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(54) **REFRIGERATOR**

(57) Provided is a refrigerator having excellent insulating properties which can ensure sufficient internal space. The refrigerator is provided with an insulating casing (12) and wiring (52) or piping (53). The insulating casing (12) is formed in a box shape, the inside of the box shape thereof having a housing space. The insulating walls of the insulating casing (12) are formed by sandwiching a first insulating member (15) having a fixed shape between an external sheet (13) and an internal sheet (14), or by sandwiching the first insulating member between the external sheet and the internal sheet with a fillable second insulating member (151). The wiring (52) and the piping (53) is provided in the housing space.

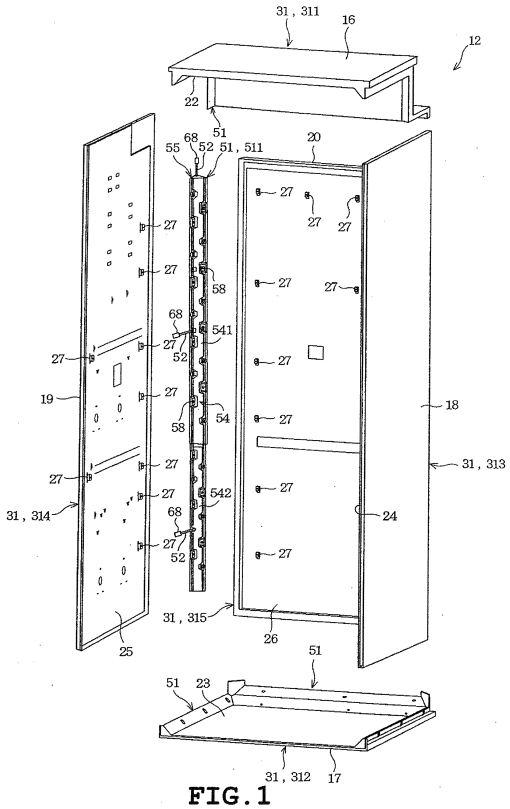

FIG.1

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Description

Technical Field

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

Background Art

[0002] Refrigerators have recently been required to reduce thicknesses of heat insulation walls composing a heat insulation box in order to cope with increase in an interior space. It is now considered to use a vacuum heat insulation wall as a heat insulating member of the heat insulation wall. Since the vacuum heat insulation panel has a higher heat insulation performance than conventionally used foam urethane, the thickness of the heat insulation wall can be reduced with the result that the interior space can be increased.

[0003] In a conventional construction using the vacuum heat insulation panel as the heat insulating member, for example, piping constituting a refrigeration cycle, an electrical cable connected to electrical components in the refrigerator interior, and the like are buried in the foam urethane inside the heat insulation wall.

[0004] However, the vacuum heat insulation panel has a fixed form. Accordingly, when piping and electrical cable are to be disposed so as to avoid the vacuum heat insulation panel inside the heat insulation wall in the case where the vacuum heat insulation panel is used as the heat insulating member, it is necessary either to thin the vacuum insulation panel or to thicken the insulating wall. In this case, the former results in a reduction in the heat insulation performance, and the latter results in a reduction in the interior space.

Prior Art Document

Patent Document

[0005] Patent Document 1: Japanese Patent Application Publication No. JP-A-H04-260780

Summary of the Invention

Problem to be overcome by the Invention

[0006] An object of the invention is to provide a refrigerator which has a superior heat insulation performance and can ensure a sufficient interior space.

Means for Overcoming the Problem

[0007] One embodiment of the present invention provides a refrigerator comprising a heat insulation box formed into a box shape and having a storage space thereinside, and an electrical cable or piping, wherein a heat insulation wall constituting the heat insulation box is constructed of a first heat insulating member having a fixed form and interposed between an outer plate and an inner plate, or of the first heat insulating member having a fixed form and interposed between an outer plate and an inner plate with a fillable second heat insulating member filling a gap between the outer and inner plates, and the electrical cable or the piping is provided in the storage space.

Brief Description of the Drawings

[0008]

FIG. 1 is a perspective view of a heat insulation box and a fixture of the refrigerator in accordance with a first embodiment;
FIG. 2 is a perspective view of an appearance of the refrigerator;
FIG. 3 is a perspective view showing an interior of the refrigerator as viewed at right front;
FIG. 4 is a perspective view showing an interior of the refrigerator as viewed at a left front;
FIG. 5 is a longitudinal side section of the heat insulation box;
FIG. 6 is a schematic transverse sectional plan view of a refrigerating compartment in the heat insulation box;
FIG. 7 is an exploded perspective view of a heat insulation wall;
FIG. 8 is a schematic transverse sectional plan view of the right front of the heat insulation box;
FIG. 9 is a schematic transverse sectional plan view of the left inner corner of the heat insulation box;
FIG. 10 is a perspective view of the fixture provided at the left inner corner of the heat insulation box;
FIG. 11 is a perspective view showing the status before the fixture is provided at the left inner corner of the heat insulation box;
FIG. 12 is a perspective view of the fixture provided at the left inner corner of the heat insulation box;
FIG. 13 is a front view of the fixture provided at the left inner corner of the heat insulation box;
FIG. 14 is an exploded perspective view of the fixture provided at the left inner corner of the heat insulation box;
FIG. 15 is a sectional view taken along line A-A in FIG. 13;
FIG. 16 is a sectional view taken along line B-B in FIG. 13;
FIG. 17 is a sectional view taken along line C-C in FIG. 13;
FIG. 18 is a sectional view taken along line D-D in FIG. 13;
FIG. 19 is a sectional view taken along line E-E in FIG. 13;
FIG. 20 is a transverse sectional plan view of the fixture provided at the left inner corner of the heat insulation box (No. 1);

FIG. 21 is a transverse sectional plan view of the fixture provided at the left inner corner of the heat insulation box (No. 2);
FIG. 22 is a schematic transverse sectional plan view of the right inner corner;
FIG. 23 is a perspective view of the fixture provided at the right inner corner of the heat insulation box;
FIG. 24 is a perspective view of the heat insulation box before attachment of the fixture to the right inner corner;
FIG. 25 is a perspective view of the fixture provided at the right inner corner of the heat insulation box;
FIG. 26 is a front view of the fixture provided at the right inner corner of the heat insulation box;
FIG. 27 is an exploded perspective view of the fixture provided at the right inner corner of the heat insulation box;
FIG. 28 is a sectional view taken along line F-F in FIG. 26;
FIG. 29 is a sectional view taken along line G-G in FIG. 26;
FIG. 30 is a sectional view taken along line H-H in FIG. 26;
FIG. 31 is a sectional view taken along line I-I in FIG. 26;
FIG. 32 is a longitudinal sectional front view of the vicinity of the right end of the second partitioning member;
FIG. 33 is a perspective view of the fixture mounted to the left side divided heat insulation wall;
FIG. 34 is a view similar to FIG. 9, showing the fixture in a second embodiment; and
FIG. 35 is a view similar to FIG. 22, showing the heat insulation member in a third embodiment.

Best Mode for Carrying Out the Invention

[0009] Refrigerators in accordance with several embodiments will be described with reference to the drawings. Identical or similar parts in the embodiments are labeled by the same reference symbols and the description of these parts will be eliminated.

(First Embodiment)

[0010] A first embodiment will be described with reference to FIGS. 1 to 33. A refrigerator 11 includes a heat insulation box 12 as shown in FIG. 2 and refrigeration-cycle constituting equipment (not shown) to cool an atmosphere in the heat insulation box 12. The heat insulation box 12 has one open side as shown in FIGS. 3 to 6. In the specification, the open side of the heat insulation box 12 corresponds to a front of the refrigerator 11 and a right-left direction on the paper of FIG. 2 corresponds to a right-left direction of the refrigerator 11.

[0011] The heat insulation box 12 is formed by combining a plurality of divided heat insulation walls 31 and includes an outer box 13, an inner box 14 and a first heat insulating member 15. The first heat insulating member 15 is interposed between the outer and inner boxes 13 and 14 as shown in FIG. 5. The first heat insulating member 15 is a plate-shaped heat insulating member and has a fixed form. More specifically, the first heat insulating member 15 is undeformable unless any process is applied thereto.

[0012] Inside the inner box 14 are formed a storage space such as a storage compartment, a space for providing a duct if necessary, and the like. The outer box 13 is made of steel, for example and formed into a box shape having an open front. The outer box 13 constitutes outer side surfaces of the heat insulation box 12. The outer box 13 is formed by combining a plurality of divided outer plates as shown in FIGS. 1 and 3 to 6. More specifically, the outer box 13 includes an upper outer plate 16, a bottom outer plate 17, a right outer plate 18, a left outer plate 19 and a rear outer plate 20.

[0013] The upper outer plate 16 constitutes an upper outer surface of the heat insulation box 12 and is formed into a stepped shape such that a rear thereof is located below the front thereof. The bottom outer plate 17 constitutes a bottom outer surface of the heat insulation box 12 and is formed into a substantially flat plate shape in parallel to the upper outer plate 16. The right and left outer plates 18 and 19 are each formed into a substantially flat plate shape and constitute right and left side surfaces of the heat insulation box 12 respectively. The right and left outer plates 18 and 19 are formed so as to be bilaterally symmetrical. The rear outer plate 20 is formed into a substantially flat plate shape and is provided on the rear of the heat insulation box 12. The rear outer plate 20 constitutes a rear outer surface of the heat insulation box 12.

[0014] A mechanical compartment 21 is formed in a rear upper side of the upper outer plate 16, as shown in FIGS. 3 to 5. A compressor (not shown) constituting the refrigeration cycle (not shown), and the like are provided in the mechanical compartment 21. An upper separation part 211 is formed at a position corresponding to the bottom of the mechanical compartment 21 as shown in FIG. 5. The upper separation part 211 is an opening formed by providing a space between the heat insulating members 15 adjacent to each other. In the embodiment, the heat insulating members 15 located at an upper part of the heat insulation box 12 are separated from the heat insulating member 15 disposed at a rear side of the heat insulation box 12, whereby the upper separation part 211 is formed.

[0015] A second heat insulating member 151 is provided in the upper separation part 211. The second heat insulating member 151 is a foam insulation except for a vacuum heat insulation panel, such as foam urethane. The second heat insulating member 151 has fluidity during manufacture of the heat insulation wall 31 thereby to be capable of filling an interior of the heat insulation wall 31. When filling the interior of the heat insulation wall 31, the second heat insulating member 15 foams and hard-

ens and thereafter exhibits a heat insulation performance. The upper separation part 211 has a communication hole 211a extending in the up-down direction. The communication hole 211a is formed so as to extend through the second heat insulating member 151 and the upper inner plate 22 in the up-down direction. The communication hole 211a may be formed into a slit.

[0016] A component chamber 212 is formed at the lower rear side of the heat insulation box 12. In the component chamber 212 are housed a condenser of the refrigerating cycle, components used for control for refrigerating and freezing, and the like. A lower separation part 213 is formed at a location corresponding to the component chamber 212. The lower separation part 213 is formed by separating the first heat insulating member 15 located at the bottom side of the heat insulation box 12 and the first heat insulating member 15 located at the rear side. A fillable second heat insulating member 151 is also provided in the lower separation part 213. The lower separation part 213 has a communication hole extending in the up-down direction although the hole is not shown in detail. The communication hole is formed so as to extend through the second heat insulating member 151 and the bottom inner plate 23 in the up-down direction. The communication hole may be formed into a slit.

[0017] The inner box 14 is made of resin and is formed into a box shape having an open front side. The inner box 14 is provided inside the outer box 13 and constitutes an inner surface of the heat insulation box 12. The inner box 14 is constituted by combining a plurality of divided inner plates as shown in FIGS. 1 and 3 to 6. More specifically, the inner box 14 is constituted by an upper inner plate 22, a bottom inner plate 23, a right inner plate 24, a left inner plate 25 and a rear inner plate 26. The upper inner plate 22 constitutes an upper inner surface of the heat insulation box 12. The upper inner plate 22 is formed into a stepped shape such that the rear thereof is located lower than the front thereof, in the same manner as the upper outer plate 16. The bottom inner plate 23 constitutes a bottom inner surface of the heat insulation box 12 and is formed into a substantially flat plate shape so as to be parallel to the upper inner plate 22. The right and left inner plates 24 and 25 are each formed into a substantially flat plate shape and constitute right and left inner surfaces of the heat insulation box 12 respectively. In this case, the right and left inner plates 24 and 25 are disposed to be bilaterally symmetrical. The rear inner plate 26 is formed into a substantially flat plate shape and provided on the rear of the heat insulation box 12. The rear inner plate 26 constitutes a rear inner surface of the heat insulation box 12.

[0018] Each one of the right, left and rear inner plates 24, 25 and 26 is provided with a plurality of support members 27 as shown in FIGS. 1, 11 and 24. The support members 27 are arranged in an up-down direction on the right, left and rear inner plates 24, 25 and 26. Each support member 27 is made of resin and is constituted by a rectangular parallelepiped block as a main part, as shown in FIGS. 20 and 21. Each support member 27 includes a screw hole 271 and a flange 272.

[0019] The support members 27 are inserted through openings 28 formed in the inner plates 24, 25 and 26, protruding to the storage compartment side, respectively. The screw holes 271 are formed to extend from the storage compartment side toward the inner plates 24, 25 and 26. Each screw hole 271 has an inner peripheral wall formed with a female thread. Each flange 272 is formed into the shape of a plate larger than the main part of each support member 27 and located opposite the storage compartment relative to the inner plates 24, 25 and 26. Each support member 27 has a proximal end formed into the flange 272, which is bonded and fixed to the heat insulating member 15 and is also interposed between the heat insulating member 15 and the inner plates 24, 25 and 26 thereby to be fixed. In this case, each flange 272 functions as a retaining member which prevents the support member 27 from dropping off to the storage compartment side. The support members 27 may be formed integrally with the inner plates 24, 25 and 26. The support members 27 may not have any flanges 272 and the proximal ends of the support members 27 may be bonded to the heat insulating members 15.

[0020] The upper outer and inner plates 16 and 22 are opposed to each other with the heat insulating member 15 being interposed therebetween, as shown in FIGS. 5 and 6. The bottom outer and inner plates 17 and 23 are opposed to each other with the heat insulating member 15 being interposed therebetween. The right outer and inner plates 18 and 24 are opposed to each other with the heat insulating member 15 being interposed therebetween. The left outer and inner plates 19 and 25 are opposed to each other with the heat insulating member 15 being interposed therebetween. The rear outer and inner plates 20 and 26 are opposed to each other with the heat insulating member 15 being interposed therebetween. In other words, the heat insulating members 15 are provided between the outer and inner boxes 13 and 14 so as to correspond to the respective wall surfaces.

[0021] Each heat insulating member 15 is formed of a foam insulation material such as urethane or a material having a lower heat conductivity and a higher heat insulation performance than soft tape and the like, for example, a flat plate-shaped vacuum heat insulation panel. Each heat insulating member 15 has a core material and an outer bag for housing the core material although the core material and the outer bag are not shown in detail. The core material is formed by housing a material with high heat insulation performance, for example, a laminate of inorganic fiber such as glass wool in the inner bag made of a synthetic resin film such as polyethylene and thereafter compressively hardening the inner bag into a rectangular plate shape. The core material may be formed by a paper making method, a heat compression molding method or the like.

[0022] The outer bag is formed into a bag shape from

a film which is further formed by suitably combining and laminating a polyethylene terephthalate, a high-density polyethylene film, an aluminum-metallized film, an aluminum foil sheet and the like. The outer bag has a gas barrier property. The heat insulating member 15 is formed by decompressing the interior of the outer bag with the core material being housed in the outer bag and closing an opening of the outer bag by heat welding while the decompressed state is retained.

[0023] Each heat insulating member 15 has one side bonded to the inner box 14, that is, outer surfaces of the outer plates and the other side bonded to the outer box 13, that is, inner surfaces of the inner plates. The heat insulating members 15 buried in the walls constituting the heat insulation box 12 are in abutment with the outer plates 16 to 20 and the inner plates 22 to 26. For example, as shown in FIG. 7, the heat insulating member 15 is interposed between the left outer plate 19 and the left inner plate 25 opposed to the left outer plate 19. The heat insulating member 15 and the left outer plate 19 are bonded together by a bonding adhesive 29. Furthermore, the heat insulating member 15 and the left inner plate 25 are bonded together by a bonding adhesive 30. The bonding adhesives 29 and 30 are a fluid bonding adhesive, a double-faced tape or the like. The support members 27 are bonded to the heat insulating members 15 by the bonding adhesive 30.

[0024] Thus, a plurality of heat insulation walls 31 are constituted by the outer plates 16 to 20, the inner plates 22 to 26 opposed to the respective outer plates 16 to 20 and the heat insulating members 15 corresponding to the respective outer plates 16 to 20 and inner plates 22 to 26. The heat insulation box 12 is constituted by combining the heat insulation walls 31. The heat insulation walls 31 may be referred to as "divided heat insulation panel." The heat insulation walls 31 serve as an upper heat insulation wall 311, a bottom heat insulation wall 312, a right heat insulation wall 313, a left heat insulation wall 314 and a rear heat insulation wall 315.

[0025] The upper heat insulation wall 311 constitutes a top wall of the heat insulation box 12. The bottom heat insulation wall 312 constitutes a bottom wall of the heat insulation box 12. The right heat insulation wall 313 constitutes a right wall of the heat insulation box 12. The left heat insulation wall 314 constitutes a right wall of the heat insulation box 12. The rear heat insulation wall 315 constitutes a rear wall of the heat insulation box 12. In this case, the right and left inner plates 24 and 25 are disposed to be bilaterally symmetrical and opposed to each other.

[0026] Front ends of the right and left heat insulation walls 313 and 314 will be described with reference to FIGS. 3, 4 and 8. Note that the right and left heat insulation walls 313 and 314 are bilaterally symmetrical. Accordingly, only the right heat insulation wall 313 will be described and the description of the left heat insulation wall 314 will be eliminated. The right heat insulation wall 313 has two folded portions 32 located midway in the up-down direction and near a lower part in the up-down direction, as shown in FIGS. 3 and 4. Since the two folded portions 32 have the same configuration, only the folded portion located midway in the up-down direction on the front end of the wall 313 will be described.

[0027] The folded portion 32 is folded leftward at the front end of the right outer plate 18 and thereafter folded rightwardly outward relative to the outer box 13 in front of the right inner plate 24 of the inner box 14 as shown in FIG. 8. More specifically, the folded portion 32 has two flat portions 321 extending in the right-left direction and a curved portion 322 connecting the flat portions 321. The flat portions 321 are located substantially opposite each other in front of the heat insulating members 15. The curved portion 322 is bent substantially 180° so as to be folded back thereby to be formed into a U-shape and be open to the rightwardly outward with respect to the outer box 13 as viewed from above. The curved portion 322 is provided at a location where the curved portion 322 substantially overlaps the right inner plate 24 in the right-left direction in front of the right inner plate 24. In this case, the flat portion 321 has a distal end which is folded so as not to be located outside the heat insulation box 12.

[0028] An opening 33 is defined between the curved portion 322 and a front end of the right inner plate 24. An end insertion chamber 34 is also defined between the folded portion 32 and a front end of the heat insulating member 15. The opening 33 is formed by separating the front end of the right inner plate 24 and the folded portion 32 of the right outer plate 18 from each other, functioning as an entrance to the end insertion chamber 34. The end insertion chamber 34 is a space formed by separating the folded portion 32 of the right outer plate 18 and the first heat insulating member 15 from each other. The flat portions 321 are formed with through holes 35 extending through the flat portions 321 in the thicknesswise direction respectively.

[0029] The heat insulation box 12 has a first partition member 37 and a second partition member 38 both located inside the inner box 14 as shown in FIGS. 3 and 4. The first partition member 37 is provided midway in the up-down direction inside the inner box 14. The second partition member 38 is provided below the first partition member 37. The first and second partition members 37 and 38 partition an interior of the inner box 14 in the up-down direction. As a result, the storage compartment defined inside the inner box 14 is divided into a plurality of compartments.

[0030] More specifically, the refrigerator 11 includes as storage compartments a refrigerating compartment 39, a vegetable compartment 40, an ice making compartment 41, a first freezing compartment 42 and a second freezing compartment 43. The refrigerating compartment 39 is provided in a space surrounded by the inner box 14 and the first partition member 37. The vegetable compartment 40 is provided in a space surrounded by the inner box 14 and the first and second partition members

37 and 38. The ice making compartment 41 and the first and second freezing compartments 42 and 43 are provided in a lower space of the inner box 14 surrounded by the inner box 14 and the second partition member 38. In this case, the ice making compartment 41 is provided in the left side below the second partition member 38. The second freezing compartment 43 is provided on the right of the ice making compartment 41. The first freezing compartment 42 is provided below the ice making compartment 41 and the second freezing compartment 43.

[0031] The refrigerator 11 is provided with a refrigerating compartment door 391, a vegetable compartment door 401, an ice making compartment door 411, a first freezing compartment door 421 and a second freezing compartment door 431 as shown in FIG. 2. The refrigerating compartment door 391 is of a hingedly mounted type and is mounted so as to open and close a front opening of the refrigerating compartment 39. The vegetable compartment door 401 is of a slide-out type and is mounted so as to open and close a front opening of the vegetable compartment 40. The ice making compartment door 411 and the first and second freezing compartment doors 421 and 431 are also of the slide-out type and are mounted so as to open and close front openings of the ice making compartment 41 and the first and second freezing compartments 42 and 43.

[0032] The first and second partition members 37 and 38 will be described. Since the first and second partition members 37 and 38 have substantially the same construction in appearance, only the first partition member 37 will be described with reference to FIG. 8. Furthermore, since the first partition member 37 is bilaterally symmetrical in shape, only the construction of the right side thereof will be described.

[0033] The first partition member 37 includes a front partition 44 and a side partition 45. The front partition 44 is provided at the front opening side of the heat insulation box 12 and formed into the shape of a rectangular parallelepiped extending in the right-left direction. The front partition 44 includes a partition plate 441, a partition reinforcement plate 442, a partition cover 443 and a partition heat insulating member 444. The partition plate 441 is a metal plate member and constitutes a front wall of the front partition 44. The partition plate 441 has right and left ends both bent slightly rearward. The right and left ends of the partition plate 441 are passed through openings 33 formed in front ends of the right and left heat insulation walls 313 and 314 to be inserted into the end insertion chamber 34. The front partition 44 has a right end formed with three through holes 445.

[0034] The partition reinforcement plate 442 is a metal plate and is formed into the shape of a plate extending along a rear side of the partition plate 441. The partition reinforcement plate 442 has a vertical dimension which is set to be equal to or shorter than a vertical dimension of the partition plate 441. The partition reinforcement plate 442 has a horizontal dimension which is set to be longer than a horizontal dimension of the partition plate 441. The partition reinforcement plate 442 has a plate thickness which is equal to or larger than a plate thickness of the partition plate 441. The partition reinforcement plate 442 has right and left ends which are folded rearward and are in contact with a rear surface of the partition plate 441. The partition reinforcement plate 442 is used when the partition plate 441 has a small tension strength or in another case. The partition plate 441 has a right end which is interposed between the right end of the partition reinforcement plate 442 and the folded portion 32 of the right outer plate 18 in the end insertion chamber 34 of the right heat insulation wall 313. The same is applied to the left end of the partition plate 441. The partition plate 441 further has a front coplanar with the front of the folded portion 32.

