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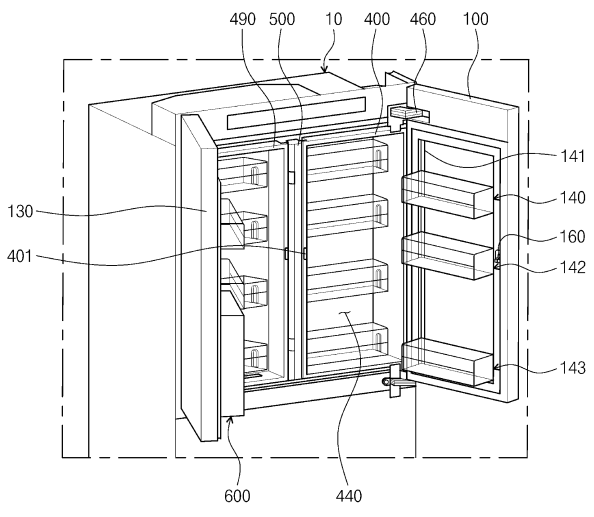
(54) REFRIGERATOR

(57) The present invention relates to a refrigerator and relates to a refrigerator which includes a storage room having an inner space efficiently configured therein and thus enables cold air to flow smoothly in the inner space. The present invention may include: a cabinet having a storage room provided therein; a main door rotatably provided on the cabinet to open or close the storage room; a main door basket installed on the main door; and a sub-door positioned inside the cabinet and rotatably provided with respect to the main door, wherein the sub-door forms an accommodation portion provided with a storage space positioned inside the storage room in a closed state thereof, and at least a part of the main door basket is positioned in the storage space.

FIG. 3



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Description

[Technical Field]

[0001] The present disclosure relates to a refrigerator, which efficiently organizes an interior space of a storeroom and allows cold air to flow smoothly in such interior space.

[Background]

[0002] In general, a refrigerator is a device that includes a compressor, a condenser, an expansion valve, an evaporator, and the like and freezes or refrigerates food or the like by discharging cold air generated by a refrigeration cycle and lowering the temperature inside the refrigerator (inside a storage room).

[0003] A refrigerator generally includes a freezing chamber for freezing and storing food or beverages as a storeroom, and a refrigerating chamber for storing the food or beverages at a low temperature.

[0004] Refrigerators are classified into a top mount type in which a freezing chamber is disposed above a refrigerating chamber, a bottom freezer type in which the freezing chamber is disposed below the refrigerating chamber, and a side-by-side type in which the freezing chamber and the refrigerating chamber are separated as left and right sides. In this case, doors are provided in the freezing chamber and the refrigerating chamber, respectively, and the freezing chamber or the refrigerating chamber are accessed through the doors.

[0005] In addition to the refrigerator in which the refrigerating chamber and the freezing chamber are separated from each other, there is also a refrigerator in which the freezing chamber and the refrigerating chamber are accessed through a single door. Most of these refrigerators are small, and a freezing chamber is generally provided in a predetermined space inside the refrigerating chamber.

[0006] Among top-mounted refrigerators, a French type refrigerator in which an upper refrigerating chamber is opened and closed through left and right doors is also provided. The freezing chamber of the French type refrigerator is also opened and closed through the left and right doors.

[0007] Recently, a home-bar, an ice maker, a shelf, a basket, and the like are mounted on a rear side of a door of a refrigerator, and there is a growing tendency to use the rear side of the door as a separate storage space or a separate function space. That is, the door defines a separate storage space or performs additional functions such as generating and supplying ice or cold water beyond the function of simply opening and closing the freezing chamber or the refrigerating chamber.

[0008] A double door refrigerator in which a sub (auxiliary) door is mounted on a main door that opens and closes a storeroom is provided. This is referred to as a door-in-door (DID) refrigerator, that is, a DID refrigerator.

[0009] When using such a DID refrigerator, a user uses a storeroom by opening the main door, and uses a sub storeroom by opening only a sub door while the main door is closed.

[0010] The sub storage room is provided behind the main door and is referred to as a storage area partitioned from the storage room through some partitions. Recently, there is a trend in that the sub storage area is not formed only in a part of the main door, but is formed in substantially the entire area of the main door

[0011] Therefore, the sub storeroom inside the main door is opened and closed to form a separate door. This is referred to as an interior door. In contrast, the main door described above is referred to as an exterior door.

[0012] Baskets for storing food or objects are provided in the main door and the sub door. However, it is difficult to supply cold air to the basket installed in the sub door or the basket installed in the main door.

[0013] In addition, there is a problem that the main door itself is too thick, or the door itself including the sub door and the main door takes up an overly large volume, thereby reducing an area of the storeroom of the refrigerator or making the refrigerator excessively large.

[0014] For example, the disclosure described in a reference (Patent Document 1) below relates to a refrigerator provided with a container in which a storage area (corresponding to a sub storeroom) different from an internal storeroom of the refrigerator is defined on a door side.

[0015] In the refrigerator disclosed in Patent Document 1, it is difficult to efficiently supply cold air to a basket installed on a side of an exterior door.

[0016] In addition, since the basket installed on the side of the exterior door has a width corresponding to the width of the exterior door, the exterior door becomes too thick in consideration of a storage space of the basket. In this regard, in such a refrigerator, it is difficult to load a lot of food or objects in a basket installed on an exterior door.

[0017] In some cases, interference occurs between an inner basket installed in the container and a basket installed in the exterior door.

[0018] Even if these baskets are arranged to prevent interference therebetween, a cold air flow path is not efficiently provided or the baskets block cold air, resulting in deterioration in refrigerating efficiency.

[0019] The invention described in another prior art document (Patent Document 2) below is a refrigerator in which an exterior door where a shelf for storage is installed in an opening that opens a storeroom of a refrigerator body, and an interior body disposed between the storeroom and the exterior door to prevent cold air leakage are installed.

[0020] According to the refrigerator disclosed in the invention described in Patent Document 2 as described above, a case of opening both the exterior door and the interior door and a case of opening only the exterior door may be selected by manipulating a handle for opening/closing.

[0021] Therefore, when opening both doors, the shelf may be kept covered. Further, to retrieve food stored on the shelf, only the exterior door may be opened, so that cold air may be clearly prevented from escaping from a side that is not related to the food retrieval, and temperature lowering during the food retrieval may be prevented.

[0022] Because such interior door is constructed to cover a shelf side of the exterior door, the opening for flow of cold air is defined at upper and lower sides of the interior door.

[0023] As such, because the interior door is constructed to prevent the cold air leakage, a separate storage space is not defined in the interior door and the interior door is merely constructed to cover an entirety of the exterior door including the shelf. Therefore, an overall storage space of the refrigerator becomes rather narrow, making it impossible to store a lot of food or items.

[0024] As such, the sub storeroom is expanding, but a method to ensure that such sub storeroom and the baskets installed inside and outside the sub storeroom have an optimal door thickness, an efficient cold air flow, a loading capacity, and the like is required.

[Prior art literature]

[Patent Document]

[0025]

1. Korean Patent Application Publication No. 10-2016-0019489 (published on February 19, 2016)
2. Japanese Utility Model Application Publication No. 1988-142682 (published on September 20, 1988)

[Summary]

[Technical Problem]

[0026] The present disclosure provides a refrigerator for efficiently configuring a storage space divided according to a partition of a refrigerator door in consideration of the volume of the refrigerator.

[0027] In addition, the present disclosure is to provide a refrigerator that may effectively supply cold air to a storage space defined by being divided based on a partition of a refrigerator door.

[0028] In addition, the present disclosure is to provide a refrigerator that may effectively supply cold air to a storage space on a door side using a cold air supply for regulating cold air on the refrigerator door side.

[0029] In addition, the present disclosure is to provide a refrigerator that may prevent reduction of a thickness of an exterior door and an unnecessary increasing of an overall volume of the refrigerator resulted therefrom.

[0030] In addition, the present disclosure is to provide a refrigerator that may efficiently load a lot of food or items into an external basket installed on an exterior door and an internal basket installed on an interior door.

[0031] In addition, the present disclosure is to provide a refrigerator that may efficiently supply cold air to an external basket and an internal basket.

[Technical Solutions]

[0032] To achieve the above-mentioned purpose, in the present disclosure, a basket installed on a main door may be located in a sub storage space defined by being divided based on a partition of a refrigerator door.

[0033] In other words, a sub door that defines the sub storage space including a first region on a storage space side and a second region adjacent thereto may be disposed, and the basket installed on the main door may be located to overlap in the second region.

[0034] In this regard, the sub door may include an accommodation portion that defines a storage space corresponding to a width between a first side in a direction of a storeroom and a second side in a direction of the main door.

[0035] A sub door basket installed away from the second side may be disposed in an at least partial space in such storage space.

[0036] In an embodiment, a width of such sub door basket may correspond to a width from the first side to a third side spaced apart from the second side in a direction of the first side.

[0037] In one example, a main door basket may be located in the storage space so as not to overlap the sub door basket by being located in a storage space between the second side and the third side.

[0038] Additionally, a cold air flow path that allows cold air to pass therethrough may be formed within such storage space.

[0039] Such cold air flow path may include an inflow path where cold air is introduced and an outflow path where cold air is discharged, and the inflow path may be connected to a cold air outlet where cold air is discharged into the storeroom of the refrigerator.

[0040] Additionally, the inflow path may be formed in the first region, and the outflow path may be formed in the second region. Accordingly, cold air may be supplied into, circulate in, and pass through the sub storage space efficiently. Additionally, even when multiple sub door and main door baskets are installed, cold air may circulate in or pass through the sub storage space efficiently.

[0041] Specifically, as a first aspect to achieve the above-mentioned purpose, the present disclosure provides a refrigerator including a cabinet having a storeroom defined therein, a main door rotatably disposed on the cabinet to open and close the storeroom, a main door basket installed on the main door, and a sub door located inside the cabinet and rotatable relative to the main door, and the sub door has an accommodation portion defining a storage space located inside the storeroom when the sub door is closed, and at least a portion of the main door basket is located in the storage space.

[0042] In one implementation, a surface of the accom-

modation portion facing the main door may be opened.

[0043] In one implementation, the refrigerator may further include a sub door basket installed within the accommodation portion.

[0044] In one implementation, the sub door basket may be located spaced apart from the open surface of the accommodation portion by a first distance, inwardly of the accommodation portion.

[0045] In one implementation, at least a portion of the main door basket may be located within the first distance from the accommodation portion.

[0046] In one implementation, a lower side of the sub door basket may include a first discharge hole, wherein cold air passes through the first discharge hole.

[0047] In one implementation, a cold air flow path allowing cold air to flow by passing therethrough may be formed in the accommodation portion.

[0048] In one implementation, the cold air flow path may include an inflow path where cold air is introduced, and an outflow path where cold air is discharged.

[0049] In one implementation, the storage space may include a first region where the sub door basket is installed, and a second region located between the first region and the main door, and the inflow path may be located in the first region.

[0050] In one implementation, the outflow path may be located in the second region.

[0051] In one implementation, the inflow path may be connected to a cold air outlet where cold air is discharged into the storeroom.

[0052] In one implementation, the sub door basket may be located closer to the cold air outlet than the main door basket.

[0053] In one implementation, a lower side of the main door basket may include a second discharge hole, wherein cold air passes through the second discharge hole.

[0054] As a second aspect to achieve the above-mentioned purpose, the present disclosure provides a refrigerator including a cabinet having a storeroom defined therein, a main door rotatably disposed on the cabinet to open and close the storeroom, a main door basket installed on the main door to face the storeroom, and a sub door rotatable relative to the main door, the sub door includes an accommodation portion defining a storage space located inside the storeroom when the sub door is closed, and the storage space includes a first region where a sub door basket is installed, and a second region located between the first region and the main door.

[0055] In one implementation, at least a portion of the main door basket may be located in the second region.

[0056] In one implementation, a cold air flow path allowing cold air to flow by passing therethrough may be formed in the accommodation portion.

[0057] In one implementation, the cold air flow path may include an inflow path where cold air is introduced, and an outflow path where cold air is discharged.

[0058] In one implementation, the inflow path may be located in the first region.

[0059] In one implementation, the outflow path may be located in the second region.

[0060] In one implementation, the inflow path may be connected to a cold air outlet where cold air is discharged into the storeroom.

[0061] In one implementation, the sub door basket may be located closer to the cold air outlet than the main door basket.

[0062] In one implementation, a lower side of the sub door basket may include a first discharge hole, wherein cold air passes through the first discharge hole.

[0063] In one implementation, a lower side of the main door basket includes a second discharge hole, wherein cold air passes through the second discharge hole.

[0064] In one implementation, the main door basket may include a first main door basket located at an upper side within the second region, a second main door basket located under the first main door basket within the second region, and a third main door basket located between the first main door basket and the second main door basket.

[0065] In one implementation, the sub door basket may include a first sub door basket located at an upper side within the first region, a second sub door basket located under the first sub door basket within the first region, and a third sub door basket located between the first sub door basket and the second sub door basket.

[0066] In one implementation, the first main door basket may be located downwardly of the first sub door basket.

[0067] As a third aspect to achieve the above-mentioned purpose, the present disclosure provides a refrigerator including a cabinet having a storeroom defined therein, a main door rotatably disposed on the cabinet to open and close the storeroom, a main door basket installed on the main door, a sub door rotatable relative to the main door, wherein the sub door includes an accommodation portion located inside the storeroom when the sub door is closed and having an open surface facing the main door, and a sub door basket installed within the accommodation portion, and the sub door basket is located spaced apart from the open surface of the accommodation portion, inwardly of the accommodation portion.

[0068] In one implementation, the sub door basket may be located spaced apart from the open surface of the accommodation portion by a first distance, inwardly of the accommodation portion.

[0069] In one implementation, at least a portion of the main door basket may be located within the first distance from the accommodation portion.

[0070] In one implementation, a cold air flow path allowing cold air to flow by passing therethrough may be formed in the accommodation portion.

[0071] In one implementation, the cold air flow path may include an inflow path where cold air is introduced, and an outflow path where cold air is discharged.

[0072] In one implementation, the sub door basket may

be located closer to the inflow path than the main door basket.

[Advantageous Effects]

[0073] According to the embodiment of the present disclosure, the storage space defined by being divided based on the partition of the refrigerator door may be efficiently defined by considering the volume of the refrigerator.

[0074] Additionally, cold air may be effectively supplied to the interior door that forms such sub-storeroom.

[0075] Cold air supplied to such interior door may be supplied using the cold air supply for regulating cold air on the refrigerator door side. Therefore, cold air may be effectively supplied to the storage space on the interior door side using the cold air supply installed in the refrigerator.

[0076] Additionally, the thickness of the exterior door may become smaller. Therefore, the overall volume of the refrigerator may be prevented from being increased unnecessarily.

[0077] Additionally, the external basket and the internal basket may not interfere with each other.

[0078] In addition, a lot of food or items may be efficiently loaded into the external basket installed on the exterior door and the internal basket installed on the interior door.

[0079] Additionally, cold air may be efficiently supplied to the external basket and the internal basket.

[0080] Furthermore, there are additional technical effects not mentioned herein. Those skilled in the art may understand additional technical effects through the description and drawings.

[Brief Description of the Drawings]

[0081]

FIG. 1 is a perspective view illustrating a refrigerator applicable to an embodiment of the present disclosure.

FIG. 2 is a front view illustrating a refrigerator according to an embodiment of the present disclosure.

FIG. 3 is a perspective view illustrating a refrigerator according to an embodiment of the present disclosure.

FIG. 4 is an exploded perspective view illustrating a main part of a main door of a refrigerator according to an embodiment of the present disclosure.

FIGS. 5 and 6 are perspective diagrams illustrating a right refrigerating chamber door of a refrigerator applicable to an embodiment of the present disclosure.

FIG. 7 is a perspective view showing a refrigerator according to an embodiment of the present disclosure.

FIG. 8 is a perspective view of a cold air supply that may be applied to a refrigerator according to an embodiment of the present disclosure.

FIG. 9 is a perspective view showing a refrigerator according to an embodiment of the present disclosure.

FIG. 10 is a perspective view individually illustrating a main door and a sub door of a refrigerator according to an embodiment of the present disclosure.

