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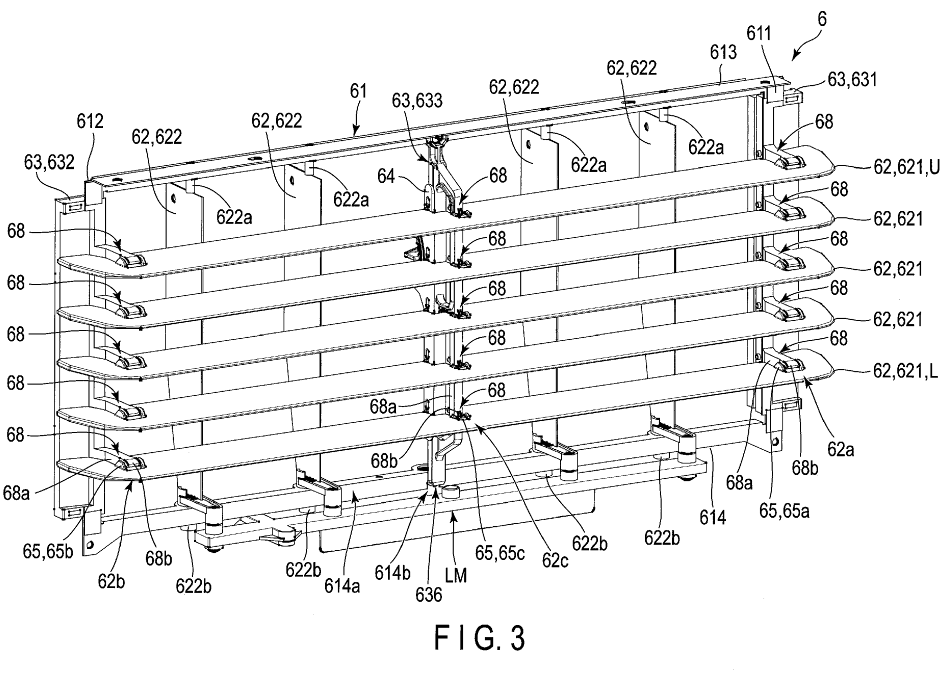
(54) **AIRFLOW DIRECTION ADJUSTMENT DEVICE AND INDOOR UNIT FOR AIR CONDITIONER**

(57) According to one embodiment, an airflow direction adjustment device (6) comprises a frame (61), a plurality of louver boards (62), a supporting member (63), and a movable member (64). The louver boards (62) comprise shaft portions (65, 67) provided at predetermined intervals in an extension direction. The supporting member (63) comprises bearing portions (68b) which rotatably support the shaft portions (65, 67) and whose diameter is greater than a shaft diameter of the shaft portions (65, 67). The supporting member (63) and the movable member (64) comprise a positioning mechanism (69) determining a position of the movable member (64) with respect to the supporting member (63) in a state where the shaft portions (65, 67) are supported in the bearing portions (68b).



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Description

FIELD

[0001] Embodiments described herein relate generally to a device (an airflow direction adjustment device) for adjusting the direction of an airflow blowing from a blower, and an indoor unit used for an air conditioner and comprising the airflow direction adjustment device.

BACKGROUND

[0002] For example, a floorstanding air conditioner comprises an indoor unit provided on the floor surface of a building. The indoor unit comprises a housing partitioned into a heat exchange room and a blast room. In the heat exchange room, a heat exchanger for exchanging heat between a refrigerant and air is provided. A blower is provided in the blast room. An inlet and an outlet for air are provided on the front surface side of the housing (in other words, a side facing the indoor space). The air of the indoor space is sucked in the blast room through the inlet by the blower and is discharged to the heat exchange room. The air discharged to the heat exchange room is adjusted in terms of the temperature by the heat exchanger, and is subsequently blown through the outlet to the indoor space.

[0003] In the outlet, an airflow direction adjustment device for adjusting the direction of the airflow blowing to the indoor space is provided. The airflow direction adjustment device adjusts the direction of the airflow from the outlet by, for example, rotating louver boards. For example, horizontal blades are flat plate pieces parallel to a horizontal surface such as a floor surface, and adjust the angle at which an airflow blows with respect to the horizontal surface. In this way, air which underwent a temperature adjustment is discharged from the outlet in a perpendicular direction (vertical direction) at a desired angle.

[0004] For example, when the horizontal blades are supported in a supporting portion of the frame attached to the outlet such that a shaft portion provided in the horizontal blades is rotatable, the position of the horizontal blades is fixed. Thus, the horizontal blades are maintained at a desired angle of inclination. To impart friction resistance to the shaft portion, a structure of applying a load to each of the shaft portion and the supporting portion is used. Specifically, the shaft diameter of the shaft portion is made greater than the diameter of the bearing portion of the supporting portion, and a rubber pipe is attached to the shaft portion. In these structures, an internal stress is generated in the bearing portion of the supporting portion. Thus, a measure should be taken to prevent the generation of this stress to prevent the aging degradation of the supporting portion, for example, solvent-induced cracking under an oil smoke atmosphere.

[0005] When the supporting intervals of the horizontal blades by the supporting portion is widened, a shake may be caused by vibration depending on the material of the horizontal blades, or a deflection may be caused by the self-weight of the horizontal blades. In this case, the shake or deflection of the horizontal blades can be prevented by, for example, providing, in the frame, a column which supports the horizontal blades in the intermediate portion of the supporting intervals in the supporting portion. However, when this type of column is provided, it is necessary to reduce an impact caused from the outside through the column to the column itself, the frame and the horizontal blades.

[0006] Embodiments described herein aim to provide an airflow direction adjustment device, and an indoor unit used for an air conditioner and comprising the airflow direction adjustment device such that horizontal blades, a column, etc., are protected, thereby improving the endurance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

FIG. 1 is a general perspective view of an indoor unit for an air conditioner according to an embodiment.
FIG. 2 is a general cross-sectional view of the indoor unit for the air conditioner according to the embodiment shown in FIG. 1.
FIG. 3 is a general perspective view of an airflow direction adjustment device provided in the indoor unit for the air conditioner according to the embodiment.
FIG. 4 is a perspective view schematically showing the structures of the louver board (horizontal blade), the supporting members and the movable member of the airflow direction adjustment device according to the embodiment.
FIG. 5 is a perspective view schematically showing the structure of the supporting members provided in the frame of the airflow direction adjustment device according to the embodiment.
FIG. 6 is a side view schematically showing an example of a state before the hook portion of the supporting member (third supporting member) of the airflow direction adjustment device is hooked on the frame according to the embodiment.
FIG. 7 is a side view schematically showing an example of a state where the hook portion of the supporting member (third supporting member) of the airflow direction adjustment device is hooked on the frame according to the embodiment.
FIG. 8 is a side view schematically showing the structure of each supporting portion in the first supporting member and the second supporting member of the airflow direction conditioning device according to the embodiment.
FIG. 9 is a side view schematically showing the structure of each supporting portion in the third supporting member of the airflow direction adjustment device

according to the embodiment.

FIG. 10 is a side view schematically showing the structure of each connection portion of the movable member of the airflow direction adjustment device according to the embodiment.

FIG. 11 is a side view schematically showing an example of a state where the five horizontal blades connected to the connection portion are inclined upward at a maximum angle in the airflow direction adjustment device according to the embodiment.

FIG. 12 is a side view schematically showing an example of a state where the five horizontal blades connected to the connection portion are inclined downward at a maximum angle in the airflow direction adjustment device according to the embodiment.

DETAILED DESCRIPTION

[0008] In general, according to one embodiment, an airflow direction adjustment device is a device which adjusts a direction of an airflow blowing from a blower and which comprises a frame, a plurality of louver boards having a flat shape, extending in a predetermined direction and arranged at predetermined intervals in parallel with each other, a supporting member provided in the frame and supporting the louver boards, and a movable member rotatably connecting the louver boards and displaced with respect to the supporting member. The louver boards comprise shaft portions provided at predetermined intervals in an extension direction. The supporting member comprises bearing portions which rotatably support the shaft portions and whose diameter is greater than a shaft diameter of the shaft portions. The supporting member and the movable member comprise a positioning mechanism determining a position of the movable member with respect to the supporting member in a state where the shaft portions are supported in the bearings.

[0009] Hereinafter, this specification explains an embodiment of the present invention with reference to FIG. 1 to FIG. 12.

[0010] The present embodiment is explained based on, as an example, an airflow direction adjustment device provided in an indoor unit for an air conditioner. The airflow direction adjustment device of the present embodiment appropriately adjusts the direction of the airflow (specifically, the air which underwent a temperature adjustment) blowing from the indoor unit of the air conditioner.

[0011] FIG. 1 is a general perspective view of the indoor unit for the air conditioner. FIG. 2 is a general cross-sectional view of the indoor unit shown in FIG. 1.

[0012] As shown in FIG. 1 and FIG. 2, the indoor unit 1 for the air conditioner is structured as a floorstanding type, and is installed on, for example, the floor surface FL of a building. In the air conditioner, the indoor unit 1 on the indoor side is connected to an outdoor unit (not shown) on the outdoor side via a pipe for circulating a refrigerant. In this way, a refrigeration cycle in which a refrigerant circulates between the indoor unit 1 and the outdoor unit is structured.

