrigerant, a heat source unit accommodating a heat source-side heat exchanger of the refrigerant circuit, an indoor unit to be installed indoors and accommodating a load-side heat exchanger of the refrigerant circuit, a refrigerant detection unit configured to receive supply of power from the heat source unit or the indoor unit, and a cap to be mounted to a lever of a power feed switch configured to switch between an on state in which the power is supplied from a main power supply to the heat source unit or the indoor unit and an off state in which the supply of the power from the main power supply to the heat source unit or the indoor unit is interrupted.

[0007] According to one embodiment of the present invention, there is provided a method of installing the refrigeration cycle apparatus including connecting at least one of the heat source unit and the indoor unit to the main power supply via the power feed switch, operating the power feed switch into the on state, and mounting the cap onto the lever.

Advantageous Effects of Invention

[0008] According to one embodiment of the present invention, the power feed switch can be prevented from being operated into the off state. Consequently, the power can be constantly supplied to the refrigerant detection unit, and hence the leakage of the refrigerant can be more reliably detected.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a refrigerant circuit diagram for illustrating a schematic configuration of an air-conditioning apparatus according to Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a front view for illustrating an external configuration of an indoor unit 1 of the air-conditioning apparatus according to Embodiment 1 of the present invention.

[Fig. 3] Fig. 3 is a front view for schematically illustrating an internal structure of the indoor unit 1 of the air-conditioning apparatus according to Embodiment 1 of the present invention.

[Fig. 4] Fig. 4 is a side view for schematically illustrating the internal structure of the indoor unit 1 of the air-conditioning apparatus according to Embodiment 1 of the present invention.

[Fig. 5] Fig. 5 is a flowchart for illustrating an example

of refrigerant leakage detection processing executed by a controller 30 of the air-conditioning apparatus according to Embodiment 1 of the present invention.

[Fig. 6] Fig. 6 is a diagram for illustrating an example of a power supply path in the air-conditioning apparatus according to Embodiment 1 of the present invention.

[Fig. 7] Fig. 7 is a diagram for illustrating another example of the power supply path in the air-conditioning apparatus according to Embodiment 1 of the present invention.

[Fig. 8] Fig. 8 is a diagram for illustrating still another example of the power supply path in the air-conditioning apparatus according to Embodiment 1 of the present invention.

[Fig. 9] Fig. 9 is a perspective view for illustrating a configuration of a cap 60 included in the air-conditioning apparatus according to Embodiment 1 of the present invention together with a power feed switch 200 onto which the cap 60 is mounted.

[Fig. 10] Fig. 10 is a perspective view for illustrating a configuration of an indicator 51 included in the air-conditioning apparatus according to Embodiment 1 of the present invention together with the power feed switch 200 to which the indicator 51 is mounted.

[Fig. 11] Fig. 11 is a view for illustrating a modification example of the configuration of the cap 60 included in the air-conditioning apparatus according to Embodiment 1 of the present invention.

[Fig. 12] Fig. 12 is a diagram for illustrating an example of a packed state when the air-conditioning apparatus according to Embodiment 1 of the present invention is shipped.

Description of Embodiments

Embodiment 1

[0010] A refrigeration cycle apparatus and a method of installing the refrigeration cycle apparatus according to Embodiment 1 of the present invention are described. In Embodiment 1, an air-conditioning apparatus of a separate type is exemplified as the refrigeration cycle apparatus. Fig. 1 is a refrigerant circuit diagram for illustrating a schematic configuration of the air-conditioning apparatus according to Embodiment 1. In Fig. 1 and the subsequent drawings, for example, a dimensional relationship and a shape of components are different from actual ones.

[0011] As illustrated in Fig. 1, the air-conditioning apparatus includes a refrigerant circuit 40 configured to circulate refrigerant. The refrigerant circuit 40 includes a compressor 3, a refrigerant flow switching device 4, a heat source-side heat exchanger 5 (for example, outdoor heat exchanger), a pressure reducing device 6, and a load-side heat exchanger 7 (for example, indoor heat exchanger), which are annularly connected through refrigerant pipes in the stated order. Further, the air-conditioning apparatus includes, for example, an outdoor unit 2, which is installed outdoors as a heat source unit. Further, the air-conditioning apparatus includes, for example, an indoor unit 1, which is installed indoors as a load unit. The indoor unit 1 and the outdoor unit 2 are connected to each other through extension pipes 10a and 10b that are parts of the refrigerant pipes.

[0012] Examples of refrigerant used as the refrigerant to be circulated in the refrigerant circuit 40 include a slightly flammable refrigerant, for example, HFO-1234yf or HFO-1234ze and a strongly flammable refrigerant, for example, R290 or R1270. These refrigerants may be each used as a single component refrigerant, or may be used as a mixed refrigerant obtained by mixing two or more kinds of the refrigerants with each other. In the following description, the refrigerant having a flammability equal to or higher than a slightly flammable level (for example, 2L or higher in category of ASHRAE 34) is sometimes referred to as "flammable refrigerant". Further, as the refrigerant to be circulated in the refrigerant circuit 40, a nonflammable refrigerant, for example, R22 or R410A, having a nonflammability (for example, 1 in category of ASHRAE 34) can be used. These refrigerants have a density larger than that of air under, for example, an atmospheric pressure.

[0013] The compressor 3 is a fluid machine configured to compress sucked low-pressure refrigerant and to discharge the refrigerant as high-pressure refrigerant. The refrigerant flow switching device 4 is configured to switch a flow direction of the refrigerant in the refrigerant circuit 40 during a cooling operation and during a heating operation. As the refrigerant flow switching device 4, for example, a four-way valve is used. The heat source-side heat exchanger 5 is a heat exchanger configured to act as a radiator (for example, condenser) during the cooling operation and to act as an evaporator during the heating operation. In the heat source-side heat exchanger 5, heat is exchanged between the refrigerant circulated through an inside of the heat source-side heat exchanger 5 and outdoor air sent by an outdoor air-sending fan 5f described later. The pressure reducing device 6 is configured to reduce the pressure of the high-pressure refrigerant so that the high-pressure refrigerant becomes the low-pressure refrigerant. As the pressure reducing device 6, for example, an electronic expansion valve having an adjustable opening degree is used. The load-side heat exchanger 7 is a heat exchanger configured to act as an evaporator during the cooling operation and to act as a radiator (for example, condenser) during the heating operation. In the load-side heat exchanger 7, heat is exchanged between the refrigerant circulated through an inside of the load-side heat exchanger 7 and air sent by an indoor air-sending fan 7f described later. In this case, the cooling operation represents an operation of supplying low-temperature and low-pressure refrigerant to the load-side heat exchanger 7, and the heating operation represents an operation of supplying high-temperature and high-pressure refrigerant to the load-side heat ex-

changer 7.

[0014] The outdoor unit 2 accommodates the compressor 3, the refrigerant flow switching device 4, the heat source-side heat exchanger 5, and the pressure reducing device 6. Further, the outdoor unit 2 accommodates the outdoor air-sending fan 5f configured to supply outdoor air to the heat source-side heat exchanger 5. The outdoor air-sending fan 5f is installed to be opposed to the heat source-side heat exchanger 5. When the outdoor air-sending fan 5f is rotated, an airflow passing through the heat source-side heat exchanger 5 is generated. As the outdoor air-sending fan 5f, for example, a propeller fan is used. The outdoor air-sending fan 5f is arranged, for example, downstream of the heat source-side heat exchanger 5 along the airflow generated by the outdoor air-sending fan 5f.

[0015] The refrigerant pipes arranged in the outdoor unit 2 include a refrigerant pipe connecting between an extension pipe connection valve 13a on the gas side during the cooling operation and the refrigerant flow switching device 4, a suction pipe 11 connected to a suction side of the compressor 3, a discharge pipe 12 connected to a discharge side of the compressor 3, a refrigerant pipe connecting between the refrigerant flow switching device 4 and the heat source-side heat exchanger 5, a refrigerant pipe connecting between the heat source-side heat exchanger 5 and the pressure reducing device 6, and a refrigerant pipe connecting between an extension pipe connection valve 13b on the liquid side during the cooling operation and the pressure reducing device 6. The extension pipe connection valve 13a is formed of a two-way valve capable of switching between open and closed states, and has one end to which a joint portion (for example, flare joint) is mounted. Further, the extension pipe connection valve 13b is formed of a three-way valve capable of switching between open and closed states. The extension pipe connection valve 13b has one end to which a service port 14a is mounted, and another end to which a joint portion (for example, flare joint) is mounted. The service port 14a is used at a time of vacuuming, which is a preliminary work of filling the refrigerant circuit 40 with refrigerant.

[0016] During both the cooling operation and the heating operation, high-temperature and high-pressure gas refrigerant compressed by the compressor 3 flows through the discharge pipe 12. During both the cooling operation and the heating operation, low-temperature and low-pressure gas refrigerant or two-phase refrigerant subjected to an evaporation action flows through the suction pipe 11. The suction pipe 11 is connected to a low-pressure-side service port 14b with a flare joint, and the discharge pipe 12 is connected to a high-pressure-side service port 14c with a flare joint. The service ports 14b and 14c are used to connect a pressure gauge to measure the operating pressure at a time of installation of the air-conditioning apparatus or at a time of a trial run for a repair.

[0017] The indoor unit 1 accommodates the load-side heat exchanger 7. Further, the indoor air-sending fan 7f configured to supply air to the load-side heat exchanger 7 is installed in the indoor unit 1. When the indoor air-sending fan 7f is rotated, an airflow passing through the load-side heat exchanger 7 is generated. As the indoor air-sending fan 7f, a centrifugal fan (for example, sirocco fan or turbofan), a cross flow fan, a mixed flow fan, an axial-flow fan (for example, propeller fan), or other fans is used depending on a configuration of the indoor unit 1. The indoor air-sending fan 7f of Embodiment 1 is arranged upstream of the load-side heat exchanger 7 along the airflow generated by the indoor air-sending fan 7f, but may be arranged downstream of the load-side heat exchanger 7.

[0018] Of the refrigerant pipes of the indoor unit 1, a gas-side indoor pipe 9a is provided in a connection portion to the gas-side extension pipe 10a with a joint portion 15a (for example, flare joint) for connection to the extension pipe 10a. Further, of the refrigerant pipes of the indoor unit 1, a liquid-side indoor pipe 9b is provided in a connection portion to the liquid-side extension pipe 10b with a joint portion 15b (for example, flare joint) for connection to the extension pipe 10b.

[0019] Further, the indoor unit 1 includes, for example, a suction air temperature sensor 91 configured to measure a temperature of indoor air sucked from the indoors, a heat exchanger entrance temperature sensor 92 configured to measure a refrigerant temperature at an entrance portion of the load-side heat exchanger 7 during the cooling operation (exit portion during the heating operation), and a heat exchanger temperature sensor 93 configured to measure a refrigerant temperature (evaporating temperature or condensing temperature) of a two-phase portion of the load-side heat exchanger 7. In addition, the indoor unit 1 includes a refrigerant detection unit 99 described later. These sensors are configured to output a detection signal to a controller 30 configured to control an entirety of the indoor unit 1 or the air-conditioning apparatus.

