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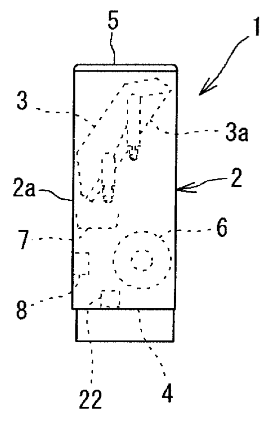
(54) **INDOOR UNIT OF AIR CONDITIONING SYSTEM**

(57) There is provided an indoor unit 1 of an air conditioning apparatus in which an conditioned air heat-exchanged by a heat exchanger 3 using a slightly flammable refrigerant or a flammable refrigerant having specific gravity higher than that of air is blown out from a blowout port 5 by an indoor fan 6. The indoor unit 1 is provided with a refrigerant sensor 8 for detecting leakage of the refrigerant and a blowout port opening/closing mechanism capable of closing a part of the blowout port 5. When the refrigerant sensor 8 detects leakage of the refrigerant, the indoor fan 6 is driven in a state in which a part of the blowout port 5 is closed by the blowout port opening/closing mechanism.

FIG. 3



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Description

TECHNICAL FIELD

[0001] The present invention relates to an indoor unit of an air conditioning apparatus. More specifically, it relates to an indoor unit of an air conditioning apparatus using a slightly flammable refrigerant or a flammable refrigerant.

BACKGROUND ART

[0002] In recent years, in an air conditioning apparatus which performs indoor heating and cooling by a vapor compression type refrigerating cycle, adoption of R32 refrigerant with low global warming potential is progressing. However, the R32 refrigerant is slightly flammable (slight flammable), especially in the case of a floor mount type indoor unit, when a refrigerant having specific gravity larger than that of air leaks, there is a possibility that the refrigerant stays around the floor surface and reaches the flammable concentration. For this reason, it has been proposed that a refrigerant sensor is arranged inside the indoor unit to determine the presence or absence of leakage from the refrigerant circuit, and when this refrigerant sensor detects leakage of the refrigerant, the indoor fan installed in the indoor unit is driven to diffuse the leaked refrigerant (See, for example, Patent Document 1). According to the air conditioning apparatus described in Patent Document 1, it is possible to prevent the refrigerant from reaching the flammable concentration by diffusing leaked refrigerant by blowing, which in turn can secure the safety of indoor residents at the time of leakage of the refrigerant.

PRIOR ART

PATENT DOCUMENT

[0003] Patent Document 1: Japanese Unexamined Patent Publication No. 11-37619

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] However, if the operation is continuously performed in a state in which contamination of air is terrible and therefore the filter provided at the air suction port of the indoor unit clogs, the air blowing volume of the indoor fan decreases. For example, in the indoor unit arranged on the wall side of the perimeter zone of the living space, generally, the distance from the floor surface to the blowout port formed in the upper surface of the indoor unit is as short as about 600 mm. Therefore, as the air blowing volume decreases, the wind speed decreases, which prevents the air from being blown up to a high position. When the air blown up from the blowout port spreads into the living space from the high position of the living space, the efficient diffusion effect of the leaked refrigerant can be obtained. However, when the blowing up height becomes low, it becomes impossible to obtain a sufficient diffusion effect.

[0005] The present invention was made in view of such circumstances, and it is an objective of the present invention to provide an indoor unit of an air conditioning apparatus capable of improving a diffusion effect of a leaked refrigerant.

MEANS FOR SOLVING THE PROBLEMS

[0006]

(1) An indoor unit of an air conditioning apparatus (hereinafter simply may also be referred to as "indoor unit") according to the present invention is an indoor unit of an air conditioning apparatus in which conditioned air heat-exchanged by a heat exchanger using a slightly flammable refrigerant or a flammable refrigerant having specific gravity higher than that of air is blown out from a blowout port by an indoor fan, the indoor unit including:

a refrigerant detector configured to detect leakage of the refrigerant; and
a blowout port opening/closing mechanism capable of closing a part of the blowout port,
wherein when the refrigerant detector detects the leakage of the refrigerant, the indoor fan is driven in a state in which the part of the blowout port is closed by the blowout port opening/closing mechanism to suppress or block blowing of the conditioned air from the part of the blowout port.

In the indoor unit of the present invention, in performing the diffusion operation to diffuse the refrigerant when the refrigerant detector such as a refrigerant sensor detects leakage of the refrigerant, the part of the blowout port is closed by the blowout port opening/closing mechanism to thereby suppress or block the blowing out of conditioned air from the part of the blowout port. By doing this, the wind speed can be increased as compared with a wind speed in the normal operation in which the blowout port is fully opened to blow out the conditioned air from the blowout port. Therefore, the diffusion effect of the leaked refrigerant can be improved. For example, in the case of a floor mount type indoor unit, the air blowing height from the floor surface can be increased and air can be diffused from the high position of the living space, and therefore the diffusion efficiency of the leaked refrigerant can be enhanced. Also, even in cases where the wind speed from the blowout port is decreased due to clogging, etc., of the filter, by closing a part of the blowout port to reduce the blowing area to thereby ensure the wind speed of blowing air, the diffusion effect of the leaked refrigerant can be improved.

In this specification, the term "closing a part of the blowout port" means the concept including not only the case in which the air blowing from the part of the blowout port is substantially blocked but also the case in which, when, for example, an openable and closable flap is used, the degree of opening is reduced to suppress the blowing of air.

(2) In the indoor unit of the aforementioned Item (1), it may be configured such that a plurality of flaps are arranged in the blowout port, at least a part of the plurality of flaps is an openable and closable flap, and the blowout port opening/closing mechanism closes the openable and closable flap. In this case, by closing a part of the plurality of flaps, the blowout port area can be reduced to thereby increase the wind speed of the blowing air from the blowout port.

(3) In the indoor unit according to the aforementioned Item (1), it may be configured such that a shielding plate capable of closing the part of the blowout port is provided in the blowout port and the blowout port opening/closing mechanism closes the part of the blowout port with the shielding plate. In this case, by closing the part of the blowout port of the shielding plate, the blowout port area can be reduced to thereby increase the wind speed of the blowing air from the blowout port.

(4) In the indoor unit according to the aforementioned Items (1) to (3), it may be configured such that the indoor unit is a floor mount type indoor unit,

the blowout port is a rectangular blowout port formed in an upper surface of a casing of the indoor unit,

the indoor unit is configured to be disposed on a wall side so that one long side of the rectangular blowout port is arranged along a wall surface, and

the blowout port opening/closing mechanism is configured to close a part of the rectangular blowout port along a long side of the rectangular blowout part opposite to a wall. In this case, the air blown out from the blowout port is blown out along a wall. Therefore, due to the synergistic effect with the increased wind speed of the blownout air by reducing the area of the blowout port, the air blowing height can be increased. As a result, the leaked refrigerant is diffused from the high position of the living space, so the possibility that the leaked refrigerant becomes a flammable concentration decreases.

(5) In the indoor unit according to the aforementioned Item (1) to (4), it may be configured such that a wind speed sensor is arranged in a suction port, and the blowout port is further closed by the blowout port opening/closing mechanism when the wind speed measured by the wind speed sensor is equal to or less than a predetermined value. In this case, by judging that the filter provided at the suction port is clogged based on the value of the wind speed measured by the wind speed sensor and by further closing the blowout port than the part of the blowout port closed in accordance with the refrigerant detection to thereby further reduce the blowing area of the blowout port, the wind speed of the air blown out from the blowout port can be secured. With this, the diffusion effect of the leaked refrigerant can be improved.

(6) In the indoor unit according to the aforementioned Items (1) to (5), it may be configured such that the blowout port is formed in a rectangular shape, and the blowout port opening/closing mechanism closes the part of the blowout port so that an aspect ratio of a shape of the blowout port approaches "1" as compared with the shape of the blowout port before detection of the leakage. In this case, air is blown out from the blowout port which is an approximately square shape having an aspect ratio close to "1" compared with the shape of the blowout port before detection of the leakage. Therefore, compared with the case in which the air is blown out from a rectangular blowout port having the same area, the blowing distance can be extended. This in turn can improve the diffusion effect of the leaked refrigerant. For example, in the case of a floor mount type indoor unit, by setting the aspect ratio of the blowout port shape close to "1", the blowing height of the air to be blown out from the blowout port can be increased.

EFFECTS OF THE INVENTION

[0007] According to the indoor unit of the present invention, the diffusion effect of a leaked refrigerant can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1 is an explanatory front view of one embodiment of an indoor unit according to the present invention.

FIG. 2 is an explanatory plan view of the indoor unit shown in FIG. 1.

FIG. 3 is an explanatory side view of the indoor unit shown in FIG. 1.

FIG. 4A is an explanatory cross-sectional view taken along the line A-A when flaps arranged in a blowout port are in a fully opened state.

FIG. 4B is an explanatory cross-sectional taken along the line A-A when a part of the flaps arranged in the blowout port is in a closed state.

FIG. 5 is an explanatory cross-sectional view of a blowout port portion of another embodiment of an indoor unit according to the present invention.

FIG. 6 is an explanatory plan view of still another embodiment of an indoor unit according to the present invention.

FIG. 7A is an explanatory cross-sectional view taken along the line B-B when flaps arranged in a blowout port are in a fully opened state.

FIG. 7B is an explanatory cross-sectional view taken along the line B-B when flaps arranged in a blowout port are in a fully closed state.

FIG. 8 is a perspective view showing an external appearance of another embodiment of an indoor unit according to the present invention.

FIG. 9 is a front view showing an external appearance of another embodiment of the indoor unit according to the present invention.

