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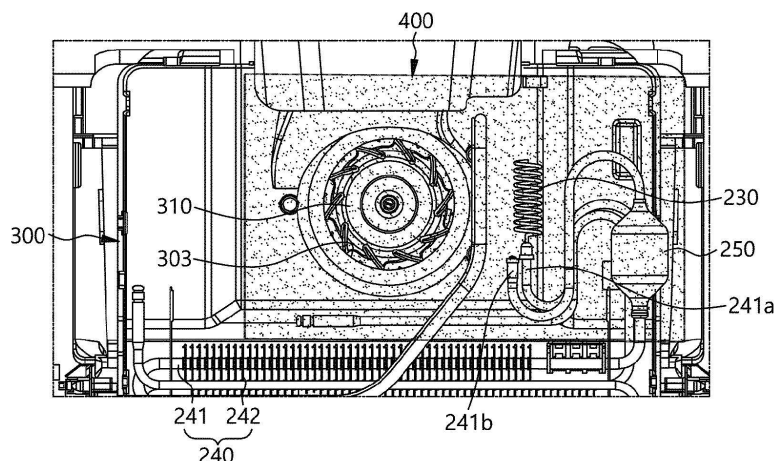
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(54) **REFRIGERATOR**

(57) A refrigerator of the present invention provides a noise reduction unit at a position where noise in an audible frequency band that is audible to a person is generated in a place other than a machine room and provided to the rear of the refrigerator, thereby preventing

the noise from penetrating the rear wall of the refrigerator or reducing the noise penetrating the rear wall of the refrigerator so that consumer satisfaction can be improved.

Fig. 12



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Description**Technical Field**

[0001] The present disclosure relates to a refrigerator to which a noise reduction structure is applied to reduce operational noise generated at the rear surface of the refrigerator.

Background Art

[0002] In general, a refrigerator is a household appliance configured to preserve stored items for an extended period by using cold air. The refrigerator provides at least one storage compartment in which the items are stored, and the storage compartment is configured to be opened and closed by a door.

[0003] The refrigerator includes various sources of noise. For example, operational noise is generated during the process of producing cold air to cool the storage compartment, and operational noise is also generated during the process of circulating the cold air within the storage compartment.

[0004] Recently, various noise reduction structures have been provided to reduce the noise generated in the aforementioned refrigerator.

[0005] For example, Korean Patent No. 10-2492677 (Prior Art 1) provides a technique in which a noise reduction unit is provided on a rear cover of a machine room of a refrigerator in order to reduce noise generated in the machine room of the refrigerator.

[0006] In addition, Korean Patent No. 10-0750252 (Prior Art 2) provides a technique in which an additional wall is formed inside the machine room of a refrigerator to reduce noise generated in the machine room.

[0007] In addition, Korean Utility Model Application Publication No. 20-1999-0004841 (Prior Art 3) provides a technique in which a noise-absorbing and noise-blocking material is attached to the exterior of the casing of a compressor to reduce noise generated by the compressor during operation of a refrigerator.

[0008] However, all of Prior Art 1 to Prior Art 3 described above are techniques designed to reduce noise generated in the machine room of the refrigerator, but the techniques are unable to reduce noise emitted to the rear side of the refrigerator outside the machine room.

[0009] Of course, Korean Patent No. 10-1106643 (Prior Art 4) provides a technique in which a noise reduction member is attached between an inner casing, which constitutes a wall of a refrigerator, and an insulating member to prevent friction noise therebetween caused by thermal deformation of the inner casing. That is, Prior Art 4 provides a technique capable of reducing noise outside the machine room.

[0010] However, in the case of the aforementioned Prior Art 4, there is a drawback in that it is impossible to reduce noise in areas where thermal deformation does not occur.

Disclosure**Technical Problem**

[0011] The present disclosure has been made to solve various problems associated with the aforementioned prior art, and an objective of the present disclosure is to provide a new type of refrigerator capable of reducing noise generated to the rear surface of the refrigerator from areas other than a machine room of the refrigerator.

[0012] Another objective of the present disclosure is to provide a refrigerator in which an installation position for a noise reduction structure is defined so that the effect of noise reduction can be sufficiently achieved regardless of the model of the refrigerator.

[0013] Another objective of the present disclosure is to provide a refrigerator capable of reducing noise transmitted through the rear wall of the refrigerator.

Technical Solution

[0014] In order to accomplish the above objectives, according to a refrigerator of the present disclosure, a noise reduction unit may be provided to block noise generated by refrigerant flow from being transmitted outside a cabinet.

[0015] According to the refrigerator of the present disclosure, the noise reduction unit may be provided in the cabinet and may block noise from being transmitted through the cabinet.

[0016] According to the refrigerator of the present disclosure, the noise reduction unit may be provided to block noise generated inside the cabinet outside a machine room from being transmitted to the outside.

[0017] According to the refrigerator of the present disclosure, the noise reduction unit may be provided to block transmission of noise to the rear side of the cabinet.

[0018] According to the refrigerator of the present disclosure, the noise reduction unit may be provided on an inner wall surface of an inner casing.

[0019] According to the refrigerator of the present disclosure, the noise reduction unit may be provided between the inner casing and an outer casing.

[0020] According to the refrigerator of the present disclosure, the noise reduction unit may be provided on at least one wall surface between the inner casing and the outer casing.

[0021] According to the refrigerator of the present disclosure, the noise reduction unit may be provided on an outer wall of the outer casing.

[0022] According to the refrigerator of the present disclosure, an insulating member is provided between the inner casing and the outer casing, and the noise reduction unit may be positioned between the inner casing and the insulating member or between the insulating member and the outer casing.

[0023] According to the refrigerator of the present disclosure, the noise reduction unit may block or reduce

noise generated during operation of a blower fan from being transmitted to the rear side of the cabinet.

[0024] According to the refrigerator of the present disclosure, the noise reduction unit may be positioned behind the blower fan.

[0025] According to the refrigerator of the present disclosure, the noise reduction unit may be positioned behind at least a portion of the blower fan.

[0026] According to the refrigerator of the present disclosure, at least a portion of the noise reduction unit may be formed to block at least a portion of the blower fan.

[0027] According to the refrigerator of the present disclosure, the noise reduction unit may be formed larger than the blower fan.

[0028] According to the refrigerator of the present disclosure, the noise reduction unit may reduce or block noise generated from a refrigerant inlet pipe through which refrigerant flows into the evaporator or a refrigerant outlet pipe through which refrigerant flows out of the evaporator from being transmitted to the rear side of the refrigerator.

[0029] According to the refrigerator of the present disclosure, at least a portion of the noise reduction unit may be formed to block the refrigerant inlet pipe or refrigerant outlet pipe of the evaporator.

[0030] According to the refrigerator of the present disclosure, an expansion valve may be connected to the refrigerant inlet pipe of the evaporator.

[0031] According to the refrigerator of the present disclosure, the noise reduction unit may block or reduce noise generated during operation of the expansion valve from being transmitted to the rear side of the cabinet.

[0032] According to the refrigerator of the present disclosure, the noise reduction unit may be positioned behind the expansion valve.

[0033] According to the refrigerator of the present disclosure, the noise reduction unit may be positioned behind at least a portion of the expansion valve.

[0034] According to the refrigerator of the present disclosure, at least a portion of the noise reduction unit may be formed to block at least a portion of the expansion valve.

[0035] According to the refrigerator of the present disclosure, the noise reduction unit may be formed larger than the expansion valve.

[0036] According to the refrigerator of the present disclosure, an accumulator may be connected to the refrigerant outlet pipe of the evaporator.

[0037] According to the refrigerator of the present disclosure, the noise reduction unit may block or reduce noise generated during the operation of the accumulator from being transmitted to the rear side of the cabinet.

[0038] According to the refrigerator of the present disclosure, the noise reduction unit may be positioned behind the accumulator.

[0039] According to the refrigerator of the present disclosure, the noise reduction unit may be positioned behind at least a portion of the accumulator.

[0040] According to the refrigerator of the present disclosure, At least a portion of the noise reduction unit may be formed to block at least a portion of the accumulator.

5 **[0041]** According to the refrigerator of the present disclosure, the noise reduction unit may be formed larger than the accumulator.

[0042] According to the refrigerator of the present disclosure, the refrigerant inlet pipe and the refrigerant outlet pipe of the evaporator may be arranged to be adjacent to each other on one portion of the evaporator.

[0043] According to the refrigerator of the present disclosure, the accumulator and the expansion valve may be arranged to be adjacent to each other on one side portion of an upper portion of the evaporator.

15 **[0044]** According to the refrigerator of the present disclosure, the noise reduction unit may simultaneously block or reduce noise generated during the operation of the accumulator and the expansion valve from being transmitted to the rear side of the cabinet.

20 **[0045]** According to the refrigerator of the present disclosure, the noise reduction unit may be formed to simultaneously block at least a portion of each of the accumulator and the expansion valve.

25 **[0046]** According to the refrigerator of the present disclosure, the noise reduction unit may be formed to simultaneously block at least a portion of each of the accumulator and the blower fan.

[0047] According to the refrigerator of the present disclosure, the noise reduction unit may be formed to simultaneously block at least a portion of each of the expansion valve and the blower fan.

30 **[0048]** According to the refrigerator of the present disclosure, the noise reduction unit may be formed to simultaneously block at least a portion of each of the accumulator, the expansion valve, and the blower fan.

35 **[0049]** According to the refrigerator of the present disclosure, the noise reduction unit may be formed as a plate-shaped member.

[0050] According to the refrigerator of the present disclosure, the noise reduction unit may be provided to be attached to, coupled with, or in contact with the cabinet.

[0051] According to the refrigerator of the present disclosure, the noise reduction unit may be formed to have an air layer formed therein.

45 **[0052]** According to the refrigerator of the present disclosure, the noise reduction unit may be formed to protrude outward from the rear wall surface of the outer casing while having the air layer inside.

50 **[0053]** According to the refrigerator of the present disclosure, the noise reduction unit may be formed to be recessed inward from the rear wall surface of the outer casing while having the air layer inside.

[0054] According to the refrigerator of the present disclosure, the air layer provided by the noise reduction unit may be formed of multiple protruded or recessed portions that are partitioned from each other.

55 **[0055]** According to the refrigerator of the present disclosure, the air layer provided by the noise reduction unit

may be formed to have a regular arrangement.

Advantageous Effects

[0056] The refrigerator having the noise reduction unit according to the present disclosure may provide the following various effects.

[0057] According to the refrigerator of the present disclosure, the noise reduction unit may block or reduce noise transmitted to the rear side of the refrigerator, thereby reducing user complaints caused by noise.

[0058] In addition, according to the refrigerator of the present disclosure, the noise reduction unit may be provided only at a localized position considering components generating noise toward the rear side, thereby achieving maximum noise reduction effect at a minimum position.

[0059] In addition, according to the refrigerator of the present disclosure, the noise reduction unit may reduce noise transmitted from the blower fan to the rear side of the refrigerator, thereby reducing user complaints caused by noise generated during the operation of the blower fan.

[0060] In addition, according to the refrigerator of the present disclosure, the noise reduction unit may reduce noise transmitted from the expansion valve to the rear side of the refrigerator, thereby reducing user complaints caused by noise generated during the operation of the expansion valve.

[0061] In addition, according to the refrigerator of the present disclosure, the noise reduction unit may reduce noise transmitted from the accumulator to the rear side of the refrigerator, thereby reducing user complaints caused by noise generated during the operation of the accumulator.

[0062] In addition, according to the refrigerator of the present disclosure, the noise reduction unit may reduce refrigerant flow noise generated at a connection portion between the refrigerant inlet pipe of a refrigerant pipe constituting the evaporator and the expansion valve, or at a connection portion between the refrigerant outlet pipe and the accumulator.

