



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.06.2011 Bulletin 2011/24

(51) Int Cl.:
F25D 23/02 (2006.01)

(21) Application number: **10192863.8**

(22) Date of filing: **29.11.2010**

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

(30) Priority: **08.12.2009 KR 20090121434**

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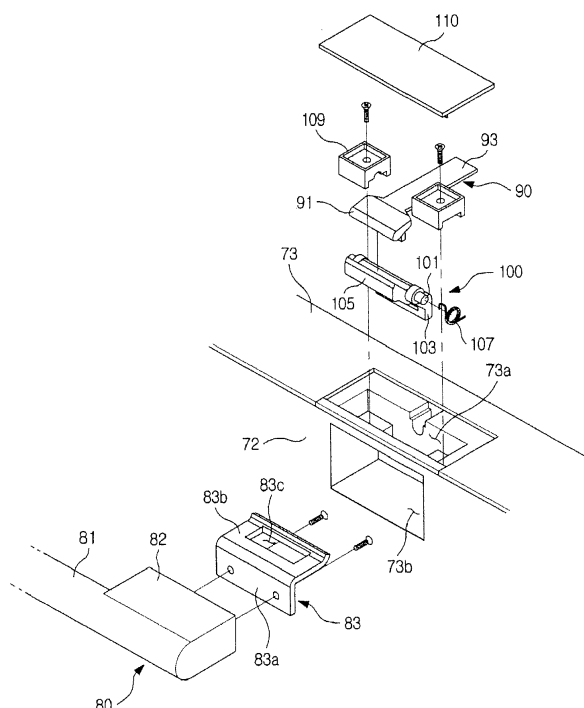
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(54) **Refrigerator having door opening apparatus**

(57) A refrigerator with a handle unit allows a user to open a door with a small force. The refrigerator includes a main body including upper and lower storage chambers, a pair of rotating first doors to open and close the upper storage chamber, a second drawer type door to open and close the lower storage chamber, a handle unit mounted on the second door to slidably move in forward

and backward directions of the second door, push members moving forward and backward in a direction of the rear surface of the second door, and interlocking units provided between the handle unit and the push members, wherein the interlocking units move the push members in connection with the forward sliding movement of the handle unit to separate the second door from the main body.

FIG. 2



Description

BACKGROUND

1. Field

[0001] Example embodiments relate to a refrigerator with a door opening apparatus to allow a user to easily open a door of the refrigerator.

2. Description of the Related Art

[0002] In general, a refrigerator is an apparatus having a separate cooling unit chamber provided in the rear of a freezing chamber, an evaporator provided in the cooling unit chamber, and cool air generated from the evaporator provided by operation of a compressor which is forcibly supplied to the freezing chamber or a refrigerating chamber. The cool air in the freezing chamber or the refrigerating chamber is returned to the cooling unit chamber, to freeze or refrigerate the corresponding chamber to maintain freshness of food stored in the corresponding chamber for a long time.

[0003] When a door of the freezing chamber or the refrigerating chamber is opened for a designated time and then is closed in order to put/take articles into/from the freezing chamber or the refrigerating chamber, humid and warm external air from outside of the freezing chamber or the refrigerating chamber is rapidly introduced into the freezing chamber or the refrigerating chamber.

[0004] The external air introduced into the freezing chamber or the refrigerating chamber is rapidly cooled due to cool temperature conditions within the freezing chamber or the refrigerating chamber, and thus is reduced in volume and temporarily maintains a pressure a little lower than the external atmospheric pressure (hereinafter, referred to as "a negative pressure") for a designated time.

[0005] Therefore, when opening the door the negative pressure is generated in the freezing chamber or the refrigerating chamber, and the door may be difficult to open without forcibly removing the negative pressure.

[0006] Particularly, a French-type refrigerator, may have a refrigerating chamber and a freezing chamber disposed vertically, may have a pair of hinge-type doors provided on the upper refrigerating chamber and a drawer-type door may be provided on the lower freezing chamber which has a larger width than the refrigerating chamber and the freezing chamber and also has a larger size than a general refrigerator. This may cause greater difficulty when opening of the freezing chamber due to weight of the door, magnetic force of a gasket at the edge of the rear surface of the door, weights of articles stored on racks, and a pressure difference between the inside and the outside of the lower freezing chamber.

SUMMARY

[0007] Therefore, it is an aspect of the example embodiments to provide a refrigerator with a handle unit which allows a user to open a door with a small force.

[0008] It is another aspect of the example embodiments to provide a refrigerator having a plurality of push members mounted on a single handle unit.

[0009] It is another aspect of the example embodiments to provide a refrigerator with a handle unit having a structure with an aesthetically pleasing external appearance of connection parts with a door.

[0010] It is a further aspect of the example embodiments to provide a refrigerator having a structure where push members move in connection with forward movement of a handle unit.

[0011] The foregoing and/or other aspects are achieved by providing a refrigerator, including a main body including an upper storage chamber and a lower storage chamber provided under the upper storage chamber, the upper and lower storage chambers divided from each other, a pair of rotatable first doors to open and close the upper storage chamber, a second drawer type door to open and close the lower storage chamber, a handle unit mounted on the second door in a horizontal direction to slidably move in forward and backward directions of the second door, push members moving forward and backward in a direction of a rear surface of the second door, and interlocking units provided between the handle unit and the push members to transmit moving force of the handle unit to the push members, wherein the interlocking units move the push members in the direction of the rear surface of the second door in connection with the forward sliding movement of the handle unit to pressurize the main body, and separate the second door from the main body.

[0012] The handle unit may include a grip part gripped by a user, and a pair of sliding connection parts provided at both ends of the grip part and connected to the second door to slidably move forward and backward.

[0013] The second door may include guide parts opened forward at positions corresponding to the sliding connection parts to guide sliding movement of the sliding connection parts.

[0014] The handle unit may further include slots to prevent separation of the handle unit from the second door during the sliding movement of the handle unit.

[0015] The interlocking units may be rotated by the forward sliding movement of the handle unit, and the push members may slidably move backward toward the main body by the rotation of the interlocking units.

[0016] Each of the interlocking units may include a rotary shaft, a first rotating part connected to each sliding connection part, and a second rotating part formed at a position opposite to the first rotating part and connected to each push member.