FIG. 10 is a front view of the indoor unit shown in FIGs. 8 to 9 in a state in which the front lower panel, the lower panel cover, and the vertical flaps are removed.

FIG. 11 is a cross-sectional view taken along the line I-I of FIG. 8.

FIG. 12 is a cross-sectional view taken along the line II-II of FIG. 9.

FIG. 13 is a perspective view showing an external appearance of an indoor unit to which the present invention can be applied.

FIG. 14 is a cross-sectional view of the indoor unit shown in FIG. 13.

FIG. 15 is a front view of the indoor unit shown in FIGS. 13 to 14 in a state in which the front panel and the front grill are removed.

EMBODIMENT FOR CARRYING OUT THE INVENTION

[0009] Hereinafter, some embodiments of an indoor unit according to the present invention will be described in detail with reference to the accompanying drawings. FIG. 1 is an explanatory front view of an indoor unit 1 according to an embodiment of the present invention, FIG. 2 is an explanatory plan view of the indoor unit 1 shown in FIG. 1, and FIG. 3 is an explanatory side view of the indoor unit 1 shown in FIG. 1.

[0010] The indoor unit 1 according to this embodiment is a floor mount type indoor unit normally disposed on a wall side in a perimeter zone of a living space. In this indoor unit, air is sucked in from a suction port 4 formed in a lower surface (bottom surface) of a box type casing 2, and conditioned air is blown out from a blowout port 5 formed in the upper surface of the casing 2 to a living space. The blowout port 5 is formed in a rectangular shape, and its long side is arranged on the wall side along the wall surface 13 (see FIG. 2). The height of the casing 2 is usually about 600 mm from the floor surface, and conditioned air is blown out from a relatively low position to the living space. In the casing 2, as shown in FIG. 3, a heat exchanger 3 and an indoor fan 6 are arranged. The heat exchanger 3 is arranged in the upper region in the casing 2, and the indoor fan 6 is arranged in the lower region in the casing 2.

[0011] A drain pan 7 is arranged below the heat exchanger 3, and a refrigerant sensor 8 which is a refrigerant detector for detecting leakage of a refrigerant is provided on the rear surface of the front panel 2a of the casing 2 further below the drain pan 7. The refrigerant sensor 8 detects leakage of the refrigerant from the heat exchanger 3 or a connection portion between a refrigerant tube 3a of the heat exchanger 3 and a refrigerant pipe (not shown) from an outside, etc. In this embodiment, a wind speed sensor 22 for measuring the wind speed of the air sucked into the indoor unit from the suction port 4 is arranged on the rear side of the suction port 4. Further, a filter (not shown) is provided in the suction port 4.

[0012] A plurality of flaps 10 is arranged in the suction port 4. The flaps 10 are arranged along the longitudinal direction of the casing 2 (in the right-left direction in FIGs. 1 and 2). The flap 10 has a band plate shape and can be made of synthetic resin such as, e.g., ABS. In this embodiment, among the six flaps 10, two flaps 10 on the front side (the lower side in FIG. 2) of the indoor unit 1 are configured to be opened and closed by the motor 9. The remaining four flaps 10 are configured to be able to adjust the opening manually. In this embodiment, a blowout port opening/closing mechanism is constituted by the motor 9 and two openable and closable flaps 10.

[0013] The indoor unit 1 is in a state (see FIG. 4A) in which all the six flaps 10 are opened during the normal operation. When leakage of the refrigerant is detected by the refrigerant sensor 8, a detection signal is transmitted to a controller (not shown) of the indoor unit 1, and the motor 9 is driven by a drive signal from the controller to close the most front side flap 10 (the leftmost side flap in FIG. 4). Further, in this embodiment, the wind speed sensor 22 is arranged in the suction port 4 as described above. When the value of the wind speed measured by the wind speed sensor 22 is equal to or lower than a predetermined value (for example, 80% of the set wind speed), the motor 9 is driven by a driving signal from the controller to close the second flap 10 from the front side (see FIG. 4B). That is, by judging that the filter provided at the suction port 4 is clogged when the value of the wind speed measured by the wind speed sensor 22 is equal to or lower than the predetermined value and by further closing the blowout port 5 than the part closed in accordance with the refrigerant detection to thereby further reduce the blowing area of the blowout port 5, the wind speed of the air blown out from the blowout port 5 is secured. In this embodiment, one more flap 10 is closed, and a total of two flaps 10 are closed.

[0014] When the indoor unit 1 is in operation, even if the refrigerant is leaked, the leaked refrigerant is diffused by the air sucked from the suction port 4, so there is little possibility of being detected by the refrigerant sensor 8. Leakage of the refrigerant is normally detected when the operation of the indoor unit 1 is stopped. In this case, first, the indoor fan 6 is driven in a state in which one flap 10 on the front most side is closed, and if the value of the wind speed measured by the wind speed sensor 22 is equal to or lower than a predetermined value, the second flap 10 from the front surface side is also closed. In the above description, the number of openable and closable movable flaps and the number of flaps to be closed when leakage of the refrigerant is detected are one example, and these numbers may be other numbers.

[0015] Further, as described above, the "closing" of the flap 10 includes not only the case in which blowing of air from the flap 10 is substantially blocked as indicated by the solid line in FIG. 4B but also the case in which the opening degree of the flap 10 is reduced to suppress the blowing of air as indicated by the two-dot chain line in FIG. 4B.

[0016] In performing the diffusion operation to diffuse the refrigerant when the refrigerant sensor 8 detects leakage of the refrigerant, some of the plurality of flaps 10 are closed by the motor 9 to suppress or block the conditioned air from blowing out from the some of the plurality of flaps. This increases the wind speed as compared with the normal operation in which the blowout port 5 is fully opened to blow out the conditioned air from the blowout port 5. This makes it possible to raise the air blowing height from the floor surface, and thus to diffuse air from the high position of the living space, which can enhance the diffusion efficiency of the leaked refrigerant.

[0017] Further, in this embodiment, the portion of the rectangular blowout port 5 along the long side opposite to the wall is closed. In this case, the air blown out from the blowout port 5 is blown out along the wall surface 13. Therefore, due to the synergistic effect with the increased wind speed of the blowout air by reducing the area of the blowout port 5, the air blowing height can be increased. As a result, the leaked refrigerant is diffused from the high position in the living space, so the possibility that the leaked refrigerant becomes a flammable concentration decreases.

[0018] FIG. 5 is an explanatory cross-sectional view of a blowout port of an indoor unit according to another embodiment of the present invention. In FIG. 5, the left side is the front side of the indoor unit. In this embodiment, a grill 19 made of synthetic resin is arranged in the blowout port 18 of the indoor unit. On the rear side of the grill 19, a shielding plate 20 having a band plate shape (an elongated shape in the penetrating direction of the paper in FIG. 5) capable of closing a part of the blowout port 18 is arranged. A rotating shaft 17 is provided at one side edge of the shielding plate 20, and a rotating shaft (not shown) of a motor 21 similarly disposed on the rear side of the grill 19 is connected to the rotating shaft 17. By driving the motor 21, it is possible to rotate the shielding plate 20 between the open position indicated by the two-dot chain line in FIG. 5 and the closed position indicated by the solid line in FIG 5. In this embodiment, the shielding plate 20, the rotating shaft 17, and the motor 21 constitute a blowout port opening/closing mechanism capable of closing a part of the blowout port 18. Note that the shielding plate may be arranged outside the casing 2, that is, on the surface side of the grill 19 in this embodiment.

[0019] During the normal operation, the shielding plate 20 is in an open position indicated by the two-dot chain line. When leakage of the refrigerant is detected by the refrigerant sensor 8, the detection signal is transmitted to a controller (not shown) of the indoor unit 1, so that the motor 21 is driven by a drive signal from the controller to rotate the shielding plate 20 to the position indicated by the solid line. Thus, a part of the blowout port 18 is closed. In this way, a part of the blowout port 18 is closed to suppress or block the blowout of the conditioned air from the part. As a result, in a state in which the wind speed is increased as compared with the wind speed during the normal operation in which the blowout port 18 is fully opened, the conditioned air can be blown out from the blowout port 18. This makes it possible to raise the air blowing height from the floor surface, and thus to diffuse air from the high position of the living space, which can enhance the diffusion efficiency of the leaked refrigerant.

[0020] FIG. 6 is an explanatory plan view of an indoor unit according to still another embodiment of the present invention. In this embodiment, a grill 31 made of synthetic resin is arranged in the longitudinal center portion of the blowout port 30, and a plurality of openable and closable flaps 32 are respectively provided in the left region L and the right region R on both sides of the grill 31. A plurality of flaps 32 are each provided with a rotating shaft 33. Each flap 32 is configured to take two states: an open state (see FIG. 7A) in which the flap stands substantially vertically about the rotating shaft 33 as a rotation center and a closed state (see FIG. 7B) in which the flap is horizontally arranged. To attain this, the plurality of flaps 32 is connected to an interlocking plate 34. By moving the interlocking plate 34 in the horizontal direction, the flap 32 can take the aforementioned two states. The horizontal movement of the interlocking plate 34 can be performed by using, for example, a stepping motor (not shown). In this embodiment, the flap 32, the rotating shaft 33, the interlocking plate 34, and the stepping motor constitute a blowout port opening/closing mechanism capable of closing a part of the blowout port 30.

