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(54) **AIR-CONDITIONING INDOOR UNIT**

(57) The present invention provides, in relation to an air conditioning indoor unit disposed with an air inlet adjacent to the rear side of an air outlet, an air conditioning indoor unit that prevents the occurrence of short-circuiting. In an air conditioning indoor unit (2), an opening and closing plate (311) exists on a path (position A) of air trying to flow directly from an air outlet (19) to a first air inlet (21), so the flow of the air is deflected by the opening and closing plate (311) in a direction away from the first air inlet (21). Position A of the opening and closing plate (311) is a position in which an end portion of the opening and closing plate (311) and a lower end of a bottom frame (17) are in close proximity to one another and in which substantially no gap appears between the opening and closing member (311) and the lower end of the bottom frame (17). Among the routes leading from the air outlet (19) to the first air inlet (21), the route by which the air-conditioned air is most easily sucked in is the route where the air-conditioned air flows in such a way as to graze the lower end of the bottom frame (17), so by ensuring that no gap appears between the opening and closing member (311) and the lower end of the bottom frame (17), the air-conditioned air is suppressed from being sucked into the first air inlet (21).

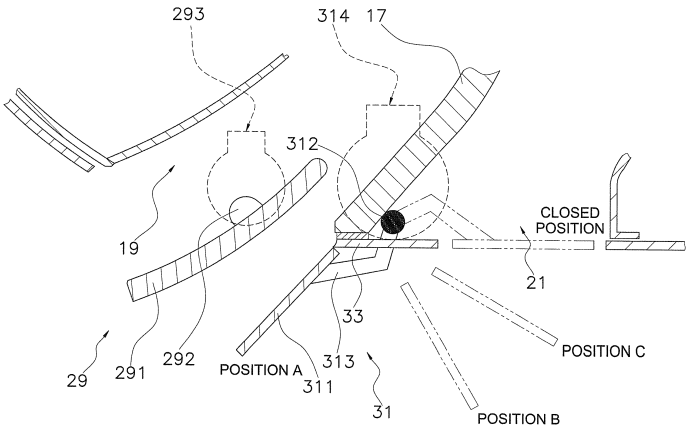

FIG. 5

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Description

TECHNICAL FIELD

[0001] The present invention relates to an air conditioning indoor unit.

BACKGROUND ART

[0002] Patent citation 1 (JP-A No. 2001-116346) discloses an air conditioning indoor unit having an upper portion air inlet in a front surface upper portion and an upper surface of a body and a lower portion air inlet in a bottom surface of the body. Flaps are rotatably attached in the upper portion air inlet, and an opening and closing plate is rotatably attached in the lower portion air inlet. Further, an air purification unit is mounted in a ventilation passage for air sucked in from the lower portion air inlet. According to patent citation 1, the opening and closing plate completely opens the lower portion air inlet in normal operation and closes the lower portion air inlet as needed while operation is shut down or in the case of performing maintenance such as cleaning an electric dust collector.

SUMMARY OF INVENTION

<Technical Problem>

[0003] In a general air conditioning indoor unit, the air inlet is positioned in an upper portion on the upper side of the air outlet; during cooling, for example, the air conditioning indoor unit blows the air after air conditioning out from the air outlet horizontally or slightly obliquely upward and sucks in the air from the air conditioning target space from the air inlet positioned in the upper portion on the upper side of the air outlet, so air stagnation occurs in the air conditioning target space.

[0004] With respect to this, in the air conditioning indoor unit disclosed in patent citation 1, the lower portion air inlet is adjacent to the rear side of the air outlet, and during cooling the occurrence of air stagnation can be suppressed by sucking in air from the lower portion air inlet placed on the rear side of the air outlet.

[0005] However, the flip side is that the potential for what is called short-circuiting, which is a phenomenon where the air-conditioned air blown out from the air outlet is directly sucked into the lower portion air inlet, to occur is high, and short-circuiting must be avoided because it leads to a decline in capacity.

[0006] It is a problem of the present invention to provide, in relation to an air conditioning indoor unit disposed with an air inlet adjacent to the rear side of an air outlet, an air conditioning indoor unit that prevents the occurrence of short-circuiting.

<Solution to Problem>

[0007] An air conditioning indoor unit pertaining to a first aspect of the present invention is a wall-mounted air conditioning indoor unit comprising a body casing, an opening and closing member, and a drive mechanism. The body casing has an air outlet and a lower portion air inlet that is positioned on a side of the air outlet towards the wall. The opening and closing member opens and closes the lower portion air inlet. The drive mechanism causes the opening and closing member to move. Further, when the opening and closing member has opened the lower portion air inlet, the opening and closing member moves to a position in which it blocks the flow of air heading from the air outlet to the lower portion air inlet.

[0008] In this air conditioning indoor unit, the opening and closing member exists on the path of the air trying to flow directly from the air outlet to the lower portion air inlet, so the flow of the air is deflected by the opening and closing member in a direction away from the lower portion air inlet. As a result, the occurrence of short-circuiting is suppressed.

[0009] An air conditioning indoor unit pertaining to a second aspect of the present invention is the air conditioning indoor unit pertaining to the first aspect, wherein the open position of the opening and closing member includes a position in which substantially no gap appears between the opening and closing member and an outside end of a partition wall partitioning the air outlet and the lower portion air inlet from one another.

[0010] In this air conditioning indoor unit, among the routes leading from the air outlet to the lower portion air inlet, the route by which the outlet air is most easily sucked in is the route where the outlet air crosses over the outside end of the partition wall partitioning the air outlet and the lower portion air inlet from one another and flows to the lower portion air inlet, so by ensuring that no gap appears between the opening and closing member and the outside end of the partition wall, the outlet air is suppressed from being sucked into the lower portion air inlet.

[0011] An air conditioning indoor unit pertaining to a third aspect of the present invention is the air conditioning indoor unit pertaining to the second aspect, wherein in the position of the opening and closing member in which substantially no gap appears, the end portion of the opening and closing member on the side nearest to the lower portion air inlet and the outside end of the partition wall are in close proximity to one another. In this air conditioning indoor unit, the outlet air is suppressed from being sucked into the lower portion air inlet.

[0012] An air conditioning indoor unit pertaining to a fourth aspect of the present invention is the air conditioning indoor unit pertaining to the first aspect, further comprising a flap and a flap drive mechanism. The flap adjusts the blow-out angle of the air blown out from the air outlet. The flap drive mechanism drives the flap. The open position of the opening and closing member includes a

position in which substantially no gap appears between the opening and closing member and the flap.

[0013] In this air conditioning indoor unit, there is the potential for the air to be sucked into the lower portion air inlet from a gap between the flap and the peripheral edge of the air outlet while the air is being blown out from the air outlet, so by moving the opening and closing member onto the path of the air leading from that gap to the lower portion air inlet to thereby block the path, the outlet air is suppressed from being sucked into the lower portion air inlet.

[0014] An air conditioning indoor unit pertaining to a fifth aspect of the present invention is the air conditioning indoor unit pertaining to the fourth aspect, wherein in the position of the opening and closing member in which substantially no gap appears, an outside end of a partition wall partitioning the air outlet and the lower portion air inlet from one another and one end of the opening and closing member are in close proximity to one another and an edge of the flap and the other end of the opening and closing member are in close proximity to one another.

[0015] In this air conditioning indoor unit, a gap appears between the edge of the flap and the outside end of the partition wall while the air is being blown out from the air outlet, so there is the potential for the air to be sucked into the lower portion air inlet from there. By moving the opening and closing member to a position in which it closes off that gap, the outlet air is suppressed from being sucked into the lower portion air inlet.

[0016] An air conditioning indoor unit pertaining to a sixth aspect of the present invention is the air conditioning indoor unit pertaining to the second aspect, wherein the blow-out angle of the air from the air outlet is adjusted when the opening and closing member has opened the lower portion air inlet. In this air conditioning indoor unit, when the lower portion air inlet has been opened, the blow-out angle is adjusted in such a way that the air is blown out in a direction away from the lower portion air inlet, so short-circuiting is suppressed.

<Advantageous Effects of Invention>

[0017] In the air conditioning indoor unit pertaining to the first aspect of the present invention, the opening and closing member exists on the path of the air trying to flow directly from the air outlet to the lower portion air inlet, so the flow of the air is deflected by the opening and closing member. As a result, the occurrence of short-circuiting is suppressed.

[0018] In the air conditioning indoor unit pertaining to the second aspect or the third aspect of the present invention, among the routes leading from the air outlet to the lower portion air inlet, the route by which the outlet air is most easily sucked in is the route where the outlet air crosses over the outside end of the partition wall partitioning the air outlet and the lower portion air inlet from one another and flows to the lower portion air inlet, so by ensuring that no gap appears between the air outlet and the outside end of the partition wall, the outlet air is suppressed from being sucked into the lower portion air inlet.

