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(54) **REFRIGERATOR**

(57) A refrigerator is provided with: a thermal insulation box having a storage chamber and an opening connected to the storage chamber; and a refrigeration cycle for refrigerating the storage chamber. The walls configuring the thermal insulation box are configured so as to have a thermal insulation member sandwiched between an interior member and an exterior member. The exterior member of at least one of the walls has a projection projecting outward from the storage chamber or a recess sinking inward into the storage chamber. A heat-dissipating pipe that configures a section of the refrigeration cycle is positioned so as to contact the projection or recess at a location between the exterior member and the interior member.

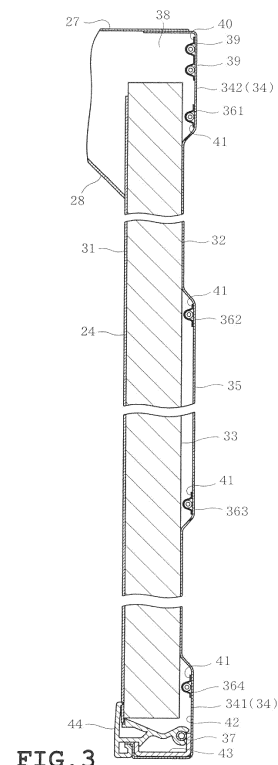


FIG. 3

EP 2 789 938 A1

Description**Brief Description of the Drawings****Technical Field****[0007]**

[0001] Embodiments of the present invention relate to a refrigerator.

Background Art

[0002] A refrigerator has been recently disclosed in which a radiating pipe constituting a part of refrigerating cycle is disposed in a wall of an insulation box.

Prior Art Document**Patent Document****[0003]**

Patent Document 1: Japanese Patent No. 2728318
Patent Document 2: Japanese Patent Application Publication No. JP-A-2011-80692

Summary of the Invention**Problem to be overcome by the Invention**

[0004] However, when the refrigerator is installed with a wall of the insulation box being in close vicinity to a room wall, heat fills a space around the radiating pipe, resulting in a possibility of reduction in a heat radiation efficiency.

[0005] Therefore, an object is to provide a refrigerator in which a radiating pipe is disposed in a wall of an insulation box and which can suppress a reduction in the radiating efficiency of the radiating pipe even when the refrigerator is installed with the wall of the insulation box being in close vicinity to the room wall.

Means for Overcoming the Problem

[0006] According to one embodiment, a refrigerator includes an insulation box having a storage compartment and an opening communicating with the storage compartment and a refrigerating cycle which refrigerates an atmosphere in the storage compartment. The insulation box includes a plurality of walls constructed of an inner member, an outer member and an insulating member provided between the inner member and the outer member. At least one of the walls has a convex portion formed on the outer member and protruding outward with respect to the storage compartment or a concave portion formed in the outer member and recessed inward with respect to the storage compartment. A radiating pipe is provided between the inner member and the outer member so as to be adjacent to the convex portion or the concave portion, the radiating pipe constituting a part of the refrigerating cycle.

FIG. 1 is a perspective view of a refrigerator in accordance with a first embodiment as viewed from right front;
FIG. 2 is a perspective view of a heat insulation box as viewed from right front;
FIG. 3 is a transverse section taken along line A-A in FIG. 2;
FIG. 4 is an enlarged transverse section of a middle convex portion and its periphery in FIG. 3;
FIG. 5 is an enlarged transverse section of a front peripheral convex portion and its periphery in FIG. 3;
FIG. 6 is a view similar to FIG. 3, showing a second embodiment;
FIG. 7 is a view similar to FIG. 3, showing a third embodiment;
FIG. 8 is a view similar to FIG. 3, showing a fourth embodiment;
FIG. 9 is a perspective view of the insulation box of a refrigerator in accordance with a fifth embodiment as viewed from right rear;
FIG. 10 is a transverse section taken along line B-B in FIG. 9;
FIG. 11 is a view similar to FIG. 10, showing a sixth embodiment;
FIG. 12 is a view similar to FIG. 9, showing a seventh embodiment; and
FIG. 13 is a transverse section taken along line C-C in FIG. 12.

Best Mode for Carrying Out the Invention

[0008] A plurality of embodiments of refrigerators will be described with reference to the drawings. Substantially identical parts are labeled by the same reference symbols throughout the embodiments and redundant description of these parts will be eliminated.

First Embodiment

[0009] A first embodiment will be described with reference to FIGS. 1 to 5. Referring to FIG. 1, a refrigerator 10 is mainly constructed of a heat insulation box 11. A refrigerating cycle (not shown) is incorporated in the refrigerator 10. The refrigerating cycle includes a compressor, a condenser and an evaporative cooler. The insulation box 11 is formed into a rectangular box shape and has an open side. In the following description, the open side of the insulation box 11 corresponds with a front of the refrigerator 10.

[0010] The insulation box 11 has an interior divided into storage compartments belonging to a refrigeration temperature zone and storage compartments belonging to a freezing temperature zone. More specifically, a refrigerating compartment 12 is defined in an uppermost

interior of the insulation box 11, and a vegetable compartment 13 is defined below the refrigerating compartments 12, as shown in FIG. 1. An ice-making compartment 14 and a small freezing compartment 15 are defined below the vegetable compartment 13 in juxtaposition. A freezing compartment 16 is defined below the ice-making and small freezing compartments 14 and 15 or in a lowermost interior of the insulation box 11.

[0011] The refrigerating compartment 12 and the vegetable compartment 13 belong to the refrigeration temperature zone or a positive (+) temperature zone. The refrigerating compartment 12 and the vegetable compartment 13 are normally set to different temperatures. For example, a retention temperature of the refrigerating compartment 12 is set to range from 1° to 5°, and a retention temperature of the vegetable compartment 13 is set to range from 2° to 6° and is thus set to be slightly higher than of the refrigerating compartment 12. Further, the ice-making compartment 14, the small freezing compartment 15 and the freezing compartment 16 belong to the freezing temperature zone or a negative (-) temperature zone. A retention temperature of each of the compartments 14 to 16 is set to range from -10° to -20°. Atmospheres in the refrigerating compartment 12, the vegetable compartment 13, the ice-making compartment 14, the small freezing compartment 15 and the freezing compartment 16 are refrigerated by the refrigerating cycle so as to be in the respective temperature zones.

[0012] The front opening of the insulation box 11 communicates with the storage compartments 12 to 16. Articles to be stored are put through the opening into the storage compartments 12 to 16. A plurality of insulation doors is provided on the front of the insulation box 11 to open and close the front opening. More specifically, refrigerating compartment insulation doors 17 and 18 constituting a clamshell door are provided on the front of the refrigerating compartment 12. The doors 17 and 18 are rotated in the right-left direction about right and left hinges 171 and 181 serving as rotation axes respectively, thereby opening and closing the refrigerating compartment 12.

[0013] A pullout vegetable compartment insulation door 19 is provided on the front of the vegetable compartment 13. The door 19 opens and closes the vegetable compartment 13 and is provided with a vegetable container (not shown) mounted on the back side or inside thereof. A pullout ice-making compartment insulation door 20 is provided on the front of the ice-making compartment 14. The door 20 opens and closes the ice-making compartment 14 and is provided with an ice container (not shown) mounted on the back side or inside thereof. A small freezing compartment insulation door 21 is provided on the front of the small freezing compartment 15. The door 21 opens and closes the small freezing compartment 15 and is provided with a storage container (not shown) mounted on the back side or inside thereof. A freezing compartment insulation door 22 is provided on the front of the freezing compartment 16. The door 22 opens and closes the freezing compartment 15 and is

provided with a storage container (not shown) mounted on the back side or inside thereof.

[0014] The insulation box 11 is formed into a box shape with an open front by combining a plurality of divided insulation walls together. More specifically, as shown in FIG. 2, the insulation box 11 is constructed by combining a left insulation wall 23, a right insulation wall 24, a ceiling insulation wall 25, a bottom insulation wall 26 and a rear insulation wall 27 together. In this case, the left insulation wall 23 forms a left wall. The right insulation wall 24 forms a right wall. The ceiling insulation wall 25 forms a ceiling wall. The bottom insulation wall 26 forms a bottom wall. The rear insulation wall 27 forms a rear wall.

[0015] The insulation walls 23 to 27 are fixed to one another by fixing members 28, 29 and the like. In this case, the ceiling insulation wall 25 is formed into a shape such that a rear part thereof is lower than a front part thereof, as shown in FIG. 9. A component chamber 30 is formed by the lower part and a part surrounded by the left insulation wall 23 and the right insulation wall 24. The compressor constituting the refrigerating cycle and other components are housed in the component chamber 30 although the details of the component chamber 30 are not shown.

[0016] The walls constituting the insulation box 11, namely, the insulation walls 23 to 27 have insulation members between inner members and outer members respectively. In this case, the inner members constitute an inner surface of the insulation box 11, and the outer members constitute an outer surface of the insulation box 11. The right insulation wall 24 will now be described. The right and left insulation walls 24 and 23 are constructed in the same manner with only exception that the walls are disposed bilaterally symmetrically.

[0017] The right insulation wall 24 includes a vacuum insulation panel 33 serving as an insulating member and interposed between an inner member 31 and an outer member 32, as shown in FIG. 3. The inner member 31 is made of synthetic resin such as ABS resin and is formed into a substantially flat plate shape. The outer member 32 is made, for example, by processing a steel plate and formed into a plate shape as a whole. The outer member 32 has a plurality of convex portions 34 and 35 as shown in FIGS. 1 and 2. The outer member 32 has an outer periphery bent to the storage compartment 12-16 side as shown in FIG. 3. A heat radiating pipe 36 is provided inside the right insulation wall 24 so as to be adjacent to the convex portions 34 and 35. The radiating pipe 36 constitutes a part of the refrigerating cycle.

[0018] The outer member 32 is formed with a peripheral convex portion 34 and a middle convex portion 35 as shown in FIGS. 2 and 3. The peripheral convex portion 34 and the middle convex portion 35 each function as a convex portion. The peripheral convex portion 34 and the middle convex portion 35 each protrude from the storage compartments 12 to 16, namely, to the side opposed to the inner member 31. As shown in FIG. 2, the peripheral convex portion 34 is formed along a peripheral edge

of the outer member 32, surrounding the outer periphery of the outer member 32. The peripheral convex portion 34 includes a front peripheral convex portion 341, a rear peripheral convex portion 342, an upper peripheral convex portion 343 and a lower peripheral convex portion 344. The middle peripheral convex portion 35 is connected to the lower peripheral convex portion 344 of the peripheral convex portion 34 and is formed into a vertically long rectangular shape. The middle convex portion 35 is lateral to the storage compartments 14 to 16 belonging to the freezing temperature zone or, in this case, is located on the right of the storage compartments 14 to 16.