[0035] The partition reinforcement plate 442 has a right end which is bent at a location on the right of the partition plate 441 so that the right end has a generally L-shaped section. In other words, the right end of the partition plate 441 is folded rearward along the shape of a right front corner of the right outer plate 18. The same is applied to the left end of the partition plate 441. The partition reinforcement plate 442 has three screw holes 446 formed in the right end thereof. The screw holes 446 have inner peripheral walls formed with respective female threads. The screw holes 446 correspond to the through holes 445 formed through the partition plate 441 respectively. A screw 46 is provided in the rightmost screw hole 446. The screw 46 is screwed through the hole 35 of the right outer plate 18 and the hole 445 of the partition plate 441. Screws 47 are provided in the other screw holes 446 of the partition reinforcement plate 442 respectively. The screws 47 are screwed through the through holes 445 of the partition plate 441. As a result, the right ends of the partition plate 441 and the partition reinforcement plate 442 are connected and fixed to the folded portion 32 of the right outer plate 18.

[0036] The above-described construction of the right ends of the partition plate 441 and the partition reinforcement plate 442 are also applied to the left ends of the partition plate 441 and the partition reinforcement plate 442 although the construction of the left ends are not shown in detail. In other words, the left ends of the partition plate 441 and the partition reinforcement plate 442 are connected and fixed to a folded portion (not shown) of the left heat insulation wall 314, namely, the left outer plate 19. In this case, the partition plate 441 functions as a connecting member which connects and fixes the right and left heat insulation walls 313 and 314 at the front opening side of the heat insulation box 12. The folded portion 32 functions as a connected member.

[0037] The partition cover 443 is made of a metal and formed into the shape of a horizontally long open-front box. The partition cover 443 constitutes an outer peripheral wall of the rectangular parallelepiped of the partition 44 together with the partition plate 441. The partition cover 443 is supported by the support members 27. In this case, the partition cover 443 has mounts (not shown)

which are provided on a lower part thereof and fixed to the support members 27 respectively. The partition heat insulating member 444 is provided in a rectangular parallelepiped space defined by the partition cover 443 and the partition plate 441. The partition heat insulating member 444 is constituted by a heat insulating member such as foam polystyrene or urethane and formed into the shape of a rectangular parallelepiped.

[0038] The side partition 45 is constituted by a resin member and formed into a rectangular plate shape as a whole as shown in FIGS. 3 and 4. The side partition 45 of the second partition member 38 contains a heat insulating member such as a vacuum heat insulation panel therein, whereby the side partition 45 of the second partition member 38 has heat insulating properties. The side partition 45 is placed on the support members 27 thereby to be held. The side partition 45 has a front end in abutment with a rear of the front partition 44 and right and left ends in abutment with the right and left inner plates 24 and 25 respectively.

[0039] The first partition member 37 has a clearance gap between a rear end of the side partition 45 and the rear inner plate 26, whereby the refrigerating compartment 39 communicated with the vegetable compartment 40 via the clearance gap, as shown in FIG. 4. On the other hand, the second partition member 38 has the side partition 45 further having a rear end in abutment with the rear inner plate 26, whereby the refrigerating compartment 39 and the vegetable compartment 40 are heat-insulated from the ice-making compartment 41 and the first and second freezing compartments 42 and 43.

[0040] The heat insulation walls 31 are connected and fixed to adjacent other divided heat insulation walls 31 by fixtures 51 as shown in FIGS. 1 and 3 to 6. In this case, the fixtures 51 are provided in a corner formed by the upper and right inner plates 22 and 24, a corner formed by the upper and left inner plates 22 and 25, a corner formed by the upper and rear inner plates 22 and 26, a corner formed by the bottom and right inner plates 23 and 24, a corner formed by the bottom and left inner plates 23 and 25 and a corner formed by the bottom and rear inner plates 23 and 26, respectively. In other words, the fixtures 51 are fixed at the locations opposed to two heat insulating members 15 which are adjacent to but separated from each other.

[0041] An electrical cable 52 is disposed at one of the corners located in the rear of the inner box 14, for example, the left inner corner formed by the left and rear inner plates 25 and 26, as shown in FIGS. 6 and 9. The electrical cable 52 extends along the corner. The electrical cable 52 is power supply and signal transmission electrical cable for connecting a blowing fan and various sensors to a control device although an electrical arrangement is not shown in detail. Each electrical cable 52 is formed by bundling a plurality of electrical wires. Note that the drawings show the electrical cable 52 in which a plurality of electrical wires is bundled so as to have a circular section.

[0042] Pipes 53 are disposed at the other corner located in the rear of the inner box 14, that is, a corner which differs from the corner where the electrical cable 52 is disposed and is formed by the left and rear inner plates 25 and 26, as shown in FIGS. 6 and 22. The pipes 53 extend along the corner. The pipes 53 serve as suction pipes connecting between refrigerating and freezing evaporators and a compressor neither of which is shown, or the like. In this case, the two pipes 53 are provided side by side. Refrigerant used for refrigeration flows through one pipe 53 and refrigerant used for freezing flows through the other pipe 53.

[0043] The pipes 53 are connected to refrigerating freezing evaporators and further to a blowing fan (not shown). The blowing fan supplies cold air generated by the evaporators into the storage compartment, recirculating the air. It is preferable that the blowing fan is disposed between the right and left fixtures in the storage compartment. In this case, a duct, which is not shown in detail, is provided between the right and left fixtures 51. It is preferable that the duct has a thickness which is equal to or smaller than a thickness of the fixture 51 in the front-rear direction or larger.

[0044] The fixtures 51 provided at respective corners of the inner box 14 are similar in the construction. Accordingly, the following will describe the fixture 511 provided at a corner formed by the right and rear inner plates 24 and 26 and the fixture 512 provided at the corner formed by the right and rear inner plates 24 and 26. In the description of the fixture 512, part thereof common to the fixture 511 will be eliminated.

[0045] The fixture 511 will firstly be described with reference to FIGS. 1 and 9 to 21. The fixture 511 is formed into a vertically long pillar shape and has a right-angled triangle-shaped section as a whole as shown in FIGS. 1, 9 and 10. The fixture 511 extends in the up-down direction along the corner formed by the left and rear inner plates 25 and 26 as shown in FIG. 10. The fixture 511 includes a fixing cover 54, a reinforcing member 55 and a corner heat insulating member 56 as shown in FIGS. 12 to 14. The fixture 511 is formed into a cylindrical shape having the right-angled triangle-shaped section. The corner heat insulating member 56 is disposed inside the cylindrical shape formed by the fixing cover 54 and the reinforcing member 55.

[0046] More specifically, the fixing cover 54 is comprised of a resin member and formed into a vertically long rectangular substantially plate-like shape. The fixing cover 54 constitutes an inclined plane out of three sides of the right-angled triangle-shaped section of the fixture 511. The fixing cover 54 has a plurality of through holes 58 and openings 59 and 60 as shown in FIGS. 14 to 21. The holes 58 are located at both widthwise ends perpendicular to the lengthwise direction. The holes 58 at both ends are formed so as to extend through the fixing covers 54 toward the left or rear heat insulation wall 314 or 315 as shown in FIGS. 16 and 19.

[0047] The holes 58 are disposed so as to be separated

from the holes 58 of the other side end as far as possible. More specifically, the holes 58 are displaced from the holes 58 at the other end side so as to be disposed alternately in the up-down direction. In this case, the holes 58 are arranged in a zig-zag manner along the lengthwise direction of the fixing cover 54 as shown in FIG. 13. The screws 57 are to be inserted through the holes 58 respectively. A direction in which the screw 57 is inserted through the hole 58 at the left divided heat insulation wall 314 side is perpendicular to an inner surface of the left divided heat insulation wall 314, that is, the left inner plate 25, as shown in FIG. 19. Furthermore, a direction in which the screw 57 is inserted through the hole 58 at the rear heat insulation wall 315 side is perpendicular to an inner surface of the rear divided heat insulation wall 315, that is, the rear inner plate 26, as shown in FIG. 16.

[0048] The openings 59 are provided near an upper part of the fixing cover 54 in the lengthwise or up-down direction, as shown FIG. 13. The openings 60 are provided near a lower part of the fixing cover 54 in the up-down direction. The openings 59 and 60 communicate with an inside of the cylindrical fixture 511.

[0049] The reinforcing member 55 is comprised of a resin member. The reinforcing member 55 is formed into a shape such that lengthwise sides of two vertically long rectangular plates are butted against each other at a right angle, that is, formed so as to have an L-shaped section, as shown in FIG. 14. The reinforcing member 55 constitutes two of the three sides constituting the rectangular parallelepiped of the fixture 511, other than the inclined surface. The reinforcing member 55 reinforces the fixing cover 54 and improves the strength of the fixture 511. The reinforcing member 55 has a lengthwise dimension set to be substantially equal to the lengthwise dimension of the fixing cover 54.

[0050] The reinforcing member 55 is disposed so that one of two sides thereof is opposed to the left inner plate 25 or the left heat insulation wall 314 and so that the other side is opposed to the rear inner plate 26 or the rear heat insulation wall 315. As a result, the reinforcing member 55 is disposed between ends of the adjacent heat insulation walls 31 or in this case, so as to stride over ends of the left and rear divided heat insulation walls 314 and 315. Since no first heat insulating member 15 is provided on the corner where the adjacent heat insulation walls 31 are butted against each other, the corner has a lower heat insulating performance than the other part of the divided heat insulation wall 31. The fixture 511 is disposed in the part of the divided heat insulation wall 31 having a lower heat insulating performance.

[0051] The reinforcing member 55 has a plurality of screw holes 61 and a plurality of through holes 62 as shown in FIGS. 14, 16 and 17. The screw holes 61 and the through holes 62 are provided in both widthwise ends perpendicular to the lengthwise direction of the reinforcing member 55. The screw holes 61 and the through holes 62 correspond to the through holes 58 of the fixing cover 54 and are disposed in the zig-zag manner along the lengthwise direction of the reinforcing member 55.

[0052] The screw holes 61 include cylindrical portions protruding to the fixing cover 54 side respectively. Each cylindrical portion has a female thread formed inside. Each screw hole 61 has an axial direction corresponding with an axial direction of the through hole 58 of the fixing cover 54 in the state where the fixing cover 54 is mounted on the reinforcing member 55. The screws 57 are screwed into the screw holes 61 respectively.

[0053] The holes 62 are formed through bulging portions 63 provided on the reinforcing members 55 so as to extend to the left inner plate 25 or the rear inner plate 26 side, respectively. The bulging portions 63 are formed so that both ends of the reinforcing members 55 bulge to the fixing cover 54 side. In this case, the bulging portions 63 are also disposed in the zig-zag manner along the lengthwise direction of the reinforcing members 55. The screws 57 are inserted through the holes 62 respectively.

[0054] The corner heat insulating member 56 is disposed so as to cover the butted portions of the adjacent heat insulation walls 31 as shown in FIG. 9. The corner heat insulating member 56 is comprised of a heat insulating member, such as foam polystyrene, formed into a vertically long substantially triangular prism shape, as shown in FIG. 14. The corner heat insulating member 56 has a plurality of cutouts 64, two openings 65 and 66 and housing part 67.

[0055] The cutouts 64 are formed by cutting out both widthwise ends of the corner heat insulating member 56 perpendicular to the lengthwise direction into a rectangular shape. The cutouts 64 are disposed in the zig-zag manner along the lengthwise direction of the corner heat insulating member 56 so as to be prevented from interference with the through holes 58 of the fixing cover 54, the screw holes 61 of the reinforcing member 55 and the screws 57 screwed through the respective holes 62.

[0056] The openings 65 and 66 are formed by cutting out both widthwise ends of the corner heat insulating member 56 perpendicular to the lengthwise direction into a rectangular shape. The openings 65 correspond to the openings 59 of the fixing cover 54 respectively. The openings 66 correspond to the openings 60 of the fixing cover 54 respectively.

[0057] The housing part 67 is formed in a right-angled portion in the section of the corner heat insulating member 56 perpendicular to the lengthwise direction, that is, in a part close to the corner of the inner box 14, into a groove shape extending in the lengthwise direction.

[0058] The electrical cable 52 is housed in the housing part 67. More specifically, the fixture 511 houses the electrical cable 52 in the cylindrical portion thereof. The electrical cable 52 is held by an inner surface of the housing part 67 serving as the holding portion so as not to be displaced from a predetermined position. Note that the electrical cable 52 is also held by a hook (not shown) or the like. In this case, the part of the electrical cable 52 provided inside the cylindrical portion of the fixture 511

is not viewed from the opening side of the refrigerator 11.

[0059] The fixture 511 is constituted by connecting two parts divided at the height position of a second partition member 38 in the lengthwise direction or the up-down direction, in this case, the upper fixture 511 and the lower fixture 511. Accordingly, the fixing cover 54 is constituted by two parts divided in the lengthwise direction thereof, in this case, an upper fixing cover 541 and a lower fixing cover 542 as shown in FIGS. 1, 12, 13 and 14. This construction renders handling of the fixing cover 54 easier, with the result that deformation such as torsion is hard to occur. In this case, the opening 59 is formed in the upper fixing cover 541 and the opening 60 is formed in the lower fixing cover 542.

[0060] The reinforcing member 55 is also constituted by two parts divided in the lengthwise direction thereof, in this case, an upper reinforcing member 551 and a lower reinforcing member 552 in the similar manner. The corner heat insulating member 56 is also constituted by two parts divided in the lengthwise direction thereof, in this case, an upper corner heat insulating member 561 and a lower corner heat insulating member 562. The opening 65 is formed in the upper corner heat insulating member 561 and the opening 66 is formed in the lower corner heat insulating member 562.

[0061] In the above-described construction, the upper fixing cover 541, the upper fixture 511 is constituted by the upper reinforcing member 551 and the upper corner heat insulating member 561. Furthermore, the lower fixing cover 542, the lower reinforcing member 552 and the lower corner heat insulating member 562 constitute the lower fixture 511. At the left corners of the inner box 14, the upper fixture 511 is disposed at the refrigerating compartment 39 and vegetable compartment 40 side and the lower fixture 512 is disposed at the ice making compartment 41 and first freezing compartment 42 side.

[0062] The upper reinforcing member 551 has a lower end formed with two screw holes 48. The lower reinforcing member 552 has an upper end formed with two through holes 49 located to correspond to the respective screw holes 48. The upper and lower reinforcing members 551 and 552 are fixed together by inserting screws 50 through the holes 49 and further screwing the screws 50 into the screw holes 48, respectively.

[0063] The fixture 511 is thus configured to be dividable into two parts along the corner or in the lengthwise direction. In this case, the lower end of the upper corner heat insulating member 561 is in abutment with the upper end of the lower corner heat insulating member 562 as shown in FIGS. 12 and 13. Furthermore, the lower end of the upper fixing cover 54 is separate from the upper end of the lower fixing cover 54.

[0064] The electrical cable 52 extends from the mechanical compartment 21 through the upper separation part 211 to the refrigerating compartment 39 side, being further drawn from the upper end of the fixture 511 into the housing part 67 of the corner heat insulating member 56. The electrical cable 52 is bifurcated in two directions in the housing part 67. One bifurcated electrical cable 52 is passed through the opening 65 of the upper corner heat insulating member 561, extending from the opening 59 of the upper fixing cover 541 to the refrigerating compartment 39 side. The other bifurcated electrical cable 52 is passed through the opening 66 of the lower corner heat insulating member 562, extending from the opening 60 of the lower fixing cover 542 to the first freezing compartment 42 side. The openings 59 and 60 are thus provided to guide a part of the electrical cable 52 accommodated in the fixture 511 to the storage compartment side. A part of the electrical cable 52 may be guided from a lower end surface of the fixture 511 through the lower separation part 213 into the component chamber 212, instead.

[0065] The electrical cable 52 has connections 68 on the respective ends thereof as shown in FIGS. 13 and 14. The connections 68 are made of resin and each formed into a plug shape. The connections 68 are connected to an electrical cable (not shown) outside the fixture 511 thereby to be connected via the electrical cable to electrical components such as a control device and a blowing fan.

[0066] A first sealing member 71 is provided between the fixing cover 54 and the reinforcing member 55, more specifically, between a widthwise end of the fixing cover 54 and a widthwise end of the reinforcing member 55, as shown in FIGS. 14 and 16 to 19. The first sealing member 71 is a sheet-shaped member extending in the lengthwise direction of the fixing cover 54 and the reinforcing member 55 and is comprised of a soft tape, for example. The first sealing member 71 seals between the fixing cover 54 and the reinforcing member 55. More specifically, the first sealing member 71 improves airtightness between the fixing cover 54 and the reinforcing member 55.

[0067] Second sealing members 72 are provided between the reinforcing member 55 and the left heat insulation wall 314 and between the reinforcing member 55 and the rear heat insulation wall 315 as shown in FIGS. 14 to 19. The second sealing members 72 are sheet-shaped members extending in the lengthwise direction of the fixing cover 54 and the reinforcing member 55 and are made of a soft tape, for example. The second sealing members 72 seal between the reinforcing member 55 and left heat insulation wall 314 and between the reinforcing member 55 and the rear heating insulation wall 315. More specifically, the second sealing members 72 improve air tightness between the reinforcing member 55 and the left inner plate 25 and air tightness between the reinforcing member 55 and the rear inner plate 26.

[0068] Third sealing members 73 are provided on ends of the heat insulation walls 31, for example, butted portions of the left heat insulation wall 314 and the rear heat insulation wall 315 respectively, as shown in FIG. 9. Each third sealing member 73 is a square pole-shaped member extending in parallel to the lengthwise direction of the fixing cover 54 and the reinforcing member 55 and is

comprised of a soft tape, for example. The third sealing members 73 assist heat insulation in a space defined in the butted portion of the left heat insulation wall 314 and the rear heat insulation wall 315 and further limit invasion of damp air into the space. The third sealing members are eliminated in FIGS. 20 and 21.

[0069] The fixture 511 is thus constituted by the fixing cover 54 and the reinforcing member 55 interposing the corner heat insulating member 56 therebetween. The corner heat insulating member 56 includes the housing part 67 housing the electrical cable 52. The screws 57 are inserted through the holes 58 respectively while the widthwise end of the fixing cover 54 is in abutment with the widthwise end of the reinforcing member 55. The screws 57 having been inserted through the holes 58 are screwed into the screw holes 61 of the reinforcing member 55, respectively. As a result, the fixing cover 54 is fixed to the reinforcing member 55 and the corner heat insulating member 56 and the electrical cable 52 are also fixed in the fixture 511.

[0070] In this case, the fixing cover 54, the reinforcing member 55, the corner heat insulating member 56 and the electrical cable 52 is integrated with one another. The left rear end of the second partition member 38 is inserted between the upper and lower fixing covers 541 and 542 thereby to contact with the connection of the upper and lower heat insulating members 561 and 562. A divided part of the fixture 511 is thus covered by the left rear end of the second partition member 38.

[0071] Furthermore, the left and rear heat insulation walls 314 and 315 are opposed to the reinforcing member 55 with the second sealing members 72 being interposed therebetween. As a result, the left and rear heat insulation walls 314 and 315 adjacent to each other are connected and fixed together by the fixture 511, and an angle made between the left and rear heat insulation walls 314 and 315 is retained at 90° which value corresponds to a right angle part of the reinforcing member 55. More specifically, the reinforcing member 55 functions as an angle retainer which retains the angle between the left and rear walls 314 and 315 at 90°.

[0072] Next, the fixture 512 will be described with reference to FIGS. 22 to 31. The fixture 512 is formed into a columnar shape long in the up-down direction and has a right triangle-shaped horizontal section as a whole, as shown in FIGS. 22, 23 and 25. The fixture 512 extends in the up-down direction along a corner formed by the right inner plate 24 and the rear inner plate 26 as shown in FIG. 23. The fixture 512 includes a fixing cover 81, a reinforcing member 82 and a corner heat insulating member 83 as shown in FIGS. 25 to 27. The fixture 512 is formed into a cylindrical shape and has the right-angled triangle-shaped section. The corner heat insulating member 83 is disposed inside the cylindrical shape formed by the fixing cover 81 and the reinforcing member 82.

[0073] The fixing cover 81 has substantially the same configuration as the fixing cover 54. More specifically, the fixing cover 81 is comprised of a resin member and formed into a vertically long rectangular substantially plate-like shape. The fixing cover 81 constitutes an inclined plane out of three planes of the right-angled triangle-shaped section of the fixture 512. The fixing cover 81 has a plurality of through holes 84 as shown in FIG. 27. The holes 84 are formed in the same manner as the holes 58 of the fixing cover 54. More specifically, the holes 84 are formed through widthwise ends perpendicular to the lengthwise direction of the fixing cover 81. The holes 84 at both ends are formed so as to extend through the fixing covers 81 toward the right or rear heat insulation wall 313 or 315.

[0074] The holes 84 are displaced from the holes 84 at the other end side so as to be disposed alternately in the up-down direction. In this case, the holes 84 are arranged in a zig-zag manner along the lengthwise direction of the fixing cover 54 as shown in FIG. 27. The screws 57 are to be inserted through the holes 84 respectively. A direction in which the screws 57 are inserted through the respective holes 58 at the rear heat insulation wall 315 side is perpendicular to an inner surface of the rear heat insulation wall 315, that is, the rear inner plate 26, as shown in FIG. 29. Furthermore, a direction in which the screw 57 is inserted through the hole 84 at the right heat insulation wall 313 side is perpendicular to an inner surface of the right heat insulation wall 313, that is, the right inner plate 24, as shown in FIG. 31.

[0075] Furthermore, the fixing cover 81 has a first protrusion 85, an opening 86, a second protrusion 87 and an opening 88 as shown in FIGS. 26 and 27. The first protrusion 85 is located near an upper part of the fixing cover 81 in the lengthwise direction and protrudes outward. More specifically, the first protrusion 85 horizontally extends from the surface of the fixing cover 81 along the rear inner plate 26. The first protrusion 85 is formed into a rectangular container shape and has an opening at the rear inner plate 26 side. The opening 86 is formed in a distal end of the first protrusion 85 and communicates between the inside and the outside of the first protrusion 85.

[0076] The second protrusion 87 is located near a lower part of the fixing cover 81 in the lengthwise direction and also protrudes outward in the same manner as the first protrusion 85. More specifically, the second protrusion 87 horizontally extends from the surface of the fixing cover 81 along the rear inner plate 26. The second protrusion 87 is also formed into a rectangular container shape and has an opening at the rear inner plate 26 side. The opening 88 is formed in a distal end of the second protrusion 87 and communicates between the inside and the outside of the second protrusion 87.

[0077] The reinforcing member 82 is constructed substantially in the same manner as the reinforcing member 55. More specifically, the reinforcing member 82 is comprised of a resin member. The reinforcing member 82 is formed into a shape such that lengthwise sides of two vertically long rectangular plates are butted against each

other at a right angle, that is, formed so as to have an L-shaped section. The reinforcing member 82 constitutes two of the three sides constituting the rectangular parallelepiped of the fixture 512, other than the inclined surface. The reinforcing member 82 reinforces the fixing cover 81 and improves the strength of the fixture 512. The reinforcing member 82 has a length set to be substantially equal to the length of the fixing cover 54.

