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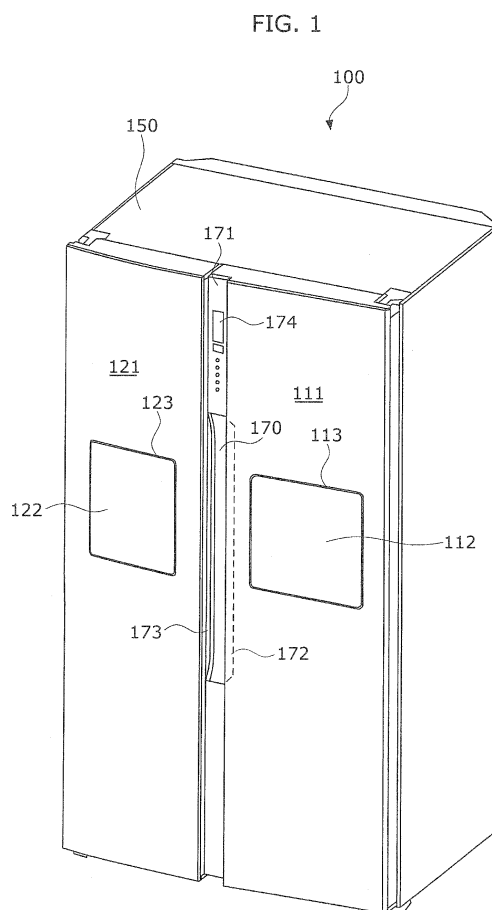
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(54) **REFRIGERATOR**

(57) Functions and design of a refrigerator are improved at the same time. A refrigerator (100) includes a main body with heat-insulating property, having an opening at a front face, and a first door (111) and a second door (121) on the right and left, in which the first door (111) includes: a cutaway (170) provided at a front side of a free-end side end portion from an upper end portion to a lower end portion; a covering member (101) which is made of resin integrally covering a front face facing the cutaway (170) and a free-end side end face facing the cutaway (170), and provided from the upper end portion to the lower end portion, and the covering member (101) includes: a concave (172) recessed toward the axis of the first door (111) at the free-end side end face portion facing the cutaway (170) and at an intermediate portion in vertical direction, and is for inserting fingers when opening the first door (111).



Description

[Technical Field]

[0001] The present invention relates to refrigerators, and particularly to a refrigerator having two storage compartments arranged on the right and left, and two doors covering the storage compartments such that the door is capable of opening and closing.

[Background Art]

[0002] There is a conventional refrigerator having a vertically long cuboid shape, and in which an intermediate portion in the width direction is partitioned by a wall, and different types of storage compartments are provided on the right and left. In such a refrigerator, one of the storage compartments serves as a refrigerator compartment, and the other storage compartment serves as a freezer compartment. The storage volume of the refrigerator compartment is set to be larger than the freezer compartment by taking a width of the refrigerator compartment wider than the width of the freezer compartment. This refrigerator includes two doors, namely, a door for opening and closing the refrigerator compartment and a door for opening and closing the freezer compartment. These two doors are large, and a large force is necessary for opening and closing the door. For this reason, a handle that can be firmly grabbed is provided projecting from the front face of the door (for example, see FIG. 1 in Patent Literature 1).

[Citation List]

[Patent Literature]

[0003]

[Patent Literature 1] Japanese Unexamined Patent Application Publication No. 2003-207263

[Summary of Invention]

[Technical Problem]

[0004] However, the handle projecting from the front face of the refrigerator may be uncomfortable for the user when the handle touches the user's arm, for example. Furthermore, the refrigerator is usually installed in the kitchen, and the handle may interrupt work at the kitchen.

[0005] Furthermore, the handle greatly affects the design of the entire refrigerator, making it difficult to significantly change the design of the refrigerator.

[0006] In response to these problems, the inventors of the present invention have suggested another refrigerator without a projecting handle for opening and closing the door. Furthermore, after diligent experiments and research, the inventors have found a more preferable em-

bodiment for a door without a projecting handle with respect to a portion for placing the user's fingers when opening and closing the door and the part around that portion.

[0007] The present invention has been conceived in view of the findings, and it is an object of the present invention to provide a refrigerator which includes a door facilitating the assembly and manufacturing, and is capable of easily changing design without affecting the capability of the door for a refrigerator.

[Solution to Problem]

[0008] In order to achieve the abovementioned object, the refrigerator according to the present invention is a refrigerator including: a main body with heat-insulating property, having an opening at a front face; a partition for partitioning an inside of the main body into a left part and a right part to form a first storage compartment and a second storage compartment having a smaller width than the first storage compartment; a first door having an axis vertically extending in front of a side wall of the main body, and for covering the first storage compartment such that the first door opens and closes by swinging; and a second door having an axis vertically extending in front of a side wall of the main body, and for covering the second storage compartment such that the second door opens and closes by swinging, in which the first door includes: a cutaway provided at a front side of a free-end side end portion from an upper end portion to a lower end portion; a covering member which is made of resin integrally covering a front face facing the cutaway and a free-end side end face facing the cutaway, and provided from the upper end portion to the lower end portion, and the covering member includes: a concave recessed toward the axis of the first door at the free-end side end face portion facing the cutaway and at an intermediate portion in vertical direction, and is for inserting fingers when opening the first door.

[0009] With this, the concave for inserting the fingers when opening and closing the door is formed by resin, allowing arbitrarily and easily designing and implementing the shape of the concave. Furthermore, since the concave is provided on the covering member integrally covering the front face facing the cutaway and the free-end side end face, it is possible for the covering member made of resin to work against foaming pressure of the heat-insulating material when manufacturing the door.

[0010] It is preferable that the first door further includes a reinforcing member for latching the covering member from inside of the first door to reinforce the covering member, the reinforcing member being provided from the upper end portion to the lower end portion.

[0011] With this, it is not necessary to manufacture a covering member with high strength, and it is possible to increase the flexibility in designing the covering member. Furthermore, since the covering member is reinforced from a hidden part, it is possible to use a reinforcing mem-

ber suitable for reinforcing the strength only. Accordingly, it is possible to freely design the shape and material of the reinforcing member.

[0012] Furthermore, it is preferable that the covering member is formed by joining a plurality of members in vertical direction.

[0013] This facilitates manufacturing of the covering member, since it is possible to use short member even when the width of the door in vertical direction is long. This also facilitates handling and complementing of the members. Furthermore, each member can serve for different functions such as the concave provided on a member to be arranged at the intermediate portion, and thereby improving the flexibility in design.

