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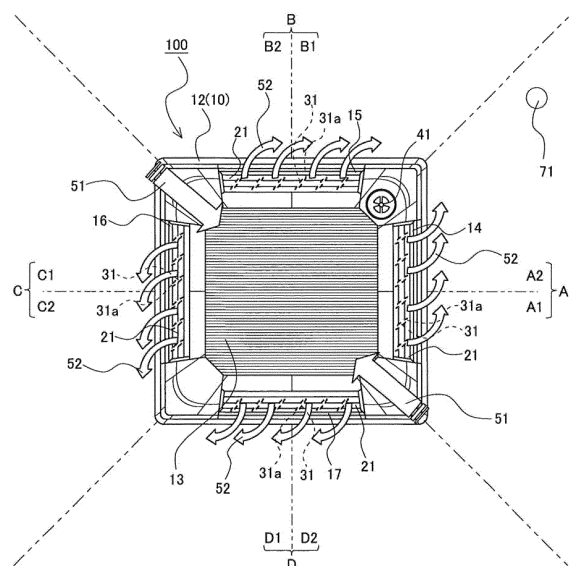
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(54) **INDOOR UNIT OF AIR CONDITIONER**

(57) An air-conditioning-apparatus indoor unit includes a casing having an air inlet and four air outlets arranged in a lower surface portion such that the four air outlets surround four sides of the air inlet, and lateral air flow direction members adjusting a lateral angle of air blown through the air outlets. When one of the air outlets is defined as a first air outlet, the air outlets next to the first air outlet are defined as a second air outlet and a third air outlet, the air outlet facing the first air outlet across the air inlet is defined as a fourth air outlet, and when the lateral air flow direction member disposed in the first air outlet is in a state for blowing the air toward the second air outlet, the lateral air flow direction member disposed in the second air outlet is in a state for blowing the air toward the first air outlet, the lateral air flow direction member disposed in the third air outlet is in a state for blowing the air toward the fourth air outlet, and the lateral air flow direction member disposed in the fourth air outlet is in a state for blowing the air toward the third air outlet.

FIG. 5



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Description

Technical Field

[0001] The present invention relates to an air-conditioning-apparatus indoor unit to be installed in concealed fashion in a ceiling of an air-conditioned space or in suspended fashion from a ceiling of an air-conditioned space.

Background Art

[0002] Air-conditioning-apparatus indoor units known in the art include indoor units to be installed in concealed fashion in a ceiling of an air-conditioned space or in suspended fashion from a ceiling of an air-conditioned space. Examples of the known indoor units to be installed in such fashion include an indoor unit that has an air inlet disposed in substantially central part of a lower surface portion of a casing and four air outlets arranged in the lower surface portion so as to surround four sides of the air inlet and that is capable of blowing conditioned air (air subjected to heat exchange in a heat exchanger) in four directions. A recently developed indoor unit capable of blowing conditioned air in four directions includes an infrared sensor for detecting the position of a human body and lateral air flow direction members respectively arranged in four air outlets such that each adjusting member adjusts a lateral angle of the conditioned air blown through the air outlet (refer to Patent Literature 1).

[0003] The indoor unit disclosed in Patent Literature 1 has, as air-conditioning modes, a temperature equalizing mode and a spot air-conditioning mode. The temperature equalizing mode is an air-conditioning mode in which temperatures in all of the areas of an air-conditioned space are equalized. In the temperature equalizing mode, the indoor unit disclosed in Patent Literature 1 individually causes the lateral air flow direction members in the air outlets to swing independently of one another. More specifically, the indoor unit disclosed in Patent Literature 1 individually causes the angles of conditioned air blown from the air outlets in the temperature equalizing mode to change over time independently of one another. Patent Literature 1 describes that the above-described temperature equalizing mode enables the temperatures in all of the areas of the air-conditioned space to be equalized as much as possible and thus improves comfort.

[0004] The spot air-conditioning mode is an air-conditioning mode in which a region surrounding a person present in the air-conditioned space is intensively air-conditioned and unnecessary air-conditioning for a region in which no person is present is avoided. To implement the spot air-conditioning mode, the indoor unit disclosed in Patent Literature 1 divides the air-conditioned space into four areas in one-to-one correspondence to the air outlets, that is, the lateral air flow direction members arranged in the air outlets. Each of the lateral air

flow direction members arranged in the air outlets is operable independently of the other lateral air flow direction members in the following manner: when a person is present in an area corresponding to the lateral air flow direction member, the member adjusts the angle of conditioned air blown through the air outlet such that the conditioned air is blown to a region surrounding the person present in the corresponding area. Patent Literature 1 describes that the above-described spot air-conditioning mode allows improvement of energy conservation.

Citation List

Patent Literature

[0005] Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2003-1 94389

Summary of Invention

Technical Problem

[0006] The indoor unit disclosed in Patent Literature 1 causes the lateral air flow direction members in the air outlets in the temperature equalizing mode and the spot air-conditioning mode to operate in the above-described manner, thus achieving the improvement of comfort and energy conservation. However, any passage for air to be sucked from an air-conditioned space into the air inlet surrounded by the air outlets is not considered in the indoor unit disclosed in Patent Literature 1. Disadvantageously, the air in the air-conditioned space is hardly sucked through the air inlet depending on the angles of conditioned air blown from the air outlets in the indoor unit disclosed in Patent Literature 1. Unfortunately, a short cycle phenomenon, in which the conditioned air blown from the air outlets is sucked into the air inlet, occurs in the indoor unit disclosed in Patent Literature 1.

[0007] The present invention has been made to overcome the above-described problems and aims to provide an air-conditioning-apparatus indoor unit that has an air inlet and four air outlets surrounding four sides of the air inlet and includes a lateral air flow direction member disposed in each of the four air outlets and that is capable of preventing the short cycle phenomenon.

Solution to Problem

[0008] An embodiment of the present invention provides an air-conditioning-apparatus indoor unit including a casing having an air inlet and four air outlets arranged in a lower surface portion of the casing such that the four air outlets surround four sides of the air inlet; and a lateral air flow direction member swingably disposed in each of the air outlets, the lateral air flow direction member adjusting a lateral angle of air blown through the air outlet, wherein when one of the air outlets is defined as a first air outlet, one of the air outlets next to the first air outlet

is defined as a second air outlet, an other one of the air outlets next to the first air outlet is defined as a third air outlet, the air outlet facing the first air outlet across the air inlet is defined as a fourth air outlet, and when the lateral air flow direction member in the first air outlet is in a state for blowing the air toward the second air outlet, the lateral air flow direction member in the second air outlet is in a state for blowing the air toward the first air outlet, the lateral air flow direction member in the third air outlet is in a state for blowing the air toward the fourth air outlet, and the lateral air flow direction member in the fourth air outlet is in a state for blowing the air toward the third air outlet.

Advantageous Effects of Invention

[0009] The indoor unit according to the embodiment of the present invention is configured such that when the angles of air blown through the air outlets are changed by using the lateral air flow direction members, at least two of spaces between the four air outlets are not blocked by the air blown from the air outlets. In the indoor unit according to the embodiment of the present invention, air in an air-conditioned space can be sucked into the air inlet through the two spaces, serving as passages. Thus, the indoor unit according to the embodiment of the present invention can prevent the short cycle phenomenon when the angles of air blown through the air outlets are changed by using the lateral air flow direction members.

Brief Description of Drawings

[0010]

[Fig. 1] Fig. 1 is a perspective view of an air-conditioning-apparatus indoor unit according to Embodiment of the present invention viewed from below.

[Fig. 2] Fig. 2 is a longitudinal sectional view of the air-conditioning-apparatus indoor unit according to Embodiment of the present invention taken along the line Z-Z in Fig. 1.

[Fig. 3] Fig. 3 is a bottom view of the air-conditioning-apparatus indoor unit according to Embodiment of the present invention.

[Fig. 4] Fig. 4 is a bottom view of the air-conditioning-apparatus indoor unit according to Embodiment of the present invention for explanation of an air-conditioning operation state of the indoor unit.

[Fig. 5] Fig. 5 is a bottom view of the air-conditioning-apparatus indoor unit according to Embodiment of the present invention for explanation of an air-conditioning operation state of the indoor unit.

[Fig. 6] Fig. 6 is a bottom view of the air-conditioning-apparatus indoor unit according to Embodiment of the present invention for explanation of an air-conditioning operation state of the indoor unit.

[Fig. 7] Fig. 7 is a bottom view of the air-conditioning-

apparatus indoor unit according to Embodiment of the present invention for explanation of another example of division of an air-conditioned space.

[Fig. 8] Fig. 8 is a longitudinal sectional view illustrating a modification of an air-conditioning apparatus according to Embodiment of the present invention.

Description of Embodiments

Embodiment

[0011] Fig. 1 is a perspective view of an air-conditioning-apparatus indoor unit according to Embodiment of the present invention viewed from below. Fig. 2 is a longitudinal sectional view of the air-conditioning-apparatus indoor unit according to Embodiment of the present invention taken along the line Z-Z in Fig. 1. Fig. 3 is a bottom view of the air-conditioning-apparatus indoor unit according to Embodiment of the present invention.

[0012] The indoor unit 100 according to Embodiment is to be installed in concealed fashion in a ceiling of an air-conditioned space, such as a room, or in suspended fashion from the ceiling of the air-conditioned space. The indoor unit 100 includes a casing 10 having an air inlet 13 and air outlets 14 to 17 arranged in a lower surface portion of the casing 10. The casing 10 is, for example, a substantially rectangular-parallelepiped hollow box. The air inlet 13 is disposed in substantially central part of the lower surface portion of the casing 10. The air outlets 14 to 17 are arranged in the lower surface portion of the casing 10 so as to surround four sides of the air inlet 13. These air outlets 14 to 17 each have, for example, a rectangular shape. The air outlets 14 to 17 are arranged such that longitudinal sides of the air outlets 14 to 17 extend along respective sides of the lower surface portion of the casing 10.

[0013] In the casing 10, a fan 2, which is a centrifugal fan such as a turbo fan, is disposed so as to face the air inlet 13. The fan 2 causes air in the air-conditioned space to be sucked into the casing 10. In addition, in the casing 10, a heat exchanger 1 of, for example, a fin-and-tube type, is disposed so as to enclose the fan 2. The heat exchanger 1 causes the air sucked from the air-conditioned space into the casing 10 by the fan 2 to exchange heat with refrigerant flowing through the heat exchanger 1. The heat exchanger 1 is disposed between the periphery of the air inlet 13 and inner ends of the air outlets 14 to 17 in plan view. With such arrangement, as indicated by outlined arrows in Fig. 2, the rotation of the fan 2 causes the air in the air-conditioned space to be sucked into the casing 10 through the air inlet 13 and then flow into the fan 2 and the heat exchanger 1. The air that has flowed from the air-conditioned space into the heat exchanger 1 exchanges heat with the refrigerant flowing through refrigerant passages in the heat exchanger 1 while passing through the heat exchanger 1, so that the air is conditioned. The conditioned air is blown from the

air outlets 14 to 17 to the air-conditioned space. The indoor unit 100 according to Embodiment further includes a bell mouth 3 disposed between the air inlet 13 and the fan 2. The bell mouth 3 guides the air, sucked from the air-conditioned space into the casing 10 through the air inlet 13, to the fan 2.