[0017] Each of the interlocking units may further include an elastic member to return each push member

and the handle unit to backward movement positions if external force applied to the handle unit is removed.

[0018] The elastic member may include a coil spring connected to the rotary shaft.

[0019] The second door may include a front panel forming an external appearance of the second door, and the front panel may be provided with openings having four closed surfaces corresponding to the sliding connection parts.

[0020] A distance from the rotary shaft to the first rotating part may be longer than a distance from the rotary shaft to the second rotating part.

[0021] The refrigerator may further include base parts to rotatably fix the interlocking units, and each of the base parts may include a slot to delimit a moving distance of the second rotating part.

[0022] The second door may further include a door cap mounted on the upper surface of the second door with exposed parts to mount the interlocking units and covers to close the exposed parts, and regions of the second door between the sliding connection parts and the covers may be exposed by the front panel.

[0023] The handle unit may have a width corresponding to a width of the second door.

[0024] The refrigerator may further include separation prevention pieces to fix the rotary shaft.

[0025] The foregoing and/or other aspects are achieved by providing a refrigerator, including a main body including storage chambers, doors to open and close the storage chambers, a handle unit horizontally mounted on an upper portion of one of the doors to slidably move in forward and backward directions of the door, and a pair of push members moving forward and backward toward an upper edge of the door corresponding to both ends of the handle unit to separate the door from the main body, wherein the pair of push members pressurizes an edge of the main body in connection with forward sliding movement of the handle unit to separate the door from the main body, and the handle unit is elastically returned to its initial state.

[0026] The storage chambers may include upper and lower storage chambers vertically divided from each other, and the door with the handle unit mounted thereon may be a drawer-type door to slidably open and close the lower storage chamber.

[0027] The handle unit may include a grip part gripped by a user, and a pair of sliding connection parts provided at both ends of the grip part and connected to the door to slidably move forward and backward.

[0028] The door may include a front panel forming an external appearance of the door, and the front panel may be provided with openings having four closed surfaces corresponding to the sliding connection parts.

[0029] Additional aspects, features, and/or advantages of embodiments will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] These and/or other aspects and advantages will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a perspective view illustrating a schematic external appearance of a refrigerator in accordance with example embodiments;

FIG. 2 is an exploded perspective view illustrating a door and a handle unit of the refrigerator in accordance with example embodiments;

FIGS. 3 and 4 are views illustrating an operating state of the door of the refrigerator in accordance with example embodiments;

FIG. 5 is an exploded perspective view illustrating a door and a handle unit of a refrigerator in accordance with example embodiments; and

FIGS. 6 and 7 are views illustrating an operating state of the door of the refrigerator of FIG. 5.

DETAILED DESCRIPTION

[0031] Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

[0032] FIG. 1 is a perspective view illustrating a schematic external appearance of a refrigerator in accordance with example embodiments, FIG. 2 is an exploded perspective view illustrating a door and a handle unit of the refrigerator in accordance with example embodiments, and FIGS. 3 and 4 are views illustrating an operating state of the door of the refrigerator in accordance with example embodiments.

[0033] As shown in FIG. 1, a refrigerator in accordance with example embodiments includes a plurality of storage chambers 20, 30, and 40 vertically divided by insulating diaphragms 11 and 12, and doors 51, 52, 60, and 70 provided on the front surfaces of the storage chambers 20, 30, and 40 to open and close the respective storage chambers 20, 30, and 40.

[0034] In the same manner as a general refrigerator, components comprising a refrigerating cycle, such as a compressor (not shown), a condenser (not shown), an expansion device (not shown), and an evaporator (not shown), are provided in the refrigerator in accordance with example embodiments.

[0035] The storage chambers 20, 30, and 40 may include an upper storage chamber 20 provided above a first insulating diaphragm 11 through division using the first insulating diaphragm 11, a variable chamber 30 provided through division using the first insulating diaphragm 11 and a second insulating diaphragm 12 such that the temperature in the variable chamber 30 is variable, and a lower storage chamber 40 provided below the second insulating diaphragm 12. The upper storage chamber 20

and the lower storage chamber 40 may be variably used as a freezing chamber and a refrigerating chamber, as needed by a user.

[0036] The example embodiments describe a French-type refrigerator, i.e., a kind of a bottom mounted freezer (BMF) refrigerator in which the lower storage chamber 40 may be a freezing chamber and the upper storage chamber 20 may be a refrigerating chamber. The French-type refrigerator may have a relatively larger width to store wide articles, such as pizza, as compared with a side by side refrigerator, a general BMF refrigerator, and a top mounted freezer (TMF) refrigerator.

[0037] Although example embodiments describe a structure of the refrigerator including three divided storage chambers, the refrigerator may include only two divided storage chambers, i.e., an upper storage chamber and a lower storage chamber.

[0038] Racks 21 to receive food to be stored in a refrigerated state may be installed in the upper storage chamber 20 and separated from each other by a designated interval, and receipt drawers 61 and 71 to receive food may be integrally connected to doors 60 and 70 of the variable chamber 30 and the lower storage chamber 40.

[0039] A pair of doors 51 and 52 horizontally rotatable may be provided in front of the upper storage chamber 20.

[0040] The doors 60 and 70 to open and close the variable chamber 30 and the lower storage chamber 40 may be respectively provided in front of the variable chamber 30 and the lower storage chamber 40. Since the doors 60 and 70 may be a drawer type to slidably open and close the variable chamber 30 and the lower storage chamber 40, when the doors 60 and 70 are opened, the receipt drawers 61 and 71 formed integrally with the doors 60 and 70 may be taken out.

[0041] Since each of the variable chamber 30 and the lower storage chamber 40 may have the single door 60 or 70, a strong force may be required to open the door 60 or 70 of the variable chamber 30 and the lower storage chamber 40 because of magnetic force of a gasket 75 (with reference to FIG. 3) at the edge of the rear surface of the door 60 or 70, weights of the door 60 or 70 and the receipt drawer 61 or 71, weight of food stored in the receipt drawer 61 or 71, and a pressure difference between the inside and outside of the variable chamber 60 or the lower storage chamber 70.

[0042] In order to solve the above problem, the refrigerator in accordance with the example embodiments may include a door opening apparatus to easily open the door 60 or 70 of the variable chamber 30 or the lower storage chamber 40.