[0019] The peripheral convex portion 34 and the middle peripheral convex portion 35 are formed by drawing press of the plate-shaped outer member 32 or the steel plate in this case. Further, the peripheral convex portion 34 and the middle peripheral convex portion 35 have substantially the same amount of protrusion, which is set to range from 3 to 5 mm in the embodiment. The rectangular middle convex portion 35 has a width or the dimension in the front-back direction that is set to about one-third of the width of the right insulation wall 24, namely, the dimension in the front-back direction.

[0020] The radiating pipe 36 includes a part located inside the right insulation wall 24, namely, between the inner member 31 and the outer member 32. The part is adjacent to the peripheral convex portion 34 and the middle convex portion 35. The radiating pipe 36 constitutes a part of the refrigerating cycle (not shown). In the embodiment, the radiating pipe 36 constitutes a part or a whole of the condenser provided between the compressor and the cooler of the refrigerating cycle. The radiating pipe 36 is constructed of a single continuous copper pipe, for example. Refrigerant discharged from the compressor is caused to flow so that heat of the refrigerant is radiated.

[0021] The radiating pipe 36 is caused to meander so as to go through the inside of the right insulation wall 24 as shown in FIG. 2. More specifically, the radiating pipe 36 extends from the compressor (not shown) provided in the component chamber 30, entering the inside of the right insulation wall 24 from the upper rear end of the right insulation wall 24. The radiating pipe 36 then extends downward along the rear peripheral convex portion 342 of the peripheral convex portion 34. The radiating pipe 36 is thereafter bent forward at a lower end of the rear peripheral convex portion 342, further extending forward along the lower peripheral convex portion 344 of the peripheral convex portion 34. The radiating pipe 36 includes a halfway portion which extends along the peripheral edge of the middle convex portion 35 and again extends forward along the lower peripheral convex portion 344 of the peripheral convex portion 34. The radiating pipe 36 is then bent upward at a front end of the lower peripheral convex portion 344, further extending upward along the front peripheral convex portion 341. The radiating pipe 36 is subsequently bent rearward at an upper end of the front peripheral convex portion 341, extending

rearward along the upper peripheral convex portion 343.

[0022] The radiating pipe 36 thus goes through the inside of the right insulation wall 24 and thereafter exits from the upper rear end of the right insulation wall 24 to the component chamber 30 side. Subsequently, the radiating pipe 36 is connected, by welding or the like, to one end of another radiating pipe which has the same construction as the radiating pipe 36 and is provided in the left insulation wall 23, although the radiating pipe is not shown. The other end of the radiating pipe provided in the left insulation wall 23 is connected to the cooler (not shown).

[0023] The construction of the inside of the right insulation wall 24 will now be described with reference to FIGS. 4 and 5. Radiating pipes 361 to 364 which will be described later show transverse sections of the radiating pipe 36 at different positions respectively and therefore constitute the continuous single radiating pipe 36.

[0024] The rear part of the right insulation wall 24 will be first described. Referring to FIG. 3, the radiating pipe 361 is provided inside the rear peripheral convex portion 342, extending downward along the rear peripheral convex portion 342. Further, a space 38 is defined in a connection of the right insulation wall 24 and the rear insulation wall 27 in the rear of the radiating pipe 361 and the vacuum insulation panel 33 on the rear of the right insulation wall 24. Two suction pipes 39 are provided in the space 38 and constitute a part of the piping connecting from the cooler to the compressor. Cooled refrigerant discharged from the cooler (not shown) is caused to flow through the suction pipes 39. In this case, the two suction pipes 39 are fixed to the inside of the rear peripheral convex portion 342 of the peripheral convex portion 34 by a metal tape 40 such as aluminum tape. A radiating material such as sponge or urethane foam may be provided in the space 38, whereby the suction pipes 39 may be fixed.

[0025] Describing a middle part of the right insulation wall 24, the radiating pipes 362 and 363 extend through the inside of the middle convex portion 35 between the vacuum insulation panel 33 and the outer member 32. The radiating pipe 362 extends upward along the rear of the middle convex portion 35. The radiating pipe 363 extends downward along the front of the middle convex portion. The radiating pipes 362 and 363 are provided so as to be adjacent inside the middle convex portion 35.

[0026] Describing a front of the right insulation wall 24, the radiating pipe 364 extends through the inside of the front peripheral convex portion 341 between the vacuum insulation panel 33 and the outer member 32. The radiating pipe 364 extends upward along the front peripheral convex portion 341. The radiating pipe 364 is provided so as to be adjacent inside the front peripheral convex portion 341. In this case, the radiating pipes 361 to 364 are fixed to the outer member 32 by a metal tape 41 such as aluminum tape, for example.

[0027] A storage part 42 is formed in a front part of the right insulation wall 24 so as to be surrounded by the

inner member 31, the outer member 32 and the vacuum insulation panel 33, as shown in FIG. 5. The storage part 42 communicates with a space defined between the inner member 31 and the outer member 32. The storage part 42 further has an insertion hole 421 formed between the inner member 31 and the outer member 32. A dew proofing pipe 37 and a reinforcing member 43 are housed in the storage part 42, and a sealing member 44 is provided so as to close the insertion hole 421. In this case, the dew proofing pipe 37 is inserted through the insertion hole 421 into the storage part 42.

[0028] The dew proofing pipe 37 constitutes a part of the piping connecting from the compressor to the radiating pipe 36 or from the radiating pipe 36 to the cooler. The dew proofing pipe 37 is constructed of components differing from those of the radiating pipe 36. High temperature refrigerant compressed by the compressor is caused to flow into the dew proofing pipe 37 in the same manner as the radiating pipe 36. As a result, a peripheral part of the opening of the insulation box 11 is warmed, whereby dew condensation in the opening periphery can be suppressed.

[0029] The reinforcing member 43 is made of a steel plate, for example, and reinforces a front end of the right insulation wall 24. The reinforcing member 43 is bent along an inner surface of the front end of the outer member 32 so as to be opened at the rear side, thereby being formed into a U-shape. The reinforcing member 43 extends along the front end of the right insulation wall 24 in the up-down direction. The reinforcing member 43 is bonded or fixed by a screw (not shown) to the outer member 32.

[0030] The sealing member 44 is made of a material having a lower heat conductivity than the outer member 32, such as synthetic resin or hard rubber, by pultrusion or extrusion. The sealing member 44 holds the dew proofing pipe 37 and closes the insertion hole 421 thereby to connect the inner and outer members 31 and 32.

[0031] More specifically, the sealing member 44 has a holding portion 441 on one end thereof. The holding portion 441 holds the dew proofing pipe 37 so as to wrap it. In this case, a part of the dew proofing pipe 37 is exposed from the holding portion 441 to be in contact with the reinforcing member 43. In other words, the dew proofing pipe 37 is in direct contact with the reinforcing member 43 and in indirect contact with the outer member 32 via the reinforcing member 43. As a result, the dew proofing pipe 37 can indirectly warm the outer member 32.

[0032] The sealing member 44 further has a closing portion 442 and claws 443 and 444 all provided at the side opposed to the holding portion 441. The inner member 31 is held between the closing portion 442 and the claw 443, and the outer member 32 is held between the closing portion 442 and the claw 444. The sealing member 44 still further has an elastic deforming portion 445 between the holding portion 441 and the closing portion 442. The elastic deforming portion 445 is elastically deformable in a thickness direction of the vacuum insulation

panel 33 with the result that the sealing member 44 can allow error in the thickness of the vacuum insulation panel 33 occurring during manufacture of the vacuum insulation panel 33.

[0033] The vacuum insulation panel 33 is formed into a plate shape and bonded to the inner member 31 and the outer member 32 by a resin adhesive such as hot melt. In this case, the vacuum insulation panel 33 is bonded to the outer member 32 while being spaced from the peripheral convex portion 34 and the middle convex portion 35, as shown in FIG. 3. Further, the vacuum insulation panel 33 is spaced from the radiating pipe 36 and the metal tape 41 and is accordingly out of contact with the radiating pipe 36 and the metal tape 41.

[0034] The vacuum insulation panel 33 is constructed by putting a core material 45 into an enclosure 46 and evacuating the enclosure 46 so that the interior of the enclosure 46 is depressurized and sealed. The core material 45 is constituted by a laminated material of inorganic fiber such as glass wool, shaped into a plate shape. The enclosure 46 is made by superposing two laminate films having gas barrier properties and welding peripheries of the films thereby to be formed into a plate shape. In this case, the enclosure 46 comprises two types of laminate films having different properties, that is, an inner laminate film 461 and an outer laminate film 462 in this case.

[0035] The inner laminate film 461 and the outer laminate film 462 are made by sandwiching a layer to obtain the gas barrier properties, namely, a metal layer between resin films and further stacking a plurality of types of resin films. The inner laminate film 461 and the outer laminate film 462 have different properties depending upon which one of an aluminum foil layer and a vapor-deposited aluminum layer is the metal layer to obtain the gas barrier properties. Describing the differences between the aluminum foil layer and the vapor-deposited aluminum layer, a film thickness of the vapor-deposited aluminum layer can be rendered thinner than the aluminum foil layer since aluminum is generally deposited on a film serving as a base material in a vacuum in the vapor-deposited aluminum layer. Accordingly, the vapor-deposited aluminum layer has a lower heat conductivity than the aluminum foil layer and is superior in the heat insulation performance to the aluminum foil layer. On the other hand, since the aluminum foil layer is made by sandwiching aluminum foil formed by rolling, for example, between two films and by laminating the aluminum foil, the aluminum foil layer is rendered thinner than the vapor-deposited aluminum layer. As a result, the aluminum foil layer is superior in the gas barrier properties and the durability performance to the vapor-deposited aluminum layer.

[0036] In the embodiment, the inner laminate film 461 located at the inner member 31 side has a vapor-deposited aluminum layer as the metal layer to obtain the gas barrier properties. On the other hand, the outer laminate film 462 located at the outer member 32 side has an aluminum foil layer as the metal layer to obtain the gas

barrier properties. In this case, the vacuum insulation panel 33 includes a side which is located at the radiating pipe 36 side and has an aluminum foil laminate superior in the durability performance. This reduces damage of the vacuum insulation panel 33 due to the contact with the radiating pipe 36. Further, the vacuum insulation panel 33 includes a side which is located at the storage compartments 12-16 side and has a vapor-deposited aluminum layer which has a low heat conductivity and is superior in the insulation performance. This suppresses heat bridge that cold air in the storage compartments 12 to 16 flows through a surface of the enclosure 46 of the vacuum insulation panel 33 from the inner member 31 side to the outer member 32 side.

