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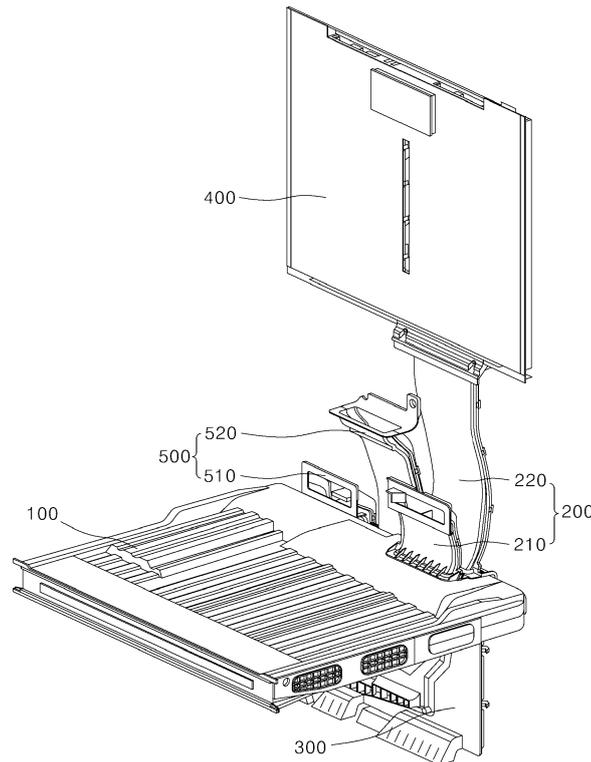
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(54) **REFRIGERATOR**

(57) Disclosed is a refrigerator in which a first cool air supply duct and a second cool air supply duct are arranged so as to at least partially overlap each other in

a front-back direction, thereby increasing space utilization in rear of a storage chamber such that an internal volume of the refrigerator is increased.

FIG. 3



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## Description

### BACKGROUND

#### Field

[0001] The present disclosure relates to a refrigerator, and more specifically, a refrigerator having a coupling structure between cool air ducts defining a new cool air flow path, and a cool air supply system.

#### Description of Related Art

[0002] A refrigerator is a home appliance that supplies cool air produced through the circulation of refrigerant to a storage chamber to keep various types of objects fresh in the storage chamber for a long period of time.

[0003] The cool air supplied to the refrigerator may be generated in a process in which the refrigerant circulating along a compressor, a condenser, an evaporator, and the compressor in this order flows into the evaporator in which the liquid refrigerant is vaporized into gaseous refrigerant, thereby taking away the heat inside the refrigerator.

[0004] The cool air produced while the refrigerant passes through the evaporator in this way may be supplied to the storage chamber by a grille-fan assembly that includes a cool air flow path through which the cool air flows and a blow fan that blows the cool air into the storage chamber.

[0005] For example, in the present disclosure, a case in which the evaporator and the grille-fan assembly for the supply of the cool air to the storage chamber constitute a cool air supply system is described. Embodiments of the present disclosure are not limited thereto. The cool air supply system may include additional cool air supply-related parts in addition to the evaporator and the grille-fan assembly.

[0006] The storage chamber may be used for a variety of purposes and may include a refrigerating chamber or a freezing chamber.

[0007] Because the refrigerating chamber refrigerates and stores a storage target object therein, and the freezing chamber freezes and stores the storage target object, amounts of the cool air supplied thereto need to be adjusted to be different from each other so that the refrigerating chamber and the freezing chamber may be maintained at different temperatures.

[0008] Therefore, the refrigerator may be equipped with a plurality of storage chambers that are independent of each other to secure a plurality of storage spaces for various purposes.

[0009] When, in this way, the refrigerator is equipped with the plurality of storage chambers having the independent storage spaces, the cool air may be supplied to the storage chambers using various cool air supply systems, respectively.

[0010] In one example, when the refrigerator includes

a plurality of storage chambers having independent storage spaces, a separate grille-fan assembly and a separate evaporator may be disposed in each of the storage chambers.

5 [0011] Accordingly, each of the storage chambers may be cooled using an independent cool air supply system.

[0012] However, when each of the plurality of storage chambers is cooled with each of the separate cool air supply systems, there may be a problem in that not only power consumption, noise, and component costs increase, but also an internal volume of the storage chamber decreases.

[0013] In another example, when the refrigerator includes the plurality of storage chambers, having the independent storage spaces, the grille-fan assembly and the evaporator may be disposed in only one storage chamber, while a cool air duct may be formed between the storage chambers.

[0014] Accordingly, the cool air produced by one cool air supply system may be supplied to each of the other storage chambers through each cool air duct, so that the plurality of storage chambers may be cooled by one cool air supply system.

[0015] When the number of storage chambers that receive the cool air from one cool air supply system increases, the number of the cool air ducts constituting the cool air flow path increases.

[0016] When the number of the cool air ducts increases in this way, the space occupied by the cool air ducts increases, such that an internal volume in a rear area of the refrigerator may decrease.

[0017] Moreover, the cool air ducts connecting the storage chambers to each other should include a cool air recovery duct that recovers the cool air as well as a cool air supply duct that supplies the cool air. Thus, as the number of storage chambers to which one cool air supply system supplies the cool air increases, the number of the cool air ducts that should be provided increases.

[0018] Therefore, an efficient arrangement structure of the cool air ducts may be needed to minimize interference between the cool air ducts and increase space utilization.

[0019] Moreover, because a difference between a temperature of the cool air flowing through the cool air supply duct and a temperature of the cool air flowing through the cool air recovery duct is large, an efficient arrangement structure of the cool air ducts may be needed in which the cool air supply duct and the cool air recovery duct may be arranged so that they do not interfere with each other as much as possible.

[0020] In addition, when the cool air is supplied from one cool air supply system to the plurality of the cool air ducts, an efficient cool air flow path structure in which the cool air is supplied from one cool air supply system to the plurality of the cool air ducts with minimized cool air loss may be necessary.

[0021] Further, when the plurality of the cool air ducts is provided, each of the cool air ducts is connected to an inner casing to define a cool air flow path. In this case,

the inner casing and a connection duct may be fixed to each other via an adhesive member such as adhesive foam.

**[0022]** However, as the number of the cool air ducts connected to the inner casing increases, the number of the processes for connecting and fixing the cool air duct increases. As the number of processes increases, the possibility at which connection failure occurs at a connection site increases.

**[0023]** When, in this way, the connection failure occurs at the connection site between the cool air duct and the inner casing, this leads to a defective cool air flow path through which the cool air passes, such that the cool air efficiency of the refrigerator is greatly reduced.

### SUMMARY

**[0024]** A purpose of the present disclosure is to provide a refrigerator with a new cool air supply system that can efficiently supply the cool air produced from one evaporator to three or more independent storage chambers.

**[0025]** A purpose of the present disclosure is to provide a refrigerator with a plurality of the cool air supply ducts that can increase space utilization of the storage chamber.

**[0026]** Moreover, a purpose of the present disclosure is to provide a refrigerator with an arrangement structure of a plurality of the cool air supply ducts that can reduce interference between the plurality of the cool air supply ducts and a plurality of the cool air recovery ducts.

**[0027]** Moreover, a purpose of the present disclosure is to provide a refrigerator that can reduce occurrence of a connection failure at a connection area between a plurality of the cool air supply ducts and an inner casing to each other.

**[0028]** Moreover, a purpose of the present disclosure is to provide a refrigerator that can increase process efficiency for connection and fixation between a plurality of the cool air supply ducts and inner casings to each other.

**[0029]** Moreover, a purpose of the present disclosure is to provide a refrigerator in which the cool air can be supplied to a plurality of the cool air supply ducts connected to a single grille-fan assembly at a minimized cool air loss.

**[0030]** Purposes of the present disclosure are not limited to the above-mentioned purpose. Other purposes and advantages of the present disclosure that are not mentioned may be understood based on following descriptions, and may be more clearly understood based on embodiments of the present disclosure. Further, it will be easily understood that the purposes and advantages of the present disclosure may be realized using means shown in the claims and combinations thereof.

**[0031]** A refrigerator according to an embodiment of the present disclosure to achieve the above-described purpose includes an inner casing including an upper storage chamber and a lower storage chamber, a barrier

disposed in the lower storage chamber so as to divide the lower storage chamber into a first lower storage chamber and a lower storage chamber, and a grille-fan assembly that is disposed in the second lower storage chamber and supplies cool air to the upper storage chamber and the first lower storage chamber.

**[0032]** In this case, the barrier includes a plurality of connection ducts through which the cool air supplied from the grille-fan assembly flows.

**[0033]** Moreover, the refrigerator according to one embodiment of the present disclosure may be filled with a thermally-insulating foam so as to surround a first cool air supply duct and a second cool air supply duct disposed in a space between the inner casing and the outer casing, and surround a first connection duct and a second connection duct located in an inner space of the barrier.

**[0034]** Moreover, the refrigerator according to one embodiment of the present disclosure includes a first cool air supply duct, and a second cool air supply duct disposed in rear of the first cool air supply duct so as to at least partially overlap the first cool air supply duct in a front-to-back direction.

**[0035]** Moreover, a refrigerator according to another embodiment of the present disclosure to achieve the above-described purpose includes an inner casing including an upper storage chamber, and a lower storage chamber divided into a first lower storage chamber and a second lower storage chamber, a first cool air supply duct disposed on an outer rear surface of the inner casing so as to communicate the second lower storage chamber and the first lower storage chamber with each other, and a second cool air supply duct disposed in rear of the first cool air supply duct and communicating the second lower storage chamber and the upper storage chamber with each other.

**[0036]** In this case, the second cool air supply duct at least partially overlaps the first cool air supply duct in the front-to-back direction.

**[0037]** Moreover, a refrigerator according to still another embodiment of the present disclosure to achieve the above-described purpose includes an inner casing, a first cool air supply duct and the second cool air supply duct disposed on an outer rear surface of the inner casing, and a first cool air recovery duct and a second cool air recovery duct disposed on the outer rear surface of the inner casing.

**[0038]** In this case, the second cool air supply duct is disposed in rear of the first cool air supply duct so as to at least partially overlap the first cool air supply duct in the front-to-back direction, wherein the first cool air recovery duct and the second cool air recovery duct are arranged side by side in the left and right direction.

**[0039]** The refrigerator according to the present disclosure includes the barrier including the connection duct distributing the cool air supplied from one lower storage chamber where the grille-fan assembly is disposed to the other lower storage chamber and the upper storage chamber, thereby providing a new cool air supply system

that may efficiently supply the cool air generated from one evaporator to the three storage chambers.

**[0040]** Moreover, in the refrigerator according to the present disclosure, the thermally-insulating foam surrounding the cool air supply duct assembly disposed on the outer surface of the inner casing and the connection duct assembly disposed in the inner space of the barrier may be injected into and fill the refrigerator along a single flow communication path.

**[0041]** Accordingly, in the refrigerator according to the present disclosure, the cool air supply duct assembly and the connection duct assembly may be thermally insulated at once in a quick and easy process without the need to thermally insulate the cool air supply duct assembly and the connection duct assembly using separate processes or parts, respectively.

**[0042]** Moreover, in the refrigerator according to the present disclosure, the first cool air supply duct and the second cool air supply duct are arranged so as to at least partially overlap each other in the front-rear direction, thereby increasing space utilization in rear of the storage chamber such that the internal volume of the refrigerator may be increased.

**[0043]** Moreover, in the refrigerator according to the present disclosure, the first cool air supply duct and the second cool air supply duct are arranged so as to at least partially overlap each other in the front-rear direction, thereby providing an efficient arrangement structure of the cool air supply ducts that may reduce a space which may interfere with the plurality of the cool air recovery ducts.

**[0044]** Moreover, the refrigerator according to the present disclosure has not only the fixing structure of connecting and fixing the first cool air supply duct and the second cool air supply duct to the inner casing, but also the fitting structure that guides the connection therebetween or fastens the first cool air supply duct and the second cool air supply duct to the inner casing in the forward and backward direction. Thus, the connection of the first cool air supply duct and the second cool air supply duct to the inner casing may be easily guided, and the fastening of the first cool air supply duct and the second cool air supply duct to the inner casing may be more robust.

**[0045]** Accordingly, not only may the process efficiency for the connection and fixation of plurality of the cool air supply ducts and the inner casings to each other be increased, but also the occurrence of connection failure at the connection areas between the plurality of the cool air supply ducts and the inner casings may be reduced.

**[0046]** Moreover, in the refrigerator according to the present disclosure, the plurality of cool air supply ducts connected to one grille-fan assembly are arranged so as to at least partially overlap each other in the front-rear direction, so that the cool air blown from the grille-fan assembly may flow in a concentrated manner into a space where the plurality of cool air supply ducts are positioned, thereby forming a cool air flow path that may

supply the cool air with as little cool air loss as possible.

**[0047]** In addition to the above-mentioned effects, the specific effects of the present disclosure as not mentioned will be described below along with the descriptions of the specific details for carrying out the present disclosure.

## BRIEF DESCRIPTION OF DRAWINGS

**[0048]**

FIG. 1 is a front perspective view of a refrigerator in a state in which a door is closed.

FIG. 2 is a front perspective view of an inner casing equipped with a barrier.

FIG. 3 is a perspective view showing a connection structure of a grille-fan assembly, a barrier, a cool air supply duct assembly, a recovery duct assembly, and an upper duct assembly.

FIG. 4 is a rear perspective view of an inner casing onto which a cool air supply duct, a cool air recovery duct, and an ice-making duct are mounted.

FIG. 5 is an enlarged rear perspective view of an inner casing onto which a cool air supply duct is mounted.

FIG. 6 is an enlarged rear perspective view of an area where an inner casing and a cool air supply duct are connected to each other.

FIG. 7 is a side cross-sectional view of an inner casing including a grille-fan assembly, a barrier, and a cool air supply duct communicated with each other to define a cool air supply flow path.

FIG. 8 is a front view of a state in which components that constitute a cool air supply system are combined with a lower casing and an upper casing.

FIG. 9 is a side cross-sectional view of an inner casing including a cool air recovery duct that defines a cool air recovery flow path.

FIG. 10 is a perspective view of a barrier.

FIG. 11 is a right side view of a barrier.

FIG. 12 is a diagram for illustrating a lower surface of an upper barrier.

FIG. 13 is a diagram for illustrating an upper surface of a lower barrier.

FIG. 14 is a perspective view of a cool air supply duct assembly.

FIG. 15 is an exploded perspective view of a cool air supply duct assembly.

FIG. 16 is a side cross-sectional view of a cool air supply duct assembly.

FIG. 17 is a perspective view of a cool air recovery duct assembly.

FIG. 18 is an exploded perspective view of a cool air recovery duct assembly.

FIG. 19 is an enlarged front view of a fitting structure between a first recovery duct and a second recovery duct. FIG. 20 is an enlarged upper cross-sectional view of a fitting structure between the first recovery

duct and the second recovery duct. FIG. 21 is an enlarged rear view of an upper fitting structure between the first recovery duct and the second recovery duct.

FIG. 22 is a rear perspective view showing a filling hole of an outer casing filled with a thermally-insulating foam.

FIG. 23 is a side cross-sectional view of a lower storage chamber area showing that a thermally-insulating foam fills a space between an inner casing and an outer casing so as to surround a connection duct assembly and a cool air supply duct assembly.

FIG. 24 is a front cross-sectional view of a lower storage chamber area showing that a thermally-insulating foam fills a space between an inner casing and an outer casing so as to surround a connection duct assembly and a cool air supply duct assembly.

FIGS. 25 to 27 are cross-sectional views of a connection duct assembly and a cool air supply duct assembly according to another embodiment of the present disclosure.

## DETAILED DESCRIPTIONS

**[0049]** The above-mentioned purpose, features and advantages are described in detail below with reference to the attached drawings. Accordingly, a person skilled in the art in the technical field to which the present disclosure belongs will be able to easily implement the technical idea of the present disclosure. In describing the present disclosure, when it is determined that a detailed description of the known technology related to the present disclosure may unnecessarily obscure the gist of the present disclosure, the detailed description thereof is omitted. Hereinafter, preferred embodiments according to the present disclosure will be described in detail with reference to the attached drawings. In the drawings, identical reference numerals are used to indicate identical or similar components.

**[0050]** It will be understood that, although the terms "first", "second", "third", and so on may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are used to distinguish one element, component, region, layer or section from another element, component, region, layer or section. Thus, a first element, component, region, layer or section described below could be termed a second element, component, region, layer or section, without departing from the spirit and scope of the present disclosure.

**[0051]** The terminology used herein is directed to the purpose of describing particular embodiments only and is not intended to be limiting of the present disclosure. As used herein, the singular constitutes "a" and "an" are intended to include the plural constitutes as well, unless the context clearly indicates otherwise.

**[0052]** It will also be understood that when a first ele-

ment or layer is referred to as being present "on" a second element or layer, the first element may be disposed directly on the second element or may be disposed indirectly on the second element with a third element or layer being disposed between the first and second elements or layers. It will also be understood that when a first element or layer is referred to as being present "under" a second element or layer, the first element may be disposed directly under the second element or may be disposed indirectly under the second element with a third element or layer being disposed between the first and second elements or layers.

**[0053]** It will be understood that when an element or layer is referred to as being "connected to", or "coupled to" another element or layer, it may be directly connected to or coupled to another element or layer, or one or more intervening elements or layers therebetween may be present. In addition, it will also be understood that when an element or layer is referred to as being "between" two elements or layers, it may be the only element or layer between the two elements or layers, or one or more intervening elements or layers therebetween may also be present.

**[0054]** It will be further understood that the terms "comprise", "comprising", "include", and "including" when used in this specification, specify the presence of the stated features, integers, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, operations, elements, components, and/or portions thereof. As used herein, the term "and/or" includes any and all combinations of one or more of associated listed items. Expression such as "at least one of" when preceding a list of elements may modify the entire list of elements and may not modify the individual elements of the list. In interpretation of numerical values, an error or tolerance therein may occur even when there is no explicit description thereof.

**[0055]** As used herein, "A and/or B" means A, B or A and B, unless specifically stated otherwise. Expression such as "at least one of" when preceding a list of elements may modify the entirety of list of elements and may not modify the individual elements of the list. As used herein, "C to D" means C inclusive to D inclusive unless otherwise specified.

**[0056]** Hereinafter, a refrigerator according to some embodiments of the present disclosure will be described.

**[0057]** First, referring to FIGS. 1 to 9, the present disclosure will describe the refrigerator according to an embodiment of the present disclosure, and a connection relationship between major components that constitute the refrigerator.

**[0058]** Referring to FIG. 1, an appearance of a refrigerator 1 may be defined by a cabinet 2 having one or more storage chambers defined therein as storage spaces of objects, and a plurality of doors 20 and 30 that may open/close an open front surface of the cabinet 2.

**[0059]** The cabinet 2 may include an outer casing 10

and an inner casing 70 coupled to an inner side of the outer casing 10.

**[0060]** The cabinet 2 may have a box-shape with an open front surface, and may have one or more storage spaces defined therein including a refrigerating chamber and/or a freezing chamber.

**[0061]** Moreover, in addition to the refrigerating chamber and the freezing chamber, the cabinet 2 may include a convertible chamber as a convertible storage chamber that may be converted into a refrigerating chamber or a freezing chamber depending on the user's selection.

**[0062]** An upper portion of the cabinet 2 may be opened/closing by a plurality of upper doors 20, and a lower portion of the cabinet 2 may be opened/closing by a plurality of lower doors 30.

**[0063]** In one example, the upper door 20 may include a pair of a first upper door 21 and a second upper door 22 that may be opened/closed around a hinge.

**[0064]** A dispenser 21a capable of dispensing water or ice may be disposed at the first upper door 21. Embodiments of the present disclosure are not limited thereto.

**[0065]** The lower door 30 may include a pair of a first lower door 31 and a second lower door 32 as a drawer type door that may be opened/closing in a sliding manner in front-rear direction.

**[0066]** A vertical level of the first lower door 31 may be higher than that of the second lower door 32. The first lower door 31 may have a vertical dimension smaller than that of the second lower door 32. However, embodiments of the present disclosure are not limited thereto.

**[0067]** The upper door 20 may open/close the refrigerating chamber, the first lower door 31 may open/close the convertible chamber, and the second lower door 32 may open/close the freezing chamber.

**[0068]** The inner casing 70 may include an upper casing 71 and a lower casing 72 located under the upper casing 71.

**[0069]** For example, the inner casing 70 may be formed such that the upper casing 71 and the lower casing 72 are integral to each other. Embodiments of the present disclosure are not limited thereto, and the upper casing 71 and the lower casing 72 may be formed as separate casings and fastened to each other to constitute the inner casing 70.

**[0070]** The upper casing 71 may have an upper storage chamber 711 defined therein, and the upper storage chamber 711 may be a refrigerating chamber.

**[0071]** The lower casing 72 may have a plurality of lower storage chambers defined therein, including a first lower storage chamber 721 and a second lower storage chamber 722.

**[0072]** The first lower storage chamber 721 may be disposed above the second lower storage chamber 722, the first lower storage chamber 721 may be the convertible chamber, and the second lower storage chamber 722 may be a freezing chamber.

**[0073]** Referring to FIG. 2, the lower casing 72 may

include a barrier 100 disposed therein, and may be divided into the first lower storage chamber 721 and the second lower storage chamber 722 via the barrier 100.

**[0074]** The barrier 100 may be detachably coupled to the inner casing 70 in a sliding manner in the front-back direction.

**[0075]** For example, a guide rail (not shown) may be provided on an inner surface of the lower casing 72 to guide sliding movement of each of both opposing sides of the barrier 100, thereby guiding the sliding movement of the barrier 100 in the front-rear direction.

**[0076]** The barrier 100 may be disposed closer to a top of the lower casing 72 than a bottom of the lower casing 72 so that the second lower storage chamber 722 may have a space larger than that of the first lower storage chamber 721.

**[0077]** Referring to FIG. 3, a positional relationship of various parts that constitute the cool air supply system that may supply the cool air to the plurality of storage chambers and may include one evaporator and a grille-fan assembly will be described based on the barrier 100.

**[0078]** A grille-fan assembly 300 may be disposed under the barrier 100.

**[0079]** The evaporator that generates the cool air may be disposed on a back surface of the grille-fan assembly 300, and the cool air produced from the evaporator may be blown to each of the storage chambers by a blow fan disposed in the grille-fan assembly 300 and may flow in each storage chamber.

**[0080]** The grille-fan assembly 300 may be in communication with a lower surface of a rear side of the barrier 100 such that the cool air produced from the evaporator may flow into the barrier 100.

**[0081]** The grille-fan assembly 300 may be disposed in a rear side of an inner space of the lower casing 72.

**[0082]** Specifically, the barrier 100 may divide the lower casing 72 into the first lower casing 72 and the second lower casing 72. The grille-fan assembly 300 disposed under the barrier 100 may be disposed in the rear side of the inner space of the second lower casing 72.

**[0083]** Since the grille-fan assembly 300 is disposed in the second lower casing 72 which has the inner space larger than that of the first lower casing 72, the space utilization of the first lower casing 72 which has a relatively narrower space may be improved.

**[0084]** A cool air supply duct assembly 200 may be disposed on top of the barrier 100.

**[0085]** The cool air supply duct assembly 200 may include a first cool air supply duct 210 and a second cool air supply duct 220 arranged in the front-back direction.

**[0086]** Connection of the first cool air supply duct 210 and the second cool air supply duct 220 may be guided via various fitting structures or the first cool air supply duct 210 and the second cool air supply duct 220 may be fastened to each other via various fitting structures to constitute one cool air supply duct assembly 200.