[0020] The controller 30 includes a microcomputer including a CPU, a ROM, a RAM, an input-output port, and a timer. The controller 30 can perform data communications with an operation unit 26 (see Fig. 2). The operation unit 26 is configured to receive an operation performed by a user and output an operation signal based on the operation to the controller 30. The controller 30 of Embodiment 1 is configured to control the operation of the entirety of the indoor unit 1 or the air-conditioning apparatus including an operation of the indoor air-sending fan 7f on the basis of an operation signal received from the operation unit 26, the detection signal received from the sensors, or other signals. The controller 30 may be provided inside a casing of the indoor unit 1, or may be provided inside a casing of the outdoor unit 2. Further, the controller 30 may include an outdoor unit controller that is provided to the outdoor unit 2 and an indoor unit controller that is provided to the indoor unit 1 and capable of performing data communications with the outdoor unit

controller.

[0021] Next, description is made of the operation of the refrigerant circuit 40 of the air-conditioning apparatus. First, the operation during the cooling operation is described. In Fig. 1, the solid arrows indicate flow directions of the refrigerant during the cooling operation. The refrigerant circuit 40 is configured such that, during the cooling operation, a refrigerant flow passage is switched by the refrigerant flow switching device 4 as indicated by the solid line, and the low-temperature and low-pressure refrigerant flows into the load-side heat exchanger 7.

[0022] The high-temperature and high-pressure gas refrigerant discharged from the compressor 3 first flows into the heat source-side heat exchanger 5 after passing through the refrigerant flow switching device 4. During the cooling operation, the heat source-side heat exchanger 5 acts as a condenser. That is, in the heat source-side heat exchanger 5, heat is exchanged between the refrigerant circulated through the inside and the outdoor air sent by the outdoor air-sending fan 5f, and heat of condensation of the refrigerant is transferred to the outdoor air. With this operation, the refrigerant that has flowed into the heat source-side heat exchanger 5 is condensed to become high-pressure liquid refrigerant. The high-pressure liquid refrigerant flows into the pressure reducing device 6, and is reduced in pressure to become low-pressure two-phase refrigerant. The low-pressure two-phase refrigerant passes through the extension pipe 10b, and flows into the load-side heat exchanger 7 of the indoor unit 1. During the cooling operation, the load-side heat exchanger 7 acts as an evaporator. That is, in the load-side heat exchanger 7, heat is exchanged between the refrigerant circulated through the inside and the air (for example, indoor air) sent by the indoor air-sending fan 7f, and heat of evaporation of the refrigerant is received from the sent air. With this operation, the refrigerant that has flowed into the load-side heat exchanger 7 evaporates to become low-pressure gas refrigerant or two-phase refrigerant. Further, the air sent by the indoor air-sending fan 7f is cooled by a heat receiving action of the refrigerant. The low-pressure gas refrigerant or two-phase refrigerant evaporated by the load-side heat exchanger 7 passes through the extension pipe 10a and the refrigerant flow switching device 4, and is sucked by the compressor 3. The refrigerant sucked by the compressor 3 is compressed to become the high-temperature and high-pressure gas refrigerant. During the cooling operation, the above-mentioned cycle is repeated.

[0023] Next, the operation during the heating operation is described. In Fig. 1, the dotted arrows indicate flow directions of the refrigerant during the heating operation. The refrigerant circuit 40 is configured such that, during the heating operation, the refrigerant flow passage is switched by the refrigerant flow switching device 4 as indicated by the dotted line, and the high-temperature and high-pressure refrigerant flows into the load-side heat exchanger 7. During the heating operation, the refrigerant flows in a direction reverse to the refrigerant flow during the cooling operation, and the load-side heat exchanger 7 acts as a condenser. That is, in the load-side heat exchanger 7, heat is exchanged between the refrigerant circulated through the inside and the air sent by the indoor air-sending fan 7f, and the heat of condensation of the refrigerant is transferred to the sent air. With this operation, the air sent by the indoor air-sending fan 7f is heated by a heat transferring action of the refrigerant.

[0024] Fig. 2 is a front view for illustrating a configuration of an outer appearance of the indoor unit 1 of the air-conditioning apparatus according to Embodiment 1. Fig. 3 is a front view for schematically illustrating an internal structure of the indoor unit 1. Fig. 4 is a side view for schematically illustrating the internal structure of the indoor unit 1. The left side of Fig. 4 indicates a front surface side (indoor space side) of the indoor unit 1. In Embodiment 1, as the indoor unit 1, the indoor unit 1 of a floor type, which is installed on a floor surface of an indoor space that is an air-conditioned space, is described as an example. In the following description, positional relationships (for example, top-bottom relationship) of components are, in principle, exhibited when the indoor unit 1 is installed in a usable state.

[0025] As illustrated in Fig. 2 to Fig. 4, the indoor unit 1 includes a casing 111 having a vertically elongated rectangular parallelepiped shape. An air inlet 112 configured to suck air inside the indoor space is formed in a lower portion of a front surface of the casing 111. The air inlet 112 of Embodiment 1 is provided at a position close to the floor surface and below a center portion of the casing 111 along a vertical direction. An air outlet 113 configured to blow off the air sucked from the air inlet 112 indoors is formed in the upper portion of the front surface of the casing 111, that is, at a position higher than the air inlet 112 (for example, above the center portion of the casing 111 along the vertical direction). The operation unit 26 is provided to the front surface of the casing 111, above the air inlet 112, and below the air outlet 113. The operation unit 26 is connected to the controller 30 through a communication line, and is capable of performing data communications with the controller 30. In the operation unit 26, an operation start operation, an operation end operation, s switching operation of an operation mode, a setting operation of a set temperature and a set airflow rate, and other operations for the air-conditioning apparatus are performed by a user. The operation unit 26 includes a display unit or an audio output unit as a notifier configured to inform a user of various information. Adjacent to a position below the operation unit 26, an indicator 50 different from the display unit of the operation unit 26 is provided. Although the indicator 50 is provided adjacent to the position below the operation unit 26 in Embodiment 1, the indicator 50 may be provided above or on a side of (beside) the operation unit 26 or may be provided on the operation unit 26 as indicated by the broken line in Fig. 2. Details of the indicator 50 are described later.

[0026] The casing 111 is a hollow box body, and a front opening part is formed in a front surface of the casing 111. The casing 111 includes a first front panel 114a, a second front panel 114b, and a third front panel 114c, which are removably mounted to the front opening part. The first front panel 114a, the second front panel 114b, and the third front panel 114c all have a substantially rectangular flat outer shape. The first front panel 114a is removably mounted to a lower part of the front opening part of the casing 111. In the first front panel 114a, the air inlet 112 described above is formed. The second front panel 114b is arranged immediately above the first front panel 114a, and is removably mounted to a center part of the front opening part of the casing 111 along the vertical direction. In the second front panel 114b, the operation unit 26 and the indicator 50 that are described above are provided. The third front panel 114c is arranged immediately above the second front panel 114b, and is removably mounted to an upper part of the front opening part of the casing 111. In the third front panel 114c, the air outlet 113 described above is formed.

[0027] An internal space of the casing 111 is roughly divided into a space 115a being an air-sending part and a space 115b being a heat-exchanging part located above the space 115a. The space 115a and the space 115b are partitioned by a partition portion 20. The partition portion 20 has, for example, a flat shape, and is arranged approximately horizontally. In the partition portion 20, at least an air passage opening part 20a is formed to serve as an air passage between the space 115a and the space 115b. The space 115a is defined to be exposed to the front surface side when the first front panel 114a is removed from the casing 111, and the space 115b is defined to be exposed to the front surface side when the second front panel 114b and the third front panel 114c are removed from the casing 111. That is, the partition portion 20 is mounted at approximately the same height as a height of an upper edge of the first front panel 114a or a lower edge of the second front panel 114b. In this case, the partition portion 20 may be formed integrally with a fan casing 108 described later, may be formed integrally with a drain pan described later, or may be formed separately from the fan casing 108 or the drain pan.

[0028] In the space 115a, there is arranged the indoor air-sending fan 7f, which is configured to cause a flow of air from the air inlet 112 to the air outlet 113 in the air passage 81 of the casing 111. The indoor air-sending fan 7f of Embodiment 1 is a sirocco fan including a motor (not shown) and an impeller 107. The impeller 107 is connected to an output shaft of the motor, and has a plurality of blades arranged, for example, at regular intervals along a circumferential direction. A rotary shaft of the impeller 107 is arranged substantially in parallel with a depth direction of the casing 111.

[0029] The impeller 107 of the indoor air-sending fan 7f is covered with the fan casing 108 having a spiral shape. The fan casing 108 is formed, for example, separately from the casing 111. A suction opening part 108b for sucking the indoor air through the air inlet 112 into the fan casing 108 is formed in the vicinity of the center of a spiral of the fan casing 108. The suction opening part 108b is located to be opposed to the air inlet 112. Further, an air outlet opening part 108a for blowing off the sent air is formed along a direction of a tangential line of the spiral of the fan casing 108. The air outlet opening part 108a is arranged to be oriented upward, and is connected to the space 115b through the air passage opening part 20a of the partition portion 20. In other words, the air outlet opening part 108a communicates to the space 115b through the air passage opening part 20a. An opening end of the air outlet opening part 108a and an opening end of the air passage opening part 20a may be directly connected to each other, or may be indirectly connected to each other through a duct member or other members.

[0030] Further, in the space 115a, there is provided an electrical component box 25 accommodating, for example, a microcomputer that forms the controller 30, various electrical components, and a board.

[0031] The load-side heat exchanger 7 is arranged in the air passage 81 in the space 115b. The drain pan (not shown) configured to receive condensed water that is condensed on a surface of the load-side heat exchanger 7 is provided below the load-side heat exchanger 7. The drain pan may be formed as a part of the partition portion 20, or may be formed separately from the partition portion 20 and arranged on the partition portion 20.

[0032] The refrigerant detection unit 99 is provided at a lower part of the space 115a. As the refrigerant detection unit 99, an electric refrigerant detection unit such as an electric gas sensor (for example, a semiconductor gas sensor or a hot-wire type semiconductor gas sensor) is used. The refrigerant detection unit 99 is configured to detect, for example, a refrigerant concentration in the air around the refrigerant detection unit 99, and to output the detection signal to the controller 30. The controller 30 determines presence or absence of leakage of the refrigerant on the basis of the detection signal received from the refrigerant detection unit 99.

[0033] In the indoor unit 1, leakage of refrigerant is liable to occur at a brazed portion of the load-side heat exchanger 7 and at the joint portions 15a and 15b. Further, the refrigerant used in Embodiment 1 has a density larger than that of the air under the atmospheric pressure. Hence, the refrigerant detection unit 99 of Embodiment 1 is provided at a position lower in height than the load-side heat exchanger 7 and the joint portions 15a and 15b in the casing 111. With this arrangement, the refrigerant detection unit 99 can reliably detect the leaked refrigerant at least when the indoor air-sending fan 7f is stopped. In Embodiment 1, the refrigerant detection unit 99 is provided at the lower part of the space 115a, but an arrangement position of the refrigerant detection unit 99 may be another position.

[0034] Fig. 5 is a flowchart for illustrating an example

of the flow of the refrigerant leakage detection processing executed by the controller 30 of the air-conditioning apparatus according to Embodiment 1. The refrigerant leakage detection processing is executed repeatedly with predetermined time intervals at normal time including time when the air-conditioning apparatus is operating and is stopped, or only time when the air-conditioning apparatus is stopped.

