



(11)

EP 4 015 930 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
22.06.2022 Bulletin 2022/25

(21) Application number: **20866280.9**

(22) Date of filing: **07.09.2020**

(51) International Patent Classification (IPC):
F24F 11/74 ^(2018.01) **F24F 11/79** ^(2018.01)
F24F 13/20 ^(2006.01)

(52) Cooperative Patent Classification (CPC):
F24F 11/74; F24F 11/79; F24F 13/20; Y02B 30/70

(86) International application number:
PCT/JP2020/033794

(87) International publication number:
WO 2021/054180 (25.03.2021 Gazette 2021/12)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **17.09.2019 JP 2019168494**

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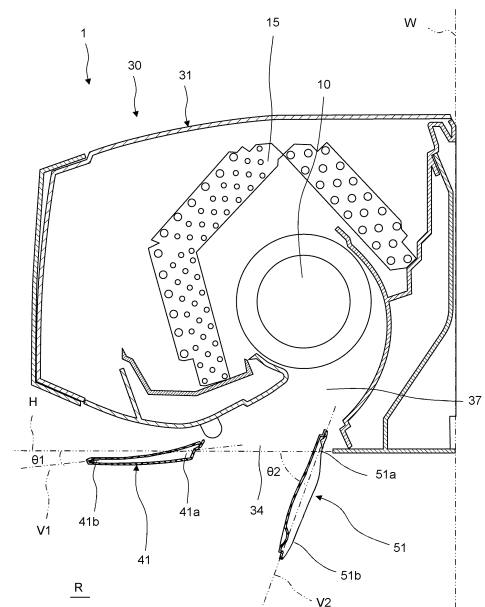
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(54) **AIR-CONDITIONING INDOOR UNIT AND AIR CONDITIONER**

(57) An air conditioning indoor unit (1) includes a control device (100). The control device (100) performs an operation in a first airflow control mode in which a distance between a first horizontal blade (41) and a second horizontal blade (51) is set to be larger on a downstream side of a flow of blow-out air than on an upstream side of the flow of the blow-out air, part of the blow-out air is allowed to flow along a lower wing surface of the first horizontal blade (41), and another part of the blow-out air is allowed to flow along an upper wing surface of the second horizontal blade (51) after an operation in a second airflow control mode in which a separation angle between the first horizontal blade (41) and the second horizontal blade (51) is set to be smaller than a predetermined separation angle between the first horizontal blade (41) and the second horizontal blade (51) in the first airflow control mode, and the blow-out air is blown out.

Fig.5



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Description

TECHNICAL FIELD

[0001] The present disclosure relates to an air conditioning indoor unit and an air conditioner including the air conditioning indoor unit.

BACKGROUND ART

[0002] Conventionally, an example of an air conditioning indoor unit includes a casing having a blow-out port, a first horizontal blade attached to a leading edge of the blow-out port, and a second horizontal blade attached to a trailing edge of the blow-out port (see, for example, Patent Literature 1 (JP 2017-125678 A)). The first and second horizontal blades adjust an up-and-down wind direction of blow-out air flowing from the blow-out port of the casing into an indoor space.

CITATION LIST

PATENT LITERATURE

[0003] Patent Literature 1: JP 2017-125678 A

SUMMARY OF INVENTION

TECHNICAL PROBLEMS

[0004] In the conventional air conditioning indoor unit described above, although the first and second horizontal blades are controlled so as to supply the blow-out air in a wide range, an airflow cannot flow along wing surfaces of the first and second horizontal blades. The conventional air conditioning indoor unit thus has a problem that the blow-out air cannot be supplied to a wide range.

[0005] An object of the present disclosure is to provide an air conditioning indoor unit capable of supplying a blow-out air stably to a wide range.

SOLUTIONS TO PROBLEMS

[0006] An air conditioning indoor unit according to one aspect of the present disclosure includes:

- a casing having a blow-out port through which air from a fan is blown out;
- a first horizontal blade that controls an up-and-down wind direction of blow-out air from the blow-out port;
- a first drive unit that drives the first horizontal blade;
- a second horizontal blade that is disposed on a rear side of the first horizontal blade and controls the up-and-down wind direction of the blow-out air;
- a second drive unit that drives the second horizontal blade; and
- a control device that controls the fan, the first drive unit, and the second drive unit, in which

when the control device performs an operation in a first airflow control mode in which a distance between the first horizontal blade and the second horizontal blade is set to be larger on a downstream side of a flow of the blow-out air than on an upstream side of the flow of the blow-out air, part of the blow-out air is allowed to flow along a lower wing surface of the first horizontal blade, and another part of the blow-out air is allowed to flow along an upper wing surface of the second horizontal blade,

the control device performs an operation in a second airflow control mode in which a separation angle between the first horizontal blade and the second horizontal blade is set to be smaller than a predetermined separation angle between the first horizontal blade and the second horizontal blade in the first airflow control mode, and the blow-out air is blown out, the control device then shifting to the operation in the first airflow control mode subsequently after the operation in the second airflow control mode.

[0007] In the above configuration, when the operation in the first airflow control mode is performed, the control device is configured to consecutively shift from the operation in the second airflow control mode to the operation in the first airflow control mode. In the second airflow control mode, the blow-out air is blown out with the separation angle between the first horizontal blade and the second horizontal blade set to be smaller than the predetermined separation angle between the first horizontal blade and the second horizontal blade in the first airflow control mode. Thus, the second airflow control mode shifts to the first airflow control mode while Coanda effect on the lower wing surface of the first horizontal blade and the upper wing surface of the second horizontal blade is maintained. As a result, after the shift to the first airflow control mode, part of the blow-out air is allowed to flow along the lower wing surface of the first horizontal blade, and another part of the blow-out air is allowed to flow along the upper wing surface of the second horizontal blade. Therefore, the blow-out air can be supplied stably to a wide range.

[0008] The air conditioning indoor unit according to one aspect, in which the fan has a number of rotations that is set larger in the operation in the second airflow control mode than in the first airflow control mode.

[0009] According to the above aspect, the number of rotations of the fan in the operation in the second airflow control mode is set to be larger than the number of rotations of the fan in the operation in the first airflow control mode. Thus, the Coanda effect on the lower wing surface of the first horizontal blade and the upper wing surface of the second horizontal blade can be enhanced.

[0010] The air conditioning indoor unit according to one aspect, in which during the operation in the second airflow control mode performed before the operation in the first airflow control mode, one of the first horizontal blade or the second horizontal blade is driven to decrease the

separation angle between the first horizontal blade and the second horizontal blade.

[0011] According to the above aspect, since the separation angle between the first horizontal blade and the second horizontal blade is decreased by driving one of the first horizontal blade or the second horizontal blade, the drive control for the first and second horizontal blades in decreasing the separation angle is easier than when both the first horizontal blade and the second horizontal blade are driven.

[0012] In the air conditioning indoor unit according to one aspect, one of the first horizontal blade or the second horizontal blade having a larger angle with respect to a wind direction of the blow-out air during the operation in the first airflow control mode is driven in the second airflow control mode to decrease the separation angle between the first horizontal blade and the second horizontal blade.

[0013] According to the above aspect, one of the first horizontal blade or the second horizontal blade having the larger angle with respect to the wind direction of the blow-out air during the operation in the first airflow control mode is driven in the second airflow control mode to decrease the separation angle between the first horizontal blade and the second horizontal blade. Thus, it is easy to obtain an airflow along the horizontal blade having the larger angle.

[0014] In the air conditioning indoor unit according to one aspect, the first horizontal blade and/or the second horizontal blade during the operation in the second airflow control mode pivots faster when the first horizontal blade and/or the second horizontal blade pivots in a shift from the operation in the second airflow control mode to the operation in the first airflow control mode.

[0015] According to the above aspect, the first horizontal blade and/or the second horizontal blade pivots at a relatively lower speed in the shift from the operation in the second airflow control mode to the operation in the first airflow control mode. Therefore, the airflow in the first horizontal blade and/or the second horizontal blade can be prevented from being separated.

[0016] An air conditioner according to one aspect of the present disclosure includes:

the air conditioning indoor unit of any one of the plurality of air conditioning indoor units; and
an air conditioning outdoor unit connected to the air conditioning indoor unit via a refrigerant pipe.

[0017] The above configuration including the air conditioning indoor unit can supply the blow-out air stably to a wide range.

BRIEF DESCRIPTION OF DRAWINGS

[0018]

FIG. 1 is a refrigerant circuit diagram of an air con-

ditioner in a first embodiment of the present disclosure.

FIG. 2 is a schematic cross-sectional view of an indoor unit in an operation stop state in the first embodiment of the present disclosure.

FIG. 3 is an internal configuration diagram of the indoor unit.

FIG. 4 is a control block diagram of the air conditioner.

FIG. 5 is a schematic cross-sectional view of the indoor unit in a first diagonal airflow control mode.

FIG. 6 is a schematic cross-sectional view of the indoor unit in a ceiling airflow control mode.

FIG. 7 is a schematic cross-sectional view of the indoor unit in a perpendicular airflow control mode.

FIG. 8 is a schematic cross-sectional view of the indoor unit in a second diagonal airflow control mode.

FIG. 9 is a perspective view of a first horizontal flap in the first embodiment of the present disclosure.

FIG. 10 is a plan view of the first horizontal flap.

FIG. 11 is a bottom view of the first horizontal flap.

FIG. 12 is a cross-sectional view taken along the line XII-XII of FIG. 11.

FIG. 13 is a cross-sectional view taken along the line XIII-XIII of FIG. 11.

FIG. 14 is a perspective view of a second horizontal flap in the first embodiment of the present disclosure.

FIG. 15 is a plan view of the second horizontal flap.

FIG. 16 is a bottom view of the second horizontal flap.

FIG. 17 is a cross-sectional view taken along the line XVII-XVII of FIG. 16.

FIG. 18 is a cross-sectional view taken along the line XVIII-XVIII of FIG. 16.

FIG. 19 is a simulation result diagram of blow-out air of the indoor unit in the first embodiment.

FIG. 20 is another simulation result diagram of the blow-out air of the indoor unit in the first embodiment.

FIG. 21 is a simulation result diagram of blow-out air of an indoor unit in a comparative example.

FIG. 22 is a simulation result diagram of the blow-out air of the indoor unit in the comparative example.

FIG. 23 is an image diagram of the blow-out air of the indoor unit in the first embodiment.

FIG. 24 is a diagram for describing a wind speed of the blow-out air of the indoor unit in the first embodiment.

FIG. 25 is a schematic cross-sectional view of the indoor unit in a pre-diagonal airflow control mode.

FIG. 26 is a flowchart for describing a shift from an operation in the pre-diagonal airflow control mode to an operation in the first diagonal airflow control mode.

FIG. 27 is a schematic cross-sectional view of the indoor unit in another pre-diagonal airflow control mode.

FIG. 28 is a schematic cross-sectional view of the indoor unit in another pre-diagonal airflow control mode.

FIG. 29 is a control block diagram of an air conditioner in a second embodiment of the present disclosure.

DESCRIPTION OF EMBODIMENTS

[0019] An air conditioning indoor unit and an air conditioner of the present disclosure will be described in detail below with embodiments shown in the drawings. Note that common parts are denoted with the same reference symbols in each diagram, and duplicate descriptions will be omitted.

[First embodiment]

[0020] FIG. 1 is a diagram showing a refrigerant circuit RC provided in an air conditioner of a first embodiment of the present disclosure. This air conditioner is a pair type in which an indoor unit 1 is paired one-to-one with an outdoor unit 2. The indoor unit 1 is one example of an air conditioning indoor unit. The outdoor unit 2 is one example of an air conditioning outdoor unit. Connection pipes L1 and L2 are one example of refrigerant pipes.

[0021] The air conditioner includes: a compressor 11; a four-way switching valve 12 having one end connected to a discharge side of the compressor 11; an outdoor heat exchanger 13 having one end connected to the other end of the four-way switching valve 12; an electric expansion valve 14 having one end connected to the other end of the outdoor heat exchanger 13; an indoor heat exchanger 15 having one end connected to the other end of the electric expansion valve 14 via a shutoff valve 21 and the connection pipe L1; and an accumulator 16 having one end connected to the other end of the indoor heat exchanger 15 via the connection pipe L2, a shutoff valve 22, and the four-way switching valve 12, and the other end connected to an intake side of the compressor 11. Here, the compressor 11, the four-way switching valve 12, the outdoor heat exchanger 13, the electric expansion valve 14, the indoor heat exchanger 15, the accumulator 16, and the like constitute the refrigerant circuit RC of the air conditioner. The indoor heat exchanger 15, an indoor fan 10, and the like constitute the indoor unit 1. Meanwhile, the compressor 11, the four-way switching valve 12, the outdoor heat exchanger 13, the electric expansion valve 14, the accumulator 16, an outdoor fan 20, and the like constitute the outdoor unit 2. The indoor fan 10 is one example of a fan. The electric expansion valve 14 is one example of a decompression mechanism.

[0022] The indoor unit 1 includes an indoor heat exchanger temperature sensor T4 that detects the temperature of the indoor heat exchanger 15, an indoor temperature sensor T5 that detects the indoor temperature, and a floor temperature sensor T6 that detects the temperature of a floor facing an indoor space R (shown in FIGS. 2 and 5 to 8). The indoor fan 10 that circulates indoor air via the indoor heat exchanger 15 is installed in the indoor unit 1. For example, a thermistor or the like is used as

the indoor heat exchanger temperature sensor T4 and the indoor temperature sensor T5. For example, an infrared temperature sensor or the like is used as the floor temperature sensor T6. The indoor space R is one example of an air conditioning target space.

[0023] The outdoor unit 2 includes an outdoor heat exchanger temperature sensor T1 that detects the temperature of the outdoor heat exchanger 13, an outdoor air temperature sensor T2 that detects the outdoor air temperature, and an evaporation temperature sensor T3 that detects the evaporation temperature of the electric expansion valve 14. The outdoor fan 20 that supplies outside air to the outdoor heat exchanger 13 is installed in the outdoor unit 2. For example, a thermistor or the like is used as the outdoor heat exchanger temperature sensor T1, the outdoor air temperature sensor T2, and the evaporation temperature sensor T3.

[0024] The air conditioner includes a remote controller that is not shown in the drawings (hereinafter referred to as "remote control device"). Manipulation of the remote control device makes it possible to start or stop one of operations such as a cooling operation, dehumidifying operation, and heating operation, and to switch to another operation. Manipulation of the remote control device also makes it possible to change the set temperature for the indoor temperature and adjust an airflow volume of the air blown out by the indoor unit 1.

[0025] When the cooling operation or the dehumidifying operation is selected with the remote control device and the four-way switching valve 12 is switched to the state of the solid line in FIG. 1, a refrigerant from the compressor 11 flows through the refrigerant circuit RC in the order of the four-way switching valve 12, the outdoor heat exchanger 13, the electric expansion valve 14, the indoor heat exchanger 15, the four-way switching valve 12, and the accumulator 16, as shown by the solid arrow. Meanwhile, when the heating operation is selected and the four-way switching valve 12 is switched to the state of the broken line in FIG. 1, the refrigerant from the compressor 11 flows through the refrigerant circuit RC in the order of the four-way switching valve 12, the indoor heat exchanger 15, the electric expansion valve 14, the outdoor heat exchanger 13, the four-way switching valve 12, and the accumulator 16, as shown by the broken arrow.

[0026] FIG. 2 is a schematic vertical cross-sectional view of the indoor unit 1 in an operation stop state. The indoor unit 1 is a wall-mounted type.

[0027] The indoor unit 1 includes a casing 30 including a casing body 31 and a front panel 32. The casing 30 is attached to a wall surface W facing the indoor space R, and houses the indoor fan 10, the indoor heat exchanger 15, a drain pan 33, and the like. The indoor space R is one example of the air conditioning target space.

[0028] The casing body 31 includes a plurality of members and includes a front surface portion 31a, an upper surface portion 31b, a rear surface portion 31c, and a lower surface portion 31d. The front panel 32 is attached

to the front surface portion 31a in an openable and closable manner. An intake port (not shown) is provided from the front surface portion 31a to the upper surface portion 31b.

[0029] The front panel 32 covers the front surface portion 31a of the indoor unit 1, and has, for example, a flat shape with no intake port. An upper end of the front panel 32 is pivotably supported by the upper surface portion 31b of the casing body 31 and can operate as a hinge.

[0030] The indoor fan 10 and the indoor heat exchanger 15 are attached to the casing body 31. The indoor heat exchanger 15 exchanges heat with the indoor air taken into the casing 30 via the intake port. The shape of the side view of the indoor heat exchanger 15 is an inverted V shape with both ends facing downward and a bent portion located on the upper side. The indoor fan 10 is located below the bent portion of the indoor heat exchanger 15. The indoor fan 10 is, for example, a cross-flow fan, and sends the indoor air that has passed through the indoor heat exchanger 15 to a blow-out port 34 of the lower surface portion 31d of the casing body 31.

[0031] First and second partition walls 35 and 36 are provided in the casing body 31. The space sandwiched between the first partition wall 35 and the second partition wall 36 is a blow-out channel 37 that connects the indoor fan 10 to the blow-out port 34.

[0032] The drain pan 33 is disposed below the front part of the indoor heat exchanger 15 and receives condensate from the front part. This condensate is discharged to the outdoors via a drain hose (not shown).

[0033] The indoor unit 1 includes a first horizontal flap 41 and a second horizontal flap 51 disposed on a rear side (wall surface W side) of the first horizontal flap 41. The first horizontal flap 41 and the second horizontal flap 51 adjust the up-and-down wind direction of the blow-out air that flows through the blow-out channel 37 and blows out of the blow-out port 34. The first horizontal flap 41 is one example of a first horizontal blade. The second horizontal flap 51 is one example of a second horizontal blade.

[0034] The first horizontal flap 41 includes a first end 41a and a second end 41b. When the operation of the indoor unit 1 is performed, the first end 41a is disposed upstream of the flow of the blow-out air and the second end 41b is disposed downstream of the flow of the blow-out air. The first horizontal flap 41 is pivotably attached to the lower surface portion 31d of the casing body 31.

[0035] In more detail, the first horizontal flap 41 includes a piece 41g connected to the second end 41b (shown in FIGS. 9 to 13). The piece 41g is attached to an attachment part 38 of the casing body 31, and the first horizontal flap 41 is pivotable around the attachment part 38. When the operation of the indoor unit 1 is stopped, the first horizontal flap 41 takes a posture along the front portion of the lower surface portion 31d of the casing body 31. When the operation of the indoor unit 1 starts, a first horizontal flap motor 73 (shown in FIGS. 3 and 4) drives the first horizontal flap 41 to pivot, and the distance

between the front portion of the lower surface portion 31d of the casing body 31 and the second end 41b of the first horizontal flap 41 increases. At this time, the first horizontal flap 41 can take a plurality of inclined postures with respect to the horizontal plane. As the first horizontal flap motor 73, for example, a four-phase winding stepping motor is used.

