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(54) **REFRIGERATOR**

(57) A refrigerator according to an embodiment of the present invention is equipped with an insulated housing, and a covering member. The insulated housing is provided as a refrigerator main body, and is coupled to a plurality of insulated wall members provided to an insulated panel between an outer shell and an inner shell. The covering member is provided to a required coupling section among coupling sections of the plurality of insulated wall members, and seals said coupling section.

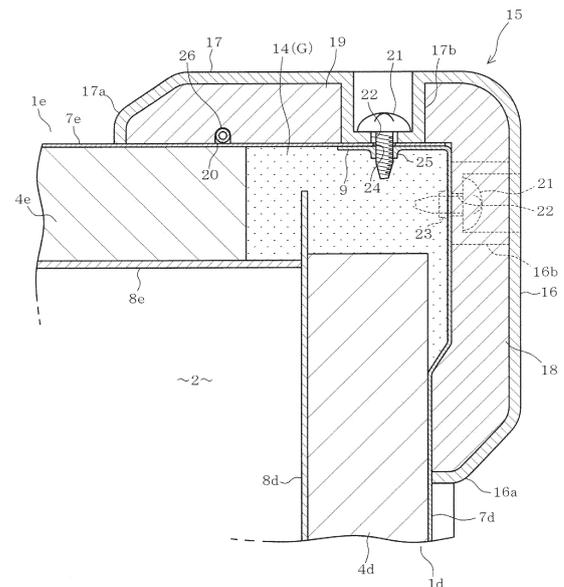


FIG. 1

Description**Technical Field**

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

Background Art

[0002] For example, interior volumes of household refrigerators have had an increasing tendency. The increase in the interior volume has been tried to be realized by reducing a thickness of peripheral wall of a heat insulation box which is a refrigerator body, but not by increasing the size of the insulation box. In this case, a sufficient insulation performance needs to be ensured even when the peripheral wall is rendered thinner. For this purpose, a vacuum insulation panel is used in addition to filling the peripheral wall of the insulation box with foam insulation panel. The vacuum insulation panel has a higher insulation performance than a foam insulation panel, in other words, has a lower heat conductivity than the foam insulation panel.

[0003] The vacuum insulation panel comprises a core material made by forming, for example, glass wool as a flock of fine glass fiber into a mat shape, by putting the core material into a gas barrier container made of a laminate film comprising aluminum foil and synthetic resin, and by evacuating an interior of the gas barrier container and closing an opening. As a result, the vacuum insulation panel maintains the container interior in an evacuated state. The vacuum insulation panel has a low heat conductivity, in other words, high insulation properties even though thin. Accordingly, the use of the vacuum insulation panel can allow the peripheral wall of the insulation box to have high heat insulation properties.

Prior Art Document**Patent Document****[0004]**

Patent Document 1: Japanese Patent No. 2728318
Patent Document 2: Japanese Patent Application Publication No. JP-A-H06-147744

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

[0005] The insulation box using the vacuum insulation panel is constructed by dividing the insulation box into a plurality of insulation walls and combining the insulation walls with one another. In the insulation box constructed by combining the insulation walls, external air invades

an interior of the insulation box through connections of the insulation walls, or cold air exits from the insulation box. This results in a defect that dew condensation occurs inside or outside the connections of the insulation walls.

[0006] Therefore, an object is to provide a refrigerator which can seal the connections of a plurality of insulation walls.

Means for Overcoming the Problem

[0007] According to one embodiment, a refrigerator includes an insulation box and a covering member. The insulation box is provided as a refrigerator body and is formed by connecting a plurality of insulation walls each of which includes an insulation panel between an outer shell and an inner shell. The covering member is provided at a predetermined one of connections of the insulation walls in order to cover the connection.

Brief Description of the Drawings**[0008]**

FIG. 1 is a partial transverse section of an insulation box according to one embodiment;
FIG. 2 is a partial transversely sectional perspective view of the insulation box;
FIG. 3 is a perspective view of the insulation box as viewed from the front;
FIG. 4 is a perspective view of the insulation box as viewed from the rear;
FIG. 5 is an exploded perspective view of the insulation box; and
FIGS. 6A and 6B are an exploded perspective view of the vacuum insulation panel and a sectional view of the vacuum insulation panel, respectively.

Best Mode for Carrying Out the Invention

[0009] One embodiment will be described with reference to the drawings. A refrigerator has a side where doors are located, and the side is referred to as "front" and a right side as viewed from the front is referred to as "front."

[0010] FIGS. 3 and 4 illustrate a heat insulation box 1 constituting a refrigerator body. The insulation box 1 is generally formed into the shape of a vertically long box or a rectangular parallelepiped having an open front. The insulation box 1 has an interior serving as a storage space 2. A ceiling wall 1a, a bottom wall 1b, a left sidewall 1c, a right sidewall 1d and a rear wall 1e are separately manufactured as a peripheral wall as shown in FIG. 5. The insulation box 1 is constructed by combining the walls or insulation walls 1a to 1e. In this case, the number of walls is 5. Each one of the bottom wall 1b, the left sidewall 1c, the right sidewall 1d and the rear wall 1e is formed into a rectangular flat plate shape, except for the ceiling wall 1e. The ceiling wall 1a has a rear part which is lower than

the other part thereof, so that the ceiling wall 1a is formed into a stepped shape. As a result, a component chamber 3 is formed in the upper rear of the insulation box 1 when the walls 1a to 1e are combined together to be constructed into the insulation box 1. A compressor constituting a refrigerating cycle (not shown) and the like are disposed in the component chamber 3.

[0011] The construction of the walls 1a to 1e will now be described. A heat insulation function of each one of the walls 1a to 1e is obtained by a heat insulator, for example, a vacuum insulation panel 4. As shown in FIG. 6A, the vacuum insulation panel 4 includes a core material 5 made by forming, for example, glass wool as a flock of fine glass fiber into a mat shape, by putting the core material into a gas barrier container 6 made of a laminate film comprising aluminum foil and synthetic resin and by evacuating an interior of the gas barrier container and closing an opening. As a result, the vacuum insulation panel maintains the interior of the gas barrier container 6 in an evacuated state.