[0013] The indoor unit 1 comprises a housing 2. The housing 2 has a depth D, a width W and a height H. The depth D of the housing 2 is less than the width W. The height H of the housing 2 is sufficiently greater than the depth D and the width W. The housing 2 is formed of a thin metal plate such as a sheet metal material, is substantially a boxy element which defines the outline of the indoor unit 1, and is secured to the floor surface FL via a securing metal part 20 by a bolt (not shown), etc. The housing 2 comprises a top plate 21, a bottom plate 22, a right-side plate 23, a left-side plate 24, a front plate 25, a rear plate 26 and a lower cover 27.

[0014] In the housing 2, the top plate 21, the bottom plate 22, the right-side plate 23, the left-side plate 24, the front plate 25 and the rear plate 26 define the upper surface, the bottom surface, the right-side surface, the left-side surface, the front surface and the rear surface, respectively. In the present embodiment, the right and left are defined in a state directly confronting the front surface of the housing 2. The top plate 21 faces the bottom plate 22 across an intervening space in the height direction of the housing 2. The right-side plate 23 faces the left-side plate 24 across an intervening space in the width direction of the housing 2. The front plate 25 faces the rear plate 26 across an intervening space in the depth direction of the housing 2. In the present embodiment, the bottom plate 22 faces the floor surface FL, and the rear plate 26 faces a wall surface WL.

[0015] An operation unit 3 which is operated by a user is provided on the front surface 25. For example, the user can activate and stop the indoor unit 1 and change the setting temperature of the indoor unit 1 by operating the operation unit 3. For these operations and the confirmation of the operations, the operation unit 3 comprises a button, a switch, a display panel, etc.

[0016] The indoor unit 1 comprises an inlet 4 and an outlet 5 on the front surface of the housing 2. The inlet 4 is an opening portion which sucks the air of the indoor space, and is provided between the lower cover 27 and the front plate 25 in the height direction. A plurality of louver boards (horizontal blades) 41 are provided in the inlet 4. The outlet 5 is an opening portion which blows air which underwent a temperature adjustment, and is provided above the front plate 25 in the height direction. An airflow direction adjustment device 6 which adjusts the direction of the air (airflow) discharged to the indoor space is provided in the inlet 5. The details of the airflow direction adjustment device 6 are described later.

[0017] As shown in FIG. 2, the indoor unit 1 comprises a heat exchanger 7, a drain pan 8, a control unit box 9 and a blower 10. These components are accommodated in the housing 2, and are relatively provided in the order of the control unit box 9, the drain pan 8, the heat exchanger 7 and the blower 10 from the bottom to the top in the height direction of the housing 2.

[0018] The heat exchanger 7 is provided in substantially the lower half of the housing 2 in the height direction in a state where the heat exchanger 7 is inclined such that an upper end portion 7a is close to the front plate 25 and a lower end portion 7b is close to the rear plate 26. FIG. 2 shows an example of a layout in which a large part of the heat exchanger 7 faces the inlet 4. The heat exchanger 7 comprises a plurality of fins 71 and a plurality of heat-transfer pipes 72 through which a refrigerant flows. The fins 71 are arranged in the width direction of the housing 2 at predetermined intervals. The heat-transfer pipes 72 extend in the arrangement direction of the fins 71. A refrigerant pipe (not shown) is connected to the inlet and the outlet of the channel structured by each heat-transfer pipe 72. These refrigerant pipes are connected to the outdoor unit via the pipe holes of the housing 2.

[0019] The drain pan 8 is provided under the heat exchanger 7 so as to receive the water droplets falling from the heat exchanger 7. For example, the drain pan 8 is provided so as to extend from the right-side plate 23 and the left-side plate 24 between the lower end portion 7b of the heat exchanger 7 and the bottom plate 22. The dew condensation water generated in the heat exchanger 7 is received by the drain pan 8, and is discharged to the outside of the housing 2 through a discharge pipe (not shown).

[0020] The control unit box 9 is provided under the drain pan 8. A control substrate for activating and stopping the indoor unit 1 and changing the setting temperature of the indoor unit 1, a temperature sensor, a refrigerant leak sensor and a control substrate for these sensors are accommodated in the control unit box 9.

[0021] The blower 10 comprises a fan motor 11, a fan 12 and a fan case 13.

[0022] The fan motor 11 is provided such that the axis of rotation extends in the depth direction of the housing 2. It should be noted that the fan motor may be provided such that the axis of rotation extends in the width direction of the housing 2. The fan 12 is structured as a cylindrical multiblade fan (sirocco fan), and is coaxially attached to the axis of rotation. The fan case 13 comprises a suction hole 13a and a discharge hole 13b. The suction hole 13a opens to the front side in the depth direction of the housing 2 (in other words, in the axial direction of the fan 12). The discharge hole 13b opens to the upper side in the height direction of the housing 2 (in other words, in a direction perpendicular to the axial direction of the fan 12).

[0023] When the fan 12 rotates, air flows along a channel K passing through the inlet 4, the heat exchanger 7, the fan case 13 and the outlet 5. In the channel K, the air of the indoor space sucked into the inside of the housing 2 through the inlet 4 is subjected to heat exchange with the refrigerant flowing through the heat-transfer pipes 72 and a temperature adjustment when the air passes between the fins 71 of the heat exchanger 7. The air which underwent a temperature adjustment passes through the fan case 13 via the suction hole 13a and the discharge hole 13b, and is blown from the outlet 5 to the indoor space.

[0024] As shown in FIG. 1 and FIG. 2, the indoor unit 1 comprises the airflow direction adjustment device 6 in the outlet 5. The airflow direction adjustment device 6 is a device which adjusts the direction of the air (airflow) which underwent a temperature adjustment and is blown from the outlet 5 to the indoor space.

[0025] FIG. 3 is a schematic perspective view of the airflow direction adjustment device 6. As shown in FIG. 3, the airflow direction adjustment device 6 comprises a frame 61, a plurality of louver boards 62, supporting members 63 and a movable member 64.

[0026] The frame 61 is a frame-like element surrounding the outlet 5 of the indoor unit 1, and is formed of, for example, sheet metal. The frame 61 is structured so as to surround the outlet 5 in a rectangular shape by vertical frame portions 611 and 612 and lateral frame portions 613 and 614, and is secured to the housing 2 by a bolt (not shown). The vertical frame portions 611 and 612 are provided upright in the height direction of the housing 2 along the right-side plate 23 and the left-side plate 24, respectively. The lateral frame portions 613 and 614 are located on the upper side and the lower side, respectively, and extend in the width direction of the housing 2.

[0027] The louver boards 62 are flat elements for defining the direction of an airflow. The louver boards 62 include first louver boards 621 defining the direction of an airflow in a first direction, and second louver boards 622 defining the direction of an airflow in a second direction crossing the first direction. In the present embodiment, the first direction is defined as the height direction (vertical direction) of the housing 2, and the second direction is defined as the width direction (horizontal direction) of the housing 2. Thus, the first louver boards 621 define the direction of an airflow with respect to the vertical direction, and the second louver boards 622 define the direction of an airflow with respect to the horizontal direction.

[0028] The first louver boards (hereinafter, referred to as horizontal blades) 621 are formed of synthetic resin such as ABS resin. In the present embodiment, five horizontal blades 621 extend in the width direction of the housing 2, and are arranged at predetermined intervals such that they are parallel to each other. The extension length of each horizontal blade is substantially equal to the distance between the right-side plate 23 and the left-side plate 24 of the housing 2. These horizontal blades 621 are connected by the movable member 64 such that they can operate together. The cooperative form of the horizontal blades 621 is described later. The number of horizontal blades 621 is not particularly limited, and may be four or less, or six or greater. The case where the number of horizontal blades 621 is four or less includes a case where only one horizontal blade 621 is provided.

[0029] FIG. 4 is a perspective view schematically showing the structure of the horizontal blade 621. As shown in FIG. 4, the horizontal blade 621 comprises shaft portions 65 supported in the supporting members 63. The shaft portions 65 are provided at predetermined intervals in the extension direction of the horizontal blade 621. In the present embodiment, for example, the shaft portions 65 (65a, 65b and 65c) are provided at three positions, specifically, in the right end portion vicinity 62a, the left end portion vicinity 62b and the intermediary portion vicinity 62c of the horizontal blade 621 in the extension direction. The shaft core of each shaft portion 65 is matched with the extension direction of the horizontal blade 621. At these three positions, cutout portions 66 are formed. Cutout portions 66a, 66b and 66c are voids prepared by cutting the right end portion vicinity 62a, the left end portion vicinity 62b and the intermediate portion vicinity 62c of the horizontal blade 621 from a rear edge portion 621b to a position which is close to and does not reach a front edge portion 621a. At the ends of the cutout portions 66a, 66b and 66c, the shaft portions 65a, 65b and 65c are provided, respectively.

[0030] In the intermediate portion vicinity 62c of the horizontal blade 621, a cutout portion 66d continuous with the cutout portion 66c is formed. The cutout portion 66d is a void prepared by further cutting a part of the left edge portion 66e of the cutout portion 66c along the rear edge portion 621b. At the edge of the cutout portion 66d, a shaft portion 67 is provided. The shaft portion 67 is a cylindrical protrusion (boss) for connecting the horizontal blade 621 to the movable member 64 (the details are described later). The shaft core of the shaft portion 67 is matched with the extension direction of the horizontal blade 621.