[0014] It is preferable that the first door further includes a holding member for latching the covering member including the plurality of members from inside of the first door to integrally hold the covering member, the holding member being provided from the upper end portion to the lower end portion.

[0015] With this, upon manufacturing the door, it is possible to handle the members integrally in a state joined by the holding member, thereby facilitating the manufacturing of the door. Furthermore, it is possible to prevent the members from being separated by the foaming pressure of the heat-insulating material when manufacturing the door. In the state where the manufacturing of the door is completed, it is possible to maintain the joining by the holding member in vertical direction, improving the strength of the door.

[0016] Note that, the reinforcing member and the holding member may be implemented as one member. More specifically, the reinforcing member may hold each member, or the holding member may reinforce the strength of the covering member.

[0017] Furthermore, it is preferable that a decorative member covering a front face of the covering member is included.

[0018] With this, it is possible to improve the design of the refrigerator.

[0019] It is preferable that the first door further includes: an upper end member covering an upper end portion of the first door and for latching onto the covering member; and a lower end member covering a lower end portion of the first door.

[0020] With this, even when a member (for example, a metal plate on the surface) comprising the door significantly changed due to temperature with respect to the covering member made of resin which extends and contracts less in response to the change in temperature, it is possible to prevent the covering member from being distorted or damaged by pulling.

[0021] It is preferable that the lower end portion of the covering member and a part of the lower end member are arranged to overlap with each other.

[0022] With this, even when the position of the covering member is displaced in vertical direction due to extension and contraction of the other part of the door with respect

to the lower end member, it is possible to prevent the gap between the lower end member and the covering member. Therefore, it is possible to maintain the design of the refrigerator.

[Advantageous Effects of Invention]

[0023] According to the present invention, it is possible to provide a refrigerator without a handle projecting at the front face.

[Brief Description of Drawings]

[0024]

[FIG. 1] FIG. 1 is a perspective view illustrating an external appearance of a refrigerator.

[FIG. 2] FIG. 2 is a perspective view illustrating an external appearance of the refrigerator with the first door and the second door open.

[FIG. 3] FIG. 3 is a perspective view illustrating only the first door.

[FIG. 4] FIG. 4 is a view schematically illustrating a cross-section of a part near the cutaway of the first door in the horizontal direction.

[FIG. 5] FIG. 5 is a perspective view of a covering material before assembly.

[FIG. 6] FIG. 6 is a perspective view of a covering material after assembly.

[FIG. 7] FIG. 7 is a perspective view illustrating only the second door.

[FIG. 8] FIG. 8 is a perspective view illustrating the first door 111 for assembly.

[Description of Embodiments]

[0025] An embodiment of a refrigerator according to the present invention shall be described with reference to the drawings.

[0026] FIG. 1 is a perspective view illustrating the external appearance of the refrigerator.

[0027] FIG. 2 is a perspective view illustrating the external appearance of the refrigerator with the first door and the second door open.

[0028] As illustrated in these drawings, the refrigerator 100 includes a main body 150, a partition 153, a first door 111, a second door 121, a third door 112, a through hole 113, a third door 112, a fourth door 122, a cutaway 170, an interface device 171, a concave 172, and a second concave 173.

[0029] The main body 150 is a box with an opening at a front face, and has heat-insulating property blocking the exchange of heat between the inside and the outside of the refrigerator 100.

[0030] The partition 153 is a wall partitioning the inside of the main body 150 into the left part and the right part. In this Embodiment, the right side of the partition 153 in the main body 150 is a first storage compartment 151,

which is a refrigerator compartment. Meanwhile, the left side of the partition 153 inside of the main body 150 is a second storage compartment 152, and is a freezer compartment narrower than the refrigerator compartment in width. The partition 153 is a wall partitioning the refrigerator compartment and the freezer compartment, and has heat-insulating property.

[0031] The through hole 113 is a hole through the first door 111 in the thickness direction. The through hole 113 is a hole for taking out the items stored behind the first door 111 and taking the items into the storage compartment for storing behind the first door 111, without opening the first door 111.

[0032] The third door 112 is a door freely opens and closes the through hole 113. In this Embodiment, the third door 112 is attached to the first door 111 by a hinge (not illustrated) such that the third door 112 pivots with an axis laterally extending at the lower end of the through hole 113 as the center. The third door 112 is substantially square-shaped when view from front (with rounded corners), and the axis passes through the lower end portion of the third door 112.

[0033] The fourth door 122 is a door freely opens and closes at a receiving space 123 for receiving ice supplied from the inside of the refrigerator 100 and other items.

[0034] FIG. 3 is a perspective view illustrating only the first door.

[0035] The first door 111 is a door which freely opens and closes at the opening on the right side of the user when facing the main body 150. In this Embodiment, the first door 111 is attached to the main body 150 in front of the wall on the right side of the main body 150 by a hinge (not illustrated) such that the first door 111 pivots with a vertically extended axis as the center. The first door 111 is rectangular when viewed from front, and the axis passes through a right end portion of the first door 111.

[0036] FIG. 4 is a view schematically illustrating a cross-section of a part near the cutaway of the first door in the horizontal direction.

[0037] As illustrated in FIG. 4, the first door 111 includes a cutaway 170 and a concave 172 which exist as space. The first door 111 also includes a covering member 101, a reinforcing member (holding member) 102, a decorative member 103, an inner wall 104, an outer wall 105, and a heat-insulating member 106.

[0038] The cutaway 170 (the portion illustrated in chain line in FIG. 4) is provided at the front side of the free-end side end portion of the first door 111, that is, at a front side of the first door 111 on a side opposite to the first door 111 in a width direction of the axis, and is a space provided extending in vertical direction. In this Embodiment, the cutaway 170 has a quadrangular prism shape, and is provided vertically along the first door 111. The width of the cutaway 170 is set at a length which allows the user to insert his fingers, is sufficient for bending the inserted fingers to insert to the concave 172, and for preventing the fingers from hitting the free end of the second

door 121 when inserting the fingers 172 to open the first door 111.

[0039] Note that, it is not necessary to form the cutaway 170 by removing the existing free-end side end portion of the first door 111, but the cutaway 170 may be created as a result of forming the first door 111.

[0040] As such, providing the cutaway 170 at the first door 111 which is relatively wide gives an impression to the user that two doors of similar widths are symmetrically arranged when viewing the refrigerator 100 from front with the doors closed, improving the design of the refrigerator 100.