[0035] In Step S1 of Fig. 5, the controller 30 acquires information on the refrigerant concentration around the refrigerant detection unit 99 on the basis of the detection signal received from the refrigerant detection unit 99.

[0036] Next, in Step S2, the controller 30 determines whether or not the refrigerant concentration around the refrigerant detection unit 99 is equal to or larger than a threshold value set in advance. When the controller 30 determines that the refrigerant concentration is equal to or larger than the threshold value, the processing proceeds to Step S3. When the controller 30 determines that the refrigerant concentration is smaller than the threshold value, the processing is terminated.

[0037] In Step S3, the controller 30 starts the operation of the indoor air-sending fan 7f. When the indoor air-sending fan 7f is already operating, the operation is continued as it is. In Step S3, the display unit, the audio output unit, or other units provided in the operation unit 26 may be used to inform a user that the leakage of the refrigerant has occurred. Further, the indoor air-sending fan 7f that has started to operate in Step S3 may be stopped after a predetermined time set in advance has elapsed.

[0038] As described above, in the refrigerant leakage detection processing, when the leakage of the refrigerant is detected (that is, when the refrigerant concentration detected by the refrigerant detection unit 99 is equal to or larger than the threshold value), the operation of the indoor air-sending fan 7f is started. With this operation, it is possible to diffuse the leaked refrigerant. Hence, it is possible to inhibit the refrigerant concentration from increasing locally indoors.

[0039] As described above, in Embodiment 1, examples of the refrigerant to be circulated in the refrigerant circuit 40 include flammable refrigerants such as HFO-1234yf, HFO-1234ze, R290, and R1270. Consequently, in case of leakage of refrigerant in the indoor unit 1, there is a fear in that the indoor refrigerant concentration is increased to form a flammable concentration region (for example, region in which the refrigerant concentration is equal to or larger than the lower flammable limit (LFL)).

[0040] These flammable refrigerants have a density larger than that of air under the atmospheric pressure. Consequently, when the leakage of the refrigerant occurs at a position at which the height from the floor surface of the indoor space is relatively large, the leaked refrigerant is diffused while descending. Thus, the refrigerant concentration becomes uniform in the indoor space, and hence the refrigerant concentration is less liable to be increased. In contrast, when the leakage of the refrigerant occurs at a position at which the height from the floor surface of the indoor space is small, the leaked refrigerant remains at a low position close to the floor surface, and hence the refrigerant concentration tends to be locally increased. As a result, in the indoor unit 1 of a floor type, in particular, the risk of the formation of the flammable concentration region is relatively increased.

[0041] While the air-conditioning apparatus is operated, air is blown off to the indoor space due to the operation of the indoor air-sending fan 7f of the indoor unit 1. Consequently, even when the flammable refrigerant leaks to the indoor space, the leaked flammable refrigerant is diffused in the indoor space by the air being blown off. In this manner, the flammable concentration region can be inhibited from being formed in the indoor space. However, while the air-conditioning apparatus is stopped, the indoor air-sending fan 7f of the indoor unit 1 is also stopped, and hence the leaked refrigerant cannot be diffused by the air being blown off. Consequently, detection of the leaked refrigerant is more required while the air-conditioning apparatus is stopped. In Embodiment 1, the operation of the indoor air-sending fan 7f is started when the leakage of the refrigerant is detected, and hence the flammable concentration region can be inhibited from being formed in the indoor space even when the flammable refrigerant leaks to the indoor space while the air-conditioning apparatus is stopped.

[0042] To reliably detect the leakage of the refrigerant, however, the power is required to be constantly supplied to the refrigerant detection unit 99. Further, to reliably activate the indoor air-sending fan 7f when the leakage of the refrigerant is detected, the power is required to be constantly supplied to the indoor air-sending fan 7f, that is, the indoor unit 1.

[0043] Fig. 6 is a diagram for illustrating an example of a power supply path in the air-conditioning apparatus according to Embodiment 1 of the present invention. In Fig. 6, an outdoor power-receiving type air-conditioning apparatus including the outdoor unit 2 connected to a power supply is exemplified. In Fig. 6, to schematically illustrate the power supply path, the operation unit 26, which is a part of the indoor unit 1, is illustrated separately from the indoor unit 1. As illustrated in Fig. 6, power (for example, three-phase 200 V AC power) is supplied from a main power supply through a power supply line 120, a power feed switch 200, and a power supply line 121 to the outdoor unit 2 of the air-conditioning apparatus. The power is supplied to the indoor unit 1 from the outdoor unit 2 through an indoor and outdoor connection line 122. The indoor unit 1 and the outdoor unit 2 perform communication with each other through the indoor and outdoor connection line 122. The power is supplied to the operation unit 26 from the indoor unit 1 through a control line 123. Further, the controller of the indoor unit 1 and the operation unit 26 perform communication with each other through the control line 123. Although not illustrated in Fig. 6, the power is supplied to the refrigerant detection unit 99 from the indoor unit 1.

[0044] The power feed switch 200 is configured to

switch between an on state in which the power is supplied from the main power supply to the outdoor unit 2 and an off state in which the supply of the power from the main power supply to the outdoor unit 2 is interrupted. In general, when a lever of the power feed switch 200 is moved up by an operation of a user or other personnel, the on state is achieved. When the lever is moved down, the off state is achieved. The power feed switch 200 includes an earth leakage breaker, an ampere breaker, a knife switch, and other components. When the power feed switch 200 is the earth leakage breaker, for example, the on state and the off state of the power feed switch 200 are switched by the operation of the lever. Besides, when earth leakage occurs, or an overcurrent is generated, the power feed switch 200 is brought into the off state regardless of the operation of the lever to protect a load circuit. The power feed switch 200 is set up by an installation worker independently of the air-conditioning apparatus, and is generally set up on site.

[0045] Although the outdoor power-receiving type air-conditioning apparatus is exemplified in Fig. 6, the power supply path of the air-conditioning apparatus is not limited to that of the above-mentioned type. Fig. 7 is a diagram for illustrating another example of the power supply path in the air-conditioning apparatus according to Embodiment 1 of the present invention. In Fig. 7, there is exemplified an indoor power-receiving type air-conditioning apparatus in which the indoor unit 1 is connected to the power supply through the power feed switch 200. As illustrated in Fig. 7, the power is supplied to the indoor unit 1 from the main power supply through the power supply line 120, the power feed switch 200, and the power supply line 121. The power is supplied to the outdoor unit 2 from the indoor unit 1 through the indoor and outdoor connection line 122.

[0046] Fig. 8 is a diagram for illustrating still another example of the power supply path in the air-conditioning apparatus according to Embodiment 1 of the present invention. In Fig. 8, there is exemplified an indoor and outdoor separate power-receiving type air-conditioning apparatus in which the outdoor unit 2 and the indoor unit 1 are each connected to a power supply. As illustrated in Fig. 8, the power is supplied to the outdoor unit 2 from the main power supply through a power supply line 120a, a power feed switch 200a, and a power supply line 121a. The power is supplied to the indoor unit 1 from the main power supply through a power supply line 120b, a power feed switch 200b, and a power supply line 121b.

[0047] When the power is supplied through the power supply paths as illustrated in Fig. 6 to Fig. 8, the power feed switches 200, 200a, 200b, and other power feed switches are required to be constantly kept in the on state so that the power is constantly supplied to the indoor unit 1 including the refrigerant detection unit 99.

[0048] Fig. 9 is a perspective view for illustrating a configuration of a cap 60 included in the air-conditioning apparatus according to Embodiment 1 together with the power feed switch 200 onto which the cap 60 is mounted. In Fig. 9, the power feed switch 200 in the on state is illustrated. As illustrated in Fig. 9, a vertically elongated opening port 202 is formed in a front surface of a casing 201 of the power feed switch 200. A lever 203 projects forward to a position in front of the casing 201 from an inside of the casing 201 through the opening port 202. The lever 203 is rotatable about a rotary shaft provided horizontally inside the casing 201 within a range between an upper end and a lower end of the opening port 202. The lever 203 is stabilized at two positions corresponding to the upper end and the lower end of the opening port 202. When the lever 203 is moved up from the lower end to the upper end of the opening port 202 by an operation of a user or other personnel, the power feed switch 200 is brought into the on state. At this time, the lever 203 projects obliquely upward from the opening port 202. When the lever 203 is moved down from the upper end to the lower end of the opening port 202, the power feed switch 200 is brought into the off state. At this time, the lever 203 projects obliquely downward from the opening port 202.

[0049] The cap 60 is mounted onto the lever 203 being in the on state to prevent the lever 203 in the on state from being needlessly moved down by a user. The cap 60 includes a hollow tubular portion 61 and a flange portion 62. The hollow tubular portion 61 receives the lever 203. The flange portion 62 extends obliquely from one axial end portion of the tubular portion 61, and is configured to close a portion of the opening port 202 corresponding to the lower part of the lever 203. The cap 60 has a shape fittable over the lever 203 being in the on state as a whole. In this manner, it is possible to give a user (or unspecified person accessible to the power feed switch 200) who sees the cap 60 mounted onto the lever 203 a visual impression that the lever 203 must not be needlessly operated. Consequently, the power feed switch 200 can be prevented from being operated into the off state by a user. It is desired that the cap 60 have such shape and color as to allow a user to visually confirm that the cap 60 is mounted on the lever 203 in a distinct manner.

[0050] The cap 60 is made of an insulating material. It is desired that the cap 60 be formed of a soft material having flexibility or elasticity (for example, a resin, a rubber, a silicon resin, or other materials). When the cap 60 is made of a material having flexibility or elasticity, the lever 203 can be operated even with the cap 60 mounted. In this manner, for example, when the power feed switch 200 is an earth leakage breaker, the cap 60 does not affect functions as the earth leakage breaker to be brought into the off state to protect the load circuit when the earth leakage occurs or the overcurrent is generated.

[0051] Further, for example, even in the case where the earth leakage breakers are used, a size of the lever 203 of the power feed switch 200 slightly differs depending on a manufacturer. When the cap 60 is made of a material having elasticity, the cap 60 can be reliably mounted to the lever 203 regardless of the manufacturer

of the power feed switch 200. Consequently, the cap 60 can be prevented from coming off the lever 203 due to a large size of the opening port of the cap 60 in comparison to that of the lever 203, and the cap 60 can be prevented from failing to be mounted onto the lever 203 due to a small size of the opening port of the cap 60 in comparison to that of the lever 203. When the cap 60 is made of a relatively hard resin, a plurality of kinds of the caps 60 having different sizes or shapes may be grouped as one set so that the cap 60 can be reliably mounted onto the lever 203 regardless of the manufacturer of the power feed switch 200.

[0052] When the air-conditioning apparatus according to Embodiment 1 is shipped, the cap 60 is packed together with at least one of the indoor unit 1 and the outdoor unit 2. Specifically, when the indoor unit 1 and the outdoor unit 2 are packed separately, the cap 60 is packed together with one of the indoor unit 1 and the outdoor unit 2. Further, when the indoor unit 1 and the outdoor unit 2 are packed together, the cap 60 is packed together with both the indoor unit 1 and the outdoor unit 2. In this manner, the cap 60 can be reliably provided to an installation worker or a user of the air-conditioning apparatus.

