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(54) **REFRIGERATOR**

(57) A refrigerator includes a refrigerator body and a door. The refrigerator body is configured as a heat-insulating case by putting a vacuum heat-insulating material between an inner box and an outer box thereof. The door is for opening and closing a front opening portion of the heat-insulating case. The door includes a vacuum heat-

insulating material put between an inner plate and an outer plate thereof. An end of the vacuum heat-insulating material of the door, which is positioned at a side of a side wall of the heat-insulating case, extends to an outer side with respect to an inner plate surface of the side wall.

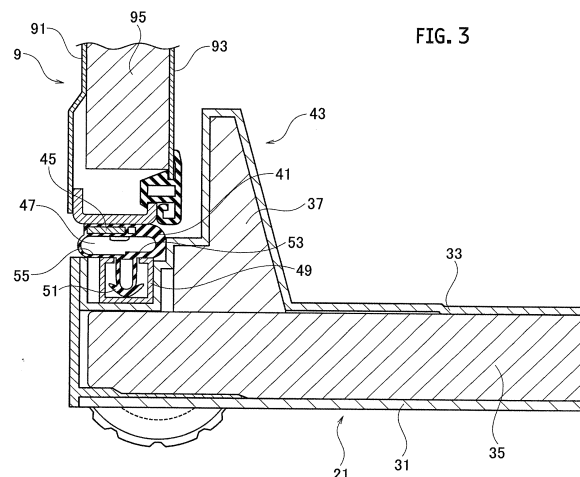


FIG. 3

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Description

[Technical Field]

[0001] An embodiment of the present invention relates to a refrigerator.

[Background Art]

[0002] In order to enhance heat insulation performance and save energy, a refrigerator has a vacuum heat-insulating material filled between an outer box and an inner box thereof, the outer box and the inner box constituting a heat-insulating case that is a refrigerator body. The refrigerator also has a vacuum heat-insulating material filled between an inner plate and an outer plate thereof that constitute a door for opening and closing a front opening portion of the heat-insulating case.

[Summary of Invention]

[Technical Problem]

[0003] However, a conventional refrigerator does not have a vacuum heat-insulating material disposed in the vicinity of an end of the door, that faces the front end (close to the door) of a side wall portion of the heat-insulating case, since there are provided a gasket and the like. Therefore, heat insulation in the vicinity of the end of the door is lost, thereby having a problem that the effect of heat insulation as the entire refrigerator goes down and water condensation occurs in the vicinity of the end of the door.

[0004] The present invention has an object to provide a refrigerator capable of enhancing heat insulation performance in the vicinity of the end of the door which is for opening and closing the front opening portion of the heat-insulating case.

[Solution to problem]

[0005] According to an aspect of the present invention, there is provided a refrigerator including: a refrigerator body configured as a heat-insulating case by putting a vacuum heat-insulating material between an inner box and an outer box thereof; and a door for opening and closing a front opening portion of the heat-insulating case, wherein the door has a vacuum heat-insulating material put between an inner plate and an outer plate thereof, and wherein an end of the vacuum heat-insulating material of the door, which is positioned at a side of a side wall of the heat-insulating case, extends an outer side with respect to an inner plate surface of the side wall.

[Brief Description of Drawings]

[0006]

[FIG. 1]

FIG. 1 is a perspective view showing the whole structure of a refrigerator according to an embodiment of the present invention.

[FIG. 2]

FIG. 2 is a cross-sectional view of the refrigerator shown in FIG. 1.

[FIG. 3]

FIG. 3 is an enlarged sectional view showing a detailed inner structure of a corner that is within a circle A of a dotted line in the cross-sectional view of the refrigerator shown in FIG. 2.

[FIG. 4]

FIG. 4 is a view showing a temperature characteristic at a corner of a first freezer door, which faces a front end of a left plate portion, the temperature characteristic overlapped on the structure of the corner according to the embodiment of the present invention.