**[0087]** For example, the first cool air supply duct 210 may be disposed in front of the second cool air supply

duct 220. The first cool air supply duct 210 and the second cool air supply duct 220 may at least partially overlap each other in the front-back direction, such that space utilization of each of left and right areas around an area of the inner casing 70 where the cool air supply duct assembly 200 is disposed may be improved.

**[0088]** More preferably, the first cool air supply duct 210 and the second cool air supply duct 220 may be arranged so that an overlapping area therebetween in the front-back direction is increased as much as possible.

**[0089]** The cool air supply duct assembly 200 may be disposed so as to be closer to one of both opposing sides of the barrier 100 than to the other thereof.

**[0090]** For example, the cool air supply duct assembly 200 may be disposed so as to be closer to a right side of the barrier 100 than to a left side thereof.

**[0091]** As previously described, the first cool air supply duct 210 and the second cool air supply duct 220 may not be arranged side by side in left-right direction but may be arranged so as to overlap each other in the front-back direction. The cool air supply duct assembly 200 may be disposed so as to be closer to one of both opposing sides of the barrier 100 than to the other thereof.

**[0092]** Referring to FIG. 4 and FIG. 5, the cool air supply duct assembly 200 may be disposed on a rear outer surface of the inner casing 70.

**[0093]** The grille-fan assembly 300 and the cool air supply duct assembly 200 while the barrier 100 is disposed therebetween may communicate with each other through the barrier 100.

**[0094]** A vertical length of the first cool air supply duct 210 may be smaller than a vertical length of the second cool air supply duct 220, such that storage chambers located close to each other may communicate with each other via each of the first cool air supply duct 210 and the second cool air supply duct 220.

**[0095]** The first cool air supply duct 210 may communicate the second lower storage chamber 722 and the first lower storage chamber 721 with each other.

**[0096]** Therefore, both one end and the other end of the first cool air supply duct 210 may be connected to the lower casing 72.

**[0097]** The second cool air supply duct 220 located behind the first cool air supply duct 210 may communicate the second lower storage chamber 722 and the upper storage chamber 711 with each other.

**[0098]** Therefore, one end of the second cool air supply duct 220 may be connected to the lower casing 72, while the other end thereof may be connected to the upper casing 71.

**[0099]** Since the second cool air supply duct 220 which has a larger vertical length is disposed behind the first cool air supply duct 210 which has a smaller vertical length, each of the first cool air supply duct 210 and the second cool air supply duct 220 arranged to overlap each other in the front-back direction may communicate with the corresponding storage chambers while the first cool air supply duct 210 and the second cool air supply duct

220 does not interfere with each other.

**[0100]** The other end of the second cool air supply duct 220 which communicates with the upper casing 71 including the upper storage chamber 711 may communicate with the upper duct assembly 400.

**[0101]** Specifically, the second cool air supply duct 220 and the upper duct assembly 400 may communicate with each other while the upper casing 71 is disposed therebetween.

**[0102]** Because the second cool air supply duct 220 is disposed on the rear outer surface of the inner casing 70, a separate duct having a cool air flow path structure that may discharge the cool air flowing from the second cool air supply duct 220 to the upper storage chamber 711 may be required.

**[0103]** Therefore, the other end of the second cool air supply duct 220 communicates with the upper duct assembly 400 disposed in a rear side of the inner space of the upper casing 71. Thus, the cool air flowing from the second cool air supply duct 220 may be discharged into the upper storage chamber 711 through the upper duct assembly 400.

**[0104]** A cool air recovery duct assembly 500 may be disposed on a rear outer surface of the inner casing 70.

**[0105]** The cool air recovery duct assembly 500 may include a first cool air recovery duct 510 and a second cool air recovery duct 520 arranged side by side in the left-right direction.

**[0106]** Connection of the first cool air recovery duct 510 and the second cool air recovery duct 520 may be guided via various fitting structures, or the first cool air recovery duct 510 and the second cool air recovery duct 520 may be fastened to each other via various fitting structures to constitute one cool air recovery duct assembly 500.

**[0107]** For example, the first cool air recovery duct 510 and the second cool air recovery duct 520 may be arranged side by side, such that space utilization of each of front and rear areas around an area of the inner casing 70 where the cool air recovery duct assembly 500 is disposed may be improved.

**[0108]** The cool air recovery duct assembly 500 may be disposed to be closer to the other side of the barrier 100 than one side while the cool air supply duct assembly 200 may be disposed closer to one side thereof than the other side thereof.

**[0109]** For example, the cool air recovery duct assembly 500 may be disposed closer to a left side of the barrier 100 than to the right side thereof in FIG. 4, while the cool air supply duct assembly 200 may be disposed closer to the right side of the barrier 100 than to the left side thereof in FIG. 4.

**[0110]** The first cool air recovery duct 510 may communicate the second lower storage chamber 722 and the first lower storage chamber 721 with each other.

**[0111]** Therefore, both one end and the other end of the first cool air supply duct 210 may be connected to the lower casing 72.

**[0112]** For example, the first cool air recovery duct 510 may be in communication with each of a first recovered cool air inlet 7241i formed in a back surface of a portion of the lower casing 72 corresponding to the first lower storage chamber 721, and a first recovered cool air outlet 7241o formed in a back surface of a portion of the lower casing 72 corresponding to the second lower storage chamber 722.

**[0113]** The second cool air supply duct 220 may communicate the second lower storage chamber 722 and the upper storage chamber 711 with each other.

**[0114]** Therefore, one end of the second cool air supply duct 220 may be connected to the lower casing 72, while the other end thereof may be connected to the upper casing 71.

**[0115]** For example, the second cool air recovery duct 520 may be communicated with each of a second recovered cool air inlet 7242i formed in a back surface of a portion of the upper casing 71 corresponding to the upper storage chamber 711, and a second recovered cool air outlet 7242o formed in a back surface of a portion of the lower casing 72 corresponding to the second lower storage chamber 722.

**[0116]** A difference between temperatures of the cool airs passing through the first cool air recovery duct 510 and the second cool air recovery duct 520 which recover the cool airs from different storage chamber having different temperatures, respectively may be large.

**[0117]** In this way, when the difference between the temperatures of the cool airs recovered through the first cool air recovery duct 510 and the second cool air recovery duct 520, respectively is large, dew or frost may be produced in an area of the first cool air recovery duct 510 adjacent to the second cool air recovery duct 520 or in an area of the second cool air recovery duct 520 adjacent to the first cool air recovery duct 510.

**[0118]** Therefore, the first cool air recovery duct 510 and the second cool air recovery duct 520 may not be arranged so as to overlap each other in the front-back direction, but may be arranged side by side in the left-right direction, thereby reducing the possibility at which the dew or frost is produced.

**[0119]** On the contrary, the first cool air supply duct 210 and the second cool air supply duct 220 as described above may receive the same cool air blown from one grille-fan assembly 300. Thus, a difference between a temperature of the cool air flowing through the first cool air supply duct 210 and a temperature of the cool air flowing through the second cool air supply duct 220 is not substantially large. Thus, even when the first cool air supply duct 210 and the second cool air supply duct 220 overlap each other in the front-back direction, the possibility at which the dew or frost is produced thereon may be reduced.

**[0120]** An ice-making chamber duct assembly 600 may be disposed on the other side surface of the inner casing 70 closer to the cool air recovery duct assembly 500.

**[0121]** The ice-making chamber duct assembly 600 may be in communication with an ice-making chamber (not shown) installed in the first upper door 21.

**[0122]** Ice produced in the ice-making chamber (not shown) may be dispensed to the user through the dispenser 21a installed in a front surface of the first upper door 21.

**[0123]** One side and the other end of the ice-making chamber duct assembly 600 may be in communication with the upper casing 71 and the lower casing 72, respectively.

**[0124]** Specifically, the ice-making chamber duct assembly 600 may include an ice-making chamber cool-air supply duct 610 and an ice-making chamber cool-air recovery duct 620.

**[0125]** The ice-making chamber cool-air supply duct 610 may supply the cool air blown from the grille-fan assembly 300 to the ice-making chamber (not shown). The cool air recovered from the ice-making chamber (not shown) may return back to the grille-fan assembly 300 through the ice-making chamber cool-air recovery duct 620.

**[0126]** In the cool air supply system according to the present disclosure as described above, the cool air produced from one evaporator 360 may be blown to three different storage chambers using only one blow fan disposed in the grille-fan assembly 300.

**[0127]** Specifically, under an operation of the grille-fan assembly 300 disposed in the second lower storage chamber 722 and the evaporator 360, the cool air may be supplied to not only the second lower storage chamber 722, but also the first lower storage chamber 721 and upper storage the chamber 711.

**[0128]** For example, under an operation of the grille-fan assembly 300 disposed in the freezing chamber and the evaporator 360, the cool air may be supplied to the convertible chamber and the refrigerating chamber through the first cool air supply duct 210 and the second cool air supply duct 220, respectively.

**[0129]** In this way, using the cool air supply system according to the present disclosure, the cool air produced from one evaporator 360 may be distributed into various storage chambers via the cool air supply duct assembly 200 defining two different and independent cool air flow paths.

**[0130]** Accordingly, a general configuration of the cool air supply system is simplified.

**[0131]** Moreover, as reliability of the cool air supply system is improved, cool air loss may be minimized, thereby reducing the number of employed parts and fixing modules.

**[0132]** Referring to FIG. 5 and FIG. 6, a recessed lower recess 723 recessed in a frontward direction may be formed in an upper end of a rear outer surface of the lower casing 72 such that a lower end of each of the first cool air supply duct 210 and the second cool air supply duct 220 are received in the recessed lower recess 723.

**[0133]** As previously described, the first cool air supply

duct 210 and the second cool air supply duct 220 are arranged to overlap each other in the front-back direction. Thus, a space receiving therein the cool air supply duct assembly 200 is required.

**[0134]** For example, the lower recess 723 may be disposed in the rear outer surface of a portion of the lower casing 72 corresponding to the first lower storage chamber 721.

**[0135]** A left-right directional dimension of the lower recess 723 is not particularly limited as long as the cool air supply duct assembly 200 may be inserted and seated into the lower recess. However, in order to minimize decrease in an internal volume of the first lower storage chamber 721, the left-right directional dimension of the lower recess 723 may be substantially equal to a left-right directional dimension of the cool air supply duct assembly 200.

**[0136]** Moreover, a front-back directional dimension of the lower recess 723 is not particularly limited as long as the cool air supply duct assembly 200 may be inserted and seated into the lower recess. However, in order to minimize decrease in an internal volume of the first lower storage chamber 721, the front-to back directional dimension of the lower recess 723 may be substantially equal to a front-back directional dimension of the cool air supply duct assembly 200.

**[0137]** In a side view of a state in which the cool air supply duct assembly 200 has been seated in the lower recess 723, the first cool air supply duct 210 may be inserted into the lower recess such that the first cool air supply duct 210 is hidden by the lower casing 72 and thus is not visible.

**[0138]** That is, the lower recess 723 may be disposed closer to one side of the inner casing 70 than to the other side thereof as the cool air supply duct assembly 200 is disposed closer to one side of the inner casing 70 than to the other side thereof. Thus, the cool air supply duct assembly 200 may be received in the lower recess.

**[0139]** However, in order to minimize the reduction in the internal volume of the first lower storage chamber 721, the lower recess 723 may be recessed in the forward direction so as to have a recessed space corresponding to a space into which the cool air supply duct assembly 200 is seated.

**[0140]** Therefore, both opposing side surfaces and a front surface of the lower recess 723 may be surrounded with and thus defined by the lower casing 72. A rear surface of the lower recess 723 may be opened so that the cool air supply duct assembly 200 may be inserted into the lower recess through the open rear surface.

**[0141]** An upper surface of the lower recess 723 may be opened so that the second cool air supply duct 220 may extend in an upward direction and communicate with the upper casing 71.

**[0142]** A lower surface of the lower recess 723 may be formed such that an upper surface of the lower casing 72 corresponding to an upper surface of the barrier 100 dividing the space of the lower casing into the first lower

storage chamber 721 and the second lower storage chamber 722 is exposed to an outside.

**[0143]** The lower surface of the lower recess 723 may be referred to as a connection duct opening 726 exposing a connection duct assembly 130 of the barrier 100 which transmits the cool air blown from the grille-fan assembly 300 to the cool air supply duct assembly 200.

**[0144]** The connection duct assembly 130 may include a first connection duct 131 and a second connection duct 132 extending in a vertical direction so as to extend through a lower surface and an upper surface of the barrier 100.

**[0145]** Hereinafter, an embodiment in which the connection duct assembly 130 includes two connection ducts is described. However, embodiments of the present disclosure are not limited thereto, and the connection duct assembly 130 may include a larger number of connection ducts, such as three or four or more connection ducts.

**[0146]** A lower end of the connection duct assembly 130 may be in communication with an inner space of the inner casing 70 and may receive the cool air from the grille-fan assembly 300, while an upper end of the connection duct assembly 130 may be exposed to an outside through the connection duct opening 726 and thus may communicate with an outer space out of the inner casing 70.

**[0147]** That is, the cool air blown from the grille-fan assembly 300 may flow through the connection duct assembly 130 and flow to the cool air supply duct assembly 200.

**[0148]** One end and the other end of the first connection duct 131 may be in communication with the grille-fan assembly 300 and the first cool air supply duct 210, respectively.

**[0149]** One end and the other end of the second connection duct 132 may be in communication with the grille-fan assembly 300 and the second cool air supply duct 220, respectively.

**[0150]** Accordingly, along a first cool air flow path 41 composed of the grille-fan assembly 300, the first connection duct 131, and the first cool air supply duct 210, the cool air may be supplied up to the first lower storage chamber 721.

**[0151]** Further, along a second cool air flow path 42 composed of the grille-fan assembly 300, the second connection duct 132, and the second cool air supply duct 220, the cool air may be supplied up to the upper storage chamber 711.

**[0152]** Because the first cool air flow path 41 and the second cool air flow path 42 communicate with different storage chambers, respectively, the first connection duct 131 and the first cool air supply duct 210 constitute the first cool air flow path 41, and the second connection duct 132 and the second cool air supply duct 220 constituting the second cool air flow path 42 may be separate from each other so as to have independent cool air flow paths.

**[0153]** Therefore, the first connection duct 131 and the second connection duct 132 may be formed integrally

with each other to constitute the connection duct assembly 130, but may be separate from each other so as to have independent cool air flow paths.

**[0154]** However, embodiments of the present disclosure are not limited thereto. The first connection duct 131 and the second connection duct 132 may be fastened and fixed to each other via various joining structures to constitute one connection duct assembly 130.

**[0155]** For example, the first connection duct 131 may be disposed in front of the second connection duct 132. The first connection duct 131 and the second connection duct 132 may be arranged so as to at least partially overlap each other in the front-back direction.

**[0156]** That is, the first connection duct 131 and the second connection duct 132 may be arranged so as to entirely overlap with each other in the front-back direction, or so as to partially overlap each other in the front-back direction.

**[0157]** The overlapping area of the first connection duct 131 and the second connection duct 132 as used in the present disclosure may refer to an area constituting a cool air flow path of each of the connection ducts through which the cool air flows.

**[0158]** The first connection duct 131 and the second connection duct 132 may be spaced from each other by a predetermined distance in the front-rear direction.

**[0159]** For example, a spacing having a predetermined dimension in the front-back direction may be defined between the first connection duct 131 and the second connection duct 132.

**[0160]** In this case, in the spacing, a separate spacing member that maintains the distance between the first connection duct 131 and the second connection duct 132 may be disposed. However, embodiments of the present disclosure are not limited thereto, and the spacing may be empty while the separate separation member is not disposed therein.

**[0161]** Because the first connection duct 131 and the second connection duct 132 are connected to the first cool air supply duct 210 and the second cool air supply duct 220, respectively, an arrangement of the first connection duct 131 and the second connection duct 132 may be the same as the arrangement of the first cool air supply duct 210 and the second cool air supply duct 220.

**[0162]** Therefore, for effective space utilization due to the cool air supply duct assembly 200, the first connection duct 131 and the second connection duct 132 may be arranged so as to overlap with each other in the front-to-rear direction by a maximum area.

**[0163]** However, the arrangement of the first connection duct 131 and the second connection duct 132 is not limited to the arrangement as described above in which the first connection duct 131 and the second connection duct 132 overlap each other in the front-back direction, and may be implemented in various arrangement structures.

**[0164]** For example, the first connection duct 131 and the second connection duct 132 may be arranged so as

to at least partially overlap with each other in the left-right direction, such that a dimension in the front-back direction of the grille-fan assembly 300 may be reduced.

**[0165]** Therefore, the first connection duct 131 and the second connection duct 132 may be arranged so as to entirely overlap with each other in the left-right direction, or so as to partially overlap with each other in the left-right direction.

**[0166]** The first connection duct 131 and the second connection duct 132 may be spaced from each other by at a predetermined distance in the left-right direction.

**[0167]** For example, a spacing having a predetermined dimension in the left-right direction may be defined between the first connection duct 131 and the second connection duct 132.

**[0168]** In this case, in the spacing, a separate separation member that maintains the distance between the first connection duct 131 and the second connection duct 132 may be disposed. However, embodiments of the present disclosure are not limited thereto, and the spacing may be empty while the separate separation member is not disposed therein.

**[0169]** In another example, the first connection duct 131 and the second connection duct 132 may be arranged so as not to overlap each other in both the front-back and left-right directions. In addition, the first connection duct 131 and the second connection duct 132 may be formed in substantially the same shape. Embodiments of the present disclosure are not limited thereto, and a shape of each of the first connection duct 131 and the second connection duct 132 may vary depending on a location and a shape of the cool air supply duct connected thereto. An angle of an inclined surface in the front-back direction thereof may vary depending on that of the cool air supply duct connected thereto.

**[0170]** Moreover, each of the first connection duct 131 and the second connection duct 132 may be formed such that a dimension in the left-right direction thereof is larger than a dimension in the front-rear direction thereof. Embodiments of the present disclosure are not limited thereto, and the dimension in the front-back direction thereof may be formed to be larger than the dimension in the left-right direction thereof.

**[0171]** The first connection duct 131 and the second connection duct 132 may have different opening areas which the cool air may flow through. Thus, the shapes of the connection ducts or the opening areas thereof may be controlled such that amounts of the cool air flowing into the storage chambers, respectively, may be set to be different from each other.

**[0172]** In one example, an upper recess 713 recessed in a frontward direction may be formed in a rear outer surface of the upper casing 71 so that an upper end of the second cool air supply duct 220 is seated in the upper recess.

**[0173]** The lower end of the second cool air supply duct 220 may be disposed in the lower recess 723 and may communicate with the second connection duct 132. The

upper end of the second cool air supply duct 220 extending from the lower recess 723 in the upward direction may be disposed in the upper recess 713 and communicate with the rear surface of the upper casing 71.

**[0174]** A second supplied cool air outlet 7252o may be formed in a rear surface of a portion of the upper casing 71 corresponding to the upper recess 713.

**[0175]** The second cool air supply duct 220 may communicate with the upper duct assembly 400 disposed in an inner space of the upper storage chamber 711 through the second supplied cool air outlet 7252o and may supply the cool air to the inner space of the upper storage chamber 711.

**[0176]** The lower recess 723 and the upper recess 713 may be arranged so as to at least partially overlap each other in a vertical direction. Preferably, the lower recess 723 and the upper recess 713 may be arranged so as to overlap each other in a vertical direction by a maximum area.

**[0177]** The lower end of the second cool air supply duct 220 may be located in the lower recess 723, and the upper end of the second cool air supply duct 220 may be located in the upper recess 713. Thus, a position of each of the lower recess 723 and the upper recess 713 may vary depending on a position of each of one end and the other end of the second cool air supply duct 220 extending in the vertical direction.

**[0178]** In this case, in order that the flow of the cool air flowing through the second cool air supply duct 220 is not interrupted as much as possible, one end and the other end of the second cool air supply duct 220 may overlap with each other in the vertical direction by a maximum area.

**[0179]** Referring to FIG. 7 to FIG. 9, a connection structure of each of the ducts constituting each of the first cool air flow path 41 and the second cool air flow path 42 to the inner casing 70, and a connection structure of each of the ducts constituting the recovery flow path to the inner casing 70 may be described.

**[0180]** The grille-fan assembly 300 disposed in the rear side of the inner space of the second lower storage chamber 722 may have an outer structure composed of a grille-fan 310 constituting a front surface of the grille-fan assembly 300 and a shroud 320 constituting a rear surface thereof.

**[0181]** A first blow fan 331 and a flow path opening/closing module 340 may be disposed between the grille-fan 310 and the shroud 320.

**[0182]** The evaporator 360 that generates the cool air may be located in rear of the grille-fan assembly 300, that is, between the grille-fan assembly 300 and a rear surface of the lower casing 72.

**[0183]** The cool air produced from the evaporator 360 may be supplied to the grille-fan assembly 300, and may flow into the second lower storage chamber 722, the first lower storage chamber 721, and the upper storage chamber 711 under an operation of the first blow fan 331 of the grille-fan assembly 300.

**[0184]** The grille-fan assembly 300 may additionally include a second blow fan 332 that supplies the cool air to the ice-making chamber (not shown).

**[0185]** The second blow fan 332 and the flow path opening/closing module 340 may be respectively disposed at opposite sides around the first blow fan 331.

**[0186]** At upper and lower sides of a front surface of the grille-fan 310, a first grille-fan discharge hole 351 and a second grille-fan discharge hole 352 may be formed, respectively, to discharge a portion of the cool air blown from the first blow fan 331 into the inner space of the second lower storage chamber 722.

**[0187]** A grille-fan recovering hole 353 may be formed at the lowest level of the front surface of the grille-fan 310 and may recover the cool air from the second lower storage chamber 722.

**[0188]** A portion of the cool air blown by the first blow fan 331 may be delivered to the cool air supply duct assembly 200 through the connection duct assembly 130 in communication with the flow path opening/closing module 340.

**[0189]** The flow path opening/closing module 340 may include a first flow path opening/closing damper 341 which control an amount of the cool air to be supplied to the first connection duct 131 and a second flow path opening/closing damper 342 which controls an amount of the cool air to be supplied to the second connection duct 132.

**[0190]** The first flow path opening/closing damper 341 and the second flow path opening/closing damper 342 may be disposed at one side of the grille-fan assembly 300 while being surrounded with a damper cover 343.

**[0191]** The damper cover 343 may be made of a thermally insulating material such as Styrofoam. However, embodiments are not limited thereto.

**[0192]** The second flow path opening/closing damper 342 may be disposed behind the first flow path opening/closing damper 341 while at least partially overlapping with the first flow path opening/closing damper 341 in the front-back direction.

**[0193]** In this way, the first flow path opening/closing damper 341 and the second flow path opening/closing damper 342 are arranged so as to overlap each other in the front-back direction, thereby achieving an arrangement structure that can increase space utilization in a narrow space of the grille-fan assembly 300 as much as possible.

**[0194]** Accordingly, the flow path opening/closing module 340 may be disposed to be closer to one side of the barrier 100 than to the other side thereof. Specifically, the flow path opening/closing module 340 may be disposed between the first blow fan 331 and one side of the barrier 100.

**[0195]** The flow path opening/closing module 340 may not overlap with the first blow fan 331 in the front-back direction. However, the flow path opening/closing module 340 and the first blow fan 331 may be arranged side by side so as to overlap with each other in the left-right

direction.