[0014] The indoor unit 100 according to Embodiment further includes a vertical air flow direction member 21 and a lateral air flow direction member 31 arranged in each of the air outlets 14 to 17. The vertical air flow direction member 21 and the lateral air flow direction member 31 each adjust the angle of conditioned air blown through the air outlet.

[0015] The vertical air flow direction members 21 adjust a vertical angle of conditioned air blown through the air outlets 14 to 17. The vertical air flow direction members 21 arranged in the air outlets 14 to 17 have the same structure. For this reason, the following description will be focused on the vertical air flow direction member 21 disposed in the air outlet 14 as a typical example of the vertical air flow direction members 21 arranged in the air outlets 14 to 17.

[0016] The vertical air flow direction member 21 is a plate-shaped member extending in a longitudinal direction of the air outlet 14. The vertical air flow direction member 21 is connected to a rotating shaft 22 extending in the longitudinal direction of the air outlet 14. The rotating shaft 22 is rotatably supported by the casing 10 (more specifically, a decorative panel 12, which will be described later). The rotating shaft 22 is connected to a driving mechanism (not illustrated) for rotating and driving the rotating shaft 22. The driving mechanism includes a motor. More specifically, the rotation of the rotating shaft 22 causes an outer end 21a of the vertical air flow direction member 21 to move in the vertical direction. In other words, the vertical air flow direction member 21 is swingably disposed in the air outlet 14. As the outer end 21a of the vertical air flow direction member 21 is located at a higher level, the conditioned air blown through the air outlet 14 is blown at an angle closer to the horizontal direction. Furthermore, as the outer end 21a of the vertical air flow direction member 21 is located at a lower level, the conditioned air blown through the air outlet 14 is blown further downward.

[0017] The lateral air flow direction members 31 adjust a lateral angle of conditioned air blown through the air outlets 14 to 17. The lateral air flow direction members 31 arranged in the air outlets 14 to 17 have the same structure. For this reason, the following description will be focused on the lateral air flow direction member 31 disposed in the air outlet 14 as a typical example of the lateral air flow direction members 31 arranged in the air outlets 14 to 17.

[0018] The lateral air flow direction member 31 is a plate-shaped member and is one of a plurality of lateral air flow direction members 31 arranged in the air outlet 14. Specifically, the plurality of lateral air flow direction members 31 are arranged parallel to one another at pre-

scribed intervals in the longitudinal direction of the air outlet 14. For example, an upper end of each of the lateral air flow direction members 31 is movably connected to a support member 32 fixed to the casing 10 (more specifically, an attachment member 18, which will be described later). In other words, the lateral air flow direction members 31 are swingably arranged in the air outlet 14. Furthermore, for example, inner ends of the lateral air flow direction members 31 are coupled by a link member 33. The link member 33 is supported by the casing 10 (more specifically, the attachment member 18, which will be described later) such that the link member 33 is movable in the longitudinal direction of the air outlet 14. The link member 33 is connected to a driving mechanism (not illustrated) for moving the link member 33 in the longitudinal direction of the air outlet 14. The driving mechanism includes a motor and gears.

[0019] More specifically, the movement of the link member 33 in the longitudinal direction of the air outlet 14 causes outer ends 31a of the lateral air flow direction members 31 to move in the lateral direction (the direction orthogonal to the drawing sheet of Fig. 2 or the vertical direction in Fig. 3). As the outer ends 31a of the lateral air flow direction members 31 in the air outlet 14 are located closer to the air outlet 15 (or to an upper level in Fig. 3), the conditioned air is blown from the air outlet 14 such that the blown air sharply turns further toward the air outlet 15. Furthermore, as the outer ends 31a of the lateral air flow direction members 31 in the air outlet 14 are located closer to the air outlet 17 (or to a lower level in Fig. 3), the conditioned air is blown from the air outlet 14 such that the blown air sharply turns further toward the air outlet 17.

[0020] The casing 10 in Embodiment includes a main body 11, the attachment member 18, and the decorative panel 12. The main body 11 is, for example, a substantially rectangular-parallelepiped box having an open lower portion. The main body 11 receives the fan 2 and the heat exchanger 1. The attachment member 18 covers the open lower portion of the main body 11. The attachment member 18 is, for example, a substantially rectangular plate-shaped member. The attachment member 18 includes part of the air inlet 13, part of the air outlet 14, part of the air outlet 15, part of the air outlet 16, and part of the air outlet 17. The decorative panel 12 covers an open lower portion of the attachment member 18. The decorative panel 12 is, for example, a substantially rectangular plate-shaped member. In other words, the decorative panel 12 serves as the lower surface portion of the casing 10. The decorative panel 12 includes part of the air inlet 13, part of the air outlet 14, part of the air outlet 15, part of the air outlet 16, and part of the air outlet 17.

[0021] More specifically, the part of the air inlet 13 included in the attachment member 18 communicates with the part of the air inlet 13 included in the decorative panel 12. The part of the air inlet 13 included in the attachment member 18 and the part of the air inlet 13 included in the

decorative panel 12 constitute the air inlet 13. The part of the air outlet 14 included in the attachment member 18 communicates with the part of the air outlet 14 included in the decorative panel 12. The part of the air outlet 14 included in the attachment member 18 and the part of the air outlet 14 included in the decorative panel 12 constitute the air outlet 14. The part of the air outlet 15 included in the attachment member 18 communicates with the part of the air outlet 15 included in the decorative panel 12. The part of the air outlet 15 included in the attachment member 18 and the part of the air outlet 15 included in the decorative panel 12 constitute the air outlet 15. The part of the air outlet 16 included in the attachment member 18 communicates with the part of the air outlet 16 included in the decorative panel 12. The part of the air outlet 16 included in the attachment member 18 and the part of the air outlet 16 included in the decorative panel 12 constitute the air outlet 16. The part of the air outlet 17 included in the attachment member 18 communicates with the part of the air outlet 17 included in the decorative panel 12. The part of the air outlet 17 included in the attachment member 18 and the part of the air outlet 17 included in the decorative panel 12 constitute the air outlet 14.

[0022] The lateral air flow direction members 31 arranged in the air outlets 14 to 17 are located in the parts (portions) of the air outlets 14 to 17 included in the attachment member 18. Furthermore, the support members 32 and the link members 33 used to swing the lateral air flow direction members 31 are also located in the parts (portions) of the air outlets 14 to 17 included in the attachment member 18. The vertical air flow direction members 21 arranged in the air outlets 14 to 17 are located in the parts (portions) of the air outlets 14 to 17 included in the decorative panel 12. In addition, the rotating shafts 22 used to swing the vertical air flow direction members 21 are also located in the parts (portions) of the air outlets 14 to 17 included in the decorative panel 12.

[0023] The indoor unit 100 according to Embodiment further includes a plurality of sensors and a controller 60 that controls the angle of each of the vertical air flow direction members 21 and the lateral air flow direction members 31 (i.e., the angle of conditioned air blown through each of the air outlets 14 to 17) on the basis of detection values of the sensors.

[0024] Specifically, the indoor unit 100 according to Embodiment includes an infrared sensor 41 that detects a radiant temperature in an air-conditioned space such that the infrared sensor 41 is disposed on, for example, the decorative panel 12. The infrared sensor 41 is rotatable laterally by a driving mechanism (not illustrated). The infrared sensor 41 detects radiant temperatures in the entire air-conditioned space during one lateral rotation. The indoor unit 100 according to Embodiment further includes a temperature sensor 42 that detects a temperature of air sucked into the casing 10 through the air inlet 13 and a humidity sensor 43 that detects a humidity (e.g., relative humidity) of the air sucked into the casing

10 through the air inlet 13 such that the sensors are arranged in, for example, the casing 10.

[0025] The controller 60 includes a central processing unit (CPU; also called a central processor, a processing unit, an arithmetic and logic unit, a microprocessor, a microcomputer, or a processor) that runs a program stored in dedicated hardware or a memory. The controller 60 may be disposed in the casing 10 or may be disposed outside the casing 10 (e.g., in an outdoor unit included together with the indoor unit 100 in an air-conditioning apparatus).

[0026] When the controller 60 is dedicated hardware, the controller 60 corresponds to a single circuit, a composite circuit, an application specific integrated circuit (ASIC), a field-programmable gate array (FPGA), or a combination thereof. Functions to be achieved by the controller 60 may be achieved by individual hardware components or may be achieved by a single hardware component.

[0027] When the controller 60 is a CPU, functions to be performed by the controller 60 are achieved by software, firmware, or a combination of software and firmware. Software or firmware is written as a program and is stored in the memory. The CPU reads the program stored in the memory and runs the program, thus achieving the functions of the controller 60. In this case, the memory is, for example, a nonvolatile or volatile semiconductor memory, such as a random access memory (RAM), a read-only memory (ROM), a flash memory, an erasable programmable read-only memory (EPROM), or an electrically erasable programmable read-only memory (EEPROM).

[0028] Some of the functions of the controller 60 may be achieved by dedicated hardware and some of the functions of the controller 60 may be achieved by software or firmware.

[0029] The controller 60 according to Embodiment includes, as functional components, a human body detecting unit 61, a comparing unit 62, and a driving unit 63.

[0030] The human detecting unit 61 detects the position of a human body present in the air-conditioned space on the basis of a detection value of the infrared sensor 41. Various known methods can be used to detect the position of a human body using the human body detecting unit 61. For example, when radiant temperature data about radiant temperatures in the air-conditioned space detected by the infrared sensor 41 includes a temperature higher than a reference temperature, the human body detecting unit 61 detects a position corresponding to the higher temperature as a human body position. Furthermore, for example, the human body detecting unit 61 can detect a range corresponding to temperatures higher than the reference temperature in the radiant temperature data about the radiant temperatures in the air-conditioned space detected by the infrared sensor 41, and detect a human body position based on the shape of the range.

[0031] The infrared sensor 41 and the human body de-

tecting unit 61 correspond to a human body position detector in the present invention.