[FIG. 5]

FIG. 5 is a view showing a temperature characteristic at a corner of a first freezer door, which faces a front end of a left plate portion, the temperature characteristic overlapped on the structure of the corner according to a conventional refrigerator.

[Description of Embodiments]

[0007] An exemplary embodiment of the present invention (hereinafter referred to as an embodiment) will be described with reference to the drawings.

[0008] FIG. 1 is a perspective view showing the whole structure of a refrigerator according to the embodiment of the present invention. As shown in FIG. 1, a refrigerator 1 includes a heat-insulating case 3 comprised of an inner box and an outer box with a vacuum heat-insulating material put therebetween. The heat-insulating case 3 includes a top plate portion 5 that constitutes a top wall thereof as the ceiling, a bottom plate portion 7 that constitutes a bottom wall thereof, a left plate portion 9 that constitutes a left sidewall thereof, a right plate portion 11 that constitutes a right sidewall thereof, and a back plate portion 13 that constitutes a back wall thereof.

[0009] It is noted that the right plate portion 11, the back plate portion 13, and the bottom plate portion 7 are kept out of sight in FIG. 1. Moreover, when a general term is given to the top plate portion 5, the bottom plate portion 7, the left plate portion 9, the right plate portion 11, and the back plate portion 13, they are referred to merely as a plate portion.

[0010] Moreover, there are mounted refrigerated-room hinged-double-doors 15 and 15, a crisper drawer door 17, an ice-making-room drawer door 19, a first freezer drawer door 21, and a second freezer drawer door 23 on the side of a front opening portion of the heat-insulating case 3 which is surrounded by the top plate portion 5, the bottom plate portion 7, the left plate portion 9, the right plate portion 11, and the back plate portion 13. It is noted that the second freezer door 23 is aligned with the

ice-making-room door 19 side by side. It is noted that there are provided a refrigerated room, a crisper, a ice-making room, a first freezer, and a second freezer within the heat-insulating case 3, which are respectively closed by the refrigerated-room doors 15 and 15, the crisper door 17, the ice-making-room door 19, the first freezer drawer door 21, and the second freezer drawer door 23.

[0011] FIG. 2 is a cross-sectional view of the refrigerator 1 shown in FIG. 1. To be concrete, it is a cross-sectional view, for example, made by horizontally cutting the middle of the first freezer door 21 of the refrigerator 1 in FIG. 1. As shown in FIG. 2, the heat-insulating case 3 of the refrigerator 1 is formed in an almost U-shape surrounded by the left plate portion 9, the right plate portion 11, and the back plate portion 13. The second freezer door 21 is mounted on the front opening portion of the heat-insulating case 3.

[0012] FIG. 3 is an enlarged sectional view showing a detailed inner structure of a corner where a front end of the left plate portion 9 abuts on a left end of the second freezer door 21, which is within a circle A of a dotted line in the cross-sectional view of the refrigerator 1 shown in FIG. 2. As shown in FIG. 3, the first freezer door 21 includes a vacuum heat-insulating material 35 fitted between a door outer plate 31 and a door inner plate 33 thereof.

[0013] For manufacture reasons, the vacuum heat-insulating material 35 usually has an excess part of a film, such as a laminate film, that surrounds a core material thereof. As shown in FIG. 3, the excess part of the film is folded while formed as an ear part, such that the ear part adheres to the vacuum heat-insulating material 35. Thereby, the end part of the vacuum heat-insulating material 35 is formed in an almost square. Specifically, while the excess part of the film is formed as an ear part, the ear part is folded from a position of the end of the vacuum heat-insulating material 35 toward the side of the door inner plate 33, and thereby the ear part adheres to the vacuum heat-insulating material 35. That is, as shown in FIG. 3, the ear part adheres to the side surface of a gasket 41 so that the film seals a gap between the vacuum heat-insulating material 35 and the gasket 41, thereby enabling to reinforce an adhering surface part of the vacuum heat-insulating material 35. It is noted that the folded portion is firmly kept hermetically-sealed by an inner binding material.