[0031] As shown in FIG. 3, the second louver boards (hereinafter, referred to as perpendicular blade) 622 are formed of, for example, the same sheet metal as the frame 61. In the present embodiment, four perpendicular blades 622 extend in the height direction of the housing 2, and are arranged at predetermined intervals such that they are parallel to each other. The extension length of each perpendicular blade 622 is substantially equal to the upright height of the vertical frame portions 611 and 612 of the frame 61. The perpendicular blades 622 are pivotally supported in the lateral frame portions 613 and 614 by the vertical shaft portions 622a and 622b, and are connected by a linkage mechanism LM such that they can operate together. The linkage mechanism LM is operated by an actuator 14 (see FIG. 2) and changes the angle of inclination of the perpendicular blades 622 in a synchronization manner. The angle of inclination of the perpendicular blades 622 is defined as the angle of inclination of the perpendicular blades 622 in a horizontal direction with respect to the depth direction of the housing 2, in other words, with respect to the direction in which the airflow adjusted in terms of the temperature blows.

[0032] FIG. 5 is a perspective view schematically showing the structure of the supporting members 63. As shown in FIG. 3 and FIG. 5, the supporting members 63 are elements provided in the frame 61 to rotatably support the louver boards 62, specifically, the horizontal blades 621. The supporting members 63 are immobile members with respect to the movable member 64, and are elements which are secured to the frame 61 and maintained in a static state. In the present embodiment, the supporting members 63 are formed of synthetic resin such as ABS resin, and include three supporting members 631, 632 and 633. The horizontal blades 621 are supported at three positions by the three supporting members 631, 632 and 633.

[0033] The first supporting member 631 and the second supporting member 632 are structured as a pair. The first supporting member 631 is provided in the vertical frame portion 611, and supports the right end portion vicinity 62a of each horizontal blade 621. The second supporting member 632 is provided in the vertical frame portion 612, and supports the left end portion vicinity 62b of each horizontal blade 621.

[0034] The third supporting member 633 is a column provided in the frame 61, and is provided so as to connect the lateral frame portions 613 and 614. In the present embodiment, the third supporting member 633 is provided substantially in the intermediate portions of the lateral frame portions 613 and 614 in parallel with the vertical frame portions 611 and 612. In other words, the third supporting member 633 is provided substantially in the intermediate portion between the first and second supporting members 631 and 632 provided at a predetermined interval. Thus, the third supporting member 633 supports the intermediate portion vicinity 62c of each horizontal blade 621.

[0035] The third supporting member 633 is attached to the frame 61 in the upper end portion and the lower end portion. The upper end portion is an end portion in a direction connected to the lateral frame portions 613 and 614, and the lower end portion is the other end portion in a direction connected to the lateral frame portions 613 and 614. In the upper end portion of the third supporting member 633, a screw receiving portion 634 is provided. The screw receiving portion 634 is the first attachment portion of the third supporting member 633 for the frame 61. By tightening a securing screw 635 into the screw receiving portion 634, the upper end portion of the third supporting member 633 is attached to the lateral frame portion 613 of the frame 61. Thus, the upper end portion of the third supporting member 633 is attached to the frame 61 in a state where they cannot be relatively displaced.

[0036] As shown in FIG. 5 to FIG. 7, in the lower end portion of the third supporting member 633, a hook portion 636 hooked on the lateral frame portion 614 of the frame 61 is provided. The hook portion 636 is the second attachment portion of the third supporting member 633 for the frame 61. The lateral frame portion 614 comprises a pendent piece 614a for hooking the hook portion 636. FIG. 6 is a side view schematically showing an example of a state before the hook portion 636 is hooked on the lateral frame portion 614. FIG. 7 is a side view schematically showing an example of a state where the hook portion 636 is hooked on the lateral frame portion 614.

[0037] As shown in FIG. 3 and FIG. 5, a concave portion 614b defining the hooked position of the hook portion 636 is formed in the pendent piece 614a. The concave portion 614b is a cutout substantially in the intermediate portion of the pendent piece 614a in the length direction (in other words, of the lateral frame portion 614 in the extension direction). By hooking the hook portion 636 on the concave portion 614b, the lower end portion of the third supporting member 633 is attached to the lateral frame portion 614 of the frame 61. Thus, even in a state where the lower end portion of the third supporting member 633 is attached to the frame 61, the lateral frame portion 614 is allowed to be warped upward. In other words, the lower end portion of the third supporting member 633 is attached to the frame 61 in a state where they can be relatively displaced.

[0038] Each supporting member 63 comprises supporting portions 68 which rotatably support the shaft portions 65 of the horizontal blades 621. FIG. 5 is a perspective view schematically showing the structure of the supporting portions 68. As shown in FIG. 4 and FIG. 5, each supporting portion 68 comprises a protrusion 68a protruding forward, and claws 68b provided at the protrusion end of the protrusion 68a. The claws 68b are the bearing portions of the shaft portions 65 in the supporting portions 68. The claws 68b correspond to bearing portions in the supporting members 63.

[0039] FIG. 8 is a side view schematically showing the structure of each supporting portion 68 in the first supporting member 631 and the second supporting member 632. As shown in FIG. 4, FIG. 5 and FIG. 8, protrusions 681a and 682a are formed in the first supporting member 631 and the second supporting member 632 into a columnar shape fitted in the cutout portions 66a and 66b of each horizontal blade 621. A pair of claws 681b and a pair of claws 682b extend from the protrusion ends of the protrusions 681a and 682a so as to be curved at a predetermined curvature. The portion between the claws 681b and the portion between the claws 682b are open forward.

[0040] This opening interval (distance D1 shown in FIG. 8) is less (narrower) than the shaft diameter (distance D2 shown in FIG. 8) of the shaft portions 65a and 65b. The shaft portion 65a is inserted between the claws 681b while expanding opening interval D1 by elastically deforming the pair of claws 681b, and is supported between the claws 681b. Similarly, the shaft portion 65b is inserted between the claws 682b while expanding opening interval D1 by elastically deforming the claws 682b, and is supported between the claws 682b. After the shaft portions 65a and 65b are inserted, the pair of claws 681b and the pair of claws 682b are elastically recovered, thereby preventing the removal of the shaft portions 65a and 65b from the pair of claws 681b and the pair of claws 682b.

[0041] FIG. 9 is a side view schematically showing the structure of each supporting portion 68 in the third supporting member 633. As shown in FIG. 4, FIG. 5 and FIG. 9, a protrusion 683a is formed in the third supporting member 633 so as to be fitted in the cutout portion 66c of each horizontal blade 621. The protrusion 683a is formed like a cross-link including three leg portions P1, P2 and P3, and a girder portion G laid over the leg portions P1, P2 and P3. The leg portions P1, P2 and P3 are connected to the third supporting member 633 in the upper portion, the lower portion and the intermediate portion of the third supporting member 633. A claw 683b extends from the protrusion end of the protrusion 683a so as to be curved at a predetermined curvature. A bump 683c for reducing the interval between the protrusion end of the protrusion 683a and the distal end of the claw 683b is provided at the protrusion end of the protrusion 683a.

[0042] The portion between the claw 683b and the bump 683c is open upward. The opening interval (distance D4 in FIG. 9) is less (narrower) than the shaft diameter of the shaft portion 65c (distance D5 shown in FIG. 9). The shaft portion 65c is inserted between the claw 683b and the bump 683c while expanding opening interval D4 by elastically deforming the claw 683b, and is supported between the claw 683b and the bump 683c. After the shaft portion 65c is inserted, the claw 683b is elastically recovered, thereby preventing the removal of the shaft portion 65c from the claw 683b and the bump 683c.

[0043] As shown in FIG. 5, in the present embodiment, each of three supporting members 631, 632 and 633 comprises five supporting portions 68. In this way, the three supporting members 631, 632 and 633 are allowed to support five horizontal blades 621.

[0044] As described above, the supporting portions 68 comprises the claws 68b as the bearing portions of the shaft portions 65. The diameter of the claws 68b is greater than the shaft diameter of the shaft portions 65. FIG. 8 and FIG. 9 show examples of these forms. As shown in FIG. 8, the diameter (D3) of a pair of claws 681b is greater than the shaft diameter (D2) of the shaft portion 65a. The diameter (D3) of a pair of claws 682b is greater than the shaft diameter (D2) of the shaft portion 65b. As shown in FIG. 9, the diameter (D6) of the claw 683b is greater than the shaft diameter (D5) of the shaft portion 65c.

[0045] Since the diameter of the claws 68b is greater than the shaft diameter of the shaft portions 65, a stress for a force in which the shaft portions 65 press the claws 68b is difficult to generate in the claws 68b, in other words, in the bearing portions of the supporting portions 68. However, the claws 68b rotatably support the shaft portions 65. Thus, a stress is difficult to generate in the claws 68b. Further, to rotatably support the shaft portions 65, the difference between the diameter of the claws 68b and the shaft diameter of the shaft portions 65 is adjusted so as to be, for example, approximately 0.1 to 0.5 mm. In this way, a gap of approximately 0.2 mm is generated between the claws 68b and the shaft portions 65.

