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(54) Title of the Invention: Indoor unit and air conditioner
Abstract Title: Indoor unit and air conditioner

(57) One embodiment of an indoor unit according to the present disclosure is an indoor unit for an air conditioner, said indoor unit comprising: a blower which has an impeller that is rotatable about a rotation shaft; a bell-mouth which has an inflow port that opens on a first side in the axial direction of the rotation shaft, and which is positioned on the first side of the blower; an electrical component box which is positioned on the first side of the bell-mouth and at least part of which is disposed oppositely from the inflow port in the axial direction; and an air guiding plate which is disposed oppositely from the inflow port in the axial direction and which is disposed so as to face the inside of the electrical component box in a radial direction that is centered on the rotation shaft.

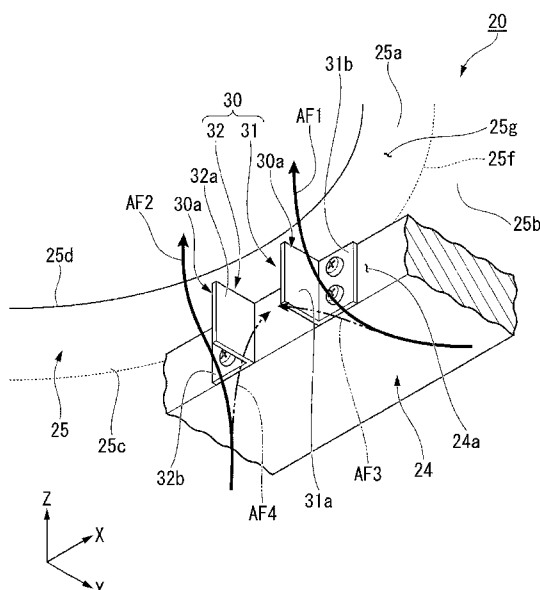


FIG. 1

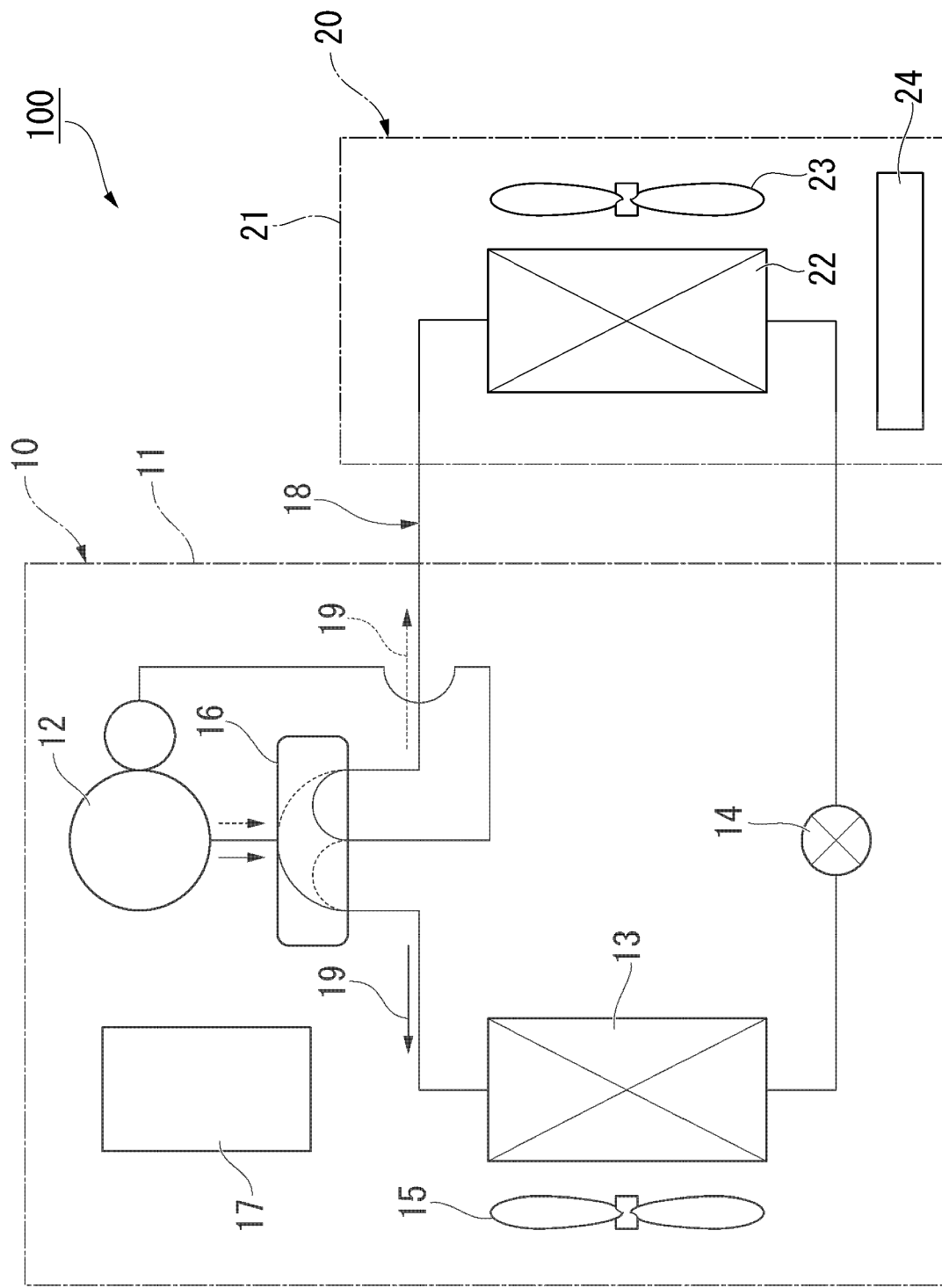


FIG. 2

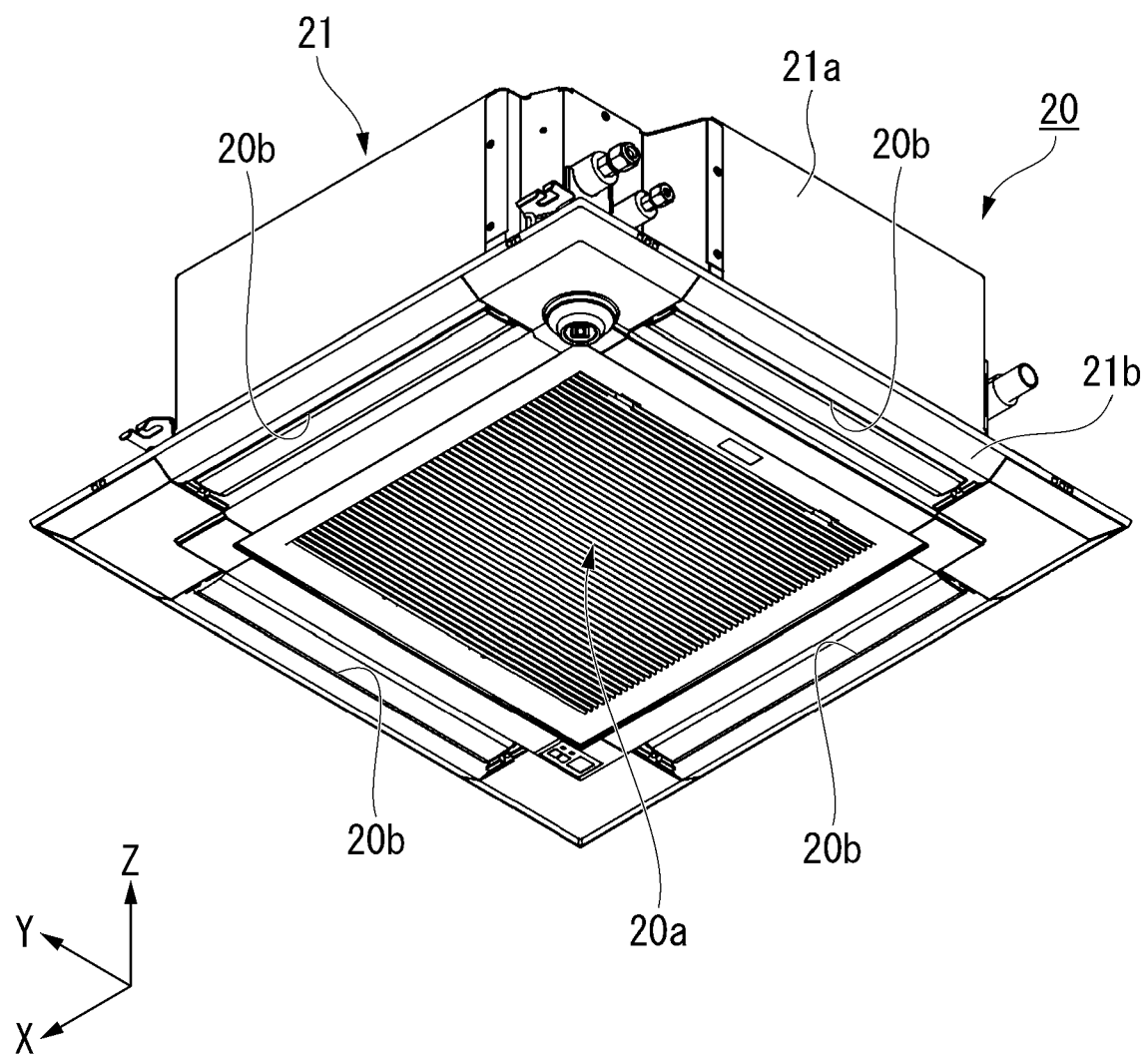
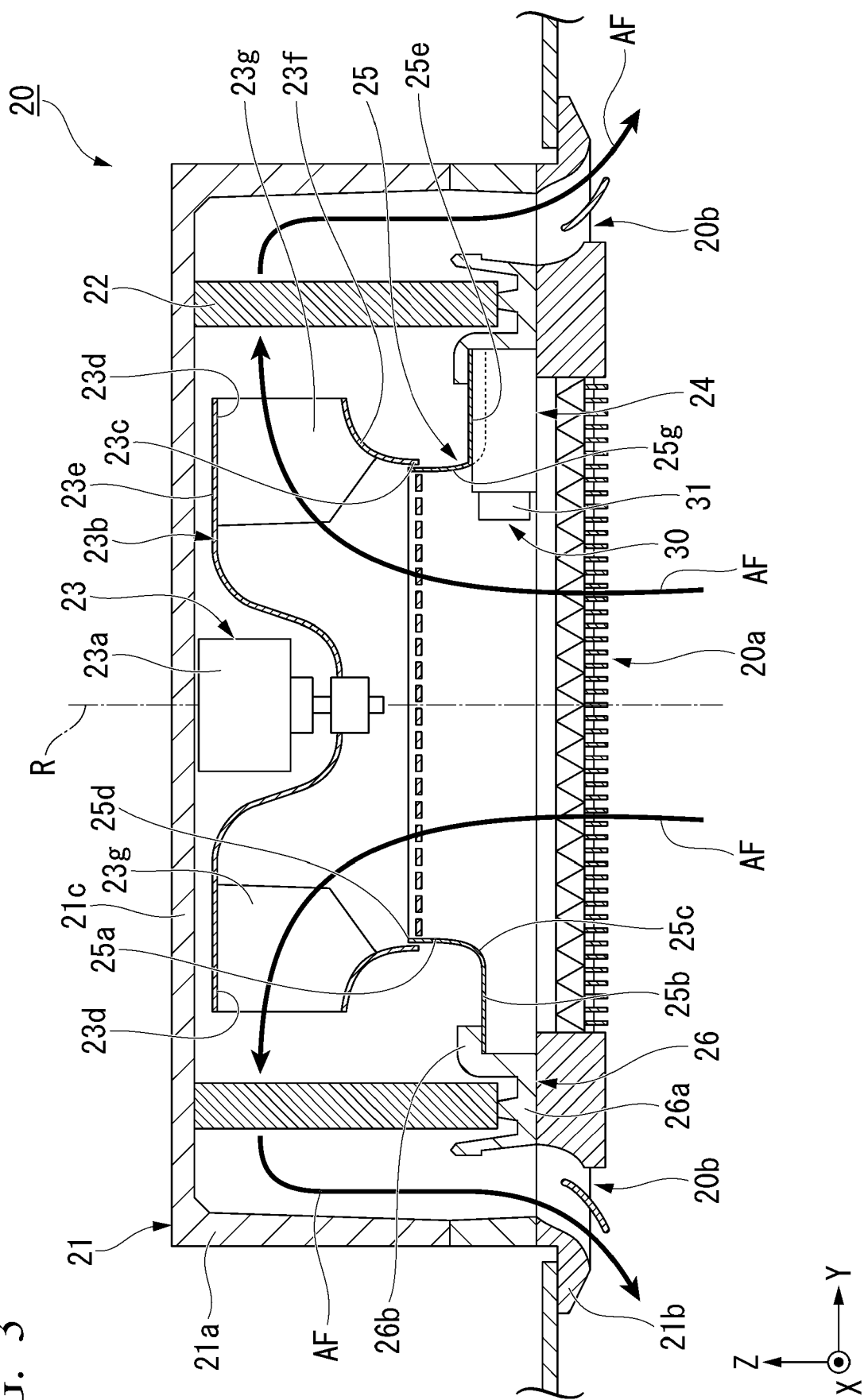