[0063] In addition, according to the refrigerator of the present disclosure, the noise reduction unit may effectively block or reduce noise transmitted to the rear side of the refrigerator even with a minimal size due to structural characteristics thereof.

[0064] In addition, according to the refrigerator of the present disclosure, the noise reduction unit may block noise in the audible frequency range of fan noise and refrigerant flow noise, thereby reducing user complaints caused by the noise.

Description of Drawings

[0065]

FIG. 1 is a side cross-sectional view of the internal

structure of a refrigerator according to an embodiment of the present disclosure.

FIG. 2 is a rear-side view of the internal structure of the refrigerator according to an embodiment of the present disclosure.

FIG. 3 is an enlarged rear-side view of a grille fan assembly of the refrigerator according to an embodiment of the present disclosure.

FIGS. 4 to 8 are views illustrating various embodiments of the installation portions of a noise reduction unit in the refrigerator according to an embodiment of the present disclosure.

FIGS. 9 to 12 are views illustrating various embodiments of the installation positions of the noise reduction unit in a refrigerator according to an embodiment of the present disclosure.

FIGS. 13 to 18 are views illustrating various embodiments of the shape of the noise reduction unit in a refrigerator according to an embodiment of the present disclosure.

FIG. 19 is a view illustrating an example of a state in which the noise reduction unit according to an embodiment of the present disclosure is installed in a type of refrigerator different from the embodiment.

FIG. 20 is a graph evaluating sound insulation performance against the noise of the rear surface of the refrigerator according to an embodiment of the present disclosure.

FIG. 21 is a graph illustrating the noise evaluation of the refrigerator according to an embodiment of the present disclosure.

Mode for Invention

[0066] Prior to describing embodiments of the present disclosure, when adding reference numerals to components in each drawing, it should be noted that identical components are given the same reference numerals as much as possible even if they are shown in different drawings.

[0067] In addition, when describing the embodiments of the present disclosure, if a detailed description of the relevant known configuration or function is judged to hinder understanding of the embodiments of the present disclosure, detailed descriptions thereof will be omitted.

[0068] In addition, in describing the components of the embodiments of the present disclosure, terms such as first, second, A, B, (a), and (b) may be used. These terms are only for distinguishing the components from other components, and the nature or order of the components is not limited by the terms. When a component is described as being "connected" or "coupled" to another component, the component may be directly connected to or coupled to the another component, but it should be understood that still another component may be "connected" or "coupled" thereto between each component.

[0069] Hereinafter, preferred embodiments of a refrigerator having a noise reduction unit of the present dis-

closure will be described with reference to the accompanying FIGS. 1 to 21.

[0070] FIG. 1 is a side cross-sectional view of the internal structure of the refrigerator according to an embodiment of the present disclosure, and FIG. 2 is a rear-side view of the internal structure of the refrigerator according to an embodiment of the present disclosure.

[0071] As shown in these figures, the refrigerator according to an embodiment of the present disclosure may be configured to prevent or reduce noise in an audible frequency band, which is audible to a human, outside a machine room from being transmitted through the rear wall of the refrigerator, thereby enhancing consumer satisfaction.

[0072] The refrigerator according to an embodiment of the present disclosure will be described in further detail for each component thereof.

[0073] First, the refrigerator according to an embodiment of the present disclosure may include a cabinet (100) constituting the exterior thereof.

[0074] The cabinet (100) may be formed in a box shape with an open front surface.

[0075] The cabinet (100) may include an outer casing (110) constituting an outer wall surface thereof and an inner casing (120) constituting an inner wall surface thereof.

[0076] A storage compartment (121) is provided inside the inner casing (120). The storage compartment (121) is a space in which food, beverages, or other types of stored items are kept. The storage compartment (121) may be configured to preserve the stored items for an extended period by using cold air generated by a refrigeration cycle.

[0077] The storage compartment (121) may include a single storage compartment or two or more storage compartments. In order for the storage compartment (121) to include the plurality of storage compartments, the inner casing (120) may include a plurality of inner casings (120). Alternatively, a plurality of storage compartments (121) may be provided by partitioning the interior of a single inner casing (120) into separate spaces vertically or horizontally.

[0078] When the storage compartment (121) includes a plurality of storage compartments, each of the storage compartments (121) may be maintained at a different temperature. For example, one storage compartment (121) (an upper storage compartment in the drawings) may be maintained at a refrigeration temperature, while another storage compartment (121) (a lower storage compartment in the drawings) may be maintained at a freezing temperature. Conversely, the one storage compartment (121) may be maintained at a freezing temperature, and the another storage compartment (121) may be maintained at a refrigeration temperature.

[0079] Meanwhile, the storage compartment (121) may be opened and closed by a door (130). When the storage compartment (121) includes a plurality of storage compartments, the door (130) may also include a plurality

of doors.

[0080] The outer casing (110) may be formed to be spaced apart from the inner casing (120). In this case, a foamed material may be filled between the outer casing (110) and the inner casing (120) to reduce heat transfer between the two casings (110, 120).

[0081] Inside the outer casing (110), a single inner casing (120) may be provided, or two or more inner casings (120) may be provided. When a plurality of inner casings (120) are provided, separate members for partitioning may be provided between the plurality of inner casings (120), or the plurality of inner casings (120) may simply be formed to be spaced apart from each other.

[0082] Next, the refrigerator according to an embodiment of the present disclosure may include an evaporator (240).

[0083] The evaporator (240), as one of the components constituting the refrigeration cycle of the refrigerator, may exchange heat between refrigerant provided through a refrigerant pipe (241) and the air passing around it.

[0084] The refrigeration cycle may generate cold air by sequentially compressing, condensing, expanding, and evaporating circulating refrigerant, and may include a compressor (210), a condenser (not shown), an expansion valve (230), and the evaporator (240).

[0085] Here, the compressor (210) and the condenser, which constitute the refrigeration cycle, may be provided in a machine room (140) that provides a space separate from the storage compartment (121) of the cabinet (100). The machine room (140) may be located on the rear lower end of the cabinet (100). At least one surface of opposite side surfaces or a rear surface of the machine room (140) may be provided with a vent (141) through which air flows between the inside and outside of the machine room (140). That is, air may be introduced through one vent (141) and discharged from the machine room (140) through another vent (141) after flowing inside the machine room (140).

[0086] The evaporator (240) may be located inside the inner casing (120) constituting the cabinet (100). When a plurality of inner casings (120) is provided, the evaporator (240) may be provided in at least one of the plurality of inner casings (120). For example, the evaporator (240) may be provided in only one of the inner casings (120), or the evaporator (240) may be provided in all of the inner casings (120).

[0087] The evaporator (240) may be in contact with or positioned adjacent to the internal rear wall surface of the inner casing (120).

[0088] The evaporator (240) may include the refrigerant pipe (241) and multiple cooling fins (242) as shown in FIG. 3. Here, a refrigerant inlet pipe (241a) through which refrigerant flows in and a refrigerant outlet pipe (241b) through which refrigerant flows out are provided on the opposite ends of the refrigerant pipe (241), respectively. The refrigerant inlet pipe (241a) may be defined as the portion of the refrigerant pipe (241) through which refrigerant

erant flows in, and the refrigerant outlet pipe (241b) may be defined as the portion of the refrigerant pipe (241) through which refrigerant flows out. Of course, the refrigerant inlet pipe (241a) and the refrigerant outlet pipe (241b) may be formed separately from the refrigerant pipe (241) and then connected to the opposite ends of the refrigerant pipe (241), respectively.

[0089] The refrigerant inlet pipe (241a) and the refrigerant outlet pipe (241b) may be formed to be positioned at any one portion of the evaporator (240). For example, the refrigerant inlet pipe (241a) or the refrigerant outlet pipe (241b) may be formed to be positioned at one side portion of the upper portion of the evaporator (240). That is, when considering that a blower fan (310), which will be described later, is located above the evaporator (240), the refrigerant inlet pipe (241a) or the refrigerant outlet pipe (241b) may be provided at one side portion of the blower fan (310) above the evaporator (240) so as to avoid the position of the blower fan (310).

[0090] In particular, the refrigerant inlet pipe (241a) and the refrigerant outlet pipe (241b) of the evaporator (240) may be arranged to be positioned adjacent to each other. Accordingly, a noise reduction unit (400), which will be described later, may be formed to simultaneously block the refrigerant inlet pipe (241a) and the refrigerant outlet pipe (241b) of the evaporator (240) with a minimal size thereof.

[0091] Meanwhile, the expansion valve (a capillary tube) (230) may be connected to the refrigerant inlet pipe (241a) of the evaporator (240). The expansion valve (230) may serve to reduce the pressure of refrigerant provided from the condenser to the evaporator (240), thereby expanding the refrigerant and lowering its temperature.

[0092] In addition, an accumulator (liquid separator) (250) may be provided on the refrigerant outlet pipe (241b) of the evaporator (240). The accumulator (250) may serve to separate liquid refrigerant, which is completely vaporized while passing through the evaporator (240), from the refrigerant gas.

[0093] The expansion valve (230) and the accumulator (250) may be provided adjacent to each other. For example, the expansion valve (230) and the accumulator (250) may be positioned at one side above the evaporator (240).

[0094] Next, the refrigerator according to an embodiment of the present disclosure may include a grille fan assembly (300).

[0095] The grille fan assembly (300) may be formed to partition the interior of the inner casing (120) into a rear space, where the evaporator (240) is located, and a front space, which is provided as the storage compartment (121). To this end, the grille fan assembly (300) may be positioned in front of the evaporator (240) within the inner casing (120).

[0096] In particular, the rear surface of the grille fan assembly (300) may be arranged to be as close as possible to the front surface of the evaporator (240) or

in contact with the front surface of the evaporator (240). Accordingly, air that flows into the lower portion of the evaporator (240) and passes through the evaporator (240) for heat exchange may pass directly through a gap between the rear surface of the grille fan assembly (300) and the front surface of the evaporator (240), thereby preventing or minimizing the problem of unexchanged heat. Of course, when the grille fan assembly (300) is placed as close as possible to the evaporator (240), space for the storage compartment (121) within the inner casing (120) may be maximized.

[0097] The grille fan assembly (300) may be provided with the blower fan (310) for blowing air. By the air blowing force generated by driving the blower fan (310), the air inside the storage compartment (121) may pass through the evaporator (240) for heat exchange and then be supplied back into the storage compartment (121).

[0098] The blower fan (310) may be positioned above the evaporator (240). Preferably, the blower fan (310) may be located above the center of the evaporator (240). Accordingly, the air drawn by the blower fan (310) may pass evenly through the entire portion of the evaporator (240).

[0099] The distance between the blower fan (310) and the evaporator (240) may vary depending on the type of refrigerator. For example, in a refrigerator with a tall storage compartment (121), the distance between the blower fan (310) and the evaporator (240) may be greater than in a refrigerator with a relatively short storage compartment (121). When the distance between the blower fan (310) and the evaporator (240) is large, the blower fan (310) may be positioned above any one side of the evaporator (240) rather than above the center of the evaporator (240).

[0100] Meanwhile, the grille fan assembly (300) may be formed to guide air, which has passed through the evaporator (240) and exchanged heat, to flow into the storage compartment (121) within the inner casing (120). To this end, the grille fan assembly (300) may be provided with a plurality of discharge openings (not shown) that communicates with the interior of the storage compartment (121). That is, the air, which has become cold after exchanging heat in the evaporator (240), may be supplied into the storage compartment (121) through each of the discharge openings of the grille fan assembly (300), thereby cooling stored items (e.g., food) inside the storage compartment (121).

