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(54) INDOOR UNIT OF AIR-CONDITIONER

INNENRAUMEINHEIT EINER KLIMAANLAGE

UNITÉ INTÉRIEURE DE CLIMATISEUR

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to an indoor unit of an air conditioner.

BACKGROUND ART

[0002] A known indoor unit of an air conditioner (hereinafter simply referred to as the "indoor unit") is a ceiling-suspended indoor unit that includes a casing having an air inlet through which indoor air is sucked, and an air outlet through which conditioned air is blown into the room (see, for example, JP 2010 249447 A). The casing of this indoor unit has a back portion having the air inlet at its bottom, and has a front surface having the air outlet. In the casing, a fan and a heat exchanger sequentially arranged between the air inlet and the air outlet.

[0003] EP 0 943 875 A2 discloses an air conditioner, wherein a motor is attached on the bottom surface side of a motor base with a pinion gear and an output gear housed in a gear housing portion thereof, and an output shaft of the output gear is inserted through a side plate of an air outlet and is coupled to a flap while the output shaft is supported by a bearing hole formed on the bottom portion of the motor base, and by a burring hole formed at the side plate.

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0004] An indoor unit of JP 2010 249447 A has an air outlet which is located immediately behind a heat exchanger in the airflow direction and at which an airflow direction adjusting flap curved downward in the airflow direction is provided. The airflow direction adjusting flap is configured to blow air obliquely downward. This configuration makes it difficult for the air to reach a region far away from the indoor unit even if the angle of air blown is set at the upper limit of its adjustable range. Accordingly, it is difficult for conditioned air to circulate through the room.

[0005] It is therefore an object of the present disclosure to provide a ceiling-suspended indoor unit which is capable of blowing air over wider areas and which allows conditioned air blown out of an air outlet to easily circulate through a room.

SOLUTION TO THE PROBLEM

[0006] The present invention is defined by the appended set of claims. In aspects of the present disclosure, terms indicating the directions or positions of components of an indoor unit indicate the directions or positions of such components in a situation where the indoor unit is installed in a target space to be air-conditioned.

[0007] The present invention discloses a ceiling-suspended indoor unit of an air conditioner. The indoor unit includes a casing (33) including a plurality of side plates (34), one of the side plates (34) having an air outlet (75); a heat exchanger (31) disposed in the casing (33); a fan (32) configured to blow air that has been passed through the heat exchanger (31) out of the air outlet (75) to an associated side of the casing (33); and an airflow direction adjusting flap (85) provided at the air outlet (75).

[0008] This ceiling-suspended indoor unit of the air conditioner further includes: a blow-out passage (73) extending from the heat exchanger (31) toward the air outlet (75). The blow-out passage (73) has a first lower end (76) that represents a lower end of one of end portions of the blow-out passage (73) near the heat exchanger (31) into which air flows, a second lower end (77) that represents a lower end of the other end portion of the blow-out passage (73) near the air outlet (75) out of which air flows and a bottom surface (78) located at a bottom of the blow-out passage (73). The second lower end (77) is located below the first lower end (76) in a height direction. The bottom surface (78) of the blow-out passage (73) includes an inclined portion (83) formed on an end portion near the air outlet (75) and inclined in a direction that allows an area of an opening of the air outlet (75) to increase, and a horizontal blow-out surface (84a) located more upstream in an airflow direction than the inclined portion (83) and adjacent to the inclined portion (83). The airflow direction adjusting flap (85) is capable of directing air flowing out of the blow-out passage (73) upward relative to a horizontal plane.

[0009] In the present invention, the blow-out passage (73) is provided downstream of the heat exchanger (31) in the airflow direction; the air that has flowed out of the heat exchanger (31) is thus straightened in the blow-out passage (73) without being diffused. In addition, the direction in which the air straightened in the blow-out passage (73) is blown is adjusted by the airflow direction adjusting flap (85). Providing the airflow direction adjusting flap (85) immediately behind the heat exchanger (31) in the airflow direction makes it difficult to adjust the direction of the air that is about to be diffused. However, the air is straightened in the blow-out passage (73), and then the direction in which the straightened air is blown is adjusted by the airflow direction adjusting flap (85). This facilitates adjusting the airflow direction.

[0010] In the present invention, the second lower end (77) of the blow-out passage (73) is located below the first lower end (76) thereof, and the blow-out passage (73) extends downward. This allows the ceiling-suspended indoor unit to blow air downward through the air outlet (75). In addition, adjusting the angle of the airflow direction adjusting flap (85) allows air to be blown upward. Blowing the air upward allows the air to be blown over wider areas, and makes it easy for conditioned air to reach a region far away from the indoor unit to easily circulate through the room.

[0011] In a further aspect, the indoor unit further in-

cludes a drain pan (35) for receiving drain water generated in the heat exchanger (31), the drain pan (35) being disposed in the casing (33), and the blow-out passage (73) is disposed downstream of an outer peripheral portion (37) of the drain pan (35) in the airflow direction.

[0012] In the further aspect, the air that has passed through the heat exchanger (31) passes through the outer peripheral portion (37) of the drain pan (35), and then flows into the blow-out passage (73). This configuration allows air to be straightened on the downstream side of the heat exchanger (31) through the blow-out passage (73).

[0013] In addition, if an upstream portion of the blow-out passage (73) in the airflow direction is located upstream of the outer peripheral portion (37) of the drain pan (35) in the airflow direction, the blow-out passage (73) and the drain pan (35) overlap each other in plan view. In this case, shifting the blow-out passage (73) and the drain pan (35) in the height direction of the indoor unit may increase the height of the indoor unit. In contrast, the fourth aspect eliminates the need for shifting the blow-out passage (73) and the drain pan (35) in the height direction of the indoor unit, and reduces the height of the indoor unit.

[0014] In a further aspect, the airflow direction adjusting flap (85) that is directing the air upward relative to the horizontal plane has a flat upper surface.

[0015] If the airflow direction adjusting flap (85) is curved downward along the air flow, the air blown out of the blow-out passage (73) is easily directed downward. However, the air is hardly blown upward. In the further aspect, the airflow direction adjusting flap (85) that is directing the air upward relative to the horizontal plane has the flat upper surface. Thus, this airflow direction adjusting flap (85) easily directs the air blown out of the blow-out passage (73) either downward or upward. Specifically, if the airflow direction adjusting flap (85) is directed downward, the air flowing through the blow-out passage (73) from the first lower end (76) to the second lower end (77) can be blown downward. If the airflow direction adjusting flap (85) is directed upward, the air flowing through the blow-out passage (73) from the first lower end (76) to the second lower end (77) moves to the flat upper surface of the airflow direction adjusting flap (85) so as to be easily directed upward. Accordingly, the airflow direction adjusting flap (85) can easily direct the air either downward or upward.

[0016] In a further aspect, the airflow direction adjusting flap (85) includes a plurality of blade members (86) extending in a direction intersecting with a direction of air flowing through the blow-out passage (73) and intersecting with a vertical direction, and the blade members (86) are vertically arranged.

[0017] In the further aspect, the blade members (86) vertically arranged are used to adjust the direction of the air flowing through the entire blow-out passage (73) from the bottom to the top thereof. Using about four to five blade members (86) makes it easier to direct the air than using a smaller number of blade members (86), such as one blade member (86), does.

[0018] In a further aspect, an angle range in which the airflow direction adjusting flap (85) is capable of directing the air upward relative to the horizontal plane is greater than 0° and less than or equal to 10°, where the horizontal plane has an angle of 0°.

[0019] In the further aspect, the airflow direction adjusting flap (85) can direct the air blown out of the blow-out passage (73) upward relative to the horizontal plane within an angle range of 10°. If the angle of the air blown increases to above 10°, the angle of the air blown is excessively sharp. This makes it difficult for the blown air to reach a region far away from the indoor unit. As a result, the conditioned air hardly circulates through the room. However, the further aspect reduces the risk of causing such a problem. In addition, the angle range is greater than 0° and less than or equal to 10°; the blown air thus hardly strikes the ceiling of the room. If the blown air strikes the ceiling in the room, the ceiling tends to be dirty. However, the further aspect avoids the dirt on the ceiling.

[0020] In a further aspect, a wall surface defining the blow-out passage (73) has an overhanging portion (80a) corresponding to an upper portion of a downstream opening of the blow-out passage (73) in an airflow direction and overhanging downward, and the overhanging portion (80a) extends in a direction intersecting with a direction of air flowing through the blow-out passage (73) and intersecting with a vertical direction.

[0021] In the further aspect, the air blown out of an upper portion of the blow-out passage (73) flows easily downward while being curved along the overhanging portion (80a). This stabilizes the flow of the air blown downward through the air outlet (75).

[0022] In a further aspect, another one (56) of the side plates of the casing (33) opposed to the one (81) of the side plates having the air outlet (75) has an air inlet (60).

[0023] In the further aspect, the casing (33) includes the side plates (81) and (56) opposed to each other. The side plates (81) and (56) respectively have the air outlet (75) and the air inlet (60). The air sucked from the air inlet (60) flows to the air outlet (75) of the side plate (81) opposed to the side plate (56) having the air inlet (60) so as to be blown out of the casing (33). In the further aspect, the air flows through the casing (33) in one direction. This makes it less likely for the air to receive resistance in the casing (33). This allows the air to flow easily through the casing (33).

[0024] In a further aspect, the casing (33) includes: a first casing (51) in which the heat exchanger (31) and the fan (32) are disposed; and a second casing (71) having the blow-out passage (73) and the air outlet (75), and fitted to the first casing (51).

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a refrigerant circuit diagram schematically illustrating a configuration of an air conditioner.
FIG. 2 is a perspective view of an indoor unit of an embodiment as viewed obliquely from the front and above.
FIG. 3 is a plan view of the indoor unit.
FIG. 4 is a cross-sectional view taken along line IV-IV shown in FIG. 3.
FIG. 5 is a perspective view of a blow-out unit as viewed obliquely from the front and above.
FIG. 6 is a cross-sectional view taken along line VI-VI shown in FIG. 5.
FIG. 7 is a perspective cross-sectional view of a portion of the blow-out unit as viewed obliquely from the back and above.
FIG. 8 is a cross-sectional view showing a general cross-sectional shape of a blow-out passage and an operation of an airflow direction adjusting flap.
FIG. 9 is an enlarged perspective cross-sectional view showing the shape of a blade member.
FIG. 10 is a cross-sectional view showing a general shape of a blow-out passage according to a first variation of the first embodiment that is not according to the present invention.
FIG. 11 is a cross-sectional view showing a general shape of a blow-out passage according to a second variation of the first embodiment.
FIG. 12 is a cross-sectional view of an indoor unit according to a third variation of the first embodiment.
FIG. 13 is a perspective view of an indoor unit according to a second embodiment as viewed obliquely from the front and above.
FIG. 14 is a cross-sectional view taken along line XIV-XIV shown in FIG. 13.

DESCRIPTION OF EMBODIMENTS

«First Embodiment»

[0026] The first embodiment will be described. An air conditioner (10) according to this embodiment includes an indoor unit (30), and an outdoor unit (20) connected to the indoor unit (30), and conditions air in an indoor space to be air-conditioned. As used herein, terms indicating directions and positions, such as "upper," "lower," "right," "left," "lateral," "top panel," "bottom plate," "side plates," "front surface," and "back surface," all mean directions and positions of associated components of the installed indoor unit (30) as viewed from the front. As used herein, a situation where side plates or any other associated components are "opposed" to each other means that the side plates or any other associated components face each other, but does not mean that the side plates or any other associated components are parallel to each other.

-Air Conditioner-

[0027] The air conditioner (10) will be described with reference to FIGS. 1 to 9.

[0028] As shown in FIG. 1, the air conditioner (10) includes the indoor unit (30) and the outdoor unit (20). The air conditioner (10) includes a refrigerant circuit (11) having a compressor (21), a four-way switching valve (22), an outdoor heat exchanger (23), an expansion valve (24), and an indoor heat exchanger (31) which are connected together through refrigerant pipes. The refrigerant circuit (11) performs a vapor compression refrigeration cycle.

[0029] The refrigerant circuit (11) includes an outdoor circuit (12), an indoor circuit (13), a first connection pipe (14) on the liquid side of the refrigerant circuit (11), and a second connection pipe (15) on the gas side thereof. The first connection pipe (14) is connected to a first shutoff valve (16) of the outdoor circuit (12) and a first pipe fitting (18) of the indoor circuit (13). The second connection pipe (15) is connected to a second shutoff valve (17) of the outdoor circuit (12) and a second pipe fitting (19) of the indoor circuit (13).

<General Configuration of Indoor Unit>

[0030] The indoor unit (30) is installed in the indoor space to be air-conditioned, and includes the indoor heat exchanger (31), an indoor fan (32), and a drain pan (35).

[0031] The indoor heat exchanger (31) exchanges heat between a refrigerant flowing therethrough and indoor air supplied by the indoor fan (32). The indoor heat exchanger (31) is configured as, for example, a fin-and-tube heat exchanger. The indoor heat exchanger (31) constitutes a heat exchanger according to the present disclosure.

[0032] The indoor fan (32) is used to supply indoor air to the indoor heat exchanger (31), and to further supply air that has passed through the indoor heat exchanger (31) to the indoor space. The indoor fan (32) constitutes a fan according to the present disclosure.

<General Configuration of Outdoor Unit>

[0033] The outdoor unit (20) is installed outdoors, and includes the compressor (21), the four-way switching valve (22), the outdoor heat exchanger (23), an outdoor fan (25), the expansion valve (24), the first shutoff valve (26) on the liquid side of the outdoor unit (20), and the second shutoff valve (27) on the gas side thereof.

[0034] The compressor (21) sucks a low-pressure gas refrigerant that has flowed out of one of the indoor or outdoor heat exchanger (31) or (23) functioning as an evaporator, and compresses the sucked low-pressure gas refrigerant to discharge the compressed high-temperature and high-pressure gas refrigerant. The high-pressure gas refrigerant discharged from the compressor (21) flows into the other one of the indoor or outdoor heat exchanger (31) or (23) functioning as a radiator.