[0037] The enclosure 46 is made by superposing two laminate films having gas barrier properties and welding peripheries of the films thereby to be formed into the bag shape. In this case, the vacuum insulation panel 33 has an outer edge formed with a welding lug 463 with the periphery of the enclosure 46 protruding from the core material 45. The lug 463 is folded back to be placed inside the front peripheral convex portion 341 which serves as a front edge of the right insulation wall 24. The lug 463 is fixed along a surface of the outer laminate film 462 located at the outer member 32 side, by an adhesive agent, a metal tape or the like although this is not shown in detail. In this case, the lug 463 is spaced from the radiating pipe 36 and the metal tape 41. The lug 463 is also spaced from the outer member 32. Accordingly, a stepped portion 464 resulting from folding the lug 463 back is not in contact with the outer member 32.

[0038] According to the above-described construction, the insulation wall forming the opening of the insulation box includes the left insulation wall 23, the right insulation wall 24, the ceiling insulation wall 25 and the bottom insulation wall 26. Of these insulation walls, at least the right and left insulation walls 23 and 24 have the peripheral convex portions 34 protruding out of the storage compartments 12 to 16 and the middle convex portions 35 in the outer member 32. The radiating pipe 36 constituting a part of the refrigerating cycle is provided in contact with the insides of the peripheral convex portion 34 and the middle convex portion 35 between the outer and inner members 32 and 31.

[0039] According to this, for example, when the refrigerator 10 is installed so that the right lateral thereof or the lateral surface of the right insulation wall 24, in this case, is in contact with a room wall or the like, the peripheral convex portion 34 and the middle convex portion 35 are brought into contact with the room wall, so that a space is defined between the room wall and a part of the right insulation wall 24 provided with no peripheral convex portion 34 and the middle convex portion 35. In other words, an entire lateral surface of the right insulation wall 24 is not brought into contact with the room wall, whereupon a space for heat radiation is ensured around the radiating pipe 36. This can suppress a reduction in the radiating efficiency due to the heat filling the space

around the radiating pipe 36 even when the refrigerator 10 is installed so that the right insulation wall 24 forming the right surface thereof is in close proximity to or in contact with the room wall or the like. The left insulation wall 23 having the same construction as the right insulation wall 24 can achieve the same effect as described above.

[0040] The refrigerator 10 includes the vacuum insulation panel 33 serving as the insulating member of the right insulation wall 24. The vacuum insulation panel 33 is bonded to the outer member 32 thereby to be fixed while being spaced from the peripheral convex portion 34 and the middle convex portion 35. This can reduce contact of the vacuum insulation panel 33 with the radiating pipe 36 adjacent to the peripheral convex portion 34 and the middle convex portion 35. As a result, the vacuum insulation panel 33 can maintain a high insulation performance.

[0041] The radiating pipe 36 is located between the vacuum insulation panel 33 and the peripheral and middle convex portions 34 and 35 and fixed to the outer member 32 by the metal tape 41. The vacuum insulation panel 33 is spaced from the radiating pipe 36 and the metal tape 41. This can reduce heat which is generated by the radiating pipe 36 and transmitted directly or through the metal tape 41 to the vacuum insulation panel 33. This can suppress heat bridge that cold air in the storage compartments 12 to 16 flows through a surface of the enclosure 46 of the vacuum insulation panel 33 from the inner member 31 side to the outer member 32 side, thereby reducing inflow of heat to the storage compartments 12 to 16.

[0042] The radiating pipe 36 is provided along the insides of the peripheral convex portion 34 and the middle convex portion 35. Accordingly, the radiating pipe 36 can be arranged along the peripheral convex portion 34 and the middle convex portion 35 during the manufacture of the refrigerator 10. This can render the mounting of the radiating pipe 36 to the outer member 32 easier than in the case where the outer member 32 is of a flat shape without the peripheral convex portion 34 and the middle convex portion 35 with the result that the working efficiency can be improved.

[0043] The peripheral convex portion 34 and the middle convex portion 35 are formed by the drawing of the plate-shaped outer member 32. Accordingly, the outer member 32 increases the strength in a part thereof in the periphery of the peripheral convex portion 34 and the middle convex portion 35 as the result of work hardening due to the drawing. Further, a second moment of area of the whole outer member 32 is increased by the forming of the peripheral convex portion 34 and the middle convex portion 35 with the result of an increase in the strength of the whole outer member 32 in the bending direction.

[0044] The front peripheral convex portion 341 which is a part of the peripheral convex portion 34 is provided on the edge of the right insulation wall 24 located at the opening side of the insulation box 11, namely, on the front edge of the right insulation wall 24. According to

this, the edge of the right insulation wall 24 located at the opening side of the insulation box 11. or the front edge of the right insulation wall 24 is not connected to any other insulation wall and particularly requires strength. The strength of the front edge of the right insulation wall 24 can be increased.

[0045] The reinforcing member 43 is provided along the front edge of the right insulation wall 24 inside the front peripheral convex portion 341. According to this, the strength of the front edge of the right insulation wall 24 can be further increased.

[0046] The vacuum insulation panel 33 includes the core material 45 and the enclosure 46 into which the core material 45 is put. The enclosure 46 has the bonding lug 463 protruding around the core material 45. The lug 463 is folded back to the outer member 32 side thereto to be put into the front peripheral convex portion 341 of the peripheral convex portion 34. In this case, the stepped portion resulting from folding the lug 463 back is out of contact with the outer member 32. Accordingly, no space is defined by the stepped portion 464 between the outer member 32 and the vacuum insulation panel 33. This can maintain a desirable bonding property between the outer member 32 and the vacuum insulation panel 33. Further, the stepped portion 464 is prevented from standing out in its shape when the stepped portion 464 is adjacent to the outer member 32. Accordingly, an appearance of the outer member 32, namely, the design of the refrigerator 10 can be kept desirable.

[0047] The vacuum insulation panel 33 is provided while the inner laminate film 461 including the deposited aluminum layer is located at the inner member 31 side and the outer laminate film 462 is located at the outer laminate film 462 including the aluminum foil layer. This can effectively suppress the heat bridge that cold air in the storage compartments 12 to 16 flows through a surface of the enclosure 46 of the vacuum insulation panel 33 from the inner member 31 side to the outer member 32 side. Still further, the outer laminate film 462 superior in the durability can effectively protect the vacuum insulation panel against damage due to contact with the radiating pipe 36, or the like.

[0048] The radiating pipe 36 is also provided inside the middle convex portion 35 which is lateral to the storage compartments 14 to 16 in the freezing temperature zone. According to this, the sides of the storage compartments 14 to 16 belonging to the freezing temperature zone in which the cooling temperature is lower can be warmed by the heat of the radiating pipe 35. Even if the vacuum insulation panel 33 is damaged with the result that the insulation performance thereof is lowered, the outer member 32 is cooled by cold air from the storage compartments 14 to 16 in the freezing temperature zone, whereupon dew condensation can be suppressed on the periphery of outer member 32.

[0049] The above-described effects are particularly effective when the right and left insulation walls 24 and 23 have respective thicknesses equal to or smaller than 35

mm. In the embodiment, the vacuum insulation panel 33 has the thickness of about 20 mm and a total thickness of the inner member 31 and the outer member 32 is about 1.5 mm. A total thickness of the vacuum insulation panel 33, the inner member 31 and the outer member 32 or the thickness of each one of the insulation walls 23 and 24 is 21.5 mm. Thus, each insulation wall has a further effective thickness equal to or smaller than 25 mm.

10 Second Embodiment

[0050] A second embodiment will be described with reference to FIG. 6. In the second embodiment, the outer member 32 is formed with a first middle convex portion 47 and a second middle convex portion 48, instead of the middle convex portion 35 in the first embodiment. The first and second middle convex portions 47 and 48 have respective widths or front-back dimensions which are set to be slightly larger than the outer diameter of the radiating pipe 36. In this case, an upwardly extending radiating pipe 362 is passed through an interior of the first middle convex portion 47, and a downwardly extending radiating pipe 363 is passed through an interior of the second middle convex portion 48.

[0051] According to this, the second embodiment can achieve the same advantageous effect as the first embodiment. Further, for example, when the refrigerator 10 is installed with the outer surface of the right insulation wall 24 being adjacent to the room wall or the like, a space is also defined between the first and second middle convex portions 47 and 48. This can ensure a further larger space for the radiating pipes 364 and 365. Accordingly, a reduction in the radiating efficiency due to heat filling the space around the radiating pipe 36 can be suppressed more effectively even when the refrigerator 10 is installed so that the wall of the insulation box 11 is in close proximity to or in contact with the room wall or the like.

40 Third Embodiment

[0052] A third embodiment will be described with reference to FIG. 7. In the third embodiment, the outer member 32 is formed with a peripheral concave portion 49 and a middle concave portion 50 both serving as the convex portions, instead of the peripheral convex portion 34 and the middle convex portion 35 in the first embodiment. The peripheral concave portion 49 and the middle concave portion 50 are formed to be recessed inward with respect to the storage compartments 12 to 16, that is, to the inner member 31 side. In this case, the peripheral concave portion 49 includes a front peripheral concave portion 491, a rear peripheral concave portion 492, an upper peripheral concave portion and a lower peripheral concave portion the latter two of which are not shown. The front and rear peripheral concave portions 491 and 492 and the upper and lower peripheral concave portions are formed along the peripheral edge of the outer mem-

ber 32 so as to surround the outer member 32 in the same manner as the peripheral convex portion 34. Further, the middle concave portion 50 is connected to the lower peripheral concave portion of the peripheral concave portion 49 and formed into a vertically long rectangular shape in the same manner as the middle convex portion 35. The middle concave portion 50 is also located sideways with respect to the storage compartments 14 to 16 in the freezing temperature zone or in the right of the storage compartments 14 to 16.

[0053] The vacuum insulation panel 33 further has a peripheral escape portion 51 and a middle escape portion 52 both formed by recessing the surface of the vacuum insulation panel 33 at the outer member 32 side. The peripheral escape portion 51 and the middle escape portion 52 are formed using a die simultaneously with the molding of the core material 45, for example. In this case, the peripheral escape portion 51 is formed along the configuration of the peripheral concave portion 49 and includes a front peripheral escape portion 511, a rear peripheral escape portion 512, an upper peripheral escape portion and a lower peripheral escape portion the latter two of which are not shown. Further, the middle escape portion 52 is formed along the configuration of the middle concave portion 50.

[0054] The radiating pipe 361 is provided between the rear peripheral escape portion 512 of the vacuum insulation panel 33 and the rear peripheral concave portion 492 of the outer member 32 so as to be adjacent to the inside of the rear peripheral concave portion 492. The radiating pipe 362 is provided between the middle escape portion 52 of the vacuum insulation panel 33 and the middle concave portion 50 of the outer member 32 so as to be adjacent to the rear inside of the middle concave portion 50. The radiating pipe 363 is provided between the middle escape portion 52 of the vacuum insulation panel 33 and the middle concave portion 50 of the outer member 32 so as to be adjacent to the front inside of the middle concave portion 50. The radiating pipe 364 is provided between a front peripheral escape portion 511 of the vacuum insulation panel 33 and a front peripheral concave portion 491 of the outer member 32 so as to be adjacent to the inside of the front peripheral concave portion 491.