[0078] The reinforcing member 82 has a first reinforcement protrusion 91 and a second reinforcement protrusion 92 both of which are formed into a plate shape and are provided so as to correspond to the first and second protrusions 85 and 87 of the fixing cover 81 respectively. The first and second reinforcement protrusions 91 and 92 are formed integrally with the main part of the reinforcing member 82. The first protrusion 85 and the first reinforcement protrusion 91 are assembled into a cylindrical shape, and the second protrusion 87 and the second reinforcement protrusion 92 are assembled into a cylindrical shape.

[0079] The reinforcing member 82 is disposed so that one side thereof is opposed to the right inner plate 24, that is, the right heat insulation wall 313 and so that the other side thereof is opposed to rear inner plate 26, that is, the rear heat insulation wall 315. As a result, the reinforcing member 82 is disposed between ends of the heat insulation walls 31 adjacent to each other, in this case, so as to straddle the end of the right heat insulation wall 313 and the end of the rear heat insulation wall 315. Since no heat insulating member 15 is provided at a corner where the heat insulation walls 31 adjacent to each other are butted, the corner has a lower heat insulation performance as compared with the other part of the heat insulation wall 31. The fixture 512 is disposed at a part where the heat insulation performance of the heat insulation wall 31 is lower than the other part of the heat insulation wall 31.

[0080] The reinforcing member 82 has a plurality of screw holes 89 and a plurality of through holes 90 as shown in FIG. 27. The screw holes 89 are formed in the same manner as the screw holes 61 of the reinforcing member 55, and the holes 90 are also formed in the same manner as the holes 62 of the reinforcing member 55. More specifically, the screw holes 89 and the holes 90 are provided in widthwise ends perpendicular to the lengthwise direction of the reinforcing member 82. The screw holes 89 and the holes 90 correspond to the holes 84 of the fixing cover 81 and are disposed in a zig-zag manner along the lengthwise direction of the reinforcing member 82.

[0081] The screw holes 89 include cylindrical portions protruding to the fixing cover 81 side respectively. Each cylindrical portion has a female thread formed inside. Each screw hole 89 has an axial direction corresponding with an axial direction of the through hole 84 of the fixing cover 54 in the state where the fixing cover 54 is mounted on the reinforcing member 82. The screws 57 are provided in the screw holes 89 respectively.

[0082] The through holes 90 are formed through bulging portions 77 provided on the reinforcing members 82 so as to extend to the right inner plate 24 or the rear inner plate 26 side. The bulging portions 77 are formed so that both ends of the reinforcing members 82 bulge to the fixing cover side 81. In this case, the bulging portions 77 are also disposed in the zig-zag manner along the lengthwise direction of the reinforcing members 82. The screws 57 are inserted through the holes 90 respectively.

[0083] The corner heat insulating member 83 is formed substantially in the same manner as the corner heat insulating member 56. More specifically, the corner heat insulating member 83 is disposed so as to cover the butted portions of the adjacent heat insulation walls 31. The corner heat insulating member 83 is comprised of a heat insulating member, such as foam polystyrene, formed into a vertically long substantially triangular prism shape, as shown in FIG. 27. The corner heat insulating member 83 has a plurality of cutouts 93, a first heat insulation protrusion 94, an opening 95, a second heat insulation protrusion 96, an opening 97 and a housing part 98.

[0084] The cutouts 93 are formed by cutting out both widthwise ends of the corner heat insulating member 83 perpendicular to the lengthwise direction into a rectangular shape. The cutouts 93 are disposed in the zig-zag manner along the lengthwise direction of the corner heat insulating member 83 so as to be prevented from interference with the through holes 84 of the fixing cover 81, the screw holes 89 of the reinforcing member 82 and the screws 57 provided in the through holes 90.

[0085] The housing part 98 is formed in the same manner as the housing part 67 of the corner heat insulating member 56. More specifically, the housing part 98 is formed in a right-angled portion in the section of the corner heat insulating member 83 perpendicular to the lengthwise direction, that is, in a part close to the corner of the inner box 14, into a groove shape extending in the lengthwise direction.

[0086] The first heat insulation protrusion 94 is located near the upper part of the corner heat insulating member 83, that is, so as to correspond to the first protrusion 85 and protrudes outward, as shown in FIG. 27. More specifically, the first heat insulation protrusion 94 horizontally extends from the main part of the corner heat insulating member 83 along the rear inner plate 26 and is formed into a square pole shape. The opening 95 is provided in a distal end of the first heat insulation protrusion 94 and communicates with the inside of the housing part 98. The first heat insulation protrusion 94 is inserted into a cylindrical portion defined by the first protrusion 85 and the first reinforcement protrusion 91.

[0087] The second heat insulation protrusion 96 is located near the lower part of the corner heat insulating member 83, that is, so as to correspond to the second protrusion 87 and protrudes outward. More specifically, the second heat insulation protrusion 96 horizontally extends from the main part of the corner heat insulating member 83 along the rear inner plate 26 and is also

formed into a square pole shape. The opening 97 is provided in a distal end of the second heat insulation protrusion 96 and communicates with the inside of the housing part 98. The second heat insulation protrusion 96 is housed in a cylindrical portion constituted by the second protrusion 87 and the second reinforcement protrusion 92.

[0088] The pipe 53 is housed in the housing part 98. More specifically, the fixture 512 houses the pipe 53 in the cylindrical interior thereof. The pipe 53 is held by an inner surface of the housing part 98 so as not to be displaced from a predetermined position. The pipe 53 is also held by a hook (not shown). In this case, a part of the pipe 53 provided inside the cylindrical part of the fixture 512 is not viewed from the opening side of the refrigerator 11. A plurality of pipes 53 is housed depending upon portions of the corners.

[0089] The fixture 512 is formed by connecting two parts divided at the height position of the second partition member 38 in the lengthwise direction, that is, in the up-down direction, in this case, an upper fixture 512 and a lower fixture 512. Accordingly, the fixing cover 81 is comprised of two parts divided in the lengthwise direction of the fixing cover 81, in this case, an upper fixing cover 811 and a lower fixing cover 812. As the result, the handling of the fixing cover 81 is rendered easier and deformation such as distortion is difficult to cause. In this case, the upper fixing cover 811 is provided with the first protrusion 85 and the opening 86, and the lower fixing cover 812 is provided with the second protrusion 87 and the opening 88.

[0090] The reinforcing member 82 is comprised of two parts divided in the lengthwise direction thereof, in this case, an upper reinforcing member 821 and a lower reinforcing member 822. The corner heat insulating member 83 is also comprised of two parts divided in the lengthwise direction thereof, in this case, an upper corner heat insulating member 831 and a lower corner heat insulating member 832. The upper corner heat insulating member 831 is provided with the first heat insulation protrusion 94 and the opening 95, and the lower corner heat insulating member 832 is provided with the second heat insulation protrusion 96 and the opening 97.

[0091] In this construction, the upper fixture 512 is constituted by the upper fixing cover 811, the upper reinforcing member 821 and the upper corner heat insulating member 931. Furthermore, the lower fixture 512 is constituted by the lower fixing cover 812, the lower reinforcing member 822 and the lower corner heat insulating member 932. At the right corner of the inner box 14, the upper fixture 512 is disposed at the refrigerating compartment 39 and the vegetable compartment 40 side, and the lower fixture 512 is disposed at the second freezing compartment 43 and first freezing compartment 42 side.

[0092] The upper reinforcing member 821 has a lower end provided with two screw holes 74. The lower reinforcing member 822 has an upper end formed with two through holes 75 which are located so as to correspond to the screw holes 74 respectively. The upper and lower reinforcing members 821 and 822 are fixed together by screwing the screws 76 having been passed through the holes 75 into the screw holes 74, respectively.

[0093] The fixture 512 is thus configured to be dividable into two parts in the direction in which the fixture 512 extends along the corner, that is, in the lengthwise direction. In this case, as shown in FIGS. 24 and 26, the lower end of the upper corner heat insulating member 831 is in abutment with the upper end of the lower corner heat insulating member 832. Furthermore, the lower end of the upper fixing cover 811 is separate from the upper end of the lower fixing cover 812.

[0094] The pipe 53 is constituted by two bent pipes. The pipes 53 have respective bypasses 531 as shown in FIGS. 5 and 25 to 27. The bypasses 531 are located near upper portions of the pipes 53 and are each bent at a plurality of times in the horizontal direction, respectively. The pipes 53 can each ensure a long distance by the respective bypasses 531, whereby heat exchange of a refrigerant flowing through the pipes 53 can be carried out desirably.

[0095] Each pipe 53 has one end connected to a compressor provided in the mechanical compartment 21 and the other end connected to a cooler. More specifically, the pipes 53 are passed through a communication hole 211a of the upper separation part 211 to extend to the refrigerating compartment 39 side. In this case, it is preferable that the communication hole 211a is formed on the upper surface of the fixture 512. Subsequently, the pipes 53 extend through the bypasses 531 into the housing part 98 of the corner heat insulating member 83 from the upper end of the fixture 512. In this case, the bypasses 531 are buried in the second heat insulation member 151 of the separation part 211. One of the pipes 53 is passed through interior of the first heat insulation protrusion 94 provided on the upper corner heat insulating member 831, extending from the openings 95 and 86 to the refrigerating compartment 39 side. The pipe 53 having exited from the openings 95 and 86 is connected to a refrigerating cooler (not shown).

[0096] The other pipe 53 is passed through the interior of the second heat insulation protrusion 96 provided on the lower corner heat insulating member 832, extending from the openings 97 and 88 to the first freezing compartment 42 side. The pipe 53 having exited from the openings 97 and 88 is connected to a freezing cooler (not shown). In this case, the openings 86 and 88 are provided for guiding a part of the pipe 53 housed in the fixture 512 to the storage compartment side. A part of the pipe 53 may be guided from the lower end of the fixture 512 through a communication hole (not shown) of the lower separation part 213 to the component chamber 212.

[0097] Each pipe 53 has weld portions on both ends thereof respectively as shown in FIGS. 25 and 27. One of the pipes 53 has a larger diameter than the other so that the weld portions 99 of one pipe 53 are capable of

adhering to the weld portions of the other pipe 53. Each pipe 53 is caused to adhere to the other pipe 53 outside the fixture 512 thereby to be connected. The other pipe is connected to a refrigerating evaporator, freezing evaporator or a compressor.

[0098] A first sealing member 101 is provided between the fixing cover 81 and the reinforcing member 82, more specifically, between widthwise ends of the fixing cover 81 and widthwise ends of the reinforcing member 82, as shown in FIGS. 29 to 31. The first sealing member 101 is formed in the same manner as the first sealing member 71 provided on the fixture 511.

[0099] A second sealing member 102 is provided between the reinforcing member 82 and the right heat insulation wall 313 and between the reinforcing member 82 and the rear heat insulation wall 315 as shown in FIGS. 29 to 31. The second sealing member 102 is formed in the same manner as the second sealing member 72 provided at the fixture 511.

[0100] Furthermore, a third sealing member 103 is provided on a portion where the right and rear heat insulation walls 313 and 315 are butted with each other, as shown in FIG. 22. The third sealing member 103 is formed in the same manner as the third sealing member 73 provided at the butted portion of the right and rear heat insulation wall 313 and 315.

[0101] The fixture 512 is thus configured with the corner heat insulating member 83 being interposed between the fixing cover 81 and the reinforcing member 82. The pipes 53 are housed in the housing part 98 of the corner heat insulating member 83. The screws 57 are inserted through the holes 84 respectively while the widthwise end of the fixing cover 81 is in abutment with the widthwise end of the reinforcing member 82. The screws 57 having been inserted through the holes 84 are screwed into the screw holes 61 of the reinforcing member 82, respectively. As a result, the fixing cover 81 is fixed to the reinforcing member 82 and the corner heat insulating member 83 and the pipe 53 are also fixed in the fixture 51.

[0102] In this case, the fixing cover 81, the reinforcing member 82, the corner heat insulating member 83 and the pipes 53 are integrated with one another. The right rear end of the second partition member 38 is inserted between the upper and lower fixing covers 811 and 812 thereby to contact with the connection of the upper and lower corner heat insulating members 831 and 832. A divided part of the fixture 512 is thus covered by the right rear end of the second partition member 38.

[0103] Furthermore, the right and rear heat insulation walls 313 and 315 are opposed to the reinforcing member 82 with the second sealing members 102 being interposed therebetween. As a result, the right and rear heat insulation walls 313 and 315 adjacent to each other are connected and fixed together by the fixture 512, and an angle made between the right and rear heat insulation walls 313 and 315 is retained at 90° which value corresponds to a right angle part of the reinforcing member 82. More specifically, the reinforcing member 82 functions as an angle retainer which retains the angle between the left and rear walls 314 and 315 at 90°.

[0104] The pipe 53 may be passed between the right edge of the second partition member 38 and the right inner plate 24 as shown in FIG. 32. In this case, a partition heat insulating member 105 is provided between the side partition 45 of the second partition member 38 and the right inner plate 24 of the inner box 14 in the interior of the inner box 14. The partition heat insulating member 105 is made of foam polystyrene, for example and functions as a heat insulating member. The partition heat insulating member 105 is formed into a quadratic prism shape and is elongate in the front-rear direction along a right edge of the second partition member 38. The partition heat insulating member 105 has a recess 106 which is open at the right inner plate 24 side of the partition heat insulating member 105. A part of the pipe 53 is provided inside the recess 106 of the partition heat insulating member 105. In this case, the pipe 53 may be arranged as follows although the arrangement is not shown in detail.

[0105] For example, two pipes 53 enter the housing part 98 of the upper corner heat insulating member 831 through the upper end of the fixture 512, extending downward. Subsequently, the pipes 53 extend forward out of the housing part 98 through the connection of the upper and lower corner heat insulating members 831 and 832. The pipes 53 pass through the inside of the recess 106 of the partition heat insulating member 105, extending forward along the right edge of the second partition member 38. Subsequently, the pipes 53 are folded backward at a front end of the second partition member 38, again extending rearward along the right edge of the second partition member 38 in the inside of the recess 106. The pipes 53 enter the inside of the housing part 98 of the lower corner heat insulating member 832 through the connection of the upper and lower corner heat insulating members 831 and 832. Subsequently, the pipes 53 are drawn out of the openings 86 and 88 to be connected to the refrigerating cooler and the freezing cooler respectively.

[0106] A member having the same construction as the partition heat insulating member 105 may be provided between the side partition 45 of the second partition member 38 and the left inner plate 25 of the inner box 14 and the electrical cable 52 may be disposed along the left edge of the second partition member 38 in the same manner as the aforementioned pipes 53, although the member is not shown.

[0107] A procedure for assembling the heat insulating box 12 of the refrigerator according to the embodiment will be described with reference to FIGS. 1 and 33.

[0108] Firstly, the divided heat insulation walls 31 and the fixtures 51 as shown in FIG. 1 are manufactured. The fixture 511 is mounted to one of the adjacent two heat insulation walls 31, for example, the left heat insulation wall 314 by the screws 57. The rear heat insulation wall 315 is then mounted to an integrated object of the left heat insulation wall 314 and the fixture 511. As a result,

the adjacent heat insulation walls 31, in this case, the left and rear heat insulation walls 314 and 315 are connected together to be fixed, whereby the right inner corner of the inner box 14 is formed. In this case, the angle between adjacent walls formed by the left and rear heat insulation walls 314 and 315 is held at 90° so as to correspond to the right-angle portion of the reinforcing member 55. The other corners of the inner box 14 are also formed by connecting and fixing the heat insulation walls 31 and the fixtures 51. As a result, the inner box 14 with the angle of the adjacent heat insulation walls 31 being set at 90° is formed, and the rectangular parallelepiped heat insulating box 12 is formed.

[0109] The fixture 51 thus sets the angle between the adjacent divided heat insulation walls 31 at a predetermined value, for example, 90°. In this case, the angle between the adjacent divided heat insulation walls 31 may be adjusted substantially to 90°, with the result that the corners of the heat insulation box 12 are set substantially at 90°. In other words, the angles set by the fixture 51 need not be set strictly but may be set in a range of error generally caused in the manufacturing steps.

[0110] The first partition member 37 and the second partition member 38 are mounted to the heat insulating box 12 assembled as described above so as to be located at predetermined positions respectively. This results in the forming of the refrigerating compartment 39, the vegetable compartment 40, the ice making compartment 41, the first freezing compartment 42 and the second freezing compartment. The front ends of the right and left heat insulation walls 313 and 314 are connected and fixed by the first and second partition members 37 and 38.

[0111] The following effects can be achieved from the above-described construction.

[0112] According to the above-described construction, the electrical cable 52 and the pipes 53 are provided in the storage space of the heat insulation box 12. In other words, the electrical cable 52 and the pipes 53 are not buried in the heat insulation wall 31. This does not require consideration of ensuring a space to house the electrical cable 52 and the pipes 53, in the inside of the heat insulation wall 31, with the result that the first heat insulating member 15 superior in the heat insulation performance to the second hat insulating member 151 can be thickened as much as possible in the heat insulation wall 31. Consequently, the refrigerator is superior in the heat insulation performance and can ensure a sufficient interior space.

[0113] The electrical cable 52 and the pipes 53 are provided in the rear of the inner box 14 or in this case, at the rear corners of the heat insulation box 12. Accordingly, the electrical cable 52 and the pipes 53 are hard to get in the way of putting food into the refrigerator interior.

[0114] The upper separation part 211 leading to the mechanical compartment 21 is provided immediately above the fixture 51. Furthermore, the lower separation part 213 leading to the component chamber 212 is provided immediately below the fixture 51. Accordingly, the electrical cable 52 and the pipes 53 passing through the fixture 51 can easily be guided through the upper and lower separation parts 211 and 213 into the mechanical compartment 21 and the component chamber 212 respectively. Consequently, the electrical cable 52 and the pipes 53 can easily be connected to another electrical cable and the other pipes in the mechanical compartment 21 and the component chamber 212, respectively.

[0115] Furthermore, the communication hole 211a communicating through the second insulating member 151 of the separation part 211 with the mechanical compartment 21 is provided above the fixture 51. Accordingly, the electrical cable 52 and the pipes 53 can be caused to extend in the up-down direction, with the result that arrangement of the electrical cable 52 and the pipes 53 can be rendered easier.

[0116] The second heat insulating member 151 is configured to be fillable. Accordingly, the communication hole 211a can be formed easily. Furthermore, the bypasses 531 of the pipes 53 can easily be covered by the second insulating member 151.

[0117] The electrical cable 52 and the pipes 53 provided at the corners of the inner box 14 are covered by the fixing covers 54 and 81 of the fixtures 51. Accordingly, food stored in storage compartments can be prevented from contacting with the electrical cable 52 and the pipes 53 as much as possible. Furthermore, the designability of the interior of the storage compartment can be improved since the electrical cable 52 and the pipes 53 are not viewed by the user.

[0118] The heat insulation box 12 of the refrigerator 11 is constructed by combining a plurality of divided heat insulation walls 31 and connecting and fixing the adjacent heat insulation walls 31 by the fixture 51. According to this construction, an assembling work of the refrigerator 11 can be rendered easier as compared with the conventional construction of providing a heat insulation member in a stereoscopic or three-dimensional inner box.

[0119] The heat insulating member 15 is comprised of the vacuum heat insulation panel. Accordingly, a high heat insulation effect can be achieved by the vacuum heat insulation panel, and the heat insulation constituting the heat insulation box 12 can be thinned, with the result that the interior space can be increased.

[0120] The reinforcing members 55 and 82 of the fixture 51 function as the angle retention portion which retains the angle between the adjacent heat insulation walls 31 at 90°. Consequently, the inner box 14 can be formed into the shape of a rectangular parallelepiped. Furthermore, since the inner box 14 is configured so that the corners thereof are retained at 90°, the heat insulating members of the heat insulation box 12 can be combined together more easily.

[0121] The fixture 51 is fixed at the position opposed to two heat insulating members 15 which are adjacent to each other but are separate from each other. According-

ly, the heat insulating members 15 can be fixed on the basis of the fixture 51. Consequently, the angle between the adjacent heat insulation walls 31 can easily be retained at 90°.

[0122] The right and left heat insulation walls 313 and 314 are connected and fixed at portions near the vertically central portions by the first and second partition members 37 and 38. Accordingly, the front ends of the right and left heat insulation walls 313 and 314 can be fixed rigidly. Consequently, the opening of the inner box 14 can be prevented from expanding in the right-left direction, whereby the inner box 14 and the heat insulation box 12 can be retained in a rectangular parallelepiped shape.

[0123] The corner heat insulating members 56 and 83 are provided at the corners of the inner box 14. This can improve the heat insulating effect at the corners. Furthermore, sine the corner heat insulating members 56 and 83 are covered by the fixtures 51, the designability of the interior of the storage compartment can also be improved in the same manner as described above.

[0124] The corner heat insulating members 56 and 83 are disposed so as to cover the butted portions of the adjacent divided heat insulation walls 31. More specifically, the heat insulation performance is apt to become lower at the butted portions of two divided heat insulation walls 31. The heat insulation performance is compensated by the corner heat insulating members 56 and 83. Consequently, the heat insulation performance of the entire heat insulation box 12 can be improved.

[0125] The fixture 51 is formed into the cylindrical shape, and the electrical cable 52 or the pipes 53 and accommodates the corner heat insulating members 56 and 83 therein. Consequently, since the electrical cable 52, the pipes 53 and the corner heat insulating members 56 and 83 are not viewed by the user, the designability of the interior of the storage compartments can further be improved.

[0126] The fixture 51 has the reinforcing members 55 and 82 each of which has an L-shaped section. This can improve the strength of the fixture 51 against deformation such as distortion and bending. Furthermore, since the fixture 51 is configured so that the fixing covers 54 and 81 are provided on the reinforcing members 55 and 82 both having respective L-shaped sections, the fixture 51 can easily be formed into the cylindrical shape.

[0127] The electrical cable 52 and the pipes 53 are held by the housing parts 67 and 98 of the corner heat insulating members 56 and 83. This can suppress the displacement of the electrical cable 52 and the pipes 53 from the respective predetermined positions.

[0128] The fixing cover 54 of the fixture 511 has the openings 59 and 60. The electrical cable passed through the fixture 511 is guided through the openings 59 and 60 to the storage compartment side. Consequently, the electrical cable 52 can be passed through the openings 59 and 60 to the storage compartment side thereby to be connectable to the electrical cable located outside the fixture 511, namely, located at the storage compartment side. In particular, the electrical cable 52 has the end which is passed out of the openings 59 and 60 of the fixture 511 and has the connection 68 to be connected to another electrical cable.

[0129] The fixing cover 81 of the fixture 512 has the openings 86 and 88. The pipes 53 drawn through the fixture 512 are guided through the openings 86 and 88 to the storage compartment side. Consequently, the pipes 53 can be guided through the openings 86 and 88 to the storage compartment side and can be connected to other pipes located at the storage compartment side. In particular, the pipes 53 have the ends which are passed out of the openings 86 and 88 of the fixture 512, and the ends have the weld portions 99 to be caused to adhere to other pipes. Consequently, the pipes 53 can easily adhere to the other pipes thereby to be connected to the other pipes outside the fixture 512.