[0032] The comparing unit 62 compares a temperature detected by the temperature sensor 42 with a previously stored prescribed temperature in a cooling operation of the indoor unit 100. The prescribed temperature is, for example, a preset temperature for the cooling operation. For the prescribed temperature, a fixed value may be used, or a temperature higher than the preset temperature by a predetermined value may be used. In addition, the comparing unit 62 compares a humidity detected by the humidity sensor 43 with a previously stored prescribed humidity in the cooling operation of the indoor unit 100. The prescribed humidity is, for example, a fixed value. The prescribed humidity may be changed based on, for example, a temperature detected by the temperature sensor 42 or the preset temperature. For example, the prescribed humidity may be increased with increasing preset temperature.

[0033] The driving unit 63 drives the vertical air flow direction members 21 and the lateral air flow direction members 31 in accordance with a detection result of the human body detecting unit 61 and a comparison result of the comparing unit 62. The indoor unit 100 according to Embodiment includes a remote control 65 capable of performing wired or wireless communication with the controller 60. For example, a user can set the angles of the vertical air flow direction members 21 and the lateral air flow direction members 31 (i.e., the angles of conditioned air blown through the air outlets 14 to 17) by using the remote control 65. At this time, the driving unit 63 drives the vertical air flow direction members 21 and the lateral air flow direction members 31 such that the vertical air flow direction members 21 and the lateral air flow direction members 31 are oriented at the angles set by, for example, the user.

[0034] An operation of the indoor unit 100 according to Embodiment will now be described.

[0035] As illustrated in Fig. 2, when the fan 2 is rotated, the air in the air-conditioned space is sucked into the casing 10 through the air inlet 13, passes through the fan 2, and flows into the heat exchanger 1. The air that has flowed from the air-conditioned space into the heat exchanger 1 exchanges heat with the refrigerant flowing through the refrigerant passages in the heat exchanger 1. Specifically, while the indoor unit 100 is performing the cooling operation, the air that has flowed from the air-conditioned space into the heat exchanger 1 is cooled by the refrigerant flowing through the refrigerant passages in the heat exchanger 1. While the indoor unit 100 is performing a heating operation, the air that has flowed from the air-conditioned space into the heat exchanger 1 is heated by the refrigerant flowing through the refrigerant passages in the heat exchanger 1. The air cooled or heated in the heat exchanger 1 is then blown as conditioned air from the air outlets 14 to 17 to the air-conditioned space.

[0036] In this case, the indoor unit 100 according to

Embodiment can adjust a lateral angle of the conditioned air blown through each of the air outlets 14 to 17 using the lateral air flow direction members 31 in an air-conditioning operation (the cooling operation or the heating operation) to implement at least one of an area air-conditioning operation mode and a temperature equalizing operation mode. The term "area air-conditioning operation mode" as used herein refers to an air-conditioning mode in which a particular area in the air-conditioned space, for example, an area surrounding a person present in the air-conditioned space, is intensively air-conditioned and unnecessary air-conditioning for an area in which no person is present is avoided. The term "temperature equalizing operation mode" as used herein refers to an operation mode for equalizing temperatures in all of the areas of the air-conditioned space. The indoor unit 100 according to Embodiment causes the lateral air flow direction members 31 to operate in the following manner in the temperature equalizing operation mode and the area air-conditioning operation mode to prevent the short cycle phenomenon, in which conditioned air blown from the air outlets 14 to 17 is sucked into the air inlet 13.

[0037] Figs. 4 to 6 are bottom views of the air-conditioning-apparatus indoor unit according to Embodiment of the present invention for explanation of air-conditioning operation states of the indoor unit. In Figs. 4 to 6, flows of air sucked from the air-conditioned space into the air inlet 13 are illustrated as air flows 51. In addition, flows of conditioned air blown from the air outlets 14 to 17 are illustrated as air flows 52 in Figs. 4 to 6.

[0038] Fig. 4 illustrates a state in which the lateral angle of the conditioned air blown through the air outlets 14 to 17 is not changed by the lateral air flow direction members 31 in the air-conditioning operation of the indoor unit 100. In other words, in the state illustrated in Fig. 4, the lateral air flow direction members 31 are not at an oblique angle to the air outlets 14 to 17. More specifically, in the state illustrated in Fig. 4, the outer ends 31a of the lateral air flow direction members 31 arranged in each of the air outlets 14 to 17 are not moved to the adjacent air outlet on either side, that is, each of the lateral air flow direction members 31 is located at an intermediate position of its swing range. For example, the lateral air flow direction members 31 arranged in the air outlet 14 are not moved to either of the air outlets 15 and 17, that is, each of the lateral air flow direction members 31 is located at the intermediate position of the swing range.

[0039] While the lateral air flow direction members 31 arranged in the air outlets 14 to 17 are in the state illustrated in Fig. 4, the conditioned air blown from the air outlets 14 to 17 are blown as the air flows 52 in directions substantially perpendicular to respective sides of the decorative panel 12 of the indoor unit 100 viewed from below. In this case, spaces between the air outlets 14 to 17 of the indoor unit 100 viewed from below serve as passages through which the air in the air-conditioned space is sucked into the air inlet 13. More specifically, the air in

the air-conditioned space flows as air flows 51 passing between the air outlets 14 to 17 and is sucked into the air inlet 13.

[0040] If the angles of the lateral air flow direction members 31 in the air outlets 14 to 17 are individually adjusted such that the angle of the air flows 52 is changed for each of the air outlets 14 to 17, the spaces between the air outlets 14 to 17 of the indoor unit 100 viewed from below may be blocked by the air flows 52. In other words, the passages, through which the air in the air-conditioned space is sucked into the air inlet 13, on the indoor unit 100 viewed from below may be blocked. In such a case, the air in the air-conditioned space would hardly be sucked into the air inlet 13. Although the air in the air-conditioned space would be sucked into central part of the air inlet 13, the air flows 52 blown from the air outlets 14 to 17 would be sucked into peripheral part of the air inlet 13, that is, the short cycle phenomenon would occur. For this reason, the indoor unit according to Embodiment causes the lateral air flow direction members 31 arranged in the air outlets 14 to 17 in the area air-conditioning operation mode to operate as illustrated in Figs. 5 and 6, for example.

[0041] For example, as illustrated in Fig. 5, the human body detecting unit 61 divides the air-conditioned space into eight areas. Specifically, the human body detecting unit 61 divides the air-conditioned space into four areas A, B, C, and D radially extending from the indoor unit 100 such that the areas A, B, C, and D correspond to the air outlets 14 to 17, respectively. The human body detecting unit 61 further divides each of the areas A, B, C, and D at the center line thereof into two subareas. In Embodiment, as illustrated in Figs. 5 and 6, numerals "1" and "2" are added to the above-described two subareas, obtained by dividing each area, to distinguish between the two subareas. The subarea with the numeral "1" in each area is located in a clockwise direction from the center line of the area when the indoor unit 100 is viewed from below. The subarea with the numeral "2" in each area is located in a counterclockwise direction from the center line of the area when the indoor unit 100 is viewed from below. For example, the area A1 is the subarea that is included in the area A corresponding to the air outlet 14 and that is closer to the air outlet 17 than the center line of the area A. The area A2 is the subarea that is included in the area A corresponding to the air outlet 14 and that is closer to the air outlet 15 than the center line of the area A.

[0042] The human body detecting unit 61 determines which area a person is present in. For example, as illustrated in Fig. 5, it is assumed that the infrared sensor 41 and the human body detecting unit 61 of the controller 60 detect a person at a position 71 in the area A2. The area A2 corresponds to the air outlet 14. The driving unit 63 of the controller 60 drives the lateral air flow direction members 31 in the air outlet 14 to change the lateral angle of air flows 52 blown through the air outlet 14 such that the air flows 52 blown from the air outlet 14 flow

toward the area A2 including the position 71 as a human body position. In other words, the driving unit 63 drives the lateral air flow direction members 31 in the air outlet 14 such that the air flows 52 blown from the air outlet 14 turn toward the air outlet 15. More specifically, the driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 14 toward the air outlet 15, thus putting the lateral air flow direction members 31 in the air outlet 14 into a state for blowing the air flows 52 toward the air outlet 15.

[0043] In this case, the air outlet 14 corresponds to a first air outlet in the present invention.

[0044] Furthermore, the driving unit 63 puts the lateral air flow direction members 31 in the air outlet 15, which corresponds to a second air outlet in the present invention, into a state for blowing the air flows 52 toward the air outlet 14. The driving unit 63 puts the lateral air flow direction members 31 in the air outlet 17, which corresponds to a third air outlet in the present invention, into a state for blowing the air flows 52 toward the air outlet 16. The driving unit 63 puts the lateral air flow direction members 31 in the air outlet 16, which corresponds to a fourth air outlet in the present invention, into a state for blowing the air flows 52 toward the air outlet 17.

[0045] Since the area air-conditioning operation mode is implemented in the above-described manner, the space between the air outlets 15 and 16 and the space between the air outlets 14 and 17 of the indoor unit 100 viewed from below are not blocked by the air flows 52. Consequently, the air in the air-conditioned space can be sucked into the air inlet 13 through these spaces as passages. In other words, the air in the air-conditioned space flows as an air flow 51 passing between the air outlets 15 and 16 and an air flow 51 passing between the air outlets 14 and 17, so that the air in the air-conditioned space can be sucked into the air inlet 13. Thus, the indoor unit 100 according to Embodiment can prevent the short cycle phenomenon in the area air-conditioning operation mode.

[0046] Another example of the area air-conditioning operation mode will now be described. For example, as illustrated in Fig. 6, it is assumed that the infrared sensor 41 and the human body detecting unit 61 of the controller 60 detect a person at a position 72 in the area B2. The area B2 corresponds to the air outlet 15. The driving unit 63 of the controller 60 drives the lateral air flow direction members 31 in the air outlet 15 to change the lateral angle of the air flows 52 blown through the air outlet 15 such that the air flows 52 blown from the air outlet 15 flow toward the area B2 including the position 72 as a human body position. In other words, the driving unit 63 drives the lateral air flow direction members 31 in the air outlet 15 such that the air flows 52 blown from the air outlet 15 turn toward the air outlet 16. More specifically, the driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 15 toward the air outlet 16, thus putting the lateral air flow direction members 31 in the air outlet 15 into a state for blowing the air

flows 52 toward the air outlet 16.

[0047] In this case, the air outlet 15 corresponds to the first air outlet in the present invention.