[0055] The radiating pipe 36 is fixed by the metal tape 41 such as aluminum tape in the same manner as in the first embodiment. The vacuum insulation panel 33 is spaced from the peripheral concave portion 49 and the middle concave portion 50 and bonded to the inner member 31 and the outer member 32 thereby to be fixed. The vacuum insulation panel 33 is also spaced from the radiating pipe 36 and the metal tape 41.

[0056] According to the above-described construction, the third embodiment can achieve the same advantageous effect as the first embodiment. Further, the outer member 32 requires no convex portions protruding out of the storage compartments 12 to 16. Accordingly, an increase in the thickness of the right insulation wall 24

can be suppressed even though the radiating pipe 36 is disposed in the interior of the right insulation wall 24. This can achieve space saving in the whole refrigerator 10.

5 Fourth Embodiment

[0057] A fourth embodiment will be described with reference to FIG. 8. In the fourth embodiment, the outer member 32 is formed with a first middle concave portion 53 and a second middle concave portion 54, instead of the middle concave portion 50 in the third embodiment. The first middle concave portion 53 and the second middle concave portion 54 have respective widths or front-back dimensions which are set to be slightly larger than the outer diameter of the radiating pipe 36. In this case, the radiating pipe 362 is passed through an interior of the first middle concave portion 53, and the radiating pipe 363 is passed through an interior of the second middle concave portion 54. The vacuum insulation panel 33 is formed with a first middle escape portion 55 and a second middle escape portion 56, instead of the middle escape portion 52 in the third embodiment. The first middle escape portion 55 and a second middle escape portion 56 are formed along the first middle concave portion 53 and the second middle concave portion 54 respectively. The vacuum insulation panel 33 is spaced from the radiating pipe 36 and the metal tape 41 and also spaced from the peripheral concave portion 49, the first middle concave portion 53 and the second middle concave portion 54.

[0058] According to the above-described construction, the fourth embodiment can achieve the same advantageous effect as the third embodiment. Further, the vacuum insulation panel fills a space between the first middle concave portion 53 and the second middle concave portion 54. Accordingly, even when a concave portion is formed in the vacuum insulation panel 33, a part of the vacuum insulation panel 33 where the thickness thereof is decreased can be reduced as much as possible. As a result, the reduction in the insulation performance in the whole right insulation wall 24 can be suppressed as much as possible.

Fifth Embodiment

[0059] A fifth embodiment will be described with reference to FIGS. 9 and 10. In the fifth embodiment, the insulation box 11 of the refrigerator 10 has a rear convex portion 60 serving as the convex portion. The rear convex portion 60 is provided along a peripheral edge of the rear insulation wall 27 in a rear wall not defining the opening of the insulation box 11, namely, the rear insulation wall 27. The rear convex portion 60 includes first rear convex portions 601 and a second rear convex portion 602 as shown in FIG. 9. The first rear convex portions 601 are provided on right and left edges of the rear insulation wall 27, extending downward from the component chamber 30 side, respectively. The second rear convex portion is provided on a lower part of the rear insulation wall 27 and

extends in the right-left direction thereby to connect between lower ends of the right and left first rear convex portions 601.

[0060] The rear insulation wall 27 has the vacuum insulation panel 63 which is located between the inner member 61 and the outer member 62 and serves as the insulating member, in the same manner as the right and left insulation walls 23 and 24 in the foregoing embodiments, as shown in FIG. 10. The vacuum insulation panel 63 is bonded to the inner member 61 and the outer member 62 by a resin adhesive such as hot melt thereby to be fixed. The inner member 61, the outer member 62 and the vacuum insulation panel 63 are constructed substantially in the same manner as the inner member 31, the outer member 32 and the vacuum insulation panel 33 in the foregoing embodiments, except for the shapes.

[0061] The outer member 62 has a rear convex portion 60 formed to protrude outward with respect to the storage compartments 12 to 16. In this case, the rear convex portion 60 is formed into a rectangular, or more specifically, trapezoidal shape. The rear convex portion 60 is formed by the press drawing of the outer member 62. The vacuum insulation panel 63 is provided at a position where the vacuum insulation panel 63 does not overlap the rear convex portion 60. A soft tape 64 is provided between the inner member 61 and the outer member 62 so as to be lateral to the vacuum insulation panel 33 in front of the rear convex portion 60. The soft tape 64 is made of synthetic rubber or open-cell foam, for example and is superior in the elasticity, stretching properties, heat insulating properties and waterproof properties.

[0062] The radiating pipe 65 is provided between the inner member 61 and the outer member 62 so as to be in contact with the inside of the rear convex portion 60. The radiating pipe 65 is fixed to the outer member 62 by a metal tape 66 such as an aluminum tape 66. In this case, an amount of protrusion of the rear convex portion 60 is set to be smaller than a diameter of the radiating pipe 65. Accordingly, the radiating pipe 65 is pressed by the soft tape 64 with the metal tape 66 being interposed therebetween. Further, the rear convex portion 60 has a width that is set to be slightly larger than the diameter of the radiating pipe 65. The radiating pipe 65 and the metal tape 66 are spaced from the vacuum insulation panel 63. Thus, the radiating pipe 65 and the metal tape 66 are out of contact with the vacuum insulation panel 63.

[0063] The radiating pipe 65 also constitutes a part of the refrigerating cycle in the same manner as in the radiating pipes 36 of the foregoing embodiments. The radiating pipe 65 enters the inside of the rear insulation wall 27 from the component chamber 30 and extends through the peripheral edge interior of the rear insulation wall 27 along the rear convex portion 60, thereafter exiting from the rear insulation wall 27 into the component chamber 30, as shown in FIG. 9. The radiating pipe has two ends connected to a compressor, the radiating pipe 36 or the like located in the component chamber 30 although connections are not shown.

[0064] According to the embodiment, the rear insulation wall 27 of the refrigerator 10 can achieve the same advantageous effects as mainly in the first embodiment. More specifically, even when the refrigerator 10 is installed so that the rear thereof or the outer surface of the rear insulation wall 27 is adjacent to the room wall or the like, the rear convex portion 60 abuts on the room wall, whereupon a space is defined between the room wall and a part of the outer surface of the rear insulation wall 27 except for the rear convex portion 60. Accordingly, the whole outer surface of the rear insulation wall 27 is prevented from being adjacent on the room wall with the result that a space is ensured for heat radiation by the radiating pipe 65. Consequently, a reduction in the radiating efficiency due to heat filling the space around the radiating pipe 36 can be suppressed even when the refrigerator 10 is installed while the rear insulation wall 27 constituting the rear thereof is in proximity to or in contact with the room wall or the like.

[0065] Further, the radiating pipe 65 is enclosed in the inside of the rear convex portion 60. Accordingly, the radiating pipe 65 can be disposed along the rear convex portion 60 in the manufacture of the refrigerator 10. This can render the mounting of the radiating pipe 36 to the outer member 32 easier than in the case where the outer member 32 is of a flat shape without the rear convex portion 60 of the outer member 62 with the result that the working efficiency can be improved.

[0066] The rear convex portion 60 is formed by the press drawing of the plate-shaped outer member 62. Accordingly the outer member 62 increases the strength in a part thereof in the periphery of the rear convex portion 60 as the result of work hardening due to the drawing. Further, a second moment of area of the whole outer member 62 is increased by the forming of the rear convex portion 60 with the result of an increase in the strength of the whole outer member 62 in the bending direction.

[0067] The rear convex portion 60 is formed into a trapezoidal shape. This can ensure a larger radiation surface area with the result that the radiation efficiency of the radiating pipe 65 can be improved.

[0068] The outer member 62 may have a concave portion recessed to the inner member 61 side, instead of the rear convex portion 60.

[0069] A sixth embodiment will be described with reference to FIG. 11. The sixth embodiment differs from the fifth embodiment in the shape of the rear convex portion 60. More specifically, the rear convex portion 60 in the sixth embodiment is formed into a substantially semicircular shape along a part of the outer diameter of the radiating pipe 65 but not the trapezoidal shape. According to this, the radiating pipe 65 is rendered easier to dispose in the inside of the rear convex portion 60 and harder to displace after disposition. As a result, the radiating pipe 65 can be mounted to the outer member 62 easier with the result that the working efficiency can be further improved.

Seventh Embodiment

[0070] A seventh embodiment will be described with reference to FIGS. 12 and 13. In the seventh embodiment, the component chamber 30 is provided in a lower rear part of the interior of the insulation box 11. A compressor constituting a part of the refrigerating cycle is provided in the component chamber 30 in the same manner as in the foregoing embodiments although not shown. In this case, the first rear convex portions 601 extend upward from the component chamber 30 side along the right and left edges of the rear insulation wall 27 respectively. The second rear convex portion 602 is located on an upper part of the rear insulation wall 27 and extends in the right-left direction, thereby connecting between upper ends of the first rear convex portions 601. The radiating pipe 65 is disposed in the rear convex portion 60.

[0071] Further, in the seventh embodiment, the walls defining the opening of the insulation box 11 are provided with neither convex portions nor concave portions are provided although the rear insulation wall 27 not defining the opening of the insulation box 11 is provided with the convex portions 60. In other words, the right and left insulation walls 24 and 23 in the seventh embodiment are provided with no convex portions 34, 35, 47 and 48 or no concave portions 49, 50, 53, 54 and the like as provide in the foregoing embodiments.

[0072] Accordingly, the outer members 32 of the right and left insulation walls 24 and 23 are substantially flat without any convex portions or concave portions in the seventh embodiment. In this case, as shown in FIG. 13, recesses 331 are formed at the outer member 32 side of the vacuum insulation panel 33, instead of the convex portions 34, 35, 47 and 58 or the concave portions 49, 50, 53 and 54. The radiating pipe 36 is disposed along the recesses 331.

[0073] According to the above-described construction, the seventh embodiment can achieve the same advantageous effects as the fifth embodiment. Further, the component chamber 30 is provided in the lower rear part of the interior of the insulation box 11. According to this, heat radiated from the compressor disposed in the component chamber 30 flows through a space defined between the rear insulation wall 27 formed by the rear convex portions 60 and the room wall surface and further flows upward from the component chamber 30 thereby to be radiated. According to the construction, heat generated by the compressor can be effectively radiated without any new member being provided for radiation. Further, the right and left sides of the refrigerator 10, that is, the outer surfaces of the right and left insulation walls 24 and 23 have flat appearances. As a result, the appearances of the right and left sides can be rendered desirable in the installed state of the refrigerator 10.