[0036] The second horizontal flap 51 includes a first end 51a and a second end 51b in a similar manner to the first horizontal flap 41. The first end 51a is disposed upstream of the flow of the blow-out air. The second end 51b is disposed downstream of the flow of the blow-out air. In the second horizontal flap 51, the first end 51a is pivotably attached to the lower surface portion 31d of the casing body 31.

[0037] In more detail, when the operation of the indoor unit 1 is stopped, the second horizontal flap 51 takes a posture to close the blow-out port 34. When the operation of the indoor unit 1 starts, a second horizontal flap motor 74 (shown in FIGS. 3 and 4) drives the second horizontal flap 51. This causes the second horizontal flap 51 to pivot around the first end 51a, whereby the second end 51b separates from the attachment part 38 to open the blow-out port 34. At this time, the second horizontal flap 51 can take a plurality of inclined postures with respect to the horizontal plane. As the second horizontal flap motor 74, for example, a four-phase winding stepping motor is used.

[0038] The indoor unit 1 includes a plurality of perpendicular flaps 61 (shown in FIG. 3) that adjusts the right-and-left wind direction of the blow-out air. The plurality of perpendicular flaps 61 is arranged in the blow-out channel 37 at predetermined intervals along a longitudinal direction of the blow-out port 34 (direction perpendicular to the paper surface of FIG. 2). The perpendicular flap 61 is one example of a perpendicular blade.

[0039] FIG. 3 is a schematic diagram showing the internal configuration of the indoor unit 1.

[0040] The first and second horizontal flaps 41 and 51 are pivotably supported by first and second rotating shafts 71 and 72, respectively, in the up-and-down direction. The first and second horizontal flap motors 73 and 74 drive the first and second rotating shafts 71 and 72 to rotate, respectively, thereby causing the first and second horizontal flaps 41 and 51 to pivot in the up-and-down direction. Note that the first horizontal flap motor 73 is one example of a first drive unit. The second horizontal flap motor 74 is one example of a second drive unit.

[0041] The plurality of perpendicular flaps 61 is divided into a first perpendicular flap group G1 and a second perpendicular flap group G2. The perpendicular flaps 61 constituting the first perpendicular flap group G1 are one example of the perpendicular blades on one side of the plurality of perpendicular blades. The perpendicular flaps 61 constituting the second perpendicular flap group G2 are one example of the perpendicular blades on the other side of the plurality of perpendicular blades.

[0042] The first perpendicular flap group G1 includes

the plurality of perpendicular flaps 61 facing an opening region on the left side of the center in the right-and-left direction of the blow-out port 34. The perpendicular flaps 61 belonging to the first perpendicular flap group G1 are coupled to each other by a first coupling rod 81. A first perpendicular flap group motor 83 drives the first coupling rod 81 in the right-and-left direction, thereby causing the plurality of perpendicular flaps 61 to pivot in the right-and-left direction around respective pivotal axes (not shown).

[0043] The second perpendicular flap group G2 includes the plurality of perpendicular flaps 61 facing an opening region on the right side of the center in the right-and-left direction of the blow-out port 34. The perpendicular flaps 61 belonging to the second perpendicular flap group G2 are also coupled to a second coupling rod 82 and can pivot by a second perpendicular flap group motor 84, in a similar manner to the perpendicular flaps 61 belonging to the first perpendicular flap group G1.

[0044] FIG. 4 is a control block diagram of the air conditioner.

[0045] The air conditioner includes a control device 100 including a microcomputer, an input-output circuit, and the like. The control device 100 includes an indoor control unit (not shown) provided on the indoor unit 1 side and an outdoor control unit (not shown) provided on the outdoor unit 2 side.

[0046] Based on signals from the outdoor heat exchanger temperature sensor T1, the outdoor air temperature sensor T2, the evaporation temperature sensor T3, the indoor heat exchanger temperature sensor T4, the indoor temperature sensor T5, and other sensors, the control device 100 controls the compressor 11, the four-way switching valve 12, an indoor fan motor 85, an outdoor fan motor 86, a display unit 50, the first horizontal flap motor 73, the second horizontal flap motor 74, the first perpendicular flap group motor 83, the second perpendicular flap group motor 84, and the like. The display unit 50 is an LED provided in the indoor unit 1 to display at least the operating state, or the like. The indoor fan motor 85 drives the indoor fan 10. The outdoor fan motor 86 drives the outdoor fan 20.

[0047] The indoor unit 1 can operate in a first diagonal airflow control mode, a ceiling airflow control mode, a perpendicular airflow control mode, and a second diagonal airflow control mode (for example, cooling operation, heating operation, and the like). Based on the above-described signals and the like, one airflow control mode may be automatically selected from among the first diagonal airflow control mode, the ceiling airflow control mode, the perpendicular airflow control mode, and the second diagonal airflow control mode, which will be described later, or may be switched to another airflow control mode. Manipulation of the remote control device also makes it possible to select one of the first diagonal airflow control mode, the ceiling airflow control mode, the perpendicular airflow control mode, and the second diagonal airflow control mode. The first diagonal airflow control

mode is an example of a first airflow control mode.

<First diagonal airflow control mode>

[0048] FIG. 5 is a schematic vertical cross-sectional view of the indoor unit 1 after completion of a shift to the first diagonal airflow control mode.

[0049] In the first diagonal airflow control mode, a distance between the first horizontal flap 41 and the second horizontal flap 51 is wider on the downstream side of the flow of the blow-out air than on the upstream side of the flow of the blow-out air, and the blow-out air flowing from the blow-out port 34 to the indoor space R flows diagonally downward on the front side (side opposite the wall surface W side).

[0050] In more detail, when a virtual plane V1 passing through the center in a thickness direction of the first end 41a of the first horizontal flap 41 and the center in a thickness direction of the second end 41b of the first horizontal flap 41 is defined, an inclination angle $\theta 1$ of the virtual plane V1 with respect to a horizontal plane H in the first diagonal airflow control mode is, for example, $+10^\circ$. Meanwhile, when a virtual plane V2 passing through the center in a thickness direction of the first end 51a of the second horizontal flap 51 and the center in the thickness direction of the second end 51b is defined, an inclination angle $\theta 2$ of the virtual plane V2 with respect to the horizontal plane H in the first diagonal airflow control mode is, for example, $+70^\circ$. At this time, a separation angle between the first horizontal flap 41 and the second horizontal flap 51 is, for example, 60° . When the inclination angles $\theta 1$ and $\theta 2$ are $+$ angles, the front side of the virtual planes V1 and V2 is located below the rear side of the virtual planes V1 and V2. The separation angle corresponds to the angle obtained by subtracting the inclination angle $\theta 1$ from the inclination angle $\theta 2$. Note that 60° is an example of a predetermined separation angle.

[0051] In other words, when pivoted by 25° from the state where the operation of the indoor unit 1 is stopped, the first horizontal flap 41 takes the posture in the first diagonal airflow control mode. Meanwhile, when pivoted by 70° from the state where the operation of the indoor unit 1 is stopped, the second horizontal flap 51 takes the posture in the first diagonal airflow control mode. Here, the angle obtained by subtracting the pivot angle of the first horizontal flap 41 from the pivot angle of the second horizontal flap 51 is the separation angle between the first horizontal flap 41 and the second horizontal flap 51 in the first diagonal airflow control mode.

[0052] In the first airflow control mode, each perpendicular flap 61 of the first perpendicular flap group G1 takes an inclined posture such that the downstream end of the flow of the blow-out air is located on the left side of the casing 30 more than the upstream end of the flow of the blow-out air. In the first airflow control mode, each perpendicular flap 61 of the second perpendicular flap group G2 takes an inclined posture such that the downstream end of the flow of the blow-out air is located on

the right side of the casing 30 more than the upstream end of the flow of the blow-out air.

[0053] In more detail, the distance between the perpendicular flap 61 of the first perpendicular flap group G1 and the perpendicular flap 61 of the second perpendicular flap group G2 is wider on the downstream side of the flow of the blow-out air than on the upstream side of the flow of the blow-out air. In other words, each perpendicular flap 61 of the first perpendicular flap group G1 pivots such that the end located on the downstream side of the flow of the blow-out air is closer to the left side surface of the casing body 31, and that the end located on the upstream side of the flow of the blow-out air is away from the left side surface of the casing body 31. Meanwhile, each perpendicular flap 61 of the second perpendicular flap group G2 pivots such that the end located on the downstream side of the flow of the blow-out air is closer to the right side surface of the casing body 31, and that the end located on the upstream side of the flow of the blow-out air is away from the right side surface of the casing body 31.

<Ceiling airflow control mode>

[0054] FIG. 6 is a schematic vertical cross-sectional view of the indoor unit 1 after completion of a shift to the ceiling airflow control mode.

[0055] In the ceiling airflow control mode, the blow-out air flowing from the blow-out port 34 to the indoor space R flows horizontally.

[0056] In more detail, in the ceiling airflow control mode, the inclination angle θ_1 of the virtual plane V1 with respect to the horizontal plane H is, for example, -5° . Meanwhile, in the ceiling airflow control mode, the inclination angle θ_2 of the virtual plane V2 with respect to the horizontal plane H is, for example, $+15^\circ$. At this time, the inclination angles θ_1 and θ_2 are smaller than in the first diagonal airflow control mode. Conversely, the inclination angles θ_1 and θ_2 in the first diagonal airflow control mode are larger than the inclination angles θ_1 and θ_2 in the ceiling airflow control mode. When the inclination angle θ_1 is a $-$ angle, the front side of the virtual plane V1 is located above the rear side of the virtual plane V1.

[0057] In other words, when pivoted by 10° from the state where the operation of the indoor unit 1 is stopped, the first horizontal flap 41 takes the posture in the ceiling airflow control mode. Meanwhile, when pivoted by 15° from the state where the operation of the indoor unit 1 is stopped, the second horizontal flap 51 takes the posture in the ceiling airflow control mode.

<Perpendicular airflow control mode>

[0058] FIG. 7 is a schematic vertical cross-sectional view of the indoor unit 1 after completion of a shift to the perpendicular airflow control mode.

[0059] In the perpendicular airflow control mode, the blow-out air flowing from the blow-out port 34 to the indoor

space R flows downward along the wall surface W.

[0060] In more detail, in the perpendicular airflow control mode, the inclination angle θ_1 of the virtual plane V1 with respect to the horizontal plane H is, for example, $+105^\circ$. Meanwhile, in the perpendicular airflow control mode, the inclination angle θ_2 of the virtual plane V2 with respect to the horizontal plane H is, for example, $+100^\circ$.

[0061] In other words, when pivoted by 125° from the state where the operation of the indoor unit 1 is stopped, the first horizontal flap 41 takes the posture in the perpendicular airflow control mode. Meanwhile, when pivoted by 100° from the state where the operation of the indoor unit 1 is stopped, the second horizontal flap 51 takes the posture in the perpendicular airflow control mode.

<Second diagonal airflow control mode>

[0062] FIG. 8 is a schematic vertical cross-sectional view of the indoor unit 1 after completion of a shift to the second diagonal airflow control mode.

[0063] In the second diagonal airflow control mode, the distance between the first horizontal flap 41 and the second horizontal flap 51 is wider on the downstream side of the flow of the blow-out air than on the upstream side of the flow of the blow-out air, and the blow-out air flowing from the blow-out port 34 to the indoor space R flows diagonally downward on the front side. At this time, the up-and-down expansion of the blow-out air is smaller than in the first diagonal airflow control mode.

[0064] In more detail, in the second diagonal airflow control mode, the inclination angle θ_1 of the virtual plane V1 with respect to the horizontal plane H is, for example, -5° . Meanwhile, in the second diagonal airflow control mode, the inclination angle θ_2 of the virtual plane V2 with respect to the horizontal plane H is, for example, $+45^\circ$. At this time, the separation angle between the first horizontal flap 41 and the second horizontal flap 51 is, for example, 50° . The separation angle corresponds to the angle obtained by subtracting the inclination angle θ_1 from the inclination angle θ_2 .

[0065] In other words, when pivoted by 15° from the state where the operation of the indoor unit 1 is stopped, the first horizontal flap 41 takes the posture in the second diagonal airflow control mode. Meanwhile, when pivoted by 52.5° from the state where the operation of the indoor unit 1 is stopped, the second horizontal flap 51 takes the posture in the second diagonal airflow control mode. Here, the angle obtained by subtracting the pivot angle of the first horizontal flap 41 from the pivot angle of the second horizontal flap 51 is the separation angle between the first horizontal flap 41 and the second horizontal flap 51 in the second diagonal airflow control mode.

<Configuration of first horizontal flap 41>

[0066] FIG. 9 is a perspective view of an upper wing surface 41c of the first horizontal flap 41. FIG. 10 is a

front view of the upper wing surface 41c of the first horizontal flap 41. FIG. 11 is a front view of a lower wing surface 41d of the first horizontal flap 41. FIG. 12 is a cross-sectional view taken along the line XII-XII of FIG. 11. FIG. 13 is a cross-sectional view taken along the line XIII-XIII of FIG. 11. Note that the cross-sectional view taken along the line XII'-XII' of FIG. 11 is similar to the cross-sectional view of FIG. 12, and thus the illustration will be omitted.

[0067] As shown in FIGS. 9 to 13, the first horizontal flap 41 shows a shape in which a thickness becomes thinner as approaching from the first end 41a side to the second end 41b side, except for some part on the first end 41a side. The first horizontal flap 41 includes the upper wing surface 41c facing the casing body 31 when the operation of the indoor unit 1 is stopped, and the lower wing surface 41d facing the indoor space when the operation of the indoor unit 1 is stopped.

[0068] The upper wing surface 41c includes a curved surface 41e that is curved and recessed in the thickness direction of the first horizontal flap 41. In other words, when the first horizontal flap 41 is cut along a lateral direction of the first horizontal flap 41, the line showing the cross section of the upper wing surface 41c includes a curved line protruding to the lower wing surface 41d side. Here, the lateral direction of the first horizontal flap 41 corresponds to a direction orthogonal to a longitudinal direction of the first horizontal flap 41 and the thickness direction of the first horizontal flap 41.

[0069] The lower wing surface 41d includes a curved surface 41f that is curved and protrudes in the thickness direction of the first horizontal flap 41. In other words, when the first horizontal flap 41 is cut along the lateral direction, the line showing the cross section of the lower wing surface 41d includes a curved line protruding on the opposite side of the upper wing surface 41c.

[0070] A radius of curvature of the curved surface 41e of the upper wing surface 41c is set to be smaller than a radius of curvature of the curved surface 41f of the lower wing surface 41d of the first horizontal flap 41.

[0071] The curved surfaces 41e and 41f are provided from one end in the longitudinal direction of the first horizontal flap 41 to the other end in the longitudinal direction of the first horizontal flap 41.

<Configuration of second horizontal flap 51>

[0072] FIG. 14 is a perspective view of an upper wing surface 51c of the second horizontal flap 51. FIG. 15 is a front view of the upper wing surface 51c of the second horizontal flap 51. FIG. 16 is a front view of a lower wing surface 51d of the second horizontal flap 51. FIG. 17 is a cross-sectional view taken along the line XVII-XVII of FIG. 16. FIG. 18 is a cross-sectional view taken along the line XVIII-XVIII of FIG. 16. Note that the cross-sectional view taken along the line XV'-XV' of FIG. 16 is similar to the cross-sectional view of FIG. 17, and thus the illustration will be omitted.

[0073] As shown in FIGS. 14 to 18, the second horizontal flap 51 includes the upper wing surface 51c facing the blow-out channel 37 when the operation of the indoor unit 1 is stopped and the lower wing surface 51d facing the indoor space when the operation of the indoor unit 1 is stopped. In the second horizontal flap 51, a thickness of the central portion between the first end 51a and the second end 51b is thicker than a thickness of the first end 51a and the second end 51b.

[0074] The upper wing surface 51c includes a curved surface 51e that is curved and protrudes in the thickness direction of the second horizontal flap 51. In other words, when the second horizontal flap 51 is cut along a lateral direction of the second horizontal flap 51, the line showing the cross section of the upper wing surface 51c includes a curved line protruding on the opposite side of the lower wing surface 51d. Here, the lateral direction of the second horizontal flap 51 corresponds to a direction orthogonal to a longitudinal direction of the second horizontal flap 51 and the thickness direction of the second horizontal flap 51.

[0075] A concave portion 51h located on the second end 51b side is provided on the upper wing surface 51c. When the operation of the indoor unit 1 is stopped, part of the attachment part 38 enters the concave portion 51h to prevent the second horizontal flap 51 from interfering with the attachment part 38.

[0076] The lower wing surface 51d includes a first curved surface 51f that is curved and recessed in the thickness direction of the second horizontal flap 51, and a second curved surface 51g that is curved and protrudes in the thickness direction of the second horizontal flap 51. In other words, when the second horizontal flap 51 is cut along the lateral direction, the line showing the cross section of the lower wing surface 51d includes a curved line protruding to the upper wing surface 51c side and a curved line protruding on the opposite side of the upper wing surface 51c.

[0077] The first curved surface 51f is provided on the second end 51b side of the lower wing surface 51d, and overlaps with the curved surface 51e in the thickness direction of the second horizontal flap 51.

[0078] The second curved surface 51g is provided on the first end 51a side of the lower wing surface 51d, and is connected to the first curved surface 51f.

[0079] A radius of curvature of the curved surface 51e of the upper wing surface 51c (for example, 396 mm or more) is set to be smaller than a radius of curvature of the first curved surface 51f of the lower wing surface 51d (for example, 1800 mm or more). In other words, the radius of curvature of the first curved surface 51f of the lower wing surface 51d of the second horizontal flap 51 is set within a range of four to five times the radius of curvature of the curved surface 51e of the upper wing surface 51c of the second horizontal flap 51.

[0080] Except for both ends in the longitudinal direction of the second horizontal flap 51, the shape of the cross section along the lateral direction is formed to be the

same. Conversely, both ends in the longitudinal direction of the second horizontal flap 51 show a cross-sectional shape different from the shape of other parts of the second horizontal flap 51.

[0081] In more detail, the upper wing surface 51c at both ends in the longitudinal direction of the second horizontal flap 51 does not include the curved surface 51e. The lower wing surface 51d at both ends in the longitudinal direction of the second horizontal flap 51 does not include the first and second curved surfaces 51f and 51g. FIG. 14 shows a region where the curved surface 51e is formed by the dotted line.

[0082] In the air conditioner having the above-described configuration, when the operation of the first airflow control mode (for example, heating operation) is executed, the distance between the first horizontal flap 41 and the second horizontal flap 51 is wider on the downstream side of the flow of the blow-out air than on the upstream side of the flow of the blow-out air, and the blow-out air flows diagonally downward on the opposite side of the wall surface W side. At this time, part of the blow-out air flows along the lower wing surface 41d of the first horizontal flap 41. Since the lower wing surface 41d of the first horizontal flap 41 includes the curved surface 41f, which is a protrusion, the Coanda effect on the lower wing surface 41d of the first horizontal flap 41 is enhanced. As a result, part of the blow-out air is strongly drawn to the lower wing surface 41d of the first horizontal flap 41 and flows along the lower wing surface 41d of the first horizontal flap 41. Meanwhile, since the upper wing surface 51c of the second horizontal flap 51 includes the curved surface 51e, which is a protrusion, the Coanda effect on the upper wing surface 51c of the second horizontal flap 51 is enhanced. As a result, another part of the blow-out air is strongly drawn to the upper wing surface 51c of the second horizontal flap 51.

