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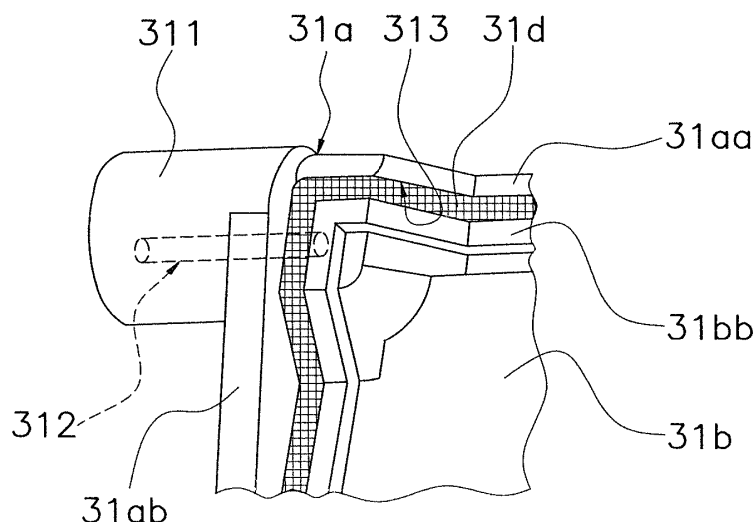
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(54) **INDOOR AIR-CONDITIONING UNIT**

(57) It is intended in an air-conditioning indoor unit to enhance airtightness of a hollow structure of an airflow direction adjustment louver and prevent expansion and shrinkage of the airflow direction adjustment louver itself. In the air-conditioning indoor unit (10), air movement is enabled between inside and outside of the airflow direc-

tion adjustment louver (31) only through a vent hole (312). Moreover, the vent hole (312) does not exist in a pathway of blown air. Hence, it is avoided that cold air blown out in a cooling operation intrudes into the airflow direction adjustment louver through the vent hole.

FIG. 7



Description

TECHNICAL FIELD

[0001] The present invention relates to an air-conditioning indoor unit, and particularly to an air-conditioning indoor unit that an airflow direction adjustment louver is mounted in the vicinity of a blow-out port.

BACKGROUND ART

[0002] An airflow direction adjustment louver, mounted in the vicinity of a blow-out port in an air-conditioning indoor unit, is entirely cooled down by cold air. Thus, when the surface temperature of the airflow direction adjustment louver gets lower than the dew point, dew condensation occurs on its surface unexposed to the cold wind.

[0003] To prevent occurrence of the dew condensation, a thermal insulator has been conventionally attached to a predetermined part of the airflow direction adjustment louver. In recent years, however, the airflow direction adjustment louver has had a hollow structure as described in, for instance, Patent Literature 1 (Japan Laid-open Patent Application Publication No. 2009-14289) in order to avoid deterioration in its aesthetic appearance attributed to attachment of the thermal insulator. Thus, the airflow direction adjustment louver is designed to achieve thermal insulation performance equivalent to that achieved by attachment of the thermal insulator without deteriorating its aesthetic appearance.

SUMMARY OF THE INVENTION

<Technical Problem>

[0004] Because of the hollow structure, however, chances are that cold air is sucked into the internal space by variation in volume of internal air attributed to variation in temperature. This contributes to degradation in thermal insulation performance. When the hollow structure is completely sealed for preventing occurrence of the phenomenon, a drawback is produced that the airflow direction adjustment louver itself deforms by its expansion and shrinkage.

[0005] It is an object of the present invention to enhance airtightness of the hollow structure of the airflow direction adjustment louver, and also, to prevent expansion and shrinkage of the airflow direction adjustment louver itself.

<Solution to Problem>

[0006] An air-conditioning indoor unit according to a first aspect of the present invention includes an airflow direction adjustment louver and a body casing. The airflow direction adjustment louver is configured to adjust a flow direction of air to be blown out of a blow-out port.

The body casing has a blown-out airflow path directing air-conditioned air to the blow-out port. Further, the airflow direction adjustment louver has a hollow sealed structure allowing air movement between inside and outside thereof only through a predetermined vent hole. Yet further, the vent hole is bored in a part located out of the blown-out airflow path.

[0007] In the present air-conditioning indoor unit, air movement is enabled between inside and outside of the airflow direction adjustment louver only through the vent hole. Moreover, the vent hole does not exist in a pathway of blown air. Hence, it is avoided that cold air blown out in a cooling operation intrudes into the airflow direction adjustment louver through the vent hole.

[0008] An air-conditioning indoor unit according to a second aspect of the present invention relates to the air-conditioning indoor unit according to the first aspect, and wherein the airflow direction adjustment louver has a pivot shaft functioning as a pivot center in changing a tilt angle thereof with respect to a horizontal plane. Further, the vent hole is bored in the pivot shaft.

[0009] In general, a pair of the pivot shafts is disposed on the both lengthwise ends of the airflow direction adjustment louver, and is thus designed to be located outside the both ends of the blow-out port. Therefore, in the present air-conditioning indoor unit, the vent hole does not exist in the pathway of blown air, and it is avoided that cold air blown out in the cooling operation intrudes into the airflow direction adjustment louver through the vent hole.

[0010] An air-conditioning indoor unit according to a third aspect of the present invention relates to the air-conditioning indoor unit according to the second aspect, and wherein the pivot shaft is located outside a sidewall forming the blown-out airflow path.

[0011] In the present air-conditioning indoor unit, the blown-out airflow path and the vent hole are divided through the sidewall. Hence, it is avoided that cold air blown out in the cooling operation intrudes into the airflow direction adjustment louver through the vent hole.

[0012] An air-conditioning indoor unit according to a fourth aspect of the present invention relates to the air-conditioning indoor unit according to the first aspect, and wherein the vent hole is configured to be used as an air injection hole in an airtight test for checking airtightness by air injection into the hollow sealed structure.

[0013] In the present air-conditioning indoor unit, it is required to connect an air nozzle to an air-injected part when air injection is performed in the airtight test. However, the vent hole is herein bored in the pivot shaft, and consequently, it is only required to connect the nozzle to one end of the airflow direction adjustment louver. This is productive in that the nozzles are connectable to the airflow direction adjustment louvers to be consecutively transported in a manufacturing process without changing the postures of the airflow direction adjustment louvers.

[0014] An air-conditioning indoor unit according to a fifth aspect of the present invention relates to the air-

conditioning indoor unit according to the first aspect, and wherein the airflow direction adjustment louver includes a plurality of plate members and a sealing member. The plural plate members are configured to form a hollow part when being combined. The sealing member fills up a boundary between the plate members.

[0015] Reduction in thickness is normally required for the airflow direction adjustment louver despite its hollow structure. Due to this, the inside of its end surface has a large thickness, and this inevitably reduces the volume of the hollow part. However, in the present air-conditioning indoor unit, increase in thickness of the inside of the end surface can be inhibited and reduction in volume of the hollow part can be prevented by the combination of the plate members of the airflow direction adjustment louver and the method of filling up the boundary between the plate members with the sealing member.

[0016] An air-conditioning indoor unit according to a sixth aspect of the present invention relates to the air-conditioning indoor unit according to the fifth aspect, and wherein the plate members and the sealing member are molded by the same resin material. The hollow sealed structure is formed by injecting the resin material in a molten state on the boundary between the plural plate members after the plate members are inserted into a resin molding mold while forming the hollow part.

[0017] In the present air-conditioning indoor unit, the plate members and the sealing member are made of the same material. Thus, durability against thermal expansion and thermal shrinkage is more enhanced than joining of resin materials with different linear expansion coefficients. This results in enhancement in reliability.

<Advantageous Effects of Invention>

[0018] In the air-conditioning indoor unit according to the first aspect of the present invention, air movement is enabled between inside and outside of the airflow direction adjustment louver only through the vent hole. Moreover, the vent hole does not exist in the pathway of blown air. Hence, it is avoided that cold air blown out in the cooling operation intrudes into the airflow direction adjustment louver through the vent hole.