[0074] If each embodiment, the left insulation wall 23 is constructed substantially in the same manner as the right insulation wall 24, except for being bilaterally symmetric with the right insulation wall 24. The left insulation

wall 23 is also provided with a radiating pipe corresponding to the radiating pipe 36.

[0075] The ceiling insulation wall 25 may be provided with convex or concave portions and the radiating pipe may be disposed in the interiors of the convex or concave portions. In this case, a space is defined between an upper surface of the refrigerator 10 or the outer surface of the ceiling insulation wall 25 and the ceiling of the room. Accordingly, the user can arrange the refrigerator 10 without being aware of securement of a radiation space with respect to the radiating pipe.

[0076] The insulation box 11 should not be limited to the front opening but may have an opening in an upper surface. In this case, the radiating pipe and the convex or concave portion may be provided on or in four peripheral insulation walls defining the upper opening.

[0077] Urethane foam may be used as the insulating members of the insulation walls 23 to 27, instead of the vacuum insulation panel. Both the vacuum insulation panel and the urethane foam may be used together.

[0078] The insulation box 11 should not be limited to the construction that the divided insulation walls 23 to 27 are combined together. For example, an inner box constituting the storage compartment 12-16 side surfaces may be formed into an integral box shape, and an insulating member and an outer box may be provided outside the inner box.

[0079] In each embodiment, the inner laminate film 461 of the enclosure 46 of the vacuum insulation panel 33 may have an aluminum foil layer. In the same manner, the outer laminate film 462 may have a vapor-deposited aluminum layer. Further, each one of the inner and outer laminate films 461 and 462 may have either the vapor-deposited aluminum layer or the aluminum foil layer or may be composed of a plurality of vapor-deposited aluminum layers and a plurality of aluminum foil layers superposed one upon another.

[0080] Regarding the enclosure 46, aluminum is suitable as the metal layer to obtain the gas barrier properties, in view of economic efficiency and the like. However, the metal layer should not be limited to aluminum. For example, titanium, chromium, copper, gold or the like may be used. In this case, the forming of the metal layer should not be limited to the laminate or vapor deposition of a metal foil. For example, the metal layer may be formed by plating. Further, the layer to obtain gas barrier properties should not be limited to the aforesaid metal layer but an oxide such as silica or alumina may be deposited on the metal layer.

[0081] According to the foregoing embodiments, when the refrigerator is installed so that a wall forming a side surface of the insulation box is adjacent to a room wall, the convex portion of the wall is adjacent to the room wall, whereupon a space is defined between the room wall and the part of the wall formed with no convex portion. Accordingly, a space into which heat is radiated is ensured around the radiating pipe. As a result, a reduction in the radiating efficiency due to heat filling the space

around the radiating pipe 36 can be suppressed even when the refrigerator is installed so that the wall of the insulation box is in proximity to or in contact with the room wall.

[0082] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the invention. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the invention. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the invention.

Claims

1. A refrigerator comprising:
 - an insulation box having a storage compartment and an opening communicating with the storage compartment; and
 - a refrigerating cycle which refrigerates an atmosphere in the storage compartment, wherein the insulation box includes a plurality of walls constructed of an inner member, an outer member and an insulating member provided between the inner member and the outer member; wherein at least one of the walls has a convex portion formed on the outer member and protruding outward with respect to the storage compartment or a concave portion formed in the outer member and recessed inward with respect to the storage compartment; and
 - wherein a radiating pipe is provided between the inner member and the outer member so as to be adjacent to the convex portion or the concave portion, the radiating pipe constituting a part of the refrigerating cycle.
2. The refrigerator according to claim 1, wherein the insulating member comprises a vacuum insulation panel, and the vacuum insulation panel is bonded to the outer member thereby to be fixed to the outer member while being spaced from the convex portion or the concave portion.
3. The refrigerator according to claim 2, wherein the radiating pipe includes a part which is located between the convex portion or the concave portion and the vacuum insulation panel and fixed to the outer member by a metal tape; and wherein the vacuum insulation panel is spaced from the radiating pipe and the metal tape.
4. The refrigerator according to any one of claims 1 to

3, wherein the convex portion is provided on at least one of the walls defining the opening.

5. The refrigerator according to claim 4, wherein the convex portion is provided on at least an edge of the wall.
6. The refrigerator according to claim 5, wherein the convex portion located on the edge of the wall is provided with a reinforcing member extending along the edge of the wall.
7. The refrigerator according to claim 5 or 6, wherein the vacuum insulation panel includes a core material and an enclosure enclosing the core material; wherein the enclosure has a bonding lug which protrudes around the core material; and wherein the lug is folded back to the outer member side thereby to be placed inside the convex portion located on the edge of the wall.
8. The refrigerator according to any one of claims 1 to 7, wherein the convex portion is provided on a rear wall not defining the opening.
9. The refrigerator according to any one of claims 1 to 3, wherein the convex portion is provided on a rear wall not defining the opening and is not provided on the walls defining the opening.
10. The refrigerator according to claims 8 or 9, wherein the insulation box is provided with a component chamber which is defined in a lower part thereof and in which a compressor constituting a part of the refrigerating cycle is provided.

