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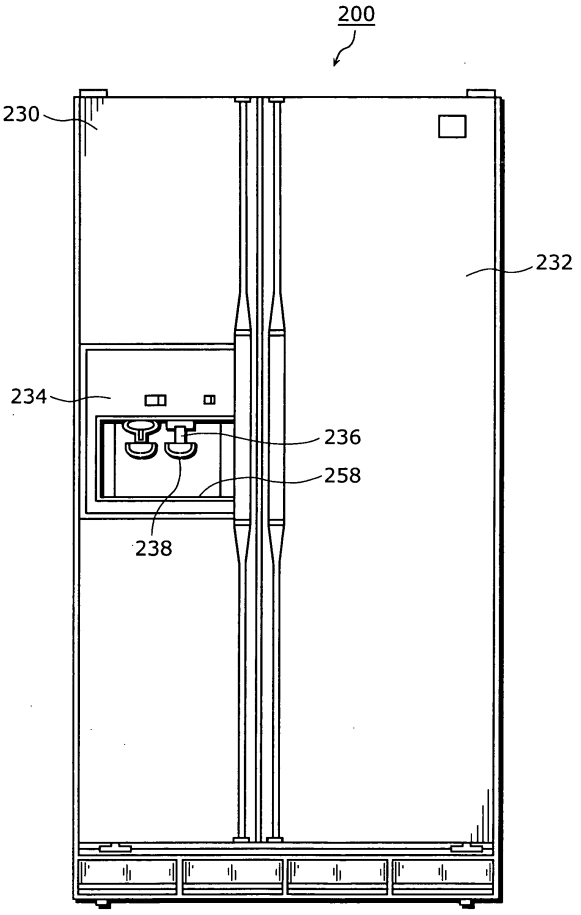
(54) Refrigerator

(57) The refrigerator (100) includes: a heat-insulating main body (150) having an opening in a front surface; a main door (121) which covers the opening with flexibility in opening and closing; a supply apparatus (124) which supplies a storage item stored inside the heat-insulating main body (150) to an outside of the heat-insulating main body; and a supply opening (123) which is a concavity formed in the front surface of the main door (121) and is connected to the supply apparatus (124), and the refrigerator further includes a subdoor (122) which covers the supply opening (123) with flexibility in opening and closing.

FIG. 1



EP 2 159 522 A1

Description

BACKGROUND OF THE INVENTION

(1) Field of the Invention

[0001] The present invention relates to a refrigerator, and relates particularly to a refrigerator including a supply apparatus which supplies cold water and so on to the outside.

(2) Description of the Prior Art

[0002] Conventionally, some refrigerators include a supply apparatus which supplies cold water and so on to the outside. The supply apparatus, or an apparatus made up of the supply apparatus, members forming a supply opening and so on is referred to as a dispenser.

[0003] Techniques relating to refrigerators including dispensers have been disclosed (for example, Patent-Reference 1: US5,033,273).

[0004] FIG. 1 is an elevation view of a conventional refrigerator disclosed in Patent-Reference 1.

[0005] A conventional refrigerator 200 shown in FIG. 1 includes a refrigerator compartment on the observers' right and a freezer compartment on the observers' left. In addition, the refrigerator 200 includes a refrigerator-compartment door 232 and a freezer-compartment door 230.

[0006] The freezer-compartment door 230 includes a dispenser 234 which supplies cold water and ice to the outside. The dispenser 234 includes a supply opening 258 that opens outwardly. The supply opening 258 includes a faucet 236 and a lever 238.

[0007] Note that a supply apparatus which generates cold water and ice is attached to the back surface of the freezer-compartment door 230.

[0008] For example, the supply apparatus supplies cold water or ice to the faucet 236 by a user of the refrigerator 200 pressing the lever 238 with a glass. With this, water or ice is poured into the glass.

[0009] In the conventional refrigerator 200 described above, however, the supply opening 258 is externally exposed. Because of this, for example, the supply opening 258 is liable to collect dust, causing problems from the standpoint of hygiene.

SUMMARY OF THE INVENTION

[0010] Thus, the present invention is conceived in view of the above conventional problem, and it is an object of the present invention to provide a refrigerator which includes a supply apparatus supplying storage items to the outside, and which can keep the supply opening in good hygienic conditions.

[0011] In order to achieve the above object, the refrigerator of the present invention includes: a heat-insulating main body having an opening in a front surface; a main door which covers the opening with flexibility in opening and closing; a supply apparatus which supplies a storage item to an outside of the heat-insulating main body, the storage item being stored inside the heat-insulating main body; and a supply opening which is a concavity formed in the front surface of the main door and is connected to the supply apparatus, and the refrigerator further includes a subdoor which covers the supply opening with flexibility in opening and closing.

[0012] According to the structure, a subdoor covers the supply opening through which to supply to the outside, for example, cold water that is a storage item. This prevents the supply opening from collecting dust, and can keep the supply opening in good hygienic conditions.

[0013] In addition, by covering the supply opening with the subdoor, it is possible, for example, to reduce heat coming into the freezer compartment through a continuous hole connecting the supply opening and the supply apparatus. With this, it is possible to equalize the temperature inside, thereby reducing power consumption.

[0014] In addition, it is possible to make the main-door front appear flat in shape since the supply opening, which is a concavity formed in the main door, is covered by the subdoor.

[0015] In addition, the subdoor may be turnably attached to the main door, and a horizontal axis of the subdoor may be provided in a lower-end portion of the subdoor, and the refrigerator may further include: a stopper which keeps a posture of the subdoor so that an inner surface of the subdoor becomes level when the subdoor is opened; and a damper which gives force against opening force of the subdoor.

[0016] According to this structure, it is possible, for example, to use the subdoor as a table to temporarily place a glass on, when pouring water supplied by the supply apparatus into the glass.

[0017] In addition, since the damper reduces the opening speed of the subdoor, it is possible to reduce a load that is given onto members making up the axis when the subdoor opens.

[0018] In addition, the subdoor may be detachably attached to the main door.

[0019] According to this structure, it is possible, for example, to clean up the attachment part of the subdoor, which is for attachment to the second main door, when the part becomes dusty. In other words, it is possible to keep the vicinity of the supply opening clean.