[0035] The four-way switching valve (22) is used to reversibly change the direction of the refrigerant flowing through the refrigerant circuit (11). Specifically, the four-way switching valve (22) is switchable between a first state (the state indicated by the solid lines in FIG. 1) where the indoor heat exchanger (31) serves as an evaporator so that the air conditioner (10) performs cooling operation, and a second state (the state indicated by the broken lines in FIG. 1) where the indoor heat exchanger (31) serves as a radiator so that the air conditioner (10) performs a heating operation.

[0036] The outdoor heat exchanger (23) exchanges heat between the refrigerant flowing therethrough and outdoor air supplied by the outdoor fan (25). The outdoor heat exchanger (23) is configured as, for example, a fin-and-tube heat exchanger.

[0037] The outdoor fan (25) is used to supply outdoor air to the outdoor heat exchanger (23).

[0038] The expansion valve (24) is used to decompress the refrigerant that has flowed out of the other one of the indoor or outdoor heat exchanger (31) or (23) functioning as the radiator. The expansion valve (24) is configured as, for example, an electronic expansion valve with an adjustable opening degree.

<Specific Configuration of Indoor Unit>

[0039] The indoor unit (30) according to this embodiment is a ceiling-suspended indoor unit, and is installed near the ceiling of the indoor space. The indoor unit (30) according to this embodiment will now be described with reference to FIGS. 2 to 4 as needed.

[0040] As illustrated in FIGS. 2 to 4, the indoor unit (30) has a flat cuboid shape as a whole. This indoor unit (30) includes one body unit (50), one blow-out unit (70), and a pair of decorative covers (91, 92). The body unit (50) has an air inlet (60) through which air in the indoor space is to be sucked into the body unit (50). The blow-out unit (70) has an air outlet (75) through which conditioned air that has passed through the indoor heat exchanger (31) is to be blown to a side (the front) of the indoor unit (30) so as to be supplied to the indoor space.

[0041] As will be described below, the body unit (50) includes a first casing (51), and the blow-out unit (70) includes a second casing (71). The first and second casings (51) and (71) that are separate from each other constitute an overall casing (33) for the indoor unit (30) according to this embodiment.

[0042] The overall casing (33) includes a plurality of side plates (34). One of the side plates (34) having the air inlet (60) and another one of the side plates (34) having the air outlet (75) are opposed to each other. In the present disclosure, the overall casing (33) may be simply referred to also as the "casing." In addition, in the present disclosure, a top panel, a bottom plate, and a plurality of side plates of the first casing are respectively referred to as the "first top panel, first bottom plate, and first side plates" so as to be distinguished from a top panel, a bottom plate, and the side plates of the overall casing (where reference numerals are omitted).

<Body Unit>

[0043] The body unit (50) includes the first casing (51) having a cuboid shape. The first casing (51) includes a frame (not shown), the first top panel (52), the first bottom plate (53), and the first side plates (54) arranged between the first top panel (52) and the first bottom plate (53). The first top panel (52), the first bottom plate (53), and the first side plates (54) are attached to the frame. The first top panel (52) is a plate-shaped member that forms an upper surface of the first casing (51) of the installed indoor unit (30), and forms part of the top panel (34a) of the casing (33). The first bottom plate (53) is a plate-shaped member that forms a lower surface of the first casing (51) of the installed indoor unit (30), and forms part of the bottom plate (34b) of the casing (33). One of a pair of two of the four first side plates (54) of the body unit (50) along the long sides of the body unit (50) in plan view forms a front surface of the body unit (50), and the other one thereof forms a back surface of the body unit (50). One of a pair of the other two of the four first side plates (54) along the short sides of the body unit (50) in plan view forms a right side surface of the body unit (50), and the other one thereof forms a left side surface of the body unit (50).

[0044] The first side plates (54) of the body unit (50) include a first front panel (55) located on the front side of the installed indoor unit (30), a first back panel (56) located on the back side thereof, a first right panel (57) located on the right side thereof, and a first left panel (58) located on the left side thereof. The first back panel (56) and the first front panel (55) are opposed to each other. The first right panel (57) and the first left panel (58) are opposed to each other.

[0045] In FIG. 4, the first back panel (56) of this body unit (50) has the air inlet (60), and the first front panel (55) opposed to the first back panel (56) has an air outflow port (59). The body unit (50) has therein an air passage (61) extending from the air inlet (60) to the air outflow port (59). The air passage (61) in the body unit (50) houses the indoor heat exchanger (31), the indoor fan (32), and the drain pan (35). The indoor heat exchanger (31) is disposed in a portion of the air passage (61) located on the leeward side of the indoor fan (32) and between the air inlet (60) and the air outflow port (59).

[0046] The indoor heat exchanger (31) extends in the lateral direction of the body unit (50). As illustrated in FIG. 4, the indoor heat exchanger (31) has two heat exchanger surfaces angularly arranged to form an inclined L-shape in side view.

[0047] As illustrated in FIG. 4, the drain pan (35) is provided inside the first casing (51), and is disposed above the first bottom plate (53). The drain pan (35) is made from foamed resin, and receives drain water (condensed water) generated in the indoor heat exchanger

(31). The drain pan (35) includes a drain pan bottom portion (36) having a drain water receiving surface that is rectangular as viewed from above, and a raised portion (37) formed on an outer peripheral portion of the drain pan bottom portion (36). The outer peripheral portion of the drain pan bottom portion (36) is an edge portion of the drain pan bottom portion (36) along the periphery thereof.

<Air-flow unit>

[0048] As illustrated in FIGS. 2 to 5, the blow-out unit (70) has an outer shape forming a horizontally long cuboid, and is fitted to the front surface of the body unit (50). The blow-out unit (70) includes the second casing (71), which is attached to the first casing (51) such that the back surface of the second casing (71) is in contact with the first front panel (55) of the body unit (50).

[0049] As illustrated in FIGS. 4 and 5, the blow-out unit (70) includes therein a passage member (72) defining a blow-out passage (73). The back surface of the second casing (71) of the blow-out unit (70) has an air entrance (74) communicating with the air outflow port (59) of the first casing (51). The air entrance (74) thus allows conditioned air to pass therethrough. The blow-out unit (70) includes a front surface member (81) having a front surface (81a) opposed to the above-described back surface. The front surface member (81) has the air outlet (75) for blowing conditioned air out.

<Air-Flow Passage>

[0050] In FIGS. 4 and 6 to 8, the blow-out passage (73) extends obliquely downward as a whole from the indoor heat exchanger (31) and the air entrance (74) toward the air outlet (75), and is defined by the passage member (72) made from foamed resin. An upstream end of the blow-out passage (73) in the airflow direction has the air entrance (74), and a downstream end thereof in the airflow direction has the air outlet (75). The entire blow-out passage (73) is disposed downstream of the raised portion (37), which serves as the outer peripheral portion of the drain pan (35), in the airflow direction.

[0051] As illustrated in FIG. 8, the blow-out passage (73) has a first lower end (76) and a second lower end (77). The first lower end (76) corresponds to the lower end of the air entrance (74), which is an opening end of the blow-out passage (73) near the indoor heat exchanger (31). The second lower end (77) corresponds to the lower end of an opening end of the blow-out passage (73) near the air outlet (75). The second lower end is located below the first lower end (76) in the height direction. The blow-out passage (73) extends gently obliquely downward as a whole from the indoor heat exchanger (31) and the air entrance (74) toward the air outlet (75). A level difference Δh is found between the first and second lower ends (76) and (77).

[0052] The blow-out passage (73) has a bottom surface (78) located at the bottom of the blow-out passage (73) with the indoor unit (30) installed, and an upper surface (79) opposed to the bottom surface (78). As illustrated in FIG. 7, which is a perspective cross-sectional view of a portion of the blow-out unit (70) as viewed from the back, the blow-out passage (73) has a rectangular opening or a rectangular cross section generally perpendicular to the airflow direction, and has two side surfaces (82) between the bottom surface (78) and the upper surface (79). FIGS. 6 and 7 illustrate only one of the side surfaces (82).

[0053] Among the bottom surface (78) and the upper surface (79), the upper surface (79) has a curved end portion near the air entrance. As can be seen, at least one portion of the bottom surface (78) and/or the upper surface (79) is configured as a curved surface that is curved from the air inlet toward the air outlet.

[0054] An end portion of the bottom surface (78) of the blow-out passage (73) near the air outlet (75) has a stepped inclined portion (83) that is inclined in a direction that allows the area of the opening of the air outlet (75) to increase. An end portion of the bottom surface (78) of the blow-out passage (73) near the inclined portion (83) has a horizontal blow-out surface (84a). The term "horizontal" here includes a state where the blow-out surface (84a) is slightly inclined in addition to a state where the blow-out surface (84a) is perpendicular to a vertical plane.

<Airflow Direction Adjusting Flap>

[0055] The air outlet (75) is provided with an airflow direction adjusting flap (85) including a plurality of (four in this embodiment) blade members (86) made from synthetic resin. The blade members (86) are elongated rectangular plate-shaped members. Each of the blade members (86) is arranged to laterally cross the air outlet (75) in a position in which its longitudinal direction is generally horizontal (see FIGS. 2 and 5 to 7). The term "generally horizontal" here indicates a direction orthogonal to the airflow direction and also orthogonal to the vertical direction, but may include directions slightly inclined relative to this direction. Further, the term "orthogonal" here includes not only a state where two elements form a right angle, but also a state where two elements form a nearly right angle. The four blade members (86) are spaced uniformly in the top-to-bottom direction. Both longitudinal ends of each of the blade members (86) are rotatably supported by the respective side surfaces (82) of the second casing (71). Each of the blade members (86) is rotatable about its axis (C) extending along its longitudinal direction within a predetermined angle range. The airflow direction adjusting flap (85) closes the air outlet (75) while the indoor unit (30) is inactive. The term "close" here may indicate a state where a slight gap remains.

[0056] In the blow-out unit (70), driving the blade members (86) with an airflow direction adjusting motor (not shown) allows the blade members (86) to rotate about

their respective axes (C) as illustrated in FIG. 8. This triggers a change in the angle of each of the blade members (86). The blade members (86) guide air blown out of the blow-out passage (73). Thus, a change in the angle of each of the blade members (86) allows the direction of the air blown out of the blow-out passage (73) to change vertically.

[0057] Each of the blade members (86) is configured to be capable of adjusting the direction of the air flowing out of the blow-out passage (73) within a range from a predetermined angle at which the blade member (86) is directed downward relative to the horizontal plane to another predetermined angle at which the blade member (86) is directed upward relative to the horizontal plane with the indoor unit (30) installed. In this embodiment, the angle range $\theta 1$ in which each of the blade members (86) can direct the air upward relative to the horizontal plane is greater than 0° and less than or equal to 10°, where the horizontal plane has an angle of 0°. Each of the blade members (86) is configured to be capable of directing the air downward as well relative to the horizontal plane as described above, and the angle range $\theta 2$ in which the blade members (86) can direct the air downward is set to be from 0° to 55°.

[0058] FIG. 9 illustrates a cross-sectional shape of one of the blade members (86). As illustrated in the figure, each of the blade members (86) is configured as a plate-shaped member having front and back surfaces that are not curved but flat. The front and back surfaces of each of the blade members (86) respectively correspond to upper and lower surfaces of the blade member (86) while air is blown out of the air outlet (75) upward relative to the horizontal plane. Thus, while each of the blade members (86) is set at an angle at which the air is blown upward, both the upper and lower surfaces of the blade member (86) are not curved but flat. In the present disclosure, only the upper surface of each of the blade members (86) needs to be flat. Upper and lower edge portions of the blade members (86) each have an inclined surface (86a) over which an adjacent one of the blade members (86) is placed while the air outlet (75) is closed.

[0059] The back surface of each of the blade members (86) that has closed the air outlet (75) has a plurality of fine grooves (87) arranged parallel to the longitudinal direction of the blade member (86). The surface having the grooves (87) corresponds to the lower surface of the blade member (86) that has opened the air outlet (75). Thus, even if condensate adheres to the blade members (86) during the cooling operation of the indoor unit (30), the condensate is retained in the grooves (87). In this embodiment, the lower surface of each of the blade members (86) that has opened the air outlet (75) has the fine grooves (87).

[0060] The airflow direction adjusting flap (85) may include three or less blade members (86), or five or more blade members (86). The grooves (87) of each of the blade members (86) do not have to be parallel as long as the surface of the blade member (86) with the grooves (87) is uneven. The grooves (87) may be formed on both surfaces of the blade member (86), or may be formed only on one of the surfaces of the blade member (86) opposite to the surface of the blade member (86) with the grooves (87) in FIG. 9.

<Decorative Cover>

[0061] The decorative covers (91, 92) are elongated rectangular cuboid-shaped members. Each of the decorative covers (91, 92) opens through its side surface on the long side thereof and its back surface. The length of each of the decorative covers (91, 92) is generally equal to the length from the back surface of the body unit (50) to the front surface of the blow-out unit (70).

[0062] The decorative covers (91, 92) are attached to the body unit (50) such that their open side surfaces face the body unit (50), and cover both the side surfaces of the body unit (50) and the side surfaces of the blow-out unit (70). The right decorative cover (91) disposed on the right side of the body unit (50) covers the right panel (57) of the body unit (50) and a right panel of the blow-out unit (70). The left decorative cover (92) disposed on the left side of the body unit (50) covers the left panel (58) of the body unit (50) and a left panel of the blow-out unit (70). The right and left decorative covers (91) and (92) are slidable in the front-to-back direction of the overall casing (33). Sliding the right and left decorative covers (91) and (92) backward from the front of the overall casing (33) to a predetermined position allows the right and left decorative covers (91) and (92) to be attached to the overall casing (33). Sliding the right and left decorative covers (91) and (92) forward from the back of the overall casing (33) in the reverse direction allows the right and left decorative covers (91) and (92) to be detached from the overall casing (33).

<Operation>

[0063] The air conditioner (10) selectively performs cooling operation and heating operation.

[0064] In the cooling operation, the four-way switching valve (22) is set to the first state, and a refrigerant circulates through the refrigerant circuit (11). The outdoor heat exchanger (23) functions as a radiator, and the indoor heat exchanger (31) functions as an evaporator. The indoor unit (30) cools air sucked from the indoor space in the indoor heat exchanger (31), and blows the cooled air into the indoor space.