[0019] In the air conditioning indoor unit pertaining to the fourth aspect of the present invention, there is the potential for the air to be sucked into the lower portion air inlet from a gap between the flap and the peripheral edge of the air outlet while the air is being blown out from the air outlet, so by moving the opening and closing member onto the path of the air leading from that gap to the lower portion air inlet to thereby block the path, the outlet air is suppressed from being sucked into the lower portion air inlet.

[0020] In the air conditioning indoor unit pertaining to the fifth aspect of the present invention, a gap appears between the edge of the flap and the outside end of the partition wall while the air is being blown out from the air outlet, so there is the potential for the air to be sucked into the lower portion air inlet from there. By moving the opening and closing member to a position in which it closes off that gap, the outlet air is suppressed from being sucked into the lower portion air inlet.

[0021] In the air conditioning indoor unit pertaining to the sixth aspect of the present invention, when the lower portion air inlet has been opened, the blow-out angle is adjusted in such a way that the air is blown out in a direction away from the lower portion air inlet, so short-circuiting is suppressed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

FIG. 1 is a cross-sectional view of an air conditioning indoor unit pertaining to an embodiment of the present invention.

FIG. 2 is an enlarged side view of an air outlet and a first air inlet shown in FIG. 1.

FIG. 3 is an enlarged side view of a second air inlet shown in FIG. 1.

FIG. 4 is a cross-sectional view of the air conditioning indoor unit in operation.

FIG. 5 is a side view of the area around an opening and closing plate stopped in various open positions.

FIG. 6 is a cross-sectional view of the air conditioning indoor unit pertaining to a first modification.

FIG. 7 is a cross-sectional view of the air conditioning indoor unit pertaining to a second modification.

FIG. 8A is a cross-sectional view of the area around the first air inlet, in a closed state, of the air conditioning indoor unit pertaining to a third modification.

FIG. 8B is a cross-sectional view of the area around the first air inlet, in an open state, of the air conditioning indoor unit pertaining to the third modification.

DESCRIPTION OF EMBODIMENT

[0023] An embodiment of the present invention will be

described below with reference to the drawings. The embodiment below is a specific example of the present invention and is not intended to limit the technical scope of the present invention.

(1) Configuration of Air Conditioning Indoor Unit

[0024] FIG. 1 is a cross-sectional view of an air conditioning indoor unit pertaining to the embodiment of the present invention. In FIG. 1, an air conditioning indoor unit 2 is a wall-mounted type and is equipped with a body casing 11, an indoor heat exchanger 13, an indoor fan 15, a bottom frame 17, a filter 25, and a control unit 41.

[0025] The body casing 11 has a front grille 11a, a front panel 11b, and a back plate 11c that form a three-dimensional space, and the indoor heat exchanger 13, the indoor fan 15, the bottom frame 17, the filter 25, and the control unit 41 are housed in that three-dimensional space. The front panel 11b covers the front of the front grille 11a, and the upper end of the front panel 11b is rotatably supported on the front grille 11a so that the front panel 11b can move in a hinged manner. Further, the body casing 11 is mounted on the wall via an attachment plate 11d.

[0026] The indoor heat exchanger 13 and the indoor fan 15 are attached to the bottom frame 17. The indoor heat exchanger 13 performs heat exchange with the air passing through it. Further, the indoor heat exchanger 13 has a shape of inverted V that is bent with both ends extending downward as seen in a side view, and the indoor fan 15 is positioned on the lower side of the indoor heat exchanger 13. The indoor fan 15 is a cross-flow fan, applies air taken in from the room to the indoor heat exchanger 13, causes the air to pass through the indoor heat exchanger 13, and thereafter blows the air out into the room.

[0027] An air outlet 19 is disposed in the lower surface portion of the body casing 11. A flap 291 that guides the air blown out from the air outlet 19 is rotatably attached in the air outlet 19. The flap 291 is driven by a motor and not only changes the blow-out direction of the air but can also open and close the air outlet 19. The air outlet 19 is connected to the interior of the body casing 11 by an outlet air passage 18, and the outlet air passage 18 is formed along the bottom frame 17 from the air outlet 19.

[0028] Moreover, a first air inlet 21 is disposed in the lower surface portion of the body casing 11 on the wall side of the air outlet 19. The first air inlet 21 is connected to the interior of the body casing 11 by an inlet air passage 16, and the inlet air passage 16 is formed along the bottom frame 17 from the first air inlet 21. That is, the inlet air passage 16 is adjacent to the outlet air passage 18 across the bottom frame 17.

[0029] The room air in the neighborhood of the first air inlet 21 is sucked, by the working of the indoor fan 15, into the indoor fan 15 via the first air inlet 21, the inlet air passage 16, the filter 25, and the indoor heat exchanger 13 and is blown out from the air outlet 19 via the outlet air passage 18 from the indoor fan 15.

[0030] The filter 25 is placed between the front grille 11a of the body casing 11 and the indoor heat exchanger 13. The filter 25 removes dirt and dust included in the air flowing in toward the indoor heat exchanger 13.

[0031] A second air inlet 22 is disposed in the front upper portion of the front grille 11a of the body casing 11. The room air in the neighborhood of the second air inlet 22 is sucked, by the working of the indoor fan 15, into the indoor fan 15 via the second air inlet 22, the filter 25, and the indoor heat exchanger 13 and is blown out from the air outlet 19 via the outlet air passage 18 from the indoor fan 15.

[0032] The control unit 41 is housed in the front section of the body casing 11 and issues orders for controlling the number of rotations of the indoor fan 15, adjusting the opening degree of the air outlet 19, adjusting the opening degree of the first air inlet 21, and adjusting the opening degree of the second air inlet 22.

(2) Detailed Configuration

(2-1) Air Outlet 19 and Air Outlet Opening and Closing Mechanism 29

[0033] FIG. 2 is an enlarged side view of the air outlet and the first air inlet shown in FIG. 1. In FIG. 2, the air outlet 19 is opened and closed by an air outlet opening and closing mechanism 29. The air outlet opening and closing mechanism 29 includes the flap 291, a spindle 292, and a flap drive motor 293.

[0034] The flap 291 is an arc-shaped plate that curves in such a way that its cross-sectional shape projects toward the outer side of the air outlet 19, and one width direction end of the flap 291 is in close proximity to the lower end of the bottom frame 17. The flap 291 is rotatable.

[0035] The spindle 292 is a shaft for allowing the flap 291 to rotate and is supported on a side wall of the body casing 11 intersecting an imaginary central axis of rotation.

[0036] The flap drive motor 293 is a stepping motor or a stepping motor with a built-in reduction gear mechanism, and a rotating shaft of the flap drive motor 293 is coupled to the spindle 292. When the state in which the flap 291 closes the air outlet 19 is taken as an origin position, the flap drive motor 293 causes the rotating shaft to rotate to correspond to the number of applied pulses so that the flap 291 rotates in the direction in which it opens the air outlet 19.

(2-2) First Air Inlet 21

[0037] The first air inlet 21 is positioned between the lower end of the bottom frame 17 and the lower end of the back plate 11c. As shown in FIG. 1, the first air inlet 21 is part of the entrance of the inlet air passage 16 and is an opening having a predetermined width from the low-

er end of the back plate 11c toward the lower end of the bottom frame 17.

[0038] The section of the entrance of the inlet air passage 16 between the first air inlet 21 and the lower end of the bottom frame 17 is covered by a blocking plate 33. The reason for this is because the inlet air passage 16 and the outlet air passage 18 are adjacent to one another across the bottom frame 17 and there is the potential for some of the outlet air to pass in such a way as to graze the lower end of the bottom frame 17 and head into the entrance of the inlet air passage 16, so the blocking plate 33 is for preventing this. By placing the blocking plate 33, the substantial entrance of the inlet air passage 16 can be moved away to the first air inlet 21.

(2-3) First Air Inlet Opening and Closing Mechanism 31

[0039] A first air inlet opening and closing mechanism 31 is installed in the first air inlet 21. The first air inlet opening and closing mechanism 31 includes an opening and closing plate 311, a hinge 312, a link 313, and a drive motor 314.

[0040] The opening and closing plate 311 is of a size that can fit into the opening of the first air inlet 21 and close off the first air inlet 21. The opening and closing plate 311 is rotatable, and an imaginary central axis of rotation thereof is positioned in the neighborhood of the corner of the bottom frame 17 and the blocking plate 33.

[0041] The hinge 312 is the support point on which the opening and closing plate 311 rotates, and the hinge 312 is disposed on a wall of the body casing 11 intersecting the imaginary central axis of rotation. The hinge 312 and the opening and closing plate 311 are coupled together by the link 313.

[0042] A slit-like escape portion (not illustrated) is formed in the blocking plate 33 along the path traveled by the link 313 so that the link 313 does not interfere with the blocking plate 33 when the link 313 rotates together with the opening and closing plate 311.