[0041] Furthermore, since the cutaway 170 exists near the end portion of the partition 153, it is possible to suppress the reduction in the heat-insulating property of the entire first door 111 expeditiously even when the thickness of the first door 111 is thinner.

[0042] The concave 172 is provided at the free-end side end face portion of the first door 111, is recessed from the cutaway 170 toward the axis of the first door 111, and is formed by the covering member 101. The concave 172 has a width that allows the user to insert his fingers to a depth up to approximately second joints.

[0043] The covering member 101 is a member made of resin integrally covering the front face f facing the cutaway 170 and a free-end side end face e facing the cutaway 170, and is provided from the upper end portion to the lower end portion of the first door 111. Furthermore, the covering member 101 has a concave 172 at the free-end side end face portion facing the cutaway 170 and an intermediate portion in the vertical direction. The concave 172 is recessed toward the axis of the first door 111 and is a portion to which the fingers are inserted when opening and closing the first door 111.

[0044] Furthermore, the covering member 101 includes a first insertion portion 131, a second insertion portion 132, and a third insertion portion 133.

[0045] The first insertion portion 131 is a portion to which the end portion of the decorative member 103 is inserted to join the covering member 101 and the decorative member 103.

[0046] The second insertion portion 132 is a portion to which the end portion of the outer wall 105 is inserted to join the covering member 101 and the outer wall 105.

[0047] The third insertion portion 133 is a portion to which the end portion of the reinforcing member 102 is inserted to join the covering member 101 and the reinforcing member 102.

[0048] FIG. 5 is a perspective view illustrating the covering member before assembly.

[0049] FIG. 6 is a perspective view illustrating the covering member after assembly.

[0050] As illustrated in these drawings, in this Embodiment, the covering member 101 is divided into three members, namely, a first covering member 141, a second covering member 142, and a third covering member 143.

[0051] The first covering member 141 composes the uppermost portion of the covering member 101, and has

an attachment hole 145 for attaching an interface housing member 144 for encasing an interface device for controlling the refrigerator 100. The first covering member 141 integrally covers the front face facing the cutaway 170 and the free-end side end face to fill the cutaway 170.

[0052] The second covering member 142 composes an intermediate part of the covering member 101, and in which the concave 172 is provided. Note that, the cross-sectional view illustrated in FIG. 4 is a cross-section of the second covering member 142.

[0053] The third covering member 143 composes the lowermost part of the covering member 101.

[0054] Note that, the decorative member 103 is to be attached to the front faces of the second covering member 142 and the third covering member 143. The third covering member 143 integrally covers the front face facing the cutaway 170 and the free-end side end face to fill the cutaway 170.

[0055] The reinforcing member 102 latches the covering member 101 from the inside of the first door 111, and is for reinforcing the covering member 101. The reinforcing member 102 is provided integrally from the upper end portion to the lower end portion of the first door 111, and latches the covering member 101 at multiple points, as illustrated in FIG. 6. In this Embodiment, the reinforcing member 102 is a C-channel made of metal, and is arranged to surround three sides of the concave 172 provided at the covering member 101. With this, the reinforcing member 102 can receive the force from the fingers inserted into the concave 172 when opening the first door 111.

[0056] Furthermore, the reinforcing member 102 joins multiple members (the first covering member 141, the second covering member 142, and the third covering member 143) in vertical direction by latching the covering member 101. To put it differently, in this Embodiment, the reinforcing member 102 also serves as a holding member for integrally holding the covering member 101.

[0057] Furthermore, the reinforcing member 102 also contributes to increase the strength of the first door 111 which is vertically long, particularly the strength against twisting.

[0058] The decorative member 103 covers the front face of the covering member 101. The decorative member 103 is attached to the surface of the covering member 101 to improve the design of the refrigerator 100. With this, it is possible to use the covering member 101 for securing mechanical strength, and to use the decorative member 103 for appearance, for example, and thereby increasing the flexibility in design.

[0059] As illustrated in FIG. 4, the inner wall 104 is a member made of resin covering the back end face of the first door 111. The inner wall 104 is arranged at a position facing the first storage compartment 151, and is joined with the end portion of the covering member 101 by adhesive.

[0060] The outer wall 105 covers a front end face of the first door 111. In this Embodiment, the outer wall 105

is a thin metal plate, and a free-end side of the outer wall 105 is bent, forming a part of the free-end side end face portion of the first door 111. The end portion of the outer wall 105 is inserted into the second insertion portion 132 of the covering member 101 to join the covering member 101.

[0061] The heat-insulating member 106 is foamed resin filled into the space surrounded by the covering member 101, the inner wall 104, the outer wall 105, an upper end member, and a lower end member which shall be described later. The heat insulating member 106 is a member securing heat-insulating property of the first door 111.

[0062] FIG. 7 is a perspective view illustrating only the second door.

[0063] As illustrated in FIG. 7 and FIG. 1, the second door 121 is a door which freely opens and closes at the opening on the left of the user when facing the main body 150. In this Embodiment, the second door 121 is attached to the main body 150 in front of the wall on the left side of the main body 150 by a hinge (not illustrated) such that the second door 121 pivots with a vertically extended axis as the center. The second door 121 is rectangular when viewed from front, and the axis passes through a left end portion of the second door 121. Furthermore, the second door 121 has a second concave 173.

[0064] The second concave 173 is a portion provided at the free-end side end face portion of the second door 121 and is recessed from the cutaway 170 toward the axis of the second door 121. The second concave 173 has a width that allows the user to insert his fingers to a depth that allows the insertion up to the second joints.

[0065] As illustrated in FIG. 1, the interface device 171 is housed in the interface housing member 144 attached to the covering member 101. The interface device 171 is a device for communicating information between the user and the refrigerator 100.

[0066] For example, the interface device 171 has a display device displaying the temperature inside of the refrigerator 100, and is for sending the information of the refrigerator 100 to the user. The interface device 171 also includes a switch for setting a target temperature for the user to adjust the temperature of the refrigerator 100.

[0067] FIG. 8 is a perspective view illustrating the first door 111 for assembly.

[0068] As illustrated in FIG. 8, the first door 111 includes an upper end member 107 and a lower end member 108.

[0069] The upper end member 107 composes an upper end portion of the first door 111, and when the first door 111 is assembled, the upper end member 107 latches the outer wall 105, and the upper end member 107 latches the upper end of the covering member 101. Accordingly, the covering member 101 is joined with the outer wall 105 via the upper end member 107.