[0021] During the normal operation, the flap 32 is in the open position shown in FIG. 7A. When leakage of the refrigerant is detected by the refrigerant sensor 8, a detection signal is transmitted to a controller (not shown) of the indoor unit 1. The stepping motor is driven by the drive signal from the controller to horizontally move the interlocking plate 34. As a result, the flap 32 takes a laid down state (see FIG. 7B), so that parts of the blowout port 30, that is, the right and left regions of the central portion where the grill 31 is disposed, are closed. In this way, the parts of the blowout port 30 are closed to suppress or block the blowout of the conditioned air from the parts. As a result, with the wind speed increased as compared with the wind speed during the normal operation in which the blowout port 30 is fully opened, the conditioned air can be blown out from the blowout port 30. This makes it possible to raise the air blowing height from the floor surface, and thus to diffuse air from the high position of the living space, which can enhance the diffusion efficiency of the leaked refrigerant.

[0022] In addition, in this embodiment, the regions at the both ends of the rectangular blowout port 30 are closed so that the shape of a region through which the conditioned air is blown out is made into a shape that is closer to a square. In other words, as compared with the blowout port shape before the leakage detection, portions of the blowout port 30 are closed so that the aspect ratio of the shape of the blowout port 30 approaches "1". In this way, air is blown out from the blowout port which is formed in an approximately square shape having an aspect ratio close to "1" compared with the shape of the blowout port before detection of the leakage. Therefore, compared with the case in which the air is blown out from a rectangular blowout port having the same area, the blowing distance can be extended, that is, the flowing height can be increased. This in turn can improve the diffusion effect of the leaked refrigerant.

[0023] FIG. 8 is a perspective view showing an external appearance of an indoor unit 120 according to another embodiment of the present invention, and FIG. 9 is a front view showing the external appearance. In the explanation of the indoor unit shown in FIGs. 8 to 12 depicted below, the explanation will be made while defining the right, left, front, rear, up, and down as the directions indicated by the arrows in FIG. 8.

[0024] The indoor unit 120 is a floor type to be installed on a floor of a room. The indoor unit 120 is formed in a shape elongated in the height direction (vertical direction), and the width gradually decreases from the center portion in the height direction to the upper portion and to the lower portion, respectively. The outer surface of the indoor unit 120 is formed by a casing member 131.

[0025] The casing member 131 is made of synthetic resin and is composed mainly of a front cover covering the front surface to the side surfaces and a rear cover 131b covering from the side faces to the rear surface. The front cover is comprised of parts, such as, e.g., a front upper panel 131a, a front lower panel 131c, and a lower panel cover 133.

[0026] The front upper panel 131a covers from the upper side surface of the indoor unit 120 to the upper rear surface thereof, and a vertically extended rectangular hole for a blowout port Q is formed in the widthwise center of the front surface. The front lower panel 131c covers from the lower side surface of the indoor unit 120 to the lower front surface thereof, and a vertically extended rectangular hole for a suction port P is formed in the widthwise center of the front surface. In the front lower panel 131c, a hole for a suction port P is also formed in a lattice shape in each of the portions corresponding to both side surfaces.

[0027] The lower panel cover 133 covers the front of the hole formed as the suction port P in the widthwise center of the lower front part. A gap is formed between both widthwise ends of the lower panel cover 133 and the front lower panels 131c. This gap serves a suction port P which takes in indoor air inside the indoor unit 120.

[0028] Above the height direction center portion of the front surface of the indoor unit 120, two vertical flaps 132 extending in the height direction are provided. Behind the two vertical flaps 132, that is, on the rear side, a blowout port Q through which air passed thorough the heat exchanger 121 is brown out is provided. The combined width of the two vertical flaps 132 and the width of the lower panel cover 133 are the same, and both right and left ends of the two combined vertical flaps 132 are aligned with the right and left ends of the lower panel cover 133. For this reason, it gives an excellent aesthetic appearance. A dent 131 d is provided in a portion near the blowout port Q of the front upper panel 131 a.

[0029] The indoor fan 122 is, for example, a sirocco fan as shown in FIG. 10, and is arranged below the central portion of the indoor unit 120 in the height direction and behind the lower panel cover 133 and the suction port P. The indoor fan 122 sucks indoor air into the indoor unit 120. The sucked air moves upward in the indoor unit 120.

[0030] Fig. 11 is a cross-sectional view taken along the line I-I in FIG. 8, and FIG. 12 is a cross-sectional view taken along the line II-II in FIG. 9. The indoor air sucked into the indoor unit 120 by the indoor fan 122 moves upward in the indoor unit 120 and passes through the heat exchanger 121 shown in FIG. 11. The air heat-exchanged with a refrigerant when passing through the heat exchanger 121 is blown out from the blowout port Q into a room. A refrigerant sensor (not shown) for detecting leakage of the refrigerant is arranged below the heat exchanger 121.

[0031] The blowout port Q is provided above the height direction center portion of the front surface of the indoor unit 120. The blowout port Q is formed in a rectangular shape elongated in the height direction and is an opening from the inside of the indoor unit 120 to the room. The blowout port Q is formed by a blowout port forming member.

[0032] As shown in FIG. 11, the heat exchanger 121 is arranged behind the blowout port Q, and a horizontal flap 134 is provided in front of the blowout port Q. In front of the horizontal flap 134, the vertical flap 132 is provided.

[0033] A plurality of horizontal flaps 134 are arranged side by side in the height direction in the blowout port Q. The plurality of horizontal flaps 134 are pivotally supported by rotating shafts 136 arranged in the vertical direction and extending in the horizontal direction. The plurality of horizontal flaps 134 are configured so as to be inclined in the horizontal direction by each being rotated around the rotating shaft 136 as a fulcrum.

[0034] Two vertical flaps 132 are provided, one of them arranged on the left side being a first vertical flap 132a and the other arranged on the right side being a second vertical flap 132b. These two vertical flaps 132 are each supported by a rotating shaft 135 extending in the vertical direction and are configured to be inclined in the right-left direction separately by being rotated by being driven by first and second actuators (not shown). The vertical flap 132 adjusts the wind direction in the right-left direction in accordance with the inclination in the right-left direction. The two vertical flaps 132 are configured to be in a closed state in which the blowout port Q is closed when air is not blown out from the blowout port Q. That is, in the closed state, as shown in FIGS. 9 and 12, it is configured such that the first vertical flap 132a covers the left end portion (left half) of the blowout port Q and the second vertical flap 132b is configured to cover the right end portion (right half) of the blowout port Q. When two vertical flaps 132 are in a closed state, the blowout port Q is hidden behind the vertical flap 132 and cannot be seen from the outside.

[0035] The vertical flap 132 rotates inward from the closed state as shown by the two-dot chain line in FIG. 12, and the blowout port Q becomes in an open state in which the appearance can be visually recognized. Specifically, the first vertical flap 132a on the left side rotates so that its left end moves forward and its right end moves rearward. The second vertical flap 132b on the right side rotates so that its right end moves forward and its left end moves rearward. In this open state, it becomes possible to blow out the air that passed through the heat exchanger 121 from the blowout port Q into the room.

[0036] Of the plurality of horizontal flaps 134, the upper half horizontal flaps 134a are connected to each other by a connecting member 163a, and are configured to be driven by a third actuator (not shown) to move together. Further, the lower half horizontal flaps 134b are connected to each other by a connecting member 163b, and are configured to be driven by a fourth actuator (not shown) to move together. The plurality of horizontal flaps 134 adjusts the wind direction from the blowout port Q in the vertical direction in accordance with the inclination in the vertical direction.

[0037] Also in the embodiment shown in FIGS. 8 to 12, at the time of leakage of the refrigerant, the opening/closing and the opening degree of the horizontal flaps 134 arranged in front of the blowout port Q (indoor side) and/or the vertical flaps 132 arranged in front of the horizontal flaps 134 are adjusted to narrow the opening. With this, it becomes possible to blow out the conditioned air into the room with increasing the wind speed as compared with the normal operation in the same manner as in the aforementioned embodiments. With this, the diffusion effect of the leaked refrigerant can be improved.

[Other Modifications]

[0038] The present invention is not limited to the embodiments described above, and various modifications may be made within the scope of the claims.

[0039] For example, in the aforementioned embodiments, the wind speed of the conditioned air blown out from the blowout port is increased by opening/closing a part of the plurality of flaps arranged in the blowout port of the floor mount type indoor unit or by opening and closing the shielding plates. However, other than the above, for example, in a ceiling-embedded type indoor unit or a ceiling-hung type indoor unit having a plurality of blowout ports and a flap arranged in each blowout port, a part of blowout ports of the indoor unit may be closed by closing a part of the plurality of blowout ports by flaps.

[0040] Further, in the aforementioned embodiments, a part of the blowout port is closed by substantially closing the flap. However, in a wall mount type indoor unit capable of changing the wind direction by a rotatable flap arranged in the blowout port, a part of the blowout port may be closed by narrowing the blowout port by adjusting the angle of the flap.

[0041] Further, in the aforementioned embodiments, leakage of the refrigerant is detected by a refrigerant sensor which is a refrigerant detector. However, for example, a temperature difference between the temperature of the evaporator and its surrounding temperature or a temperature difference between the temperature of the condenser and its surrounding temperature is obtained by a thermistor, and it may be judged that there is a gas shortage, that is, leakage of the refrigerant when a state in which any one of the temperature differences is less than a reference value continues for a predetermined time. In this case, a temperature sensor such as a thermistor constitutes the refrigerant detector according to the present invention.

[0042] Also, although it is an indoor unit of the same floor mount type, the present invention can also be applied to a floor mount type indoor unit of a type different from the indoor unit according to the aforementioned embodiments. For example, the present invention can be applied to a floor mount type indoor unit 202 shown in FIGS. 13 to 15. The indoor unit 202 shown in FIGS. 13 to 15 mainly includes a casing unit 250, and a heat exchanger 220 and an indoor fan 221 which are accommodated inside the casing unit 250. In FIGS. 13 and 15, the reference characters X, Y, and Z indicate the right-left direction, the front-rear direction, and the up-down direction of the indoor unit 202, respectively.