[0043] The drive motor 314 is a stepping motor or a stepping motor with a built-in reduction gear mechanism, and a rotating shaft of the drive motor 314 is coupled to the hinge 312. When the state in which the opening and closing plate 311 closes the first air inlet 21 is taken as an origin position, the drive motor 314 causes the rotating shaft to rotate in accordance with the number of applied pulses so that the opening and closing plate 311 rotates in the direction in which it opens the first air inlet 21.

(2-4) Second Air Inlet 22 and Second Air Inlet Opening and Closing Mechanism 32

[0044] FIG. 3 is an enlarged side view of the second air inlet shown in FIG. 1. In FIG. 3, the second air inlet 22 is disposed from the position of the front grille 11a opposing the upper end of the front panel 11b to the center of the top surface. Further, the second air inlet 22 is opened and closed by a second air inlet opening and closing mechanism 32. The second air inlet opening and closing mechanism 32 includes a sliding opening and closing plate 322, a pinion gear 324, a pinion drive motor 325, and a guide 326.

[0045] The sliding opening and closing plate 322 is a curvable resin plate, and a rack gear 323 is formed on both ends of the surface thereof opposing the filter 25 (see FIG. 1). Further, the pinion gear 324, which meshes with the rack gear 323, is placed on the lower side of the sliding opening and closing plate 322. The pinion gear 324 is rotatably supported on a side wall of the body casing 11.

[0046] The pinion drive motor 325 is a stepping motor or a stepping motor with a built-in reduction gear mechanism, and a rotating shaft of the pinion drive motor 325 is coupled to a central shaft of the pinion gear 324. When the state in which the sliding opening and closing plate 322 closes the second air inlet 22 is taken as an origin position, the pinion drive motor 325 causes the rotating shaft to rotate to correspond to the number of applied pulses to thereby cause the sliding opening and closing plate 322 to slidingly move in the direction in which it opens the second air inlet 22.

[0047] The guide 326, which forms a path along which the sliding opening and closing plate 322 slidingly moves, is disposed on a side wall of the body casing 11. In FIG. 3, the guide 326 is indicated by long dashed double-short dashed lines so that the sliding opening and closing plate 322 and the guide 326 can be distinguished from one another.

(3) Operation

[0048] FIG. 4 is a cross-sectional view of the air conditioning indoor unit in operation. In FIG. 4, the first air inlet 21 and the second air inlet 22 are open. In the air conditioning indoor unit pertaining to the present embodiment, a cross-flow fan is employed for the indoor fan 15, so the principal flow is the air flow flowing from the second air inlet 22 to the air outlet 19, and there is practically no air intake even if just the first air inlet 21 is opened. Consequently, when the first air inlet 21 is open, the second air inlet 22 is also open.

(3-1) Operation by Which Opening and Closing Plate 311 Opens and Closes First Air Inlet 21

[0049] As shown in FIG. 4, when the opening and closing plate 311 is in a predetermined open position, the opening and closing plate 311 takes a form in which one end of the opening and closing plate 311 is in close proximity to the lower end of the bottom frame 17 and the opening and closing plate 311 is located on an extension plane of the wall of the bottom frame 17. Here, for convenience of description, the position of the opening and closing plate 311 shown in FIG. 1 will be called a closed position, and the open position of the opening and closing plate 311 shown in FIG. 4 will be called position A.

[0050] The wall surface of the bottom frame 17 is a curved surface that gradually deflects, toward the front side of the lower portion, the air that has been air-conditioned (hereinafter called air-conditioned air) and is forced out from the indoor fan 15, so the air-conditioned air advances along the wall surface of the bottom frame 17 until it exits the air outlet 19.

[0051] The blow-out direction of the air-conditioned air reaching the air outlet 19 is varied in the up-and-down direction by the flap 291 and specifically is varied in a range from vertically downward of the air outlet 19 to horizontally frontward of the air outlet 19. However, the air-conditioned air whose blow-out direction is actually to be controlled is the air-conditioned air passing over the concave surface side of the flap 291, and the air-conditioned air passing over the convex surface side is blown out along the curved surface of the bottom frame 17. Consequently, in a case where the volume of the air-conditioned that is blown out is small and the air-conditioned air has no momentum, there is the potential for the air-conditioned air to be directly sucked into the first air inlet 21 on the rear side.

[0052] However, because the opening and closing plate 311 takes a form in which one end of the opening and closing plate 311 is in such close proximity to the lower end of the bottom frame 17 that substantially no gap appears and the opening and closing plate 311 is located on an extension plane of the wall surface of the bottom frame 17 or on a plane parallel to that extension plane, the air-conditioned air advances along the opening and closing plate 311 toward the front side of the lower portion even if the volume of the air-conditioned air that is blown out is small and the air-conditioned air has no momentum.

[0053] As described above, in position A, the opening and closing plate 311 controls the direction of the air-conditioned air blown out from the air outlet 19 and suppresses the phenomenon (what is called short-circuiting) where the air-conditioned air is directly sucked into the first air inlet 21.

(3-2) Adjustment of Opening Degree of First Air Inlet 21 by Opening and Closing Plate 311

[0054] The open position of the opening and closing plate 311 is not limited to position A (the open position shown in FIG. 4); the opening and closing plate 311 can also rest in open positions that restrict the suction volume from the first air inlet 21.

[0055] FIG. 5 is a side view of the area around the opening and closing plate stopped in various open positions. In FIG. 5, the opening and closing plate 311 can stop in arbitrary positions between the closed position and position A. For convenience of description, position B is an open position to which the opening and closing plate 311 has rotated 60° in the clockwise direction from the closed position, and position C is an open position to which the opening and closing plate 311 has rotated 30° in the clockwise direction from the closed position. In position C, the volume of air sucked in from the first air inlet 21 is more restricted than in position B.

(3-2-1) Adjustment of Opening Degree of First Air Inlet 21 during Cooling Operation

[0056] Conventionally, during cooling operation, an air conditioning indoor unit blows the air after air conditioning out from the air outlet horizontally or slightly obliquely upward and sucks in the air from the air conditioning target space from the air inlet positioned in the upper portion on the upper side of the air outlet, so it has been easy for air stagnation to occur in the air conditioning target space.

[0057] On the other hand, the ideal flow of the air that prevents air stagnation is a flow (hereinafter called the ideal flow) where the air-conditioned air blown out from the air outlet 19 horizontally or slightly obliquely upward produces convection along the ceiling, walls, and floor of the air conditioning target space and is sucked in from the first air inlet 21, but heretofore this has been unable to be realized out of concern for short-circuiting.

[0058] However, during cooling operation, when the difference (Ts - Tr) between the set temperature Ts and the temperature Tr of the air conditioning target space becomes equal to or greater than a predetermined value, it is difficult for short-circuiting to occur because the volume of the outlet air becomes larger and the momentum of the air-conditioned air exiting from the air outlet 19 exceeds the suction force of the first air inlet 21. Thus, when Ts - Tr is equal to or greater than the predetermined value, the ideal flow of the air-conditioned air can be realized while moving the opening and closing plate 311 to position B or position C to adjust the opening degree of the first air inlet 21.

[0059] In the air conditioning indoor unit of the present embodiment, when the difference between the set temperature Ts and the temperature Tr of the air conditioning target space is less than the predetermined value, the blow-out direction of the outlet air is downward and the air volume is also small and it is therefore easy for short-circuiting to occur, so the opening and closing plate 311 is moved to the closed position so that the first air inlet 21 is closed.

(3-2-2) Adjustment of Opening Degree of First Air Inlet 21 during Heating Operation

[0060] Generally, during heating operation, the flow of air is such that the air-conditioned air that has been heated is blown out downward, produces convection along the floor, walls, and ceiling of the air conditioning target space, and is sucked in from the air inlet in the front upper portion. In the present embodiment, the second air inlet 22 corresponds to the conventional air inlet in the front upper portion, so the conventional flow of the air-conditioned air can be realized with the first air inlet 21 being

kept closed.

[0061] Further, when the air-conditioned air is being blown out downward, it is preferred that the first air inlet 21 be kept closed because opening the first air inlet 21 leads to short-circuiting.

[0062] However, when one wishes to raise the heating capacity, it is necessary to adjust the opening degree of the first air inlet 21 to increase the volume of inlet air in a case where a sufficient volume of inlet air is not obtained with just the second air inlet 22.

[0063] At that time, when the difference (Ts - Tr) between the set temperature Ts and the temperature Tr of the air conditioning target space becomes equal to or greater than a predetermined value, it is difficult for short-circuiting to occur because the volume of the outlet air becomes larger and the momentum of the air-conditioned air exiting from the air outlet 19 exceeds the suction force of the first air inlet 21.

[0064] Thus, when Ts - Tr is equal to or greater than the predetermined value, the heating capacity can be raised by moving the opening and closing plate 311 to position B or position C to thereby adjust the opening degree of the first air inlet 21.