[0046] As shown in FIG. 3, the movable member 64 is an element connecting a plurality of louver boards 62, specifically, five horizontal blades 621, such that they can operate together. The movable member 64 is an element which is displaced with respect to the supporting member 63. The movable member 64 is formed of a material having high elasticity, flexibility and grease resistance. In the present embodiment, for example, the movable element 64 is formed of synthetic resin such as polypropylene.

[0047] As shown in FIG. 4, the movable member 64 comprises a main portion 64a and connection portions 64b.

[0048] The main portion 64a is a movable piece formed into a plate shape and displaced with respect to the third supporting member 633. The main portion 64a is shorter than the third supporting portion 633 and is continuous beyond the maximum interval of the horizontal blades 621 in the height direction (vertical direction) of the housing 2. The maximum interval of the horizontal blades 621 is the interval between the highest blade and the lowest blade (in other words, the interval between horizontal blade U and horizontal blade L shown in FIG. 3) of the five horizontal blades 621 parallelly arranged at predetermined intervals. In this way, the main portion 64a is structured such that it is allowed to connect five horizontal blades 621. In the present embodiment, for example, the main portion 64a is provided on the left side of the third supporting member 633. Thus, the main portion 64a is displaced in the intermediate portion vicinities 62c of the horizontal blades 621. The main portion 64a may be provided on the right side of the third supporting member 633.

[0049] FIG. 10 is a side view schematically showing the structure of each connection portion 64b. As shown in FIG. 3, FIG. 4 and FIG. 10, the connection portions 64b are provided in the main portion 64a, and are portions for connecting the horizontal blades 621 such that the horizontal blades 621 are integrated with the connection portions 64b. In the present embodiment, each connection portion 64b comprises three through holes 64c, 64d and 64e, and slits 64f and 64g connecting these through holes. These elements penetrate the main portion 64a in the plate-thickness direction. The through hole 64c is a hole for inserting the shaft portion 67 of the horizontal blade 621, and corresponds to the bearing portion of the shaft portion 67 in the main portion 64a (simply, in the movable member 64).

[0050] By inserting the shaft portion 67 into the through hole 64c, the horizontal blade 621 is connected to the connection portion 64b. The diameter (pore diameter) of the through hole 64c is greater than the shaft diameter of the shaft portion 67. Thus, a stress for a force in which the shaft portion 67 presses the circumferential surface of the through hole 64c is difficult to generate in the through hole 64c. However, the through hole 64c rotatably supports the shaft portion 67 and also supports the shaft portion 67 in a state where the shaft portion 67 is not rotated (that is, the state shown in FIG. 11 and FIG. 12 described later). Thus, the difference between the diameter (pore diameter) of the through hole 64c and the shaft diameter of the shaft portion 67 is adjusted so as to be less than the difference between the diameter of the claws 68b and the shaft diameter of the shaft portions 65. In short, the diameter (pore diameter) of the through hole 64c and the shaft diameter of the shaft portion 67 should be set so as to hardly generate a stress for a force in which the shaft portion 67 presses the circumferential surface of the through hole 64c. For example, they are set so as to be substantially equal to each other. Alternatively, they are set such that the diameter of the through hole 64c is slightly greater than the shaft diameter of the shaft portion 67.

[0051] The through holes 64d and 64e are long holes provided in the both sides of the through hole 64c in the continuous direction (vertical direction) of the main portion 64a. The through holes 64d and 64e are connected to each other by the through hole 64c and the slits 64f and 64g. The through holes 64d and 64e and the slits 64f and 64g are provided as a deformation area for expanding the pore diameter of the through hole 64c when the shaft portion 67 is inserted such that the shaft portion 67 can be smoothly inserted into the through hole 64c. These elements 64d, 64e, 64f and 64g also function as a deformation area for expanding the pore diameter of the through hole 64c when the shaft portion 67 inserted into the through hole 64c rotates such that the shaft portion 67 can smoothly rotate and for recovering the pore diameter of the through hole 64c and supporting the shaft portion 67 in the through hole 64c in a state where the shaft portion 67 does not rotate.

[0052] FIG. 11 and FIG. 12 are side views schematically showing a state in which the horizontal blades 621 are connected to the connection portions 64b. As shown in FIG. 11 and FIG. 12, in the present embodiment, the main portion 64a comprises five connection portions 64b. By connecting the horizontal blades 621 to the five connection portions 64b one by one, the five horizontal blades 621 are connected via the main portion 64a such that they can operate together.

[0053] As shown in FIG. 4 and FIG. 10 to FIG. 12, the supporting member 63 and the movable member 64 comprise a positioning mechanism 69. The positioning mechanism 69 is a mechanism for determining the position of the movable member 64 with respect to the supporting member 63 in a state where the shaft portions 65 of the horizontal blades 621 are supported by the claws 68b of the supporting portions 68.

[0054] The positioning mechanism 69 comprises a positioning portion 69a, and a positioned portion 69b whose position is determined by the positioning portion 69a. One of the positioning portion 69a and the positioned portion 69b is provided in the supporting member 63, and the other one of them is provided in the movable member 64. In the present embodiment, for example, the positioning portion 69a is provided in the third supporting member 633, and the positioned portion 69b is provided in the main portion 64a of the movable member 64.

[0055] As shown in FIG. 5 and FIG. 9 to FIG. 12, the positioning portion 69a comprises a flexible piece 691 and a positioning piece 692.

[0056] The flexible piece 691 is structured by expanding the rear surface portion 633a of the third supporting member 633 backward and functions as a spring piece. Thus, the flexible piece 691 is structured so as to be slightly elastically deformable in a front-to-back direction. In this way, the flexible piece 691 generates a pressing force to the positioning guide 693 of the positioned portion 69b described later with respect to the positioning piece 692. In the present embodiment, for example, the flexible piece 691 forms a trapezoidal outline in a plan view from the left side. However, the form is not limited to this example.

[0057] The positioning piece 692 is a protrusion piece protruding from the flexible piece 691 to the front side and the left side in parallel with the horizontal surface. The positioning piece 692 is the protrusion of the positioning portion 69a and presses the positioned portion 69b (specifically, the positioning guide 693 described later) by a pressing force generated by the flexible piece 691. The horizontal surface is, for example, a surface parallel to the floor surface FL, and a reference surface for determining the position in the positioning mechanism 69. The positioning piece 692 protrudes to the left side since the main portion 64a is provided on the left side of the third supporting member 633 in the present embodiment. In short, the positioning piece 692 should protrude to a side on which the main portion 46a is provided with respect to the third supporting member 633.

[0058] As shown in FIG. 10 to FIG. 12, the positioned portion 69b comprises the positioning guide 693, a regulatory piece 694 and a through hole 695.

[0059] The positioning guide 693 is an arcuate outline portion formed in the rear portion 641a of the main portion 64a, and forms a wavy-line shape in which mountains M and valleys V are alternately continuous with each other in a plan view from the left side. By fitting the distal end 692a of the positioning piece 692 in a valley V, the position of the movable member 64 is defined with respect to the third supporting member 633. In other words, the positioning guide 693 is a guide for defining the position of the movable member 64 with respect to the positioning piece 692 along the wavy line in which mountains M and valleys V are alternately continuous with each other. The distal end 692a of the positioning piece 692 climbs over the mountain M adjacent to a valley V against the force pressing the positioning guide 693. At this time, as a change in the pressing force to the positioning guide 693, predetermined moderation feeling (click feeling) is caused.

[0060] Adjacent valleys V are provided based on the steps of the angle (in other words, the change angle) of inclination of the horizontal blades 621. In other words, mountains M and valleys V are provided based on the rotation angle of the horizontal blades 621 around the shaft portions 65. The angle of inclination of the horizontal blades 621 is defined as the direction in which an airflow adjusted in terms of the temperature blows, simply, as the vertical inclination of the horizontal blades 621 with respect to the horizontal surface. As shown in FIG. 10, in the present embodiment, the horizontal blades 621 are allowed to be inclined upward from the horizontal surface which is the reference surface at an angle of inclination by four stages and to be inclined downward at an angle of inclination by three stages. Thus, four valleys V are provided above a valley V (valley V0 shown in FIG. 10) corresponding to the horizontal surface as the border, and three valleys V are provided under the border (valley V0).

[0061] In the present embodiment, for example, the change angles of the horizontal blades 621, in other words, the intervals at which the valleys V are provided in the circumferential direction in the positioning determination guide 693, are constant. It should be noted that the change angles of the horizontal blades 621 may not be constant, and may differ from each other. The change angle may differ between the upward direction and the downward direction. The number of stages of the angle of inclination of the horizontal blades 621 in the upward direction may be the same as that in the downward direction.

[0062] The regulatory piece 694 regulates the positioning piece 692 so as not to go over the highest valley V (valley VU shown in FIG. 10) of the positioning guide 693 and the lowest valley V (valley VL shown in FIG. 10). The regulatory piece 694 comprises an upper regulatory piece 694u continuous with valley VU, and a lower regulatory piece 6941 continuous with valley VL. The upper regulatory piece 694u is in contact with the positioning piece 692 fitted in valley VU and regulates the position relative to the positioning piece 692 (the state shown in FIG. 11). The lower regulatory piece 6941 is in contact with the positioning piece 692 fitted in valley VL and regulates the position relative to the positioning piece 692 (the state shown in FIG. 12).