[0043] The casing unit 250 constituting the external appearance of the indoor unit 202 includes a bottom frame 251, a front grill 252, and a front panel 253. As shown in FIG. 15, the internal space formed by the casing unit 250 is divided into a fan chamber 250A in which the heat exchanger 220, the indoor fan 221, etc., are installed, and a piping chamber 250B in which electrical equipment units 222, etc., are provided.

[0044] The bottom frame 251 is formed in a substantially rectangular shape and constitutes the rear portion of the indoor unit 202. At the lower portion of the bottom frame 251, there is provided a pipe introduction port 251a for introducing a connection piping into the piping chamber 250B.

[0045] The front grill 252 is attached to the front side of the bottom frame 251. An upper blowout port 252a is provided at the upper portion of the front grill 252 and a lower blowout port 252b is provided at a lower portion of the front grill 252. A flap 254 is rotatably provided in the upper blowout port 252a, so that cold air or warm air is blown out from the upper blowout port 252a in a desired direction when the air conditioning is in operation, and the upper blowout port 252a is covered when the air conditioning is in non-operation. A substantially rectangular opening is provided in the center portion of the front grill 252. This opening is provided with a filter 255 for collecting dust contained in the air sucked from each suction port 253a, 253b, 253c (see FIG. 13) of the front panel 253 which will be described later.

[0046] As shown in FIG. 13, a front panel 253 is attached so as to cover the opening of the front grill 252. An upper suction port 253a is provided at the upper portion of the front panel 253 and a lower suction port 253b is provided at a lower portion of the front panel 253. The upper suction port 253a and the lower suction port 253b are each elongated in the width direction (X direction), and the side suction port 253c is an elongated opening in the vertical direction (Z direction). With this, indoor air can be sucked from the four directions of up, down, left, and right, and the air sucked from the suction ports 253a, 253b, and 253c is uniformly passed through the heat exchanger 220 and blown out from the upper blowout port 252a and the lower blowout port 252b.

[0047] The present invention can also be suitably applied to the floor mount type indoor unit of a blowout type in which air in the room is sucked from the center and conditioned air is blown out from the upper and lower blowout ports as shown in FIGS. 13 to 15.,

DESCRIPTION OF REFERENCE SYMBOLS

[0048]

1 :	INDOOR UNIT
2 :	CASING
2a:	FRONT PANEL
3 :	HEAT EXCHANGER
3a:	REFRIGERANT TUBE
4 :	SUCTION PORT
5 :	BLOWOUT PORT
6 :	INDOOR FAN
7 :	DRAIN PAN
8 :	REFRIGERANT SENSOR (REFRIGERANT DETECTOR)
9 :	MOTOR
10 :	FLAP
13 :	WALL SURFACE
17 :	ROTATING SHAFT
18 :	BLOWOUT PORT
19 :	GRILL
20 :	SHIELDING PLATE
21 :	MOTOR
22 :	WIND SPEED SENSOR
30 :	BLOWOUT PORT
31 :	GRILL
32 :	FLAP
33 :	ROTATING SHAFT
34 :	INTERLOCKING PLATE
120:	INDOOR UNIT
121:	HEAT EXCHANGER
122:	INDOOR FAN
131:	CASING MEMBER
131a:	FRONT UPPER PANEL
131b:	REAR COVER
131c:	FRONT LOWER PANEL
131d:	DENT
132:	VERTICAL FLAP
132a:	FIRST VERTICAL FLAP
132b:	SECOND VERTICAL FLAP
133:	LOWER PANEL COVER
134:	HORIZONTAL FLAP
135:	ROTATING SHAFT
136:	ROTATING SHAFT
Q :	BLOWOUT PORT
P :	SUCTION PORT
163a:	CONNECTING MEMBER
163b:	CONNECTING MEMBER

Claims

1. An indoor unit (1) of an air conditioning apparatus in which conditioned air heat-exchanged by a heat exchanger (3) using a slightly flammable refrigerant or a flammable refrigerant having specific gravity higher than that of air is blown out from a blowout port (5) by an indoor fan (6), the indoor unit (1) comprising:

   a refrigerant detector (8) configured to detect leakage of the refrigerant; and
   a blowout port opening/closing mechanism capable of closing a part of the blowout port (5),
   wherein when the refrigerant detector (8) detects the leakage of the refrigerant, the indoor fan (6) is driven in a state in which the part of the blowout port (5) is closed by the blowout port opening/closing mechanism to suppress or block blowing of the conditioned air from the part of the blowout port (5).

2. The indoor unit (1) of the air conditioning apparatus according to claim 1, wherein
   a plurality of flaps (10) are arranged in the blowout port (5),
   at least a part of the plurality of flaps (10) is openable and closable flaps (10), and
   the blowout port opening/closing mechanism is configured to close the openable and closable flaps (10).

3. The indoor unit (1) of the air conditioning apparatus according to claim 1, wherein
   a shielding plate (20) capable of closing the part of

the blowout port (5) is provided in the blowout port (5), and
the blowout port opening/closing mechanism is configured to close the part of the blowout port (5) with the shielding plate (20).

4. The indoor unit (1) of the air conditioning apparatus according to any one of claims 1 to 3, wherein
the indoor unit (1) is a floor mount type indoor unit (1),
the blowout port (5) is a rectangular blowout port (5) formed in an upper surface of a casing (2) of the indoor unit (1),
the indoor unit (1) is configured to be disposed on a wall side so that one long side of the rectangular blowout port (5) is arranged along a wall surface, and
the blowout port opening/closing mechanism is configured to close a part of the rectangular blowout port (5) along a long side of the rectangular blowout port (5) opposite to a wall.

5. The indoor unit (1) of the air conditioning apparatus according to any one of claims 1 to 4, wherein
a wind speed sensor (22) is arranged in a suction port (4) communicated to the indoor unit (1), and
the blowout port (5) is further closed by the blowout port opening/closing mechanism when the wind speed measured by the wind speed sensor (22) is equal to or less than a predetermined value.

6. The indoor unit (1) of the air conditioning apparatus according to any one of claims 1 to 5, wherein
the blowout port (5) is formed in a rectangular shape, and
the blowout port opening/closing mechanism closes the part of the blowout port (5) so that an aspect ratio of a shape of the blowout port (5) approaches "1" as compared with the shape of the blowout port before detection of the leakage.