FIG. 11 is a perspective view individually illustrating a main door and a sub door of a refrigerator according to another embodiment of the present disclosure.

FIGS. 12 and 13 are schematic diagrams illustrating relative positions of a main door and a sub door of a refrigerator with respect to a cabinet according to an embodiment of the present disclosure.

FIG. 14 is a side cross-sectional view showing a coupled structure of a sub door and a main door of a refrigerator according to an embodiment of the present disclosure.

FIG. 15 is a side cross-sectional view to illustrate a flow of cold air in a sub door and a main door of a refrigerator according to an embodiment of the present disclosure.

[Best Mode]

[0082] Reference will now be made in detail to embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts, and redundant description thereof will be omitted. As used herein, the suffixes "module" and "unit" are added or used interchangeably to facilitate preparation of this specification and are not intended to suggest distinct meanings or functions. In describing embodiments disclosed in this specification, relevant well-known technologies may not be described in detail in order not to obscure the subject matter of the embodiments disclosed in this specification. In addition, it should be noted that the accompanying drawings are only for easy understanding of the embodiments disclosed in the present specification, and should not be construed as limiting the technical scope disclosed in the present specification.

[0083] Furthermore, although the drawings are separately described for simplicity, embodiments implemented by combining at least two or more drawings are also within the scope of the present disclosure.

[0084] In addition, when an element such as a layer, region or module is described as being "on" another element, it is to be understood that the element may be directly on the other element or there may be an intermediate element between them.

[0085] Hereinafter, with reference to the accompanying drawings, embodiments of the present disclosure will be described in detail.

[0086] FIG. 1 is a perspective view illustrating a refrigerator applicable to an embodiment of the present dis-

closure. First, a refrigerator applicable to an embodiment of the present disclosure will be described with reference to FIG. 1.

[0087] The refrigerator shown in FIG. 1 is a bottom freezer type refrigerator in which a refrigerating chamber is provided as an upper part of a cabinet 10 and a freezing chamber is provided as a lower part of the cabinet 10. The refrigerating chamber and the freezing chamber of the refrigerator may be a part of the storeroom or main storeroom 11 provided inside the cabinet 10.

[0088] As described above, the present disclosure is not limited to this type of refrigerator, and the present disclosure may be applied to any refrigerator including a door that is rotatably mounted on a cabinet and opens and closes a storeroom of the refrigerator.

[0089] Referring to FIG. 1, as doors for opening and closing the refrigerating chamber, a left refrigerating chamber door 20 and a right refrigerating chamber door 25 may be rotatably installed on left and right sides of the cabinet 10, respectively. Needless to say, unlike this, the refrigerating chamber door may be rotatably mounted one door.

[0090] A freezing chamber door provided below a refrigerating chamber door may also include a left freezing chamber door 30 and a right freezing chamber door 40 rotatably mounted on both sides of a front lower part of the cabinet 10, respectively. Unlike this, the freezing chamber door may be one rotatable door or may be a drawer-type door that is retractable and extendable in forward and backward directions.

[0091] As shown in FIG. 1, the right refrigerating chamber door 25 may include a main door 26 rotatably mounted on one side of the cabinet 10 and a sub door 27 rotatably mounted with respect to the main door 26 or the cabinet 10. That is, when the main door 26 and the sub door 27 are opened together, the refrigerating chamber (the main storeroom 11) may be accessed.

[0092] An opening 29 may be provided inside a central portion of the main door 26, and a sub storeroom (storage space) or a door basket (not shown) may be provided at an inner side (toward the storeroom) of the main door 26.

[0093] A rotate direction of the sub door 27 may be the same as that of the main door 26.

[0094] As mentioned above, the left refrigerating chamber door 20 and the right refrigerating chamber door 25 may be installed symmetrically on left and right sides of the cabinet 10. At this time, unlike shown in FIG. 1, the left refrigerating chamber door 20 and the right refrigerating chamber door 25 may have the same structure. That is, the left refrigerating chamber door 20 may also have a structure including the main door 26 and the sub door 27 as described above.

[0095] FIG. 2 is a front view illustrating a refrigerator according to an embodiment of the present disclosure. FIG. 3 is a perspective view illustrating a refrigerator according to an embodiment of the present disclosure. FIG. 4 is an exploded perspective view illustrating a main part of a main door of a refrigerator according to an embodiment of the present disclosure.

[0096] FIGS. 2 and 3 show a state in which the left refrigerating chamber door 20 and the right refrigerating chamber door 25 have symmetrically identical structures and both the left refrigerating chamber door 20 and the right refrigerating chamber door 25 are open.

[0097] Description of these doors may be separately applied to the left refrigerating chamber door 20 and the right refrigerating chamber door 25 shown in FIG. 2. In addition, the description of the door may be separately applied to the left freezing chamber door 30 and the right freezing chamber door 40.

[0098] A main door frame 141 defining a frame of the main door 100 may be installed in the main door 100, and baskets (main door baskets 140, 142, and 143) for receiving storage items may be accommodated in the main door frame 141.

[0099] At this time, referring to FIG. 4, in order to accommodate the main door baskets 140, 142, and 143, guides 4; 4a, and 4b may be installed on the main door frame 141. The guides 4 may include a first guide 4a provided on one side of the main door frame 141 and a second guide 4b provided on the other side of the main door frame 141.

[0100] More specifically, the first guide 4a and the second guide 4b may be fixed to both sides of a door recess 43, respectively. The first guide 4a may be disposed in a direction away from a hinge part 460, and the second guide 4b may be disposed in a direction closer to the hinge part 460.

[0101] A plurality of guide fasteners 41 provided along a height direction of the main door 100 may be included on the guides 4. The plurality of guide fasteners 41 may be spaced apart from each other in the height direction.

[0102] The main door baskets 140, 142, and 143 may be coupled to these guide fasteners 41. The guide fasteners 41 may be formed as coupling holes 42 penetrating one surface of the guides 4.

[0103] In particular, the coupling holes 42 may be formed through one side of the guides 4 facing the main door baskets 140, 142, and 143. Parts of the main door baskets 140, 142, and 143 may be inserted into the coupling holes 42 to be coupled to and supported by the guides 4.

[0104] As the coupling holes 42 are provided in a plural number along the height direction, coupling positions of the main door baskets 140, 142, and 143 coupled to and supported by the coupling holes 42 may be freely selected. As the number of the coupling holes 42 is increased, the installation height of the main door baskets 140, 142, and 143 may be more precisely adjusted.

[0105] For example, the guide fasteners 41 may be provided in ten or more in the height direction. That is, the coupling holes 42 may be provided in ten or more in the height direction. When the coupling holes 42 are provided in ten, height adjustment of the main door baskets 140, 142, and 143 may also be performed in ten steps. The above number is only a simple example and is not

limited thereto.

[0106] The coupling holes 42 may be formed to pass through one surface of the guides 4 in a forward and backward direction. This forward and backward direction may mean a forward and backward direction in a state where the main door 100 is closed.

[0107] In addition, when the main door baskets 140, 142, and 143 are coupled to the coupling holes 42, the main door baskets 140, 142, and 143 may be coupled in the forward and backward direction in the penetration direction of the coupling holes 42.

[0108] As shown in FIG. 4, the right refrigerating chamber door 25 may include the main door 100 rotatably mounted on one side of the cabinet 10 and a sub door 400 rotatably mounted with respect to the main door 100 or the cabinet 10. That is, when the main door 100 and the sub door 400 are opened together, the refrigerating chamber (the main storeroom 11) may be accessed.

[0109] Referring to FIG. 4, the refrigerator according to an embodiment of the present disclosure may include the hinge part 460 rotatably supporting the right refrigerating chamber door 25 to the cabinet 10. The hinge part 460 may include a first hinge 461 rotatably supporting an exterior door 100 to the cabinet 10. In addition, the hinge part 460 may include a second hinge 462 rotatably supporting the interior door 400 to the cabinet 10 or the exterior door 100.

[0110] The first hinge 461 and the second hinge 462 may be provided to be rotated based on a rotate shaft positioned on the same line. The first hinge 461 and the second hinge 462 may be separately rotatably provided. Also, the second hinge 462 may be disposed inside the first hinge 461.

[0111] A rotatable range of the second hinge 462 may depend on an angle of the first hinge 461. For example, when the first hinge 461 is opened by being rotated by a first angle in a closed state, the second hinge 462 may be separately rotated within the first angle range in the closed state. When the first hinge 461 is opened by being rotated by a second angle in the closed state, the second hinge 462 may be separately rotated within the second angle range in the closed state. That is, rotating of the second hinge 462 at an angle greater than an opening angle of the first hinge 461 may be restricted.

[0112] The hinge part 460 as described above is provided at each of upper and lower portions of the right refrigerating chamber door 25, and may be rotatably support the right refrigerating chamber door 25 to the cabinet 10.

[0113] Referring back to FIG. 3, a refrigerator according to an embodiment of the present disclosure may include an accessory part 600 detachably coupled to main doors 100 and 130. The accessory part 600 may be disposed on one surface of a one-side (e.g., left) main door 130, which faces the main storeroom 11.

[0114] For example, a user may access the accessory part 600 disposed on one side of the left main door 130 by rotating and opening the left main door 130.

[0115] Referring to FIG. 3, the accessory part 600 is shown in a basket shape for accommodating various storage items such as cans and bottles. However, the present disclosure is not limited thereto, and the accessory part 600 may be provided as a device having various functions. A detailed description thereof will be omitted.

[0116] As such, the right refrigerating chamber door 25 may include the main door 100 rotatably coupled to the cabinet 10. In addition, the right refrigerating chamber door 25 may further include the sub door 400 inserted into the cabinet 10. The sub door 400 may be rotatably coupled to at least one of the main door 100 and the cabinet 10.

[0117] The sub door 400 and the main door 100 may be separately rotatably provided. That is, in a state in which the sub door 400 is closed, the sub door 400 does not rotate, and only the main door 100 may be opened by being rotated. When only the main door 100 is opened, the user may access the sub storeroom (storage space 440).

[0118] The sub door 400 and the main door 100 may be detachably coupled to each other. In particular, one side of the sub door 400 and one side of the main door 100, which are positioned in a direction away from a rotate shaft, may be detachably coupled to each other.

[0119] When the sub door 400 and the main door 100 are coupled, the sub door 400 and the main door 100 may rotate together, and when the sub door 400 and the main door 100 are separated, only the main door 100 may rotate. Needless to say, even when the sub door 400 and the main door 100 are separated, coupling of one side of the sub door 400 and one side of the main door 100, which are positioned on the rotate shaft, may be maintained.

[0120] In a state in which the refrigerating chamber door 25 is closed, the sub door 400 may be rotated together with the main door 100 to open a storeroom 11. In this regard, a state in which the sub door 400 and the main door 100 integrally rotate will be described later.

[0121] Hereinafter, configuration implementing coupling and separation of the sub door 400 and the main door 100 will be briefly described.

[0122] The main door 100 may include a latch 160, and the sub door 400 may include a latch insertion hole 401. The latch 160 may be inserted into and coupled to the latch insertion hole 401. In this way, in a state in which engagement between the latch 160 and the latch insertion hole 401 is maintained, the sub door 400 and the main door 100 may be coupled and rotate together. In a state in which engagement between the latch 160 and the latch insertion hole 401 is released, the sub door 400 and the main door 100 are separated and rotate separately.

[0123] As such, the sub door 400 may include the latch insertion hole 401 coupled to the latch 160 of the main door 100. The latch insertion hole 401 may be recessed at one side of the sub door 400, which faces the main door 100. The latch 160 provided in the main door 100 may be inserted into the latch insertion hole 401.

[0124] Separation of the latch 160 and the latch insertion hole 401 may be implemented through separate manipulation. The latch 160 may be separated from the latch insertion hole 401 through manipulation of a lever (not shown) provided separately in the main door 100.

[0125] For example, when the main door 100 is opened in a state where a lever is not operated, the sub door 400 may be opened together with the main door 100. In addition, when the main door 100 is opened while the lever is manipulated, the sub door 400 does not move and only the main door 100 may be rotated and open.

[0126] The right refrigerating chamber door 25 and the left refrigerating chamber door 20 may include sub doors 400 and 490, respectively. In this case, a filler 500 may be disposed between the right sub door 400 and the left sub door 490. The filler 500 may prevent cold air of the storeroom 11 from leaking to the outside through a space between the right sub door 400 and the left sub door 490.

[0127] FIGS. 5 and 6 are perspective diagrams illustrating a right refrigerating chamber door of a refrigerator applicable to an embodiment of the present disclosure.

[0128] FIG. 5 shows a state in which the main door 100 in the right refrigerating chamber door 25 is opened, and FIG. 6 shows a state in which the main door 100 and the sub door 400 in the right refrigerating chamber door 25 are both opened.

[0129] Hereinafter, detailed configurations of the main door 100 and the sub door 400 will be described in detail with reference to FIGS. 9 and 10.

[0130] As described above, the description of the door may be applied in the same way to all doors (left/right refrigeration/freezing chamber doors). For example, the description below may be applied in the same way to the left refrigerating chamber door 20.

[0131] Referring to FIGS. 5 and 6, the right refrigerating chamber door 25 may include the main door 100 and the sub door 400. The main door 100 may be rotatably coupled with respect to the cabinet 10. When the main door 100 is opened, the user may access the sub storeroom (storage space 440) formed in the sub door 400.

[0132] The main door 100 disposed outside the sub door 400 may also be referred to as the exterior door 100. That is, when the sub door 400 is provided, the main door 100 combined with the sub door 400 may be referred to as an exterior door. Also, the sub door 400 may be referred to as an interior door. Hereinafter, the term the main door 100 may be used interchangeably with the term exterior door. Likewise, the term the sub door 400 may be used interchangeably with the term interior door.

[0133] The sub door 400 may include the storage space 440. One side of the storage space 440 may be opened. For example, the storage space 440 may be opened in a direction toward the main door 100. Specifically, a surface of the storage space 440, which faces the main door 100, may be opened.

[0134] The storage space 440 may be formed by an accommodation portion 430. That is, the storage space 440 may be formed by the accommodation portion 430 having a container shape with at least one surface open.

[0135] Inside the storage space 440 formed by the accommodation portion 430, interior door baskets 150 and 151 may be installed.

[0136] In this case, the main door baskets 140, 142, and 143 and the interior door baskets 150, 151, and 152 may be provided not to overlap each other. More specifically, the main door baskets 140, 142, and 143 and the interior door baskets 150, 151, and 152 may be provided not to overlap each other in a horizontal direction.

[0137] Also, the storage space 440 may include a first region 441 facing the storeroom 11 and a second region 442 toward the outside. That is, the storage space 440 may include the first region 441 formed inwardly in a depth direction of the cabinet 10 and the second region 442 disposed outside the first region 441.

[0138] Sub door baskets 150 and 151 may be installed in the first region 441. In addition, at least a part of the main door basket 140 may be positioned in the second region when the main door 100 is closed. Accordingly, the sub door 400 including the sub door baskets 150 and 151 and the main door 100 including the main door basket 140 are combined to form the efficient storage space 440 without interfering with each other.

[0139] As described above, the sub door 400 may form the storage space 440 having a width between a first surface toward the storeroom 11 and a second surface toward the main door 100. The storage space 440 may be formed by the accommodation portion 430 having an approximate container shape.

[0140] The storage space 440 of the sub door 400 may have a predetermined width from a front surface of the cabinet 10 to a depth direction of the cabinet 10

[0141] In this case, the sub door baskets 150 and 151 may be positioned within the storage space 440 and spaced apart from the front surface of the cabinet 10. That is, since the sub door baskets 150 and 151 are positioned in the first region 441, the sub door baskets 150 and 151 may be spaced apart from the open surface of the storage space 440 by a predetermined distance.

[0142] At this time, the sub door baskets 150 and 151 may be installed over a certain width in at least a portion of the storage space 440. In other words, the sub door baskets 150 and 151 may have a width corresponding to the first region 441. Also, at least a part of the main door basket 140 may be positioned in the second region 442 when the main door 100 is closed. The storage space 440 including the first region 441 and the second region 442 will be described later in detail.

