



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
15.10.2014 Bulletin 2014/42

(51) Int Cl.:
F25D 23/06^(2006.01) F25D 23/02^(2006.01)

(21) Application number: **12854737.9**

(86) International application number:
PCT/JP2012/079647

(22) Date of filing: **15.11.2012**

(87) International publication number:
WO 2013/084685 (13.06.2013 Gazette 2013/24)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **07.12.2011 JP 2011267805**

(71) Applicants:
• **Kabushiki Kaisha Toshiba**
Minato-ku
Tokyo 105-8001 (JP)
• **Toshiba Consumer Electronics Holdings Corporation**
Tokyo 101-0021 (JP)
• **Toshiba Home Appliances Corporation**
Tokyo 101-0021 (JP)

(72) Inventors:
• **ISHIBASHI, Ikuo**
Minato-ku, Tokyo 105-8001 (JP)
• **SAEKI, Tomoyasu**
Minato-ku, Tokyo 105-8001 (JP)
• **ABE, Masanori**
Minato-ku, Tokyo 105-8001 (JP)
• **KOMABA, Takashi**
Minato-ku, Tokyo 105-8001 (JP)

(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(54) **THERMAL INSULATION CABINET**

(57) An insulated cabinet includes a cabinet body and a defining member. The cabinet body is formed with an opening in a front and has a storage compartment in an interior thereof. The storage compartment communicates with the opening. The defining member is located in at least two of walls constituting a periphery of the opening, thereby defining positions of the walls.

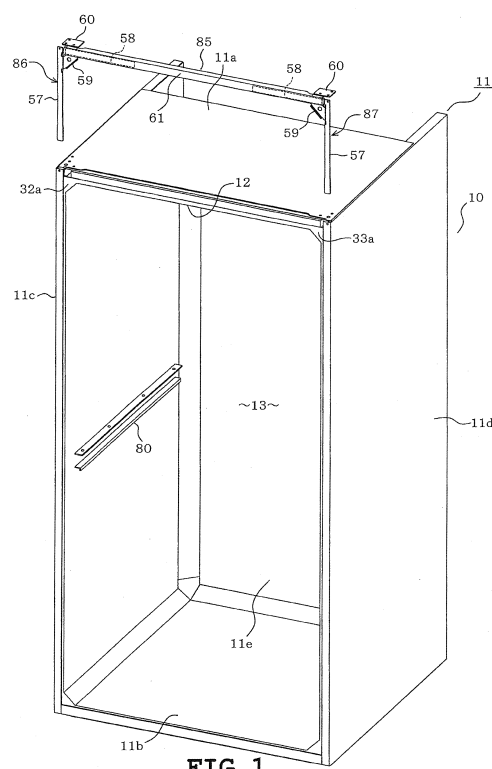


FIG. 1

Description

Technical Field

[0001] Embodiments of the present invention relate to an insulated cabinet.

Background Art

[0002] Household refrigerators have been recently increased in capacity. The thickness of a peripheral wall of an insulated cabinet has been reduced in order that capacity enlargement may be realized with suppression of increase in external dimensions of the refrigerator. In this case, the insulated cabinet requires to ensure a sufficient heat insulation performance while the thickness of the peripheral wall is reduced. Accordingly, an insulation panel such as vacuum insulation panel having a high heat insulation performance is used as an insulation material provided on the peripheral wall of the insulated cabinet in addition to foam insulation.

[0003] The vacuum insulation panel mainly comprises a core material and a gas barrier container. The core material is, for example, glass wool formed into a mat shape. The gas barrier container is a bag-shaped container made of a laminate film of a layer having gas barrier property, such as aluminum foil and a synthetic resin layer. The core material is put into the gas barrier container, which is then evacuated. An opening of the gas barrier container is closed in the evacuated state, whereby the interior of the gas barrier container is retained in a vacuum state. The vacuum insulation panel is thin and has a low heat conductivity, namely, high insulation property. The insulated cabinet can achieve a high insulation performance with a reduction in the peripheral wall thickness by the use of the vacuum insulation panel.

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] However, when the thickness of the peripheral wall is reduced, the rigidity of the entire insulated cabinet tends to be deficient, with the result that the insulated cabinet becomes easy to deform. FIG. 22 shows deformation of an insulated cabinet 1 having a peripheral wall 1a having a reduced thickness in an exaggerated manner. The insulated cabinet shown in FIG. 22 is deformed

so as to fall down to the left as viewed at the front. Further, the insulated cabinet is sometimes deformed to the right which is opposed to the direction as shown in FIG. 22 although the deformation is not shown.

[0006] The following causes for the deformation of the insulated cabinet 1 are considered as follows, for example. A first cause is that the insulated cabinet 1 is formed with an opening 2 communicating with an inner storage compartment 3. A second cause is that the insulated cabinet 1 has a door 4 opening and closing the opening 2. Two doors 4 as shown in FIG. 22 are provided on the front of the insulated cabinet 1 and are supported at outer upper and lower portions by hinges (not shown). The doors 4 are caused to pivot about the hinges.

[0007] When the insulated cabinet 1 is deformed, the deformation degrades the appearance of the refrigerator and reduces operability of the doors 4, with the result that the refrigerator is unbearable to use.

[0008] In view of the foregoing problems, an object is to provide an insulated cabinet which can reduce deformation even when the thickness of the peripheral wall is small.

Means for Overcoming the Problem

[0009] According to one embodiment, an insulated cabinet includes a cabinet body and a defining member. The cabinet body is formed with an opening in a front and has a storage compartment in an interior thereof. The storage compartment communicates with the opening. The defining member is provided in at least two of walls constituting a periphery of the opening, thereby defining positions of the walls.

Brief Description of the Drawings

[0010]

FIG. 1 is an exploded perspective of a cabinet body and a reinforcing plate, showing a first embodiment; FIG. 2 is a perspective view of the reinforcing plate as viewed at the front;

FIG. 3 is a perspective view of the reinforcing plate as viewed at the rear;

FIG. 5 is a perspective view of an upper left corner of the cabinet body;

FIG. 6 is a transverse section taken along line X5-X5 in FIG. 4;

FIG. 7 is a side view of the insulated cabinet (refrigerator);

FIG. 8 is a longitudinally sectional front view of one side of a reinforcing part located between right and left sidewalls of the cabinet body;

FIG. 9 is a schematic perspective view of the cabinet body;

FIG. 10 is an exploded perspective view of the cabinet body before assembly;

FIG. 11 is a longitudinally sectional side view of the

cabinet body;
 FIG. 12 is a longitudinally sectional front view of the cabinet body;
 FIG. 13 is an enlarged view of part X13 in FIG. 11;
 FIG. 14 is a partially eliminated enlarged view of part X14 in FIG. 12;
 FIG. 15 is an enlarged view of part X15 in FIG. 11;
 FIG. 16 is a partially eliminated enlarged view of part X16 in FIG. 12;
 FIG. 17 is a partially eliminated transverse section of an inner part along line X17-X17 in FIG. 12;
 FIG. 18 is a perspective view of the cabinet body, showing a second embodiment;
 FIG. 19 is a view similar to FIG. 5, showing a third embodiment;
 FIG. 20 is a view similar to FIG. 18, showing a fourth embodiment;
 FIG. 21 is a view similar to FIG. 18, showing a fifth embodiment; and
 FIG. 22 is a front view showing deformation in a conventional example in an exaggerated manner.

Best Mode for Carrying Out the Invention

[0011] Insulated cabinets of a plurality of embodiments will be described with reference to the drawings. Substantially identical parts are labeled by the same reference symbols throughout the embodiments and the description of these parts will be eliminated.

First Embodiment

[0012] A first embodiment will be described with reference to FIGS. 1 to 17. Referring to FIG. 9, a cabinet body 11 of an insulated cabinet 10 is schematically shown. The cabinet body 11 has an opening 12 in a front and is formed into the shape of a generally rectangular parallelepiped box as shown in FIG. 9. The cabinet body 11 has a storage compartment 13 therein. The storage compartment 13 communicates with the opening 12. The cabinet body 11 has a peripheral wall including a ceiling wall 11a, a bottom wall 11b, a left sidewall 11c, a right sidewall 11d and an inner wall 11e. These ceiling wall 11a, bottom wall 11b, left sidewall 11c, right sidewall 11d and inner wall 11e are separated from one another. The cabinet body 11 is constructed by combining the ceiling wall 11a, the bottom wall 11b, the left sidewall 11c, the right sidewall 11d and the inner wall 11e.

[0013] The ceiling wall 11a has an outer shell 14, an inner shell 15, a vacuum insulation panel 16 and a foam insulation 17. The vacuum insulation panel 16 is provided between the outer shell 14 and the inner shell 15. The foam insulation 17 fills a space defined around the vacuum insulation panel 16 between the outer shell 14 and the inner shell 15. The bottom wall 11b is constructed substantially in the same manner as the ceiling wall 11a. More specifically, the bottom wall 11b has an outer shell 18, an inner shell 19, a vacuum insulation panel 20 and

a foam insulation 17. The vacuum insulation panel 20 is provided between the outer shell 18 and the inner shell 19. The foam insulation 17 fills a space defined around the vacuum insulation panel 20 between the outer shell 18 and the inner shell 19.

[0014] The left sidewall 11c has an outer shell 21, an inner shell 22 and a vacuum insulation panel 23 as shown in FIG. 12. The vacuum insulation panel 23 is provided between the outer shell 21 and the inner shell 22. The right sidewall 11d is also constructed substantially in the same manner as the left sidewall 11c. More specifically, the right sidewall 11d has an outer shell 24, an inner shell 25, a vacuum insulation panel 26. The vacuum insulation panel 26 is provided between the outer shell 24 and the inner shell 25. The inner wall 11e is also constructed substantially in the same manner as the right and left sidewall 11d and 11c. More specifically, the inner wall 11e has an outer shell 27, an inner shell 28, a vacuum insulation panel 29 as shown in FIG. 11. The vacuum insulation panel 29 is provided between the outer shell 27 and the inner shell 28.

[0015] The outer shells 14, 18, 21, 24 and 27 are formed of a metal such as a steel plate, for example and function as outer plates. The inner shells 15, 19, 22, 25 and 28 are formed of plastic, for example and function as inner plates.

[0016] In the ceiling wall 11a, the vacuum insulation panel 16 is affixed to an inner surface of the outer shell 14, and front ends of the outer shell 14 and inner shell 15 are joined to each other. Further, a recessed step 30 is formed in a rear part of the ceiling wall 11a. The recessed step 30 constitutes a bent portion. Although the recessed step 30 is filled with the foam insulation 17, no vacuum insulation panel is provided in the recessed step 30. However, a thin vacuum insulation panel may be provided in the recessed step 30.

[0017] The ceiling wall 11a has an upper rear inclined portion 31 as shown in FIG. 13. The ceiling wall 11a also has an upper left inclined portion 32 and an upper right inclined portion 33 as shown in FIG. 14. The inclined portions 31, 32 and 33 are formed integrally with the inner shell 15. The upper rear inclined portion 31 is located at a rear edge of the recessed step 30 of the ceiling wall 11a and is inclined so as to descend rearward along the inner shell 15. The upper rear inclined portion 31 is formed over an entire dimension of the inner shell 15 in the right-left direction at the rear edge of the recessed step 30, that is, at the rear edge of the inner shell 15.

[0018] The upper left inclined portion 32 is located at a left edge of the ceiling wall 11a and is inclined so as to descend leftward along the inner shell 15. The upper left inclined portion 31 is formed over an entire dimension of the inner shell 15 in the right-left direction at the left edge of the ceiling wall 11a. In the same manner, the upper right inclined portion 33 is located at a right edge of the ceiling wall 11a and is inclined so as to descend rightward along the inner shell 15. The upper right inclined portion 33 is formed over an entire dimension of the inner shell

15 in the right-left direction at the right edge of the ceiling wall 11a.

[0019] The inclined portions 31, 32 and 33 of the inner shell 15 are spaced from the vacuum insulation panel 16. The inner shell 15 further has a left closure 32a and a right closure 33a as shown in FIGS. 1 and 4. The closures 32a and 33a are each formed into a triangular shape integrally with the inner shell 15.

[0020] A space S4 is defined in a connection between the ceiling wall 11a and the left sidewall 11c as shown in FIG. 14. The left closure 32a covers a front of the space S4. More specifically, the left closure 32a covers the front of the space S4 surrounded by the outer shell 14 of the ceiling wall 11a, the upper left inclined portion 32 of the inner shell 15 of the ceiling wall 11a and the outer shell 21 of the left sidewall 11c.

[0021] A space S5 is defined in a connection between the ceiling wall 11a and the right sidewall 11d as shown in FIG. 14. The right closure 33a covers a front of the space S5. More specifically, the right closure 33a covers the front of the space S5 surrounded by the outer shell 14 of the ceiling wall 11a, the upper right inclined portion 33 of the inner shell 15 of the ceiling wall 11a and the outer shell 24 of the right sidewall 11d.

[0022] The vacuum insulation panel 20 is attached to an inner surface of the outer shell 18 in the bottom wall 11b, as shown in FIG. 11. Front ends of the outer and inner shells 18 and 19 are joined to each other in the bottom wall 11b. The bottom wall 11b has a lower rear inclined portion 34, a lower left inclined portion 35 and a lower right inclined portion 36. The inclined portions 34, 35 and 36 are formed integrally with the inner shell 19. The lower rear inclined portion 34 is located at a rear edge of the bottom wall 11b and is inclined so as to ascend rearward along the inner shell 19. The lower rear inclined portion 34 is formed over an entire dimension of the inner shell 19 in the right-left direction of the inner shell 19 at the rear edge of the inner shell 19.

[0023] The lower left inclined portion 35 is located at a left edge of the bottom wall 11b and is inclined so as to ascend leftward along the inner shell 19. The lower left inclined portion 35 is formed over an entire dimension of the inner shell 19 in the front-back direction of the inner shell 19. In the same manner, the lower right inclined portion 36 is located at a right edge of the bottom wall 11b and is inclined so as to ascend rightward along the inner shell 19. The lower right inclined portion 36 is formed over an entire dimension of the inner shell 19 in the front-back direction at the right edge of the bottom wall 11b. The inclined portions 34, 35 and 36 of the inner shell 19 are spaced from the vacuum insulation panel 20.

[0024] The vacuum insulation panel 23 is attached to inner surfaces of the outer and inner shells 21 and 22 in the left sidewall 11c, as shown in FIG. 16. Front edges of the outer and inner shells 21 and 22 are joined to each other in the left sidewall 11c. The left sidewall 11c has a left upper bent portion 37 as shown in FIG. 14, a left lower bent portion 38 as shown in FIG. 16 and a left rear bent

portion 39 as shown in FIG. 17. The bent portions 37, 38 and 39 are formed integrally with the outer shell 21.

[0025] The left upper bent portion 37 is formed by bending an upper edge of the outer shell 21 inward, namely, to the right sidewall 11d side substantially at a right angle, as shown in FIG. 14. The left lower bent portion 38 is formed by bending a lower edge of the outer shell 21 inward, namely, to the right sidewall 11d side substantially at a right angle, as shown in FIG. 16. The left rear bent portion 39 is formed by bending a rear edge of the outer shell 21 inward, namely, to the right sidewall 11d side substantially at a right angle.

[0026] Further, the left sidewall 11c has a left rear bent portion 40 as shown in FIG. 17. The left rear bent portion 40 is formed integrally with the inner shell 22. The left rear bent portion 40 is formed by bending an upper edge of the inner shell 22 inward, namely, to the right sidewall 11d side substantially at a right angle.

[0027] The vacuum insulation panel 26 is attached to inner surfaces of the outer and inner shells 24 and 25 in the right sidewall 11d, as shown in FIG. 16. Front edges of the outer and inner shells 24 and 25 are joined to each other in the right sidewall 11d. The right sidewall 11d has a right upper bent portion 41 as shown in FIG. 14, a right lower bent portion 42 as shown in FIG. 16 and a right rear bent portion 43 as shown in FIG. 17. The bent portions 41, 42 and 43 are formed integrally with the outer shell 24.

[0028] The right upper bent portion 41 is formed by bending an upper edge of the outer shell 24 inward, namely, to left sidewall 11c side substantially at a right angle, as shown in FIG. 14. The right lower bent portion 42 is formed by bending a lower edge of the outer shell 24 inward, namely, to the left sidewall 11c side substantially at a right angle, as shown in FIG. 16. The right rear bent portion 43 is formed by bending a rear edge of the outer shell 24 inward, namely, to left sidewall 11c side substantially at a right angle, as shown in FIG. 17.

[0029] The right sidewall 11d further has a right rear bent portion 44 as shown in FIG. 17. The bent portion 44 is formed integrally with the inner shell 25. The bent portion 44 is formed by bending an upper end of the inner shell 25 inward, namely, to the left sidewall 11c side substantially at a right angle.

[0030] The assembly of the walls 11a to 11d will be described. Firstly, the left sidewall 11c and the right sidewall 11d are assembled to the inner wall 11e. In the assembly of the left sidewall 11c, the bent portion 39 of the outer shell 21 is placed on the left edge 27a of the outer shell 27 of the inner wall 11e with a seal material being interposed therebetween, as shown in FIG. 17. A plurality of screws 48 are passed through the bent portion 39 and then screwed into the left edge 27a. With this, the bent portion 40 of the inner shell 22 of the left sidewall 11c is placed on the left edge 28a of the inner shell 28 of the inner wall 11e. Screws (not shown) are passed through the bent portion 40 of the inner shell 22 of the left sidewall 11c and then screwed into the left edge 28a of the inner

shell 28. As a result, the left sidewall 11c and the inner wall 11e are fixed to each other.

[0031] In the assembly of the right sidewall 11d, the bent portion 43 of the outer shell 24 is also placed on the right edge 27b of the outer shell 27 of the inner wall 11e with a seal material 47 being interposed therebetween, in the same manner as described above. With this, the bent portion 44 of the inner shell 25 of the right sidewall 11d is placed on a right edge 28b of the inner shell 28 of the inner wall 11e. Screws (not shown) are passed through the bent portion 44 and then screwed into the right edge 28b of the inner shell 28. As a result, the right sidewall 11d and the inner wall 11e are fixed to each other.

[0032] The bottom wall 11b and the ceiling wall 11a are next assembled to the inner wall 11e, and the left sidewall 11c and the right sidewall 11d respectively. In the assembly of the bottom wall 11b to the inner wall 11e, a rear edge 18a of the outer shell 18 of the bottom wall 11b is placed on a lower bent portion 46 of the outer shell 27 of the inner wall 11e, as shown in FIG. 15. A plurality of screws (not shown) is passed through the rear edge 18a and then screwed into the bent portion 46. With this, a distal end of the inclined portion 34 of the inner shell 19 of the bottom wall 11b is placed on a lower end 28c of the inner shell 28 of the inner wall 11e with a seal material 49 being interposed therebetween. A plurality of screws 50 is passed through the distal end of the inclined portion 34 and then screwed into the lower edge 28c. As a result, the bottom wall 11b and the inner wall 11e are fixed to each other.