[0065] In the heating operation, the four-way switching valve (22) is set to the second state, and the refrigerant circulates through the refrigerant circuit (11). The indoor heat exchanger (31) functions as a radiator, and the outdoor heat exchanger (23) functions as an evaporator. The indoor unit (30) heats air sucked from the indoor space in the indoor heat exchanger (31), and blows the heated air into the indoor space.

<Flow of Blown Air During Operation>

[0066] During operation of the indoor unit (30), actuating the indoor fan (32) allows air sucked through the air inlet (60) into the overall casing (33) to pass through the indoor heat exchanger (31), thereby obtaining conditioned air. After passing through the indoor heat exchanger (31), the conditioned air passes through the blow-out passage (73) to be straightened without being diffused. The blown air straightened through the blow-out passage (73) is blown forward (in the lateral direction) of the overall casing (33) through the air outlet (75) provided at the opening end of the blow-out passage (73) near the outlet thereof.

[0067] If the airflow direction adjusting flap (85) is set within the angle range $\theta 1$ in which air is blown (e.g., upward at 5°), the conditioned air is blown upward relative to the horizontal plane along the airflow direction adjusting flap (85). In this case, the conditioned air that has flowed gently obliquely downward along the blow-out passage (73) passes through the horizontal blow-out surface (84a), and then moves to the airflow direction adjusting flap (85). A portion (78a) of the bottom surface (78) of the blow-out passage (73) transitioning to the blow-out surface (84a), the blow-out surface (84a), and the airflow direction adjusting flap (85) vary gradually in angle. Thus, the conditioned air flows smoothly through these portions, and is blown out of the air outlet (75). Each of the blade members (86) is configured as a flat plate; thus the air flowing through the blow-out passage (73) moves easily to the upper surfaces of the blade members (86), and the airflow direction smoothly changes upward.

[0068] The conditioned air blown upward from the air outlet (74), for example, at an angle θ equal to 5° (within the angle range of greater than 0° and less than or equal to 10°) reaches a region far away from the indoor unit (30). For example, the indoor space in which the indoor unit (30) is installed is presumed not to be excessively large for the air conditioning capacity of the indoor unit (30). In this case, if the indoor unit (30) is installed near one wall surface of the room, the angle of the airflow direction adjusting flap (85) set as described above allows the conditioned air to easily reach another wall surface of the room opposite to the one wall surface thereof near which the indoor unit (30) is installed. Air reaches another wall surface, and then moves downward along another wall surface. In contrast, indoor air is sucked through the back surface of the indoor unit (30) into the overall casing (33), and thus moves upward along the one wall surface near which the indoor unit (30) is provided. As described above, in the room, the air blown out of the indoor unit (30) flows substantially horizontally to reach the opposite wall surface far away from the indoor unit, flows downward along another wall surface opposite to the one wall surface near which the indoor unit (30) is installed, and flows upward along the one wall surface near which the indoor unit (30) is installed. This makes it easy for air to circulate through the room. As a result, the temperature of the indoor air during operation is substantially prevented from becoming nonuniform.

[0069] During the operation of the indoor unit (30), setting the volume of air delivered by the indoor fan (32) to a maximum volume allows the conditioned air to reach a further area. This makes it easy for air to flow to circulate through the room. Thus, in one preferred embodiment, when the indoor unit (30) is operated with the conditioned air blown upward, the volume of the air delivered by the indoor fan (32) is set to the maximum volume.

-Advantages of First Embodiment-

[0070] In this embodiment, the indoor unit (30) has the blow-out passage (73) extending from the indoor heat exchanger (31) toward the air outlet (75). The second lower end (77) is located below the first lower end (76) in the height direction. The second lower end (77) is the lower end of one of the end portions of the blow-out passage (73) near the air outlet (75) out of which air flows. The first lower end (76) is the lower end of the other one thereof near the heat exchanger (31) into which air flows. The indoor unit (30) is provided with the airflow direction adjusting flap (85) capable of directing the air flowing out of the blow-out passage (73) upward relative to the horizontal plane.

[0071] Here, while the air outlet (75) is located downstream of the indoor heat exchanger (31) in the airflow direction, the airflow direction adjusting flap (85) is simply provided at the air outlet (75) without the provision of a passage through which air is straightened. In that case, even if the angle of the air blown is set at an upward angle, the air that has passed through the indoor air (31) tends to be diffused. Thus, the air blown out of the indoor air (31) hardly reaches a region far away from the indoor unit. This makes it difficult for conditioned air to circulate through the room.

[0072] In this embodiment, the blow-out passage (73) is provided downstream of the indoor heat exchanger (31) in the airflow direction. Thus, the air that has flowed out of the indoor heat exchanger (31) passes through the blow-out passage (73) without being diffused. The air is straightened in the blow-out passage (73) between the first and second lower ends (77) and (78) to flow in one direction. The direction in which the air straightened in the blow-out passage (73) is blown is adjusted by the airflow direction adjusting flap (85). As can be seen, in this embodiment, the air is straightened in the blow-out passage (73), and then the direction in which the straightened air is blown is adjusted by the airflow direction adjusting flap (85). This makes it easy to adjust the airflow direction. The end portion of the bottom surface (78) of the blow-out passage (73) near the outlet has the horizontal blow-out surface (84a). Thus, air flows through, in this order, a portion of the blow-out passage (73) located upstream of the blow-out surface (84a) and facing downward, the horizontal blow-out surface (84a), and the air-

flow direction adjusting flap (85) facing upward. Thus, the airflow direction smoothly changes upward. The straightened conditioned air blown upward as described above easily reaches a region far away from the indoor unit (30). This allows the conditioned air to easily circulate through the room. As a result, the room temperature during air conditioning operation can be substantially prevented from becoming nonuniform.

[0073] In this embodiment, the second lower end (77) of the blow-out passage (73) is located below the first lower end (76) thereof. Thus, the blow-out passage (73) is entirely inclined downward from the inlet toward the outlet of the blow-out passage (73). Thus, if the ceiling-suspended indoor unit is configured to be capable of adjusting the angle at which air is blown downward through the airflow direction adjusting flap (85) as well, the air is also easily blown downward out of the air outlet (75). In particular, the air is easily blown downward at an angle that is greater than the angle at which the air is blown upward.

[0074] In this embodiment, a portion of the upper surface of the blow-out passage (73) is a curved surface that is curved from the air inlet toward the air outlet. If surfaces defining the blow-out passage (73) are all flat, portions of the flat surfaces adjacent to each other which form a bend in the blow-out passage (73) serve adversely as points of separation of the air flow. However, using the curved surface makes it difficult for the air flow to split. This makes it easy for the air to flow smoothly through the blow-out passage (73).

[0075] In this embodiment, the blow-out passage (73) is disposed downstream of the outer peripheral portion (37) of the drain pan (35) in the airflow direction. According to this configuration, the air that has passed through the heat exchanger (31) passes through the outer peripheral portion (37) of the drain pan (35), and then flows into the blow-out passage (73). This facilitates straightening the air on the downstream side of the heat exchanger (31) through the blow-out passage (73).

[0076] In addition, if a portion of the blow-out passage (73) is located upstream of the outer peripheral portion (37) of the drain pan (35) in the airflow direction, the blow-out passage (73) and the drain pan (35) overlap each other in plan view. In this case, to shift the blow-out passage (73) and the drain pan (35) in the height direction of the indoor unit (30), the height of the indoor unit (30) may increase. In contrast, in this embodiment, the entire blow-out passage (73) is disposed downstream of the raised portion (37), which serves as the outer peripheral portion of the drain pan (35), in the airflow direction. This configuration eliminates the need for shifting the blow-out passage (73) and the drain pan (35) in the height direction of the indoor unit (30), and reduces the height of the indoor unit.

[0077] Here, if the airflow direction adjusting flap (85) is curved, for example, downward along the air flow with the air outlet (75) open, the air blown out of the blow-out passage (73) is easily directed downward. However, the air is hardly blown upward. In this embodiment, the airflow direction adjusting flap (85) is configured as a flat plate, and has upper and lower surfaces that are both flat with the air outlet (75) open. If the flat plate-shaped airflow direction adjusting flap (85) is directed downward, the air flowing through the blow-out passage (73) from the first lower end (76) to the second lower end (77) can be blown downward within the angle range $\theta 2$. If the flat plate-shaped airflow direction adjusting flap (85) is directed upward, the air flowing through the blow-out passage (73) moves to the upper surface of the flat plate-shaped airflow direction adjusting flap (85) to easily undergo a change of direction as illustrated in FIG. 8. This facilitates directing the air upward. As can be seen, according to this embodiment, regardless of whether the air blown out of the blow-out passage (73) is directed downward or upward, the airflow direction is easily adjusted. Thus, in this embodiment, conditioned air is blown out of the indoor unit (30) downward during normal operation, and after a lapse of a certain period of time, an operation can be performed so that the air is blown out of the indoor unit (30) upward to circulate the indoor air through the room.

[0078] In this embodiment, the airflow direction adjusting flap (85) includes the plurality of blade members (86) extending in a direction that intersects with the direction in which the air flows through the blow-out passage (73) and with the vertical direction. The blade members (86) are vertically arranged. According to this configuration, using the blade members (86) vertically arranged allows the direction of the air flowing through the entire blow-out passage (73) from the bottom to the top thereof to be adjusted. Using about four blade members (86) makes it easier to adjust the airflow direction than using a smaller number of blade members (86) does. In addition, according to this embodiment, the upper and lower edge portions of the blade members (86) each have the inclined surface (86a) over which an adjacent one of the blade members (86) is placed while the air outlet (75) is closed. This enables closing of the gap that may be formed between each adjacent pair of the blade members (86) while the air outlet (75) is closed. As a result, the appearance of the indoor unit (30) is improved.

[0079] In this embodiment, the angle range in which the airflow direction adjusting flap (85) can direct the air upward relative to the horizontal plane is greater than 0° and less than or equal to 10°, where the horizontal plane has an angle of 0°. If the angle of the airflow direction adjusting flap (85) increases to above 10°, the angle at which the air is blown is excessively sharp. This makes it difficult for the blown air to reach a region far away from the indoor unit. As a result, the conditioned air hardly circulates through the room. In contrast, according to this embodiment, the range in which the angle of the airflow direction adjusting flap (85) is adjustable is set to be greater than 0° and less than or equal to 10°. This can reduce the degree of difficulty in circulating the conditioned air through the room.

[0080] In this embodiment, two of the side plates (34) of the overall casing (33) opposed to each other, i.e., the first back panel (56) and the front member (81), respectively have the air inlet (60) and the air outlet (75). The air sucked from the air inlet (60) flows to the air outlet (75) opposed to the air inlet (60) so as to be blown out of the overall casing (33). In this embodiment, the air flows through the overall casing (33) in one direction. This makes it less likely for the air to receive resistance in the casing (33). This allows the air to flow easily through the casing (33).

[0081] In this embodiment, the overall casing (33) of the indoor unit (30) includes the first casing (51) in which the indoor heat exchanger (31) and the fan (32) are provided, and the second casing (71) having the blow-out passage (73) and the air outlet (75) and fitted to the first casing (51). According to this embodiment, the second casing (71) is separate from the first casing (51). Thus, the second casing (71) may be attached to an already installed indoor unit. Alternatively, the second casing (71) to be attached to the different first casing (51) may be standardized. An air-conditioning system including ducts connecting an outdoor unit and a plurality of rooms together may include an indoor unit that includes a second casing (71) fitted to the duct.

[0082] In addition, the indoor unit according to this embodiment is a ceiling-suspended indoor unit, and can direct the blown air upward. Thus, the indoor unit according to this embodiment is effectively used in an indoor space to which pipes and other components are exposed and which has a high ceiling and a large portion above the indoor unit (30).

-Variations of First Embodiment-

<First Variation>

[0083] A first variation that is not according to the present invention shown in FIG. 10 is an example in which the shape of a blow-out passage (73) is different from that of the first embodiment shown in FIG. 8. A bottom surface (78) of the blow-out passage (73) according to this first variation has a downstream bottom portion (78a) on the downstream side of the blow-out passage (73) in the airflow direction. The downstream bottom portion (78a) is a predetermined region of the bottom surface (78) of the blow-out passage (73) extending upstream from the downstream opening end of the blow-out passage (73). In this embodiment, the downstream bottom portion (78a) is a portion of the blow-out passage (73) extending upstream from the downstream opening end of the blow-out passage (73) and having a length that is about 1/3 of the passage length of the blow-out passage (73). This length may be about 1/2 of the passage length of the blow-out passage (73). However, the downstream bottom portion (78a) with a shorter length tends to allow the angle range in which blown air is directed downward to be greater than the angle range in which blown air is directed upward.

[0084] A second lower end (77) of the blow-out passage (73) of the first variation is located above the lowermost end of the downstream bottom portion (78a) in the height direction. Thus, the blow-out passage (73) has an inclined surface that is inclined obliquely upward from the lowermost end of the downstream bottom portion (73) toward the second lower end (77). This inclined surface constitutes a blow-out surface (84b).

[0085] In this first variation, an upper surface (79) of the blow-out passage (73) is configured as a combination of a flat surface and a curved surface. The bottom surface (78) is entirely configured as a curved surface that is curved from the air inlet toward the air outlet.

[0086] The level difference between the first and second lower ends (76) and (77) is denoted by $\Delta h1$. The level difference between the lowermost end of the downstream bottom portion (78a) and the second lower end (77) is denoted by $\Delta h2$. Similarly to the first embodiment, a portion of the blow-out surface (84b) near the opening end of the blow-out passage (73) may have an inclined surface that is inclined in the direction that allows the opening area to increase.

[0087] The other configuration of this variation is the same as, or similar to, that of the first embodiment.

[0088] In this first variation, the second lower end (77) is located below the first lower end (76), and the height of the second lower end (77) of the bottom surface (78) of the blow-out passage (73) is greater than that of the lowermost end of the downstream bottom portion (78a). This relationship in height allows air flowing along the bottom surface (78) of the blow-out passage (73) to flow downward through the blow-out passage (73), and then allows the flow of the air to be turned upward by the blow-out surface (84b) upon passing of the air through the lowermost end. Thus, the air is blown out of the blow-out passage (73). At this time, the airflow direction is changed smoothly due to the entire bottom surface configured as the curved surface.