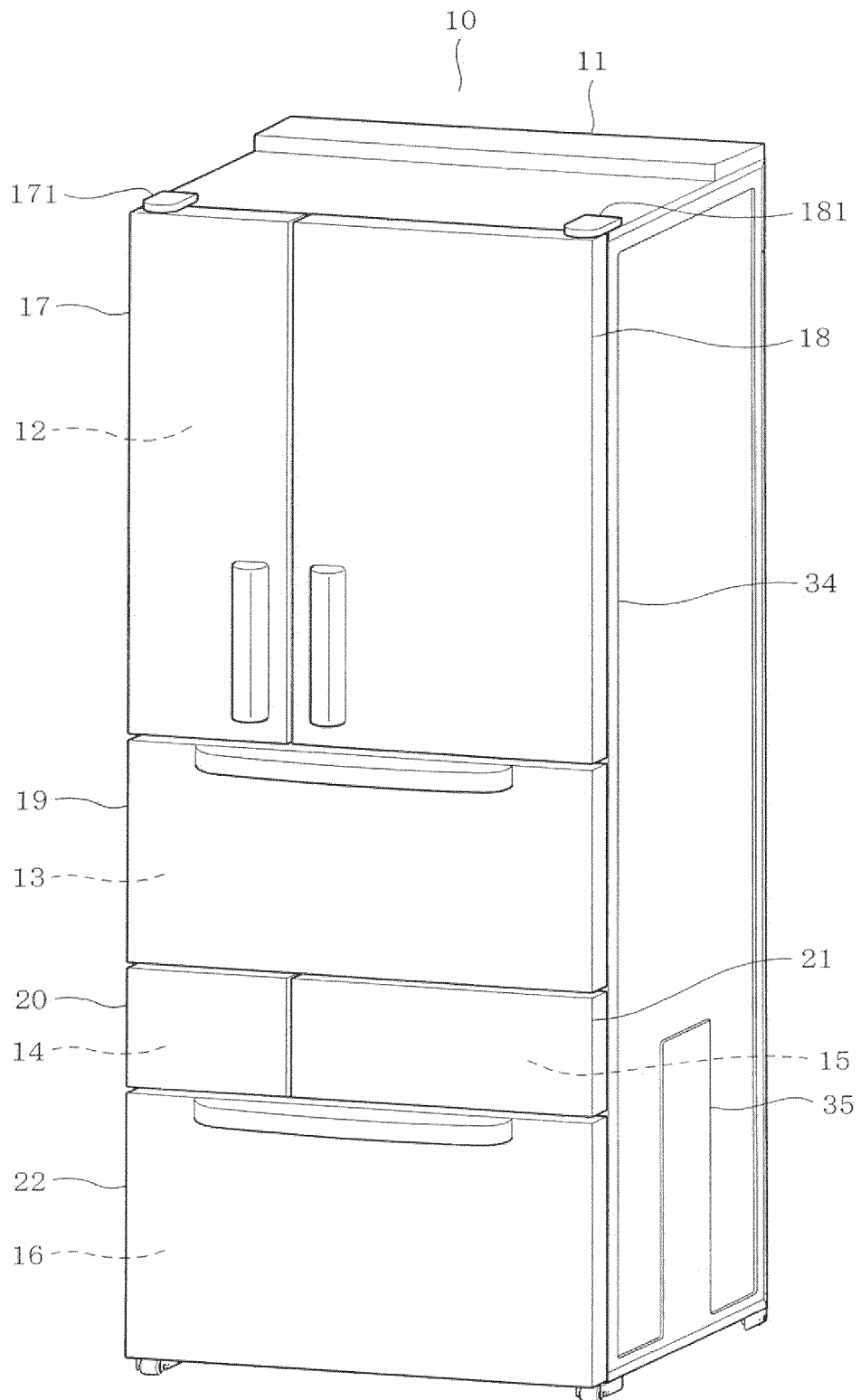


FIG. 1

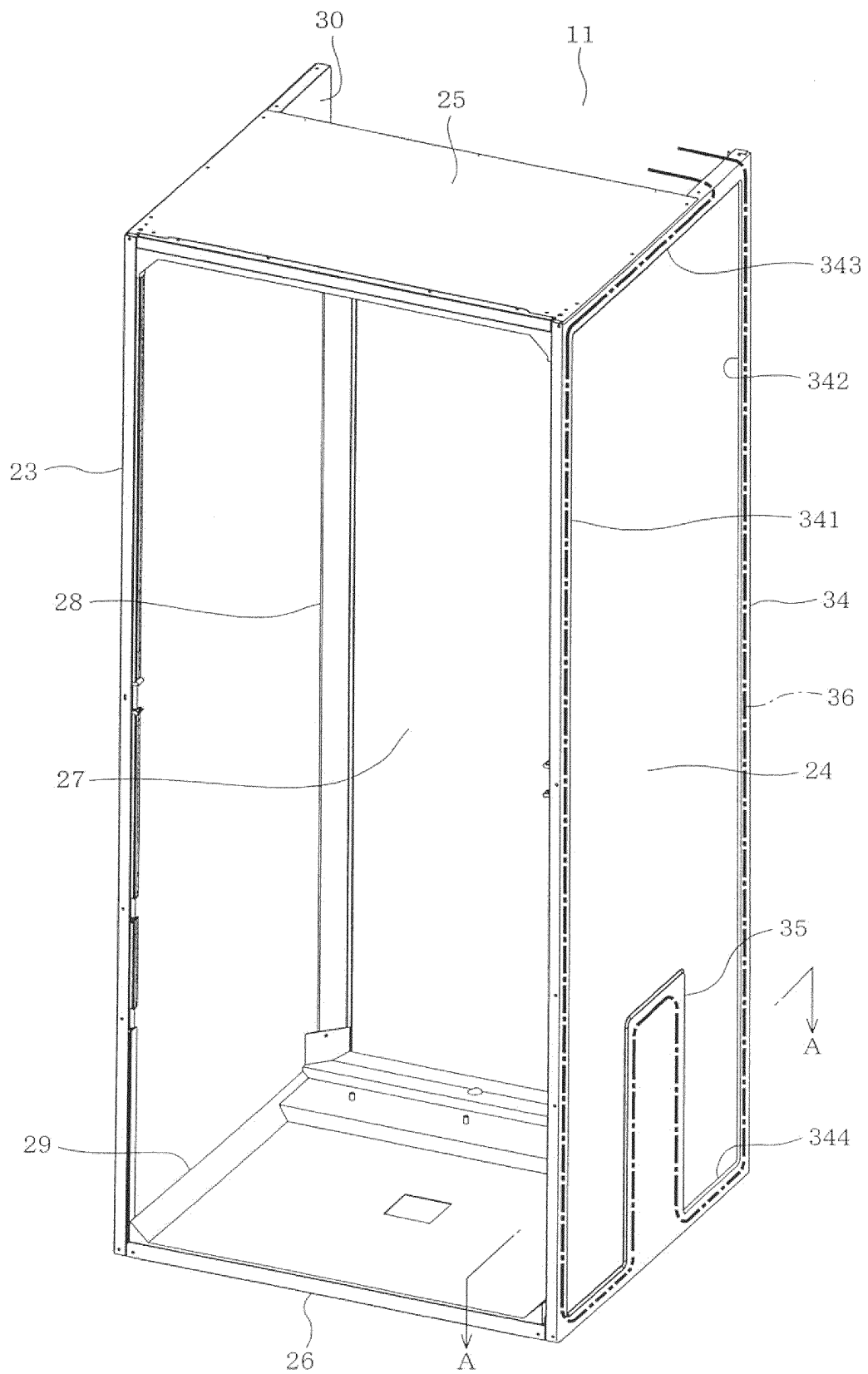
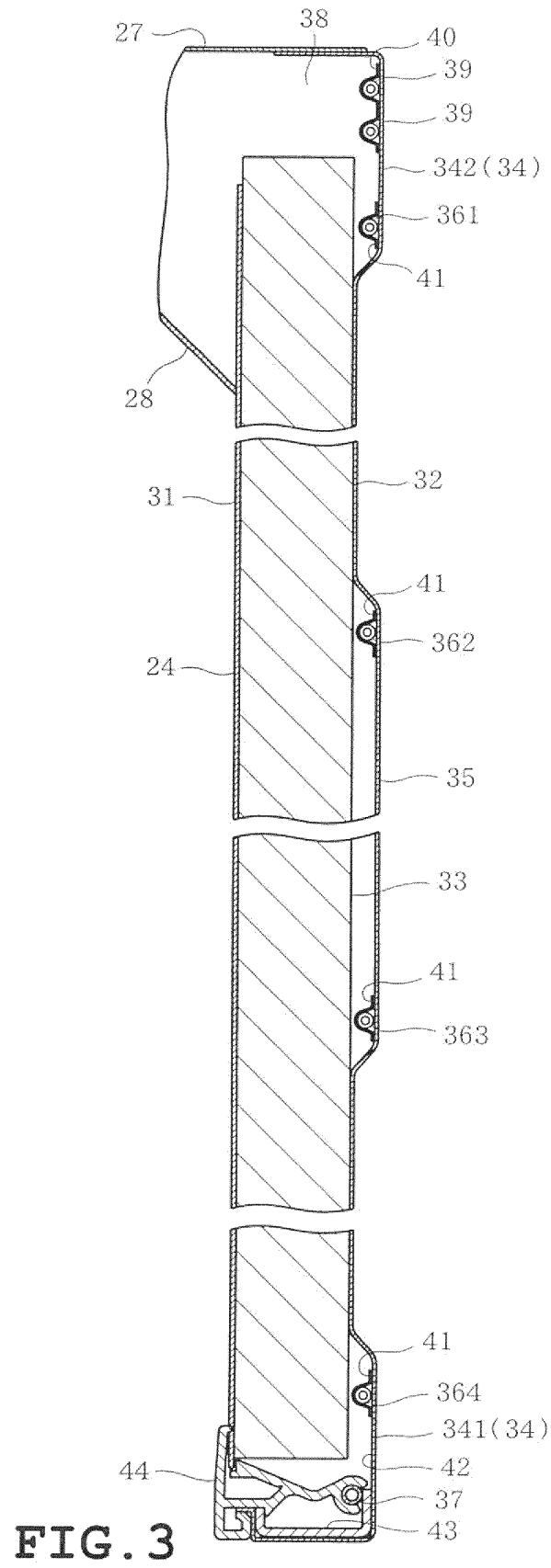