[0033] In the assembly of the bottom wall 11b to the left sidewall 11c, a left edge 18b of the outer shell 18 of the bottom wall 11b is placed on a bent portion 38 of the outer shell 21 of the left sidewall 11c, as shown in FIG. 16. A plurality of screws (not shown) is passed through the left edge 18b and then screwed into the bent portion 38. With this, a distal end of the inclined portion 35 of the inner shell 19 of the bottom wall 11b is placed on a lower end 22a of the inner shell 22 of the left sidewall 11c with a seal material 51 being interposed therebetween. A plurality of screws 52 is passed through the distal end of the inclined portion 35 and then screwed into the lower end 22a of the inner shell 22. As a result, the bottom wall 11b and the left sidewall 11c are fixed to each other.

[0034] In the assembly of the bottom wall 11b to the right sidewall 11d, a right end 18c of the outer shell 18 of the bottom wall 11b is placed on the bent portion 42 of the outer shell 24 of the right sidewall 11d in the same manner as described above. A plurality of screws (not shown) is passed through the right end 18c and then screwed into the bent portion 42. With this, a distal end of the inclined portion 36 of the inner shell 19 of the bottom wall 11b is placed on a lower end 25a of the inner shell 25 of the right sidewall 11d with the seal material 51 being interposed therebetween. A plurality of screws 52 is passed through the distal end of the inclined portion 36 and then screwed into the lower end 25a of the inner

shell 25. As a result, the bottom wall 11b and the right sidewall 11d are fixed to each other.

[0035] In the assembly of the ceiling wall 11a to the inner wall 11e, a rear end 14a of the outer shell 14 of the ceiling wall 11a is placed on a bent portion 45 of the outer shell 27 of the inner wall 11e, as shown in FIG. 13. A plurality of screws (not shown) is passed through the rear end 14a and then screwed into the bent portion 45. With this, a distal end of the inclined portion 31 of the inner shell 15 of the ceiling wall 11a is placed on an upper end 28d of the inner shell 28 of the inner wall 11e with a seal material 53 being interposed therebetween. A plurality of screws 54 is passed through the distal end of the inclined portion 31 and then screwed into the upper end 28d of the inner shell 28. As a result, the ceiling wall 11a and the inner wall 11e are fixed to each other.

[0036] In the assembly of the ceiling wall 11a to the left sidewall 11c, a left end 14b of the outer shell 14 of the ceiling wall 11a is placed on the bent portion 37 of the outer shell 21 of the left sidewall 11c, as shown in FIG. 14. A plurality of screws (not shown) is passed through the left end 14b and then screwed into the bent portion 37. With this, a distal end of the inclined portion 32 of the inner shell 15 of the ceiling wall 11a is placed on an upper end 22b of the inner shell 22 of the left sidewall 11c with a seal material 55 being interposed therebetween. A plurality of screws 56 is passed through the distal end of the inclined portion 32 and then screwed into the upper end 22b of the inner shell 22. As a result, the ceiling wall 11a and the left sidewall 11c are fixed to each other.

[0037] In the assembly of the ceiling wall 11a to the right sidewall 11d, a right end 14b of the outer shell 14 of the ceiling wall 11a is placed on the bent portion 41 of the outer shell 24 of the right sidewall 11d in the same manner as described above. A plurality of screws (not shown) is passed through the right end 14c and then screwed into the bent portion 41. With this, a distal end of the inclined portion 33 of the inner shell 15 of the ceiling wall 11a is placed on an upper end 25b of the inner shell 25 of the right sidewall 11d with a seal material 55 being interposed therebetween. A plurality of screws 56 is passed through the distal end of the inclined portion 33 and then screwed into the upper end 25b of the inner shell 25. As a result, the ceiling wall 11a and the right sidewall 11d are fixed to each other.

[0038] A space defined inside the walls 11a to 11e is filled with a foam insulation 17. The foam insulation 17 is foamed polyurethane, for example. A stock solution of polyurethane foam is poured into the space inside the walls 11a to 11e and caused to foam in the space, thereby filling the space.

[0039] More specifically, inside the ceiling wall 11a, the foam insulation 17 sequentially fills a space S1 between the inner shell 15 of the ceiling wall 11a and the vacuum insulation panel 16, a gap g1 defined on the left of the vacuum insulation panel 16, a gap g2 defined on the right of the vacuum insulation panel 16 and spaces S4 and S5 below the vacuum insulation panel 16, as shown in

FIG. 14.

[0040] In this case, the gap g1 is defined between a left end of the vacuum insulation panel 16 of the ceiling wall 11a and an upper end of the vacuum insulation panel 23 of the left sidewall 11c. The gap g2 is defined between a right end of the vacuum insulation panel 16 of the ceiling wall 11a and an upper end of the vacuum insulation panel 26 of the right sidewall 11d. The space S4 is defined by the left inclined portion 32 of the inner shell 15 of the ceiling wall 11a, a left end of the vacuum insulation panel 16 of the ceiling wall 11a and an upper end of the vacuum insulation panel 23 of the left sidewall 11c. The space S5 is defined by the right inclined portion 33 of the inner shell 15 of the ceiling wall 11a, a right end of the vacuum insulation panel 16 of the ceiling wall 11a and an upper end of the vacuum insulation panel 26 of the right sidewall 11d.

[0041] Further, inside the ceiling wall 11a, the foam insulation 17 sequentially fills the space S1, a gap g3 defined in the rear of the vacuum insulation panel 16 of the ceiling wall 11a and the space S3, as shown in FIG. 13. In this case, the gap g3 is defined between a rear end of the vacuum insulation panel 16 of the ceiling wall 11a and an upper end of the vacuum insulation panel 29 of the inner wall 11e, namely, the gap g3 is formed in a bent portion including the recessed end 30 of the ceiling wall 11a. The space S3 is defined by the inclined portion 31 in the rear of the inner shell 15 of the ceiling wall 11a and a rear end of the outer shell 14 of the ceiling wall 11a and an upper end of the vacuum insulation panel 29 of the inner wall 11e.

[0042] Inside the bottom wall 11b, the foam insulation 17 sequentially fills a space S2 defined between the inner shell 19 of the bottom wall 11b and the vacuum insulation panel 20, a gap g4 located on the left of the vacuum insulation panel 20, a gap g5 located on the right of the vacuum insulation panel 20 and spaces S7 and S8 located above the vacuum insulation panel 20.

[0043] In this case, the gap g4 is defined between a left end of the vacuum insulation panel 20 of the bottom wall 11b and a lower end of the vacuum insulation panel 23 of the left sidewall 11c. The gap g5 is defined between a right end of the vacuum insulation panel 20 of the bottom wall 11b and a lower end of the vacuum insulation panel 26 of the right sidewall 11d. The space S7 is defined by the left inclined portion 35 of the inner shell 19 of the bottom wall 11b, a left end of the vacuum insulation panel 20 of the bottom wall 11b and a lower end of the vacuum insulation panel 23 of the left sidewall 11c. The space S8 is defined by the right inclined portion 36 of the inner shell 19 of the bottom wall 11b, a right end of the vacuum insulation panel 20 of the bottom wall 11b and a lower end of the vacuum insulation panel 26 of the right sidewall 11d.

[0044] Further, inside the bottom wall 11b, the foam insulation 17 sequentially fills the space S2, a gap g6 located in the rear of the vacuum insulation panel 20 of the bottom wall 11b and a space S6 located above the

vacuum insulation panel 20, as shown in FIG. 15. In this case, the gap g6 is defined between a rear end of the vacuum insulation panel 20 of the bottom wall 11b and a lower end of the vacuum insulation panel 29 of the inner wall 11e. The space S6 is defined by the inclined portion 34 in the rear of the inner shell 19 of the bottom wall 11b, a rear end of the vacuum insulation panel 20 of the bottom wall 11b and a lower end of the vacuum insulation panel 29 of the inner wall 11e.

[0045] The foam insulation 17 further fills a gap g7 located on the left of the vacuum insulation panel 29 of the inner wall 11e and a gap g8 located on the right of the vacuum insulation panel 29, as shown in FIG. 17. In this case, the gap g7 is defined between a left end of the vacuum insulation panel 29 of the inner wall 11e and a rear end of the vacuum insulation panel 23 of the left sidewall 11c. The gap g8 is defined between a right end of the vacuum insulation panel 29 of the inner wall 11e and a rear end of the vacuum insulation panel 26 of the right sidewall 11d.

[0046] The opening 12 of the cabinet body 11 has a left upper corner constituted by a front of the ceiling wall 11a and a front of the left sidewall 11c, as shown in FIG. 1. In this case, the front of the ceiling wall 11a is an upper side which constitutes the left upper corner of the opening 12 together with the left side. On the other hand, the front of the left sidewall 11c is the left side which constitutes the left upper corner together with the upper side. Further, when the front of the ceiling wall 11a is one of two sides constituting the left upper corner of the opening 12, the front of the left sidewall 11c is the other side.

[0047] In the same manner, the opening 12 has a right upper corner constituted by a front of the ceiling wall 11a and a front of the right sidewall 11d. In this case, the front of the ceiling wall 11a is an upper side which constitutes the right upper corner of the opening 12 together with the right side. On the other hand, the front of the right sidewall 11d is the right side which constitutes the right upper corner together with the upper side. Further, when the front of the ceiling wall 11a is one of two sides constituting the right upper corner of the opening 12, the front of the right sidewall 11d is the other side.

[0048] The insulated cabinet 10 is provided with a defining member 85 which defines a positional relation of at least two of the walls 11a to 11d defining the opening 12, as shown in FIG. 1. In this case, the defining member 85 defines a positional relation between the right and left sidewalls 11d and 11c within a predetermined range.

[0049] The defining member 85 comprises a left reinforcing member 86, a right reinforcing member 87 and a front plate 61. The front plate 61 constitutes a front of the outer shell 14 of the ceiling wall 11a. The right reinforcing member 87 is provided at the right upper corner of the opening 12. The left reinforcing member 86 is provided at the left upper corner of the opening 12. The right and left reinforcing members 87 and 86 are bilaterally symmetric thereby to be paired. Accordingly, only the left reinforcing member 86 will be described here.

[0050] The left reinforcing member 86 includes a longitudinal reinforcing plate 57, a lateral reinforcing plate 58 and a connecting portion 59 all of which are formed integrally with the left reinforcing member 86 as also shown in FIGS. 2 and 3. The left reinforcing member 86 is also provided with a hinge fixing plate 60 formed integrally therewith. The left reinforcing member 86 is formed by cutting a desirable shape out of a rigid material such as steel plate by a press machine. The longitudinal reinforcing plate 57 is formed into an elongated shape and extends into a longitudinal direction, namely, in the up-down direction. The longitudinal reinforcing plate 57 is provided along the front of the left sidewall 11c. The lateral reinforcing plate 58 is provided along a left part of the front of the ceiling wall 11a.

[0051] The connecting portion 59 of the left reinforcing member 86 connects the longitudinal and lateral reinforcing plates 57 and 58 together. The connecting portion 59 is formed into the shape of a broad triangular plate and connects an upper end of the longitudinal reinforcing plate 57 and a left end of the lateral reinforcing plate 58. In this case, the longitudinal and lateral reinforcing members 57 and 58 are integrated into a shape obtained by butting the plates 57 and 58 substantially at a right angle, that is, into an L-shape. The longitudinal and lateral reinforcing plates 57 and 58 are thus connected to each other by the connecting portion 59 thereby to be rigidified. "To be rigidified" here means that the strength of the whole left reinforcing member 86 is improved by integrally connecting the longitudinal and lateral reinforcing plates 57 and 58 by the connecting portion 59.

[0052] The hinge fixing plate 60 is formed into a rectangular plate shape and has a plurality of, in the embodiment, three hinge mounting holes 72. The hinge mounting holes 72 extend through the hinge fixing plate 60 in a thickness direction thereof to be each formed into a circular shape. The hinge fixing plate 60 of the left reinforcing member 86 is provided on a left end of the lateral reinforcing plate 58, namely, at the longitudinal reinforcing member 86 side and extends rearward from an upper edge of the lateral reinforcing plate 58.

[0053] For comparison, a longitudinal reinforcing plate 57 is provided along a front of the right sidewall 11d in the right reinforcing member 87. A lateral reinforcing plate 58 of the right reinforcing member 87 is provided along a right part of the front of the ceiling wall 11a. Further, a connecting portion 59 of the right reinforcing member 87 connects an upper end of the longitudinal reinforcing plate 57 and a right end of the lateral reinforcing plate 58. A hinge fixing plate 60 of the right reinforcing member 87 is provided on a right end of the lateral reinforcing plate 58.

[0054] Each of the reinforcing members 86 and 87 may be formed by integrating, by welding or the like, the longitudinal reinforcing plate 57, the lateral reinforcing plate 58, the connecting portion 59 and the hinge fixing plate 60 all of which are formed independent of one another. The right and left reinforcing members 87 and 86 are

connected to each other by a front plate 61 as shown in FIG. 1. In this case, the front plate 61 is provided in front of the lateral reinforcing plates 58 of the right and left reinforcing members 87 and 86 and joined to the lateral reinforcing plates 58 by welding, bonding, screwing or the like. As a result, the right and left reinforcing plates 57 and 58 and the front plate 61 are integrated together.

[0055] Front ends of the right and left sidewalls 11d and 11c will be described. The longitudinal reinforcing plate 57 of the left reinforcing member 86 is inserted into the front of the left sidewall 11c, namely, the side of the opening 12 in the longitudinal direction. The longitudinal reinforcing plate 57 of the right reinforcing member 86 is also inserted into the front of the right sidewall 11d, namely, the side of the opening 12 in the longitudinal direction.

[0056] Auxiliary reinforcing plates 62 are provided in front ends of the right and left sidewalls 11d and 11c respectively although FIG. 5 shows only the front end of the left sidewall 11c. The auxiliary reinforcing plates 62 are made of a steel plate, for example and each formed into an elongated shape extending over substantially entire vertical dimensions of the right and left sidewalls 11d and 11c.

[0057] Regarding the left sidewall 11c, the auxiliary reinforcing plate 62 is provided along the inside of the front end of the outer shell 21 inside the front end of the left sidewall 11c as shown in FIG. 5. The longitudinal reinforcing plate 57 of the left reinforcing member 86 is adjacent to the side of the auxiliary reinforcing plate 62 located at the vacuum insulation panel 23 side. Regarding to the right sidewall 11d, the auxiliary reinforcing plate 62 is provided along the inside of the front end of the outer shell 24 inside the front end of the right sidewall 11d although not shown. The longitudinal reinforcing plate 57 of the right reinforcing member 87 is adjacent to the side of the auxiliary reinforcing plate 62 located at the vacuum insulation panel 26 side.

[0058] The auxiliary reinforcing plates 62 have bent portions 62b and 62a formed by bending the right and left sides thereof rearward, respectively. The longitudinal reinforcing plate 57 is inserted between the bent portions 62a and 62b. In this case, a distance between one bent portion 62a and the other bent portion 62b is slightly larger than the width of the longitudinal reinforcing plate 57. Accordingly, when the longitudinal reinforcing plate 57 is inserted between the bent portions 62a and 62b, gaps a1 and a2 are defined between widthwise ends of the longitudinal reinforcing plate 57 and the bent portions 62a and 62b respectively. The gaps a1 and a2 serve as small gaps or allowances for insertion of the longitudinal reinforcing plate 57.

[0059] When the longitudinal reinforcing plate 57 has been inserted in the bent portions 62a and 62b, the bent portions 62a and 62b limit the widthwise or right-left movement of the longitudinal reinforcing plate 57. In this case, the bent portions 62a and 62b of the auxiliary reinforcing plate 62 function as first limiting portions which limit the widthwise movement of the reinforcing plate 57.

[0060] Inner sashes are provided for connecting between the front ends of the outer and inner shells 24 and 25 of the ceiling wall 11a, between the front ends of the outer and inner shells 18 and 19 of the bottom wall 11b, between the front ends of the outer and inner shells 21 and 33 of the left sidewall 11c and between the front ends of outer and inner shells 24 and 25 of the right sidewall 11d, respectively. FIG. 5 shows only the front ends of the left sidewall 11c. The inner sash 63 has a pipe holder 63a formed integrally therewith. The pipe holder 63a has a distal end which is formed into a semi-cylindrical shape and is open at the outer shell 21 side. The pipe holder 63a holds a dew-proofing pipe 64 at the distal end thereof. The dew-proofing pipe 64 is provided for preventing dew condensation on the front end of the cabinet body 11.

[0061] A radiating pipe 65 is provided between the outer shell 21 and the vacuum insulation panel 23 in the left sidewall 11c. Another radiating pipe is provided between the outer shell 24 and the vacuum insulation panel 26 in the right sidewall 11d although not shown. These radiation pipes constitute a part of a condenser of a refrigeration cycle which generates cold air to be supplied into the storage compartment 13. Further, the dew-proofing pipe 64 also constitutes a part of the condenser of the refrigeration cycle.

[0062] The left reinforcing member 86 includes the butting portion of the longitudinal and lateral reinforcing plates 57 and 58 serving as the corner of the left reinforcing member 86, namely, the upper end of the longitudinal reinforcing plate 57. The left reinforcing member 86 is fixed to the front of the left sidewall 11c at the upper end of the reinforcing plate 57 by a screw 66 serving as a fastening part. The right reinforcing member 87 is also fixed to the front of the right sidewall 11d at the upper end of the reinforcing plate 57 by a screw 66 serving as a fastening part. Each longitudinal reinforcing plate 57 is not fastened to another part. In this case, at least the lower distal end of the reinforcing plate 57 has only to be disconnected from another part.

[0063] Regarding deformation causing the cabinet body 11 to fall in the right-left direction, the shape of the cabinet body 11 is determined by defining a positional relation of at least two of the walls 11a to 11d constituting the periphery of the opening 12, that is, an angle made by the two walls, with the result that deformation of the cabinet body 11 is reduced.

[0064] In the embodiment, when the cabinet body 11 is deformed to fall down in the right-left direction with the result that angles of the right and left sidewalls 11d and 11c to the ceiling wall 11a change, the longitudinal reinforcing plate 57 is rotated about the screw 66 relative to the right or left sidewall 11d or 11c. When the rotation of the reinforcing plate 57 exceeds the gaps a1 and a2, the lower distal end of the reinforcing plate 57 butts against the bent portions 62a and 62b. This limits the rotation of the reinforcing plate 57, that is, the widthwise movement. The right and left sidewalls 11d and 11c are connected via the defining member 85 to each other. Accordingly,

when the movement of the defining member 85 is limited, the positional relation or angle between the right and left sidewalls 11d and 11c is defined. As a result, the shape of the cabinet body 11 is determined and further deformation of the cabinet body 11 is suppressed.