[0043] The door opening apparatus may be provided on each of the variable chamber 30 and the lower storage chamber 40, or may be provided on any one of the variable chamber 30 and the lower storage chamber 40 as needed.

[0044] The door opening apparatuses respectively provided on the variable chamber 30 and the lower stor-

age chamber 40 may have the same structure. Therefore, only the door opening apparatus provided on the lower storage chamber 40 will be described hereinafter, and a description of the door opening apparatus provided on the variable chamber 30 will be omitted.

[0045] As shown in FIGS. 2 to 4, the refrigerator in accordance with the example embodiments may include the second door 70 to open and close the lower storage chamber 40 in a sliding manner, a handle unit 80 on the upper portion of the second door 70 in the horizontal direction movable forward and backward, push members 90 rectilinearly moving in a direction of the rear surface of the second door 70 in connection with the forward movement of the handle unit 80, and interlocking units 100 provided between the handle unit 80 and the push members 90 to transmit moving force of the handle unit 80 to the push members 90.

[0046] The receipt drawer 71 to receive articles to be stored may be formed integrally with the rear surface of the second door 70 to slide according to the forward and backward movement of the second door 70, and the gasket 75 in which a magnet 75a is received may be disposed along the edge of the rear surface of the second door 70 to prevent leakage of cool air from the lower storage chamber 40 and to improve hermetic sealing of the lower storage chamber 40.

[0047] Sliding rails 41 to guide smooth sliding of the second door 70 may be provided on both side surfaces of the receipt drawer 71.

[0048] A front panel 72 forming the external appearance of the second door 70 may be mounted on the front surface of the second door 70, and a door cap 73 may be mounted on the upper surface of the second door 70.

[0049] The front panel 72 may provide an aesthetically pleasing external appearance of the second door 70, and may be made of tempered glass, resin, and metal. In the example embodiments, the front panel 72 may be made of a metal plate.

[0050] Receipt parts 73a to mount the respective components of the door opening apparatus, such as the handle unit 80, the interlocking units 100, and the push members 90, and guide parts 73b to guide forward and backward sliding of sliding connection parts 82, which will be described later, may be formed on the door cap 73.

[0051] The front panel 72 may be provided with openings having a size corresponding to the guide parts 73b. The sliding connection parts 82 of the handle unit 80 are received in the guide parts 73b through the openings, and may be mounted to be slidable forward and backward.

[0052] The handle unit 80 may be mounted on the upper portion of the front surface of the second door 70 allowing a user to easily grip the handle unit 80 to move the second door 70 forward and backward.

[0053] The handle unit 80 may include a grip part 81 gripped by a user, a pair of sliding connection parts 82 provided at both ends of the grip part 81 and connected to the second door 70 to be slidable forward and back-

ward, and pressure parts 83 connected to the rear surfaces of the sliding connection parts 82 to transmit force to the interlocking units 100.

[0054] The handle unit 80 may be substantially parallel and disposed on the upper edge of the second door 70.

[0055] The grip part 81 may be formed at a width which is substantially equal to the width of the second door 70 or may be smaller than the width of the second door 70 by a designated length, thereby allowing a user to grasp a wide area of the grip part 81.

[0056] The sliding connection parts 82 may protrude from both ends of the grip part 81 in a direction of the second door 70, and connect the handle unit 80 to the second door 70 so that the handle unit 80 may be slidably moved forward and backward relative to the second door 70.

[0057] The guide parts 73b opened forward corresponding to the sliding connection parts 82 may be formed on the second door 70. The guide parts 73b receive the sliding connection parts 82, and guide sliding movement of the sliding connection parts 82. In example embodiments, the guide parts 73b may be formed on the door cap 73 of the second door 70.

[0058] The pressure parts 83 may move forward and backward according to the forward and backward sliding movement of the sliding connection parts 82. Each of the pressure parts 83 may include a connection plane 83a screw-connected to the sliding connection part 82, a bent plane 83b bent forward from the connection plane 83a and extended, and an opening 83c formed on the bent plane 83b to receive a front end of a first rotating part 103 of the interlocking unit 100, which will be described later.

[0059] The first rotating part 103 may be mounted and inserted into the pressure part 83. Therefore, when a user grasps the grip part 81 and pulls the handle part 80 forward, the sliding connection parts 82 slide forward along the guide parts 73b, and the first rotating parts 103 may be inserted into the openings 83c of the pressure parts 83 which may be pressurized by movement of the pressure parts 83, thereby rotating the interlocking units 100.

[0060] Each of the interlocking units 100 may include a rotary shaft 101. The first rotating part 103 may be extended from one end of the rotary shaft 101 and connected to the pressure part 83, and a second rotating part 105 may be extended from the other end of the rotary shaft 101 opposite to the first rotating part 103 and connected to the push member 90.

[0061] The first rotating part 103 of the interlocking unit 100 may be connected to the pressure part 83, and when a user grasps the grip part 81 and pulls the handle unit 80 forward, the pressure part 83 may rotate the interlocking unit 100 and cause the push member 90 connected to the second rotating part 105 to slide forward in a direction of the lower storage chamber 40.

[0062] The end of the first rotating part 103 may be bent downward and inserted into the opening 83c of the

pressure part 83.

[0063] When the pressure part 83 moves forward, the pressure part 83 and the first rotating part 103 reciprocally slidably contact each other to rotate the interlocking unit 100 according to forward and backward movement of the pressure part 83, and the first rotating part 103 slides relative to the pressure part 83 and is rotated.

[0064] The interlocking unit 100 further includes an elastic member 107 to return the handle unit 80 to its original position when external force is removed.

[0065] For example, the elastic member 107 may be provided in the shape of a coil spring and be connected to the rotary shaft 101, as shown in FIG. 2.

[0066] One end of the coil spring 107 may be fixed to one end of the receipt part 73a of the door cap 73, and the other end of the elastic member 107 may be fixed to the interlocking unit 100. Thus, the coil spring 107 may provide elastic force to pressurize the interlocking unit 100 in a direction A.

[0067] Therefore, when a user grasps the grip part 81 and pulls the handle unit 80 forward, the interlocking units 100 may be rotated in a direction B by the pressure parts 83 and the elastic member 107 may be elastically compressed. When the user releases the grip part 81, i.e., when external force applied to the handle unit 80 is removed, the interlocking units 100 may be rotated in the direction A by restoring force of the elastic member 107, and the grip part 81 slides backward, thereby returning the handle unit 80 to its original position.