**[0196]** Specifically, the flow path opening/closing module 340 may be disposed in a flow path of the cool air that circulates in one direction under an operation of the first blow fan 331, such that the cool air blown from the first blow fan 331 may flow toward the flow path opening/closing module 340 at a minimized loss.

**[0197]** That is, the cool air blown from the first blow fan 331 may flow in a concentrated manner into a space where the first flow path opening/closing damper 341 and the second flow path opening/closing damper 342 are disposed. Thus, a cool air flow path 40 that may supply the cool air at a minimized loss may be formed.

**[0198]** The cool air flowing through the flow path opening/closing module 340 may flow to the connection duct assembly 130 of the barrier 100.

**[0199]** Referring further to FIGS. 10 to 13, the barrier 100 may be formed by combining an upper barrier 110 which constitutes an upper portion thereof, and a lower barrier 120 which constitutes a lower portion thereof with each other.

**[0200]** The upper barrier 110 and the lower barrier 120 may be fixed to each other by fastening a plurality of upper fasteners 116 disposed in the upper barrier 110 and a plurality of lower fasteners 126 disposed in the lower barrier 120 to each other.

**[0201]** In this case, there is no particular limitation on a fastening manner in which the upper fastener 116 and the lower fastener 126 are fastened to each other.

**[0202]** A front surface, a rear surface, and both opposing side surfaces of the barrier 100 may be formed by combining outer components of the upper barrier 110 and the lower barrier 120 with each other. There is no particular limitation on a manner in which the components are combined with each other.

**[0203]** A first connection inlet 1311i may be formed at a bottom of the first connection duct 131 so as to be in communication with the first flow path opening/closing damper 341. A first connection outlet 1311o communicating with the first cool air supply duct 210 may be formed at a top of the first connection duct 131.

**[0204]** At a bottom of the second connection duct 132, the second connection inlet 1321i in communication with the second flow path opening/closing damper 342 may be formed. A second connection outlet 1321o communicating with the second cool air supply duct 220 may be formed at a top of the second connection duct 132.

**[0205]** The connection duct assembly 130 including the first connection duct 131 and the second connection duct 132 as formed in this way may be located in a rear area of the barrier 100 and may be disposed to be closer to one side of the barrier 100 than to the other side thereof.

**[0206]** That is, the connection duct assembly 130 including the first connection duct 131 and the second connection duct 132 may be disposed between the first blow fan 331 and one side of the barrier 100.

**[0207]** Accordingly, the connection duct assembly 130

including the first connection duct 131 and the second connection duct 132 may be disposed so as not to overlap the first blow fan 331 in the front-back direction.

**[0208]** The connection duct assembly 130 is disposed between the first blow fan 331 and one side of the barrier 100 as the flow path opening/closing module 340 is disposed between the first blow fan 331 and one side of the barrier 100. Thus, the cool air supplied from the flow path opening/closing module 340 may flow to the connection duct assembly 130 through the shortest possible travel path.

**[0209]** An upper opening 112 may be formed in an upper surface of a portion of the upper barrier 110 corresponding to an area where the connection duct assembly 130 is disposed, such that the first connection outlet 1311o and the second connection outlet 1321o may be exposed to an outside through the upper opening 112.

**[0210]** Moreover, a lower opening 122 including a first lower opening 1221 and a second lower opening 1222 may be formed in a lower surface of a portion of the lower barrier 120 corresponding to the area where the connection duct assembly 130 is disposed. Thus, the first connection inlet 1311i and the second connection inlet 1321i of the connection duct assembly 130 may be exposed to an outside through the first lower opening 1221 and the second lower opening 1222, respectively.

**[0211]** In a rear area of the barrier 100, an upper step 111 protruding in the upward direction may be formed on the upper surface of the upper barrier 110 such that the rear area thereof has a vertical length larger than a vertical length of a front area of the barrier.

**[0212]** In a corresponding manner thereto, in the rear area of the barrier 100, a lower step 121 protruding in the downward direction may be formed on the lower surface of the lower barrier such that the rear area thereof has a vertical length larger than a vertical length of a front area of the barrier.

**[0213]** Accordingly, the upper surface in the rear area of the barrier 100 may have the protrusion protruding therefrom in the upward direction beyond the upper surface in the front area of the barrier 100. The lower surface in the rear area of the barrier 100 may have the protrusion protruding therefrom in the downward direction beyond the lower surface in the front area of the barrier 100.

**[0214]** The upper opening 112 may be defined in the upper step 111, while the lower opening 122 may be defined in the lower step 121.

**[0215]** The lower step 121 formed in this way may correspond to a space in which the grille-fan assembly 300 located under the barrier 100 is seated.

**[0216]** The lower surface of the barrier 100 having the lower step 121 may not only stably support the grille-fan assembly 300 located under the barrier 100, but also guide a position onto which the grille-fan assembly 300 is seated more accurately.

**[0217]** The upper and lower barriers 110 and 120 may include an upper body 113 and a lower body 123 in front of the upper step 111 and the lower step 121, respec-

tively, and having smaller vertical lengths than those of the upper step 111 and the lower step 121, respectively.

**[0218]** The upper body 113 may include a plurality of ribs 114 formed on the upper barrier 110 and having a predetermined vertical length and protruding in the upward direction and extending in the front-back direction.

**[0219]** The plurality of ribs 114 may serve to prevent deformation of the barrier 100, which may otherwise occur when an inner space of the barrier 100 is filled with the thermally-insulating foam.

**[0220]** A heater 150 may be disposed in an area where the upper body 113 of the upper barrier 110 is disposed.

**[0221]** As previously described, the freezing chamber may be disposed under the convertible chamber while the barrier 100 is disposed therebetween.

**[0222]** In this case, when the convertible chamber acts as the refrigerating chamber having a higher temperature than that of the freezing chamber, frost may occur in a lower end thereof located close to the freezing chamber. Thus, the heater 150 may be disposed in a back surface of the upper body 113 to remove the frost.

**[0223]** To operate the heater 150, a plurality of sockets 115 that may supply power and a signal to the heater 150 may be formed on the rear surface of the barrier 100.

**[0224]** A plurality of foam passage holes 141 may be formed in a side surface of the barrier 100 and may provide a path through which the thermally-insulating foam fills the inner space of the barrier 100.

**[0225]** The plurality of foam passage holes 141 may be formed in each of both opposing side surfaces of the barrier 100 and may be formed to protrude outwardly beyond the side surface of the barrier 100.

**[0226]** Moreover, in addition to the foam passage hole 141, a fixing protrusion 142 may be formed on the side surface of the barrier 100 so as to protrude outwardly beyond the side surface of the barrier 100 as the foam passage hole 141 does.

**[0227]** As the foam passage hole 141 and the fixing protrusion 142 are formed to protrude outwardly beyond the side surface of the barrier 100, the foam passage hole 141 and the fixing protrusion 142 slightly protruding outwardly beyond the side surface of the barrier may be coupled to the inner casing 70 such that the barrier 100 may be mounted on and fixed to the inner casing 70 as shown in FIG. 5..

**[0228]** In this way, the barrier 100 includes the foam passage hole 141 and the fixing protrusion 142 disposed on the side surface thereof so as to protrude outwardly beyond the side surface thereof, thereby providing a structure in which the barrier 100 can be fastened and fixed to the inner casing 70 without a separate fastening member.

**[0229]** Each of the first connection duct 131 and the second connection duct 132 of the connection duct assembly 130 formed as described above may extend in an inclined manner backwardly as it extends upwardly.

**[0230]** For example, the first connection duct 131 located in front of the second connection duct 132 may

extend in the inclined manner more backwardly than the second connection duct 132 may extend in the inclined manner backwardly. That is, an angle between the first connection duct 131 and a vertical axis may be larger than an angle between the second connection duct 132 and the vertical axis.

**[0231]** Because each of the first connection duct 131 and the second connection duct 132 extends in the inclined manner backwardly as it extends upwardly, space utilization of each of the connection duct assembly 130 extending through the barrier 100 and the flow path opening/closing module 340 communicating with the lower surface of the barrier 100 may be improved.

**[0232]** For example, when an area where the connection duct assembly 130 is located, that is, an area of the lower recess 723 is too large, an internal volume of the first lower storage chamber 721 located in front of the lower recess 723 may be reduced.

**[0233]** Therefore, it is desirable to reduce the area of the lower recess 723 as much as possible.

**[0234]** In this regard, when each of the first connection duct 131 and the second connection duct 132 does not extend in the inclined manner backwardly as it extends upwardly but extends in a non-inclined manner upwardly, an area occupied by the flow path opening/closing module 340 disposed under the barrier 100 should be substantially equal to the area occupied by the lower recess 723.

**[0235]** However, the flow path opening/closing module 340 includes the plurality of flow path opening/closing dampers 341 and 342 and the damper cover 343 which has a thermal insulating function. Thus, when an area of the flow path opening/closing module 340 is reduced to the area occupied by the lower recess 723, the flow path opening/closing module 340 may not operate properly.

**[0236]** For example, when a size of each of the flow path opening/closing dampers 341 and 342 is reduced, the cool air supply efficiency may decrease. When a size of the damper cover 343 is reduced, the thermal insulation performance may decrease.

**[0237]** That is, when each of the first connection duct 131 and the second connection duct 132 does not extend in the inclined manner backwardly as it extends upwardly but extends in a non-inclined manner upwardly, the internal volume of the first lower storage chamber 721 and the cool air supply efficiency by the flow path opening/closing module 340 respectively based on the area occupied by the lower recess 723 and the area occupied by the flow path opening/closing module 340 may have a trade-off relationship with each other.

**[0238]** However, in one embodiment of the present disclosure, each of the first connection duct 131 and the second connection duct 132 does extend in the inclined manner backwardly as it extends upwardly. Thus, regardless of the area occupied by the lower recess 723, the area occupied by the flow path opening/closing module 340 can be larger. Thus, the internal volume of the first lower storage chamber 721 and the cool air supply effi-

ciency by the flow path opening/closing module 340 may be out of the trade-off relationship.

**[0239]** Therefore, according to the embodiment of the present disclosure, based on the barrier 100, the area occupied by the lower recess 723 disposed at the upper portion of the barrier 100 is reduced, and the flow path disposed at the lower portion of the barrier 100 is reduced. The area occupied by the opening/closing module 340 may be increased.

**[0240]** Accordingly, according to an embodiment of the present disclosure, the cool air supply efficiency by the flow path opening/closing module 340 may be improved while the reduction in the internal volume of the first lower storage chamber 721 may be minimized.

**[0241]** In one example, referring further to FIGS. 14 to 16, the cool air supply duct assembly 200 may include the first cool air supply duct 210, and the second cool air supply duct 220 disposed so as to overlap with the first cool air supply duct 210 in the front-back direction.

**[0242]** The first cool air supply duct 210 may include a first supply duct inlet 2121 into which the cool air flows, a first supply duct body 211 in and along which the cool air flowing from the first supply duct inlet 2121 flows, and a first supply duct outlet 2122 which the cool air flowing through the first supply duct body 211 flows out of.

**[0243]** For example, the first cool air supply duct 210 may be composed of a first supply duct front portion 2111 constituting a front surface thereof, and a first supply duct rear portion 2112 constituting a rear surface thereof.

**[0244]** The first supply duct outlet 2122 including a first supply duct outlet hole 212o opening in the frontward direction may be formed at an upper end of the first supply duct front portion 2111.

**[0245]** The first supply duct outlet hole 212o may be in communication with the first supply the cool air outlet 7251o of the lower casing 72 and may serve as a passage for supplying the cool air delivered along the first cool air flow path 41 to the first lower storage chamber 721.

**[0246]** A flow path guide 213 may be formed at one side of the first supply duct outlet 2122, specifically, at a left side of a front surface thereof.

**[0247]** The cool air supply duct assembly 200 is positioned so as to be closer to the right side of the front surface than to the left side thereof. Thus, the first supply duct outlet 2122 which discharges the cool air to the first lower storage chamber 721 may be positioned so as to be closer to the right side of the front surface than to the left side thereof.

**[0248]** Accordingly, a cool air imbalance phenomenon may occur in which the cool air discharged to the first lower storage chamber 721 is concentrated on an area near the right side.

**[0249]** In order to resolve this cool air imbalance phenomenon, the flow path guide 213 formed to have an inclined surface in a left direction is formed in a left area of the first supply duct outlet 2122. Thus, the cool air discharged through the first cool air supply duct 210 may be directed to the left side as much as possible.

**[0250]** At a lower end of a front surface of the first cool air supply duct front portion 2111, a plurality of support ribs 214 extending in the front-rear direction may be arranged side by side in the left-right direction, such that strength of the lower end of the first cool air supply duct 210 may be reinforced.

**[0251]** The first supply duct rear portion 2112 may include a first guide rib 216 disposed on an inner surface thereof and extending in the front-back direction.

**[0252]** The first guide rib 216 may guide the flow direction of the cool air flowing through the first cool air supply duct 210 and reduce occurrence of cool air eddy therein.

**[0253]** A first bottom joint 219 extending rearwardly may be formed at a lower end of the first supply duct rear portion 2112.

**[0254]** The first bottom joint 219 may provide a fastening structure to the second cool air supply duct 220 disposed in rear thereof.

**[0255]** At least one first hook 217 may be formed on a side surface of the first supply duct front portion 2111. One or more first protrusions 218 disposed at positions corresponding to positions of the the first hooks 217 may be formed on a side surface of the first supply duct rear portion 2112.

**[0256]** The first supply duct front portion 2111 and the first supply duct rear portion 2112 may be fastened to each other via coupling between the first hook 217 and the first protrusion 218 to constitute the first cool air supply duct 210.

**[0257]** At a lower end of the first cool air supply duct 210 formed in this way, a first supply duct inlet 2121 may be formed which may include a first supply duct inlet hole 212i opened to communicate with the first connection outlet 1311o of the first connection duct 131.

**[0258]** The second cool air supply duct 220 may include a second supply duct inlet 2221 into which the cool air flows, a second supply duct body 221 along and in which the cool air flowing from the second supply duct inlet 2221 flows, and a second supply duct outlet 2222 which the cool air flowing through the second supply duct body 221 flows out of.

**[0259]** The second cool air supply duct 220 may be composed of a second supply duct front portion 2211 constituting a front surface thereof, and a second supply duct rear portion 2212 constituting a rear surface thereof.

**[0260]** The second supply duct outlet 2222 with a surface inclined upwardly and frontwards may be formed at an upper end of the second supply duct front portion 2211.

**[0261]** A plurality of duct fixing members 225 protruding frontwards may be formed at both opposing sides of the second supply duct outlet 2222, respectively.

**[0262]** The plurality of duct fixing members 225 may serve as fastening members for fastening the second cool air supply duct 220 and the upper duct assembly 400 to each other.

**[0263]** A second bottom joint 229 may be formed at a lower end of the second supply duct front portion 2211

and may provide a fastening structure to the first cool air supply duct 210 disposed in front thereof.

**[0264]** The second bottom joint 229 may be formed to extend frontwards and may be connected to or fastened to the first bottom joint 219 formed to extend rearwardly.

**[0265]** For example, the second bottom joint 229 may be coupled to the first bottom joint 219 so as to cover an upper surface of the first bottom joint 219. That is, the first bottom joint 219 may be inserted into a groove formed in a lower surface of the second bottom joint 229.

**[0266]** In this way, the first cool air supply duct 210 and the second cool air supply duct 220 are connected to each other via a supply duct fastening mechanism 230 as a fitting structure in which the first bottom joint 219 thereof and the second bottom joint 229 thereof at the lower end thereof are coupled to each other.

**[0267]** In this case, the first bottom joint 219 and the second bottom joint 229 may be fastened to each other in a fixing manner using various male and female combinations, for example, in a hooking manner, or a catching manner. However, the fixing manner is not particularly limited.

**[0268]** The second supply duct rear portion 2212 may include a second guide rib 226 disposed on an inner surface thereof and extending in the front-back direction.

**[0269]** The second guide rib 226 may guide the flow direction of the cool air flowing through the second cool air supply duct 220 and reduce occurrence of the cool air eddy therein.

**[0270]** An upper extension 223 extending in the upward direction may be formed at an upper end of the second supply duct rear portion 2212.

**[0271]** The upper extension 223 may be formed to have a predetermined vertical length in the vertical direction and may serve to support a back surface of the upper casing 71.

**[0272]** A plurality of fixing through-holes 2231 extending through the upper extension 223 in the front-to-rear direction may be respectively formed in both opposing side surfaces of the upper extension 223. When the upper end of the second cool air supply duct 220 is fixed to the rear surface of the upper casing 7, a separate fastening member extends through each of the plurality of fixing through-holes 2231.

**[0273]** A lower extension 224 extending rearwards and bent downwardly may be formed at a lower end of the second supply duct rear portion 2212.

**[0274]** The lower extension 224 having a bent shape may be formed to surround an edge portion including upper and rear surfaces of a portion of the lower casing 72 corresponding to the lower recess 723, and thus may accurately and easily guide a position of the cool air supply duct assembly 200 including the second cool air supply duct 220.

**[0275]** At least one second hook 227 may be formed on a side surface of the second supply duct front portion 2211. One or more second protrusions 228 disposed at positions corresponding to positions of the second hooks

227 may be formed on a side surface of the second supply duct rear portion 2212.

**[0276]** The second supply duct front portion 2211 and the second supply duct rear portion 2212 may be fastened to each other via coupling between the second hook 227 and the second protrusion 228 to constitute the second cool air supply duct 220.

**[0277]** In a lower end of the second cool air supply duct 220 formed in this way, a supply duct inlet 2221 may be formed which includes a second supply duct inlet hole 2221i opened to communicate with the second connection outlet 1321o of the second connection duct 132.

**[0278]** Moreover, in an upper end of the second cool air supply duct 220, a second supply duct outlet 2222 may be formed which includes a second supply duct outlet hole 2222o opened to communicate with the second supplied cool air outlet 7252o defined in the back surface of the upper casing 71.

**[0279]** The second supply duct outlet hole 2222o may be in communication with the second supplied cool air outlet 7252o of the upper casing 71 and thus may serve as a passage for supplying the cool air delivered along the second cool air flow path 42 to the upper storage chamber 711.

**[0280]** The first cool air supply duct 210 and the second cool air supply duct 220 may be arranged so that a spacing in the front-back direction therebetween increases as the first cool air supply duct 210 and the second cool air supply duct 220 extend upwardly.

**[0281]** As previously described, the first cool air supply duct 210 and the second cool air supply duct 220 have independent cool air flow paths. Thus, the difference between the temperatures of the cool airs flowing through the first cool air supply duct 210 and the second cool air supply duct 220, respectively may occur.

**[0282]** In particular, the farther away from the cool air inlets of the first cool air supply duct 210 and the second cool air supply duct 220 into which the cool air flows, the greater the difference between the temperatures of the cool airs flowing through the first cool air supply duct 210 and the second cool air supply duct 220.

**[0283]** Therefore, in an embodiment of the present disclosure, the spacing in the front-rear direction of the first cool air supply duct 210 and the second cool air supply duct 220 increases as the first cool air supply duct 210 and the second cool air supply duct 220 extend upwardly. Thus, a sufficient space therebetween into which the foam fills may be secured.

**[0284]** The first cool air supply duct 210 and the second cool air supply duct 220 having this shape may be fastened and fixed to the upper end of the first connection duct 131 and the upper end of the second connection duct 132, respectively.

**[0285]** The upper end of the first connection duct 131 and the upper end of the second connection duct 132 may protrude in an upward direction beyond a top surface of the upper barrier 110 of the barrier 100.

**[0286]** Specifically, the first connection outlet 1311o of

the first connection duct 131 and the second connection outlet 1321 of the second connection duct 132 may protrude in the upward direction.

**[0287]** Accordingly, the first cool air supply duct 210 and the second cool air supply duct 220 may be easily fastened to the upper end of the first connection duct 131 and the upper end of the second connection duct 132, respectively.

**[0288]** For example, the cool air supply duct assembly 200 and the connection duct assembly 130 may be fastened to each other in a following order.

**[0289]** First, the first cool air supply duct 210 may be coupled to the first connection duct 131.

**[0290]** In this case, a separate adhesive member may be formed on the lower surface of the first cool air supply duct 210 where the first supply duct inlet 2121 is located. The adhesive member may assist in fixing the lower surface of the first cool air supply duct 210 onto an exposed upper surface of the lower casing 72.

**[0291]** Next, the second cool air supply duct 220 in rear of the first cool air supply duct 210 may be coupled to the second connection duct 132.

**[0292]** A separate adhesive member may be formed on the lower surface of the second cool air supply duct 220 where the second supply duct inlet 2221 is located. The adhesive member may assist in fixing the lower surface of the second cool air supply duct 220 to the exposed upper surface of the lower casing 72.

**[0293]** When the second cool air supply duct 220 is coupled to the second connection duct 132, the first bottom joint 219 formed at the lower surface of the first cool air supply duct 210 and the second bottom joint 229 formed at the lower surface of the second cool air supply duct 220 may be additionally connected or fastened to each other.

**[0294]** However, the fastening between the first bottom joint 219 and the second bottom joint 229 as used in the present disclosure does not mean necessarily fixation but may mean including a combination such as a guide fitting structure that guides a combination position.

**[0295]** In this case, the fitting structure may be formed such that the second bottom joint 229 covers the upper surface of the first bottom joint 219 so that the first bottom joint 219 is inserted into a groove defined in the lower surface of the second bottom joint 229. Thus, after the first cool air supply duct 210 is combined with the second cool air supply duct 220, a position at which the second cool air supply duct 220 is combined with the first cool air supply duct 210 may be easily guided.

**[0296]** According to an embodiment of the present disclosure, the first cool air supply duct 210 and the second cool air supply duct 220 may be connected and fixed to the inner casing 70 and may be additionally connected and fastened to each other in the front-rear direction via the fitting structure. Thus, a more robust and easy connection and fixing structure may be achieved.

**[0297]** Accordingly, not only may process efficiency for connection and fixation between the plurality of the cool

air supply ducts and the inner casings be increased, but also occurrence of connection failure at the connection areas between the plurality of the cool air supply ducts and the inner casings may be reduced.

5 **[0298]** Referring to FIG. 8, the first cool air supply duct 210 may extend in an inclined manner toward one side toward a center area of the first lower storage chamber 721 as the first cool air supply duct 210 extends in the upward direction.

10 **[0299]** In this case, the first cool air supply duct 210 may extend in the inclined manner along an entire length thereof or only along a portion of the entire length thereof.

**[0300]** Because the first cool air supply duct 210 is positioned so as to be closer to one side around the first blow fan 331 located in a relatively central area than to the other side around the first blow fan 331, the cool air supplied to each storage chamber through the first cool air supply duct 210 may be discharged into one side of the storage chamber in a biased manner.

20 **[0301]** Accordingly, the first cool air supply duct 210 may extend in an inclined manner toward one side toward a center area of each of the storage chamber as the first cool air supply duct 210 extends in the upward direction. Thus, the cool air flowing into each storage chamber may be directed so as to be discharged to a position close to the center area thereof as much as possible.

25 **[0302]** In addition, the cool air flowing through the first cool air supply duct 210 extending in the inclined manner has a cool air flow direction directed toward the center area. Thus, when the cool air flowing through the first cool air supply duct 210 extending in the inclined manner is discharged into the first lower storage chamber 721, the cool air flow may be naturally directed to the central area thereof.

30 **[0303]** Moreover, the above description applied to the first cool air supply duct 210 may be equally applied to the second cool air supply duct 220.