[0065] The space S4 is formed in the butting portion of the ceiling wall 11a and the left sidewall 11c by an inclined portion 32. Since the space S4 is filled with the foam insulation 17, the butting portion of the ceiling wall 11a and the left sidewall 11c has a larger thickness than the other portion. The connecting portion 59 of the left reinforcing member 86 is disposed on the rear of a thickened part as the result of the butting of the ceiling wall 11a and the left sidewall 11c, namely, the closure 32a.

[0066] The space S5 is also formed by an inclined portion 33 in the butting portion of the ceiling wall 11a and the right sidewall 11d. The space S5 is filled with the foam insulation 17. Accordingly, the butting portion of the ceiling wall 11a and the right sidewall 11d has a larger thickness than the other portion. The connecting portion 59 of the right reinforcing member 87 is disposed on the rear of a thickened part as the result of the butting of the ceiling wall 11a and the right sidewall 11d, namely, the closure 33a.

[0067] A left door 67, a right door 68 and a partition wall 69 are provided on the cabinet body 11 as shown in FIG. 6. The partition wall 69 is a plate-shaped wall having insulation properties, for example and is provided inside the cabinet body 11. The partition wall 69 partitions the storage compartment 13 in the cabinet body 11 vertically. In this case, for example, a space above the partition wall 69 in the storage compartment 13 serves as a refrigerating compartment 70.

[0068] The doors 67 and 68 are provided in the front of the refrigerating compartment 70. The doors 67 and 68 are double or French doors and open and close the opening 12 in the front of the refrigerating compartment 70. In this case, hinges (not shown) are provided on right and left ends of the front of the ceiling wall 11a and on right and left ends of the front of the partition wall 69. The doors 67 and 68 are supported by the hinges and caused to pivot about the hinges.

[0069] The hinges (not shown) at the ceiling wall 11a side are mounted to hinge fixing plates 60 provided on the upper surface of the ceiling wall 11a. An upper plate 71 is mounted on the upper surface of the ceiling wall 11a so as to cover the hinge fixing plates 60. The upper plate 71 has a plurality of holes 73 corresponding to a plurality of hinge mounting holes 72 formed through the hinge fixing plate 60 respectively. Hinge mounting parts such as screws (not shown) are passed through the holes 73 respectively.

[0070] Further, the left door 67 has a protrusion 74 as shown in FIG. 6. The protrusion 74 is formed into a rectangular frame shape, extending along the periphery of the left door 67. The protrusion 74 protrudes from a rear surface of the left door 67 toward the storage compartment 13 side. The right door 68 also has a protrusion 75.

The protrusion 75 is formed into a rectangular frame shape, extending along the periphery of the right door 68. The protrusion 75 protrudes from a rear surface of the right door 68 toward the storage compartment 13 side. The protrusions 74 and 75 are provided for preventing leak of cold air from the storage compartment 13 of the cabinet body 11, in this case, from the refrigerating compartment 70. Further, the protrusions 74 and 75 are provided for forming a plurality of stages of storage portions, that is, door pockets on the rear of the doors 67 and 68.

[0071] When the cabinet body 11 is deformed so as to fall down in the right-left direction, central axes of the hinges (not shown) supporting the right and left doors 68 and 67 also tilt. Accordingly, with tilt of the central axes of the hinges, the right and left doors 68 and 67 are also inclined. When the inclination of the cabinet body 11 is large, the protrusions 74 and 75 contact with the peripheral wall of the cabinet body 11 defining the opening 12. For example, when the cabinet body 11 is deformed as shown in FIG. 22, a right upper corner of the protrusion 74 contacts with the ceiling wall 11a and a left upper corner of the protrusion 75 contacts with the partition wall 69.

[0072] As shown in FIG. 6, reference symbol "b1" designates a dimension between the lower end corners of the protrusions 74 and 75 and the cabinet body 11. More specifically, the symbol b1 designates a distance between the lower end corners of the protrusions 74 and 75 and the cabinet body 11. Reference symbol "Ld" designates a width of the left door 67 or the right door 68. In FIG. 6, the width of the right door 68 is designated by the symbol "Ld." As shown in FIG. 4, reference symbol "Lc" designates the length from the screw 66 to the lower distal end of the reinforcing plate 57. The gap between the left edge of the reinforcing plate 57 and the bent portion 62a of the auxiliary reinforcing plate 62 is designated by reference symbol "a1." Further, as shown in FIG. 5, the gap between the right edge of the reinforcing plate 57 and the bent portion 62b of the auxiliary reinforcing plate 62 is designated by reference symbol "a2."

[0073] The following relationship of numerical expression (1) is defined among the above-mentioned dimensions a1, a2, Lc, b1 and Ld:

$$(a1 + a2)/Lc < (b1/Ld) \dots (1)$$

[0074] In expression (1), the gaps a1 and a2 at both sides of the reinforcing plate 57 are set to be equal to or smaller than dimensions by which the protrusions 74 and 75 of the doors 67 and 68 move by the deformation of the cabinet body 11 thereby to contact with the partition wall 69 which is a part of the cabinet body 11.

[0075] More specifically, when the cabinet body 11 is deformed as shown in FIG. 22, the reinforcing plate 57 is rotated about the screw 66 relative to the right and left

sidewalls 11d and 11c. On the other hand, with deformation of the cabinet body 11, the right and left doors 68 and 67 tilt so as to pivot. In this case, the gaps a1 and a2 at both sides of the lower end of the reinforcing plate 57 are approximated to a distance by which the distal end of the reinforcing plate 57 abuts against the first limiting portions 62a and 62b when the cabinet body 11 is deformed and the reinforcing plate 57 is turned about the screw 66. Accordingly, $(a1 + a2)/Lc$ in expression (1) shows an arc tangent function of an angle by which the reinforcing plate 57 is rotatable about the screw 66.

[0076] The gap b1 between the corner of the protrusion 74 of the door 67 opposed to the hinge and the partition wall 69 or the ceiling wall 11a is approximated to the distance that the corners of the protrusions 74 and 75 move until abutting against the partition wall 69 or the ceiling wall 11a when the cabinet body 11 is deformed and the doors 67 and 68 are rotated about the hinge. Hence, $b1/Ld$ in equation (1) shows the arc tangent function of the angle by which the door 67 is rotatable until the corner of the door 67 located below the protrusion 74 contacts with the partition wall 69. Accordingly, equation (1) shows that the lower end of the reinforcing plate 57 contacts with the bent portions 62a and 62b before the corner of the door 67 located below the protrusion 74 contacts with the partition wall 69 in the deformation of the cabinet body 11. The same is also applied to the door 68.

[0077] A compressor 76 of the refrigerating cycle is mounted in the cabinet body 11 as shown in FIG. 7. In this case, the compressor 76 is mounted on the recessed step 30 formed in the rear upper part of the cabinet body 11. More specifically, the upper surface of the recessed step 30 functions as a mounting surface on which the compressor 76 is mounted. In this case, the lower distal end of the reinforcing plate 57 is located below the recessed step 30 serving as a compressor mounting surface.

[0078] A plurality of racks 77 is provided in the storage compartment 13 of the cabinet body 11, in this case, the refrigerating compartment 70. The lower distal end of the reinforcing plate 57 is located below the uppermost one of the racks 77.

[0079] Further, a part of the interior of the storage compartment 13 located below the refrigerating compartment 70 are divided as a vegetable compartment and a freezing compartment. On the front of the cabinet body 11 are mounted a vegetable compartment door 78 opening and closing the front opening of the vegetable compartment and a freezing compartment door 79 opening and closing the front opening of the freezing compartment.

[0080] The insulated cabinet 10 is provided with reinforcing plate supports 80 as shown in FIGS. 1 and 8. The reinforcing plate supports 80 are provided on a vertical middle inside of the inner shell 22 of the left sidewall 11c and a vertical middle inside of the inner shell 25 of the right sidewall 11d respectively. Each reinforcing plate support 80 extends long in the front-back direction. A

reinforcing plate 81 is provided on the middle of each reinforcing plate support 80 in the front-back direction as shown in FIG. 12. The reinforcing plate 81 connects between the reinforcing plate support 80 provided on the left sidewall 11c and the reinforcing plate support 80 provided on the right sidewall 11d.

[0081] FIG. 8 illustrates the mounting structure of the reinforcing plate support 80 and the reinforcing plate 81 at the right sidewall 11d side. The reinforcing plate support 80 has a longitudinal section formed into a C-shape open to the storage compartment 13 side, that is, a groove-shape. More specifically, the reinforcing plate support 80 includes a middle portion 80a, an upper portion 80b and a lower portion 80c all of which are formed integrally therewith. The middle portion 80a is formed into the shape of a flat plate parallel to the sidewall 11d. The upper portion 80b is located at an upper end of the middle portion 80a and constructed into the shape of a flat plate perpendicular to the middle portion 80a. The lower portion 80c is located at a lower end of the middle portion 80a and constructed into the shape of a flat plate perpendicular to the middle portion 80a. The lower portion 80c has a distal end folded further downward.

[0082] In the right sidewall 11d, the middle portion 80a of the reinforcing plate support 80 bonded to the vacuum insulation panel 26 by an adhesive agent or the like thereby to be fixed. The upper portion 80b and the lower portion 80c pass through the inner shell 25 and protrude into the storage compartment 13. The upper portion 80b has an upper surface on which an end of the reinforcing plate 81 is placed. Further, the reinforcing plate 81 has an upper surface on which the partition wall 69 serving as the refrigerating compartment bottom wall as also shown in FIG. 12. A screw 82 is passed through the upper portion 80b and the reinforcing plate 81 from below the upper portion 80b to be screwed into the partition wall 69. As a result, the reinforcing plate 81 is fixed to the reinforcing plate support 80 and the partition wall 69. The above-described structure is also applied to the left sidewall 11c. Thus, both ends of the reinforcing plate 81 are fixed to the reinforcing plate supports 80 provided on the right and left sidewalls 11d and 11c, respectively.

[0083] The inner shells 25 and 22 of the right and left sidewalls 11d and 11c are made of a resin such as plastic. Accordingly, each of the inner shells 22 and 25 has a relatively larger heat shrinkage caused by cooling. On the other hand, each of the outer shells 24 and 21 of the right and left sidewalls 11d and 11c is made of a metal such as steel plate. Accordingly, each of the outer shells 21 and 24 has a relatively smaller heat shrinkage caused by cooling. Thus, the inner shells 22 and 25 and the outer shells 21 and 24 differ in the heat shrinkage. Consequently, the inner shells 22 and 25 shrink larger as compared with the outer shells 21 and 24 when the atmosphere in the storage compartment 13 is cooled, with the result that the right and left sidewalls 11d and 11c are subjected to a force which expands the sidewalls 11d and 11c outward.

[0084] In the embodiment, the right and left sidewalls 11d and 11c are connected to each other by the reinforcing plates 81. Accordingly, the sidewalls 11d and 11c are subjected to a force which pulls them toward each other. As a result, even when the sidewalls 11d and 11c are subjected to a force which expands them outward, deformation of the right and left sidewalls 11d and 11c is suppressed.

[0085] The insulated cabinet 10 is provided with the longitudinal reinforcing plates 57 and the lateral reinforcing plates 58. Each lateral reinforcing plate 58 is provided in one of the sides constituting a corner of the opening 12 of the cabinet body 11. Each longitudinal reinforcing plate 57 is provided in the other side constituting the corner of the opening 12 of the cabinet body 11. The longitudinal and lateral reinforcing plates 57 and 58 are connected to each other by the connecting portion 59, thereby constituting the reinforcing members 86 and 87. As a result, the strength of each of the entire right and left reinforcing members 87 and 86 can be improved. Accordingly, even when the peripheral wall of the cabinet body 11 has a small thickness, the corners of the opening 12 can be effectively reinforced. Further, according to the reinforcing members 86 and 87, angles of the corners of the opening 12 can be maintained tenaciously, and deformation of the cabinet body 11 caused by angular changes in the corners can be suppressed. Consequently, the insulated cabinet can be provided which can sufficiently withstand practical use.

[0086] The ceiling wall 11a serving as the upper side of the opening 12 is set as one of the sides constituting the corner of the opening 12. Further, each of the right and left sidewalls 11d and 11c are set as the other side constituting the corner of the opening 12. The lateral reinforcing plates 58 of the right and left reinforcing members 87 and 86 are integrally connected to the front plate 61 constituting the front of the upper side. Consequently, the reinforcing plates 57 and 58 at both right and left sides are integrated by the front plate 61 with the result that the corners of the opening 12 can be reinforced further rigidly. This can suppress deformation of the insulated cabinet 10 more effectively. Further, the gap between the right and left sidewalls 11d and 11c can be controlled more reliably with the result that the accuracy in the width of the cabinet body can be improved.

[0087] The longitudinal and lateral reinforcing plates 57 and 58 are connected to each other by the connecting portion 59. Further, the connecting portion 59 has a larger width than the longitudinal and lateral reinforcing plates 57 and 58. Accordingly, the angle between the longitudinal and lateral reinforcing plates 57 and 58 is maintained more stably in the reinforcing members 86 and 87. This improves the strength of the reinforcing members 86 and 87 with the result that deformation of the insulated cabinet 10 can be suppressed more effectively.

[0088] The portion where the ceiling wall 11a and the left sidewall 11c are butted against each other is rendered thicker by the foam insulation 17 filling the inclined portion

32 and the space S4, as compared with the other part. The connecting portion 59 of the left sidewall member 86 is provided on the rear of the thicker portion, that is, the closure 32a. The portion where the ceiling wall 11a and the right sidewall 11d are butted against each other is also rendered thicker by the foam insulation 17 filling the inclined portion 33 and the space S4, as compared with the other part. The connecting portion 59 of the right sidewall member 87 is provided on the rear of the thicker portion, that is, the closure 33a. As a result, the connecting portions 59 can be prevented from being exposed and the appearance of the refrigerator can be prevented from being degraded.

[0089] The connecting portions 59 of the reinforcing members 86 and 87 are buried in the foam insulation 17. This increases the strength of the cabinet body 11 against angular changes with the result that deformation of the insulated cabinet 10 can be suppressed more effectively.

[0090] The upper portions of the reinforcing plates 59 which are the corners of the reinforcing plates 58 and 57 are fastened to the front surfaces of the right and left sidewalls 11d and 11c by the screws 66 respectively. This can achieve a higher mounting accuracy of the reinforcing plates 57 and 58 and is more effective in the prevention of deformation of the insulated cabinet.

[0091] The hinges (not shown) supporting the doors 67 and 68 are provided on the upper surface of the ceiling wall 11a. The hinge fixing plate 60 to which the hinges are mounted is integrated with the longitudinal and lateral reinforcing plates 57 and 58. Accordingly, the support of the doors 67 and 68 can be reinforced by the reinforcing plates 57 and 58. This can achieve a high opening-closing accuracy of the doors 67 and 68. This is further effective in suppression of deformation of the cabinet body due to the weight of the doors 67 and 68, in particular, offset load during the opening of the doors.

[0092] At least the distal end of the reinforcing plate 57 is not fastened to the other parts. The widthwise movement of the reinforcing plate 57 is limited by the bent portions 62a and 62b of the auxiliary reinforcing plate 62 serving as the first limiting portion. As a result, the longitudinal reinforcing plate 57 can be easily assembled by inserting into the cabinet body 11 from outside. Further, at least the distal end of the reinforcing plate 57 is not fastened to the other parts. Accordingly, no fastening parts are provided at least near the distal end of the reinforcing plate 57. Accordingly, a higher closeness can be achieved between rear peripheral edges of the doors 67 and 68 and gaskets attached to the edges with the result that a higher seal effect preventing leak of cold air can be obtained.

[0093] The first limiting portion is formed on the auxiliary reinforcing plate 62 mounted on the side of the opening 12 of the cabinet body 11. Consequently, the widthwise limitation of the reinforcing plate 57 can be carried out by the auxiliary reinforcing plate 62 more firmly with the result that a reinforcing effect of the cabinet body 11 by the reinforcing plates 57 and 58 can be improved.

[0094] The relationship of the aforementioned expression (1) is defined among the length L_c of the reinforcing plate 57, the gaps a_1 and a_2 located at both sides of the lower distal end of the reinforcing plate 57, the horizontal lengths L_d of the protrusion 74 located on the rear of the door 67 and the protrusion 75 located on the rear of the door 68, and the dimension b_1 of the gaps at upper and lower sides of the protrusions 74 and 75. According to this, the protrusions 74 and 75 of the doors 67 and 68 can be prevented from contact with the cabinet body 11 upon deformation of the cabinet body 11.

[0095] When the cabinet body 11 is used for a refrigerator, the compressor 76 of the refrigerating cycle which is one of heaviest structures of the refrigerator is mounted on the upper rear of the cabinet body 11. According to this, the weight balance of the whole insulated cabinet 10 in the front-back direction can be desirably retained by the reinforcing plates 57 and 58 and the compressor 76. Accordingly, for example, the insulated cabinet 10 can be prevented from falling over rearward due to the weight of the compressor 76.

[0096] The distal end of the reinforcing plate 57 is located below the uppermost rack 77 provided in the storage compartment 13 of the cabinet body 11. In other words, the mounting portions of the uppermost rack 77 and the right and left sidewalls 11d and 11c are located above the distal end of the reinforcing plate 57. Force due to the weight of an article placed on the rack 77 acts on the mounting portions of the uppermost rack 77 and the right and left sidewalls 11d and 11c. The right and left sidewalls 11d and 11c would deform so as to be curved to the storage compartment 13 side with the connections to the bottom wall 11b serving as fulcrums respectively. In other words, the right and left sidewalls 11d and 11c would be curved from the mounting portions to the uppermost rack 77 serving as a site of action to the connections to the bottom wall 11b. The distal end of the reinforcing plate 57 is located between the sites of action and the fulcrums in the right and left sidewalls 11d and 11c. Accordingly, when the right and left sidewalls 11d and 11c are curved, the distal ends of the reinforcing plates 57 abut against the first limiting portions 62a and 62b respectively. This suppresses deformation of the portions of the right and left sidewalls 11d and 11c where the reinforcing plates 57 are provided, in the curvature direction, with the result that deformation of each of the right and left sidewalls 11d and 11c can be reduced in its entirety.