[0053] Although the cap 60 having an overall shape fittable to the lever 203 being in the on state is illustrated in Fig. 9 as an example, the shape of the cap 60 is not limited to the example. The cap 60 only needs to have a shape allowing its mounting onto the lever 203. For example, the cap 60 may include the tubular portion 61 alone into which the lever 203 is fitted. As long as the cap 60 is mounted onto the lever 203 being in the on state, attention of a user who looks at the power feed switch 200 can be drawn to the power feed switch 200. Consequently, the power feed switch 200 can be prevented from being operated into the off state by a user.

[0054] Fig. 10 is a perspective view for illustrating a configuration of an indicator 51 included in the air-conditioning apparatus according to Embodiment 1 together with the power feed switch 200 to which the indicator 51 is mounted. As illustrated in Fig. 10, the indicator 51 has a sheet-like or plate-like shape. The indicator 51 is bonded onto the surface of the casing 201 of the power feed switch 200 to be mounted to the power feed switch 200. On the indicator 51, information indicating that the power feed switch 200 needs to be constantly kept in the on state except for maintenance and repair of the air-conditioning apparatus is displayed by printing. Although the indicator 51 of this example displays the information by printing, a mode of display is not limited to the example. For example, when the indicator 51 includes a display device, the above-mentioned information may be electromagnetically displayed on a display surface of the display device. Further, although the indicator 51 of this example is directly mounted onto the power feed switch 200, the indicator 51 may be mounted in the vicinity of the power feed switch 200.

[0055] The indicator 51 is packed together with at least one of the indoor unit 1 and the outdoor unit 2 at the time of shipment of the air-conditioning apparatus according to Embodiment 1. In this manner, the indicator 51 can be reliably provided to an installation worker or a user of the air-conditioning apparatus.

[0056] With the configuration described above, visual and intuitive attention-drawing effects for a user are provided by the cap 60. In addition, an attention-drawing effect for a user is also provided by the information (for example, character information) displayed on the indicator 51. Consequently, the power feed switch 200 can be more reliably prevented from being operated into the off state by a user.

[0057] Further, as illustrated in Fig. 2, the indicator 50 may be provided to the indoor unit 1. The indicator 50 is bonded to the front surface of the casing 111 at a position adjacent to the operation unit 26 or onto the operation unit 26 to be mounted to the indoor unit 1. On the indicator 50, information indicating that the power feed switch 200 needs to be constantly kept in the on state except for maintenance and repair of the air-conditioning apparatus is displayed by printing. Although the indicator 50 of this example displays the information by printing, a mode of display is not limited to the example. For example, as the indicator 50, the indicator being the notifier of the operation unit 26 may be used. When the indicator 50 includes a display device, the above-mentioned information may be electromagnetically displayed on a display surface of the display device. For example, the indicator 50 has already been mounted to the indoor unit 1 at the time of shipment of a product. Alternatively, the indicator 50 may be packed together with the indoor unit 1 at the time of shipment of the product to be mounted to the indoor unit 1 by an installation worker or a user.

[0058] To prevent the power feed switch 200 from being operated into the off state by a user, a great effect can be directly obtained by mounting the indicator 51 onto the power feed switch 200, which is operated by a user or other personnel. However, it is the indoor unit 1 that a user touches or looks at in the air-conditioning apparatus on the daily basis. Consequently, when the indicator 50 is provided to the indoor unit 1, a user can be daily made aware that the power feed switch 200 needs to be constantly kept in the on state.

[0059] It is the operation unit 26 or the notifier (for example, an indicator or a liquid crystal display unit) that a user, in particular, frequently touches or looks at in the indoor unit 1. In this example, the notifier is a part of the operation unit 26. Consequently, when the indicator 50 is provided adjacent to the operation unit 26, a user can be made aware in a more effective manner that the power feed switch 200 needs to be constantly kept in the on state. Further, the operation unit 26 is inevitably operated by the installation worker or a worker for maintenance and repair. Consequently, when the indicator 50 is provided adjacent to the operation unit 26, even an installation worker or a worker for maintenance and repair can be made aware that the power feed switch 200 needs to

be constantly kept in the on state.

[0060] Fig. 11 is a view for illustrating a modification example of the configuration of the cap 60 included in the air-conditioning apparatus according to Embodiment 1 of the present invention. As illustrated in Fig. 11, an indicator 52 is attached to the cap 60 of this example. A string 63 is brought to pass through a hole formed in the flange portion 62 and a hole formed in the indicator 52, and is tied to bind the cap 60 and the indicator 52 together. The indicator 52 is attached to the power feed switch 200 through the cap 60.

[0061] The indicator 52 has a sheet-like or plate-like shape. On one or both of surfaces of the indicator 52, information indicating that the power feed switch 200 needs to be constantly kept in the on state except for maintenance and repair of the air-conditioning apparatus is displayed by printing. In this example, the above-mentioned information is displayed as a combination of the "!" mark and character information indicating "KEEP POWER ON EXCEPT FOR MAINTENANCE AND REPAIR". Although the indicator 52 of this example displays the information by printing, a mode of display is not limited to the example. For example, when the indicator 52 includes a display device, the above-mentioned information may be electromagnetically displayed on a display surface of the display device.

[0062] The cap 60 and the indicator 52 are packed together with at least one of the indoor unit 1 and the outdoor unit 2 at the time of shipment of the air-conditioning apparatus. The cap 60 and the indicator 52 may be bound together at the time of shipment of the air-conditioning apparatus. Alternatively, the string 63 may be a component to be packed together with the cap 60 and the indicator 52, and the cap 60 and the indicator 52 may be bound together with the string by the worker at an installation site of the air-conditioning apparatus.

[0063] In this modification example, the indicator 52 is attached to the cap 60. Consequently, the indicator 52 is not required to be directly mounted to the power feed switch 200 at an installation site of the air-conditioning apparatus. In this modification example, the indicator 52 can be attached to the power feed switch 200 when the cap 60 is mounted onto the lever 203. Thus, there is no fear of leaving the indicator 52 unattached to the power feed switch 200.

[0064] The indicator 52 may be attached to the lever 203 of the power feed switch 200 using a string or a rubber string.

[0065] Next, an installation manual and an instruction manual included in the air-conditioning apparatus according to Embodiment 1 are described. The installation manual and the instruction manual are packed together with at least one of the indoor unit 1 and the outdoor unit 2 at the time of shipment of the air-conditioning apparatus. The installation manual and the instruction manual may be printed materials or electronic recording media. A service manual distributed to service centers and other places is described below together with the installation manual and the instruction manual.

[0066] In the installation manual, there is a description of a method of installing at least one of the indoor unit 1 and the outdoor unit 2 and other information as information for an installation worker who installs the air-conditioning apparatus. For example, the installation manual contains the following information.

1. List of bundled components
2. Procedure of installation of the indoor unit and the outdoor unit
3. Procedure of refrigerant pipe laying work (including connection of extension pipes between the indoor unit and the outdoor unit, an airtightness test, vacuuming, and refrigerant filling)
4. Electric work procedure
5. Test run procedure

[0067] In this case, the installation work for the air-conditioning apparatus is carried out in the order of installation of the indoor unit 1 and the outdoor unit 2, the refrigerant pipe laying work, the electric work, the test run, and delivery.

[0068] As a description of the electric work procedure, there is a description at least that, after at least one of the indoor unit 1 and the outdoor unit 2 is connected to the main power supply via the power feed switch 200, the power feed switch 200 is operated into the on state and the cap 60 is mounted onto the lever 203. When the indicators 51 and 52 are packed together, there is a description that the indicators 51 and 52 are mounted to the power feed switch 200 by a predetermined method as a description of the electric work procedure.

[0069] Further, in the installation manual, there is a description that the power feed switch 200 is constantly kept in the on state without being operated into the off state after end of the electric work or the test run. Further, in the installation manual, there is a description that the installation worker needs to inform a user that the power feed switch 200 is constantly kept in the on state when the air-conditioning apparatus is delivered to a user.

[0070] An installation worker can understand the contents described above by reading the installation manual. Specifically, on the basis of the description of the installation manual, when an installation worker installs the air-conditioning apparatus, at least one of the indoor unit 1 and the outdoor unit 2 is connected to the main power supply via the power feed switch 200. Subsequently, the power feed switch 200 is operated into the on state. The cap 60 is mounted onto the lever 203, and the indicators 51 and 52 are mounted to the power feed switch 200. After completion of the installation work (for example, the test run carried out before the delivery), the installation worker keeps the power feed switch 200 in the on state. In this manner, after the completion of the installation work, the power supply to the air-conditioning apparatus can be prevented from being interrupted by the installation worker. Further, the cap 60 and the indicators 51 and

52 are mounted to the power feed switch 200. As a result, the power supply to the air-conditioning apparatus can be prevented from being interrupted by a user (or unspecified person accessible to the power feed switch 200).

[0071] In the service manual distributed to the service centers or other places, there is a description of a maintenance and repair method for at least one of the indoor unit 1 and the outdoor unit 2 as information for workers for maintenance and repair of the air-conditioning apparatus. For example, in the service manual, there is a description that the power feed switch 200 is operated into the off state to prevent electric shock hazard at the time of maintenance and repair and that the power feed switch 200 is operated into the on state and the cap 60 and the indicator 52 are mounted to the lever 203 as they were after end of the maintenance and repair, and other information.

[0072] A worker for maintenance and repair can understand the above-mentioned contents by reading the service manual. Consequently, after the end of the maintenance and repair, the power feed switch 200 is reliably operated into the on state by the worker. Further, after the end of the maintenance and repair, the cap 60 and the indicator 52 are reliably mounted to the lever 203 by the worker. In this manner, the power supply to the air-conditioning apparatus can be prevented from being interrupted by a user (or unspecified person accessible to the power feed switch 200).

[0073] In the instruction manual, there is a description of a usage instruction of at least one of the indoor unit 1 (including the operation unit 26) and the outdoor unit 2 as information for users. For example, in the instruction manual, there is a description that the indoor unit 1 and the outdoor unit 2 need to be used with the cap 60 mounted to the lever 203, and that the power feed switch 200 needs to be constantly kept in the on state (during spring and fall during which the air-conditioning apparatus is not used and a long period over which the air-conditioning apparatus is unused as idle apparatus) except for maintenance and repair. Further, in the instruction manual, there is a description that the indoor unit 1 includes the refrigerant detection unit 99 configured to detect the leakage of the refrigerant, and that the indoor unit 1 is required to be constantly supplied with the power to allow the refrigerant detection unit 99 to function constantly.

[0074] A user can understand the above-mentioned contents by reading the instruction manual. Consequently, except for a period in which a specialized worker carries out maintenance and repair, the supply of power to the air-conditioning apparatus can be prevented from being interrupted by a user over a whole period in which the air-conditioning apparatus is used (for example, a period from the delivery to removal). The attention-drawing effects for a user, which are provided by the cap 60 mounted onto the lever 203 of the power feed switch 200, the indicators 51 and 52 mounted to the power feed switch 200, and the indicator 50 provided to the indoor unit 1, are made more reliable because of the above-mentioned contents contained in the instruction manual.