FIG. 3



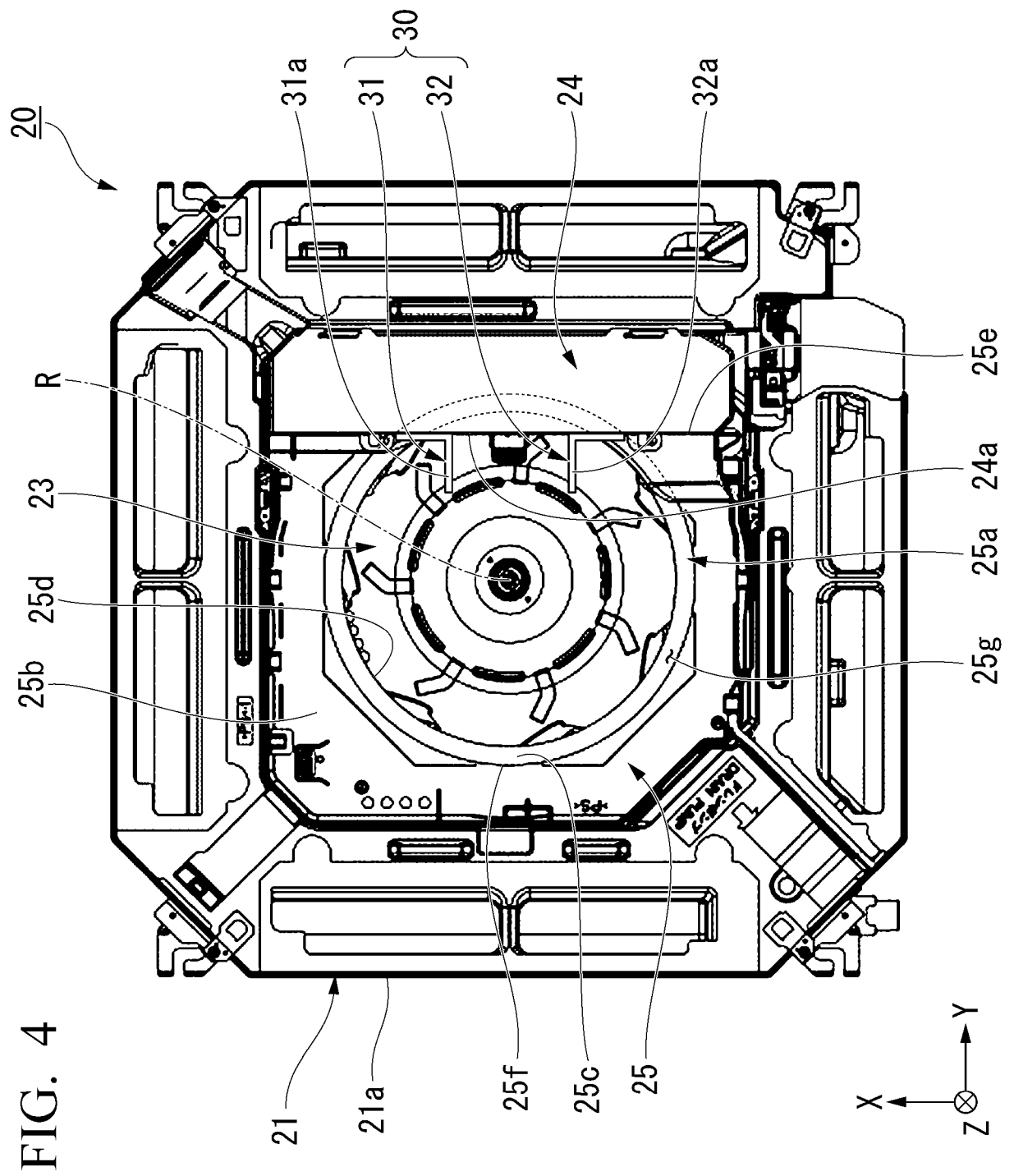


FIG. 5

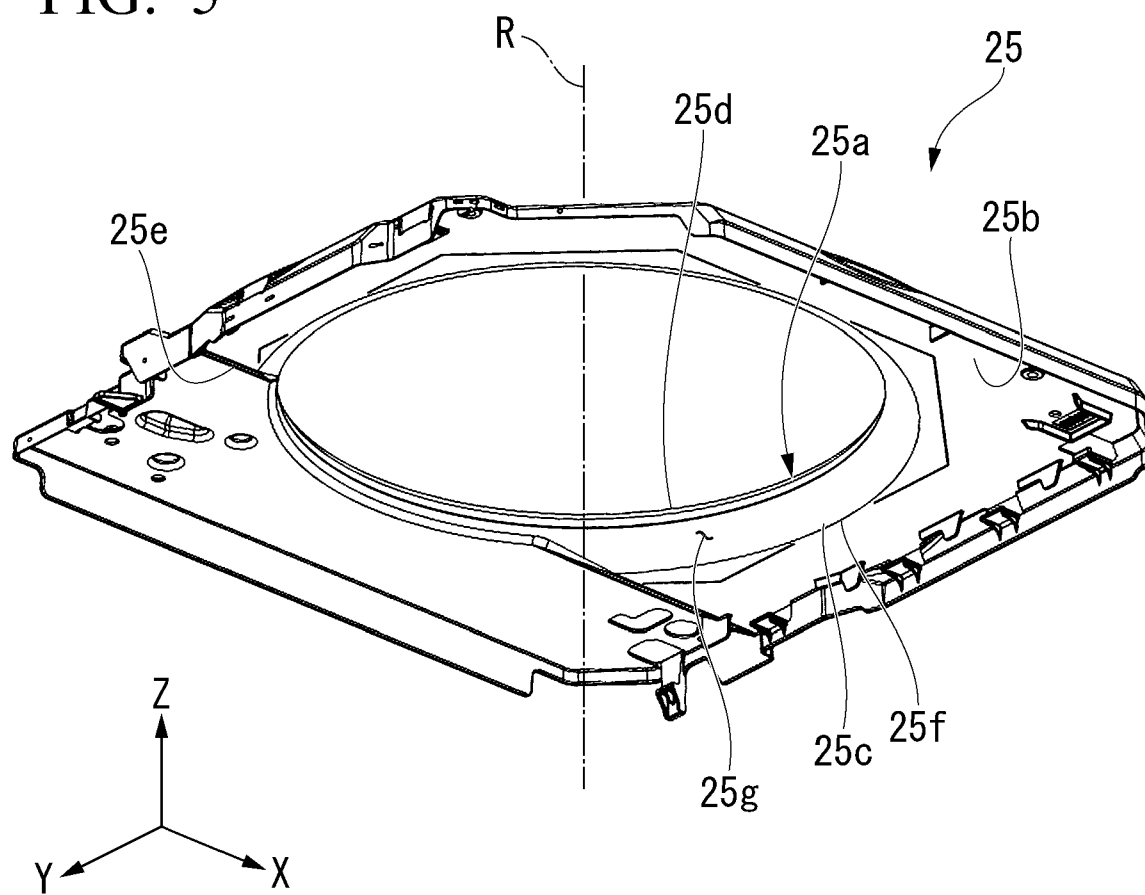


FIG. 6

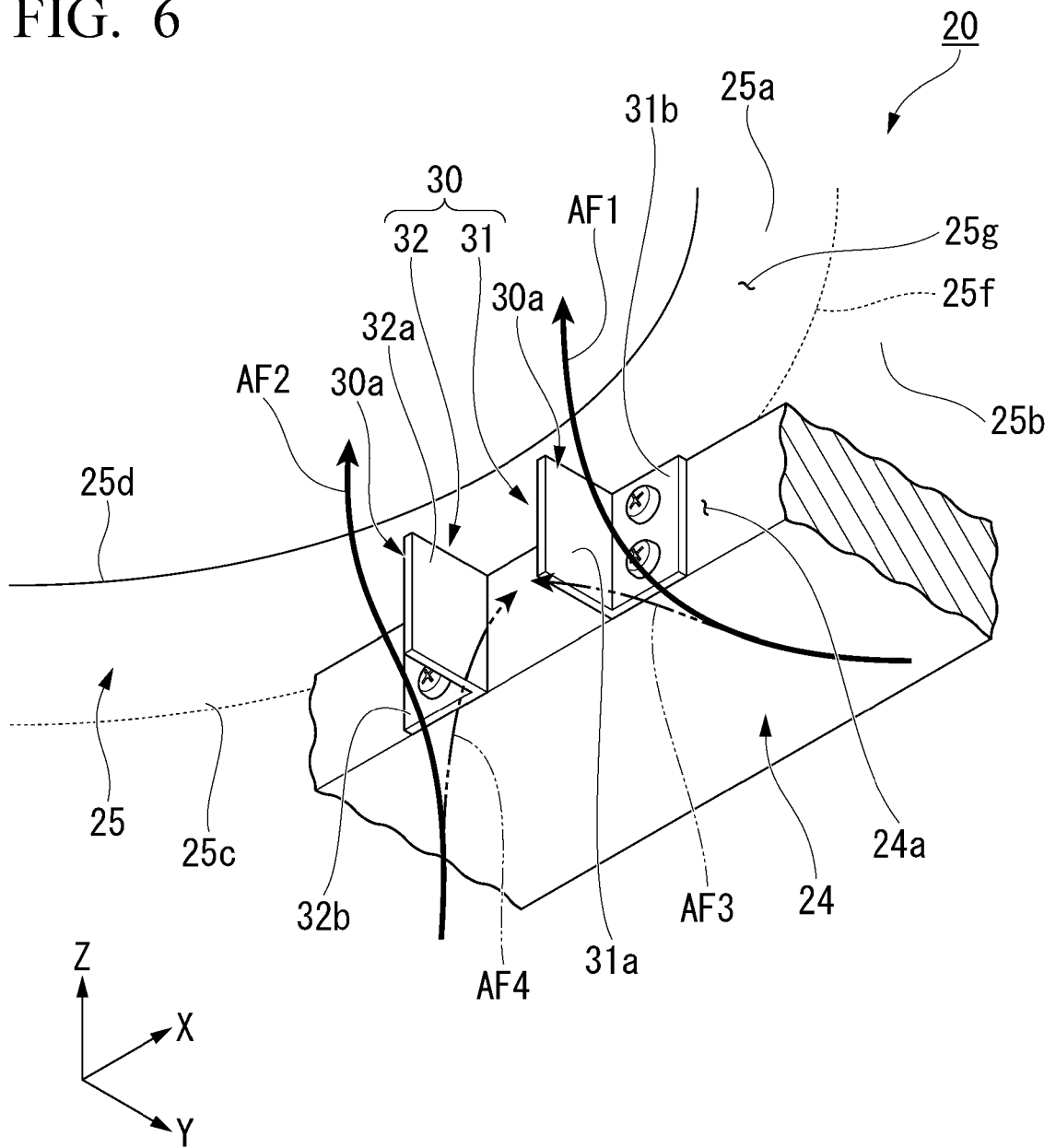


FIG. 8

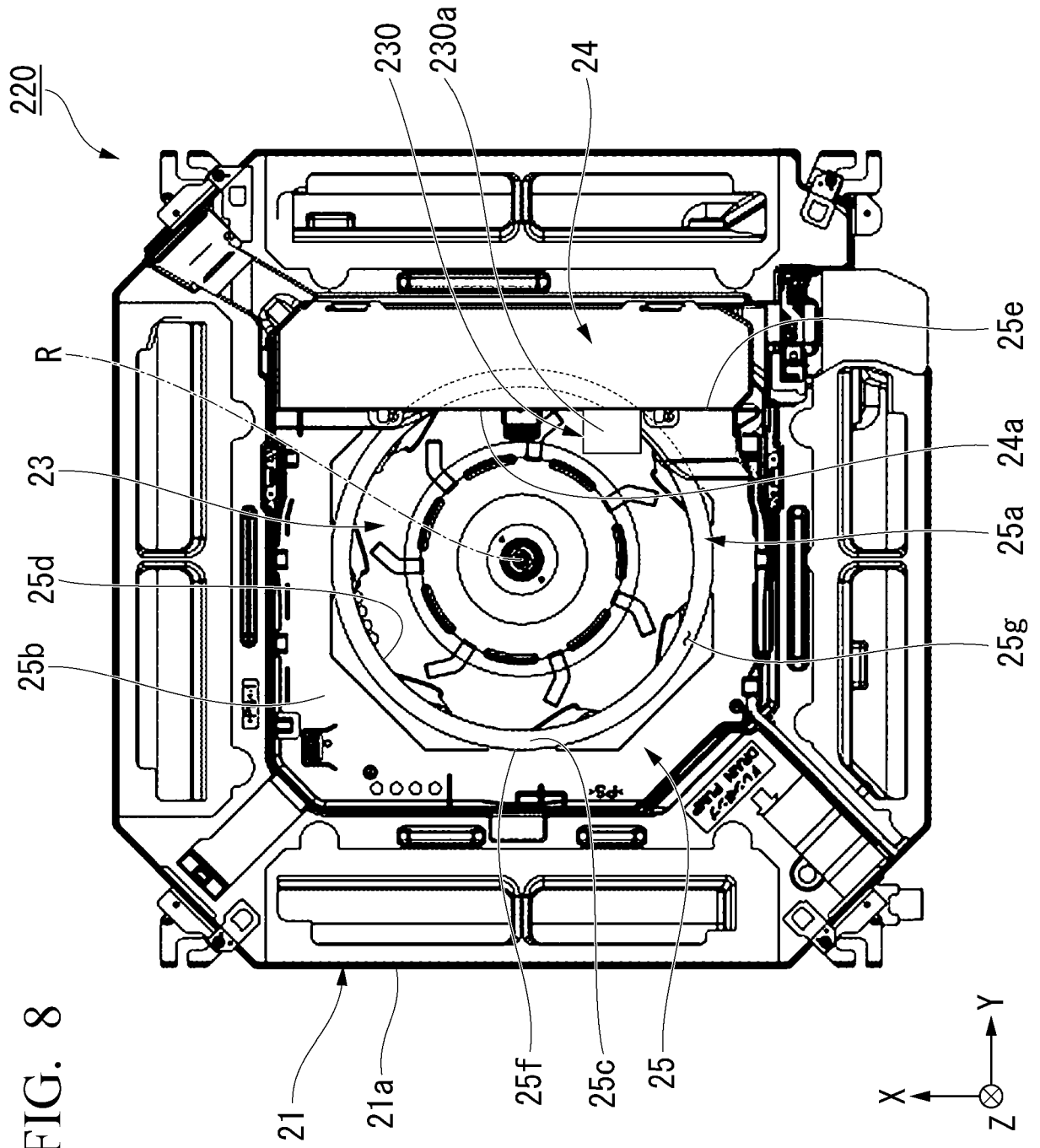


FIG. 9

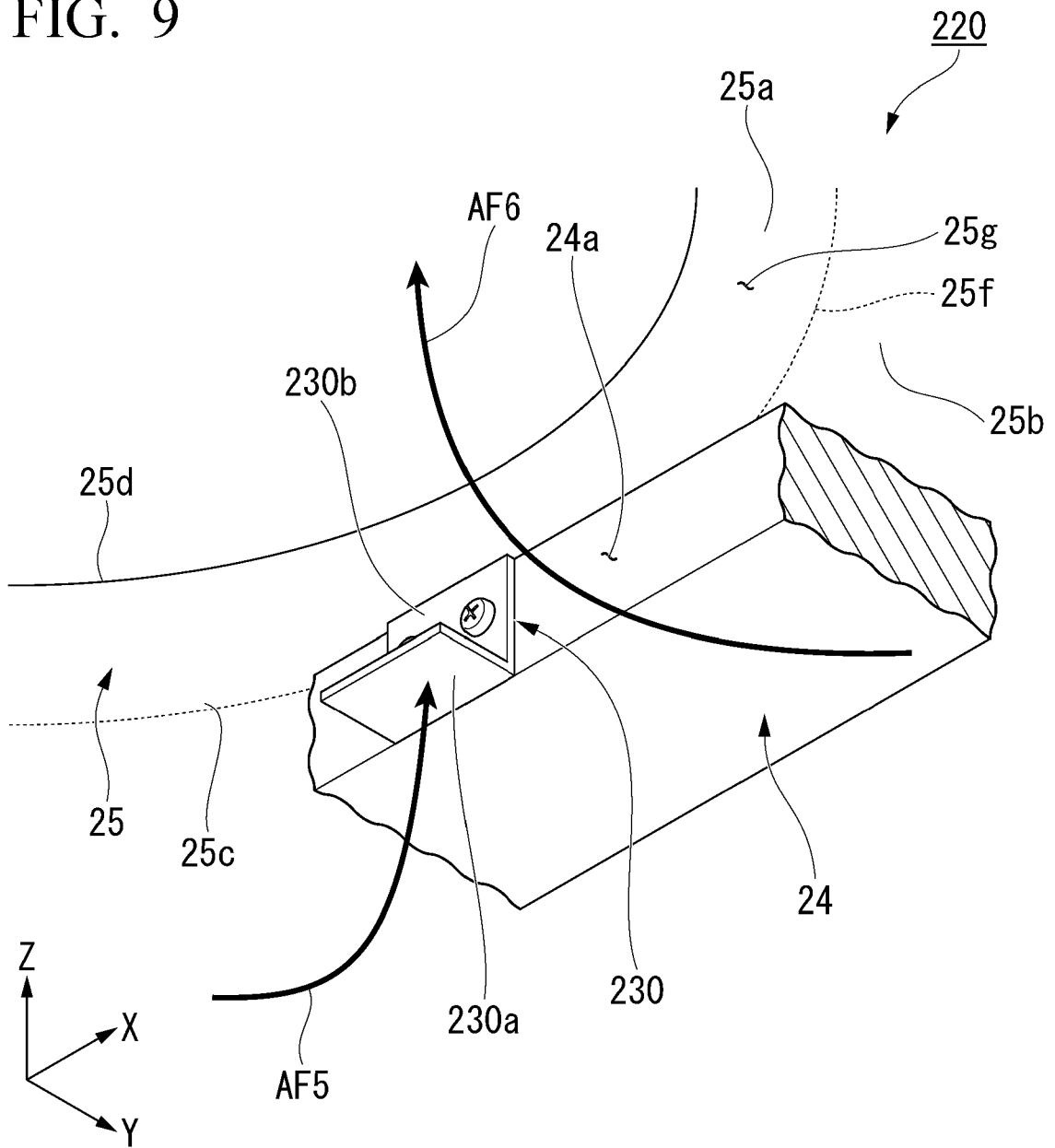
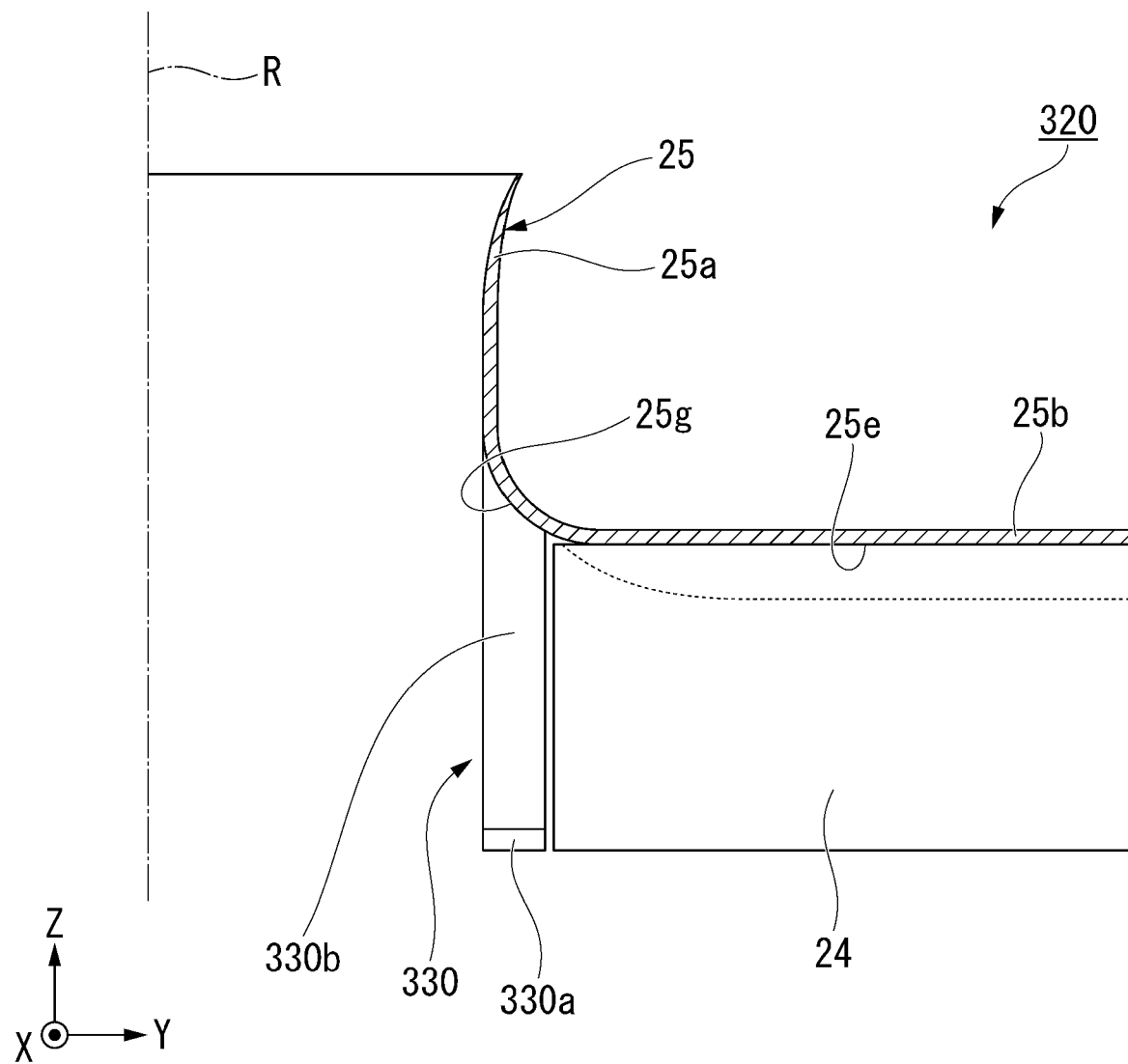


FIG. 10



[DESCRIPTION]

[TITLE OF INVENTION]

INDOOR UNIT AND AIR CONDITIONER

[Technical Field]

[0001]

The following disclosure is related to an indoor unit and an air conditioner.

[Background Art]

[0002]

For example, as shown in Patent Document 1, an indoor unit with of an air conditioner with an electric components box that is disposed so as to face a bell-mouth is known.

[Citation List]

[Patent Document]

[0003]

[Patent Document 1] Japanese Unexamined Patent Application, First Publication No. H10-19370

[Summary of Invention]

[PROBLEM TO BE SOLVED BY THE INVENTION]

[0004]

In an indoor unit such as the indoor unit mentioned above, by disposing at least a portion of an electric components box so as to face an intake port of a bell-mouth, a flow of a portion of air taken into the intake port changes due to the portion that faces the intake port out of the electric components box, and noise is generated due to the air colliding with one another. In contrast, for example, as shown in Patent Document 1, by forming the electric components box so as to be a concave shape or the like, it is possible to prevent having the electric components box face the intake port of the bell-mouth. However, in such a case, a problem of a capacity of the electric components box that is formed into a concave shape being reduced by an amount of a concavity thereof exists.

[0005]

The present disclosure has been made in order to address the problem above, and an object is to provide an indoor unit having an electric components box where it is possible to secure a capacity thereof, as well as having a construction that makes suppression of noise generation possible, and to provide an air conditioner that includes such indoor unit.

[MEANS TO SOLVE THE PROBLEM]

[0006]

An indoor unit of an air conditioner according to an embodiment of the present disclosure includes: a blower that has an impeller that is rotatable around a rotation axis; a bell-mouth having an inflow port that opens to a first direction in an axial direction of the rotation axis, and that is located on the first side of the blower; an electric components box that is located on the first side of the bell-mouth, and that has at least a portion thereof disposed so as to face the inflow port in the axial direction, and an air guide plate that is disposed so as to face the inflow port in the axial direction, and is disposed so as to face an inside of the electric components box in a radial direction with the direction of rotation being a center thereof.