[0068] A receipt groove (not shown) corresponding to the rotary shaft 101 may be formed on the receipt part 73a of the door cap 73, and separation prevention pieces 109 surrounding the rotary shaft 101 to firmly fix the rotary shaft 101 may be connected to the receipt groove.

[0069] The push members 90 are slidably provided on the upper surface of the second door 70, and serve to pressurize the edge of the main body 10, i.e., the front surface of the second insulating diaphragm 12 to separate the second door 70 from the main body 10.

[0070] An arc-shaped first contact part 91 corresponding to the second rotating part 105 is formed at one end of the push member 90, and a second contact part 93 to transmit the pressurizing force of the pressure part 83 to the main body 10 may be formed at the other end of the push member 90.

[0071] Slots 73c are formed on the upper surface of the second door 70, for example, on the door cap 73, to slidably move the push members 90.

[0072] The receipt parts 73a exposed to the outside to obtain working spaces to assemble the handle unit 80, the interlocking units 100, and the push members 90 with the upper surface of the second door 70 may be formed on the door cap 73, and covers 110 to cover assembly portions of the push members 90, the elastic member 107, and the handle unit 80 may be mounted on the door cap 73.

[0073] In the example embodiments, the handle unit 80 only moves forward and backward and only regions

of the front panel 72 corresponding to the sliding connection parts 82 may be opened. Front surface regions of the second door 70 except for the sliding connection parts 82 may be covered with one front panel 72. Therefore, connection portions of the front surface of the door 70 exposed to the user with a different material may be minimized, thereby improving the aesthetically pleasing external appearance of the door 70.

[0074] Next, an assembly procedure of the handle unit of the refrigerator in accordance with example embodiments will be described.

[0075] The door cap 73 provided with the receipt parts 73a to receive the respective components may be connected to the front surface of the second door 70, and the push members 90 connected to the interlocking units 100 may be mounted on the receipt parts 73a of the door cap 73. The second contact parts 93 of the push members 90 may protrude from the rear surface of the second door 70 through the slots 73c.

[0076] Thereafter, the handle unit 80 connected with the pressure parts 83 may slide and connect to receipt spaces through the guide parts 73b, and the interlocking units 100 may be rotatably fixed to the receipt parts 73a using the separation prevention pieces 109.

[0077] Thereafter, the covers 110 may be mounted on the door cap 73, completing installation of the door opening apparatus on the door 70.

[0078] Next, operation of the refrigerator in accordance with example embodiments will be described with reference to FIGS. 3 and 4.

[0079] If the lower storage chamber 40 of the refrigerator in accordance with example embodiments is opened, when the grip part 81 is moved forward, the sliding connection parts 82 may slide forward and the pressure parts 83 connected to the sliding connection parts 82 may pressurize the first rotating parts 103, thereby rotating the interlocking units 100 in the direction B. When the interlocking units 100 are rotated in the direction B, the second rotating parts 105 may pressurize the push members 90, and the pressurized push members 90 may rectilinearly move and pressurize the upper edge of the lower storage chamber 40, i.e., the front surface of the second insulating diaphragm 12.

[0080] The second door 70 is separated from the main body 10 by a designated distance because of the above pressurizing force. Then, pressure equilibrium between the inside and the outside of the lower storage chamber 40 may be achieved and by weakening connecting force of the second door 70 with the main body 10 because of magnetic force of the gasket 75, thereby enabling the second door 70 to be easily slidably opened.

[0081] Therefore, if the second door 70 of the lower storage chamber 40 having a heavy weight is opened, a user may allow a pair of the push members 90 to pressurize the main body 10 through movement only in one direction, i.e., grasping and moving of the grip part 81 forwards, thereby easily opening the second door 70 with small or minimal movement and force.

[0082] Thereafter, when the user releases the grip part 81 and external force applied to the handle unit 80 is removed, the interlocking units 100 may be rotated in the direction A by the elastic members 107 connected to the interlocking units 100. When the first rotating parts 103 are rotated by the rotation of the interlocking units 100, the pressure parts 83 connected to the first rotating parts 103 may rectilinearly move backward according to the rotation of the first rotating parts 103. The sliding connection parts 82 connected to the pressure parts 83 and the grip part 81 connected to the sliding connection parts 82 may slide toward the second door 70, and are returned to their initial state.

[0083] Simultaneously, the push members 90 may slide backward according to the rotation of the interlocking units 100, and are returned to their initial state.

[0084] Next, a refrigerator in accordance with example embodiments will be described.

[0085] Some parts, which are substantially the same as those in the example embodiments described with reference to FIGS. 1 to 4, are denoted by the same reference numerals even though they are depicted in different drawings, and a detailed description thereof will thus be omitted because it is considered to be unnecessary.

[0086] FIG. 5 is an exploded perspective view illustrating a door and a handle unit of the refrigerator in accordance with example embodiments, and FIGS. 6 and 7 are views illustrating an operating state of the door of the refrigerator in accordance with example embodiments.

[0087] As shown in FIGS. 5 to 7, the refrigerator in accordance with example embodiments may include a second door 70 to open and close a lower storage chamber 40 in a sliding manner, a handle unit 80 disposed on the upper portion of the second door 70 in the horizontal direction movable forward and backward, push members 190 rectilinearly moving in a direction of the rear surface of the second door 70 in connection with the forward movement of the handle unit 80, and interlocking units 200 provided between the handle unit 80 and the push members 190 to transmit moving force of the handle unit 80 to the push members 190.

[0088] A door cap 73 may include receipt parts 73a, each receiving respective components of a door opening apparatus, such as the handle unit 80, the interlocking unit 200 and the push member 190, and guide parts 73b to guide forward and backward sliding of sliding connection parts 82, which will be described later.

[0089] Pressure parts 183 of the handle unit 80 may be screw-connected to the sliding connection parts 82. Each of the pressure parts 183 may include a first connection plane 183a connected to the sliding connection part 82, an extension plane 183b bent perpendicularly from the first connection plane 183a, and a second connection plane 183c bent perpendicularly forward from the expansion plane 183b.