[0020] In addition, the refrigerator of the present invention may further include: a lighting unit which illuminates the supply opening; a detection unit which detects open and closed states of the subdoor; and a control unit which causes the lighting unit to turn on when the detection unit detects that the subdoor is open.

[0021] According to this structure, for example, when the refrigerator is installed in a dark room, it is possible to illuminate the supply opening when the user is supplied with cold water and so on from the supply apparatus.

[0022] In addition, the refrigerator of the present inven-

tion may further include an operating unit which operates a behavior of the supply apparatus, and the control unit may be provided at a position where the control unit becomes exposed when the subdoor is open.

[0023] According to this structure, for example, the operating unit is kept from dust and stain. In other words, the operating unit can be protected from foreign substances causing breakdown, and can also be kept clean.

[0024] In addition, the subdoor may have a heat insulation material inside.

[0025] According to this structure, it is possible, for example, to suppress the amount of heat exchange between the inside and outside of the refrigerator through the supply opening. In other words, this prevents the degradation of cooling efficiency of the refrigerator that is caused by energy loss at the supply opening.

[0026] In addition, the heat insulation material may be a vacuum insulation material.

[0027] According to this structure, for example, it becomes possible to reduce the thickness and weight of the subdoor. With this, it is possible to reduce the load onto the attachment part of the subdoor, which is for attachment to the main door.

[0028] As described above, according to the present invention, it is possible to provide a refrigerator which includes a supply apparatus supplying storage items to the outside, and which can keep the supply opening in hygienic conditions.

[0029] Accordingly, the user receiving a supply of cold water or ice from the supply apparatus in the refrigerator of the present invention can feel assured when taking the cold water, ice or the like that is supplied.

[0030] In addition, it is possible to make the main-door front appear flat in shape since the supply opening is usually covered by the subdoor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031]

FIG. 1 is an elevation view of a conventional refrigerator.

FIG. 2 is a perspective view showing an external view of the refrigerator of an embodiment.

FIG. 3 is a perspective view showing an external appearance of the refrigerator of the embodiment when a first main door and a second main door are open.

FIG. 4 is a perspective view showing an external appearance of the refrigerator of the embodiment when a first subdoor and a second subdoor are open.

FIG. 5 is an enlarged perspective view of a supply-opening portion of the refrigerator of the embodiment.

FIG. 6 is a schematic view showing the relationship between the opening and closing of the second subdoor and the ON and OFF of a lighting unit.

FIG. 7 is a schematic view showing the structure in the vicinity of the axis of the second subdoor in the embodiment.

FIG. 8 is a cross-sectional view showing a section of the second subdoor 122 in the embodiment taken along from line A-A shown in FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0032] Hereinafter, an embodiment of the refrigerator according to the present invention shall be described with reference to the drawings.

[0033] FIG. 2 is a perspective view showing an external appearance of a refrigerator 100 of the embodiment.

[0034] FIG. 3 is a perspective view showing an external appearance of the refrigerator 100 of the embodiment when a first main door 111 and a second main door 121 are open.

[0035] FIG. 4 is a perspective view showing an external appearance of the refrigerator 100 of the embodiment when a first subdoor 112 and a second subdoor 122 are open.

[0036] As these figures show, the refrigerator 100 includes: a heat-insulating main body 150, a supply apparatus 124, a first main door 111, a second main door 121, a first subdoor 112, a second subdoor 122, a through hole 113, and a supply opening 123.

[0037] The heat-insulating main body 150 is a box-shaped body having an open front surface, and has heat insulating properties that shut off heat coming in and out of the refrigerator 100.

[0038] The space inside the heat-insulating main body 150 is partitioned into right and left by a divider 153, so that two storage compartments are formed thereby. These two storage compartments are: a refrigerator compartment 151 on the observers' right and a freezer compartment 152 on the observers' left. In addition, the refrigerator compartment 151 and the freezer compartment 152 are separated by selves, cases and so on into a plurality of storage spaces.

[0039] The supply apparatus 124 is an apparatus which supplies a storage item that is stored inside the heat-insulating main body 150 to the outside of the heat-insulating main body 150. Specifically, the supply apparatus 124 generates cold water and ice, and supplies the cold water and ice through the supply opening 123 connected to the supply apparatus 124.

[0040] Note that the supply apparatus 124, or an apparatus made up of the supply apparatus 124 and the supply opening 123, is also referred to as a "dispenser."

[0041] The first main door 111 is a door which covers the opening of the refrigerator 151 with flexibility in opening and closing. In the present embodiment, the first main door 111 is attached to the heat-insulating main body 150 using a hinge (not shown) so as to turn back and forth centering on a vertical axis that extends in an anterior portion of the right-side wall of the heat-insulating main body 150. In addition, the first main door 111 is rectangular in shape as viewed from the front, with an

axis extending along the right-edge rim of the first main door 111.

[0042] The second main door 121 is an example of the main door in the refrigerator of the present invention, and is a door which covers the opening of the freezer compartment 152 with flexibility in opening and closing. In the present embodiment, the second main door 121 is attached to the heat-insulating main body 150 using a hinge (not shown) so as to turn back and forth centering on a vertical axis that extends in an anterior portion of the left-side wall of the heat-insulating main body 150. In addition, the second main door 121 is rectangular in shape as viewed from the front, with an axis extending along the left-edge rim of the second main door 121.

[0043] The through hole 113 is a hole penetrating through the first main door 111 in the thickness direction. The through hole 113 is a hole through which to take out a storage item that is stored behind the first main door 111 and to put in an item for storage behind the first main door 111, without opening the first main door 111.

[0044] The first subdoor 112 is a door which covers the through hole 113 with flexibility in opening and closing. In the present embodiment, the first subdoor 112 is attached to the fist main door 111 so as to turn centering on a horizontal axis that extends (in a direction parallel to an X-axis in FIG. 2 and so on; hereinafter, the same) at the lower end of the through hole 113. In addition, the first subdoor 112 is square in shape as viewed from the front (round-cornered), with an axis extending along the lower-end rim of the first subdoor 112.