[0007]

An air conditioner according to an embodiment of the present disclosure may include: the indoor unit mentioned above, and an outdoor unit.

[EFFECTS OF THE INVENTION]

[0008]

According to the present disclosure, it is possible to secure capacity of an electric components box, and to suppress noise generation in an indoor unit of an air conditioner.

[Brief Description of Drawings]

[0009]

[FIG. 1] A schematic view that shows an outline configuration of an air conditioner in a first embodiment.

[FIG. 2] A perspective view that shows an indoor unit in the first embodiment.

[FIG. 3] A cross-sectional view that shows the indoor unit in the first embodiment.

[FIG. 4] A view that shows a portion of the indoor unit as seen from a bottom side in the first embodiment.

[FIG. 5] A perspective view that shows a bell-mouth in the first embodiment.

[FIG. 6] A perspective view that shows a portion of an air guide member, an electric components box, and the bell-mouth in the first embodiment.

[FIG. 7] A cross-sectional view that shows an indoor unit in a second embodiment.

[FIG. 8] A view that shows a portion of the indoor unit from the bottom side in the second embodiment.

[FIG. 9] A perspective view that shows an air guide member, an electric components box, and a bell-mouth in the second embodiment.

[FIG. 10] A cross-sectional view that shows a portion of an indoor unit in a third

embodiment.

[Description of Embodiments]

[0010]

Hereinafter, embodiments of the present disclosure are explained with reference to the drawings. The scope of the present disclosure is not limited to the embodiments below, and may be changed so long as the embodiments do not depart from the technical scope of the present disclosure. In the drawings below, scales and dimensions of various configurations may differ from scales and dimensions in the drawings below to facilitate better understanding of the various embodiments.

[0011]

The drawings show an X axis, a Y axis, and a Z axis where appropriate. The X axis shows a side out of sides of a horizontal direction. The Y axis shows another side out of sides of the horizontal direction. The Z axis shows a vertical direction. In the explanation below, a horizontal direction along the X axis is referred to as a “first horizontal direction X”, and a horizontal direction