[0143] When the sub door 400 is closed, the storage space 440 formed by the accommodation portion 430 of the sub door 400 may be inserted and positioned inside the storeroom 11. In this case, both the first region 441 and the second region 442 may be inserted and positioned inside the storeroom 11.

[0144] Due to this, the sub door 400 including the sub door baskets 150 and 151 and the main door 100 includ-

ing the main door basket 140 are combined to form the efficient storage space 440 without interfering with each other. Accordingly, the amount of load to be accommodated compared to the same volume may be increased. In addition, since at least a part of the main door basket 140 is positioned within the storage space 440, cold air may be efficiently supplied to the main door basket 140. Also, fluidity of air flowing through the main door basket 140 and the sub door baskets 150 and 151 may be increased. In addition, the overall thickness of the door may be reduced.

[0145] In some cases, the first region 441 may be inserted and positioned inside the storeroom 11, a part of the second region 442 may be inserted and positioned inside the storeroom 11, and the remaining part of the second region 442 may be positioned outside the storeroom 11.

[0146] As such, the sub door 400 forms the storage space 440 positioned inside the storeroom 11 in a closed state, and at least a part of the main door basket 140 may be positioned in the storage space 440.

[0147] FIG. 5 shows a state in which the sub door 400 is closed without rotating with the main door 100. FIG. 6 shows a state in which the sub door 400 rotates with the main door 100 and is open.

[0148] Referring to FIG. 5, the main door 100 may include a door gasket 146 to prevent leakage of cold air inside the storeroom 11. For example, the door gasket 146 may be disposed between an inner surface of the main door 100 and the cabinet 10 in a closed state of the main door 100 to prevent cold air in the storeroom 11 from leaking. The door gasket 146 may be provided along a circumference of the main door frame 141.

[0149] Referring to FIG. 6, in a state in which the sub door 400 rotates with the main door 100 and is open, the main storeroom 11 may be exposed.

[0150] A shelf 13 (or a storage box) may be provided inside the main storeroom 11. The shelf 13 may partition the inside of the storeroom 11. The shelf 13 may improve space utilization of the main storeroom 11 by partitioning the inside of the main storeroom 11 in a height direction.

[0151] Referring to FIG. 6, an inflow path 410 of cold air penetrating one side surface (e.g., top surface) of the sub door 400 may be formed in the sub door 400. For example, the inflow path 410 may be positioned to allow cold air inside the storeroom 11 to be introduced. As another example, the inflow path 410 may be connected to a cold air outlet 330 (refer to FIG. 7) through which cold air is supplied through a separate cold air supply 300 (refer to FIG. 8).

[0152] Although not shown in FIG. 6, an outflow path 420 (refer to FIG. 9) through which cold air is discharged may be formed on the other side surface (e.g., a bottom surface) of the sub door 400. The inflow path 410 and the outflow path 420 as described above may form a flow path through which cold air is circulated through the storage space 440.

[0153] Referring to FIG. 6, in a state in which the sub door 400 and the main door 100 are coupled (for example, by coupling the latch 160 and the latch insertion hole 401), the storage space 440 of the sub door 400 includes the sub door basket 150 and the main basket 140 that are disposed together. Therefore, cold air may be efficiently supplied to the main door basket 140 through the storage space 440.

[0154] As mentioned above, in the storage space 440 of the sub door 400, a part in which the sub door basket 150 is disposed may correspond to the first region 441, and a part in which the main door basket 140 is disposed may correspond to the second region 442.

[0155] At this time, for efficient flow and circulation of cold air, the position of the sub door basket 150 installed at the uppermost part of the sub door 400 is provided higher than the position of the main door basket 140 installed at the uppermost part of an inner surface (at a side of the storeroom) of the main door. Therefore, cold air introduced through the inflow path 420 is first supplied to the sub door basket 150 adjacent to the inflow path 420, and then may flow toward the main door basket 140.

[0156] In addition, referring to FIG. 6, the main storeroom 11 formed in the cabinet 10 may be seen in a state in which both the left refrigerating chamber door 20 and the right refrigerating chamber door 25 are open (the state of FIG. 2 indicates a state in which the sub door 400 is closed state, in this case, the main storeroom 11 may be seen through the sub door 400).

[0157] FIG. 7 is a perspective view showing a refrigerator according to an embodiment of the present disclosure.

[0158] Referring to FIG. 7, a state in which a frame 12 constituting the cabinet 10 of the refrigerator according to an embodiment of the present disclosure is viewed from below is shown. the cabinet 10 and the frame 12 as such may substantially be the same component. In other words, the cabinet 10 may be formed by forming an exterior on the frame 12.

[0159] As described above, the sub door 400 may be disposed inwardly of the main door 100. That is, the refrigerator according to an embodiment of the present disclosure may include the cabinet 10 or 12 in which the storeroom 11 is defined, the main door 100 rotatably disposed on the cabinet 10 or 12 to open and close the storeroom 11, and the sub door 400 located within the storeroom 11 and rotatable with respect to the main door 100.

[0160] Such sub door 400 may include the storage space (sub storeroom 440). Additionally, the sub door 400 may include the cold air flow path (inflow path) 410 that allows cold air circulation A to be performed in the storage space 440. Cold air may flow into the storage space 440 by such inflow path 410.

[0161] As an embodiment, the separate cold air outlet 330 may be defined in the refrigerator. Such cold air outlet 330 may be a component for regulating cold air based on opening and closing of the door.

[0162] As such, the inflow path 410 of cold air formed in

the storage space 440 may be connected to the cold air outlet 330. Therefore, cold air discharged from the cold air outlet 330 may be circulated via the storage space 440 defined in the sub door 400.

[0163] Such cold air outlet 330 may be located at an upper portion of the storeroom 11 of the refrigerator. Cold air supplied to the storeroom 11 of the refrigerator may be supplied together via such cold air outlet 330. That is, cold air for cooling the food and the like stored in the storeroom 11 of the refrigerator may be supplied via the cold air outlet 330 with a different route. Such cold air outlet 330 may constitute an air curtain-type cold air regulator.

[0164] In one example, cold air may be supplied to the storage space 440 defined in the sub door 400 via the separate cold air supply 300 (refer to FIG. 8). That is, according to an embodiment, the separate cold air supply 300 that is installed at the upper side of the cabinet 10 or 12 and discharges cold air downward may be disposed.

[0165] FIG. 8 is a perspective view of a cold air supply that may be applied to a refrigerator according to an embodiment of the present disclosure.

[0166] Hereinafter, with reference to FIG. 8, the cold air supply 300 that may supply cold air to the storage space 440 defined in the sub door 400 will be described as an example.

[0167] As described above, cold air may be supplied to the storage space 440 defined in the sub door 400 via the separate cold air supply 300 as shown in FIG. 8.

[0168] The cold air supply 300 according to an embodiment of the present disclosure may form an outer appearance by a housing 321 and a front cover 322 coupled to a front surface of the housing 321.

[0169] A cold air discharge grill 311 may be formed at a lower side of the front surface of the housing 321, and the front cover 322 may be located above the cold air discharge grill 311.

[0170] In addition, an intake grill 312 may be disposed on a rear surface of the housing 321 to allow air outside the cold air supply 300 to flow into the housing 321.

[0171] An evaporator 306 may be installed inside the housing 321. The evaporator 306 may be connected in parallel with a refrigerating chamber evaporator or a freezing chamber evaporator disposed in the storeroom 11 inside the refrigerator cabinet 10. As another example, a separate cooling cycle including a compressor, a condenser, and expansion valve may be disposed inside the housing 321.

[0172] A blower including a blowing fan 303, a fan housing 305, and a fan motor 324 may be disposed at a front end of the housing 321. Such blower may be shielded by the front cover 322.

[0173] FIG. 9 is a perspective view showing a refrigerator according to an embodiment of the present disclosure.

[0174] Referring to FIG. 9, a state in which the frame 12 constituting the cabinet 10 of the refrigerator according to an embodiment of the present disclosure viewed from above is shown. As mentioned above, the cabinet 10 and the frame 12 as such may substantially be the same component. In other words, the cabinet 10 may be formed by forming the exterior on the frame 12.

[0175] As described above, the sub door 400 may be disposed inwardly of the main door 100. That is, the storeroom 11 inward of the main door 100 may have the sub door 400 rotatable with respect to the main door 100.

[0176] Specifically, the refrigerator according to an embodiment of the present disclosure may include the cabinet 10 or 12 in which the storeroom 11 is defined, the main door 100 rotatably disposed on the cabinet 10 or 12 to open and close the storeroom 11, and the sub door 400 rotatable with respect to the main door 100.

[0177] Such sub door 400 may include the storage space (sub storeroom 440). Additionally, the sub door 400 may include a cold air flow path that allows cold air circulation (in a direction A -> B -> C) in which cold air may pass through an upper portion and then a lower portion of the sub door 400 to be performed in the storage space 440.

[0178] The cold air flow path of the sub door 400 may include the inflow path 410 into which cold air is introduced and the outflow path 420 from which cold air is discharged. In this regard, as described above, the inflow path 410 may be connected to the cold air outlet 330 from which cold air is discharged into the storeroom of the refrigerator.

[0179] As described above, the refrigerator may be equipped with the cold air outlet 330 to regulate cold air based on the opening and the closing of the door. The inflow path 410 of cold air formed in the storage space 440 as such may be connected to the cold air outlet 330.

[0180] Therefore, cold air discharged from the cold air outlet 330 may be circulated via the storage space 440 defined in the sub door 400. That is, cold air discharged from the cold air outlet 330 may be first introduced into the sub door 400 along the inflow path 410 and flow in the path indicated by the arrow A.

[0181] Cold air introduced into the sub door 400 by passing through the inflow path 410 as such may be discharged out of the sub door 400 via the outflow path 420, as indicated by the arrow B.

[0182] Thereafter, cold air discharged out of the sub door 400 via the outflow path 420 may bypass and be introduced into a space in the storeroom 11 of the refrigerator, as indicated by the arrow C. Cold air introduced into the space in the storeroom 11 as such may later pass through the inflow path 410 and flow into the sub door 400 again.

[0183] FIG. 10 is a perspective view individually illustrating a main door and a sub door of a refrigerator according to an embodiment of the present disclosure. FIG. 11 is a perspective view individually illustrating a main door and a sub door of a refrigerator according to another embodiment of the present disclosure.

[0184] Hereinafter, operation and effects of the refrig-

erator according to an embodiment of the present disclosure will be described in detail with reference to FIGS. 10 and 11. In this regard, the description will be mainly made with reference to FIG. 10.

[0185] Referring to FIG. 10, the sub door 400 that is rotatable with respect to the main door 100 may be disposed. In FIG. 10, a structure such as the hinge 460 part (refer to FIG. 4) for the rotating between the main door 100 and the sub door 400 is omitted.

[0186] Referring to FIG. 10, the sub door 400 may include the accommodation portion 430 that defines the storage space (sub storeroom 440).

[0187] As shown, such accommodation portion 430 may have a box shape forming five surfaces excluding a front open surface 432. Additionally, the accommodation portion 430 may have a roughly rectangular shape to define the storage space.

[0188] The accommodation portion 430 may have a shape so as to be stably seated in the storeroom 11 when the sub door 400 is closed. For example, the accommodation portion 430 may be formed such that a portion thereof located at a central side of the cabinet 10 is curved, so that the two sub doors 400 may be stably accommodated inside the storeroom 11.

[0189] For example, the accommodation portion 430 may form an inclined or curved surface at one side of the first region 441 (a direction toward the sub door 490 at the other side of the refrigerator). That is, the first region 441 of the storage space 440 of the sub door 400 may include the inclined surface or the curved surface.

[0190] In one example, in some cases, a cover 450 that may be opened and closed may be installed on the front open surface of the accommodation portion 430. Such cover 450 may be made of a transparent or translucent material, so that the food or items stored in the sub storeroom 440 may be seen. For example, such cover 450 may be located at a boundary surface between the first region 441 and the second region 442. That is, the cover 450 may be located inwardly of the open surface 432 of the accommodation portion 430 at a certain depth (first distance W) from the open surface 432.

[0191] Accordingly, the sub door baskets 150, 151, and 152 may be positioned at the first distance W from the open surface 432 of the accommodation portion 430 inwardly of the accommodation portion 430.

[0192] As such, the accommodation portion 430 may define the storage space (sub storeroom 440) having the open one side or having a portion excluding the cold air flow path, defining an enclosed space by the cover 450. That is, when the cover 450 is disposed, the sub door 400 including the accommodation portion 430 and the cover 450 may define a closed interior space. Therefore, the sub door 400 may act as the sub door 400 that may regulate the storeroom 11. In this regard, the closed interior space may be defined in the first region 441.

[0193] In one example, the cover 450 may be omitted. In other words, even when the cover 450 is omitted, cold air in the storeroom 11 may be regulated by a portion defining the first region 441 of the storage space 440 that is defined by the accommodation portion 430.

[0194] Referring to FIG. 10, in some cases, the accommodation portion 430 may have an opening 431 defined in an opposite surface of the front open surface 432 (i.e., a rear surface).

[0195] In one example, referring to FIG. 11, the accommodation portion 430 may form a rear open surface 433 where the entire opposite surface of the front open surface 432 is omitted. That is, the rear open surface 433 in which the entire rear surface of the accommodation portion 430 is opened may be formed.

[0196] Accordingly, edge surfaces where the front open surface 432 and the rear open surface 433 are respectively formed may be formed in the accommodation portion 430, and the storage space 440 may be formed by such edge surfaces.

[0197] As described above, the storage space 440 may include the first region 441 facing the storeroom 11 (or directed in the depth direction of cabinet 10) and the second region 442 facing the outside of the storeroom 11 (i.e., direction in the direction of the main door 100). The sub door baskets 150, 151, and 152 may be installed in the first region 441.

[0198] In one example, the main door baskets 140, 142, and 143 may be installed on the main door 100. In this regard, when the main door 100 is closed, that is, when the main door 100 is coupled to the sub door 400, at least portions of the main door baskets 140, 142, and 143 may be located in the second region 442. For example, an entirety of the main door baskets 140, 142, and 143 may be located within the second region 442.

[0199] Accordingly, the main door 100 itself may become thinner. Therefore, an overall volume of the refrigerator may be prevented from being increased unnecessarily.

[0200] Additionally, the main door baskets 140, 142, and 143 and the sub door baskets 150, 151, and 152 may not interfere with each other.

[0201] When the main door baskets 140, 142, and 143 and the sub door baskets 150, 151, and 152 interfere with each other, a flow of cold air flowing through such main door baskets 140, 142, and 143 and sub door baskets 150, 151, and 152 may not be smooth, which may reduce refrigeration efficiency. Additionally, as a result, an amount of the food or the items loaded into the main door baskets 140, 142, and 143 and the sub door baskets 150, 151, and 152 may be drastically reduced.

[0202] Accordingly, a lot of food or items may be efficiently loaded into the main door baskets 140, 142, and 143 installed on the main door 100 and the sub door baskets 150, 151, and 152 installed on the sub door 400.

[0203] Additionally, cold air may be efficiently supplied to the main door baskets 140, 142, and 143 and the sub door baskets 150, 151, and 152.

[0204] As an embodiment, the sub door 400 may define the enclosed space at least in an opening and closing direction of the sub door 400. That is, a portion of the sub

door 400 excluding the inflow path 410 and the outflow path 420 may be formed to be enclosed.

[0205] Referring to FIGS. 10 and 11, the inflow path 410 may be defined in a top surface of the accommodation portion 430 and the outflow path 420 may be defined in a bottom surface of the accommodation portion 430.

[0206] Such inflow path 410 may be freely defined at a position in communication with the storage space 440 in the top surface of the accommodation portion 430. Additionally, the outflow path 420 may be freely defined at a position in communication with the storage space 440 in the bottom surface of the accommodation portion 430.

[0207] For example, the inflow path 410 may be defined in the top surface of the accommodation portion 430 at a position corresponding to the first region 441. Considering the position of the storeroom 11 located inside the refrigerator and the position of the cold air outlet 330 resulted therefrom, it may be advantageous for the inflow path 410 to be defined at the position corresponding to the first region 441.