[0048] Furthermore, the driving unit 63 puts the lateral air flow direction members 31 in the air outlet 16, which corresponds to the second air outlet in the present invention, into a state for blowing the air flows 52 toward the air outlet 15. The driving unit 63 puts the lateral air flow direction members 31 in the air outlet 14, which corresponds to the third air outlet in the present invention, into a state for blowing the air flows 52 toward the air outlet 17. The driving unit 63 puts the lateral air flow direction members 31 in the air outlet 17, which corresponds to the fourth air outlet in the present invention, into a state for blowing the air flows 52 toward the air outlet 14.

[0049] Since the area air-conditioning operation mode is implemented in the above-described manner, the space between the air outlets 14 and 15 and the space between the air outlets 16 and 17 of the indoor unit 100 viewed from below are not blocked by the air flows 52. Consequently, the air in the air-conditioned space can be sucked into the air inlet 13 through these spaces as passages. In other words, the air in the air-conditioned space flows as an air flow 51 passing between the air outlets 14 and 15 and an air flow 51 passing between the air outlets 16 and 17, so that the air in the air-conditioned space can be sucked into the air inlet 13. Thus, the indoor unit 100 according to Embodiment can prevent the short cycle phenomenon in the area air-conditioning operation mode.

[0050] When the infrared sensor 41 and the human body detecting unit 61 of the controller 60 detect a person on the center line of any area, the driving unit 63 of the controller 60 puts the lateral air flow direction members 31 in the air outlets 14 to 17 into a state illustrated in Fig. 4. More specifically, the driving unit 63 of the controller 60 causes each of the lateral air flow direction members 31 in the air outlets 14 to 17 to be located at the intermediate position of the swing range.

[0051] Although the air-conditioned space is divided into eight areas in the area air-conditioning operation mode in Embodiment, the number of areas obtained by dividing the air-conditioned space is not limited to eight. For example, the air-conditioned space may be divided into 12 areas as illustrated in Fig. 7.

[0052] Fig. 7 is a bottom view of the air-conditioning-apparatus indoor unit according to Embodiment of the present invention for explanation of another example of division of the air-conditioned space.

[0053] For example, as illustrated in Fig. 7, each of the areas A, B, C, and D may be divided into three subareas such that the air-conditioned space is divided into 12 areas. Specifically, each area in Fig. 7 is divided into a subarea with a numeral "1", a subarea with a numeral "2", and a subarea with a numeral "3". The subarea with the numeral "3" includes the center line of each area when the indoor unit 100 is viewed from below. The subarea with the numeral "1" is located in the clockwise di-

rection from the subarea with the numeral "3" in each area when the indoor unit 100 is viewed from below. The subarea with the numeral "2" is located in the counter-clockwise direction from the subarea with the numeral "3" in each area when the indoor unit 100 is viewed from below. When the infrared sensor 41 and the human body detecting unit 61 of the controller 60 detect a person in any area with the numeral "3" of the 12 areas, into which the air-conditioned space is divided as illustrated in Fig. 7, the driving unit 63 of the controller 60 puts the lateral air flow direction members 31 in the air outlets 14 to 17 into the state illustrated in Fig. 4. More specifically, the driving unit 63 of the controller 60 causes each of the lateral air flow direction members 31 in the air outlets 14 to 17 to be located at the intermediate position of the swing range.

[0054] In the configuration in Embodiment, conditioned air is blown toward an area in which a human body is present. Conditioned air may be blown directly to a human body.

[0055] As described above, the angles of the lateral air flow direction members 31 of the indoor unit 100 according to Embodiment can be set by using the remote control 65. In such a case, the short cycle phenomenon can be prevented by operating the lateral air flow direction members 31 arranged in the air outlets 14 to 17 in the above-described manner. For example, it is assumed that the remote control 65 has received an operation of setting the lateral air flow direction members 31 in the air outlet 14 to the state for blowing the air flows 52 toward the air outlet 15. In this case, the lateral air flow direction members 31 in the air outlets 15 to 17 may be put into a state illustrated in Fig. 5. Since the lateral air flow direction members 31 in the air outlets 14 to 17 are caused to operate in the above-described manner, the space between the air outlets 15 and 16 and the space between the air outlets 14 and 17 of the indoor unit 100 viewed from below are not blocked by the air flows 52. Consequently, the air in the air-conditioned space can be sucked into the air inlet 13 through these spaces as passages. More specifically, the air in the air-conditioned space flows as the air flow 51 passing between the air outlets 15 and 16 and the air flow 51 passing between the air outlets 14 and 17, so that the air in the air-conditioned space can be sucked into the air inlet 13. Thus, the indoor unit 100 according to Embodiment can prevent the short cycle phenomenon.

[0056] In the temperature equalizing operation mode, the driving unit 63 causes the lateral air flow direction members 31 in the air outlets 14 to 17 to swing without stopping. In this operation mode, the driving unit 63 swings the lateral air flow direction members 31 in the air outlets 14 to 17 such that at least two of the spaces between the air outlets 14 to 17 of the indoor unit 100 viewed from below are not blocked by the air flows 52. In other words, as will be described below, the driving unit 63 swings the lateral air flow direction members 31 in the air outlets 14 to 17 such that air flows 51 pass

through at least two of the spaces between the air outlets 14 to 17 of the indoor unit 100 viewed from below.

[0057] In the following description, the air outlet 14 corresponds to the first air outlet in the present invention, the air outlet 15 corresponds to the second air outlet in the present invention, the air outlet 17 corresponds to the third air outlet in the present invention, and the air outlet 16 corresponds to the fourth air outlet in the present invention.

[0058] For example, assuming that the temperature equalizing operation mode is started in the state of Fig. 4, the driving unit 63 causes the lateral air flow direction members 31 in the air outlets 14 to 17 to change from the state of Fig. 4 to, for example, the state of Fig. 5. Specifically, the driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 14 toward the air outlet 15. Furthermore, the driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 15 toward the air outlet 14. The driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 16 toward the air outlet 17. The driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 17 toward the air outlet 16.

[0059] When each of the lateral air flow direction members 31 in the air outlets 14 to 17 reaches one end of the swing range such that the lateral air flow direction members 31 are in the state of Fig. 5, the driving unit 63 causes the lateral air flow direction members 31 in the air outlets 14 to 17 to change to the state of Fig. 4. Specifically, the driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 14 toward the air outlet 17. Furthermore, the driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 15 toward the air outlet 16. The driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 16 toward the air outlet 15. The driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 17 toward the air outlet 14.

[0060] When each of the lateral air flow direction members 31 in the air outlets 14 to 17 reaches the intermediate position of the swing range such that the lateral air flow direction members 31 are in the state of Fig. 4, the driving unit 63 causes the lateral air flow direction members 31 in the air outlets 14 to 17 to change to a state of Fig. 6. Specifically, the driving unit 63 further moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 14 toward the air outlet 17. The driving unit 63 further moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 15 toward the air outlet 16. The driving unit 63 further moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 16 toward the air outlet 15. The driving unit 63 further moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 17 toward the air outlet 14.

[0061] When each of the lateral air flow direction mem-

bers 31 in the air outlets 14 to 17 reaches the other end of the swing range such that the lateral air flow direction members 31 are in the state of Fig. 6, the driving unit 63 causes the lateral air flow direction members 31 in the air outlets 14 to 17 to change to the state of Fig. 4. Specifically, the driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 14 toward the air outlet 15. The driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 15 toward the air outlet 14. The driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 16 toward the air outlet 17. The driving unit 63 moves the outer ends 31a of the lateral air flow direction members 31 in the air outlet 17 toward the air outlet 16.

[0062] In the temperature equalizing operation mode, the above-described operation is repeated. In this operation mode, when the lateral air flow direction members 31 in the air outlet 14 are in the state for blowing the air flows 52 toward the air outlet 15, the lateral air flow direction members 31 in the air outlet 15 are in the state for blowing the air flows 52 toward the air outlet 14, the lateral air flow direction members 31 in the air outlet 17 are in the state for blowing the air flows 52 toward the air outlet 16, and the lateral air flow direction members 31 in the air outlet 16 are in the state for blowing the air flows 52 toward the air outlet 17. Consequently, the air in the air-conditioned space flows as the air flow 51 passing between the air outlets 15 and 16 and the air flow 51 passing between the air outlets 14 and 17, so that the air in the air-conditioned space can be sucked into the air inlet 13.

[0063] When the lateral air flow direction members 31 in the air outlet 14 are in the state for blowing the air flows 52 toward the air outlet 17, the lateral air flow direction members 31 in the air outlet 17 are in the state for blowing the air flows 52 toward the air outlet 14, the lateral air flow direction members 31 in the air outlet 15 are in the state for blowing the air flows 52 toward the air outlet 16, and the lateral air flow direction members 31 in the air outlet 16 are in the state for blowing the air flows 52 toward the air outlet 15. Consequently, the air in the air-conditioned space flows as the air flow 51 passing between the air outlets 14 and 15 and the air flow 51 passing between the air outlets 16 and 17, so that the air in the air-conditioned space can be sucked into the air inlet 13. Therefore, the indoor unit 100 according to Embodiment can also prevent the short cycle phenomenon in the temperature equalizing operation mode.

[0064] When the angles of conditioned air blown through the air outlets 14 to 17 are greatly changed by using the lateral air flow direction members 31 in the air outlets 14 to 17, that is, when the amount of swing of each of the lateral air flow direction members 31 from the intermediate position is increased, the conditioned air tends to intensively hit against a first surface of the lateral air flow direction member 31 and the air in the air-conditioned space tends to contact a second surface thereof.

In the cooling operation of the indoor unit 100, a large difference in temperature between the conditioned air blown from the air outlets 14 to 17 and the air in the air-conditioned space causes the air in the air-conditioned space to be cooled by the lateral air flow direction members 31 when the air in the air-conditioned space contacts the second surfaces of the lateral air flow direction members 31, so that condensation tends to form on the second surfaces of the lateral air flow direction members 31.

[0065] For this reason, in the cooling operation of the indoor unit 100 according to Embodiment, the comparing unit 62 of the controller 60 compares a temperature detected by the temperature sensor 42 with the previously stored prescribed temperature. More specifically, the comparing unit 62 compares the temperature of the air sucked from the air-conditioned space into the casing 10 with the previously stored prescribed temperature. The driving unit 63 of the controller 60 retains each of the lateral air flow direction members 31 in the air outlets 14 to 17 at the intermediate position of the swing range until the temperature detected by the temperature sensor 42 reaches or falls below the prescribed temperature. Consequently, condensation can be prevented from forming on the lateral air flow direction members 31, thus preventing water droplet scattering in the air-conditioned space.