**[0304]** Therefore, the second cool air supply duct 220 may extend in an inclined manner toward one side toward a center area of the upper storage chamber 711 as the second cool air supply duct 220 extends in the upward direction. Descriptions duplicate with the above descriptions applied to the first cool air supply duct 210 may be omitted.

35 **[0305]** Referring to FIG. 5, the cool air recovery duct assembly 500 may be disposed on the rear outer surface of the lower casing 72.

**[0306]** Referring further to FIGS. 17 to 21, the cool air recovery duct assembly 500 may include a first cool air recovery duct 510 and a second cool air recovery duct 520 arranged side by side in the left-right direction.

40 **[0307]** The first cool air recovery duct 510 may include a first recovery duct inlet 5121 into which recovered cool air flows, a first recovery duct body 511 along and in which the cool air flowing from the first recovery duct inlet 5121 flows, and a first recovery duct outlet 5122 which the cool air flowing through the first recovery duct body 511 flows out of.

**[0308]** The first cool air recovery duct 510 may be composed of a first recovery duct front portion 5111 constituting a front surface thereof, and a first recovery duct rear portion 5112 constituting a rear surface thereof.

**[0309]** A first recovery duct inlet 5121 including a first recovery duct inlet hole 512i opening in the frontward direction may be formed at an upper end of the first supply duct front portion 2111.

**[0310]** The first recovery duct inlet hole 512i may be in communication with the first recovered cool air inlet 7241i as an opening defined in a back surface of a portion of the lower casing 72 corresponding to the first lower storage chamber 721 and may serve as a passage to recover the cool air from the first lower storage chamber 721 and supply the recovered cool air to the second lower storage chamber 722.

**[0311]** The first recovery duct outlet 5122 including a first recovery duct outlet 512o hole opening in the frontward direction may be formed at a lower end of a front surface of the first recovery duct front portion 5111.

**[0312]** The first recovery duct outlet 5122 may communicate with the first recovered cool air outlet 7241o of the lower casing 72 and may supply the recovered cool air back to the evaporator 360.

**[0313]** A fixing through-hole 5231 may be formed on one side of the first recovery duct outlet 5122. A separate fastening member may pass through the fixing through-hole 5231 to fix the first cool air recovery duct 510 to the back surface of the inner casing 70.

**[0314]** The first recovery duct rear portion 5112 may include a first guide rib 516 disposed on an inner surface thereof and extending in the front-back direction.

**[0315]** The first guide rib 516 may guide the flow direction of the cool air flowing through the first cool air recovery duct 510 and reduce the occurrence of the cool air eddy therein.

**[0316]** One or more first hooks 517 may be formed on a side surface of the first recovery duct front portion 5111. One or more first protrusions 518 disposed at positions corresponding to positions of the one or more first hooks 517 may be formed on the side surface of the first recovery duct rear portion 5112.

**[0317]** The first recovery duct front portion 5111 and the first recovery duct rear portion 5112 may be fastened to each other via the combination of the first hook 517 and the first protrusion 518 to constitute the first cool air recovery duct 510.

**[0318]** The second cool air recovery duct 520 may include a second recovery duct inlet 5221 into which the recovered cool air flows, a second recovery duct body 521 in and along which the cool air flowing from the second recovery duct inlet 5221 flows, and a second recovery duct outlet 5222 which the cool air flowing through the second recovery duct body 521 flows out of.

**[0319]** The second cool air recovery duct 520 may be composed of a second recovery duct front portion 5211 constituting a front surface thereof, and a second recovery duct rear portion 5212 constituting a rear surface

thereof.

**[0320]** A second recovery duct inlet 5221 including a second recovery duct inlet hole 522i opening in the upward direction may be formed at an upper end of the second supply duct front portion 2211.

**[0321]** The second recovery duct inlet hole 522i may be in communication with the second recovered cool air inlet 7242i as an opening defined in the lower surface of the upper storage chamber 711 and may serve as a passage for recovering the cool air of the upper storage chamber 711 and supplying the recovered cool air into the second lower storage chamber 722.

**[0322]** A second recovery duct outlet 5222 including a second recovery duct outlet hole 522o opening in the frontward direction may be formed at a lower end of a front surface of the second recovery duct front portion 5211.

**[0323]** The second recovery duct outlet 5222 may be in communication with the second recovered cool air outlet 7242o of the lower casing 72 and may supply the recovered cool air back to the evaporator 360.

**[0324]** A fixing through-hole 5231 may be formed on one side of the second recovery duct outlet 5222. A separate fastening member may pass through the fixing through-hole 5231 to fix the second cool air recovery duct 520 through the back surface of the inner casing 70.

**[0325]** A fixing extension 523 extending rearwards and bent in an upward direction may be formed at an upper end of the second recovery duct rear portion 5212.

**[0326]** The fixing extension 523 may serve to support an edge of a lower surface and a back surface of the upper casing 71 thereon.

**[0327]** A fixing through-hole 5231 may be formed in the fixing extension 523. A separate fastening member may pass through the fixing through-hole 5231 to fix the second cool air recovery duct 520 to the back surface of the upper casing 71.

**[0328]** The second recovery duct rear portion 5212 may include a second guide rib 526 disposed on an inner surface and extending in the front-back direction.

**[0329]** The second guide rib 526 may guide the flow direction of the cool air flowing through the second cool air recovery duct 520 and reduce the occurrence of the cool air eddy therein.

**[0330]** At least one second hook 527 may be formed on a side surface of the second recovery duct front portion 5211. One or more second protrusions 528 disposed at positions corresponding to positions of the one or more second hooks 527 may be formed on a side surface of the second recovery duct rear portion 5212.

**[0331]** The second recovery duct front portion 5211 and the second recovery duct rear portion 5212 may be fastened to each other via the combination of the second hook 527 and the second protrusion 528 to constitute the second cool air recovery duct 520.

**[0332]** The first cool air recovery duct 510 and the second cool air recovery duct 520 which are arranged side by side in the left-right direction may be robustly fastened

to each other via one or more recovery duct fitting structures 531 and 532 formed on the side surfaces thereof, while a position at which the first cool air recovery duct 510 and the second cool air recovery duct 520 are fastened to each other may be guided by the one or more recovery duct fitting structures 531 and 532.

**[0333]** A first upper joint 5311 and a first lower joint 5321 may be formed at upper and lower portions of one side of the first cool air recovery duct 510 facing the second cool air recovery duct 520, respectively.

**[0334]** Moreover, a second upper joint 5312 and a second lower joint 5322 may be formed at upper and lower portions of one side of the second cool air recovery duct 520 facing the first cool air recovery duct 510, respectively.

**[0335]** The first upper joint 5311 and the first lower joint 5321 may be formed at positions corresponding to positions of the second upper joint 5312 and the second lower joint 5322, respectively, and may be fastened to the second upper joint 5312 and the second lower joint 5322 in the left-right direction, respectively.

**[0336]** For example, the first upper joint 5311 and the second upper joint 5312 which constitute the recovery duct upper fitting structure 531 may be fastened to each other in a fixing manner using various male and female combinations, for example, in a hooking manner, or a catching manner. However, the fixing manner is not particularly limited.

**[0337]** Moreover, the first lower joint 5321 and the second lower joint 5322 which constitute the recovery duct lower fitting structure 532 may be fastened to each other in a fixing manner using various male and female combinations, for example, in a hooking manner, or a catching manner. However, the fixing manner is not particularly limited.

**[0338]** FIG. 19, FIG. 20, and FIG. 21 are detailed diagrams of the recovery duct upper fitting structure 531.

**[0339]** A stopping protrusion 541 may be formed on a back surface of the first upper joint 5311 extending from one side of the first recovery duct front portion 5111 toward the second recovery duct front portion 5211.

**[0340]** A stopping hole 543 may be defined in the second upper joint 5312 extending from one side of the second recovery duct front portion 5211 toward the first recovery duct front portion 5111. The stopping protrusion 541 of the first upper joint 5311 may be engaged with the stopping hole 543.

**[0341]** Moreover, an insertion guide 544 may be formed on at least one of upper and lower sides respectively under and above the stopping protrusion 541 of the first upper joint 5311.

**[0342]** At least one inserted extension 542 may be formed on the second upper joint 5312 and may be inserted into the insertion guide 544 of the first upper joint 5311.

**[0343]** The fastening direction and position between the first cool air recovery duct 510 and the second cool air recovery duct 520 may be guided such that the fastening therebetween may be facilitated via a fastening

structure between the insertion guide 544 and the inserted extension 542.

**[0344]** The details about the recovery duct upper fitting structure 531 as described above may be equally applied to the recovery duct lower fitting structure 532.

**[0345]** According to an embodiment of the present disclosure, the first cool air recovery duct 510 and the second cool air recovery duct 520 may be more robustly and easily connected and fixed to each other via the fitting structure that fastens the first cool air recovery duct 510 and the second cool air recovery duct 520 to each other in the left-right direction.

**[0346]** Accordingly, not only may the process efficiency for connection and fixation between the plurality of the cool air recovery ducts and the inner casings be increased, but also the occurrence of connection failure at the connection area between plurality of the cool air recovery ducts and the inner casings may be reduced.

**[0347]** Hereinafter, with further reference to FIGS. 22 to 24, a thermally-insulating foam 12 that may be injected into and fill the refrigerator 1 will be described in more detail.

**[0348]** The outer casing 10 may be disposed outside the inner casing 70 so as to accommodate therein the inner casing 70 while the outer casing 10 and the inner casing 70 may be spaced from each other by a predetermined spacing. Thus, the spacing may be defined between the inner casing 70 and the outer casing 10.

**[0349]** One or more filling holes 11 may be formed in a back surface of the outer casing 10.

**[0350]** The filling hole 11 refers to a hole through which the thermally-insulating foam 12 may be injected from an outside out of the refrigerator 1 into an inner space of the refrigerator 1.

**[0351]** For example, the filling holes 11 may be formed in both opposing side surfaces of each of an upper end and a lower end of the back surface of the outer casing 10, respectively.

**[0352]** The thermally-insulating foam 12 injected through the filling hole 11 fills the spacing formed between the inner casing 70 and the outer casing 10, such that thermal insulation performance of the refrigerator 1 may be improved.

**[0353]** In this case, the spacing formed between the inner casing 70 and the outer casing 10 may receive therein the cool air supply duct assembly 200 including the first cool air supply duct 210 and the second cool air supply duct 220. Thus, the cool air supply duct assembly 200 may be surrounded with the thermally-insulating foam 12 injected through the filling hole 11, so that the cool air supply duct assembly 200 may be thermally insulated.

**[0354]** The thermally-insulating foam 12 injected through the filling hole 11 may flow through an area in which a thermally-insulating foam injection path extends, including not only the back surface of the inner casing 70, but also the lower surface, the side surface, and the upper surface thereof.

**[0355]** In this case, one or more foam passage holes 141 formed in the side surface of the barrier 100 may communicate with the thermally-insulating foam injection path, and thus may function as a passageway along which the thermally-insulating foam 12 is injected into the inner space of the barrier 100.

**[0356]** That is, the thermally-insulating foam 12 injected through the filling hole 11 of the outer casing 10 may fill the inner space of the barrier 100 through the one or more foam passage holes 141 formed in the side surface of the barrier 100. Thus, the thermally-insulating foam 12 may not only fill the inner space of the barrier 100 but also surround the connection duct assembly 130 located in the inner space of the barrier 100.

**[0357]** Accordingly, the connection duct assembly 130 may be surrounded with the thermally-insulating foam 12 injected through the foam passage hole 141, and thus may be thermally insulated.

**[0358]** In this way, the connection duct assembly 130 through which the cool air flowing through the flow path opening/closing module 340 flows may be surrounded with the thermally-insulating foam 12 while the thermally-insulating foam 12 fills the spacing between the inner casing 70 and the outer casing 10.

**[0359]** As a result, a thermal insulation material with a sufficient thermal insulation thickness may be disposed at high efficiency of the thermal insulation treatment process, such that the thermal insulation performance may be improved.

**[0360]** That is, in the refrigerator 1 according to the present disclosure, the thermally-insulating foam 12 may be injected into and fill the inner space of the refrigerator 1 along one flow communication path so as to surround the cool air supply duct assembly 200 disposed on the outer surface of the inner casing 70 and surround the connection duct assembly 130 disposed in the inner space of the barrier 100.

**[0361]** Accordingly, in the refrigerator 1 according to the present disclosure, the cool air supply duct assembly 200 and the connection duct assembly 130 may be thermally insulated at once in a quick and easy process without the need to insulating each of the cool air supply duct assembly 200 and the connection duct assembly 130 with each of separate processes or parts. Thus, the cool air flow path may be effectively thermally insulated.

**[0362]** FIGS. 25 to 27 are cross-sectional views of the connection duct assembly and cool air supply duct assembly according to another embodiment of the present disclosure.

**[0363]** The flow path opening/closing module 340 disposed in the second lower storage chamber 722 may include the second flow path opening/closing damper 342 that controls the amount of the cool air to be supplied to the connection duct assembly 130, and the damper cover 343 surrounding the second flow path opening/closing damper 342.

**[0364]** The connection duct assembly 130 may extend in the vertical direction so as to extend through the barrier

100.

**[0365]** The lower end of the connection duct assembly 130 extending through the barrier 100 may be in communication with the flow path opening/closing module 340. The upper end of the connection duct assembly 130 may be in communication with the first cool air supply duct 210 and the second cool air supply duct 220.

**[0366]** In this way, the connection duct assembly 130 extending through the barrier 100 may be embodied in a form of a single pipe rather than a plurality of pipes.

**[0367]** The cool air supply duct may pass through the barrier 10 and then may be divided into the first cool air supply duct 210 and the second cool air supply duct 220 in an area where the thermally-insulating foam 12 is located.

**[0368]** For example, referring to FIG. 25, the upper end of the connection duct assembly 130 may communicate with the second cool air supply duct 220. The first cool air supply duct 210 which communicates with one end of the second cool air supply duct 220 may branch off from the second cool air supply duct 220 at a position spaced by a predetermined distance away from the barrier 100 in the upward direction and may extend so as to communicate with the first lower storage chamber 721.

**[0369]** In another example, referring to FIG. 26, the upper end of the connection duct assembly 130 communicates with the first cool air supply duct 210. The second cool air supply duct 220 which communicates with one end of the first cool air supply duct 210 may branch off from the first cool air supply duct 210 at a position spaced by a predetermined distance away from the barrier 100 in the upward direction, and may extend so as to communicate with the upper storage chamber 711.

**[0370]** In still another example, referring to FIG. 27, the upper end of the connection duct assembly 130 may communicate with each of the first cool air supply duct 210 and the second cool air supply duct 220 into which the cool air supply duct is divided immediately from the upper surface of the barrier 100.

**[0371]** In this case, the first cool air supply duct 210 and the second cool air supply duct 220 may be formed in separate pipes and assembled and combined with each other. Embodiments of the present disclosure are not limited thereto, and the first cool air supply duct 210 and the second cool air supply duct 220 may be formed integrally with each other.

**[0372]** In one example, the first flow path opening/closing damper 341 may be disposed in a rear surface of the first lower storage chamber 721 rather than the second lower storage chamber 722.

**[0373]** For example, the first flow path opening/closing damper 341 may be disposed in the first cool air supply duct 210 located in the rear surface of the first lower storage chamber 721, and may control the amount of the cool air to be supplied to the first lower storage chamber 721.

**[0374]** Although the embodiments of the present disclosure have been described in more detail with refer-

ence to the accompanying drawings, the present disclosure is not necessarily limited to these embodiments, and may be modified in a various manner within the scope of the technical spirit of the present disclosure. Accordingly, the embodiments as disclosed in the present disclosure are intended to describe rather than limit the technical idea of the present disclosure, and the scope of the technical idea of the present disclosure is not limited by these embodiments. Therefore, it should be understood that the embodiments described above are not restrictive but illustrative in all respects. In addition, even though an effect of a configuration of the present disclosure is not explicitly described in describing the embodiment of the present disclosure above, it is obvious that the predictable effect from the configuration should be recognized.

### Claims

1. A cool air supply duct assembly arrangeable in a refrigerator, said cool air supply duct assembly comprising:
  - a first cool air supply duct (210); and
  - a second cool air supply duct (220) disposed behind of the first cool air supply duct (210) in a front-back direction of the refrigerator, wherein the second cool air supply duct (210) at least partially overlaps the first cool air supply duct (210) in the front-back direction.
2. The cool air supply duct assembly of claim 1, wherein a vertical length of the first cool air supply duct (210) is smaller than a vertical length of the second cool air supply duct (220).
3. The cool air supply duct assembly of claim 1 or 2, wherein the first cool air supply duct (210) and the second cool air supply duct (220) constitute cool air flow paths independent of each other.
4. The cool air supply duct assembly of claim 1, 2 or 3 wherein a lower end of the first cool air supply duct (210) and a lower end of the second cool air supply duct (220) are coupled to each other.
5. A refrigerator comprising:
  - an inner casing (70) having an upper storage chamber (711) and a lower storage chamber (721, 722) defined therein, wherein the lower storage chamber is divided into a first lower storage chamber (721) and a second lower storage chamber (722); and
  - a cool air supply duct assembly (200) according to any one of claims 1 to 4, wherein the first cool air supply duct (210) is disposed on an outer rear surface of the inner casing (70)
- and connecting the second lower storage chamber (722) and the first lower storage chamber (721) with each other; and
- the second cool air supply duct (220) disposed behind of the first cool air supply duct (210) connects the second lower storage chamber (722) and the upper storage chamber (711) with each other,
- wherein the first cool air supply duct (210) and the second cool air supply duct (220) at least partially overlap each other in a front-back direction of the refrigerator.
6. The refrigerator of claim 5, wherein a barrier (100) is disposed in an inner space of the inner casing (70) so as to divide the lower storage chamber into the first lower storage chamber (721) and the second lower storage chamber (722).
7. The refrigerator of claim 6, wherein the barrier (100) is detachably coupled to the inner casing (70).
8. The refrigerator of claim 6 or 7, wherein the barrier (100) includes a connection duct assembly (130) including a first connection duct (131) in communication with the first cool air supply duct (210), and a second connection duct (132) in communication with the second cool air supply duct (220), wherein the second connection duct (132) is disposed behind the first connection duct (131) and at least partially overlaps the first connection duct (131) in the front-back direction.
9. The refrigerator of claim 9, wherein each of the first connection duct (131) and the second connection duct extends (132) extend in a vertical direction.
10. The refrigerator of claim 8 or 9, wherein the first cool air supply duct (210) is fastened and fixed to an upper end of the first connection duct (131), wherein the second cool air supply duct (220) is fastened and fixed to an upper end of the second connection duct (132).
11. The refrigerator of claim 8, 9 or 10, wherein a lower end of the connection duct assembly (130) communicates with an inner space of the inner casing (70), and an upper end of the connection duct assembly (130) communicates with an outer space of the inner casing (70). (e.g., paragraph [00168])
12. The refrigerator of any one of claims 8 to 11, wherein a grille-fan assembly (300) is disposed in the second lower storage chamber (722) and is in communication with the connection duct assembly (130) and configured to blow cool air thereto.

13. The refrigerator of any one of claims 5 to 12, wherein the inner casing (70) includes an upper casing (71) defining the upper storage chamber (711), and a lower casing (72) defining the lower storage chamber (721, 722),
- 5
- wherein the lower casing (72) has a lower recess (723) recessed therein in a frontward direction so that a lower end of each of the first cool air supply duct (210) and the second cool air supply duct (220) is received in the lower recess (723), and
- 10
- the upper casing (71) has an upper recess (713) recessed therein in a frontward direction so that an upper end of the second cool air supply duct (220) is received in the upper recess (713).
- 15
14. The refrigerator of claim 13, wherein the lower recess (723) and the upper recess (713) at least partially overlap each other in a vertical direction.
- 20
15. The refrigerator of any one of claims 5 to 14, wherein
- 25
- the upper storage chamber (711) acts as a refrigerating chamber,
- the first lower storage chamber (721) acts as a convertible chamber to a refrigerating chamber or a freezing chamber, and
- the second lower storage chamber (722) acts as a freezing chamber.
- 30
16. A refrigerator comprising:
- 35
- an inner casing (70);
- a cool air supply duct assembly (200) according to any one of claims 1 to 4,
- wherein the first cool air supply duct (210) and the second cool air supply duct (220) are disposed on an outer rear surface of the inner casing (70); and
- 40
- a first cool air recovery duct (510) and a second cool air recovery duct (520) disposed on the outer rear surface of the inner casing (70),
- wherein the first cool air recovery duct (510) and the second cool air recovery duct (520) are arranged side by side in a left-right direction of the refrigerator.
- 45
17. The refrigerator of claim 16, wherein the inner casing (70) has an upper storage chamber (711) and a lower storage chamber defined therein, wherein the lower storage chamber is divided into a first lower storage chamber (721) and a second lower storage chamber (722),
- 50
- 55
- wherein each of the first cool air supply duct (210) and the first cool air recovery duct (510) is in communication with the second lower storage chamber (722) and the first lower storage chamber (721), and
- wherein each of the second cool air supply duct (220) and the second cool air recovery duct (520) is in communication with the second lower storage chamber (722) and the upper storage chamber (711).
18. The refrigerator of claim 16 or 17, wherein a lower end of the first cool air supply duct (210) and a lower end of the second cool air supply duct (220) are fastened to each other in the front-back direction of the refrigerator,
- wherein the first cool air recovery duct (510) and the second cool air recovery duct (520) are fastened to each other in the left-right direction of the refrigerator.

