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(54) **INDOOR UNIT AND AIR CONDITIONING DEVICE**

INNENEINHEIT UND KLIMAANLAGE

UNITÉ INTÉRIEURE ET DISPOSITIF DE CLIMATISATION

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EP 3 081 875 B1

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Description

Technical Field

[0001] The present invention relates to, for example, an indoor unit included in, for example, an air-conditioning apparatus, and in particular, relates to air blowing (diffusing).

Background Art

[0002] A known indoor unit included in, for example, an air-conditioning apparatus, has a function of enabling outlet vanes (air flow direction louvers) of the indoor unit to be positioned at an angle beyond, for example, a normal position so that air (blown air) from the indoor unit is not directly blown to a human (see, for example, Patent Literature 1). At the angle beyond the normal position, end part of each outlet vane on a downstream side in an air flow direction (downstream end part) is located at a higher level or position (or closer to a ceiling) than at the normal position. In such a state, the blown air tends to flow more horizontally than a normal air flow direction. Moreover, an indoor unit is known which comprises outlet vanes that are connected to each other via joints so as to be rotated synchronously (see, for example, Patent

[0003] Literature 2). Said Patent Literature 2 discloses an indoor unit according to the preamble of claim 1. Furthermore, an indoor unit is known which comprises, in addition to a main blowing direction regulating plate, an auxiliary blowing direction regulating plate, disposed to cause a flow from an outside of a path to an inside thereof, is provided along a blowing direction within a path upstream of the main blowing direction regulatory plate (see, for example, Patent Literature 3). In addition, an indoor unit is known which comprises a rotatable horizontal blade disposed at an air blow-out outlet, wherein an air direction to an indoor space may be adjusted by making use of rotation of the horizontal blade (see, for example, Patent Literature 4). Besides, a ceiling-mounted indoor unit is known which has a plurality of human detection sensors for detecting the presence of humans in the air-conditioned room (see, for example, Patent Literature 5).

Citation List

Patent Literature

[0004]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2011-075168 (Fig. 9, for example)

Patent Literature 2: EP 1 003 002 A2

Patent Literature 3: JP H10 325595 A

Patent Literature 4: JP H08 313042 A

Patent Literature 5: WO 2011/093205 A1

Summary of Invention

Technical Problem

[0005] As in the above-described related-art indoor unit of the air-conditioning apparatus, simply orienting the outlet vane upward relative to the normal position facilitates horizontal flowing of blown air. However, since the blown air flows along the ceiling, continued blowing at the orientation tends to cause smudging or staining of the ceiling. Further, when the outlet vane is at the upward position, the air flow resistance in the air outlet increases. If a fan motor is continuously driven with a high air flow resistance, a load would increase.

[0006] The present invention has been made to overcome the above-described disadvantage and is directed to, for example, an indoor unit capable of reducing smudging, for example, if an outlet vane is moved to an upward position so that blown air is not directly applied to a human. Further, a damage to the fan motor can be prevented, thus increasing liability.

Solution to Problem

[0007] The present invention provides an indoor unit as defined in claim 1. The indoor unit comprising: at least one air outlet having formed therein an inner air-passage wall and an outer air-passage wall located at outside of the inner air-passage wall; and at least one air flow direction louver disposed in the air outlet, the air flow direction louver being rotatable about a rotation axis and configured to deflect air blown from the air outlet by an angular position thereof in rotation, wherein while the indoor unit is in an operating state, the outer air-passage wall and the air flow direction louver define therebetween an outer air passage through which the blown air passes, and the inner air-passage wall and the air flow direction louver define therebetween an inner air passage through which the blown air passes, and the air flow direction louver is rotatable to an upward position, being the angular position, at which the outer air passage between the outer air-passage wall and the air flow direction louver is narrowed to have a higher air flow resistance than the inner air passage. Preferred embodiments of the invention are defined in the dependent claims.

Advantageous Effects of Invention

[0008] The indoor unit according to the present invention allows the air flow direction louver to be moved to the upward position to achieve a comfortable operation such that air is not directly blown to a human. At the upward position, the outer air passage between the air flow direction louver and the outer air-passage wall is narrowed to have a higher air flow resistance than the inner air passage. This reduces the flow velocity and flow rate of the blown air flowing along a room wall, thus reducing smudging.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a vertical sectional view of an indoor unit 100 according to Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a first sectional view illustrating the positional relationship between an air outlet 132 and an outlet vane 150 in Embodiment 1 of the present invention.

[Fig. 3] Fig. 3 is a second sectional view illustrating the positional relationship between the air outlet 132 and the outlet vane 150 in Embodiment 1 of the present invention.

[Fig. 4] Fig. 4 is a third sectional view illustrating the positional relationship between the air outlet 132 and the outlet vane 150 in Embodiment 1 of the present invention.

[Fig. 5] Fig. 5 shows an exterior of an indoor unit 100 according to Embodiment 2 of the present invention.

[Fig. 6] Fig. 6 is a diagram illustrating an exemplary configuration of an air-conditioning apparatus according to Embodiment 4 of the present invention.

Description of Embodiments

[0010] Heat exchangers according to Embodiments of the present invention will be described with reference to the drawings. Note that components designated by the same reference numerals in the drawings are the same components or equivalents. This applies to the entire description of following Embodiments. Furthermore, note that the forms of components described in the specification are intended to be illustrative only and are not intended to be limited to the descriptions. In particular, combination patterns of the components are not intended to be limited to those in Embodiments. A component in one Embodiment can be applied to another Embodiment. As used herein, the term "upward" or "upper" refers to the upward direction or upper part or level or side in the drawings and the term "downward" or "lower" refers to the downward direction or lower part or level in the drawings. Furthermore, note that the dimensional relationship among components in the drawings may differ from the actual one.

Embodiment 1

[0011] Fig. 1 is a vertical sectional view of an indoor unit 100 according to Embodiment 1 of the present invention. The indoor unit 100 according to Embodiment 1 has a ceiling-embedding structure that can be embedded or concealed in the ceiling of a room, and is also of a four-way cassette type having air outlets in four directions. The indoor unit 100 will now be described. The indoor unit 100 is connected to an outdoor unit by refrigerant pipes to form a refrigerant circuit through which refrigerant is circulated for, for example, refrigeration or

air conditioning.