[0089] In this configuration, the blow-out surface (84b) facing upward is provided. Thus, a combination of this blow-out surface (84b) and the airflow direction adjusting flap (85) capable of directing the air straightened by the blow-out passage (73) upward relative to the horizontal plane facilitates stably directing the blown air upward. This makes it easy for conditioned air to circulate through the room.

[0090] In this first variation, the second lower end (77) may be at the same height as the lowermost end of the downstream bottom portion (78a). According to this configuration, the blow-out surface (84a) forms a horizontal surface as in the first embodiment. Such a configuration also exhibits advantages substantially similar to those of the first variation that is not according to the present invention shown in FIG. 10.

<Second Variation>

[0091] A second variation shown in FIG. 11 is an example in which the shape of a blow-out passage (73) is different from that of the first embodiment shown in FIG. 8. A wall surface defining the blow-out passage (73) of the second variation has an overhanging portion (80a) corresponding to an upper portion of the downstream opening of the blow-out passage (73) in the airflow direction and overhanging downward. The overhanging portion (80a) overhangs downward from an upper surface (79) of the blow-out passage (73). The overhanging portion (80a) extends horizontally. In other words, the overhanging portion (80a) extends in a direction intersecting with the direction of the air flowing through the blow-out passage (73) and intersecting with the vertical direction. The term "horizontal" as used herein has the same meaning as described above.

[0092] The other configuration of this variation is the same as, or similar to, that of the first embodiment.

[0093] In this second variation, while an operation is performed to blow air downward through the outlet (75), the air blown out of an upper portion of the blow-out passage (73) flows easily downward while being curved along the overhanging portion (80a). This stabilizes the flow of the air downward through the air outlet (75). Also in this second variation, the blow-out passage (73) is provided; the air straightened to have its flow direction stabilized thus can be blown downward without being diffused.

[0094] In this second variation, the overhanging portion (80a) is integrated with the wall surface forming the upper surface (78). However, the overhanging portion (80a) may be a part separate from the wall surface forming the upper surface (78), and may be attached to the wall surface.

<Third Variation>

[0095] An indoor unit (39) according to a third variation shown in FIG. 12 is an example in which the first and second casings (51) and (71) of the foregoing embodiment shown in FIG. 4 are configured as an integrated casing (33). In this third variation, a first unit (50) has a blow-out passage (73) as well.

[0096] This third variation has the same configuration as the foregoing embodiment shown in FIGS. 1 to 9, except that the first and second casings (51) and (71) are replaced with the integrated casing (33). In particular, a second lower end (77), which is the lower end of one of end portions of the blow-out passage (73) through which air flows out of the blow-out passage (73), is located below a first lower end (76), which is the lower end of the other one thereof through which air flows into the blow-out passage (73), in the height direction. The blow-out passage (73) extends from the indoor heat exchanger (31) to the air outlet (75). The air outlet (75) is provided with the airflow direction adjusting flap (85) capable of directing the air flowing out of the blow-out passage (73) upward relative to the horizontal plane.

[0097] Details of other configurations will not be described.

[0098] Also in this third variation, the blow-out passage (73) is provided downstream of the indoor heat exchanger (31) in the airflow direction; the air that has flowed out of the indoor heat exchanger (31) thus passes through the blow-out passage (73) without being diffused. Air is straightened in the blow-out passage (73) between the first and second lower ends (77) and (78). The direction in which the air straightened in the blow-out passage (73) is blown is adjusted by the airflow direction adjusting flap (85).

[0099] Also in this third variation, the air is straightened in the blow-out passage (73), and then the direction in which the straightened air is blown is adjusted by the airflow direction adjusting flap (85). This makes it easy to direct the air even upward. The straightened conditioned air blown upward easily reaches a region far away from the indoor unit (30). This allows the conditioned air to easily circulate through the room.

«Second Embodiment»

[0100] A second embodiment shown in FIGS. 13 and 14 will be described below.

[0101] In this second embodiment, an overall casing (33) includes one body unit (50), one blow-out unit (70), one additional unit (100), and a pair of decorative covers (91, 92). In other words, in this second embodiment, the indoor unit (30) according to the first embodiment further includes the additional unit (100). The additional unit (100) is a unit for allowing the indoor unit (30) to have an additional function.

[0102] The additional unit (100) includes a third casing (101), and a functional component (102) disposed inside the third casing (101). The functional component (102) is, for example, a discharger that purifies air by electric discharge producing low-temperature plasma containing active species. Although not shown, the additional unit is provided with an electric component box housing a control board configured to control an operation of the discharger (102). The third casing (101) is provided with a filter (not shown) configured to adsorb dust in sucked air.

[0103] The third casing (101) has an outer shape forming a horizontally long cuboid, and is fitted to the back surface of the body unit (50). The third casing (101) has an air inlet (103) through which air is to be sucked thereinto, and an air opening (104) through which air flows out of the second casing (101) into the first casing (51). The air inlet (103) is provided with the filter. In this second embodiment, the air inlet (60) of the body casing (50) according to the first embodiment serves as an air inflow port communicating with the air opening (104).

[0104] A left panel (105) of the third casing (101) has a ventilating opening (106) through which air outside an

indoor space is to be introduced into the additional unit (100) and the body unit (50). The air outside the indoor space is air having its temperature unadjusted, such as outdoor air or air in the ceiling cavity. The ventilating opening (106) is connected to a duct (not shown) through which the air outside the indoor space is introduced into a space inside the casing (33); the inside of the casing (33) is thus ventilated.

[0105] Other configurations including the blow-out passage (73) and the airflow direction adjusting flap (85) are the same as, or similar to, those of the first embodiment.

[0106] In this second embodiment, the indoor unit (30) including the additional unit (100) can blow conditioned air straightened in the blow-out passage (73) upward, as in the first embodiment. This makes it easy for the conditioned air to reach a region far away from the indoor unit (30), as in the first embodiment. This allows the conditioned air to easily circulate through the room.

[0107] Other advantages are the same as, or similar to, those of the first embodiment.

«Other Embodiments»

[0108] The foregoing embodiments may be modified as follows.

[0109] For example, in the foregoing embodiments, the overall casing (33) should not be limited to a cuboid object, and may be a three-dimensional object that is hexagonal or octagonal in plan view. In other words, the overall casing (33) may include a plurality of left panels and a plurality of right panels. The front and back surfaces of the casing (33) do not necessarily have to be parallel to each other, and the right and left side surfaces thereof do not necessarily have to be parallel to each other.

[0110] In the first embodiment, the back panel (56) has the air inlet (60). However, any other component, such as either the left or right panel (57, 58) or the bottom plate (53), may have the air inlet (60).

[0111] In the first embodiment, the angle range in which the airflow direction adjusting flap (85) can direct the air upward relative to the horizontal plane is greater than 0° and less than or equal to 10°, where the horizontal plane has an angle of 0°. However, the upper limit of the angle range may be changed. In the foregoing embodiments and the foregoing variations, the airflow direction adjusting flap (85) includes the plurality of flat plate-shaped blade members (86). However, the airflow direction adjusting flap (85) may include one blade member (86), or the blade members (86) may have different shapes.

[0112] While the embodiments and variations thereof have been described above, it will be understood that various changes in form and details may be made without departing from the scope of the claims.

INDUSTRIAL APPLICABILITY

[0113] As can be seen from the foregoing description, the present disclosure is useful for an indoor unit of an air conditioner.

DESCRIPTION OF REFERENCE CHARACTERS

[0114]

10	Air Conditioner
30	Indoor Unit
31	Indoor Heat Exchanger (Heat Exchanger)
32	Indoor Fan (Fan)
33	Overall Casing (Casing)
34	Side Plate
35	Drain Pan
37	Raised Portion (Outer Peripheral Portion)
51	First Casing
56	First Back Panel (Side Plate)
60	Air Inlet
71	Second Casing
73	Air-Flow Passage
75	Air Outlet
76	First Lower End
77	Second Lower End
78	Bottom Surface
78a	Downstream Bottom Portion
79	Upper Surface
80a	Overhanging Portion
81	Front Panel (Side Plate)
85	Airflow Direction Adjusting Flap
86	Blade Member

Claims

1. A ceiling-suspended indoor unit of an air conditioner, the indoor unit comprising:

a casing (33) including a plurality of side plates (34), one of the side plates (34) having an air outlet (75);
a heat exchanger (31) disposed in the casing (33);
a fan (32) configured to blow air that has been passed through the heat exchanger (31) out of the air outlet (75) to an associated side of the casing (33);
an airflow direction adjusting flap (85) provided at the air outlet (75); and
a blow-out passage (73) extending from the heat exchanger (31) toward the air outlet (75),

the blow-out passage (73) having:

a first lower end (76) that represents a lower end of one of end portions of the blow-out passage

(73) near the heat exchanger (31) into which air flows,
a second lower end (77) that represents a lower end of the other end portion of the blow-out passage (73) near the air outlet (75) out of which air flows, the second lower end (77) being located below the first lower end (76) in a height direction, and
a bottom surface (78) located at a bottom of the blow-out passage (73),

characterized in that
the bottom surface (78) of the blow-out passage (73) includes:

an inclined portion (83) formed on an end portion near the air outlet (75) and inclined in a direction that allows an area of an opening of the air outlet (75) to increase, and
a horizontal blow-out surface (84a) located more upstream in an airflow direction than the inclined portion (83) and adjacent to the inclined portion (83),
the airflow direction adjusting flap (85) being capable of directing air flowing out of the blow-out passage (73) upward relative to a horizontal plane.

2. The indoor unit of any one of claim 1, further comprising

a drain pan (35) for receiving drain water generated in the heat exchanger (31), the drain pan (35) being disposed in the casing (33), wherein the blow-out passage (73) is disposed downstream of an outer peripheral portion (37) of the drain pan (35) in the airflow direction.

3. The indoor unit of any one of claims 1 or 2, wherein the airflow direction adjusting flap (85) that is directing the air upward relative to the horizontal plane has a flat upper surface.

4. The indoor unit of any one of claims 1 to 3, wherein

the airflow direction adjusting flap (85) includes a plurality of blade members (86) extending in a direction intersecting with a direction of air flowing through the blow-out passage (73) and intersecting with a vertical direction, and
the blade members (86) are vertically arranged.

5. The indoor unit of any one of claims 1 to 4, wherein an angle range in which the airflow direction adjusting flap (85) is capable of directing the air upward relative to the horizontal plane is greater than 0° and less than or equal to 10°, where the horizontal plane has an angle of 0°.

6. The indoor unit of any one of claims 1 to 5, wherein

a wall surface defining the blow-out passage (73) has an overhanging portion (80a) corresponding to an upper portion of a downstream opening of the blow-out passage (73) in an airflow direction and overhanging downward, and the overhanging portion (80a) extends in a direction intersecting with a direction of air flowing through the blow-out passage (73) and intersecting with a vertical direction.

7. The indoor unit of any one of claims 1 to 6, wherein another one (56) of the side plates of the casing (33) opposed to the one (81) of the side plates having the air outlet (75) has an air inlet (60).

8. The indoor unit of any one of claims 1 to 7, wherein the casing (33) includes:

a first casing (51) in which the heat exchanger (31) and the fan (32) are disposed; and
a second casing (71) having the blow-out passage (73) and the air outlet (75), and fitted to the first casing (51).

Patentansprüche

1. An der Decke hängende Innenraumeinheit einer Klimaanlage, wobei die Innenraumeinheit Folgendes umfasst:

ein Gehäuse (33), das eine Vielzahl von Seitenplatten (34) einschließt, wobei eine der Seitenplatten (34) einen Luftauslass (75) aufweist;
einen Wärmetauscher (31), der in dem Gehäuse (33) angeordnet ist;
ein Gebläse (32), das ausgelegt ist, um Luft, die durch den Wärmetauscher (31) hindurchgelaufen ist, aus dem Luftauslass (75) zu einer zugeordneten Seite des Gehäuses (33) zu blasen;
eine am Luftauslass (75) bereitgestellte Klappe (85) zum Anpassen der Luftstromrichtung; und
einen Ausblasdurchgang (73), der sich vom Wärmetauscher (31) zum Luftauslass (75) erstreckt,
wobei der Ausblasdurchgang (73) Folgendes aufweist:

ein erstes unteres Ende (76), das ein unteres Ende eines von Endabschnitten des Ausblasdurchgangs (73) in der Nähe des Wärmetauschers (31) darstellt, in den die Luft strömt,
ein zweites unteres Ende (77), das ein unteres Ende des anderen Endabschnitts des Ausblasdurchgangs (73) in der Nähe des

Luftauslasses (75) darstellt, aus dem Luft strömt, wobei sich das zweite untere Ende (77) in einer Höhenrichtung unterhalb des ersten unteren Endes (76) befindet, und
eine untere Oberfläche (78), die sich an einem Boden des Ausblasdurchgangs (73) befindet, **dadurch gekennzeichnet, dass**

die untere Oberfläche (78) des Ausblasdurchgangs (73) Folgendes einschließt:

einen geneigten Abschnitt (83), der an einem Endabschnitt in der Nähe des Luftauslasses (75) ausgebildet ist und in einer Richtung geneigt ist, die es ermöglicht, dass sich eine Fläche einer Öffnung des Luftauslasses (75) erhöht, und
eine horizontale Ausblasoberfläche (84a), die sich in einer Luftstromrichtung weiter stromaufwärts als der geneigte Abschnitt (83) und angrenzend an den geneigten Abschnitt (83) befindet,

wobei die Klappe (85) zum Anpassen der Luftstromrichtung in der Lage ist, die aus dem Ausblasdurchgang (73) strömende Luft relativ zu einer horizontalen Ebene nach oben zu lenken.

2. Innenraumeinheit nach Anspruch 1, weiter umfassend

eine Ablaufwanne (35) zur Aufnahme von im Wärmetauscher (31) erzeugtem Ablaufwasser, wobei die Ablaufwanne (35) im Gehäuse (33) angeordnet ist, wobei
der Ausblasdurchgang (73) stromabwärts eines Außenumfangsabschnitts (37) der Ablaufwanne (35) in der Luftstromrichtung angeordnet ist.

3. Innenraumeinheit nach einem der Ansprüche 1 oder 2, wobei
die Klappe (85) zum Anpassen der Luftstromrichtung, welche die Luft relativ zur horizontalen Ebene nach oben lenkt, eine flache obere Oberfläche aufweist.