[0083] In this way, while part of the blow-out air is strongly drawn to the lower wing surface 41d of the first horizontal flap 41, another part of the blow-out air is strongly drawn to the lower wing surface 51d of the second horizontal flap 51, making it possible to inhibit the separation of airflow from the first and second horizontal flaps 41 and 51.

[0084] When the operation of the first airflow control mode is executed, the distance between the first horizontal flap 41 and the second horizontal flap 51 on the downstream side is wider than the distance between the first horizontal flap 41 and the second horizontal flap 51 on the upstream side, and the blow-out air flows diagonally downward on the front side, and therefore the blow-out air can be applied, for example, to a wide range of the floor facing the indoor space R.

[0085] With the distance between the first horizontal flap 41 and the second horizontal flap 51 on the downstream side of the flow of the blow-out air greatly wider than the distance between the first horizontal flap 41 and the second horizontal flap 51 on the upstream side of the flow of the blow-out air, it is possible to inhibit the separation of airflow from the first and second horizontal flaps 41 and 51, and therefore the blow-out air can be greatly expanded in the up-and-down direction.

[0086] Part of the air from the blow-out channel 37 passes between the leading edge of the blow-out port 34 and the first end 41a of the first horizontal flap 41, and flows between the casing body 31 and the upper wing surface 41c of the first horizontal flap 41. At this time, since the upper wing surface 41c of the first horizontal flap 41 includes the curved surface 41e, which is a recess, the Coanda effect on the upper wing surface 41c of the first horizontal flap 41 is enhanced. As a result, part of the air is drawn to the upper wing surface 41c of the first horizontal flap 41 and flows along the upper wing surface 41c of the first horizontal flap 41. Therefore, for example, when the air from the blow-out channel 37 is cold air, the upper wing surface 41c of the first horizontal flap 41 can be covered with the cold air to inhibit dew condensation on the upper wing surface 41c of the first horizontal flap 41.

[0087] Another part of the air from the blow-out channel 37 passes between the trailing edge of the blow-out port 34 and the first end 51a of the second horizontal flap 51, and flows between the wall surface W and the lower wing surface 51d of the second horizontal flap 51. At this time, since the lower wing surface 51d of the second horizontal flap 51 includes the curved surface 51e, which is a recess, the Coanda effect on the lower wing surface 51d of the second horizontal flap 51 is enhanced. As a result, another part of the air is drawn to the lower wing surface 51d of the second horizontal flap 51 and flows along the lower wing surface 51d of the second horizontal flap 51. Therefore, for example, when the air from the blow-out channel 37 is cold air, the lower wing surface 51d of the second horizontal flap 51 can be covered with the cold air to inhibit dew condensation on the lower wing surface 51d of the second horizontal flap 51.

[0088] In the first diagonal airflow control mode, since the separation angle between the first horizontal flap 41 and the second horizontal flap 51 is set to, for example, 60°, the blow-out air can be reliably expanded in the up-and-down direction.

[0089] Since the inclination angles θ_1 and θ_2 of the virtual planes V1 and V2 with respect to the horizontal plane H are larger in the first diagonal airflow control mode than in the ceiling airflow control mode, the blow-out air is allowed to flow diagonally downward on the front side reliably.

[0090] In the first diagonal airflow control mode, each perpendicular flap 61 of the first perpendicular flap group G1 pivots such that the downstream end of the flow of the blow-out air approaches the left side, whereas each perpendicular flap 61 of the second perpendicular flap group G2 pivots such that the downstream end of the flow of the blow-out air approaches the right side. Thus, the substantial shape of the air flow path formed by the plurality of perpendicular flaps 61 of the first and second perpendicular flap groups G1 and G2 is a shape spread-

ing out from the upstream side to the downstream side of the flow of the blow-out air. As a result, the blow-out air can be expanded in the right-and-left direction.

[0091] The air conditioner, provided with the indoor unit 1, can inhibit the separation of airflow from the first and second horizontal flaps 41 and 51, and therefore can expand the blow-out air in the up-and-down direction and reduce air conditioning unevenness.

[0092] FIG. 19 is a diagram showing a result of simulating the up-and-down expansion of the blow-out air of the indoor unit 1 in the first diagonal airflow control mode.

[0093] The blow-out air of the indoor unit 1 is expanded in the up-and-down direction and hits the user from the upper body to the lower body. Therefore, when the indoor unit 1 executes the heating operation, as shown in FIG. 20, it was possible to enlarge the region with the highest temperature (region with the darkest color in FIG. 20) on the surface on the indoor unit 1 side of the user.

[0094] FIG. 21 is a diagram showing a result of simulating the up-and-down expansion of the blow-out air of an indoor unit 1001 of a comparative example.

[0095] The indoor unit 1001 of the comparative example differs from the indoor unit 1 only in that conventional first and second horizontal flaps were provided. The inclination angle of the conventional first and second horizontal flaps with respect to the horizontal plane was set in a similar manner to the simulation of FIG. 19. Each of a lower wing surface and an upper wing surface of the conventional first and second horizontal flaps did not include a curved surface and is a flat surface.

[0096] The blow-out air of such an indoor unit 1001 was not expanded in the up-and-down direction and hits the user only in the lower body. Therefore, when the indoor unit 1001 executed the heating operation, as shown in FIG. 22, the region with the highest temperature (region with the darkest color in FIG. 22) on the surface on the indoor unit 1001 side of the user was not large.

[0097] FIG. 23 is an image diagram of up-and-down and right-and-left expansion of the blow-out air of the indoor unit 1.

[0098] At a location of 1 m in front of the indoor unit 1, the blow-out air passed through a region of, for example, 1.4 m in length $\times$ 1.2 m in width. At this time, when a person sits on a chair placed at the location, it was possible to reduce the unevenness of the wind speed of the blow-out air that hits each part of the person, as shown by the solid line in FIG. 24. Moreover, it was possible to the wind speed of the blow-out air that hits each part of the person to 1 m/s or less. Meanwhile, in the operation of the indoor unit 1001 of the comparative example, as shown by the dotted line in FIG. 24, the unevenness of the wind speed of the blow-out air that hits each part of the person was large. It was possible to set the wind speed of the blow-out air that hit below the knees of the person to around 1 m/s, but the wind speed of the blow-out air that hits the chest of the person exceeded 2 m/s.

[0099] In this way, it was possible for the indoor unit 1 to send a gentle wind to each part of the user substantially

evenly more than the indoor unit 1001 of the comparative example.

[0100] FIG. 25 is a schematic vertical cross-sectional view of the indoor unit 1 after completion of a shift to the pre-diagonal airflow control mode. The pre-diagonal airflow control mode is an example of a second airflow control mode.

[0101] After the operation in the pre-diagonal airflow control mode is performed, the operation in the first diagonal airflow control mode is performed.

[0102] Specifically, the separation angle between the first horizontal flap 41 and the second horizontal flap 51 is set to be smaller than a predetermined separation angle (for example, 60°) between the first horizontal flap 41 and the second horizontal flap 51 in the first diagonal airflow control mode. In this state, the operation (for example, heating operation, cooling operation, and the like) in the pre-diagonal airflow control mode is performed and the blow-out air is blown out from the blow-out port 34 into the indoor space R. After the operation in the pre-diagonal airflow control mode, the operation is subsequently shifted to the first diagonal airflow control mode.

[0103] Upon completion of the shift to the operation in the pre-diagonal airflow control mode, the separation angle between the first horizontal flap 41 and the second horizontal flap 51 is, for example, 30°.

[0104] During the operation in the pre-diagonal airflow control mode, the indoor fan 10 has a larger number of rotations than in the first diagonal airflow control mode. For example, when the number of rotations of the indoor fan 10 in the first diagonal airflow control mode corresponds to a medium air volume (air volume higher than a low air volume and lower than a high air volume), the number of rotations of the indoor fan 10 in the pre-diagonal airflow control mode is set to correspond to the high air volume.

[0105] After the completion of the operation to increase the separation angle between the first horizontal flap 41 and the second horizontal flap 51 in a period from the start of the operation in the pre-diagonal airflow control mode until the completion of the shift to the operation in the first diagonal airflow control mode, the number of rotations of the fan is decreased to the number of rotations for performing the operation in the first diagonal airflow control mode.

[0106] When the first and second horizontal flaps 41 and 51 are in a posture shown in FIG. 25, both the first and second horizontal flaps 41 and 51 are pivoted.

[0107] The first and second horizontal flaps 41 and 51 during the operation in the pre-diagonal airflow control mode pivot at a higher speed than the first and second horizontal flaps 41 and 51 during the shift from the operation in the pre-diagonal airflow control mode to the operation in the first diagonal airflow control mode.

[0108] A two-dot chain line in FIG. 25 indicates the posture of the second horizontal flap 51 upon completion of the shift to the first diagonal airflow control mode.

<Shift to first diagonal airflow control mode>

[0109] Hereinafter, description will be made about the shift from the operation in the pre-diagonal airflow control mode to the operation in the first diagonal airflow control mode with reference to a flowchart in FIG. 26. Note that the shift is controlled by the control device 100.

[0110] For example, when the user operates the remote control device to select the heating operation in the first diagonal airflow control mode while the indoor unit 1 is in the operation stop state in FIG. 2, the processing for the shift is started, and the heating operation in the pre-diagonal airflow control mode is started in step S1.

[0111] Specifically, when the heating operation in the pre-diagonal airflow control mode is started, the compressor 11, the indoor fan 10, and the like are driven such that warm blow-out air is blown out from the blow-out port 34 into the indoor space R.

[0112] Next, in step S2, the number of rotations of the indoor fan 10 is set to a large number of rotations. The large number of rotations is higher than a set number of rotations of the indoor fan 10 during the heating operation in the first diagonal airflow control mode.

[0113] Next, in step S3, the first horizontal flap 41 is pivoted by 25° counterclockwise from the operation stop state of the indoor unit 1, while the second horizontal flap 51 is pivoted by 55° counterclockwise from the operation stop state of the indoor unit 1. This makes the separation angle between the first horizontal flap 41 and the second horizontal flap 51 smaller than in the first diagonal airflow control mode. In short, the first and second horizontal flaps 41 and 51 are changed from the posture shown in FIG. 2 to the posture shown in FIG. 25.

[0114] When the first and second horizontal flaps 41 and 51 pivot, pivot speeds of the first and second horizontal flaps 41 and 51 are higher than pivot speeds of the first and second horizontal flaps 41 and 51 when the heating operation in the pre-diagonal airflow control mode is shifted to the operation in the first diagonal airflow control mode.

[0115] Next, in step S4, it is determined whether a predetermined time (for example, one second) has elapsed since the first and second horizontal flaps 41 and 51 take the posture shown in FIG. 25. Step S4 is repeated until it is determined that the predetermined time has elapsed since the first and second horizontal flaps 41 and 51 take the posture shown in FIG. 25.

[0116] Next, in step S5, the number of rotations of the indoor fan 10 is decreased to a set number of rotations.

[0117] Next, in step S6, the heating operation in the first diagonal airflow control mode is started.

[0118] Finally, in step S7, while the posture of the first horizontal flap 41 is maintained, the second horizontal flap 51 is pivoted by 15° counterclockwise from the posture shown in FIG. 25. Accordingly, the first and second horizontal flaps 41 and 51 are in the posture shown in FIG. 5.

[0119] In this way, when the heating operation is per-

formed in the first diagonal airflow control mode, the heating operation is performed in the pre-diagonal airflow control mode in which the separation angle between the first horizontal flap 41 and the second horizontal flap 51 is set to be smaller than the predetermined separation angle between the first horizontal flap 41 and the second horizontal flap 51 in the first diagonal airflow control mode, and the blow-out air is blown out, and then the operation is shifted to the heating operation in the first diagonal airflow control mode subsequently after the heating operation in the pre-diagonal airflow control mode. As a result, the pre-diagonal airflow control mode shifts to the first diagonal airflow control mode while the Coanda effect on the lower wing surface 41d of the first horizontal flap 41 and the upper wing surface 51c of the second horizontal flap 51 is maintained. As a result, after the shift to the first diagonal airflow control mode, part of the blow-out air is allowed to flow along the lower wing surface 41d of the first horizontal flap 41, and another part of the blow-out air is allowed to flow along the upper wing surface 51c of the second horizontal flap 51. Accordingly, a difference in the wind speed decreases in each part of the blow-out air flowing between the lower wing surface 41d of the first horizontal flap 41 and the upper wing surface 51c of the second horizontal flap 51. Therefore, when the blow-out air is blown out toward, for example, a wide range of region, the blow-out air can be supplied stably to the wide range.

[0120] In short, by shifting to the heating operation in the first diagonal airflow control mode subsequently after the heating operation in the pre-diagonal airflow control mode, stable Coanda wind can be formed in the first diagonal airflow control mode.

[0121] When the operation is shifted to the heating operation in the first diagonal airflow control mode subsequently after the heating operation in the pre-diagonal airflow control mode, the blow-out air can be also supplied to a wide range.

[0122] In the heating operation in the pre-diagonal airflow control mode, the number of rotations of the indoor fan 10 is set to be larger than in the first diagonal airflow control mode. Thus, the Coanda effect on the lower wing surface 41d of the first horizontal flap 41 and the upper wing surface 51c of the second horizontal flap 51 can be enhanced.

[0123] Further, since the pivot speed of the second horizontal flap 51 for changing the posture shown in FIG. 2 to the posture shown in FIG. 25 is higher than the pivot speed of the second horizontal flap 51 for changing the posture shown in FIG. 25 to the posture shown in FIG. 5, when the posture shown in FIG. 25 is changed to the posture shown in FIG. 5, the airflow in the second horizontal flap 51 can be prevented from being separated.

[0124] The air conditioning indoor unit, which includes the indoor unit 1, can supply the blow-out air stably to a wide range.

[0125] In the first embodiment, the operation stop state of the indoor unit 1 is shifted to the heating operation in

the first diagonal airflow control mode via the heating operation in the pre-diagonal airflow control mode. Alternatively, for example, the heating operation in the ceiling airflow control mode may be shifted to the heating operation in the first diagonal airflow control mode via the heating operation in the pre-diagonal airflow control mode.

[0126] In short, in one embodiment of the present disclosure, the mode is shifted to the first diagonal airflow control mode immediately after the start of operation of the indoor unit 1, but the mode may be shifted to the first diagonal airflow control mode via another airflow control mode.

[0127] In the first embodiment, the user selects the first diagonal airflow control mode using, for example, the remote control device. Alternatively, without a selection by the user, the control device may select the heating operation in the first diagonal airflow control mode based on, for example, a detection signal of the floor temperature sensor T6. In this case, the heating operation in the first diagonal airflow control mode is automatically selected, which improves convenience of the indoor unit 1.

[0128] In the first embodiment, the operation in the pre-diagonal airflow control mode is the heating operation, but may be, for example, a cooling operation, a blowing operation, or the like.

[0129] In the first embodiment, the operation in the first diagonal airflow control mode is the heating operation, but may be, for example, a cooling operation, a blowing operation, or the like. In this case, the operation in the first diagonal airflow control mode may be the same as the operation in the preceding pre-diagonal airflow control mode.

[0130] In the first embodiment, the operation in the pre-diagonal airflow control mode is performed immediately before the heating operation in the first diagonal airflow control mode. Alternatively, the operation in the pre-diagonal airflow control mode similar to the pre-diagonal airflow control mode may be performed immediately before the heating operation in the first diagonal airflow control mode.

[0131] In the first embodiment, the first and second horizontal flaps 41 and 51 upon completion of the shift to the operation in the pre-diagonal airflow control mode take the posture shown in FIG. 25. Alternatively, the posture other than the posture shown in FIG. 25 may be taken as long as the separation angle is smaller than the separation angle in the first diagonal airflow control mode.

[0132] For example, the first and second horizontal flaps 41 and 51 upon completion of the shift to the operation in the pre-diagonal airflow control mode may take a posture shown in FIG. 27. In this case, the pivot speeds of the first and second horizontal flaps 41 and 51 for changing another posture to the posture shown in FIG. 27 may be higher than the pivot speeds of the first and second horizontal flaps 41 and 51 for changing the posture shown in FIG. 27 to the posture shown in FIG. 5.

[0133] A two-dot chain line in FIG. 27 indicates the posture of the first and second horizontal flaps 41 and 51 upon completion of the shift to the first diagonal airflow control mode.

[0134] For example, the first and second horizontal flaps 41 and 51 upon completion of the shift to the operation in the pre-diagonal airflow control mode may take a posture shown in FIG. 28. In this case, the pivot speed of the first horizontal flap 41 for changing another posture to the posture shown in FIG. 28 may be higher than the pivot speed of the first horizontal flap 41 for changing the posture shown in FIG. 28 to the posture shown in FIG. 5.

[0135] A two-dot chain line in FIG. 28 indicates the posture of the first horizontal flap 41 upon completion of the shift to the first diagonal airflow control mode.

[0136] In the first embodiment, after the completion of the operation to increase the separation angle between the first horizontal flap 41 and the second horizontal flap 51 in a period from the start of the operation in the pre-diagonal airflow control mode until the completion of the shift to the operation in the first diagonal airflow control mode, the number of rotations of the indoor fan 10 is decreased. Alternatively, the number of rotations of the indoor fan 10 may be maintained without being decreased.

[0137] In the first embodiment, when the first and second horizontal flaps 41 and 51 take the posture shown in FIG. 25, both the first and second horizontal flaps 41 and 51 pivot. However, as long as the preceding posture of the first and second horizontal flaps 41 and 51 satisfies a predetermined condition, it is sufficient that only one of the first or second horizontal flap 41 or 51 pivots. This configuration simplifies pivot control of the first and second horizontal flaps 41 and 51 for taking the posture shown in FIG. 25.

[0138] The predetermined condition may be satisfied, for example, when one of the first or second horizontal flap 41 or 51 is in the posture shown in FIG. 25.

[0139] When only one of the first or second horizontal flap 41 or 51 pivots to reduce the separation angle between the first and second horizontal flaps 41 and 51, the one of the first or second horizontal flap 41 or 51 may have a larger angle with respect to the wind direction of the blow-out air in the operation in the first diagonal airflow control mode. In this case, it is easy to obtain an airflow along the horizontal flap having the larger angle described above.

[0140] Here, the wind direction is a direction parallel to a tangent of a lower end of an inner peripheral surface of the second partition wall 36 (a direction forming 45° with respect to the horizontal plane) and a direction directed diagonally downward from the indoor unit 1.

[0141] In the first embodiment, the air conditioner is the pair type including one indoor unit 1 and one outdoor unit 2, but may be a multi-type including a plurality of indoor units 1 and one outdoor unit 2.