[0075] Based on the description of the installation manual and the service manual described above, after the end of the installation or the maintenance and repair of the air-conditioning apparatus, the cap 60 and the indicators 51 and 52 are reliably mounted to the power feed switch 200. Further, on the basis of the description of the installation manual and the service manual described above, the supply of power to the air-conditioning apparatus can be prevented from being interrupted by the installation worker or the worker for maintenance and repair.

[0076] Further, on the basis of the description of the instruction manual described above, the attention-drawing effects for a user provided by the cap 60 and the indicators 50, 51, and 52 are enhanced. Consequently, the supply of power to the air-conditioning apparatus can be more reliably prevented from being interrupted by a user.

[0077] Fig. 12 is a diagram for illustrating an example of a packed state when the air-conditioning apparatus according to Embodiment 1 is shipped. As illustrated in Fig. 12, in a package A, an installation manual 131 for the outdoor unit 2, an instruction manual 135 for the outdoor unit 2, the cap 60, the indicators 51 and 52, the string 63, and other components are packed together with the outdoor unit 2. In a package B different from the package A, an installation manual 132 for the indoor unit 1, an instruction manual 136 for the indoor unit 1, and other components are packed together with the indoor unit 1.

[0078] As described above, the refrigeration cycle apparatus according to Embodiment 1 includes the refrigerant circuit 40 configured to circulate refrigerant, the outdoor unit 2 accommodating the heat source-side heat exchanger 5 of the refrigerant circuit 40, the indoor unit 1 to be installed indoors and accommodating the load-side heat exchanger 7 of the refrigerant circuit 40, the refrigerant detection unit 99 configured to receive supply of power from the outdoor unit 2 or the indoor unit 1, and the cap 60 to be mounted to the lever 203 of the power feed switch 200 configured to switch between the on state in which the power is supplied from the main power supply to the outdoor unit 2 or the indoor unit 1 and the off state in which the supply of the power from the main power supply to the outdoor unit 2 or the indoor unit 1 is interrupted.

[0079] With the configuration described above, attention of a user or other personnel can be drawn to the power feed switch 200 by mounting the cap 60 onto the lever 203. Thus, the power feed switch 200 can be prevented from being operated into the off state by a user or other personnel. Consequently, the refrigerant detection unit 99 can be constantly receive supply of power, and hence the leakage of the refrigerant can be more reliably detected.

[0080] Further, in the refrigeration cycle apparatus ac-

cording to Embodiment 1, the cap 60 may be packed together with at least one of the outdoor unit 2 and the indoor unit 1 at the time of shipment of the product. With the configuration described above, the cap 60 can be reliably provided to an installation worker or a user.

[0081] Further, in the refrigeration cycle apparatus according to Embodiment 1, the cap 60 may be made of a material having flexibility or elasticity. Further, in the refrigeration cycle apparatus according to Embodiment 1, the cap 60 may be made of a resin, a rubber, or a silicon resin. With the configuration described above, the lever 203 can be operated even with the cap 60 mounted. Consequently, the functions of the power feed switch 200 can be prevented from being affected.

[0082] Further, the refrigeration cycle apparatus according to Embodiment 1 further includes the indicator 51 or 52 to be mounted to the power feed switch 200. The indicator 51 or 52 may display information indicating that the power feed switch 200 needs to be kept in the on state. With the configuration described above, the attention-drawing effects for a user or other personnel can be obtained by the information displayed on the indicator 51 or 52. Consequently, the power feed switch 200 can be more reliably prevented from being operated into the off state by a user or other personnel.

[0083] Further, in the refrigeration cycle apparatus according to Embodiment 1, the indicator 51 or 52 may be packed together with at least one of the outdoor unit 2 and the indoor unit 1 at the time of shipment of the product. With the configuration described above, the indicator 51 or 52 can be reliably provided to an installation worker or a user.

[0084] Further, in the refrigeration cycle apparatus according to Embodiment 1, the indicator 52 may be attached to the cap 60. With the configuration described above, the indicator 52 can be mounted to the power feed switch 200 when the cap 60 is mounted onto the lever 203. Thus, the indicator 52 can be prevented from being left unattached.

[0085] Further, in the refrigeration cycle apparatus according to Embodiment 1, the indoor unit 1 includes the operation unit 26 configured to receive the operation by a user, and the indicator 50 provided adjacent to the operation unit 26 or on the operation unit 26. The indicator 50 may display information indicating that the power feed switch 200 needs to be kept in the on state. With the configuration described above, a user or other personnel can be made aware that the power feed switch 200 needs to be kept in the on state.

[0086] Further, the refrigeration cycle apparatus according to Embodiment 1 further includes the installation manual containing the description of the installation method for at least one of the outdoor unit 2 and the indoor unit 1. The installation manual may contain information indicating that, after at least one of the outdoor unit 2 and the indoor unit 1 is connected to the main power supply via the power feed switch 200, the power feed switch 200 is operated into the on state and the cap 60 is mounted onto the lever 203. With the configuration described above, the cap 60 is reliably mounted to the power feed switch 200. Thus, the power feed switch 200 can be prevented from being operated into the off state by a user or other personnel.

[0087] Further, in the refrigeration cycle apparatus according to Embodiment 1, the service manual may contain information indicating that the power feed switch 200 is operated into the on state and the cap 60 is mounted onto the lever 203 after the end of the maintenance and repair. With the configuration described above, the cap 60 can be reliably mounted to the power feed switch 200. Thus, the power feed switch 200 can be prevented from being operated into the off state by a user or other personnel.

[0088] Further, the refrigeration cycle apparatus according to Embodiment 1 further includes the instruction manual containing the description of the usage instruction of at least one of the outdoor unit 2 and the indoor unit 1. The instruction manual may contain information indicating that at least one of the outdoor unit 2 and the indoor unit 1 needs to be used under the state in which the cap 60 is mounted onto the lever 203 and that the power feed switch 200 needs to be kept in the on state. With the configuration described above, the power feed switch 200 can be prevented from being operated into the off state by a user or other personnel.

[0089] Further, the refrigeration cycle apparatus according to Embodiment 1 further includes the air-sending fan 7f to be installed indoors and the controller 30 configured to control the air-sending fan 7f. The controller 30 is configured to operate the air-sending fan 7f when leakage of the refrigerant is detected on the basis of a detection signal from the refrigerant detection unit 99. With the configuration described above, even when the refrigerant leaks, the leaked refrigerant can be diffused.

[0090] Further, the method of installing the refrigeration cycle apparatus according to Embodiment 1 includes connecting at least one of the outdoor unit 2 and the indoor unit 1 to the main power supply via the power feed switch 200, operating the power feed switch 200 into the on state, and mounting the cap 60 onto the lever 203. With the installation method described above, attention of a user or other personnel can be drawn to the power feed switch 200 by mounting the cap 60 onto the lever 203. Consequently, the power feed switch 200 can be prevented from being operated into the off state by a user or other personnel. Consequently, the refrigerant detection unit 99 can be constantly supplied with the power, and hence the leakage of the refrigerant can be more reliably detected.

Other Embodiments

[0091] The present invention is not limited to Embodiment 1 above, and various modifications may be made to the configuration.

[0092] For example, in Embodiment 1 above, the in-

door unit 1 is exemplified by an indoor unit of a floor type, but the present invention can be applied to other indoor units of, for example, a ceiling-mounted cassette type, a ceiling-concealed type, a ceiling-suspended type, and a wall-hung type.

[0093] Further, in Embodiment 1 above, the refrigeration cycle apparatus is exemplified by the air-conditioning apparatus. However, the present invention can also be applied to other refrigeration cycle apparatus such as a heat pump water heater, a refrigerating machine, and a showcase.

[0094] Further, in the refrigeration cycle apparatus, a storage battery may be mounted. When the storage battery is mounted, the storage battery serves as a backup power supply in case of blackout.

[0095] Further, Embodiment 1 above and modification examples may be used in combinations.

Reference Signs List

[0096] 1 indoor unit 2 outdoor unit 3 compressor 4 refrigerant flow switching device 5 heat source-side heat exchanger 5f outdoor air-sending fan 6 pressure reducing device 7 load-side heat exchanger 7f indoor air-sending fan 9a, 9b indoor pipe 10a, 10b extension pipe 11 suction pipe 12 discharge pipe 13a, 13b extension pipe connecting valve 14a, 14b, 14c service port 15a, 15b joint portion 20 partition portion 20a air passage opening part 25 electrical component box 26 operation unit 30 controller 40 refrigerant circuit 50, 51, 52 indicator 60 cap 61
tubular portion 62 flange portion 63 string 81 air passage 91
suction air temperature sensor 92 heat exchanger entrance temperature sensor 93 heat exchanger temperature sensor 99 refrigerant detection unit 107 impeller 108 fan casing 108a air outlet opening part 108b suction opening part 111 casing 112 air inlet 113 air outlet 114a first front panel 114b second front panel 114c third front panel 115a, 115b space 120, 120a, 120b, 121, 121a, 121b power supply line 122 indoor and outdoor connection line 123 control line 131, 132 installation manual 135, 136
instruction manual 200, 200a, 200b power feed switch 201 casing 202
opening port 203 lever

Claims

1. A refrigeration cycle apparatus, comprising:

a refrigerant circuit configured to circulate refrigerant;
a heat source unit accommodating a heat source-side heat exchanger of the refrigerant circuit;
an indoor unit to be installed indoors and accommodating a load-side heat exchanger of the refrigerant circuit;
a refrigerant detection unit configured to receive supply of power from the heat source unit or the indoor unit; and
a cap to be mounted to a lever of a power feed switch configured to switch between an on state in which the power is supplied from a main power supply to the heat source unit or the indoor unit and an off state in which the supply of the power from the main power supply to the heat source unit or the indoor unit is interrupted.

2. The refrigeration cycle apparatus of claim 1, wherein the cap is packed together with at least one of the heat source unit and the indoor unit at a time of shipment of a product.

3. The refrigeration cycle apparatus of claim 1 or 2, wherein the cap is made of a material having flexibility or elasticity.

4. The refrigeration cycle apparatus of claim 3, wherein the cap is made of a resin, a rubber, or a silicon resin.

5. The refrigeration cycle apparatus of any one of claims 1 to 4, further comprising a first indicator to be mounted to the power feed switch,
wherein the first indicator is configured to display information indicating that the power feed switch needs to be kept in the on state.

6. The refrigeration cycle apparatus of claim 5, wherein the first indicator is packed together with at least one of the heat source unit and the indoor unit at a time of shipment of a product.

7. The refrigeration cycle apparatus of claim 5 or 6, wherein the first indicator is mounted onto the cap.

8. The refrigeration cycle apparatus of any one of claims 1 to 7,
wherein the indoor unit includes

an operation unit configured to receive an operation, and
a second indicator provided adjacent to the operation unit or on the operation unit, and

wherein the second indicator is configured to display information indicating that the power feed switch needs to be kept in the on state.

9. The refrigeration cycle apparatus of any one of claims 1 to 8, further comprising an installation manual containing a description of an installation method of at least one of the heat source unit and the indoor unit,

wherein the installation manual contains information indicating that, after at least one of the heat source unit and the indoor unit is connected to the main power supply via the power feed switch, the power feed switch is operated into the on state and the cap is mounted onto the lever.

10. The refrigeration cycle apparatus of any one of claims 1 to 9, further comprising an instruction manual containing a description of a usage instruction of at least one of the heat source unit and the indoor unit,
wherein the instruction manual contains information indicating that at least one of the heat source unit and the indoor unit needs to be used under a state in which the cap is mounted onto the lever and that the power feed switch needs to be kept in the on state.