[0090] Therefore, the pressure parts 183 may move forward and backward according to operation of the han-

dle unit 80.

[0091] The interlocking units 200 may serve to transmit moving force of the pressure parts 183 to the push members 190, and are provided in the shape of link members.

[0092] The refrigerator in accordance with example embodiments may further include base parts 120 to fix the interlocking units 200 to the receipt parts 73a.

[0093] The base parts 120 may be fixed to the receipt parts 73a of the door cap 73. Each of the base parts 120 may be provided with a rotary shaft 121 protruding upwardly, and a slot 123 formed at a position separated from the rotary shaft 121 to delimit a forward and backward moving distance of the push member 190.

[0094] The interlocking unit 200 may be connected to the rotary shaft 121 at a middle portion thereof, and one end of the interlocking unit 200 may be rotatably link-connected to the second connection plane 183c and the other end of the interlocking unit 200 may be link-connected to the push member 190.

[0095] Further, the interlocking unit 200 may include an elastic member 207 to return the handle unit 80 to its original position when external force is removed.

[0096] For example, the elastic member 207 may be provided in the shape of a coil spring and be connected to the rotary shaft 121.

[0097] One end of the elastic member 207 may be fixed to the base part 120 and the other end of the elastic member 207 may be fixed to the interlocking unit 200. The elastic member 207 may provide elastic force to pressurize the interlocking unit 200 in a direction C.

[0098] Therefore, when a user grasps the grip part 81 and pulls the handle unit 80 forward, the interlocking units 200 may be rotated in a direction D by the pressure parts 183 and the elastic member 207 may be elastically compressed. When the user releases the grip part 81, i.e., when external force applied to the handle unit 80 is removed, the interlocking units 200 may be rotated in the direction C by restoring force of the elastic member 207, and the grip part 81 may slides backward, thereby returning the handle unit 80 to its original state.

[0099] The push members 190 may be slidably provided on the upper surface of the second door 70, and serve to pressurize the edge of the main body 10, i.e., the front surface of the second insulating diaphragm 12 to separate the second door 70 from the main body 10.

[0100] A first contact part 191 connected with the other end of the interlocking unit 200 may be formed at one end of the push member 190, and a second contact part 192 to transmit rotating force of the interlocking unit 200 to the main body 10 may be formed at the other end of the push member 190.

[0101] Slots 73c may be formed on the upper surface of the second door 70, for example, on the door cap 73 to slidably move the push member 190, in the same manner as the example embodiments shown in FIGS. 1 to 4.

[0102] In the same manner as the example embodiments shown in FIGS. 1 to 4, the handle unit 80 only moves forward and backward, and only regions of the

front panel 72 corresponding to the sliding connection parts 82 are opened and front surface regions of the second door 70 except for the sliding connection parts 82 are covered with one front panel 72. Therefore, connection portions of the front surface of the door 70 exposed to the user with a different material may be minimized, thereby improving the aesthetically pleasing external appearance of the door 70.

[0103] Next, operation of the refrigerator in accordance with example embodiments will be described with reference to FIGS. 6 and 7.

[0104] If the lower storage chamber 40 of the refrigerator in accordance with example embodiments is opened, when the grip part 81 is moved forward, the sliding connection parts 82 may slide forward in the guide parts 73b and the pressure parts 183 connected to the sliding connection parts 82 pull ends of the interlocking units 200, thereby rotating the interlocking units 200 in the direction D. When the interlocking units 200 are rotated in the direction D, the push members 190 connected to the other ends of the interlocking units 200 may move along the slots 73c and rectilinearly move toward the upper edge of the lower storage chamber 40, i.e., the front surface of the second insulating diaphragm 12, thereby pressurizing the second insulating diaphragm 12.

[0105] The second door 70 may be separated from the main body 10 by a designated distance because of the above pressurizing force. Then, pressure equilibrium between the inside and the outside of the lower storage chamber 40 may be achieved weakening connecting force of the second door 70 with the main body 10 due to magnetic force of the gasket 75, thereby enabling the second door 70 to be easily slidably opened.

[0106] Therefore, if the second door 70 of the lower storage chamber 40 having a heavy weight is opened, a user may allow a pair of the push members 190 to pressurize the main body 10 through movement only in one direction, i.e., grasping and moving of the grip part 81 forward, in the same manner as example embodiments shown in FIGS. 1 to 4, thereby easily opening the second door 70 with small or minimal movement and force.

[0107] Thereafter, when the user releases the grip part 81 and external force applied to the handle unit 80 is removed, the interlocking units 200 may be rotated in the direction C by the elastic member 207. When the interlocking units 200 are rotated, the push members 190 are pulled and returned to their initial positions, and the pressure parts 183 are pulled in the opposite direction and the sliding connection parts 82 connected to the pressure parts 183 and the grip part 81 connected to the sliding connection parts 82 may slide toward the second door 70, and are returned to their initial state.

[0108] As is apparent from the above description, a refrigerator in accordance with example embodiments may cause a handle unit to move forward move push members backward, thereby reducing malfunction of a door, and which may be easily opened even when used over a long period of time.

[0109] Further, the refrigerator in accordance with example embodiments may include a plurality of push members operated through only forward movement of the handle unit, thereby allowing smooth opening and closing of the heavy-weight door with simple operation and small or minimal force.

[0110] Moreover, in the refrigerator in accordance with example embodiments, the handle unit only moves forwards and backward, and only regions of a front panel corresponding to sliding connection parts may be opened and front surface regions of the door except for the sliding connection parts may be covered with one front panel. Therefore, connection portions of the front surface of the door exposed to the user with a different material are minimized, thereby improving the aesthetically pleasing external appearance of the door.

[0111] Although example embodiments have been shown and described, it should be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

Claims

1. A refrigerator, comprising:

a main body including an upper storage chamber and a lower storage chamber provided under the upper storage chamber, the upper and lower storage chambers divided from each other;
a pair of rotatable first doors to open and close the upper storage chamber;
a second drawer type door to open and close the lower storage chamber;
a handle unit mounted on the second door in a horizontal direction to slidably move in forward and backward directions of the second door;
push members moving forward and backward in a direction of a rear surface of the second door; and
interlocking units provided between the handle unit and the push members to transmit moving force of the handle unit to the push members, wherein the interlocking units move the push members in the direction of the rear surface of the second door in connection with the forward sliding movement of the handle unit to pressurize the main body, and separate the second door from the main body.