[0142] In the first embodiment, for example, in the cooling operation, in the dehumidifying operation, or in the

heating operation, the control device 100 may appropriately select one of the first diagonal airflow control mode, the ceiling airflow control mode, the perpendicular airflow control mode, or the second diagonal airflow control mode, or may switch between those modes, based on signals from the indoor temperature sensor T5 and the like.

[0143] In the first embodiment, for example, in the cooling operation, in the dehumidifying operation, or in the heating operation, the user may be allowed to select a desired mode with, for example, the remote control device from among the first diagonal airflow control mode, the ceiling airflow control mode, the perpendicular airflow control mode, and the second diagonal airflow control mode.

[0144] In the first embodiment, the separation angle between the first horizontal flap 41 and the second horizontal flap 51 in the first diagonal airflow control mode is set to 60°, but may be other than 60°. In this case, the separation angle is set to be within a range of, for example, 53° to 60°.

[0145] In the first embodiment, in the first diagonal airflow control mode, with respect to the perpendicular flap 61 located at the left end of the plurality of perpendicular flaps 61 and the perpendicular flap 61 located at the right end of the plurality of perpendicular flaps 61, the distance on the downstream side is wider than the distance on the upstream side, but the distance may be substantially the same. In short, in the first diagonal airflow control mode, the control for expanding the blow-out air in the right-and-left direction may be executed, or the control for expanding the blow-out air in the right-and-left direction may not be executed.

[Second embodiment]

[0146] FIG. 29 is a control block diagram of an air conditioner of a second embodiment of the present disclosure.

[0147] An indoor unit of the air conditioner includes a motion sensor 91 that detects a distance to a person in an indoor space R. A control device 200 controls first and second horizontal flap motors 73 and 74 based on a detection result of the motion sensor 91.

[0148] In more detail, in a perpendicular airflow control mode, when the distance detected by the motion sensor 91 is equal to or less than a predetermined distance (for example, 1 m), the control device 200 switches the perpendicular airflow control mode to a first airflow control mode. Note that the distance is, for example, a distance in a front-and-rear direction between the indoor unit and the person.

[0149] The air conditioner having the above-described configuration has the same effects as the effects of the first embodiment, and the perpendicular airflow control mode switches to the first airflow control mode when the distance detected by the motion sensor 91 becomes equal to or less than the predetermined distance, and

therefore the blow-out air of the indoor unit can be directly hit to the person in the indoor space R timely.

[0150] Specific embodiments of the present disclosure have been described, but the present disclosure is not limited to the first and second embodiments and modifications thereof, and various changes can be made and implemented within the scope of the present disclosure. For example, some of the contents described in the first and second embodiments may be deleted or replaced to obtain one embodiment of the present disclosure. Alternatively, a combination of the modification of the first embodiment and the second embodiment may be used as one embodiment of the present disclosure.

15 REFERENCE SIGNS LIST

[0151]

1	indoor unit
20 2	outdoor unit
10	indoor fan
11	compressor
12	four-way switching valve
13	outdoor heat exchanger
25 14	electric expansion valve
15	indoor heat exchanger
16	accumulator
20	outdoor fan
30	casing
30 34	blow-out port
41	first horizontal flap
41c, 51	cupper wing surface
41d, 51d	lower wing surface
41e, 41f, 51e	curved surface
35 51	second horizontal flap
51f	first curved surface
51g	second curved surface
61	perpendicular flap
73	first horizontal flap motor
40 74	second horizontal flap motor
83	first perpendicular flap group motor
84	second perpendicular flap group motor
91	motion sensor
100, 200	control device
45 G1	first perpendicular flap group
G2	second perpendicular flap group
L1, L2	connection pipe
RC	refrigerant circuit
T1	outdoor heat exchanger temperature sensor
50 T2	outdoor air temperature sensor
T3	evaporation temperature sensor
T4	indoor heat exchanger temperature sensor
55 T5	indoor temperature sensor
T6	floor temperature sensor
θ1, θ2	inclination angle

Claims

1. An air conditioning indoor unit (1) comprising:

a casing (30) having a blow-out port (34) through which air from a fan (10) is blown out; 5
 a first horizontal blade (41) configured to adjust an up-and-down wind direction of blow-out air from the blow-out port (34);
 a first drive unit (73) configured to drive the first horizontal blade (41); 10
 a second horizontal blade (51) disposed on a rear side of the first horizontal blade (41) and controls the up-and-down wind direction of the blow-out air; 15
 a second drive unit (74) configured to drive the second horizontal blade (51); and
 a control device (100, 200) configured to control the fan (10), the first drive unit (73), and the second drive unit (74), wherein 20
 the control device (100, 200) performs an operation in a first airflow control mode in which a distance between the first horizontal blade (41) and the second horizontal blade (51) is set to be larger on a downstream side of a flow of the blow-out air than on an upstream side of the flow of the blow-out air, part of the blow-out air is allowed to flow along a lower wing surface of the first horizontal blade (41), and another part of the blow-out air is allowed to flow along an upper wing surface of the second horizontal blade (51) after an operation in a second airflow control mode in which a separation angle between the first horizontal blade (41) and the second horizontal blade (51) is set to be smaller than a predetermined separation angle between the first horizontal blade (41) and the second horizontal blade (51) in the first airflow control mode, and the blow-out air is blown out. 25 30 35 40

2. The air conditioning indoor unit (1) according to claim 1, wherein

the fan (10) has a number of rotations that is set larger in the operation in the second airflow control mode than in the first airflow control mode. 45

3. The air conditioning indoor unit (1) according to claim 1 or 2, wherein

during the operation in the second airflow control mode performed before the operation in the first airflow control mode, one of the first horizontal blade (41) or the second horizontal blade (51) is driven to decrease the separation angle between the first horizontal blade (41) and the second horizontal blade (51). 50 55

4. The air conditioning indoor unit (1) according to any one of claims 1 to 3, wherein

one of the first horizontal blade (41) or the second horizontal blade (51) having a larger angle with respect to a wind direction of the blow-out air during the operation in the first airflow control mode is driven for starting the operation in the second airflow control mode to decrease the separation angle between the first horizontal blade (41) and the second horizontal blade (51).

5. The air conditioning indoor unit (1) according to any one of claims 1 to 3, wherein

a rotation speed of the first horizontal blade (41) and/or the second horizontal blade (51) for starting the operation in the second airflow control mode is faster than a rotation speed of the first horizontal blade (41) and/or the second horizontal blade (51) for shifting from the operation in the second airflow control mode to the operation in the first airflow control mode.

6. An air conditioner comprising:

the air conditioning indoor unit (1) according to any one of claims 1 to 5; and
 an air conditioning outdoor unit (2) connected to the air conditioning indoor unit (1) via a refrigerant pipe (L1, L2).

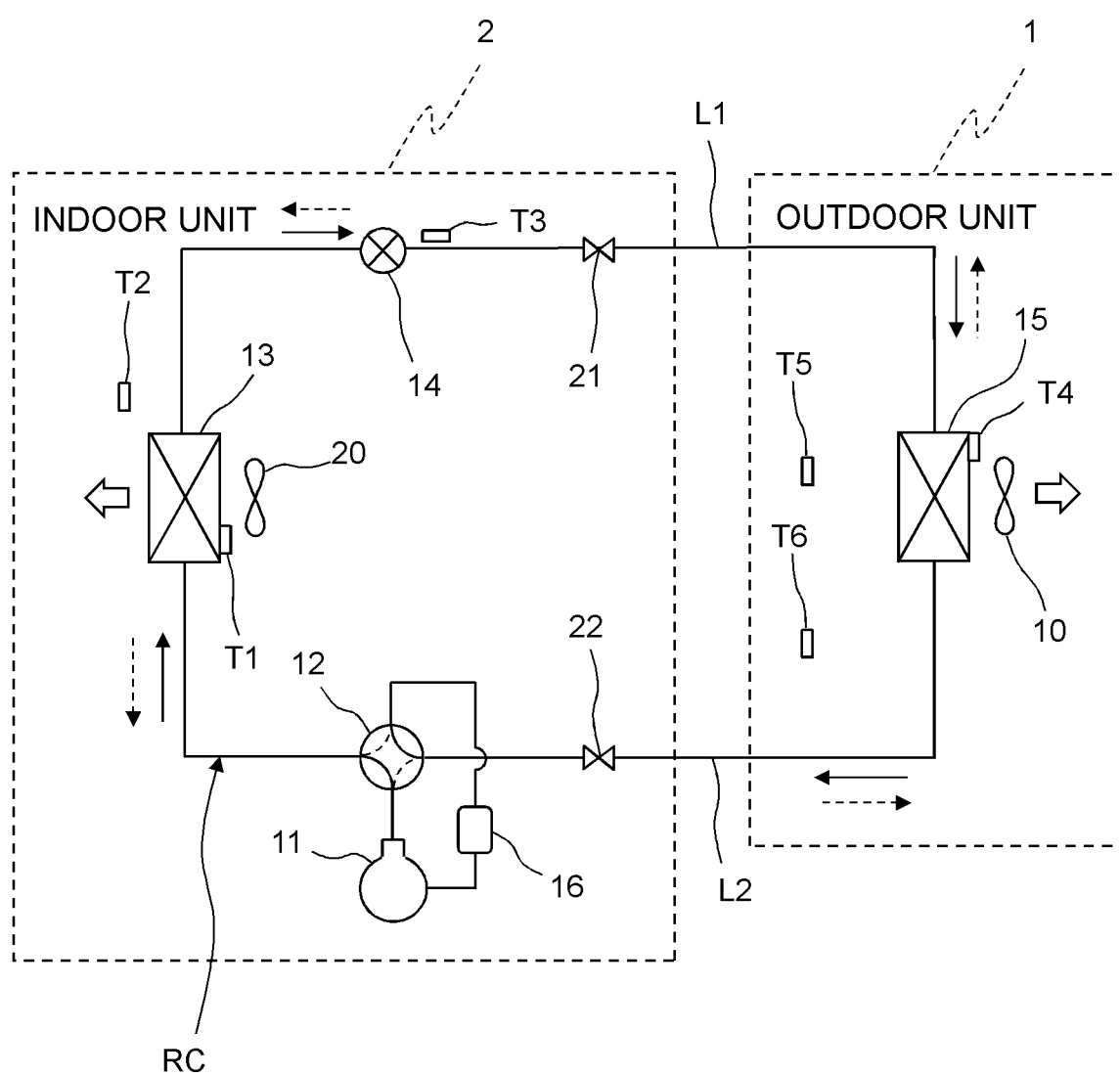
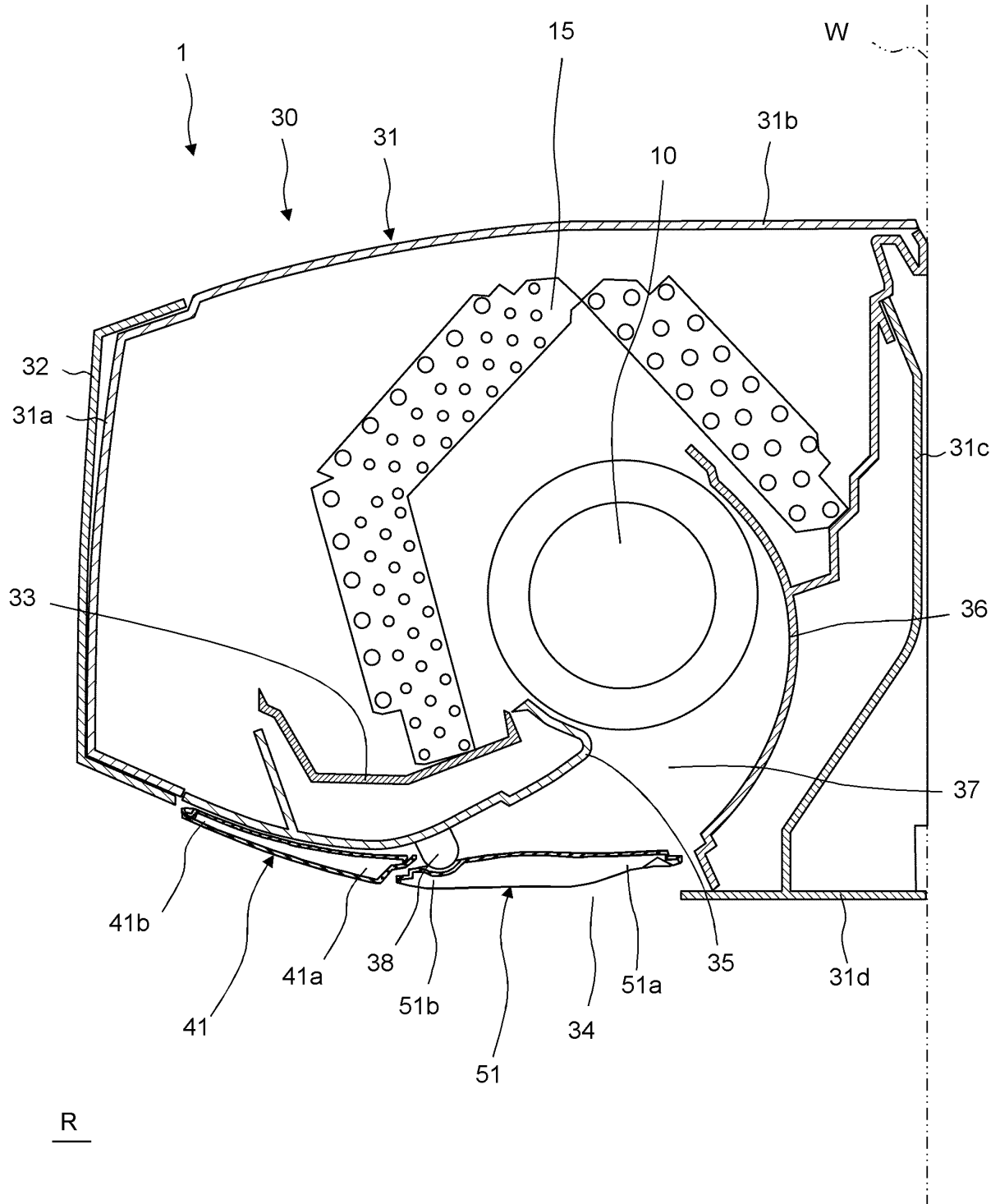
Fig. 1