[0063] The through hole 695 penetrates the main portion 64a in the plate-thickness direction. The through hole 695 is a long hole curved in an arcuate shape along the positioning guide 693 in a plan view from the left side. The through hole 695 is provided as a deformation area for warping the positioning guide 693 when the distal end 692a of the positioning piece 692 climbs over a mountain M against the force pressing the positioning guide 693. In other words, as the positioning guide 693 pressed by the distal end 692a is warped to the through hole 695 side, the distal end 692a of the positioning piece 692 easily climbs over a mountain M.

[0064] When the angle of inclination of the horizontal blades 621 is changed, one of the five horizontal blades 621 is held, and is rotated such that it is pushed up or pushed down. Since the five horizontal blades 621 are connected by the movable member 64, in cooperation with the rotated horizontal blade 621, the remaining horizontal blades 621 are also rotated. In this way, the five horizontal blades 621 are allowed to be inclined at a desired angle of inclination by stages. FIG. 11 shows an example of a state where the five horizontal blades 621 are inclined upward at a maximum angle. FIG. 12 shows an example of a state where the five horizontal blades 621 are inclined downward at a maximum angle.

[0065] Thus, in the present embodiment, the diameter of the claws 68b is greater than the shaft diameter of the shaft portions 65 of the horizontal blades 621. As the claws 68b are the bearing portions of the shaft portions 65, the generation of an internal stress in the bearing portions can be prevented when the shaft portions 65 are rotatably supported. In this way, the bearing portions can be protected, and the aging degradation can be prevented, thereby improving endurance.

[0066] The supporting member 63 and the movable member 64 comprise the positioning mechanism 69. The positioning mechanism 69 is allowed to determine the position of the movable member 64 at a desired position with respect to the supporting member 63. The movable member 64 is allowed to connect a plurality of (in the present embodiment, five) horizontal blades 621 such that they can operate together. Thus, it is possible to determine the positions of the horizontal blades 621 at a desired angle of inclination while preventing the generation of an internal stress in the bearing portions. At this time, all the horizontal blades 621 can be inclined in synchronization with each other even without individually rotating the horizontal blades 621. Thus, the efficiency of operation can be improved.

[0067] In addition, the positioning mechanism 69 has a mechanism in which the positioning piece 692 is fitted in a valley V of the positioning guide 693 so as to correspond to the angle of inclination of the horizontal blade 621. Thus, predetermined moderation feeling (click feeling) can be caused when the positioning piece 692 climbs over the adjacent mountain M before the positioning piece 692 is fitted in the valley V. Thus, a user can recognize that the position of the horizontal blades 621 is determined at a desired angle of inclination by moderation feeling. In this way, the reliability of operation can be increased.

[0068] As the movable member 64 is formed of synthetic resin such as polypropylene, elasticity, flexibility and grease resistance can be improved. When the position of the movable member 64 is determined with respect to the supporting member 63, even if a load is applied to the movable member 64, the endurance for the applied load can be imparted. For example, even if the indoor unit 1 continues to operate under an oil smoke atmosphere, the generation of solvent-induced cracking in the movable member 64 can be prevented.

[0069] The horizontal blades 621 are formed of synthetic resin such as ABS resin. Thus, the workability is better than that of a louver board formed of sheet metal. Thus, the weight can be reduced. However, a deflection or vibration may occur in the horizontal blades 621 depending on the self-weight, the pressure of the blowing airflow (airflow pressure), etc. In the present embodiment, the third supporting member 633 is provided as the central column of the frame 61, and supports the intermediate portion vicinities 62c of the horizontal blades 621 in the supporting portions 68 of the third supporting member 633. Thus, it is possible to prevent the deflection or vibration of the horizontal blades 621 while improving the workability of the horizontal blades 621 and reducing the weight.

[0070] The third supporting member 633 is attached to the frame 61 such that, whereas the upper end portion of the third supporting member 633 cannot be displaced relative to the frame 61, the lower end portion can be displaced relative to the frame 61. Thus, even when an impact is applied from the outside via the third supporting member 633, the impact can be let go and reduced by displacement relative to the frame 61. Even when a vibration is applied to the third supporting member 633 by the airflow pressure received by the horizontal blades 621, the vibration can be absorbed and reduced by similar displacement. In this way, the third supporting member 633, the frame 61, the horizontal blades 621, etc., can be protected from the above impact and vibration. For example, even when the third supporting member 633, the movable member 64 and the horizontal blades 621 are formed of resin, these elements can be protected from an impact, etc., thereby improving endurance.

[0071] Further, in the present embodiment, the positioning mechanism 69 (the positioning portion 69a and the positioned portion 69b) is provided on the upper side based on the intermediate positions of the heights of the third supporting member 633 and the main portion 64a. In this way, when the horizontal blades 621 are supported in the supporting member 63, the upper and lower sides can be easily confirmed, thereby preventing an operation mistake in which they are attached to each other upside down.

[0072] As described above, in the present embodiment, the type of the indoor unit 1 of the air conditioner is a floorstanding type. However, the type is not limited to this example. For example, the type of the indoor unit may be a roof-mounted type or a wall-mounted type. The application target of the airflow direction adjustment device is not limited to the air conditioner. The airflow direction adjustment device may be applied to various types of devices or facilities required to adjust the direction of an airflow, such as a blower, electric fan or air purification device which blows an airflow without adjusting the temperature. The airflow direction adjustment device may be applied to adjust the direction of emissions in the outdoor unit of the air conditioner.

[0073] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

Claims

1. An airflow direction adjustment device (6) which adjusts a direction of an airflow blowing from a blower (10) and **characterized by** comprising:

   a frame (61);
   a plurality of louver boards (62) having a flat shape, extending in a predetermined direction and arranged at predetermined intervals in parallel with each other;
   a supporting member (63) provided in the frame (61) and supporting the louver boards (62); and
   a movable member (64) rotatably connecting the louver boards (62) and displaced with respect to the supporting member (63), wherein
   the louver boards (62) comprise shaft portions (65, 67) provided at predetermined intervals in an extension direction,
   the supporting member (63) comprises bearing portions (68b) which rotatably support the shaft portions (65, 67) and whose diameter is greater than a shaft diameter of the shaft portions (65, 67), and
   the supporting member (63) and the movable member (64) comprise a positioning mechanism (69) determining a position of the movable member (64) with respect to the supporting member (63) in a state where the shaft portions (65, 67) are supported in the bearing portions (68b) .

2. The airflow direction adjustment device (6) of claim 1, **characterized in that**

   the positioning mechanism (69) comprises a positioning portion (69a) provided in one of the supporting member (63) and the movable member (64), and a positioned portion (69b) which is provided in the other one and whose position is determined by the positioning portion (69a),
   the positioning portion (69a) includes a protrusion (692) pressing the positioned portion (69b), and
   the positioned portion (69b) includes a guide (693) defining a position of the movable member (64) with respect to the protrusion (692) along a wavy line in which mountains (M) and valleys (V) are alternately continuous with each other.

3. The airflow direction adjustment device (6) of claim 2, **characterized in that**

   the mountains (M) and the valleys (V) of the guide (693) are provided based on a rotation angle of the louver boards (62) around the shaft portions (65, 67).

4. The airflow direction adjustment device (6) of claim 2 or 3, **characterized in that**

   the supporting member (63) includes a first supporting member (631) and a second supporting member (632) provided at a predetermined interval, and a third supporting member (633) provided substantially in an intermediate portion of the interval of the first and second supporting members (631, 632),
   the positioning portion (69a) is provided in the third supporting member (633), and
   the positioned portion (69b) is provided in the movable member (64) displaced with respect to the third supporting member (633).

5. The airflow direction adjustment device (6) of claim 4, **characterized in that**

   the third supporting member (633) is provided so as to connect a pair of frame portions (613, 614) facing the frame (61),
   a first attachment portion (634) attached to one of the pair of frame portions (613, 614) such that the first attachment portion (634) is allowed to be displaced relative to the frame (61) is provided in an end portion of the third supporting member (633) in a connecting direction, and
   a second attachment portion (636) attached to the other one of the pair of frame portions (613, 614) such that the second attachment portion (636) is allowed to be displaced relative to the frame (61) is provided in the other end portion of the third supporting member (633) in the connection direction.

6. An indoor unit (1) for an air conditioner, the indoor unit (1) **characterized by** comprising:

   a housing (2);
   a heat exchanger (7) accommodated in the housing (2) ;
   a blower (10) blowing air which underwent a temperature adjustment by the heat exchanger (7); and
   the airflow direction adjustment device (6) of one of claims 1 to 5, as an airflow direction adjustment device which adjusts a direction of the airflow blowing from the blower (10).