[0101] In addition, the grille fan assembly (300) may further include a guide (302) configured to guide the cold air flowing through the storage compartment (121) to flow to an air inlet side of the evaporator (240). In this case, the guide (302) may be provided on a lower end of the grille fan assembly (300).

[0102] Next, the refrigerator according to an embodiment of the present disclosure may include the noise reduction unit (400).

[0103] The noise reduction unit (400) may be provided to block the transmission of noise to the rear side of the

cabinet (100).

[0104] The noise reduction unit (400) may be configured to reduce noise generated from areas other than the machine room. That is, considering that various noise reduction structures are provided in the machine room, the noise reduction unit (400) may be configured to reduce noise generated from areas other than the machine room.

[0105] Of course, in the related art, a filler is provided between the inner casing (120) and the outer casing (110) that form the cabinet (100), and in some types of refrigerators, an additional insulating material is provided between the inner casing (120) and the outer casing (110), thereby partially blocking noise directed to the rear side of the refrigerator. However, the filler or insulating material is a material provided for thermal insulation, and has limitation in effectively blocking or reducing noise generated in an audible frequency band perceived by a consumer. In particular, soundproofing performance gradually deteriorates in frequency bands of approximately 1000 Hz or higher.

[0106] Accordingly, in the present disclosure, by additionally providing the noise reduction unit (400), noise in an audible frequency band may be maximally prevented without reducing thermal insulation effect between the inner casing (120) and the outer casing (110).

[0107] The noise reduction unit (400) may cause differences in its impact on surrounding components, the overall weight of the refrigerator, the difficulty of installation work, and the effectiveness of noise reduction or blocking, depending on the installation site, installation location, and shape.

[0108] Hereinafter, each of features of the installation site, installation location, and shape (or structure) of the noise reduction unit (400) according to an embodiment of the present disclosure will be described in more detail.

[0109] First, the features of the installation site of the noise reduction unit (400) will be described with reference to FIGS. 4 to 8.

[0110] The noise reduction unit (400) may be provided on the rear wall of the cabinet (100). In particular, the noise reduction unit (400) may be provided on at least one of the rear wall of the inner casing (120) and the rear wall of the outer casing (110), or between the inner casing (120) and the outer casing (110).

[0111] As an example, the noise reduction unit (400) may be provided on the inner casing (120) constituting the cabinet (100). For instance, as shown in the accompanying FIG. 4, the noise reduction unit (400) may be provided on the inner surface of the rear wall of the inner casing (120) (the surface facing the grille fan assembly (300)), or on the outer surface of the rear wall (the surface opposite to the outer casing (110)) as shown in the accompanying FIG. 5.

[0112] When the noise reduction unit (400) is installed on the inner surface of the rear wall of the inner casing (120) in this manner, there may be the advantage of preventing the noise from directly affecting the inner

casing (120). That is, when the noise directly hits the inner casing (120), a portion of the noise may flow along the wall surface of the inner casing (120) and be transmitted to the surroundings. Because the noise reduction unit (400) can prevent such problems, in a refrigerator with a relatively large rear wall of the inner casing (120), the noise reduction unit (400) may be preferably installed on the inner surface of the rear wall of the inner casing (120).

[0113] As another example, the noise reduction unit (400) may be provided on the outer casing (110) constituting the cabinet (100). For instance, as shown in the accompanying FIG. 6, the noise reduction unit (400) may be provided on the inner surface of the rear wall of the outer casing (110) (the surface facing the inner casing (120)), or may be provided on the outer surface of the rear wall (the surface exposed indoors) as shown in the accompanying FIG. 7.

[0114] In this way, installing the noise reduction unit (400) on the outer casing (110) may have the advantage of being advantageous when the structure of the inner casing (120) is complicated. That is, since the rear wall of the inner casing (120) includes structures for connection with a cold air duct or for installing components inside the inner casing (120) (e.g., the evaporator (240), the accumulator (250), or the grille fan assembly (300)), it may be difficult to secure a sufficient area to install the noise reduction unit (400). Considering this, in a refrigerator model in which the rear wall of the inner casing (120) is relatively small, the noise reduction unit (400) may preferably be installed on the outer casing (110).

[0115] As another example, the noise reduction unit (400) may be provided between the inner casing (120) and the outer casing (110) that constitute the cabinet (100). For instance, the noise reduction unit (400) may be provided in a space between the inner casing (120) and the outer casing (110). When the insulating member (150) is provided in the space between the inner casing (120) and the outer casing (110) as shown in FIG. 8, the noise reduction unit (400) may be provided on any one wall surface of the insulating member (150).

[0116] In this way, installing the noise reduction unit (400) between the inner casing (120) and the outer casing (110) has the advantage that it can be applied without modifying the existing structures of the inner casing (120) and the outer casing (110).

[0117] Next, the features of the installation position of the noise reduction unit (400) will be described with reference to the accompanying FIGS. 9 to 12.

[0118] According to an embodiment of the present disclosure, the noise reduction unit (400) may vary in overall work difficulty, manufacturing cost, and total weight depending on its installation position, and it may be preferable to determine the installation position in consideration of the factors.

[0119] For example, although not shown, the noise reduction unit (400) may be formed to cover the entire rear wall of the cabinet (100). In this case, it is possible to

block noise transmitted from the entire rear wall of the cabinet (100) to the rear side of the refrigerator, thereby achieving the greatest noise reduction effect.

[0120] However, considering the total weight of the noise reduction unit (400) and the resulting increase in manufacturing cost, as well as the difficulty of assembly, the noise reduction unit (400) may be more preferably located only on a portion of the rear wall of the cabinet (100) by having a size thereof to be most cost-effective, minimize weight increase, and be easy to assemble.

[0121] In consideration of this, the noise reduction unit (400) may be more preferably provided only on a portion of the rear wall of the cabinet (100), as in the following example.

[0122] As an example, as shown in FIG. 9, the noise reduction unit (400) may be positioned on a portion of the rear wall of the cabinet (100) behind the blower fan (310) such that at least a portion of the noise reduction unit (400) blocks at least a portion of the blower fan (310).

[0123] This structure may be advantageous for blocking or reducing noise generated by the operation of the blower fan (310) and transmitted to the rear side of the refrigerator.

[0124] In addition, in the structure, the noise reduction unit (400) may be formed to have a height and a width greater than the blower fan (310) and may be positioned to completely block the blower fan (310). Preferably, the noise reduction unit (400) may be formed to a size sufficient to block an inlet opening (303) of the grille fan assembly (300). The inlet opening (303) may be a hole in which the blower fan (310) is located and through which air passing through the evaporator (240) flows into the grille fan assembly (300).

[0125] In addition, when the noise reduction unit (400) is arranged to block the blower fan (310), the noise reduction unit (400) may be formed to be smaller than the lateral width or the vertical height of the grille fan assembly (300).

[0126] As another example, as shown in FIG. 10, the noise reduction unit (400) may be positioned behind the refrigerant inlet pipe (241a) through which refrigerant flows into the evaporator (240) or the refrigerant outlet pipe (241b) through which refrigerant flows out of the evaporator (240), so that at least a portion of the noise reduction unit (400) blocks the refrigerant inlet pipe (241a) or the refrigerant outlet pipe (241b) of the evaporator (240).

[0127] This structure may allow the noise reduction unit (400) to advantageously block or reduce noise generated at portions, through which refrigerant flows into and out of the evaporator (240), and transmitted to the rear side of the refrigerator.

[0128] When the refrigerant inlet pipe (241a) and the refrigerant outlet pipe (241b) of the evaporator (240) are positioned adjacent to each other, the noise reduction unit (400) may be formed to a size sufficient to block both the refrigerant inlet pipe (241a) and the refrigerant outlet pipe (241b) of the evaporator (240) simultaneously.

[0129] When the blower fan (310) provided in the grille fan assembly (300) and the refrigerant inlet pipe (241a) and refrigerant outlet pipe (241b) of the evaporator (240) are positioned adjacent to each other, as shown in FIG. 10, the noise reduction unit (400) may be formed to a size sufficient to simultaneously block the blower fan (310) and the refrigerant inlet pipe (241a) and refrigerant outlet pipe (241b) of the evaporator (240).

[0130] As another example, the noise reduction unit (400) may be formed such that at least a portion thereof blocks the expansion valve (230) connected to the refrigerant inlet pipe (241a). In this case, the noise reduction unit (400) may also be formed to block the refrigerant inlet pipe (241a).

[0131] This structure may be advantageous for blocking or reducing noise generated during the expansion of refrigerant passing through the expansion valve (230) or while the expanded refrigerant flows into the evaporator (240) from being transmitted to the rear side of the refrigerator.

[0132] When the expansion valve (230) is positioned adjacent to the blower fan (310), as shown in FIG. 11, the noise reduction unit (400) may be formed to block both the expansion valve (230) and the blower fan (310) simultaneously.

[0133] As another example, the noise reduction unit (400) may be formed such that at least a portion thereof blocks the accumulator (250) connected to the refrigerant outlet pipe (241b). In this case, the noise reduction unit (400) may also be formed to block the refrigerant outlet pipe (241b).

[0134] This structure may be advantageous for blocking or reducing noise generated while refrigerant flows through the evaporator (240) to the accumulator (250) or during passage of the refrigerant through the accumulator (250) from being transmitted to the rear side of the refrigerator.

[0135] When the accumulator (250) is positioned close to the blower fan (310), the noise reduction unit (400) may be formed to block both the accumulator (250) and the blower fan (310) simultaneously.

[0136] When the accumulator (250) is positioned close to the expansion valve (230), the noise reduction unit (400) may be formed to block both the accumulator (250) and the expansion valve (230) simultaneously.

[0137] When the accumulator (250), the expansion valve (230), and the blower fan (310) are all positioned close to each other as shown in FIG. 12, the noise reduction unit (400) may be formed to block the accumulator (250), the expansion valve (230), and the blower fan (310) simultaneously.

[0138] Next, the shape (or structural) features of the noise reduction unit (400) will be described.

[0139] The noise reduction unit (400) may be preferably formed with a structure, material, or shape capable of blocking or reducing fan noise or refrigerant noise.

[0140] As one example for this purpose, the noise reduction unit (400) may be formed as a plate-shaped

member. For instance, the noise reduction unit (400) may be formed of a plate made of sound-absorbing and sound-blocking materials such as rubber, fiber, or wood. Preferably, the noise reduction unit (400) may be formed of a high-density plate to effectively block noise.

[0141] When the noise reduction unit (400) is formed as such a plate, it has the advantage of easy installation while minimizing an increase in manufacturing cost.

[0142] As another example, the noise reduction unit (400) may be formed with a structure having an air layer (401) inside, as shown in FIGS. 13 and 14.

[0143] When the noise reduction unit (400) is manufactured with this structure, the air layer (401) formed in the noise reduction unit (400) may allow the corresponding noise reduction unit (400) to be made as light as possible and provides the advantage that noise passing through the noise reduction unit (400) may be reduced by the air layer (401).

[0144] The noise reduction unit (400) may be formed as a plate with a portion formed to provide the air layer (401). That is, the rear wall of the cabinet (100) and the noise reduction unit (400) with the formed portion together may constitute a double-wall structure so that the air layer (401) is provided therebetween. In this case, the opening of the formed portion may be configured to be closed by using the wall surface of the cabinet (100). For example, by bringing the opening of the formed portion into close contact with the wall surface of the cabinet (100) to close the opening, the noise reduction unit (400) having the air layer (401) formed therein may be provided.

[0145] The wall surface, which closes the opening of the formed portion, may be the outer or inner surface of the outer casing (110) constituting the cabinet (100). That is, considering that the installation area of the noise reduction unit (400) on the rear wall surface of the inner casing (120) may be insufficient for the connection of various cold air ducts (not shown), the noise reduction unit (400) may be provided on the outer casing (110).