2. The refrigerator according to claim 1, wherein the handle unit includes a grip part gripped by a user, and a pair of sliding connection parts provided at both ends of the grip part and connected to the second door to slidably move forward and backward.

3. The refrigerator according to claim 2, wherein the second door includes guide parts opened forward at positions corresponding to the sliding connection parts to guide sliding movement of the sliding connection parts.

4. The refrigerator according to claim 2, wherein the handle unit further includes slots to prevent separation of the handle unit from the second door during the sliding movement of the handle unit.

5. The refrigerator according to claim 2, wherein the interlocking units are rotated by the forward sliding movement of the handle unit, and the push members slidably move backward toward the main body by the rotation of the interlocking units.

6. The refrigerator according to claim 5, wherein each of the interlocking units includes a rotary shaft, a first rotating part connected to each sliding connection part, and a second rotating part formed at a position opposite to the first rotating part and connected to each push member.

7. The refrigerator according to claim 6, wherein each of the interlocking units further includes an elastic member to return each push member and the handle unit to backward movement positions if external force applied to the handle unit is removed.

8. The refrigerator according to claim 7, wherein the elastic member includes a coil spring connected to the rotary shaft.

9. The refrigerator according to claim 2, wherein the second door includes a front panel forming an external appearance of the second door, and the front panel is provided with openings having four closed surfaces corresponding to the sliding connection parts.

10. The refrigerator according to claim 6, wherein a distance from the rotary shaft to the first rotating part is longer than a distance from the rotary shaft to the second rotating part.

11. The refrigerator according to claim 6, further comprising base parts to rotatably fix the interlocking units, wherein each of the base parts includes a slot to delimit a moving distance of the second rotating part.

12. The refrigerator according to claim 9, wherein:

the second door further includes a door cap mounted on the upper surface of the second door with exposed parts to mount the interlocking units and covers to close the exposed parts,

and
regions of the second door between the sliding
connection parts and the covers are exposed by
the front panel.

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- 13.** The refrigerator according to claim 1, wherein the
handle unit has a width corresponding to a width of
the second door.

- 14.** The refrigerator according to claim 6, further com- 10
prising separation prevention pieces to fix the rotary
shaft.

- 15.** The refrigerator according to claim 1, wherein:

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the first doors include a pair of hinge doors to
open and close the upper storage chamber in a
rotation type; and

the second door includes a drawer-type door to 20
open and close the lower storage chamber in a
drawer type.