[0130] Furthermore, the electrical cable 52 are integrated with the fixture 511 and the pipes 53 are integrated with the fixture 512. In this case, when the heat insulation walls 31 are connected and fixed by the fixture 51, the electrical cable 52 and the pipes 53 are also provided at predetermined corners of the heat insulation walls 31. This can simplify the assembling work of the electrical cable 52 and the pipes 53.

[0131] The electrical cable 52 are provided at the left inner corner of the inner box 14 and covered by the fixture 511. The pipes 53 are provided at the right inner corner of the inner box 14 and are covered by the fixture 512. This can suppress the cooling of the electrical cable 52 by the pipes 53.

[0132] Furthermore, when parts of the pipes 53 are disposed along the right edge of the second partition member 38, the pipes 53 can be rendered longer without an increase in the size of the fixture 51. Consequently, when the pipes 53 are suction pipes, the heat exchange efficiency can be improved by ensuring the length of the pipe while a sufficient storage space of the storage compartment is ensured.

[0133] The first sealing members 71 and 101 are provided between the fixing covers 54 and 81 and the reinforcing members 55 and 82. The first sealing members 71 and 101 suppress flow of cold air into the fixtures 511 and 512. This can suppress occurrence of dew condensation on internal components of the fixture, for example, on the electrical cable 52.

[0134] The second sealing members 72 and 102 are provided between the heat insulation wall 31 and the fixture 51. The second sealing members 72 and 102 seal gaps between the reinforcing members 55 and 82 and the heat insulation wall 31. More specifically, the second sealing members 72 and 102 improve the airtightness between the reinforcing members 55 and 82 and the heat insulation wall 31. This can suppress air flowing into and out of the interior of the heat insulation box or the storage compartment through the butted portions of the adjacent two divided heat insulation walls 31. This can reduce an amount of cold air leaking from the storage compartment

to the outside of the heat insulation box 12 and an amount of warm air flowing from outside the heat insulation box 12 into the storage compartment.

[0135] The third sealing members 73 and 103 are provided at the butted portions of the adjacent heat insulation walls 31, for example, between the right and rear heat insulation walls 313 and 315 and between the left and rear heat insulation walls 314 and 315. This can sufficiently insulate the inside and the outside of the heat insulation box 12 from heat. Consequently, the atmosphere in the heat insulation box 12 can be cooled efficiently.

[0136] The fixture 51 is divided into a plurality of parts, in this case, two parts, in the direction extending along the corner. Accordingly, the handling of the fixture 51 can be rendered easier. Furthermore, the second partition member 38 is disposed at the divided portions of the fixture 51. This can reduce an amount of cold air flowing from the storage compartment through the divided portions of the second partition member 38 into the fixture 51.

[0137] The divided heat insulation wall 31 is comprised of the heat insulating members 15 interposed between the outer plates 16 to 20 and the inner plates 22 to 26. Each heat insulating member 15 is comprised of the vacuum heat insulation panel which is thin and superior in the heat insulation performance. Accordingly, each heat insulation wall 31 can achieve high heat insulation performance due to the vacuum heat insulation panel and can reduce the thickness thereof. The heat insulation box 12 can thus increase the inner capacity when having the same external dimensions as a heat insulation box comprised of a heat insulation material such as urethane.

[0138] The strength of the heat insulation wall 31 can be increased since the second heat insulating member 151 fills the separation part 211.

[0139] The inner box and the outer box are combined with each other in the conventional construction provided with the undivided heat insulation box after the inner or outer box has been assembled into a box shape, for example. This renders the assembly extensive. In the embodiment, the heat insulation box 12 is constructed by combining a plurality of heat insulation walls 31, with the result that the assembly can be rendered smaller in scale.

(Second Embodiment)

[0140] A second embodiment will be described with reference to FIG. 34. Please note that the construction of the left inner corner of the inner box 14 which will be described in the second embodiment can be applied to other corners.

[0141] A fixture 111 in the second embodiment has no reinforcing member. The fixture 111 is a plate member having substantially the same shape as the fixing cover 54 in the first embodiment and is formed so as to extend along the corner of the inner box 14. In the embodiment, two heat insulation walls 31 adjacent to each other, in this case, the left and rear heat insulation walls 314 and 315 are fixed to the fixture 111 by screws (not shown). More specifically, the two adjacent heat insulation walls 31 are connected and fixed by the fixture 111.

[0142] The fixture 111 has two extending portions 112 and 113 which are provided on widthwise ends of the fixture 111 respectively. The extending portions 112 and 113 are formed so as to extend opposite the inner plates 22 to 26 proximate to both extending portions, in this case, the left inner plate 25 of the left divided heat insulation wall 314 and the rear inner plate 26 of the rear divided heat insulation wall 315. In other words, the extending portion 112 extends along the left inner plate 25 toward the front of the heat insulation box 12. The extending portion 113 extends along the rear inner plate 26 toward the right of the heat insulation box 12.

[0143] In this case, the side extending from the left inner plate 25 of the extending portion 112 toward the rear heat insulation wall 315 is perpendicular to the side extending from the rear inner plate 26 of the extending portion 113 toward the left heat insulation wall 314. Accordingly, when the adjacent left and rear heat insulation walls 314 and 315 are connected and fixed by the fixture 111, an angle between the adjacent walls formed by the left and rear divided heat insulation walls 314 and 315 is defined to 90°. In this case, the extending portions 112 and 113 of the fixture 111 function as angle retaining portions.

[0144] Fourth sealing members 114 are provided between the extending portions 112 and 113 and the inner plates 25 and 26 of the inner box 14 close to each other, respectively. Each fourth sealing member is configured in the same manner as the second sealing members 72 and 112.

[0145] A second corner heat insulating member 115 is provided in a triangular prism-like space defined by the corner of the inner box 14 and the fixture 111 or, in this case, a space defined by the left inner plate 25, the rear inner plate 26 and the fixture 111 and having a horizontal triangular section. In this case, the second corner heat insulating member 115 is covered by the fixture 111. The second corner heat insulating member 115 is made of a heat insulation material such foam polystyrene and formed into a triangular prism shape.

[0146] The second corner heat insulating member 115 has a housing part 116 which is formed by recessing the second corner heat insulating member 115 from the left inner plate 25 side. The housing part 116 extends in the lengthwise direction of the second corner heat insulating member 115. The electrical cable 52 is provided in the housing part 116 thereby to be held. In this case, the housing part 116 functions as a holding portion which holds the electrical cable 52.

[0147] According to the above-described construction, two adjacent heat insulation walls 31 can be connected and fixed by the use of the fixture even without the reinforcing member. The fixture 111 has the extending portions 112 and 113 with the respective extending sides being perpendicular to each other. Accordingly, the angle

between the adjacent inner plates of the fixture 111 is maintained at 90°. As a result, the inner box 14, that is, the heat insulation box 12 can be formed into the shape of a rectangular parallelepiped.

[0148] The fourth sealing members 114 are provided between the extending portions 112 and 113 and the heat insulation walls 31 respectively. This can suppress leakage of refrigerant in the storage compartment outside the heat insulation box 12 and a flow of warm air outside the heat insulation box 12 into the storage compartment.

[0149] The electrical cable 52 is housed in the housing part 116 of the second corner heat insulating member 115. Accordingly, the electrical cable 52 can be prevented from being displaced from the predetermined position as much as possible.

(Third Embodiment)

[0150] A third embodiment will be described with reference to FIG. 35. The construction of a right inner corner of the inner box 14, as will be described in the third embodiment, can be applied to other corners.

[0151] A heat insulating member 120 is composed of a first heat insulating member 121 and a second heat insulating member 122 in the third embodiment, as shown in FIG. 35. The first heat insulating member 121 is comprised of a vacuum heat insulation panel. The first heat insulating member 121 is bonded to outsides of the inner plates 22 to 26 of the inner box 14 thereby to be disposed in position. The second heat insulating member 122 is comprised of a member having a higher heat conductivity than the first heat insulating member 121, in other words, a member having a lower heat insulation performance than the first heat insulating member 121. For example, the second heat insulating member 122 is a foam insulation such as soft tape or urethane.

[0152] The second heat insulating member 122 is located between the outer and inner boxes 13 and 14, covering the first heat insulating member 121. In this case, the second heat insulating member 122 is disposed in a space where the heat insulating member 120 is disposed but the first heat insulating member 121 is not disposed. More specifically, the second heat insulating member 122 is also disposed at a corner of the heat insulation box 12, that is, at a place corresponding to the third sealing member 73 in the first embodiment. In this case, the first heat insulating member 121 occupies not less than 50% or more preferably, 80% of total volume of the space in which the heat insulating member 120 is housed.

[0153] More specifically, the second heat insulating member 122 has a cubic volume set to be smaller than a cubic volume of the first heat insulating member 121. Furthermore, as shown in FIG. 35, when reference symbol T_1 designates a plate thickness of the first heat insulating member 121, reference symbol T_2 designates a plate thickness of the second heat insulating member 122 and reference symbol T_3 designates an outer diameter of the pipe 53, the plate thicknesses and the outer diameter are set so as to meet the relation, $T_1 > T_3 > T_2$. The thicknesses herein refer to thicknesses in the cross-sectional directions of the outer and inner boxes 13 and 14 in a horizontal section of the heat insulation wall 31 respectively. In other words, the plate thickness of the second heat insulating member 122 is a distance between the first heat insulating member 121 and an inner surface of the outer box 13 opposed to the first heat insulating member 121, for example, the right outer plate 18 in FIG. 35. Furthermore, a thickness obtained after solidification is employed regarding the foam insulation.

[0154] According to the above-described construction, a refrigerator provided with two heat insulating members, that is, the first and second heat insulating members 121 and 122 can be obtained. In this case, too, the electrical cable 52 and the pipes 53 are provided at the inner corner of the storage space of the heat insulation box 12. The cubic volume of the first heat insulating member 121 having a superior heat insulating effect to the second heat insulating member 122 is rendered larger. Consequently, a high heat insulating performance can be achieved while the walls of the heat insulation box 12 are rendered thinner, with the result that a sufficient storage space can be ensured.

[0155] More specifically, the thickness T_1 of the first heat insulating member 121 needs to be rendered smaller or the thickness T_2 of the second heat insulating member 122 needs to be rendered larger when a space for housing the pipes 53 is to be ensured between the first heat insulating member 121 and the outer box 13. The heat insulation performance of the heat insulation box 12 is reduced in the former case, while, in the latter case, the thickness of the divided heat insulation wall 31 is increased with the result of reduction in the storage space. In view of the problem, the pipes 53 are housed in the rear inner interior of the storage compartment, in this case, at the right inner corner of the inner box 14 in the embodiment. As a result, since the thickness T_1 of the first heat insulating member 121 need not be rendered smaller, the heat insulation box 12 can achieve a desirable heat insulation performance. Furthermore, since the thickness T_2 of the second heat insulating member 122 need not be rendered larger, the heat insulation box 12 can ensure a sufficient storage space without increase in the thickness of the heat insulation wall 31.

[0156] More specifically, when the outer diameter T_3 of each pipe 53 is larger than the plate thickness T_2 of the second heat insulating member 122 as in the embodiment, the pipes 53 cannot be housed inside the divided heat insulation wall 31 and in particular, between the first heat insulating member 121 and the outer box 13. In this case, the pipes 53 can be housed in the storage space, for example, in the interior of the storage compartment, and the plate thickness T_1 of the first heat insulating member 121 can be rendered larger than the plate thickness T_2 of the second heat insulating member 122, with the result that the heat insulation performance of the heat insulation box 12 can be rendered good.

[0157] A good heat insulation performance is achieved by using the vacuum heat insulation panel as the first heat insulating member 121. Furthermore, since the heat insulation effect is good in spite of a smaller plate thickness of the employed vacuum heat insulation panel, the walls of the heat insulation can be rendered thinner with the result that a sufficient storage space can be ensured.

[0158] The foam insulation or in this case, urethane is used as the second heat insulating member 122. This can fill gaps between the first heat insulating members 121, between the first heat insulating member 121 and the outer box 13 and between the first heat insulating member 121 and the inner box 14. Consequently, the heat insulation effect of the entire heat insulation box 12 can be improved.

[0159] Although reference symbol T_3 designates the outer diameter of each pipe 53 in the foregoing description, the reference symbol T_3 may designate an outer diameter of the electrical cable 52 or a bundle of a plurality of electrical cables at the left inner corner of the inner box 14.

(Other Embodiments)

[0160] Although the electrical cable 52 and the pipes 53 are provided at the corner of the inner box, a component, such as a hose, other than the electrical cable 52 and the pipes 53 may be provided and covered by the fixture 51.

[0161] The fixture 51 is configured to be divided into a plurality of parts in the lengthwise direction. However, the fixture 51 may not be divided into a plurality of parts in the lengthwise direction when provided at a corner without any partitioning member or a corner which is short.

[0162] The fixture 51 in the first embodiment may have the extending portions 112 and 113 of the fixture 111 in the second embodiment. In this case, the fourth sealing member 114 is provided between the fixture 51 and the inner box 14, instead of the second sealing member 72.

[0163] A part of the electrical cable 52 and parts of the pipes 53 may be disposed in the right-left direction along the rear edge of the second partition member 38 between the second partition member 38 and the rear inner plate 26. Furthermore, the part of the electrical cable 52 and the parts of the pipes 53 may be disposed so as to extend in the front-rear direction or in the right-left direction along the edge of the first partition member 37.

[0164] A vacuum heat insulation panel, urethane, foam polystyrene or the like may be used as the heat insulating member of the side partition 45. Furthermore, the side partition 45 may be configured so that the heat insulating member is vertically interposed between resin or metal plates.

[0165] The partition reinforcement plate 442 may be eliminated when the partition plate 441 has a sufficient strength.

[0166] Two adjacent heat insulation walls 31 may be connected and fixed by screws or the like in addition to the connection and fixing by the fixture 51 or 111 in the foregoing embodiments.

[0167] The above-described assembly procedure of the heat insulation box 12 is a mere example and may be modified in the following. For example, the fixture 51 or 111 may be attached to the rear divided heat insulation wall 315 and thereafter, the right left heat insulation wall 313 or 314 may be attached to the fixture 51 or 111.

[0168] The sealing members 71, 72, 73, 101, 102 and 114 should not be limited to the soft tape and may be comprised of a silicon sealer or the like.

[0169] A second corner heat insulating member 115 may be provided at the right inner corner of the inner box 14, and the pipes 53 may be housed in the housing part 116 of the second corner heat insulating member 115.

[0170] The refrigerator 11 may be provided with a mist discharge unit which generates mist by electrostatic atomization and discharges the mist into the storage compartment. The mist preferably has a diameter ranging from 1 to 1000 nm. In this case, the fixture 51 or 111 is provided at a corner formed by two adjacent heat insulation walls 31. This can reduce mist discharged outside the refrigerator through gaps between the adjacent heat insulation walls 31.

[0171] The fixture 51 or 111 may be formed integrally with one of the inner plates of the inner box 14. The heat insulation wall 31 may be formed into an L-shape or U-shape as viewed from a side or top. More specifically, the fixture 51 or 111 may connect and fix heat insulation walls other than the plate-shaped walls or the plate-shaped heat insulation wall and the heat insulation walls other than the plate-shaped walls, instead of the plate-shaped heat insulation walls 31.

[0172] The heat insulating member 15 of the heat insulation wall 31, that is, the vacuum heat insulation panel need not be formed integrally with the inner plate of the inner box 14 but may be formed integrally with an outer plate of the outer box 13, instead. In other words, the heat insulating member may be provided in contact with either an inner plate of the inner box 14 or an outer plate of the outer box 13.

[0173] The heat insulation box 12 may be assembled in the following manner, for example. Firstly, the inner plates 22 to 26 are connected and fixed together by the fixtures 51, whereby the box-shaped inner box 14 is formed. Apart from the inner box 14, the heat insulating members 15 are attached to the outer box 13. The inner box 14 is attached to the outer box 13 integrated with the heat insulation members 15, whereby the heat insulation box 12 is formed. In this case, the inner plates constituting the inner box 14 should not be limited to a flat shape but may be formed into an L-shape as viewed from top, for example.

[0174] The communication hole 211a is preferably a slit in which the rear end side of the upper heat insulation wall 311 is open. According to this construction, the electrical cable 52 and the pipes 53 can be disposed by pass-

ing the cable 52 and the pipes 53 to pass through the opening of the communication hole 211a. Accordingly, the work can easily be carried out since the ends of the electrical cable 52 and the pipes 53 do not need to be passed through the communication hole 211a from below the separation part 211. Furthermore, the inner diameter of the communication hole 211a need not to be larger than the inner diameters of the connections 68 and the weld portions 99 when the communication hole 211a has the above-mentioned slit shape. This can render the inner diameter of the communication hole 211a as small as possible.

[0175] In this case, the electrical cable 52 and the pipes 53 are inserted into the communication hole 211a after the right, left and rear heat insulation walls 313, 314 and 315 have been fixed by the fixture 51, whereby the upper heat insulation wall 311 is mounted. At this time, the communication hole 211a functions as a positioning portion to position the upper heat insulation wall 311 relative to the right, left and rear heat insulation walls 313, 314 and 315 all of which are integrated by the fixture 51. This can render the assembly of the heat insulation box 12 easier. The above-described construction can be applied to the heat insulation wall 312.

[0176] The communication hole 211a need not be located directly above the fixture 51. For example, the communication hole 211a may be located on the heat insulating member 15 of the rear heat insulation wall 315. According to this construction, the slit of the communication hole 211a can be rendered shorter, whereby an amount of urethane foam leaking from the communication hole 211a can be reduced during the filling of the urethane foam.

[0177] In this case, furthermore, the separation part 211 is provided on the upper end of the rear heat insulation wall 315 or more particularly, between an upper end of the rear heat insulation wall 315 and the upper outer plate 16 of the upper heat insulation wall 311, and the electrical cable 52 and the pipes 53 are inflected from the fixture 51 to the rear outer plate 20 side of the rear heat insulation wall 315 thereby to be caused to pass the separation part 211. As a result, the electrical cable 52 and the pipes 53 can be inserted into the communication hole 211a of the heat insulating member 15 of the rear heat insulation wall 315.

[0178] The bypass 531 of the pipes 53 may be housed in the mechanical compartment 21.

[0179] As described above, in the refrigerators of the foregoing embodiments, the electrical cable and the pipes are provided in the box-shaped storage space but not in the heat insulation wall. Accordingly, there is no necessity to consider the securement of a space for housing the electrical cable and pipes in the inside of the heat insulation wall. Consequently, the first heat insulating member 15 superior in the heat insulation performance to the second heat insulating member 151 can be thickened as much as possible in the heat insulation wall 31. Consequently, the refrigerator is superior in the heat insulation performance and can ensure a sufficient interior space.

[0180] 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:

   a heat insulation box formed into a box shape and having a storage space thereinside; and
   an electrical cable or piping, wherein:

   a heat insulation wall constituting the heat insulation box is constructed of a first heat insulating member having a fixed form and interposed between an outer plate and an inner plate, or of the first heat insulating member having a fixed form and interposed between an outer plate and an inner plate with a fillable second heat insulating member filling a gap between the outer and inner plates; and
   the electrical cable or the piping is provided in the storage space.

2. The refrigerator according to claim 1, wherein the electrical cable or the piping is provided in a rear part of the storage space.

3. The refrigerator according to claim 1 or 2, wherein:

   the heat insulation box includes a mechanical compartment provided outside the storage space and a separation part defined between the heat insulating members adjacent to each other between the storage space and the mechanical compartment; and
   the electrical cable or the piping is guided from the mechanical compartment through the separation part to the storage space.

4. The refrigerator according to any one of claims 1 to 3, wherein the electrical cable or the piping is provided at a corner of the heat insulation box.

5. The refrigerator according to any one of claims 1 to 4, further comprising a cover which covers the elec-

trical cable or the piping.

6. The refrigerator according to any one of claims 1 to 5, wherein the heat insulation box is constructed by combining a plurality of heat insulation walls, the refrigerator further comprising a fixture connecting and fixing the heat insulation walls adjacent to each other.

7. The refrigerator according to any one of claims 1 to 6, wherein the first heat insulating member has a larger cubic volume than the second heat insulating member.

8. The refrigerator according to any one of claims 1 to 7, wherein the second heat insulating member has a thickness smaller than an outer diameter of the electrical cable or the piping.

9. The refrigerator according to any one of claims 1 to 8, wherein the second heat insulating member is a foam insulation.

10. The refrigerator according to any one of claims 1 to 8, wherein the first heat insulating member is a vacuum insulation panel.