[0012] As illustrated in Fig. 1, the indoor unit 100 includes a casing 120 that includes a top panel 121 and a side panel 122. The indoor unit 100 is concealed in the ceiling of a room and is installed such that the top panel 121 is located at an upper side. The casing 120 itself opens to the room (or opens downward). Furthermore, a decorative panel 130, which is substantially rectangular in plan view, is attached to lower part of the indoor unit 100 such that the decorative panel 130 faces the room. The decorative panel 130 includes a grille 131 and a filter 140 at substantially center part of the decorative panel 130. The grille 131 serves as an air inlet through which air is taken into the indoor unit 100. The filter 140 removes dust from air passed through the grille 131.

[0013] The indoor unit 100 has a main-body air inlet 123, through which air is allowed to flow into the main body of the indoor unit 100, located at central part of a lower surface of the indoor unit 100. The indoor unit 100 further has a main-body air outlet 124, through which air is allowed to flow out of the main body, located around the main-body air inlet 123. The grille 131, the main-body air inlet 123, the main-body air outlet 124, and air outlets 132 communicate with one another, thus defining an air passage in the indoor unit 100.

[0014] The indoor unit 100 includes in the main body a turbo fan 170, a bell mouth 160, a fan motor 180, and an indoor heat exchanger 110. The turbo fan 170 is a centrifugal blower device having its rotation axis extending vertically. The turbo fan 170 blows air, sucked through the grille 131, laterally (lateral direction in Fig. 1) to produce a flow of air. Although the turbo fan 170 is used as a blower device in Embodiment 1, any other blower device, such as a sirocco fan or a radial fan, may be used in the present invention. Furthermore, the bell mouth 160 defines an inlet air passage for the turbo fan 170 and rectifies an air flow. The fan motor 180 rotates and drives the turbo fan 170.

[0015] The indoor heat exchanger 110 of, for example, a finned tube type is disposed downstream of the turbo fan 170 such that the indoor heat exchanger 110 surrounds the turbo fan 170. Assuming that the indoor unit 100 according to Embodiment 1 is included in, for example, an air-conditioning apparatus, the indoor heat exchanger 110 functions as an evaporator in a cooling operation and functions as a condenser in a heating operation.

[0016] The air outlets 132 are arranged at respective sides of the decorative panel 130 such that each of the air outlets 132 extends along the corresponding side. The indoor unit 100 according to Embodiment 1 has four air outlets 132. The indoor unit 100 further includes an outlet vane (flap) 150 disposed in each of the air outlets 132. The outlet vane 150 serves as an air flow direction louver that changes an air flow direction. Each outlet vane 150 is rotated or moved about a rotation axis 151 by driving of a motor (not illustrated), so that the outlet vane 150 is positioned.

[0017] The indoor unit 100 further includes a controller 190 configured to control operations of the components of the indoor unit 100. In Embodiment 1, the controller 190 drives and controls the motors connected to the outlet vanes 150 to position each of the outlet vanes 150.

[0018] Figs. 2 to 4 are sectional views illustrating the positional relationship between the air outlet 132 and the outlet vane 150 in Embodiment 1 of the present invention. Fig. 2 illustrates the positional relationship in a normal mode. Fig. 3 illustrates the positional relationship in a direct air-blowing avoidance mode in which an air flow (blown air) is not directly blown to a human. Fig. 4 illustrates the positional relationship in a non-operating state. The air outlet 132 includes an inner air-passage wall 132B adjacent to the grille 131 (or closer to the center of the indoor unit 100) and an outer air-passage wall 132A adjacent to an outer frame of the decorative panel 130 (or farther from the center of the indoor unit 100). The inner air-passage wall 132B and the outlet vane 150 define therebetween an inner air passage through which the blown air passes. The outer air-passage wall 132A and the outlet vane 150 define therebetween an outer air passage through which the blown air passes.

[0019] The indoor unit 100 according to Embodiment 1 is configured such that end part (downstream end part) of the outlet vane 150 located on a downstream side in a flow direction of the blown air overlaps the outer air-passage wall 132A when the indoor unit 100 is viewed from below. For example, when operation of the indoor unit 100 is stopped and the outlet vane 150 is turned to a substantially horizontal position, the outlet vane 150 does not completely close the air outlet 132 such that the outlet vane 150 and the inner air-passage wall 132B form a clearance therebetween. For example, in Fig. 4, a clearance of approximately 8.73 mm is left between the outlet vane 150 and the inner air-passage wall 132B. In contrast to the rotation axis in the related-art indoor unit, the rotation axis 151 of the outlet vane 150 is accordingly located closer to the outer air-passage wall 132A.

[0020] Referring to Fig. 2, the outlet vane 150 overlaps the outer air-passage wall 132A by a small extent (for example, approximately 2.15 mm) in the positional relationship between the air outlet 132 and the outlet vane 150 in the normal mode. In addition, the clearance between the outlet vane 150 and the inner air-passage wall 132B is the largest (for example, approximately 12.4 mm). This results in a low air flow resistance, thus facilitating flowing of the blown air.

[0021] Referring to Fig. 3, when the outlet vane 150 overlaps the outer air-passage wall 132A by a large extent (for example, approximately 8.28 mm), the outer air passage between the outlet vane 150 and the outer air-passage wall 132A is narrowed, thus increasing the air flow resistance. This reduces the flow velocity of the blown air flowing along the ceiling. On the other hand, the inner air passage between the outlet vane 150 and the inner air-passage wall 132B is left (by approximately 9.22 mm, for example) without being closed, thus allow-

ing the blown air to flow through the inner air passage.

[0022] An operation for direct air-blowing avoidance in the indoor unit 100 according to Embodiment 1 will now be described. For example, when receiving a signal indicative of a direct air-blowing avoidance instruction from a remote control or other similar devices, the controller 190 determines, based on instruction information contained in the signal, which outlet vane 150 of the outlet vanes 150 included in the indoor unit 100 is to be moved. The controller 190 then permits the determined outlet vane 150 to be moved to a position (at which direct air-blowing avoidance is achieved; hereinafter, referred to as an "upward position") at a predetermined angle at which air flows substantially horizontally (upwardly) as compared with the air flow direction provided by the outlet vane 150 in the normal mode. In this process, an edge (outer edge) of the outlet vane 150 is moved upward relative to that in the normal mode, so that the outer edge comes close to the outer air-passage wall 132A.