[0019] In the air-conditioning indoor unit according to the second aspect of the present invention, the vent hole does not exist in the pathway of blown air, and it is avoided that cold air blown out in the cooling operation intrudes into the airflow direction adjustment louver through the vent hole.

[0020] In the air-conditioning indoor unit according to the third aspect of the present invention, the blown-out airflow path and the vent hole are divided through the sidewall. Hence, it is avoided that cold air blown out in the cooling operation intrudes into the airflow direction adjustment louver through the vent hole.

[0021] In the air-conditioning indoor unit according to the fourth aspect of the present invention, it is required to connect an air nozzle to an air-injected part when air

injection is performed in the airtight test. However, the vent hole is herein bored in the pivot shaft, and consequently, it is only required to connect the nozzle to one end of the airflow direction adjustment louver. This is productive in that the nozzles are connectable to the airflow direction adjustment louvers to be consecutively transported in a manufacturing process without changing the postures of the airflow direction adjustment louvers.

[0022] In the air-conditioning indoor unit according to the fifth aspect of the present invention, increase in thickness of the inside of the end surface can be inhibited and reduction in volume of the hollow part can be prevented by the combination of the plate members of the airflow direction adjustment louver and the method of filling up the boundary between the plate members with the sealing member.

[0023] In the air-conditioning indoor unit according to the sixth aspect of the present invention, the plate members and the sealing member are made of the same material. Thus, durability against thermal expansion and thermal shrinkage is more enhanced than joining of resin materials with different linear expansion coefficients. This results in enhancement in reliability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

FIG. 1 is a cross-sectional view of an air-conditioning indoor unit according to an embodiment of the present invention when an operation is stopped.

FIG. 2 is a front view of the air-conditioning indoor unit when an operation is performed.

FIG. 3 is a perspective view of an airflow direction adjustment louver.

FIG. 4 is an exploded perspective view of the airflow direction adjustment louver.

FIG. 5 is an enlarged perspective view of a shaft wall and its surrounding.

FIG. 6 is an enlarged perspective view of the shaft wall and its surrounding when an outer plate and an inner plate are overlapped.

FIG. 7 is an enlarged perspective view of the shaft wall and its surrounding when a groove is filled up with a sealing member.

FIG. 8 is a side view of the airflow direction adjustment louver in normal front blowing of blown air.

FIG. 9 is a side view of the airflow direction adjustment louver in normal front down blowing of blown air.

FIG. 10 is a cross-sectional view of a WIM molding mold unit that an upper mold and a lower mold are opened up and down.

FIG. 11 is a cross-sectional view of the WIM molding mold unit that the upper mold and the lower mold are closed.

FIG. 12 is a perspective view of a runner and the airflow direction adjustment louver immediately after

molding of the sealing member.

DESCRIPTION OF EMBODIMENTS

[0025] An embodiment of the present invention will be hereinafter explained with reference to the drawings. It should be noted that the following embodiment is a specific example of the present invention and is not intended to limit the technical scope of the present invention.

(1) Configuration of Air-Conditioning Indoor Unit 10

[0026] FIG. 1 is a cross-sectional view of an air-conditioning indoor unit 10 according to the embodiment of the present invention when an operation is stopped. In FIG. 1, the air-conditioning indoor unit 10 is of a wall mount type, and is equipped with a body casing 11, an indoor heat exchanger 13, an indoor fan 14, a bottom frame 16 and a controller 40.

[0027] The body casing 11 has a top surface part 11 a, a front surface panel 11b, a rear surface plate 11 c and a bottom horizontal plate 11d, and accommodates the indoor heat exchanger 13, the indoor fan 14, the bottom frame 16 and the controller 40 in the interior thereof.

[0028] The top surface part 11 a is located on the top of the body casing 11, and has an intake port (not shown in the drawings) in the front part thereof.

[0029] The front surface panel 11b makes up the front surface part of the indoor unit, and has a flat shape without being provided with any intake port. In addition, the front surface panel 11b is pivotably supported at its top end by the top surface part 11a, and is capable of performing a hinge-like action.

[0030] The indoor heat exchanger 13 and the indoor fan 14 are attached to the bottom frame 16. The indoor heat exchanger 13 is configured to perform heat exchange with air passing therethrough. In addition, the indoor heat exchanger 13 has an inverted V shape with its both ends bending downward in a side view, and the indoor fan 14 is located under the indoor heat exchanger 13. The indoor fan 14 is a crossflow fan that is configured to cause air, taken in from an indoor space, to strike against and pass through the indoor heat exchanger 13 and is then configured to blow out the heat-exchanged air to the indoor space.

[0031] The body casing 11 has a blow-out port 15 in the bottom part thereof. An airflow direction adjustment louver 31 is pivotably attached to the blow-out port 15 in order to change the flow direction of air to be blown out of the blow-out port 15. The airflow direction adjustment louver 31 is configured to be driven by a motor (not shown in the drawings), and is capable of not only changing the flow direction of blown air but also opening and closing the blow-out port 15. The airflow direction adjustment louver 31 is capable of taking a plurality of positions with different tilt angles.

[0032] In addition, the blow-out port 15 communicates with the interior of the body casing 11 through a blown-

out airflow path 18. The blown-out airflow path 18 is formed from the blow-out port 15 along a scroll 17 of the bottom frame 16.

[0033] Indoor air is sucked into the indoor fan 14 through the intake port and the indoor heat exchanger 13 by the actuation of the indoor fan 14, is discharged from the indoor fan 14 so as to be blown out of the blow-out port 15 through the blown-out airflow path 18.

[0034] The controller 40 is located laterally rightward of the indoor heat exchanger 13 and the indoor fan 14 when the body casing 11 is seen from the front surface panel 11b, and is configured to control the rotation speed of the indoor fan 14 and the action of the airflow direction adjustment louver 31.

(2) Detailed Configuration

(2-1) Blow-out port 15

[0035] As shown in FIG. 1, the blow-out port 15 is formed in the bottom part of the body casing 11 as a rectangular opening that elongates in a sideward direction (a direction arranged orthogonally to the drawing plane of FIG. 1). The bottom end of the blow-out port 15 adjoins the front edge of the bottom horizontal plate 11d, and a hypothetical plane connecting the bottom end and the top end of the blow-out port 15 tilts up to the front.

(2-2) Scroll 17

[0036] The scroll 17 is a partition curved so as to face the indoor fan 14, and is a part of the bottom frame 16. The terminal end of the scroll 17 reaches the vicinity of the circumferential edge of the blow-out port 15. Air, passing through the blown-out airflow path 18, flows along the scroll 17 and is fed in a direction of a tangent on the terminal end of the scroll 17. Therefore, when the airflow direction adjustment louver 31 is not attached to the blow-out port 15, the flow direction of air blown out of the blow-out port 15 is roughly along the tangent on the terminal end of the scroll 17.

(2-3) Vertical airflow direction adjustment louver 20

[0037] As shown in FIG. 1, a vertical airflow direction adjustment louver 20 includes a plurality of louver pieces 201 and a coupling rod 203 for coupling the louver pieces 201. In addition, the vertical airflow direction adjustment louver 20 is disposed more proximal to the indoor fan 14 than the airflow direction adjustment louver 31 within the blown-out airflow path 18.

[0038] The plural louver pieces 201 are configured to pivot right and left about their positions perpendicular to the lengthwise direction of the blow-out port 15 when the coupling rod 203 is horizontally reciprocated along the lengthwise direction of the blow-out port 15. It should be noted that the coupling rod 203 is configured to be horizontally reciprocated by a motor (not shown in the draw-

ings).

(2-4) Airflow direction adjustment louver 31

[0039] FIG. 2 is a front view of the air-conditioning indoor unit when an operation is performed. In FIG. 2, the airflow direction adjustment louver 31 is pivotably supported by the body casing 11 through pivot shafts 311, and is configured to pivot about the pivot shafts 311 so as to change its tilt angle with respect to a horizontal plane. The airflow direction adjustment louver 31 has an area enough to close the blow-out port 15.