[0070] The lower end member 108 composes the lower end portion of the first door 111, and when the first door 111 is assembled, the lower end member 108 latch-

es the outer wall 105, but the lower end member 108 does not latch the covering member 101.

[0071] As such, when the outer wall 105 extends or shrinks due to temperature change, a position of the covering member 101 which is less susceptible to the change in shape due to temperature change is only displayed in the vertical direction following the change in the position of the upper end portion of the outer wall 105. Thus, it is possible to prevent the covering member 101 from being skewed or to prevent the joining from breaking by stress from the outer wall 105.

[0072] Furthermore, the lower end member 108 has an upright portion 146 at the end portion.

[0073] The upright portion 146 is arranged to cover the front of the lower end portion of the covering member 101 when the first door 111 is assembled.

[0074] As such, the lower end portion of the covering member 101 and the upright portion 146 which is a part of the lower end member 108 are arranged to overlap with each other. Thus, even if the position of the covering member 101 with respect to the lower end member 108 is displaced by the outer wall 105 extending or shrinking; it is possible to prevent a gap between the lower end member 108 and the covering member 101. Therefore, it is possible to maintain the design of the refrigerator.

[0075] The first door 111 is assembled as illustrated in FIG. 8 using a jig, and the heat-insulating member 106 before foaming is filled into the gap. Next, the inner wall 104 attached to the jig is arranged to cover the gap. After that, the heat-insulating member 106 filled before is fully foamed, completing the manufacturing of the first door 111.

[0076] As such, according to the refrigerator 100 in this Embodiment, providing the cutaway 170 at the first door 111 which is relatively wide allows reduction in the weight of the first door 111. Furthermore, since the cutaway 170 is provided at the free-end side end portion of the first door 111 which is farthest from the axis, it is possible to reduce the moment of the first door 111, allowing lightly opening and closing the first door 111. Since the partition 153 exists at the back of the free-end side end portion at which the cutaway 170 is provided, it is possible to reduce the weight of the first door 111 without significantly lowering the heat-insulating capacity of the refrigerator 100 even if the cutaway is provided at the first door 111.

[0077] By covering the front face and the free-end side end face facing the cutaway 170 with the covering member producing these effects with the covering member 101, and attaching the decorative member 103, it is possible to improve the design of the refrigerator 100. Furthermore, since the covering member 101 is made of resin, it is possible to form a complex shape relatively easily, allowing manufacturing a large volume of members in the same shape. Accordingly, the covering member 101 with the shape having the concave 172 can be easily manufactured.

[0078] Therefore, it is possible to increase the flexibility in designing the member covering the portions facing the

cutaway 170, and to use the covering member 101 which is both functional and well-designed.

[Industrial Applicability]

[0079] The present invention is applicable to refrigerators, and is particularly applicable to a refrigerator having a freezer compartment and a refrigerator compartment divided on the right and left.

[Reference Signs List]

[0080]

100	Refrigerator
101	Covering member
102	Reinforcing member
103	Decorative member
104	Inner wall
105	Outer wall
106	Heat-insulating member
107	Upper end member
108	Lower end member
111	First door
112	Third door
113	Through hole
121	Second door
122	Fourth door
123	Receiving space
131	First insertion portion
132	Second insertion portion
133	Third insertion portion
141	First covering member
142	Second covering member
143	Third covering member
144	Interface housing member
145	Attachment hole
146	Upright portion
150	Main body
151	First storage compartment
152	Second storage compartment
153	Partition
170	Cutaway
171	Interface device
172	Concave
173	Second concave

Claims

1. A refrigerator comprising:

a main body with heat-insulating property, having an opening at a front face;
a partition for partitioning an inside of said main body into a left part and a right part to form a first storage compartment and a second storage compartment having a smaller width than said

first storage compartment;
 a first door having an axis vertically extending
 in front of a side wall of said main body, and for
 covering said first storage compartment such
 that said first door opens and closes by swing- 5
 ing; and
 a second door having an axis vertically extend-
 ing in front of a side wall of said main body, and
 for covering said second storage compartment
 such that said second door opens and closes 10
 by swinging,
 wherein said first door includes:

a cutaway provided at a front side of a free-
 end side end portion from an upper end por- 15
 tion to a lower end portion;
 a covering member which is made of resin
 integrally covering a front face facing said
 cutaway and a free-end side end face facing 20
 said cutaway, and provided from the upper
 end portion to the lower end portion, and
 said covering member includes:

a concave recessed toward the axis of
 said first door at the free-end side end 25
 face portion facing said cutaway and at
 an intermediate portion in vertical direc-
 tion, and is for inserting fingers when
 opening said first door. 30

2. The refrigerator according to Claim 1,
 wherein said first door further includes
 a reinforcing member for latching said covering
 member from inside of said first door to reinforce
 said covering member, said reinforcing member be- 35
 ing provided from the upper end portion to the lower
 end portion.
3. The refrigerator according to Claim 1 or 2,
 wherein said covering member is formed by joining 40
 a plurality of members in vertical direction.
4. The refrigerator according to Claim 3,
 wherein said first door further includes
 a holding member for latching said covering member 45
 comprising said plurality of members from inside of
 said first door to integrally hold said covering mem-
 ber, said holding member being provided from the
 upper end portion to the lower end portion. 50
5. The refrigerator according to Claim 1, further com-
 prising
 a decorative member covering a front face of said
 covering member. 55
6. The refrigerator according to Claim 1,
 wherein said first door further includes:

an upper end member covering an upper end
 portion of said first door and for latching onto
 said covering member; and
 a lower end member covering a lower end por-
 tion of said first door.

7. The refrigerator according to Claim 6,
 wherein a lower end portion of said covering member
 and a part of said lower end member are arranged
 to overlap with each other.