[0023] Consequently, part of the outlet vane 150 overlapping the outer air-passage wall 132A is increased, and the outer air passage is accordingly narrowed. Thus, the flow velocity and flow rate of the blown air through the outer air passage between the outlet vane 150 and the outer air-passage wall 132A are reduced, so that the blown air is less likely to flow along the ceiling and the air flow is reduced. This results in a reduction in area of the air flow along the ceiling. Since the inner air passage is defined between the outlet vane 150 and the inner air-passage wall 132B in Embodiment 1, the blown air is further less likely to flow through the outer air passage between the outlet vane 150 and the outer air-passage wall 132A. Consequently, smudging can be reduced.

[0024] The blown air passing through the inner air passage between the outlet vane 150 and the inner air-passage wall 132B also flows in the vicinity of a design surface (facing the room) of the outlet vane 150. Assuming that the air-conditioning apparatus is performing the cooling operation, therefore, room air warmer than the blown air will not contact the outlet vane 150. Consequently, the room air can be prevented from being cooled by the outlet vane 150 (in particular, the design surface thereof) upon coming into contact with the outlet vane 150, thus preventing condensation on the outlet vane 150. Furthermore, part of the blown air passing through the inner air passage between the outlet vane 150 and the inner air-passage wall 132B flows through the grille 131 into the indoor unit 100. Consequently, the blown air is not directly blown to a human, thus achieving comfort.

[0025] As described above, when the outlet vane 150 is at the upward position, the air flow resistance in the air outlet 132 increases. If the turbo fan 170 (fan motor 180) is continuously driven with a high air flow resistance, a load would increase. In Embodiment 1, therefore, the indoor unit 100 inhibits all of the (four in Embodiment 1) outlet vanes 150 from being at the upward position at the same time. When the controller 190 determines that direct air-blowing avoidance instructions are given in as-

sociation with more than a predetermined number of outlet vanes 150, the controller 190 allows a display unit included in, for example, the remote control to display a message indicative of failed direct air-blowing avoidance.

[0026] Being at the upward position of the outlet vane 150 reduces the flow rate of blown air, resulting in a reduction in temperature of the blown air. This makes condensation more likely to form. The indoor unit 100, therefore, may inhibit all of the outlet vanes 150 from being simultaneously located at the upward position.

[0027] As described above, when the outlet vane 150 is at the upward position, the air flow resistance in the air outlet 132 increases. When the controller 190 receives a signal indicative of a direct air-blowing avoidance instruction, for example, the controller 190 may reduce the rotation speed of the turbo fan 170 (fan motor 180) to regulate the air flow rate. If, for example, an instruction can be given to a compressor included in an outdoor unit, for example, the controller 190 may reduce the rotation speed of the compressor in the refrigerant circuit to regulate a supply capacity.

[0028] As described above, the indoor unit 100 according to Embodiment 1 allows a designated outlet vane 150 to be at the upward position, thus achieving a comfortable operation in which air is not directly blown to a human. At the upward position, part of the outlet vane 150 overlapping the outer air-passage wall 132A is increased, and the outer air passage is accordingly narrowed. The flow velocity and flow rate of the blown air through the outer air passage between the outlet vane 150 and the outer air-passage wall 132A are reduced, so that the flow of the blown air is reduced. This results in a reduction in area of the blown air flow along the ceiling. In addition, a large amount of blown air flows through the inner air passage defined between the outlet vane 150 and the inner air-passage wall 132B. Thus, smudging can be reduced. Additionally, since the blown air through the inner air passage between the outlet vane 150 and the inner air-passage wall 132B flows in the vicinity of the design surface of the outlet vane 150, the room air does not come into contact with the outlet vane 150. This can prevent condensation from forming on the outlet vane 150.

[0029] In addition, inhibiting more than a predetermined number of outlet vanes 150 of the indoor unit 100 from being simultaneously located at the upward position can eliminate, for example, an increase in load on the turbo fan 170 (fan motor 180). This can prevent damage to the turbo fan 170 (fan motor 180), thus increasing reliability.

Embodiment 2

[0030] Fig. 5 is a perspective view of an indoor unit 100 according to Embodiment 2 of the present invention. In Fig. 5, components designated by the same reference numerals as those in Figs. 1 to 4 operate or act in a manner similar to those described in Embodiment 1. In Fig. 5, a human presence sensor 191 is a sensor (detec-

tor) detecting the presence or absence of an occupant or human in, for example, a room.

[0031] The controller 190 controls the components in the indoor unit 100. In Embodiment 2, the controller 190 determines, based on a signal transmitted from the human presence sensor 191, the presence or absence of a human. When determining the presence of a human, the controller 190 determines the position of the human. The controller 190 determines, based on the determined position, an outlet vane 150 to be moved, adjusts the angle of the outlet vane 150, and permits the outlet vane 150 to be moved (rotated) to the upward position.

[0032] In Embodiment 1 described above, a designated outlet vane 150 of the four outlet vanes 150 of the indoor unit 100 is moved to the upward position in accordance with a signal indicative of a direct air-blowing avoidance instruction transmitted from the remote control. The indoor unit 100 according to Embodiment 2 includes the human presence sensor 191. The controller 190 automatically determines an outlet vane 150 to be moved to the upward position in accordance with a result of detection by the human presence sensor 191, and controls the position of the outlet vane 150 to avoid direct air application.

[0033] Data associated with each of the outlet vanes 150 and indicative of a defined area where air blown through the outlet vane 150 is directly applied to a human is stored in a storage unit (not illustrated) included in, for example, the controller 190. The controller 190 determines the position of a human in accordance with a result of detection by the human presence sensor 191. When determining that the human is located in an area where blown air is directly applied to the human, the controller 190 permits the outlet vane 150 corresponding to the area to be moved to the upward position.

[0034] As described in Embodiment 1, if the number of outlet vanes 150 at the upward position exceeds the predetermined number by moving the corresponding outlet vane 150 to the upward position, the corresponding outlet vane 150 is inhibited from moving to the upward position.