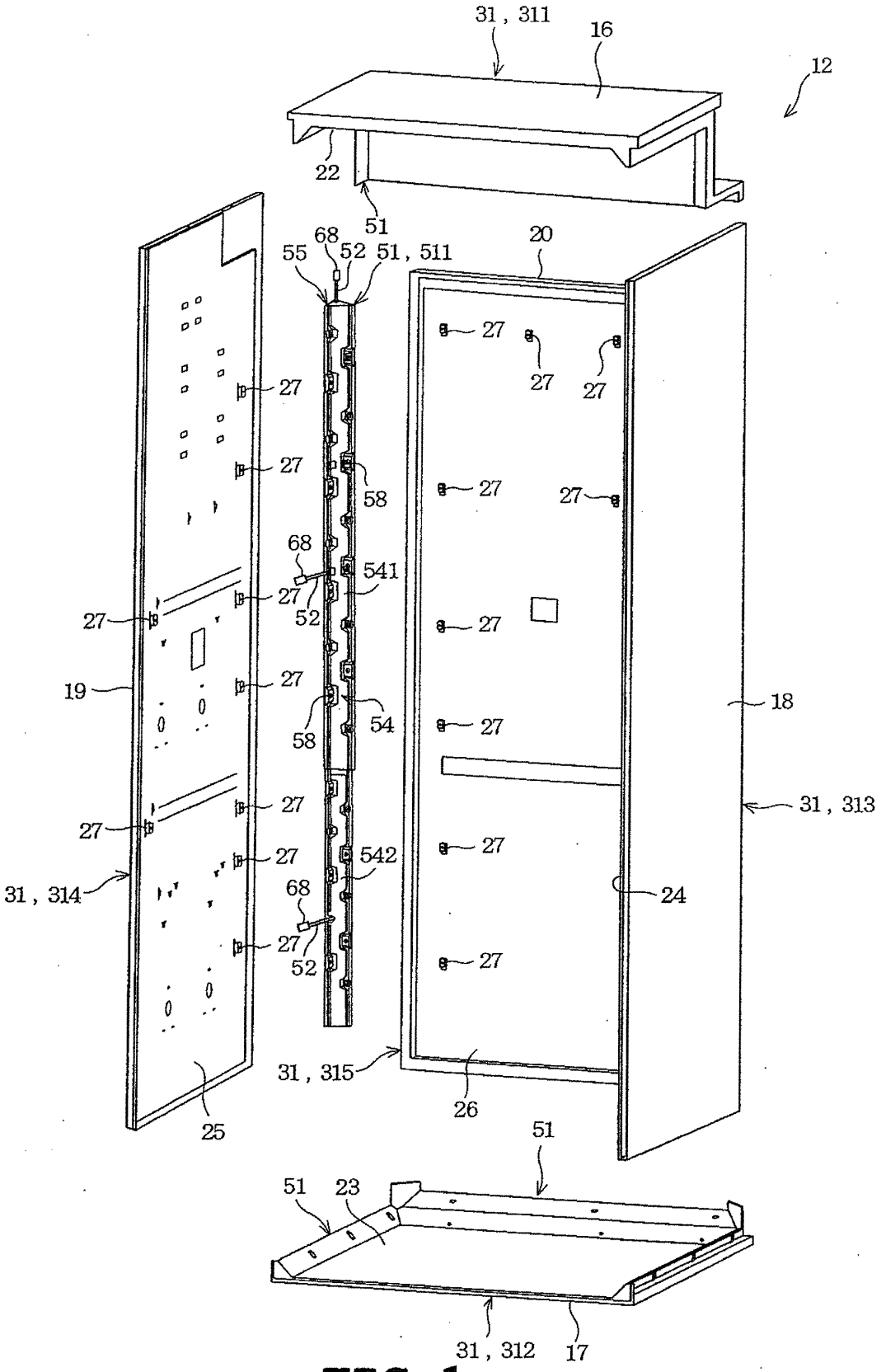
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FIG. 1

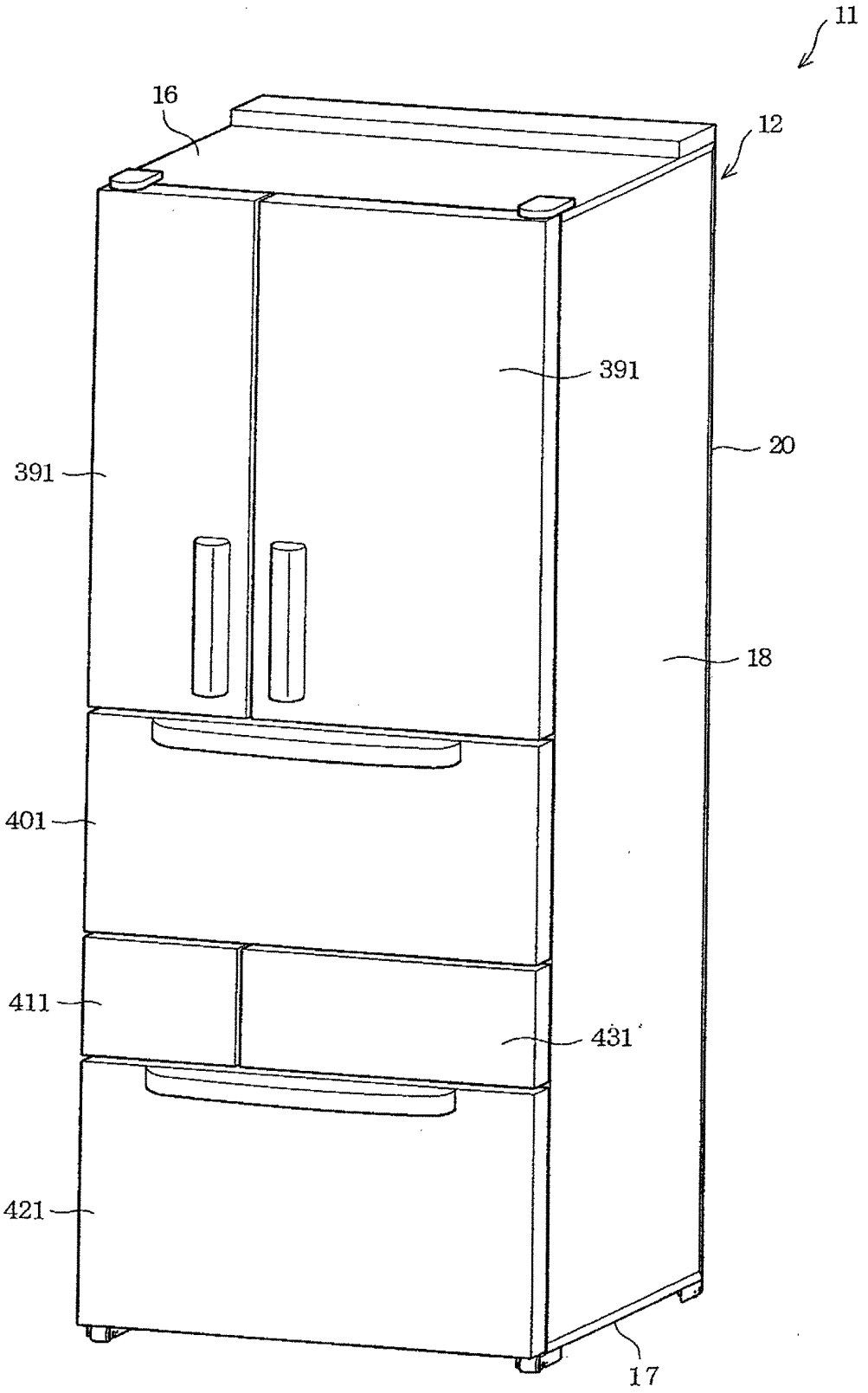

FIG. 2

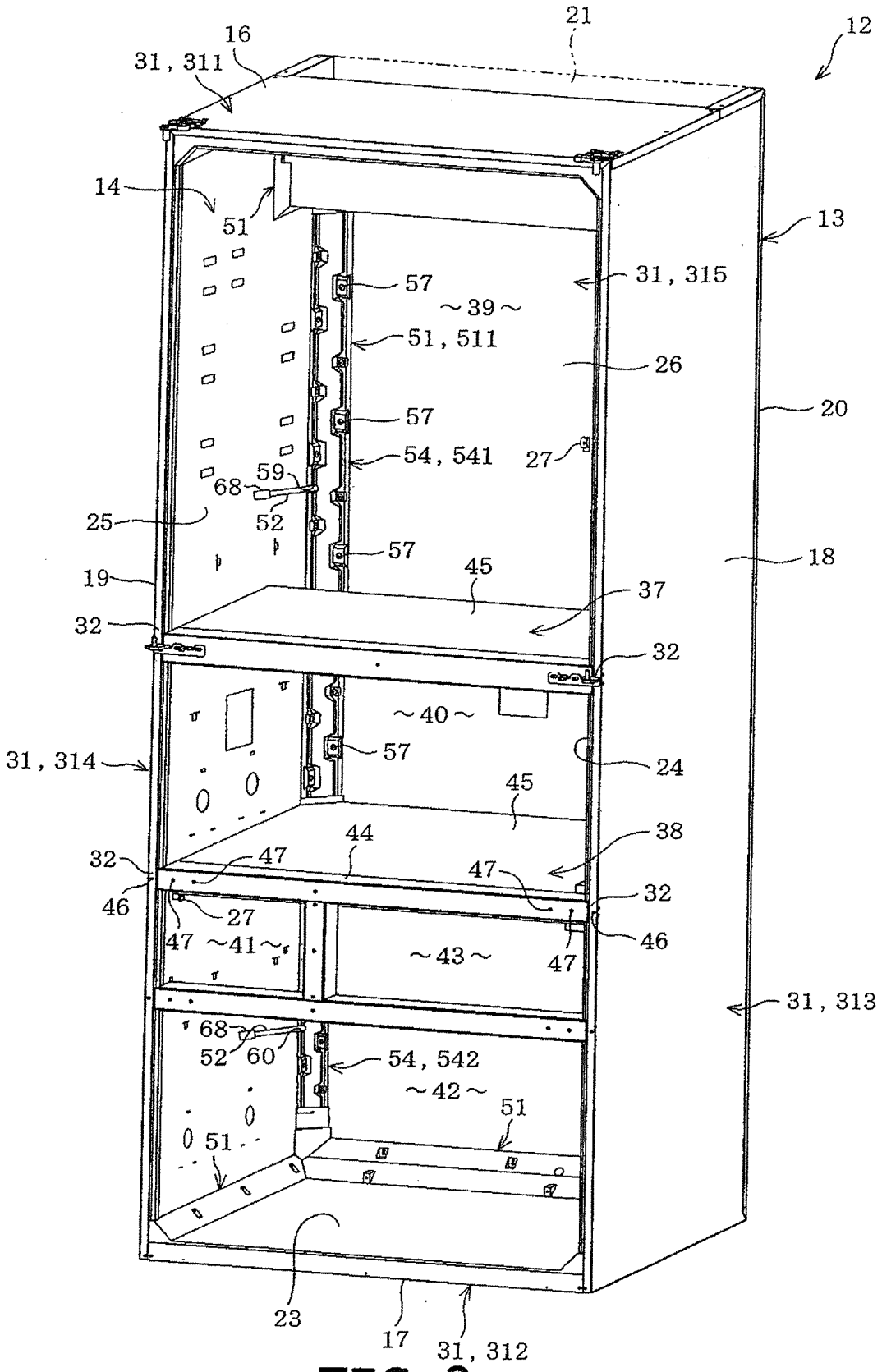
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FIG. 3

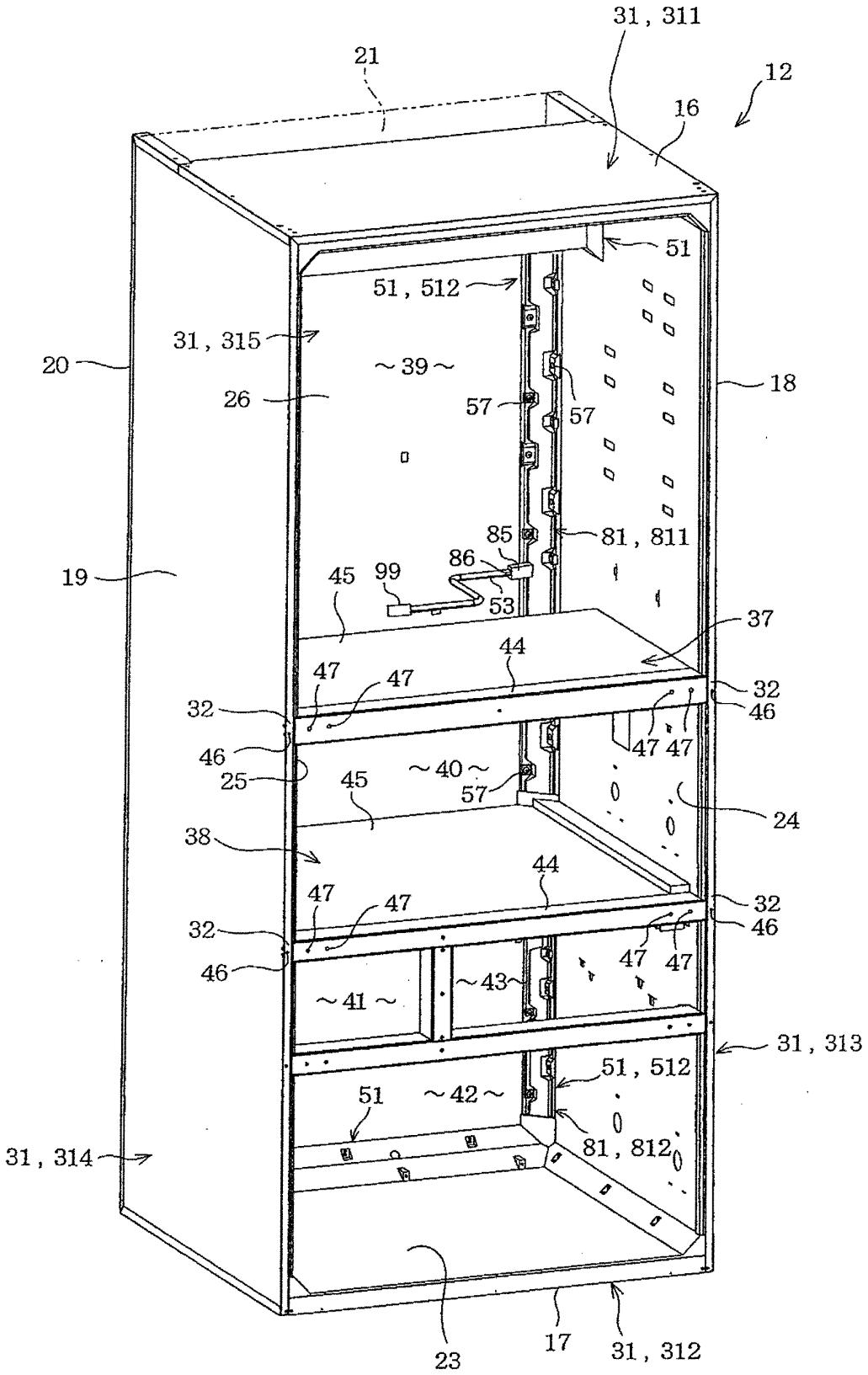
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FIG. 4

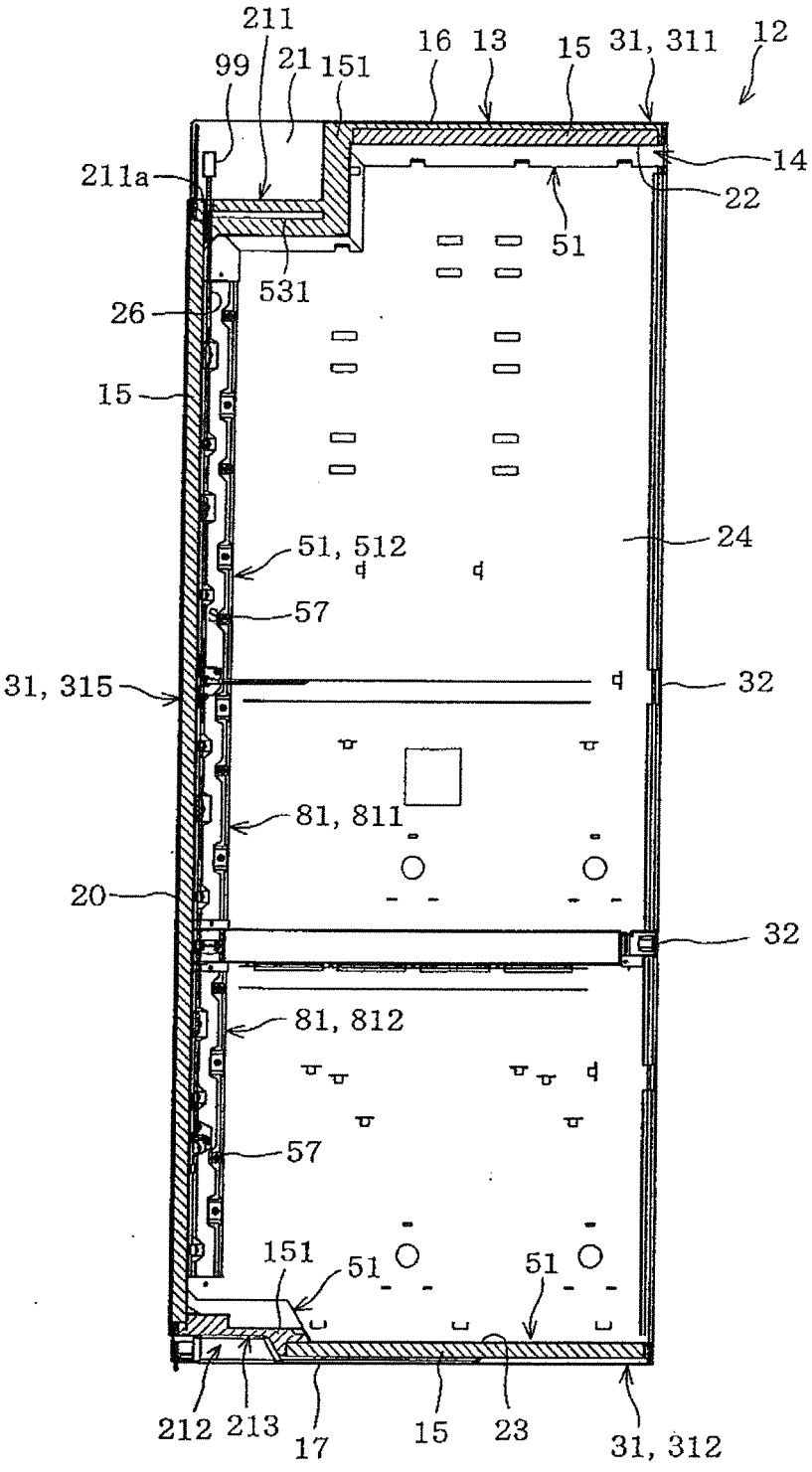
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FIG. 5

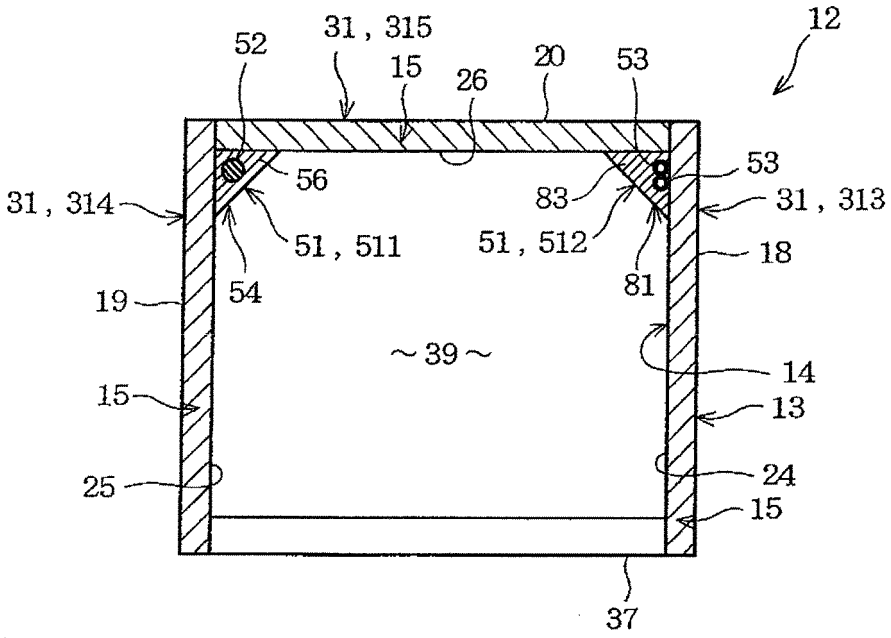
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FIG. 6

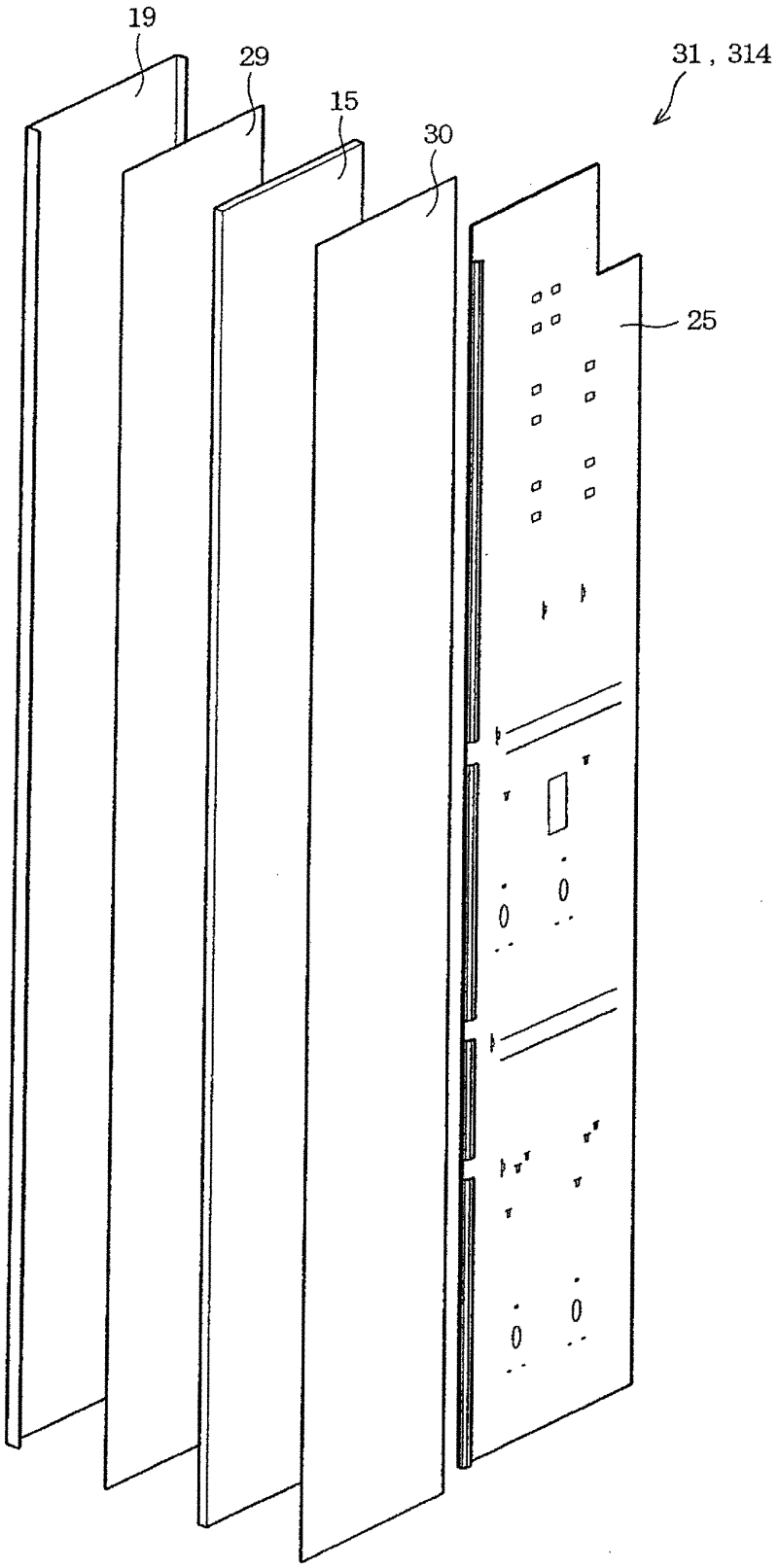

FIG. 7

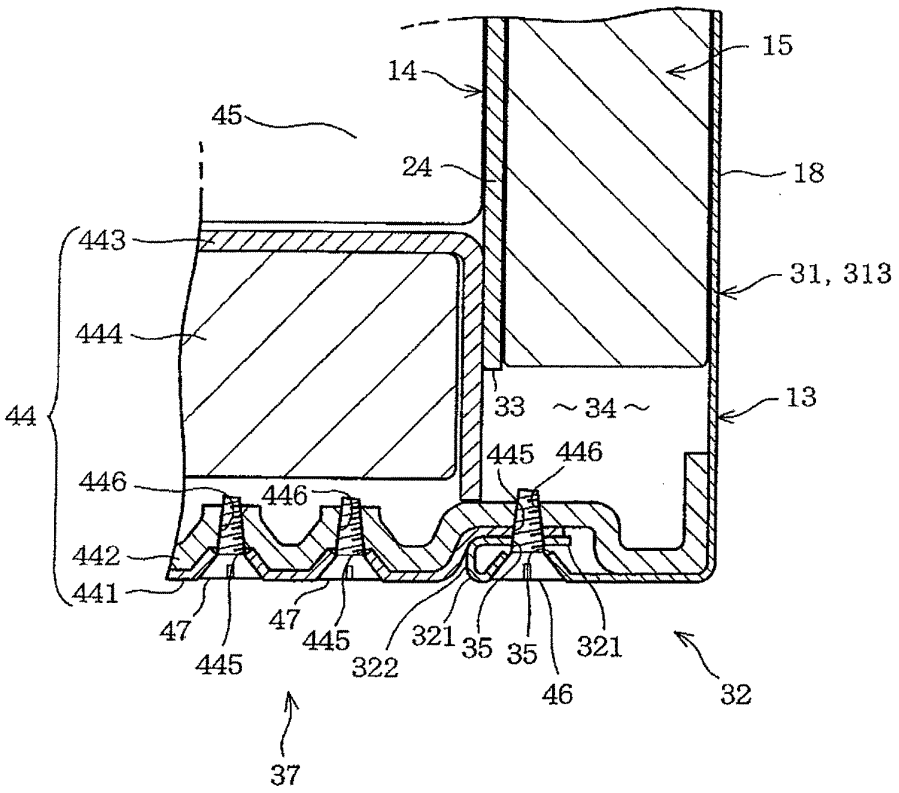
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FIG. 8