along the Y axis is referred to as a “second horizontal direction Y”. A vertical direction is referred to as a “vertical direction Z”. The front-rear direction X, the left-right direction Y, and the vertical direction Z are mutually orthogonal directions. In the explanation below, a side out of sides of the vertical direction Z in which an arrow of the Z axis faces (+Z side) is a top side. The other side out of sides of the vertical direction Z which faces an opposite side the arrow of the Z axis faces is a bottom side (-Z side). In the embodiments below, the vertical direction Z corresponds to a “rotation axis R” to be mentioned later on. The bottom side in an axial direction of the rotation axis R corresponds to a first side, and a top side in the axial direction of the rotation axis R that is opposite to the first side corresponds to a “second side”.

[0012]

First Embodiment

FIG. 1 is a schematic view that shows an outline configuration of an air conditioner 100 in a first embodiment. As shown in FIG. 1, the air conditioner 100 includes an outdoor unit 10, an indoor unit 20, and a circulation path 18. The outdoor unit 10 is disposed outdoors. The indoor unit 20 is disposed indoors. The outdoor unit 10 and the indoor unit 20 are connected by the circulation path 18 that circulates a refrigerant 19.

[0013]

By having the refrigerant 19 that flows within the circulation pathway 18, and the indoor unit 20 conduct heat exchange with the air indoors, it is possible for the air

conditioner 100 to adjust a temperature of the air indoors. A refrigerant such as a fluorine based refrigerant with a low global warming potential (GWP: Global Warming Potential), or a hydrocarbon based refrigerant or the like may be mentioned as examples of the refrigerant 19.

[0014]

The outdoor unit 10 includes a housing 11, a compressor 12, a heat exchange device 13, a flow adjustment valve 14, a blower 15, a four-way valve 16, and a control portion 17. The compressor 12, the heat exchange device 13, the flow adjustment valve 14, the blower 15, the four-way valve 16, and the control portion 17 are housed on an inner portion of the housing 11.

[0015]

Out of the circulation pathway 18, the compressor 12, the heat exchange device 13, the flow adjustment valve 14, and the four-way valve 16 are provided on a portion located on the inside portion of the housing 11. Out of the circulation pathway 18, the compressor 12, the heat exchange device 13, the flow adjustment valve 14, and the four-way valve 16 are connected by a portion located on the inside portion of the housing 11.