[0035] As described above, the indoor unit 100 according to Embodiment 2 includes the human presence sensor 191, and the controller 190 permits an outlet vane 150 determined in accordance with a result of detection by the human presence sensor 191 to be moved to the upward position. Thus, direct air-blowing avoidance can be automatically accomplished. A comfortable space can be achieved without, for example, making a human aware of direct air-blowing avoidance.

Embodiment 3

[0036] In Embodiments 1 and 2, any of the outlet vanes 150 is moved to avoid direct air application. This movement is not limited to that for direct air-blowing avoidance. For example, in the four-way cassette type indoor unit 100, air blown from a certain air outlet 132 may interfere

with air blown from a neighboring air outlet 132. This interference may cause, for example, uneven room temperature distribution. The outlet vane 150 in one of these air outlets 132 can be moved to eliminate the interference between blown air flows.

Embodiment 4

[0037] Fig. 6 is a diagram illustrating an exemplary configuration of an air-conditioning apparatus according to Embodiment 4 of the present invention. Fig. 6 illustrates the air-conditioning apparatus as an example of a refrigeration cycle apparatus. In Fig. 6, the components described with reference to, for example, Fig. 1 operate or function in a manner similar to those described above. The air-conditioning apparatus of Fig. 6 includes an outdoor unit 200 and an indoor unit 100 connected by a gas refrigerant pipe 300 and a liquid refrigerant pipe 400. The outdoor unit 200 includes a compressor 210, a four-way valve 220, an outdoor heat exchanger 230, and an expansion valve 240.

[0038] The compressor 210 compresses sucked refrigerant and discharges the refrigerant. The compressor 210 may be, but not limited to, capable of changing its operation frequency to any value by using, for example, an inverter circuit, to change the capacity (amount of refrigerant sent per unit time) of the compressor 210. The four-way valve 220 is a valve switching between, for example, a refrigerant flow direction in the cooling operation and a refrigerant flow direction in the heating operation.

[0039] The outdoor heat exchanger 230 in Embodiment 4 exchanges heat between the refrigerant and air (outdoor air). For example, the outdoor heat exchanger 230 functions as an evaporator in the heating operation to evaporate and gasify the refrigerant, and functions as a condenser in the cooling operation to condense and gasify the refrigerant.

[0040] The expansion valve 240, such as an expansion device (flow control device), reduces the pressure of the refrigerant to expand the refrigerant. For example, when the expansion valve 240 is an electronic expansion valve, the opening degree of the expansion valve 240 is controlled in accordance with an instruction from, for example, the above-described controller 190. The indoor heat exchanger 110 exchanges heat between the refrigerant and, for example, air to be conditioned. The indoor heat exchanger 110 functions as a condenser in the heating operation to condense and liquefy the refrigerant, and functions as an evaporator in the cooling operation to evaporate and gasify the refrigerant.

[0041] First, a refrigerant flow in the cooling operation in the refrigeration cycle apparatus will be described. In the cooling operation, the four-way valve 220 is switched to provide a connection indicated by full lines. High temperature, high pressure gas refrigerant, compressed and discharged by the compressor 210, passes through the four-way valve 220 and flows into the outdoor heat exchanger 230. While passing through the outdoor heat

exchanger 230, the refrigerant exchanges heat with outdoor air, and thus condenses and liquefies. The condensed and liquefied refrigerant (liquid refrigerant) flows into the expansion valve 240. The pressure of the refrigerant is reduced by the expansion valve 240, so that the refrigerant turns into two-phase gas-liquid refrigerant. The refrigerant then flows out of the outdoor unit 200.

[0042] The two-phase gas-liquid refrigerant that has flowed out of the outdoor unit 200 passes through the liquid refrigerant pipe 400 and flows into the indoor unit 100. The refrigerant is distributed by a distributor and flow control capillary tubes (not illustrated) and then flows into the indoor heat exchanger 110. As described above, while passing through the indoor heat exchanger 110, the refrigerant exchanges heat with, for example, air to be conditioned, and thus evaporates and gasifies. The evaporated and gasified refrigerant (gas refrigerant) then flows out of the indoor unit 100.

[0043] The gas refrigerant that has flowed out of the indoor unit 100 passes through the gas refrigerant pipe 300 and flows into the outdoor unit 200. The refrigerant passes through the four-way valve 220 and is again sucked into the compressor 210. The refrigerant is circulated through the air-conditioning apparatus in the above-described manner, thus achieving air conditioning (cooling).

[0044] Next, a refrigerant flow in the heating operation will be described. In the heating operation, the four-way valve 220 is switched to provide a connection indicated by dotted lines. High temperature, high pressure gas refrigerant, compressed and discharged by the compressor 210, passes through the four-way valve 220 and flows out of the outdoor unit 200. The gas refrigerant that has flowed out of the outdoor unit 200 passes through the gas refrigerant pipe 300 and flows into the indoor unit 100.

[0045] While passing through the indoor heat exchanger 110, the refrigerant exchanges heat with, for example, air to be conditioned, and thus condenses and liquefies. The refrigerant passes through the distributor and the flow control capillary tubes (not illustrated) and then flows out of the indoor unit 100.

[0046] The refrigerant that has flowed out of the indoor unit 100 passes through the liquid refrigerant pipe 400 and flows into the outdoor unit 200. The pressure of the refrigerant is reduced by the expansion valve 240, so that the refrigerant turns into two-phase gas-liquid refrigerant. The refrigerant then flows into the outdoor heat exchanger 230. While passing through the outdoor heat exchanger 230, the refrigerant exchanges heat with outdoor air, and thus evaporates and gasifies. The evaporated and gasified (liquid refrigerant) passes through the four-way valve 220 and is again sucked into the compressor 210. The refrigerant is circulated through the air-conditioning apparatus in the above-described manner, thus achieving air conditioning (heating).

[0047] As described above, the air-conditioning apparatus (refrigeration cycle apparatus) according to Embodiment 4 includes the above-described indoor unit 100,

and can accordingly achieve direct air-blowing avoidance and reduce smudging.