4. Innenraumeinheit nach einem der Ansprüche 1 bis 3, wobei

die Klappe (85) zum Anpassen der Luftstromrichtung eine Vielzahl von Schaufelelementen (86) umfasst, die sich in einer Richtung erstrecken, die sich mit einer Richtung von durch den Ausblasdurchgang (73) strömender Luft kreuzt und sich mit einer vertikalen Richtung kreuzt, und
die Schaufelelemente (86) vertikal angeordnet sind.

5. Innenraumeinheit nach einem der Ansprüche 1 bis 4, wobei
ein Winkelbereich, in dem die Klappe (85) zum Anpassen der Luftstromrichtung in der Lage ist, die Luft relativ zur horizontalen Ebene nach oben zu lenken, größer als 0° und weniger als oder gleich 10° ist, wobei die horizontale Ebene einen Winkel von 0° aufweist.

6. Innenraumeinheit nach einem der Ansprüche 1 bis 5, wobei

eine Wandoberfläche, die den Ausblasdurchgang (73) definiert, einen überhängenden Abschnitt (80a) aufweist, der einem oberen Abschnitt einer stromabwärtigen Öffnung des Ausblasdurchgangs (73) in einer Luftstromrichtung entspricht und nach unten überhängt, und
der überhängende Abschnitt (80a) sich in eine Richtung erstreckt, die sich mit einer Richtung von durch den Ausblasdurchgang (73) strömender Luft kreuzt und sich mit einer vertikalen Richtung kreuzt.

7. Innenraumeinheit nach einem der Ansprüche 1 bis 6, wobei
eine andere (56) der Seitenplatten des Gehäuses (33), die der einen (81) der Seitenplatten, die den Luftauslass (75) aufweist, gegenüberliegt, einen Lufteinlass (60) aufweist.

8. Innenraumeinheit nach einem der Ansprüche 1 bis 7, wobei
das Gehäuses (33) Folgendes einschließt:

ein erstes Gehäuse (51), in dem der Wärmetauscher (31) und das Gebläse (32) angeordnet sind; und
ein zweites Gehäuse (71), das den Ausblasdurchgang (73) und den Luftauslass (75) aufweist und an dem ersten Gehäuse (51) angebracht ist.

Revendications

1. Unité intérieure d'un climatiseur suspendue au plafond, l'unité intérieure comprenant :

un boîtier (33) incluant une pluralité de plaques latérales (34), une des plaques latérales (34) présentant une sortie d'air (75) ;
un échangeur de chaleur (31) disposé dans le boîtier (33) ;
un ventilateur (32) configuré pour souffler de l'air qui a été passé à travers l'échangeur de chaleur (31) hors de la sortie d'air (75) vers un côté associé du boîtier (33) ;

un volet de réglage de direction d'écoulement d'air (85) fourni au niveau de la sortie d'air (75) ; et

un passage de soufflage (73) s'étendant depuis l'échangeur de chaleur (31) vers la sortie d'air (75),

le passage de soufflage (73) présentant :

une première extrémité inférieure (76) qui représente une extrémité inférieure d'une de portions d'extrémité du passage de soufflage (73) près de l'échangeur de chaleur (31) dans lequel de l'air s'écoule,

une seconde extrémité inférieure (77) qui représente une extrémité inférieure de l'autre portion d'extrémité du passage de soufflage (73) près de la sortie d'air (75) hors de laquelle de l'air s'écoule, la seconde extrémité inférieure (77) étant située en dessous de la première extrémité inférieure (76) dans une direction de hauteur, et

une surface de fond (78) située au niveau d'un fond du passage de soufflage (73),

caractérisée en ce que

la surface de fond (78) du passage de soufflage (73) inclut :

une portion inclinée (83) formée sur une portion d'extrémité près de la sortie d'air (75) et inclinée dans une direction qui permet à une zone d'une ouverture de la sortie d'air (75) d'augmenter, et

une surface de soufflage horizontale (84a) située plus en amont dans une direction d'écoulement d'air que la portion inclinée (83) et adjacente à la portion inclinée (83),

le volet de réglage de direction d'écoulement d'air (85) étant capable de diriger de l'air s'écoulant hors du passage de soufflage (73) vers le haut par rapport à un plan horizontal.

2. Unité intérieure selon la revendication 1, comprenant en outre

une cuvette de récupération (35) pour recevoir de l'eau de récupération générée dans l'échangeur de chaleur (31), la cuvette de récupération (35) étant disposée dans le boîtier (33), dans laquelle

le passage de soufflage (73) est disposé en aval d'une portion périphérique extérieure (37) de la cuvette de récupération (35) dans la direction d'écoulement d'air.

3. Unité intérieure selon l'une quelconque des revendications 1 ou 2, dans laquelle

le volet de réglage de direction d'écoulement d'air (85) qui dirige l'air vers le haut par rapport au plan horizontal présente une surface supérieure plate.

4. Unité intérieure selon l'une quelconque des revendications 1 à 3, dans laquelle

le volet de réglage de direction d'écoulement d'air (85) inclut une pluralité d'éléments formant pales (86) s'étendant dans une direction croisant une direction de l'air s'écoulant à travers le passage de soufflage (73) et croisant une direction verticale, et

les éléments formant pales (86) sont agencés verticalement.

5. Unité intérieure selon l'une quelconque des revendications 1 à 4, dans laquelle

une plage d'angle dans laquelle le volet de réglage de direction d'écoulement d'air (85) est capable de diriger l'air vers le haut par rapport au plan horizontal est supérieure à 0° et inférieure ou égale à 10°, où le plan horizontal présente un angle de 0°.

6. Unité intérieure selon l'une quelconque des revendications 1 à 5, dans laquelle

une surface de paroi définissant le passage de soufflage (73) présente une portion en saillie (80a) correspondant à une portion supérieure d'une ouverture en aval du passage de soufflage (73) dans une direction d'écoulement d'air et en saillie vers le bas, et

la portion en saillie (80a) s'étend dans une direction croisant une direction d'air s'écoulant à travers le passage de soufflage (73) et croisant une direction verticale.

7. Unité intérieure selon l'une quelconque des revendications 1 à 6, dans laquelle

une autre (56) des plaques latérales du boîtier (33) opposée à l'une (81) des plaques latérales présentant la sortie d'air (75) présente une entrée d'air (60).

8. Unité intérieure selon l'une quelconque des revendications 1 à 7, dans laquelle

le boîtier (33) inclut :

un premier boîtier (51) dans lequel l'échangeur de chaleur (31) et le ventilateur (32) sont disposés ; et

un second boîtier (71) présentant le passage de soufflage (73) et la sortie d'air (75), et ajusté sur le premier boîtier (51).