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FIG. 1

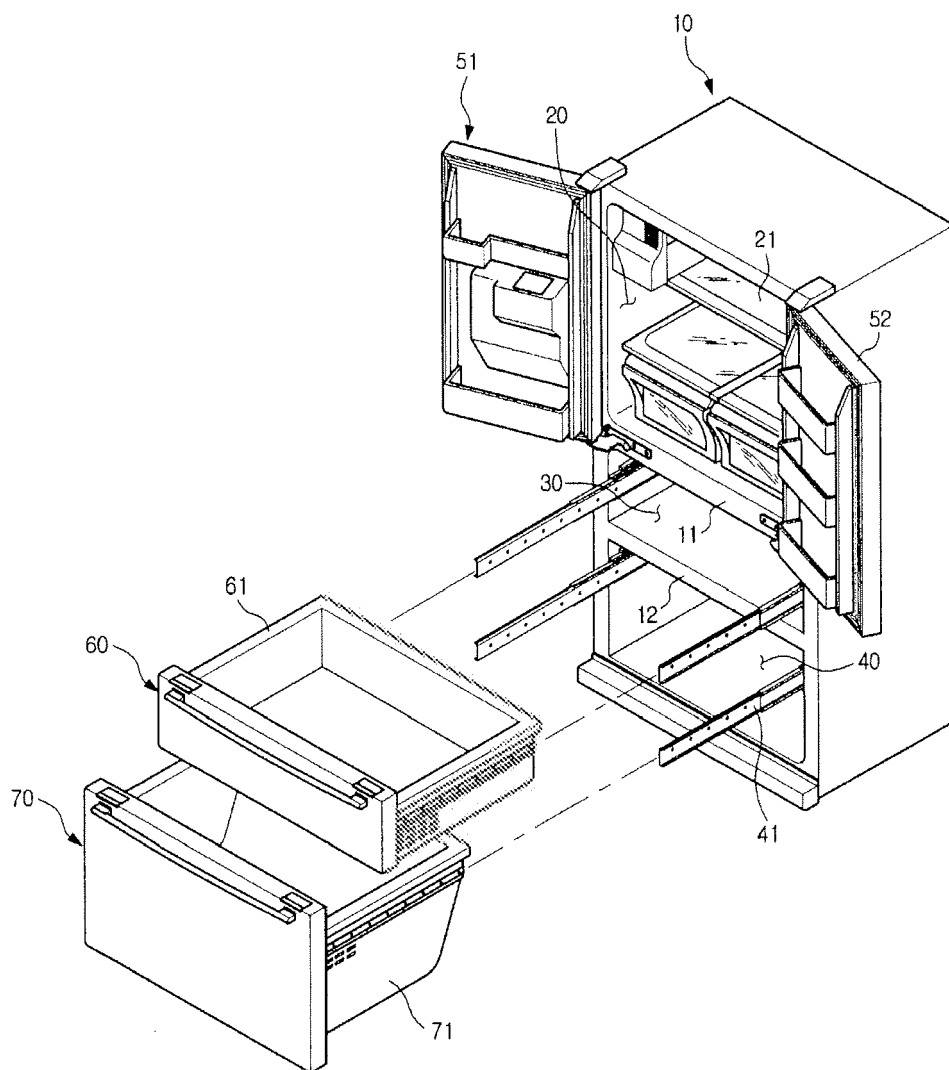


FIG. 2

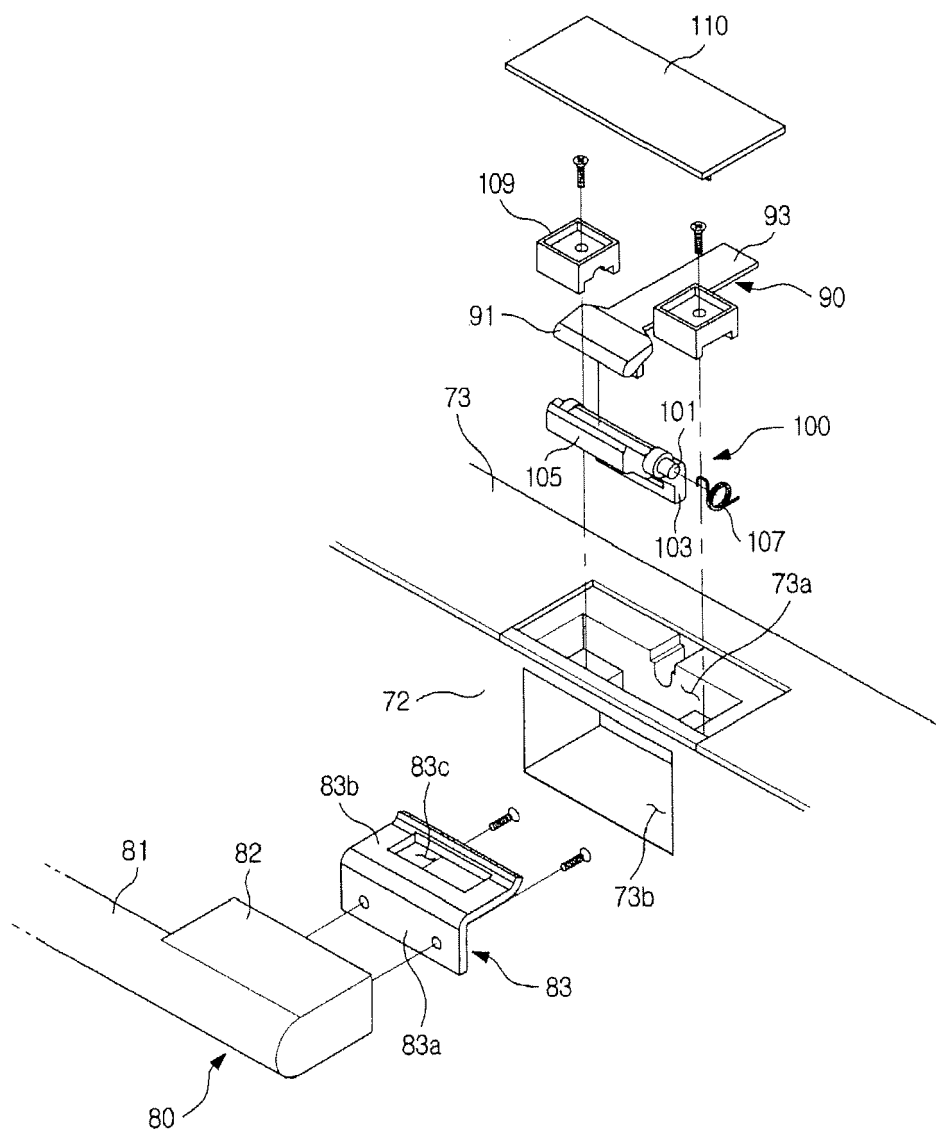


FIG. 3