[0208] As another example, the inflow path 410 may be defined in the top surface of the accommodation portion 430 at a position corresponding to the second region 442. In one example, the inflow path 410 may be defined in the top surface of the accommodation portion 430 at a position corresponding to the boundary between the first region 441 and the second region 442. Such position where the inflow path 410 is defined may correspond to at least one of the position and the shape of the storeroom 11, the position of the cold air outlet 330, and the relative positions of the sub door baskets 150, 151, and 152 and the main door baskets 140, 142, and 143.

[0209] In one example, the outflow path 420 may be defined in the bottom surface of the accommodation portion 430 at a position corresponding to the second region 442. Considering the relative positions of the sub door baskets 150, 151, and 152 and the main door baskets 140, 142, and 143 arranged in the storage space 440, it may be advantageous for the outflow path 420 to be defined at the position corresponding to the second region 442. When the outflow path 420 is defined at the position corresponding to the second region 442, cold air may be efficiently supplied to the main door baskets 140, 142, and 143, which are at least partially located in the second region 442.

[0210] As another example, the outflow path 420 may be defined in the bottom surface of the accommodation portion 430 at the position corresponding to the first region 441. In one example, the outflow path 420 may be defined in the bottom surface of the accommodation portion 430 at a position corresponding to the boundary between the first region 441 and the second region 442. The position where the outflow path 420 is defined may correspond to at least one of the position and the shape of the storeroom 11, the position of the cold air outlet 330, and the relative positions of the sub door baskets 150, 151, and 152 and the main door baskets 140, 142, and 143.

[0211] Hereinafter, an example in which the inflow path 410 is defined in the top surface of the accommodation portion 430 at the position corresponding to the first region 441 and the outflow path 420 is defined in the bottom surface of the accommodation portion 430 at the position corresponding to the second region 442 will be described in detail.

[0212] In one example, the inflow path 410 may be defined in the top surface of the accommodation portion 430 in a longitudinal direction of the top surface. Such longitudinal direction may be substantially the same as the formation direction of the cold air outlet 330.

[0213] Additionally, the outflow path 420 may be defined in the bottom surface of the accommodation portion 430 in a longitudinal direction of the bottom surface. For example, a length and a shape of such outflow path 420 may be substantially the same as those of the inflow path 410.

[0214] As such, the sub door 400 may define the storage space 440, which is the closed space in the opening and closing direction, via the rotatable hinge coupling with the cabinet 10. Therefore, with the sub door 400 closed, cold air in the storeroom 11 may be regulated.

[0215] In this regard, cold air may be circulated via the inflow path 410 and the outflow path 420 even when the sub door 400 is closed. Therefore, cold air may be supplied to the food or the like stored in the storage space 440 via the circulation of cold air.

[0216] Additionally, the interior space 440 defined by the accommodation portion 430 may have the multiple sub door baskets 150, 151, and 152 in the vertical direction. The installation positions of such multiple sub door baskets 150, 151, and 152 may be changed.

[0217] As described above, cold air discharged from the cold air outlet 330 may first flow into the sub door 400 along the inflow path 410 and flow in the path indicated by the arrow A.

[0218] Cold air that has passed through the inflow path 410 and has flowed into the sub door 400 may cool the storage items such as the food and beverages stored in the sub door basket 150. That is, cold air that has passed through the inflow path 410 and has flowed into the sub door 400 may pass through the sub door baskets 150, 151, and 152 while flowing from the upper side to the lower side of the storage space 440.

[0219] After cooling the storage items such as the food and the beverages stored in the sub door baskets 150, 151, and 152 as such, cold air may flow out of the sub door 400 as indicated by the arrow B via the outflow path 420.

[0220] Thereafter, cold air that has flowed out of the sub door 400 via the outflow path 420 may bypass and be introduced into the space of the storeroom 11 of the refrigerator, as indicated by the arrow C.

[0221] As described above, according to the embodiment of the present disclosure, the storage space 440 may be defined by being efficiently divided based on the partition of the refrigerator door. In other words, the sub

storeroom 440, which is the enclosed space, may be defined inside the main door 100.

[0222] In addition, the main door baskets 140, 142, and 143 installed on the main door 100 may be located in such sub storeroom 440, so that the main door 100 may become slimmer and overall space efficiency may be improved.

[0223] In addition, cold air may be effectively supplied to the sub door 400 that defines the sub storeroom 440.

[0224] Cold air supplied to such sub door 400 may be supplied using the cold air supply 300 for regulating cold air at a refrigerator door side. Therefore, cold air may be effectively supplied to the storage space 440 at a side of the sub door 400 using the cold air supply 300 installed in the refrigerator.

[0225] The sub door baskets 150, 151, and 152 may include the first sub door basket 150 located at the upper side within the first region 441, the second sub door basket 152 located under the first sub door basket 150 within the first region 441, and the third sub door basket 151 located between the first sub door basket 150 and the second sub door basket 152. In this regard, at least one third sub door basket 151 may be disposed. FIGS. 10 and 11 show an example in which the two third sub door baskets 151 are installed.

[0226] In addition, the main door baskets 140, 142, and 143 may include the first main door basket 140 located at the upper side within the second region 442, the second main door basket 143 located under the first main door basket 140 within the second region 442, and the third main door basket 142 located between the first main door basket 140 and the second main door basket 143. In this regard, two or more third main door baskets 142 may be disposed. In this regard, at least one third main door basket 142 may be disposed. FIGS. 10 and 11 show an example in which the one third main door basket 142 is installed.

[0227] For example, the inflow path 410 may be located close to the first sub door basket 150 located at the uppermost side. Additionally, the inflow path 410 may be located closer to the first sub door basket 150 than to the first main door basket 140 located at the upper side. That is, the first main door basket 140 may be located lower than the first sub door basket 150. Accordingly, the first sub door basket 150 may be located close to the cold air outlet 330.

[0228] As such, the sub door baskets 150, 151, and 152 may be installed in the first region 441. Additionally, the main door baskets 140, 142, and 143 may be located in the second region when the main door 100 is closed.

[0229] The accommodation portion 430 may define the storage space 440 having a width from a first side in the direction of the storeroom 11 to a second side in the direction of the main door 100.

[0230] As such, the storage space 440 including the first region 441 and the second region 442 formed by the sub door 400 when the sub door 400 is closed may be inserted into and located inside the storeroom 11.

[0231] FIGS. 12 and 13 are schematic diagrams illustrating relative positions of a main door and a sub door of a refrigerator with respect to a cabinet according to an embodiment of the present disclosure.

[0232] FIG. 12 shows a state in which the sub doors 400 and 490 are closed and the main doors 100 and 130 are open, and FIG. 13 shows a state in which both the sub doors 400 and 490 and the main doors 100 and 130 are closed.

[0233] First, referring to FIG. 12, an area occupied by the sub doors 400 and 490 may be inserted and positioned in a depth direction of the storeroom 11. That is, when the sub doors 400 and 490 are closed, the first region 441 and the second region 442 occupied by the sub doors 400 and 490 may be positioned inside a space of the storeroom 11 defined by the cabinet 10.

[0234] In this case, the area occupied by the sub doors 400 and 490 may be formed from a first side F1 to a second side F2 based on the depth direction of the storeroom 11. In addition, the first region 441 may have a width between the first side F1 and a third side F3 positioned between the first side F1 and the second side F2. The second region 442 may have a width between the second side F2 and the third side F3.

[0235] As shown in FIGS. 12 and 13, the first side F1 may mean the deepest position in the depth direction of the storeroom 11. On the other hand, the second side F2 may mean the outermost position in the depth direction of the storeroom 11. For example, the second side F2 may be a position at which an open surface of the storage space 440 formed by the accommodation portion 430 is positioned.

[0236] In this case, referring to FIG. 10, the sub door baskets 150, 151, and 152 may be installed across the third side F3, which is spaced apart from the second side F2 by the second region 442, from the first side F 1. In other words, a width extending from the first side F1 to the third side F3 may correspond to the first region 441. A width from the third side F3 to the second side F2 may correspond to the second region 442.

[0237] In this case, the inflow paths 410 and 411 may be positioned in the first region 441, that is, a region between the first side F1 and the third side F3. The outflow paths 420 and 421 may be positioned in the second region 442, that is, a region between the second side F2 and the third side F3.

[0238] The filler 500 is disposed between the two sub doors 400 and 490 to control cold air inside the storeroom 11.

[0239] As seen from FIG. 13, in a state in which the main doors 100 and 130 are closed, a thickness occupied by the main doors 100 and 130 does not substantially penetrate the storage space 440 (the first region 441 + the second region 442). Accordingly, the thickness of the main doors 100 and 130 may be reduced. Therefore, a portion unnecessarily occupied by the main doors 100 and 130 in the overall volume of the refrigerator may be reduced. That is, the volume usage efficiency of the entire

refrigerator may be increased.

[0240] This is because the main door baskets 140, 142, and 143 installed on the main doors 100 and 130 are substantially disposed inside the storage space 440 inside the sub doors 400 and 490.

[0241] Furthermore, each of the main doors 100 and 130 may only include an installation region 102 (refer to FIG. 14) where the main door baskets 140, 142, and 143 are fixedly installed, so that a thickness of the main doors 100 and 130 may be substantially reduced.

[0242] FIG. 14 is a side cross-sectional view showing a coupled structure of a sub door and a main door of a refrigerator according to an embodiment of the present disclosure.

[0243] Referring to FIG. 14, an interior of the storage space 440 in the state in which the sub door 400 and the main door 100 are coupled with each other is mainly shown.

[0244] As shown, the sub door baskets 150, 151, and 152 may be installed across a space from the first side F1 to the third side F3 spaced apart from the second side F2 by the second region 442. In other words, a width from the first side F1 to the third side F3 may correspond to the first region 441.

[0245] Additionally, the main door baskets 140, 142, and 143 may be installed across a space from the third side F3 to the second side F2 reaching an installation region 102 of the main door 100. In other words, a width from the third side F3 to the second side F2 may correspond to the second region 442.

[0246] The installation region 102 of the main door 100 may correspond to a region defined by the main door frame 141 where the main door baskets 140, 142, and 143 may be installed. A thickness of the installation region 102 may be smaller than that of an upper region 101 and a lower region 103 of the main door 100. A thickness difference between the installation region 102 and the upper region 101 and the lower region 103 may be a difference taking into account the space where the main door baskets 140, 142, and 143 are installed.

[0247] As such, the installation region 102 of the main door 100 where the main door baskets 140, 142, and 143 may be installed may form a first bent portion 104 at an upper side of the main door 100 and may form a second bent portion 105 at a lower side of the main door 100. The main door baskets 140, 142, and 143 may be freely installed in the installation region 102 extending from the first bent portion 104 to the second bent portion 105.

[0248] As mentioned above, the door baskets 150, 151, and 152 may include the first sub door basket 150 located at the upper side within the first region 441, the second sub door basket 152 located under the first sub door basket 150 within the first region 441, and the third sub door basket 151 located between the first sub door basket 150 and the second sub door basket 152.

[0249] In this regard, a discharge hole 144 may be defined in a lower side of at least one of the main door baskets 140, 142, and 143. Such discharge hole 144 may form a flow path through which cold air introduced via the inflow path 410 may be discharged downward. Hereinafter, the discharge hole 144 defined in the main door baskets 140, 142, and 143 as such will be referred to as the first discharge hole 144.

[0250] FIG. 14 shows an example in which the respective first discharge holes 144 are defined in all of the main door baskets 140, 142, and 143. Among them, a discharge hole (hereinafter, referred to as a third discharge hole 145) defined in the second main door basket 143 located at the lowermost side of the second region 442 may be located at a position corresponding to the outflow path 420. Accordingly, the outflow path 420 may not be blocked by the main door baskets 140, 142, and 143 and cold air may be circulated smoothly.

[0251] Additionally, a discharge hole 153 may be defined in a lower side of at least one of the sub door baskets 150, 151, and 152. Such discharge hole 153 may form a flow path through which cold air introduced via the inflow path 410 may be discharged downward. Hereinafter, the discharge hole 153 defined in the sub door baskets 150, 151, and 152 as such will be referred to as the second discharge hole 153.

[0252] FIG. 14 shows an example in which the respective second discharge holes 153 are defined in the sub door baskets 150 and 151, excluding the second sub door basket 152, which is located at the lowermost side among the sub door baskets 150, 151, and 152.

[0253] For example, the second sub door basket 152, which is located at the lowermost side among the sub door baskets 150, 151, and 152, may be located close to the lowermost side of the first region 441. Therefore, the second discharge hole 153 may not be defined in such second sub door basket 152 located at the lowermost side.

[0254] In one example, a reinforcing material may be disposed at at least one side of the accommodation portion 430 forming the sub door 400. For example, a first reinforcing material 433 thicker than the accommodation portion 430 may be located at an upper side of the accommodation portion 430. Additionally, a second reinforcing material 434 thicker than the accommodation portion 430 may be located at a lower side of the accommodation portion 430.

[0255] FIG. 15 is a side cross-sectional view to illustrate a flow of cold air in a sub door and a main door of a refrigerator according to an embodiment of the present disclosure.

[0256] Hereinafter, with reference to FIG. 15, a flow path of cold air in the storage space 440 in the state in which the sub door 400 and the main door 100 are coupled to each other will be described.

[0257] As shown, the sub door baskets 150, 151, and 152 may be located in the first region 441. As such, a region corresponding to a width of the sub door baskets 150, 151, and 152 may be the first region 441.

[0258] Additionally, the main door baskets 140, 142,

and 143 may be located in the second region 442. As such, a region substantially corresponding to a width of the main door baskets 140, 142, and 143 may be the second region 442. The term 'substantially' used herein because a width of the second region 442 may be smaller than the width of the main door baskets 140, 142, and 143 by a thickness of the installation region 102.

[0259] As described above, the installation region 102 of the main door 100 may correspond to a region defined by the main door frame 141 where the main door baskets 140, 142, and 143 may be installed. The thickness of such installation region 102 may be smaller than that of the upper region 101 and the lower region 103 of the main door 100.

[0260] As mentioned above, the sub door baskets 150, 151, and 152 may include the first sub door basket 150 located at the upper side within the first region 441, the second sub door basket 152 located under the first sub door basket 150 within the first region 441, and the third sub door basket 151 located between the first sub door basket 150 and the second sub door basket 152.

[0261] In this regard, the first discharge hole 144 may be defined in the lower side of at least one of the external baskets 140, 142, and 143.

[0262] FIG. 15 shows an example in which the respective first discharge holes 144 are defined in all of the main door baskets 140, 142, and 143. Among those, the third discharge hole 145 defined in the second main door basket 143 located at the lowermost side of the second region 442 may be located at the position corresponding to the outflow path 420.

[0263] Additionally, the second discharge hole 153 may be defined in the lower side of at least one of the sub door baskets 150, 151, and 152. Such second discharge hole 153 may form the flow path through which cold air introduced via the inflow path 410 may be discharged downward.

[0264] As such, the discharge holes through which cold air may flow through the sub door baskets 150, 151, and 152 and the main door baskets 140, 142, and 143 may include the first discharge holes 144 respectively defined in the first main door basket 140 and the third main door basket 142, the second discharge holes 153 through which cold air may flow through the first sub door basket 150 and the third sub door basket 151, and the third discharge hole 145 defined in the second main door basket 143.

[0265] The inflow path 410 defined in the first region 441 may be located close to the first sub door basket 150 located at the uppermost side. Additionally, the outflow path 420 defined in the second region 442 may be located close to the second main door basket 143 located at the lowermost side.

[0266] Accordingly, cold air A introduced through the inflow path 410 may first be supplied to the first sub door basket 150 located at the uppermost side and then flow in a direction D toward the second region 442. Additionally, cold air supplied to the first sub door basket 150 may flow downward (in a direction E) through the second discharge hole 153 defined in the first sub door basket 150.

[0267] As such, cold air flowing downward through the second discharge hole 153 may be supplied to the third sub door basket 151, and then may flow toward the second region 442 or flow downward through the second discharge hole 153 defined in the third sub door basket 151.

[0268] Additionally, some of cold air supplied to the third sub door basket 151 may flow beyond the third sub door basket 151 and flow to the third main door basket 142 located in the second region 442.

[0269] In one example, cold air supplied to the second region 442 in the direction D may flow to the first main door basket 140. As such, cold air supplied to the first main door basket 140 may flow downward through the first discharge hole 144.