(3-2-3) Adjustment of Opening Degree of First Air Inlet 21 According to Blow-out Angle

[0065] In addition, the control unit 41 can adjust the opening degree of the first air inlet 21 in accordance with the blow-out angle. For example, because the first air inlet 21 is positioned on the rear side of the air outlet 19, the control unit 41 may also reduce the opening degree of the first air inlet 21 by causing the opening and closing plate 311 to rotate in such a way that the position of the opening and closing plate 311 moves closer to the closed position the closer the blow-out angle of the air-conditioned air blown out from the air outlet 19 is to a downward-most limit.

[0066] In a case where, at a certain point in time, the blow-out direction of the air-conditioned air blown out from the air outlet 19 becomes horizontal and the position of the opening and closing plate 311 has been position B in FIG. 5, the control unit 41 causes the position of the opening and closing plate 311 to move to position C or a position between position C and the closed position as the flap 291 moves closer to a vertically downward position.

(3-2-4) Adjustment of Opening Degree of First Air Inlet 21 According to Capacity

[0067] Further, the control unit 41 can adjust the opening degree of the first air inlet 21 in accordance with the capacity required of the air conditioning indoor unit. Generally, when the air-conditioned air blown out from the air outlet 19 has momentum, it is difficult for the air-conditioned air to be sucked into the first air inlet 21. The air-conditioned air that is blown out has momentum at times when the air volume is large, and ordinarily these are times when the air conditioning load of the air conditioning target space is large and capacity is required. Consequently, it is preferred that the opening degree of the first air inlet 21 be adjusted in accordance with the required capacity.

[0068] For example, when the user has raised the set temperature during heating operation, a capacity according to the amount of the increase in the set temperature is required of the air conditioning indoor unit, the operating frequency of the inverter compressor (not illustrated) in the outdoor unit increases, the rotation of the indoor fan 15 also increases, and the volume of the inlet air also increases. At this time, in a case where the volume of the air sucked into the air conditioning indoor unit is insufficient with just the volume of the air sucked in from the second air inlet 22, the control unit 41 adjusts the opening degree of the first air inlet 21 to thereby supplement the insufficient inlet air.

[0069] As the volume of air supplementing the inlet air becomes larger, the volume of the air-conditioned air blown out from the air outlet 19 also becomes larger and the air-conditioned air has more momentum, so it is difficult for short-circuiting to occur even if the opening degree of the first air inlet 21 is increased.

[0070] In other words, as the volume of air supplementing the inlet air becomes smaller, the volume of the air-conditioned air blown out from the air outlet 19 also becomes smaller and the air-conditioned air has no momentum, but because the opening degree of the first air inlet 21 also becomes smaller, the momentum with which the air is sucked in also becomes smaller and it is difficult for short-circuiting to occur.

[0071] By employing a method where the opening degree of the first air inlet 21 is adjusted in accordance with the required capacity as described above, for example, it suffices for the control unit 41 to control the rotational amount of the opening and closing plate 311 in accordance with the number of rotations of the indoor fan 15, and from the standpoint of control, adjusting the opening degree is easy to perform.

(3-2-5) Adjustment of Opening Degree of First Air Inlet 21 According to Installation Conditions

[0072] Moreover, the control unit 41 has opening degree selecting means that restricts the rotational range of the opening and closing plate 311 to keep the opening degree adjustment range of the first air inlet 21 in a specific range. For example, when there is a curtain rod in close proximity to the lower side of the first air inlet 21 and the first air inlet 21 cannot be physically opened and closed, or when one does not want the air conditioning indoor unit to suck in air from the window side of a curtain, the opening degree of the first air inlet 21 can be restricted by selecting and storing a mode of opening and closing beforehand.

[0073] Because the movement of the opening and

closing plate 311 toward position A in FIG. 5 is substantially restricted, it becomes impossible to control the direction of the air-conditioned air blown out from the air outlet 19 such as described in section "(3-2-1)". Therefore, the control unit 41 avoids short-circuiting by controlling the operation of the flap 291 while controlling the operation of the opening and closing plate 311 on the basis of the range selected by the opening degree selecting means. Specifically, an orientation of the flap 291 that blows out the air-conditioned air downward is avoided.

(3-3) Adjustment of Opening Degree of Second Air Inlet 22 by Sliding Opening and Closing Plate 322

[0074] In the air conditioning indoor unit pertaining to the present embodiment, the principal flow is the air flow flowing from the second air inlet 22 to the air outlet 19, and when the first air inlet 21 is open, the second air inlet 22 is also open, but adjustment of the opening degree of the second air inlet 22 is allowed (with the exception of the closed state).

[0075] For example, in a state in which the opening and closing plate 311 is in position A and the flow of air is stable at an ideal flow of air with no occurrence of short-circuiting of the air-conditioned air, moving the sliding opening and closing plate 322 of the second air inlet 22 in the closing direction to reduce the opening degree of the second air inlet 22 can better restrict the volume of the inlet air without disrupting the stable state of the flow of the air than rotating the opening and closing plate 311 to reduce the opening degree of the first air inlet 21 when one wants to restrict the volume of the inlet air.

[0076] While the operation of the air conditioning indoor unit 2 is shut down, the sliding opening and closing plate 322 is stored on the underside of the top surface of the body casing 11 in order to keep the second air inlet 22 open. The reason for this is because, during shutdown, dust accumulates in the section where the second air inlet 22 opposes the ceiling surface, so if the sliding opening and closing plate 322 were to close the second air inlet 22, there would be the potential for dust accumulated on the upper surface of the sliding opening and closing plate 322 to be scraped off and fall inside the body casing 11 when the sliding opening and closing plate 322 opens; therefore, storing the sliding opening and closing plate 322 as described above prevents this from happening. By keeping the sliding opening and closing plate 322 open even when operation is shut down, dust accumulates on the filter, so the dust is suppressed from falling into the interior of the body casing 11.

[0077] Further, because the sliding opening and closing plate 322 is stored on the underside of the top surface of the body casing 11 while the sliding opening and closing plate 322 is opening the second air inlet 22, it is more difficult for dust to accumulate on the sliding opening and closing plate 322 than in a state in which the sliding opening and closing plate 322 is visible through the top surface of the body casing 11, and a situation where dust falls down toward the floor due to vibration when the sliding opening and closing plate 322 moves in the closing direction is also suppressed.

(4) Characteristics

(4-1)

[0078] In the air conditioning indoor unit 2, the opening and closing plate 311 exists on the path (position A) of the air trying to flow directly from the air outlet 19 to the first air inlet 21, so the flow of the air is deflected by the opening and closing plate 311 in the direction away from the first air inlet 21. As a result, the occurrence of short-circuiting is suppressed.

(4-2)

[0079] Position A of the opening and closing plate 311 is a position in which the end portion of the opening and closing plate 311 and the lower end of the bottom frame 17 are in close proximity to one another and in which substantially no gap appears between the opening and closing plate 311 and the lower end of the bottom frame 17. Among the routes leading from the air outlet 19 to the first air inlet 21, the route by which the air-conditioned air is most easily sucked in is the route where the air-conditioned air flows in such a way as to graze the lower end of the bottom frame 17, so by ensuring that no gap appears between the opening and closing plate 311 and the lower end of the bottom frame 17, the air-conditioned air is suppressed from being sucked into the first air inlet 21.

(4-3)

[0080] In the air conditioning indoor unit 2, when the first air inlet 21 has been opened, the blow-out angle is adjusted in such a way that the air-conditioned air blown out from the air outlet 19 is blown out in a direction away from the first air inlet 21, so short-circuiting is suppressed.

(5) Modifications

(5-1) First Modification

[0081] FIG. 6 is a cross-sectional view of the air conditioning indoor unit pertaining to a first modification. The operating mechanism of the flap 291 of the air outlet opening and closing mechanism 29 differs from the one in the above embodiment. In FIG. 6, in the first modification, there is nothing corresponding to the spindle 292 of the above embodiment; instead, the flap 291 is pushed out further frontward than the open position of the flap 291 in the above embodiment by a lever 295. Thus, a gap appears between the edge of the flap 291 and the lower end of the bottom frame 17.

[0082] However, by moving the opening and closing plate 311 to position A (see FIG. 5), one end of the opening and closing plate 311 moves into close proximity to the lower end of the bottom frame 17 and the other end of the opening and closing plate 311 moves into close proximity to the edge of the flap 291. As a result, while the air-conditioned air is being blown out from the air outlet 19, the gap appearing between the edge of the flap 291 and the lower end of the bottom frame 17 is substantially closed off by the opening and closing plate 311, so the air-conditioned air that has been blown out is suppressed from being sucked into the first air inlet 21.

[0083] In the air conditioning indoor unit pertaining to the first modification, the flap 291 and the opening and closing plate 311 line up in a line and function as a single, large flap, so the blow-out direction of the air-conditioned air is stable.