Industrial Applicability

[0048] In Embodiments 1 to 4 described above, the indoor unit 100 has the four air outlets 132 and the four outlet vanes 150, namely, it is of the four-way cassette type that blows air in four ways. In addition, the present invention can be applied to any other ceiling concealed indoor unit for producing, for example, two-way or three-way air flows. In addition to the ceiling concealed indoor units, the present invention can be applied to any other type of indoor unit. In addition to smudging on a ceiling, therefore, smudging on any indoor wall other than the ceiling can be reduced by appropriately installing the indoor unit. Furthermore, any number of air outlets 132 and any number of outlet vanes 150 may be arranged.

[0049] In Embodiments 1 to 4 described above, the air-conditioning apparatus has been described as an example of a refrigeration cycle apparatus. In addition, the present invention can be applied to any other refrigeration cycle apparatus, such as a refrigerator or a freezer. In addition to the refrigeration cycle apparatus, the present invention can be applied to, for example, an blower device and a ventilating device.

Reference Signs List

[0050] 100: indoor unit; 110: indoor heat exchanger; 120: housing; 121: top panel; 122: side plate; 123: main-body air inlet; 124: main-body air outlet; 130: decorative panel; 131: grille; 132: air outlet; 132A: outer air-passage wall; 132B: inner air-passage wall; 140: filter; 150: outlet vane; 151: rotation axis; 160: bell mouth; 170: turbo fan; 180: fan motor; 190: controller; 191: human presence sensor; 200: outdoor unit; 210: compressor; 220: four-way valve; 230: outdoor heat exchanger; 240: expansion valve; 300: gas refrigerant pipe; and 400: liquid refrigerant pipe.

Claims

1. An indoor unit (100) comprising:

at least one air outlet (132) having formed therein an inner air-passage wall (132B) and an outer air-passage wall (132A) located at outside of the inner air-passage wall (132B), the outer air-passage wall (132A) being between an installation surface of the indoor unit and the inner air-passage wall (132B); and
at least one air flow direction louver (150) disposed in the air outlet (132), the air flow direction louver (150) being rotatable about a rotation axis and configured to deflect air blown from the air outlet (132) by an angular position thereof in ro-

tation, wherein

while the indoor unit (100) is in an operating state, the outer air-passage wall (132A) and the air flow direction louver (150) define therebetween an outer air passage through which the blown air passes, and the inner air-passage wall (132B) and the air flow direction louver (150) define therebetween an inner air passage through which the blown air passes, and the air flow direction louver (150) is rotatable to an upward position, being the angular position, at which

the outer air passage between the outer air-passage wall (132A) and the air flow direction louver (150) and the inner air passage between the inner air-passage wall (132B) and the air flow direction louver (150)

are narrowed, and the outer air-passage has a higher air flow resistance than the inner air passage,

wherein the at least one air outlet (132) includes a plurality of air outlets (132) each being provided with the air flow direction louver (150),

characterized in that the indoor unit (100) is configured to limit a number of the air flow direction louvers (150) being at the upward position at a same time.

2. The indoor unit (100) of claim 1, wherein when the indoor unit (100) is in a non-operating state and the air flow direction louver (150) closes the air outlet (132), the air flow direction louver (150) and the inner air-passage wall (132B) form a clearance therebetween.

3. The indoor unit (100) of claim 1 or 2, wherein the at least one air outlet (132) includes a plurality of air outlets (132) and the at least one air flow direction louver (150) includes a plurality of air flow direction louvers (150), and the indoor unit (100) further includes a human presence sensor (191) configured to detect a presence or absence of a human, and when detecting the presence of a human, detecting a position of the human, and a controller (190) configured to determine at least one air flow direction louver (150) to be at the upward position of the air flow direction louvers (150) in accordance with a result of detection by the human presence sensor (191).

4. The indoor unit (100) of any one of claims 1 to 3, wherein the indoor unit (100) has a ceiling-embedding structure configured to be concealed and installed in a ceiling of a room.

5. An air-conditioning apparatus comprising:

the indoor unit (100) of any one of claims 1 to 4;
 an outdoor unit (200), and
 a refrigerant circuit including
 a compressor (210) configured to compress and
 discharge refrigerant and included in the out- 5
 door unit (200),
 a condenser configured to cause the refrigerant
 to condense by heat exchange,
 an expansion device (240) configured to reduce
 a pressure of the condensed refrigerant, and 10
 an evaporator configured to exchange heat be-
 tween the pressure-reduced refrigerant and air
 to cause the refrigerant to evaporate.
 the compressor (210), the condenser, the ex-
 pansion device and the evaporator being con- 15
 nected by pipes and provided to the indoor unit
 (100) or the outdoor unit (200).

Patentansprüche

1. Inneneinheit (100), umfassend:

zumindest einen Luftauslass (132), der darin
 ausgebildet eine innere Luftdurchlasswand 25
 (132B) und eine äußere Luftdurchlasswand
 (132A), die an der Außenseite der inneren Luft-
 durchlasswand (132B) angeordnet ist, aufweist,
 wobei sich die äußere Luftdurchlasswand
 (132A) zwischen einer Installationsoberfläche 30
 der Inneneinheit und der inneren Luftdurchlass-
 wand (132B) befindet; und
 zumindest eine Luftstromrichtungsklappe (150),
 die in dem Luftauslass (132) angeordnet ist, wo- 35
 bei die Luftstromrichtungsklappe (150) um eine
 Drehachse drehbar ist und eingerichtet ist, Luft,
 die aus dem Luftauslass (132) geblasen wird,
 durch eine Winkelposition davon in Rotation ab-
 zulenken, wobei 40
 während sich die Inneneinheit (100) in einem
 Betriebszustand befindet, die äußere Luftdurch-
 lasswand (132A) und die Luftstromrichtungs-
 klappe (150) zwischen sich einen äußeren Luft-
 durchlass definieren, durch den die geblasene
 Luft hindurchgeht, und die innere Luftdurchlass- 45
 wand (132B) und die Luftstromrichtungsklappe
 (150) zwischen ihnen einen inneren Luftdurch-
 lass definieren, durch den die geblasene Luft
 hindurchgeht, und
 die Luftstromrichtungsklappe (150) in eine nach oben 50
 gerichtete Position gedreht werden kann, wel-
 che die Winkelposition ist, in der
 der äußere Luftdurchlass zwischen der äußeren
 Luftdurchlasswand (132A) und der Luftstrom-
 richtungsklappe (150) und 55
 der innere Luftdurchlass zwischen der inneren
 Luftdurchlasswand (132B) und der Luftstrom-
 richtungsklappe (150)

verengt sind, und der äußere Luftdurchlass ei-
 nen höheren Luftstromwiderstand als der innere
 Luftdurchlass aufweist,
 wobei der zumindest eine Luftauslass (132) eine
 Vielzahl von Luftauslässen (132) umfasst, die
 jeweils mit der Luftstromrichtungsklappe (150)
 vorgesehen sind,

dadurch gekennzeichnet, dass die Innenein-
 heit (100) eingerichtet ist, eine Anzahl von Luft-
 stromrichtungsklappen (150), die sich gleichzei-
 tig in der nach oben gerichteten Position befin-
 den, zu begrenzen.