FIG. 2



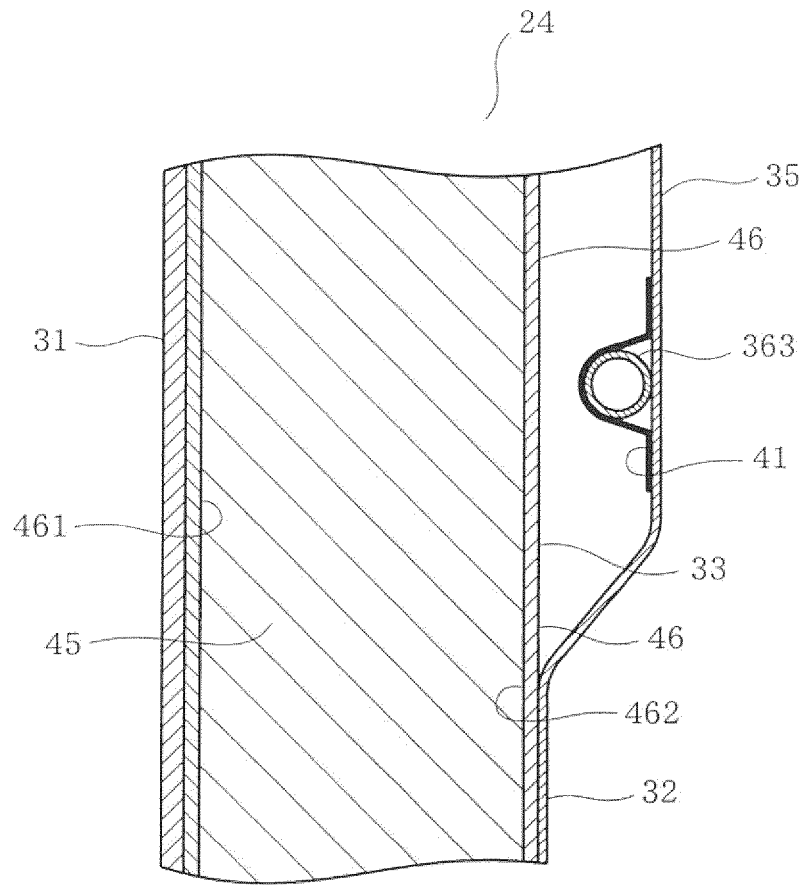


FIG. 4

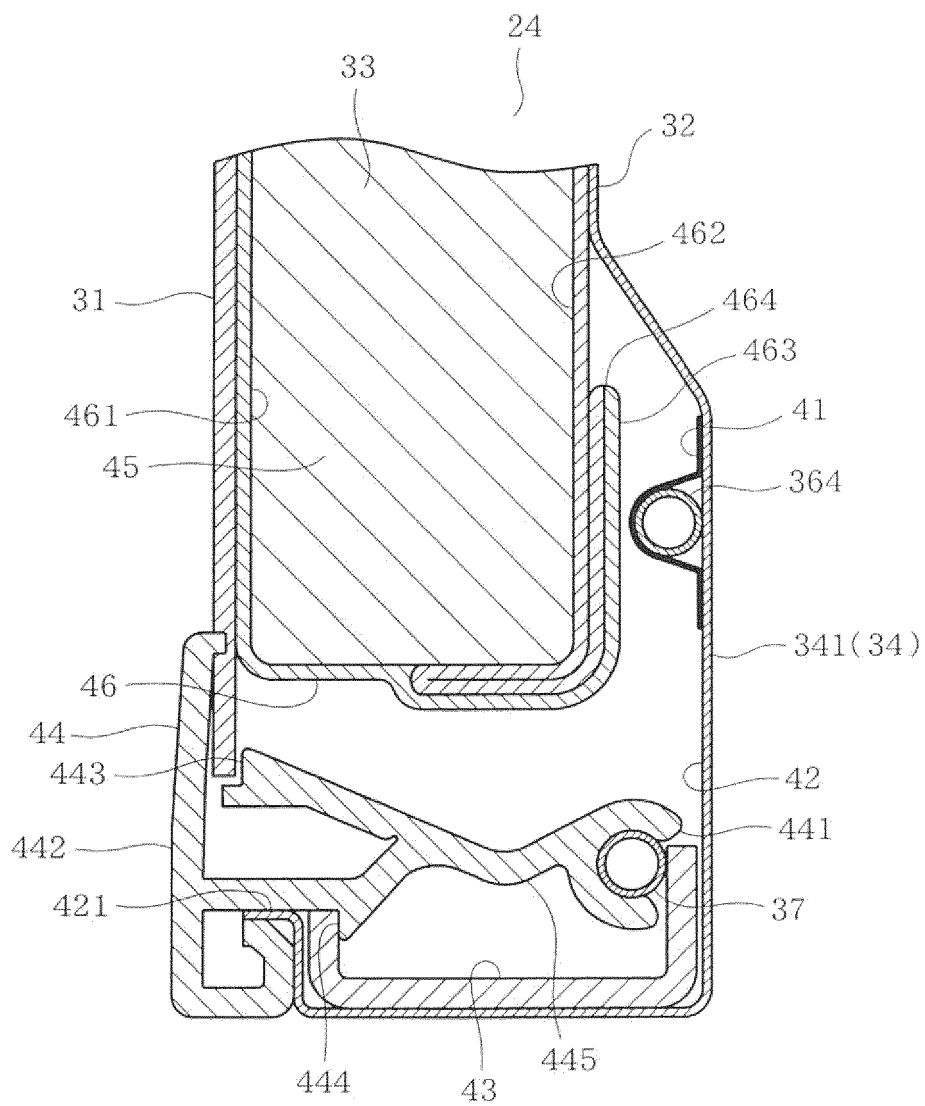


FIG. 5

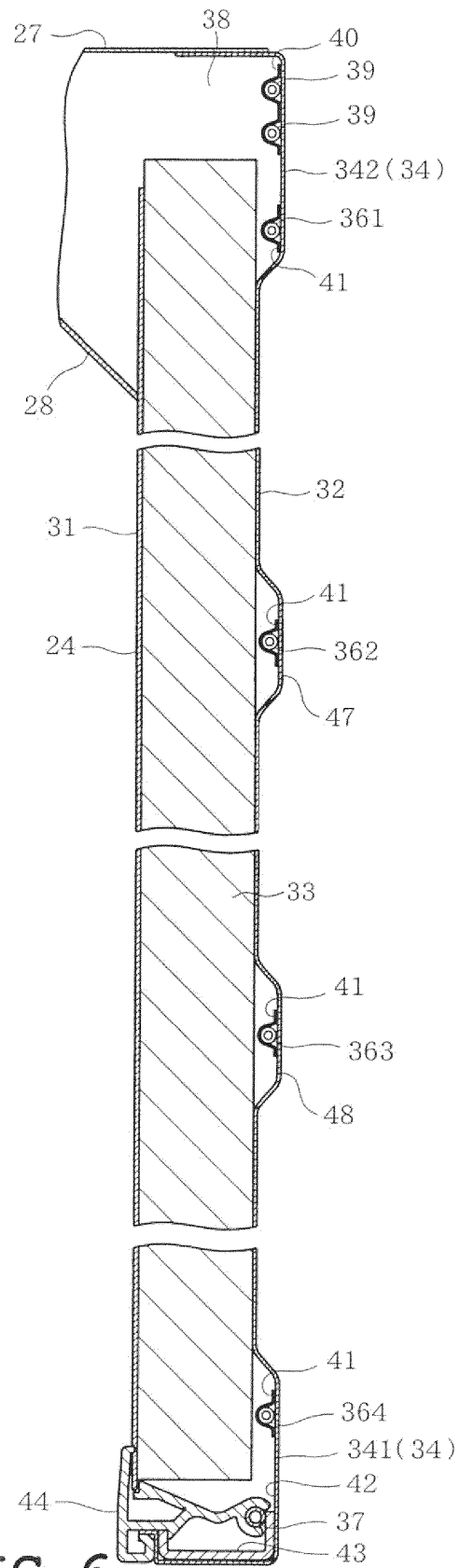


FIG. 6

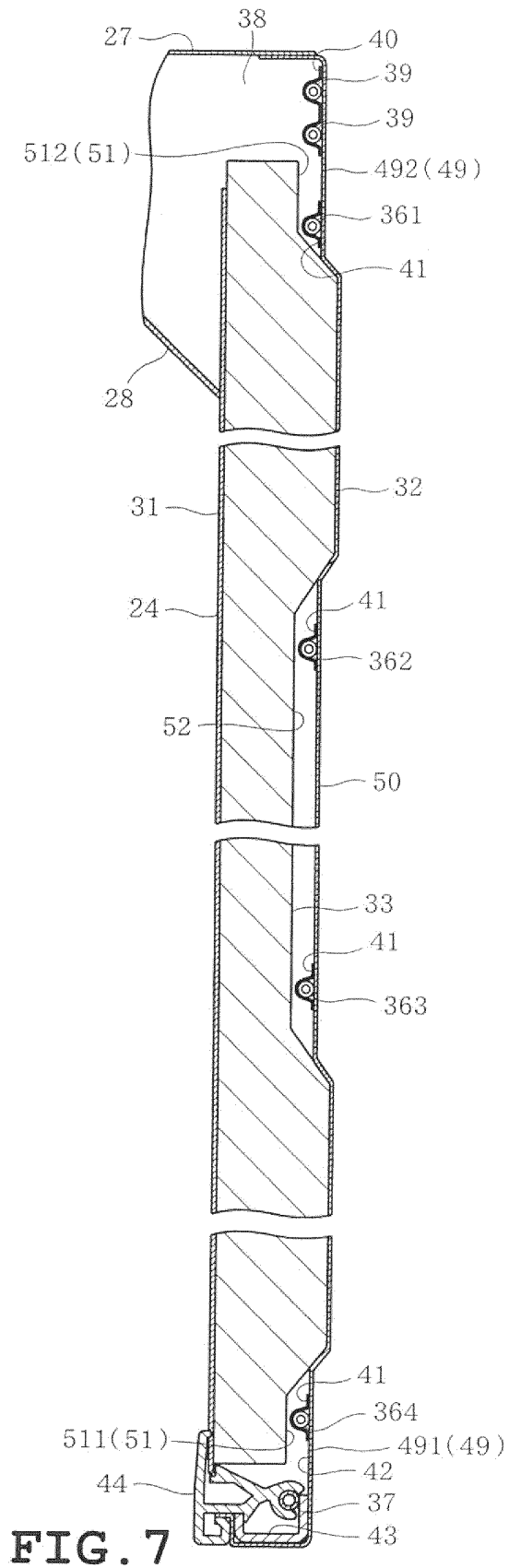


FIG. 7

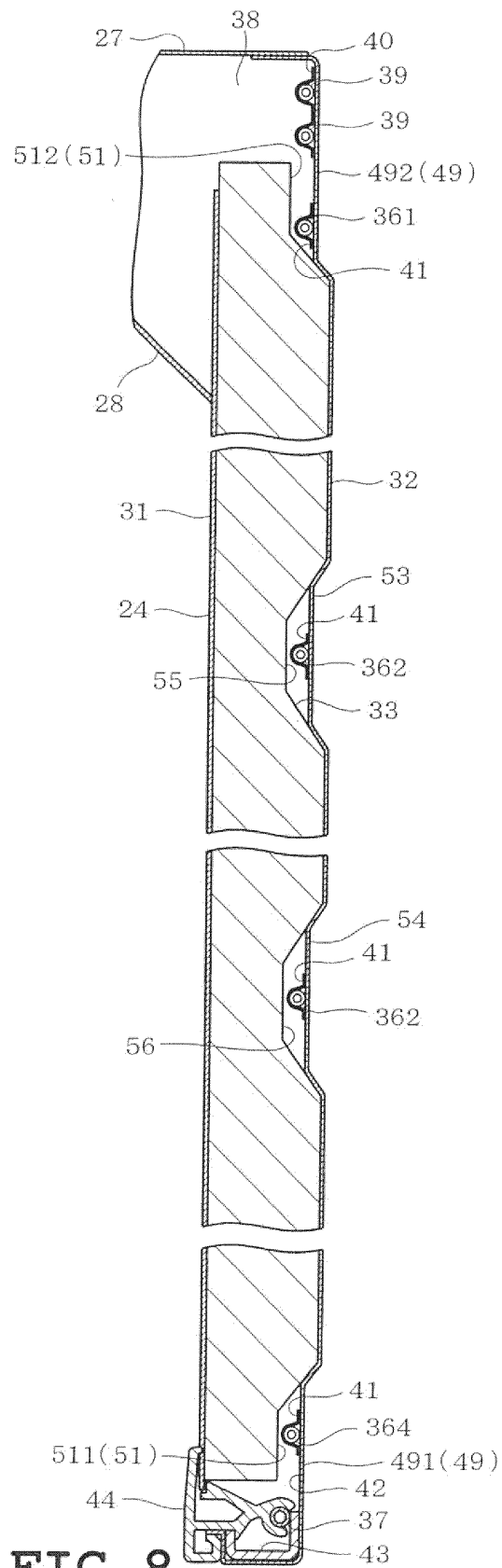


FIG. 8

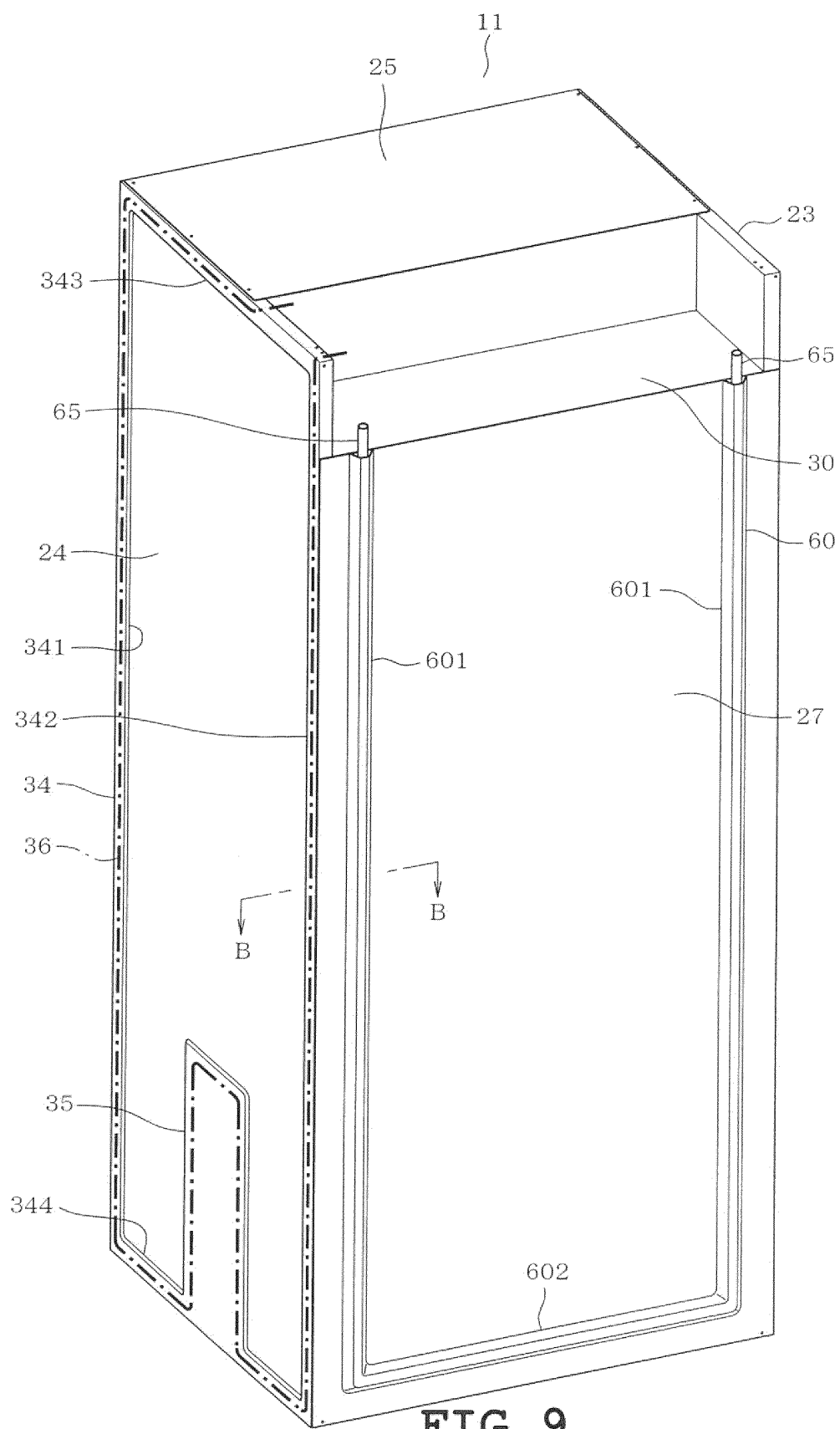


FIG. 9

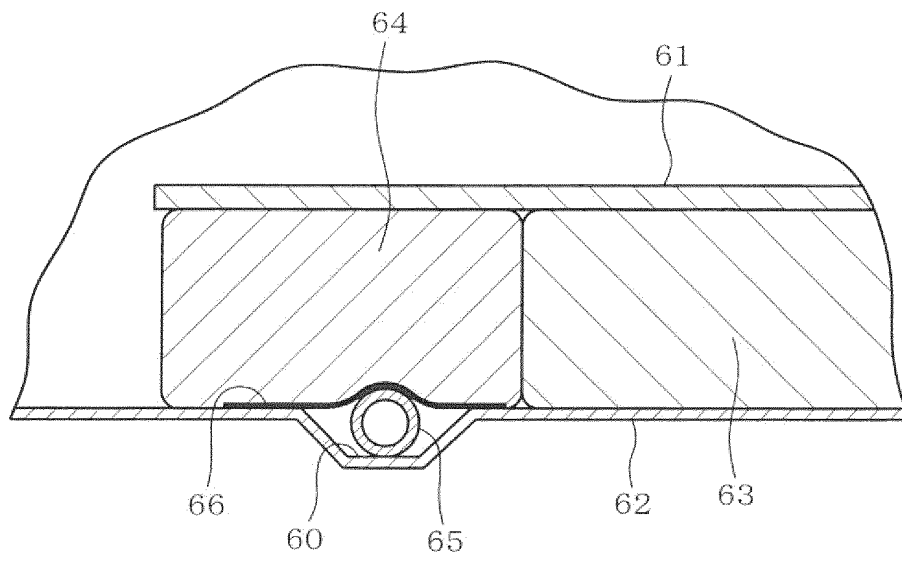


FIG. 10

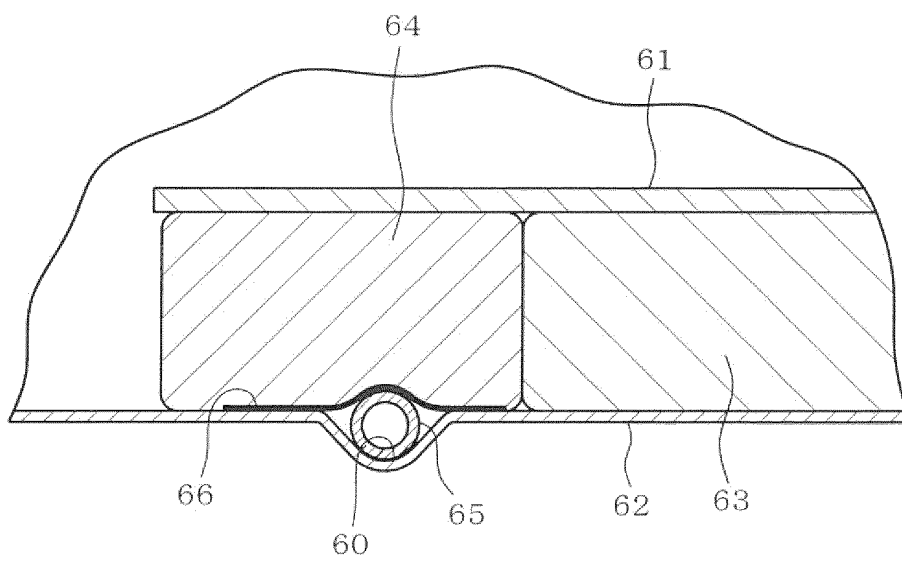


FIG. 11

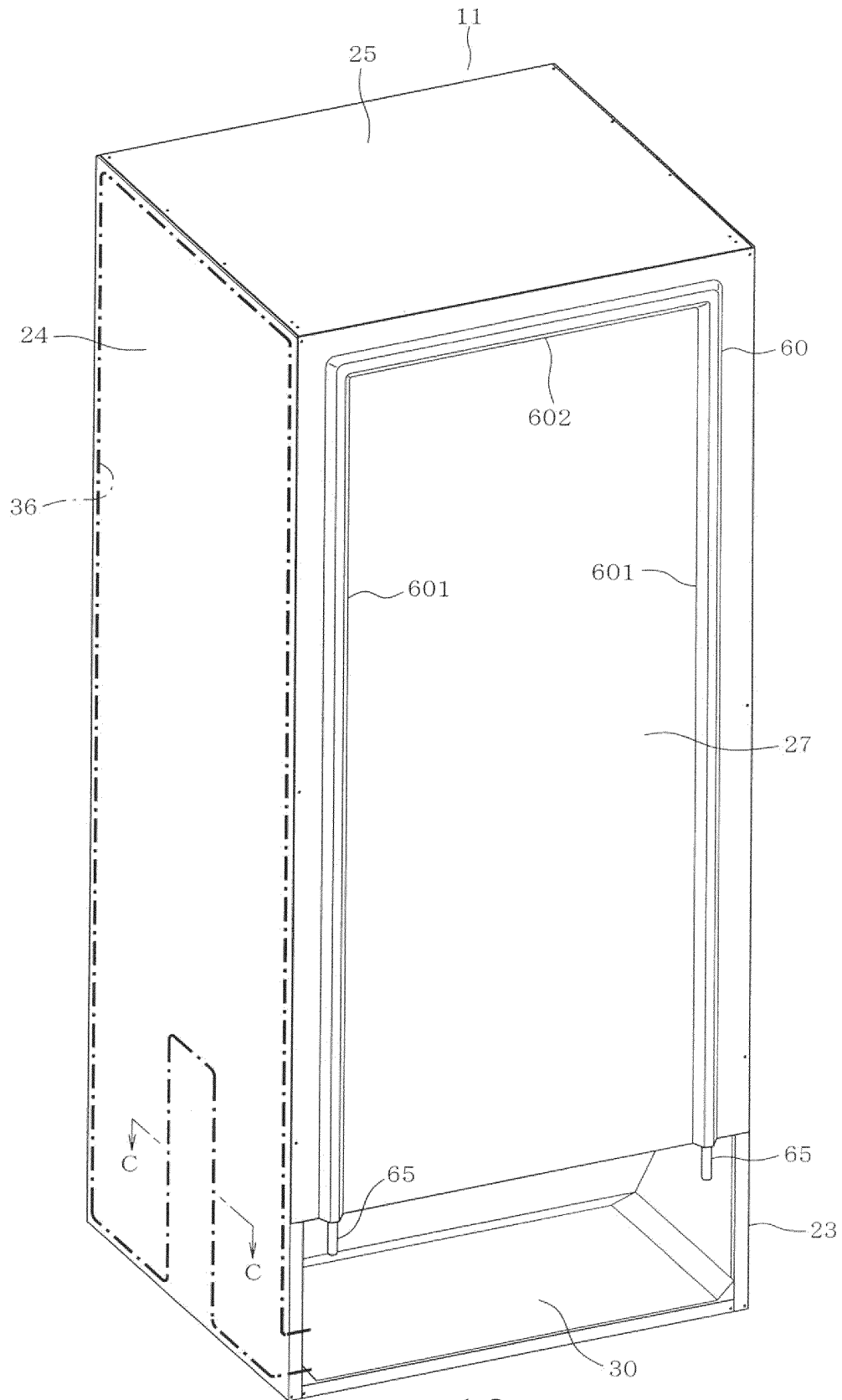


FIG. 12

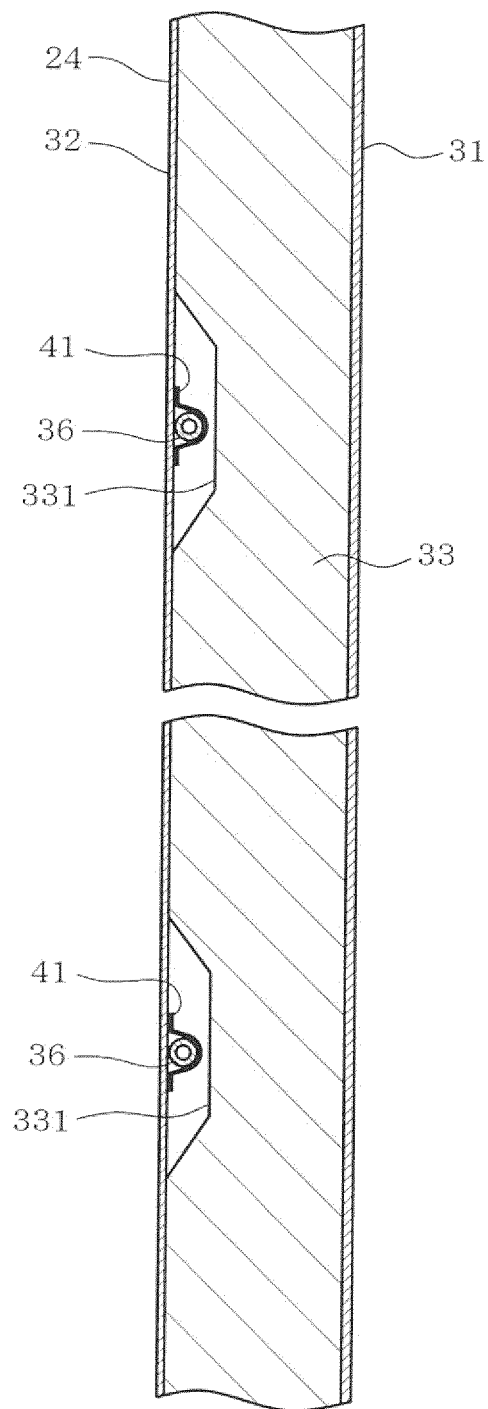


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/078843

A. CLASSIFICATION OF SUBJECT MATTER

F25D19/00 (2006.01) i, F25D23/06 (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)

F25D19/00, F25D23/06

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	JP 2010-145001 A (Sharp Corp.), 01 July 2010 (01.07.2010), entire text; all drawings (Family: none)	1, 8-10 2-6 7
Y	JP 2011-122739 A (Toshiba Corp.), 23 June 2011 (23.06.2011), paragraphs [0013] to [0015]; fig. 2, 3 & CN 201852403 U	2-6
Y	JP 2005-172307 A (Matsushita Electric Industrial Co., Ltd.), 30 June 2005 (30.06.2005), paragraph [0056]; fig. 10 (Family: none)	4-6

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

* Special categories of cited documents:

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"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

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Date of the actual completion of the international search

10 January, 2013 (10.01.13)

Date of mailing of the international search report

22 January, 2013 (22.01.13)

Name and mailing address of the ISA/
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Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/078843

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2006-284172 A (Matsushita Electric Industrial Co., Ltd.), 19 October 2006 (19.10.2006), paragraph [0056]; fig. 4 (Family: none)	6

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- JP 2011080692 A [0003]