FIG.1

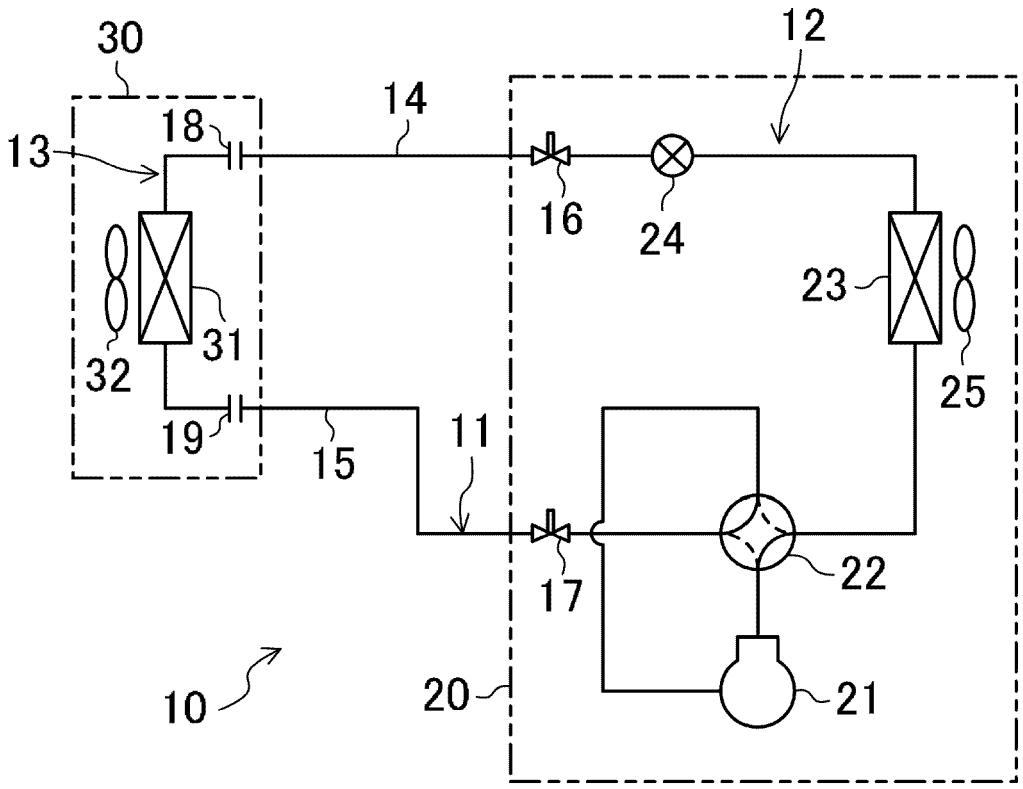

FIG.2

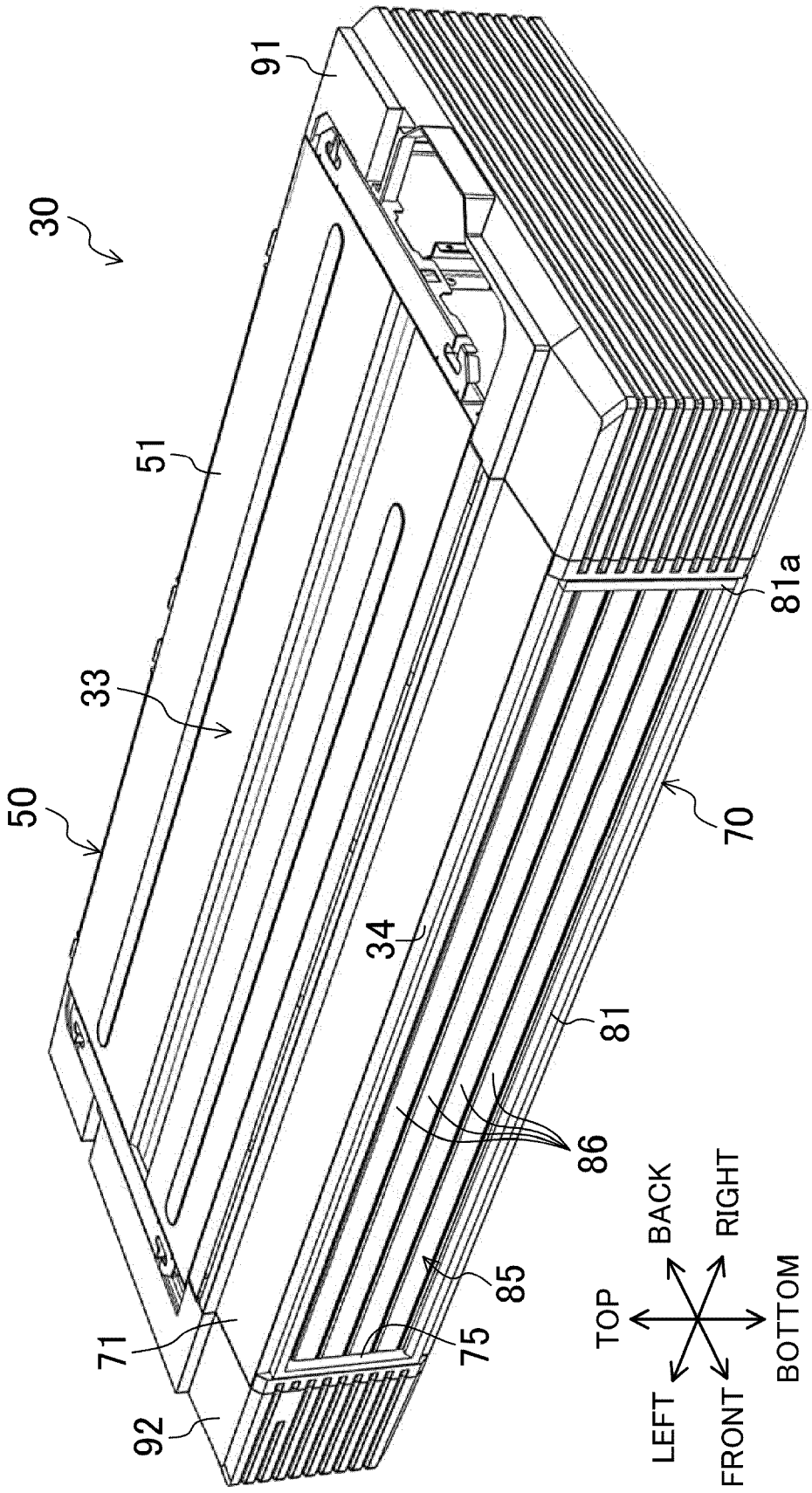
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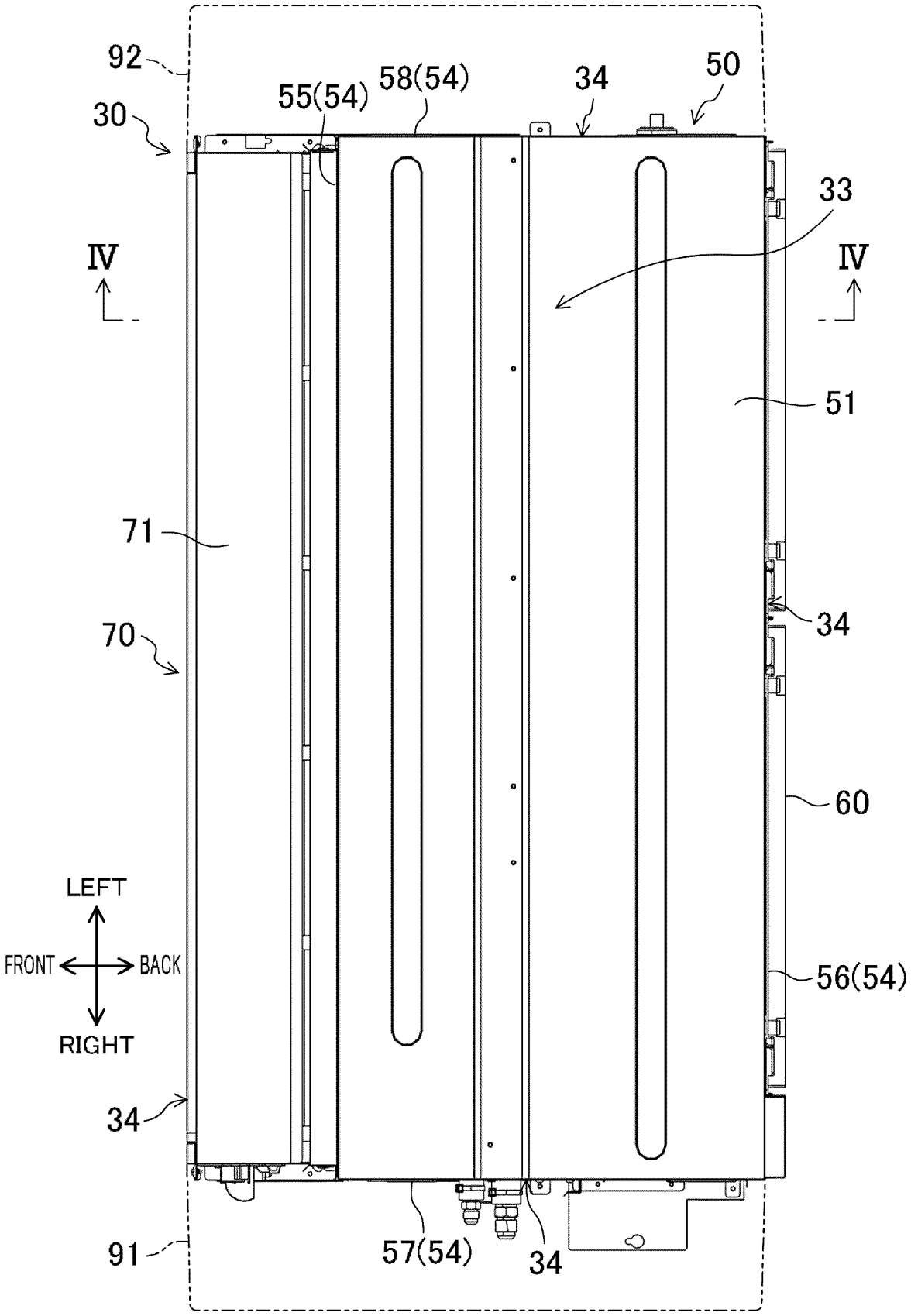
FIG.3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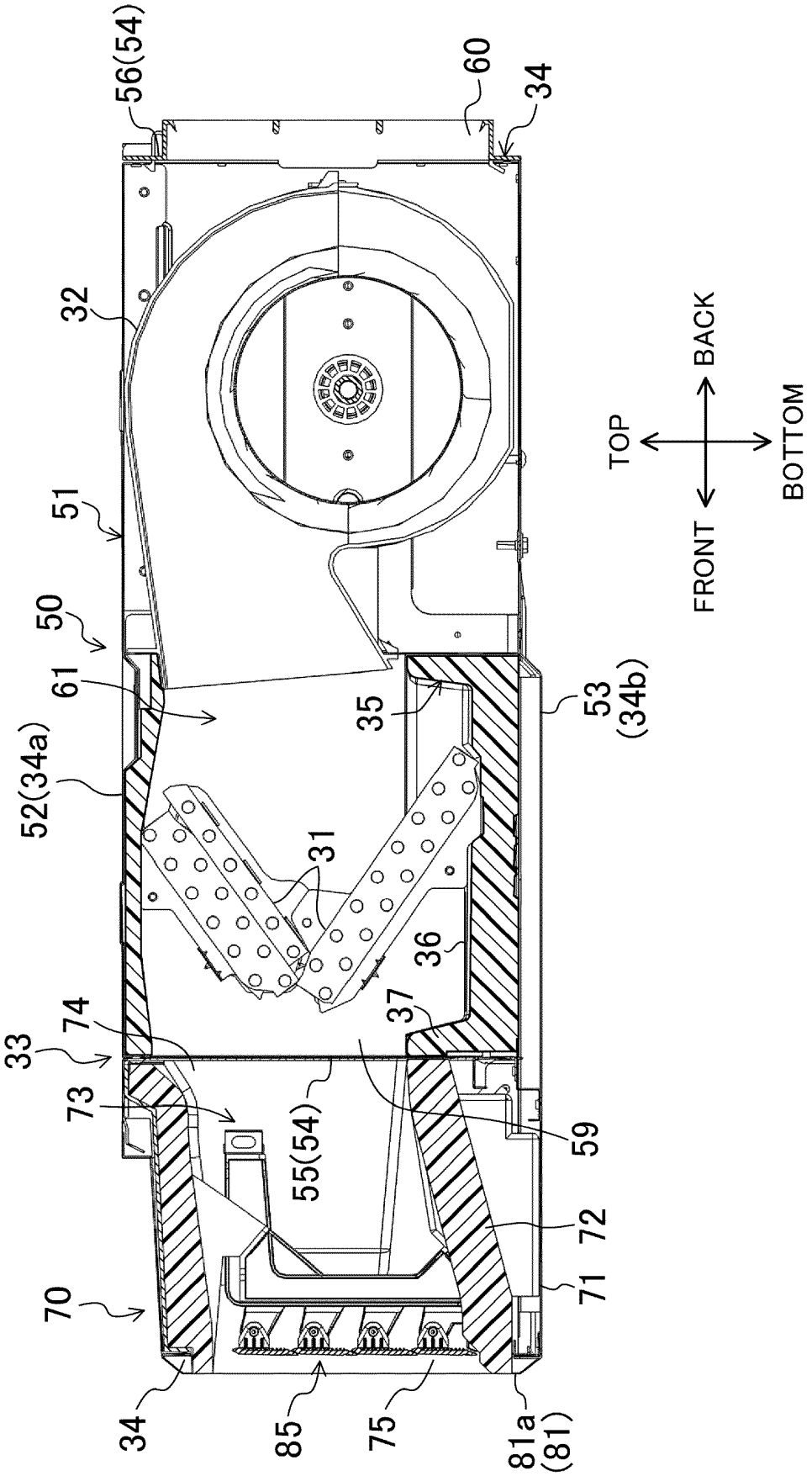
56(54)
34
91
57(54)
34

FIG.4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53
(34b)
52(34a)
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74
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72
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85
75
81a
(81)
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FIG.5

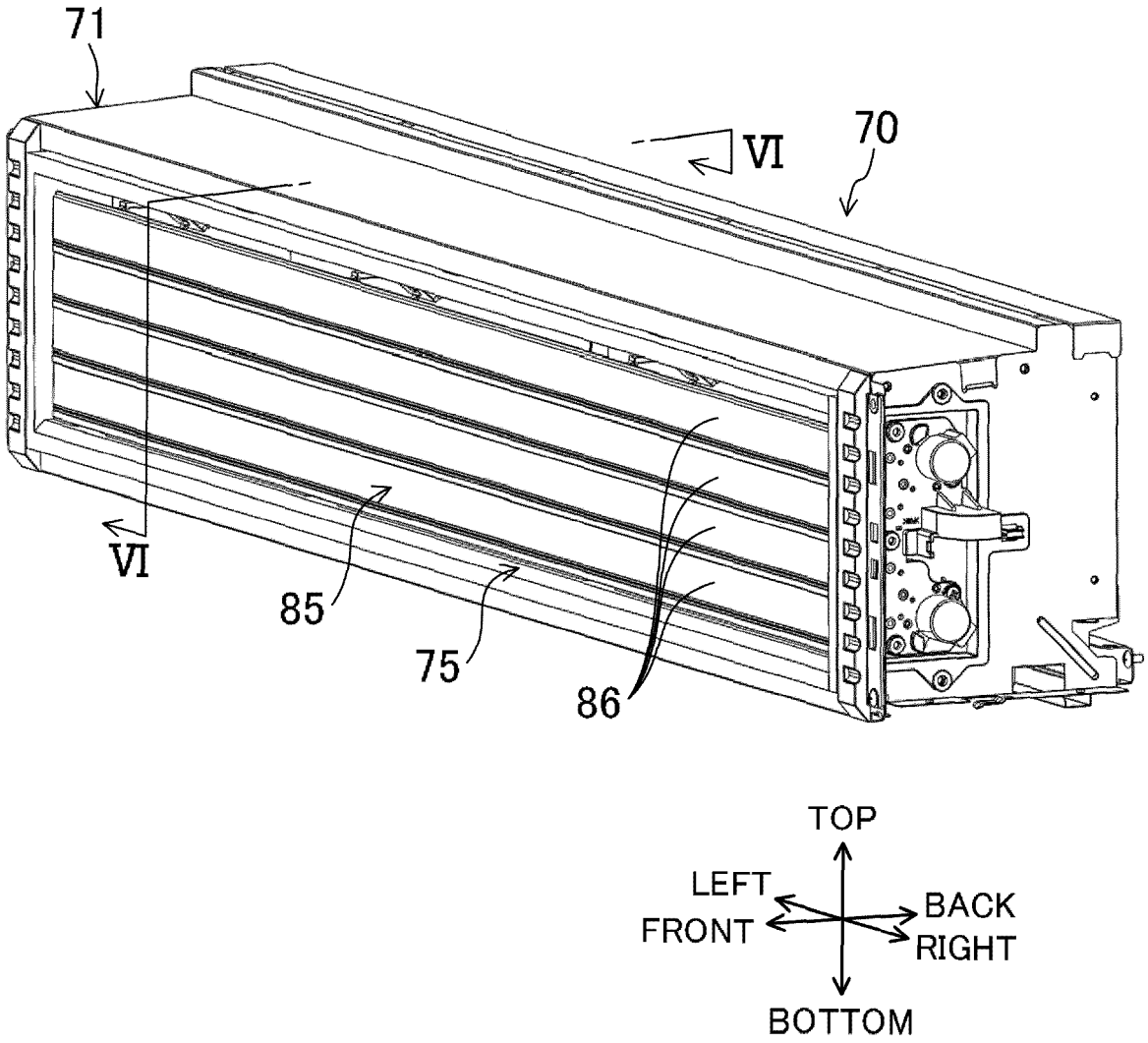

FIG.6

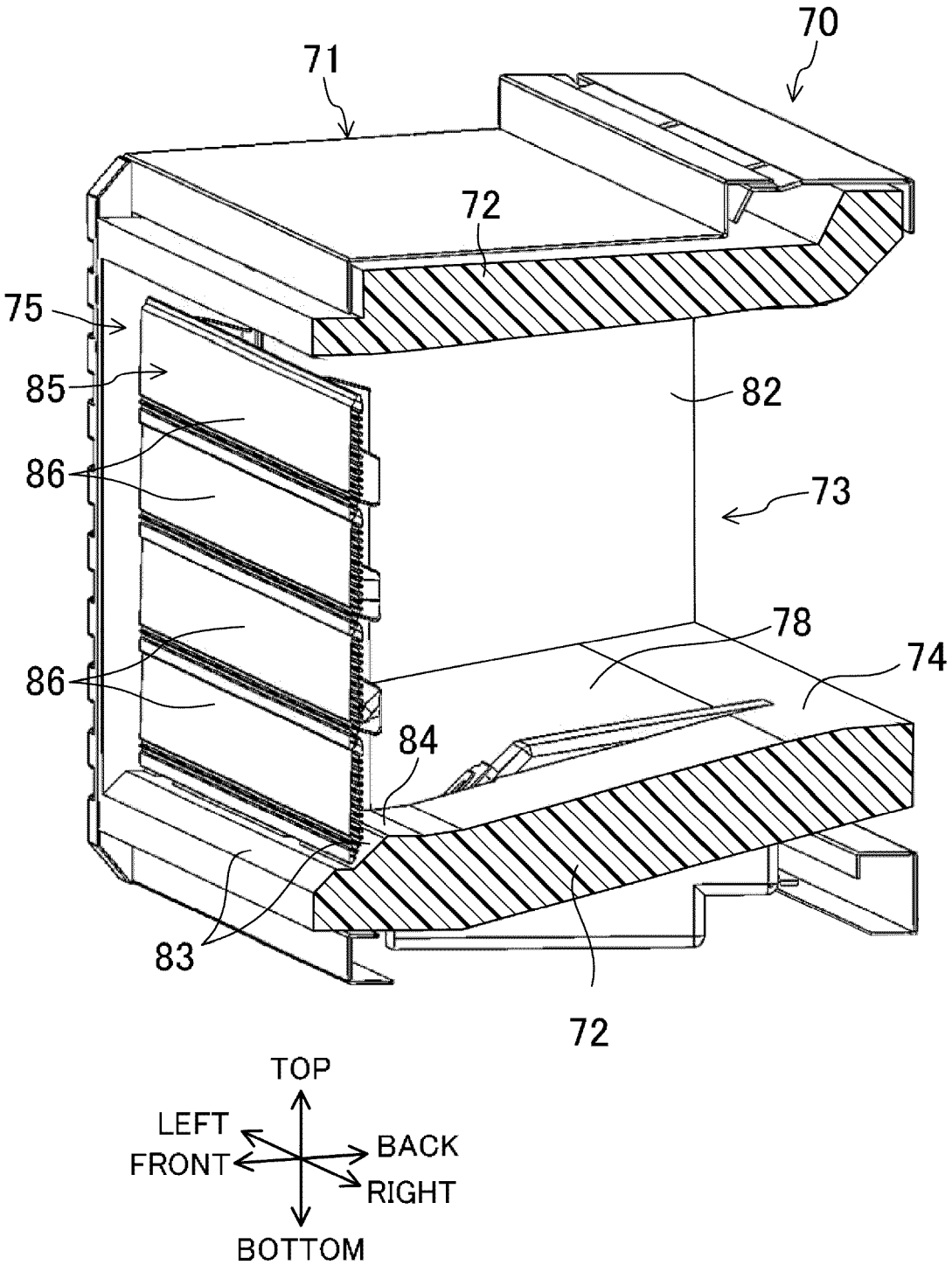
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FIG.7