[0040] An outer plate 31a, making up the outer surface of the airflow direction adjustment louver 31, is finished to have a gradual circular-arc curved surface with an outwardly convex shape so as to be located on the extension of the curved surface of the front surface panel 11b in a condition that the blow-out port 15 is closed by the airflow direction adjustment louver 31 (see FIG. 1). Likewise, an inner plate 31b, making up the inner lateral surface of the airflow direction adjustment louver 31, has a circular-arc curved surface roughly in parallel to the outer plate 31 a.

[0041] On the other hand, the pivot shafts 311 penetrate through sidewalls forming the blown-out airflow path 18 and enter the interior of the body casing 11. At least one of the pivot shafts 311 is coupled to a rotary shaft of a stepping motor (not shown in the drawings) fixed to the body casing 11.

[0042] In conjunction with counterclockwise turning of the pivot shafts 311 in the front view of FIG. 1, the airflow direction adjustment louver 31 is actuated such that the top end thereof moves away from that of the blow-out port 15, and thereby, the blow-out port 15 is opened. Contrarily in conjunction with clockwise turning of the pivot shafts 311 in the front view of FIG. 1, the airflow direction adjustment louver 31 is actuated such that the top end thereof moves closer to that of the blow-out port 15, and thereby, the blow-out port 15 is closed.

[0043] Air, blown out of the blow-out port 15, flows roughly along the inner plate 31b of the airflow direction adjustment louver 31 in a condition that the blow-out port 15 is opened by the airflow direction adjustment louver 31. Put differently, the flow direction of air blown out roughly along the direction of the tangent on the terminal end of the scroll 17 is changed slightly upward by the airflow direction adjustment louver 31.

(3) Detailed Structure of Airflow Direction Adjustment Louver 31

[0044] FIG. 3 is a perspective view of the airflow direction adjustment louver 31. FIG. 4 is an exploded perspective view of the airflow direction adjustment louver 31. In FIGS. 1 to 4, the airflow direction adjustment louver 31 has a hollow structure formed by overlapping the outer plate 31 a and the inner plate 31 b so as to form a hollow part 31 c.

[0045] In addition, when seen in a plan view, the airflow direction adjustment louver 31 is shaped such that among four corners of a rectangular, two corners located on the both ends of one longer side are cut out in a rectangular shape. For convenience of explanation, a region having the longest side will be referred to as a first region R1, whereas a region having the second longest side will be referred to as a second region R2. The pivot shafts 311 are disposed on the both lengthwise ends of the second region R2.

(3-1) Outer plate 31a

[0046] The circumferential edge of the outer plate 31 a bulges and forms a wall 31 aa. The height of the wall 31aa is set to be greater than the thickness of the inner plate 31b. Especially, shaft walls 31ab, located on the both ends of a part corresponding to the second region R2, are formed higher than the other wall 31aa part, and the pivot shafts 311 outwardly protrude from the walls 31ab.

[0047] FIG. 5 is an enlarged perspective view of the shaft wall 31ab and its periphery. In FIG. 5, a rib 31ac is formed on the inner surface of the outer plate 31a so as to be adjacent to the wall 31 aa and the shaft walls 31ab. The height of the rib 31ac is set to prevent the inner plate 31b from upwardly protruding from the top end of the wall 31aa even when the inner plate 31b is mounted onto the rib 31ac.

[0048] The outer plate 31a has vent holes 312 that penetrate through the shaft walls 31ab and the pivot shafts 311. The height positions of the vent holes 312 are lower than the center heights of the pivot shafts 311 with reference to the inner surface of the outer plate 31a. More specifically, the height positions of the vent holes 312 are set to face the hollow part 31c (see FIG. 1) that is formed between the inner plate 31b and the outer plate 31a when the inner plate 31 b is mounted onto the rib 31ac.

(3-2) Inner plate 31b

[0049] The circumferential edge 31ba of the inner plate 31b is fitted to the inside of the wall 31 aa and the shaft walls 31ab of the outer plate 31 a. The inner plate 31 b has an opposing wall 31bb that is formed inside the circumferential edge 31ba by a predetermined distance in parallel to the circumferential edge 31ba.

[0050] FIG. 6 is an enlarged perspective view of the shaft wall 31ab and its periphery when the outer plate 31a and the inner plate 31b are overlapped. In FIG. 6, a groove 313 surrounding the opposing wall 31bb is formed when the opposing wall 31bb of the inner plate 31b is opposed to the wall 31 aa and the shaft walls 31ab of the outer plate 31 a.

(3-3) Hollow part 31c

[0051] As shown in the airflow direction adjustment lou-

ver 31 of FIG. 1, the hollow part 31c is formed between the inner plate 31b and the outer plate 31 a when the inner plate 31b is mounted onto the rib 31 ac by overlapping the outer plate 31a and the inner plate 31 b.

[0052] Air blown out of the blow-out port 15 herein flows on the inner plate 31b. Hence, suppose the hollow part 31c is not formed and when the blown air is cold air, the airflow direction adjustment louver 31 is cooled from the inner plate 31b side to the outer plate 31a side, and the outer plate 31 a unexposed to the cold air is also cooled to a lower temperature. Then, dew condensation occurs when temperature decreases to the dew point or less.

[0053] However, thermal movement from the inner plate 31 b side is herein blocked (thermally insulated) by the existence of the hollow part 31c. Thus, cooling of the outer plate 31a is inhibited, and consequently, occurrence of dew condensation is prevented.

(3-4) Sealing member 31d

[0054] FIG. 7 is an enlarged perspective view of the shaft wall 31ab and its periphery when the groove 313 is filled up with a sealing member 31d. In FIG. 7, the groove 313 is a boundary between the outer plate 31a and the inner plate 31 b, and the hollow part 31 c is formed as a sealed structure when being sealed by the sealing member 31 d. The sealing member 31 d is made of the same material as the outer plate 31 a and the inner plate 31b, and is filled in a molten state into the groove 313.

[0055] Sealing of the boundary between the outer plate 31a and the inner plate 31b is completed when the sealing member 31d filled into the groove 313 is cooled and hardened. At this time, the airflow direction adjustment louver 31 is formed as a hollow sealed structure that allows air movement between inside and outside only through the vent holes 312.

(4) Blown Air Directional Control

[0056] As means for controlling the flow direction of blown air, the air-conditioning indoor unit according to the present embodiment is configured to adjust the flow direction of blown air by causing the airflow direction adjustment louver 31 to pivot.

(4-1) Normal blow-out mode

[0057] A normal blow-out mode is a mode for adjusting the flow direction of blown air by causing the airflow direction adjustment louver 31 to pivot, and is composed of "normal front blowing" and "normal front down blowing".

(4-1-1) Normal front blowing

[0058] FIG. 8 is a side view of the airflow direction adjustment louver 31 when air is blown out in the normal front blowing. In FIG. 8, when a user selects "normal front

blowing", the controller 40 is configured to cause the air-flow direction adjustment louver 31 to pivot until the inner plate 31b of the airflow direction adjustment louver 31 takes a roughly horizontal position. It should be noted that when the inner plate 31b of the airflow direction adjustment louver 31 has a circular-arc curved surface as with the embodiment of the present application, the air-flow direction adjustment louver 31 is caused to pivot until the tangent on the front end of the inner plate 31b becomes roughly horizontal. Consequently, blown air becomes a front blowing state.

(4-1-2) Normal front down blowing

[0059] FIG. 9 is a side view of the airflow direction adjustment louver 31 when air is blown out in the normal front down blowing. In FIG. 9, a user can select "normal front down blowing" when intending to more downwardly change the blow-out direction than "normal front blowing".

[0060] At this time, the controller 40 is configured to cause the airflow direction adjustment louver 31 to pivot until the tangent on the front end of the inner plate 31b of the airflow direction adjustment louver 31 tilts down to the front than its horizontal state. Consequently, blown air becomes a down blowing state.