[0012] Each of the walls 1a to 1e is constructed by interposing the vacuum insulation panel 4 between an outer shell 7 made of a metal such as steel plate and an inner shell 8 made of plastic, for example, as shown in FIGS. 6A and 6B. The outer shell 7 and the vacuum insulation panel 4 are secured to each other by bonding thereby to be integrated. Consequently, the vacuum insulation panel 4, the outer shell 7 and the inner shell 8 are formed integrally with one another. Although each wall is shown as a flat plate in FIGS. 6A and 6B, the ceiling wall 1a is formed into a stepped shape.

[0013] The inner shell 8 has smaller vertical and horizontal dimensions than the outer shell 7 in each of the walls 1a to 1e. Further, the vacuum insulation panel 4 has smaller vertical and horizontal dimensions than the inner shell 8. Accordingly, four sides or ends of the vacuum insulation panel 4 do not reach four sides or ends of the outer shell 7 and four sides or ends of the inner shell 8. More specifically, the four sides of the vacuum insulation panel 4 are located inside the four sides of the outer shell 7 and the four sides of the inner shell 8. Further, predetermined sides of the outer shell 7 of each one of the walls 1a to 1e have respective connecting pieces 9 bent at a right angle. The connecting pieces 9 formed on the predetermined sides of each one of the walls 1a to 1e are used to connect the outer shells 7 of the adjacent walls by screws or the like.

[0014] Three horizontal frames 10 to 12 are mounted on the front of the insulation box 1 constructed by combining the walls 1a to 1e so as to partition the front in the up-down direction. A vertical frame 13 is mounted between the middle horizontal frame 11 and the lower horizontal frame 12 of the insulation box 1. Although not shown, insulation walls or partition plates are provided in the rear of the horizontal frames 10 to 12 and in the rear of the vertical frame 13. The storage space 2 is partitioned by the insulation walls and the partition plates into a refrigerating compartment 2a, a vegetable com-

partment 2b, an ice-making compartment 2c, a mode changeable compartment 2d and a freezing compartment 2e. The ice-making compartment 2c and the mode changeable compartment 2d are juxtaposed to each other. Doors (not shown) are mounted on the front of the insulation box 1 to open and close fronts of the storage compartments 2a to 2e respectively.

[0015] The refrigerator is provided with two evaporators for refrigeration and freezing, as a cooler. The refrigerating evaporator is disposed in a cooling compartment formed in a rear interior of the refrigerating compartment 2a. The freezing evaporator is disposed in a cooling compartment formed in a rear interior of the freezing compartment 2e. Cold air cooled by the evaporators is supplied by a fan into the refrigerating compartment 2a, the vegetable compartment 2b, the ice-making compartment 2c, the mode changeable compartment 2d and the freezing compartment 2e, whereby an atmosphere in the refrigerating compartment is cooled to a refrigerating temperature, and an atmosphere in the freezing compartment is cooled to a freezing temperature.

[0016] FIG. 1 is a transverse section of a corner part extending in the up-down direction in the right rear part of the insulation box 1. FIG. 2 is a partial transversely sectional perspective view of the corner part extending in the up-down direction in the right rear part of the insulation box 1. FIGS. 1 and 2 show the construction of connections of the rear wall 1e and the right sidewall 1d. Suffix "d" is added to the vacuum insulation panel 4, the outer shell 7 and the inner shell 8 constituting the right sidewall 1d in FIGS. 1 and 2. On the other hand, suffix "e" is added to the vacuum insulation panel 4, the outer shell 7 and the inner shell 8 constituting the rear wall 1e. As a result, the vacuum insulation panel 4, the outer shell 7 and the inner shell 8 constituting the right sidewall 1d are distinguished from the vacuum insulation panel 4, the outer shell 7 and the inner shell 8 constituting the rear wall 1e.

[0017] In FIGS. 1 and 2, the connecting piece 9 is provided on the rear end of the outer shell 7d of the right sidewall 1d. The connecting piece 9 is abutted on a right end of the outer shell 7d of the rear wall 1d from the inside. The connecting piece 9 is then fastened to the right end of the outer shell 7e of the rear wall 1e by a screw in a manner as will be described later. Further, a right end of the inner shell 8e of the rear wall 1e is abutted on a surface of the rear end of the inner shell 8d of the right sidewall 1d.

[0018] In each of the walls 1a to 1e, the end of the vacuum insulation panel 4 is rendered slightly shorter, thus not reaching the end of the outer shell 7 as described above. Accordingly, the vacuum insulation panel 4d of the right sidewall 1d is spaced from the vacuum insulation panel 4e of the rear wall 1e with a gap G therebetween. The gap G is filled with a spongy insulation material 14 when the right sidewall 1d and the rear wall 1e are assembled together.

[0019] A slight gap is inevitably defined between the

inner shell 8d of the right sidewall 1d and the inner shell 8e of the rear wall 1e or between the connecting piece 9 of the outer shell 7d of the right sidewall 1d and a right end of the outer shell 7e of the rear wall 1e. Accordingly, there is a possibility that cold air escapes through the gap from the storage space 2 toward the outside of the insulation box 1 or that air outside the insulation box 1 flows through the gap toward the storage space 2. In view of this, a vertically long covering member 15 is provided on the corner part vertically extending in the right rear of the insulation box 1. The covering member 15 seals a connection of the right sidewall 1d and the rear wall 1e. In this case, the covering member 15 is mounted from the outside of the corner.

[0020] The covering member 15 is made of plastic, for example and has an L-shaped section as shown in FIGS. 1 and 2. The covering member 15 has a pressed portion 16 pressed against the right sidewall 1d and a pressed portion 17 pressed against the rear wall 1e. The pressed portion 16 has a width (a front-back dimension in this case) that is set to extend over the insulation material 14 to the vacuum insulation panel 4d relative to the outer shell 7d of the right sidewall 1d when the covering member 15 is applied to the corner of the right rear of the insulation box 1. Further, the pressed portion 17 has a width (a right-left dimension in this case) that is set to extend over the insulation material 14 to the vacuum insulation panel 4e relative to the outer shell 7e of the rear wall 1e when the covering member 15 is applied to the corner of the right rear of the insulation box 1.