(5-2) Second Modification

[0084] FIG. 7 is a cross-sectional view of the air conditioning indoor unit pertaining to a second modification. The operating mechanism of the opening and closing plate 311 of the first air inlet opening and closing mechanism 31 differs from the one in the above embodiment. In FIG. 7, in the second modification, there is nothing corresponding to the hinge 312 and the link 313 of the above embodiment, and the opening and closing plate 311 slidingly moves along a guide 315. The principle of the sliding movement is the same as the principle of the sliding movement of the sliding opening and closing plate 322 of the second air inlet 22: a rack gear is formed beforehand on the opening and closing plate 311, and a pinion gear that meshes with the rack gear is driven by a stepping motor or a stepping motor with a built-in reduction gear mechanism, whereby the opening and closing plate 311 slidingly moves.

[0085] In the air conditioning indoor unit pertaining to the second modification, even if there is a curtain rod in close proximity to the lower side of the first air inlet 21, for example, a situation where the first air inlet 21 cannot be physically opened and closed is avoided. Thus, it is not necessary to select and store, with the opening degree selecting means, a mode of opening and closing the opening and closing plate 311 such as described in the above embodiment.

(5-3) Third Modification

[0086] FIG. 8A is a cross-sectional view of the area around the first air inlet, in a closed state, of the air conditioning indoor unit pertaining to a third modification. Further, FIG. 8B is a cross-sectional view of the area around the first air inlet, in an open state, of the air conditioning indoor unit pertaining to the third modification. In FIG. 8A, the first air inlet opening and closing mechanism 31 is installed in the first air inlet 21. The first air inlet opening and closing mechanism 31 includes the rotary opening and closing plate 311 and a drive motor (not illustrated) that causes the opening and closing plate 311 to rotate.

[0087] The opening and closing plate 311 is of a size that can fit into the opening of the first air inlet 21 and close off the first air inlet 21. A rotating shaft 317 of the opening and closing plate 311 is positioned on the upper side of both lengthwise direction end portions of the first air inlet 21. The opening and closing plate 311 and the rotating shaft 317 are coupled together by a hinge link 319.

[0088] Further, in the closed position in which the opening and closing plate 311 closes the first air inlet 21, the rotating shaft 317 is positioned on the upper side of the opening and closing plate 311 and nearer to the air outlet 19 than the width direction center of the opening and closing plate 311. Thus, when the rotating shaft 317 rotates 90° in the clockwise direction in FIG 8A, the opening and closing plate 311 assumes a vertical orientation in which the outer surface thereof is in close proximity to the front edge of the first air inlet 21.

[0089] As a result, as shown in FIG. 8B, the opening and closing plate 311 projects vertically downward a little from the first air inlet 21. The projecting dimension is preferably equal to or less than half the width direction dimension of the opening and closing plate 311. The reason for this is because, in a case where the attachment position of the air conditioning indoor unit 2 is located directly above a curtain rod, the opening and closing plate 311 will interfere with the curtain rod if the projecting dimension of the opening and closing plate 311 is too long.

[0090] Further, the air flow flowing out in the direction of the first air inlet 21 from the air outlet 19 flows along the surface of the blocking plate 33 (see arrow AIR in FIG. 8B), so even if the projecting dimension of the opening and closing plate 311 is equal to or less than half the width direction dimension, the air flow can be sufficiently cut off. Thus, short-circuiting is prevented.

INDUSTRIAL APPLICABILITY

[0091] As described above, according to the present invention, even when an air inlet is adjacent to the rear side of an air outlet, the outlet air is suppressed from being directly sucked in, so the present invention is useful for a wall-mounted air conditioning indoor unit.

REFERENCE SIGNS LIST

[0092]

2	Air Conditioning Indoor Unit
11	Body Casing
17	Bottom Frame (Partition Wall)
19	Air Outlet
21	First Air Inlet (Lower Portion Air Inlet)
29	Air Outlet Opening and Closing Mechanism (Flap Drive Mechanism)
31	First Air Inlet Opening and Closing Mechanism

(Drive Mechanism)
291 Flap
311 Opening and Closing Member

CITATION LIST

<Patent Literature>

[0093] Patent Citation 1: JP-A No. 2001-116346

Claims

1. A wall-mounted air conditioning indoor unit (2) comprising:

a body casing (11) having an air outlet (19) and a lower portion air inlet (21) that is positioned on a side of the air outlet (19) towards the wall;
an opening and closing member (311) that opens and closes the lower portion air inlet (21); and
a drive mechanism (31) that causes the opening and closing member (311) to move,
wherein when the opening and closing member (311) has opened the lower portion air inlet (21), the opening and closing member (311) moves to a position in which it blocks the flow of air heading from the air outlet (19) to the lower portion air inlet (21).

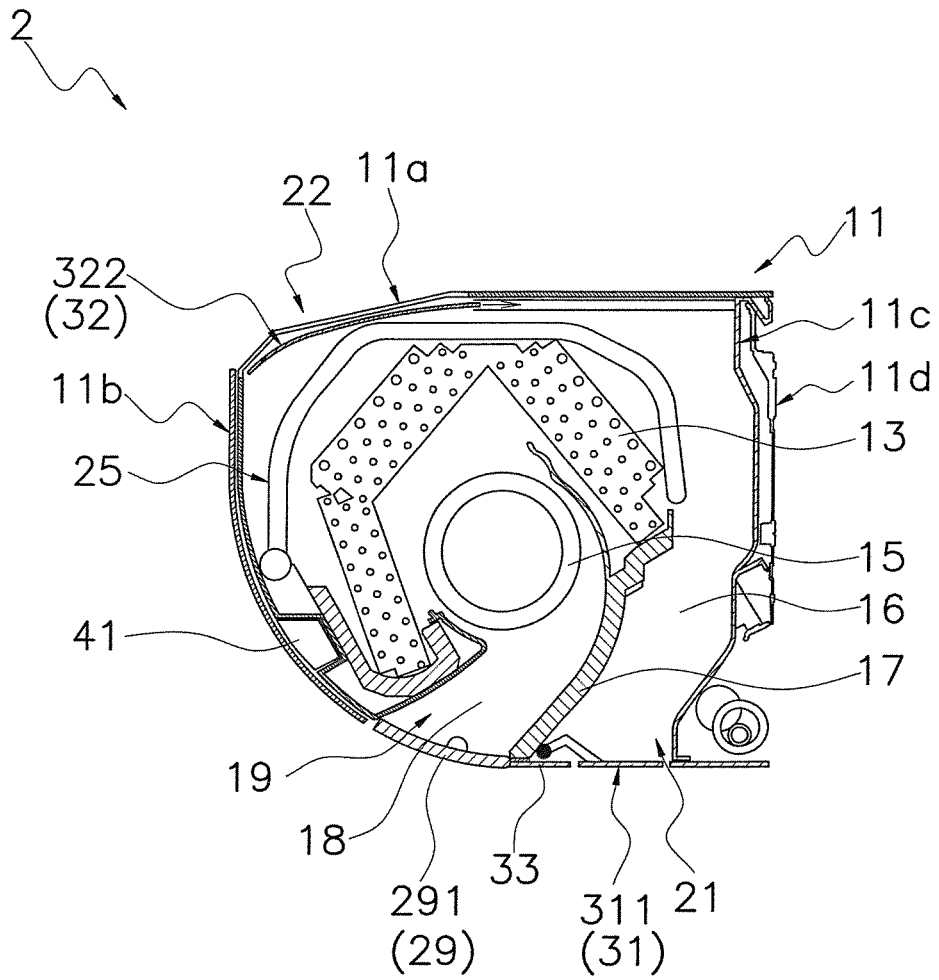
2. The air conditioning indoor unit (2) according to claim 1, wherein the open position of the opening and closing member (311) includes a position in which substantially no gap appears between the opening and closing member (311) and an outside end of a partition wall (17) partitioning the air outlet (19) and the lower portion air inlet (21) from one another.

3. The air conditioning indoor unit (2) according to claim 2, wherein in the position of the opening and closing member (311) in which substantially no gap appears, the end portion of the opening and closing member (311) on the side nearest to the lower portion air inlet (21) and the outside end of the partition wall (17) are in close proximity to one another.

4. The air conditioning indoor unit (2) according to claim 1, further comprising
a flap (291) that adjusts the blow-out angle of the air blown out from the air outlet (19) and
a flap drive mechanism (29) that drives the flap (291),
wherein the open position of the opening and closing member (311) includes a position in which substantially no gap appears between the opening and closing member (311) and the flap (291).

5. The air conditioning indoor unit (2) according to claim 4, wherein in the position of the opening and closing member (311) in which substantially no gap appears, an outside end of a partition wall (17) partitioning the air outlet (19) and the lower portion air inlet (21) from one another and one end of the opening and closing member (311) are in close proximity to one another and an edge of the flap (291) and the other end of the opening and closing member (311) are in close proximity to one another.