Fig. 2



R

Fig.3

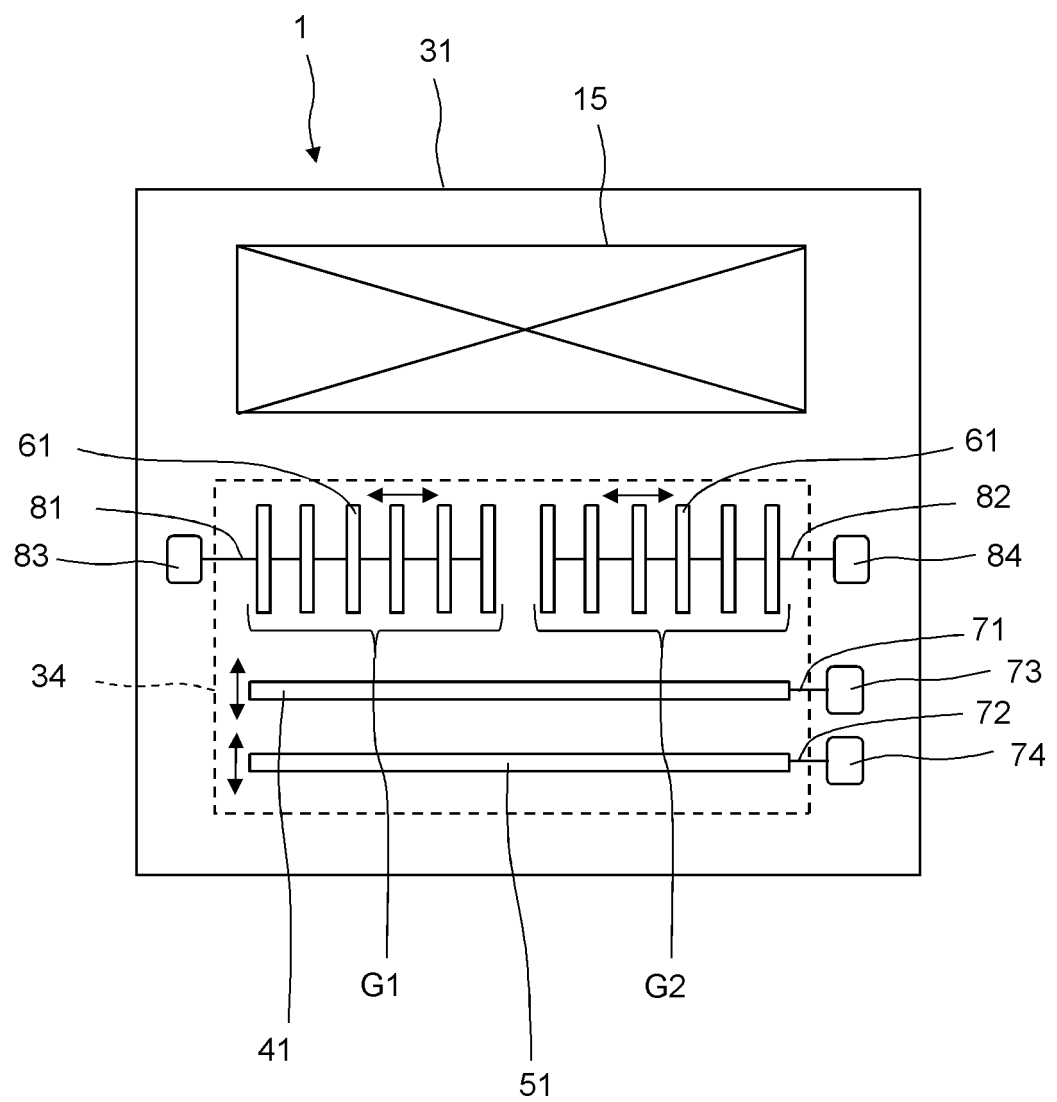


Fig. 4

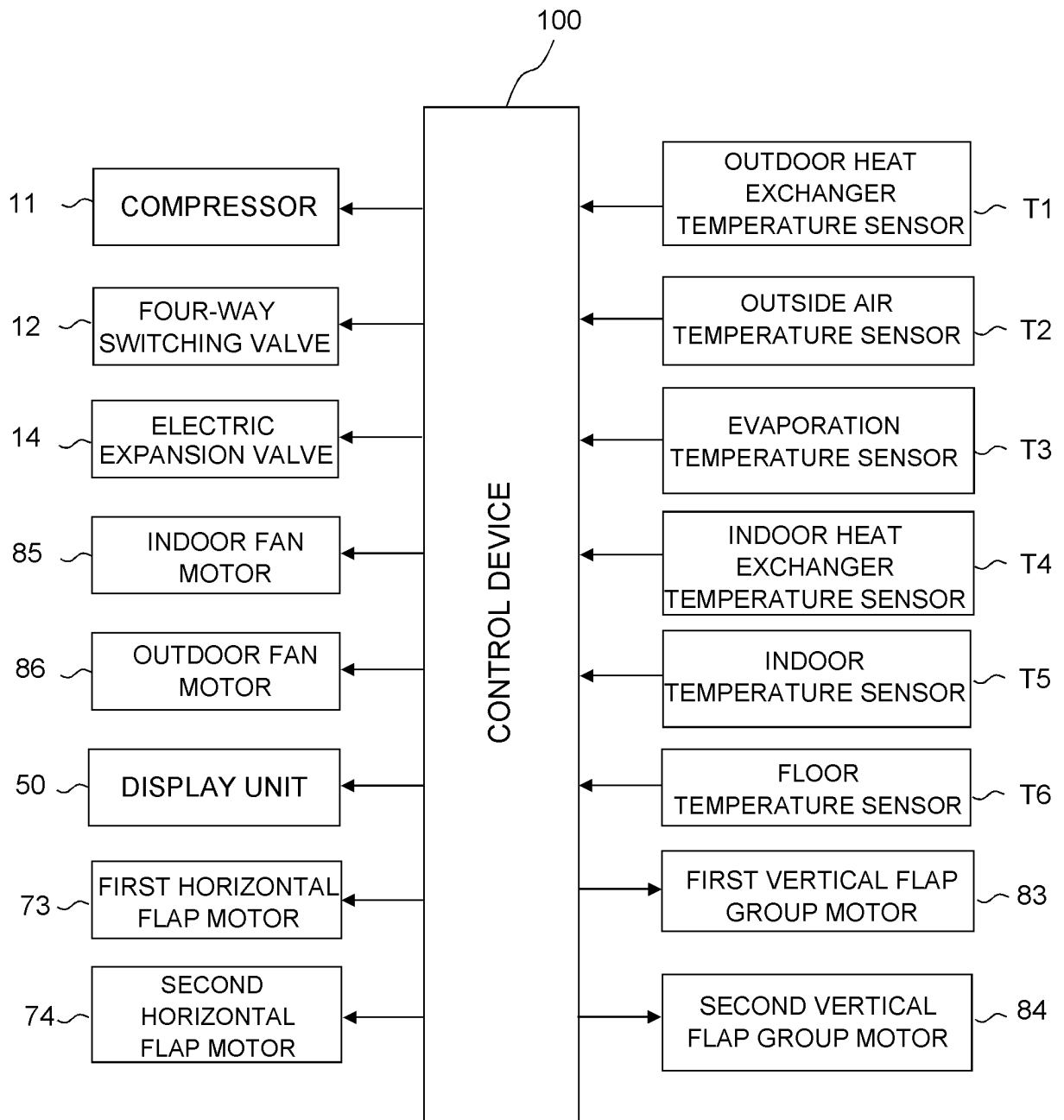


Fig.5

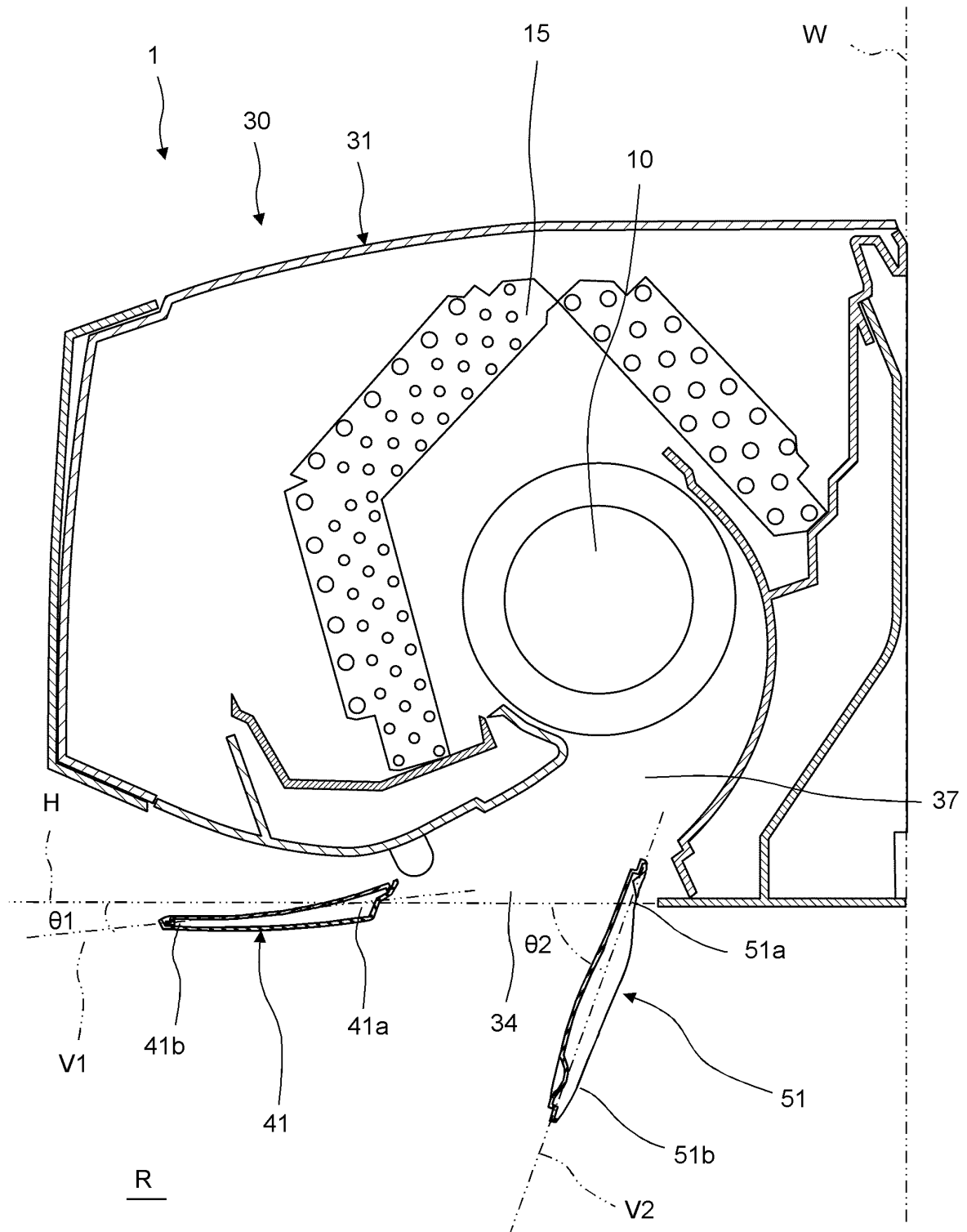


Fig. 6

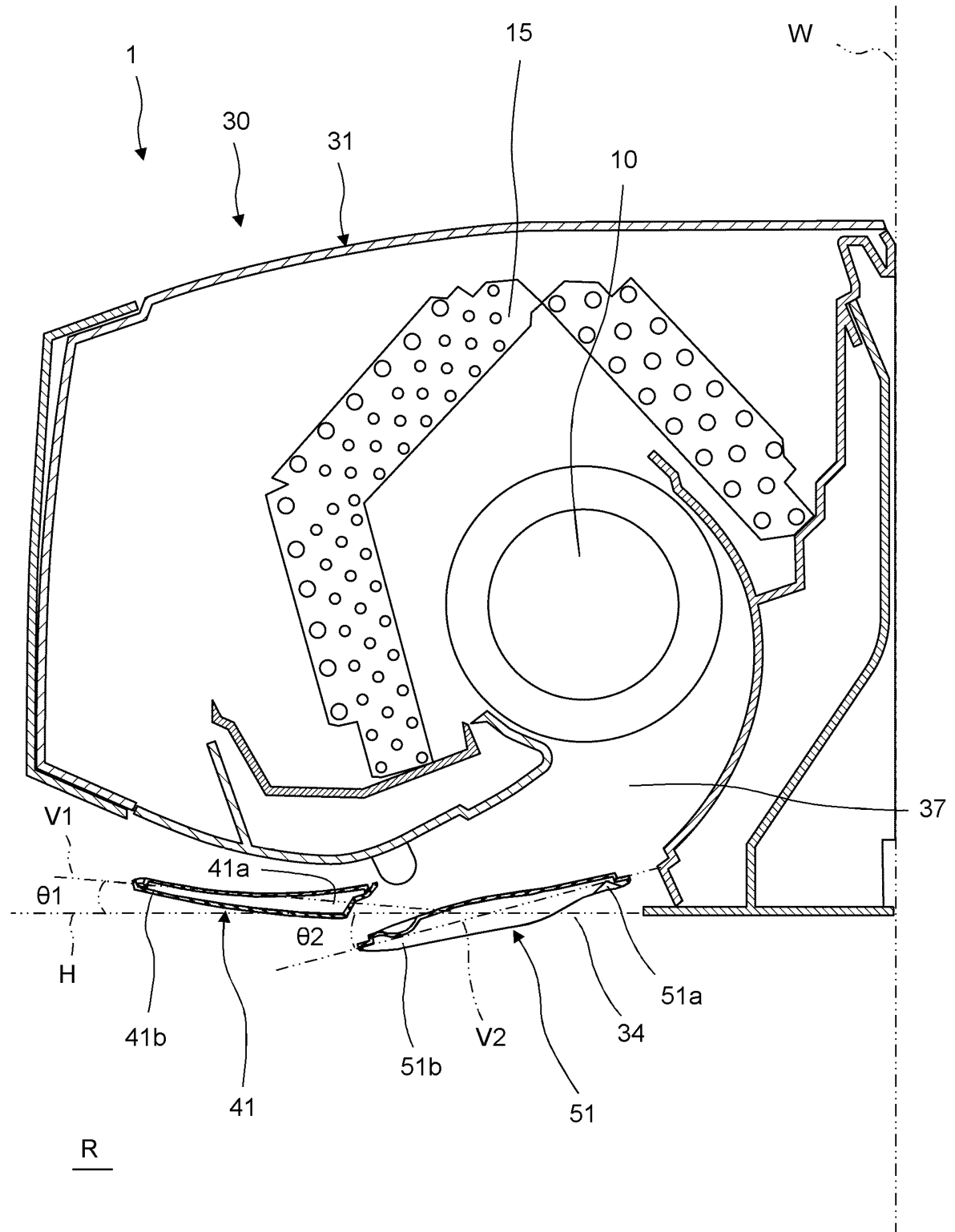


Fig. 7

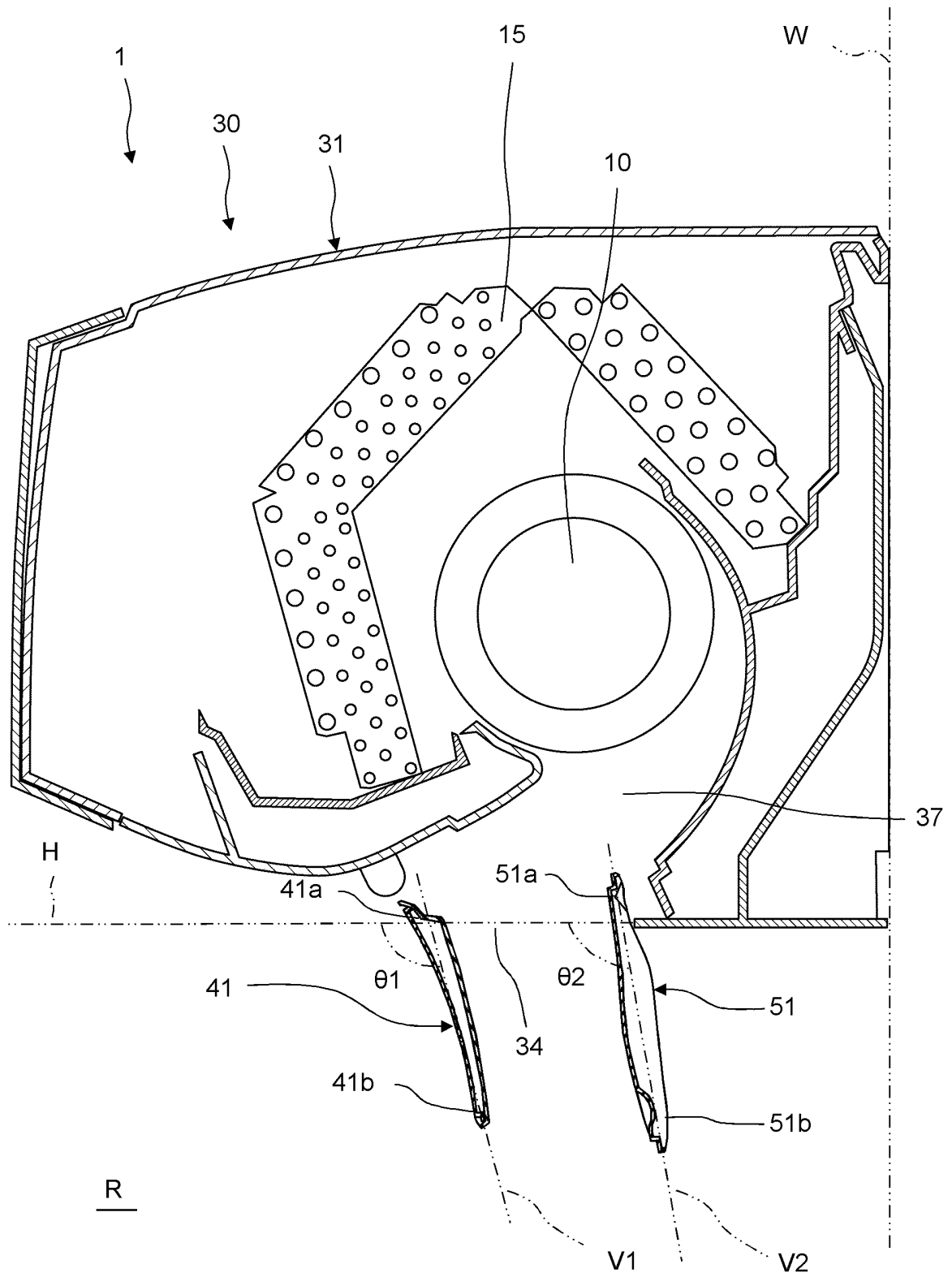


Fig. 8

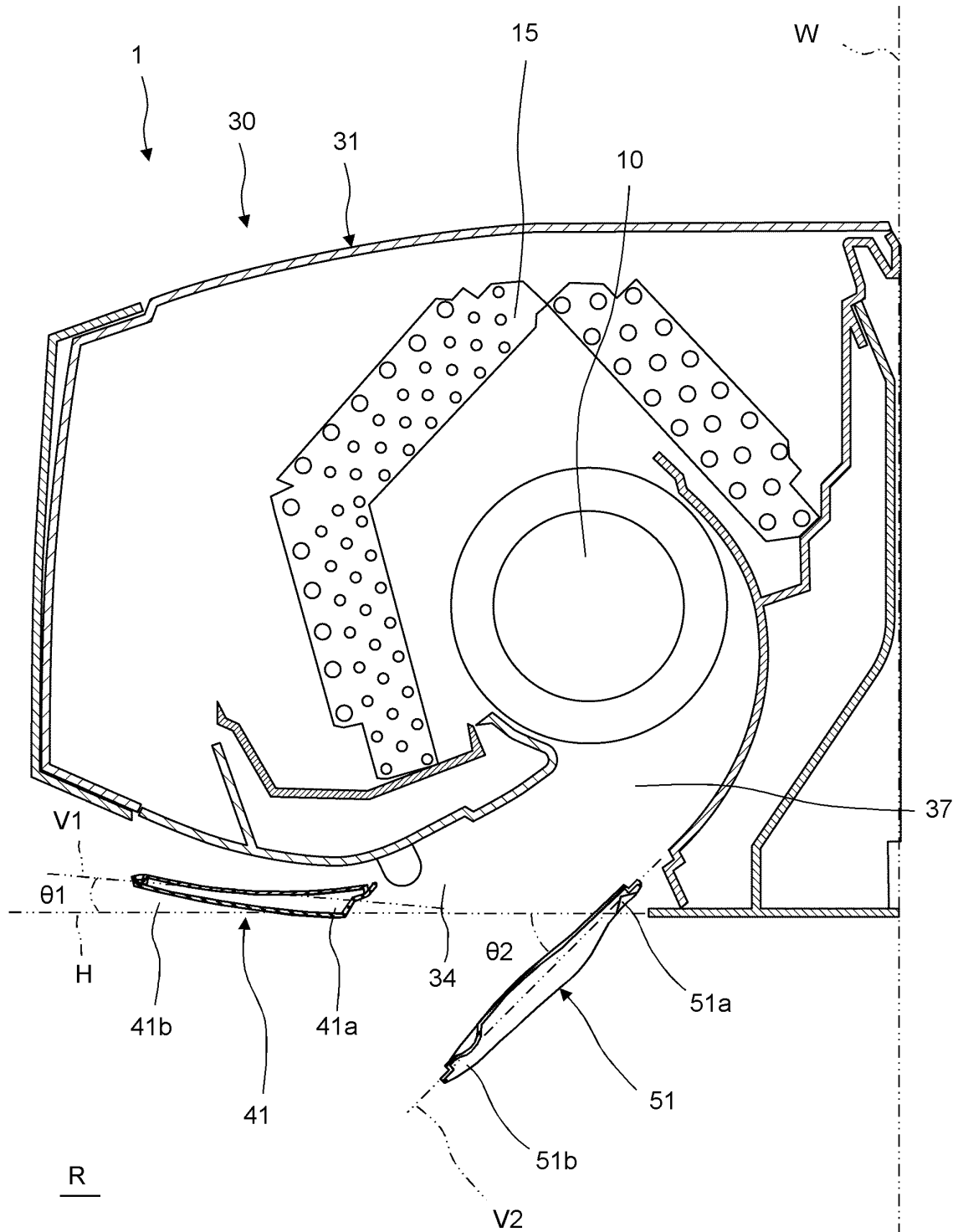


Fig.9

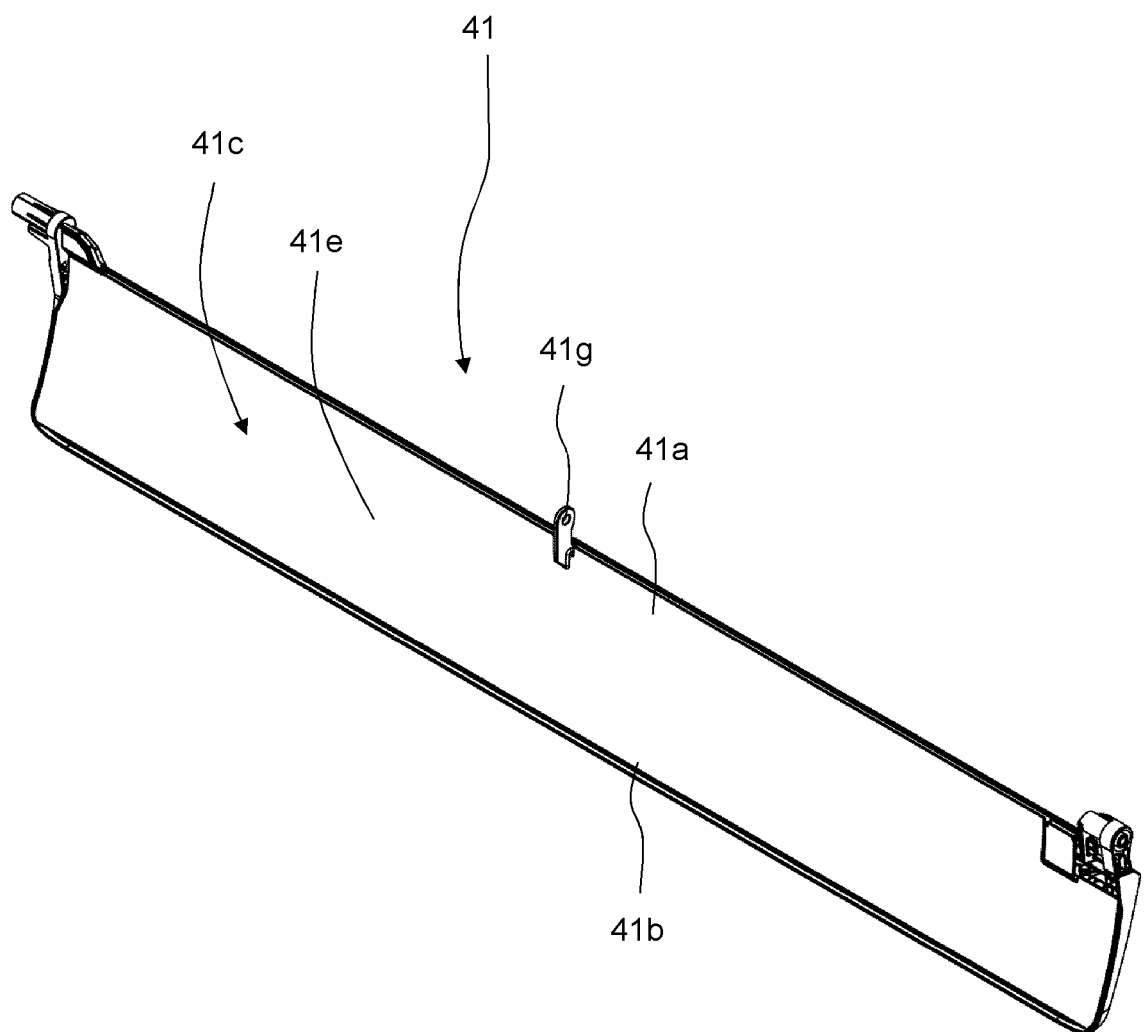


Fig. 10

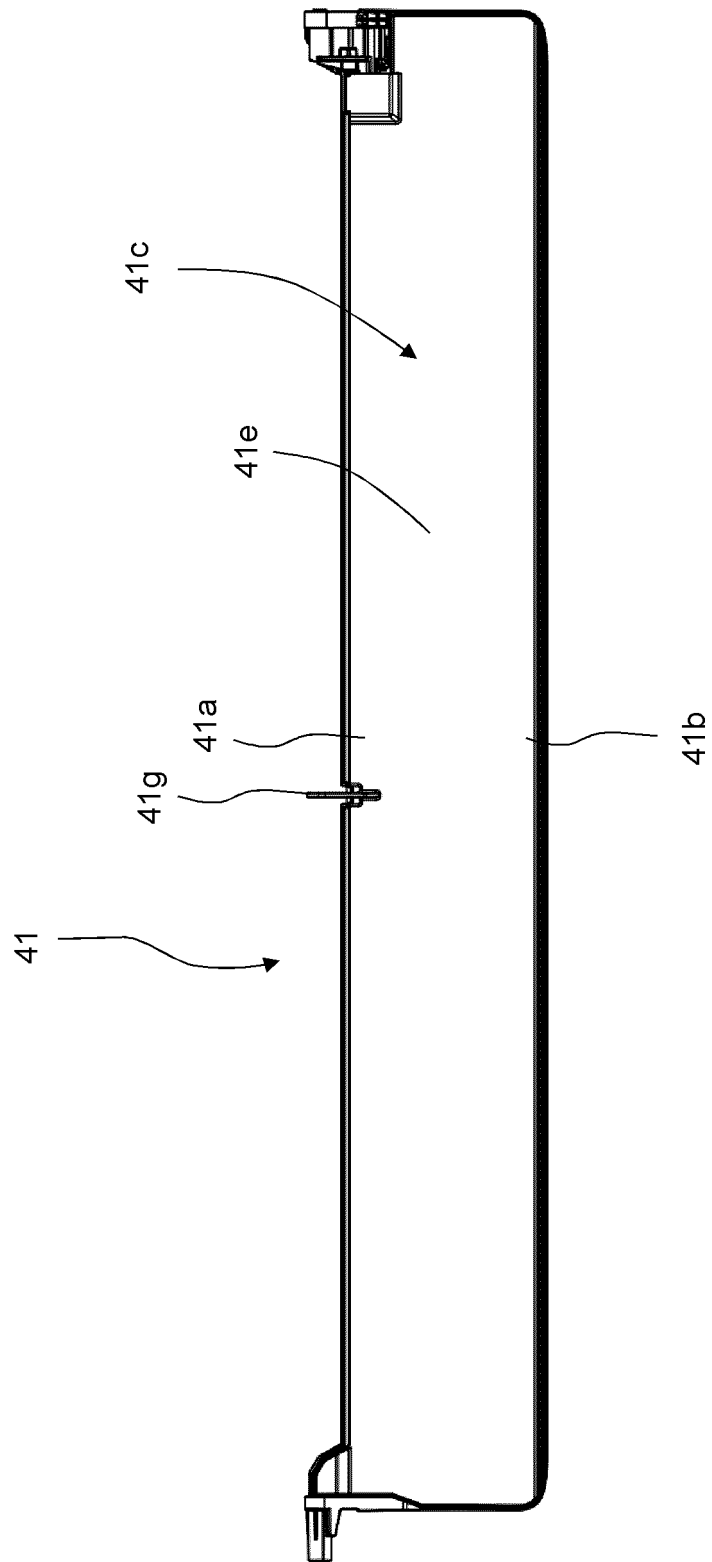


Fig. 11

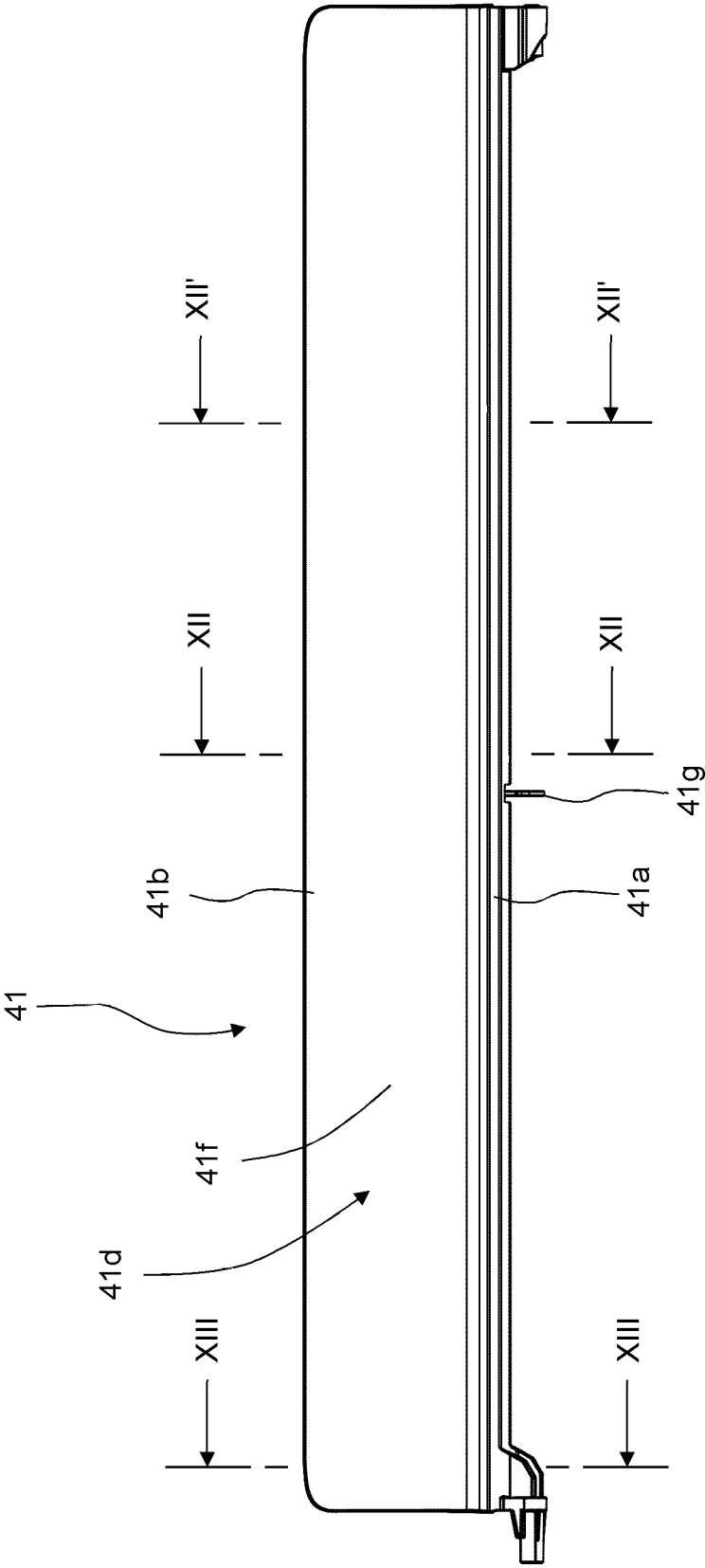


Fig. 12

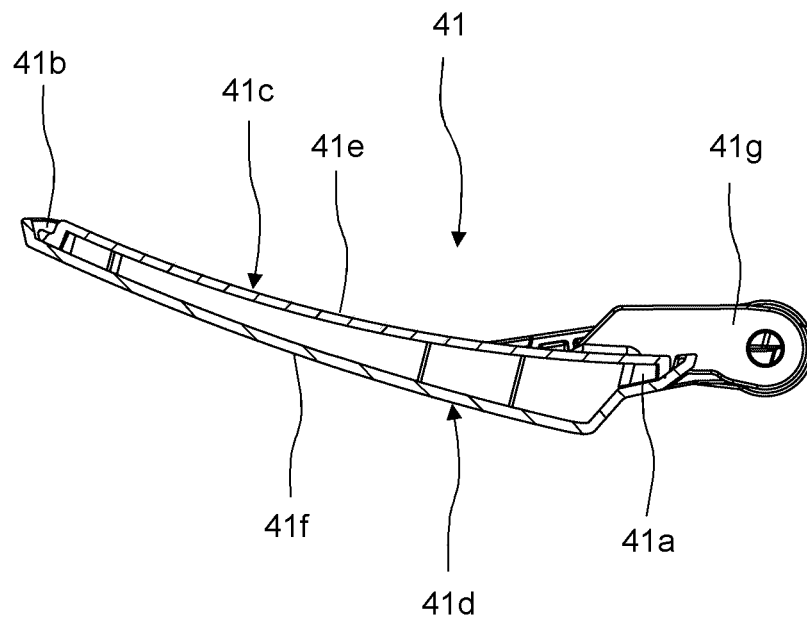


Fig. 13

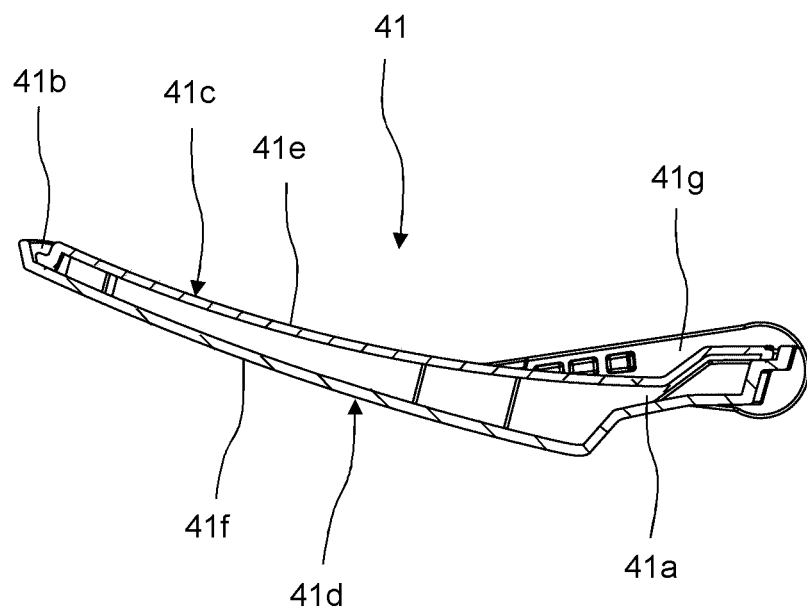


Fig.14

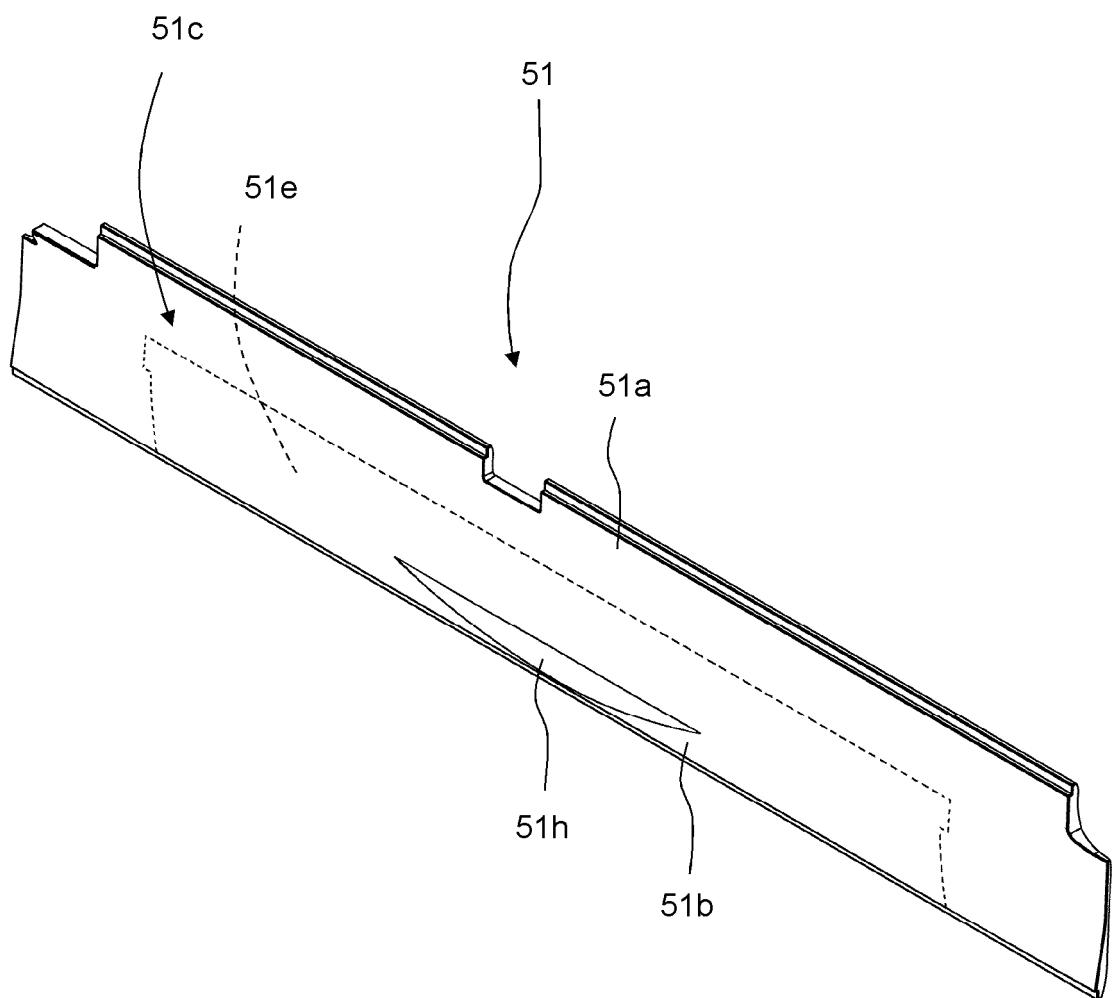


Fig. 15

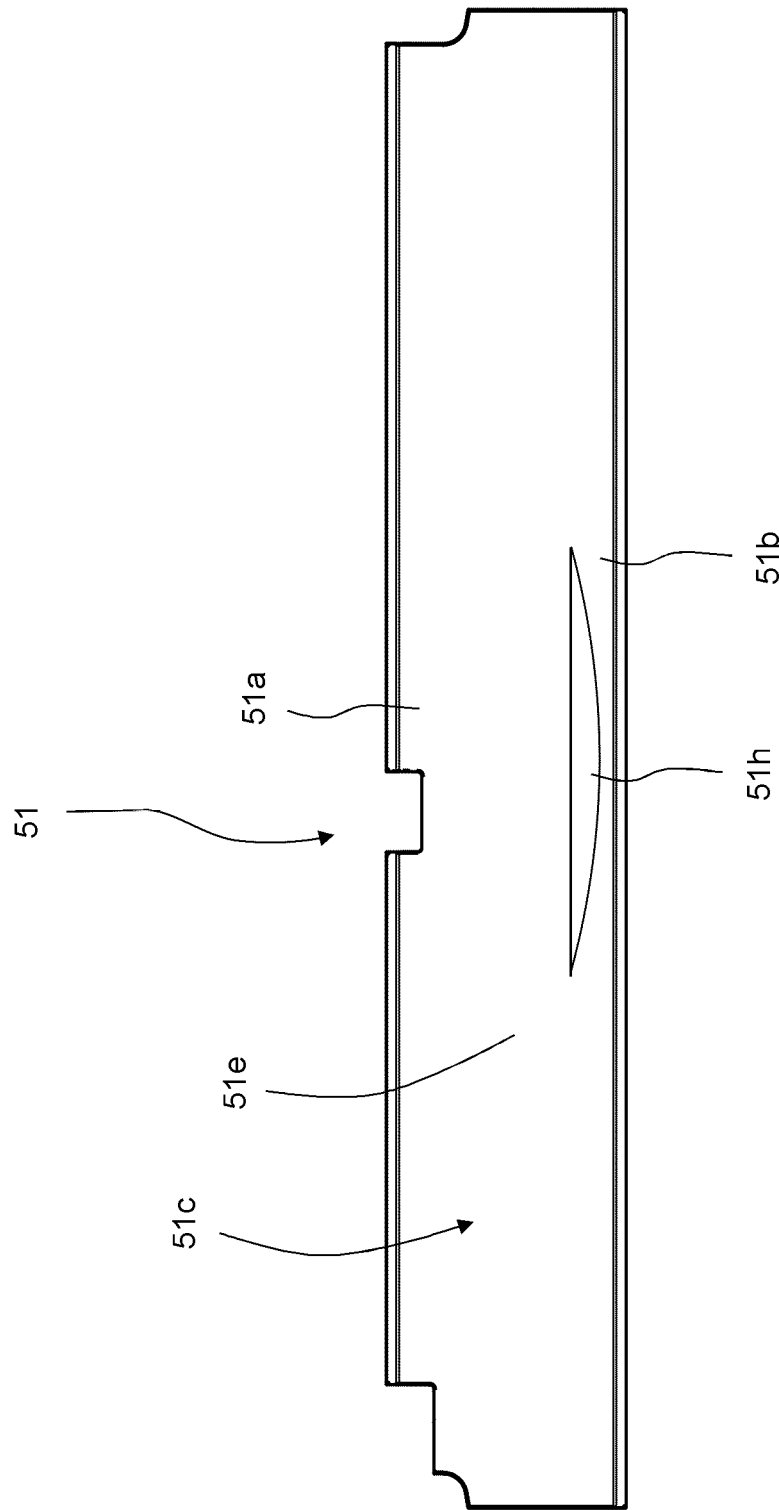