FIG. 1

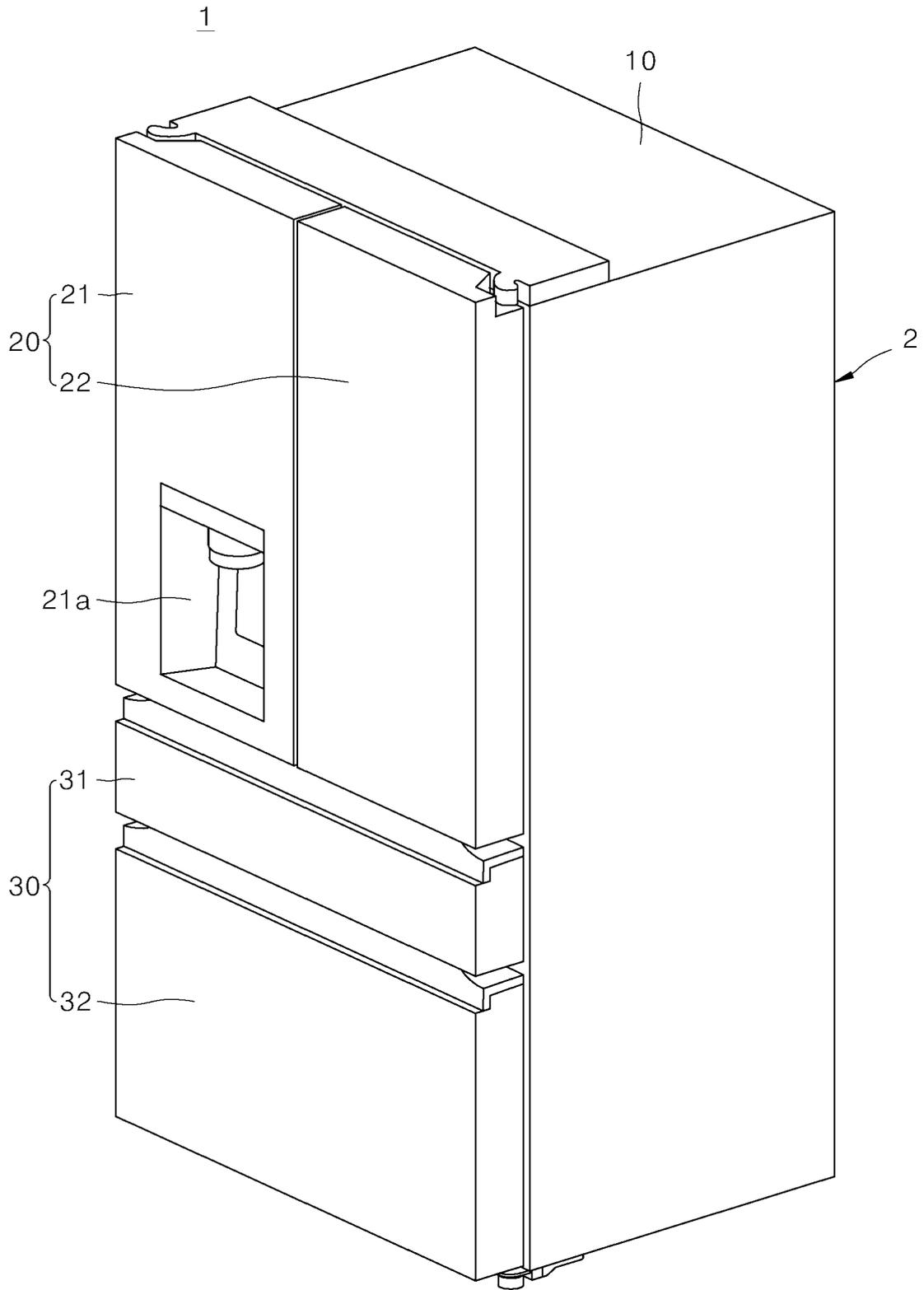


FIG. 2

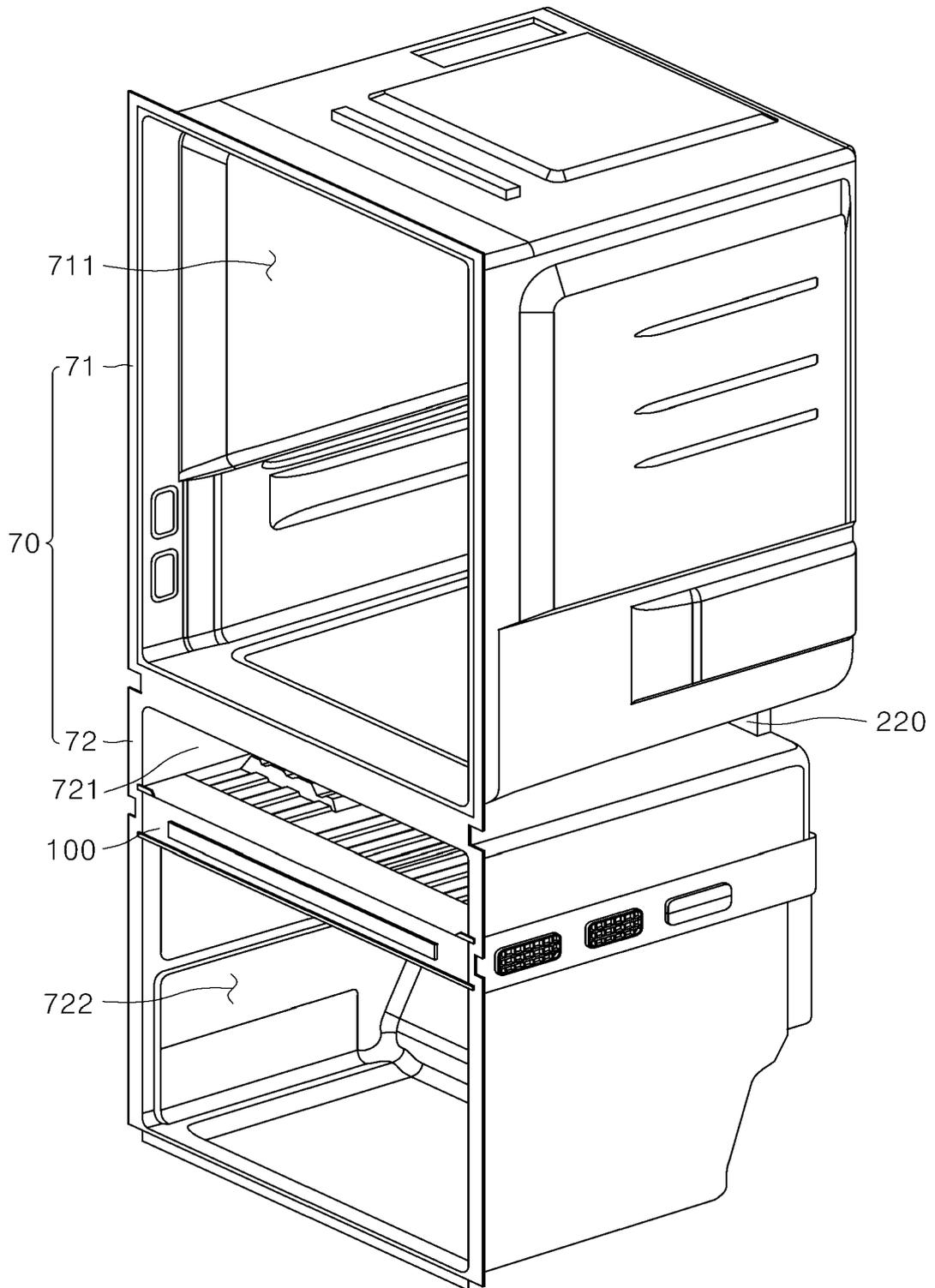


FIG. 3

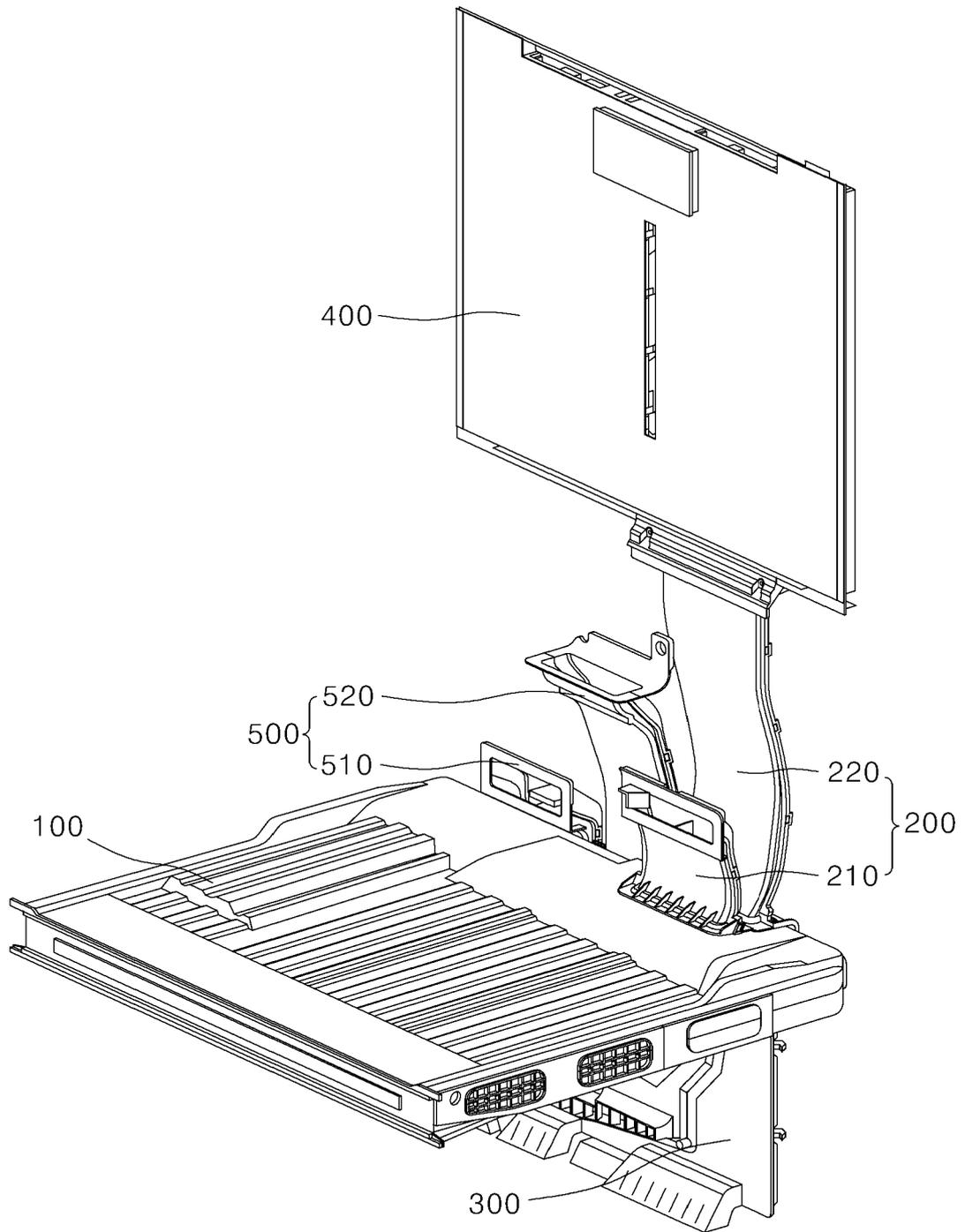


FIG. 4

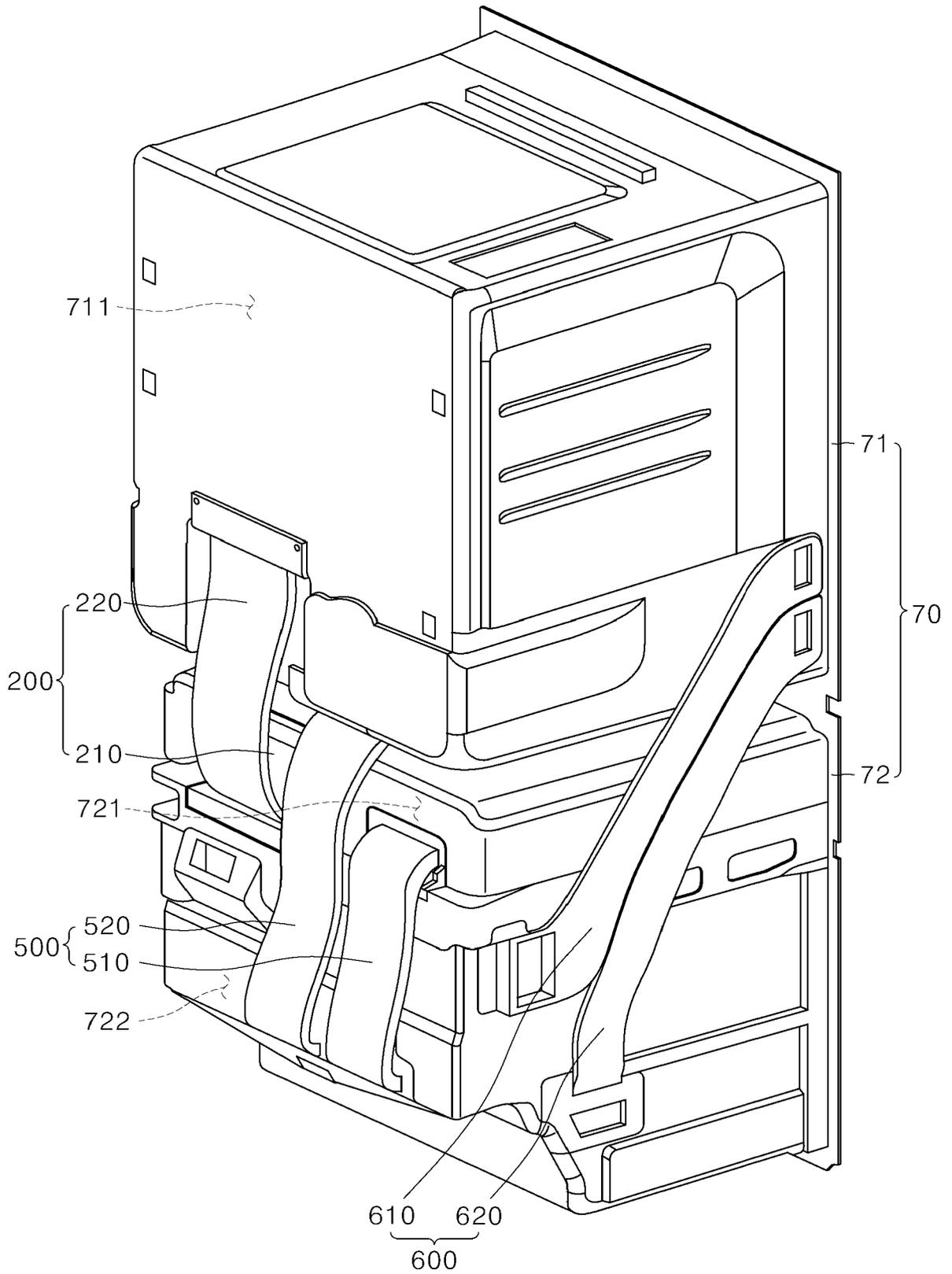


FIG. 5

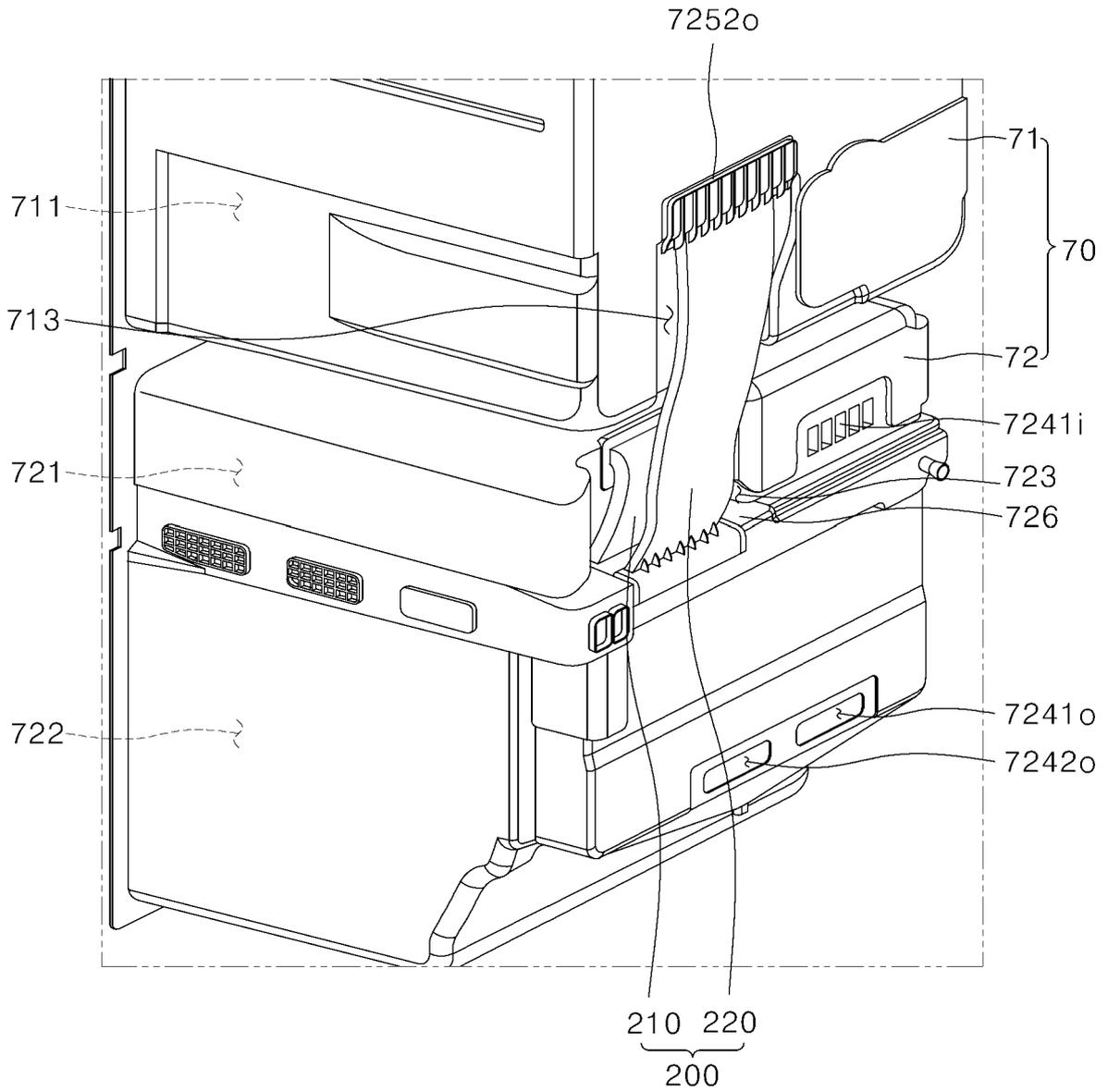


FIG. 6

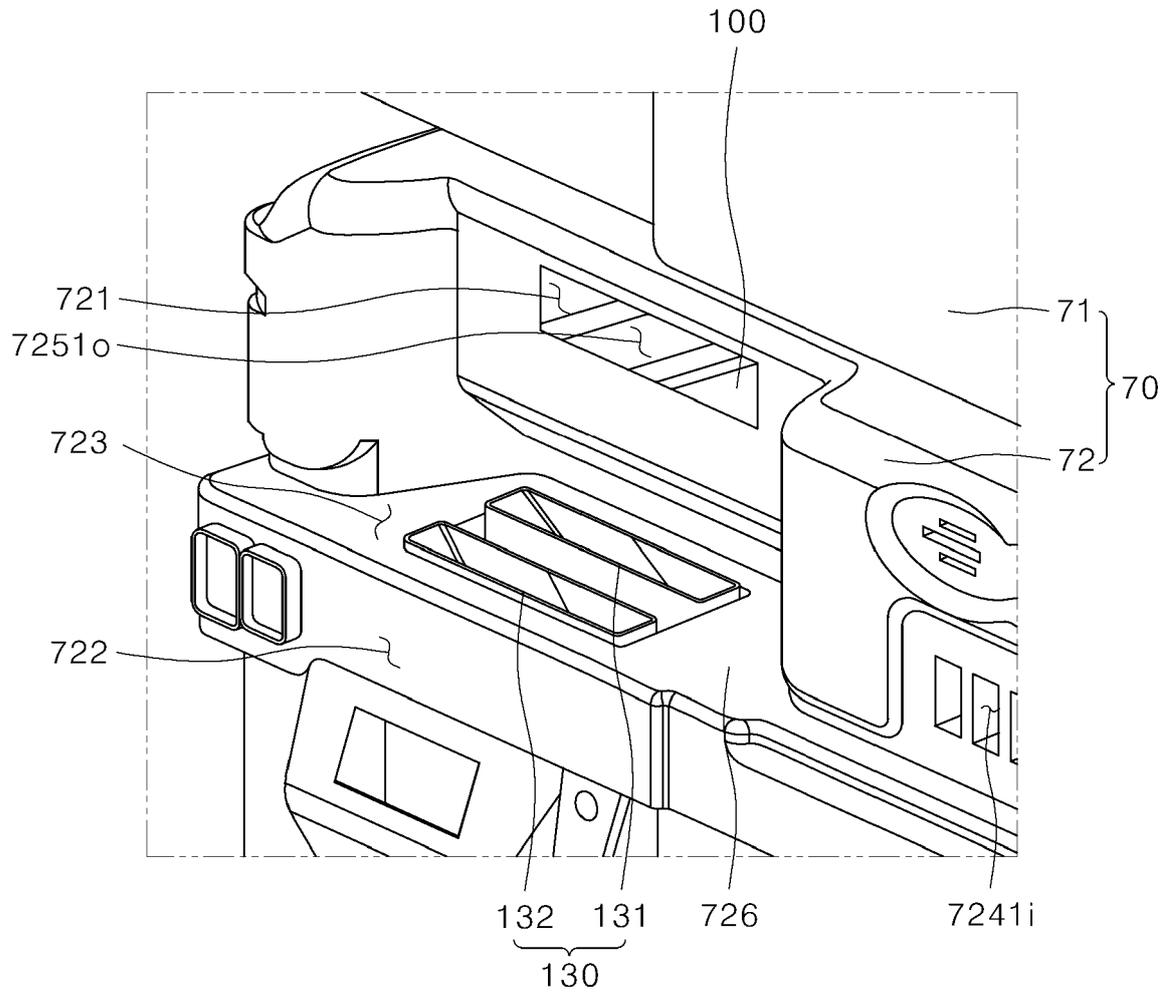


FIG. 7

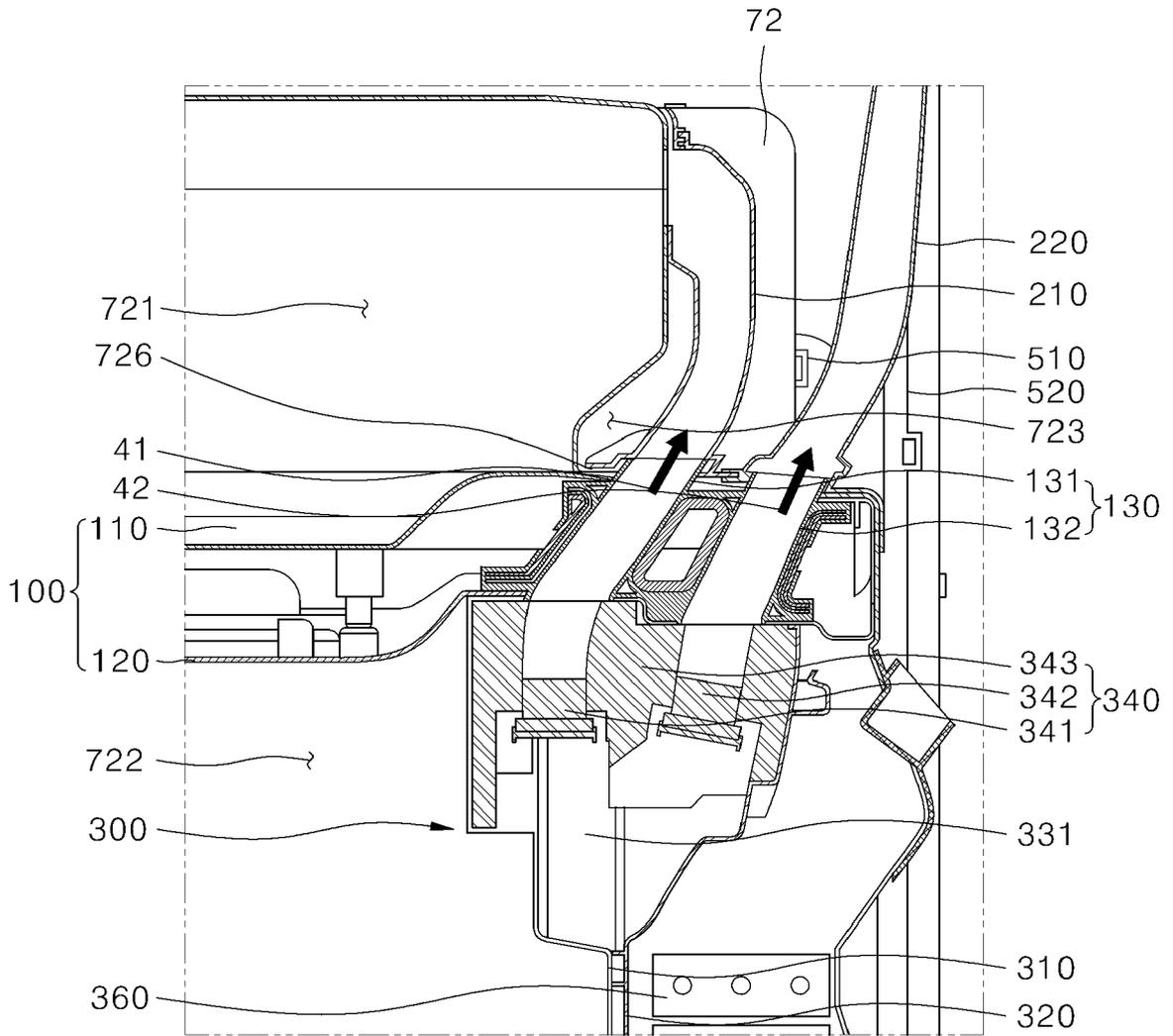


FIG. 8

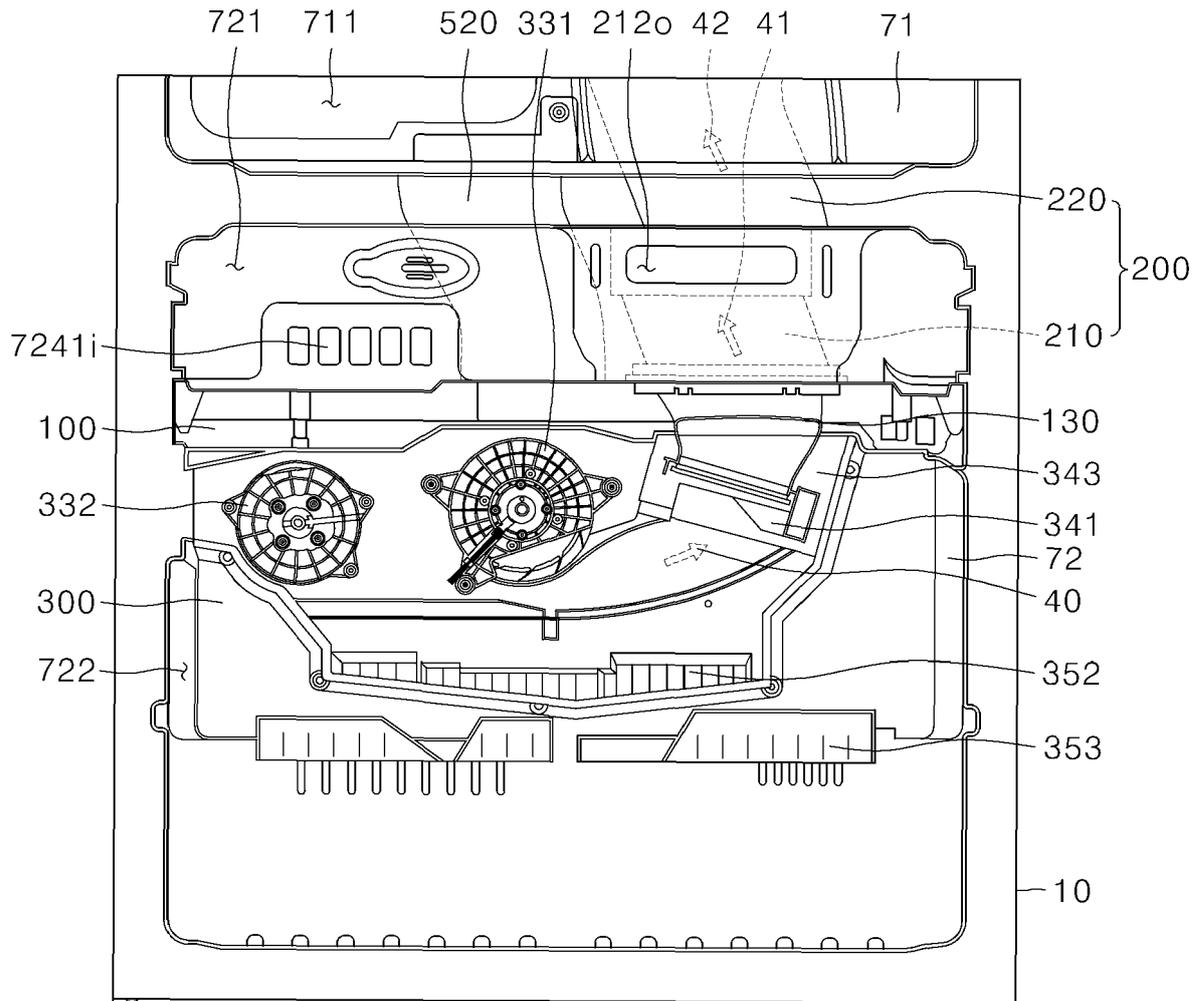


FIG. 9