[0045] The second subdoor 122 is an example of the subdoor in the refrigerator of the present invention, and is a door which covers the supply opening 123 with flexibility in opening and closing. In addition, as FIG. 4 shows, the second subdoor 122 is turnably attached to the second main door 121.

[0046] With the second subdoor 122 covering the supply opening 123 with flexibility in opening and closing, the amount of dust and so on intruding into the supply opening 123 is reduced as compared to a conventional refrigerator with a supply opening that is always exposed. With this, the supply opening 123 is kept under good hygienic conditions.

[0047] In addition, with the second subdoor 122 covering the supply opening 123, it is possible to reduce heat intruding into the freezer compartment 152 through a continuous hole connecting the supply opening 123 and the supply apparatus 124. With this, it is possible to equalize the temperature inside, thereby reducing power consumption.

[0048] In addition, as FIG. 4 shows, the supply opening 123 is a concavity formed in the second main door 121. However, as FIG. 2 shows, the front surface of the second main door 121 appears flat in shape when the second subdoor 122 is closed.

[0049] In other words, with the second subdoor 122 covering the supply opening 123, the refrigerator 100 impresses the user as clean and simple. This is preferable in design terms.

[0050] In addition, the refrigerator 100 includes an operating unit 125 which operates the performance of the supply apparatus 124. The user can make a selection between cold water and ice, and so on, by pressing down the button included in the operating unit 125.

[0051] In addition, as FIG. 4 shows, the operating unit 125 is attached to a position at which the operating unit 125 becomes exposed when the second subdoor 122 is open.

[0052] In other words, the operating unit 125 is not externally exposed when the second subdoor 122 is closed. With this, for example, the operating unit 125 is kept from dust and stain. In other words, with the second subdoor 122, the operating unit 125 is protected from foreign substances causing breakdown, and is therefore kept clean.

[0053] FIG. 5 is an enlarged perspective view of the supply-opening 123 portion of the refrigerator 100 of the present embodiment.

[0054] As FIG. 5 shows, the refrigerator 100 includes a lighting unit 126 which illuminates the supply opening 123. The lighting unit 126 illuminates the supply opening 123 with, for example, a Light Emitting Diode (LED).

[0055] Specifically, the ON and OFF of the lighting unit 126 is controlled by the control unit 140 that shall be described later with reference to FIG. 6.

[0056] In addition, a lever 127 is provided inside the supply opening 123. For example, the user presses the lever 127 inwards with a glass in hand, and can thereby pour into the glass, cold water or ice from a faucet (not shown) that is provided in an upper portion inside the supply opening 123.

[0057] In addition, a protruding part 122a is provided in an upper-end portion of the second subdoor 122.

[0058] When the second subdoor is closed, the protruding part 122a becomes engaged in an engagement hole (not shown) provided in the second main door 121, so that the second subdoor 122 is stopped. Thus, the supply opening 123 is covered.

[0059] In this state, the user presses the second subdoor 122 a little inwards, and thereby the engagement of the protruding part 122a in the engagement hole is released, so that the second subdoor 122 is opened.

[0060] In addition, in the lower-end portion of the second subdoor 122, a tab 122b for attachment and detachment of the second subdoor 122 is provided. An exemplary attachment and detachment mechanism of the second subdoor 122 shall be described later with reference to FIG. 7.

[0061] FIG. 6 is a schematic view showing a relationship between the opening and closing of the second subdoor 122 and the ON and OFF of the lighting unit 126 in the embodiment.

[0062] As FIG. 6 shows, the refrigerator 100 includes a control unit 140 and a detection unit 141.

[0063] In the present embodiment, the detection unit 141 is provided at a position corresponding to the upper-end portion of the second subdoor 122 in the second

main door 121.

[0064] In addition, the axis 130 of the second subdoor 122 extends horizontally (in a direction perpendicular to the page surface in FIG. 6), and is provided in a lower-end portion of the second subdoor 122. The second subdoor 122 opens and closes by turning centering on the axis 130.

[0065] The detection part 141 detects an open state of the second subdoor 122 when the second subdoor 122, which has been closed, is open, by losing contact with the upper-end portion of the second subdoor 122.

[0066] The control unit 140 causes, through control, the lighting unit 126 to turn ON when the detection unit 141 detects the open state of the second subdoor 122.

[0067] When the second subdoor 122 is completely closed from this state, the detection unit 141 detects a closed state of the second subdoor 122 by having contact with the upper end of the second subdoor 122.

[0068] The control unit 140 causes, through control, the lighting unit 126 to turn OFF, when the detection unit 141 detects the closed state of the second subdoor 122.

[0069] Note that detection of the open and closed states of the second subdoor 122 that is performed by the detection unit 141 may be mechanical or electrical.

[0070] For example, the detection unit 141 may have a probe which is biased forward and is movable back and forth.

[0071] In this case, the detection unit 141 can detect the open state of the second subdoor 122 by the probe moving forward. In addition, the detection unit 141 can detect the closed state of the second subdoor 122 by the probe returning to a predetermined position.

[0072] In addition, for example, the open and closed states of the second subdoor 122 may be detected according to whether or not conduction is present between the detection unit 141 and the second subdoor 122.

[0073] Thus, the refrigerator 100 of the embodiment includes a lighting unit 126 which illuminates the supply opening 123. The refrigerator 100 further includes a control unit 140 which controls the lighting unit 120 so that the lighting unit 120 turns ON when the second subdoor 122 is open.

[0074] With this, for example, when the refrigerator 100 is installed in a dark room, it is possible to illuminate the supply opening 123 when the user is supplied with water and so on from the supply apparatus 124.

[0075] In addition, the lighting unit 126 turns OFF when the second subdoor 122 is closed, thereby preventing wasteful power consumption of the lighting unit 126.

[0076] In addition, as the diagram on the right in FIG. 6 shows, the second subdoor 121 includes a stopper 121a which keeps the posture of the second subdoor 122 so that the inner surface of the second subdoor 122 (the surface located inside when the second subdoor 122 is closed) becomes level when the second subdoor 122 is open.

[0077] With this, it is possible, for example, to use the second subdoor 122 as a table to temporarily place a glass on, when pouring water supplied by the supply apparatus 124 into the glass.