2. Inneneinheit (100) nach Anspruch 1, wobei, wenn
 sich die Inneneinheit (100) in einem Nicht-Betriebs-
 zustand befindet und die Luftstromrichtungsklappe
 (150) den Luftauslass (132) schließt, die Luftstrom-
 richtungsklappe (150) und die innere Luftdurchlass-
 wand (132B) zwischen sich einen Freiraum bilden.

3. Inneneinheit (100) nach Anspruch 1 oder 2, wobei

der zumindest eine Luftauslass (132) eine Viel-
 zahl von Luftauslässen (132) umfasst und die
 zumindest eine Luftstromrichtungsklappe (150)
 eine Vielzahl von Luftstromrichtungsklappen
 (150) umfasst, und
 die Inneneinheit (100) ferner umfasst:

einen Personenanwesenheitssensor (191),
 der eingerichtet ist, eine Anwesenheit oder
 Abwesenheit einer Person zu erfassen, und
 wenn die Anwesenheit einer Person erfasst
 wird, eine Position der Person zu erfassen,
 und
 eine Steuereinheit (190), die eingerichtet
 ist, für zumindest eine Luftstromrichtungs-
 klappe (150) festzulegen, dass sie sich in
 Übereinstimmung mit einem Ergebnis einer
 Erfassung durch den Personenanwesen-
 heitssensor (191) in der nach oben gericht-
 teten Position der Luftstromrichtungsklap-
 pen (150) befindet.

4. Inneneinheit (100) nach einem der Ansprüche 1 bis
 3, wobei die Inneneinheit (100) eine Deckenein-
 baustruktur aufweist, die eingerichtet ist, in einer De-
 cke eines Raumes verborgen und installiert zu sein.

5. Klimaanlage, umfassend:

die Inneneinheit (100) nach einem der Ansprü-
 che 1 bis 4;
 eine Außeneinheit (200), und
 einen Kältemittelkreislauf, umfassend
 einen Verdichter (210), der eingerichtet ist, ein
 Kältemittel zu verdichten und abzugeben, und
 in der Außeneinheit (200) enthalten ist,

einen Kondensator, der eingerichtet ist, das Kältemittel durch Wärmetausch zur Kondensierung zu veranlassen,
 eine Expansionseinrichtung (240), die eingerichtet ist, einen Druck des kondensierten Kältemittels zu reduzieren, und
 einen Verdampfer, der eingerichtet ist, Wärme zwischen dem druckreduzierten Kältemittel und Luft auszutauschen, um das Kältemittel zur Verdampfung zu veranlassen,
 wobei der Verdichter (210), der Kondensator, die Expansionseinrichtung und der Verdampfer durch Leitungen verbunden sind und bei der Inneneinheit (100) oder der Außeneinheit (200) vorgesehen sind.

Revendications

1. Unité intérieure (100) comprenant :

au moins une sortie d'air (132) dans laquelle sont formées une paroi de passage d'air intérieur (132B) et une paroi de passage d'air extérieur (132A) située à l'extérieur de la paroi de passage d'air intérieur (132B), la paroi de passage d'air extérieur (132A) se situant entre une surface d'installation de l'unité intérieure et la paroi de passage d'air intérieur (132B) ; et
 au moins un déflecteur de direction de flux d'air (150) disposé dans la sortie d'air (132), le déflecteur de direction de flux d'air (150) pouvant tourner autour d'un axe de rotation, et étant configuré pour dévier l'air soufflé par la sortie d'air (132) d'une position angulaire de celui-ci en rotation, dans lequel
 tandis que l'unité intérieure (100) se trouve dans un état de fonctionnement, la paroi de passage d'air extérieur (132A) et le déflecteur de direction de flux d'air (150) définissent entre eux un passage d'air extérieur à travers lequel circule l'air soufflé, et la paroi de passage d'air intérieur (132B) et le déflecteur de direction de flux d'air (150) définissent entre eux un passage d'air intérieur à travers lequel circule l'air soufflé, et le déflecteur de direction de flux d'air (150) peut tourner vers une position vers le haut, étant la position angulaire à laquelle
 le passage d'air extérieur entre la paroi de passage d'air extérieur (132A) et le déflecteur de direction de flux d'air (150), et
 le passage d'air intérieur entre la paroi de passage d'air intérieur (132B) et le déflecteur de direction de flux d'air (150)
 sont rétrécis, et le passage d'air extérieur présente une résistance plus élevée au flux d'air que le passage d'air intérieur,
 dans laquelle l'une au moins des sorties d'air

(132) comprend une pluralité de sorties d'air (132), chacune d'elles étant dotée d'un déflecteur de direction de flux d'air (150),

caractérisée en ce que l'unité intérieure (100) est configurée pour limiter le nombre de déflecteurs de direction de flux d'air (150) se trouvant en même temps à la position vers le haut.

2. Unité intérieure (100) selon la revendication 1, dans laquelle, lorsque l'unité intérieure (100) se trouve dans un état inopérant et lorsque le déflecteur de direction de flux d'air (150) ferme la sortie d'air (132), le déflecteur de direction de flux d'air (150) et la paroi de passage d'air intérieur (132B), forment entre eux un dégagement.