6. The air conditioning indoor unit (2) according to claim 2, wherein the blow-out angle of the air from the air outlet (19) is adjusted when the opening and closing member (311) has opened the lower portion air inlet (21).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11a
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322
(32)
11c
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291
(29)
311
(31)
21

FIG. 1

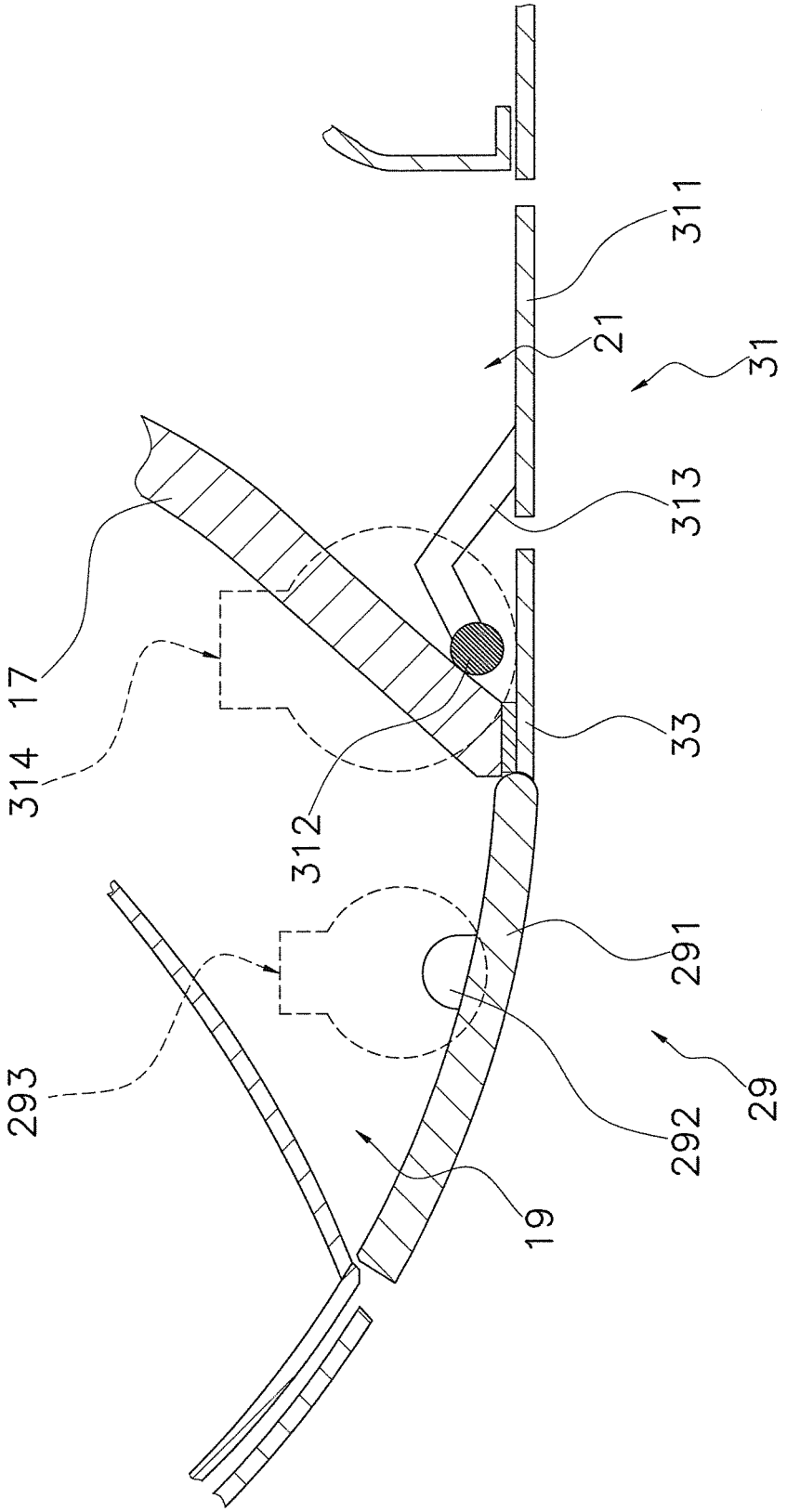