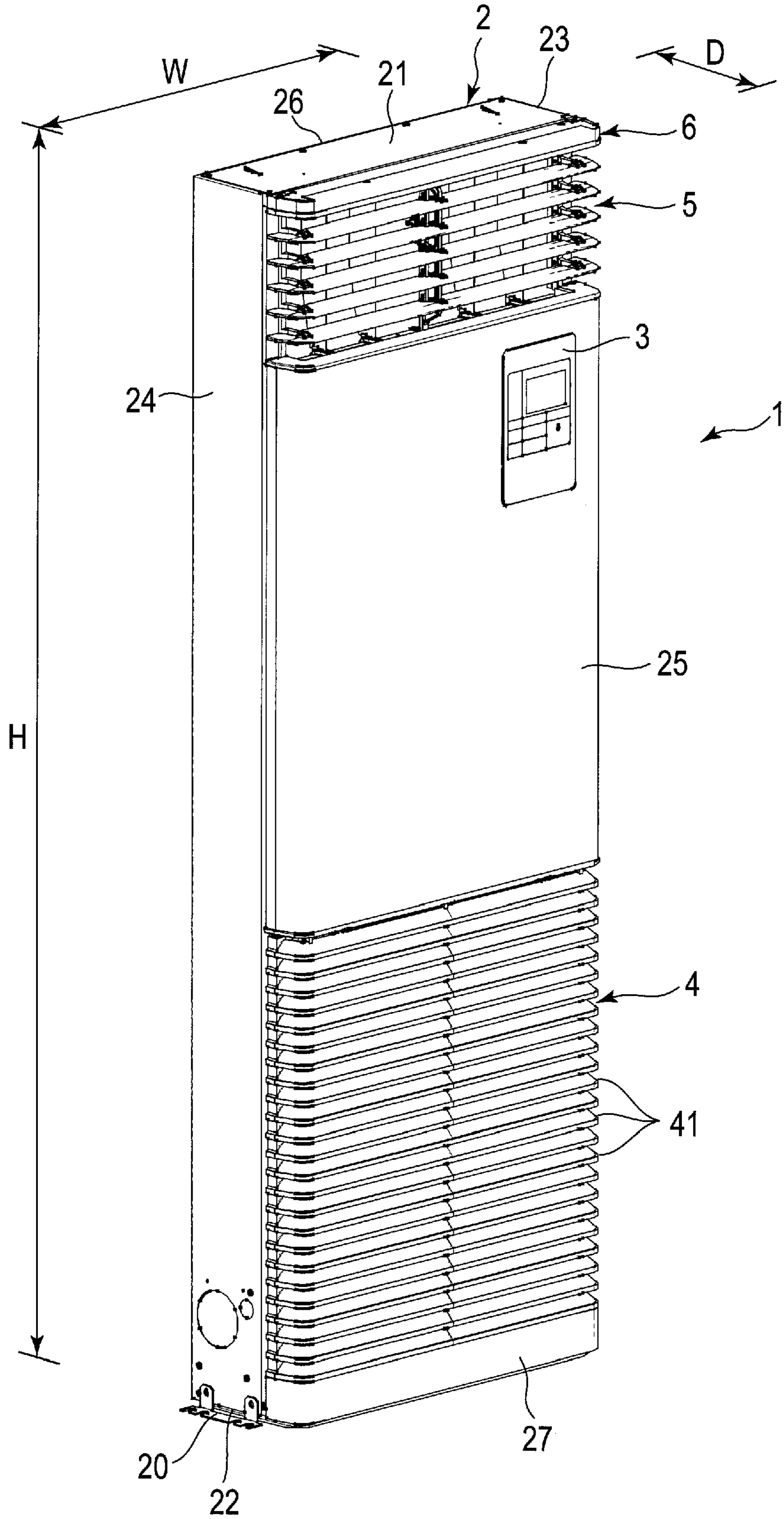


FIG. 1

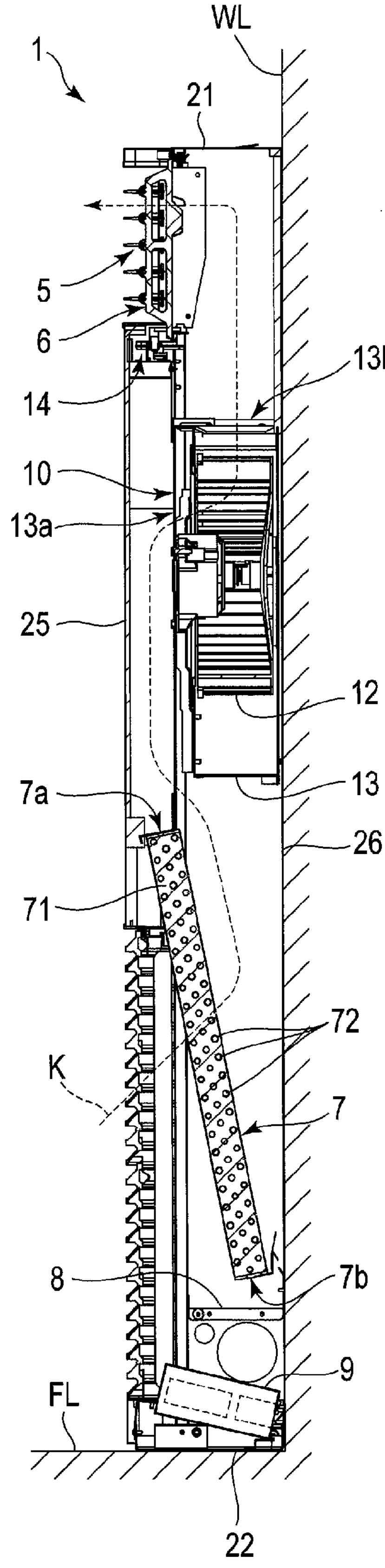
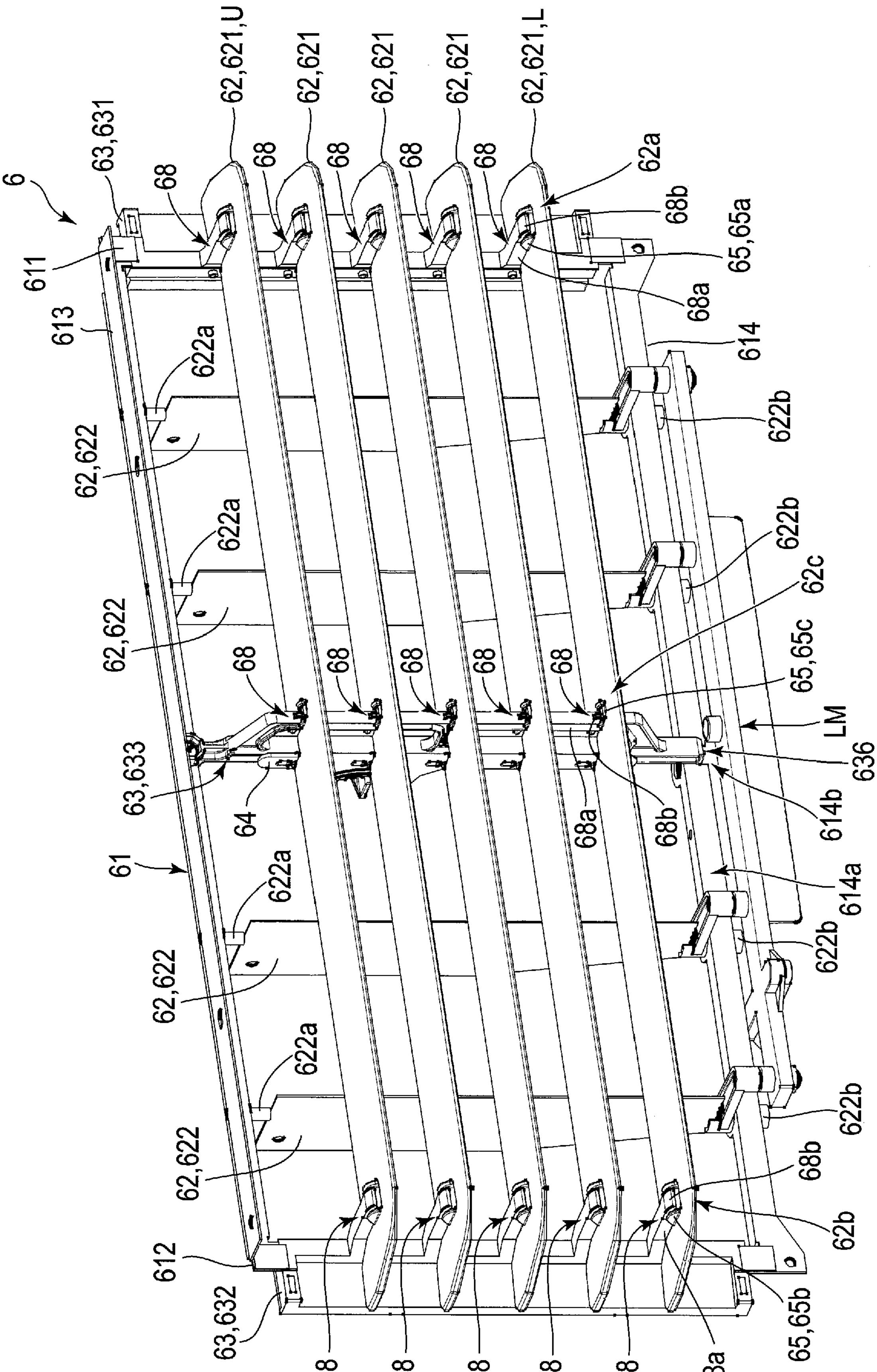