[0270] As such, cold air flowing downward along the first region 441 may reach the second sub door basket 152 located at the lowermost side. Cold air that has reached the second sub door basket 152 may flow again in a direction F toward the second region 442 and flow to the second main door basket 143.

[0271] Thereafter, cold air supplied to or located around the second main door basket 143 may flow toward the outflow path 420 (in a direction B) through the third discharge hole 145 and may be discharged to the outside through such outflow path 420.

[0272] As described above, cold air that has passed through such outflow path 420 may flow back into the space in the storeroom 11.

[0273] The above description is merely illustrative of the technical idea of the present disclosure. Those of ordinary skill in the art to which the present disclosure pertains will be able to make various modifications and variations without departing from the essential characteristics of the present disclosure.

[0274] Therefore, embodiments disclosed in the present disclosure are not intended to limit the technical idea of the present disclosure, but to describe, and the scope of the technical idea of the present disclosure is not limited by such embodiments.

[0275] The scope of protection of the present disclosure should be interpreted by the claims below, and all technical ideas within the scope equivalent thereto should be construed as being included in the scope of the present disclosure.

[Industrial Applicability]

[0276] According to the present disclosure, the refrigerator that efficiently defines the interior space of the storeroom and allows cold air to flow smoothly in such interior space may be provided.

Claims

1. A refrigerator comprising:

   a cabinet having a storeroom defined therein;
   a main door rotatably disposed on the cabinet to open and close the storeroom;
   a main door basket installed on the main door; and
   a sub door located inside the cabinet and rotatable relative to the main door,
   wherein the sub door has an accommodation portion defining a storage space located inside the storeroom when the sub door is closed, and
   at least a portion of the main door basket is located in the storage space.

2. The refrigerator of claim 1, wherein a surface of the accommodation portion facing the main door is opened.

3. The refrigerator of claim 2, further comprising a sub door basket installed within the accommodation portion.

4. The refrigerator of claim 3, wherein the sub door basket is located spaced apart from the open surface of the accommodation portion by a first distance, inwardly of the accommodation portion.

5. The refrigerator of claim 4, wherein at least a portion of the main door basket is located within the first distance from the accommodation portion.

6. The refrigerator of claim 3, wherein a lower side of the sub door basket includes a first discharge hole, wherein cold air passes through the first discharge hole.

7. The refrigerator of claim 1, wherein a cold air flow path allowing cold air to flow by passing therethrough is formed in the accommodation portion.

8. The refrigerator of claim 7, wherein the cold air flow path includes:

   an inflow path where cold air is introduced; and
   an outflow path where cold air is discharged.

9. The refrigerator of claim 8, wherein the storage space includes:

   a first portion where the sub door basket is installed; and
   a second portion located between the first portion and the main door,
   wherein the inflow path is located in the first portion.

10. The refrigerator of claim 9, wherein the outflow path is located in the second portion.

11. The refrigerator of claim 8, wherein the inflow path is connected to a cold air outlet where cold air is discharged into the storeroom.

12. The refrigerator of claim 11, wherein the sub door basket is located closer to the cold air outlet than the main door basket.

13. The refrigerator of claim 1, wherein a lower side of the main door basket includes a second discharge hole, wherein cold air passes through the second discharge hole.

14. A refrigerator comprising:

   a cabinet having a storeroom defined therein;
   a main door rotatably disposed on the cabinet to open and close the storeroom;
   a main door basket installed on the main door to face the storeroom; and
   a sub door rotatable relative to the main door,
   wherein the sub door includes an accommodation portion defining a storage space located inside the storeroom when the sub door is closed,
   wherein the storage space includes:

      a first portion where a sub door basket is installed; and
      a second portion located between the first portion and the main door.

15. The refrigerator of claim 14, wherein at least a portion of the main door basket is located in the second portion.

16. The refrigerator of claim 14, wherein a cold air flow path allowing cold air to flow by passing therethrough is formed in the accommodation portion.

17. The refrigerator of claim 16, wherein the cold air flow path includes:

   an inflow path where cold air is introduced; and
   an outflow path where cold air is discharged.

18. The refrigerator of claim 17, wherein the inflow path is located in the first portion.

19. The refrigerator of claim 17, wherein the outflow path is located in the second portion.

20. The refrigerator of claim 17, wherein the inflow path is connected to a cold air outlet where cold air is discharged into the storeroom.

21. The refrigerator of claim 20, wherein the sub door basket is located closer to the cold air outlet than the main door basket.

22. The refrigerator of claim 14, wherein a lower side of the sub door basket includes a first discharge hole, wherein cold air passes through the first discharge hole.

23. The refrigerator of claim 14, wherein a lower side of the main door basket includes a second discharge hole, wherein cold air passes through the second discharge hole.

24. The refrigerator of claim 14, wherein the main door basket includes:

a first main door basket located at an upper side within the second portion;
a second main door basket located under the first main door basket within the second portion; and
a third main door basket located between the first main door basket and the second main door basket.

25. The refrigerator of claim 24, wherein the sub door basket includes:

a first sub door basket located at an upper side within the first portion;
a second sub door basket located under the first sub door basket within the first portion; and
a third sub door basket located between the first sub door basket and the second sub door basket.

26. The refrigerator of claim 25, wherein the first main door basket is located downwardly of the first sub door basket.

27. A refrigerator comprising:

a cabinet having a storeroom defined therein;
a main door rotatably disposed on the cabinet to open and close the storeroom;
a main door basket installed on the main door;
a sub door rotatable relative to the main door, wherein the sub door includes an accommodation portion located inside the storeroom when the sub door is closed and having an open surface facing the main door; and
a sub door basket installed within the accommodation portion,
wherein the sub door basket is located spaced apart from the open surface of the accommodation portion, inwardly of the accommodation portion.

28. The refrigerator of claim 27, wherein the sub door basket is located spaced apart from the open surface of the accommodation portion by a first distance, inwardly of the accommodation portion.

29. The refrigerator of claim 28, wherein at least a portion of the main door basket is located within the first distance from the accommodation portion.

30. The refrigerator of claim 27, wherein a cold air flow path allowing cold air to flow by passing therethrough is formed in the accommodation portion.

31. The refrigerator of claim 30, wherein the cold air flow path includes:

an inflow path where cold air is introduced; and
an outflow path where cold air is discharged.

32. The refrigerator of claim 31, wherein the storage space includes:

a first portion where the sub door basket is installed; and
a second portion located between the first portion and the main door,
wherein the inflow path is located in the first portion.

33. The refrigerator of claim 32, wherein the outflow path is located in the second portion.

34. The refrigerator of claim 31, wherein the sub door basket is located closer to the inflow path than the main door basket.

35. The refrigerator of claim 27, wherein a lower side of at least one of the sub door basket and the main door basket includes a discharge hole, wherein cold air passes through the discharge hole.