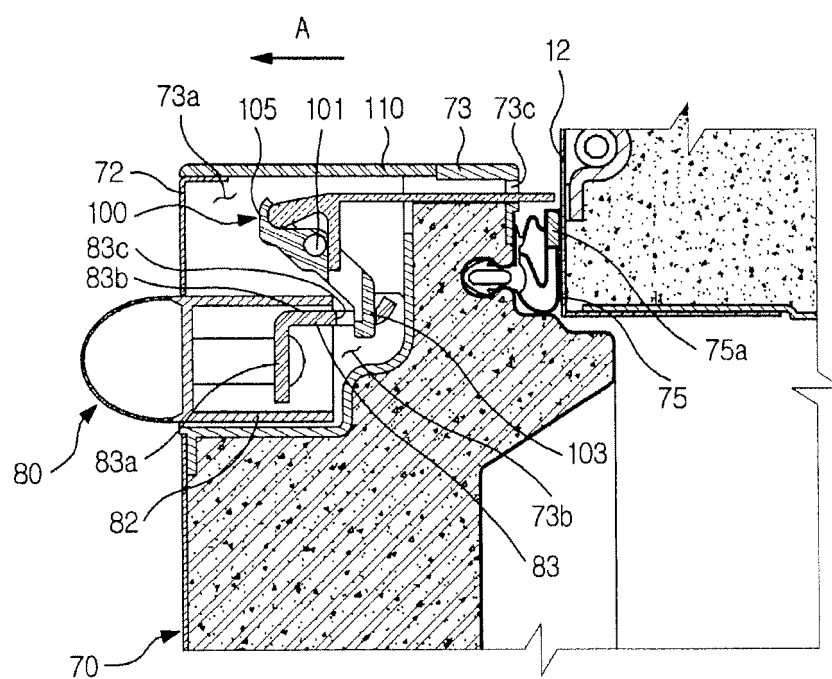


FIG. 4

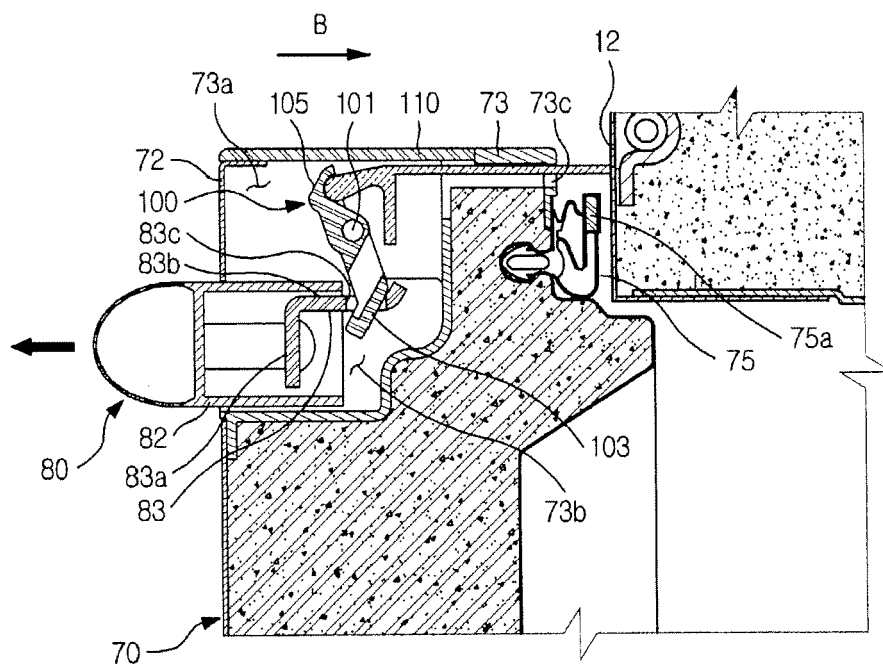


FIG. 5

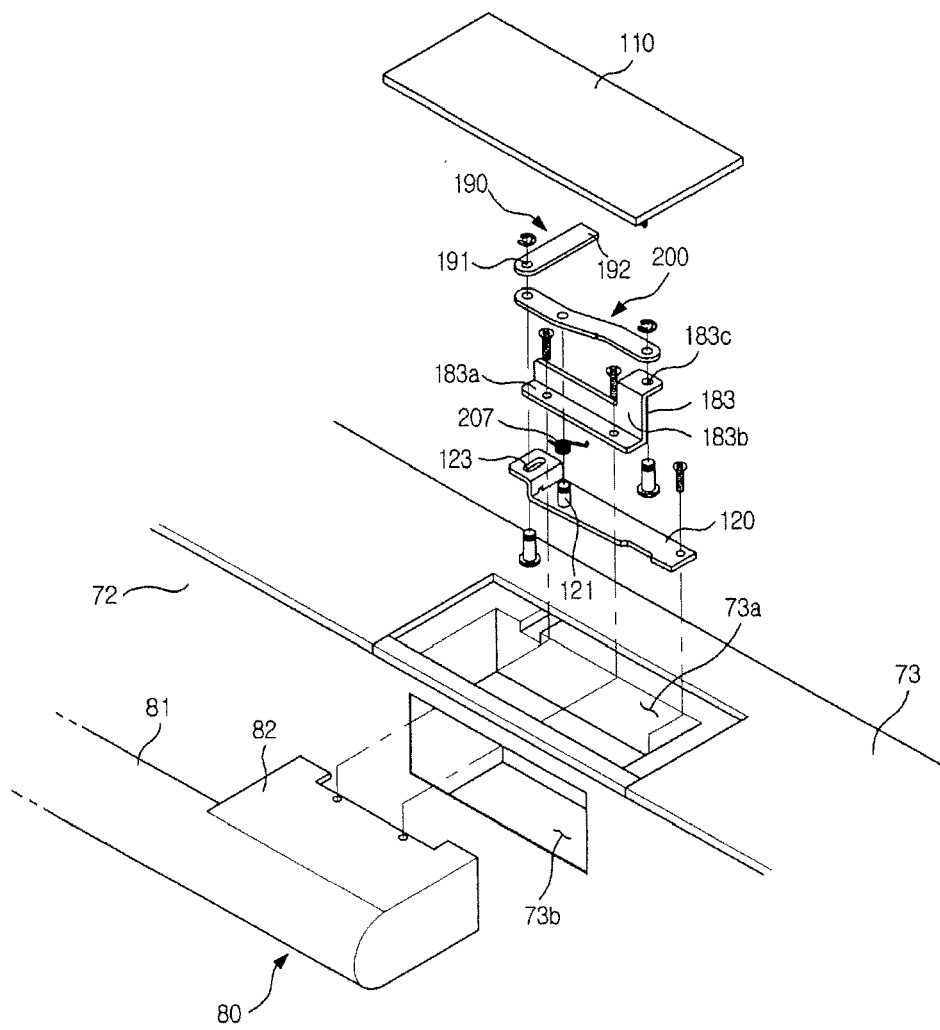


FIG. 6

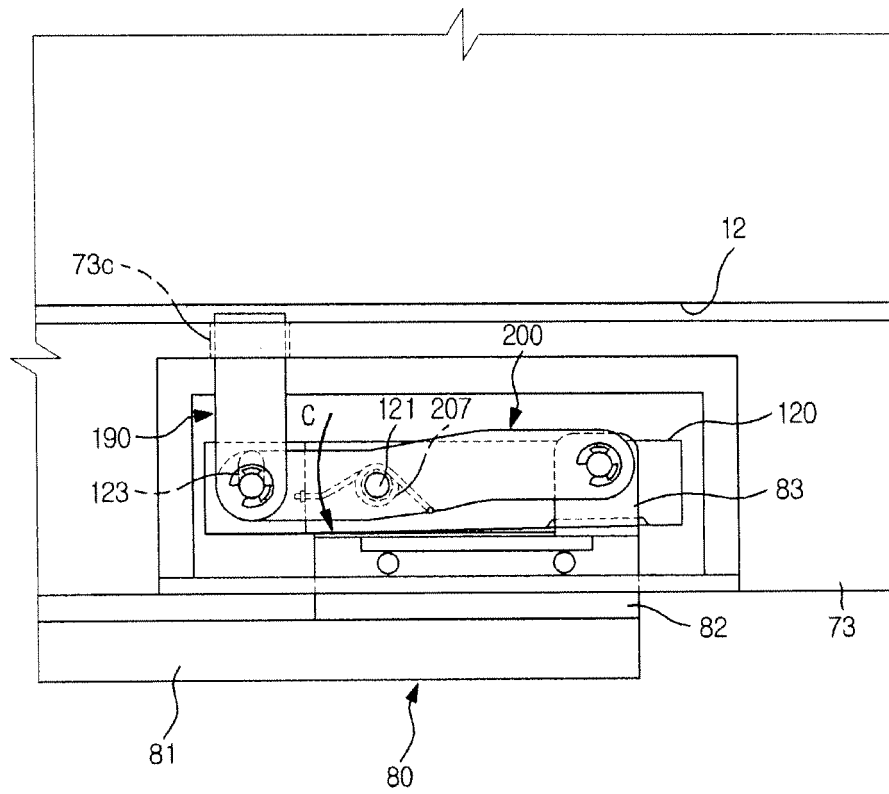


FIG. 7