11. The refrigeration cycle apparatus of any one of claims 1 to 10, further comprising an air-sending fan to be installed indoors and a controller configured to control the air-sending fan,
wherein the controller is configured to operate the air-sending fan when leakage of the refrigerant is detected on a basis of a detection signal from the refrigerant detection unit.

12. A method of installing the refrigeration cycle apparatus of any one of claims 1 to 11, comprising:

connecting at least one of the heat source unit and the indoor unit to the main power supply via the power feed switch;
operating the power feed switch into the on state; and
mounting the cap onto the lever.

FIG. 1

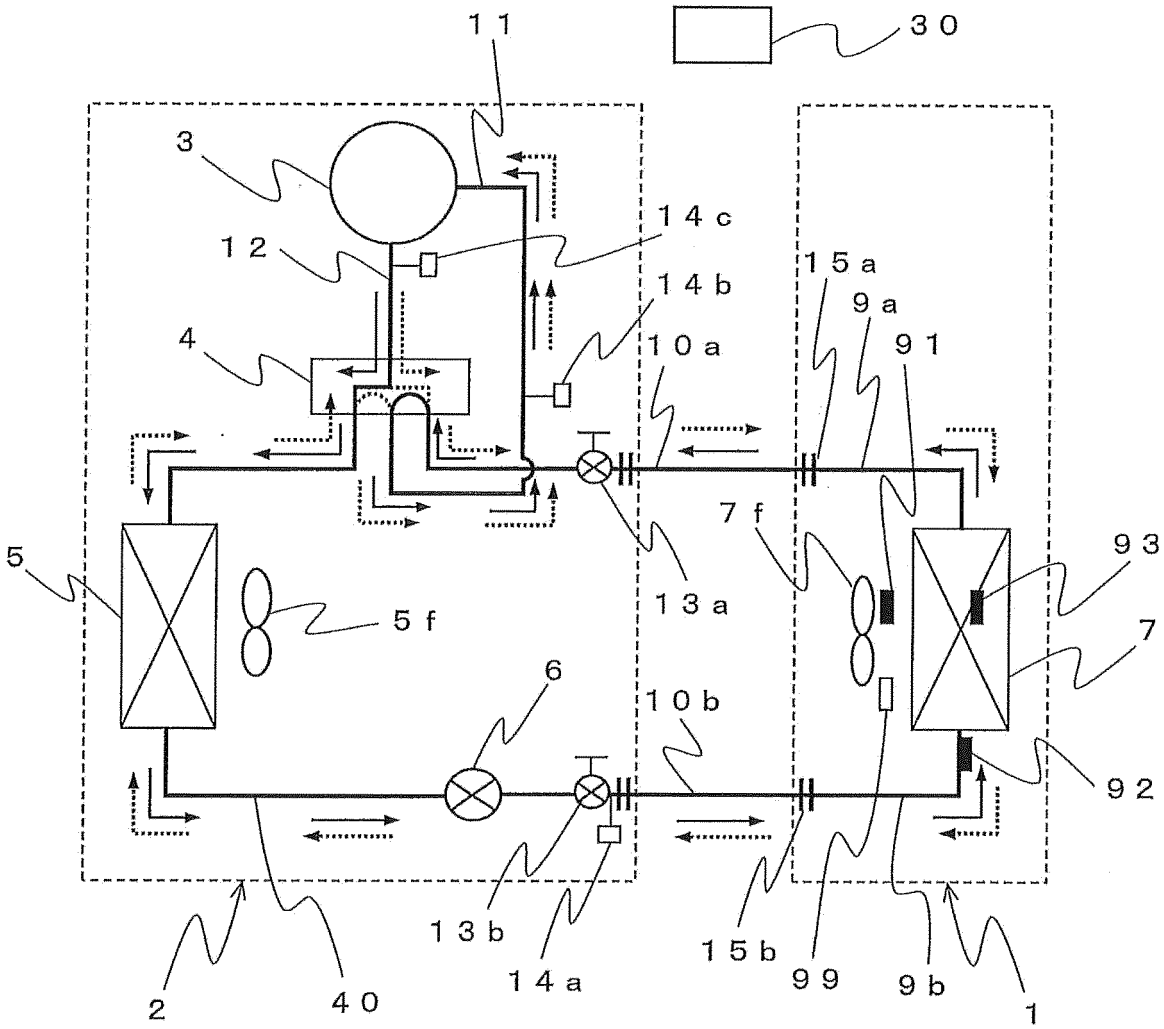

11
30
3
14c
12
15a
14b
9a
4
10a
91
7f
93
5
13a
5f
7
6
10b
92
13b
15b
14a
99
9b
2
40
1

FIG. 2

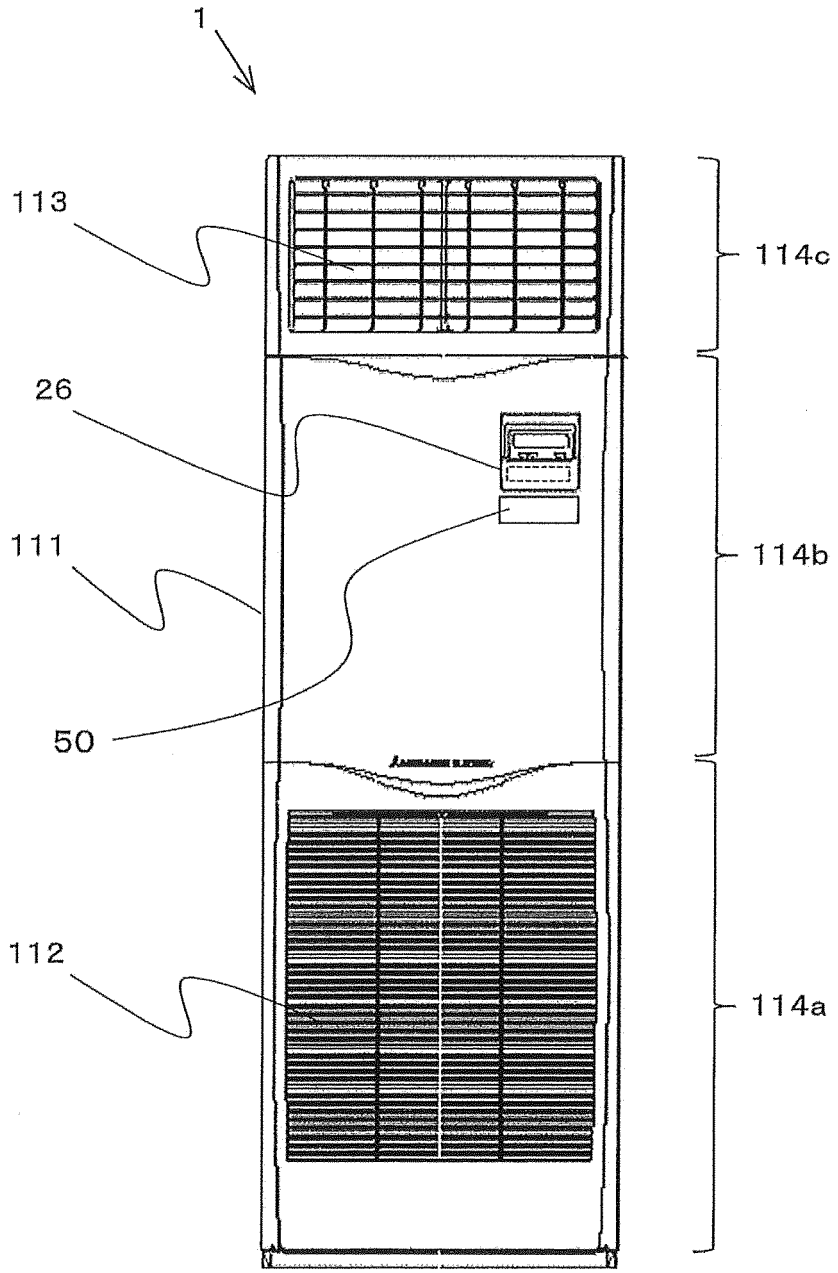


FIG. 3

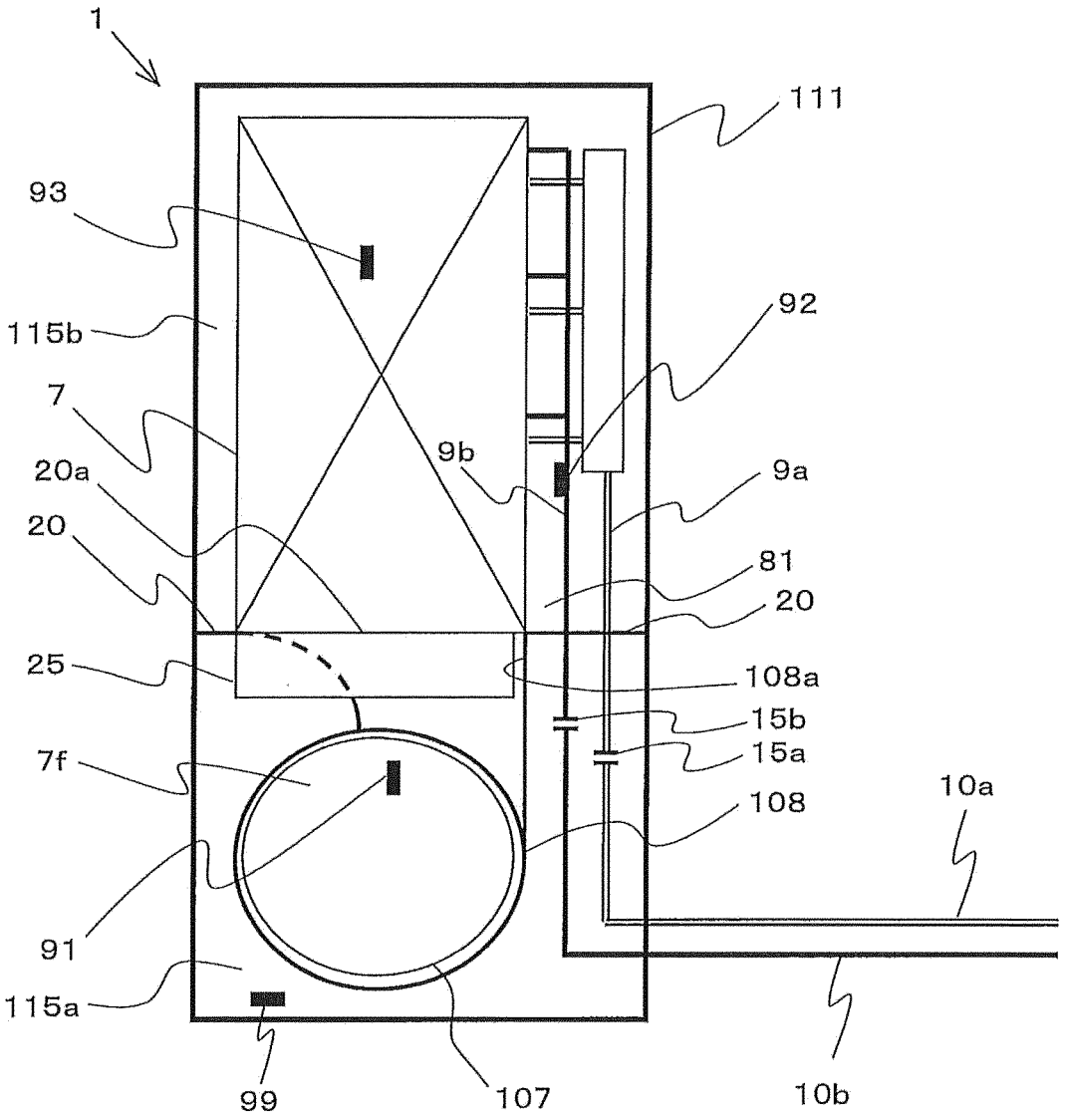

1
111
93
92
115b
7
9b
9a
20a
20
81
20
25
108a
15b
15a
7f
108
10a
91
115a
99
107
10b