(5) Air Movement through Vent Hole 312

[0061] Regardless of "normal front blowing" and "normal front down blowing", the airflow direction adjustment louver 31 is heated by warm air in a heating operation and is cooled by cold air in a cooling operation. Thus, air inside the hollow part 31c is also heated or cooled, and thereby, expansion or contraction of air occurs.

[0062] Suppose the airflow direction adjustment louver 31 has a completely sealed structure, expansion and shrinkage of the airflow direction adjustment louver 31 also occur in accordance with those of the hollow part 31c. However, the airflow direction adjustment louver 31 has a hollow structure that allows air movement between inside and outside only through the vent holes 312. Hence, the expansion and shrinkage of the airflow direction adjustment louver 31 is prevented.

[0063] Moreover, the pivot shafts 311 penetrate through the sidewalls forming the blown-out airflow path 18 and enter the interior of the body casing 11. Thus, the vent holes 312, penetrating through the pivot shafts 311, do not themselves exist in a pathway of blown air. Therefore, even when air moves within the vent holes 312 by expansion and contraction of air inside the airflow direction adjustment louver 31, blown air is prevented from intruding into the airflow direction adjustment louver 31 through the vent holes 312.

[0064] Because of the above, such a situation is avoided that cold air blown out in the cooling operation intrudes into the airflow direction adjustment louver 31 through the vent holes and cools the airflow direction adjustment

louver 31 from its inside.

[0065] On the other hand, even when a humidifying operation is performed so as to make blown air contain moisture, the moisture contained air is prevented from intruding into the airflow direction adjustment louver 31 through the vent holes 312. Consequently, there is a low possibility of causing such a situation that dew condensation occurs in the interior of the airflow direction adjustment louver 31.

(6) Manufacturing Method of Sealing Member 31d

[0066] The cross-sectional area of the groove 313 is 5 square millimeters or less, and thus, it is not easy to fill the molten sealing member 31d into the groove 313. In the present embodiment, WIM (Welding-In-Mold) molding method is employed as a method of filling molten resin.

[0067] FIG. 10 is a cross-sectional view of a WIM molding mold unit 70 that an upper mold 71 and a lower mold 81 are opened up and down. On the other hand, FIG. 11 is a cross-sectional view of the WIM molding mold unit 70 that the upper mold 71 and the lower mold 81 are closed. In FIGS. 10 and 11, for instance, an assembly, produced by overlapping the outer plate 31a and the inner plate 31b as shown in FIG. 6, is set in the lower mold, and the upper mold and the lower mold are closed.

[0068] It should be noted that FIGS. 10 and 11 are drawings for illustrating an exemplary case that molten resin is injection-molded into a narrow groove through multiple gates. Hence, a component, set within the mold unit, is indicated with a component P having a simple groove G.

[0069] The upper mold 71 is provided with multiple gates 77, and molten resin, injected from an injection molding machine through a nozzle 73, is poured into the groove G through the multiple gates 77. Due to this, molten resin poured through the respective gates moves a roughly equal distance and completely fills up the groove G. Hence, the molten resin uninterruptedly prevails through the entire groove G without especially increasing injection pressure and molten resin temperature.

[0070] It should be noted that the amount of resin, remaining in a runner 75 for directing the molten resin to the multiple gates 77, is greater than or equal to roughly 50 times the amount of resin to be filled into the groove G, and thus, the mold of a hot runner type is used for reducing the disposal amount of resin. The hot runner type employs a method of heating the surrounding of the runner 75 with heaters 78 and 79 so as to constantly maintain molten resin in a molten state. Put differently, the hot runner type is an economic method in that resin is not hardened within the runner 75 and is usable without being disposed of.

[0071] Moreover, temperature regulation is performed for each of the multiple gates 77. Hence, the temperature of molten resin within the runner 75 can be properly maintained, and the fluidity of the molten resin flowing through

the runner 75 can be also properly maintained.

[0072] It should be noted that molten resin, having accumulated for a predetermined period of time or more, is configured to be forcibly discharged so as not to degrade the original property of the resin as a result of accumulation of the molten resin within the runner 75 for the predetermined period of time or more due to a trouble or so forth. It should be noted that the predetermined period of time is preferably set to be 30 to 60 minutes in manufacturing the sealing member 31d according to the present embodiment.

[0073] FIG. 12 is a perspective view of the runner 75 and the airflow direction adjustment louver 31 immediately after molding of the sealing member 31d. It should be noted that the shape of the runner 75 is exemplary only, and is not intended to be limited to that shown in FIG. 12. In FIG. 12, an annular part painted with black indicates the sealing member 31d, and the multiple gates 77 respectively face to the sealing member 31d. Thus, the sealing member 31d can be molded by employing the multiple gates 77 even when having a small cross-sectional area and an elongated annular shape.

(7) Features

(7-1)

[0074] In the air-conditioning indoor unit 10, air movement is enabled between inside and outside of the airflow direction adjustment louver 31 only through the vent holes 312. Moreover, the vent holes 312 do not exist in the pathway of blown air. Hence, it is avoided that cold air blown out in the cooling operation intrudes into the airflow direction adjustment louver 31 through the vent holes.

(7-2)

[0075] Furthermore, the vent holes 312 do not exist in the pathway of blown air, and it is avoided that cold air blown out in the cooling operation intrudes into the airflow direction adjustment louver 31 through the vent holes.

(7-3)

[0076] Furthermore, the blown-out airflow path 18 and the vent holes 312 are divided through the sidewalls. Hence, it is avoided that cold air blown out in the cooling operation intrudes into the airflow direction adjustment louver 31 through the vent holes 312.

(7-4)

[0077] Furthermore, increase in thickness of the inside of the end surface of the airflow direction adjustment louver 31 can be inhibited and reduction in volume of the hollow part can be prevented by overlapping the outer plate 31a and the inner plate 31b of the airflow direction

adjustment louver 31 and by the method of filling up the groove 313 as the boundary between the both plates 31 a and 31 b with the sealing member 31 d.

(7-5)

[0078] The outer plate 31 a, the inner plate 31 b and the sealing member 31d are made of the same material. Thus, durability against thermal expansion and thermal shrinkage is more enhanced than joining of resin materials with different linear expansion coefficients. This results in enhancement in reliability.

(8) Others

[0079] In general, it is required to connect an air nozzle to an air-injected part when air injection is performed in an airtight test. However, the vent holes 312 are herein bored in the pivot shafts 311, and consequently, it is only required to connect the nozzle to one end of the airflow direction adjustment louver 31. This is productive in that nozzles are connectable to the airflow direction adjustment louvers 31 to be consecutively transported in a manufacturing process without changing the postures of the airflow direction adjustment louvers 31.

INDUSTRIAL APPLICABILITY

[0080] As described above, the present invention is useful not only for a sealing member of an airflow direction adjustment louver but also for a product employing an elongated annular resin member with a small cross-sectional area.

REFERENCE SIGNS LIST

[0081]

10 Air-conditioning indoor unit
11 Body casing
15 Blow-out port
18 Blown-out airflow path
31 Airflow direction adjustment louver
31a Outer plate (Plate member)
31b Inner plate (Plate member)
31d Sealing member
40 Controller
311 Pivot shaft
312 Vent hole

CITATION LIST

PATENT LITERATURE

[0082] PTL 1: Japan Laid-open Patent Application Publication No. 2009-14289

Claims

1. An air-conditioning indoor unit (10), comprising:

5 an airflow direction adjustment louver (31) being configured to adjust a flow direction of air to be blown out of a blow-out port (15); and
10 a body casing (11) having a blown-out airflow path (18) directing air-conditioned air to the blow-out port (15), wherein the airflow direction adjustment louver (31) has a hollow sealed structure allowing air movement between inside and outside thereof only through a predetermined vent hole (312), and
15 the vent hole (312) is bored in a part located out of the blown-out airflow path (18).

2. The air-conditioning indoor unit (10) according to claim 1, wherein
20 the airflow direction adjustment louver (31) has a pivot shaft (311) functioning as a pivot center in changing a tilt angle thereof with respect to a horizontal plane, and the vent hole (312) is bored in the pivot shaft (311).