[0016]

Out of the circulation pathway 18, the four-way valve 16 is provided on a portion that is connected to a discharge side of the compressor 12. By exchanging a part of the circulation pathway 18, it is possible for the four-way valve 16 to reverse a direction of flow of the refrigerant 19 within the circulation pathway 18. When the path connected by the four-way valve 16 is the path of the four-way valve 16 that is shown by solid lines in FIG. 1, the refrigerant 19 within the circulation pathway 18 flows in the direction shown by the solid line arrow in FIG. 1. On the other hand, when the path connected by the four-way valve 16 is the path of the four-way valve 16 that is shown by dashed lines in FIG. 1, the refrigerant 19 flows within the circulation pathway 18 in the direction shown by the dashed line arrow in FIG. 1.

[0017]

The indoor unit 20 includes a housing 21, a heat exchange device 22, and a blower 23. It is possible for the indoor unit 20 to have a cooling operation where the air of the room the indoor unit 20 is disposed in is cooled, and to have a heating operation where the air of the room the indoor unit 20 is disposed in is heated.

[0018]

When the indoor unit 20 is operated in the cooling operation, the refrigerant 19 that flows within the circulation pathway 18 flows in the direction shown by solid lines in

FIG. 1. In other words, when the indoor unit 20 is operated in the cooling operation, the refrigerant 19 that flows within the circulation pathway 18 circulates so as to return to the compressor 12 after passing through the compressor 12, the heat exchange device 13 of the outdoor unit 10, the flow adjustment valve 14, and the heat exchange device 22 of the indoor unit 20 in such an order. During the cooling operation, the heat exchange device 13 of the outdoor unit 10 functions as a condenser, and the heat exchange device 22 of the indoor unit 20 functions as an evaporator.

[0019]

On the other hand, when the indoor unit 20 is operated in the heating operation, the refrigerant 19 that flows within the circulation pathway 18 flows in the direction shown by dashed lines in FIG. 1. In other words, when the indoor unit 20 is operated in the heating operation, the refrigerant 19 that flows within the circulation pathway 18 circulates so as to return to the compressor 12 after passing through the compressor 12, the heat exchange device 22 of the indoor unit 20, the flow adjustment valve 14, and the heat exchange device 13 of the outdoor unit 10 in such an order. During the heating operation, the heat exchange device 13 of the outdoor unit 10 functions as the evaporator, and the heat exchange device 22 of the indoor unit 20 functions as the condenser.

[0020]

Next, the indoor unit 20 of the first embodiment is explained in further detail. FIG. 2 is a perspective view that shows the indoor unit 20. FIG. 3 is a cross-sectional view that shows the indoor unit 20. As shown in FIG. 2 and in FIG. 3, the indoor unit 20 in the first embodiment is a ceiling-mounted indoor unit that is mounted to a ceiling. As shown in FIG. 3, the indoor unit 20 further includes an electric components box 24, a bell-mouth 25, and a drain pan 26. The housing 21 houses a heat exchanger 22, the blower 23, the electric components box 24, the bell-mouth 25, and the drain pan 26 on an inside thereof.

[0021]

The housing 21 has a housing main body 21a, and a decorative panel 21b attached to the bottom side of the housing main body 21a. The housing main body 21a houses the heat exchanger 22, the blower 23, the electric components box 24, the bell-mouth 25, and the drain pan 26 on an inside thereof. The housing main body 21a is mounted so as to be embedded in the ceiling, in the indoors where the indoor unit 20 is mounted. The decorative panel 21b is exposed to the indoors where the indoor unit 20 is mounted.

[0022]

The housing 21 has an intake port 20a and an exhaust port 20b. The intake port 20a and the exhaust port 20b open to a bottom surface of the decorative panel 21b. As shown in FIG. 2, the intake port 20a is located in a center of the indoor unit 20, as seen from the vertical direction Z. A plurality of exhaust ports 20b are provided. The plurality of exhaust ports 20b are disposed so as to surround the intake port 20a, as seen from the vertical direction Z. Four exhaust ports 20b are provided.

[0023]

As shown in FIG. 3, the blower 23 is fixed to a lower surface of a ceiling plate 21c of the housing main body 21a. The blower 23 has a drive portion 23a and an impeller 23b. The drive portion 23a causes the impeller 23b to rotate around the rotation axis R. The rotation axis R appropriately shown on the drawings is an imaginary axis that extends in the vertical direction Z. In other words, the axial direction of the rotation axis R is the vertical direction Z. The rotation axis R, as seen from the vertical direction Z, passes through a center of the indoor unit 20. In the explanations below, unless otherwise specified, a radial direction having the rotation axis R as a center is simply referred to as a “radial direction”, and a circumferential direction surrounding the rotation axis R is simply referred to as a “circumferential direction”.

[0024]

The drive portion 23a in the first embodiment is a motor. The drive portion 23a is fixed to a bottom surface of the ceiling plate 21c. So long as it is possible for the drive portion 23a to cause the impeller 23b to rotate about the rotation axis R, any configuration thereof may be adopted.

[0025]

The impeller 23b is rotatable around the rotation axis R. The impeller 23b is linked to a bottom side of the drive portion 23a. The impeller 23b is rotated around the rotation axis R by the drive portion 23a. The impeller 23b has a base 23e that is connected to the drive portion 23a and that extends to the outside in the radial direction from the drive portion 23a, a shroud 23f that is disposed on a bottom side of the base 23e with a space between, and a plurality of blades 23g that are disposed in a space in the vertical direction Z between the base 23e and the shroud 23f.

[0026]

The shroud 23f is a cylindrical shape that opens to both sides in the vertical direction Z, with the rotation axis R as a center thereof. An inner diameter of the shroud 23f and an outer diameter of the shroud 23f become larger as said diameters approach the top side. A bottom end of the shroud 23f is an air intake port 23c that opens to a bottom side thereof. A top end of the shroud 23f is an edge in the radial direction of

the shroud 23f.

[0027]

A plurality of air exhaust ports 23d that open to the outside in the radial direction are formed by having the space between an edge of the shroud 23f in the radial direction and an edge of the base 23e in the radial direction be partitioned off by the plurality of blades 23g in the circumferential direction. The plurality of air exhaust ports 23d are disposed over an entire circumference of the circumferential direction with a space between each port thereof. Each of the air exhaust ports 23d is disposed so as to face the heat exchanger 22 on the outside in the radial direction. Spaces between each of the plurality of air exhaust ports 23d may be equal, or may be different from one another.

[0028]

Air is blown to the heat exchanger 22 by the blower 23. The heat exchanger 22 is a frame shaped that surrounds the blower 23. The heat exchanger 22 is disposed so as to face the air exhaust port 23d of the blower 23.

[0029]

The drain pan 26 is located on a bottom side of the heat exchanger 22. The drain pan 26 is a frame shape that surrounds the rotation axis R, as seen from the vertical direction Z. The drain pan 26 has a drain pan main body 26a and a flange 26b. The drain pan main body 26a is located on the bottom side of the heat exchanger 22. The drain pan main body 26a is a frame shape that surrounds the rotation axis R, as seen from the vertical direction Z. It is possible for the drain pan main body 26a to collect condensation water that has formed on an outside surface of the heat exchanger 22 from a bottom thereof. The flange 26b protrudes to an inside in the radial direction from a top end on an inside edge of the drain pan main body 26a in the radial direction. The flange 26b is a frame shape that surrounds the rotation axis R, as seen from the vertical direction Z.

[0030]

The bell-mouth 25 is located on the bottom side of the blower 23. The bell-mouth 25 is a member for guiding the air to the air intake port 23c of the blower 23. The bell-mouth 25 for example, is made of resin. FIG. 4 is a view that shows a portion of the indoor unit 20 as seen from a bottom side. In FIG. 4, the decorative panel 21b is omitted from the figure thereof. FIG. 5 is a perspective view that shows the bell-mouth 25. As shown from FIG. 3 to FIG. 5, the bell-mouth 25 has a bell-mouth main body 25a and a fixed portion 25b.

[0031]

The bell-mouth main body 25a is a cylindrical shape that opens to both sides in the vertical direction Z, with the rotation axis R as a center thereof. As shown in FIG. 3, an inner diameter of the bell-mouth main body 25a and an outer diameter of the bell-mouth main body 25a become smaller as the diameters thereof approach the top side. An inclination towards the vertical direction Z of an inner surface 25g of the bell-mouth main body 25a is a curve that extends and becomes smaller as the top side is approached. A top end of the bell-mouth main body 25a is inserted through an inside of the air intake port 23c of the blower 23.

[0032]

The fixed portion 25b expands from a bottom end on the outside in the radial direction of the bell-mouth main body 25a. As shown in FIG. 4 and FIG. 5, the fixed portion 25b is a semi-rectangular frame. The fixed portion 25b is a plate that has a plate surface which faces the vertical direction Z. As shown in FIG. 3, an outside edge in the radial direction of the fixed portion 25b is located on a bottom side of the flange 26b of the drain pan 26. The fixed portion 25b is fixed to the flange 26b by bolts or the like. As such, the bell-mouth 25 is fixed to the drain pan 26.

[0033]

As shown in FIG. 5, a recess 25e that recesses to the top side is formed on a bottom surface of the fixed portion 25b. The recess 25e is formed on a portion on one side (+Y side) in the second horizontal direction Y out of the fixed portion 25b. The recess 25e extends in the first horizontal direction X. An edge on the inside in the radial direction on a center of the first horizontal direction X out of the recess 25e is formed into the bell-mouth main body 25a. As shown in FIG. 3, a portion out of the fixed portion 25b in which the recess 25e is formed protrudes to the top side more than the portion out of the fixed portion 25b in which the recess 25e is not formed.

[0034]

The bell-mouth 25 has an inflow port 25c that opens to the first side in the axial direction of the rotation axis R, in other words the bottom side. The inflow port 25c is a bottom end of the bell-mouth main body 25a. The inflow port 25c is a circular shape with the rotation axis R as a center thereof. The inflow port 25c is disposed on a top side of the intake port 20a of the indoor unit 20, with an interval therebetween. An inner edge of the inflow port 25c is located more to the inside in the radial direction than an inner edge of the intake port 20a.

[0035]

The bell-mouth 25 has an outflow port 25d that opens to the second side that is an opposite side to the first side in the axial direction of the rotation axis R, in other words

the top side. The outflow port 25d is a top end of the bell-mouth main body 25a. The outflow port 25d is located on the inside of the air intake port 23c of the blower 23. As shown in FIG. 5, the outflow port 25d is a circular shape with the rotation axis R as a center thereof. An inner edge of the outflow port 25d is located to the inside in the radial direction more than the inner edge of the inflow port 25c. An inner diameter of the outflow port 25d is smaller than an inner diameter of the inflow port 25c. The inner diameter of the outflow port 25d is smaller than the inner diameter of the air intake port 23c of the blower 23.