FIG. 4

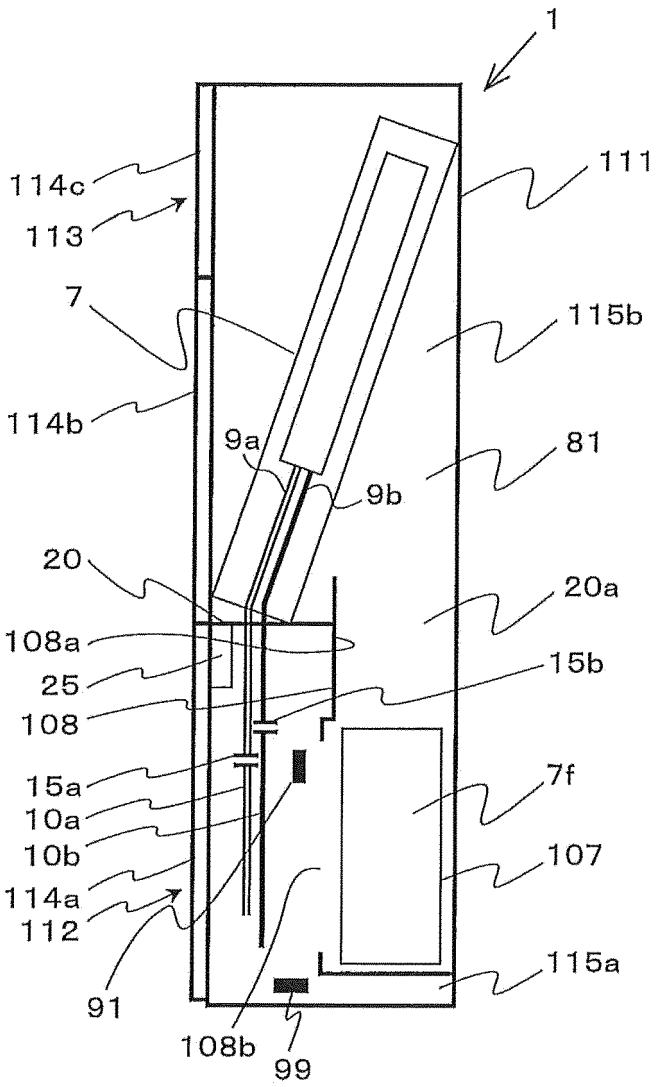

1
111
114c
113
7
115b
114b
9a
81
9b
20
20a
108a
15b
25
108
15a
7f
10a
10b
107
114a
112
115a
91
108b
99

FIG. 5

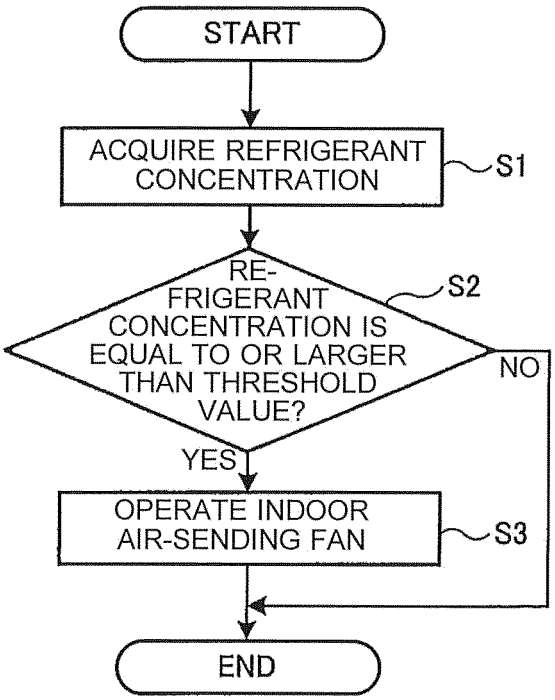

START
ACQUIRE REFRIGERANT CONCENTRATION
S1
RE-FRIGERANT CONCENTRATION IS EQUAL TO OR LARGER THAN THRESHOLD VALUE?
S2
NO
YES
OPERATE INDOOR AIR-SENDING FAN
S3
END

FIG. 6

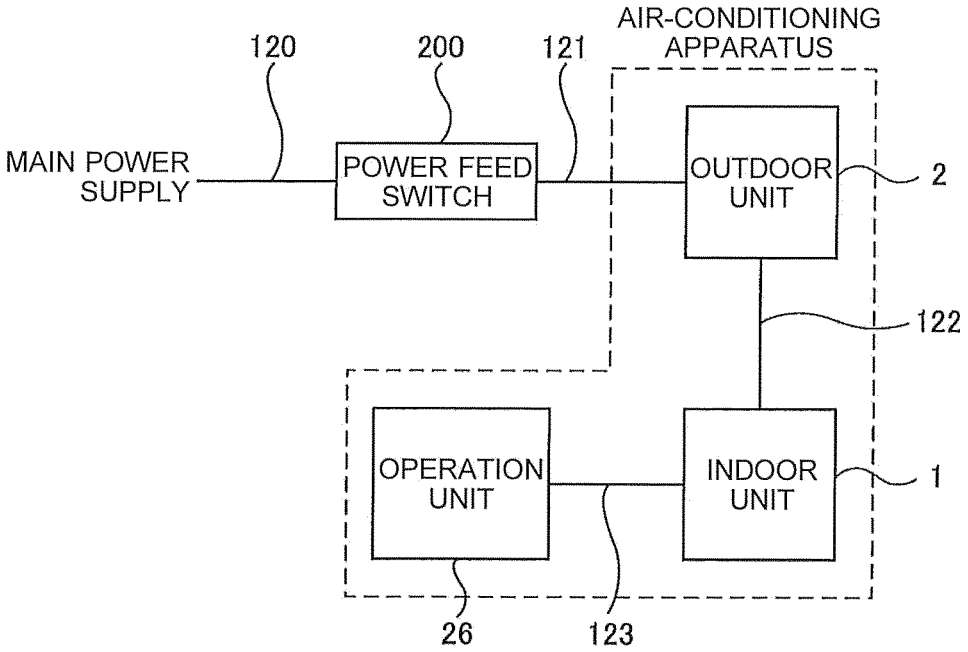

AIR-CONDITIONING APPARATUS
120
200
121
MAIN POWER SUPPLY
POWER FEED SWITCH
OUTDOOR UNIT
2
122
OPERATION UNIT
INDOOR UNIT
1
26
123

FIG. 7

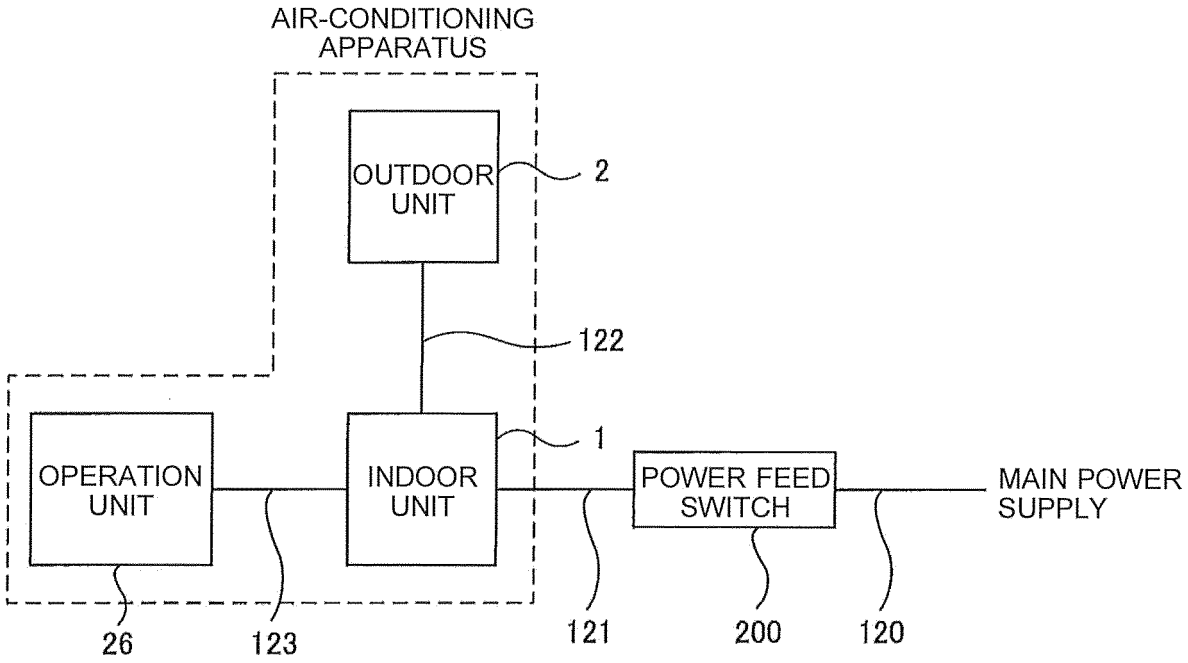

AIR-CONDITIONING APPARATUS
OUTDOOR UNIT
2
122
OPERATION UNIT
INDOOR UNIT
1
POWER FEED SWITCH
MAIN POWER SUPPLY
26
123
121
200
120