[0146] In particular, the formed noise reduction unit (400) may be formed to protrude rearward from the outer surface of the outer casing (110) or to protrude from the inner surface of the outer casing (110) toward the inner casing (120).

[0147] In addition, as shown in FIGS. 15a to 15c, the formed noise reduction unit (400) may be provided to the outer casing (110) in a state where the formed portion of the noise reduction unit (400) is closed with a separate closing member (420).

[0148] In addition, the air layer (401) formed in the noise reduction unit (400) may be formed as a single space or as multiple spaces. For example, multiple protruding or recessed portions may be formed in the noise reduction unit (400) to be partitioned from each other so that the air layer (401) is provided as multiple spaces. Through this, a noise reduction effect may be further improved.

[0149] Moreover, the multiple protruding or recessed

portions may be formed in a regular arrangement so that the noise reduction effect may be uniformly achieved. For example, the multiple protruding or recessed portions may be formed in a structure in which circular or polygonal shapes (see FIGS. 16 and 18), elliptical shapes, or track shapes (see FIGS. 17 and 18) are regularly arranged.

[0150] Next, an example of a method for installing the noise reduction unit (400) will be described.

[0151] As one example, the noise reduction unit (400) may be provided separately from the rear wall of the cabinet (100) (i.e., the rear wall of the inner casing (120) and the rear wall of the outer casing (110)) and may be fixed to the rear wall of the cabinet (100).

[0152] The fixing may be performed by various methods such as adhesive, tape, screw or bolt fastening, welding, hooks, or riveting.

[0153] As another example, the noise reduction unit (400) may be formed integrally with the rear wall of the cabinet (100) (i.e., the rear wall of the inner casing (120) and the rear wall of the outer casing (110)). For example, the noise reduction unit (400) may be formed by molding the rear wall of the inner casing (120) or by molding the rear wall of the outer casing (110). Of course, the noise reduction unit (400) may also be formed by molding both the inner casing (120) and the outer casing (110) together.

[0154] As another example, the noise reduction unit (400) may be installed on the rear wall of the cabinet (100) by using a separate installation member. For example, a separate structure may be formed on the rear wall of the inner casing (120), on the rear wall of the outer casing (110), or between the inner casing (120) and the outer casing (110) to accommodate the noise reduction unit (400), and the noise reduction unit (400) may be mounted on the structure for installation.

[0155] Thus, the noise reduction unit (400) may be provided on the rear wall of the cabinet (100) in various ways.

[0156] Next, an example of how the noise reduction unit (400) may be applied according to the type of refrigerator will be described.

[0157] As one example, in a type of refrigerator in which the a plurality of storage compartments (121) is provided but only a single evaporator (240) is provided, the noise reduction unit (400) may be provided on at least one of the following locations on the rear wall of the cabinet (100): behind the blower fan (310), behind the accumulator (250), behind the expansion valve (230), or at the refrigerant inlet pipe (241a) or refrigerant outlet pipe (241b) of the evaporator (240), or the noise reduction unit (400) may be provided to simultaneously block at least two of these locations. This is the same as the aforementioned embodiments.

[0158] As another example, as shown in FIG. 19, in a type of refrigerator in which a plurality of storage compartments (121) is provided and the evaporator (240) and the grille fan assembly (300) are provided for each of the

storage compartments (121), the noise reduction unit (400) may be provided for each of the storage compartments (121) on the rear wall of the cabinet (100). In this case, the plurality of storage compartments (121) may be provided in the vertical direction of the cabinet (100) or in the horizontal direction of the cabinet (100).

[0159] When a distance between the noise reduction units (400) installed respectively for the storage compartments (121) is close, a single noise reduction unit (400) may be configured to simultaneously block or reduce noise transmitted directly rearward from two storage compartments (121).

[0160] When each of the storage compartments (121) has an elongated vertical structure such that the positions of the blower fan (310) and the refrigerant inlet pipe (241a) and refrigerant outlet pipe (241b) of the evaporator (240) are spaced apart, a plurality of noise reduction units (400) may be provided and installed behind respective noise-generating portions.

[0161] As another example, in a type of refrigerator in which two or more blower fans (310) are provided together in a single grille fan assembly (300), the noise reduction unit (400) may be formed to block each of the blower fans (310) either simultaneously or separately.

[0162] In this case, the noise reduction unit (400) may also be formed to block at least one of the accumulator (250), the expansion valve (230), and the refrigerant inlet pipe (241a) and refrigerant outlet pipe (241b) of the evaporator (240).

[0163] As described above, according to the refrigerator having the noise reduction unit (400) of the present disclosure, noise transmitted to the rear side of the refrigerator may be blocked or reduced, thereby reducing user complaints caused by noise.

[0164] In addition, according to the refrigerator of the present disclosure, the noise reduction unit (400) may be provided only at a localized position considering components generating noise toward the rear side, thereby achieving maximum noise reduction effect at a minimum position.

[0165] In addition, according to the refrigerator of the present disclosure, the noise reduction unit (400) may reduce noise transmitted from the blower fan (310) to the rear side of the refrigerator, thereby reducing user complaints caused by noise generated during the operation of the blower fan (310).

[0166] In addition, according to the refrigerator of the present disclosure, the noise reduction unit (400) may reduce noise transmitted from the expansion valve (230) to the rear side of the refrigerator, thereby reducing user complaints caused by noise generated during the operation of the expansion valve (230).

[0167] In addition, according to the refrigerator of the present disclosure, the noise reduction unit (400) may reduce noise transmitted from the accumulator (250) to the rear side of the refrigerator, thereby reducing user complaints caused by noise generated during the operation of the accumulator (250).

[0168] In addition, according to the refrigerator of the present disclosure, the noise reduction unit (400) may reduce refrigerant flow noise generated at a connection portion between the refrigerant inlet pipe (241a) of the refrigerant pipe (241) constituting the evaporator (240) and the expansion valve (230), or at a connection portion between the refrigerant outlet pipe (241b) and the accumulator (250).

[0169] In addition, according to the refrigerator of the present disclosure, the noise reduction unit (400) may effectively block or reduce noise transmitted to the rear side of the refrigerator even with a minimal size due to structural characteristics thereof.

[0170] In addition, according to the refrigerator of the present disclosure, the noise reduction unit (400) may block noise in the audible frequency range of fan noise and refrigerant flow noise, thereby reducing user complaints caused by the noise.

[0171] That is, as shown in the graph evaluating insulation performance for rear noise of the refrigerator in FIG. 20, it may be clearly seen that in the case of the refrigerator to which the noise reduction unit (400) of the present disclosure is applied, the sound insulation performance is improved at 700 Hz or higher, compared to a conventional refrigerator in which only an insulation material was provided. The graph shows transmission loss results measured by using an impedance tube, comparing transmission loss at each Hz range.

[0172] In addition, as shown in the graph evaluating the noise of the refrigerator in FIG. 21, it may be seen that in the case of the refrigerator to which the noise reduction unit (400) of the present disclosure is applied, baseline noise in a band equal to or below 2kHz is reduced, compared to a conventional refrigerator in which only an insulation material was provided. The graph compares noise level (PWL) at each Hz range between the conventional refrigerator without the noise reduction unit (400) and the refrigerator with the noise reduction unit (400) applied.

[0173] As described above, although all the components constituting the embodiment according to the present disclosure have been described as being combined into a single unit or operating in combination, the present disclosure is not necessarily limited to such embodiments. That is, within the scope and spirit of the present disclosure, all the components may operate by being selectively combined into one or more units. In addition, the terms "include," "comprise," or "have," as used herein, unless otherwise specifically stated, imply that the relevant component may be present, and therefore should be construed to include other components rather than to exclude other components. All terms, including technical or scientific terms, unless otherwise defined, have the same meaning as commonly understood by those skilled in the art to which the present disclosure belongs. Commonly used terms, such as terms defined in the dictionary, should be interpreted to be consistent with their contextual meanings in the relevant technology and

should not be interpreted in an idealized or overly formal sense unless expressly defined in the present disclosure.

[0174] The foregoing description is merely illustrative of the technical idea of the present disclosure, and it will be understood by those skilled in the art that various modifications and variations may be made without departing from the essential characteristics of the present disclosure. Accordingly, the embodiments disclosed herein are not intended to limit the technical idea of the present disclosure, but rather to explain it, and the scope of the technical idea of the present disclosure is not limited by such embodiments. The scope of protection of the present disclosure shall be interpreted on the basis of the following claims, and all technical ideas falling within the equivalent scope thereof shall be construed as being included within the scope of rights of the present disclosure.

Claims

1. A refrigerator comprising:

a cabinet comprising an inner casing constituting an inner wall surface thereof and an outer casing constituting an outer wall surface thereof; an evaporator provided inside the inner casing and configured to receive refrigerant through a refrigerant pipe for heat exchange; and a grille fan assembly provided inside the inner casing and comprising at least one blower fan configured to operate so that air passes through the evaporator and is blown into a storage compartment, wherein the cabinet is provided with a noise reduction unit configured to block transmission of noise to a rear side thereof.

2. The refrigerator of claim 1, wherein the noise reduction unit is provided on an inner wall surface of the inner casing.

3. The refrigerator of claim 1, wherein the noise reduction unit is provided on one wall surface between the inner casing and the outer casing.

4. The refrigerator of claim 1, wherein the noise reduction unit is provided on an outer wall of the outer casing.

5. The refrigerator of claim 1, wherein an insulating member is provided between the inner casing and the outer casing, and the noise reduction unit is positioned between the inner casing and the insulating member or between the insulating member and the outer casing.

6. The refrigerator of claim 1, wherein the noise reduc-

tion unit is positioned on a portion of a rear wall of the cabinet behind the blower fan and is formed so that at least a portion of the noise reduction unit blocks the blower fan.

7. The refrigerator of claim 1, wherein the noise reduction unit is positioned behind a refrigerant inlet pipe through which refrigerant flows into the evaporator or behind a refrigerant outlet pipe through which refrigerant flows out of the evaporator, and is formed so that at least a portion of the noise reduction unit blocks the refrigerant inlet pipe or the refrigerant outlet pipe of the evaporator.

8. The refrigerator of claim 7, wherein the refrigerant inlet pipe and the refrigerant outlet pipe of the evaporator are arranged to be adjacent to each other on one side portion of an upper portion of the evaporator, and

the noise reduction unit is positioned on a portion of a rear wall of the cabinet behind the refrigerant inlet pipe and the refrigerant outlet pipe of the evaporator and is formed to a size sufficient to simultaneously block the refrigerant inlet pipe and the refrigerant outlet pipe.

9. The refrigerator of claim 7, wherein the noise reduction unit is formed to have a height and a width sufficient to also block the blower fan.

10. The refrigerator of claim 7, wherein an expansion valve, which expands refrigerant supplied to the evaporator, is connected to the refrigerant inlet pipe of the evaporator inside the inner casing, wherein the noise reduction unit is formed so that at least a portion thereof blocks the expansion valve.

11. The refrigerator of claim 7, wherein an accumulator, which separates refrigerant liquid from refrigerant gas passing through the evaporator and supplied to a compressor, is provided in the refrigerant outlet pipe of the evaporator inside the inner casing, wherein the noise reduction unit is formed so that at least a portion thereof blocks the accumulator.

12. The refrigerator of claim 1, wherein the noise reduction unit is formed as a plate-shaped member and is attached and fixed to a rear wall of the cabinet.

13. The refrigerator of claim 1, wherein the noise reduction unit is formed to protrude outward from a rear wall surface of the outer casing.

14. The refrigerator of claim 1, wherein the noise reduction unit is formed to be recessed inward from a rear wall surface of the outer casing.

15. The refrigerator of claim 1, wherein the noise reduc-

tion unit is formed to have an air layer sealed from an external environment.