[0021] The pressed portions 16 and 17 have respective widthwise distal ends bent inward. The pressed portions 16 and 17 have receded insides as the result of provision of the bent ends 16a and 17a respectively. The insides of the pressed portions 16 and 17 are filled with foam insulations 18 and 19 serving as insulation layers respectively. At least one of the foam insulations 18 and 19 is formed with a groove. In this case, a groove 20 is formed in the foam insulation 19 in the pressed portion 17 pressed against the outer shell 7e of the rear wall 1e, for example. The groove 20 is located at the widthwise distal end side of the pressed portion 17 and extends in the up-down direction.

[0022] The foam insulations 18 and 19 in the pressed portions 16 and 17 extend in the directions intersecting at a right angle respectively. The foam insulation 18 has a surface which is in contact with the outer shell 7d of the right sidewall 1d. The foam insulation 19 also has a surface which is in contact with the outer shell 7e of the rear wall 1e. In this case, the outer shell 7d of the right sidewall 1d includes a central side formed into a recessed shape for reinforcement of a peripheral edge thereof, except for the peripheral edge. Accordingly, an end 16a of the pressed portion 16 pressed against the right sidewall 1d protrudes inward longer than an end 17a at the rear wall 1e side in accordance with the recessed portion. Further, the surface of the foam insulation 18 in the pressed portion 16 includes a distal end side part which

is in contact with the recessed portion of the outer shell 7d and which protrudes inward higher than a proximal end side.

[0023] The pressed portion 16 extends over the gap G between the vacuum insulation panels 4d and 4e to a part filled with the vacuum insulation panel 4d, as described above. As a result, the foam insulation 18 covers the gap G between the vacuum insulation panels 4d and 4e from the outside, further covering an end of the vacuum insulation panel 4d. Further, the pressed portion 17 extends over the gap G between the vacuum insulation panels 4d and 4e to a part filled with the vacuum insulation panel 4e. As a result, the foam insulation 19 covers the gap G between the vacuum insulation panels 4d and 4e from the outside, further covering an end of the vacuum insulation panel 4e.

[0024] The covering member 15 has the same length as a distance from a lower end of the insulation box 1 to a bottom 3a (a rear lower surface of the ceiling wall 1a) of the component chamber 3. The pressed portions 16 and 17 each include a plurality of reinforcing portions 16b and 17b which reinforce mount portions mounted on the insulation walls and which are formed intermittently in the up-down direction, respectively. These reinforcing portions 16b and 17b also serve as mount portions mounted on the insulation walls. The reinforcing portions 16b and 17b are formed to be directed inward from the surfaces of the pressed portions 16 and 17, each protruding into a bottomed cylindrical, for example, circular cylindrical shape. Amounts of protrusion of the reinforcing portions 16a and 17b are set to be equal to the depths of the recessed pressed portions 16 and 17 respectively. The reinforcing portions 16b and 17b have undersides coplanar with the surfaces of the foam insulations 18 and 19, respectively.

[0025] The reinforcing portions 16b and 17b of the pressed portions 16 and 17 are formed with through holes 22 respectively. Self-tapping screws 21 are provided for fixing the pressed portions 16 and 17 to the right sidewall 1d and the rear wall 1e, respectively. The self-tapping screws 21 are passed through the holes 22 respectively. Further, the outer shell 7d of the right sidewall 1d is formed with a burr hole 23 through which the self-tapping screw 21 is screwed. The connecting piece 9 of the right sidewall 1d pressed against the outer shell 7e is formed with a burr hole 25 through which the self-tapping screw 21 is screwed.

[0026] When the covering member 15 is to be mounted on the right rear corner of the insulation box 1, piping such as a suction pipe 26 is inserted into the groove 20 of the foam insulation 19 and the covering member 15 is then disposed at the right rear corner of the insulation box 1. The pressed portion 16 is pressed against the outer shell 7d of the right sidewall 1d and the pressed portion 17 is pressed against the outer shell 7e of the rear wall 1e. In this state, the self-tapping screw 21 is passed through the hole 22 of the reinforcing portion 16b of the pressed portion 16 and further screwed through

the burr hole 23 of the outer shell 7d of the right sidewall 1d, with the result that the pressed portion 16 is fixed to the right sidewall 1d. Further, the self-tapping screw 21 is passed through the hole 22 of the reinforcing portion 17b of the pressed portion 17 and the hole 24 of the outer shell 7e of the rear wall 1e in turn, being screwed through the burr hole 25 of the connecting piece 9 of the right sidewall 1d with the result that the pressed portion 17 is fixed to the rear wall 1e.

[0027] The groove 20 is formed in the distal end side of the pressed portion 17. Accordingly, when the covering member 15 has been fixed, the suction pipe 26 is located at a part of the rear wall 1e corresponding to the vacuum insulation panel 4e, namely, an outer surface of a part of the outer shell 7e in contact with the vacuum insulation panel 4e. The suction pipe 26 connects between two evaporators for refrigeration and freezing and an inlet of a compressor. A low-temperature liquid refrigerant flows through the suction pipe 26.

[0028] According to the foregoing embodiment, the covering member 15 is mounted on the right rear corner of the insulation box 1. Accordingly, the connection of the tight sidewall 1d and the rear wall 1e is sealed by the covering member 15 from the outside. As a result, the cold air in the storage space 2 can be prevented from leaking outside and external air can be prevented from entering the storage space 2 even when a slight gap is formed in the connection of the right sidewall 1d and the rear wall 1e. This can prevent dew condensation in the outer shells 7d and 7e and the inner shells 8d and 8e and improve the cooling efficiency of the storage space 2.

[0029] Particularly in the embodiment, the covering member 15 is provided with the foam insulations 18 and 19. The foam insulations 18 and 19 are elastically deformed to come into close contact with the outer shells 7d and 7e of the right sidewall 1d and the rear wall 1e respectively. Accordingly, the insulation box 1 is superior particularly in the sealing effect.