FIG. 1

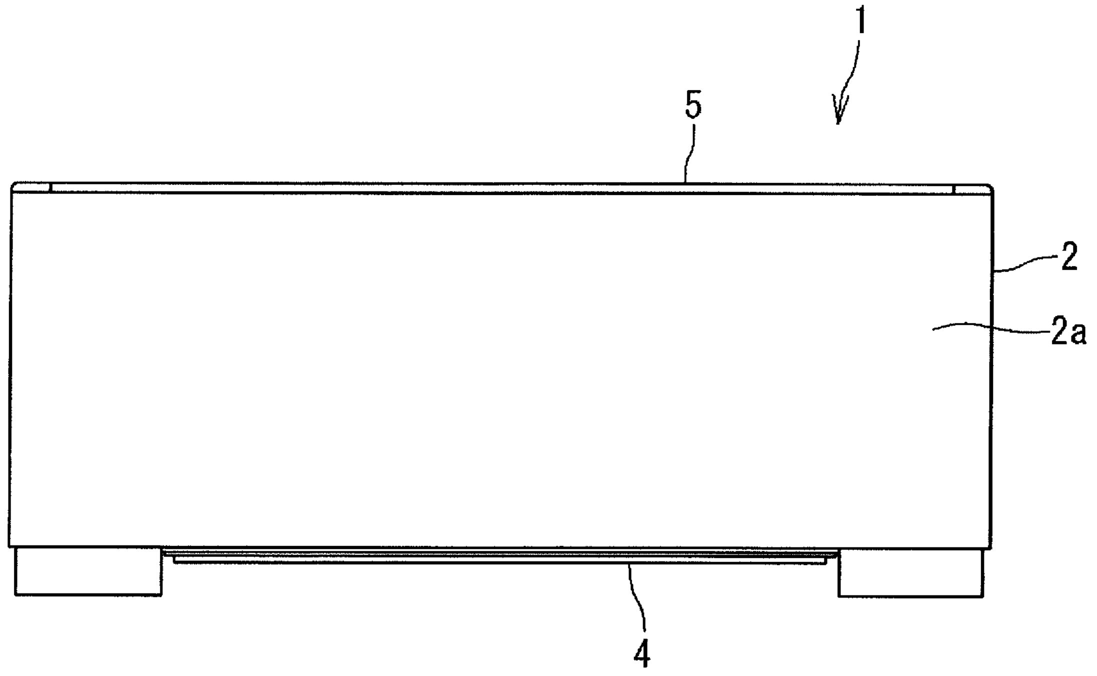


FIG. 2

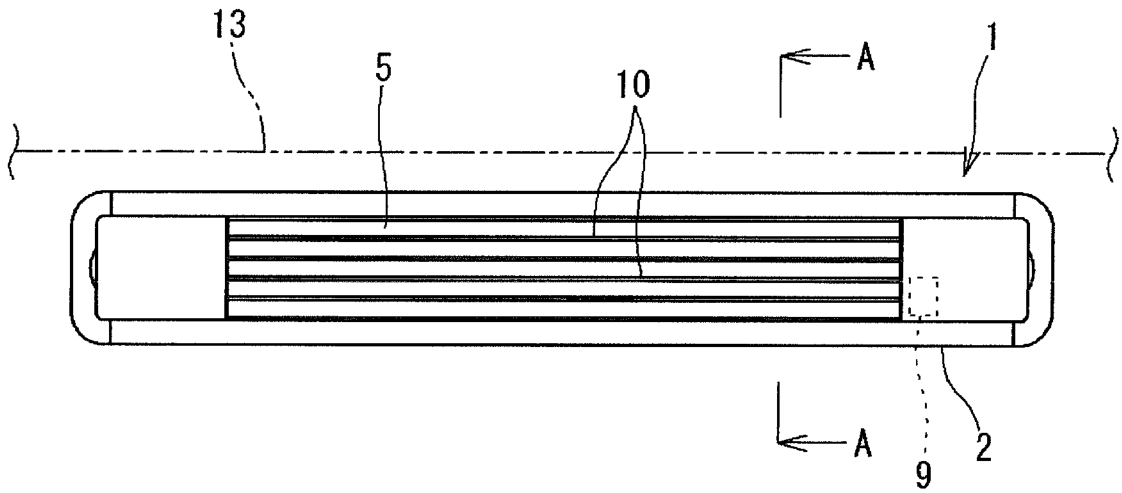


FIG. 3

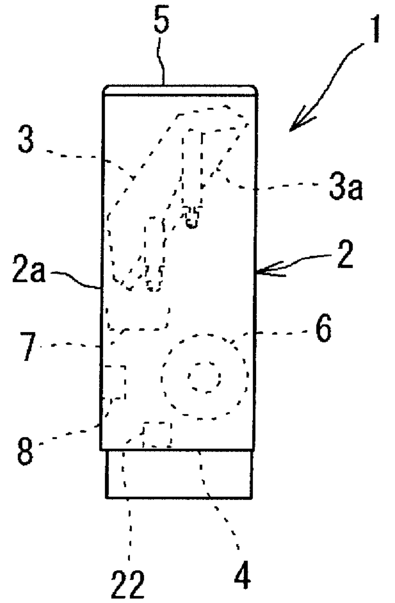


FIG. 4A

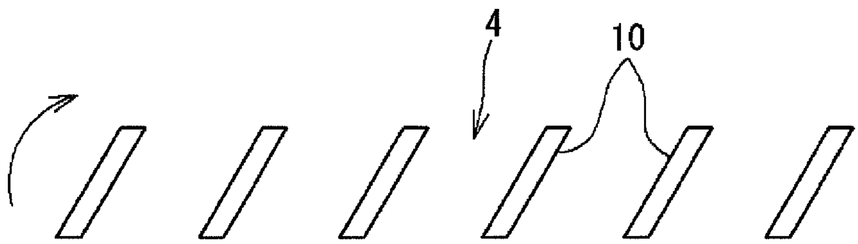


FIG. 4B

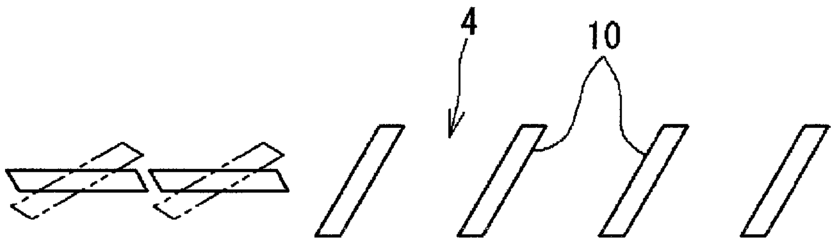


FIG. 5

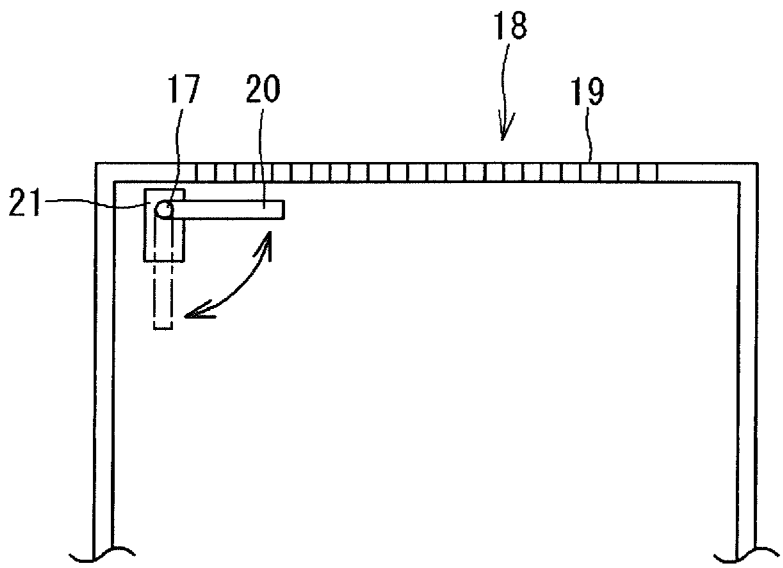


FIG. 6