FIG. 1

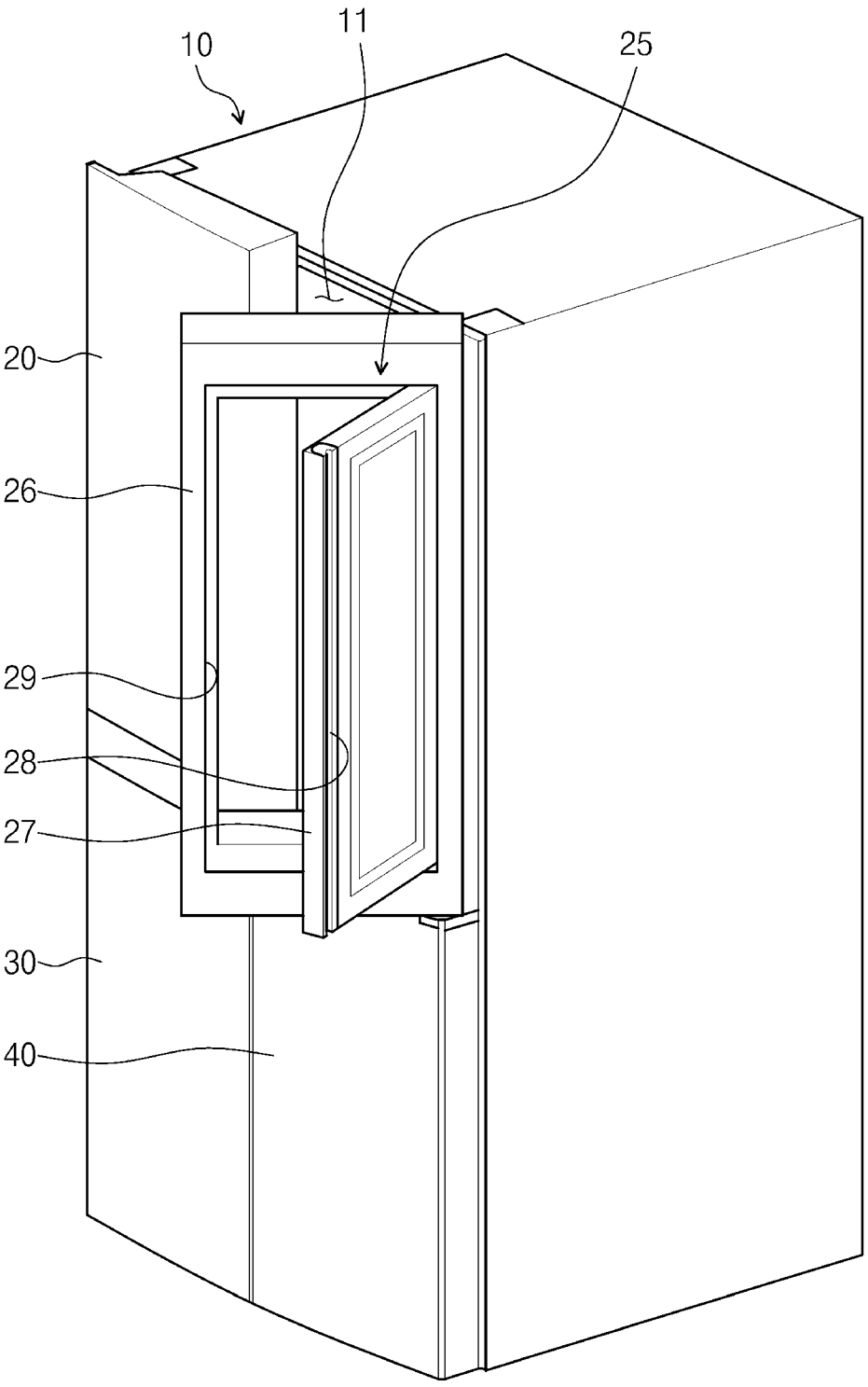

FIG. 2

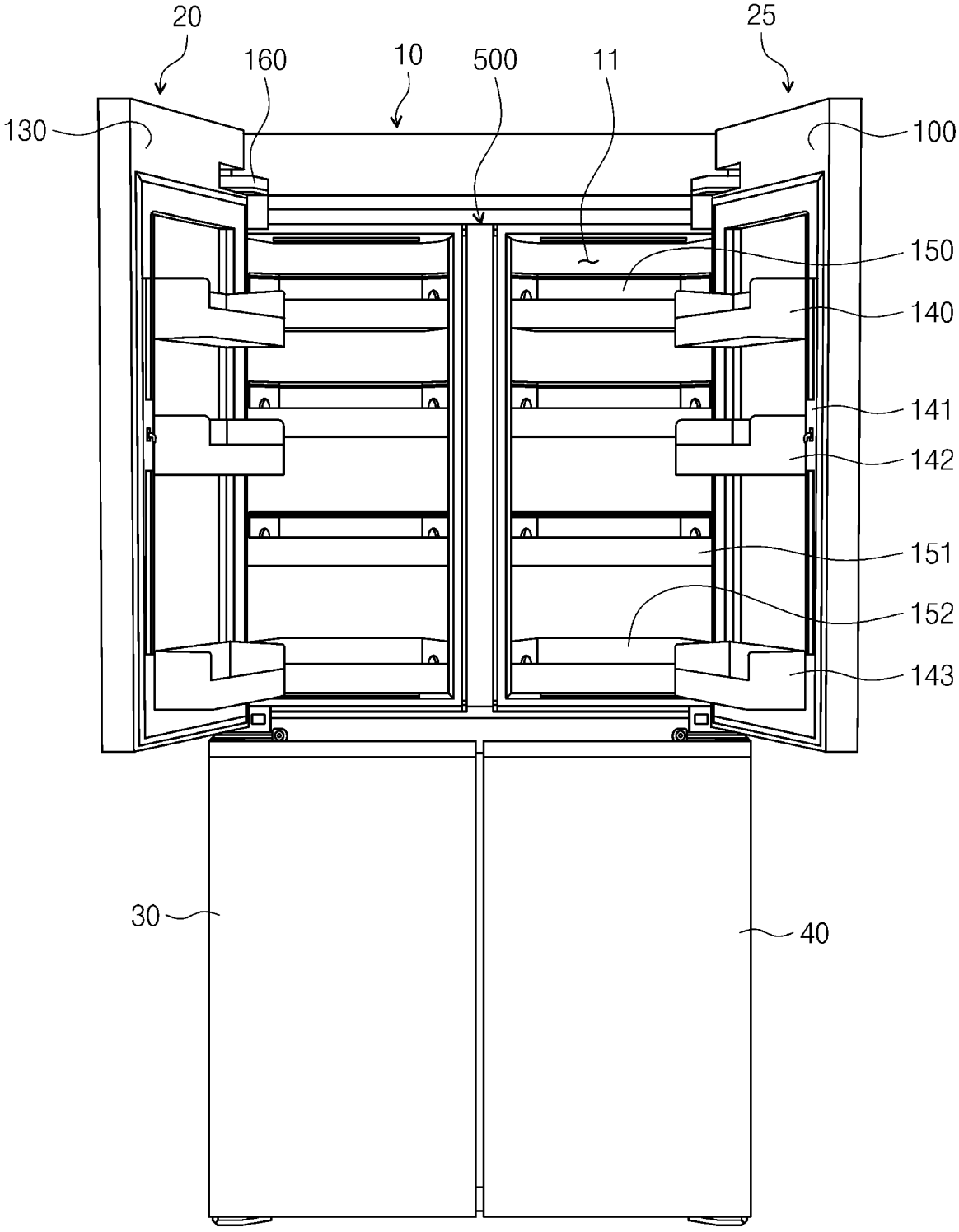

FIG. 3

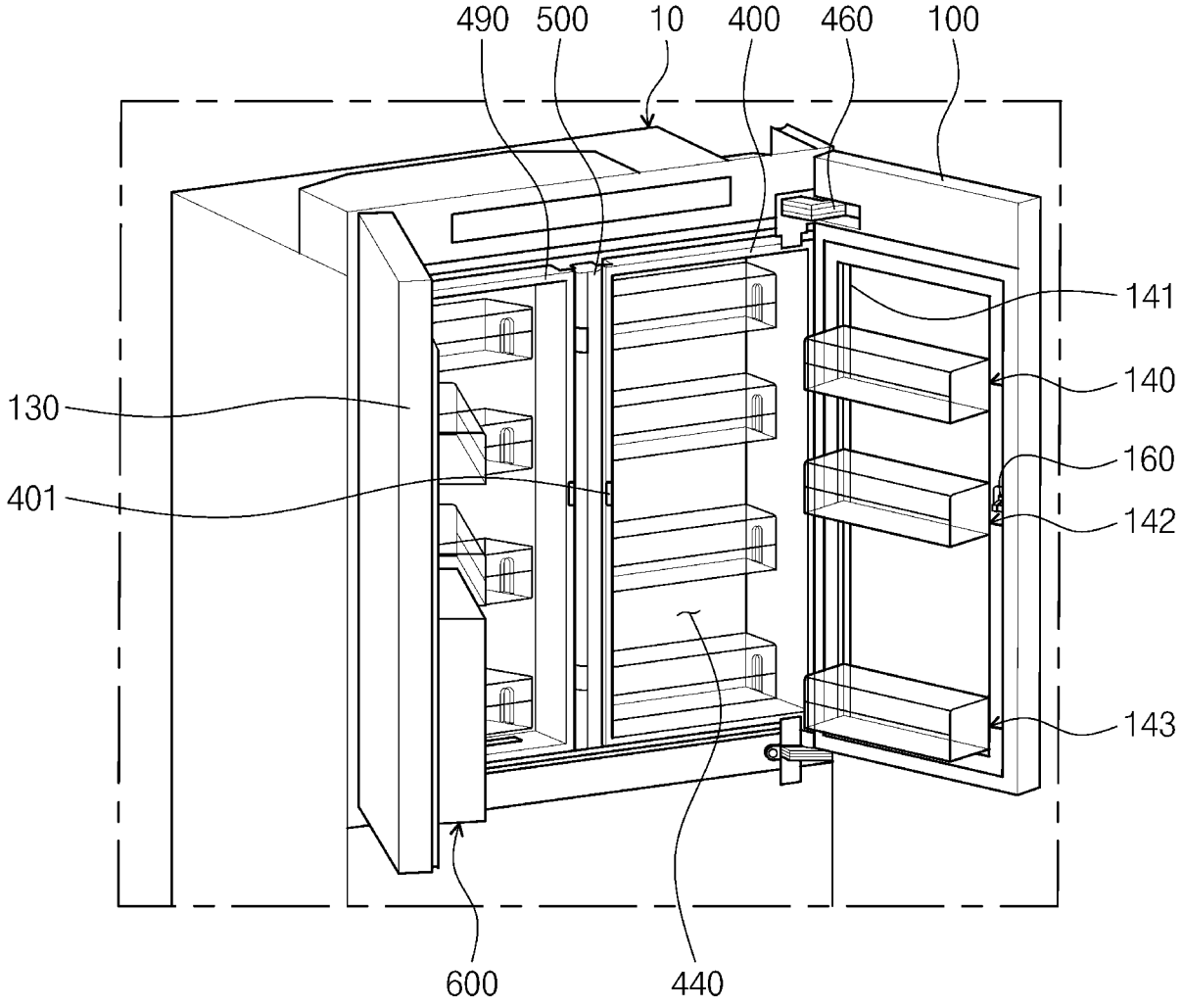

FIG. 4

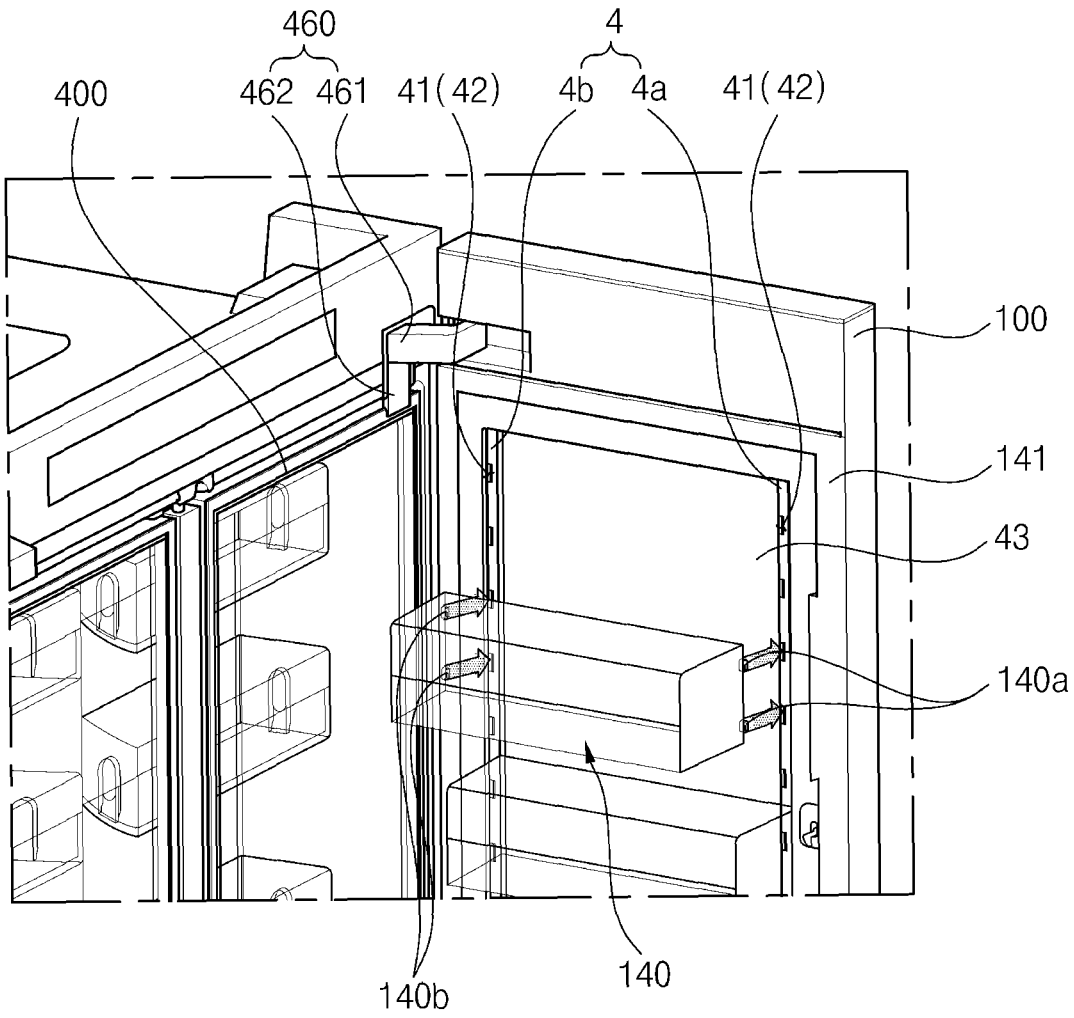

FIG. 5

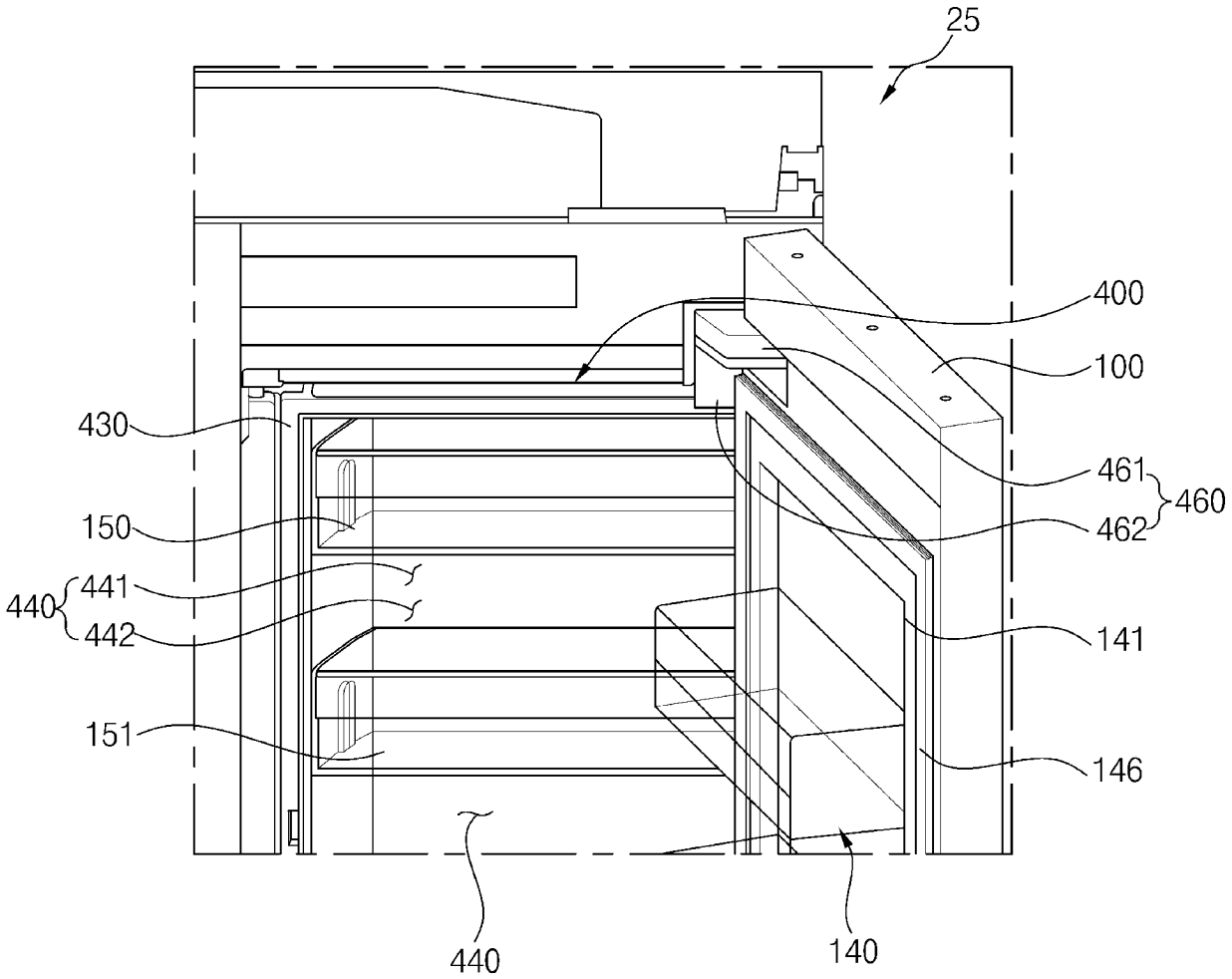

FIG. 6

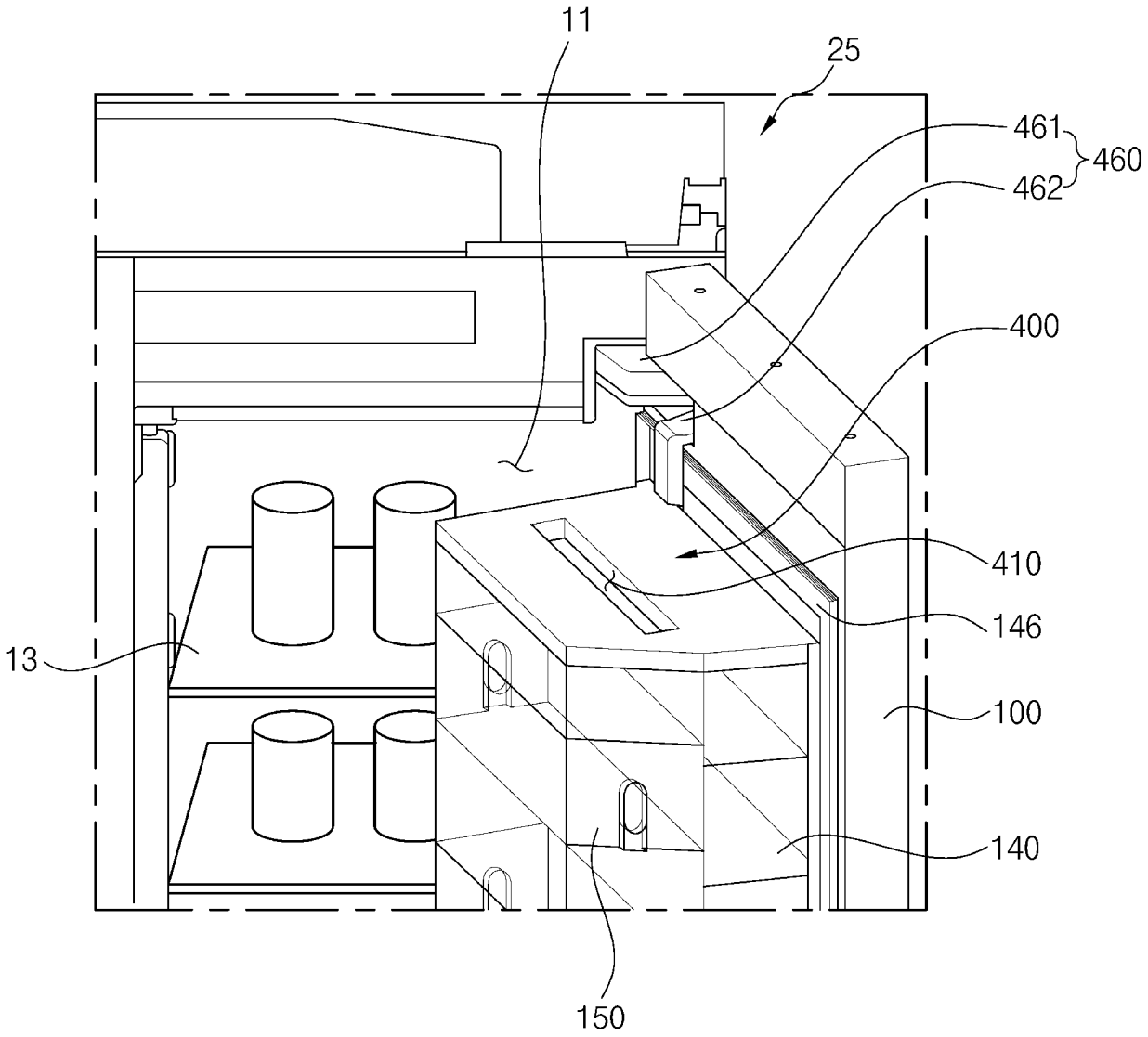

FIG. 7

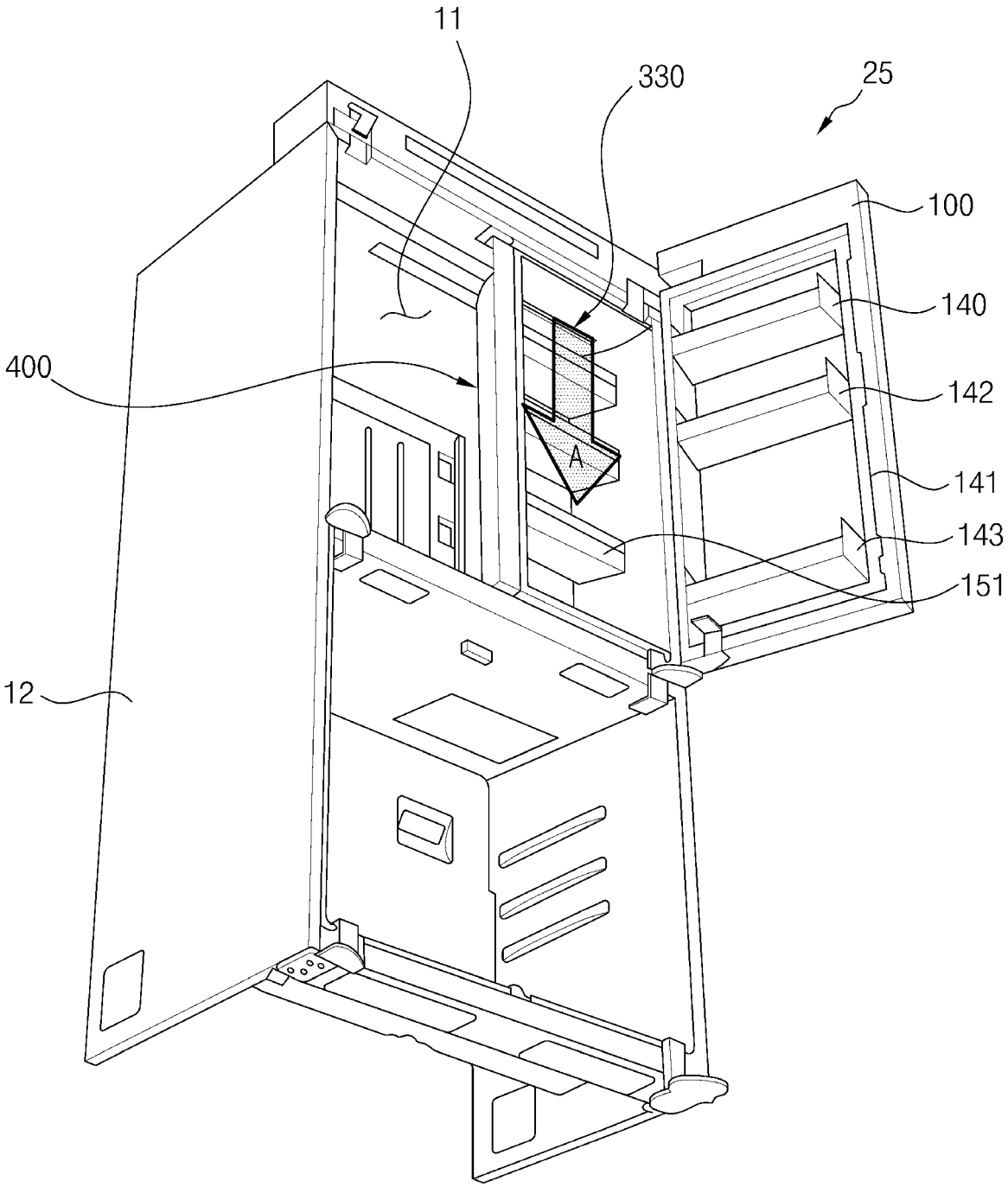