[0036]

FIG. 6 is a perspective view that shows a portion of an air guide member 30 in the first embodiment to be mentioned later on, the electric components box 24, and the bell-mouth 25. As shown in FIG. 4 and in FIG. 6, the electric components box 24 is a semi-rectangular box that extends in the first horizontal direction X. Although omitted from the drawings, electronic components such as a circuit board or the like are housed on an inside of the electric components box 24. The electronic components housed on the inside of the electric components box 24 configure a controller that controls the indoor unit 20. Said controller controls the blower 23 by controlling the drive portion 23a.

[0037]

The electric components box 24 is located on the bottom side of the bell-mouth 25. The electric components box 24 is attached to the bottom surface of the fixed portion 25b of the bell-mouth 25. The electric components box 24 is in contact with the bottom surface of the fixed portion 25b. As shown in FIG. 3, a top end of the electric components box 24 is fitted to an inside of the recess 25e that is formed on the bottom surface of the fixed portion 25b. The electric components box 24 sandwiches the fixed portion 25b in between with the flange 26b of the drain pan 26. As shown in FIG. 4, the electric components box 24 protrudes to both sides in the first horizontal direction X more than the bell-mouth main body 25a.

[0038]

At least a portion of the electric components box 24 is disposed so as to face the inflow port 25c of the bell-mouth 25 in the vertical direction Z. As shown in FIG. 4 and in FIG. 6, in the first embodiment, a portion on the inside in the radial direction in the center of the first horizontal direction X out of the electric components box 24 is disposed so as to face the inflow port 25c, in the vertical direction Z. The portion on the inside in the radial direction in the center of the first horizontal direction X out of the electric components box 24, protrudes to the inside in the radial direction more than a

boundary 25f of the fixed portion 25b and the bell-mouth main body 25a. The boundary 25f is a boundary between the inner surface 25g of the inflow port 25c and the bottom surface of the fixed portion 25b.

[0039]

At least a portion of the electric components box 24 overlaps with the outflow port 25d of the bell-mouth 25, as seen from the vertical direction Z. In the first embodiment, a portion on the inside in the radial direction of the portion that overlaps with the inflow port 25c out of the electric components box 24 as seen from the vertical direction Z, overlaps with the outflow port 25d, as seen from the vertical direction Z. As shown in FIG. 3, a portion on the inside in the radial direction of the electric components box 24 is located on a top side of the outside edge in the radial direction of the intake port 20a, and is disposed so as to face the outside edge in the radial direction of the intake port 20a in the vertical direction Z.

[0040]

As shown in FIG. 6, the indoor unit 20 includes the air guide member 30. The air guide member 30 is for example, made of resin. A plurality of air guide members 30 in the first embodiment are disposed with intervals therebetween in the first horizontal direction X. As the air guide member 30, two air guide members, an air guide member 31 and an air guide member 32 are provided. The two air guide members 31 and 32 are disposed so as to be symmetrical to one another in the first horizontal direction X. The air guide members 31 and 32 are fixed to the electric components box 24. More specifically, the air guide members 31 and 32 are fixed by bolts to an attachment surface 24a, which is a surface that faces the inside in the radial direction out of outer surfaces of the electric components box 24. The attachment surface 24a is a surface on the inside in the radial direction of the portion that overlaps with the inflow port 25c out of the electric components box 24, as seen from the vertical direction Z. The attachment surface 24a is a portion of a surface on the other side (-Y side) of the second horizontal direction Y out of the electric components box 24. The attachment surface 24a is located on the inside in the radial direction more than the inner edge of the inflow port 25c. The attachment surface 24a is a flat surface that is orthogonal with the second horizontal direction Y.

[0041]

The air guide member 31 is separately located on one side (+X side) of the first horizontal direction X of the air guide member 32. The air guide member 31 has an air guide plate 31a, and a fixing portion 31b. Since the air guide member 30 is made of resin in the first embodiment, the air guide plate 31a and the fixing portion 31b are

also made of resin.

[0042]

The air guide plate 31a is disposed so as to face the inside of the electric components box 24 in the radial direction, having the rotation axis R be a center thereof. The air guide plate 31a in the first embodiment is attached to the electric components box 24. More specifically, the air guide plate 31a is attached to the attachment surface 24a of the electric components box 24 via the fixing portion 31b. The air guide plate 31a protrudes to the inside in the radial direction from the attachment surface 24a of the electric components box 24. In the first embodiment, the air guide plate 31a protrudes to the other side (-Y side) of the second horizontal direction Y from the attachment surface 24a.

[0043]

The air guide plate 31a is a rectangular plate. A plate surface of the air guide plate 31a faces an intersecting direction where both the radial direction and the axial direction of the rotation axis R intersect. The intersecting direction that the plate surface of the air guide plate 31a faces in the first embodiment is the first horizontal direction X. The plate surface of the air guide plate 31a is orthogonal to the first horizontal direction X. As shown in FIG. 4, the air guide plate 31a is located to the one side (+X side) of the first horizontal direction X, more than the rotation axis R. The air guide plate 31a is separately located in the first horizontal direction X from both ends in the first horizontal direction X of a portion that overlaps with the inflow port 25c out of the electric components box 24, as seen from the vertical direction Z.

[0044]

The air guide plate 31a is disposed so as to face the inflow port 25c of the bell-mouth 25 in the vertical direction Z. The air guide plate 31a in the first embodiment is located to the inside in the radial direction more than an inner edge of the outflow port 25d. In other words, the air guide plate 31a overlaps with the outflow port 25d, as seen from the vertical direction Z. As seen from the vertical direction Z, an end on the inside in the radial direction of the air guide plate 31a is located to the outside in the radial direction, more than a center in the radial direction in the space between the rotation axis R and the inner edge of the outflow port 25d. A location of the second horizontal direction Y in the end on the inside in the radial direction of the air guide plate 31a is a location that is closer to the attachment surface 24a, more than the center of the second horizontal direction Y in the space between the rotation axis R and the attachment surface 24a.

[0045]

As shown in FIG. 6, the air guide plate 31a extends in the vertical direction Z from a top end to a bottom end of the electric components box 24. A top end of the air guide plate 31a is located on the same location as the top end of the electric components box 24 in the vertical direction Z. A bottom end of the air guide plate 31a is located on the same location as the bottom end of the electric components box 24 in the vertical direction Z. It is preferable that a plate thickness of the air guide plate 31a be an appropriate thickness that is large enough so as to make it hard for the air guide plate 31a to vibrate due to flow of the air that flows in from the inflow port 25c, and that is small enough so as to make it difficult for the air guide plate 31a to impose any resistance to the air that flows in from the inflow port 25c. It is preferable that the thickness of the air guide plate 31a be greater than or equal to 1mm, and less than or equal to 5mm. It is more preferable that the thickness be approximately 2mm. Further, the thickness of the air guide plate 31a is not in particular, limited to the aforementioned numerical range or values.

[0046]

The fixing portion 31b protrudes to the one side (+X side) of the first horizontal direction X from an end on the one side (+Y side) of the second horizontal direction Y, out of the air guide plate 31a. The fixing portion 31b is fixed to the electric components box 24. Accordingly, the air guide member 31 is fixed to the electric components box 24. The fixing portion 31b in the first embodiment is fixed to the attachment surface 24a by two bolts. The fixing portion 31b is a rectangular plate. A surface of the fixing portion 31b faces the second horizontal direction Y.

[0047]

The air guide member 32 is separately located on the other side (-X side) of the first horizontal direction X of the air guide member 31. The air guide member 32 has an air guide plate 32a and a fixing portion 32b. Accordingly, the indoor unit 20 in the first embodiment includes two air guide plates, the air guide plate 31a and the air guide plate 32a. The two air guide plates 31a and 32a are disposed so as to align with intervals therebetween in the intersecting direction to which plate surfaces of the two air guide plates 31a and 32a face, in other words, the first horizontal direction X. Other than an aspect of a location in the first horizontal direction X, a configuration of the air guide plate 32a is the same as the configuration of the air guide plate 31a. As shown in FIG. 4, the air guide plate 32a is located on the other side (-X side) of the first horizontal direction X, more than the rotation axis R. The air guide plate 32a is separately disposed in the first horizontal direction X from both ends of the first horizontal direction X of the portion that overlaps with the inflow port 25c out of the

electric components box 24, as seen from the vertical direction Z.

[0048]

An interval in the first horizontal direction X between the rotation axis R and the air guide plate 32a is the same as in interval in the first horizontal direction X between the rotation axis R and the air guide plate 31a. The interval between the air guide plates 31a, 32a in the first horizontal direction X is greater than or equal to a third of a maximum dimension in the first horizontal direction X of the portion that overlaps with the inflow port 25c out of the electric components box 24, as seen from the vertical direction Z. In the first embodiment, the interval between the air guide plates 31a, 32a in the first horizontal direction X is approximately half of the maximum dimension in the first horizontal direction X of the portion that overlaps with the inflow port 25c out of the electric components box 24, as seen in the vertical direction Z.

[0049]

The interval between adjacent air guide plates 31a, 32a in the first embodiment is the same over the entirety of the axial direction of the rotation axis R, in other words the vertical direction Z. The plate surface of the air guide plate 31a and the plate surface of the air guide plate 32a are parallel to one another. The plate surface of the air guide plate 31a and the plate surface of the air guide plate 32a are disposed so as to be parallel in the vertical direction Z.

[0050]

Hereinafter, in cases where there is no need to distinguish between the air guide plate 31a and the air guide plate 32a in particular, the two air guide plates 31a and 32a are collectively referred to as the "air guide plate 30a".

[0051]

As shown in FIG. 6, the fixing portion 32b protrudes to the other side (-X side) of the first horizontal direction X from an end on the one side (+Y side) of the second horizontal direction Y out of the air guide plate 32a. As with the fixing portion 31b, the fixing portion 32b is fixed to the electric components box 24. Accordingly, the air guide member 32 is fixed to the electric components box 24. The fixing portion 32b is a rectangular plate. A plate surface of the fixing portion 32b faces the second horizontal direction Y.

[0052]

When the blower 23 is driven by the controller on the inside of the electric components box 24 that is not shown on the drawings, air flows to the inside of the indoor unit 20. In FIG. 3, the flow of the air that is generated by the blower 23 being driven is shown by arrows AF. As shown by the arrows AF in FIG. 3, when the blower

23 is driven, the air is taken into the indoor unit 20 from the intake port 20a. The air that is taken into the indoor unit 20 from the intake port 20a flows to the inside of the bell-mouth 25 from the inflow port 25c, and is discharged to an outside of the bell-mouth 25 from the outflow port 25d. The air that flows in through the inflow port 25c flows to the inside in the radial direction from the outside in the radial direction, more than the bell-mouth main body 25a, and includes the air that flows into the inflow port 25c. The air that flows out from the outflow port 25d flows into an inside of the impeller 23b from the air intake port 23c. The air that flows to the inside of the impeller 23b is discharged to the outside in the radial direction from the plurality of air exhaust ports 23d. The air that is discharged to the outside in the radial direction from the plurality of air exhaust ports 23d passes through the heat exchanger 22, and is blown to the indoors from each of the four exhaust ports 20b.