3. The air-conditioning indoor unit (10) according to claim 2, wherein the pivot shaft (311) is located outside a sidewall forming the blown-out airflow path (18).

4. The air-conditioning indoor unit (10) according to claim 1, wherein the vent hole (312) is configured to be used as an air injection hole in an airtight test for checking airtightness by air injection into the hollow sealed structure.
35

5. The air-conditioning indoor unit (10) according to claim 1, wherein the airflow direction adjustment louver (31) includes
40 a plurality of plate members (31 a, 31 b) being configured to form a hollow part when being combined, and a sealing member (31d) filling up a boundary between the plate members (31 a, 31 b).

6. The air-conditioning indoor unit (10) according to claim 5, wherein
45 the plate members (31 a, 31 b) and the sealing member (31 d) are molded by the same resin material, and the hollow sealed structure is formed by injecting the resin material in a molten state on the boundary between the plural plate members (31 a, 31 b) after the plate members (31 a, 31 b) are inserted into a resin molding mold while forming the hollow part.
50

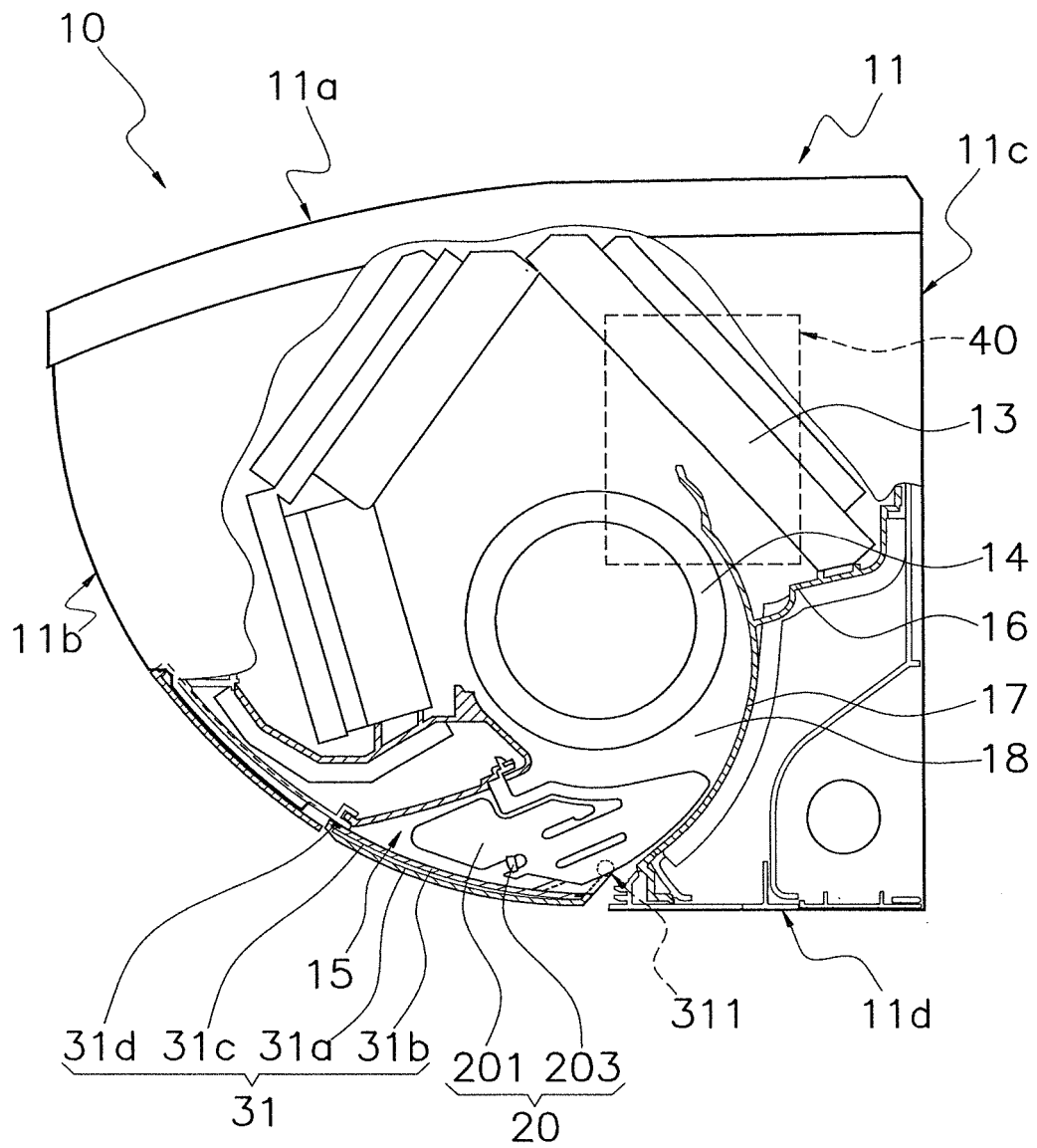


FIG. 1

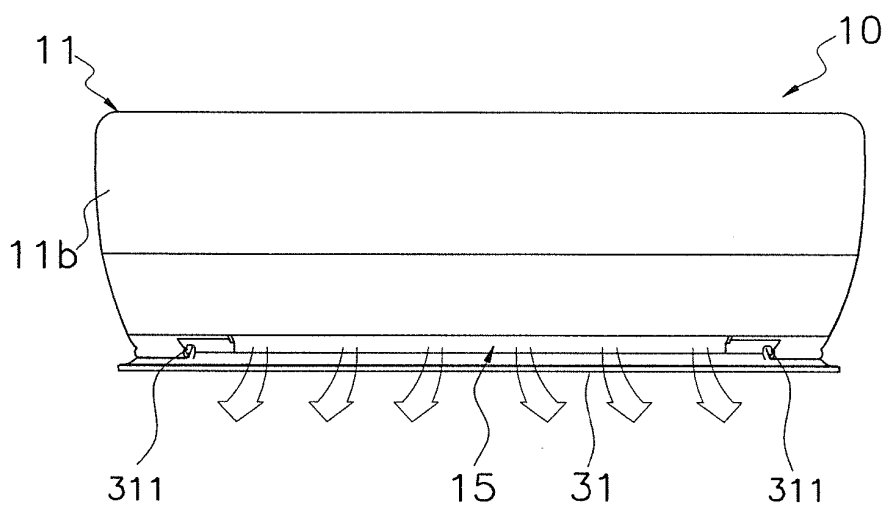


FIG. 2

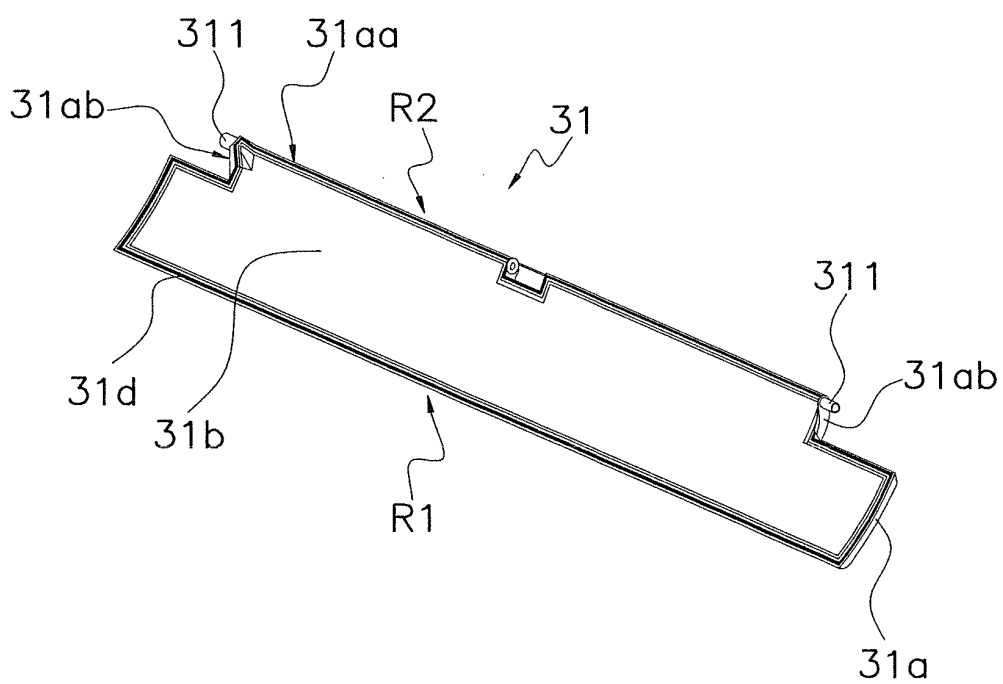


FIG. 3

FIG. 4

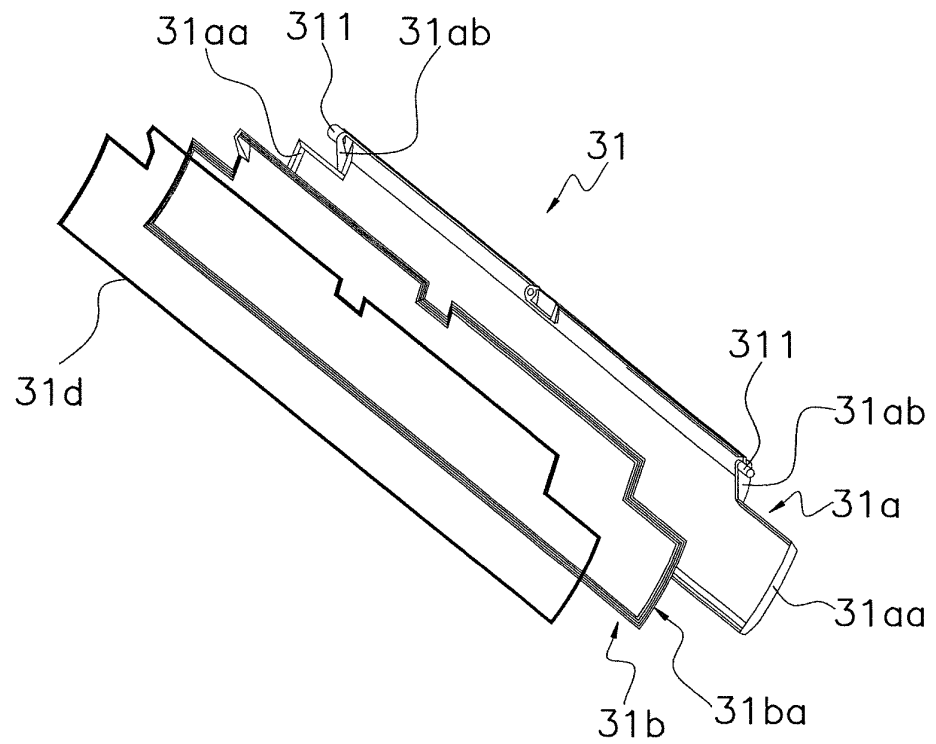


FIG. 5

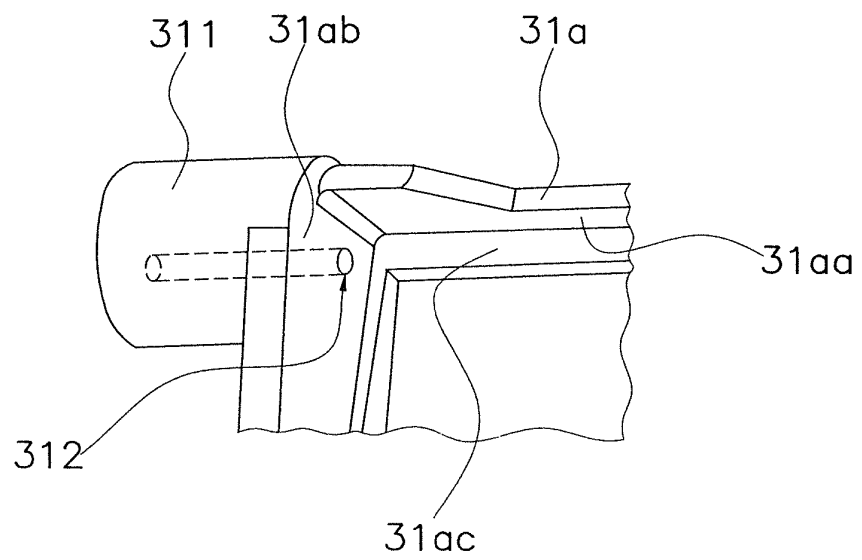


FIG. 6

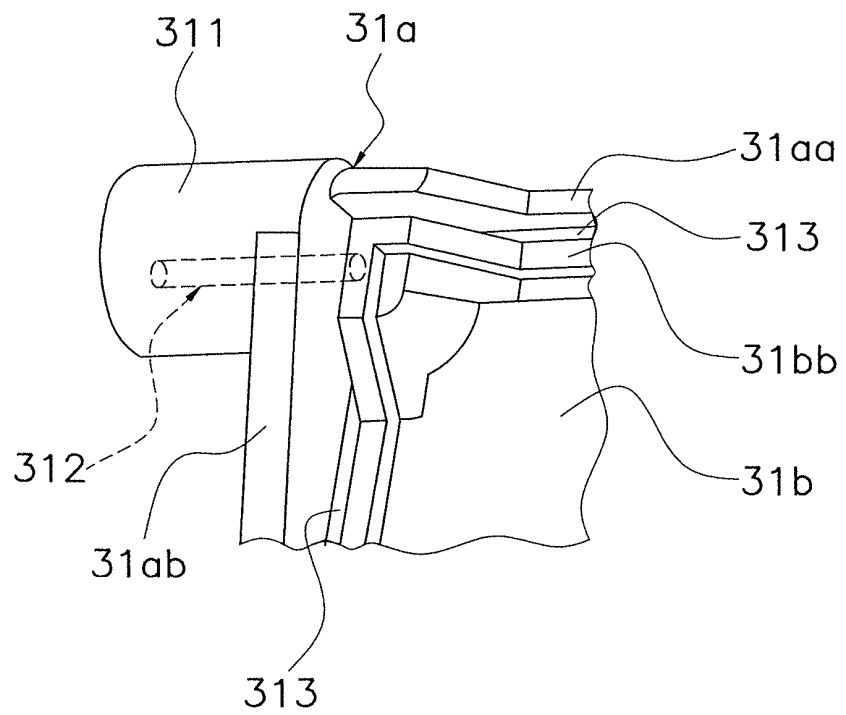


FIG. 7

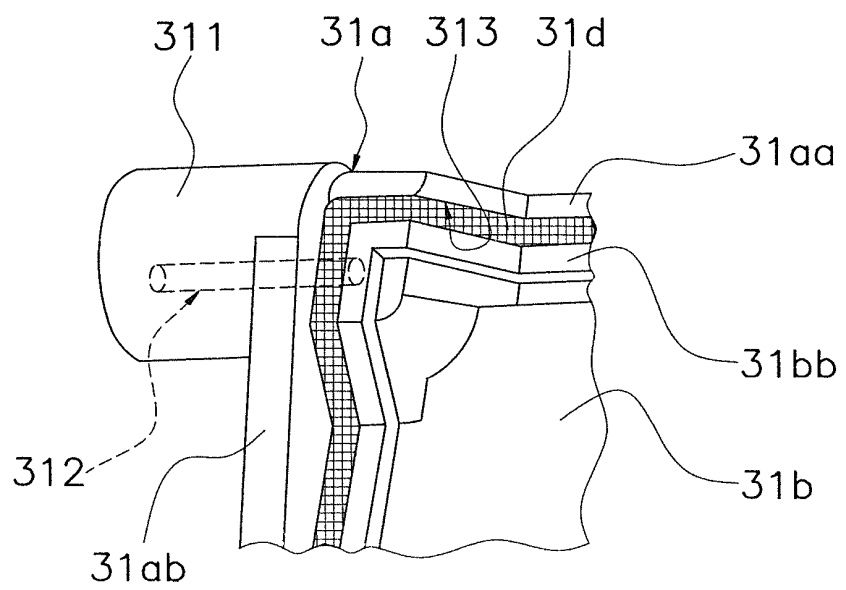


FIG. 8

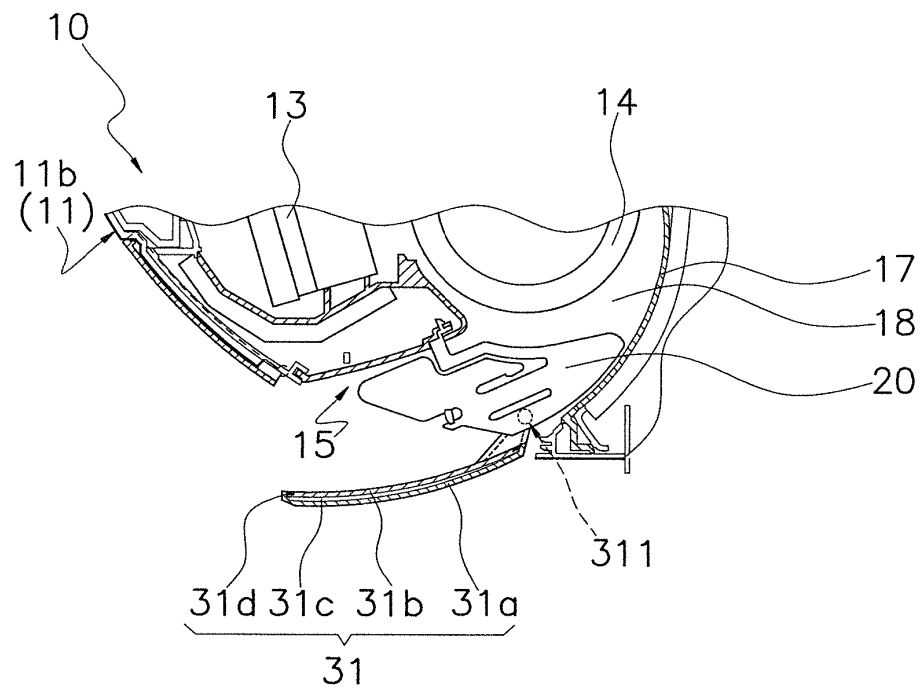
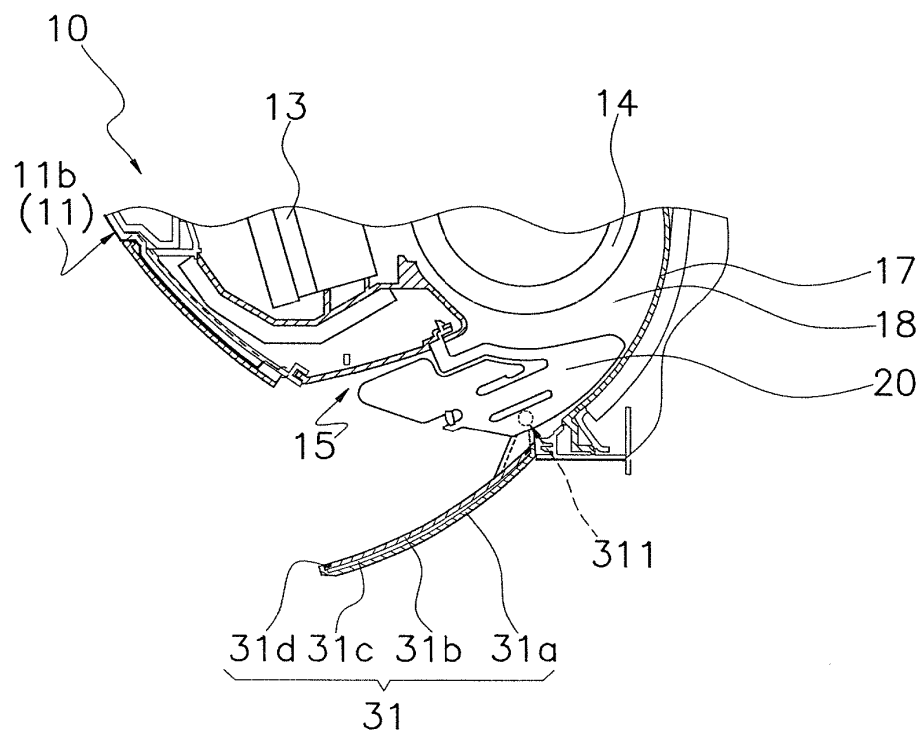