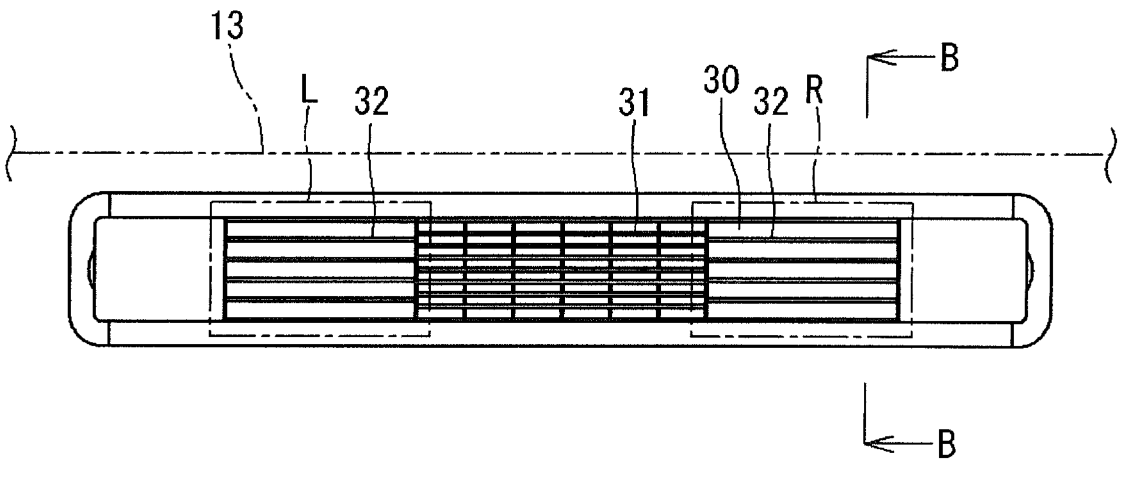


FIG. 7A

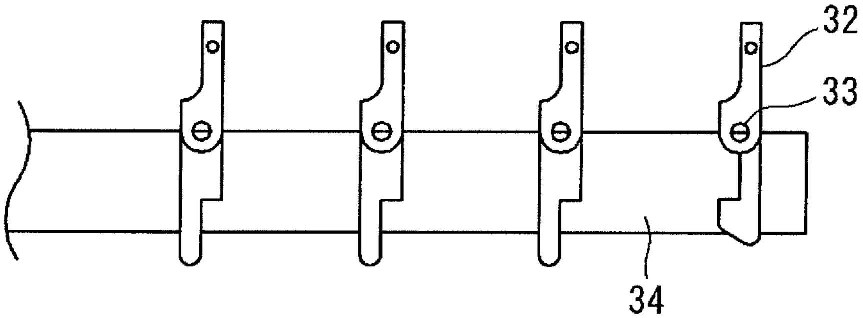


FIG. 7B

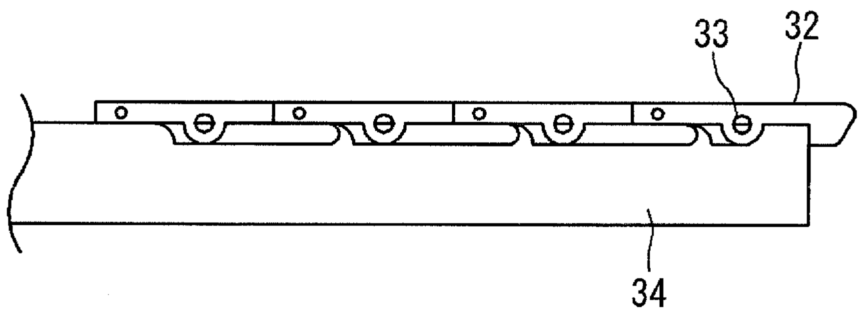


FIG. 8

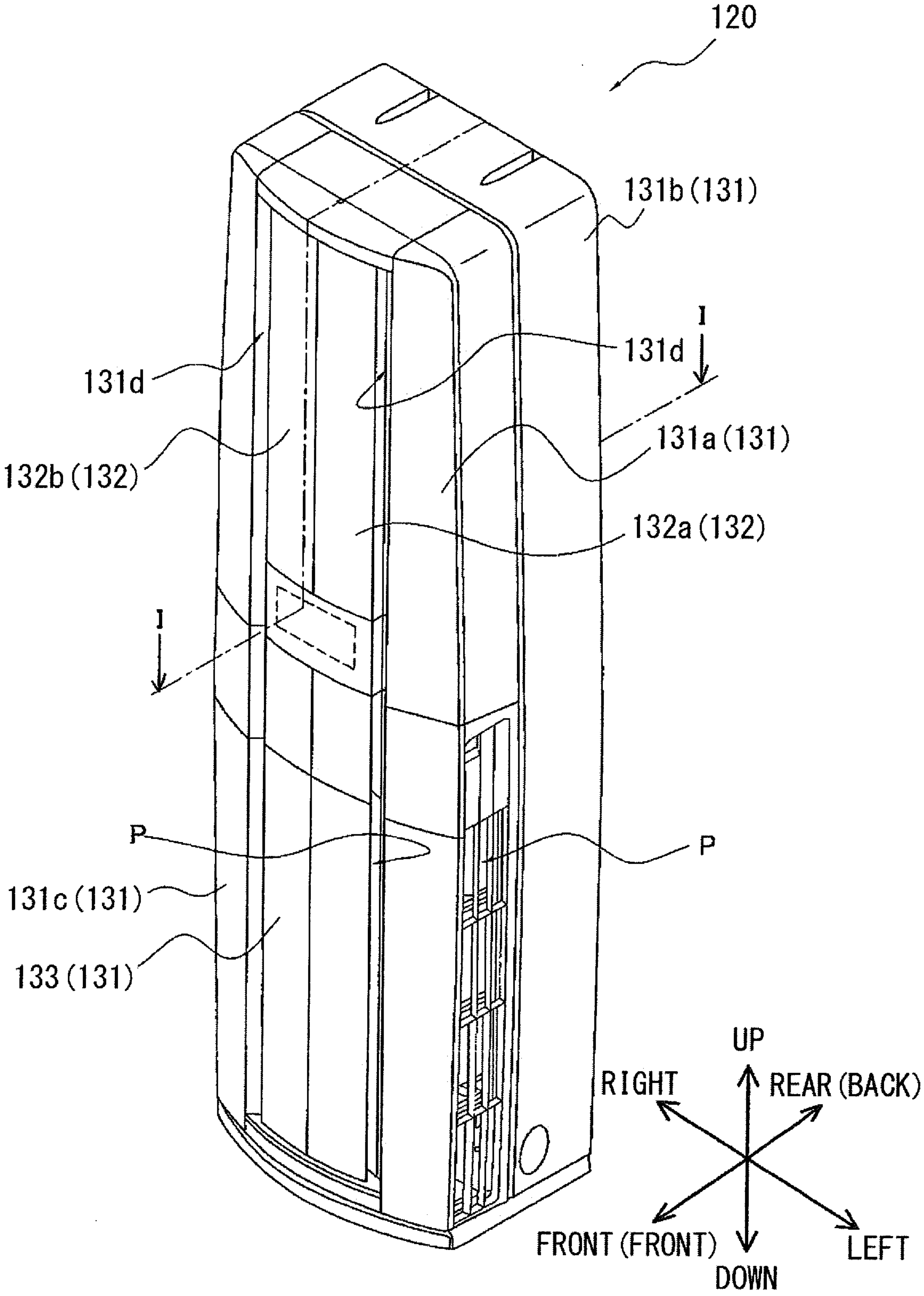

120
131b(131)
131d
131d
I
131a(131)
132b(132)
132a(132)
I
P
P
131c(131)
133(131)
UP
RIGHT
REAR(BACK)
FRONT(FRONT)
LEFT
DOWN