FIG. 2

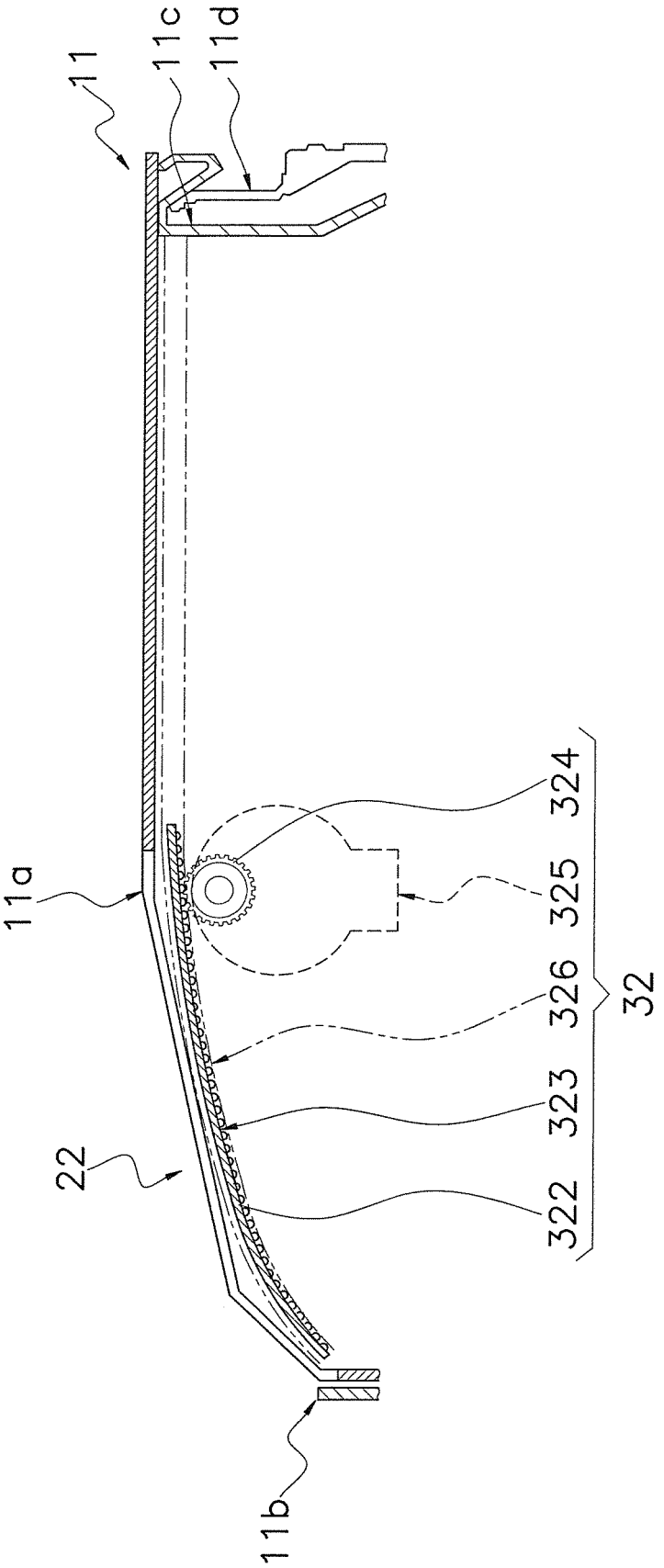

FIG. 3

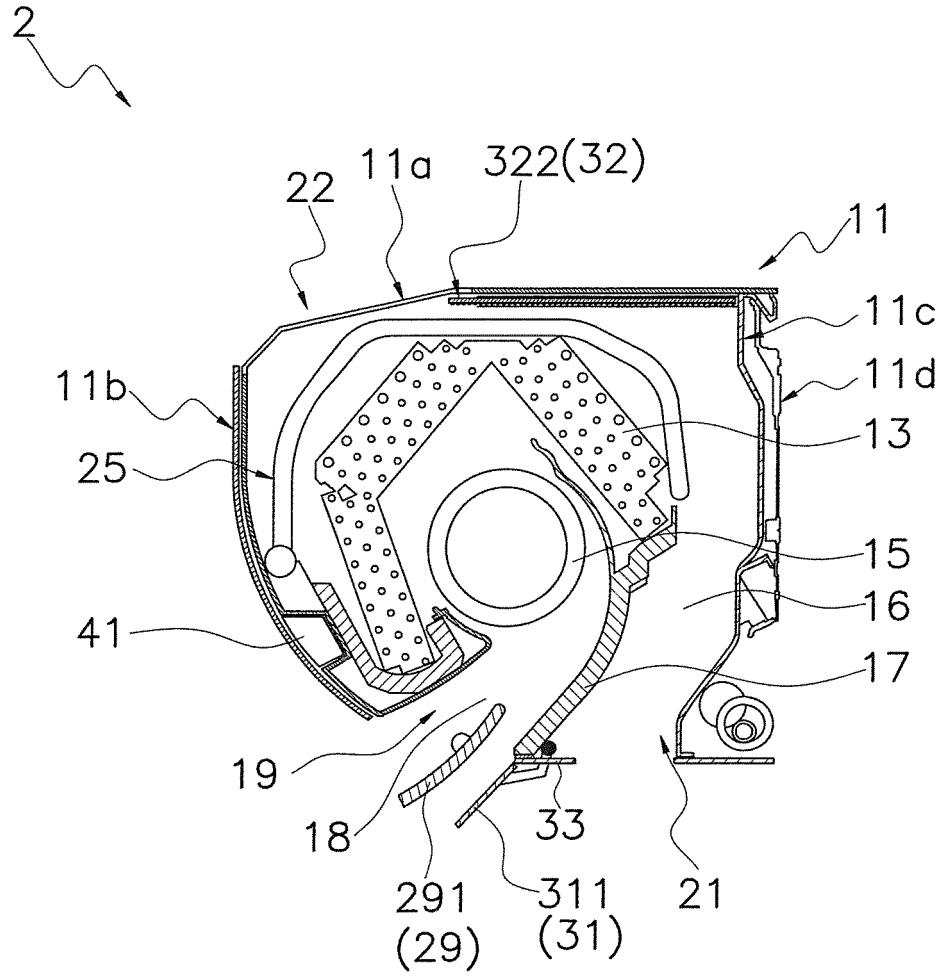
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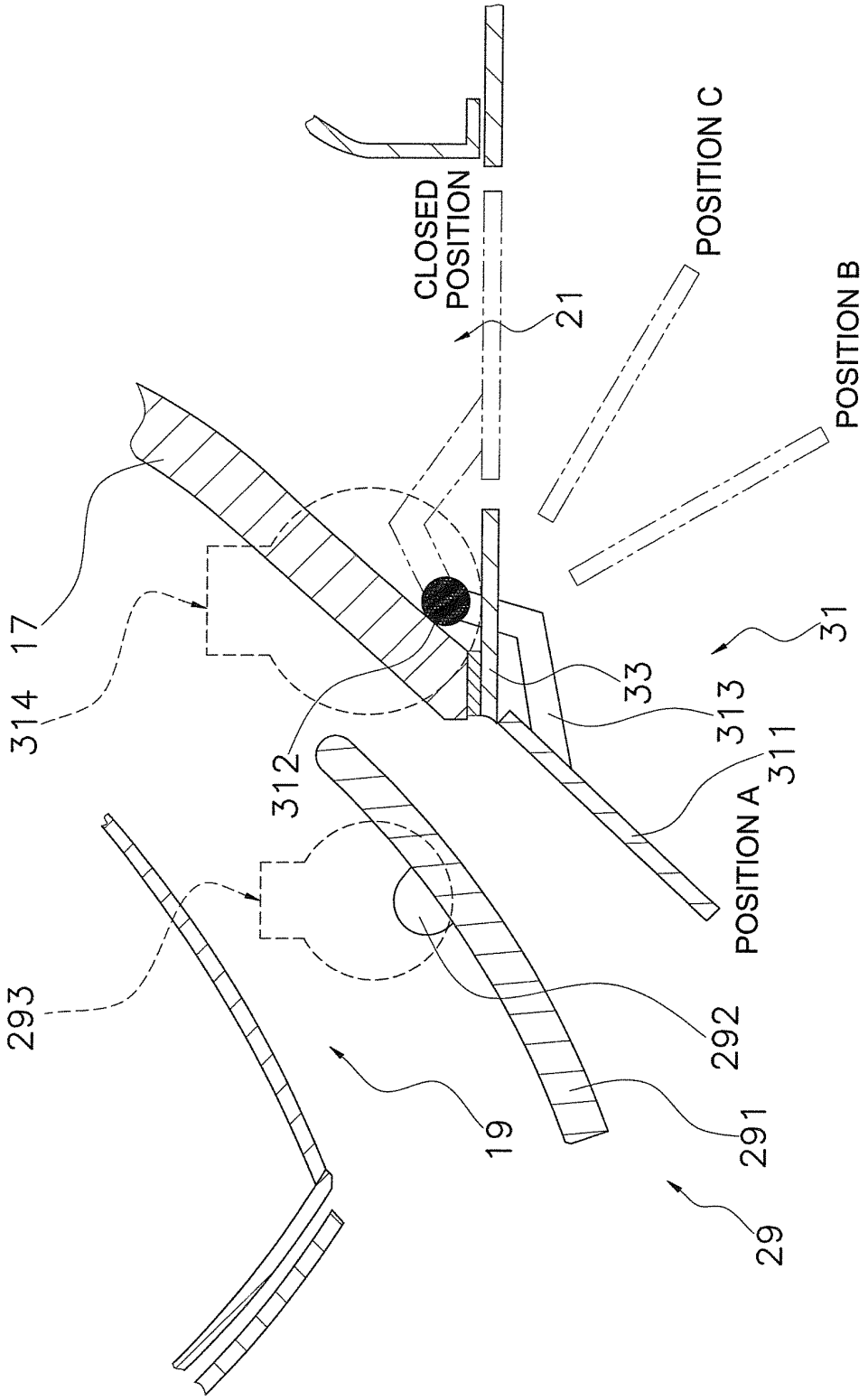
FIG. 4


CLOSED POSITION
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POSITION C
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POSITION A
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19
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29