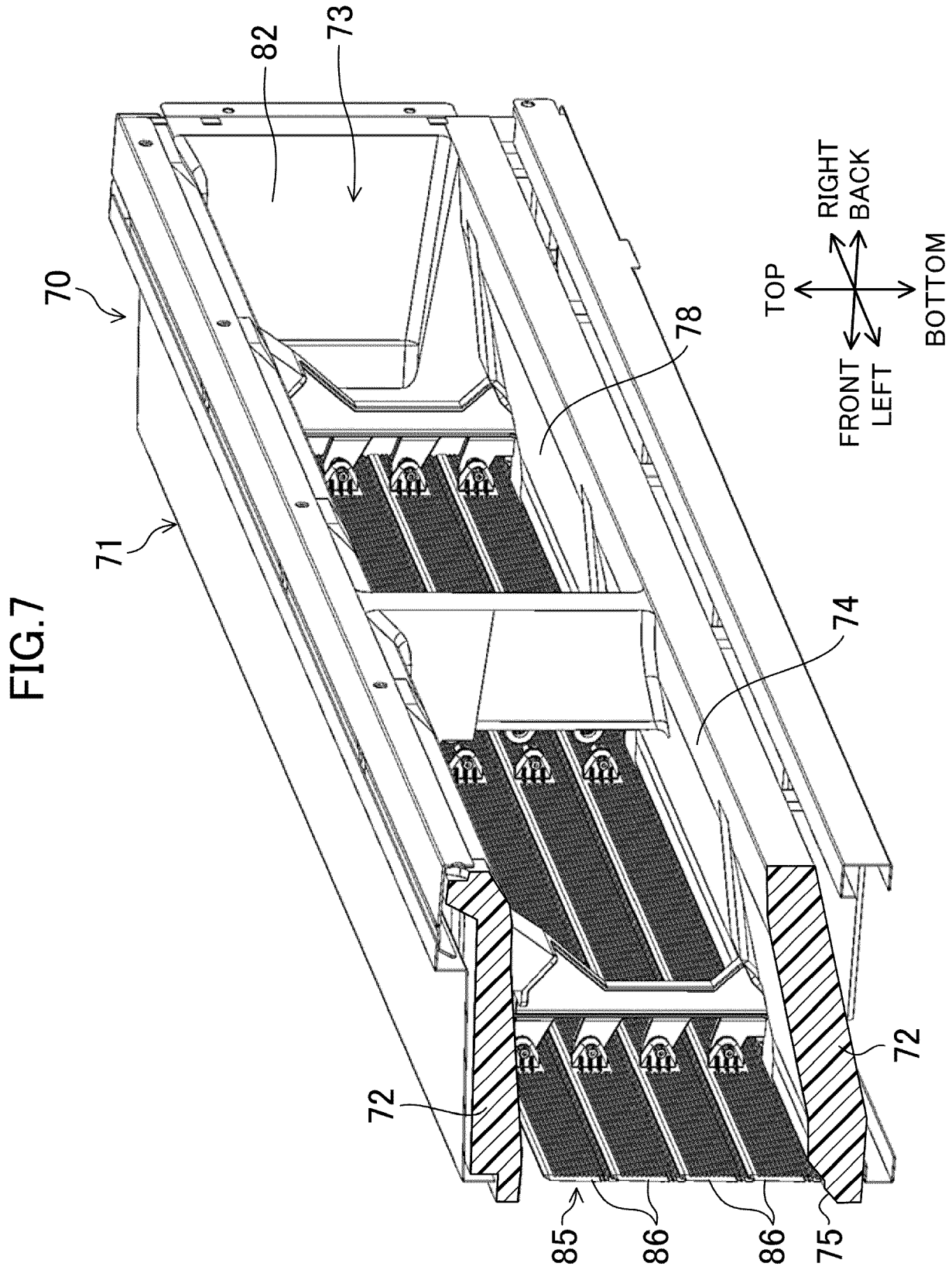
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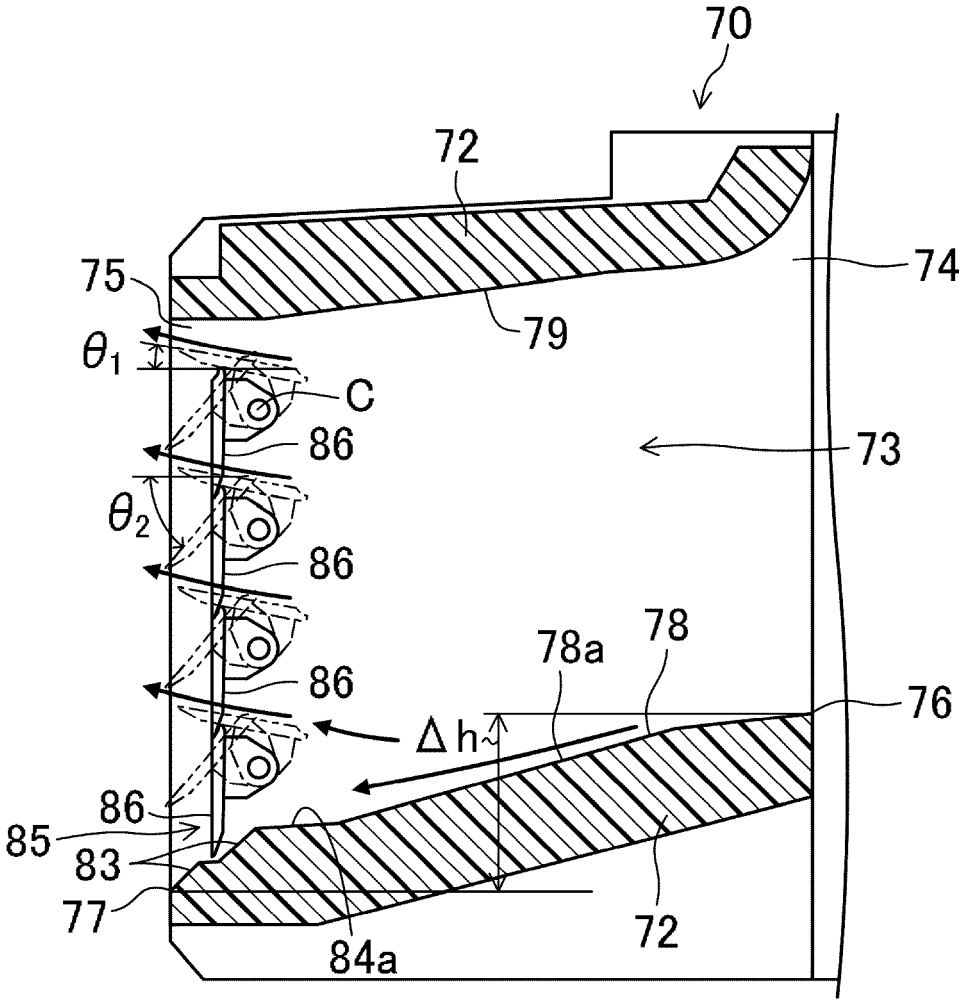
FIG.8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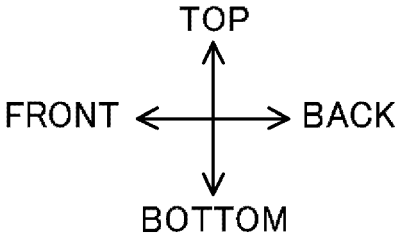
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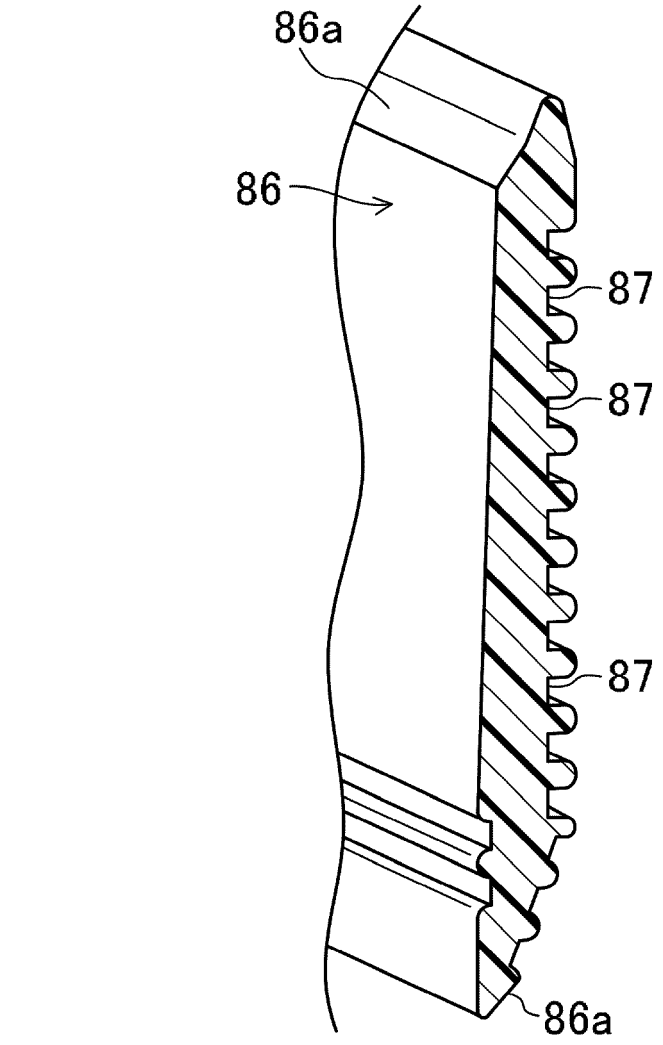
FIG.9



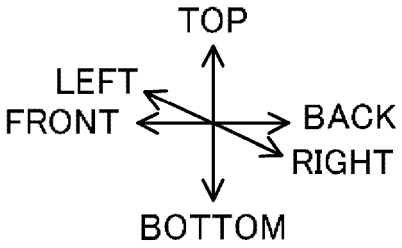
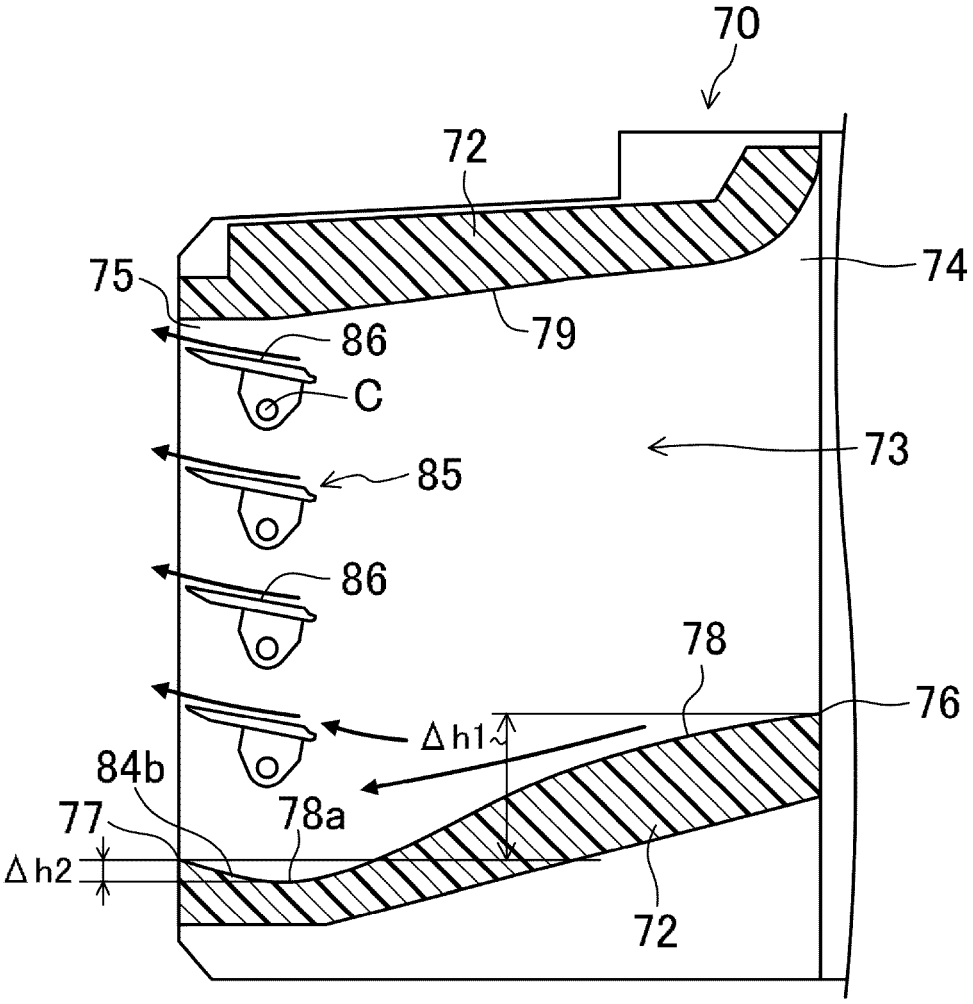


FIG.10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Δh1
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Δh2
72