[0097] Further, the sites of action of the force due to the weight of the compressor 76 are connections to the recessed steps 30 in the right and left sidewalls 11d and 11c. The distal ends of the reinforcing plates 57 are located below the recessed steps 30 serving as a mounting surface for the compressor 76. According to this, the distal ends of the reinforcing plates 57 are provided between the connections to the recessed steps 30 serving as the sites of action and the connections to the bottom wall 11b serving as fulcrums in the right and left sidewalls 11d and

11c, respectively. This suppresses deformation of the portions of the right and left sidewalls 11d and 11c where the reinforcing plates 57 are provided, in the same manner as described above, with the result that the deformation of each of the right and left sidewalls 11d and 11c can be reduced in its entirety.

[0098] The vacuum insulation panel 23 is used in the left sidewall 11c as a main insulation material. The vacuum insulation panel 26 is used in the right sidewall 11d as a main insulation material in the same manner. According to this, the thicknesses of the right and left sidewalls 11d and 11c of the insulated cabinet 10 can be reduced. On the other hand, there is a possibility that the strength of the insulated cabinet 10 may be reduced as the result of reduction in the thicknesses of the right and left sidewalls 11d and 11c. In the embodiment, however, the right and left sidewalls 11d and 11c can be effectively reinforced by the reinforcing members 86 and 87 having the reinforcing plate 57 and 58.

[0099] For example, the vacuum insulation panels 23 and 26 and the foam insulation 17 may be co-used by the right and left sidewalls 11c and 11d. The vacuum insulation panels 23 and 26 and the foam insulation 17 may be also co-used by the inner wall 11e. On the contrary, only the vacuum insulation panels 23 and 26 may be used as the insulation material in each of the ceiling wall 11a and the bottom wall 11b of the cabinet body 11.

[0100] Further, the cabinet body 11 is constructed by combining the ceiling wall 11a, the bottom wall 11b, the left sidewall 11c, the right sidewall 11d and the inner wall 11e all of which are constructed separately from one another. Although the cabinet body 11 is apt to be easily deformed, the cabinet body 11 can be effectively reinforced by the reinforcing members 86 and 87 having the reinforcing plates 57 and 58.

Second Embodiment

[0101] A second embodiment will be described with reference to FIG. 18. In the second embodiment, the reinforcing member 86 is provided at the right lower corner of the cabinet body 11, and the reinforcing member 87 is provided at the left lower corner. As a result, the right and left lower corners of the opening 12 can be reinforced with the result that the deformation of the insulated cabinet 10 can be suppressed. In the second embodiment, the right reinforcing member 87 in the first embodiment is provided at the left lower corner of the cabinet body 11, and the left reinforcing member 86 in the first embodiment is provided at the right lower corner of the cabinet body 11. Accordingly, in the second embodiment, the reinforcing member 87 is referred to as "left reinforcing member 87" and the reinforcing member 86 is referred to as "right reinforcing member 86." No hinge fixing portions 60 are provided on the reinforcing members 86 and 87 provided at the lower corners of the cabinet body 11 respectively.

[0102] In this case, the front of the bottom wall 11b is

a lower side constituting the right and left lower corners of the opening 12 together with the right and left sides. On the other hand, the fronts of the right and left sidewalls 11d and 11c are right and left sides constituting the right and left lower corners of the opening 12 together with the lower side. Further, when the front of the bottom wall 11b is one side, the fronts of the right and left sidewalls 11d and 11c are the other sides.

[0103] The space S7 is defined by the inclined portion 35 in the portion where the bottom wall 11b and the left sidewall 11c are butted against each other. The space S7 is filled with the foam insulation 17. Accordingly, the portion where the bottom wall 11b and the left sidewall 11c are butted against each other has a larger thickness than the other part. The front of the space S7 is closed by the triangular closure 35a. The connection 89 of the left sidewall reinforcing member 87 is provided on the part thickened by butting of the bottom wall 11b and the left sidewall 11c, that is, on the rear of the closure 35a.

[0104] The space S8 is also defined by the inclined portion 36 in the portion where the bottom wall 11b and the right sidewall 11d are butted against each other. The space S8 is filled with the foam insulation 17. Accordingly, the portion where the bottom wall 11b and the right sidewall 11d are butted against each other has a larger thickness than the other part. The front of the space S8 is closed by the triangular closure 36a. The connection 89 of the right sidewall reinforcing member 86 is provided on the part thickened by butting of the bottom wall 11b and the right sidewall 11d, that is, on the rear of the closure 36a.

[0105] According to this, the connecting portions 59 can be prevented from being exposed, so that the appearance of the refrigerator can be prevented from being degraded. Further, The connecting portions 59 of the right and left reinforcing members 86 and 87 are buried in the foam insulation 17 thereby to be fixed. This increases the strength against the angular changes in the cabinet body 11, thereby reducing deformation of the insulated cabinet 10 further effectively.

Third Embodiment

[0106] A third embodiment will be described with reference to FIG. 19. In the third embodiment, the auxiliary reinforcing plates 62 have second limiting portions 91 respectively. Each second limiting portion 91 is formed by cutting and raising a part of the bent portion 62a and further folding the part so that the part is parallel to the reinforcing plate 57. Inward movement of each reinforcing plate 57 is limited by the second limiting portion 91. Accordingly, each reinforcing plate 57 remains at the normal position in the front end of each of the right and left sidewalls 11d and 11c. As a result, when the reinforcing plates 57 are inserted into the front ends of the right and left sidewalls 11d and 11c, the reinforcing plates 57 can be prevented from contacting with the vacuum insulation panels 23 and 26 thereby breaking the vacuum insulation

panels 23 and 26.

Fourth Embodiment

[0107] A fourth embodiment will be described with reference to FIG. 20. In the fourth embodiment, the insulated cabinet 10 is provided with two middle reinforcing members 95. The middle reinforcing members 95 are provided at connecting portions of the partition wall 69 and the right and left sidewalls 11d and 11c. Each middle reinforcing member 95 comprises two longitudinal reinforcing plates 57 and a lateral reinforcing plate 58. The reinforcing plates 57 are disposed vertically linearly. The reinforcing plate 58 is connected perpendicular to the connecting portion of the reinforcing plates 57. The reinforcing plates 57 of the middle reinforcing members 95 are provided in front ends of the right and left sidewalls 11d and 11c respectively. The reinforcing plates 58 of the middle reinforcing members 95 are provided in the front end of the partition wall 69. According to this, the deformation of the cabinet body 11 can be suppressed while the middle reinforcing members 95 having the respective longitudinal and lateral reinforcing plates 57 and 58 are commoditized.

[0108] In this case, regarding the refrigerating compartment 70, the front of the partition wall 69 serves as a lower side constituting the lower corners of the front opening 12a of the refrigerating compartment 70 together with right and left sides. On the other hand, the fronts of the right and left sidewalls 11d and 11c serve as right and left sides constituting the lower corners of the front opening 12a of the refrigerating compartment 70 together with the lower side. Further, regarding a compartment located below the refrigerating compartment 70, the front of the partition wall 69 serves as an upper side constituting the upper corners of the front opening 12b of the compartment 101 together with the right and left sides. On the other hand, the fronts of the right and left sidewalls 11d and 11c serve as right and left sides constituting the upper corners of the front opening 12b of the compartment 101 together with the upper side. The front of the partition wall 69 serves as one side constituting the corners of the openings 12a and 12b together with the other sides. On the other hand, the fronts of the right and left sidewalls 11d and 11c serve as the other sides constituting the corners of the openings 12a and 12b.

[0109] Further, when the lateral reinforcing plates 58 of the middle reinforcing members 95 are fixed to the front of the partition wall 69, the right and left sidewalls 11d and 11c and the partition wall 69 are integrated. The positional relationship between the right and left sidewalls 11d and 11c is defined by the integrated right and left middle reinforcing members 95 and the partition wall 69. As a result, the deformation of the cabinet body 11 is suppressed. In this case, the integrated right and left middle reinforcing members 95 and the partition wall 69 function as defining members.

Fifth Embodiment

[0110] A fifth embodiment will be described with reference to FIG. 21. In the fifth embodiment, the insulated cabinet 10 is provided with a frame-shaped reinforcing member 96, which has two longitudinal reinforcing plates 57 and two lateral reinforcing plates 58. The longitudinal reinforcing plates 57 and the lateral reinforcing plates 58 are formed into the shape of a rectangular frame thereby to be integrated. In the frame-shaped reinforcing member 96, the longitudinal reinforcing plates 57 are provided in the fronts of the right and left sidewalls 11d and 11c. The lateral reinforcing plates 58 are provided in the front of the ceiling wall 11a and the front of the bottom wall 11b respectively. As a result, too, the deformation of the cabinet body 11 can be effectively suppressed.

[0111] In this case, the front of the ceiling wall 11a serves as the upper side constituting the upper corners of the opening 12 of the cabinet body 11 together with the right and left sides. Further, the front of the bottom wall 11b serves as a lower side constituting the lower corners of the opening 12 together with the right and left sides. On the other hand, the fronts of the right and left sidewalls 11d and 11c serve as the right and left sides constituting the upper corners of the opening 12 together with the upper side. The fronts of the right and left sidewalls 11d and 11c also serve as the right and left sides constituting the lower corners of the opening 12 together with the lower side. The front of the ceiling wall 11a and the front of the bottom wall 11b serve as one sides constituting the corners of the opening 12 together with the other sides. On the other hand, the fronts of the right and left sidewalls 11d and 11c serve as one sides constituting the corners of the opening 12 together with the other sides.

[0112] The constructions of the foregoing embodiments may be combined in practice. The above-described insulated cabinet should not be limited to the foregoing embodiments. The insulated cabinet may be used as an insulated cabinet of a heating cabinet, a freezing display case or any other incubator.

[0113] In each foregoing embodiment, a higher effect can be expected when the thicknesses of the right and left sidewalls 11d and 11c are not more than 35 [mm].

[0114] In each foregoing embodiment, the thicknesses of the vacuum insulation panels 23 and 26 are each assumed to be 20 [mm]. A total thickness of the outer shells 21 and 24 and the inner shells 22 and 25 is assumed to be 1.5 [mm]. Accordingly, the thicknesses of the right and left sidewalls 11d and 11c are set to be not more than 25 [mm], which value can expect high effects.

[0115] 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. An insulated cabinet comprising:

a cabinet body formed with an opening in a front and having a storage compartment in an interior thereof, the storage compartment communicating with the opening; and
a defining member provided in at least two of walls constituting a periphery of the opening, the defining member defining positions of the two walls.

2. The insulated cabinet according to claim 1, wherein:

the defining member includes a reinforcing member which is provided in a wall constituting the cabinet body so as to be located at a corner of the opening;
the reinforcing member has two reinforcing plates provided in one of sides constituting the corner of the opening of the cabinet body and the other side respectively; and
the reinforcing plate provided in the one side and the reinforcing plate provided in the other side are integrated together.

3. The insulated cabinet according to claim 2, wherein:

the one side is an upper side and the other side is a right or left side; and
the reinforcing plate provided in the upper side is integrated with a front plate constituting a front of the upper side.

4. The insulated cabinet according to claim 2, wherein the one side is a lower side and the other side is a right or left side.

5. The insulated cabinet according to any one of claims 2 to 4, wherein the reinforcing plate provided at the one side and the reinforcing plate provided at the other side are connected by a connecting portion thereby to be integrated together, the connecting portion having a larger width than the reinforcing plates.

6. The insulated cabinet according to claim 5, wherein:

the cabinet body includes a portion where a sidewall and a ceiling wall thereof are butted with each other or where the sidewall and a bottom

wall thereof are butted with each other; the portion of the cabinet body has a larger thickness than the other portion of the cabinet body, and the connecting portion is provided at the portion of the cabinet body.

7. The insulated cabinet according to any one of claims 2 to 6, wherein the reinforcing member has a corner fixed to the cabinet body by a fastening part.

8. The insulated cabinet according to any one of claims 2 to 7, further comprising:

a door opening and closing the opening; and
a hinge supporting the door at an uppermost part of the cabinet body, wherein the reinforcing member is integrated with a hinge fixing plate which fixes the hinge.

9. The insulated cabinet according to any one of claims 2 to 8, wherein the reinforcing plates have distal ends disconnected from other parts, and widthwise movement of the distal ends is limited by first limiting portions respectively.

10. The insulated cabinet according to claim 9, further comprising auxiliary reinforcing plates mounted to right and left sides of the opening of the cabinet body respectively, wherein the first limiting portions are provided on the auxiliary reinforcing plates respectively.

11. The insulated cabinet according to any one of claims 2 to 10, wherein the reinforcing plates provided in the right and left sides are inserted into right and left sides of the opening in a longitudinal direction respectively, the insulated cabinet further comprising second limiting portions provided in the rear of the reinforcing plates to limit rearward movement of the reinforcing plates, respectively.

12. The insulated cabinet according to any one of claims 2 to 11, further comprising a door opening and closing the opening and having a protrusion on a rear thereof, wherein:

gaps are defined between each reinforcing plate provided in the right or left side and a component located at both sides of each reinforcing plate; and
each gap is sized such that each reinforcing plate contacts with the component upon deformation of the cabinet body before the protrusion contacts with the cabinet body.

13. The insulated cabinet according to any one of claims 2 to 12, wherein the cabinet body includes a rear upper portion having a compressor mounting sur-

face on which a compressor of a refrigerating cycle is mounted.

14. The insulated cabinet according to any one of claims 2, 3 and 5 to 13, wherein each reinforcing plate provided in right or left side has a distal end which is located below an uppermost rack provided in a storage compartment of the cabinet body. 5
15. The insulated cabinet according to any one of claims 2, 3 and 5 to 14, wherein: 10
- the cabinet body includes a rear upper portion having a compressor mounting surface on which a compressor of a refrigerating cycle is mounted; 15
- and
- each reinforcing plate provided in right or left side has a distal end which is located below the compressor mounting surface. 20
16. The insulated cabinet according to any one of claims 2 to 15, wherein at least right and left sidewalls constituting the cabinet body have vacuum insulation panels as a main insulation material respectively. 25
17. The insulated cabinet according to any one of claims 2 to 16, wherein the cabinet body is constructed by combining a plurality of walls constructed separately from each other. 30