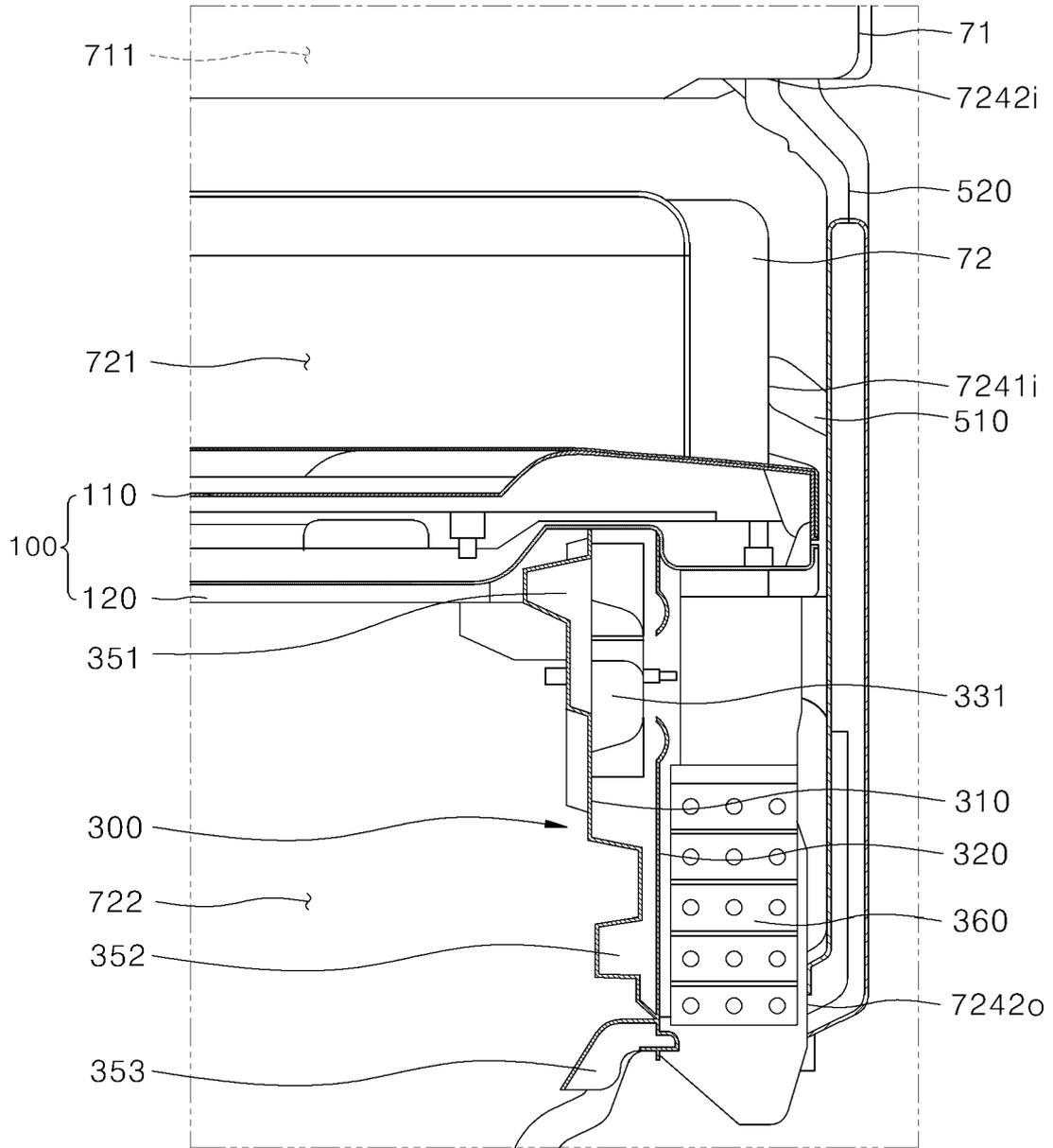


FIG. 10

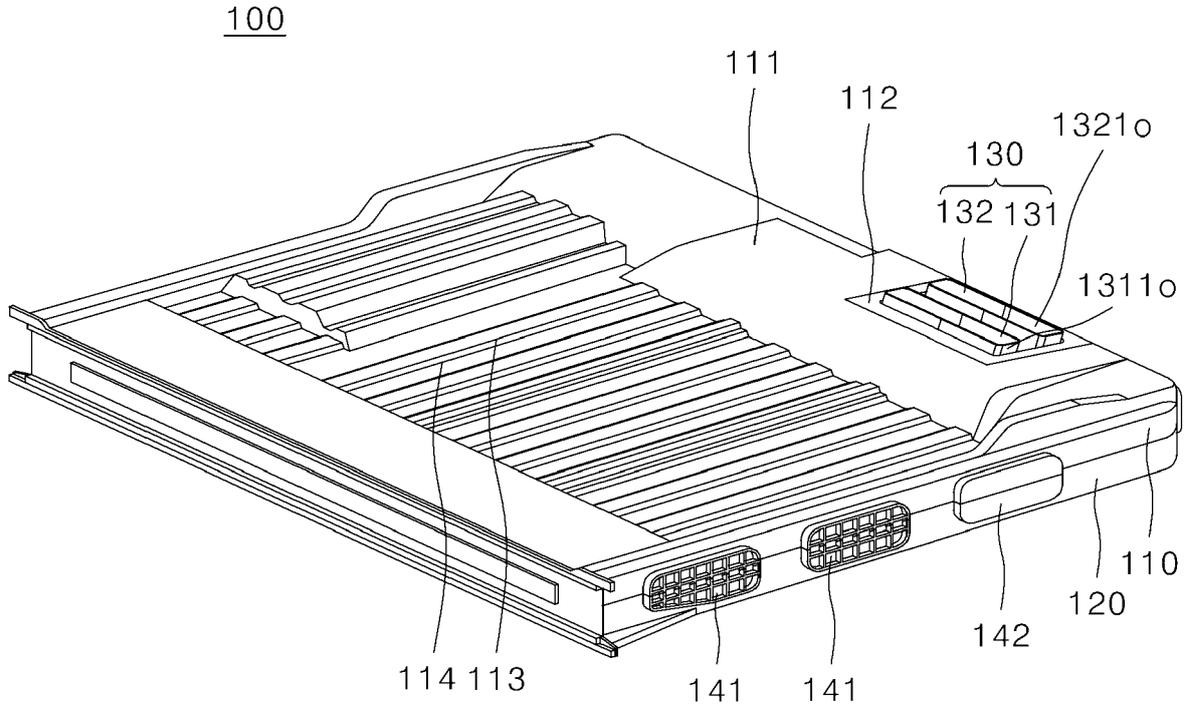


FIG. 11

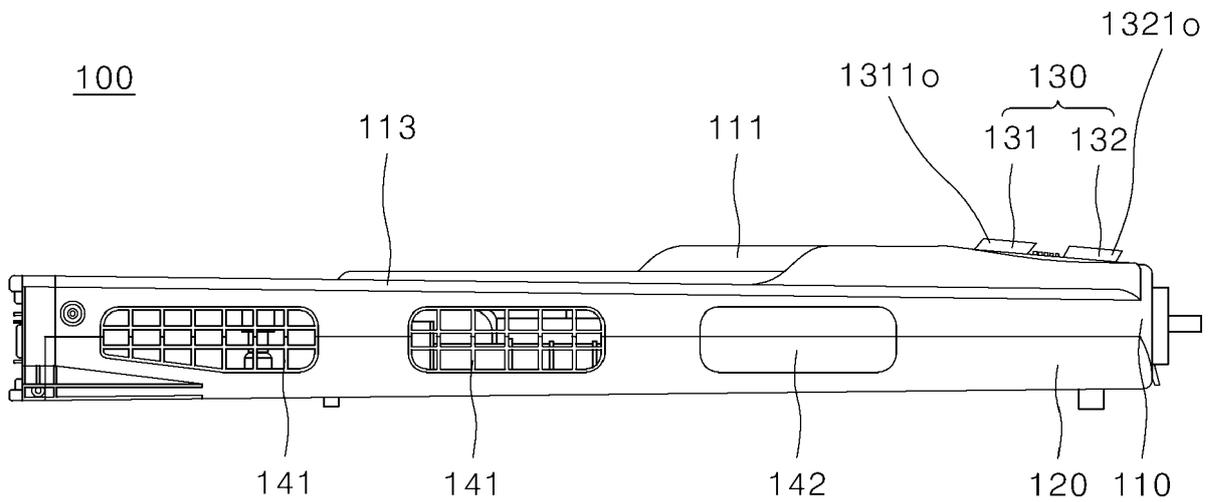


FIG. 12

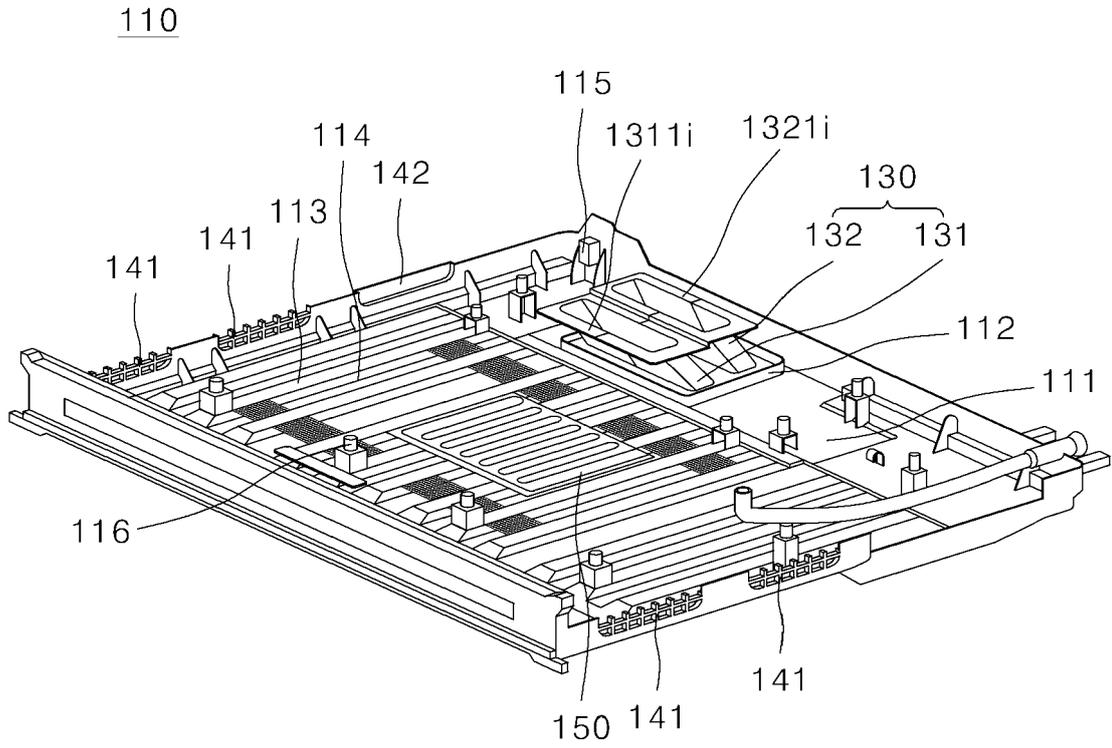


FIG. 13

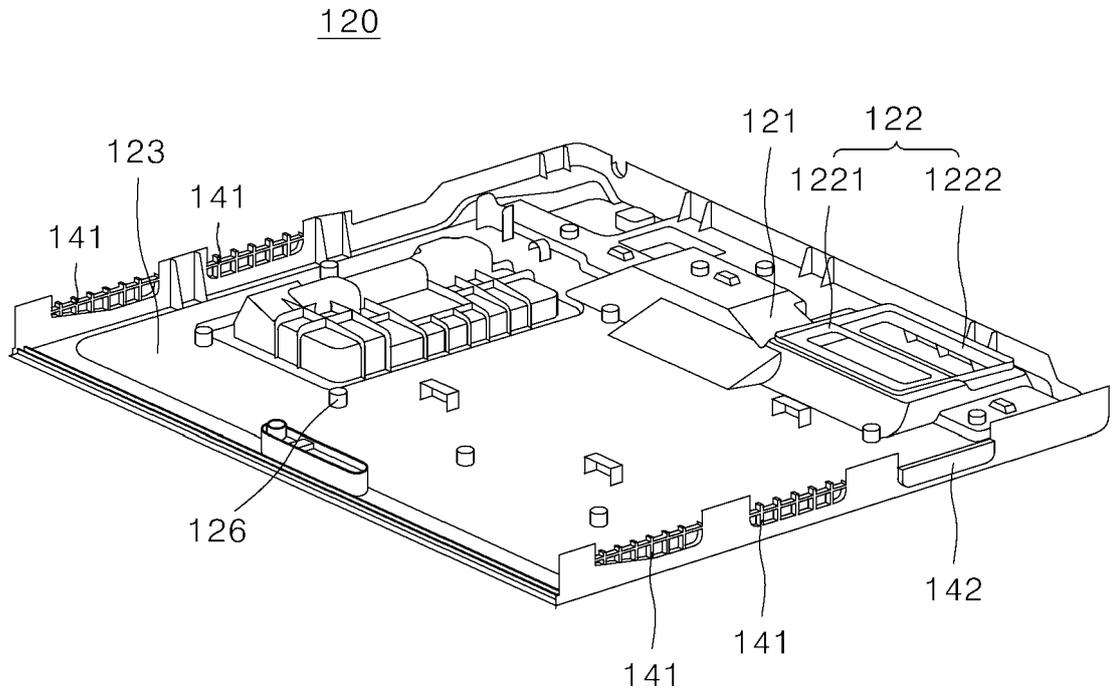


FIG. 14

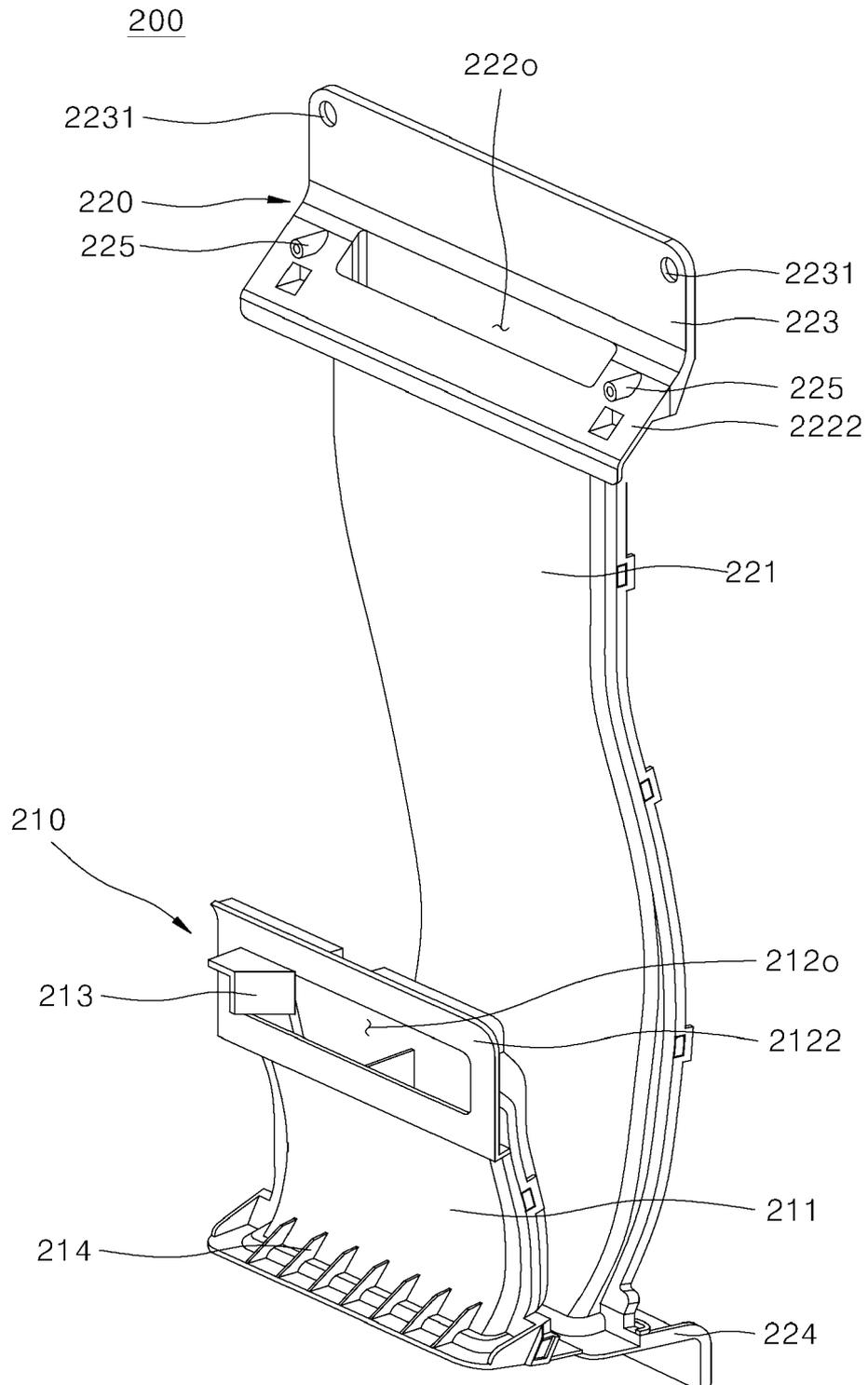


FIG. 15

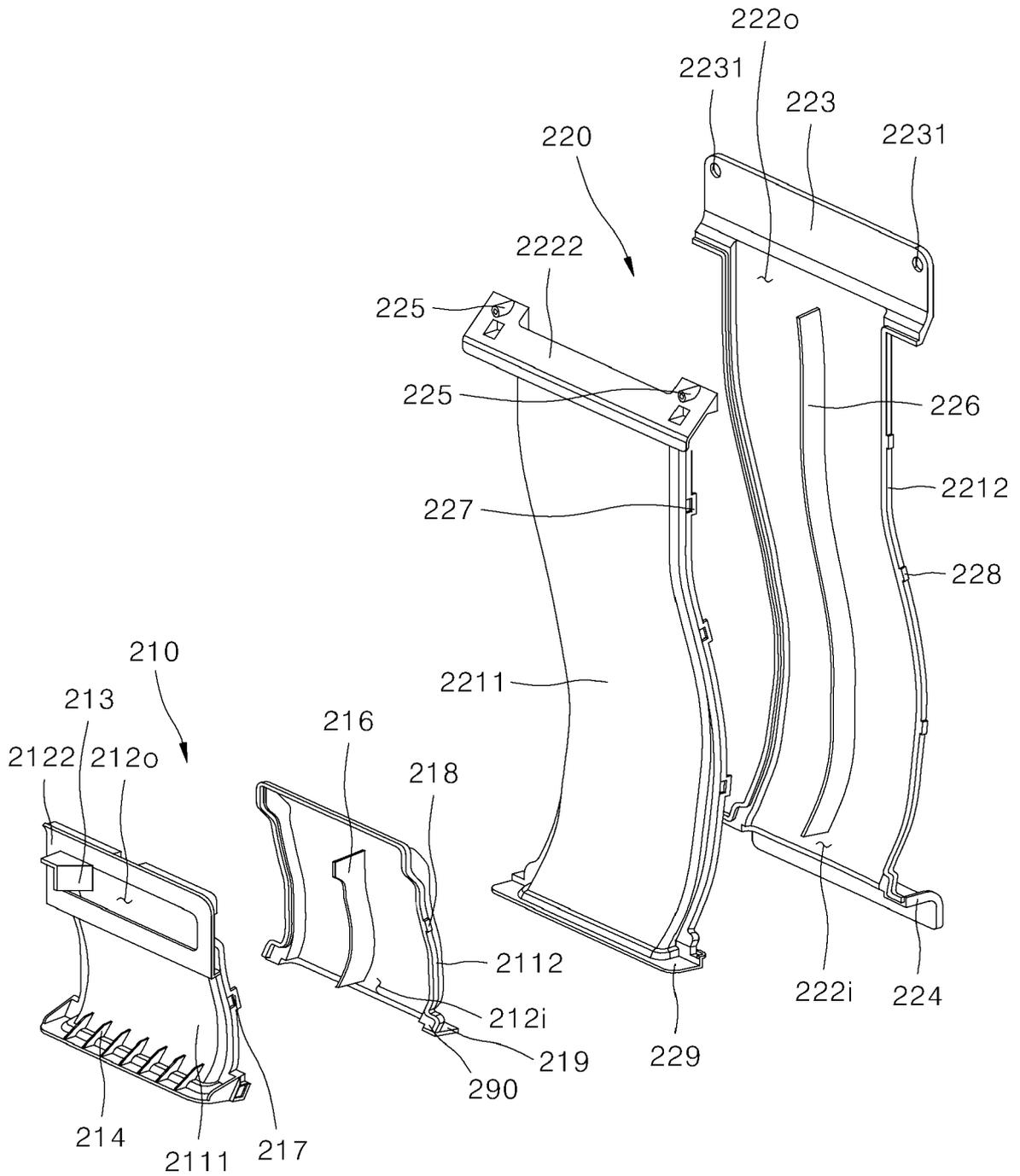


FIG. 16

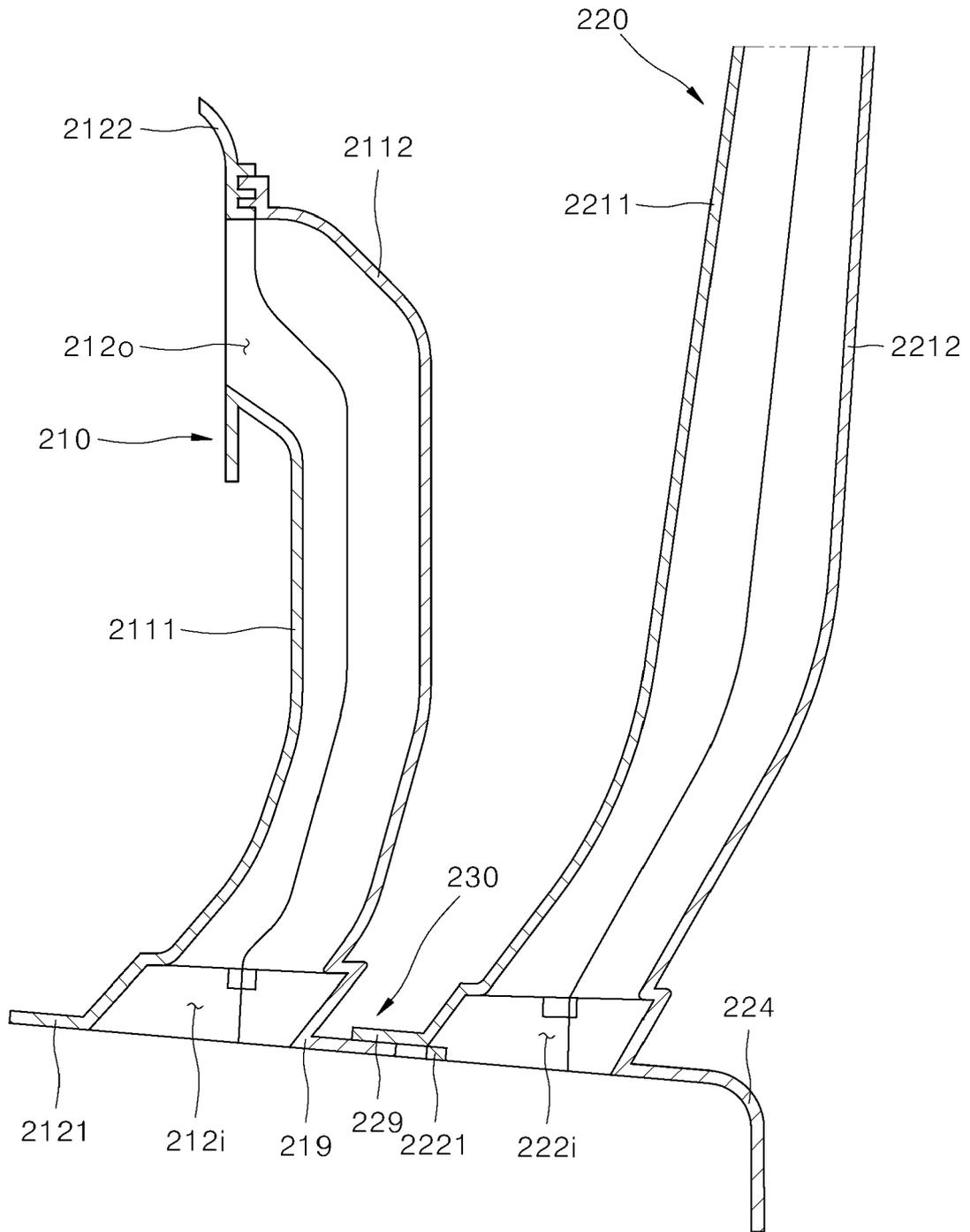


FIG. 17

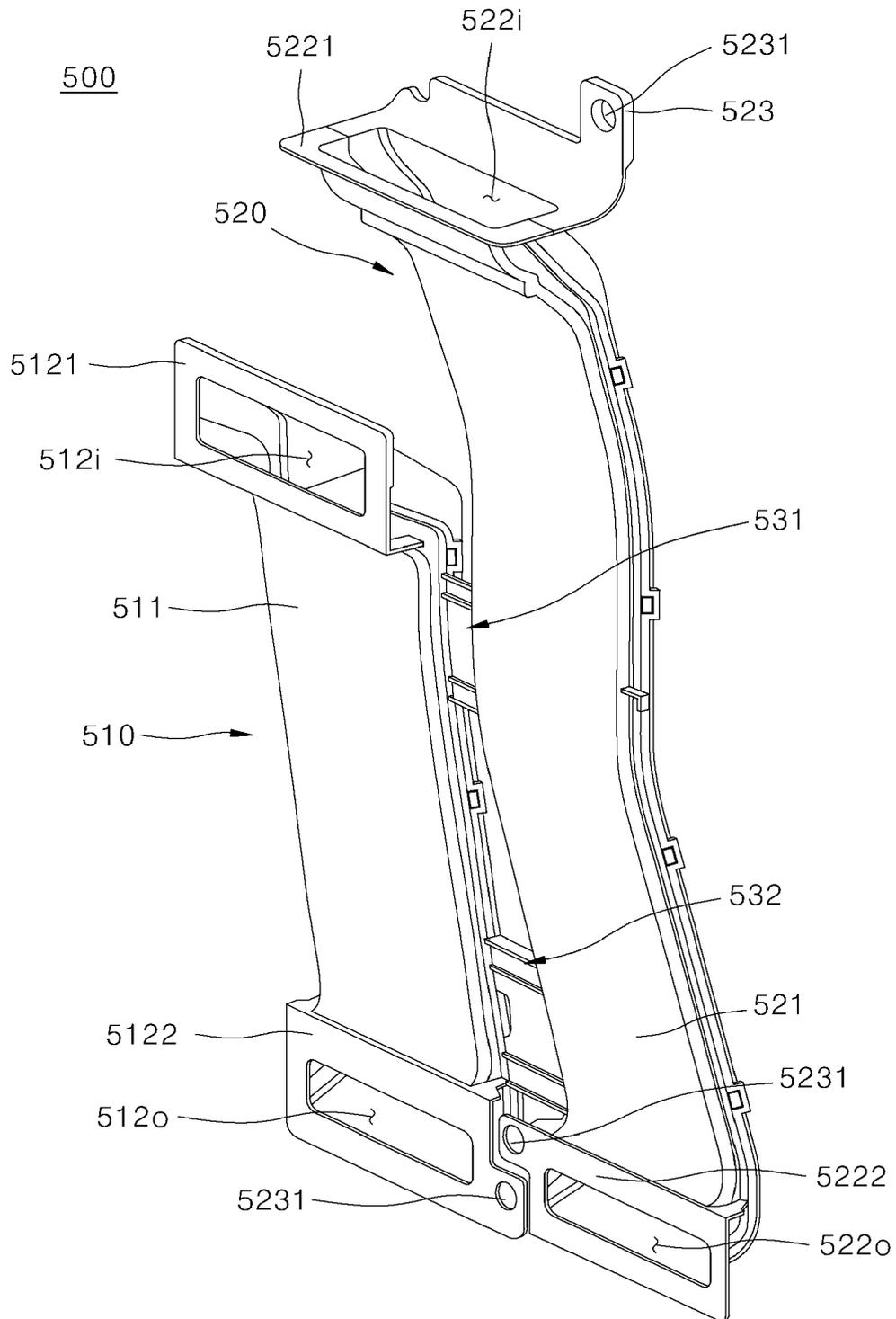