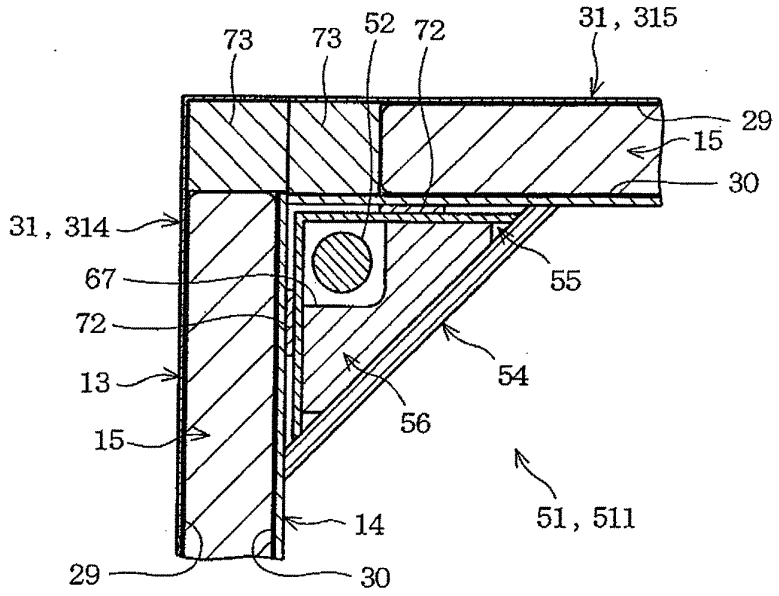
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FIG. 9

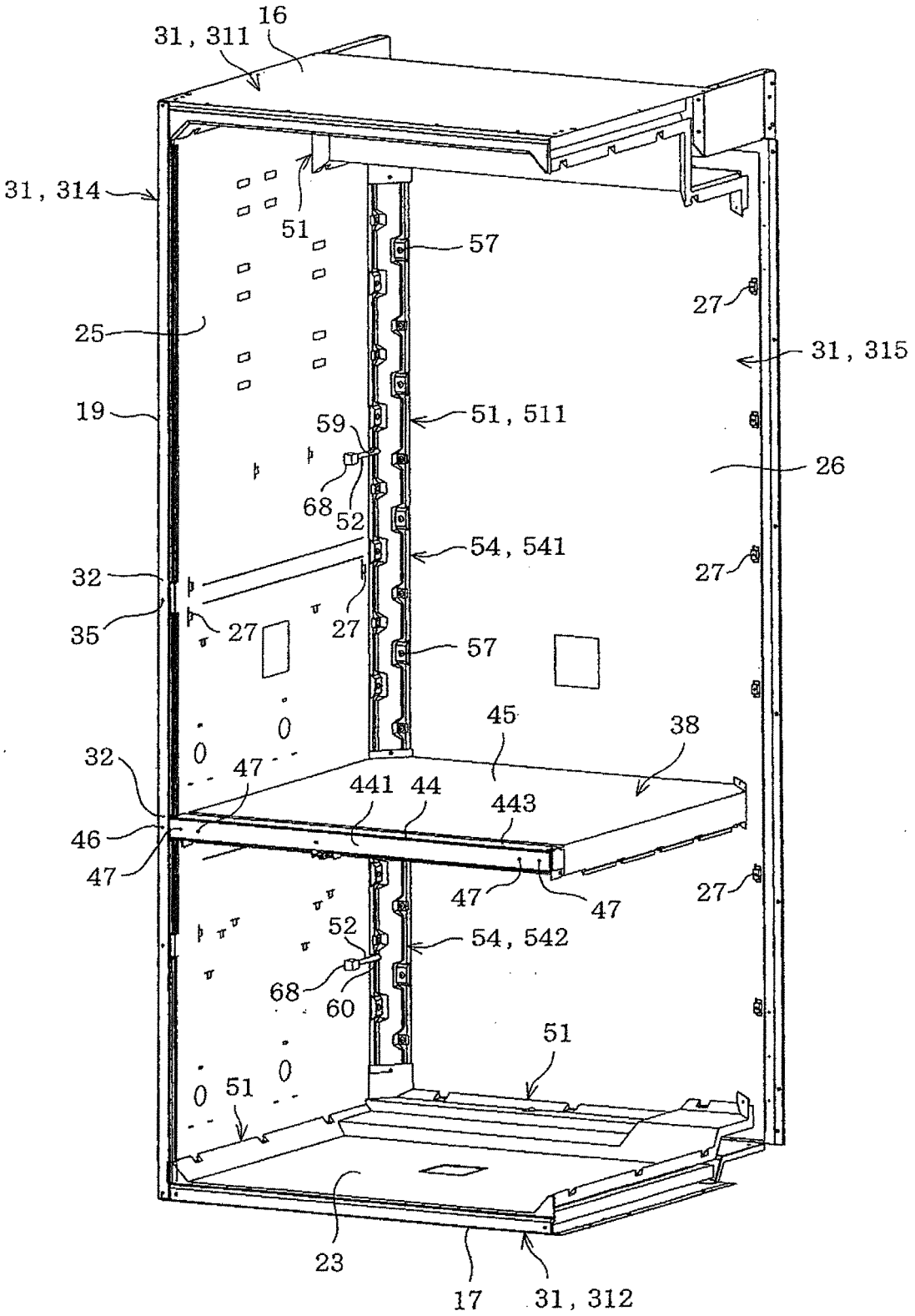
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FIG. 10

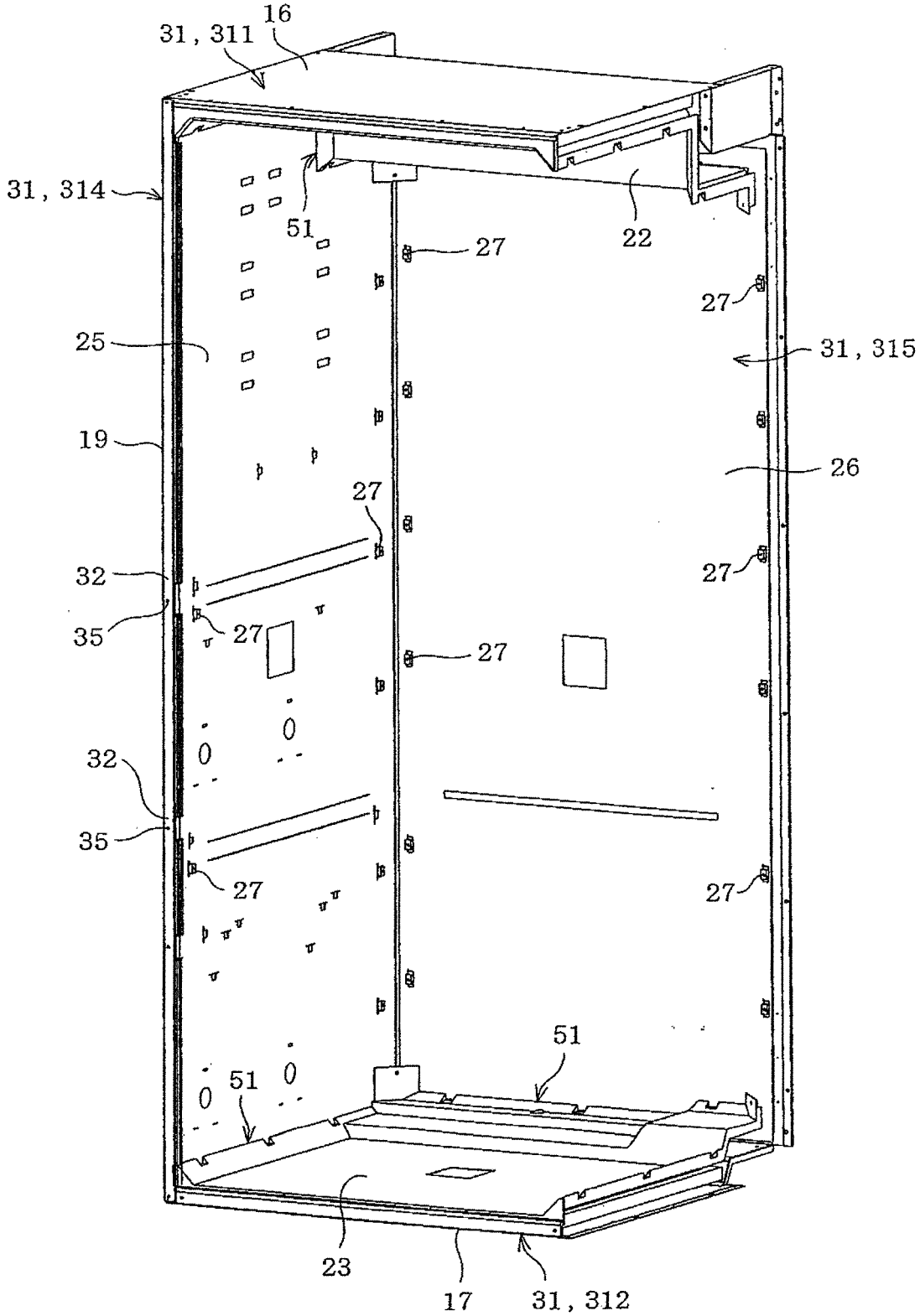
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FIG. 11

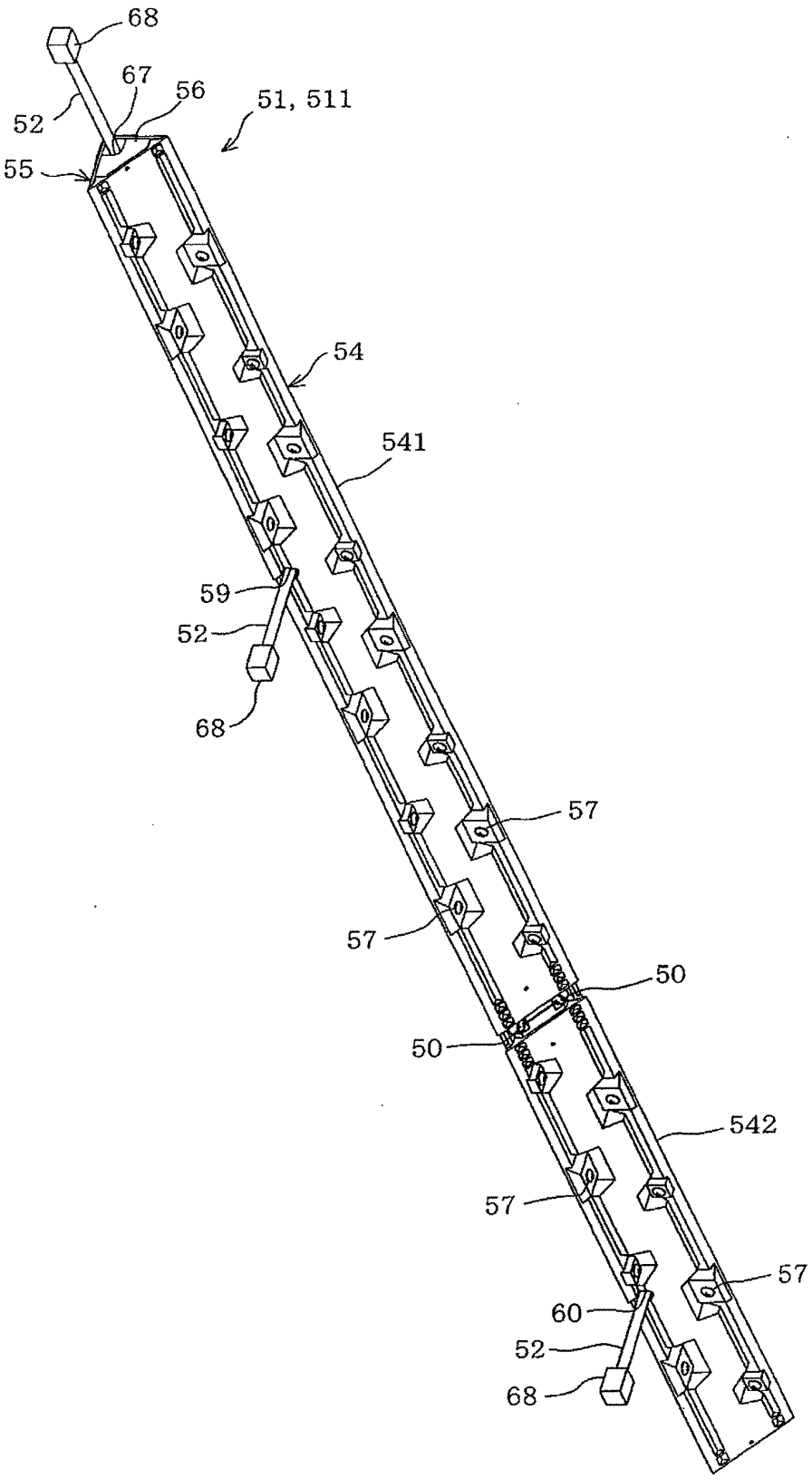

FIG. 12

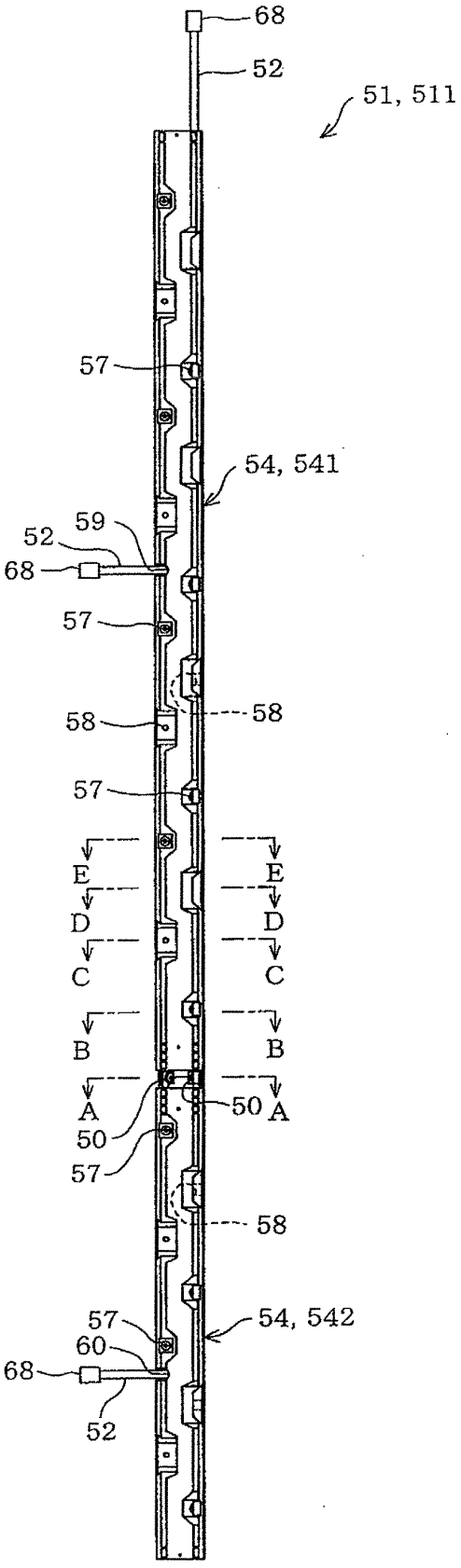
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FIG.13

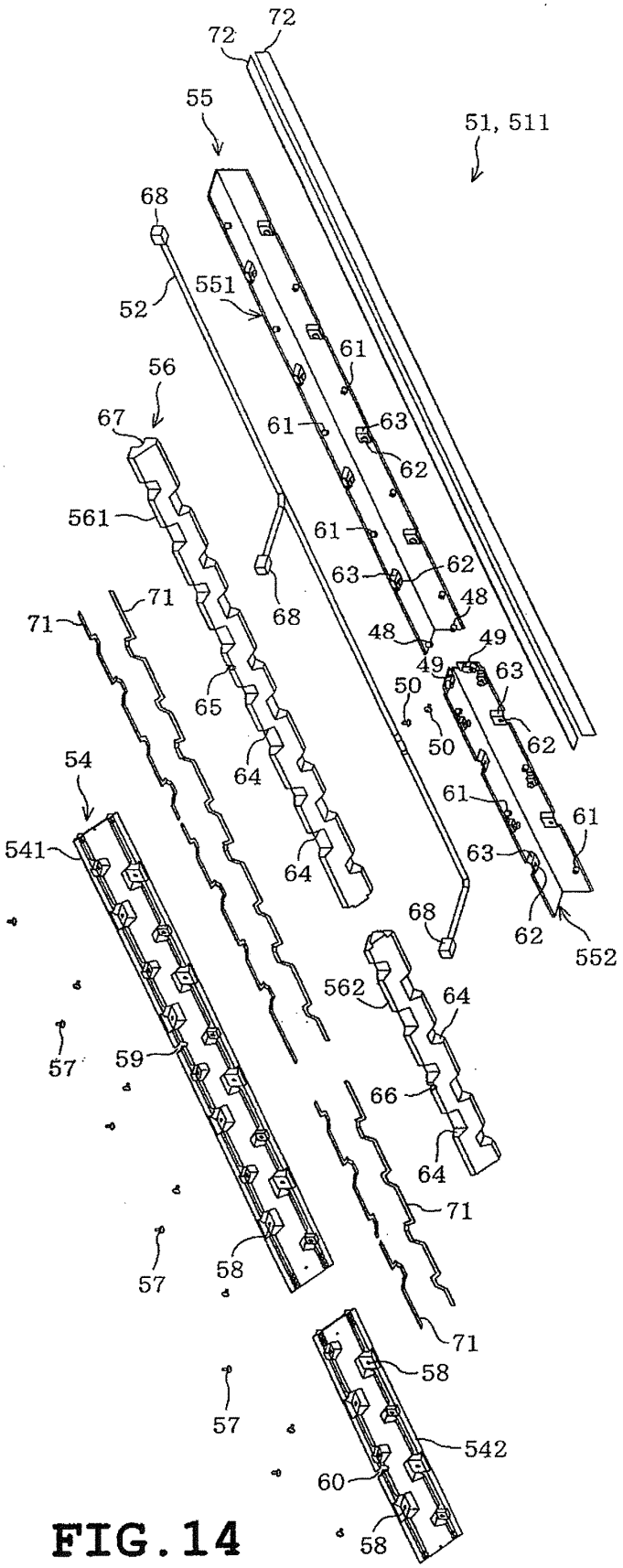
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FIG.14

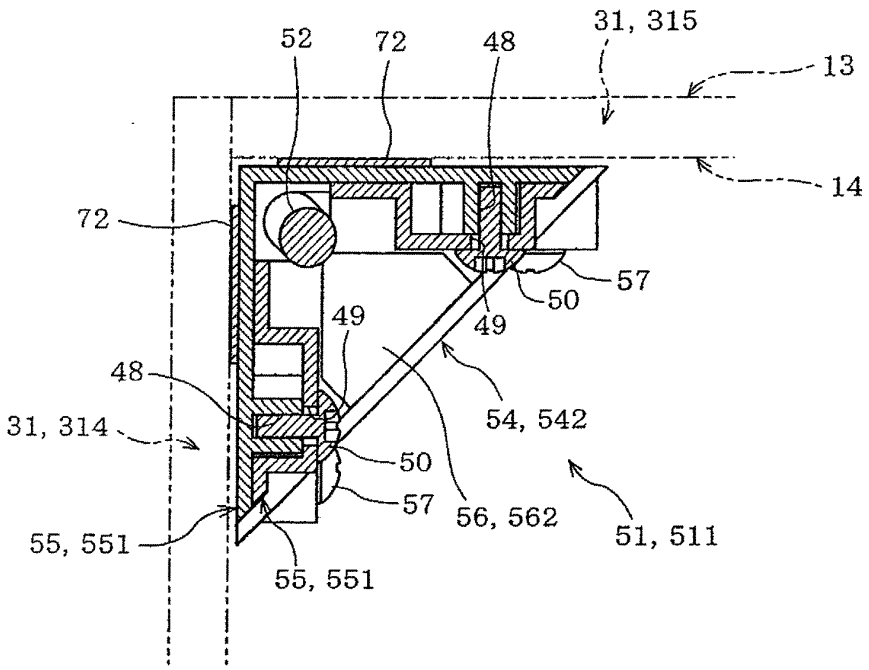
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FIG.15

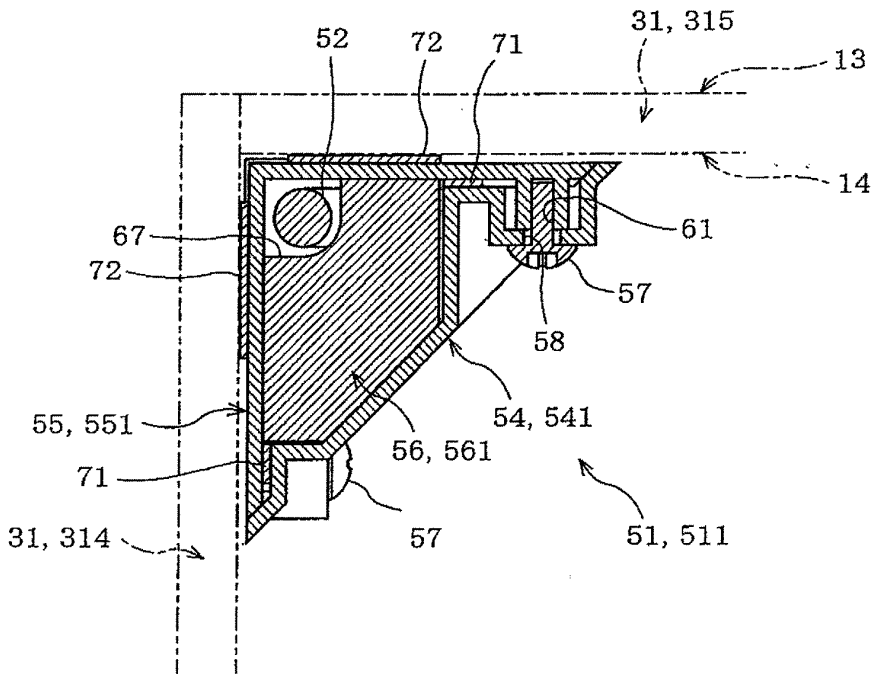
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FIG.16