FIG. 9



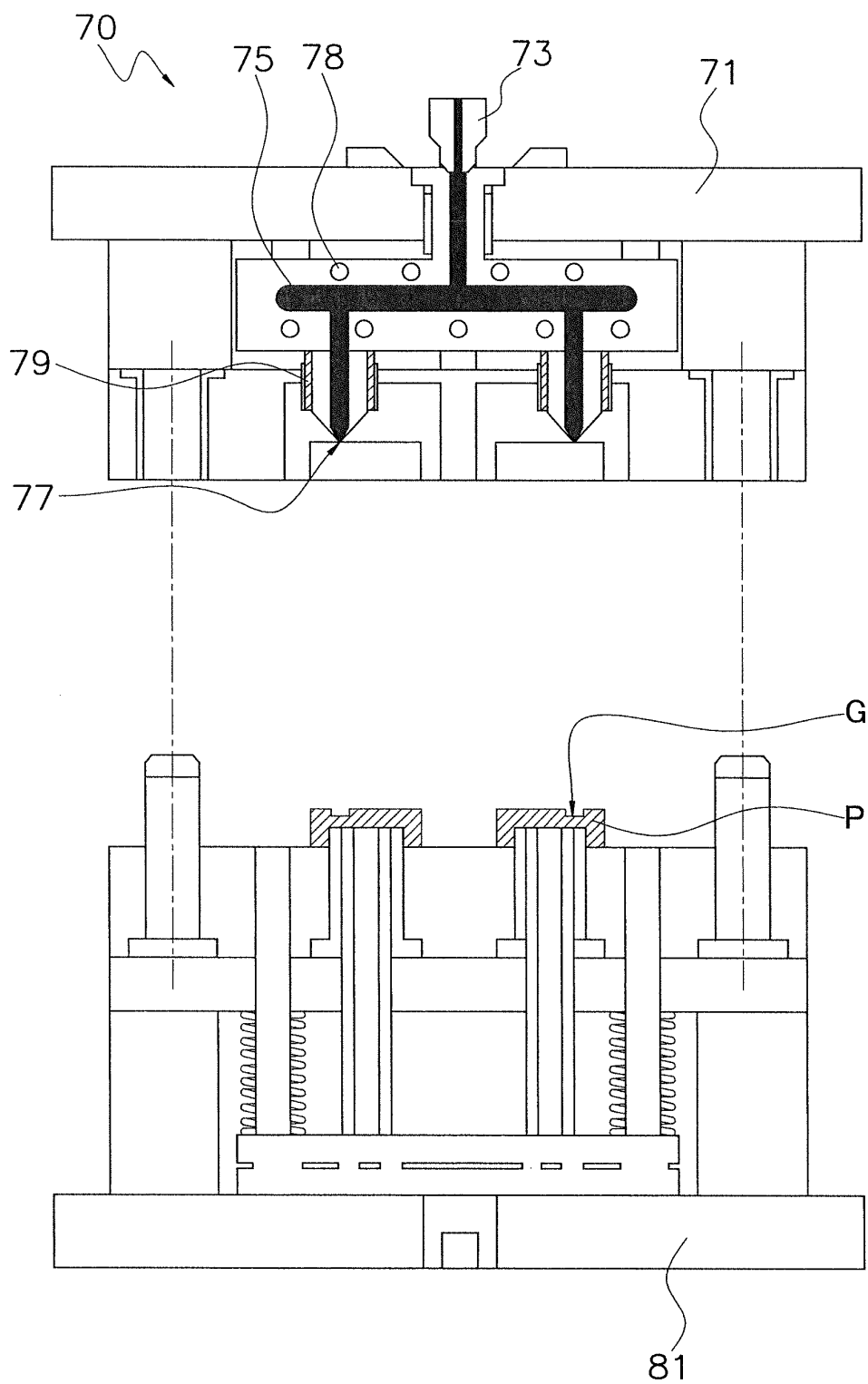


FIG. 10

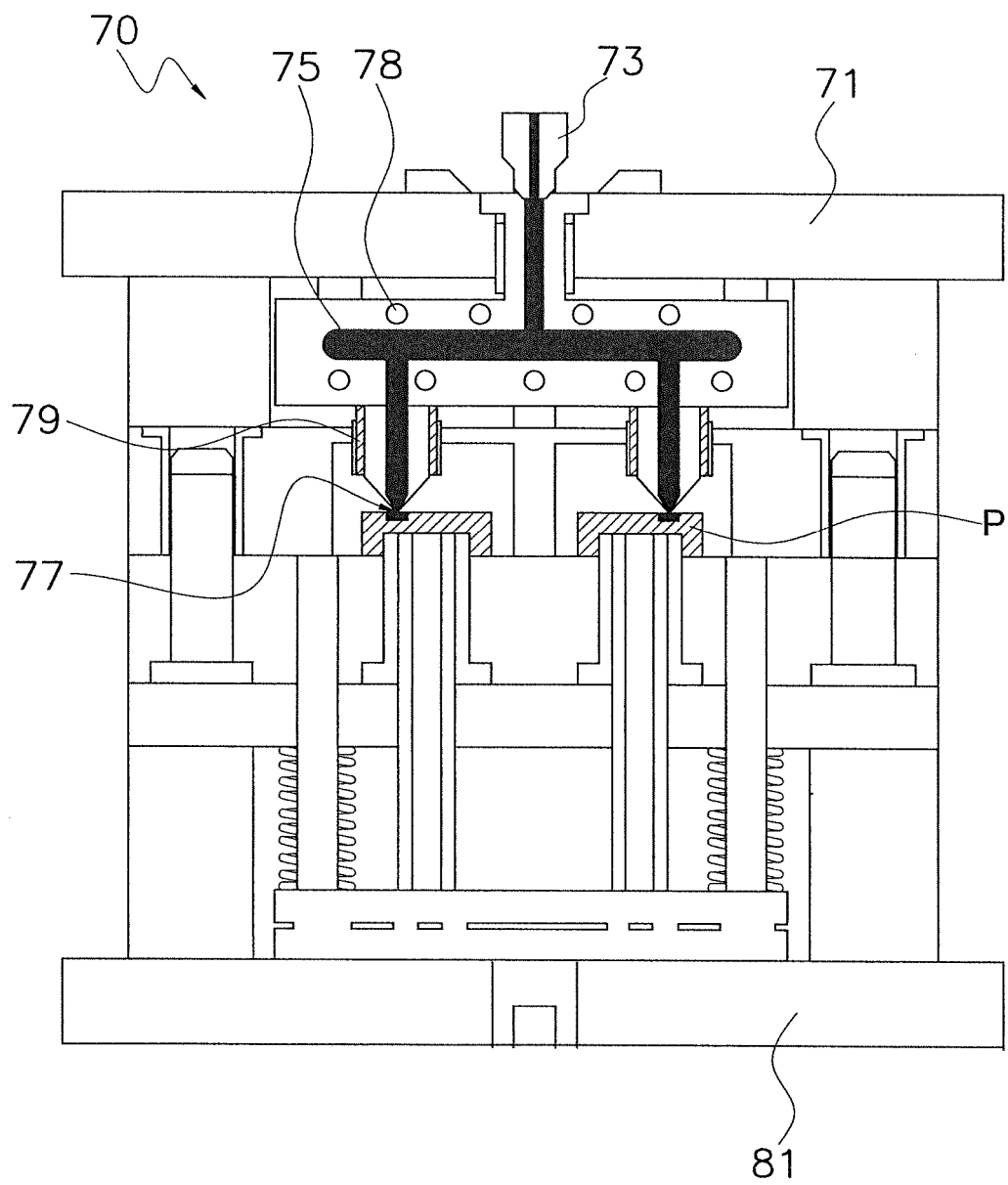


FIG. 11

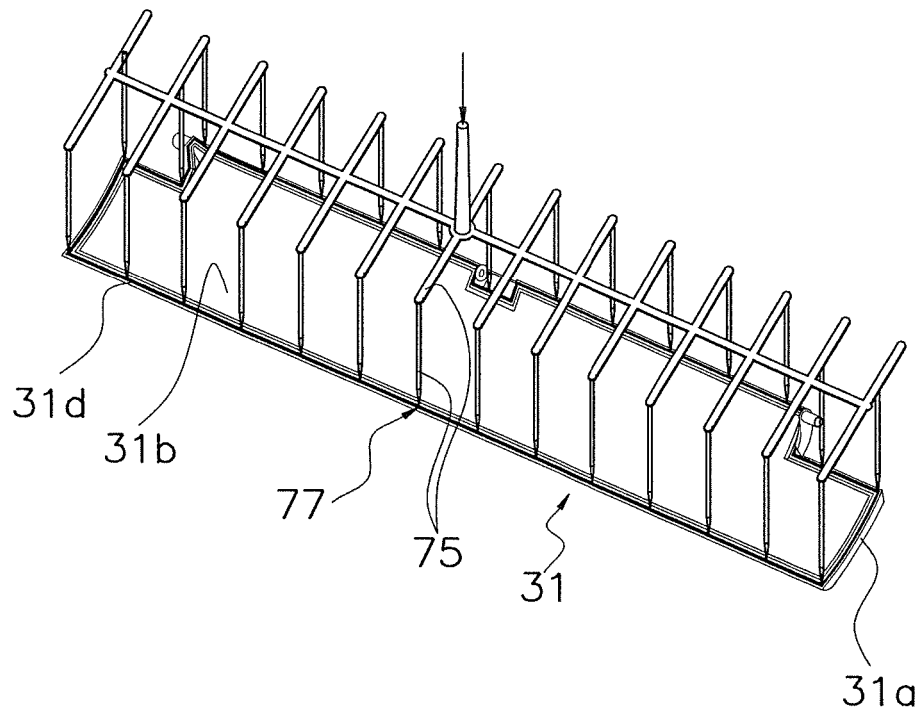


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/071035

A. CLASSIFICATION OF SUBJECT MATTER

F24F13/14(2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F13/14

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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.
Y A	JP 11-37536 A (Fujitsu General Ltd.), 12 February 1999 (12.02.1999), paragraphs [0006], [0014], [0025], [0026] (Family: none)	1-3, 5 4, 6
Y	JP 2004-347264 A (Sharp Corp.), 09 December 2004 (09.12.2004), paragraphs [0023], [0025] to [0027], [0029]; fig. 1 to 4 (Family: none)	1-3, 5
Y	JP 2009-63275 A (Panasonic Corp.), 26 March 2009 (26.03.2009), paragraphs [0009] to [0013] (Family: none)	5

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

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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

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Date of the actual completion of the international search
04 September, 2013 (04.09.13)Date of mailing of the international search report
17 September, 2013 (17.09.13)Name and mailing address of the ISA/
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Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/071035

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 11-270896 A (Toshiba Corp., Toshiba AVE Co., Ltd.), 05 October 1999 (05.10.1999), paragraphs [0028], [0029]; fig. 6 (Family: none)	1
A	JP 10-272527 A (Hitachi, Ltd.), 13 October 1998 (13.10.1998), entire text; all drawings (Family: none)	1-3

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009014289 A [0003] [0082]