FIG. 18

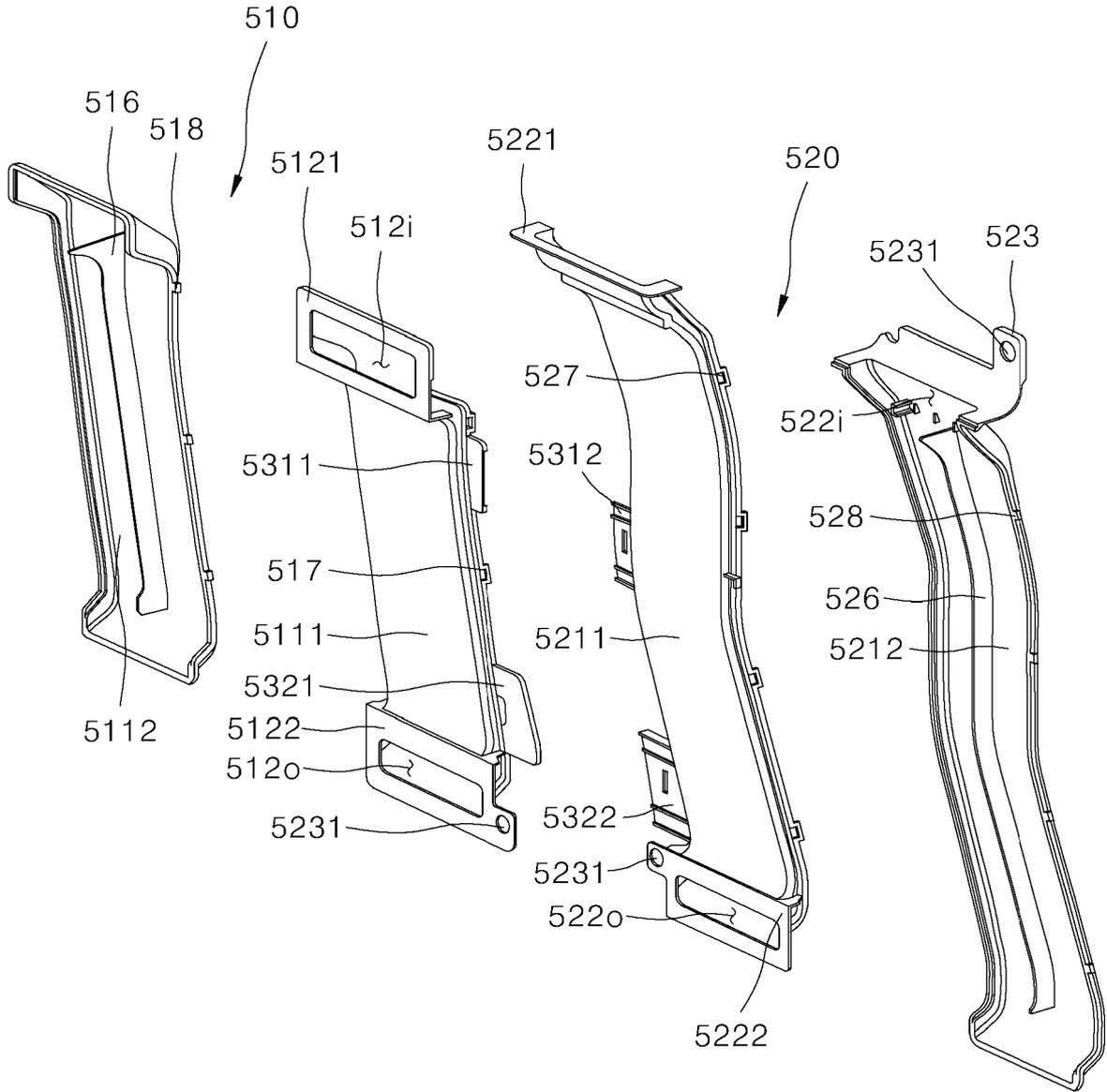


FIG. 19

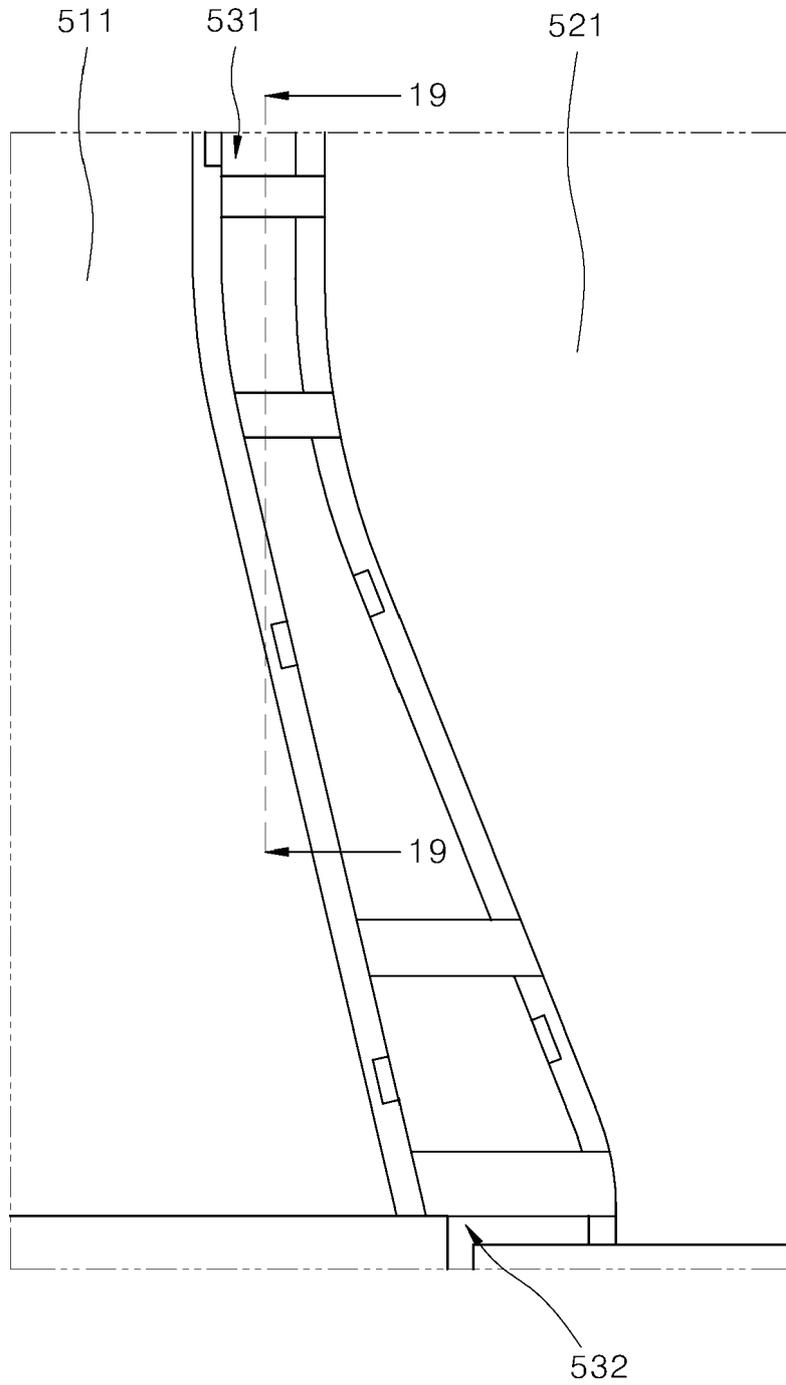


FIG. 20

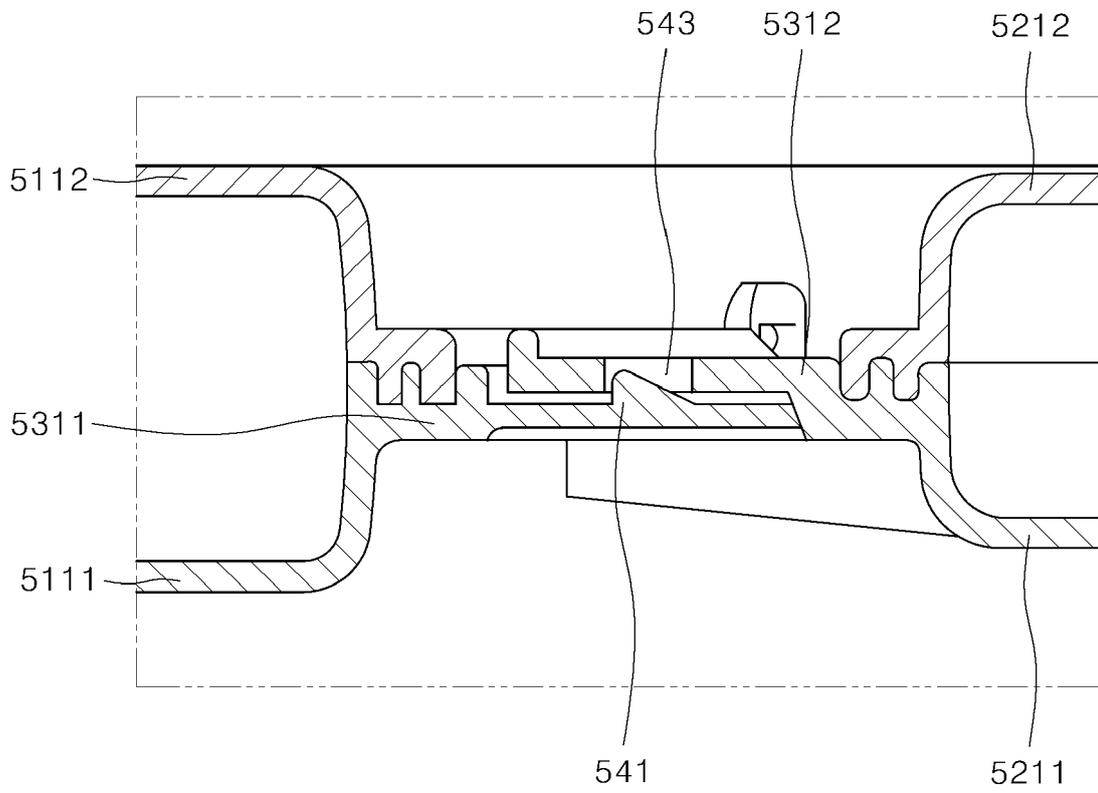


FIG. 21

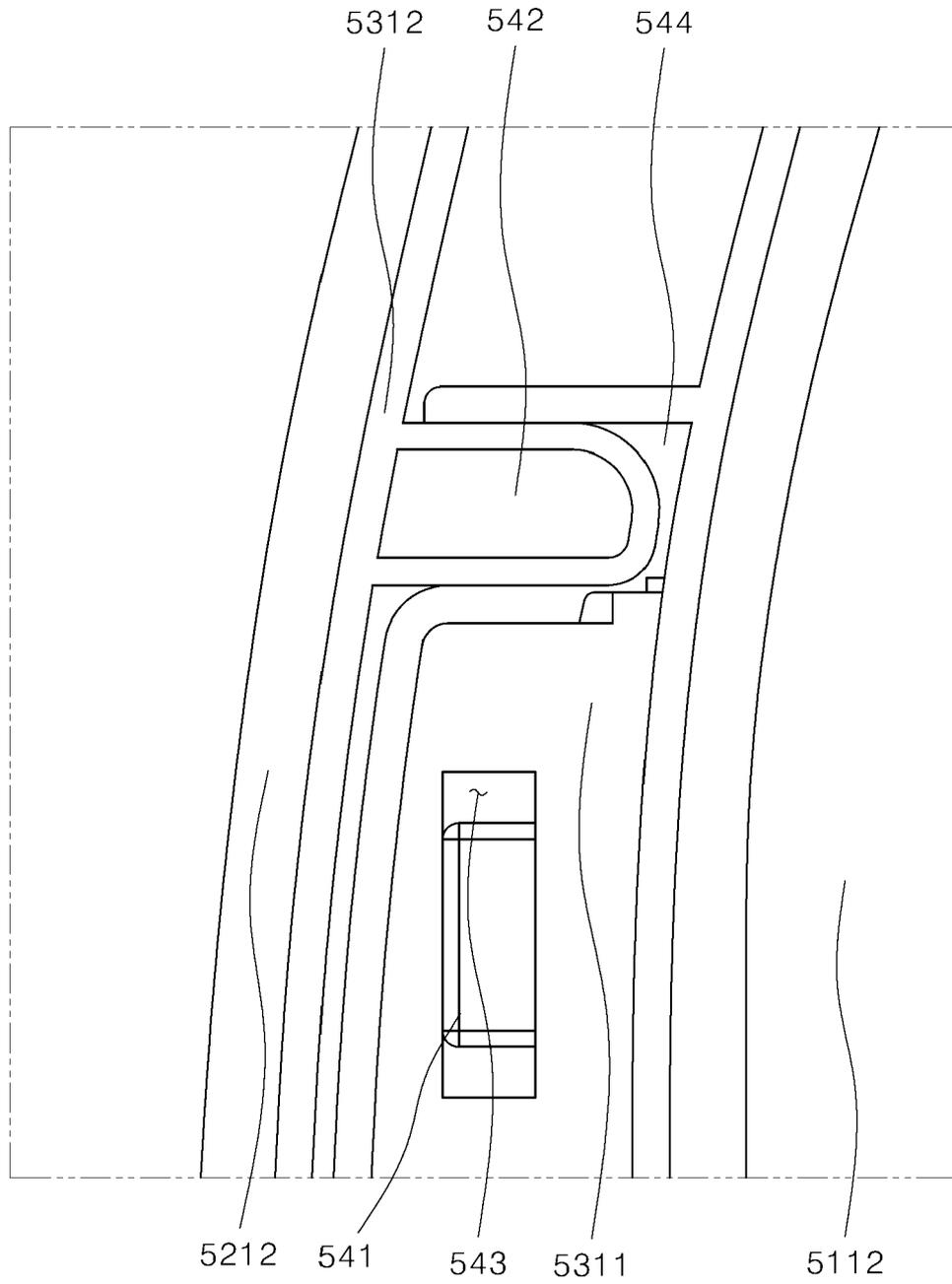


FIG. 22

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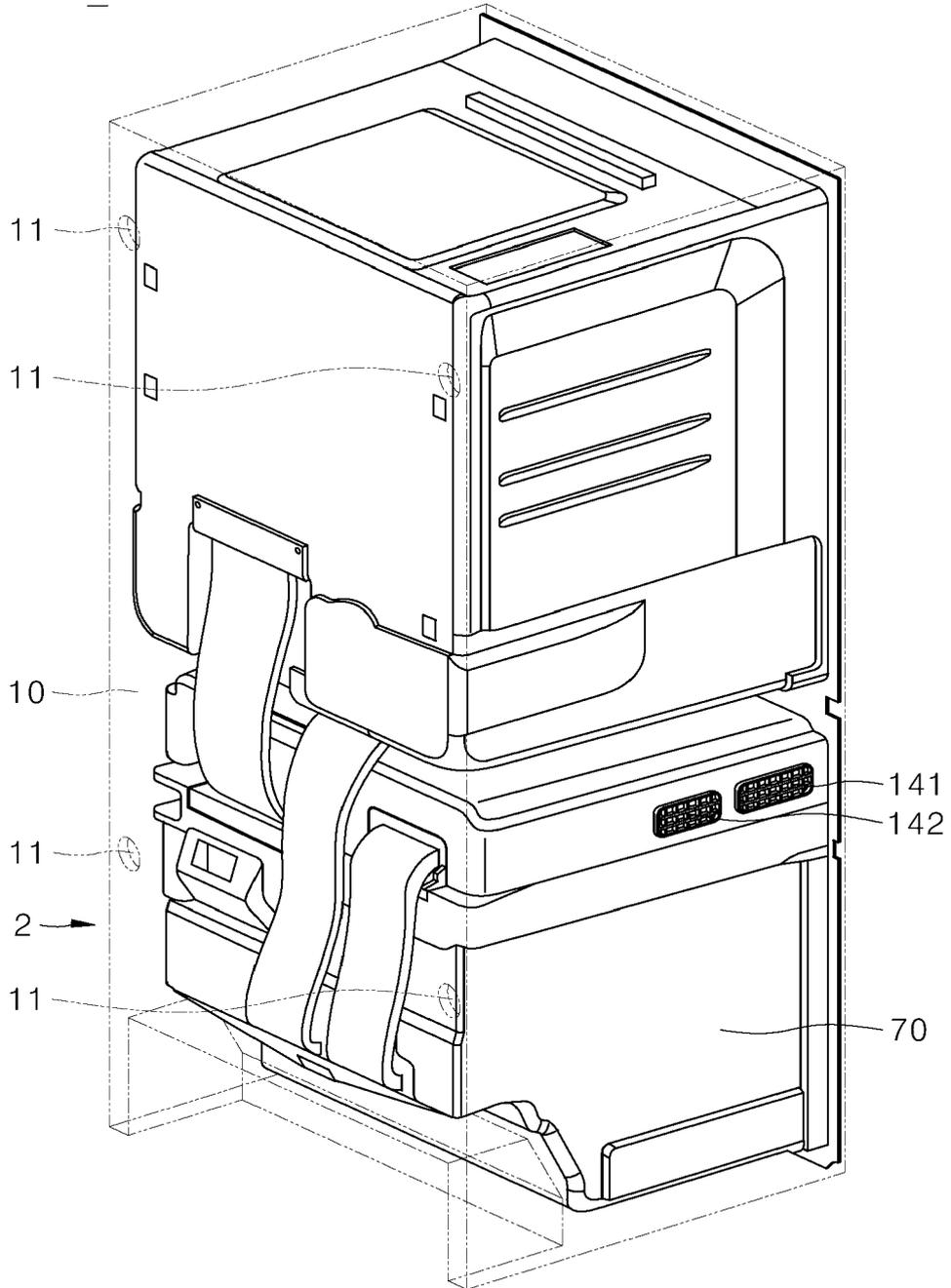


FIG. 23

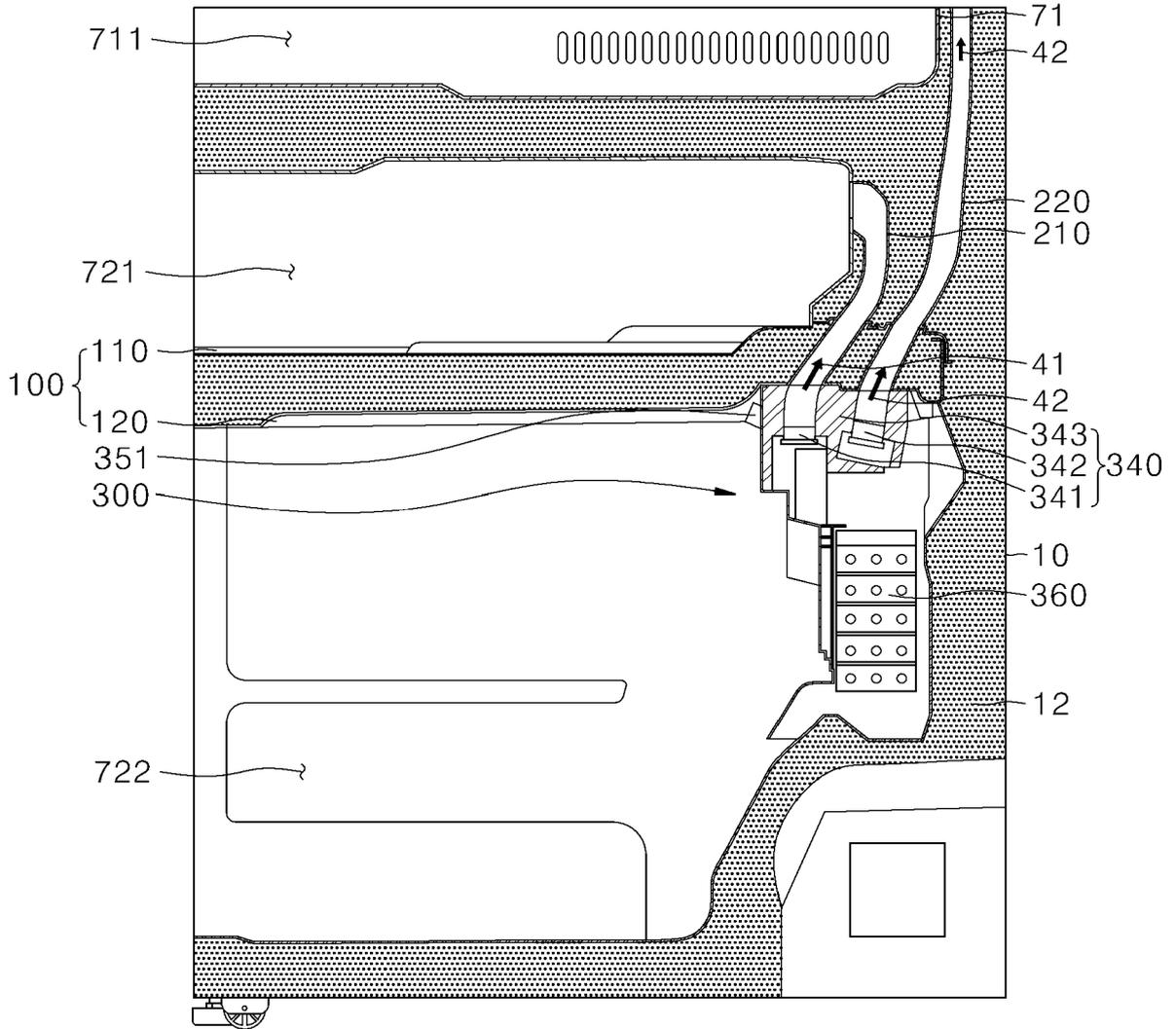


FIG. 24

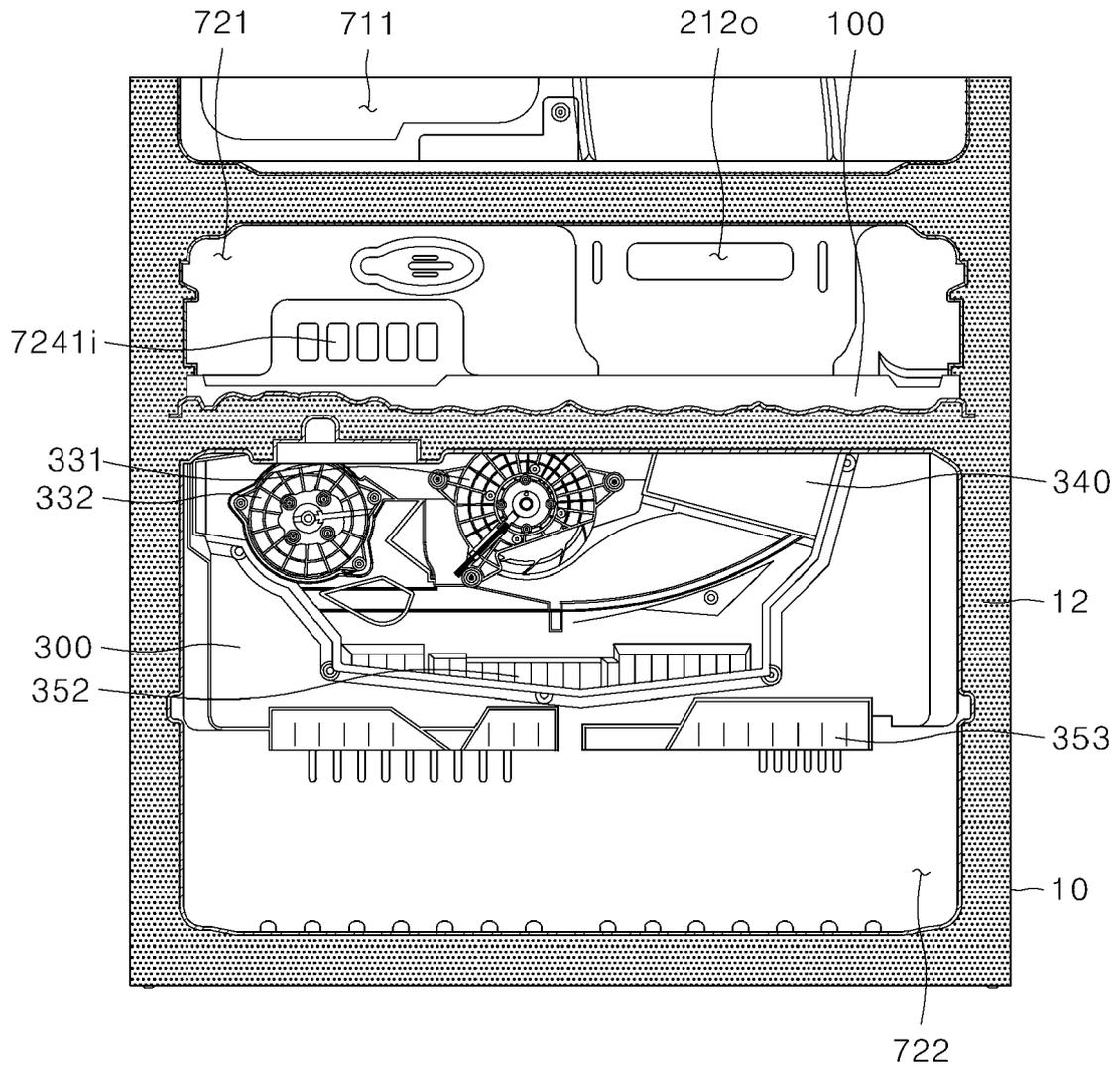


FIG. 25