FIG. 1

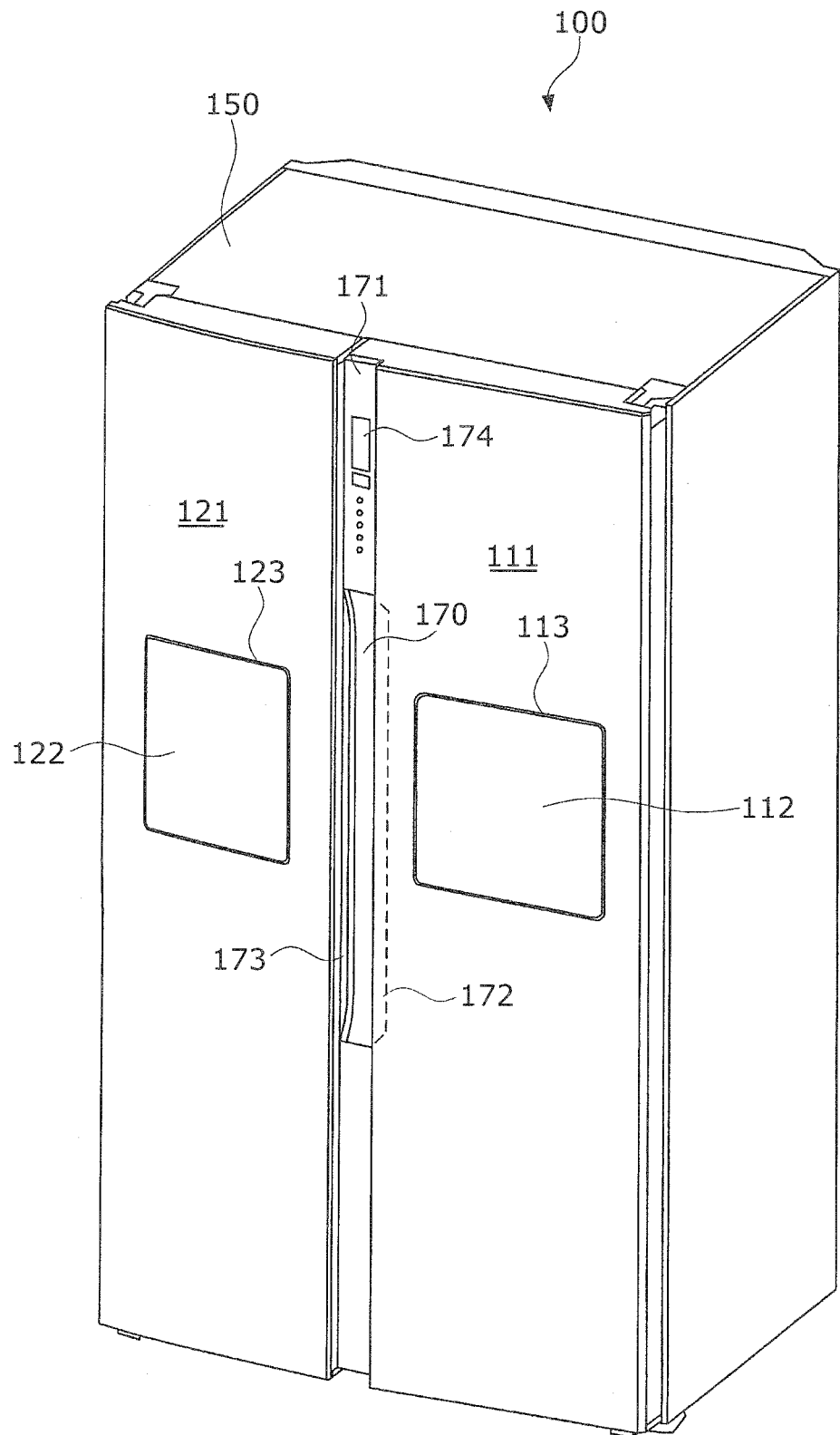


FIG. 2

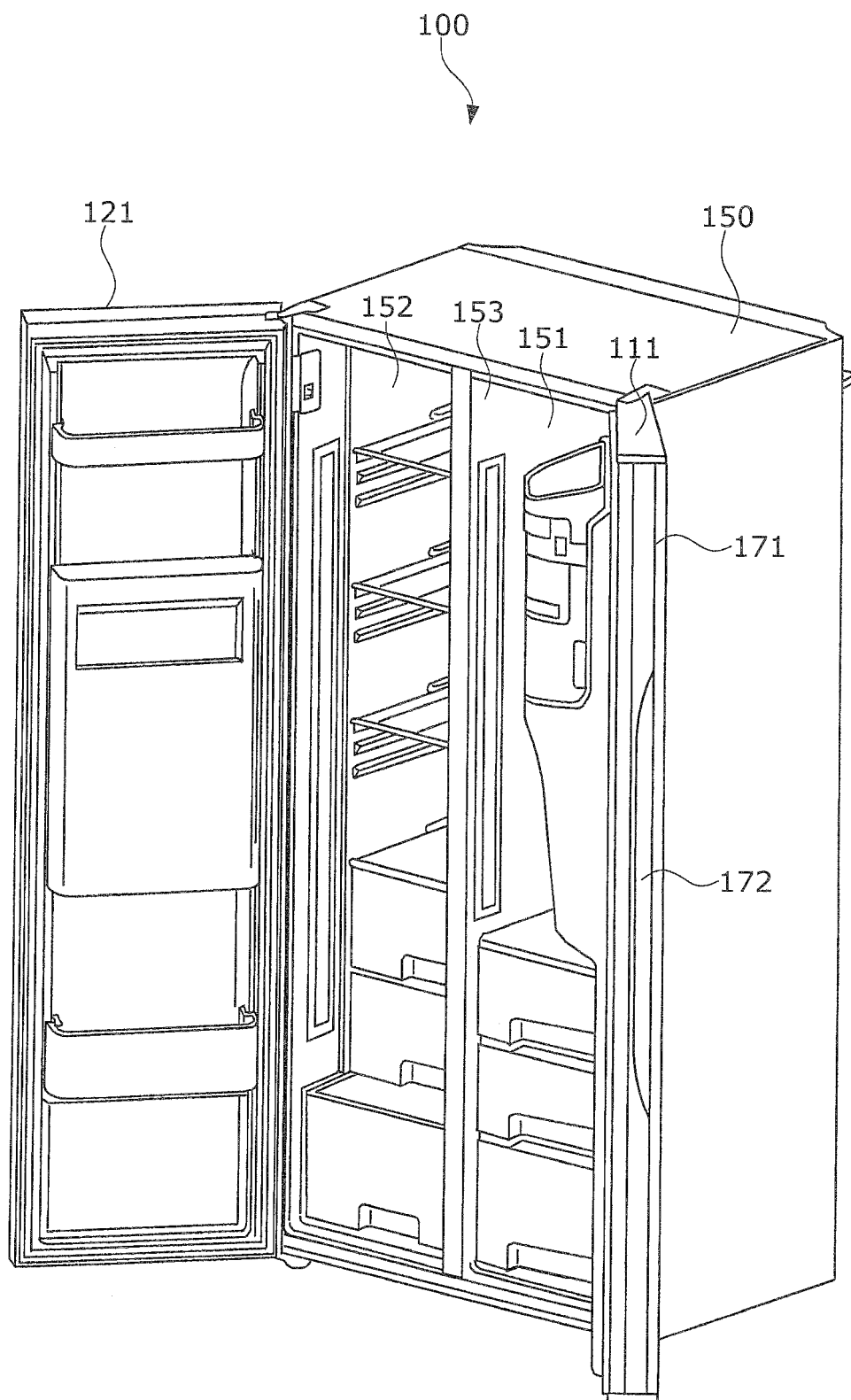


FIG. 3

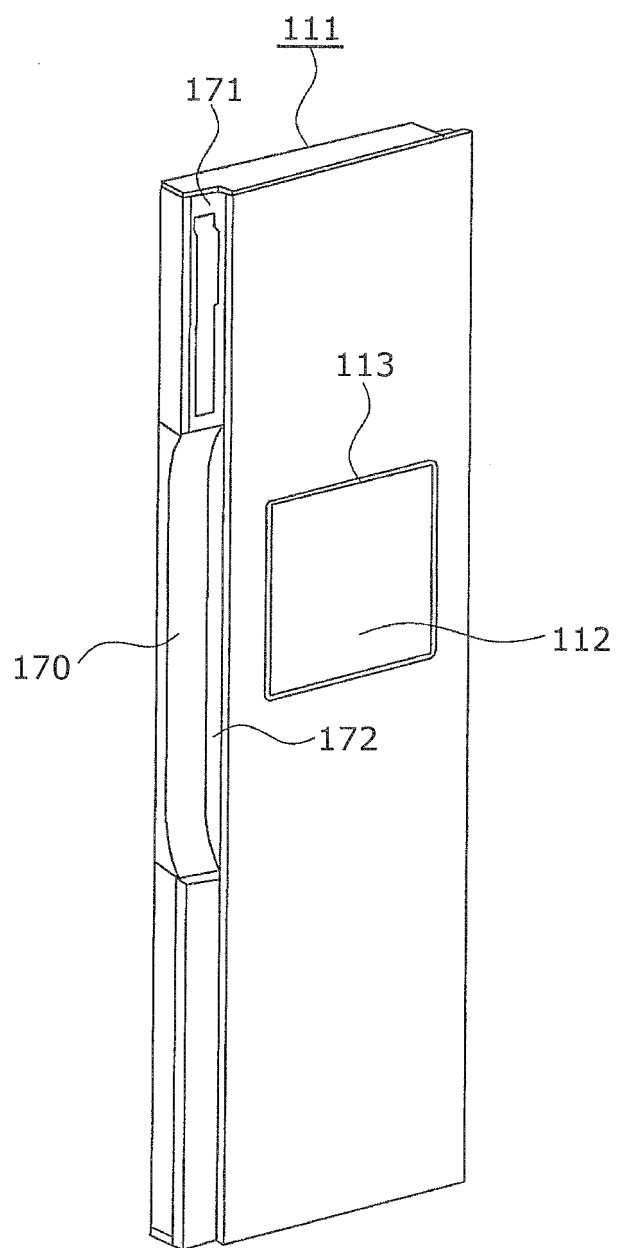


FIG. 4

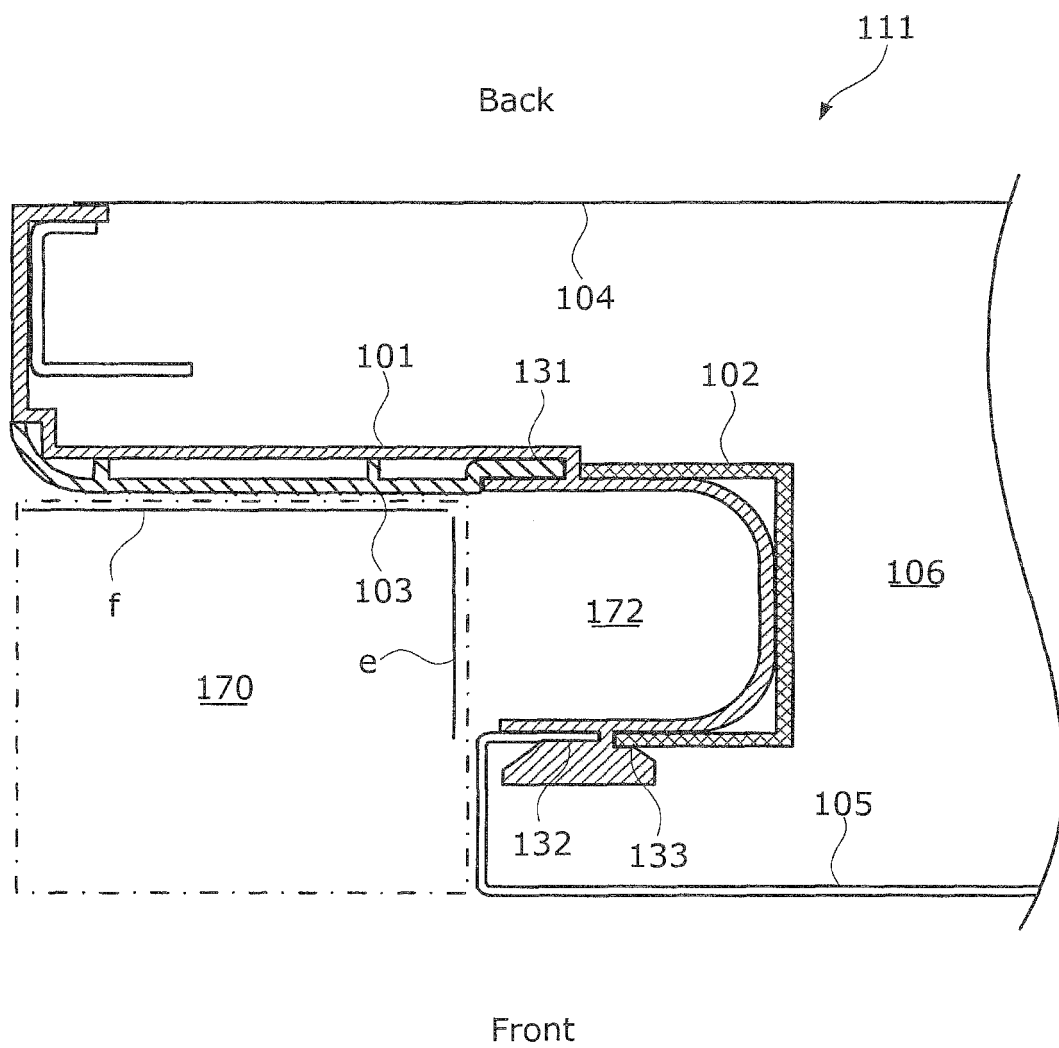


FIG. 5

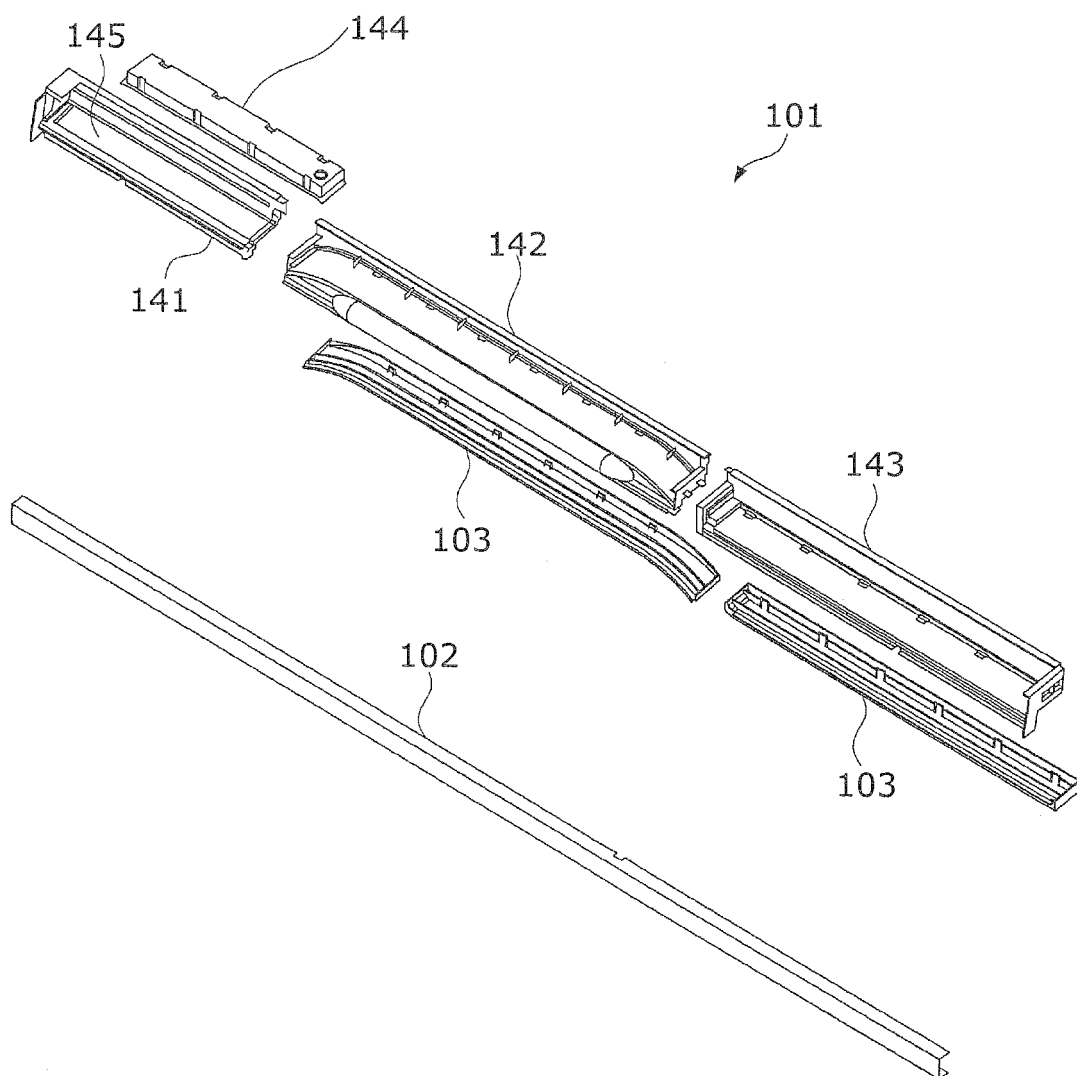


FIG. 6

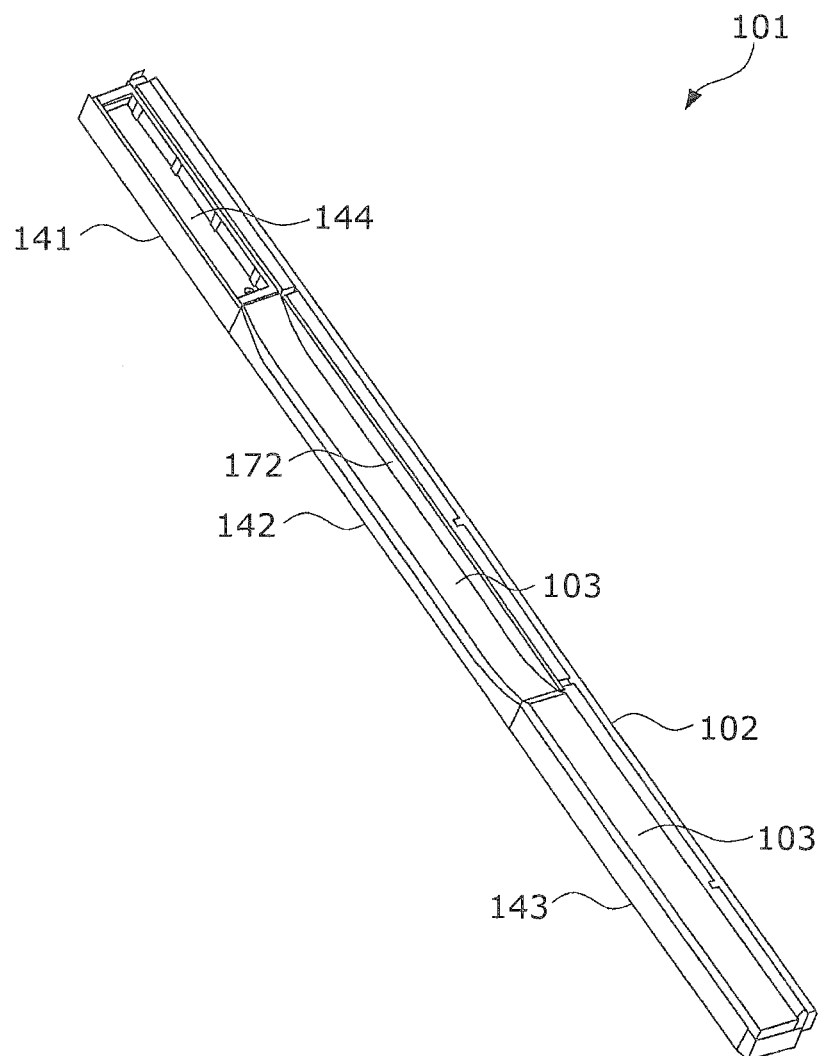


FIG. 7

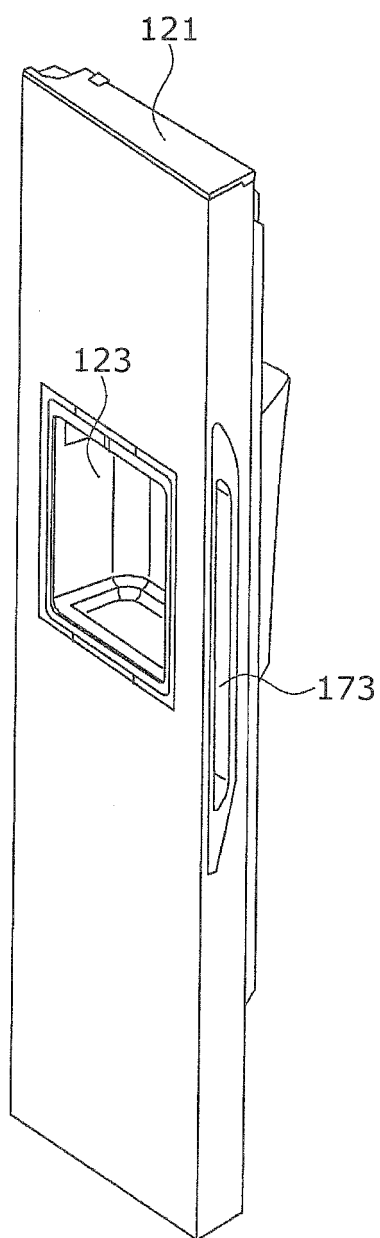
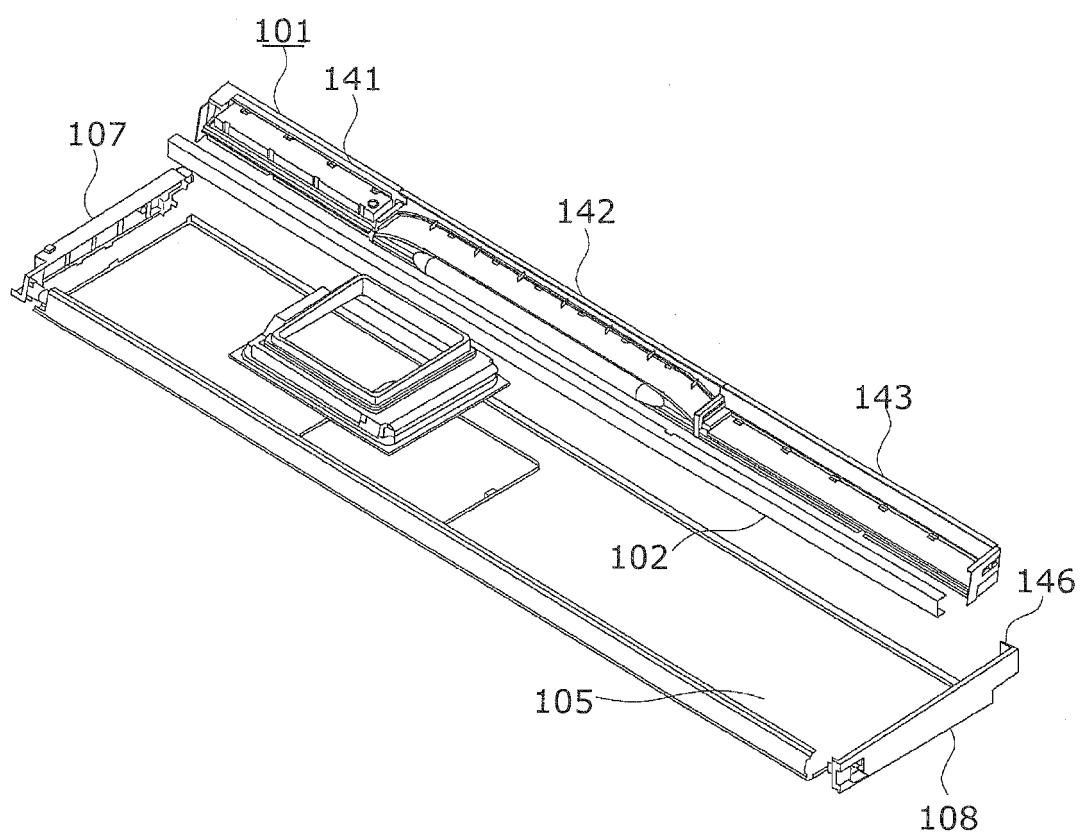


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/001489

A. CLASSIFICATION OF SUBJECT MATTER

F25D23/02 (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)

F25D23/02

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 1996-2010

Kokai Jitsuyo Shinan Koho 1971-2010 Toroku Jitsuyo Shinan Koho 1994-2010

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.
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Y	JP 2006-046837 A (Mitsubishi Electric Corp.), 16 February 2006 (16.02.2006), entire text; all drawings & CN 1731053 A & TW 287611 B	1-7

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

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2-275279 A (Toshiba Corp.), 09 November 1990 (09.11.1990), entire text; all drawings (Family: none)	1-7
Y	JP 2003-247774 A (Hitachi, Ltd.), 05 September 2003 (05.09.2003), paragraphs [0043] to [0047]; fig. 11, 12 (Family: none)	1-7
Y	JP 2001-153538 A (Toshiba Corp.), 08 June 2001 (08.06.2001), entire text; all drawings (particularly, paragraph [0024]; fig. 1, 6) (Family: none)	1-7

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- JP 2003207263 A [0003]