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【FIG. 1】

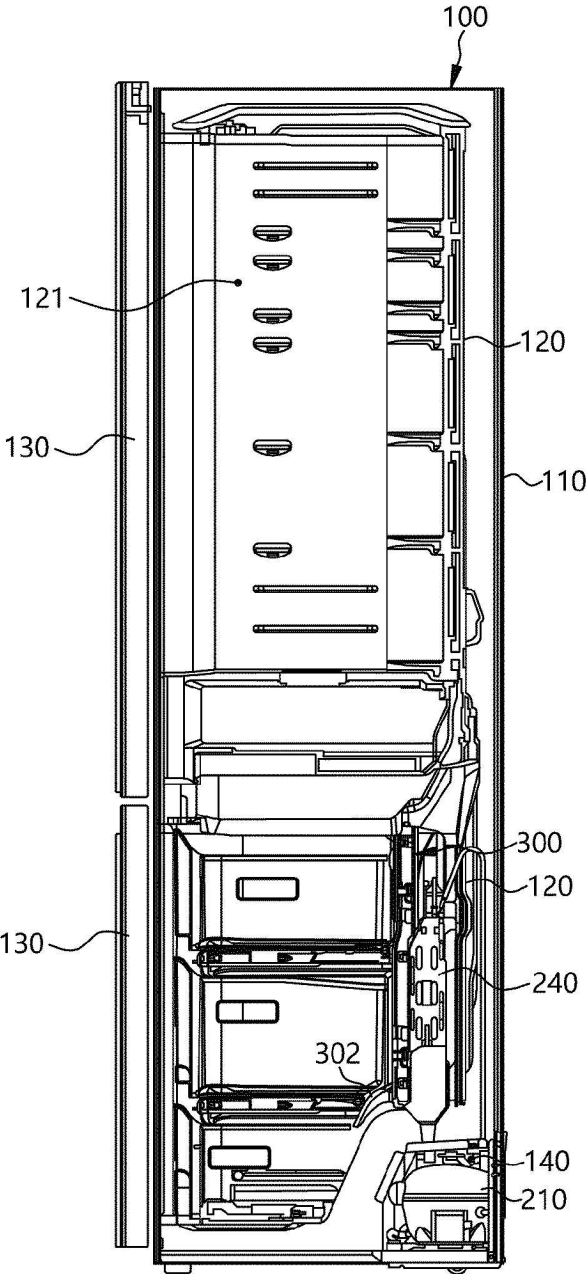


Fig. 2

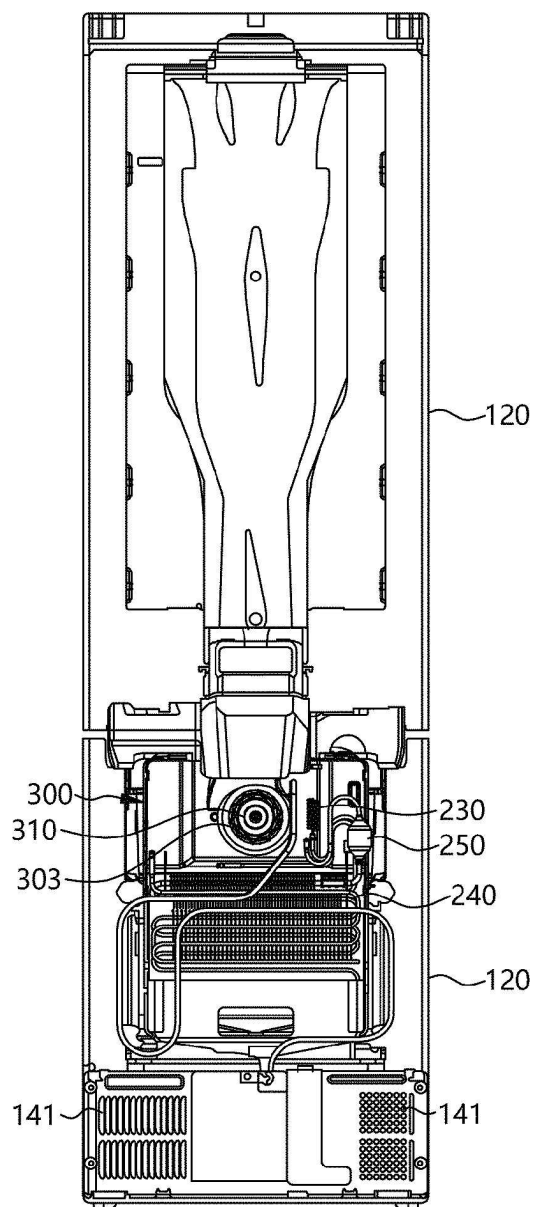


Fig. 3

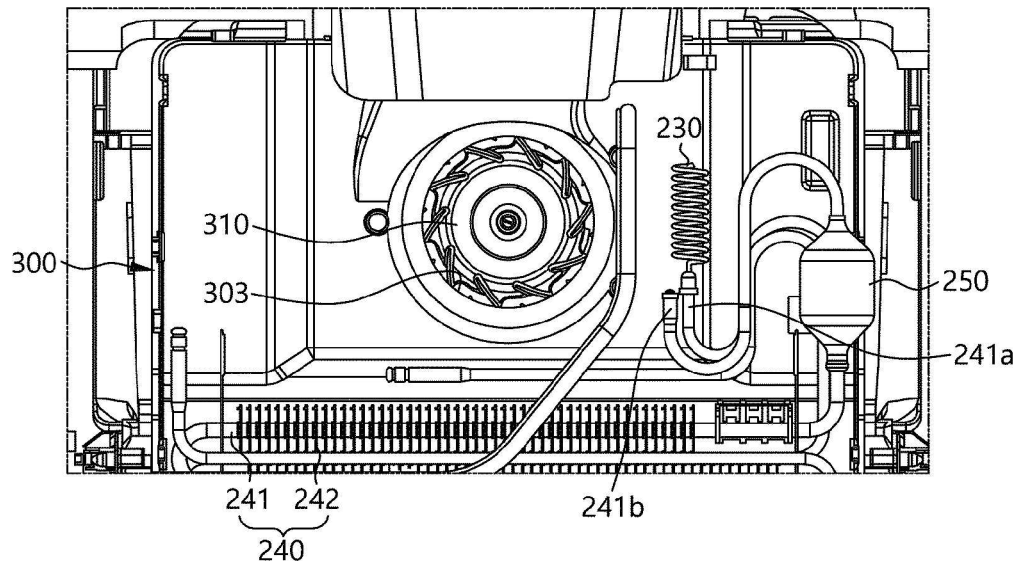


Fig. 4

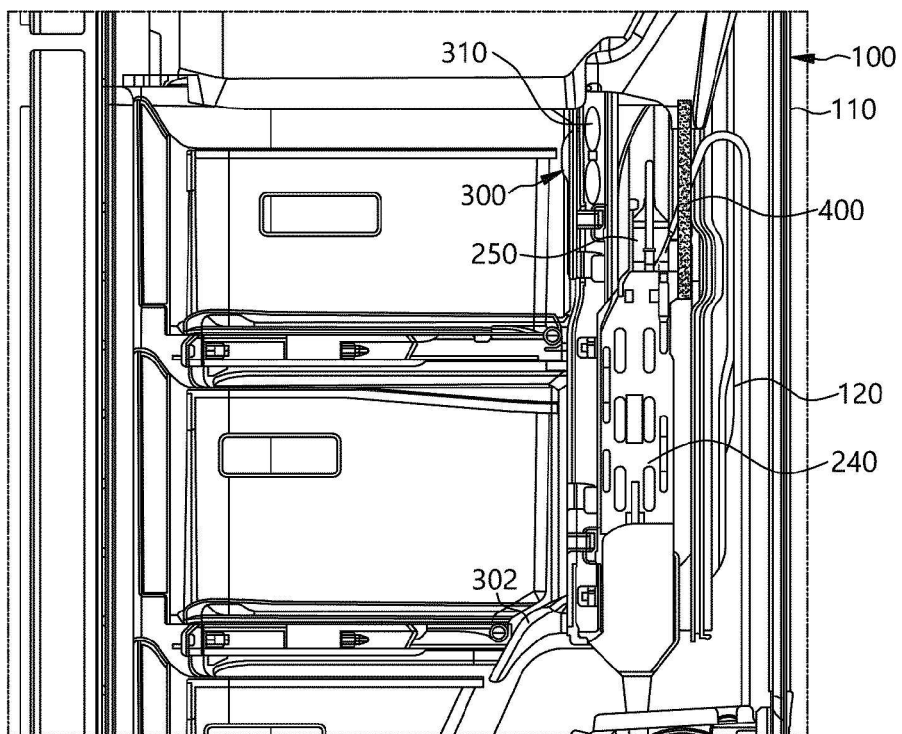


Fig. 5

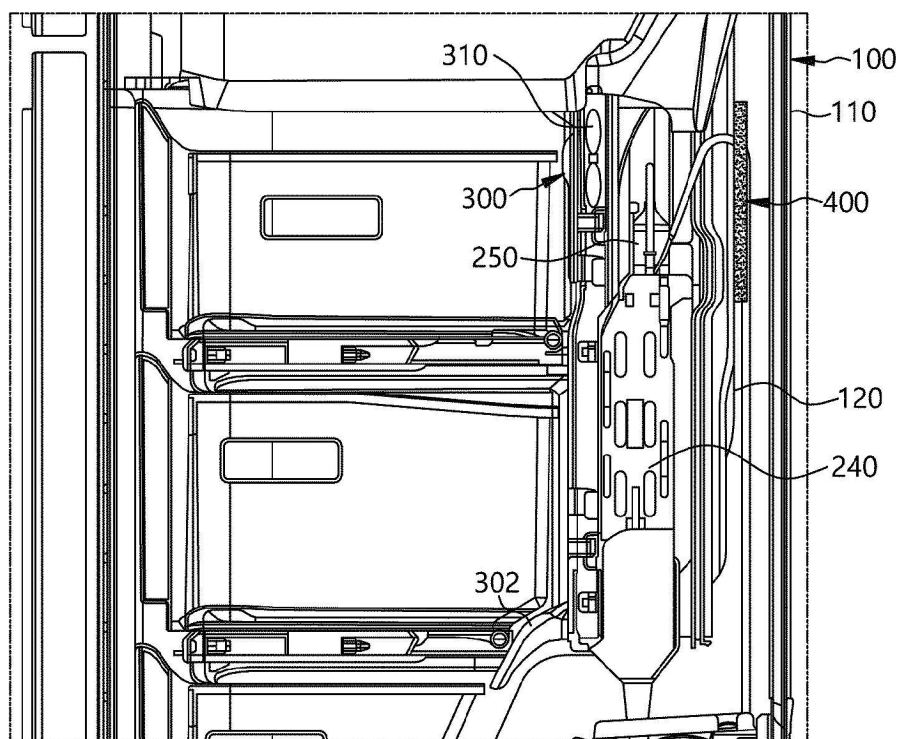


Fig. 6

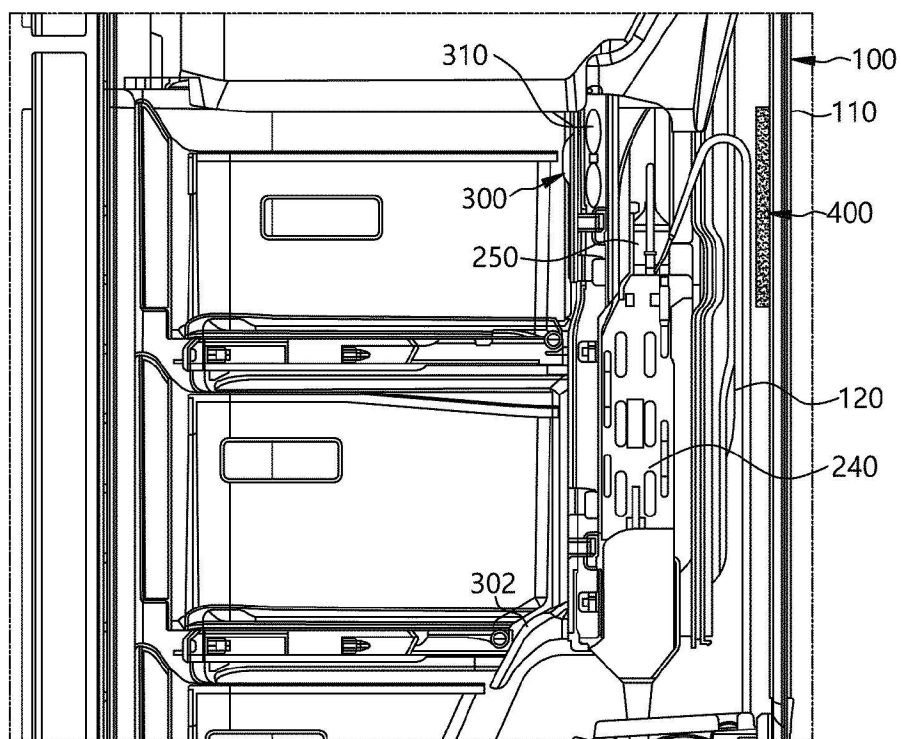


Fig. 7

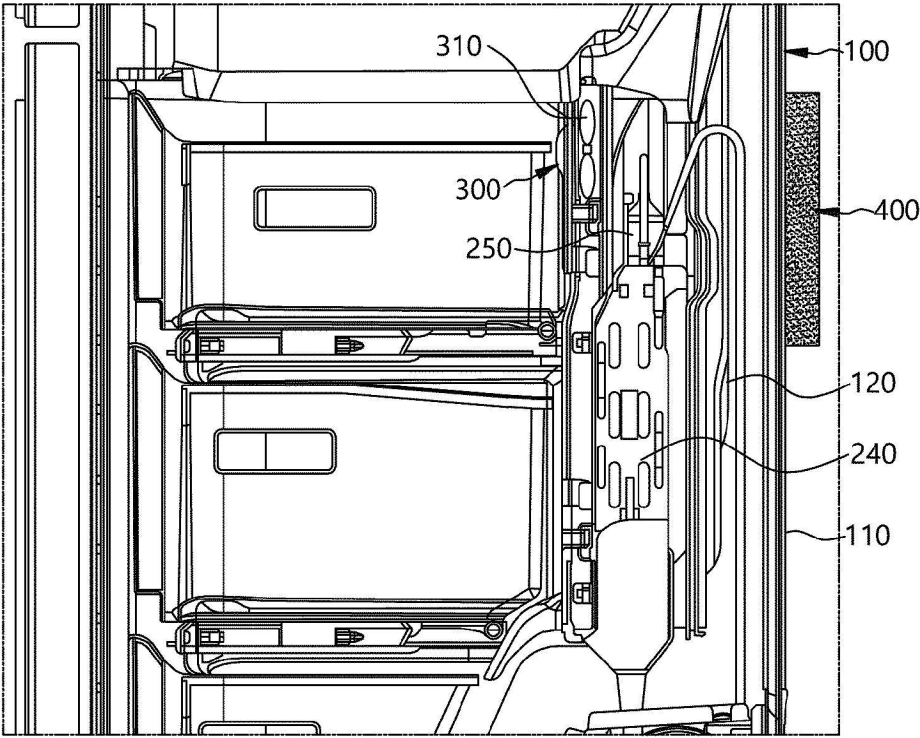


Fig. 8

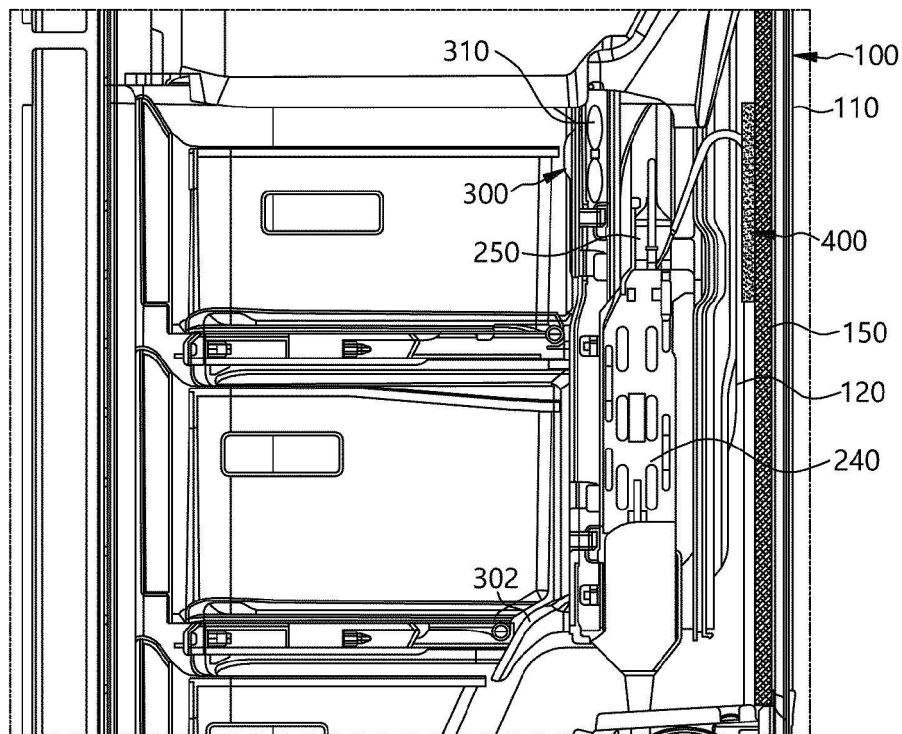


Fig. 9

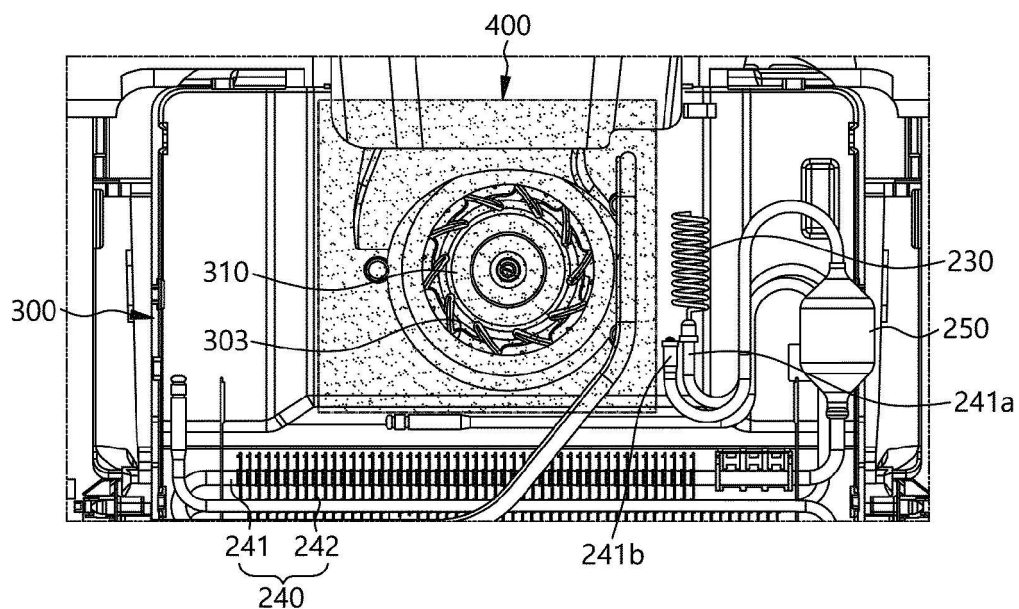


Fig. 10

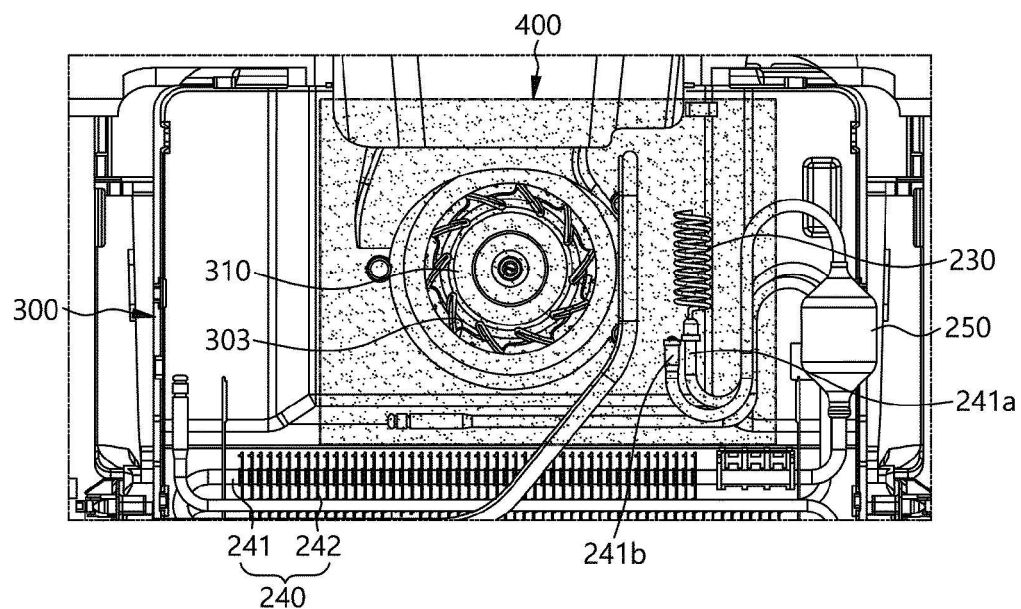


Fig. 11

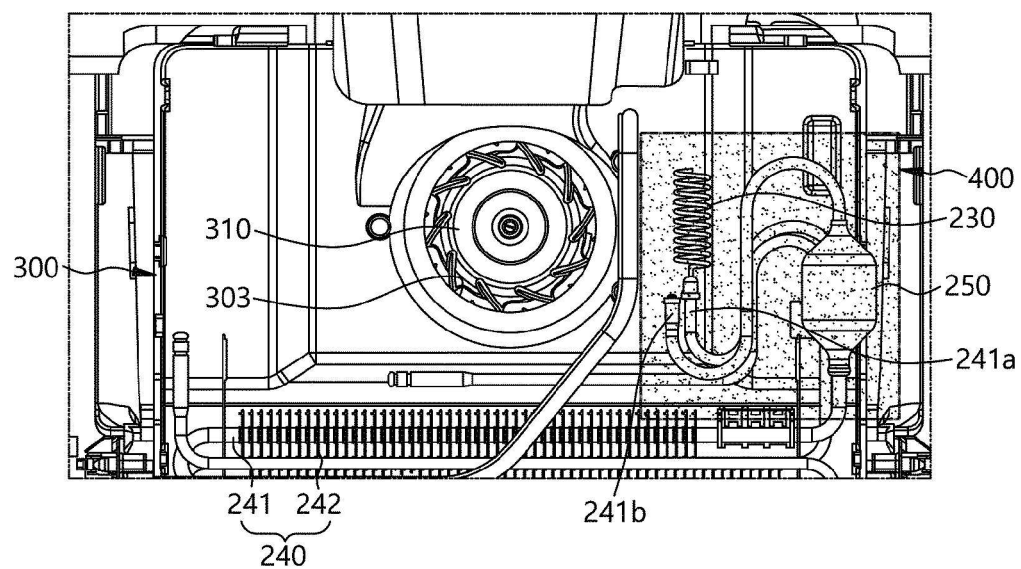


Fig. 12

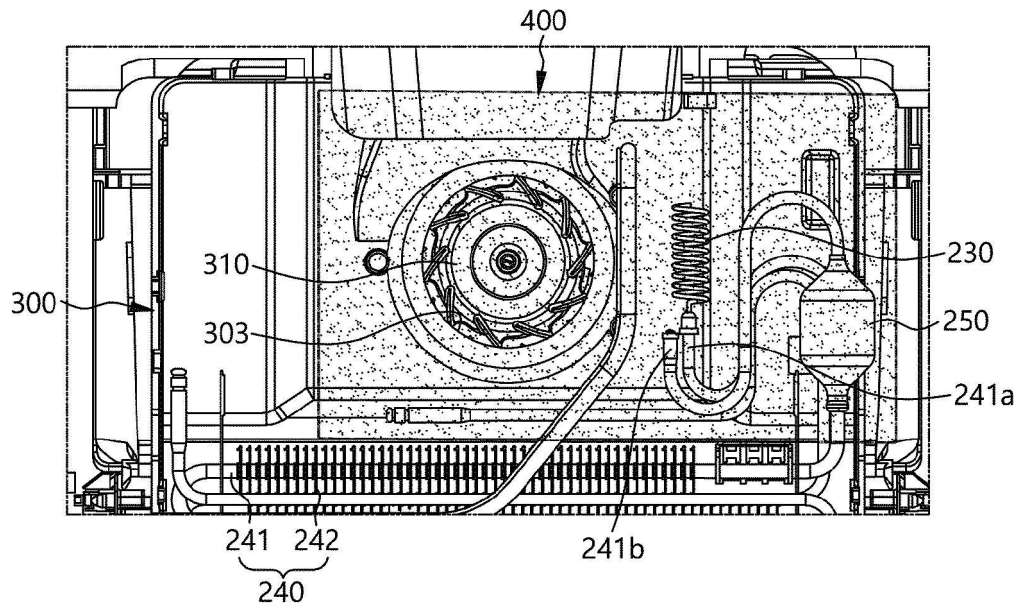


Fig. 13

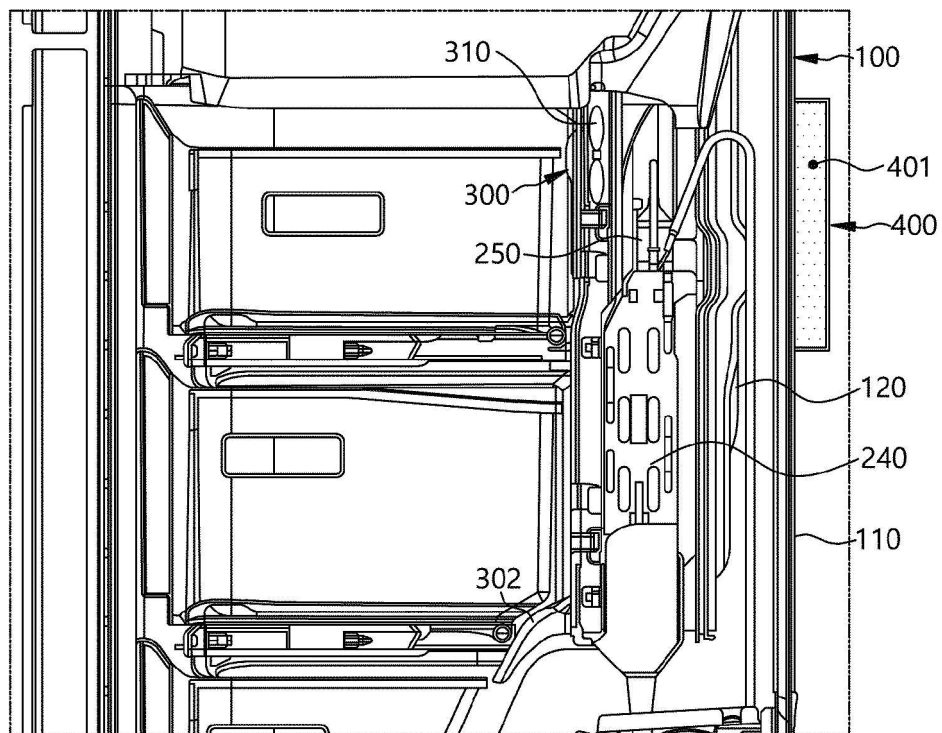


Fig. 14

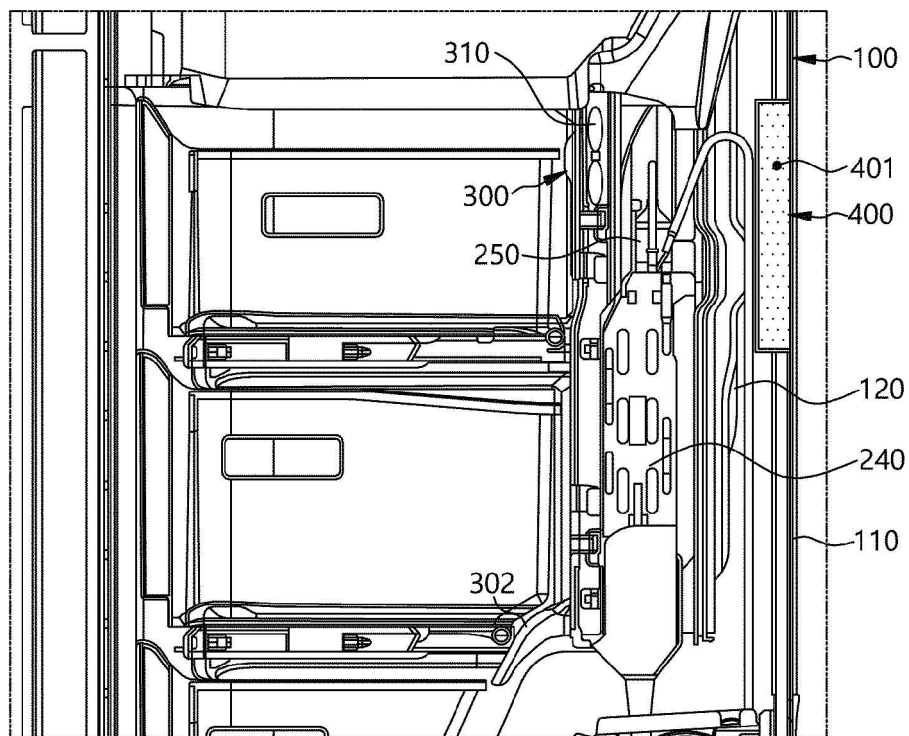


Fig. 15

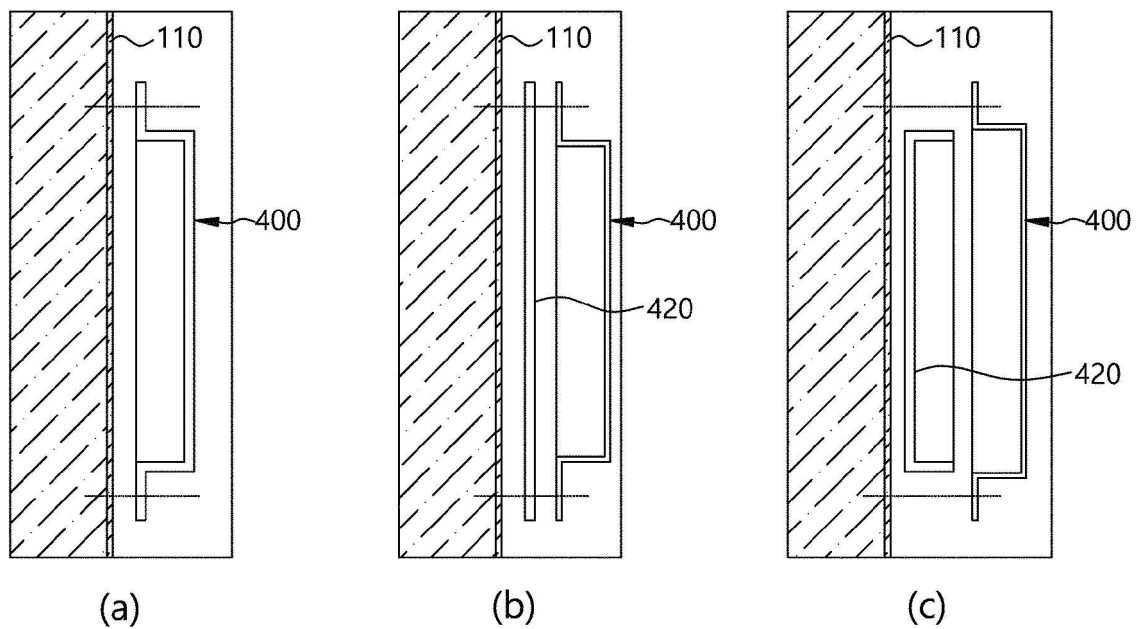


Fig. 16

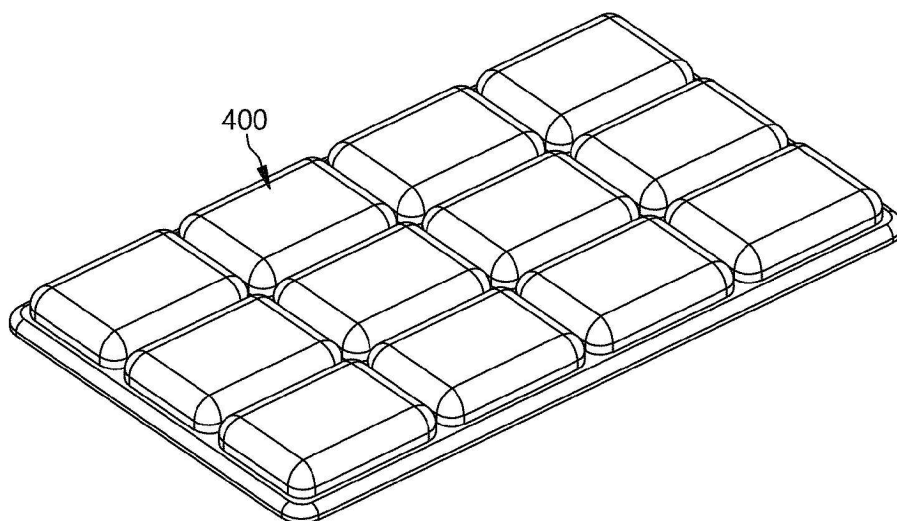