Fig. 16

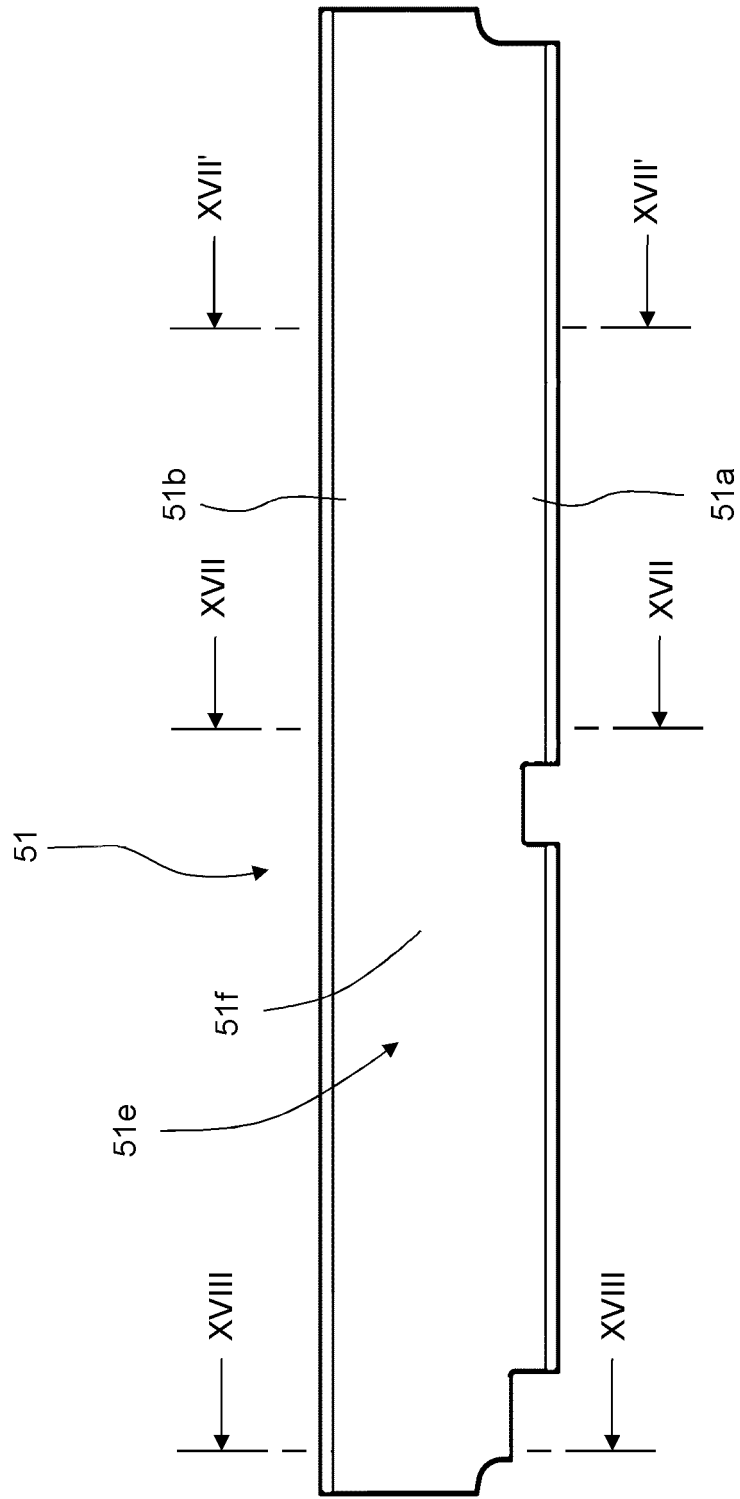


Fig. 17

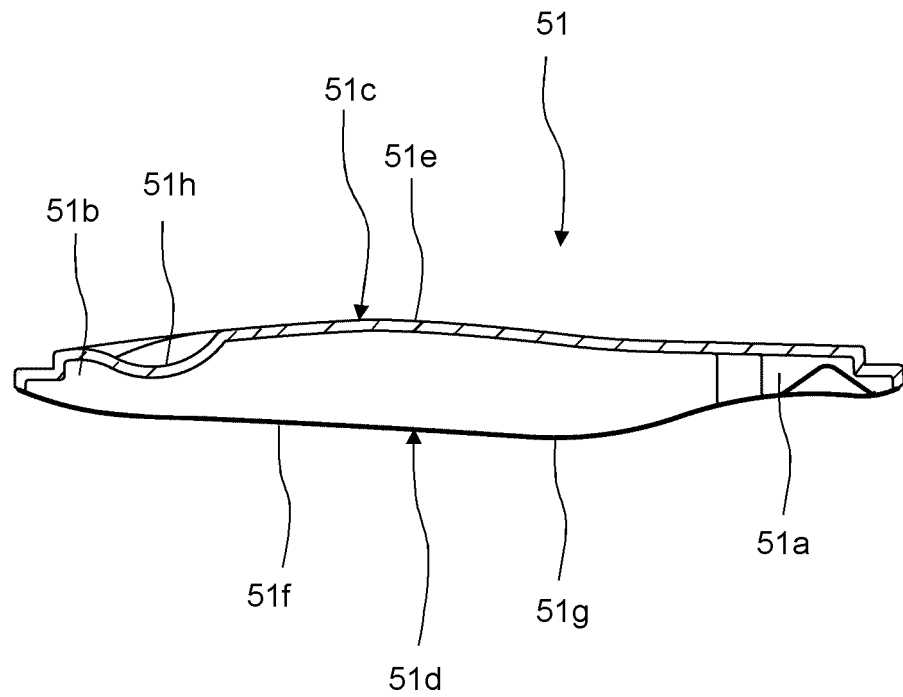


Fig. 18

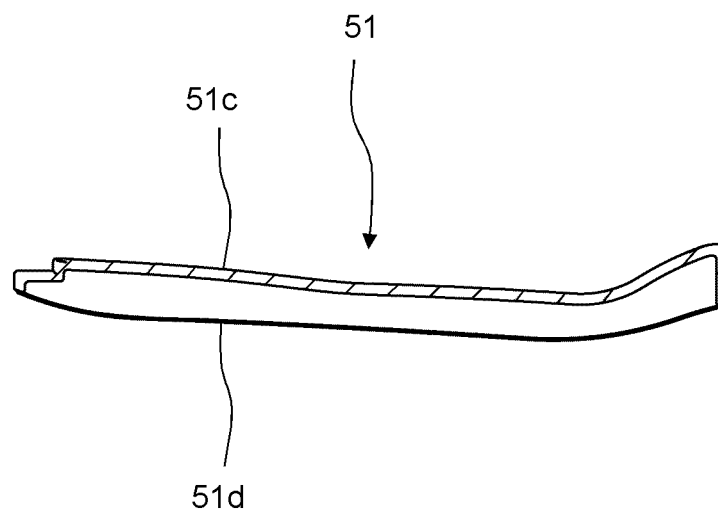


Fig.19

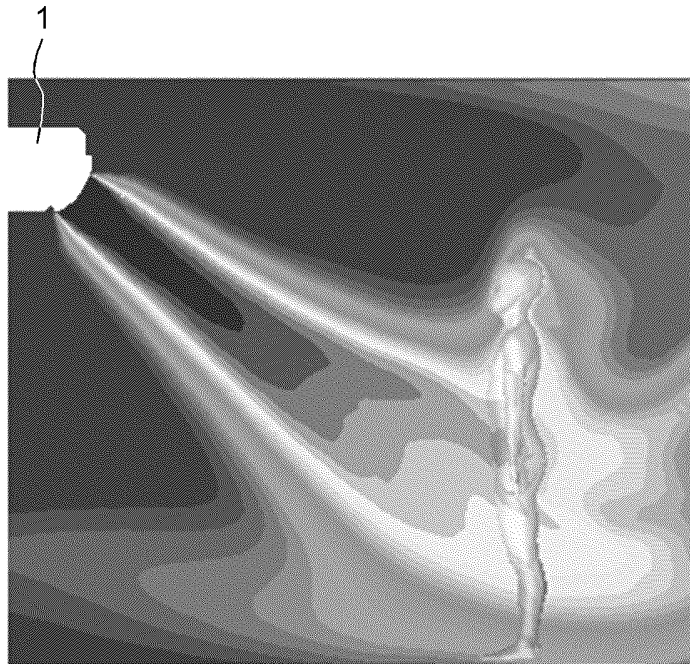


Fig.20

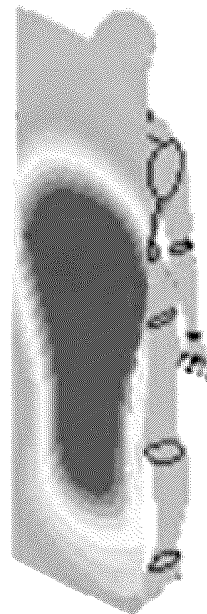


Fig.21

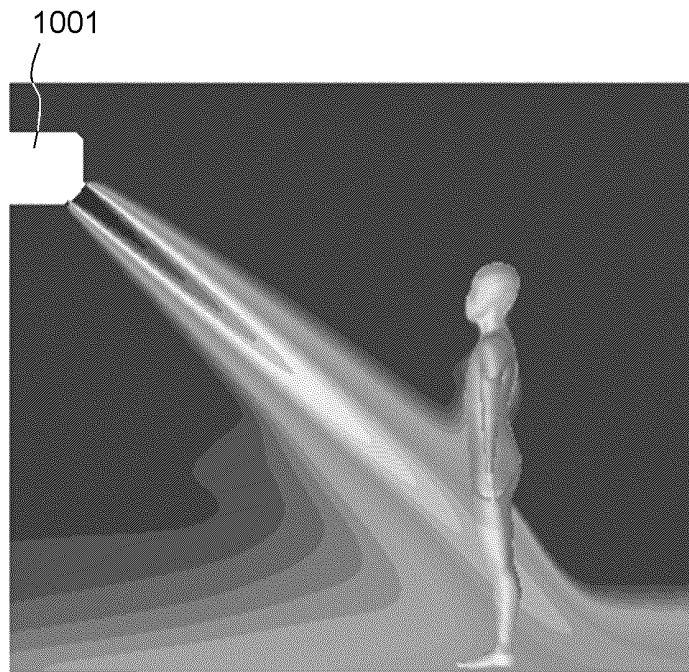


Fig.22

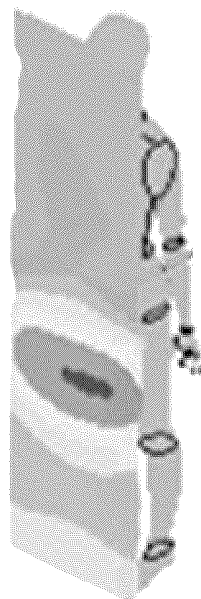


Fig. 23

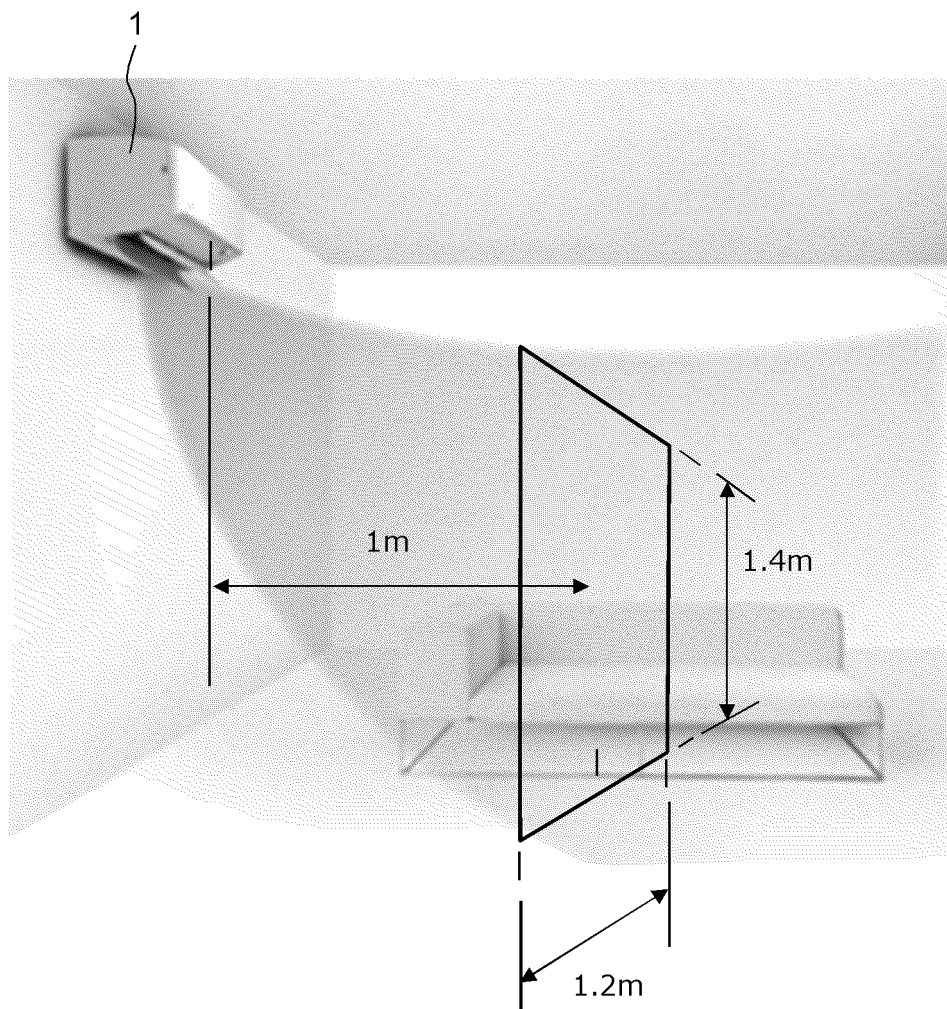


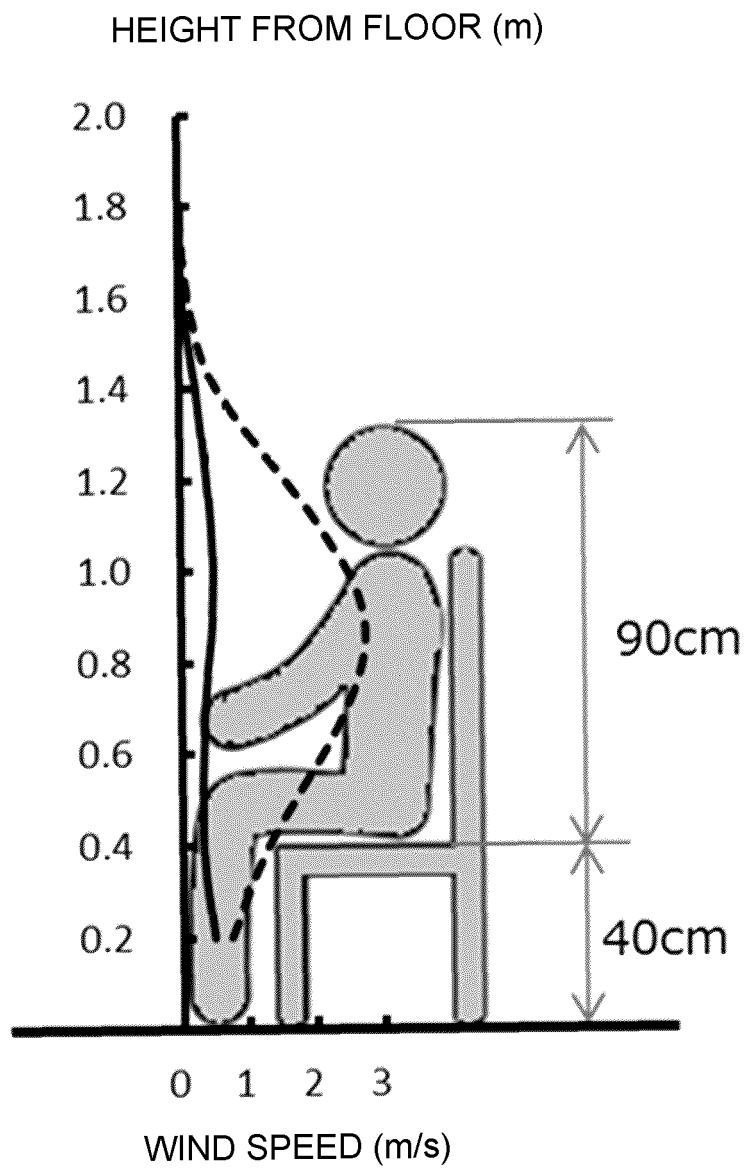
Fig.24

Fig. 25

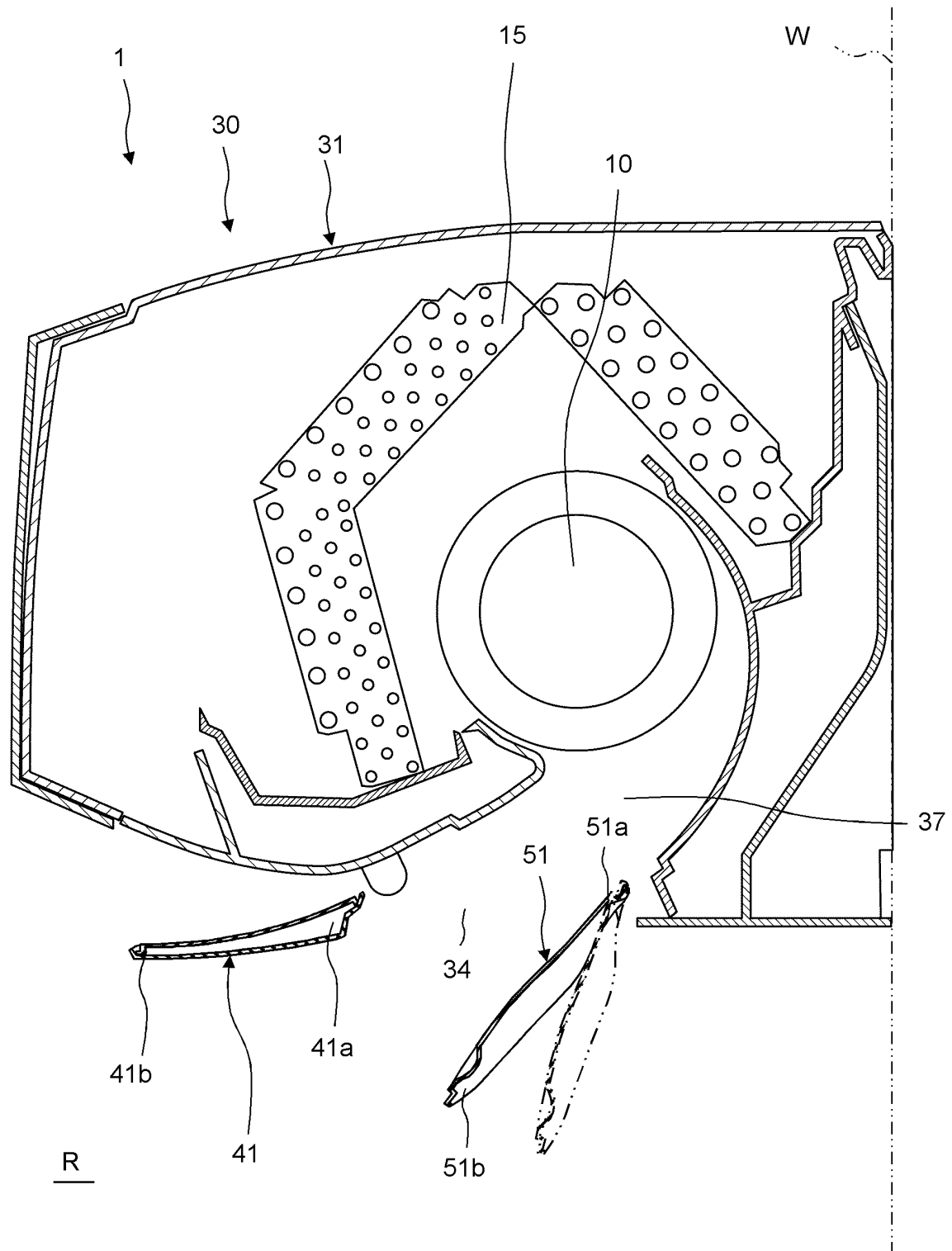


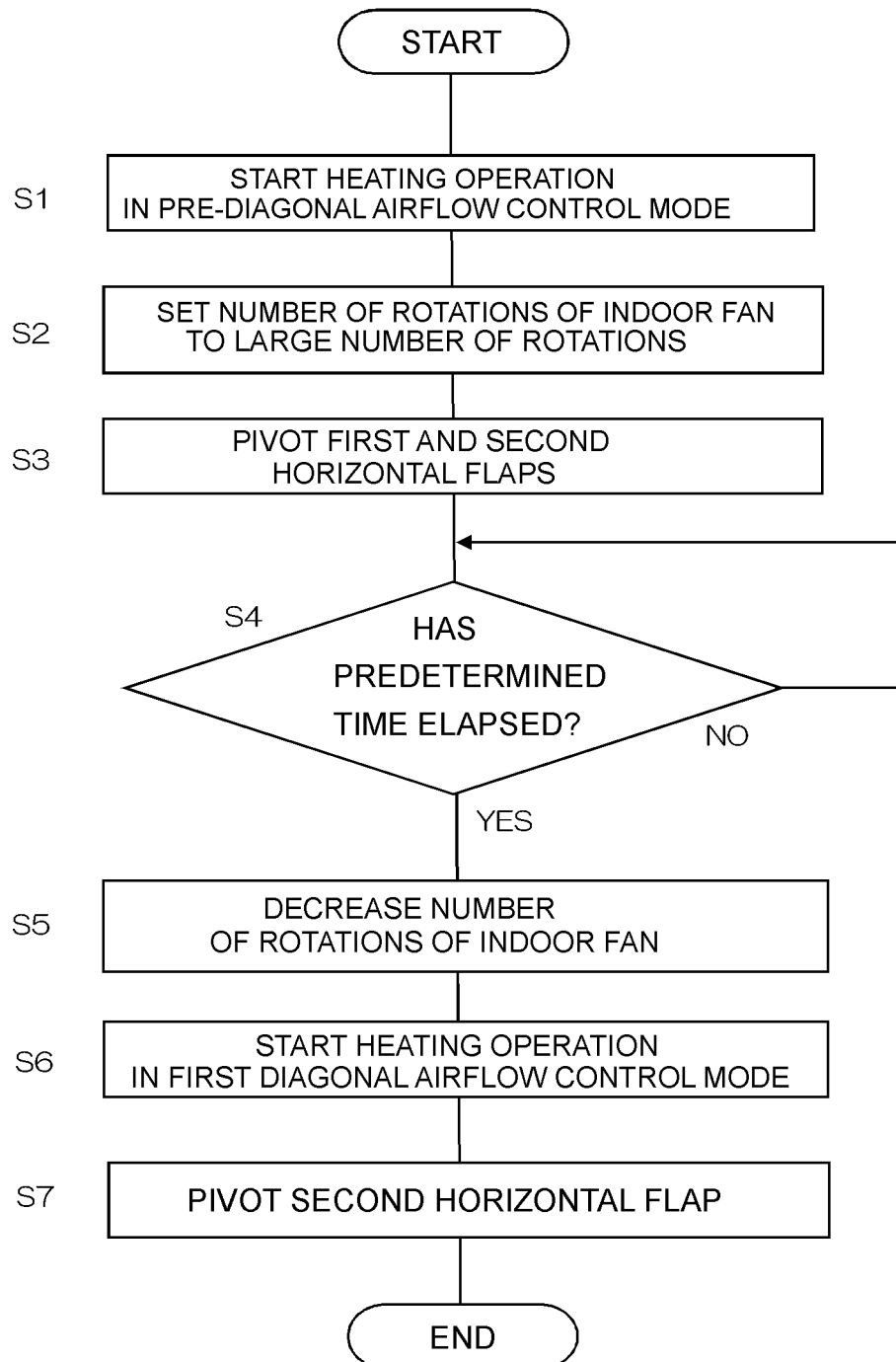
Fig.26

Fig.27

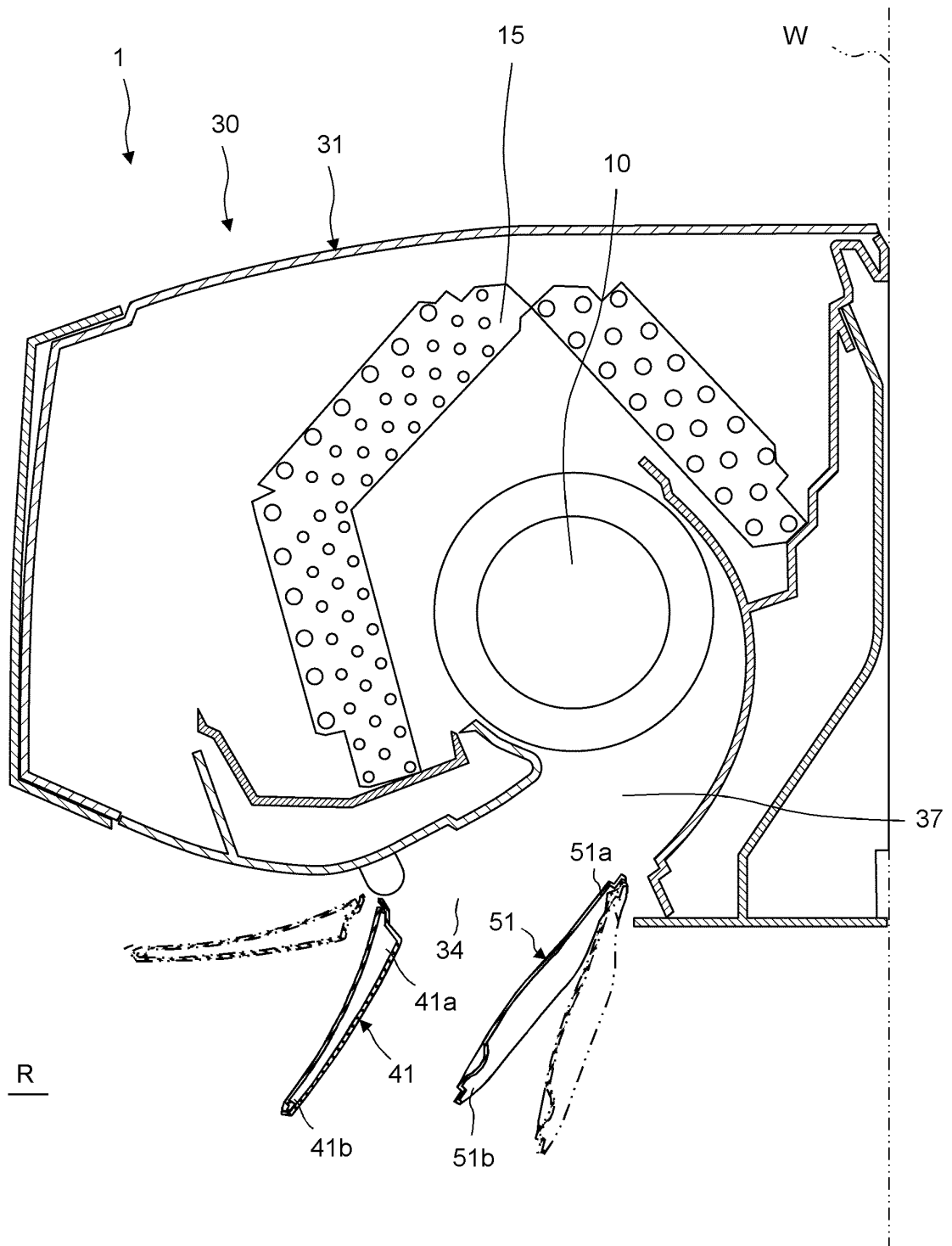


Fig. 28

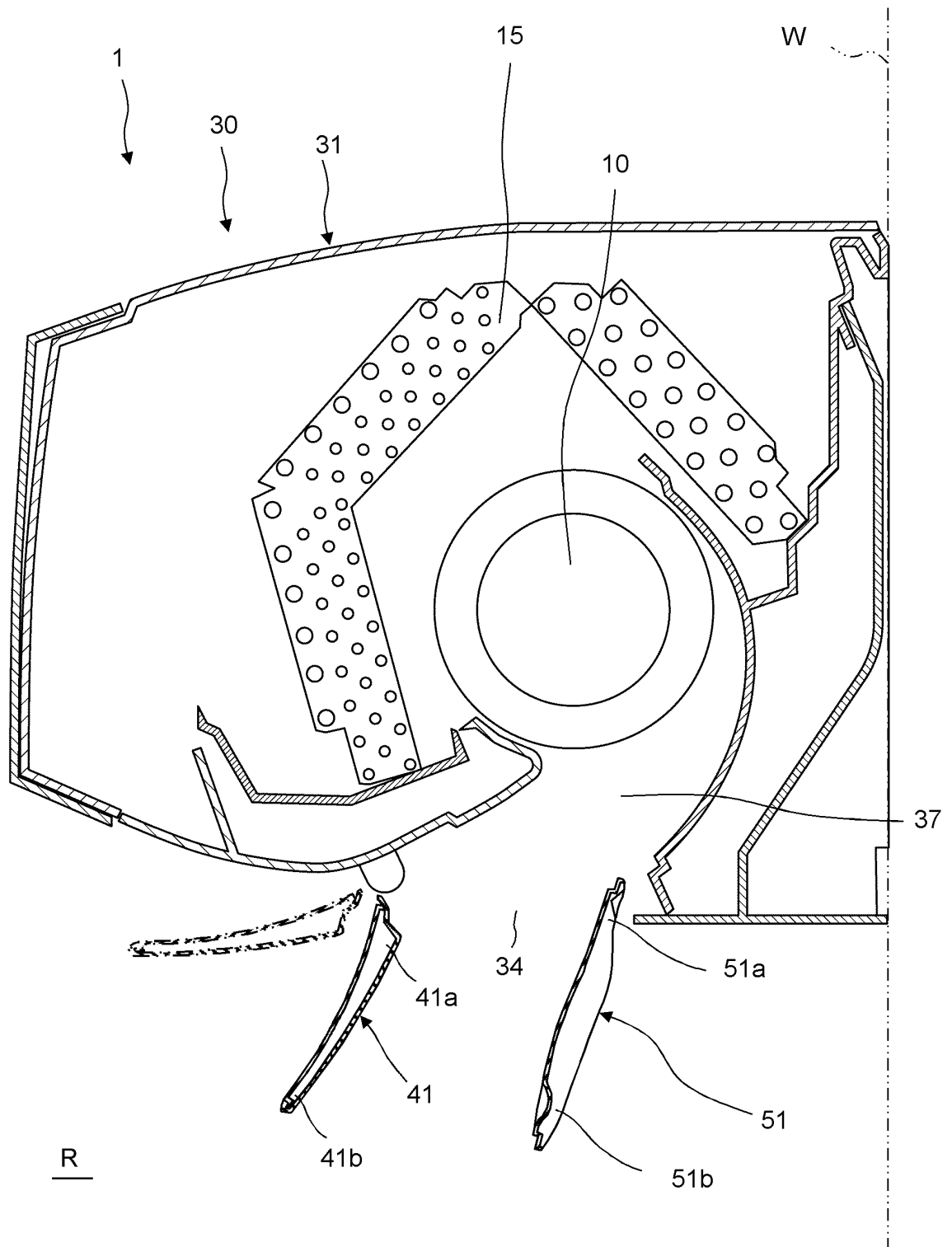