FIG. 8

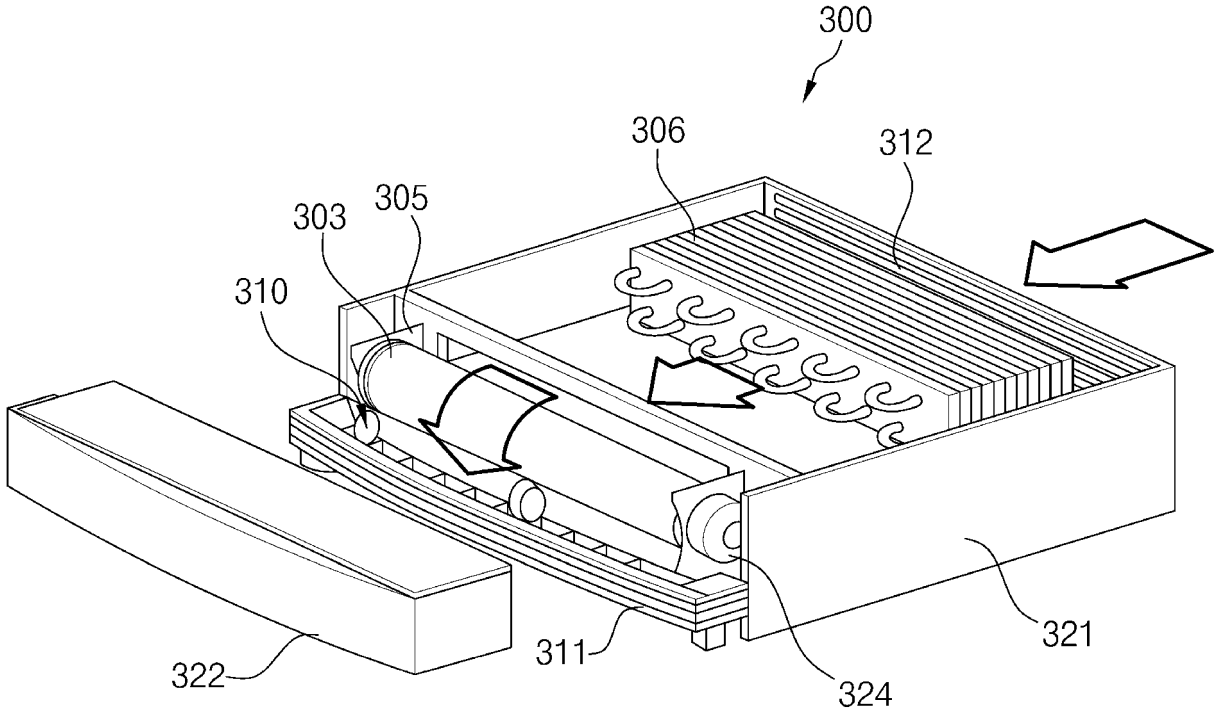

FIG. 9

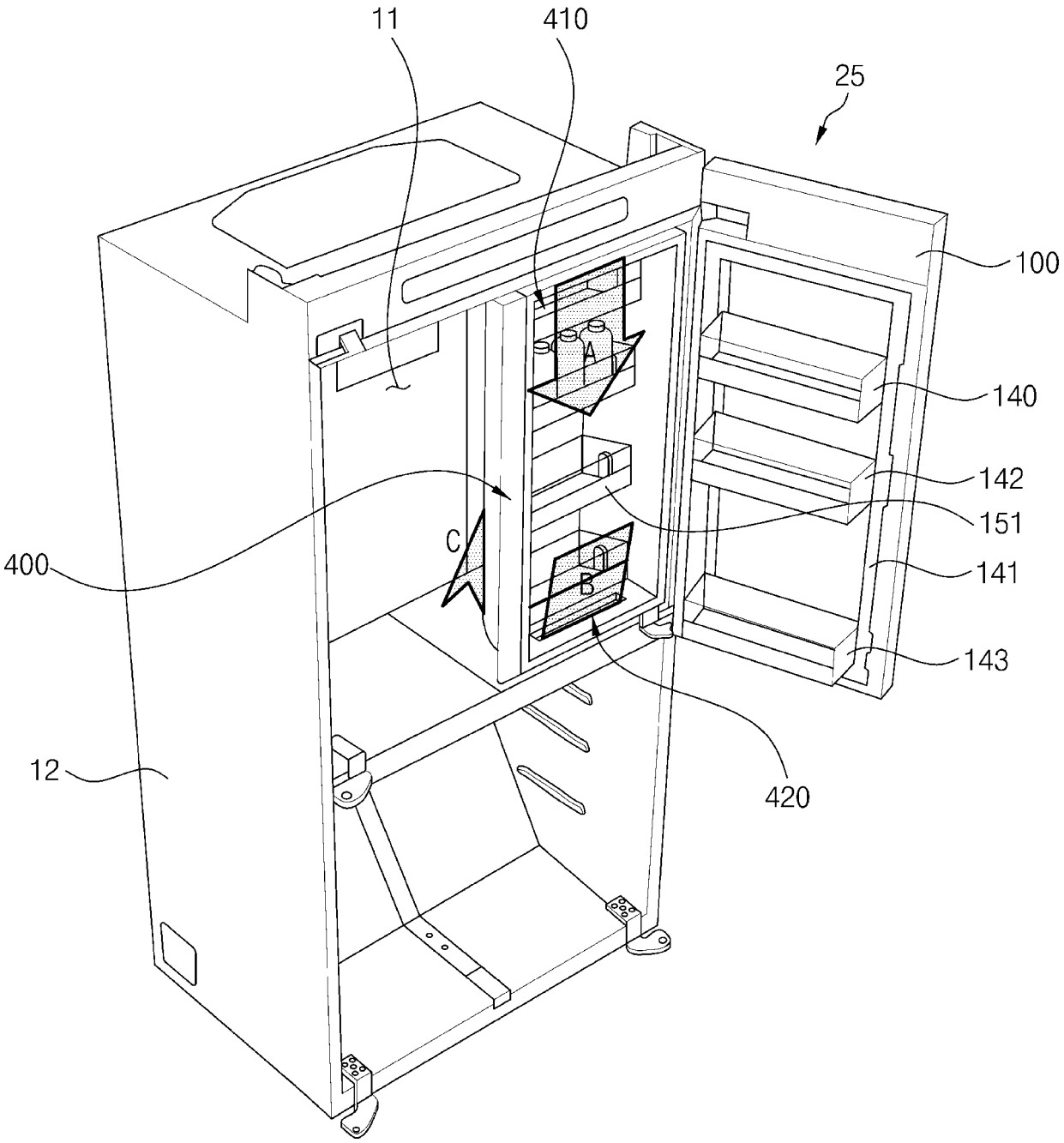

FIG. 10

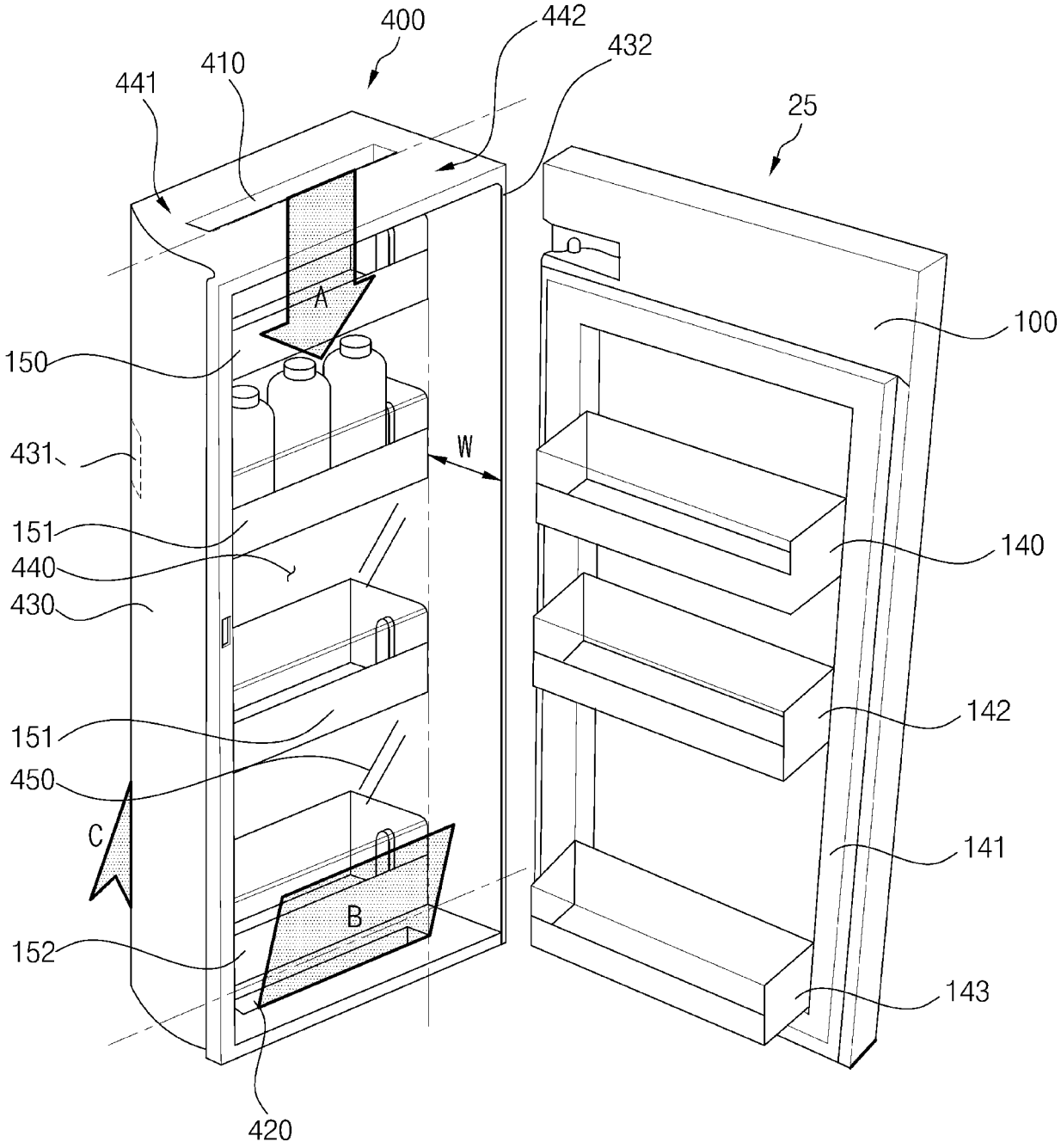
400
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FIG. 11

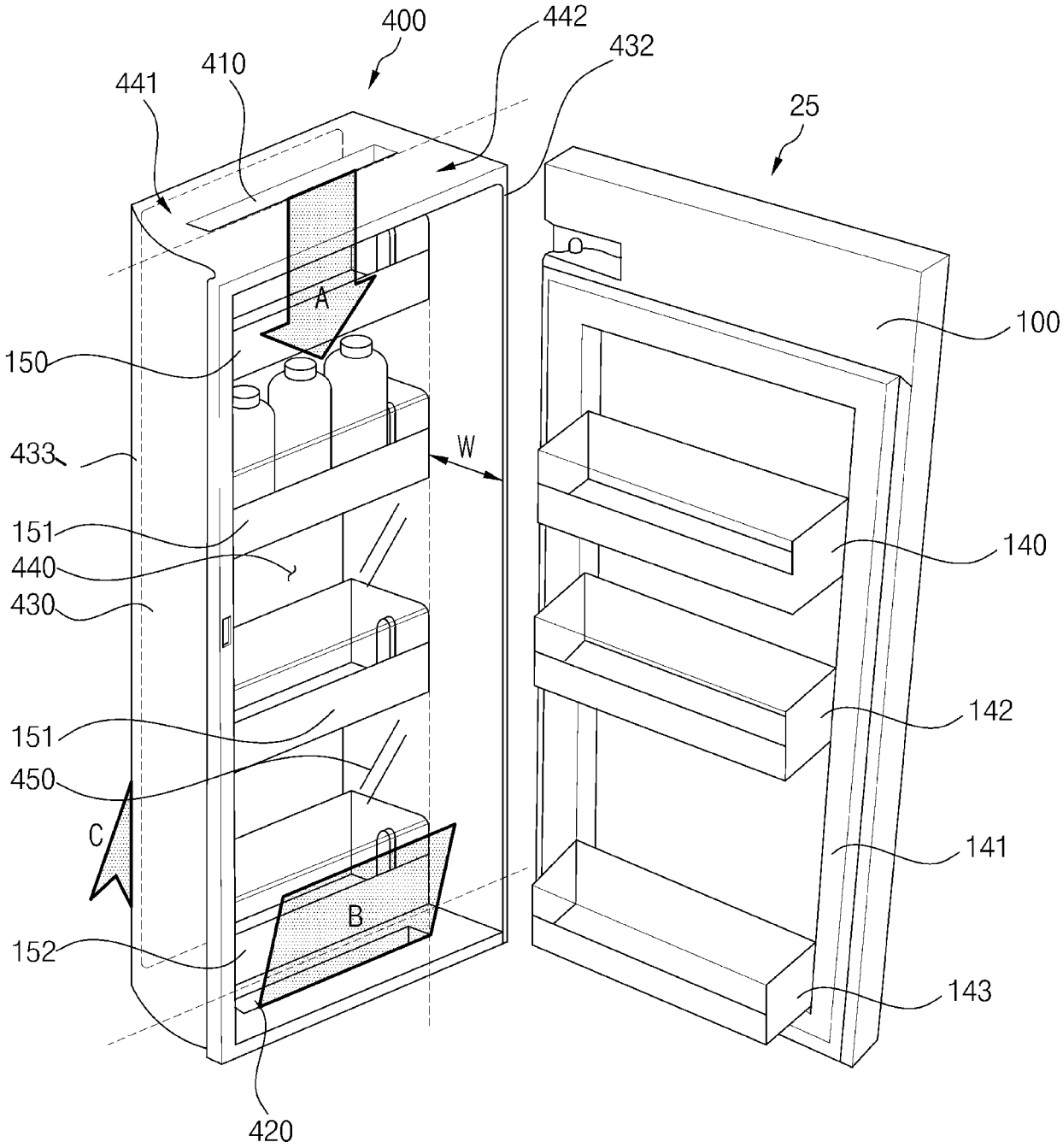
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FIG. 12