Fig. 17

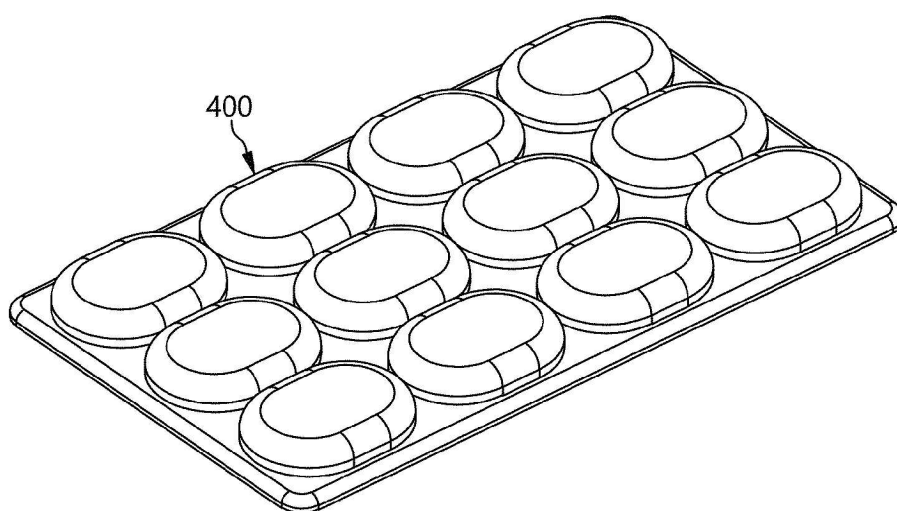


Fig. 18

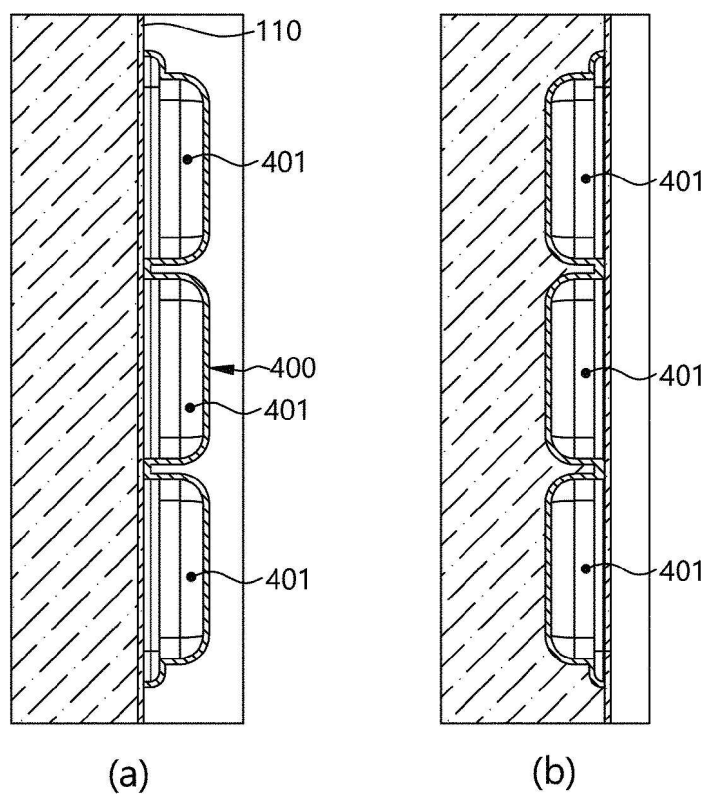


Fig. 19

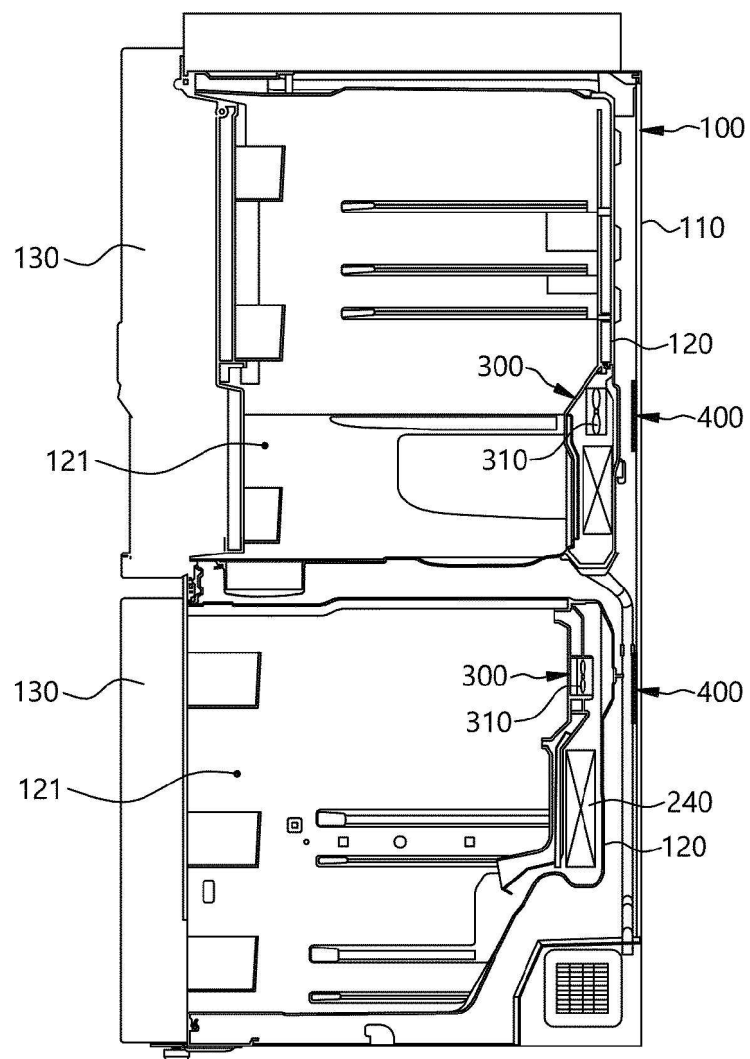


Fig. 20

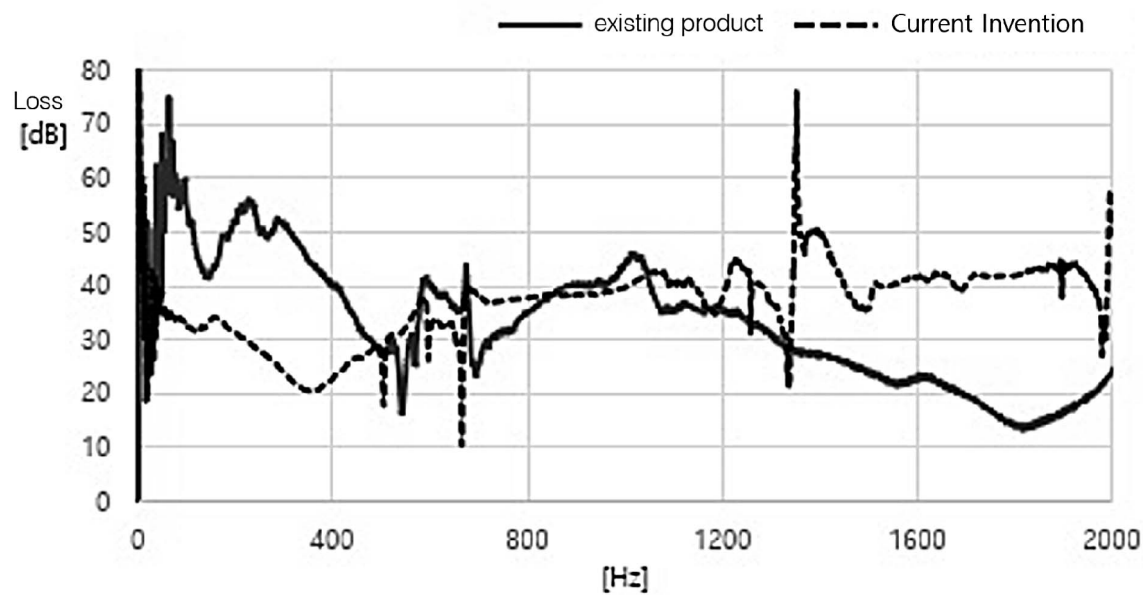
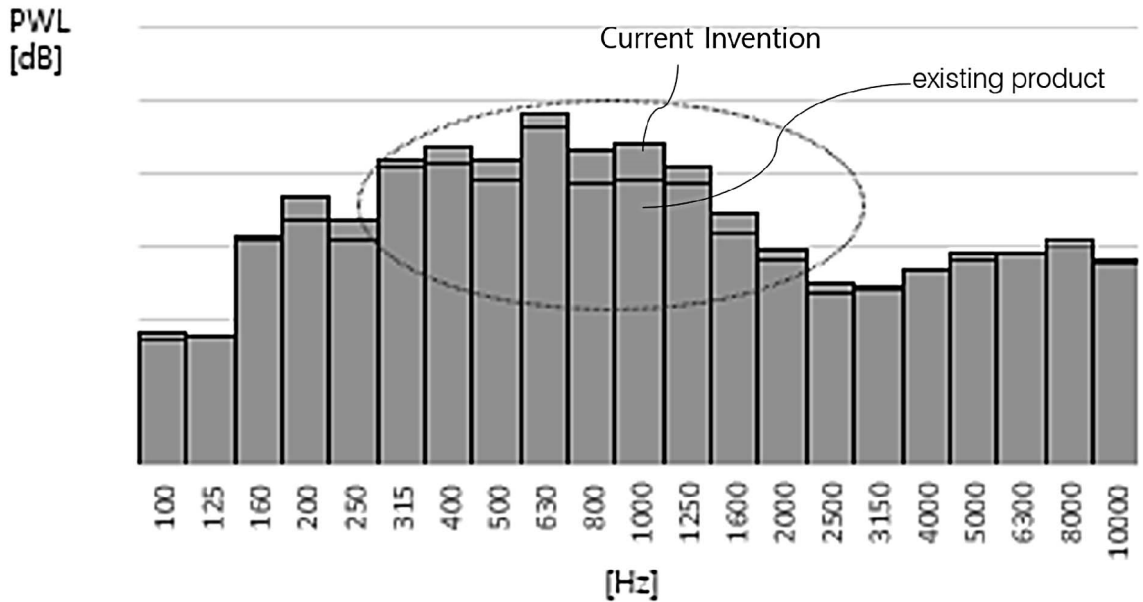


Fig. 21



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2023/019803

A. CLASSIFICATION OF SUBJECT MATTER**F25D 23/06**(2006.01)i; **F25D 19/00**(2006.01)i; **F25D 17/06**(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F25D 23/06(2006.01); F25B 43/00(2006.01); F25D 17/06(2006.01); F25D 17/08(2006.01); F25D 19/00(2006.01);
F25D 23/00(2006.01)

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

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

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

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