35

40

45

50

55

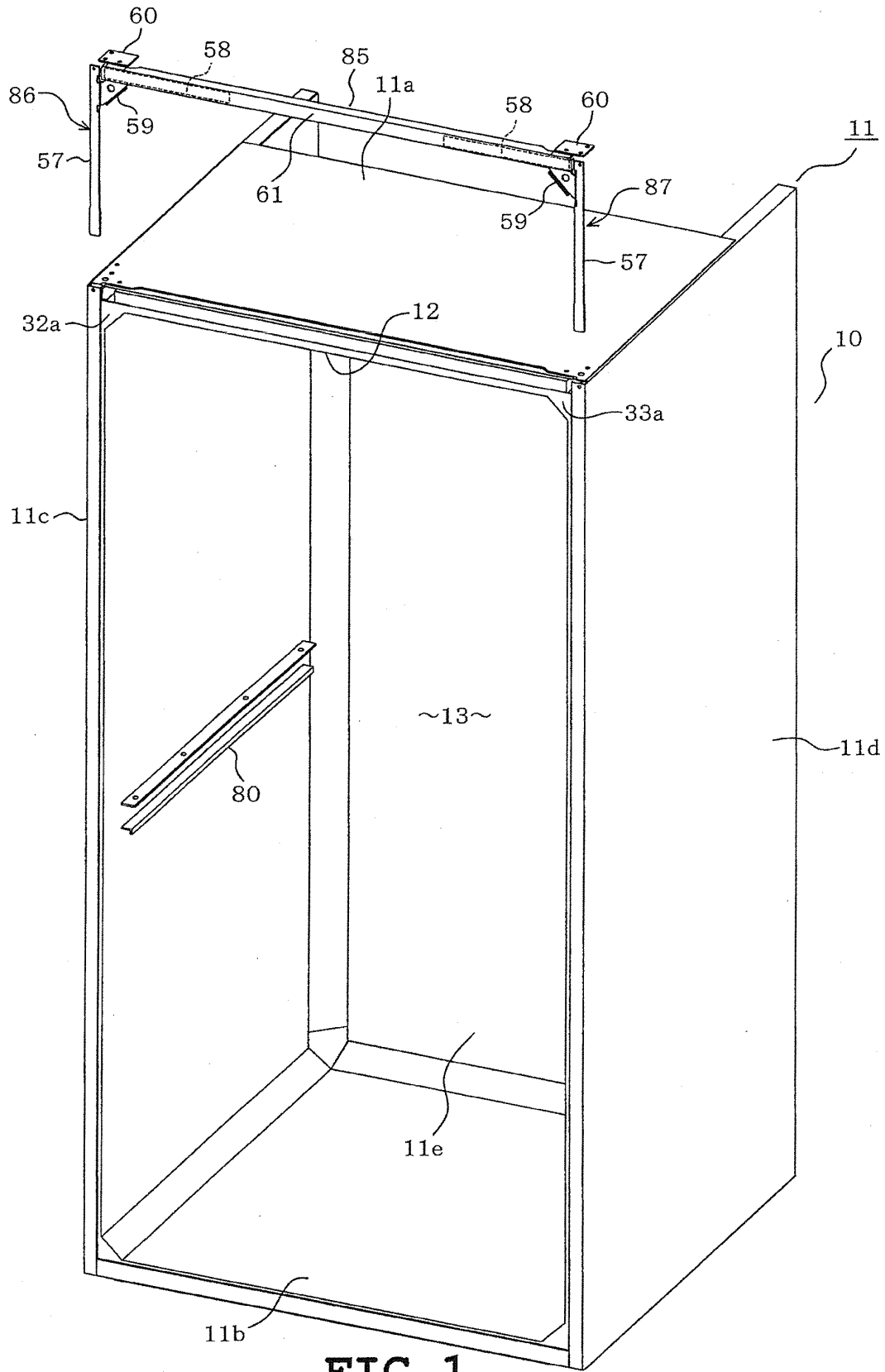


FIG. 1

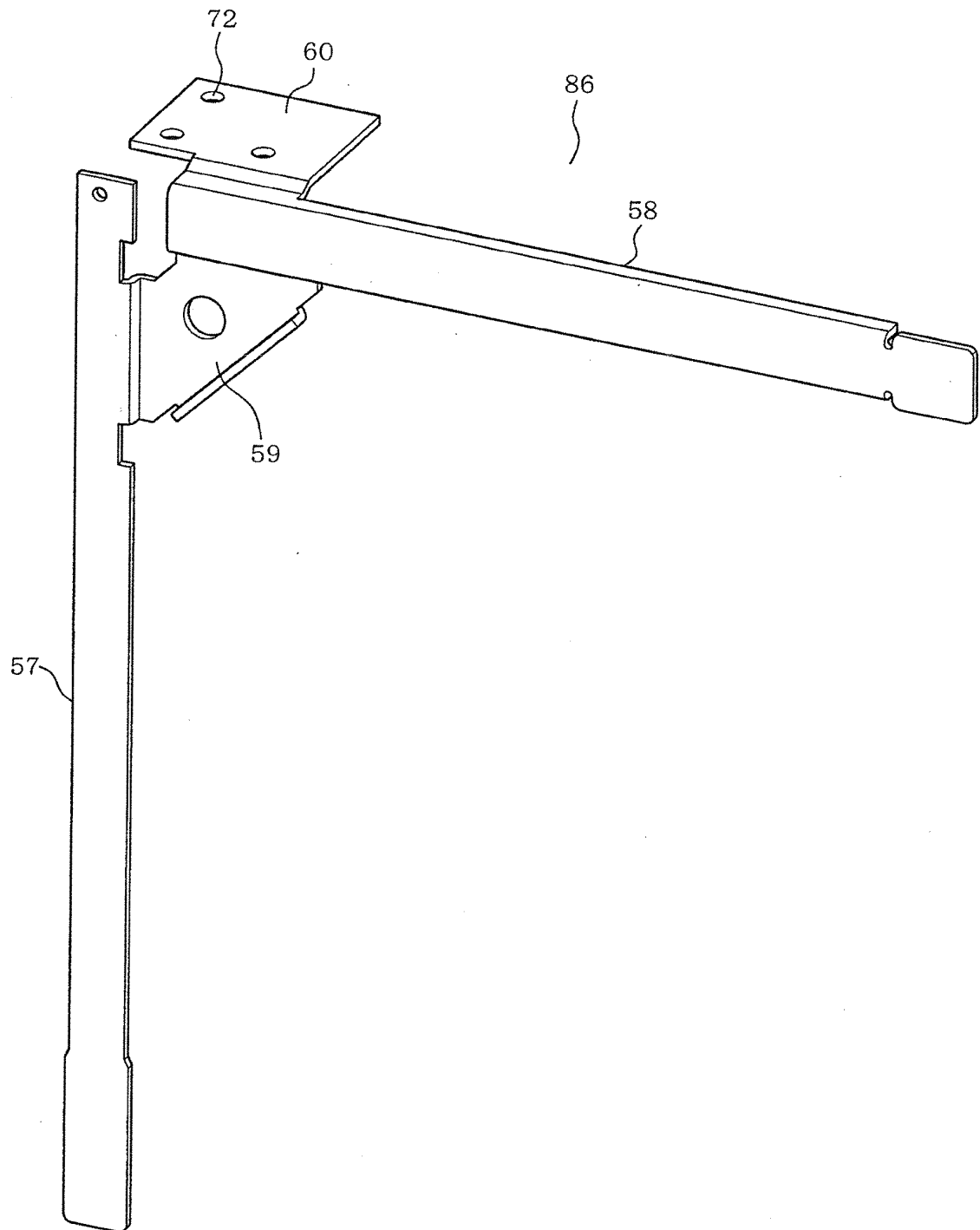


FIG. 2

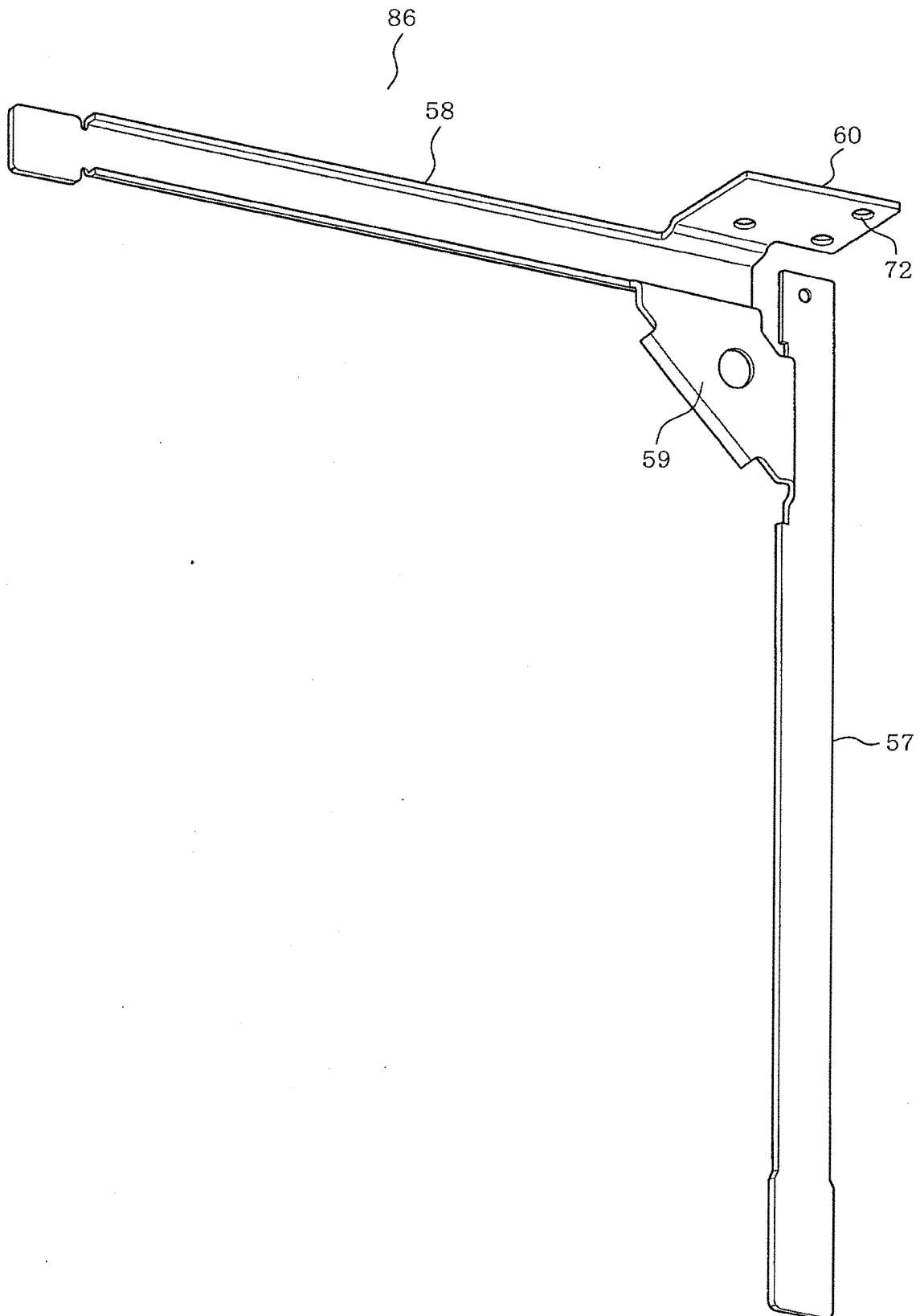


FIG. 3

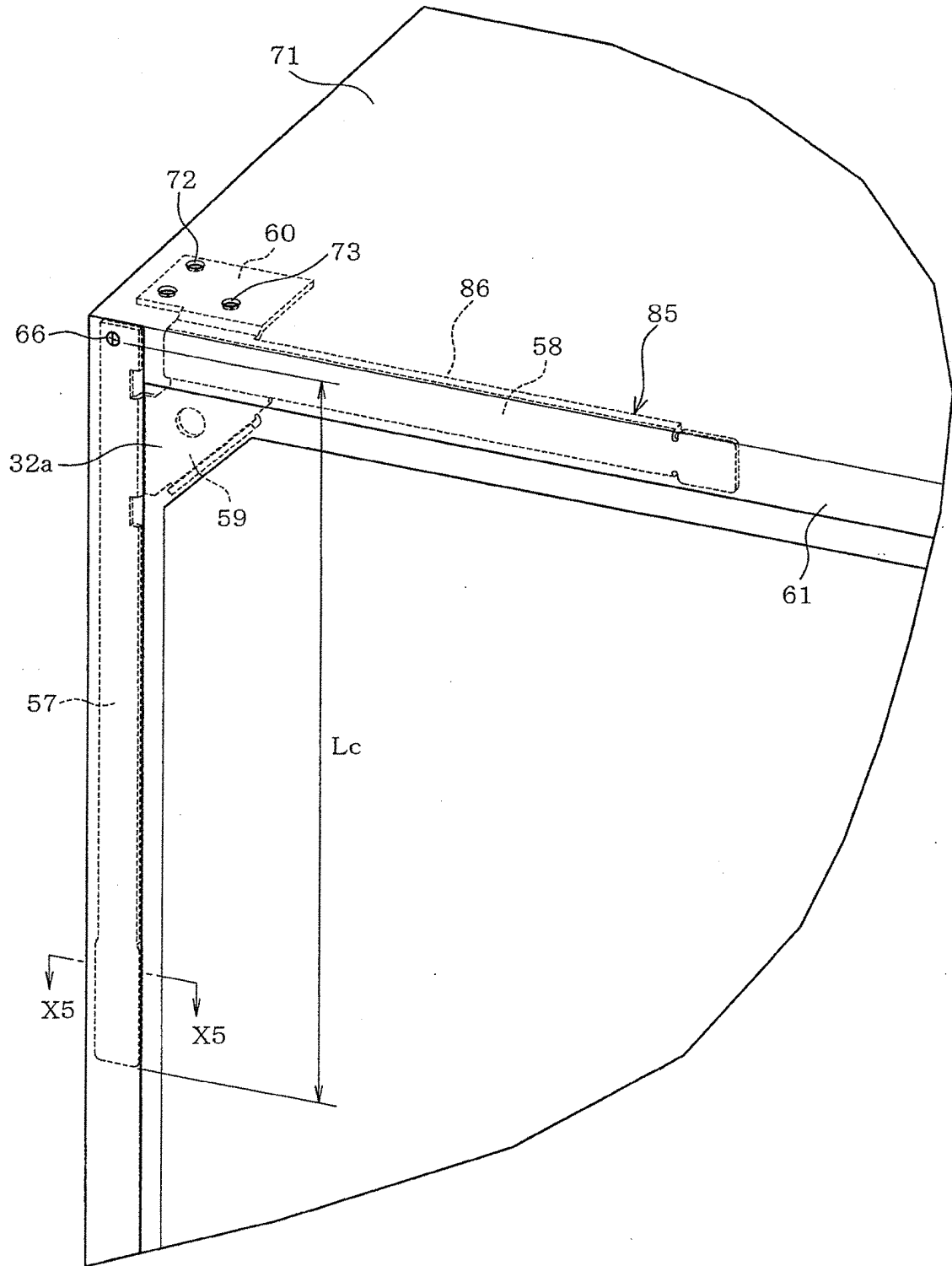


FIG. 4

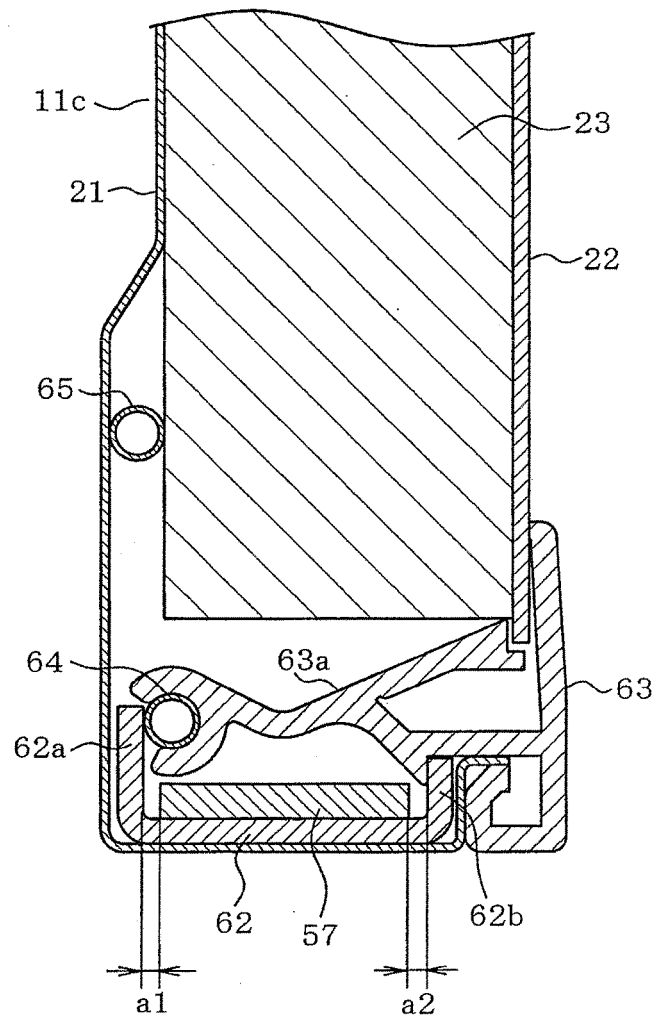


FIG. 5