[0078] Note that the stopper 121a may not necessarily be in such a mode as shown in FIG. 6 as long as it is possible to keep the posture of the second subdoor 122 so that the inner surface of the second subdoor 122 becomes level.

[0079] For example, the posture of the second subdoor 122 may be kept by an arm connecting the second main door 121 and the second subdoor 122.

[0080] FIG. 7 is a schematic view showing the structure in the vicinity of the axis 130 of the second subdoor 122 in the embodiment.

[0081] As FIG. 7 shows, the refrigerator 100 includes a damper 142.

[0082] In addition, in the present embodiment, the second subdoor 122 is attached to the second main door 121, using a right axis member 130a and a left axis member 130b.

[0083] The left axis member 130b is in the shape of a cylinder missing a portion, and is fastened to the second subdoor 122.

[0084] The left axis member 130b is engaged in the damper 142. With this structure, the damper 142 gives to the second subdoor 122, through the left axis member 130b, a force against an opening force of the second subdoor 122, when the second subdoor 122 turns in an opening direction.

[0085] This damper 142 reduces the opening speed of the second subdoor 122. Thus, it is possible, for example, to reduce a load that is given onto the right axis member 130a and the left axis member 130b when the second subdoor 122 opens.

[0086] Note that for example, the damper 142 is an apparatus which pneumatically generates larger resistance when the second subdoor 122 opens compared with when the second subdoor 122 is closed.

[0087] Note that the damper 142 may be other than the one shown in FIG. 7 in terms of structure, shape, and positional relationship to the second subdoor 122 as long as it gives force against the opening force of the second subdoor 122.

[0088] For example, the damper 142 may give force to the left axis member 130b through a gear.

[0089] The right axis member 130a is in the shape of a cylinder and includes a tab 122b. In addition, the right axis member 130b is attached with horizontal movability, and is biased rightward by a spring 122c.

[0090] Therefore, the right-end portion of the right axis member 130a is normally inserted into an attachment hole 121b provided in the second main door 121.

[0091] In addition, the right axis member 130a slides leftward, when the second subdoor 121 is opened and the tab 122b is pressed leftward by the user. With this, the right-end portion of the right axis member 130a is pulled out of the attachment hole 121b.

[0092] In this state, the user can remove the second subdoor 122 from the second main door 121 by tilting

the second subdoor 122, for example, to the left.

[0093] Meanwhile, the user can also attach the second subdoor 122 to the second main door 121 according to a procedure reversal to the procedure described above.

[0094] Note that the attachment and detachment mechanism of the second subdoor 122 is not limited to the structure shown in FIG. 7. For example, the structure may also allow the attachment and detachment of the second subdoor 122 to and from the second main door 121 by sliding both the right axis member 130a and left axis member 130b toward the center.

[0095] Thus, such detachability of the second subdoor 122 allows the user to clean up the attachment part of the second subdoor 122, which is for attachment to the second main door 121, when the part becomes dusty. In other words, it is possible to keep the vicinity of the axis 130 clean.

[0096] FIG. 8 is a cross-sectional view showing a section of the second subdoor 122 in the embodiment taken along from line A-A shown in FIG. 5.

[0097] As FIG. 8 shows, the second subdoor 122 has heat insulation material 128 inside. In the present embodiment, the heat insulation material 128 is a vacuum insulation material.

[0098] The vacuum insulation material is a heat insulation material that is processed by coating, with laminated film, a core material having a porous structure, sealing the laminated film, and reducing internal pressure.

[0099] When the vacuum insulation material is used for a part requiring heat insulation, the contribution of gas thermal conductivity becomes almost zero, thereby allowing obtainment of excellent heat insulation properties.

[0100] Thus, with the heat insulation material 128 being included inside, the second subdoor 122 can further suppress the amount of the heat exchange between the inside and outside of the refrigerator through the supply opening 123.

[0101] In other words, this prevents the degradation of cooling efficiency of the refrigerator 100 that is caused by energy loss at the supply opening 123.

[0102] In addition, the adoption of a vacuum insulation material for the heat insulation material 128 allows reduction of the thickness and weight of the subdoor. With this, it is possible to reduce the load onto the attachment part of the subdoor, which is for attachment to the main door.

[0103] In addition, for surface materials for the first main door 111, the second main door 121, the first subdoor 112, and the second subdoor 122, resins such as ABS are adoptable, and metals such as an iron plate or stainless are also adoptable.

[0104] The refrigerator 100 becomes preferable in design terms when a metal such as an iron plate and stainless is adopted for the surface material for these doors.

INDUSTRIAL APPLICABILITY

[0105] The present invention is applicable to a refrigerator, and is particularly applicable to a refrigerator including a supply apparatus which supplies cold water, ice and so on to the outside.

Claims

1. A refrigerator comprising:

a heat-insulating main body having an opening in a front surface;
a main door which covers the opening with flexibility in opening and closing;
a supply apparatus configured to supply a storage item to an outside of said heat-insulating main body, the storage item being stored inside said heat-insulating main body; and
a supply opening which is a concavity formed in the front surface of said main door and is connected to said supply apparatus, and
said refrigerator being **characterized by** further comprising a subdoor which covers the supply opening with flexibility in opening and closing.

2. The refrigerator according to Claim 1,
wherein said subdoor is turnably attached to said main door, and a horizontal axis of said subdoor is provided in a lower-end portion of said subdoor, and said refrigerator further comprising:

a stopper which keeps a posture of said subdoor so that an inner surface of said subdoor becomes level when said subdoor is opened; and
a damper which gives force against opening force of said subdoor.

3. The refrigerator according to Claim 2,
wherein said subdoor is detachably attached to said main door.

4. The refrigerator according to Claim 1, further comprising:

a lighting unit configured to illuminate said supply opening;
a detection unit configured to detect open and closed states of said subdoor; and
a control unit configured to cause said lighting unit to turn on when said detection unit detects that said subdoor is open.

5. The refrigerator according to Claim 1, further comprising an operating unit configured to operate a behavior of said supply apparatus,
wherein said control unit is provided at a position where said control unit becomes exposed when said subdoor is open.