eKOMPASS (KIPO internal) & keywords: 냉장고(refrigerator), 이너 케이스(inner case), 아웃 케이스(outer case), 증발기
(evaporator), 소음 저감(noise reduction)**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 09-026249 A (MATSUSHITA REFRIGERATION CO., LTD.) 28 January 1997 (1997-01-28) See paragraphs [0014]-[0022] and figures 1-2.	1,3,5-6
Y		2,4,7-15
Y	KR 10-0833947 B1 (SAMSUNG ELECTRONICS CO., LTD.) 30 May 2008 (2008-05-30) See paragraph [0057] and figure 5.	2
Y	JP 06-018194 Y2 (SHARP CORP.) 11 May 1994 (1994-05-11) See figure 1.	4,7-12
Y	KR 10-2021-0058239 A (LG ELECTRONICS INC.) 24 May 2021 (2021-05-24) See paragraphs [0131]-[0137] and figures 7 and 13-15.	7-11
Y	KR 10-1998-0003408 A (DAEWOO ELECTRONICS CO., LTD.) 30 March 1998 (1998-03-30) See claim 1 and figures 2-3.	13-14

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

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“D” document cited by the applicant in the international application

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

31 May 2024

Date of mailing of the international search report

03 June 2024

Name and mailing address of the ISA/KR

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Authorized officer

Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2023/019803

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 20-0114926 Y1 (SAMSUNG ELECTRONICS CO., LTD.) 18 April 1998 (1998-04-18) See page 2, figure 2.	15
X	KR 10-0402612 B1 (LG ELECTRONICS INC.) 17 October 2003 (2003-10-17) See paragraphs [0002]-[0004] and [0011]-[0025] and figures 1 and 3-4b.	1,3,5
A	KR 20-0217537 Y1 (SAMSUNG ELECTRONICS CO., LTD.) 02 April 2001 (2001-04-02) See paragraphs [0012]-[0030] and figures 1-5.	1-15

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