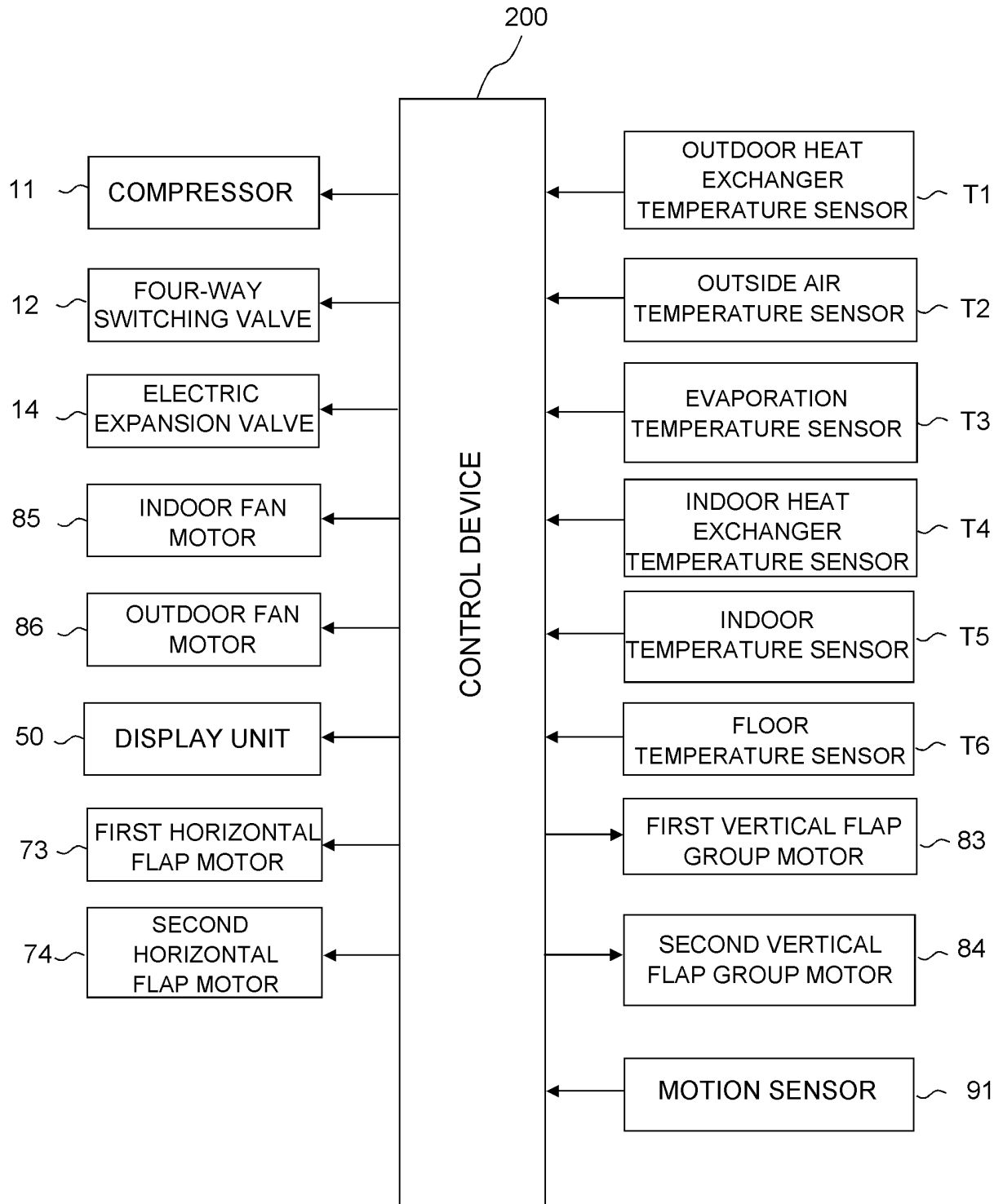


Fig. 29



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/033794

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. F24F11/74 (2018.01) i, F24F11/79 (2018.01) i, F24F13/20 (2006.01) i
 FI: F24F11/79, F24F11/74, F24F1/0007401C, F24F1/02411C

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)

Int.Cl. F24F11/74, F24F11/79, 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 1971-2020

Registered utility model specifications of Japan 1996-2020

Published registered utility model applications of Japan 1994-2020

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 2017-067401 A (DAIKIN INDUSTRIES, LTD.)	1
Y	06.04.2017 (2017-04-06), paragraphs [0027]-[0148],	2-3, 5-6
A	fig. 1-4	4
Y	JP 2014-055746 A (DAIKIN INDUSTRIES, LTD.)	2-3, 5-6
A	27.03.2014 (2014-03-27), paragraphs [0015]-[0019]	4
Y	JP 2013-096637 A (DAIKIN INDUSTRIES, LTD.)	3, 5-6
A	20.05.2013 (2013-05-20), paragraph [0096]	4
Y	JP 2001-041529 A (HITACHI, LTD.) 16.02.2001 (2001-02-16), paragraphs [0042]-[0044], fig. 13, 14	5-6



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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
29.09.2020

Date of mailing of the international search report
13.10.2020

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2020/033794

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