[0053]

As in the first embodiment, in a case where at least a portion of the electric components box 24 is disposed so as to face the inflow port 25c of the bell-mouth 25 in the axial direction of the rotation axis R, in other words, the vertical direction Z, a flow of a portion of the air that flows into the inflow port 25c is changed by the electric components box 24, and there are cases where the air collides in the space on the inside in the radial direction of the electric components box 24. Specifically, as shown by the two-dot chain lines in FIG. 6, two air flows AF3 and AF4 that face the inside in the radial direction from differing locations in the circumferential direction collide with the bottom surface of the electric components box 24 and curve in the circumferential direction as both flows come closer to facing one another, and there are cases where the flows collide with one another in the space on the inside in the radial direction of the electric components box 24. In such a case, noise is generated by the collision of the differing air flows AF3 and AF4.

[0054]

In contrast to the above, according to the first embodiment, the indoor unit 20 includes the air guide plate 30a disposed so as to face the inflow port 25c in the rotation axis R, in other words, the vertical direction Z. The air guide plate 30a is disposed so as to face the inside of the electric components box 24 in the radial direction, with the rotation axis R as a center thereof. As such, it is possible to have a flow of at least a portion of the air that flows into the inflow port 25c, which has the flow thereof changed by the electric components box 24, be changed by the air guide plate 30a in the space on the inside in the radial direction of the electric components box 24. Accordingly, it is possible to suppress different air flows from colliding with one another

in the space on the inside in the radial direction of the electric components box 24. Therefore, it is possible to suppress noise generation.

[0055]

Specifically in the first embodiment, as with the two differing air flows AF1 and AF2 shown in FIG. 6, it is possible to have both air flows AF1 and AF2 that have the air flows thereof changed by the electric components box 24 so that both air flows flow in a circumferential direction where the flows thereof come closer to one another, be rectified by a pair of the air guide plates 31a and 32a so as to flow in the axial direction of the rotation axis R, in other words, the vertical direction Z. As such, it is possible to suppress the flows of the air flow AF1 and the air flow AF2 from facing one another in the space between the pair of the air guide plates 31a and 32a, and it is possible to suppress the air flow AF1 and the air flow AF2 from colliding with one another in the space on the inside in the radial direction of the electric components box 24. As such, it is possible to prevent noise generation.

[0056]

As mentioned above, since it is possible to suppress noise generation by disposing the air guide plate 30a on the inside in the radial direction of the electric components box 24, there is no need to change the shape of the electric components box 24 to a shape that avoids the inflow port 25c. From this, there is no need to form a recess in the electric components box 24 so as to avoid the inflow port 25c, which makes avoiding downsizing the capacity of the electric components box 24 possible. From the above, according to the first embodiment, in the indoor unit 20 of the air conditioner 100, it is possible to have an electric components box 24 where a capacity thereof is secured, and noise generation is suppressed.

[0057]

Even in a case where a recess is formed in the electric components box 24 so as to avoid the inflow port 25c, by making the entirety of the electric components box 24 larger, it is possible to insure the capacity of the electric components box 24. In such a case however, a region that surrounds the inflow port 25c where the electric components box 24 is disposed becomes larger, and the air that flows towards the inflow port 25c is obstructed by the electric components box 24. Accordingly, there is a concern that the resistance of the air flowing into the bell-mouth 25 becomes larger, with noise generation increasing. In the first embodiment, it is possible to secure a capacity of the electric components box 24 without increasing an overall size of the electric components box 24, along with suppressing noise generation, suppressing both of the concerns above.

[0058]

According to the first embodiment, at least a portion of the electric components box 24 and the air guide plate 30a overlaps with the outflow port 25d of the bell-mouth 25 as seen from the axial direction of the rotation axis R, in other words the vertical direction Z. In such case, the portion out of the electric components box 24 that overlaps with the inflow port 25c of the bell-mouth 25 in the vertical direction Z becomes larger, and changing the flow of the air that flows into the inflow port 25c by the electric components box 24 becomes easier. As such, in a case where the air guide plate 30a is not provided, it is especially easy for the air flows to collide with one another, which is the main cause of noise generation. However, according to the first embodiment, even in such a case, it is possible to suppress noise generation by the air guide plate 30a rectifying the flow of the air. In other words, in a case where at least a portion of the electric components box 24 overlaps with the outflow port 25d of the bell-mouth 25 as seen from the axial direction of the rotation axis R, it is possible to usefully obtain an effect of noise suppression using the air guide plate 30a.

[0059]

According to the first embodiment, a plate surface of the air guide plate 30a faces the intersecting direction, in other words, the first horizontal direction X where the axial direction of the rotation axis R and the radial direction both intersect. A plurality of air guides plate 30a are disposed in the first horizontal direction X with intervals therebetween. Therefore, as previously mentioned, it is possible to guide the air having the flow thereof changed by the electric components box 24 using a plurality of air guide plates 31a and 32a to the axial direction of the rotation axis R, and it is possible to suitably prevent collision of air flows with one another. As such, it is possible to suppress noise generation.

[0060]

According to the first embodiment, the plurality of air guide plates 31a and 32a are separately disposed in the first horizontal direction X, from both ends in the first horizontal direction X of the portion out of the electric components box 24 that overlaps with the inflow port 25c, as seen from the vertical direction Z. As such, it is possible to prevent intervals between each of the plurality of air guide plates 31a and 32a from becoming too large. Accordingly, it is possible to suppress differing air flows from flowing into the intervals between each of the plurality of air guide plates 31a and 32a, and it is possible to prevent differing air flows from colliding with one another in the intervals between each of the plurality of air guide plates 31a and 32a. Therefore, it is possible to suppress noise generation.

[0061]

For example, by making adjacent air guide plates 31a and 32a incline with respect to the vertical direction Z so as to have the interval between both air guide plates 31a and 32a become larger as the top side is approached, a projected area of the air guide plates 31a and 32a in the vertical direction Z becomes larger. As such, a resistance of the air that flows into the inflow port 25c from the air guide plates 31a and 32a becomes large. On the other hand, by making the adjacent air guide plates 31a and 32a incline with respect the vertical direction Z so as to have the interval between both air guide plates 31a and 32a become smaller as the top side is approached, it becomes easier for the air flows that are guided by both the air guide plates 31a and 32a to collide with one another after passing through the interval between the air guide plates 31a and 32a.

[0062]

In contrast to the above, according to the first embodiment, the interval between the adjacent air guide plates 31a and 32a is the same over an entirety of the axial direction of the rotation axis R, in other words the vertical direction Z. Therefore, it is possible to suppress the resistance of the air that flows from the air guide plates 31a and 32a from becoming larger, and it is possible to suppress the air flows that are guided by the air guide plates 31a and 32a from colliding with one another after passing through the intervals between the air guide plates 31a and 32a.

[0063]

As shown in the first embodiment, in a case where the two air guide plates 31a and 32a are provided as in the first embodiment, when the interval between two air guide plates 31a and 32a is too small, rectifying the flow of the air is difficult, and there is a concern that differing air flows collide with one another in the interval on the inside in the radial direction of the electric components box 24. Specifically, there is a concern for example, that the air flows which are guided by each of the air guide plates 31a and 32a collide with one another after passing through the air guide plates 31a and 32a, in the vertical direction Z. Therefore, it is preferable that the intervals between each of the adjacent air guide plates 31a and 32a are large enough so as to suppress collisions between the air flows after passing through each of the air guide plates 31a and 32a. For example, by making a dimension of the interval between the air guide plate 31a and the air guide plate 32a in the first horizontal direction X be greater than or equal to a third of the maximum dimension in the first horizontal direction X of the portion out of the electric components box 24 that overlaps with the inflow port 25c as seen from the vertical direction, it is possible to suitably prevent the interval between the air guide

plate 31a and the air guide plate 32a from becoming too small.

[0064]

According to the first embodiment, the air guide plate 30a is attached to the electric components box 24. As such, it is possible to easily dispose the air guide plate 30a in a desirable location that faces the inflow port 25c of the bell-mouth 25 in the vertical direction Z, as well a location that faces the inside of the electric components box 24 in the radial direction.

[0065]

Second Embodiment

FIG. 7 is a cross-sectional view that shows an indoor unit 220 in a second embodiment. FIG. 8 is a view that shows a portion of the indoor unit 220 from the bottom side in the second embodiment. In FIG. 8, the decorative panel 21b is omitted from the drawing. FIG. 9 is a perspective view that shows an air guide member 230, the electric components box 24, and the bell-mouth 25 in the second embodiment. In the explanations below, where appropriate, configurations similar to the configurations of the aforementioned embodiment have the same reference symbols affixed thereto, with explanations thereof being omitted.

[0066]

As shown in FIG. 7 and in FIG. 9, only one air guide member 230 is provided in the second embodiment. The air guide member 230 is located on the other side (-X side) of the first horizontal direction X more than the rotation axis R. As shown in FIG. 9, the air guide member 230 has an air guide plate 230a and a fixing portion 230b.

[0067]

The air guide plate 230a is a rectangular plate. A plate surface of the air guide plate 230a faces the axial direction of the rotation axis R, in other words, the vertical direction Z. The plate surface of the air guide plate 230a is orthogonal to the vertical direction Z. The air guide plate 230a protrudes to the inside in the radial direction from the lower end of the electric components box 24. In the second embodiment, the air guide plate 230a protrudes to the other side (-Y side) in the second horizontal direction Y from a portion closer to the other side (-X side) of the first horizontal direction X, out of a bottom end of the attachment surface 24a.

[0068]

As shown in FIG. 8, the air guide plate 230a is located in the other side (-X side) of the first horizontal direction X more than the rotation axis R. The air guide plate 230a protrudes to the other side (-Y side) of the second horizontal direction Y from an end on the other side of the first horizontal direction X in the portion out of the electric

components box 24 that overlaps with the inflow port 25c, as seen from the vertical direction Z.

[0069]

As shown in FIG. 9, a surface that faces the bottom side out of the plate surface of the air guide plate 230a is located more to the bottom side than a center of the electric components box 24 in the vertical direction Z. In the second embodiment, the surface that faces the bottom side out of the plate surface of the air guide plate 230a is disposed in the same location as the a surface on the bottom side of the electric components box 24, in the vertical direction Z. Other configurations of the air guide plate 230a are the same as the other configurations of the air guide plate 30a of the first embodiment.