[0066] When the angles of conditioned air blown through the air outlets 14 to 17 are greatly changed by using the vertical air flow direction members 21 in the air outlets 14 to 17 at a large difference in temperature between the conditioned air blown from the air outlets 14 to 17 and the air in the air-conditioned space, the conditioned air tends to intensively hit against a first surface of each of the vertical air flow direction members 21 and the air in the air-conditioned space tends to contact a second surface thereof in a manner similar to the case of the lateral air flow direction members 31. In the cooling operation of the indoor unit 100, a large difference in temperature between the conditioned air blown from the air outlets 14 to 17 and the air in the air-conditioned space causes the air in the air-conditioned space to be cooled by the vertical air flow direction members 21 when the air in the air-conditioned space contacts the second surfaces of the vertical air flow direction members 21, so that condensation tends to form on the second surfaces of the vertical air flow direction members 21.

[0067] For this reason, in the cooling operation of the indoor unit 100 according to Embodiment, the driving unit 63 of the controller 60 retains the vertical air flow direction members 21 in the air outlets 14 to 17 at an angle at which the vertical air flow direction members 21 extend along the parts of the air outlets 14 to 17, in which the vertical air flow direction members 21 are arranged, until the temperature detected by the temperature sensor 42 reaches or falls below the prescribed temperature. Consequently, condensation can be prevented from forming on the vertical air flow direction members 21, thus preventing water droplet scattering in the air-conditioned

space.

[0068] Similarly, a high humidity level in the air in the air-conditioned space causes the air in the air-conditioned space to be cooled by the lateral air flow direction members 31 when the air contacts the second surfaces of the lateral air flow direction members 31, so that condensation tends to form on the second surfaces of the lateral air flow direction members 31.

[0069] For this reason, in the cooling operation of the indoor unit 100 according to Embodiment, the comparing unit 62 of the controller 60 compares a humidity detected by the humidity sensor 43 with the previously stored prescribed humidity. More specifically, the comparing unit 62 compares the humidity of the air sucked from the air-conditioned space into the casing 10 with the previously stored prescribed humidity. The driving unit 63 of the controller 60 retains each of the lateral air flow direction members 31 in the air outlets 14 to 17 at the intermediate position of the swing range until the humidity detected by the humidity sensor 43 reaches or falls below the prescribed humidity. Consequently, condensation can be prevented from forming on the lateral air flow direction members 31, thus preventing water droplet scattering in the air-conditioned space.

[0070] Furthermore, a high humidity level in the air in the air-conditioned space causes the air in the air-conditioned space to be cooled by the vertical air flow direction members 21 when the air contacts the second surfaces of the vertical air flow direction members 21 in a manner similar to the case of the lateral air flow direction members 31, so that condensation tends to form on the second surfaces of the vertical air flow direction members 21.

[0071] For this reason, in the cooling operation of the indoor unit 100 according to Embodiment, the driving unit 63 of the controller 60 retains the vertical air flow direction members 21 in the air outlets 14 to 17 at the angle at which the vertical air flow direction members 21 extend along the parts of the air outlets 14 to 17, in which the vertical air flow direction members 21 are arranged, until the humidity detected by the humidity sensor 43 reaches or falls below the prescribed humidity. Consequently, condensation can be prevented from forming on the vertical air flow direction members 21, thus preventing water droplet scattering in the air-conditioned space.

[0072] As described above, the indoor unit 100 according to Embodiment includes the casing 10 having the air inlet 13 and the four air outlets 14 to 17 arranged in the lower surface portion such that the air outlets 14 to 17 surround the four sides of the air inlet 13, and further includes the lateral air flow direction members 31, swingably arranged in the air outlets 14 to 17, for adjusting the lateral angles of air blown through the air outlets 14 to 17.

[0073] When one (e.g., the air outlet 14) of the air outlets is defined as a first air outlet, one (e.g., the air outlet 15) of the air outlets next to the first air outlet is defined as a second air outlet, the other one (e.g., the air outlet 17) of the air outlets next to the first air outlet is defined

as a third air outlet, the air outlet (e.g., the air outlet 16) facing the first air outlet across the air inlet 13 is defined as a fourth air outlet in the indoor unit 100 according to Embodiment, and when the lateral air flow direction members 31 in the first air outlet are in the state for blowing the air toward the second air outlet in, for example, the area air-conditioning operation mode, the lateral air flow direction members 31 in the second air outlet are in the state for blowing the air toward the first air outlet, the lateral air flow direction members 31 in the third air outlet are in the state for blowing the air toward the fourth air outlet, and the lateral air flow direction members 31 in the fourth air outlet are in the state for blowing the air toward the third air outlet.

[0074] Furthermore, when the lateral air flow direction members 31 in the first air outlet are in the state for blowing the air toward the second air outlet in the temperature equalizing operation mode, in which the lateral air flow direction members 31 are swung, of the indoor unit 100 according to Embodiment, the lateral air flow direction members 31 in the second air outlet are in the state for blowing the air toward the first air outlet, the lateral air flow direction members 31 in the third air outlet are in the state for blowing the air toward the fourth air outlet, and the lateral air flow direction members 31 in the fourth air outlet are in the state for blowing the air toward the third air outlet. In addition, when the lateral air flow direction members 31 in the first air outlet are in the state for blowing the air toward the third air outlet in the temperature equalizing operation mode, in which the lateral air flow direction members 31 are swung, of the indoor unit 100 according to Embodiment, the lateral air flow direction members 31 in the third air outlet are in the state for blowing the air toward the first air outlet, the lateral air flow direction members 31 in the second air outlet are in the state for blowing the air toward the fourth air outlet, and the lateral air flow direction members 31 in the fourth air outlet are in the state for blowing the air toward the second air outlet.

[0075] More specifically, when the angles of air blown through the air outlets 14 to 17 are changed by using the lateral air flow direction members 31 of the indoor unit 100 according to Embodiment, at least two of the spaces between the air outlets 14 to 17 of the indoor unit 100 viewed from below are not blocked by the air flows 52. Thus, the indoor unit 100 according to Embodiment can prevent the short cycle phenomenon when the angles of air blown through the air outlets 14 to 17 are changed by using the lateral air flow direction members 31.

[0076] Since the indoor unit 100 according to Embodiment includes the temperature sensor 42 that detects a temperature of air sucked into the casing 10 through the air inlet 13, each of the lateral air flow direction members 31 is retained at the intermediate position of the swing range until the temperature detected by the temperature sensor 42 reaches or falls below the prescribed temperature in the cooling operation. Thus, the indoor unit 100 according to Embodiment can prevent condensation

from forming on the lateral air flow direction members 31, thus preventing water droplet scattering in the air-conditioned space.

[0077] Since the indoor unit 100 according to Embodiment includes the temperature sensor 42 that detects a temperature of air sucked into the casing 10 through the air inlet 13, the vertical air flow direction members 21 in the air outlets 14 to 17 are retained at the angle at which the vertical air flow direction members 21 extend along the parts of the air outlets 14 to 17, in which the vertical air flow direction members 21 are arranged, until the temperature detected by the temperature sensor 42 reaches or falls below the prescribed temperature in the cooling operation. Consequently, the indoor unit 100 according to Embodiment can prevent condensation from forming on the vertical air flow direction members 21, thus preventing water droplet scattering in the air-conditioned space.

[0078] Since the indoor unit 100 according to Embodiment includes the humidity sensor 43 that detects a humidity of air sucked into the casing 10 through the air inlet 13, each of the lateral air flow direction members 31 in the air outlets 14 to 17 is retained at the intermediate position of the swing range until the humidity detected by the humidity sensor 43 reaches or falls below the prescribed humidity in the cooling operation. Consequently, the indoor unit 100 according to Embodiment can prevent condensation from forming on the lateral air flow direction members 31, thus preventing water droplet scattering in the air-conditioned space.

[0079] Since the indoor unit 100 according to Embodiment includes the humidity sensor 43 that detects a humidity of air sucked into the casing 10 through the air inlet 13, the vertical air flow direction members 21 in the air outlets 14 to 17 are retained at the angle at which the vertical air flow direction members 21 extend along the parts of the air outlets 14 to 17, in which the vertical air flow direction members 21 are arranged, until the humidity detected by the humidity sensor 43 reaches or falls below the prescribed humidity. Consequently, the indoor unit 100 according to Embodiment can prevent condensation from forming on the vertical air flow direction members 21, thus preventing water droplet scattering in the air-conditioned space.

[0080] In the indoor unit 100 according to Embodiment, the casing 10 includes the main body 11 having the open lower portion and receiving the fan 2 and the heat exchanger 1, the attachment member 18 covering the lower portion of the main body 11 and including the part of the air inlet 13 and the parts of the air outlets 14 to 17, and the decorative panel 12 covering the lower portion of the attachment member 18 and including the part of the air inlet 13 and the parts of the air outlets 14 to 17. In the indoor unit 100 according to Embodiment, the vertical air flow direction members 21 are arranged in the parts (portions) of the air outlets 14 to 17 included in the decorative panel 12, and the lateral air flow direction members 31 are arranged in the parts (portions) of the air outlets 14

to 17 included in the attachment member 18. The indoor unit 100 according to Embodiment can accordingly offer the following advantages (1) and (2).

[0081]

(1) The advantage of reducing the manufacturing cost of the indoor unit 100

(2) The advantage of increasing accuracy with which the lateral air flow direction members 31 adjust the angles of conditioned air blown through the air outlets 14 to 17

[(1) The advantage of reducing the manufacturing cost of the indoor unit 100]

[0082] There is also a demand for inexpensive indoor units with no lateral air flow direction members in a market for air-conditioning-apparatus indoor units to be installed in concealed fashion in a ceiling of an air-conditioned space or in suspended fashion from a ceiling of an air-conditioned space. Such an indoor unit will be referred to as an "inexpensive indoor unit". Since the casing 10 has the above-described configuration in Embodiment, an inexpensive indoor unit can be made by removing the attachment member 18, in which the lateral air flow direction members 31 and the components (e.g., the support members 32 and the link members 33) used to swing the lateral air flow direction members 31 are arranged, from the indoor unit 100 according to Embodiment. In other words, the configuration of the casing 10 in Embodiment allows commonality of many components between the indoor unit 100 and the inexpensive indoor unit. This commonality results in a reduction in manufacturing cost of the indoor unit 100.

[0083] Specifically, to install the indoor unit 100 according to Embodiment, the main body 11 receiving the fan 2 and the heat exchanger 1 is secured to a ceiling. Then, the attachment member 18, in which the lateral air flow direction members 31 and the components (e.g., the support members 32 and the link members 33) used to swing the lateral air flow direction members 31 are arranged, is attached to the lower portion of the main body 11 secured to the ceiling. After that, the decorative panel 12, in which the vertical air flow direction members 21 and the components (e.g., the rotating shafts 22) used to swing the vertical air flow direction members 21 are arranged, is attached to the lower portion of the attachment member 18.