6. The refrigerator according to Claim 1, wherein said subdoor has a heat insulation material inside.

7. The refrigerator according to Claim 6, wherein the heat insulation material is a vacuum insulation material.

FIG. 1

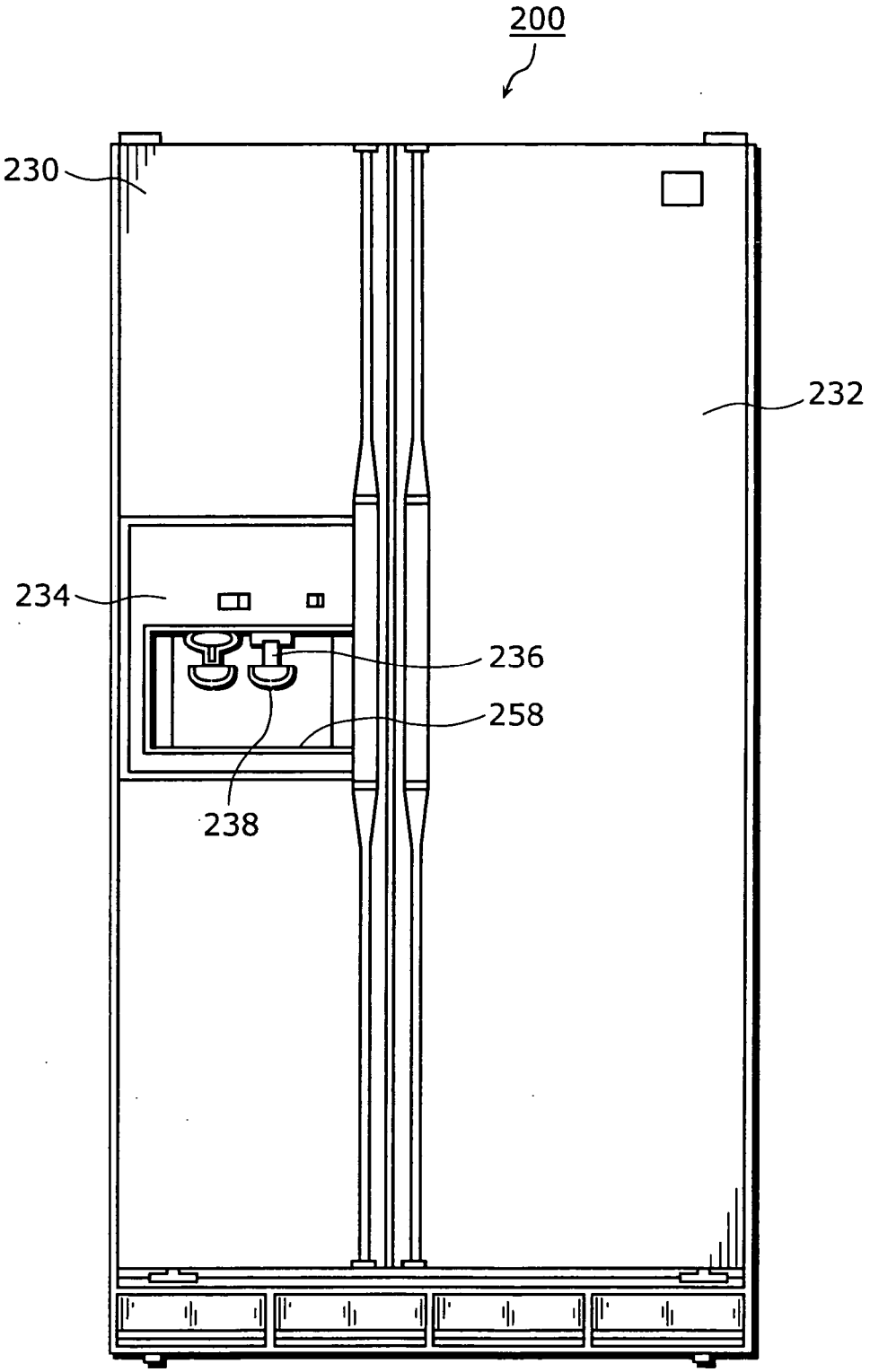


FIG. 2

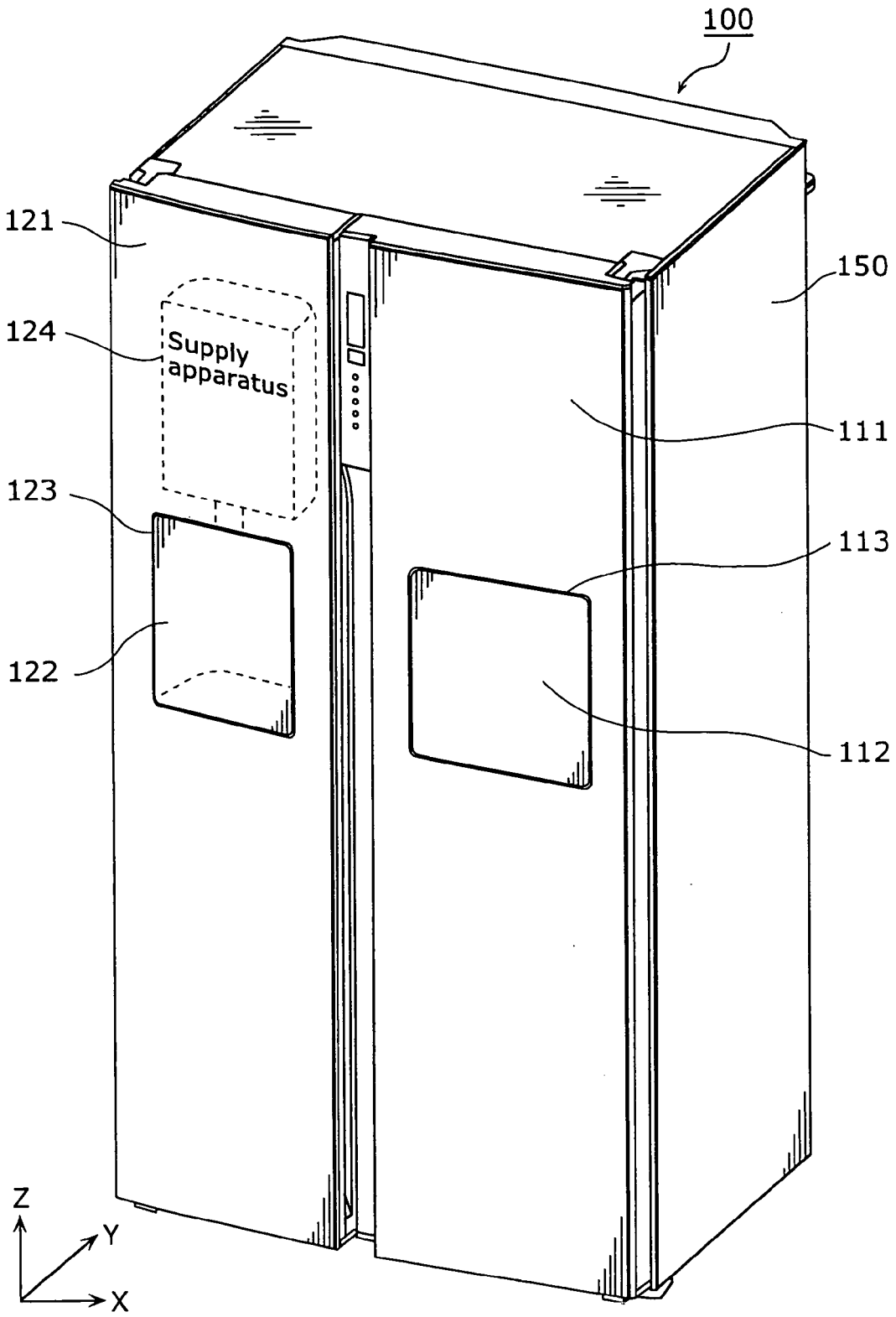