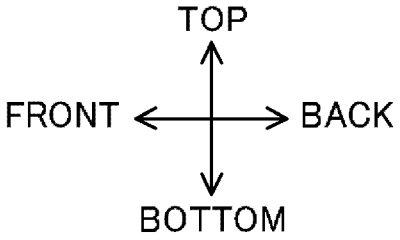
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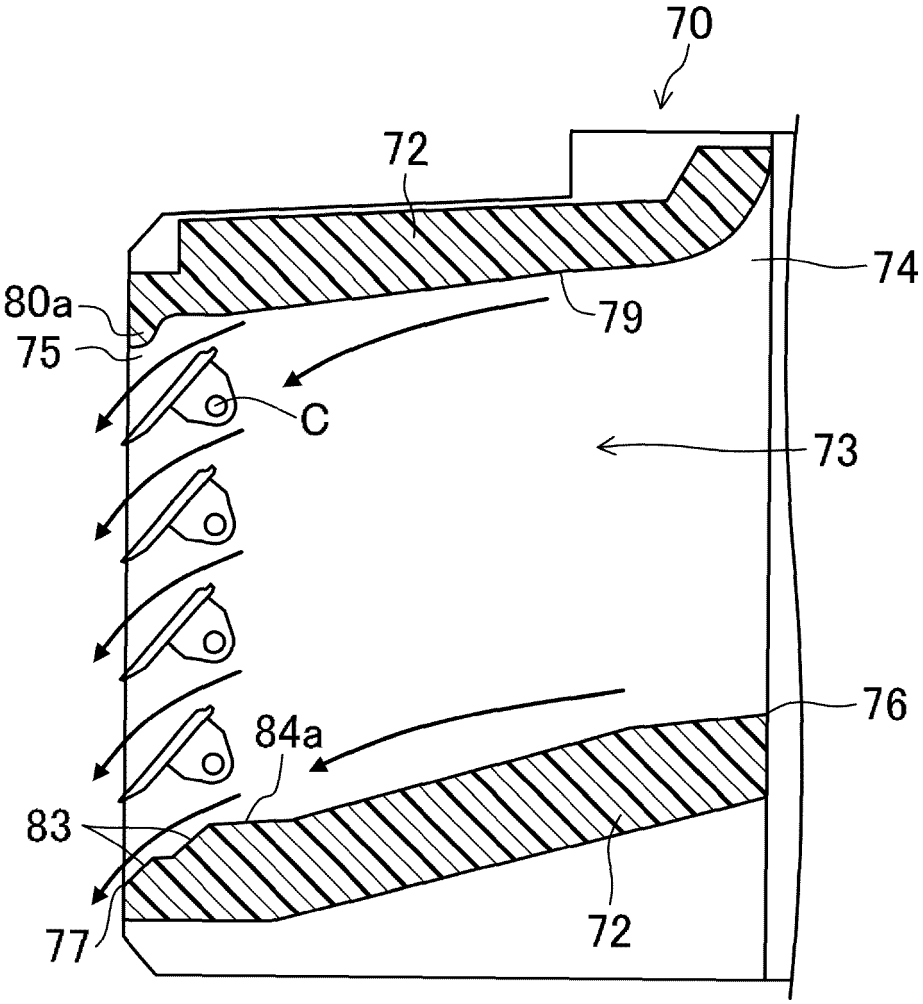
FIG.11



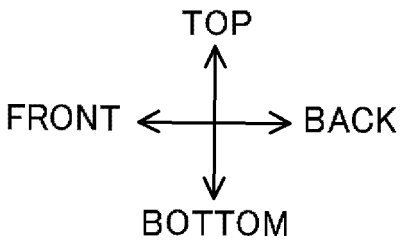


FIG.12

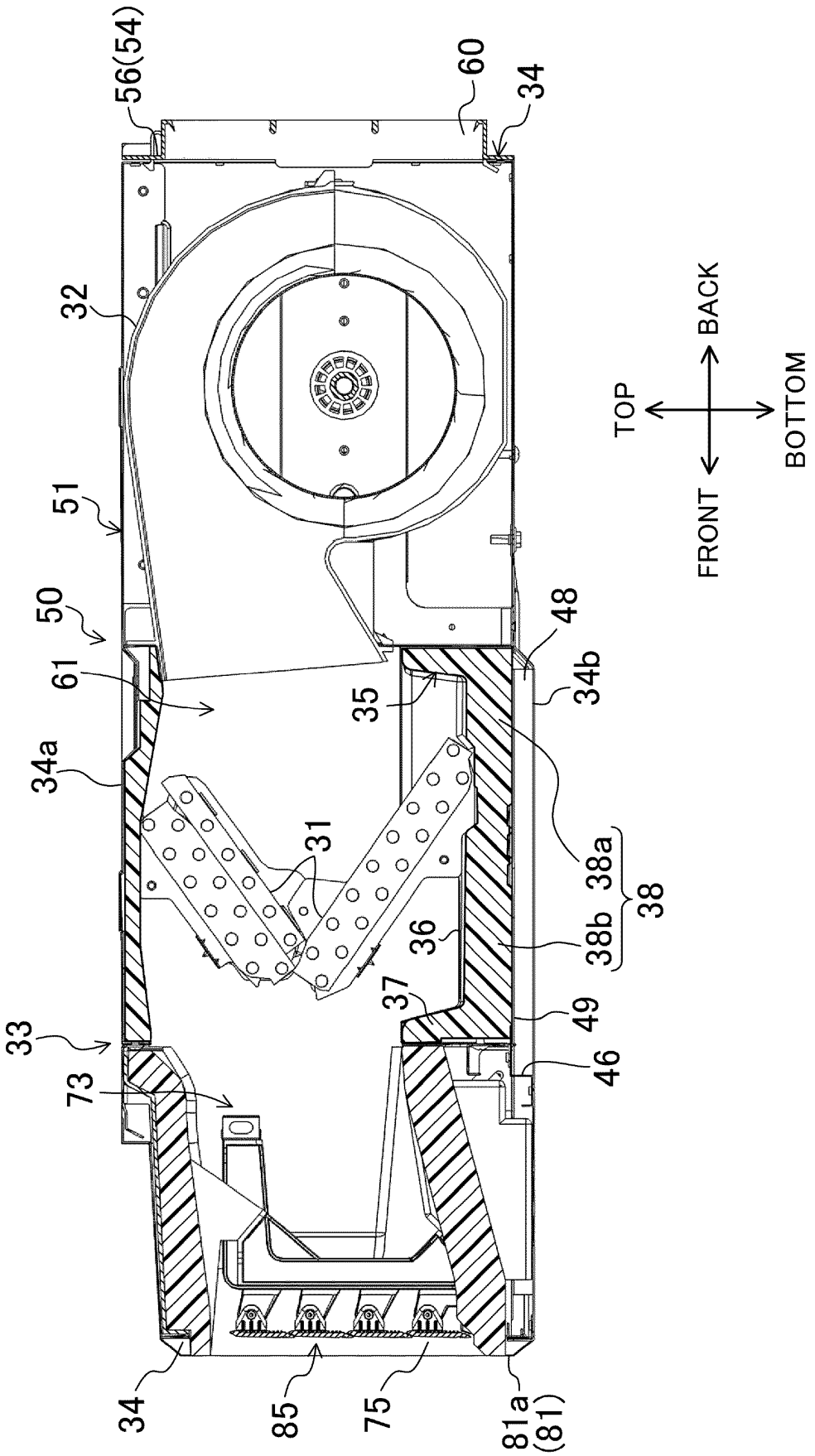

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FIG.13

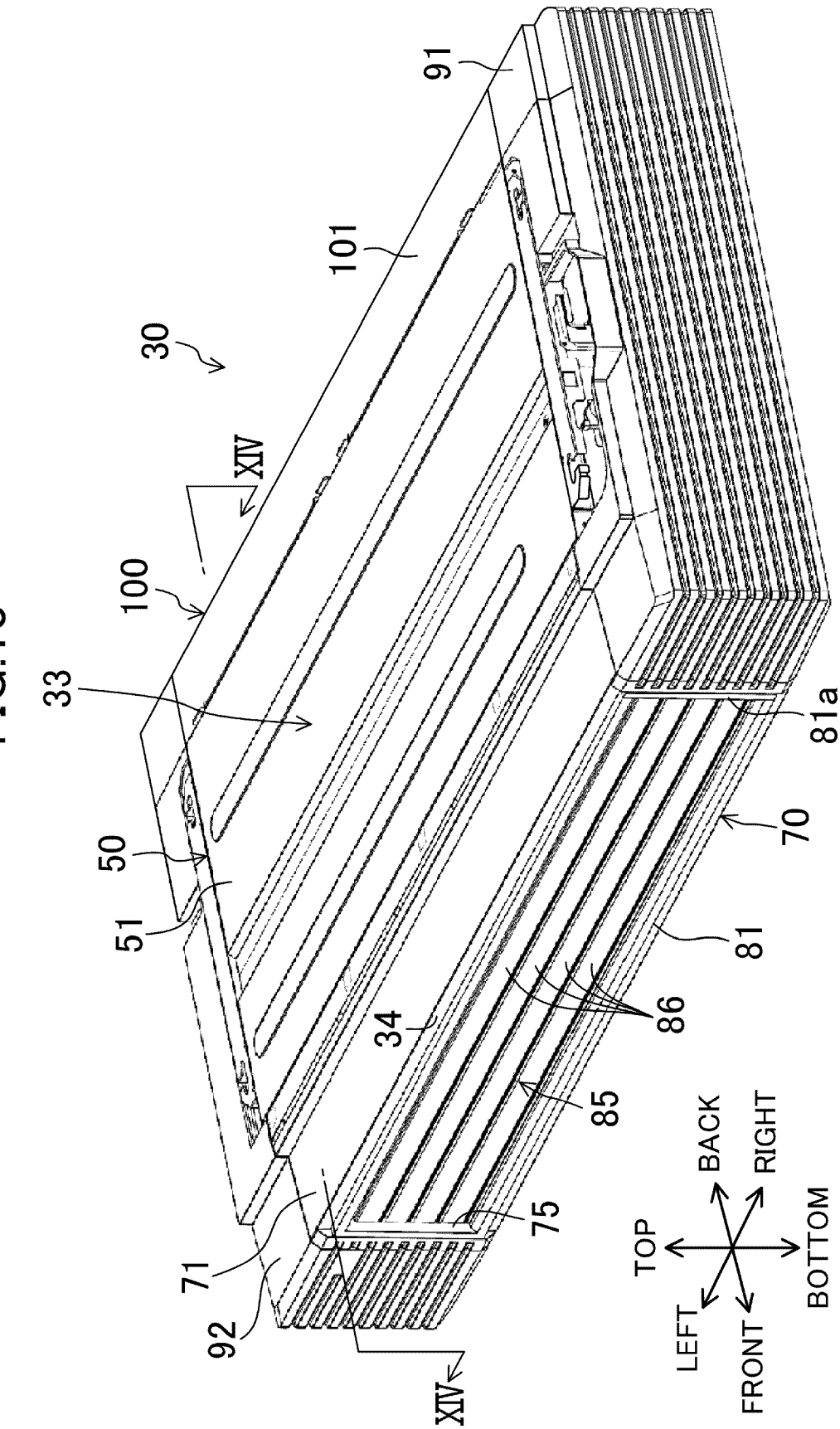
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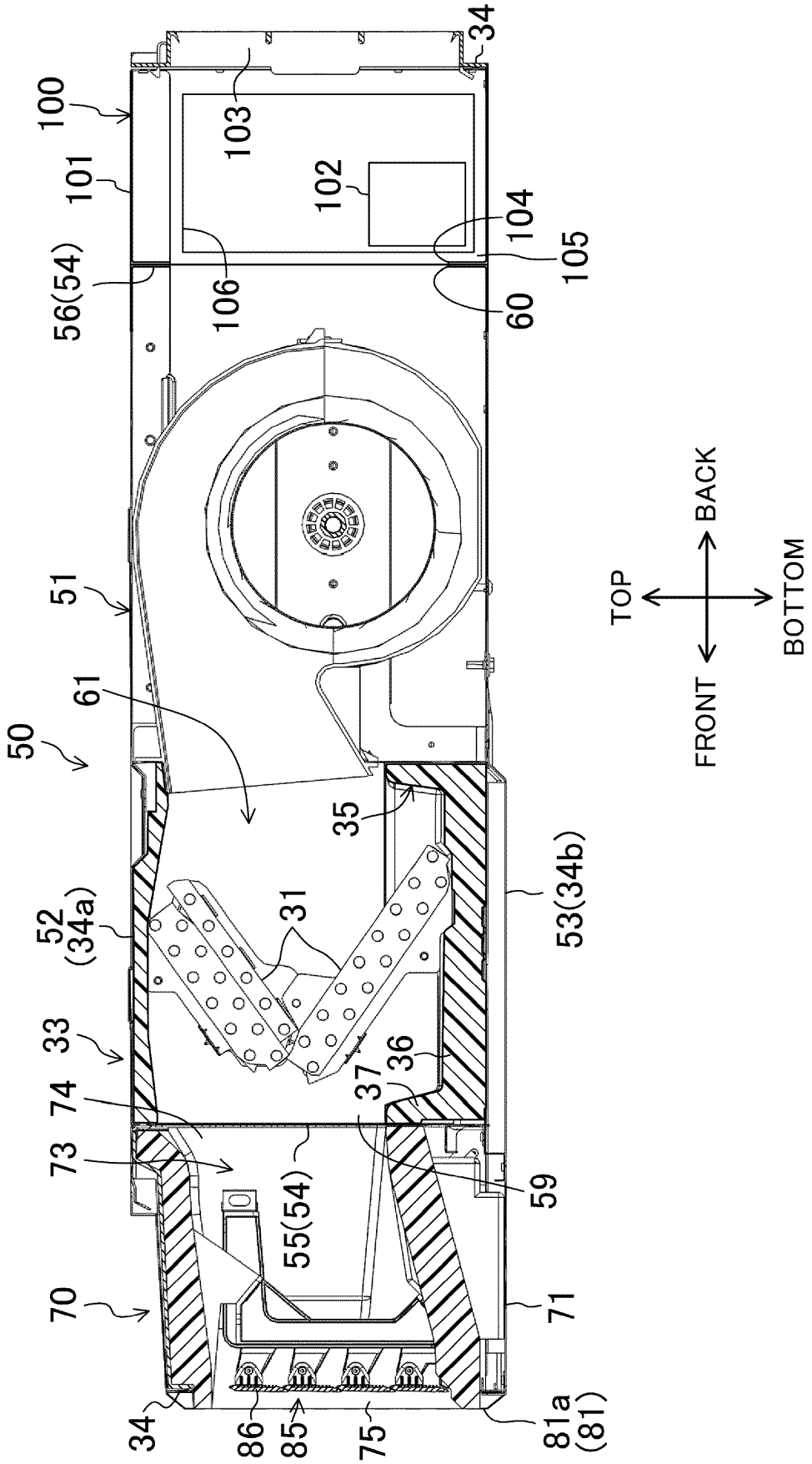
FIG.14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REFERENCES CITED IN THE DESCRIPTION

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- EP 0943875 A2 **[0003]**