[0084] On the other hand, the inexpensive indoor unit can be installed by attaching the decorative panel 12, in which the vertical air flow direction members 21 and the components (e.g., the rotating shafts 22) used to swing the vertical air flow direction members 21 are arranged, to the lower portion of the main body 11 secured to the ceiling.

[(2) The advantage of increasing the accuracy with which the lateral air flow direction members 31 adjust the angles of conditioned air blown through the air outlets 14 to 17]

5 **[0085]** Typically, the inexpensive indoor unit with no lateral air flow direction members 31 has no space available for the lateral air flow direction members 31 in the casing because the arrangement of the lateral air flow direction members 31 is not considered. Lateral air flow direction members 31 could be arranged in the casing of the inexpensive indoor unit when the lateral air flow direction members 31 have a small-size. However, the small-sized lateral air flow direction members 31 could fail to change the angles of conditioned air blown through the air outlets 14 to 17 with reliability. Leaving a space for arrangement of the lateral air flow direction members 31 in the casing of the inexpensive indoor unit in advance would increase the size of the inexpensive indoor unit.

10 **[0086]** In contrast, the lateral air flow direction members 31 of the indoor unit 100 according to Embodiment are arranged in the attachment member 18. Thus, the lateral air flow direction members 31 large enough to reliably change the angles of conditioned air blown through the air outlets 14 to 17 can be arranged in the indoor unit 100. This arrangement does not result in an increase in size of the inexpensive indoor unit including the same components as those of the indoor unit 100.

15 **[0087]** The casing 10 of the indoor unit 100 may have a configuration illustrated in Fig. 8, as will be described below.

20 **[0088]** Fig. 8 is a longitudinal sectional view illustrating a modification of the air-conditioning apparatus according to Embodiment of the present invention as viewed in the same direction as that in Fig. 2.

25 **[0089]** As illustrated in Fig. 8, the attachment member 18 and the decorative panel 12 may be integrated in one piece. In other words, the casing 10 of the indoor unit 100 in Fig. 8 includes the main body 11 receiving the fan 2 and the heat exchanger 1 and the decorative panel 12 covering the lower portion of the main body 11 and including the air inlet 13 and the air outlets 14 to 17. The lateral air flow direction members 31 and the components (e.g., the support members 32 and the link members 33) used to swing the lateral air flow direction members 31 are arranged in the air outlets 14 to 17 of the decorative panel 12.

30 **[0090]** For the configuration of the indoor unit 100 in Fig. 8, there is no commonality of the decorative panel 12 between the indoor unit 100 and the inexpensive indoor unit. However, the indoor unit 100 in Fig. 8 and the inexpensive indoor unit can have commonality of the components other than the decorative panel 12. This commonality results in a reduction in manufacturing cost of the indoor unit 100 having the configuration in Fig. 8. To install the indoor unit 100 in Fig. 8 requires only that the decorative panel 12 be attached to the lower portion of the main body 11 secured to the ceiling. Advantageously, the indoor unit 100 in Fig. 8 can be installed in

less steps than the indoor unit 100 in Fig. 2.

Reference Signs List

[0091]

1 heat exchanger 2 fan 3 bell mouth 10 casing 11 main body 12 decorative panel 13 air inlet 14 air outlet 15 air outlet 16 air outlet 17 air outlet 18 attachment member 21 vertical air flow direction member 21a outer end 22 rotating shaft 31 lateral air flow direction member 31a outer end 32 support member 33 link member 41 infrared sensor 42 temperature sensor 43 humidity sensor 51 airflow 52 airflow 60 controller 61 human body detecting unit 62 comparing unit 63 driving unit 65 remote control 71 position 72 position 100 indoor unit

Claims

1. An indoor unit of an air-conditioning apparatus, the indoor unit comprising:

a casing having an air inlet and four air outlets arranged in a lower surface portion of the casing such that the four air outlets surround four sides of the air inlet; and

a lateral air flow direction member swingably disposed in each of the air outlets, the lateral air flow direction member adjusting a lateral angle of air blown through the air outlet, wherein when one of the air outlets is defined as a first air outlet, one of the air outlets next to the first air outlet is defined as a second air outlet, an other one of the air outlets next to the first air outlet is defined as a third air outlet, the air outlet facing the first air outlet across the air inlet is defined as a fourth air outlet, and when the lateral air flow direction member in the first air outlet is in a state for blowing the air toward the second air outlet, the lateral air flow direction member in the second air outlet is in a state for blowing the air toward the first air outlet, the lateral air flow direction member in the third air outlet is in a state for blowing the air toward the fourth air outlet, and the lateral air flow direction member in the fourth air outlet is in a state for blowing the air toward the third air outlet.

2. The indoor unit of claim 1, wherein the indoor unit has an operation mode in which the lateral air flow direction members are swung, wherein when the lateral air flow direction member in the first air outlet is in the state for blowing the air toward the second air outlet in this operation mode, the lateral air flow direction member in the second

air outlet is in the state for blowing the air toward the first air outlet, the lateral air flow direction member in the third air outlet is in the state for blowing the air toward the fourth air outlet, and the lateral air flow direction member in the fourth air outlet is in the state for blowing the air toward the third air outlet, and wherein when the lateral air flow direction member in the first air outlet is in a state for blowing the air toward the third air outlet in this operation mode, the lateral air flow direction member in the third air outlet is in a state for blowing the air toward the first air outlet, the lateral air flow direction member in the second air outlet is in a state for blowing the air toward the fourth air outlet, and the lateral air flow direction member in the fourth air outlet is in a state for blowing the air toward the second air outlet.

3. The indoor unit of claim 1, further comprising:

a human body position detector that detects a human body position, wherein the lateral air flow direction member in the first air outlet is in a state for blowing the air toward an area including the human body position detected by the human body position detector and the area is one of areas into which an air-conditioned space is divided.

4. The indoor unit of any one of claims 1 to 3, further comprising:

a vertical air flow direction member swingably disposed in each of the air outlets, the vertical air flow direction member adjusting a vertical angle of the air blown through the air outlet.

5. The indoor unit of any one of claims 1 to 3, further comprising:

a temperature sensor that detects a temperature of air sucked into the casing through the air inlet, wherein the lateral air flow direction member in each of the air outlets is retained at an intermediate position of a swing range until the temperature detected by the temperature sensor reaches or falls below a prescribed temperature in a cooling operation of the indoor unit.

6. The indoor unit of claim 5, further comprising:

a vertical air flow direction member swingably disposed in each of the air outlets, the vertical air flow direction member adjusting a vertical angle of the air blown through the air outlet, wherein the vertical air flow direction member disposed in each of the air outlets is retained at an angle at which the vertical air flow direction member extends along part of the air outlet in which the vertical air flow direction member is

disposed until the temperature detected by the temperature sensor reaches or falls below the prescribed temperature.

7. The indoor unit of any one of claims 1 to 3, further comprising:

a humidity sensor that detects a humidity of air sucked into the casing through the air inlet, wherein the lateral air flow direction member in each of the air outlets is retained at an intermediate position of a swing range until the humidity detected by the humidity sensor reaches or falls below a prescribed humidity in a cooling operation of the indoor unit.

8. The indoor unit of claim 7, further comprising:

a vertical air flow direction member swingably disposed in each of the air outlets, the vertical air flow direction member adjusting a vertical angle of the air blown through the air outlet, wherein the vertical air flow direction member disposed in each of the air outlets is retained at an angle at which the vertical air flow direction member extends along part of the air outlet in which the vertical air flow direction member is disposed until the humidity detected by the humidity sensor reaches or falls below the prescribed humidity.

9. The indoor unit of any one of claims 4, 6, and 8, further comprising:

a fan that causes air in an air-conditioned space to be sucked into the casing through the air inlet; and
a heat exchanger that causes the air sucked into the casing to exchange heat with refrigerant flowing through the heat exchanger,
wherein the casing includes

a main body having an open lower portion and receiving the fan and the heat exchanger,
an attachment member covering the lower portion of the main body and including part of the air inlet and parts of the air outlets, and
a decorative panel covering a lower portion of the attachment member and including part of the air inlet and parts of the air outlets,

wherein the vertical air flow direction members are arranged in the parts of the air outlets included in the decorative panel, and
wherein the lateral air flow direction members are arranged in the parts of the air outlets included in the attachment member.

10. The indoor unit of any one of claims 4, 6, and 8, further comprising:

a fan that causes air in an air-conditioned space to be sucked into the casing through the air inlet; and
a heat exchanger that causes the air sucked into the casing to exchange heat with refrigerant flowing through the heat exchanger,
wherein the casing includes

a main body having an open lower portion and receiving the fan and the heat exchanger,
a decorative panel covering the lower portion of the main body and including the air inlet and the air outlets, and

wherein the vertical air flow direction members and the lateral air flow direction members are arranged in the air outlets included in the decorative panel.