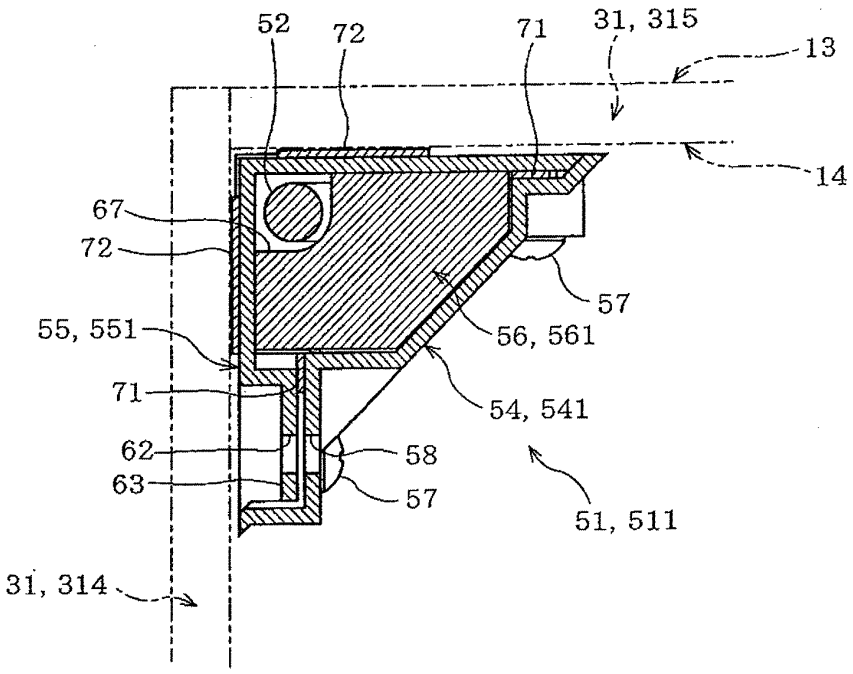
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FIG. 17

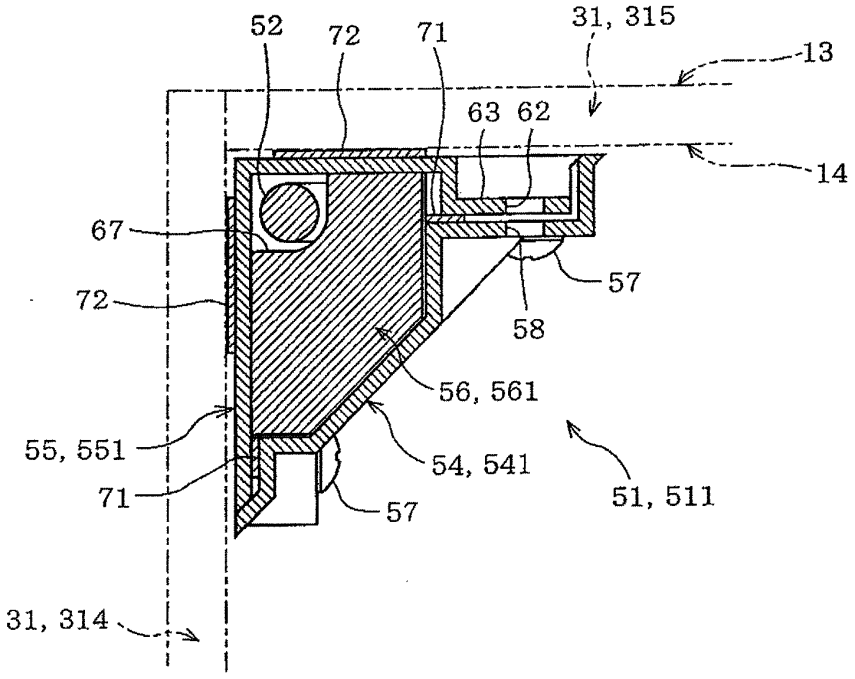
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FIG. 18

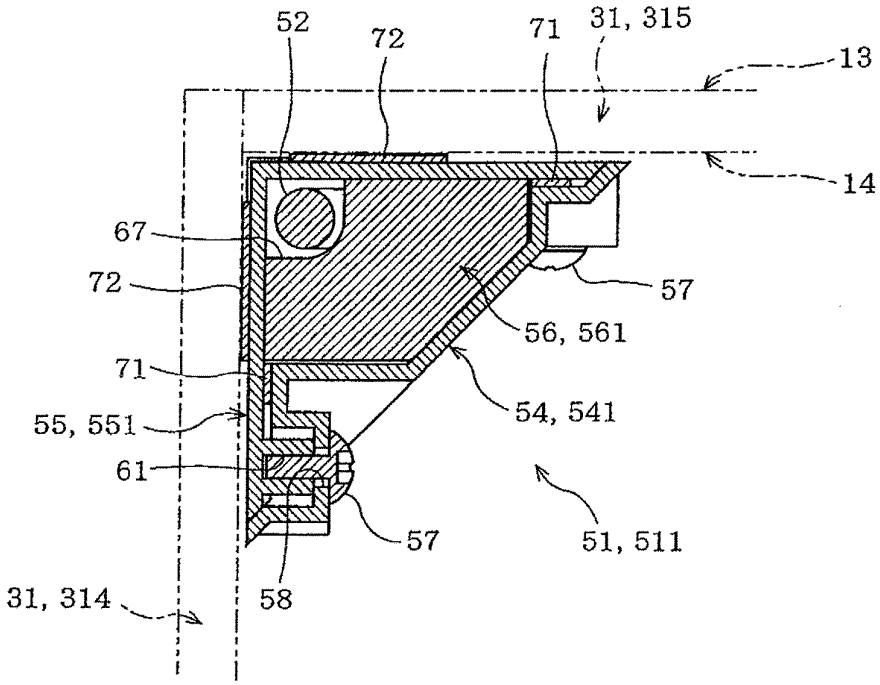
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FIG.19

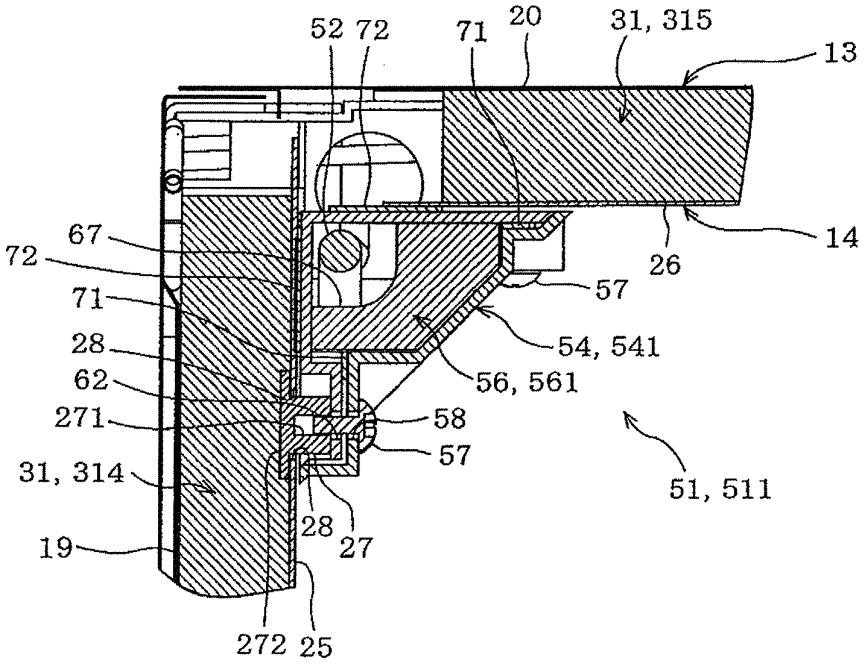
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FIG.20

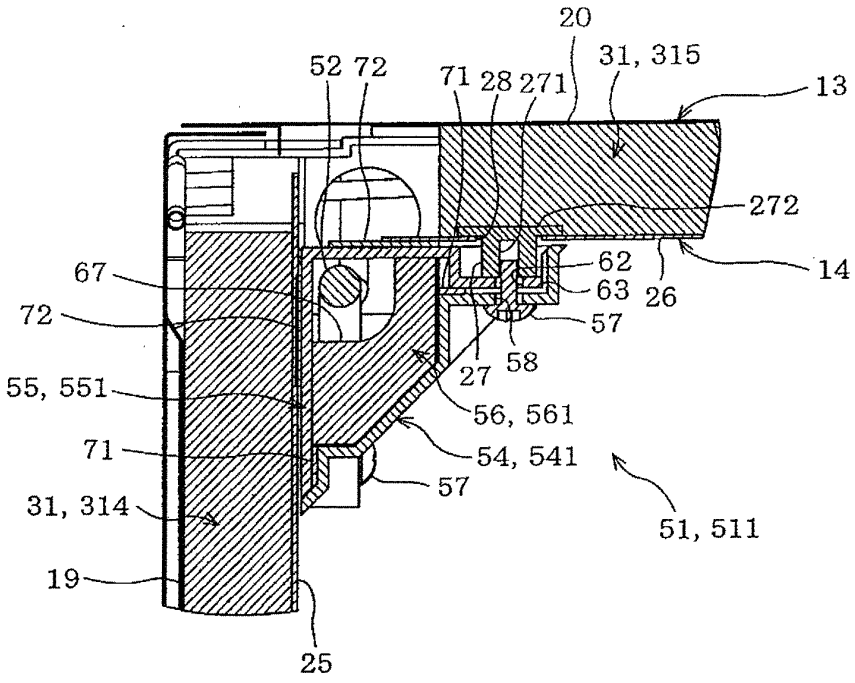
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FIG. 21

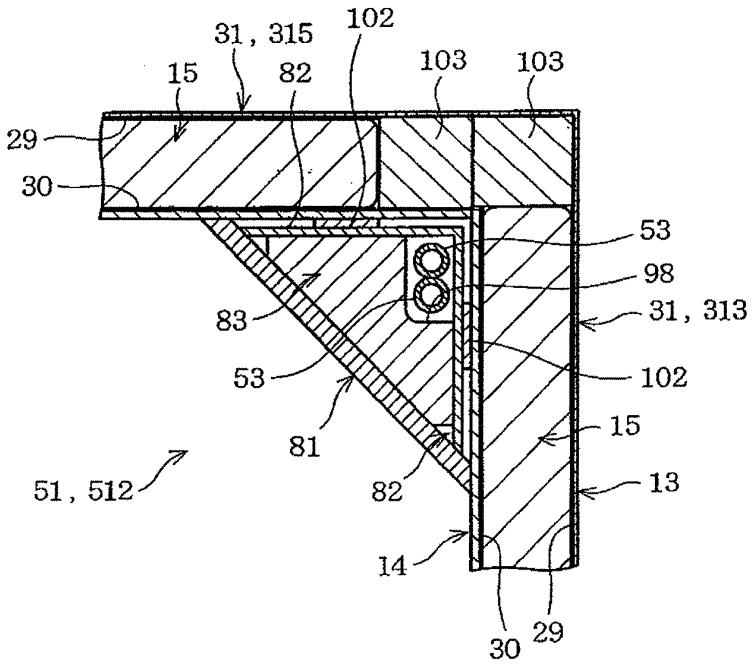
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FIG. 22

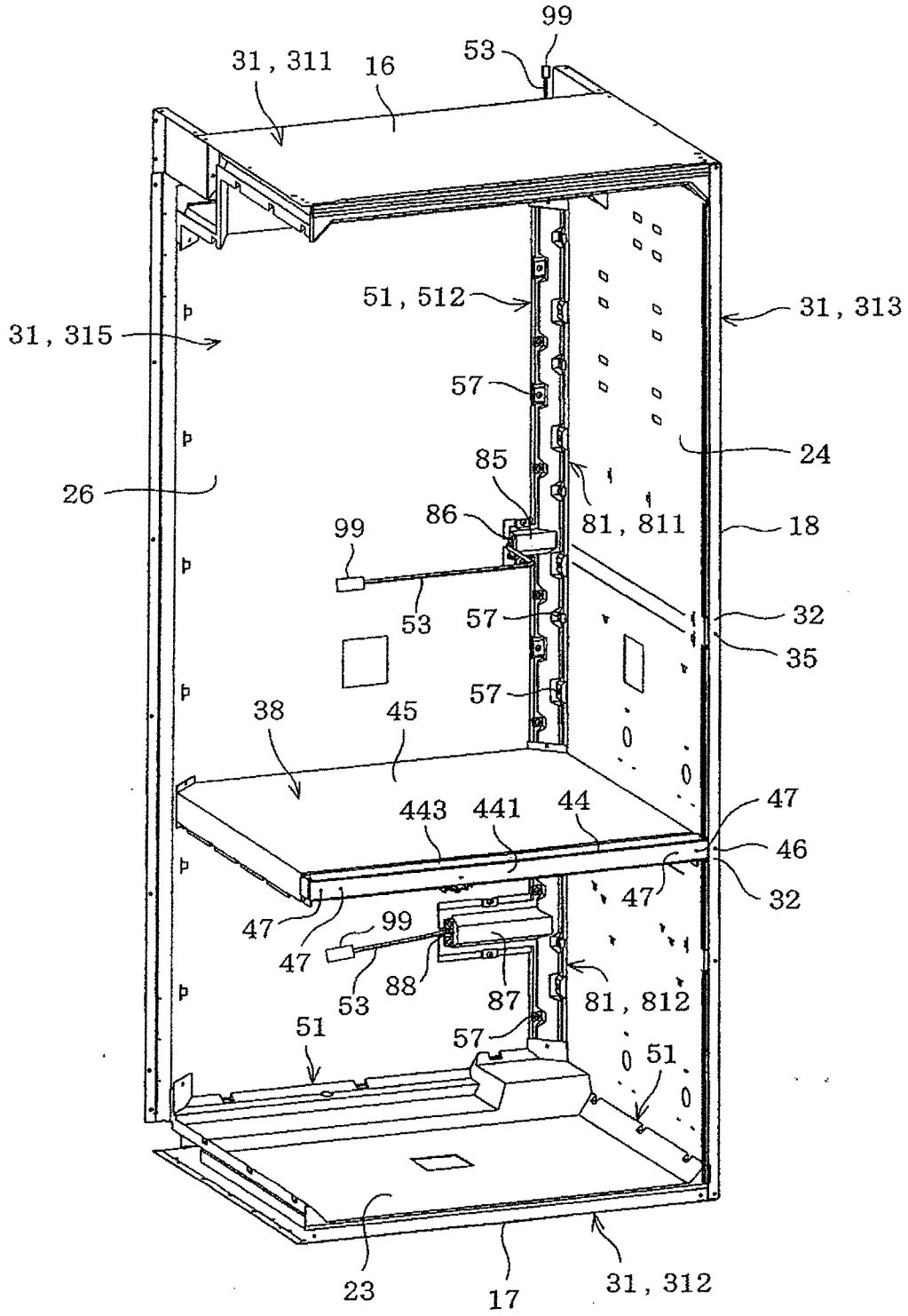
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FIG. 23

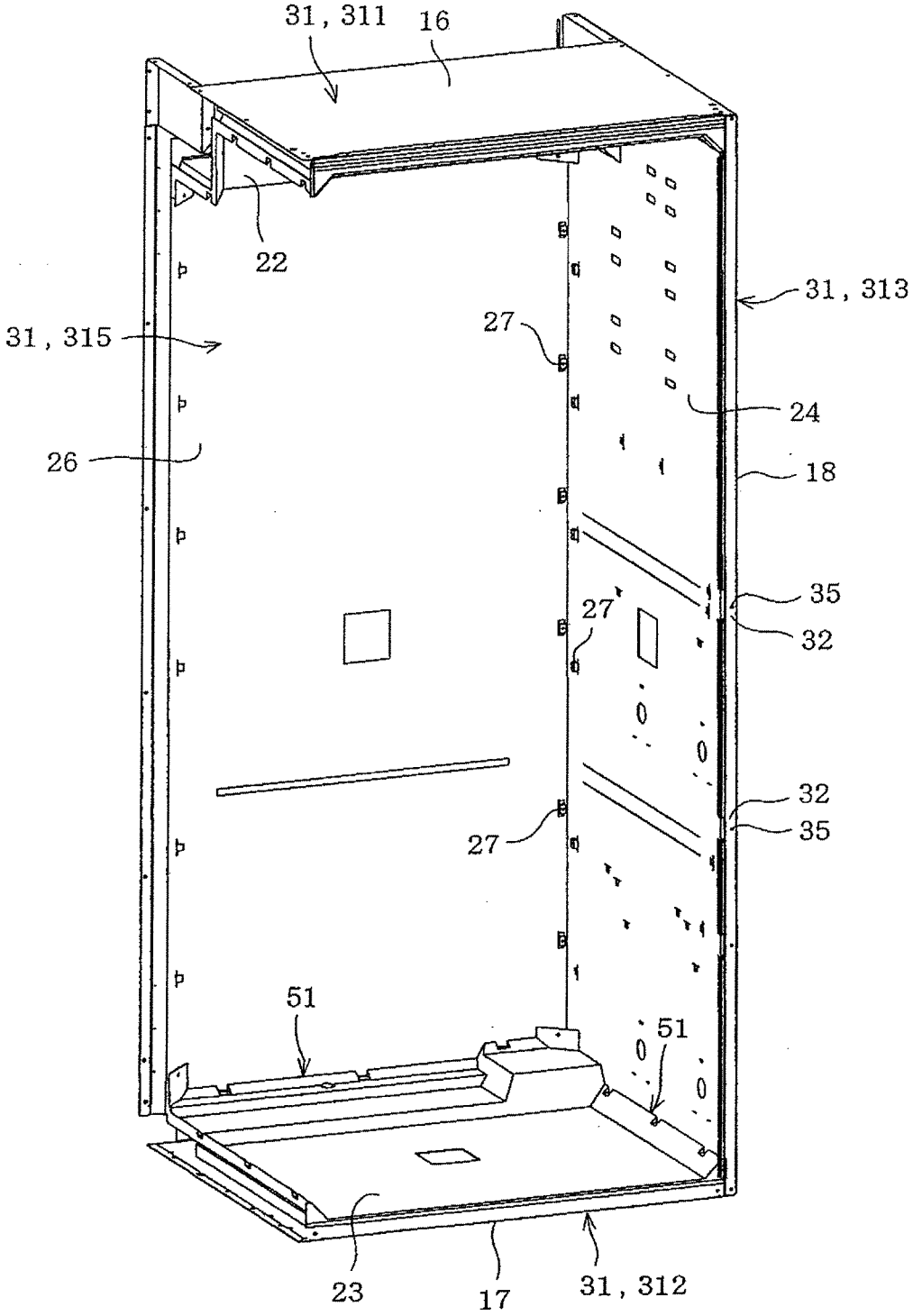
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FIG. 24

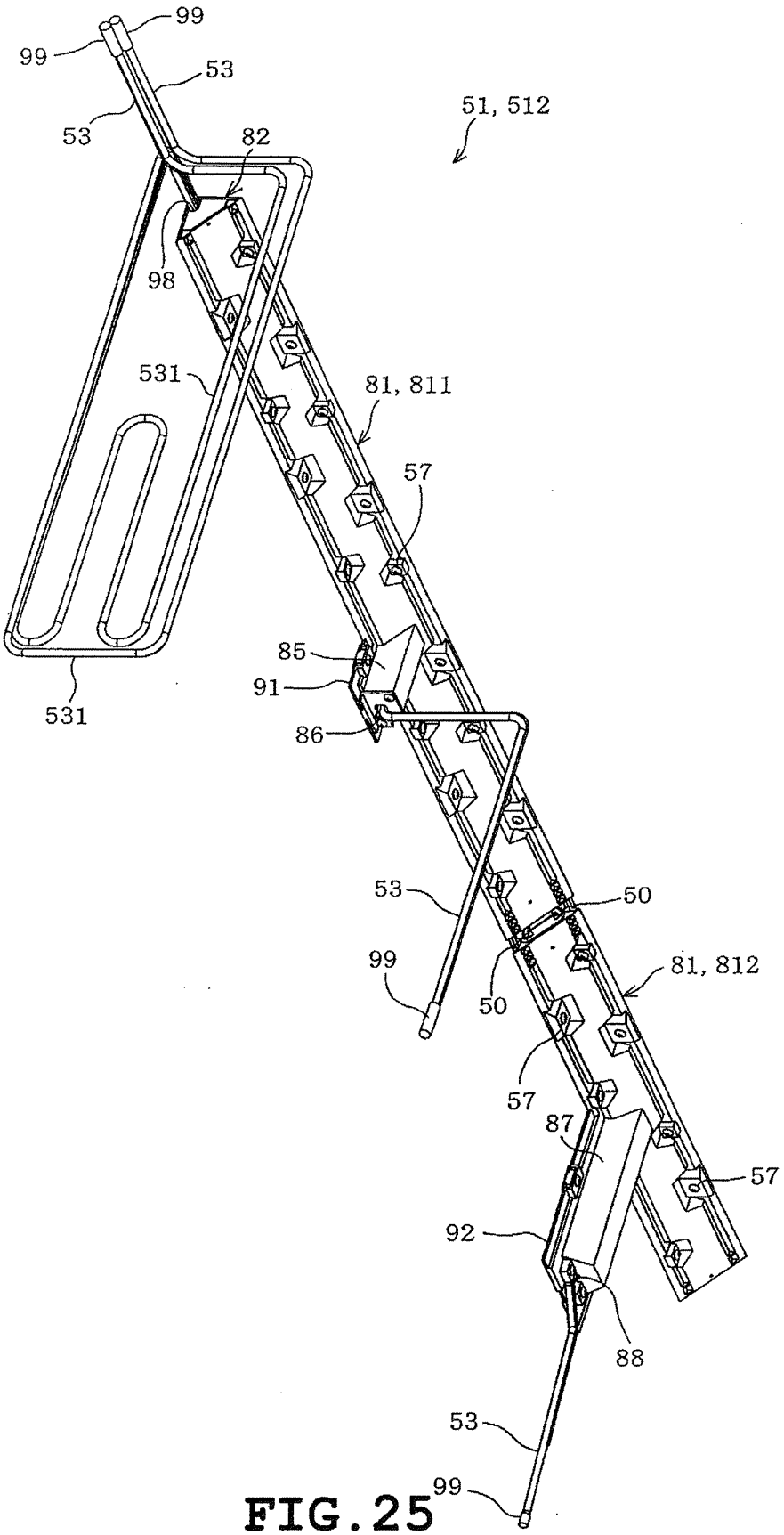
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FIG. 25