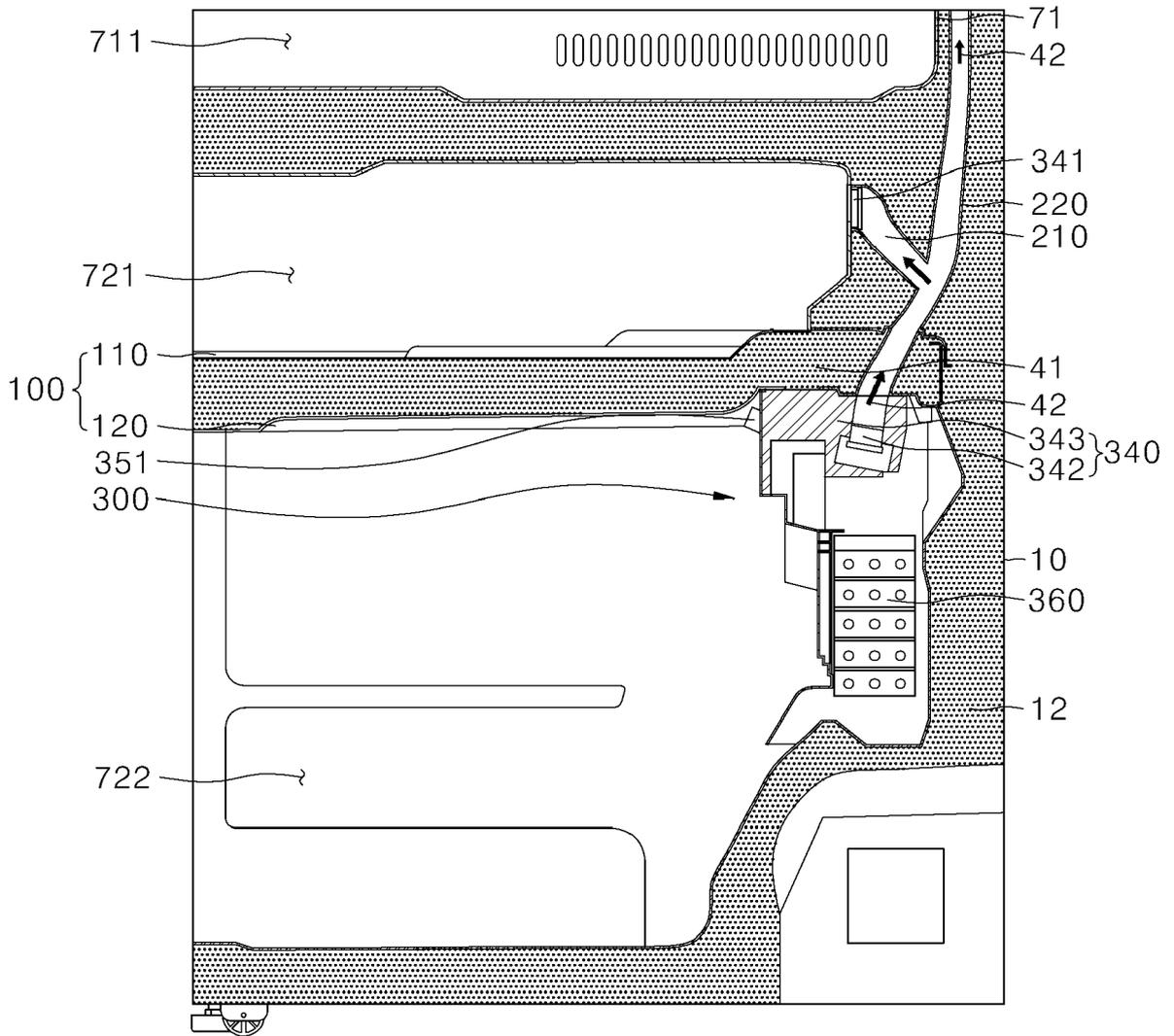


FIG. 26

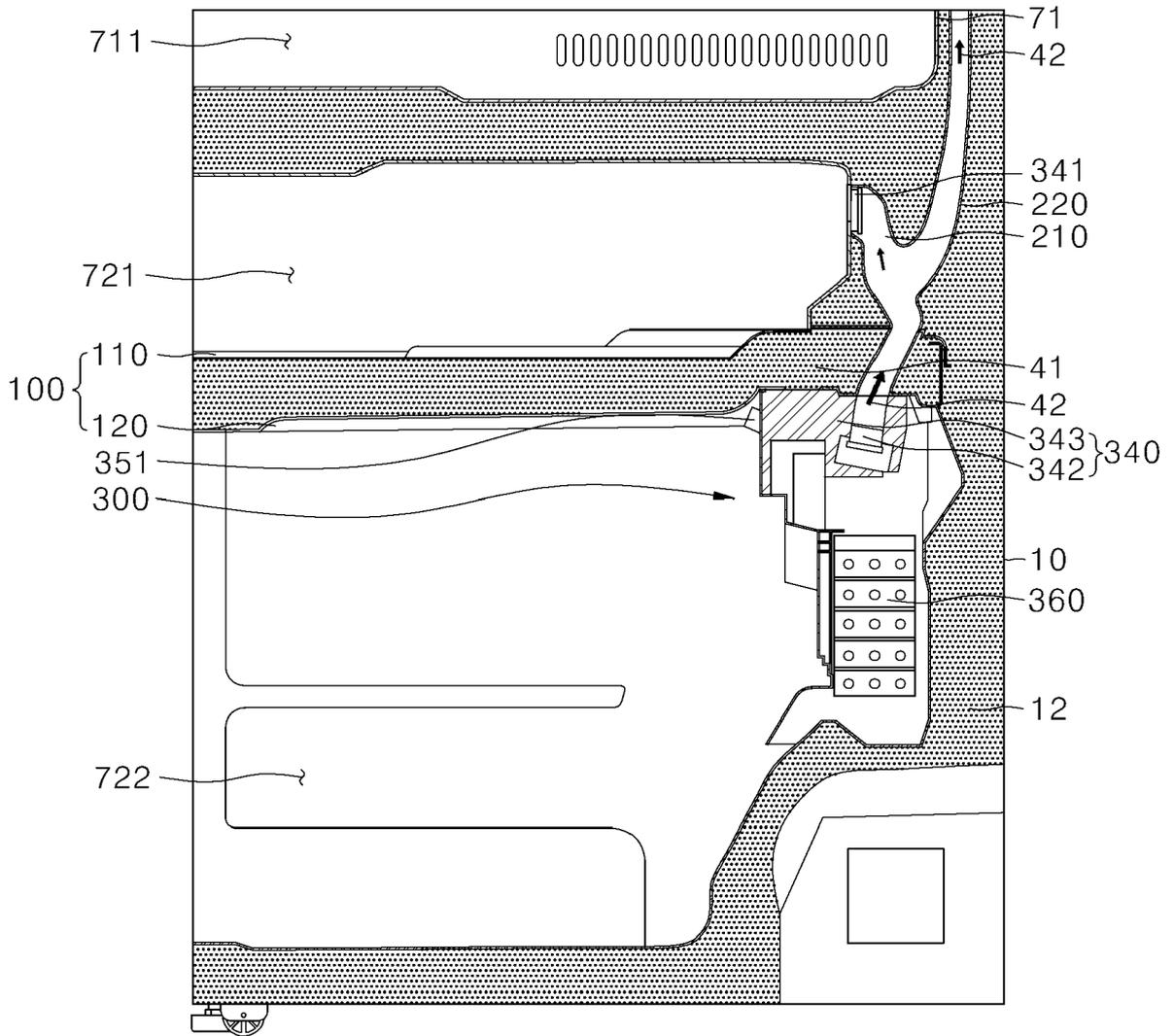
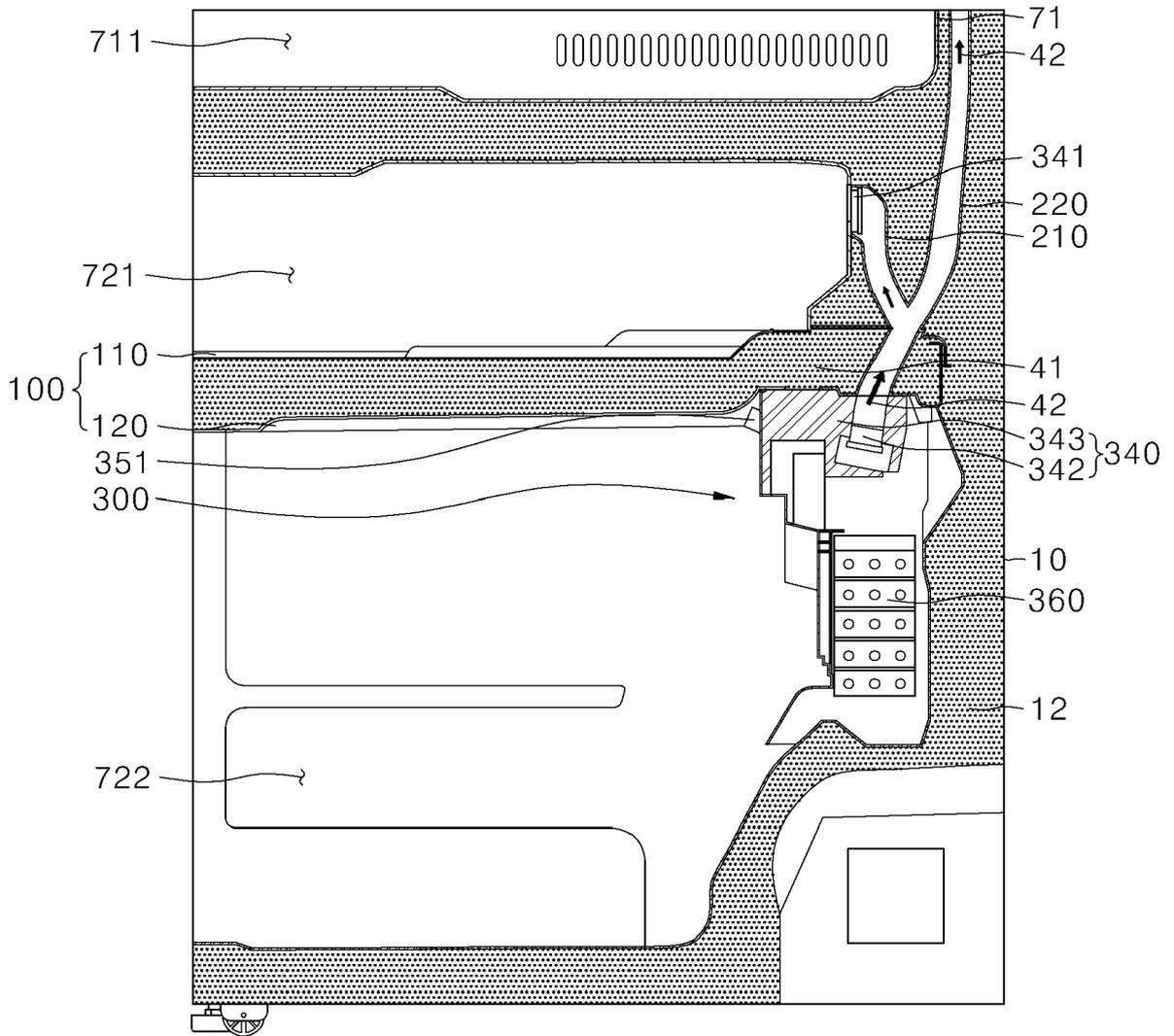


FIG. 27





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Application Number  
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Place of search <b>The Hague</b>		Date of completion of the search <b>18 July 2024</b>	Examiner <b>Bejaoui, Amin</b>
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