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FIG. 1

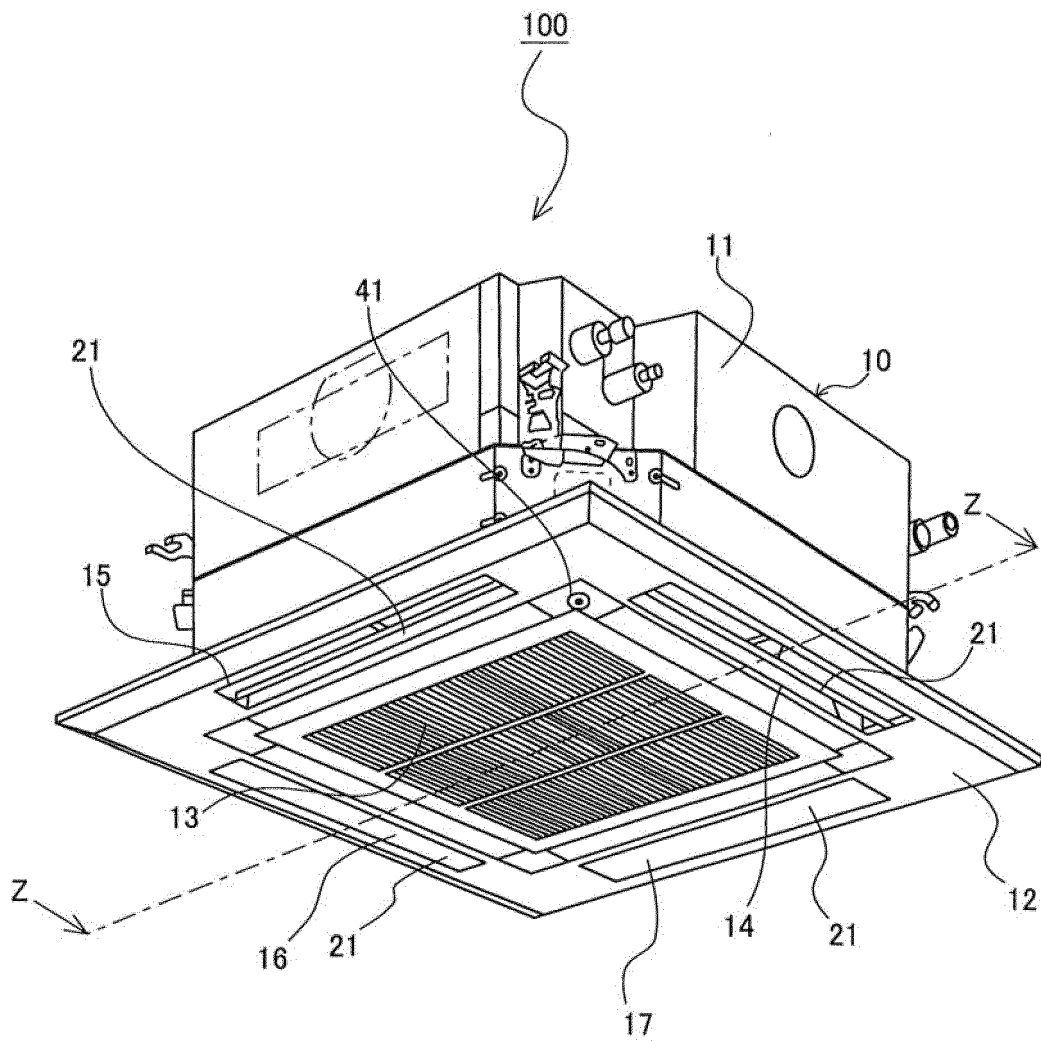


FIG. 2

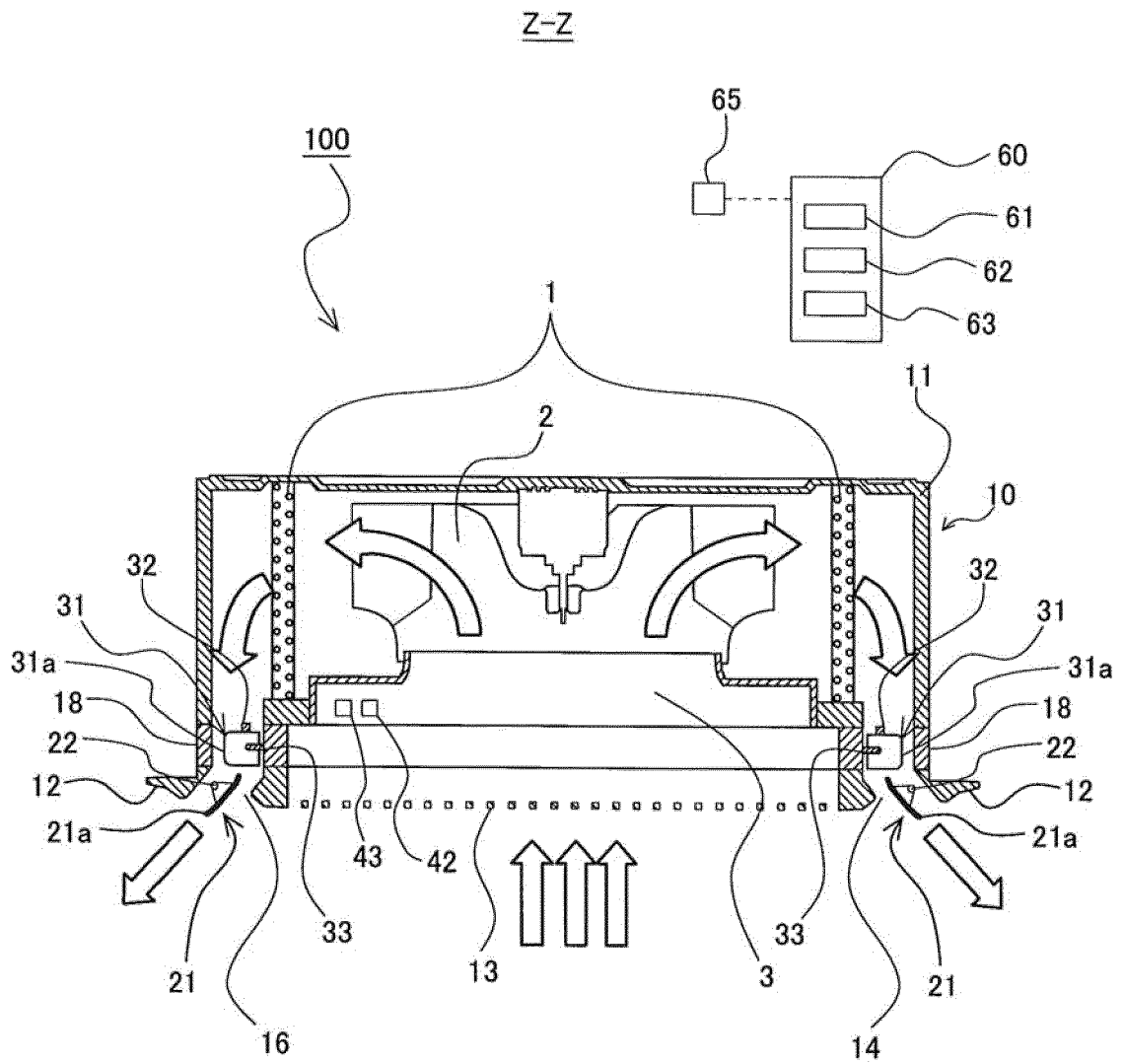


FIG. 3

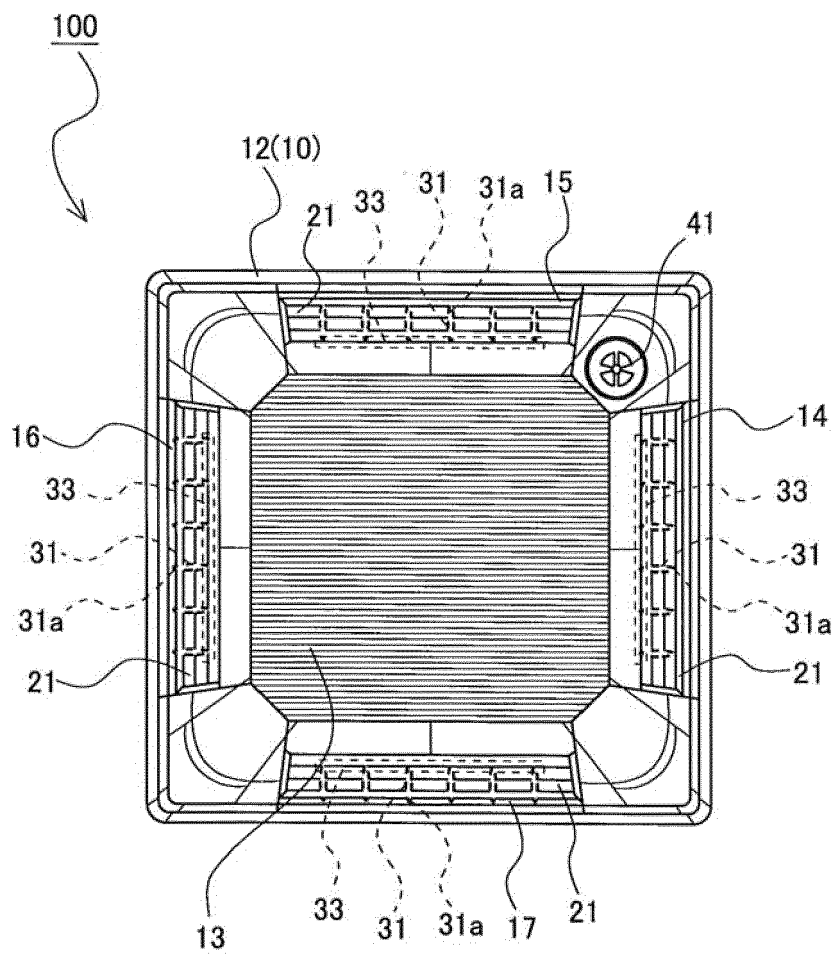


FIG. 5

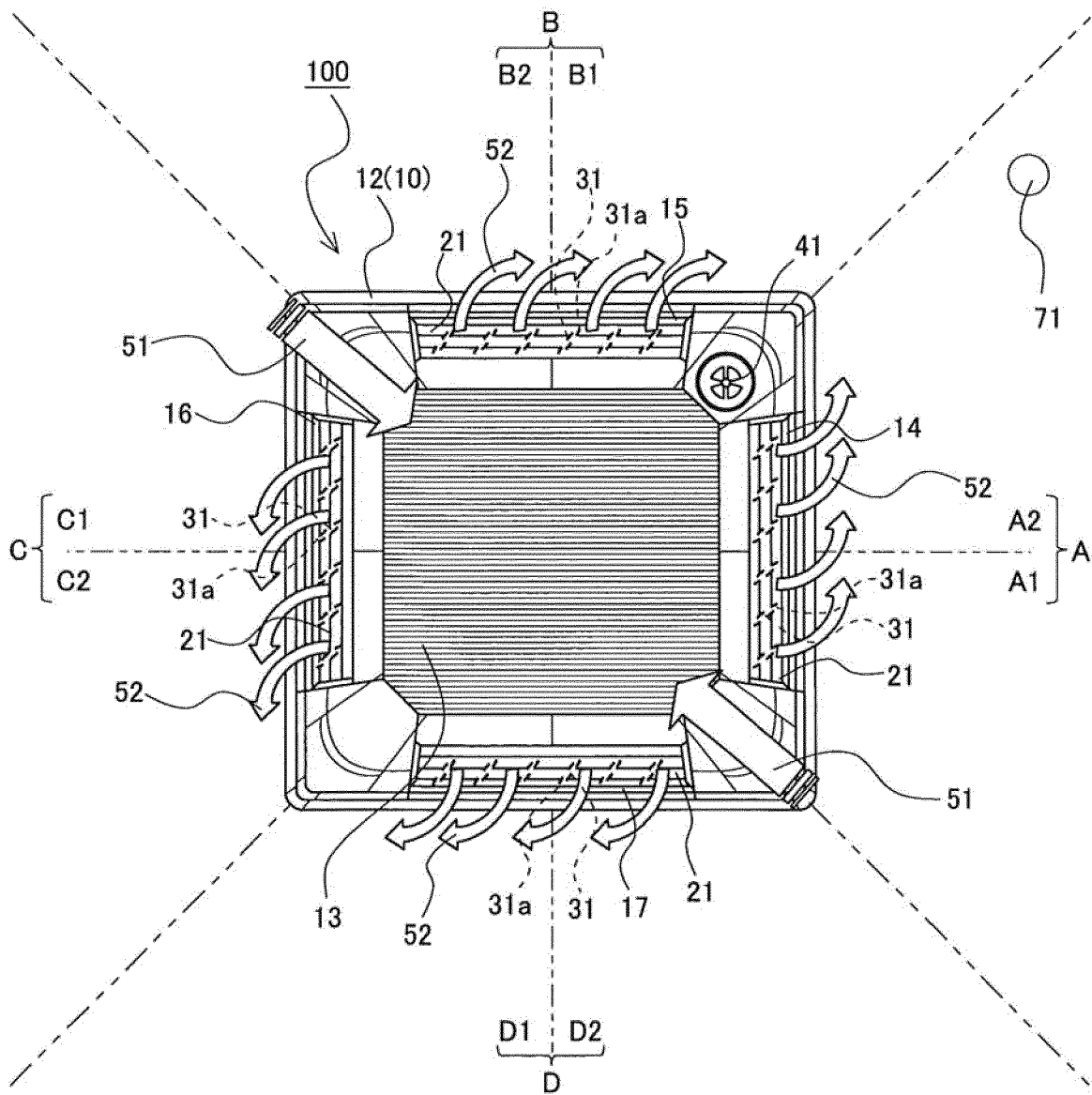


FIG. 6

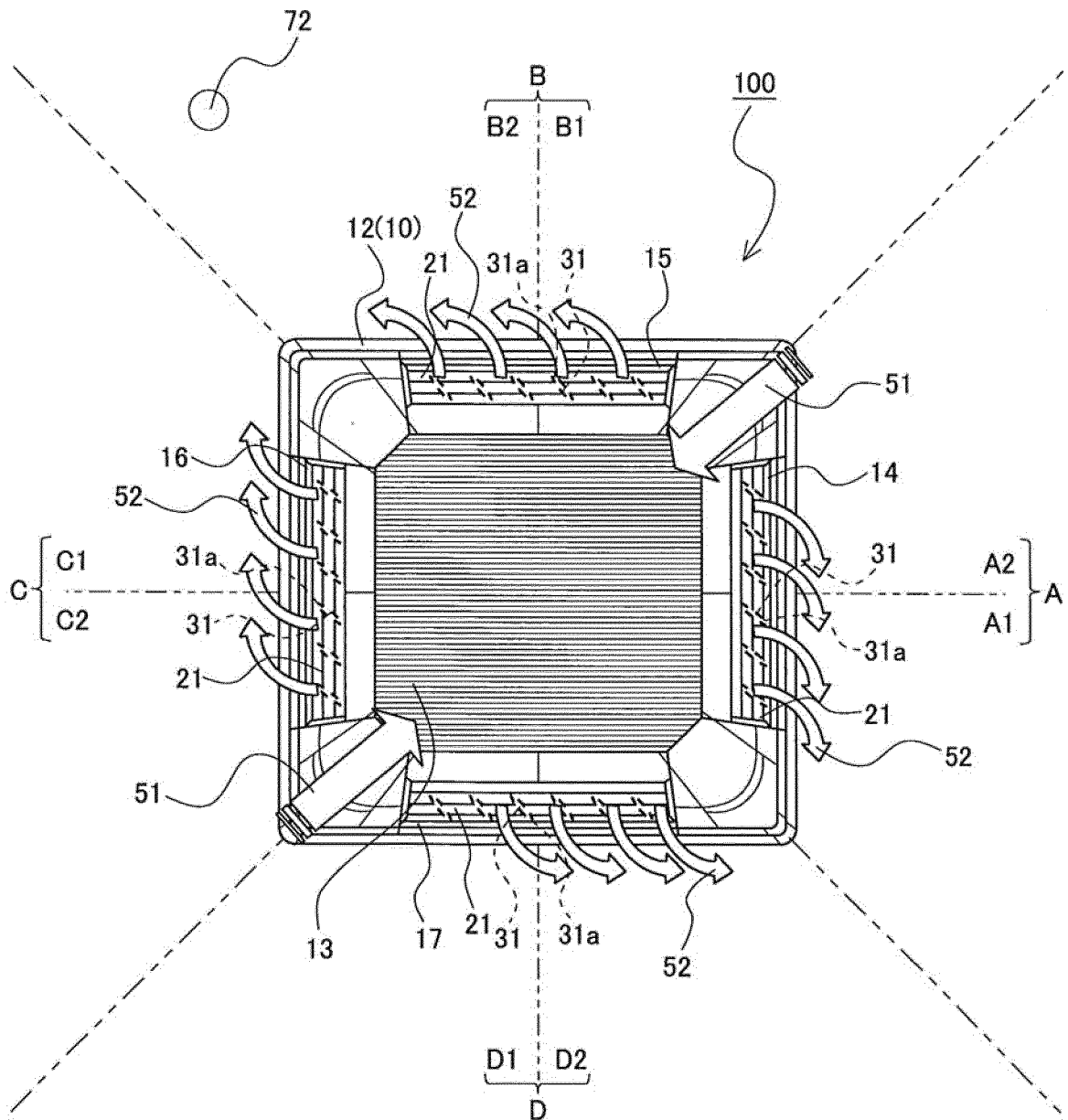
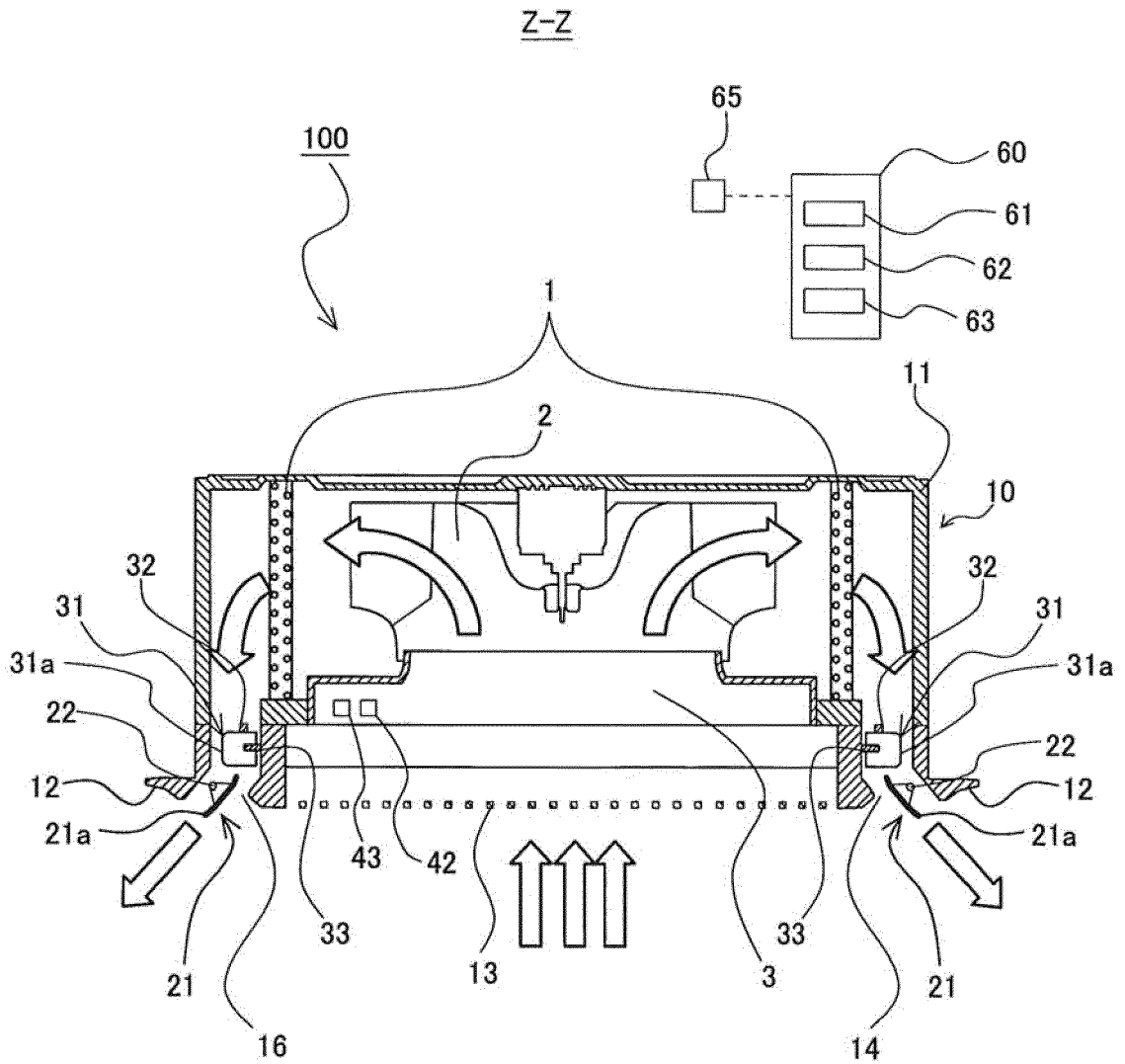


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/083648

A. CLASSIFICATION OF SUBJECT MATTER

F24F11/02(2006.01)i, F24F13/32(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)

F24F11/02, F24F13/32

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	1996-2017
Kokai Jitsuyo Shinan Koho	1971-2017	Toroku Jitsuyo Shinan Koho	1994-2017

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.
A	JP 2005-16885 A (Daikin Industries, Ltd.), 20 January 2005 (20.01.2005), paragraphs [0001] to [0124]; fig. 1 to 20 (Family: none)	1-10
A	JP 2005-249328 A (Mitsubishi Electric Corp.), 15 September 2005 (15.09.2005), paragraphs [0029] to [0032]; fig. 26 to 29 (Family: none)	1-10
A	WO 2010/125804 A1 (Daikin Industries, Ltd.), 04 November 2010 (04.11.2010), paragraphs [0019] to [0042]; fig. 1 to 15 (Family: none)	1-10

 Further documents are listed in the continuation of Box C.
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Date of the actual completion of the international search
06 January 2017 (06.01.17)Date of mailing of the international search report
24 January 2017 (24.01.17)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/083648

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2007-24453 A (Mitsubishi Electric Corp.), 01 February 2007 (01.02.2007), paragraphs [0006] to [0018]; fig. 1 to 9 (Family: none)	1-10

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2003194389 A [0005]