FIG. 9

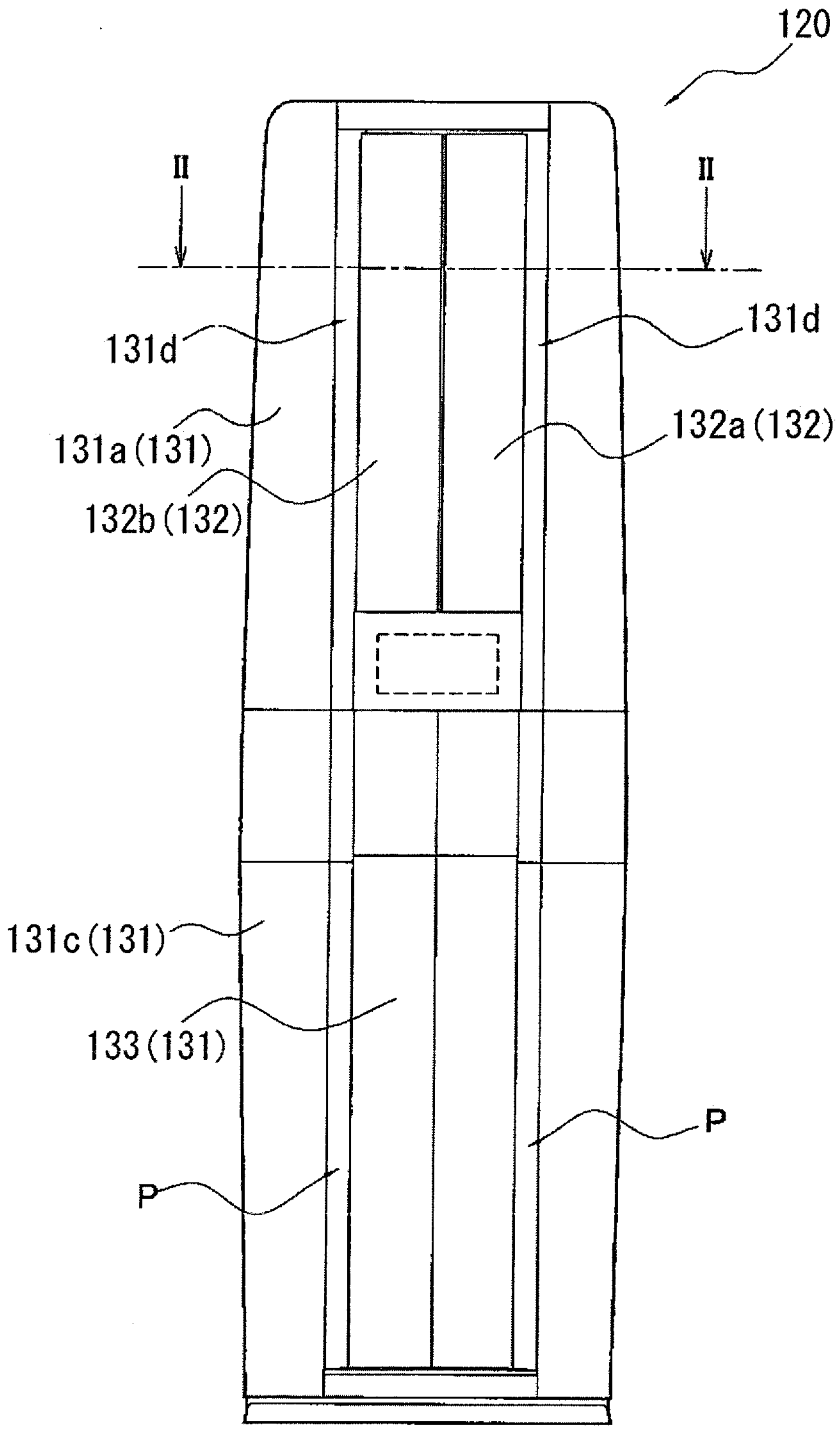

120
II
II
131d
131d
131a (131)
132a (132)
132b (132)
131c (131)
133 (131)
P
P

FIG. 10

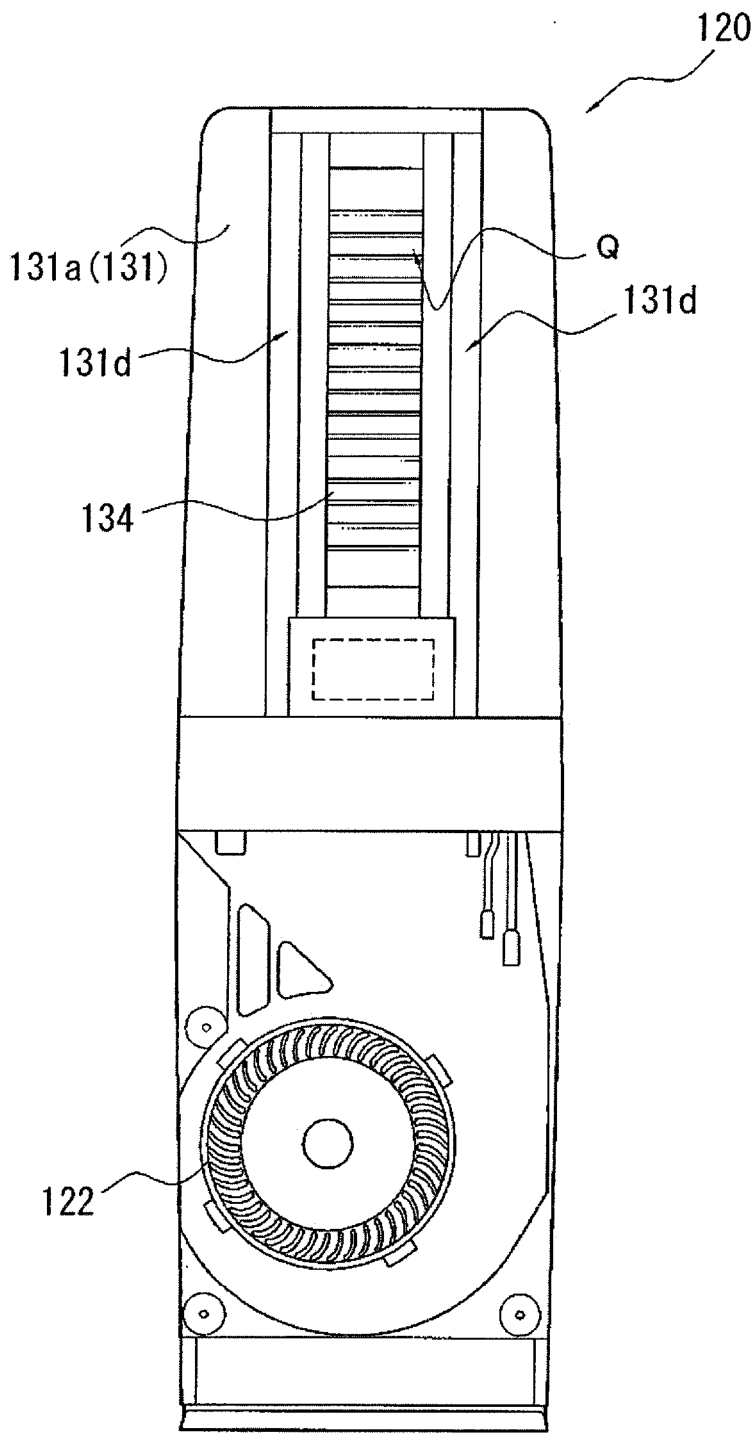


FIG. 11

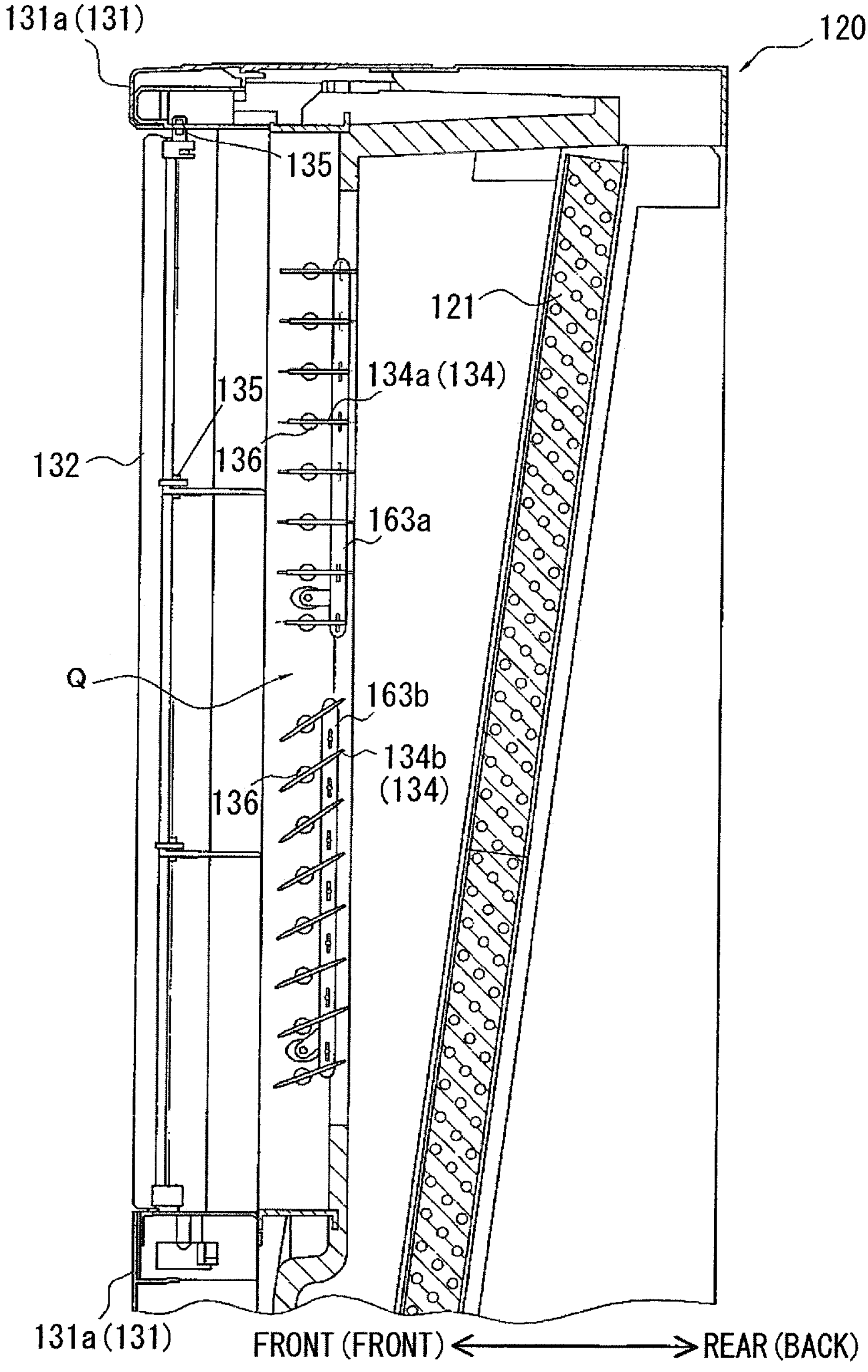

131a (131)
120
135
121
134a (134)
135
136
132
136
163a
Q
163b
134b
(134)
136
131a (131)
FRONT (FRONT)
REAR (BACK)

FIG. 12

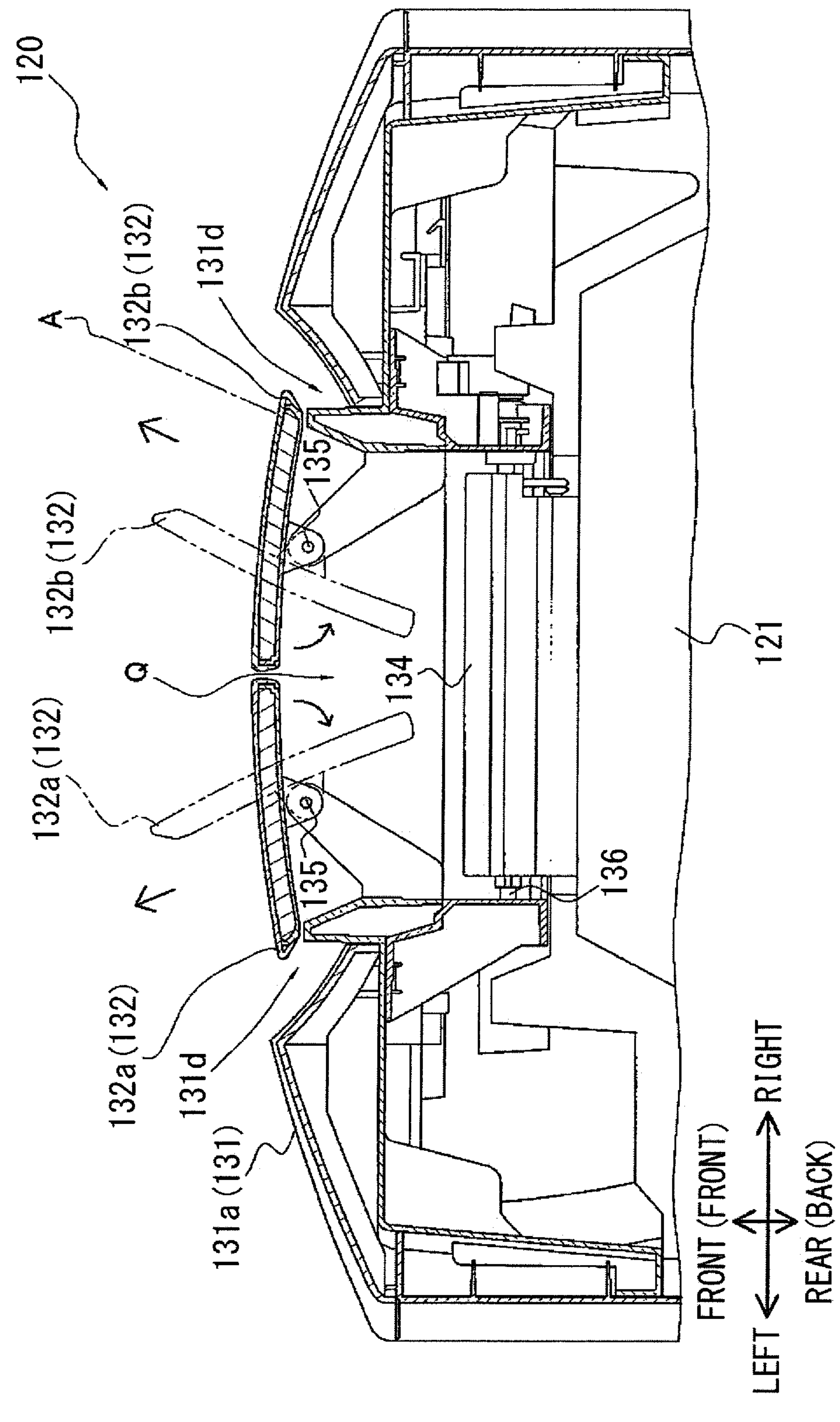

120
A
132b (132)
131d
132b (132)
135
Q
134
121
132a (132)
135
136
132a (132)
131d
131a (131)
FRONT (FRONT)
LEFT
RIGHT
REAR (BACK)