FIG. 2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622b
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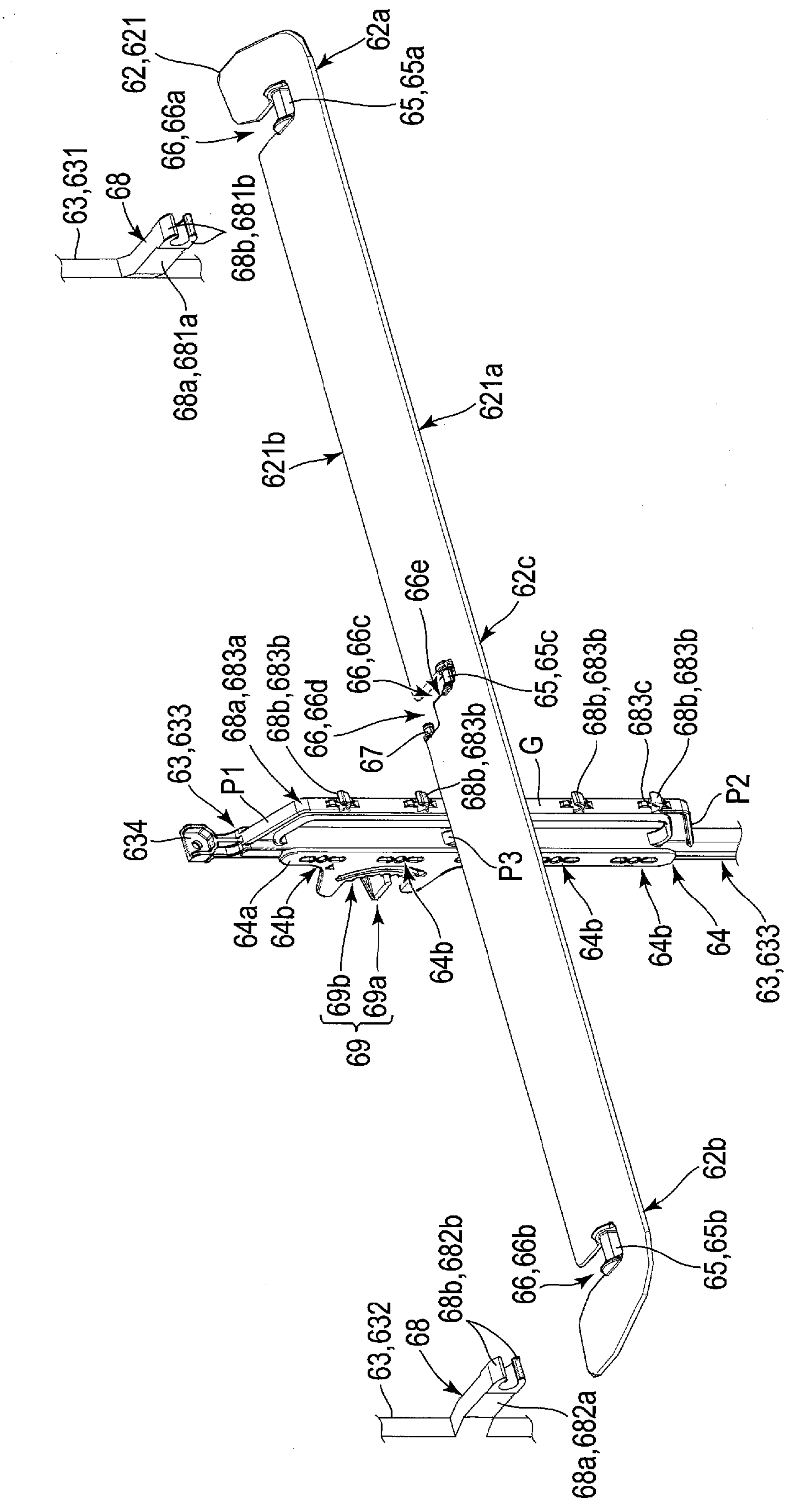
F I G. 3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68b,683b
66,66d
63,633
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P1
68b,683b
G
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683c
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P2
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P3
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64b
64b
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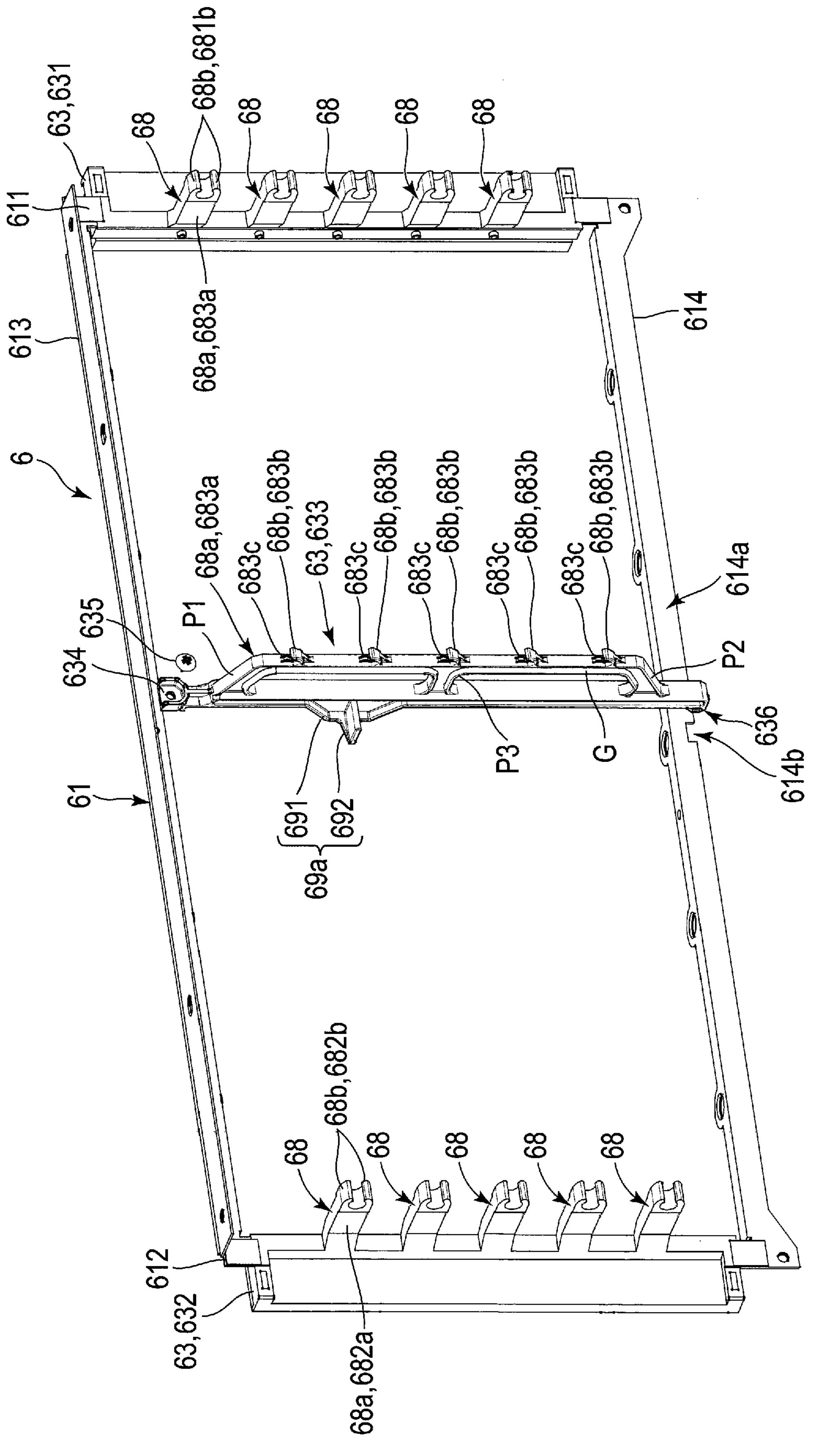
68a,682a

FIG. 4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63,633
683c
68b,683b
683c
68b,683b
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68b,683b
683c
68b,683b
614a
635
634
P1
P2
636
614b
P3
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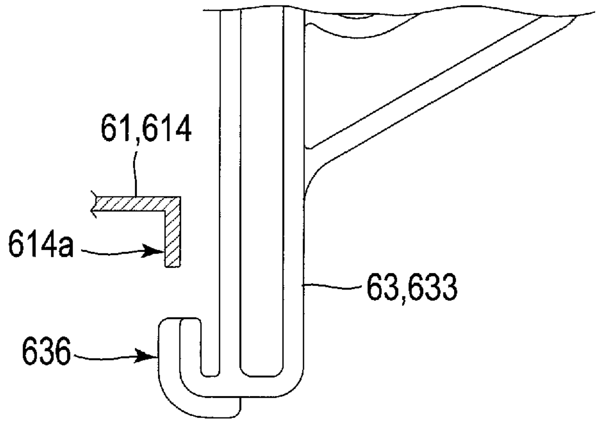
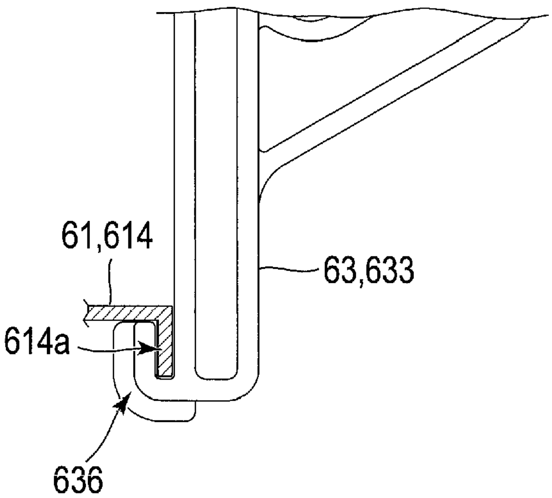
612
63,632
68a,682a