FIG. 3

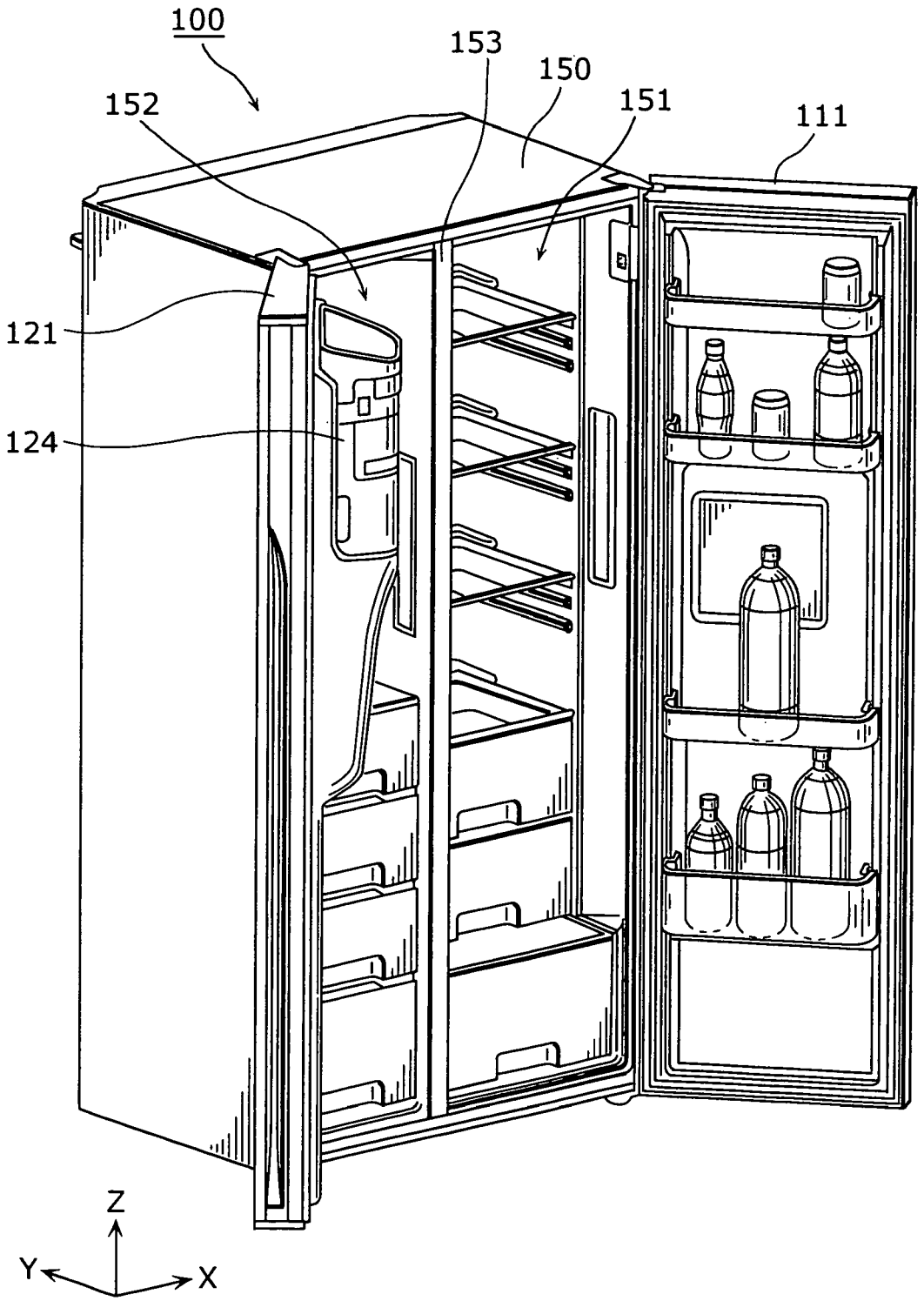


FIG. 4

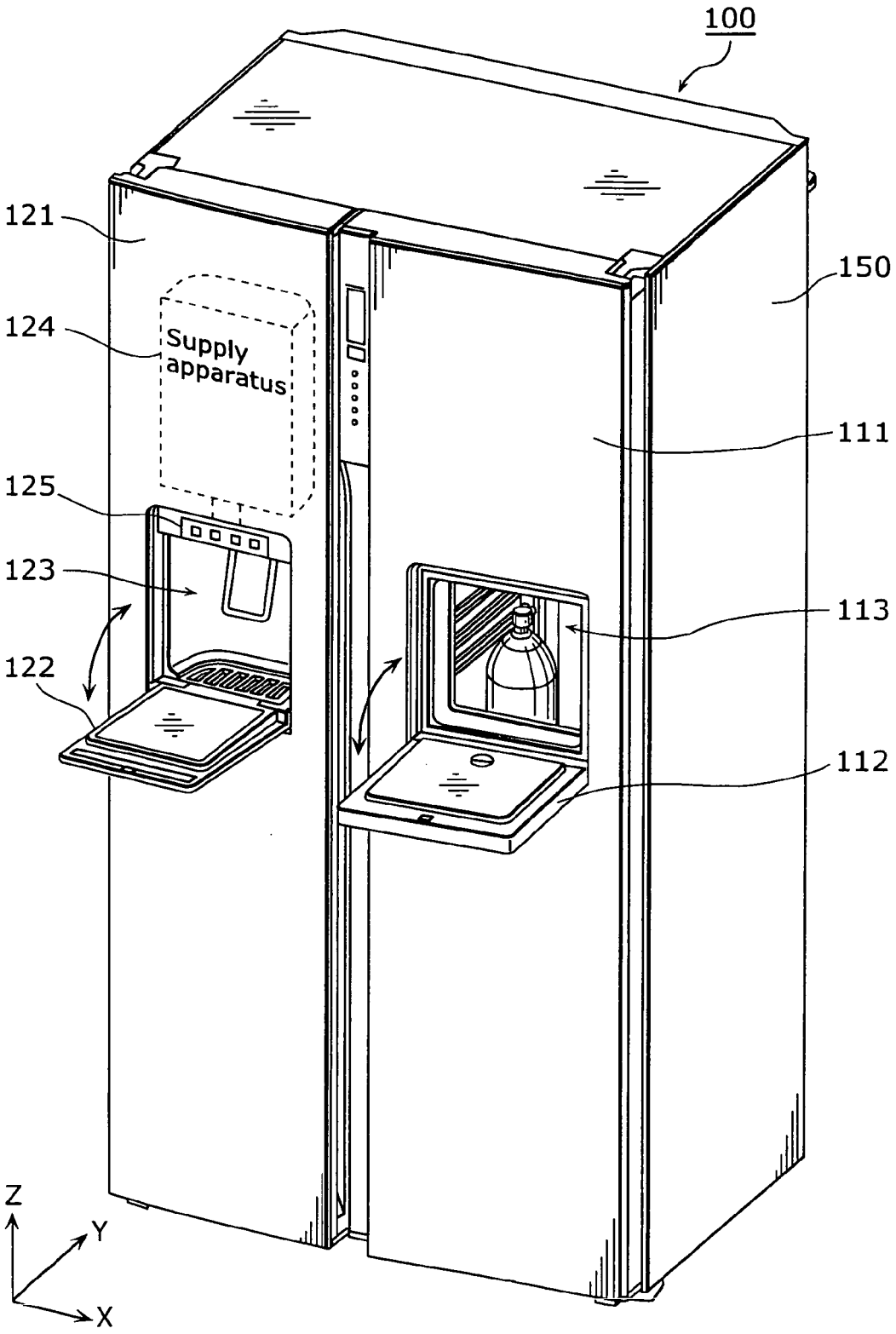


FIG. 5

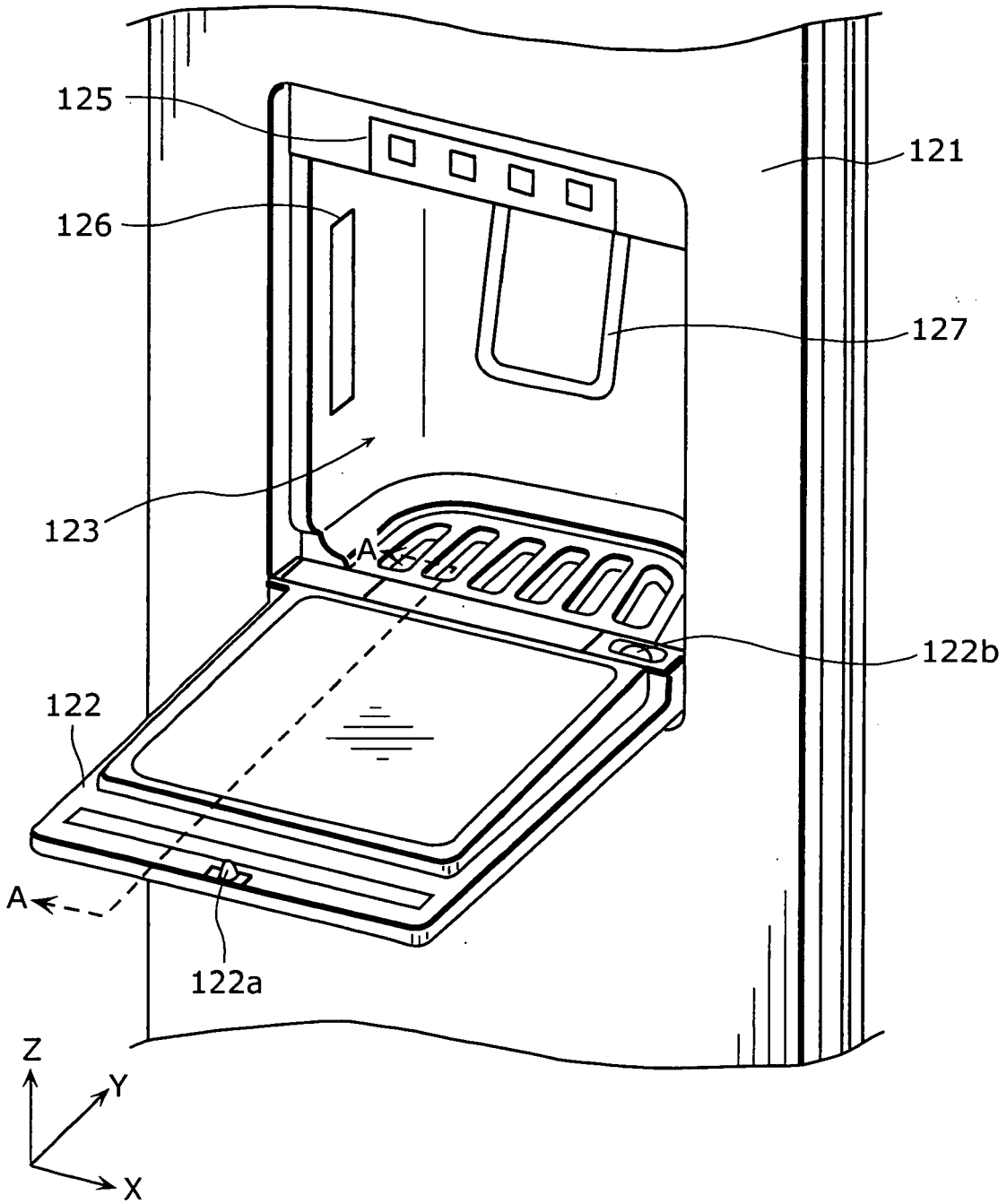


FIG. 6

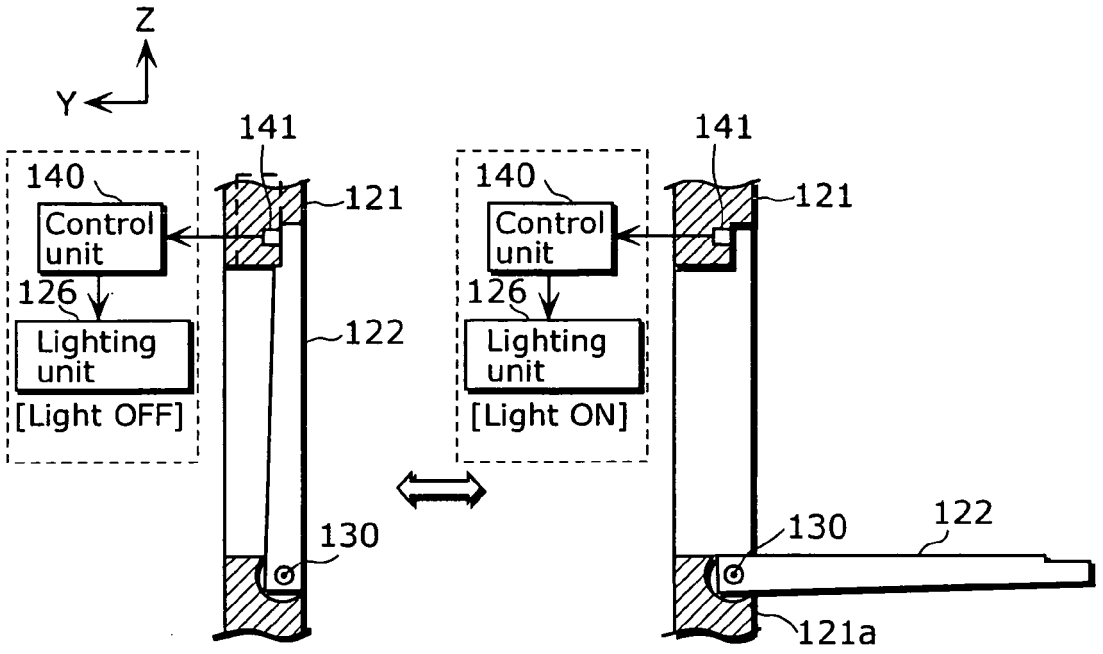

Z
Y
141
140
Control unit
126
Lighting unit
[Light OFF]
121
122
130
141
140
Control unit