FIG. 8

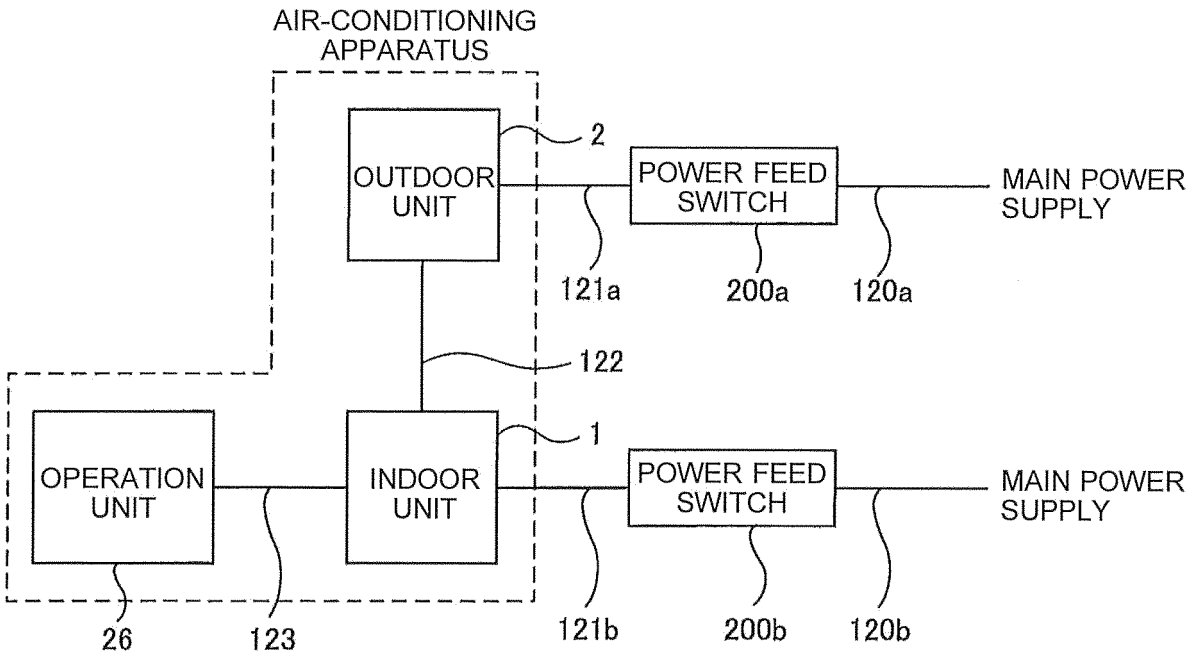

AIR-CONDITIONING APPARATUS
OUTDOOR UNIT
2
POWER FEED SWITCH
MAIN POWER SUPPLY
121a
200a
120a
122
OPERATION UNIT
INDOOR UNIT
1
POWER FEED SWITCH
MAIN POWER SUPPLY
26
123
121b
200b
120b

FIG. 9

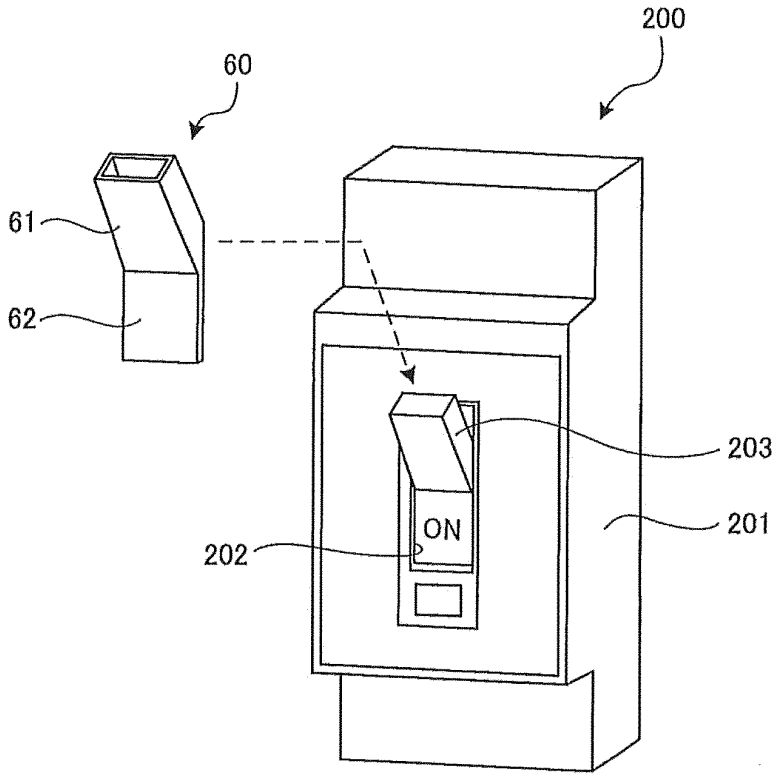


FIG. 10

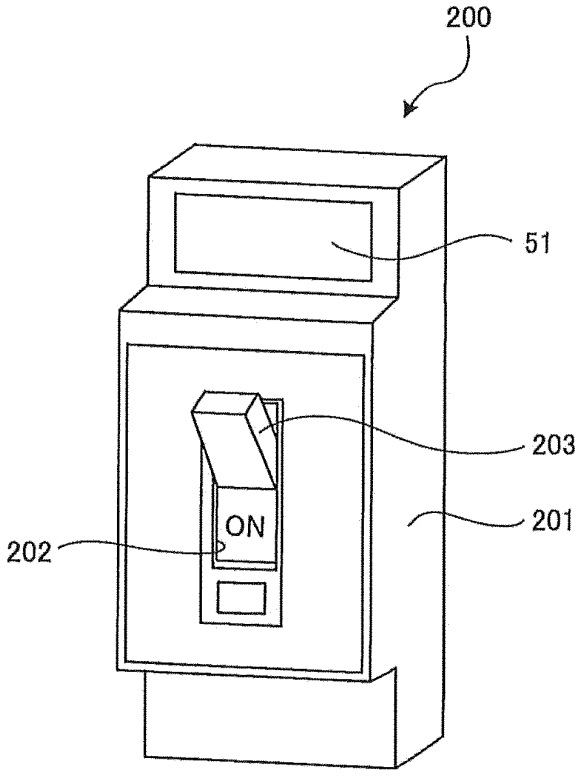


FIG. 11

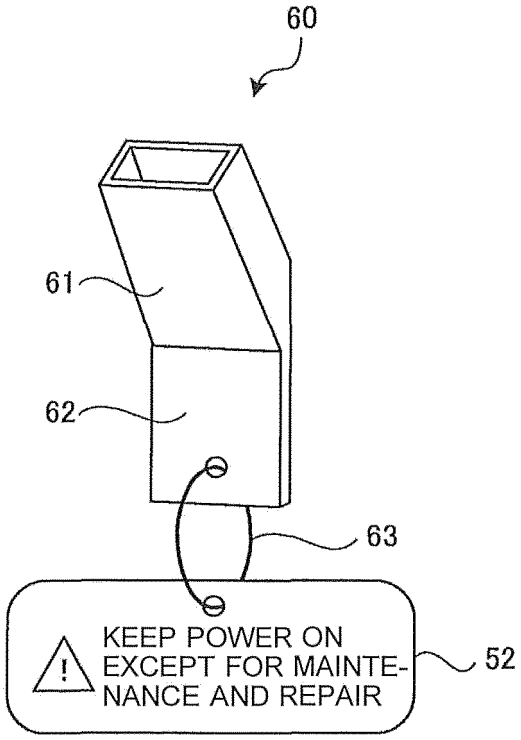
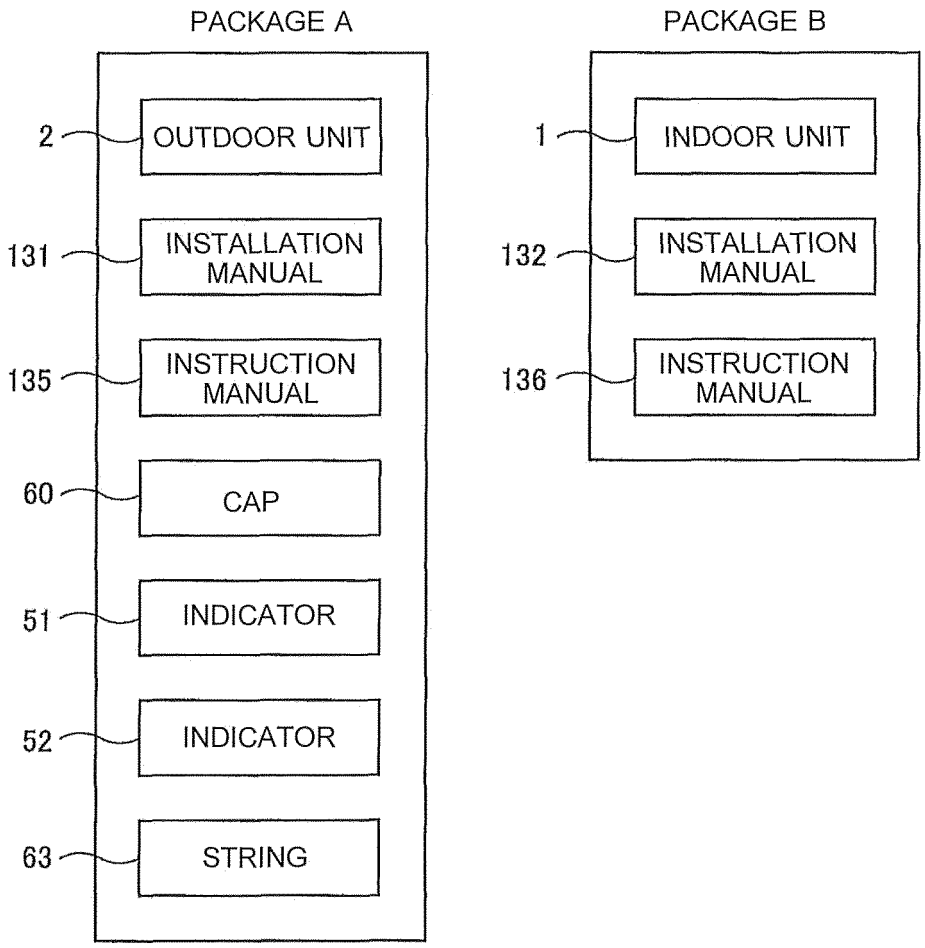

60
61
62
63
KEEP POWER ON
EXCEPT FOR MAINTE-
NANCE AND REPAIR
52

FIG. 12


PACKAGE A
2
OUTDOOR UNIT
131
INSTALLATION MANUAL
135
INSTRUCTION MANUAL
60
CAP
51
INDICATOR
52
INDICATOR
63
STRING
PACKAGE B
1
INDOOR UNIT
132
INSTALLATION MANUAL
136
INSTRUCTION MANUAL

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/074743

A. CLASSIFICATION OF SUBJECT MATTER
F25B49/02(2006.01)i, *F24F11/02*(2006.01)i, *H01H9/22*(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)
F25B49/02, F24F11/02, H01H9/22

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 2000-249434 A (Daikin Industries, Ltd.), 14 September 2000 (14.09.2000), paragraphs [0005] to [0007], [0030] to [0039], [0049] to [0061]; fig. 1 (Family: none)	1-12
Y	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 027914/1993(Laid-open No. 082737/1994) (Kawamura Electric Inc.), 25 November 1994 (25.11.1994), paragraphs [0001] to [0015]; fig. 1 to 4 (Family: none)	1-12

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 November 2015 (04.11.15)	17 November 2015 (17.11.15)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/074743

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. 137678/1987(Laid-open No. 041922/1989) (Fuji Electric Co., Ltd.), 13 March 1989 (13.03.1989), specification, page 2, line 2 to page 7, line 12; fig. 3 to 6 (Family: none)	1-12
Y	JP 2002-98393 A (Daikin Industries, Ltd.), 05 April 2002 (05.04.2002), paragraph [0030]; fig. 1 to 4 & US 2002/0178738 A1 paragraph [0046]; fig. 1 to 2, 5 to 6 & WO 2002/027245 A1 & EP 1321723 A1 & AU 8809101 A & AU 777879 B & CN 1392944 A & ES 2435718 T	11-12
A	JP 2014-72089 A (Tempearl Industrial Co., Ltd.), 21 April 2014 (21.04.2014), fig. 1 to 13 (Family: none)	5-12

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4599699 B **[0003]**