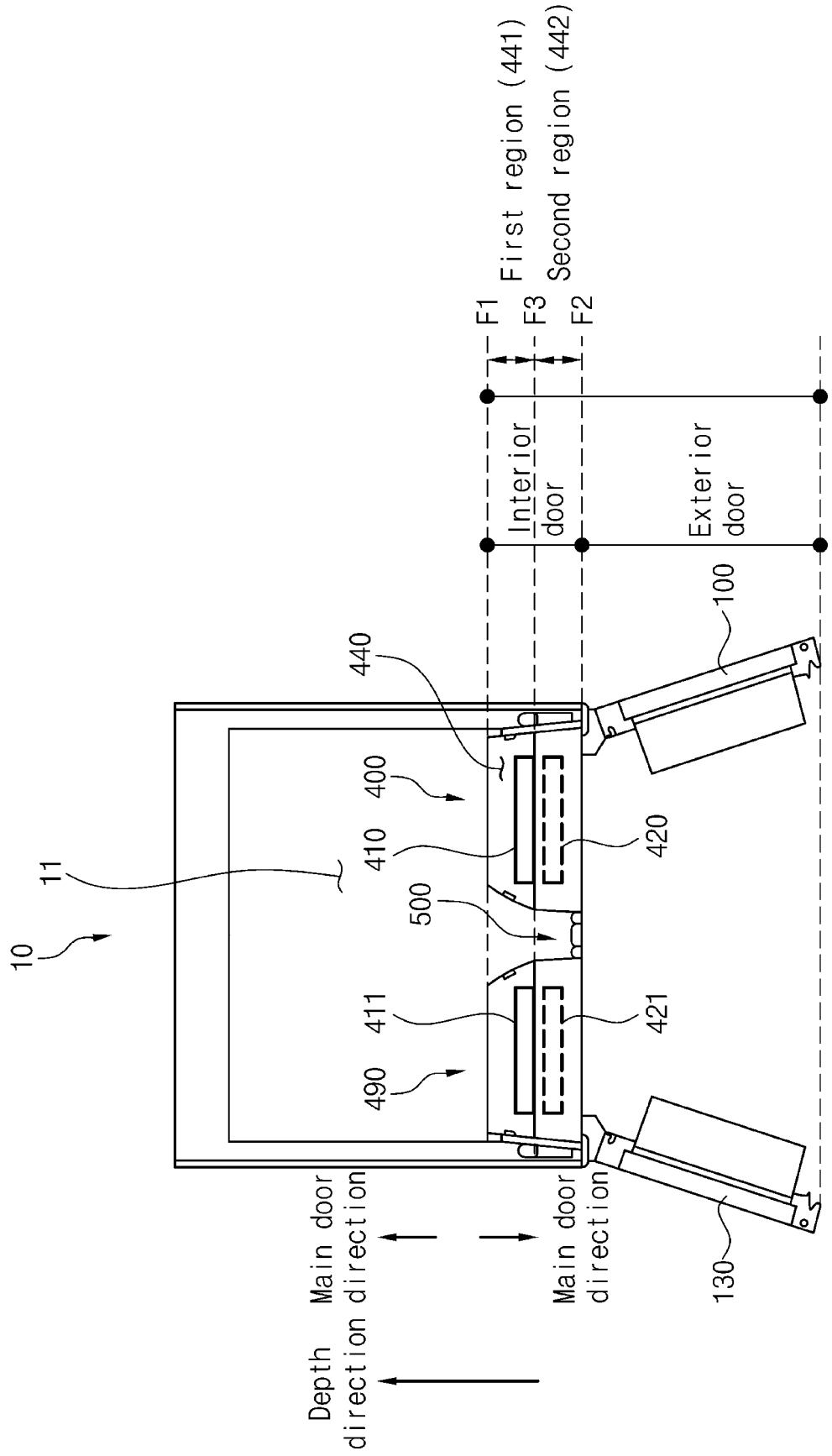
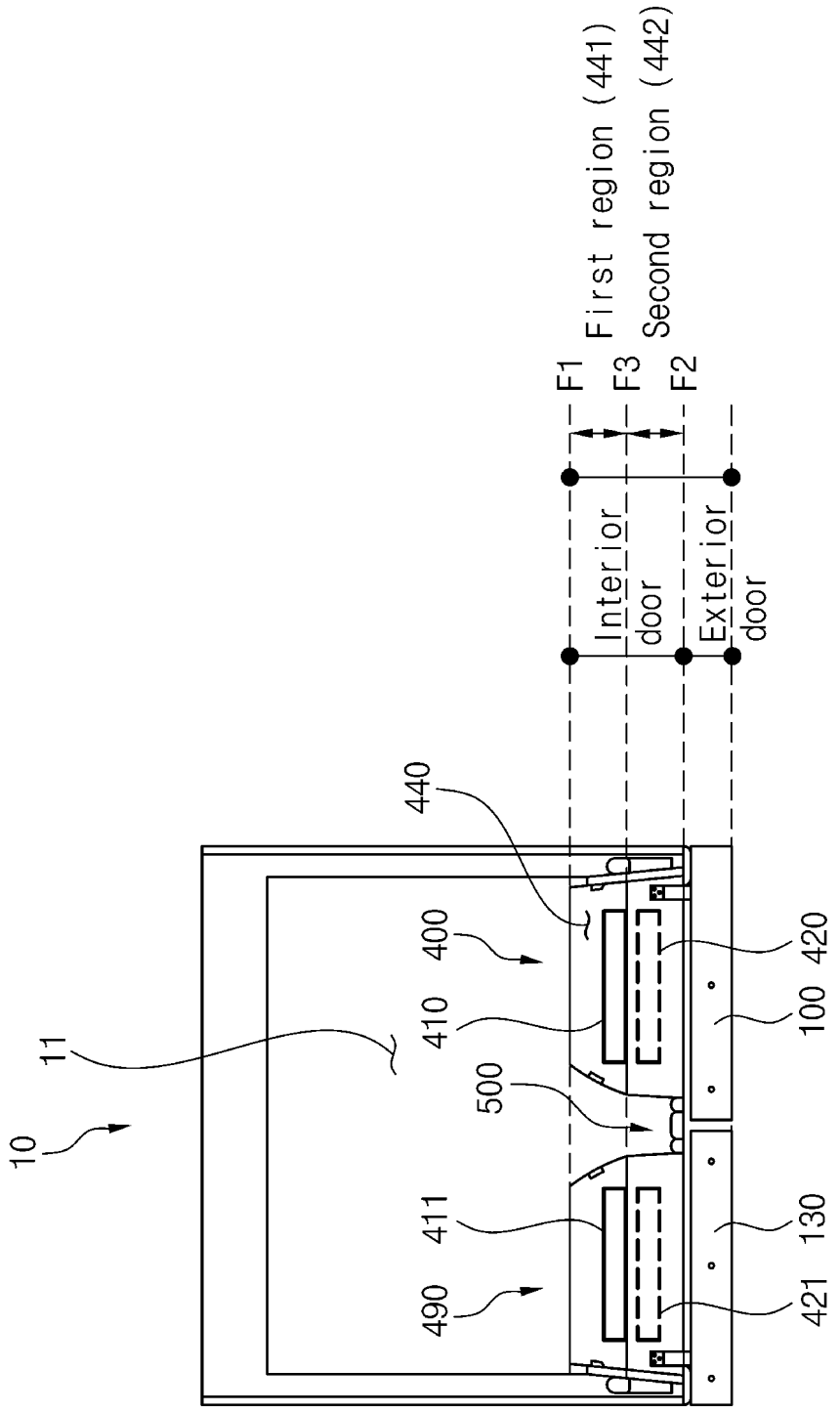

First region (441)
Second region (442)
F1
F3
F2
Interior door
Exterior door
100
440
400
410
420
11
10
500
411
421
490
130
Main door direction
Main door direction
Depth direction

FIG. 13


First region (441)
Second region (442)
F1
F3
F2
Interior door
Exterior door
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400
410
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500
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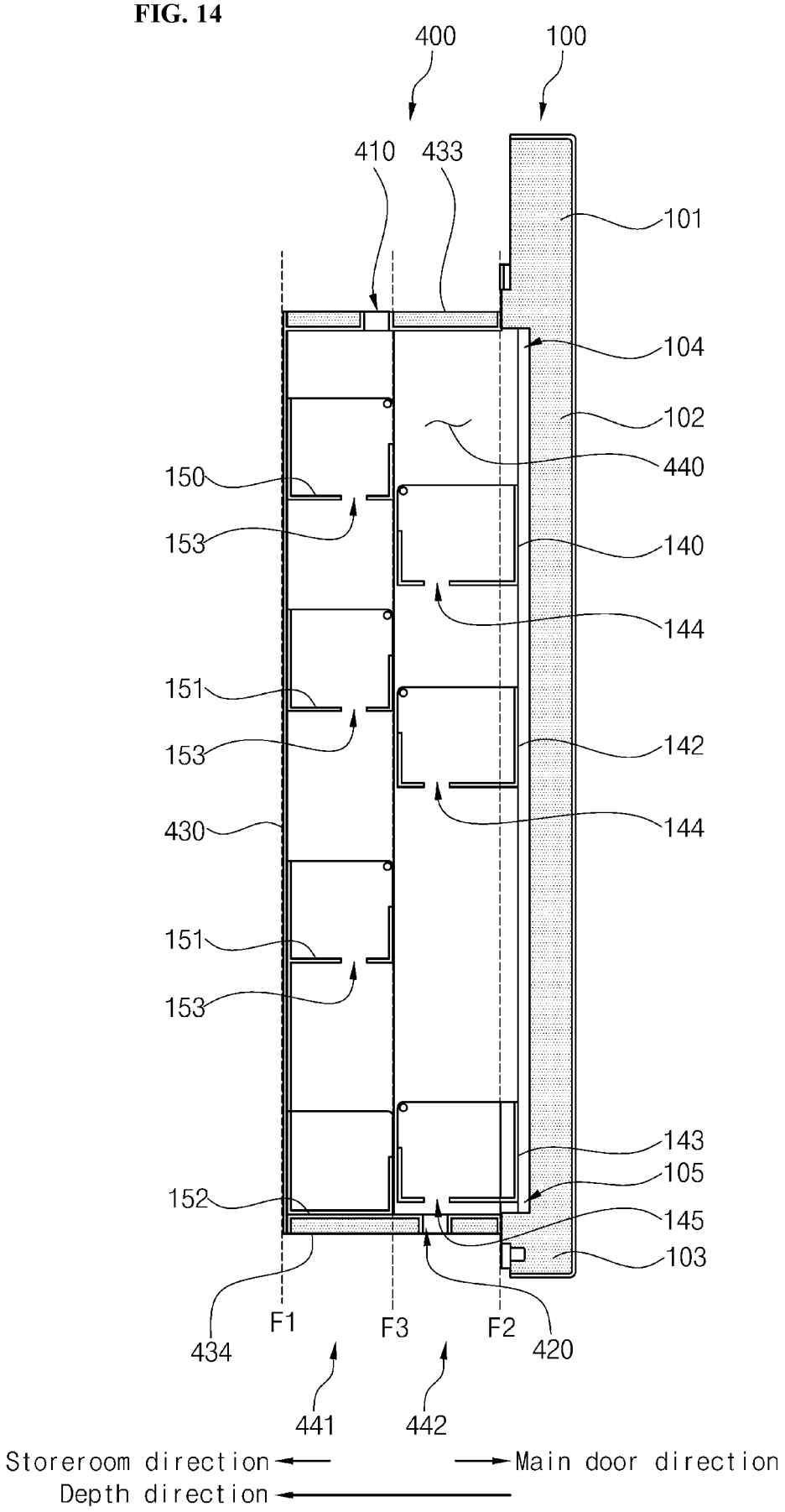
421

FIG. 14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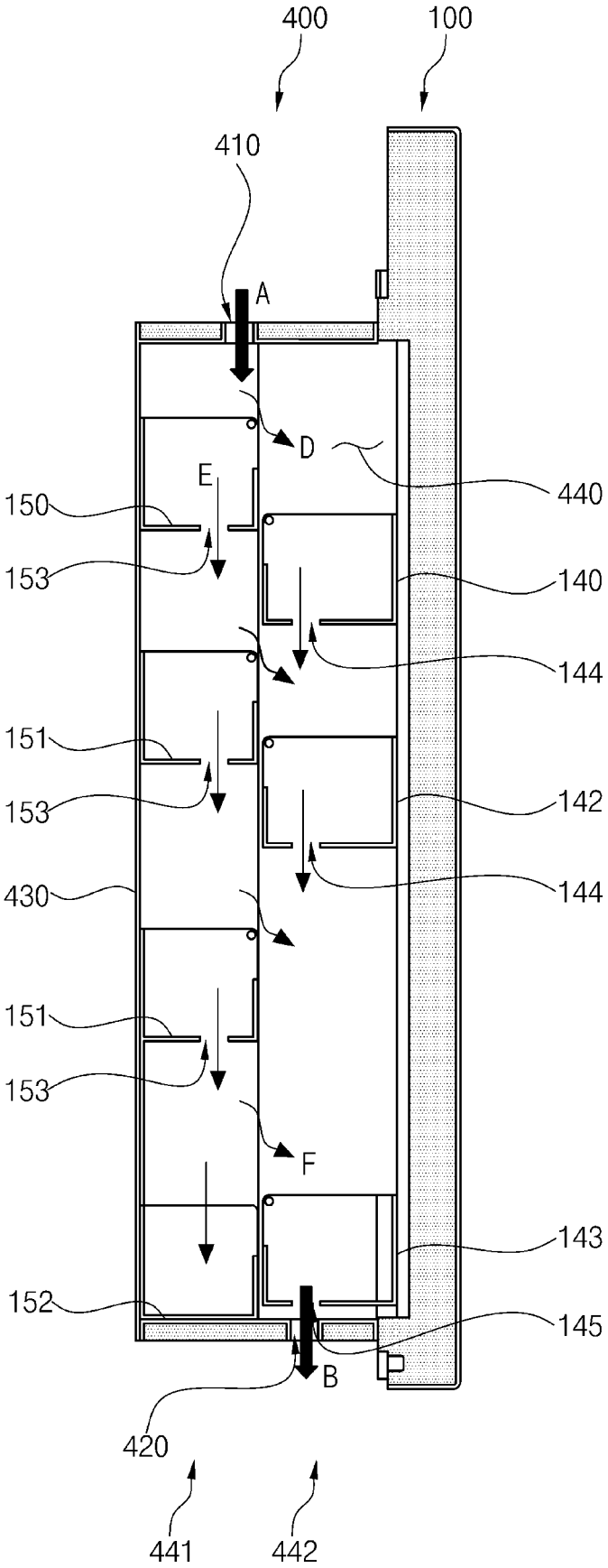
152
145
103
F1
F3
F2
434
420
441
442
Storeroom direction
Main door direction
Depth direction

FIG. 15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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2023/008685

A. CLASSIFICATION OF SUBJECT MATTER

F25D 23/02(2006.01)i; **F25D 23/04**(2006.01)i; **F25D 25/02**(2006.01)i; **F25D 17/06**(2006.01)i; **F25D 17/08**(2006.01)i; **E06B 7/16**(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)

F25D 23/02(2006.01); E05D 7/00(2006.01); F25D 17/06(2006.01); F25D 17/08(2006.01); F25D 23/04(2006.01); F25D 29/00(2006.01)

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

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & keywords: 메인 도어(main door), 서브 도어(sub door), 메인 도어 바스켓(main door basket), 서브 도어 바스켓(sub door basket), 냉장고(refrigerator)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2015-0087524 A (DAYOU WINIA CO., LTD.) 30 July 2015 (2015-07-30) See paragraphs [0030]-[0043]; and figure 2.	1-5,14-15,24-29
Y		6-13,16-23,30-35
Y	KR 10-2003-0021943 A (LG ELECTRONICS INC.) 15 March 2003 (2003-03-15) See paragraphs [0024]-[0027]; and figures 3-4.	6-13,16-23,30-35
Y	KR 10-2016-0100098 A (LG ELECTRONICS INC.) 23 August 2016 (2016-08-23) See paragraphs [0020]-[0025]; and figure 4.	8-12,17-21,31-34
A	US 2013-0104590 A1 (SEO, Woonkyu et al.) 02 May 2013 (2013-05-02) See paragraphs [0019]-[0033]; and figures 1-4.	1-35
A	KR 10-2015-0045294 A (SAMSUNG ELECTRONICS CO., LTD.) 28 April 2015 (2015-04-28) See paragraphs [0026]-[0057]; and figures 1-6.	1-35

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 October 2023	**06 October 2023**
Name and mailing address of the ISA/KR **Korean Intellectual Property Office** **Government Complex-Daejeon Building 4, 189 Cheongsa-ro, Seo-gu, Daejeon 35208** Facsimile No. **+82-42-481-8578**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2023/008685

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KR 10-2003-0021943 A	15 March 2003	KR 10-0451341 B1	06 October 2004
KR 10-2016-0100098 A	23 August 2016	CN 105890261 A	24 August 2016
		CN 105890261 B	02 July 2019
		EP 3056843 A1	17 August 2016
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