[0030] Further, the connecting piece 9 of the outer shell 7d of the right sidewall 1d is abutted on the outer shell 7e of the rear wall 1e from the inside, and the reinforcing portion 17b of the pressed portion 17 of the covering member 15 is abutted on the outer shell 7e of the rear wall 1e. The reinforcing portion 17b is fixed by screwing the self-tapping screw 21 through the burr hole 23 of the connecting piece 9. As a result, the connecting piece 9 of the outer shell 7d of the right sidewall 1d and the outer shell 7e of the rear wall 1e are tightened against each other so that a gap therebetween is reduced. This can further improve the sealing properties.

[0031] Moreover, the foam insulations 18 and 19 are provided so as to correspond to the gap G. In the embodiment, furthermore, the foam insulations 18 and 19 covers the gap G, further extending to the outer shells 7d and 7c corresponding to the vacuum insulation panels 4d and 4c respectively. Accordingly, even though the insulation material 14 filling the gap G is inferior in the insulation properties to the vacuum insulation panels 4d

and 4e, an insulation insufficiency of the insulation material 14 can be reinforced by foam insulations 18 and 19. This can improve the insulation performance of the connection of the right sidewall 1d and the rear wall 1e.

[0032] The suction pipe 26 through which the low-temperature refrigerant flows is covered by the foam insulation 19 in the embodiment. This can prevent dew condensation on the suction pipe 26.

[0033] Further, for example, when the suction pipe 26 is disposed to correspond to the gap G and the outer shell 7e is cooled by the suction pipe 26, a trouble would occur that air in the refrigerating temperature zone (2°C to 3°C, for example) in the gap G contacts with the cooled part thereby to build up dew condensation. In the embodiment, however, the suction pipe 26 is disposed to correspond to the vacuum insulation panel 4e. Accordingly, even when the outer shell 7e is cooled by the suction pipe 26, air in the refrigerating temperature zone in the gap G is prevented from coming into contact with the cooled part. This can prevent a defect that dew condensation is built up on the part cooled by the suction pipe 26.

[0034] Further, the covering member 15 is provided with the reinforcing portions 16b and 17b. The reinforcing portions 16b and 17b are fixed to the right sidewall 1d and the rear wall 1e by the self-tapping screws 21 respectively. As a result, the strength against the tightening force of the self-tapping screws 21 can be improved. In other words, when no reinforcing portions 16b and 17b are provided, a defect of the strength occurs that the covering member 15 is subjected to the tightening force of the self-tapping screws 21 to be curved, storing internal stress. In the embodiment, however, occurrence of the defect can be prevented.

[0035] Further, the pressed portion 16 of the covering member 15 is fixed to the right sidewall 1d and to the rear wall 1e. Since the pressed portions 16 and 17 extend in the directions perpendicular to each other, the covering member 15 has a function of holding the right sidewall 1d and the rear wall 1e at a connecting angle of 90°, that is, a function of maintaining a crossing angle between the right sidewall 1d and the rear wall 1e at a right angle. Further, the pressed portion 16 is formed with the reinforcing portion 16b and the pressed portion 17 is formed with the reinforcing portion 17b. This can improve the strength as the covering member 15 and enhance the function of holding the right sidewall 1d and the rear wall 1e at a connecting angle of 90°.

[0036] 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.

[0037] For example, the walls 1a to 1e may be constructed so that the space between the outer and inner shells 7 and 8 is filled with the vacuum insulation panel 4 and foam insulation located inside or outside the vacuum insulation panel 4.

[0038] The insulation box 1 should not be limited to five walls 1a to 1e. For example, two walls formed integrally with each other may be a single wall, for example, the left sidewall 1c and the rear wall 1e may be a single wall, and the bottom wall 1b and the rear wall 1e may be a single wall.

[0039] The piping covered with the foam insulation may be a pipe except for the suction pipe.

[0040] The pressed portions 16 and 17 may be formed with through holes in the surfaces, and cylindrical reinforcing portions may be formed around the holds respectively.

[0041] The reinforcing portions 16b and 17b should not be limited to the cylindrical shape.

[0042] The covering member may cover a connection of a plurality of insulation walls, for example, a corner made by the inner shell 8d of the right sidewall 1d and the inner shell 8e of the rear wall 1e, from the inside of the storage space 2.

[0043] Predetermined one or more of the connections of the walls 1a to 1e may be provided with the covering members. Accordingly, no covering member may not be provided on a part which can be sealed by applying a sealing agent thereto, for example.

[0044] Another insulator, for example, a foam insulation panel may be used instead of the vacuum insulation panel 4.

piping is provided inside the covering member.

4. The refrigerator according to claim 3, wherein the piping includes a suction pipe connecting between an evaporator and a compressor, and the suction pipe corresponds to a location of the insulation panel.

5. The refrigerator according to any one of claims 1 to 4, wherein the covering member has a reinforcing portion which reinforces a part thereof mounted on the insulation wall.

6. The refrigerator according to claim 5, wherein the reinforcing portion is formed into a bottomed cylindrical shape, and the bottomed cylindrical reinforcing portion is fastened to one of the insulation walls by a screw with the bottom thereof being in contact with the insulation wall.

7. The refrigerator according to any one of claims 1 to 6, wherein the covering member is fixed to cover a corner of the insulation box from outside, thereby maintaining, at a right angle, an intersection angle of two insulation walls connected together.

Claims

1. A refrigerator comprising:

an insulation box provided as a refrigerator body and formed by connecting a plurality of insulation walls each of which includes an insulation panel between an outer shell and an inner shell; and

a covering member provided on a predetermined one of connections of the insulation walls in order to cover the connection.

2. The refrigerator according to claim 1, wherein two of the insulation walls having the connection sealed by the covering member include the respective insulation panels spaced from each other, wherein the covering member has insulation layers between it and the two insulation walls respectively; and wherein the insulation layers cover at least a space between the insulation panels of the insulation walls.