FIG. 13

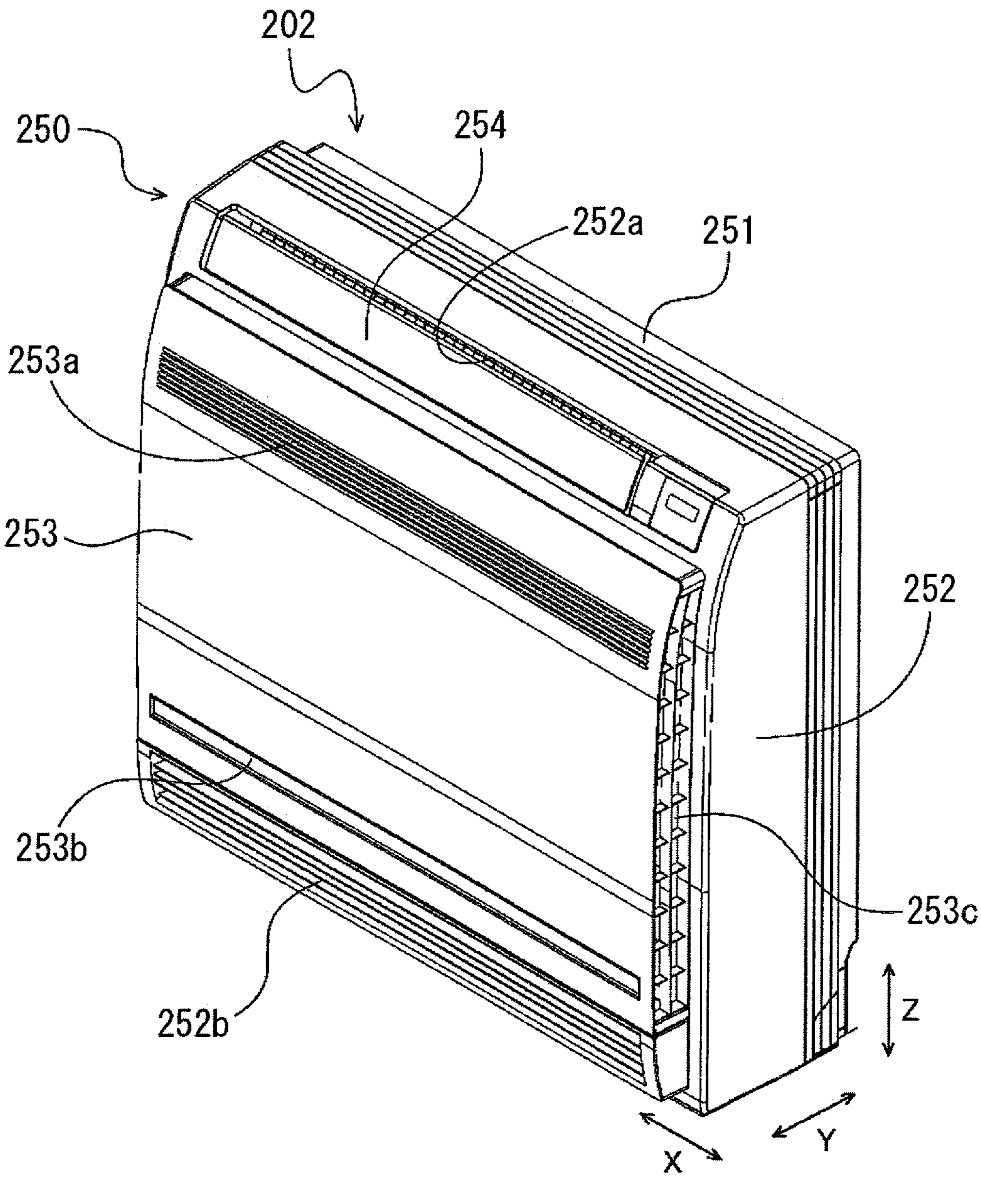


FIG. 14

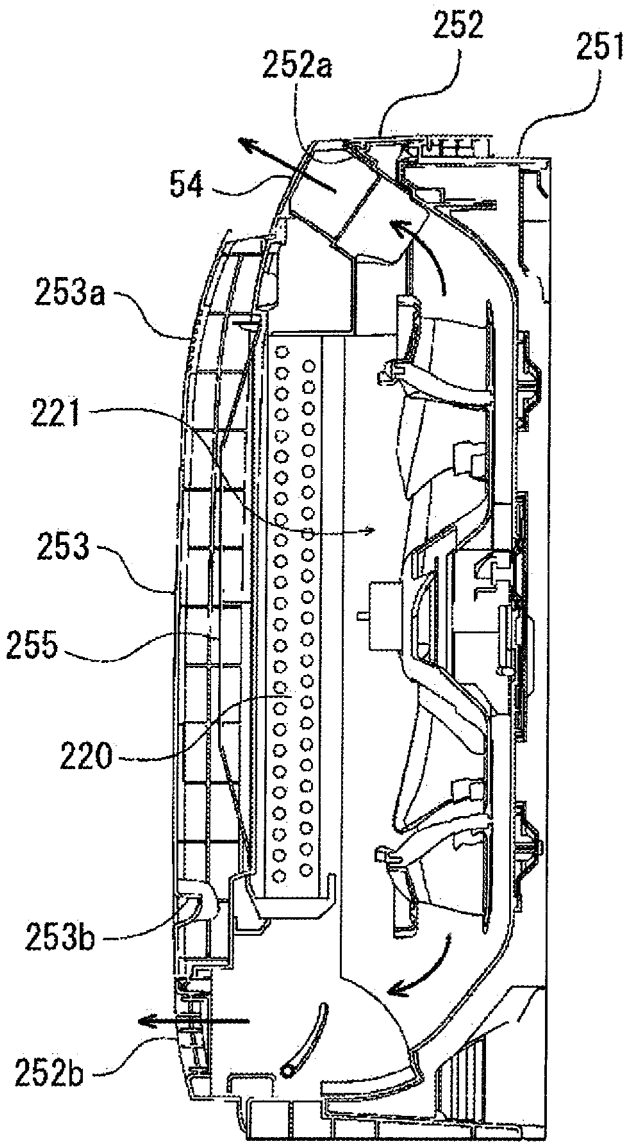
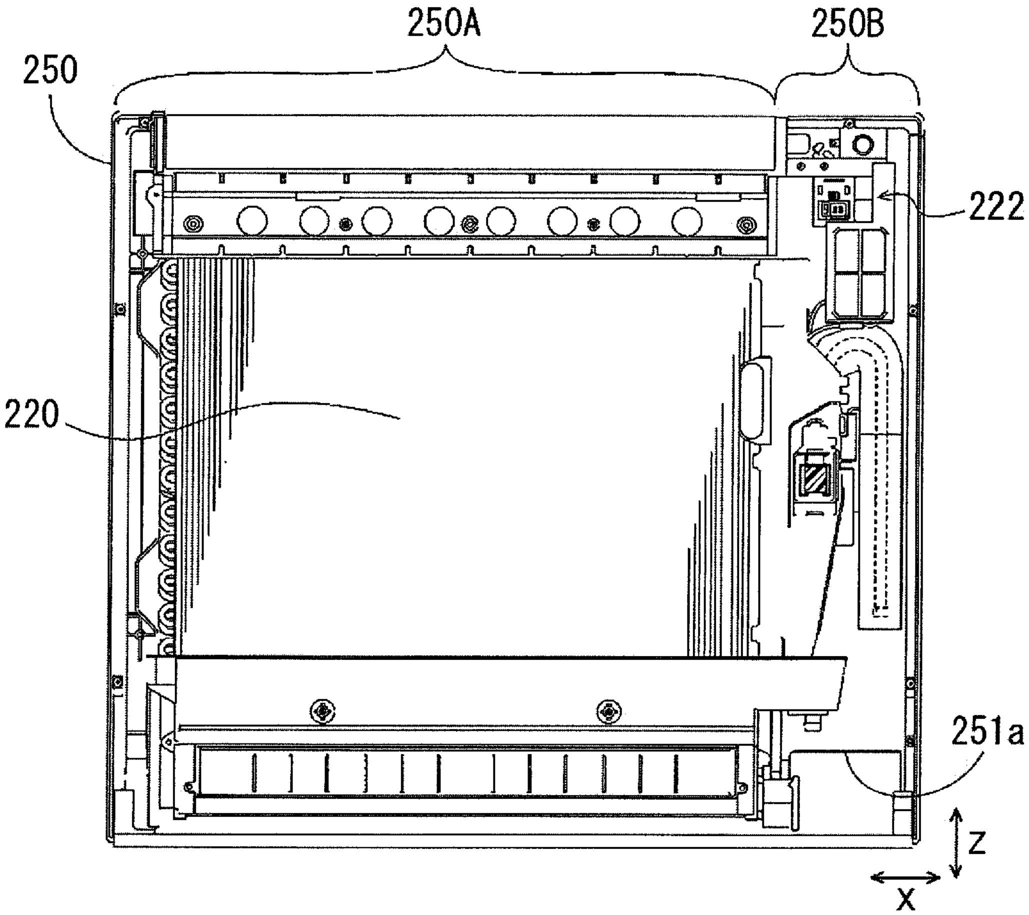


FIG. 15



INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2016/055175

A. CLASSIFICATION OF SUBJECT MATTER
F24F11/02(2006.01)i, *F24F13/20*(2006.01)i, *F24F13/32*(2006.01)i, *F25B1/00*(2006.01)i, *F25B13/00*(2006.01)i, *F25B49/02*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F24F11/02, F24F13/20, F24F13/32, F25B1/00, F25B13/00, F25B49/02

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2016
Kokai Jitsuyo Shinan Koho	1971-2016	Toroku Jitsuyo Shinan Koho	1994-2016

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 Y A	JP 8-200904 A (Sanyo Electric Co., Ltd.), 09 August 1996 (09.08.1996), paragraphs [0012] to [0026]; fig. 1 to 5 (Family: none)	1-2 3 4-6
Y	JP 11-153372 A (Matsushita Electric Industrial Co., Ltd.), 08 June 1999 (08.06.1999), paragraph [0010]; fig. 4 (Family: none)	3

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

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search 17 May 2016 (17.05.16)	Date of mailing of the international search report 24 May 2016 (24.05.16)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

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Patent documents cited in the description

- JP 11037619 A **[0003]**