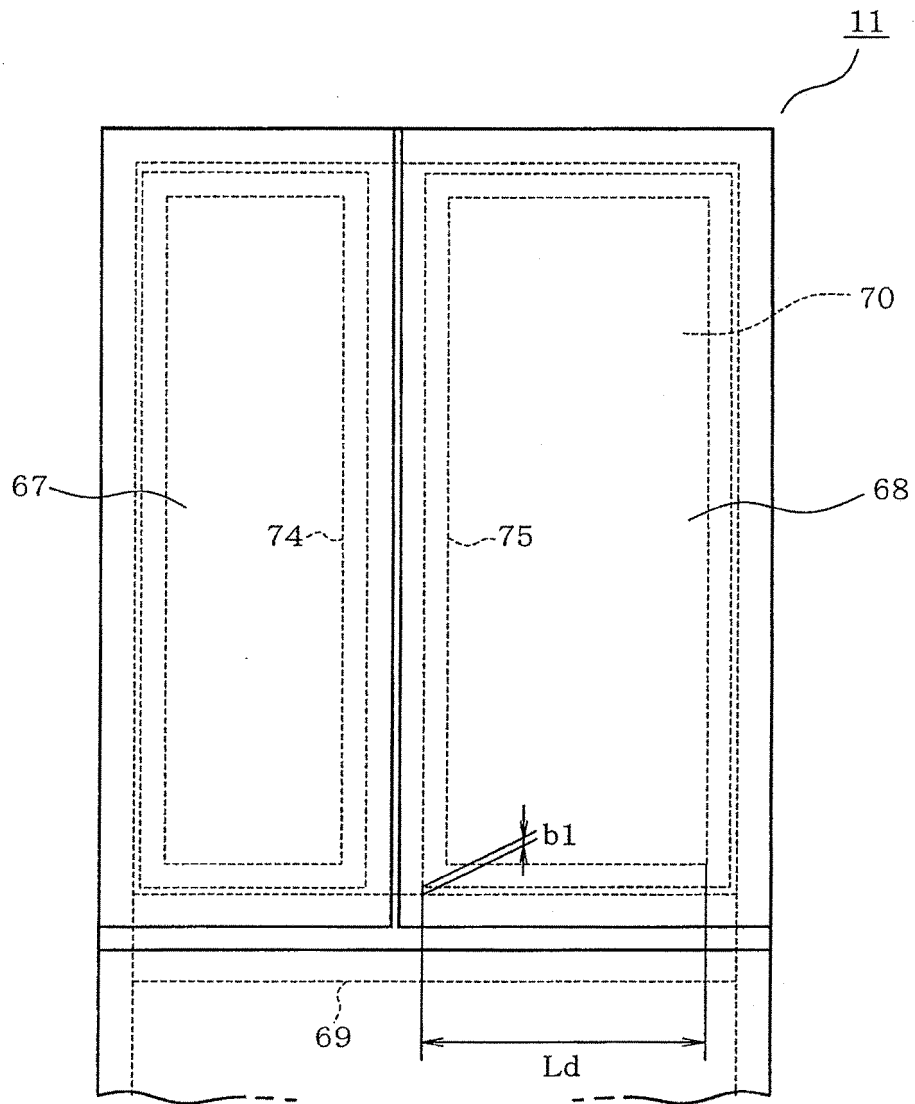


FIG. 6

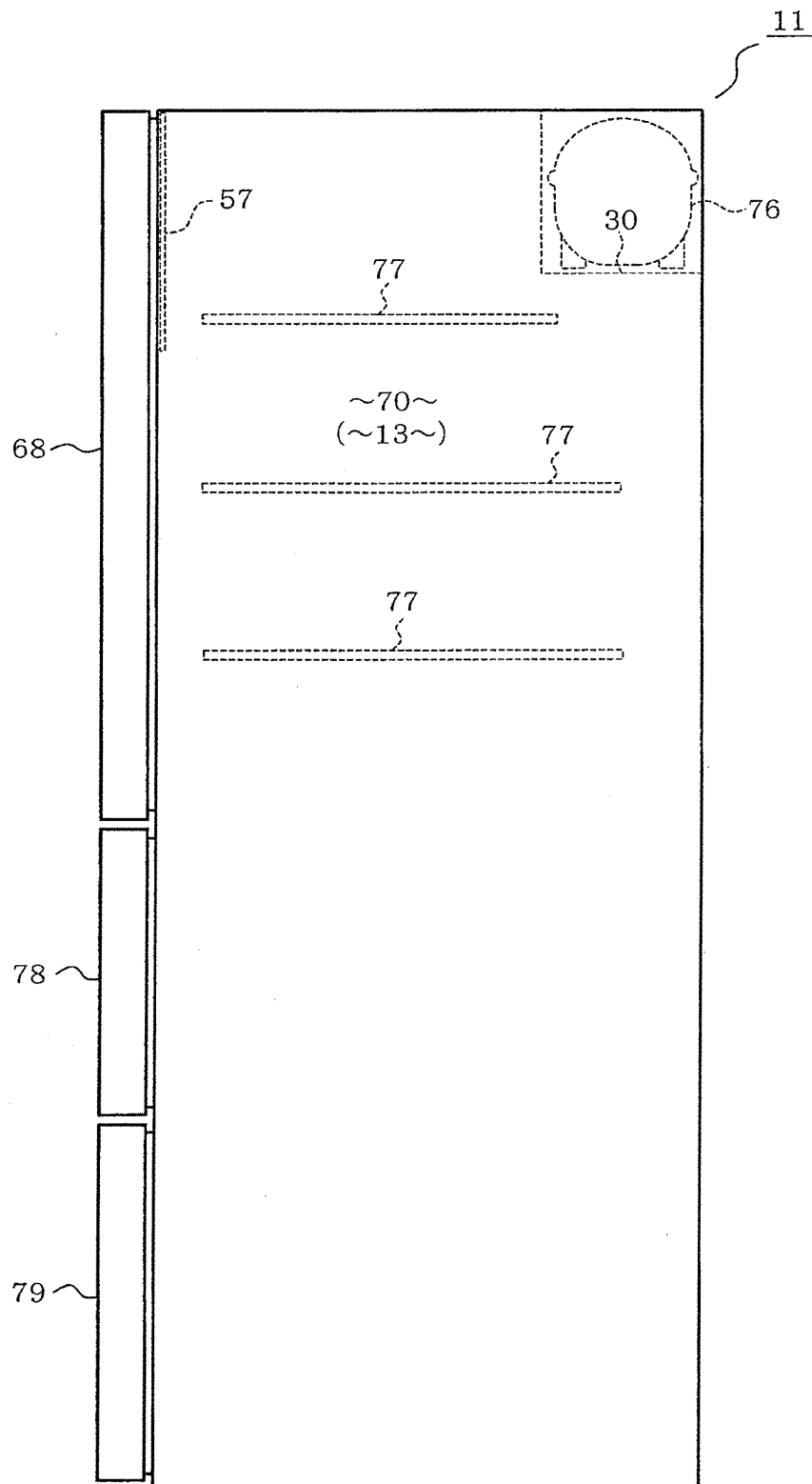


FIG. 7

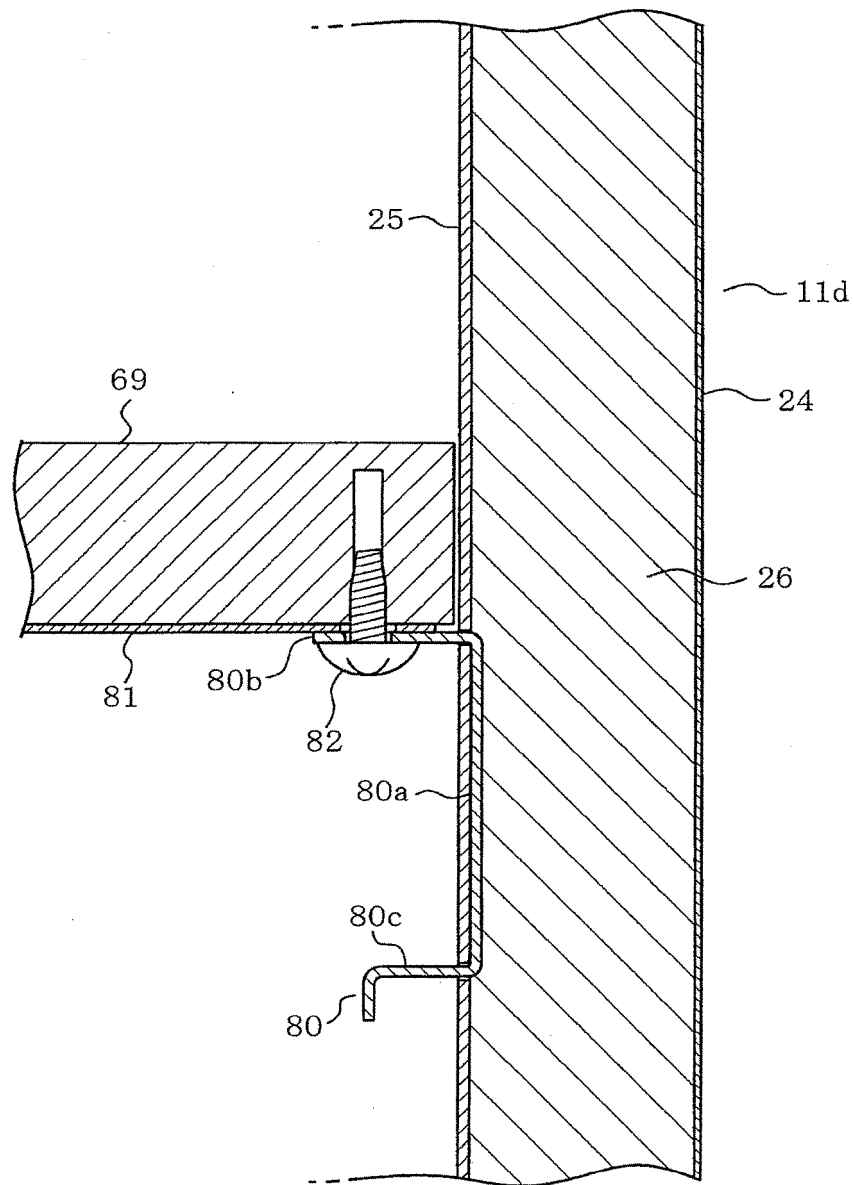


FIG. 8

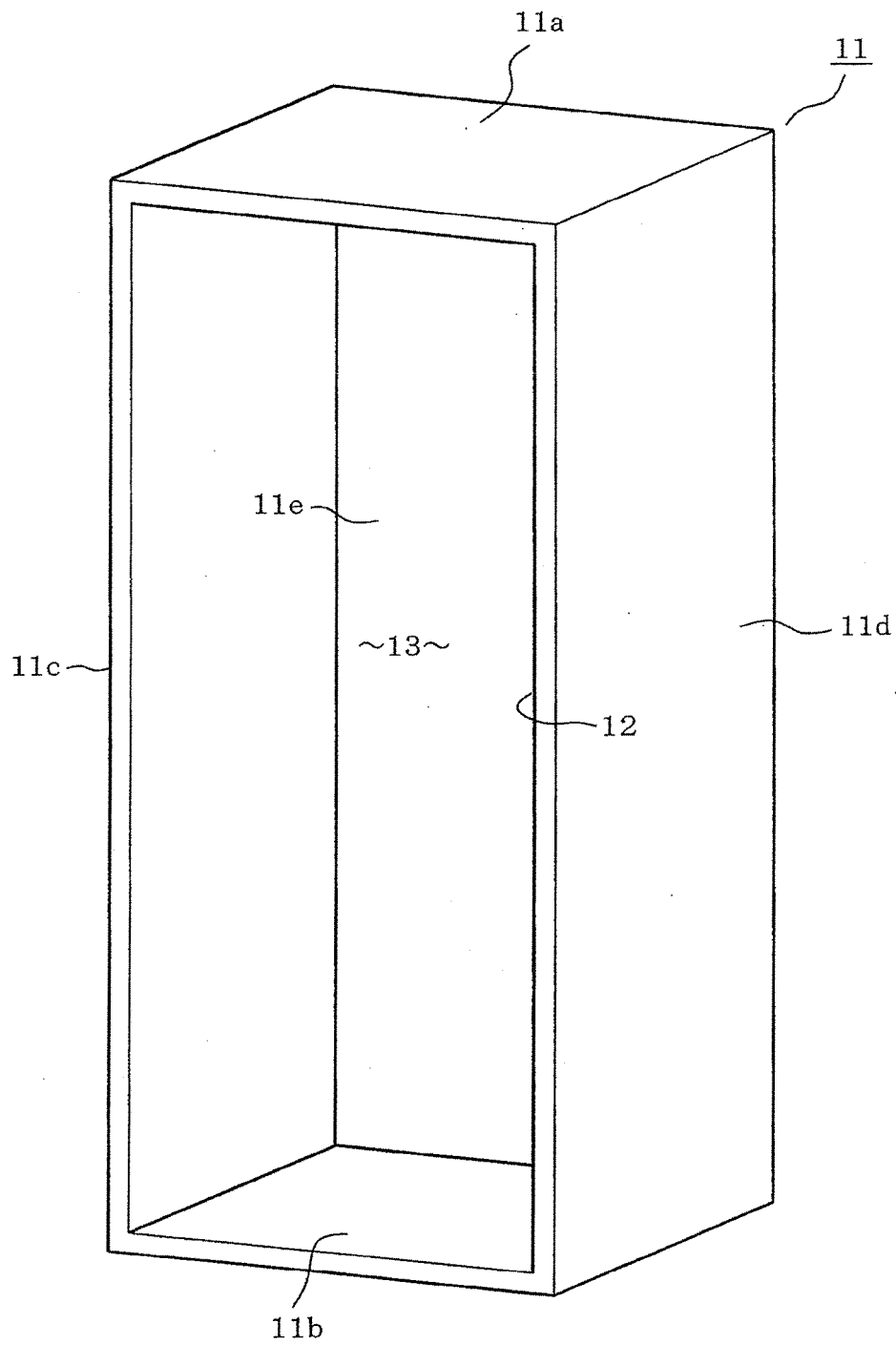


FIG. 9

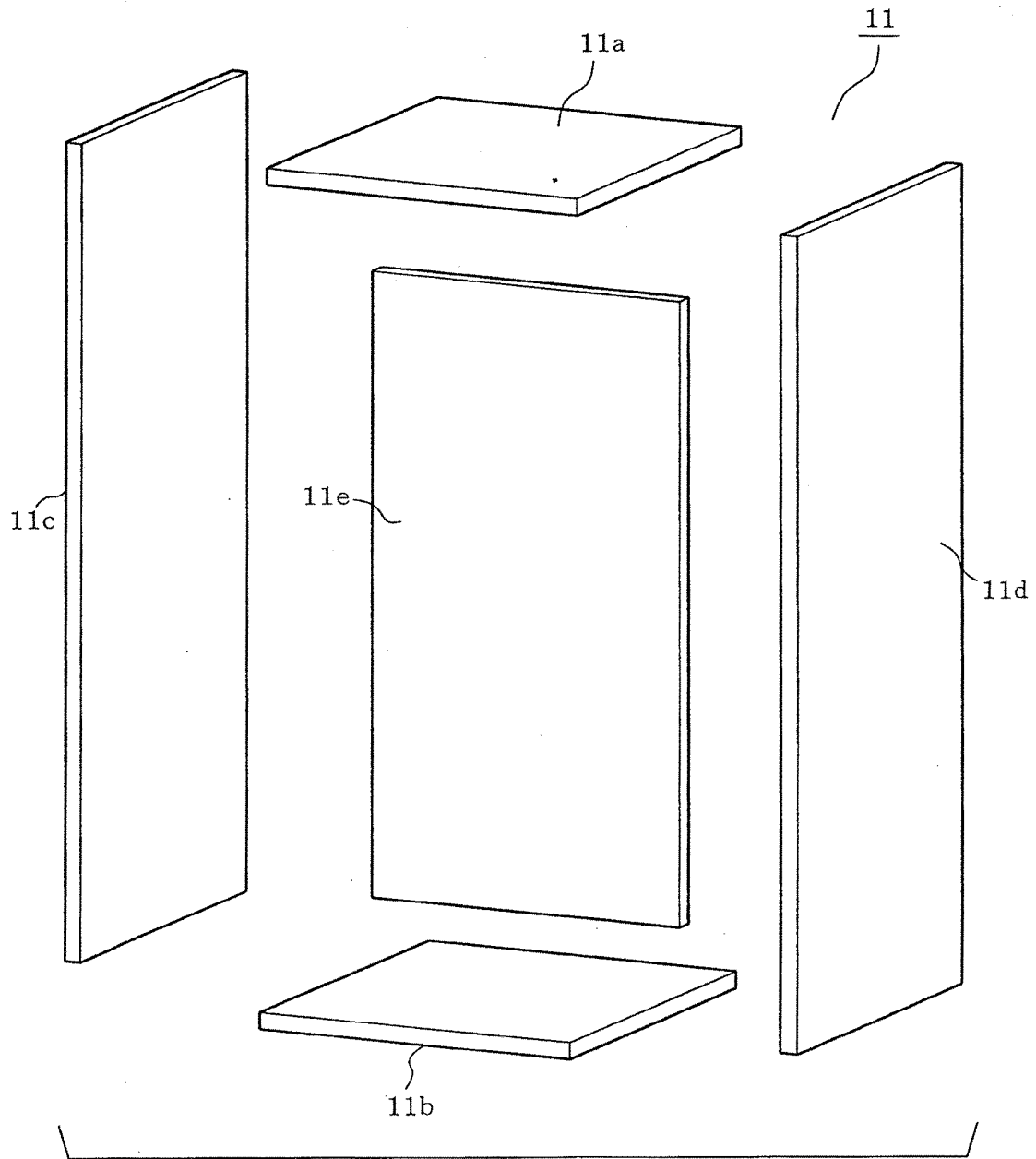
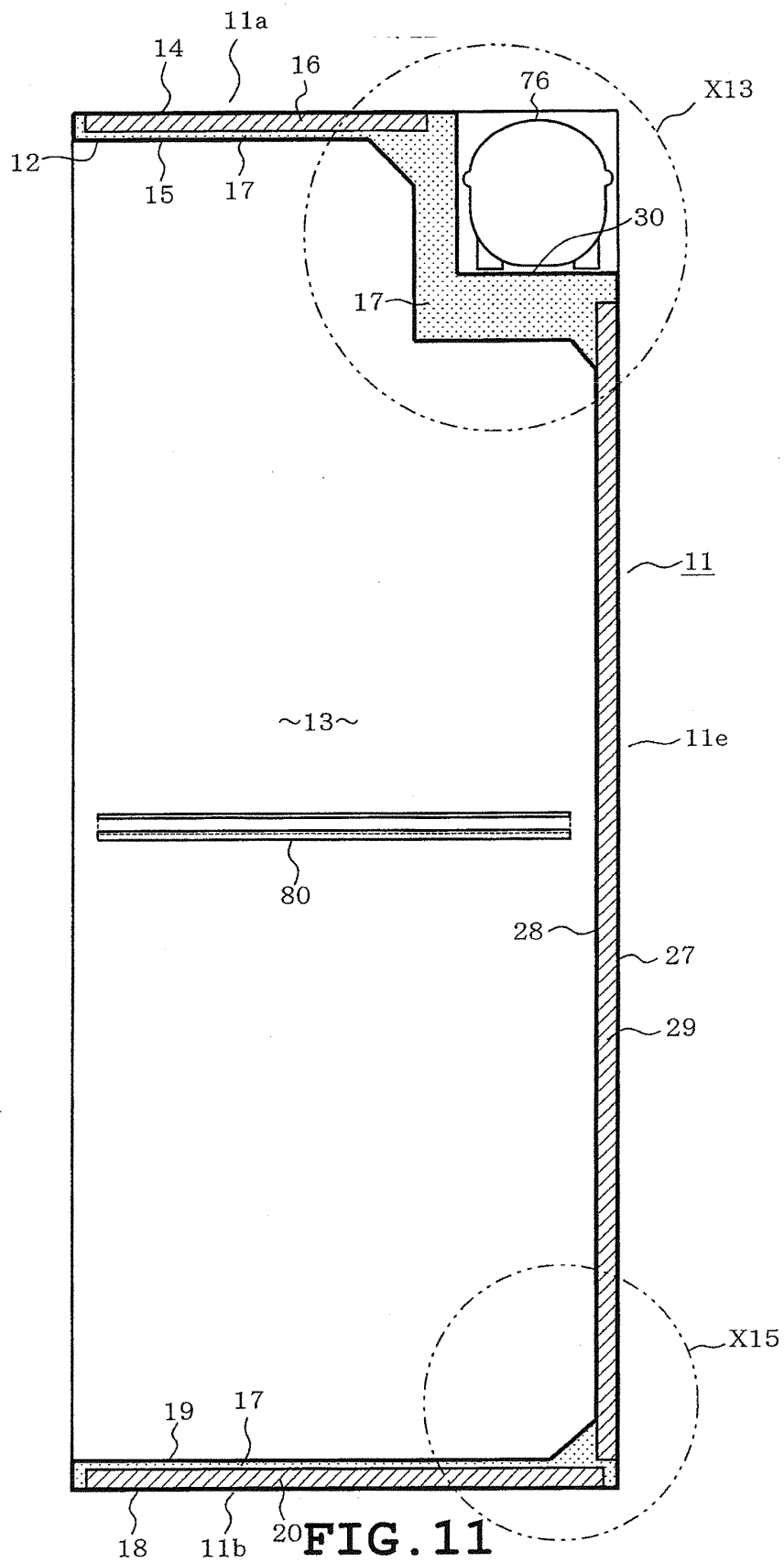