126
Lighting unit
[Light ON]
121
130
122
121a

FIG. 7

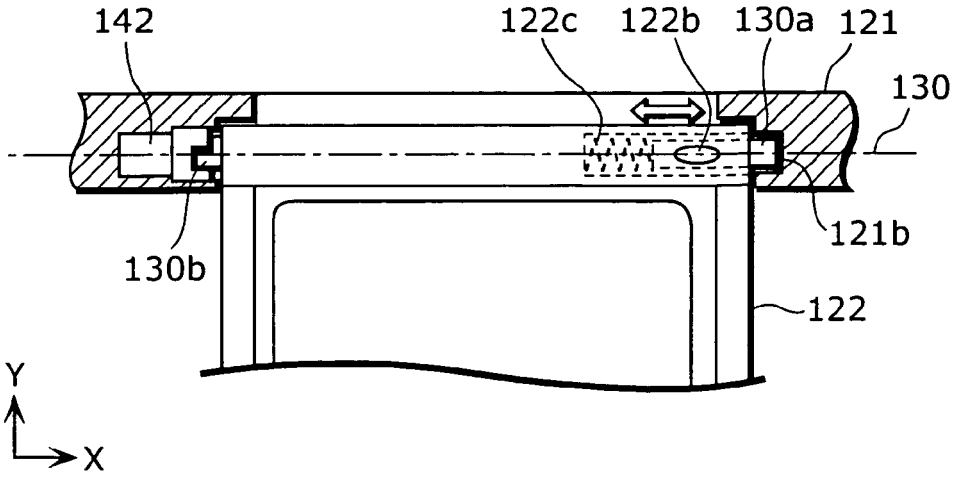
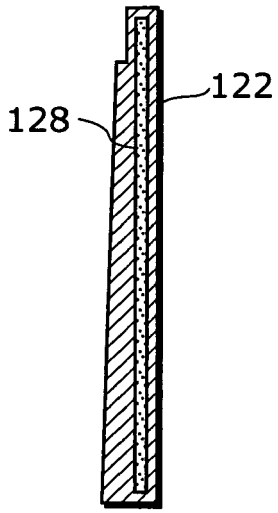

142
122c
122b
130a
121
130
121b
130b
122
Y
X

FIG. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 3059

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2005/072178 A1 (PARK JI-YOUNG [KR] ET AL) 7 April 2005 (2005-04-07) * the whole document *	1-3,6	INV. F25D23/02
X	WO 2008/007916 A (LG ELECTRONICS INC [KR]; KIM HYEONG-IL [KR]) 17 January 2008 (2008-01-17) * paragraphs [0059] - [0070]; figure 3 *	1-3,6	
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