[0070]

The fixing portion 230b protrudes to the top side from an end on the one side (+Y side) of the second horizontal direction Y out of the air guide plate 230a. The fixing portion 230b is fixed to the electric components box 24. Accordingly, the air guide member 230 is fixed to the electric components box 24. Other configurations of the air guide member 230 are the same as the other configurations of the fixing portions 31b and 32b of the first embodiment. Configurations other than the configuration of the air guide member 230 out of the indoor unit 220 are the same as the configurations of the indoor unit 20 in the first embodiment.

[0071]

According to the second embodiment, the air guide plate 230a faces the vertical direction Z. A surface that faces the bottom out of the plate surface of the air guide plate 230a is located on the bottom side more than the center of the electric components box 24. As such, as shown by an air flow AF5 in FIG. 9, it is possible for a portion of the air that flows into the inflow port 25c of the bell-mouth 25 to come into contact with a surface that faces the bottom side out of a plate surface of the air guide plate 230a, before flowing to the interval on the inside in the radial direction of the electric components box 24, or right after flowing into the interval on the inside in the radial direction of the electric components box 24. A flow speed of the air that collides with the surface that faces the bottom side out of the plate surface of the air guide plate 230a decreases. As such, even if the air flow AF5 having a decreased speed of flow due to colliding with the plate surface of the air guide plate 230a, collides with an air flow AF6 having a relatively large flow speed, and that flows into the inflow port 25c without colliding with the air guide plate 230a after flowing along the plate surface of the air guide plate 230a collide, it is possible to have the noise that is generated be

small. In other words, it is possible to prevent air flows having large flow speeds from colliding with one another in the interval on the inside in the radial direction of the electric components box 24. Accordingly it is possible to suppress noise generation.

[0072]

In the second embodiment, since it is possible to suppress noise generations by the one air guide plate 230a, compared to a case where a plurality of air guide plates 230a are provided, it is possible to decrease a number of parts of the indoor unit 220. It is also possible to suppress noise generation using the one air guide plate 230a, without needing to adjust an interval between air guide plates of the plurality of air guide plates. As such, it is possible to stabilize and suppress noise generation using the air guide plate 230a, without worrying about positional relationships between the bell-mouth 25 and the electric components box 24.

[0073]

According to the second embodiment, a surface that faces the bottom side out of the plate surface of the air guide plate 230a is disposed on the same location as the bottom side of the electric components box 24 in the vertical direction Z. As such, it is possible to have no step form between the surface that faces the bottom side out of the plate surface of the air guide plate 230a, and the surface on the bottom side out of the electric components box 24, avoiding having said step cause the air flow to become turbulent. Accordingly, it is possible to suppress noise generation.

[0074]

Third Embodiment

FIG. 10 is a cross-sectional view that shows a portion of an indoor unit 320 in a third embodiment. In the explanations below, where appropriate, configurations similar to the configurations of the aforementioned embodiment have the same reference symbols affixed thereto, with explanations thereof being omitted.

[0075]

As shown in FIG. 10, an air guide member 330 in the third embodiment is fixed to the bell-mouth 25. The air guide member 330 has an air guide plate 330a and a fixing portion 330b. Other than an aspect of the air guide plate 330a being disposed via the interval on the inside in the radial direction of the electric components box 24, the air guide plate 330a is the same as the air guide plate 230a in the second embodiment. The fixing portion 330b extends in the bottom side from the inner surface 25g of the bell-mouth 25. The air guide plate 330a is connected to the bottom end of the fixing portion 330b. Therefore, the air guide plate 330a is attached to the bell-mouth 25 via the fixing portion 330b. According to such a configuration, since there is no need to

attach the air guide plate 330a to the electric components box 24, there is no need to conduct any machining to attach the air guide plate 330a to the electric components box 24. Therefore, it is possible to dispose the air guide plate 330a without needing to change the electric components box 24.

[0076]

Although embodiments of the present disclosure have been explained above, the present disclosure is not limited to the configurations of the each of the embodiments previously mentioned, and the configurations and methods below may be adopted.

[0077]

A shape of an air guide plate is not particularly limited. The air guide plate may be any shape other than square, and may be polygonal plate shape, circular plate shape, or an elliptical plate shape. The air guide plate may be made of a metal. So long as the air guide plate is disposed on an inside in the radial direction of an electric components box, the air guide plate may be attached to any part of an indoor unit. A method of fixing the air guide plate is not particularly limited. For example, when the air guide plate is made of a metal, the air guide plate may be attached to the electric components box by welding. In such a case, the air guide plate may be fixed by being connected to a fixing portion as in each of the previously mentioned embodiments and the fixing portion be fixed to the electric components box by welding, or the fixing portion as in each of the previously mentioned embodiments need not be provided, and the air guide plate may be directly welded to the electric components box. So long as a number of the air guide plates is greater than or equal to one, the number thereof is not particularly limited. Three or more of the air guide plates may be provided.

[0078]

So long as the electric components box is located on the first side (bottom side) of a bell-mouth, and at least a portion is disposed so as to face an inflow port of the bell-mouth in an axial direction (vertical direction Z), the electric components box may have any configuration. An entirety of the electric components box may face the inflow port in the axial direction. A recess to fit the electric components box into the bell-mouth need not be formed. The electric components box may be separately disposed on the first side (bottom side) of the bell-mouth. A support member that supports the electric components box from the first side (bottom side) may be provided.

[0079]

The indoor unit of the present disclosure may be any type of indoor unit. A direction of rotation in an axial direction of a blower of the indoor unit which blows air may be any direction, and may be a direction that is orthogonal to the vertical direction Z.

[0080]

The various configurations and various methods explained in the above specification may be combined as needed, so long as no conflicts in the technical scope thereof occurs.

[Reference Signs List]

[0081]

10...Outdoor Unit, 20, 220, 320...Indoor Unit, 23...Blower, 23b...Impeller, 24...Electric Components Box, 25...Bell-Mouth, 25c...Intake Port, 25d...Exhaust Port, 30a, 31a, 32a, 230a, 230b, 330a...Air Guide Plate, 100...Air Conditioner, R...Rotation Axis, X...First Horizontal Direction (Intersecting Direction), Z...Vertical Direction Z (Axial Direction)

[CLAIMS]

[Claim 1]

An indoor unit of an air conditioner comprises:

a blower that has an impeller that is rotatable around a rotation axis;

a bell-mouth having an inflow port that opens to a first side in an axial direction of the rotation axis, and that is located on the first side of the blower;

an electric components box that is located on the first side of the bell-mouth, and that has at least a portion thereof disposed so as to face the inflow port in the axial direction, and

an air guide plate that is disposed so as to face the inflow port in the axial direction, and is disposed so as to face an inside of the electric components box in a radial direction with the direction of rotation being a center thereof.

[Claim 2]

The indoor unit according to claim 1, wherein:

the bell-mouth has an outflow port that opens to a second side that is opposite to the first side in the axial direction,

an inner edge of the outflow port is located on an inside in the radial direction more than an inner edge of the inflow port, and

at least a portion of the electric components box and the air guide plate overlap with the outflow port as seen from the axial direction.

[Claim 3]

The indoor unit according to any one of claims 1 or 2, wherein:

a plate surface of the air guide plate faces an intersecting direction that is orthogonal to both the axial direction and the radial direction, and

a plurality of air guide plates that include the air guide plate are disposed with intervals therebetween in the intersecting direction.

[Claim 4]

The indoor unit according to claim 3, wherein:

the plurality of air guide plates are separately disposed in the intersecting direction from both ends of the intersecting direction in a portion out of the electric components box that overlaps with the inflow port as seen from the axial direction.

[Claim 5]

The indoor unit according to claim 3 or claim 4, wherein:

intervals between the adjacent air guide plates are the same over an entirety of the axial direction.

[Claim 6]

The indoor unit according to claim 1 or claim 2, wherein:
a plate surface of the air guide plate faces the axial direction, and
a surface that faces the first side out of the plate surface of the air guide plate is located on the first side more than a center of the electric components box in the axial direction.

[Claim 7]

The indoor unit according to claim 6, wherein:
a surface that faces the first side out of the plate surface of the air guide plate is disposed on the same location as a surface of the first side of the electric components box in the axial direction.

[Claim 8]

The indoor unit according to any one of claims 1 to 7, wherein:
the air guide plate is attached to the electric components box.

[Claim 9]

The indoor unit according to any one of claims 1 to 7, wherein:
the air guide plate is attached to the bell-mouth.

[Claim 10]

An air conditioner comprises:
the indoor unit according to any one of claims 1 to 9, and
an outdoor unit.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/005532

A. CLASSIFICATION OF SUBJECT MATTER**F24F 13/08**(2006.01)i; **F24F 13/24**(2006.01)i; **F24F 13/20**(2006.01)i

FI: F24F1/0007 401E; F24F1/0007 401D; F24F1/0007 401C; F24F13/08 B; F24F13/24

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)

F24F13/08; F24F13/24; F24F13/20

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2022

Registered utility model specifications of Japan 1996-2022

Published registered utility model applications of Japan 1994-2022

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 2018-25356 A (HITACHI JOHNSON CONTROLS AIR CONDITIONING INC) 15 February 2018 (2018-02-15) paragraphs [0012], [0024]-[0060], fig. 1-2, 9-11, 13-19	1-2, 8, 10
Y		9
A		3-7
X	WO 2021/014562 A1 (MITSUBISHI ELECTRIC CORP) 28 January 2021 (2021-01-28) paragraphs [0009]-[0030], fig. 1-5	1-2, 6, 8, 10
X	JP 2011-106801 A (HITACHI APPLIANCES INC) 02 June 2011 (2011-06-02) paragraphs [0002]-[0005], [0016]-[0031], fig. 8-10	1-2, 8, 10
Y	JP 2012-72926 A (HITACHI APPLIANCES INC) 12 April 2012 (2012-04-12) paragraphs [0012]-[0019], fig. 1-6	9
A	JP 1-263437 A (MATSUSHITA REFRIG CO LTD) 19 October 1989 (1989-10-19) entire text, all drawings	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“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

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

01 March 2022

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Name and mailing address of the ISA/JP

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Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/005532**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2004-183994 A (MITSUBISHI HEAVY IND LTD) 02 July 2004 (2004-07-02) entire text, all drawings	1-10

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2022/005532

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP	2018-25356	A	15 February 2018	(Family: none)	
WO	2021/014562	A1	28 January 2021	(Family: none)	
JP	2011-106801	A	02 June 2011	(Family: none)	
JP	2012-72926	A	12 April 2012	(Family: none)	
JP	1-263437	A	19 October 1989	(Family: none)	
JP	2004-183994	A	02 July 2004	(Family: none)	