FIG. 10



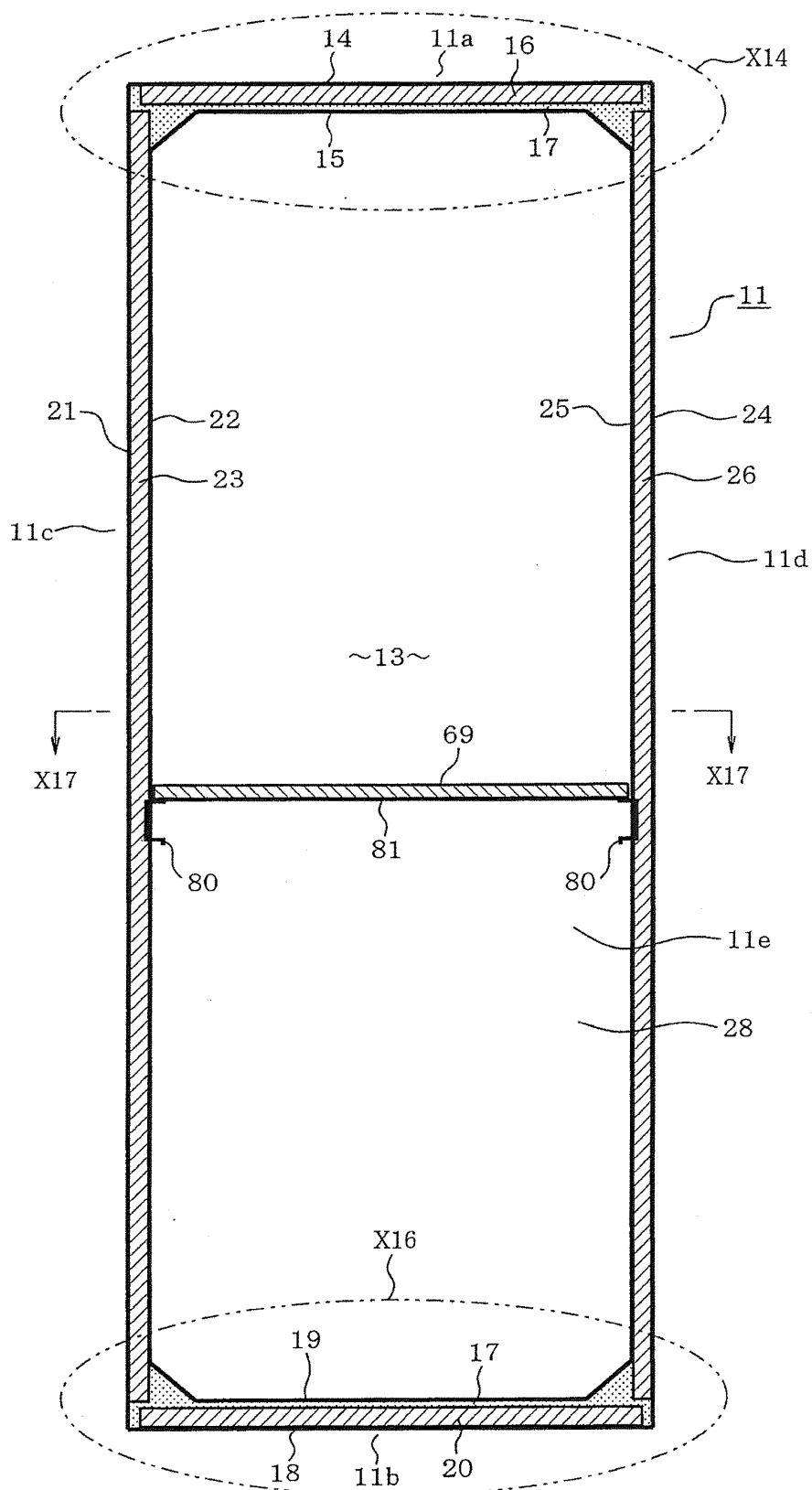


FIG. 12

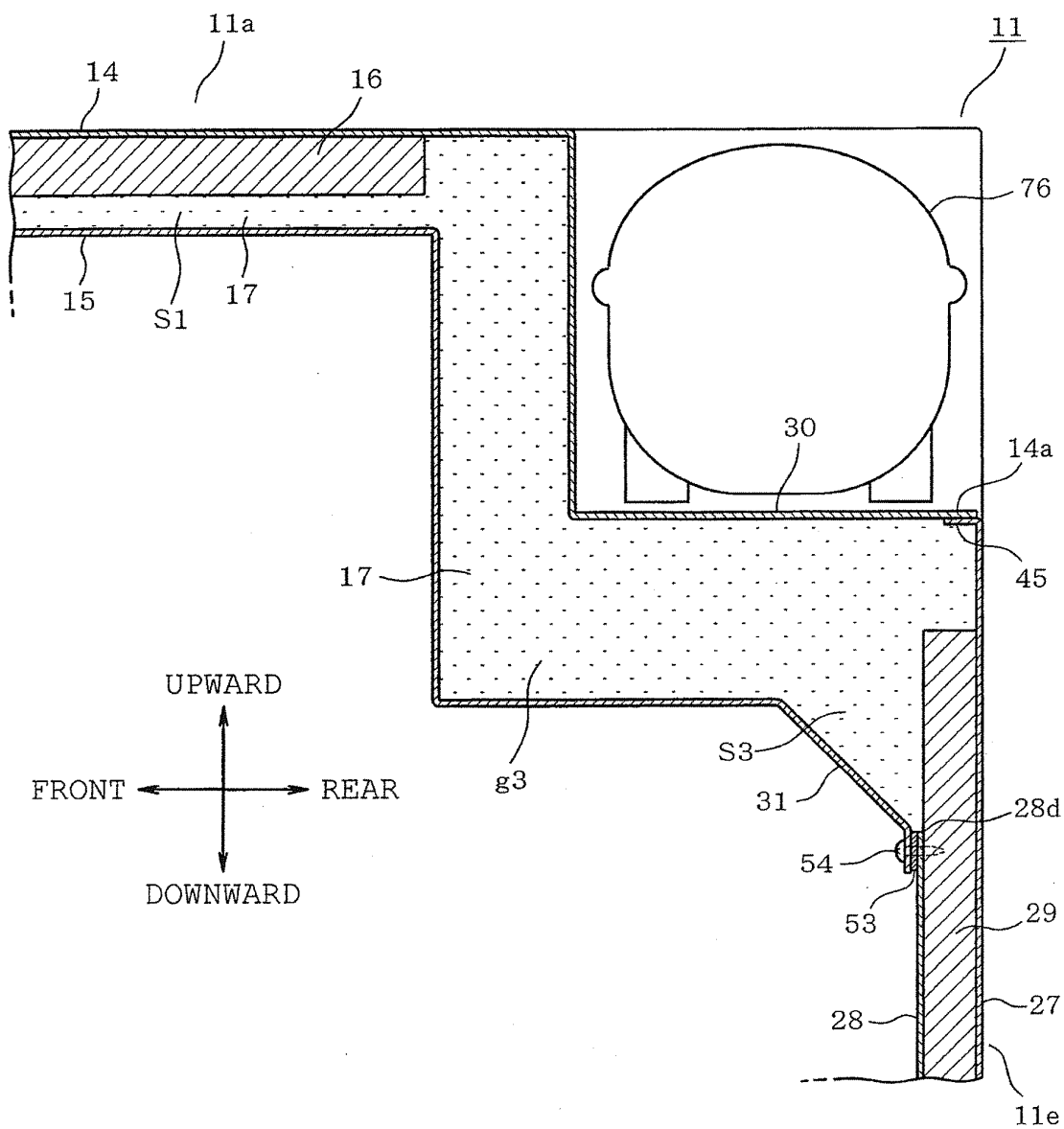


FIG. 13

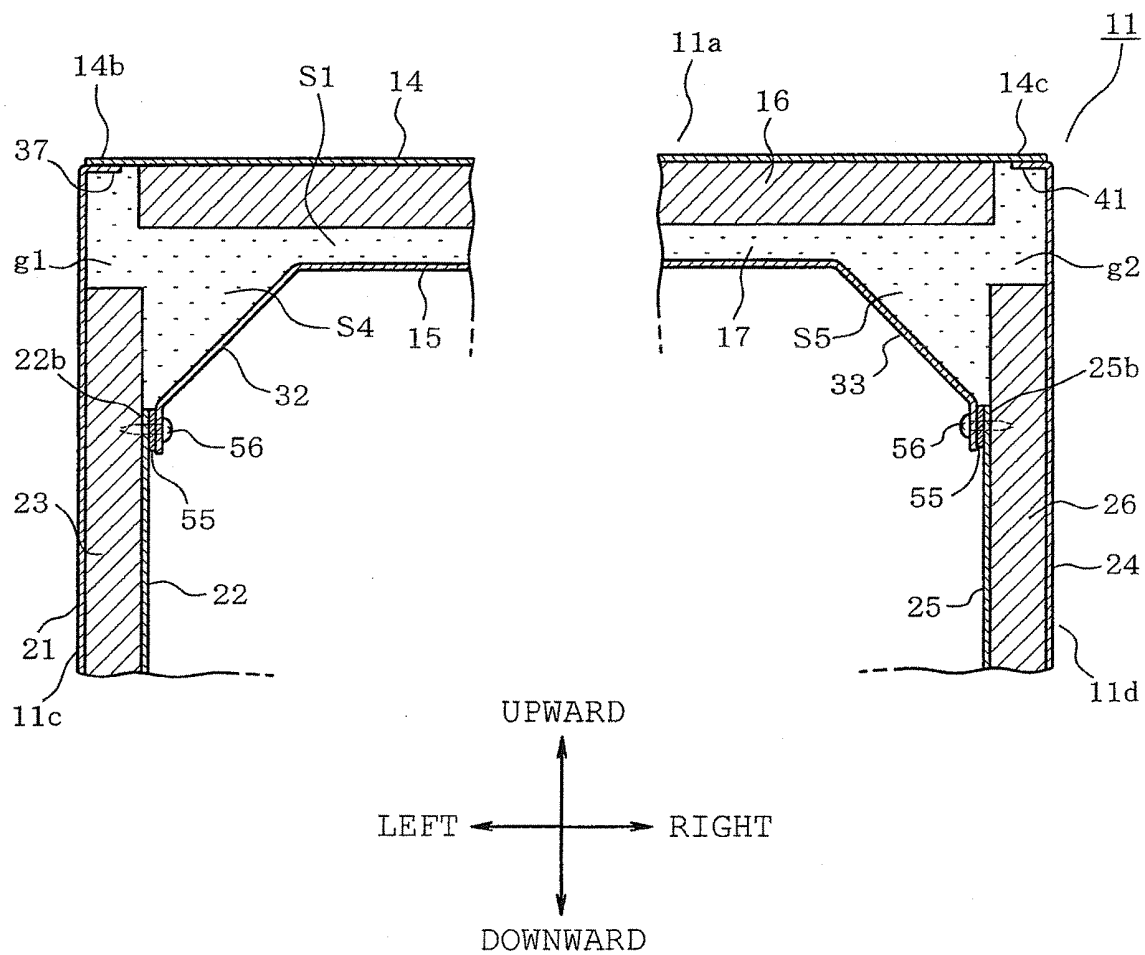


FIG. 14

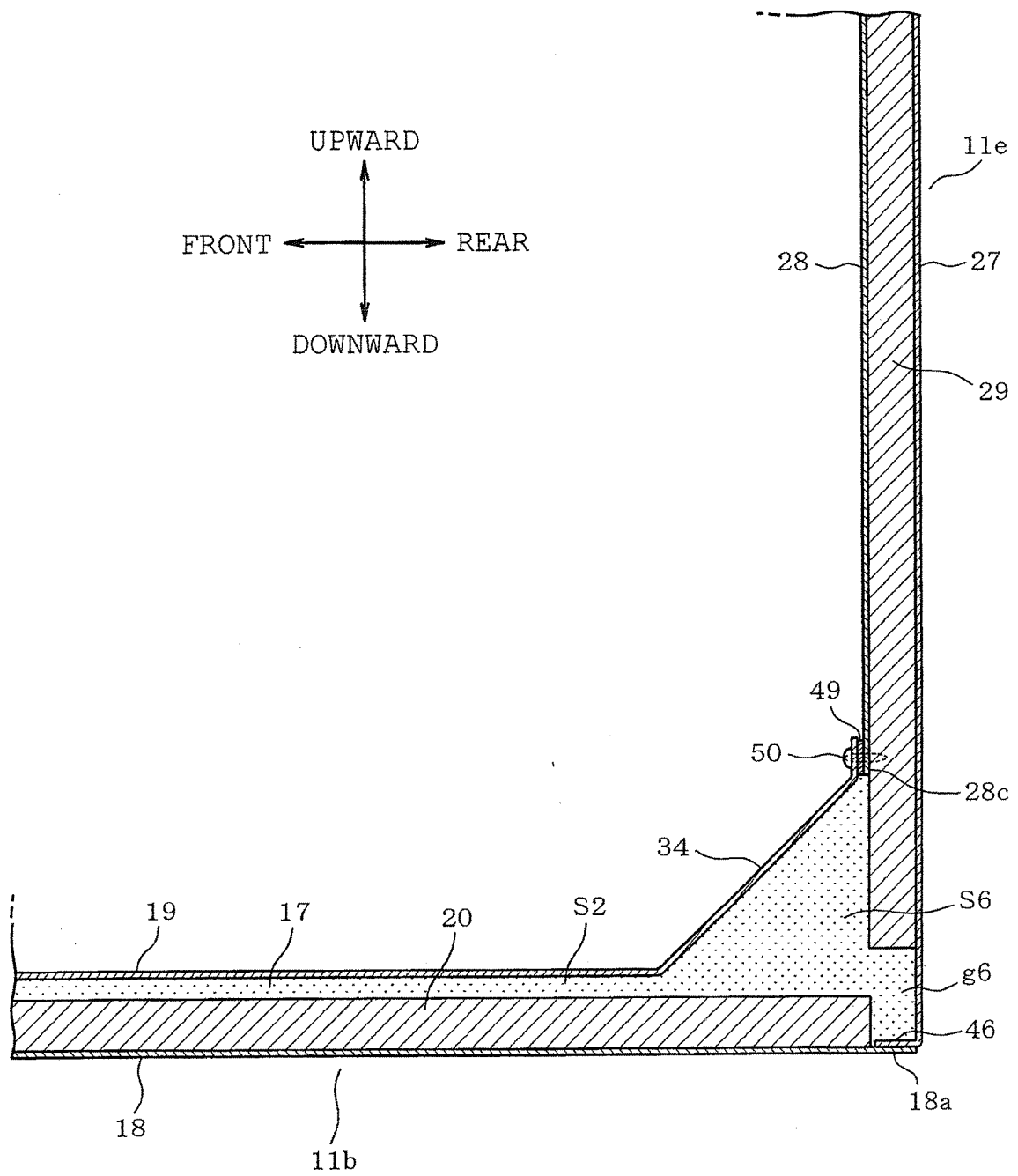


FIG. 15

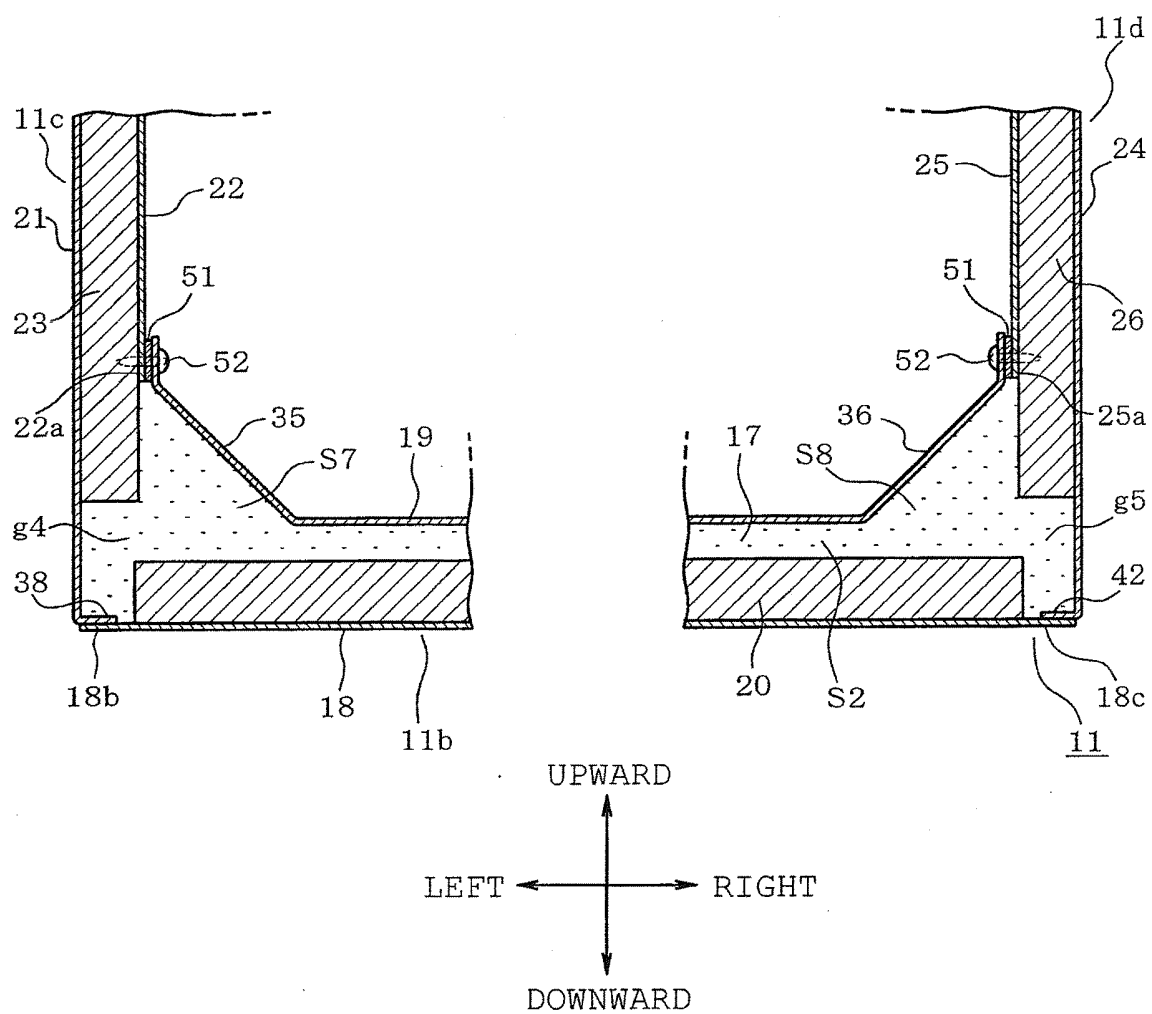


FIG. 16

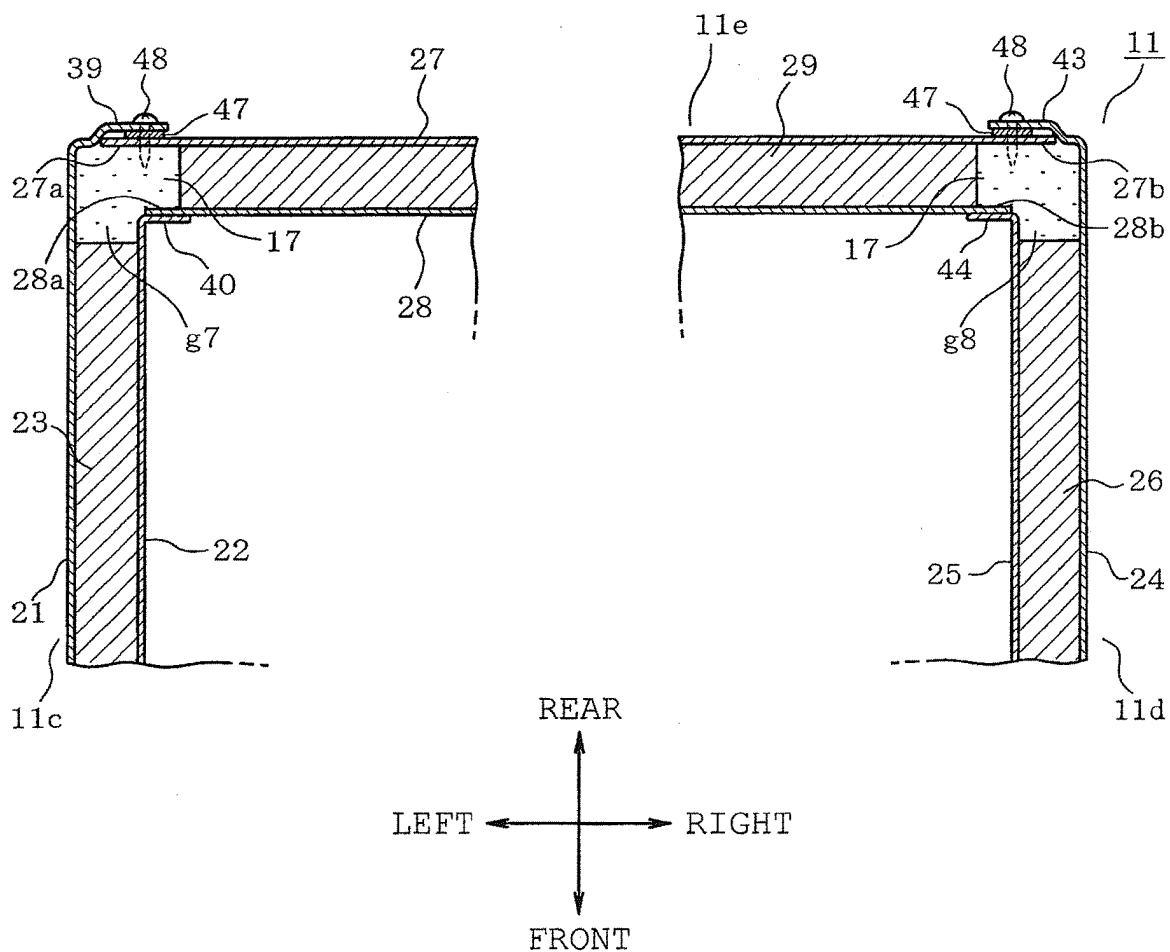


FIG. 17

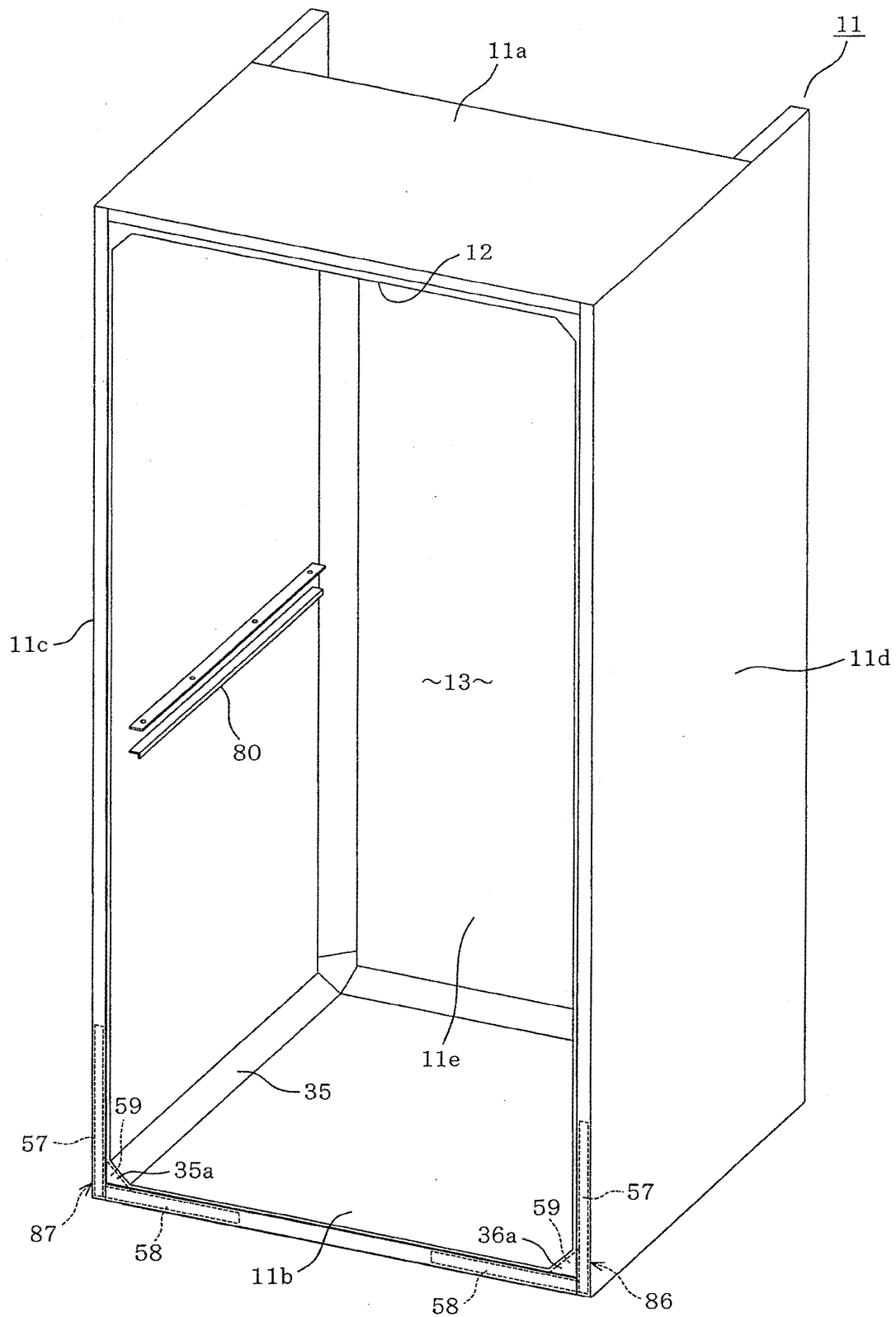


FIG. 18

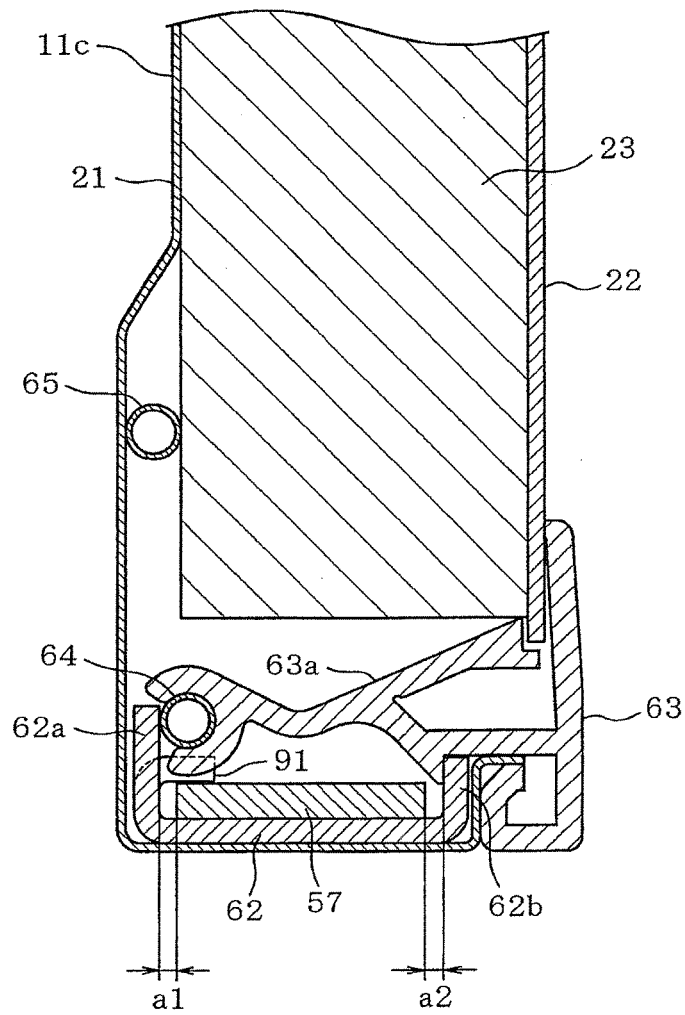


FIG. 19

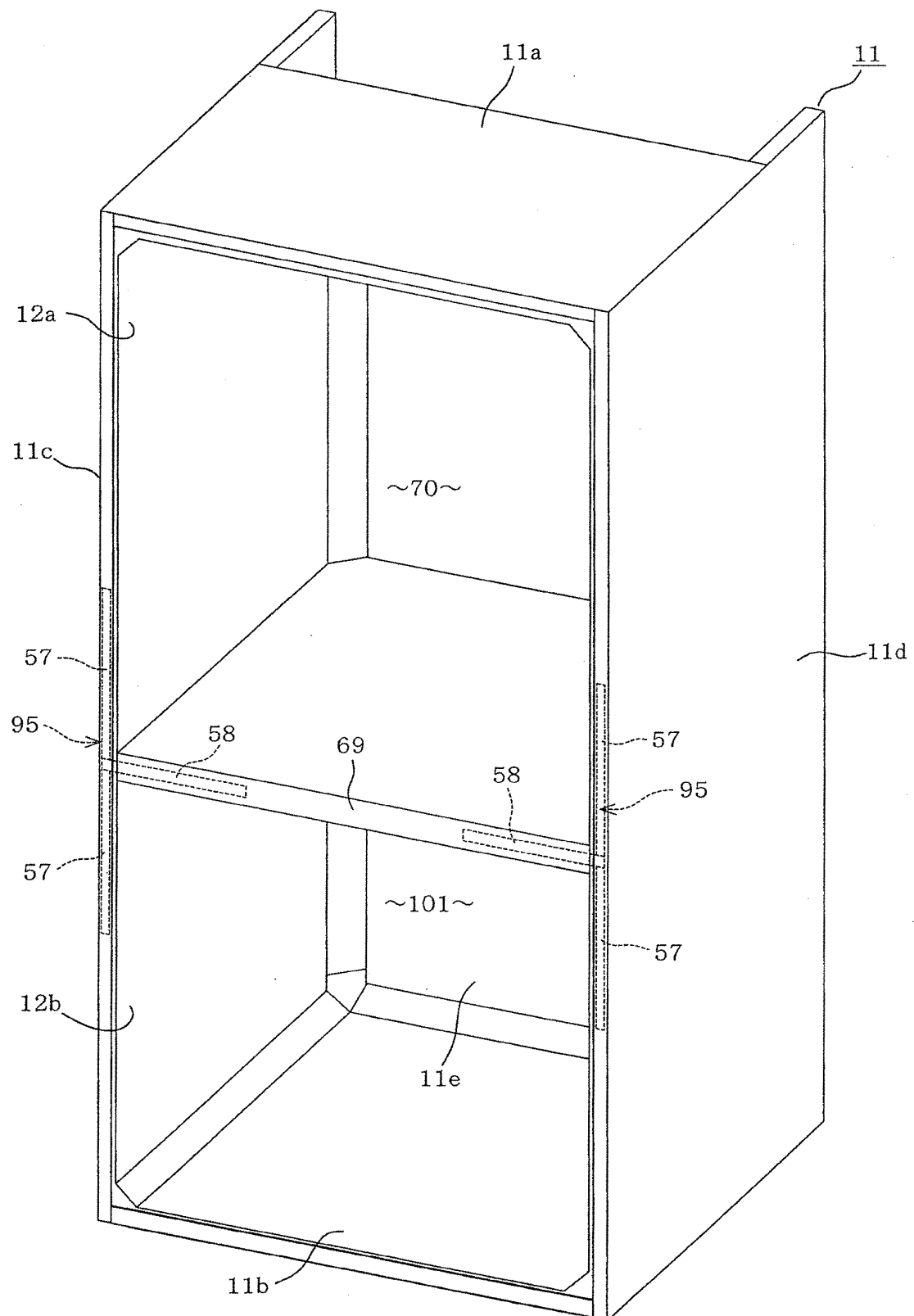


FIG. 20

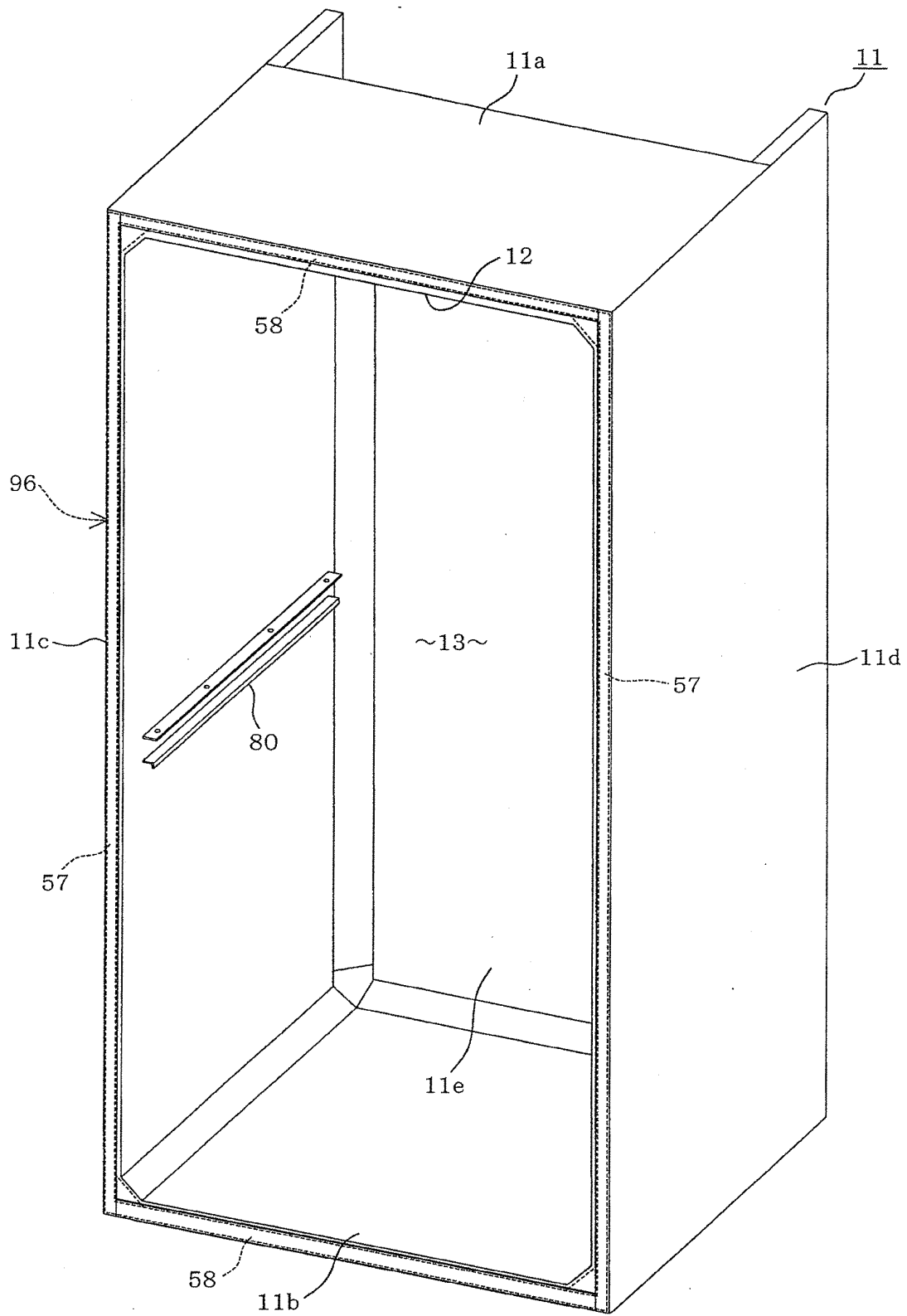


FIG. 21

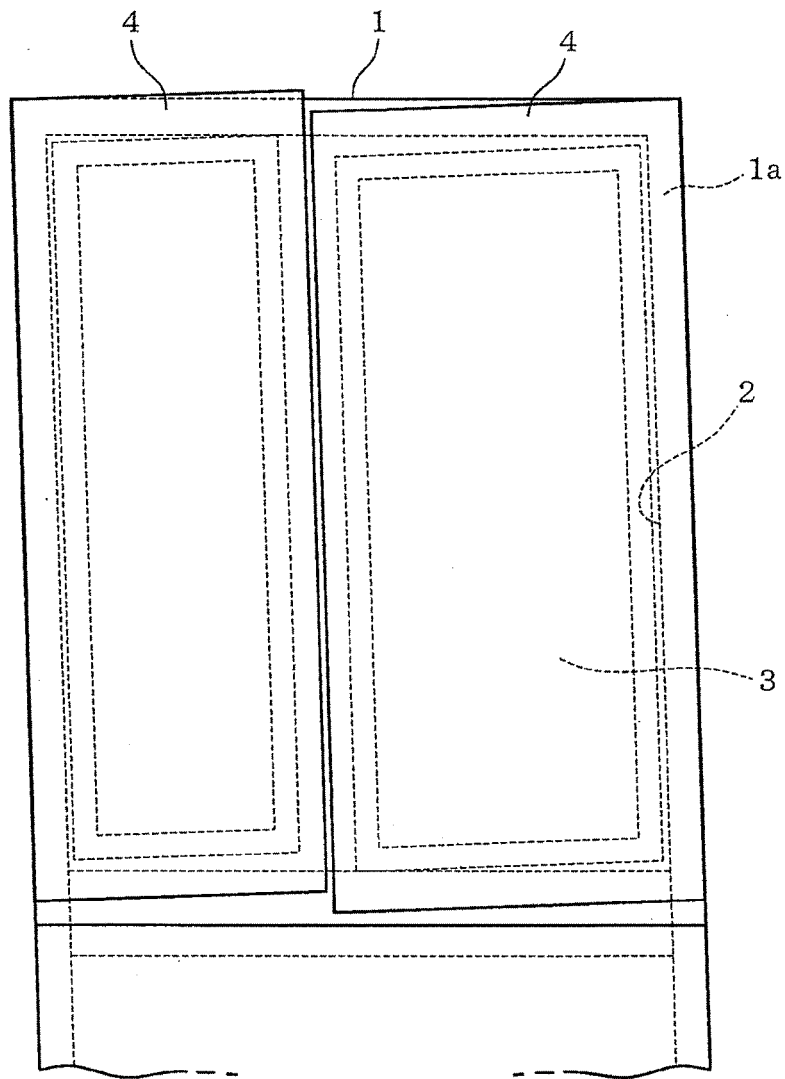


FIG. 22

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/079647

A. CLASSIFICATION OF SUBJECT MATTER

F25D23/06 (2006.01) i, F25D23/02 (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, F25D23/02

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.
X	JP 8-233445 A (Toshiba Corp.),	1-3, 8
Y	13 September 1996 (13.09.1996),	4-7, 13-17
A	paragraphs [0020] to [0031]; fig. 1, 3 (Family: none)	9-12
Y	JP 2005-241142 A (Hoshizaki Electric Co., Ltd.),	4-7, 13-17
	08 September 2005 (08.09.2005),	
	paragraphs [0010] to [0012], [0020]; fig. 1 to 4 (Family: none)	
Y	JP 9-12084 A (Daikin Industries, Ltd.),	5-7, 13-17
	14 January 1997 (14.01.1997),	
	paragraphs [0044] to [0047]; fig. 4 (Family: none)	

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

* Special categories of cited documents:

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

"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

Date of the actual completion of the international search
28 December, 2012 (28.12.12)Date of mailing of the international search report
15 January, 2013 (15.01.13)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/JP2012/079647

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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), specification, page 5, line 10 to page 6, line 15; fig. 4 (Family: none)	6, 7, 13-17
Y	JP 2011-208907 A (Panasonic Corp.), 20 October 2011 (20.10.2011), paragraph [0043]; fig. 1B (Family: none)	13-17
Y	JP 6-147744 A (Hitachi, Ltd.), 27 May 1994 (27.05.1994), paragraph [0012]; fig. 1 (Family: none)	16, 17
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 83374/1986 (Laid-open No. 195083/1987) (Toshiba Corp.), 11 December 1987 (11.12.1987), page 5, line 7 to page 9, line 1; fig. 1 to 3 (Family: none)	9-12
A	JP 5-240564 A (Toshiba Corp.), 17 September 1993 (17.09.1993), paragraph [0021]; fig. 3 (Family: none)	9-12

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2728318 B [0004]
- JP H06147744 A [0004]