FIG. 5

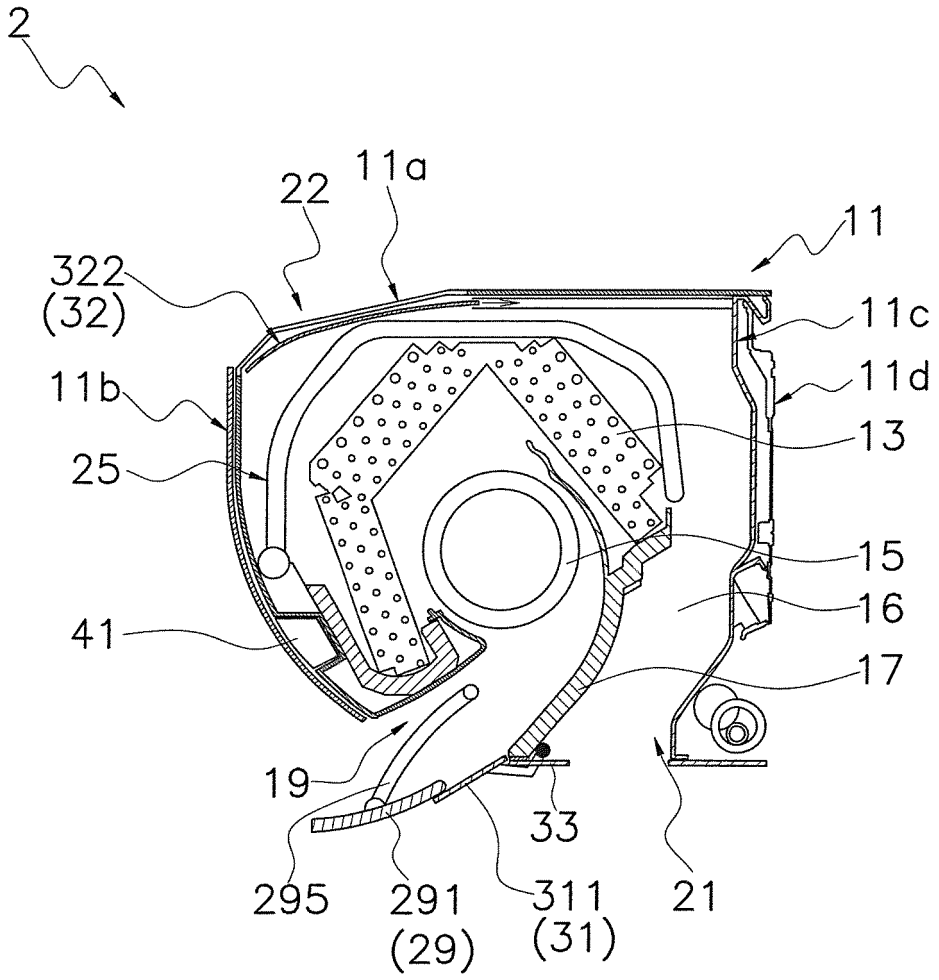
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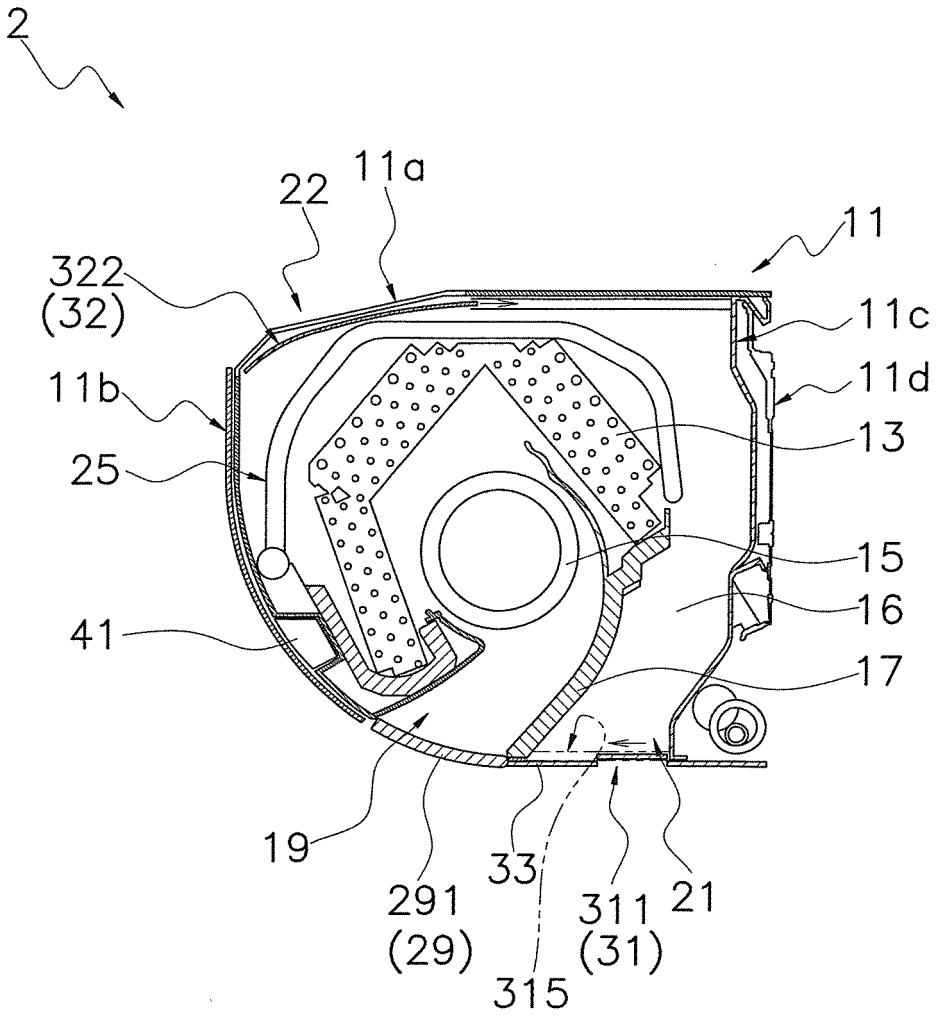
FIG. 6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(31)
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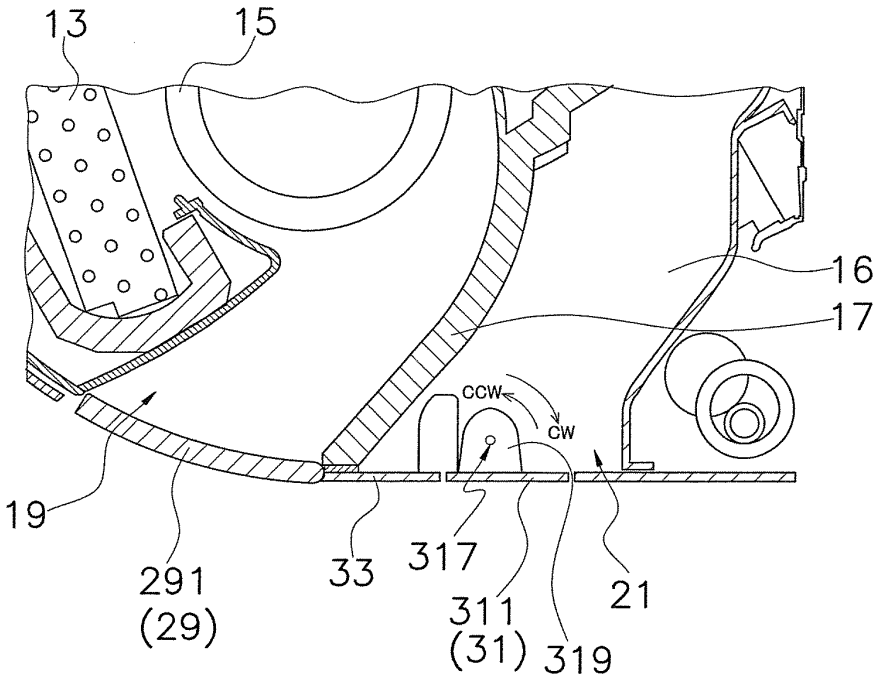
FIG. 7

FIG. 8A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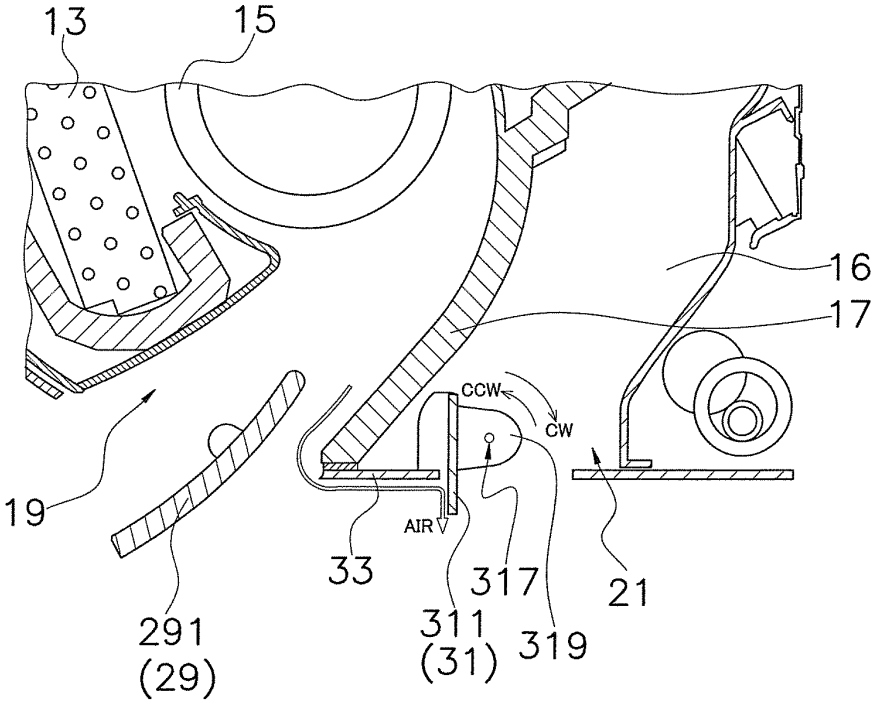
21

FIG. 8B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(31)
319
21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/057124

A. CLASSIFICATION OF SUBJECT MATTER
F24F11/02(2006.01)i, *F24F13/14*(2006.01)i, *F24F13/20*(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, F24F13/14, F24F13/20

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	1996-2012
Kokai Jitsuyo Shinan Koho	1971-2012	Toroku Jitsuyo Shinan Koho	1994-2012

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.
X	JP 2007-285533 A (Mitsubishi Electric Corp.), 01 November 2007 (01.11.2007), paragraphs [0010] to [0034]; fig. 1, 6 (Family: none)	1-3,6
Y A	JP 2001-116346 A (Fujitsu General Ltd.), 27 April 2001 (27.04.2001), paragraphs [0013] to [0020]; fig. 1 (Family: none)	1-3,6 4,5

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

* Special categories of cited documents:
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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01 June, 2012 (01.06.12)	12 June, 2012 (12.06.12)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/057124

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2007-155309 A (Daikin Industries, Ltd.), 21 June 2007 (21.06.2007), paragraphs [0042] to [0057], [0062] to [0064]; fig. 4, 9 & US 2009/0241576 A1 & EP 1947397 A1 & WO 2007/055098 A1 & KR 10-2008-0059317 A & AU 2006313235 A & KR 10-0966223 B & CN 101297161 A	1-3,6 4,5
Y	JP 2000-205644 A (Fujitsu General Ltd.), 28 July 2000 (28.07.2000), paragraph [0002]; fig. 2(A) (Family: none)	3
A	JP 2004-12060 A (Mitsubishi Heavy Industries, Ltd.), 15 January 2004 (15.01.2004), paragraphs [0029], [0030], [0063]; fig. 1 (Family: none)	1-3
A	JP 2002-295888 A (Daikin Industries, Ltd.), 09 October 2002 (09.10.2002), paragraph [0049]; fig. 1 (Family: none)	4,5
A	JP 2005-283069 A (Fujitsu General Ltd.), 13 October 2005 (13.10.2005), paragraph [0039]; fig. 4(B) (Family: none)	4,5

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2001116346 A **[0002] [0093]**