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

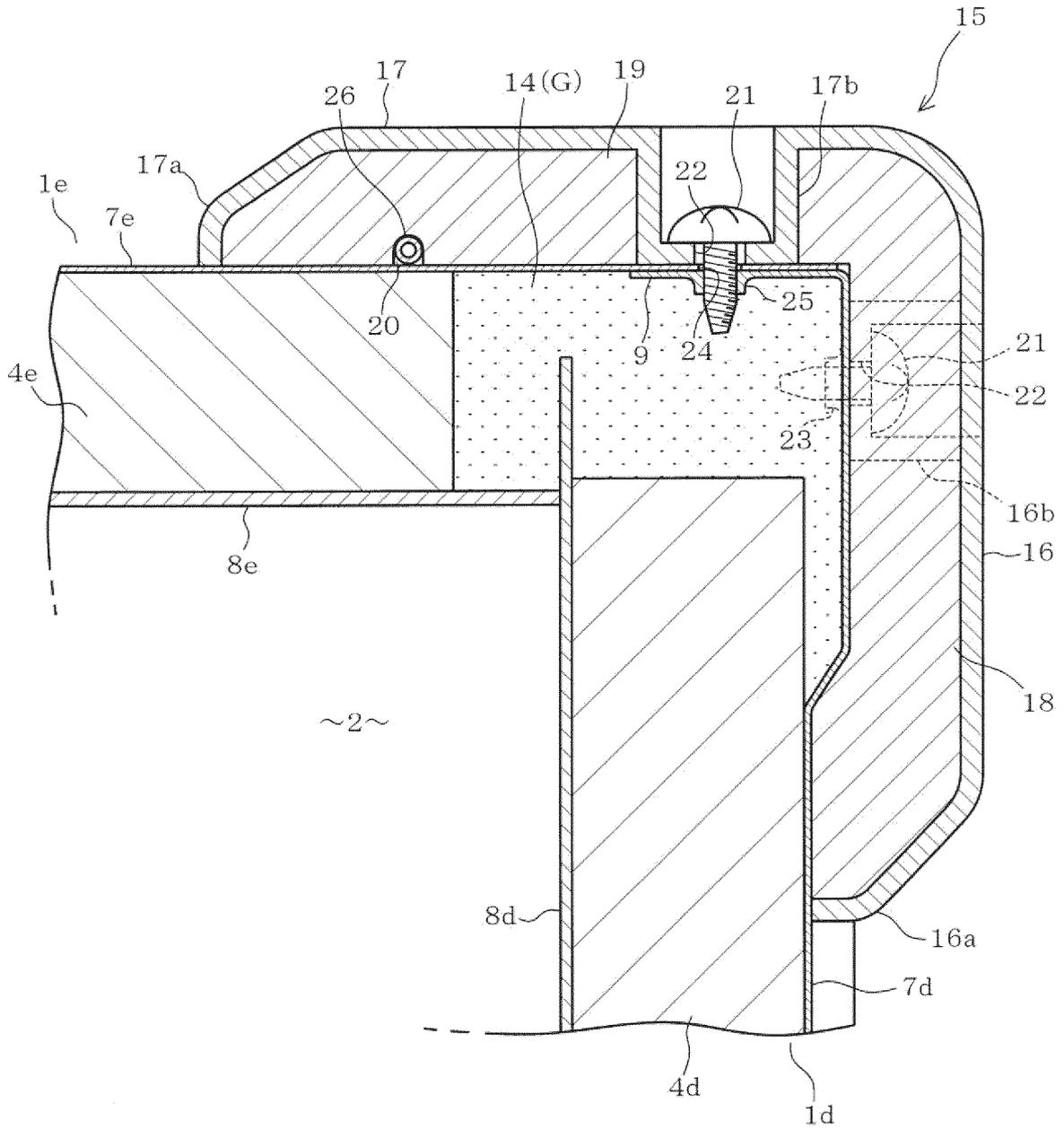


FIG. 1

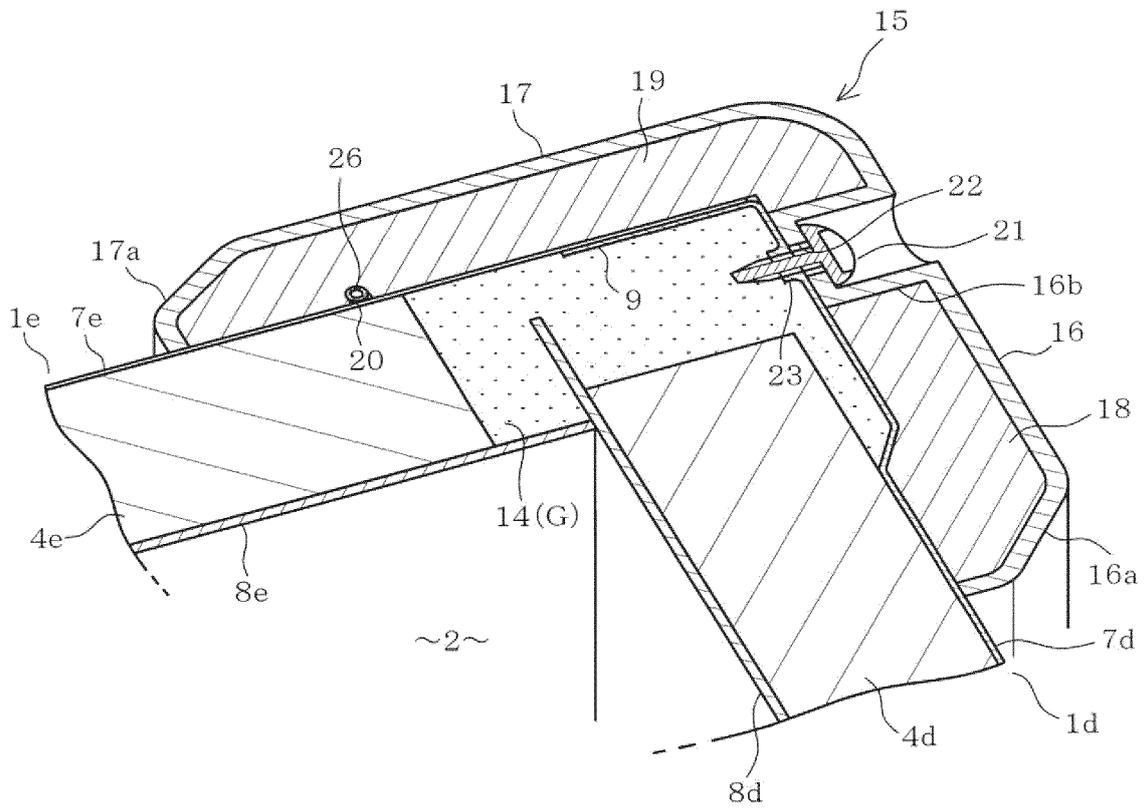


FIG. 2

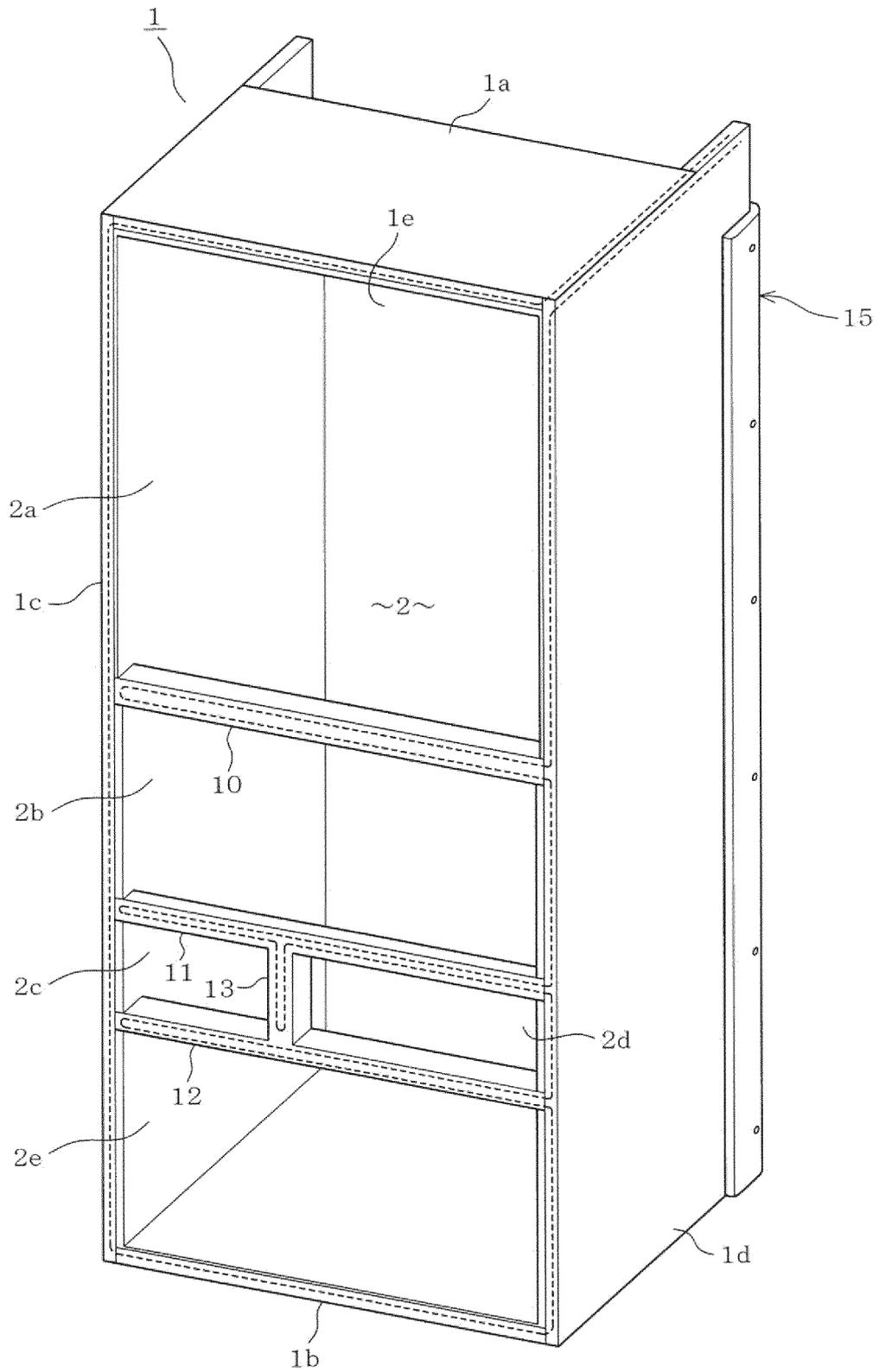


FIG. 3

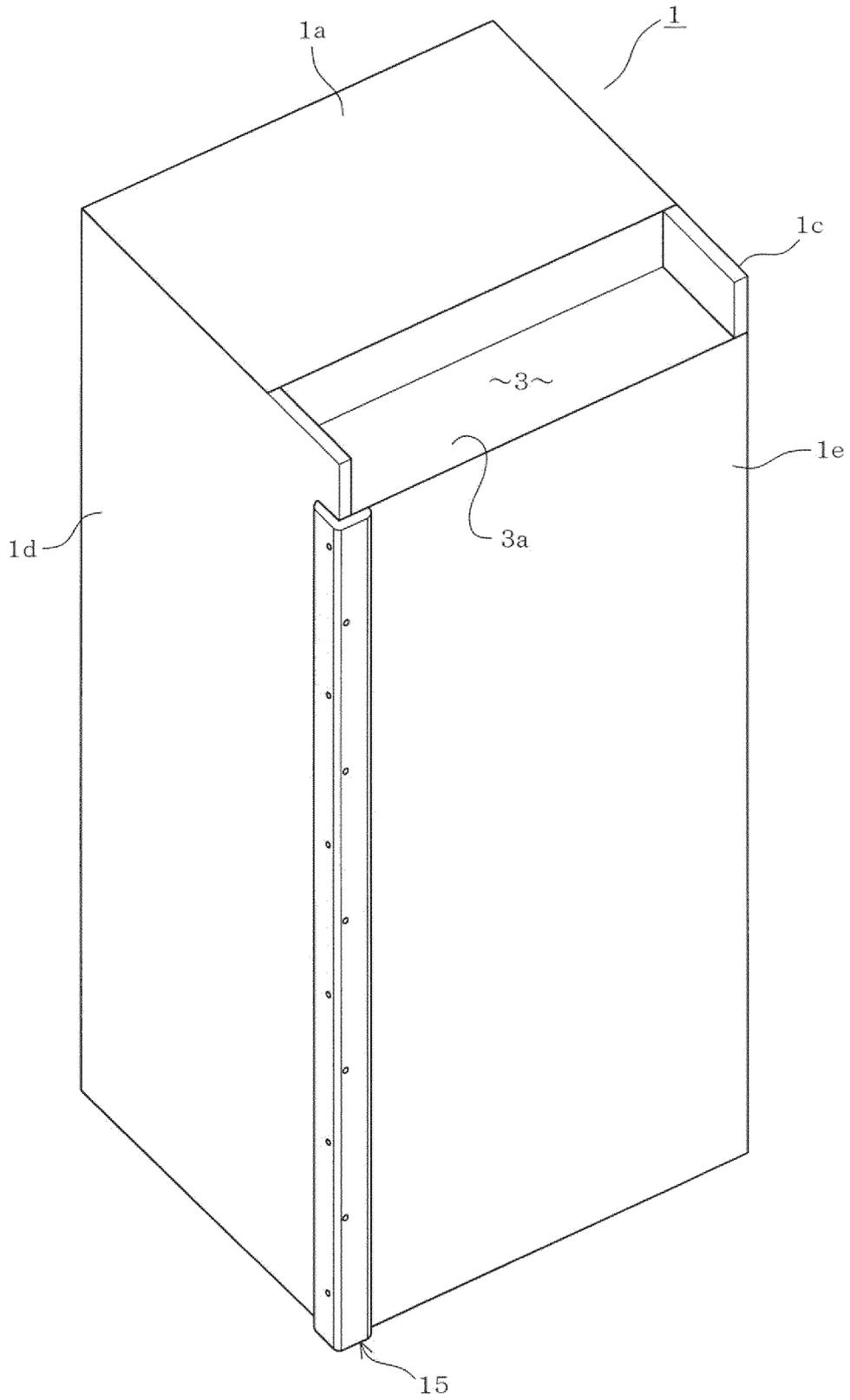


FIG. 4

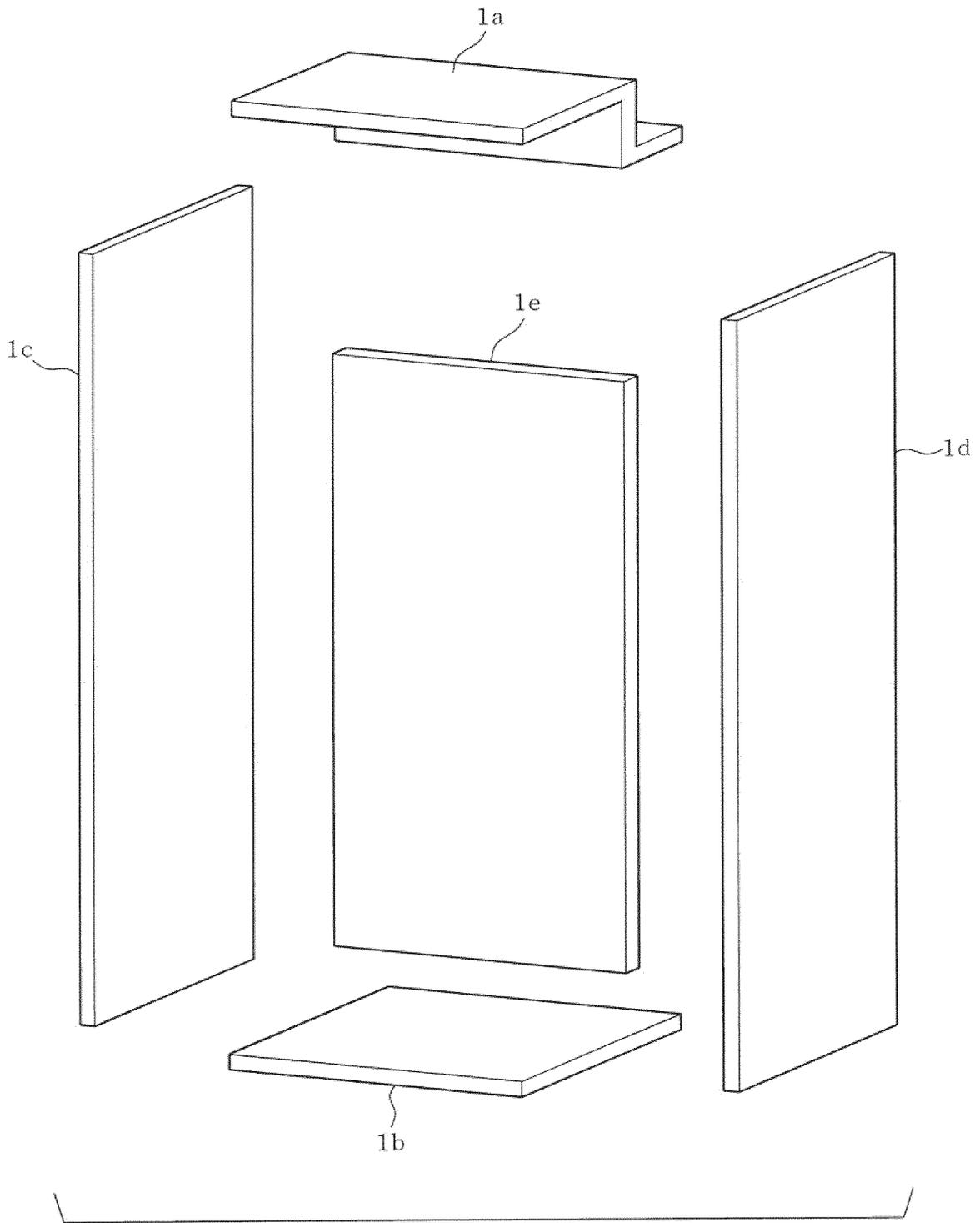


FIG. 5

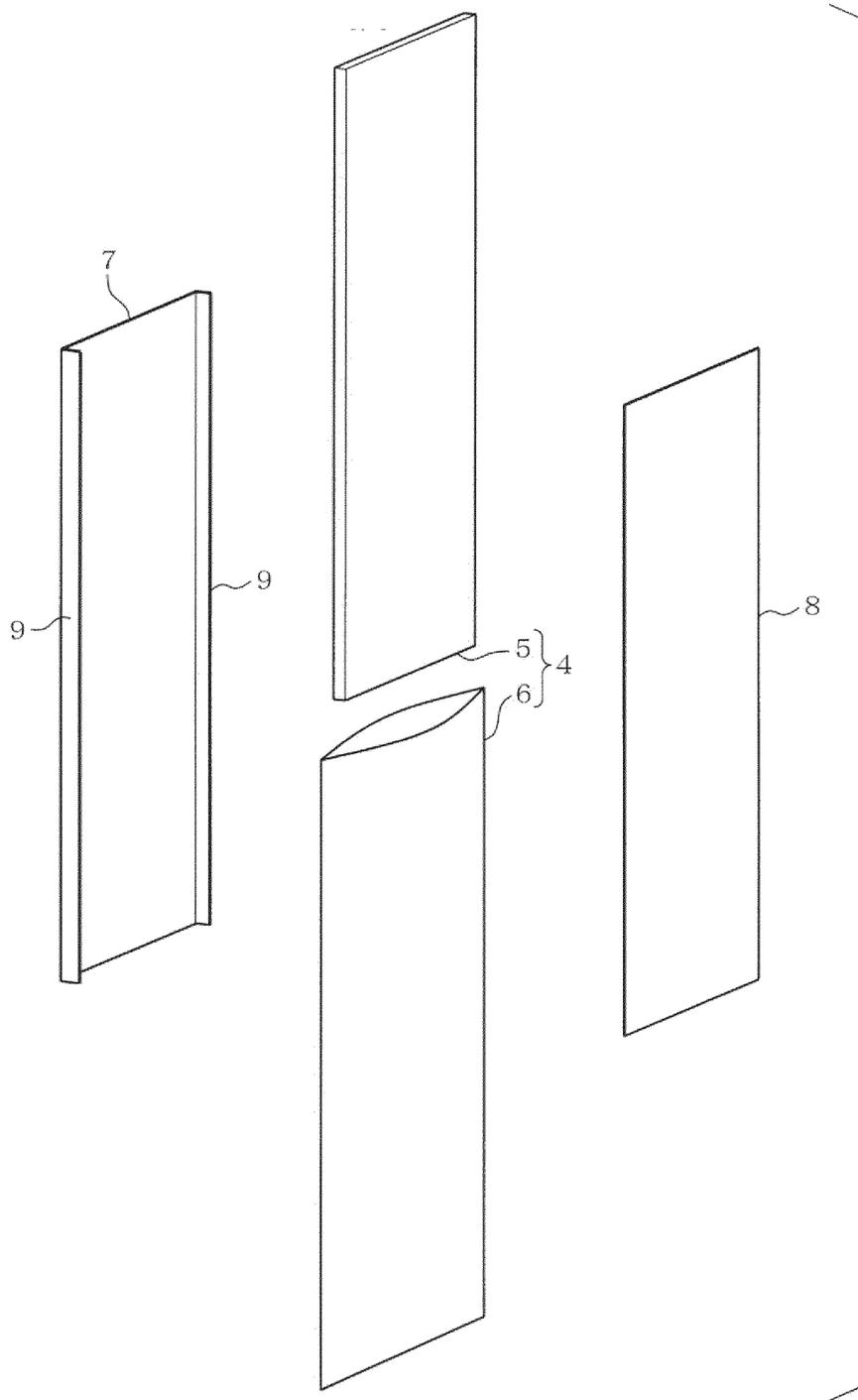


FIG. 6A

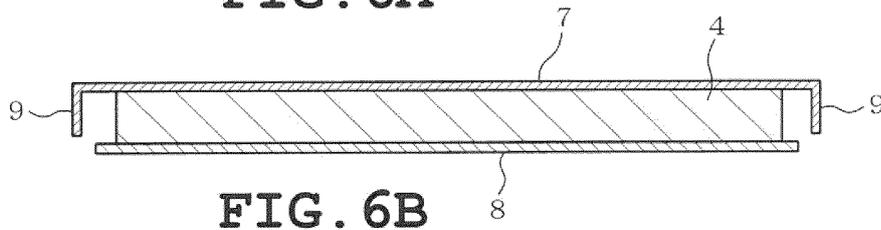


FIG. 6B

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/078984

5 A. CLASSIFICATION OF SUBJECT MATTER
F25D23/06 (2006.01) i

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

10 B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F25D23/06

15 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013
Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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

20 C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 52-148860 A (Daikin Industries, Ltd.), 10 December 1977 (10.12.1977), entire text; all drawings (Family: none)	1, 2, 7 3-6
X Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 132590/1973 (Laid-open No. 77870/1975) (Daido Kohan Kabushiki Kaisha), 05 July 1975 (05.07.1975), entire text; all drawings (particularly, fig. 1(C)) (Family: none)	1 3-6

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

* Special categories of cited documents:

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

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

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

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

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

"I" 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

50 Date of the actual completion of the international search
25 January, 2013 (25.01.13)

Date of mailing of the international search report
05 February, 2013 (05.02.13)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/078984

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 46-21583 Y1 (ShinMaywa Industries, Ltd.), 26 July 1971 (26.07.1971), entire text; all drawings (particularly, fig. 2) (Family: none)	1 3-6
X Y	JP 8-14484 A (Sanyo Electric Co., Ltd.), 26 January 1996 (26.01.1996), entire text; all drawings (particularly, paragraphs [0018] to [0020]; fig. 4, 5) & US 5857307 A & US 5950395 A	1 3-6
X Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 156258/1980 (Laid-open No. 83393/1982) (Showa Aluminum Corp.), 22 May 1982 (22.05.1982), entire text; all drawings (particularly, fig. 9) (Family: none)	1 3-6
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 000310/1981 (Laid-open No. 114392/1982) (Hitachi, Ltd.), 15 July 1982 (15.07.1982), entire text; all drawings (particularly, specification, page 3, line 4 to page 4, line 7; fig. 2) (Family: none)	3, 4
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