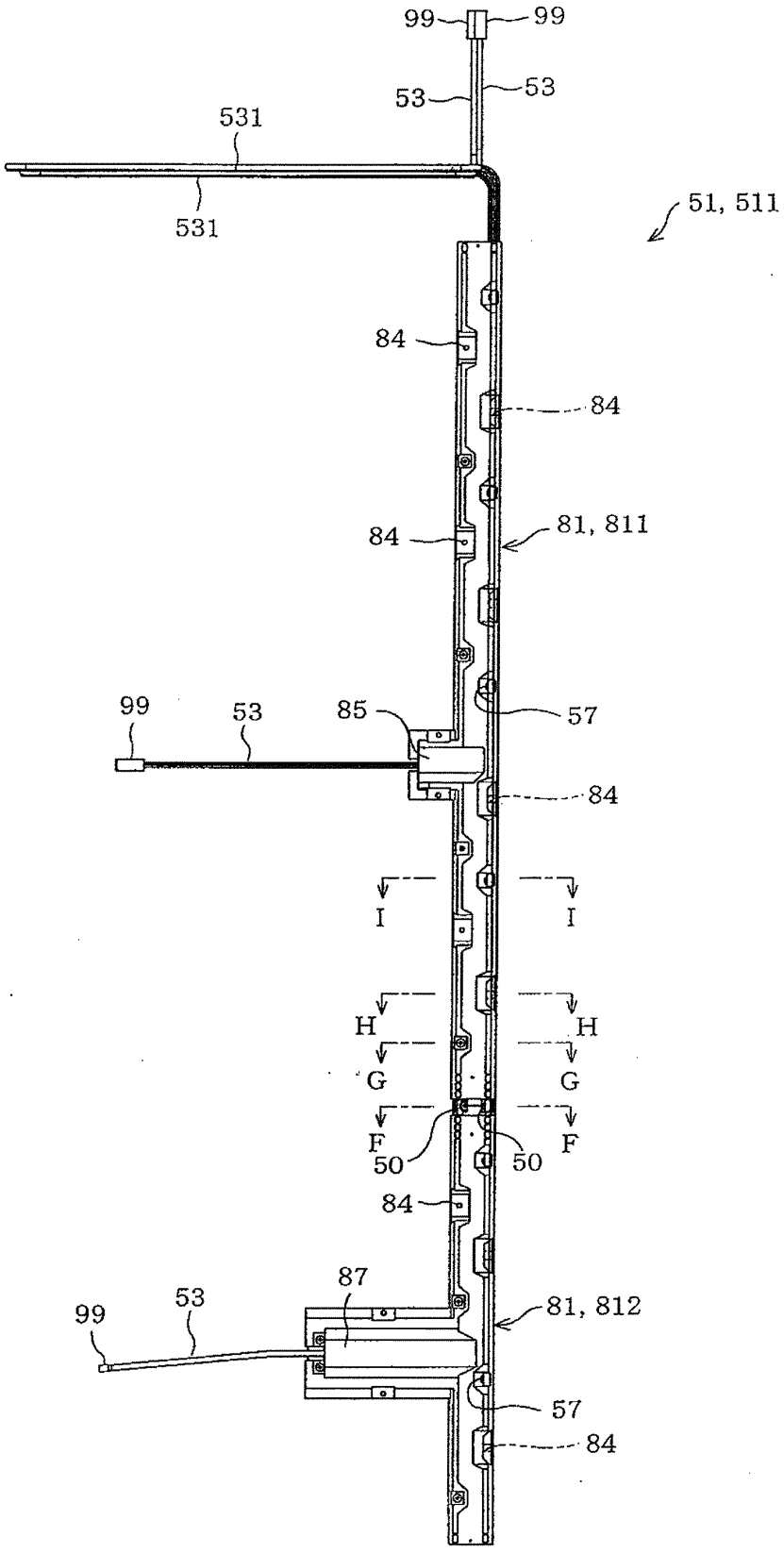
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FIG.26

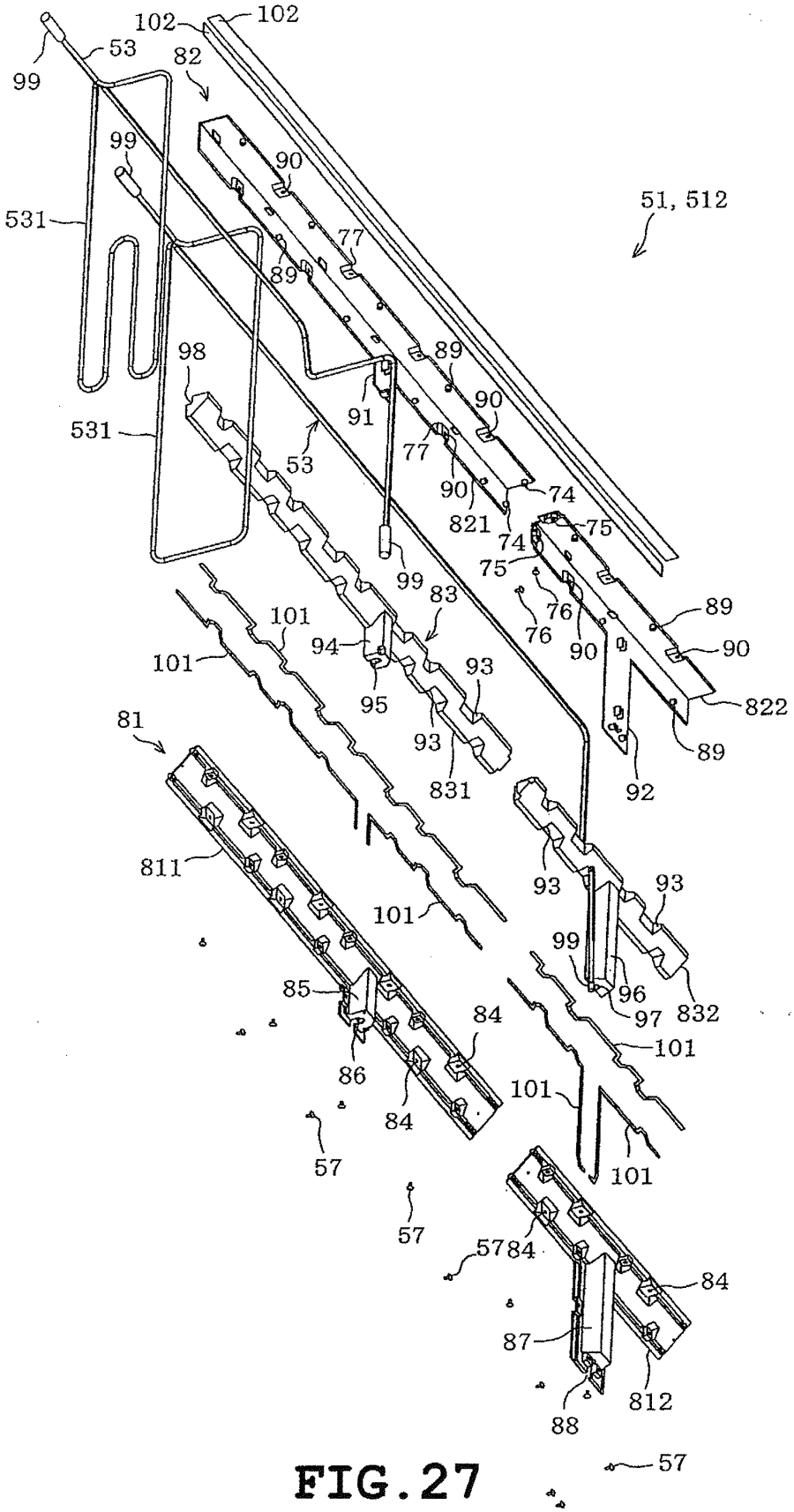
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FIG.27

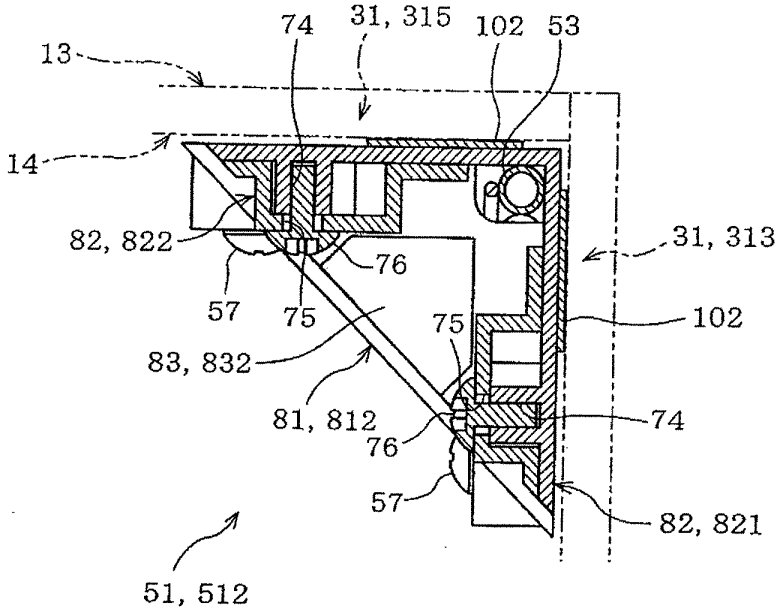
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FIG.28

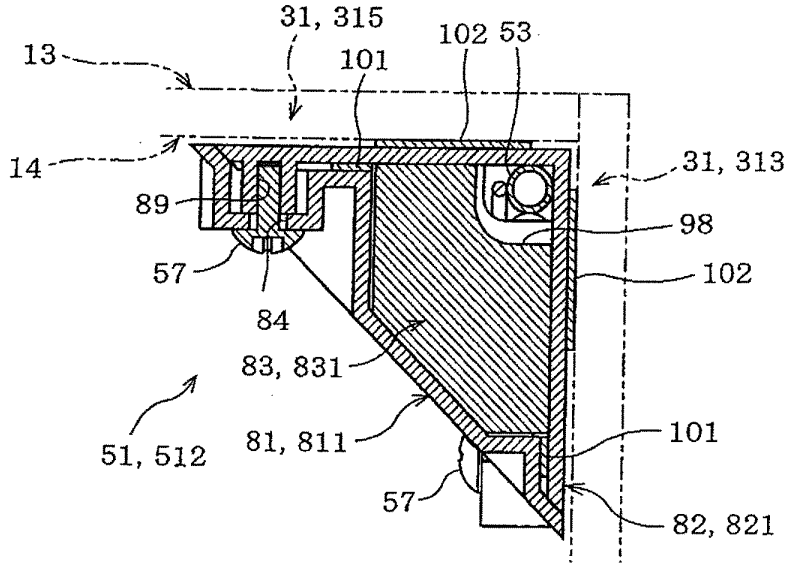
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FIG.29

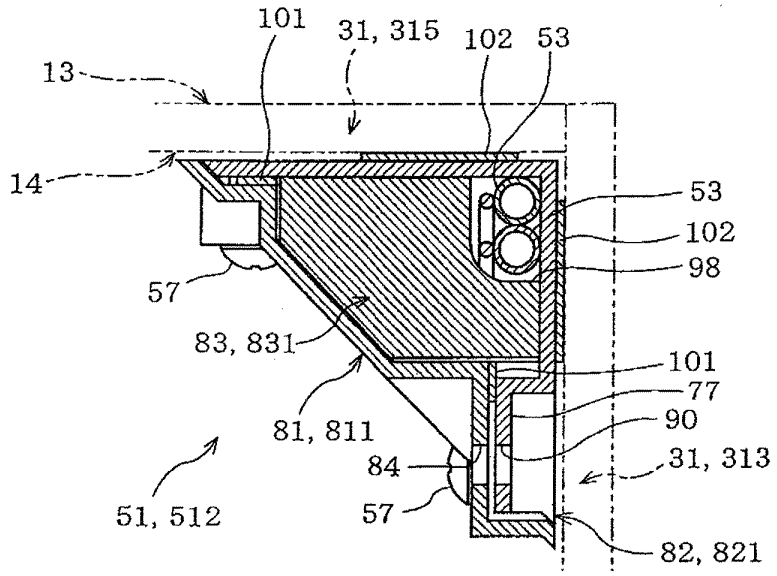
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FIG. 30

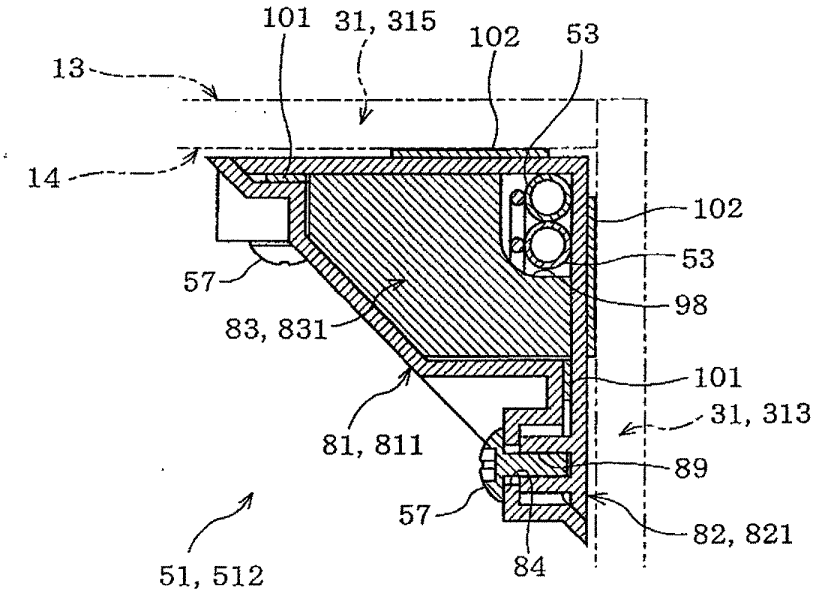
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FIG. 31

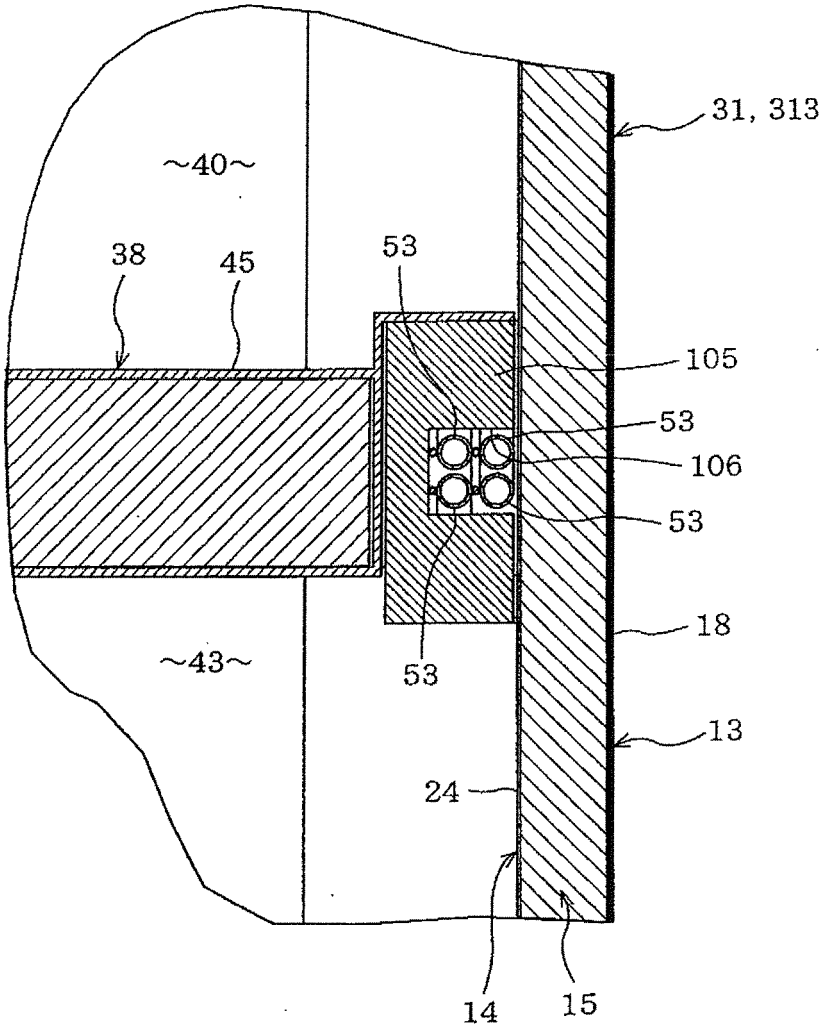

FIG. 32

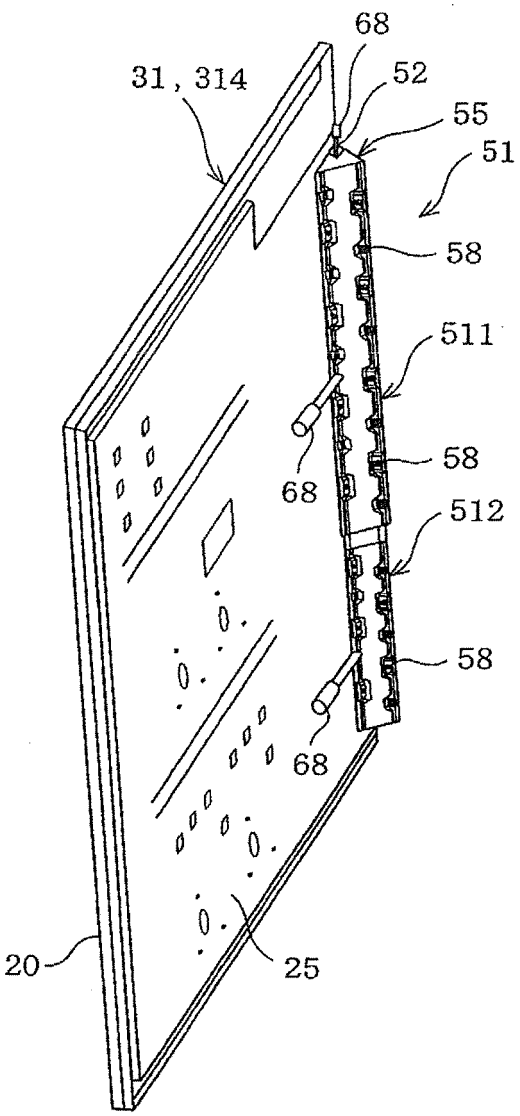

FIG. 33

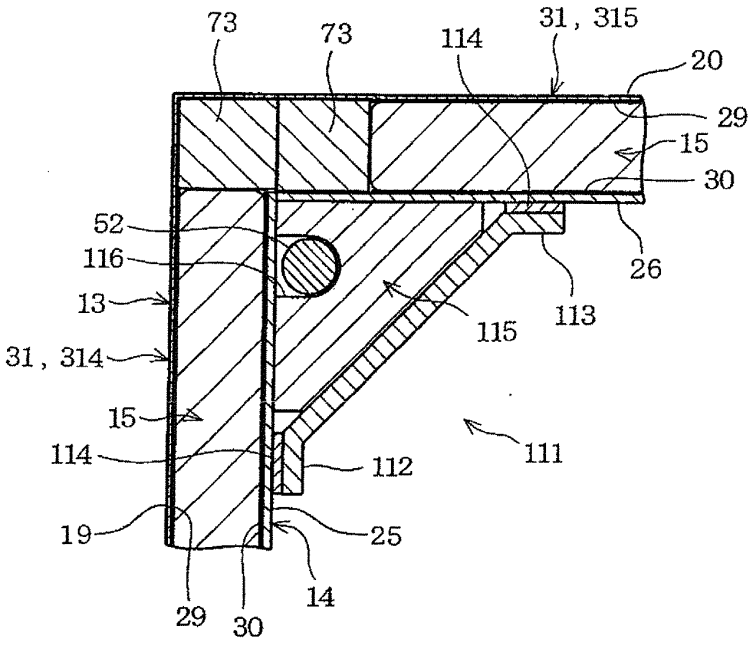
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FIG. 34

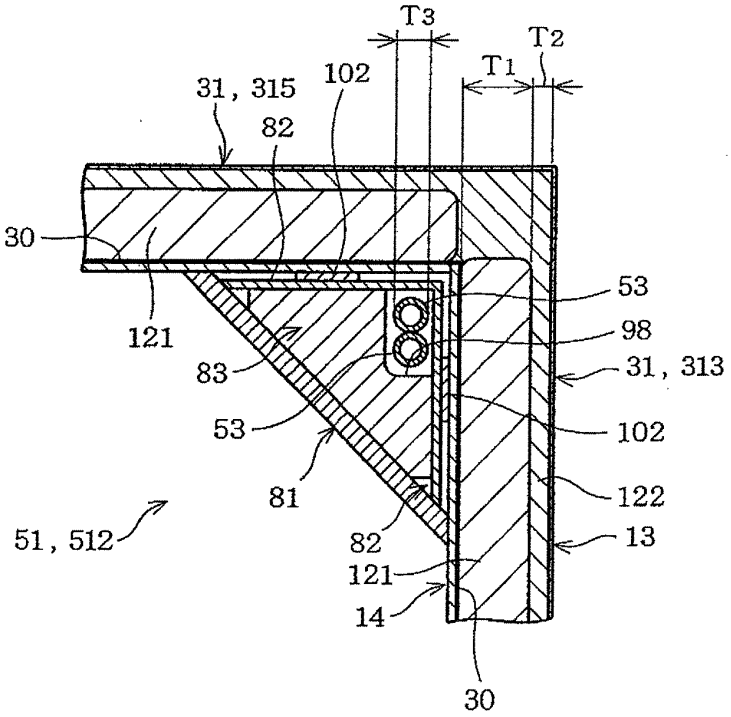
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FIG. 35

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/062166

A. CLASSIFICATION OF SUBJECT MATTER
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)
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 1996-2012
Kokai Jitsuyo Shinan Koho 1971-2012 Toroku Jitsuyo Shinan Koho 1994-2012

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.
Y	JP 2002-228345 A (Hoshizaki Electric Co., Ltd.), 14 August 2002 (14.08.2002), entire text; all drawings (particularly, paragraphs [0002] to [0007]; fig. 5) (Family: none)	1-10
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 059567/1980(Laid-open No. 161485/1981) (Sankyo Electric Co.), 01 December 1981 (01.12.1981), entire text; all drawings (particularly, specification, page 1, line 19 to page 2, line 17; fig. 1) (Family: none)	1-10

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

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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 June, 2012 (13.06.12)	26 June, 2012 (26.06.12)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/062166

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 2009-41810 A (Panasonic Corp.), 26 February 2009 (26.02.2009), entire text; all drawings (particularly, paragraph [0033]; fig. 1, 2) (Family: none)	3
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 63996/1982(Laid-open No. 177783/1983) (Nippon Trailmobile Co.), 28 November 1983 (28.11.1983), entire text; all drawings (particularly, fig. 2, 3, 4, 6) (Family: none)	6
Y	JP 10-205994 A (Sanyo Electric Co., Ltd.), 04 August 1998 (04.08.1998), entire text; all drawings (particularly, fig. 7 to 10) (Family: none)	9,10

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

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Patent documents cited in the description

- JP H04260780 A **[0005]**