3. Unité intérieure (100) selon la revendication 1 ou 2, dans laquelle
 l'au moins une sortie d'air (132) comprend une pluralité de sorties d'air (132), et l'au moins un déflecteur de direction de flux d'air (150) comprend une pluralité de déflecteurs de direction de flux d'air (150), et l'unité intérieure (100) comprend en outre :

un détecteur de présence humaine (191) configuré pour détecter la présence ou l'absence d'un être humain, et lors de la détection de la présence d'un être humain, détecter la position de l'être humain, et
 un contrôleur (190) configuré pour déterminer au moins un déflecteur de direction de flux d'air (150) à positionner à la position vers le haut parmi les déflecteurs de direction de flux d'air (150) selon un résultat de détection du détecteur de présence humaine (191).

4. Unité intérieure (100) selon l'une quelconque des revendications 1 à 3, dans laquelle l'unité intérieure (100) présente une structure pouvant être encastrée dans un plafond configurée pour être cachée et installée dans le plafond d'une pièce.

5. Appareil de climatisation comprenant :

l'unité intérieure (100) selon l'une quelconque des revendications 1 à 4 ;
 une unité extérieure (200), et
 un circuit de fluide frigorigène comprenant :

un compresseur (210) configuré pour comprimer et d'évacuer un fluide frigorigène, inclus dans l'unité extérieure (200),
 un condenseur configuré pour condenser le fluide frigorigène par un échange de chaleur,
 un dispositif d'expansion (240) configuré pour réduire la pression du fluide frigorigène condensé, et

un évaporateur configuré pour échanger la chaleur entre le fluide frigorigène dont la pression a été réduite et l'air, pour faire évaporer le fluide frigorigène,

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le compresseur (210), le condenseur, le dispositif d'expansion et l'évaporateur étant connectés par des canalisations et se situant dans l'unité intérieure (100) ou dans l'unité extérieure (200).