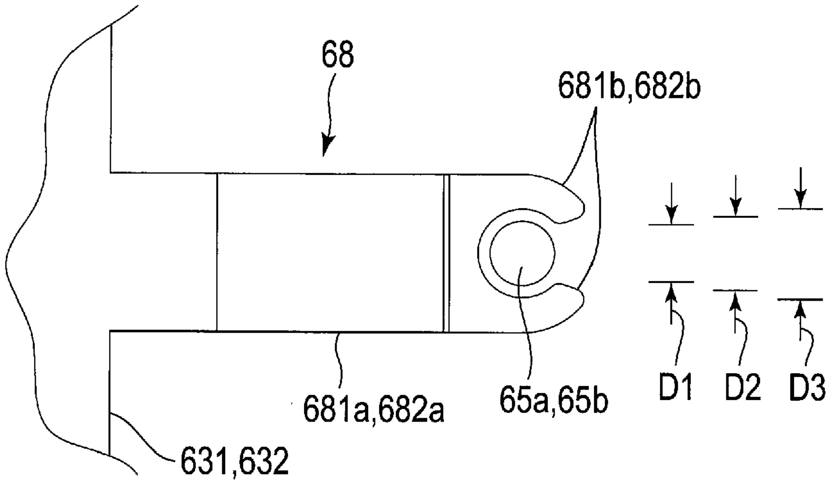
FIG. 5



F I G. 6



F I G. 7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D1
D2
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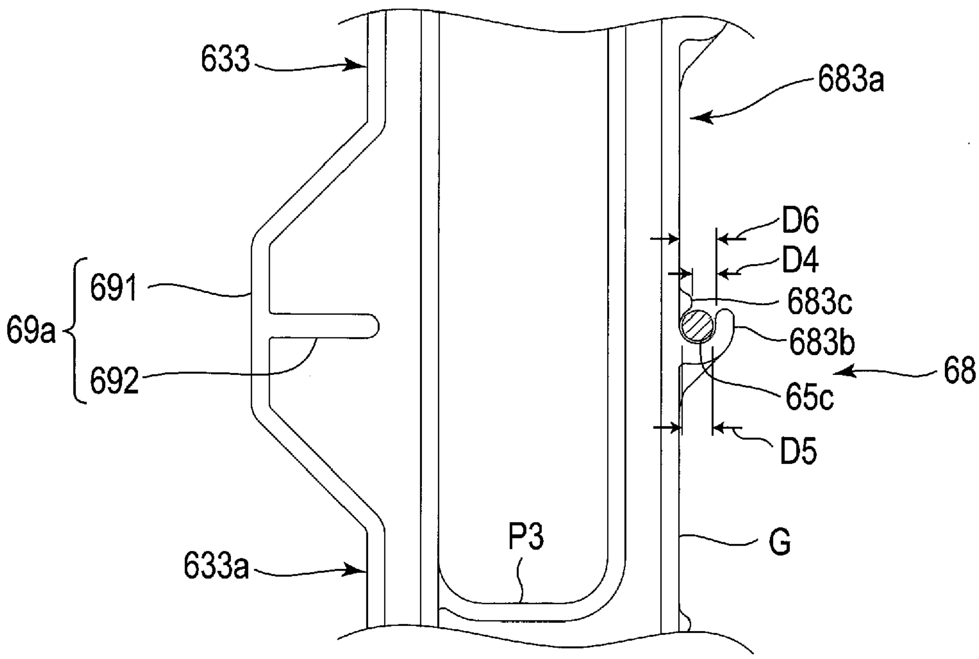
631,632

FIG. 8


633
683a
D6
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683c
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692
65c
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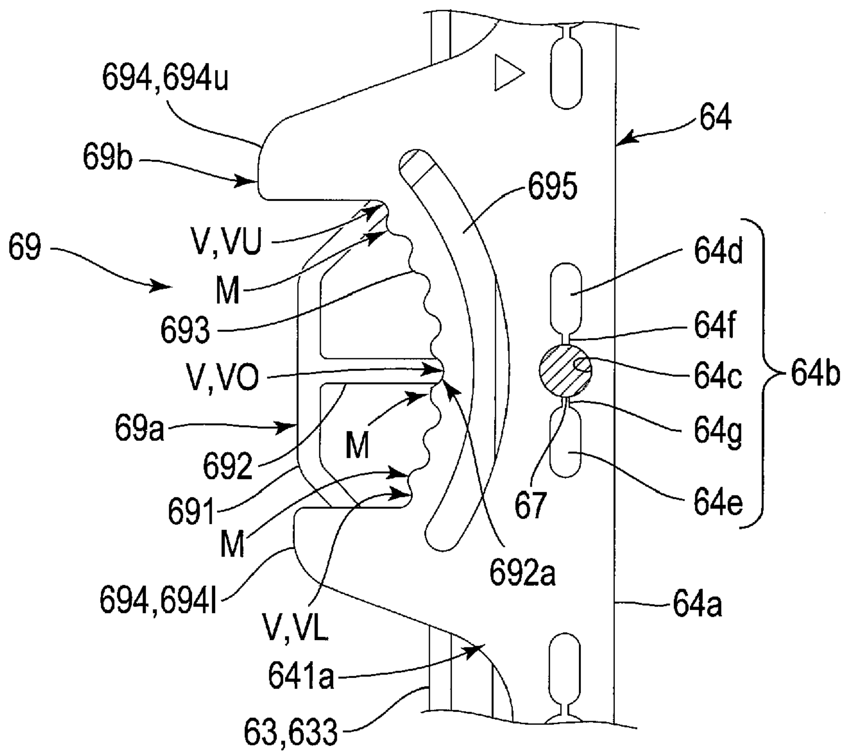
D5
P3
G
633a

FIG. 9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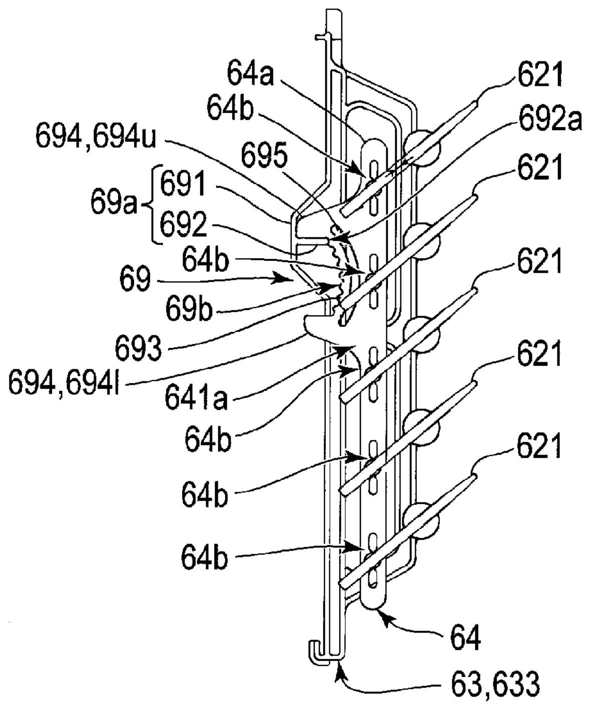
641a
63,633

F I G. 10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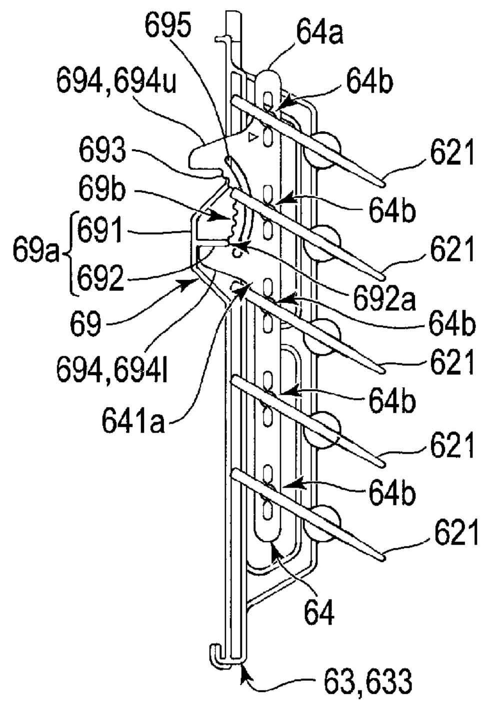
F I G. 11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64b
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64b
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64
63,633

F I G. 12

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	15 September 2020	Salaün, Eric

CATEGORY OF CITED DOCUMENTS

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