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FIG. 1

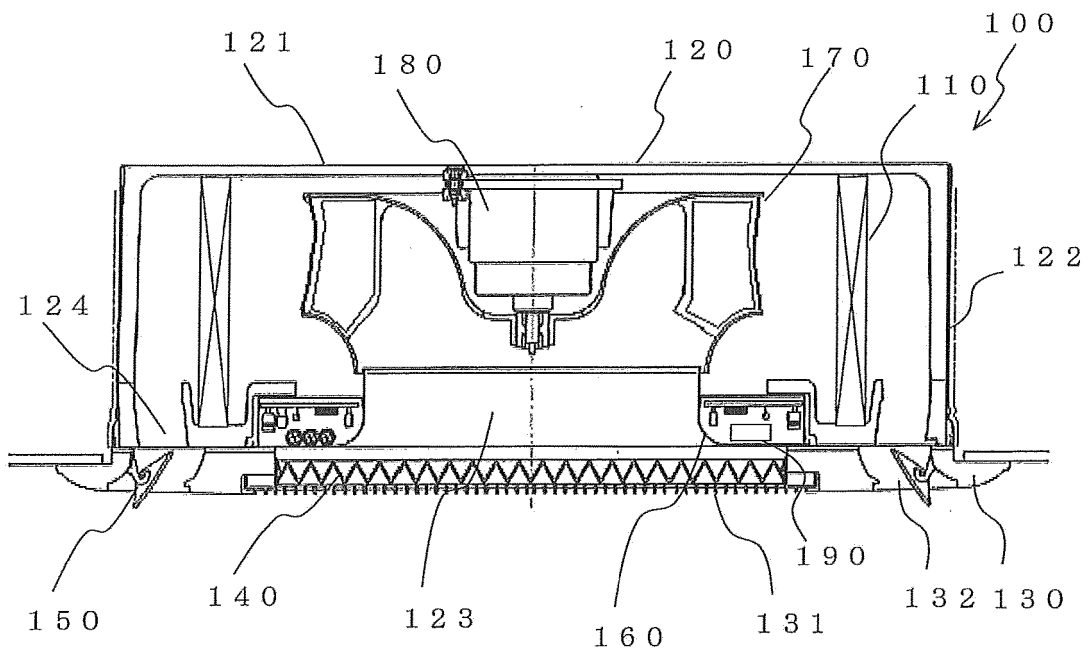


FIG. 2

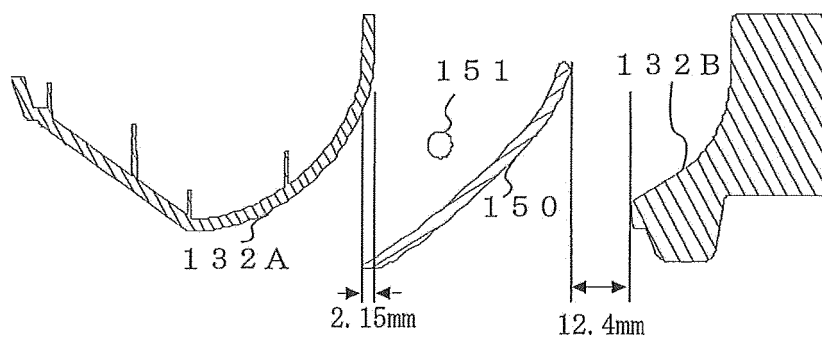


FIG. 3

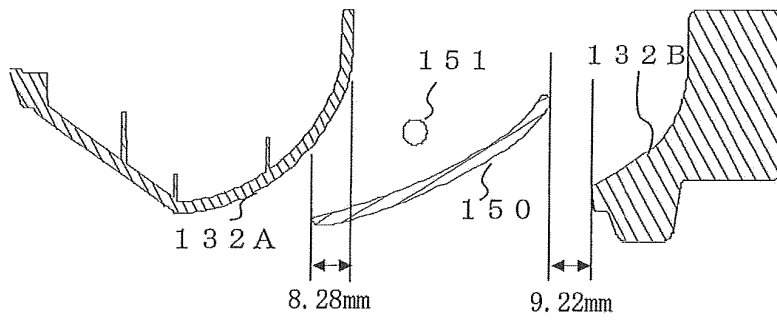


FIG. 4

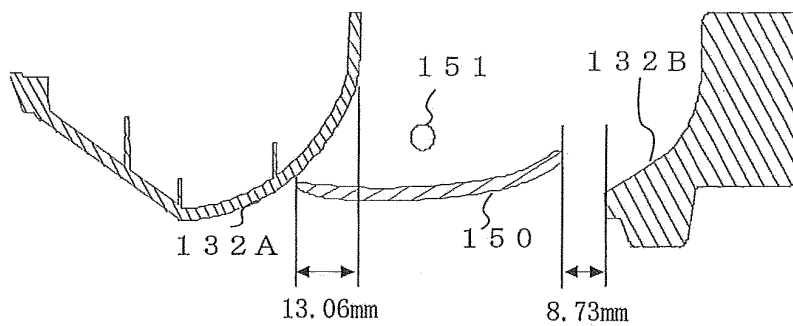


FIG. 5

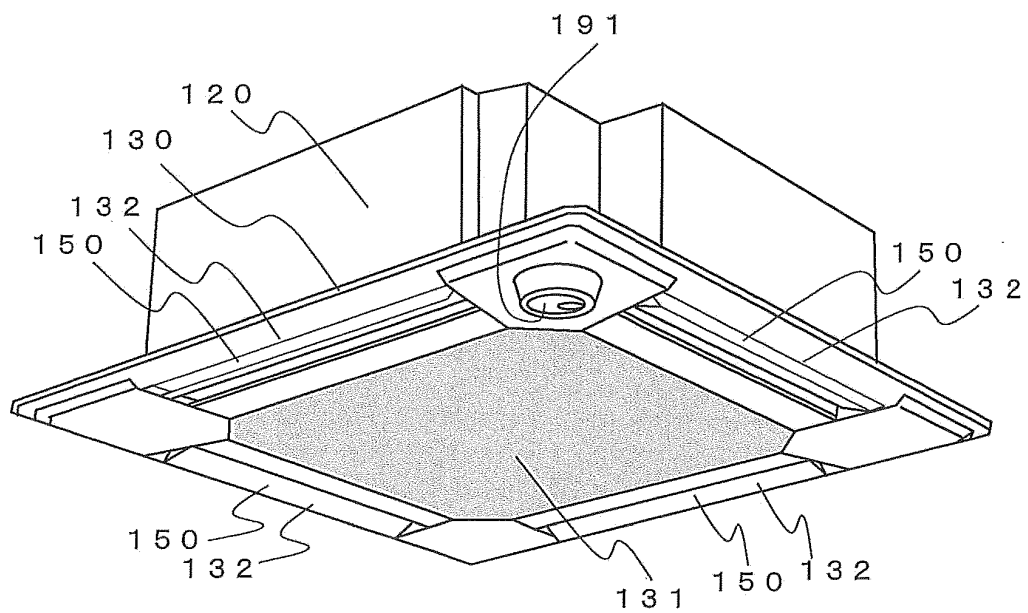
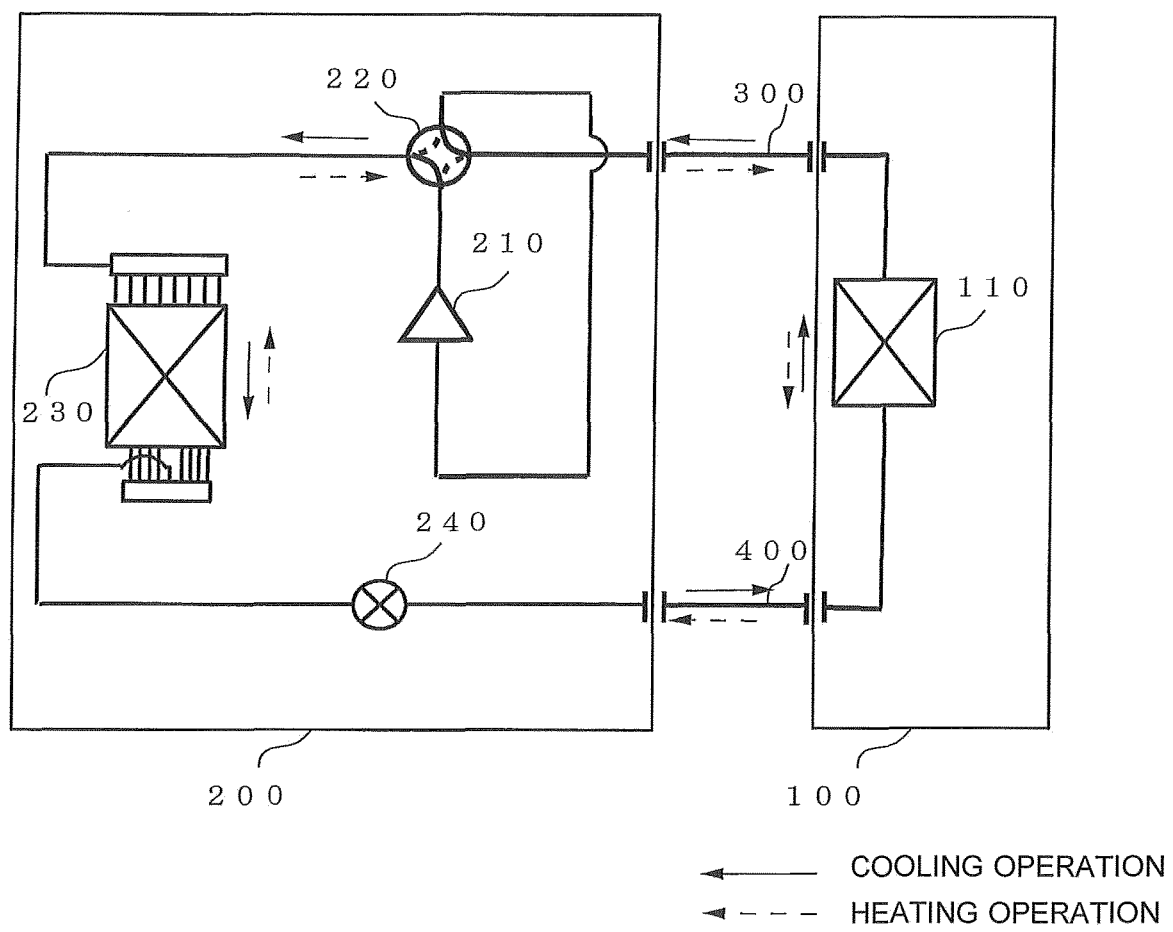


FIG. 6



REFERENCES CITED IN THE DESCRIPTION

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