[0014] Similarly, the left plate portion 9, which constitutes a side wall of the refrigerator 1, includes a vacuum heat-insulating material 95 fitted between a left outer plate 91 and a left inner plate 93 thereof.

[0015] On an inner surface of the first freezer door 21, the gasket 41 is mounted in the vicinity of the left end of the first freezer door 21. In front of the gasket 41, that is, on the right side of the gasket 41 in FIG. 3, there is provided a throat portion 43 as a protruding portion that is bent obliquely and protrudes widely toward an inner side of the first freezer. An expanded heat-insulating material 37 is filled within the throat portion 43. The throat portion

43 works as a cold air leak prevention portion that closes an escape route of cold air, thereby further enhancing freezing efficiency.

[0016] The gasket 41 includes a magnet 45 mounted on an end thereof, the end abutting on the front end of the left plate portion 9. The magnet 45 makes the vicinity of the left end of the first freezer door 21 magnetized to the front end of the left plate portion 9. There is provided an air cushion portion 47 inside of the magnet 45. The air cushion portion 47 absorbs an impact against the left plate portion 9 when the first freezer door 21 is closed.

[0017] A gasket mounting portion 49 is provided between the air cushion portion 47 and the door inner plate 33 of the first freezer door 21. An insertion portion 51, which is in an arrowhead shape and extends from the air cushion portion 47, is inserted into the gasket mounting portion 49. It is noted that the gasket mounting portion 49 may be provided with the door inner plate 33 as one body. For example, the gasket mounting portion 49 may be formed as an extension of the door inner plate 33.

[0018] Fin portions 53 and 55 are mounted between the gasket mounting portion 49 and the air cushion portion 47 and on both sides of the gasket mounting portion 49. The fin portions 53 and 55 prevent a leak of cold air from the first freezer, thereby suppressing water condensation within the first freezer door 21 due to leaked cold air.

[0019] It is noted that an ear part formed around the vacuum heat-insulating material 35 of the first freezer door 21 is folded toward the vacuum heat-insulating material 35, and the tip of the folded ear part is positioned at an inner side with respect to the center position of the gasket mounting portion 49 (a side of the right end of the first freezer door 21).

[0020] FIGS. 4 and 5 are views showing respective temperature characteristics according to the present embodiment and a conventional refrigerator at the corner of the first freezer door, which faces the front end of the left plate portion, the temperature characteristics overlapped on respective structures of the corner. It is noted that in FIGS. 4 and 5, a sign "a" is a point indicating temperature 22.6 degrees C, a sign "b" is a point indicating temperature 16.8 degrees C, a sign "c" is a point indicating temperature 11.0 degrees C, a sign "d" is a point indicating temperature 5.2 degrees C, a sign "e" is a point indicating temperature -0.6 degrees C, and a sign "f" is a point indicating temperature -6.4 degrees C. FIGS. 4 and 5 show the same temperature range in graphs where a plurality of points showing the same temperatures with the above-described points are connected as respective lines.

[0021] Firstly, a temperature characteristic of the conventional refrigerator will be described with reference to FIG. 5. As shown in FIG. 5, for the conventional refrigerator, a vacuum heat-insulating material 101 of the first freezer door 21 does not extend to the vicinity of the left end of the first freezer door 21 and is terminated at the throat portion which is positioned before the left end of the first freezer door 21. Therefore, in the temperature

range of the conventional refrigerator, a temperature range for water condensation, which is between the temperature 22.6 degrees C indicated by the sign "a" and the temperature 16.8 degrees C indicated by the sign "b", resides in the corner where a vacuum heat-insulating material does not exist, thereby having a possibility of water condensation at the corner.

[0022] Next, a temperature characteristic of the refrigerator according to the present embodiment will be described with reference to FIG. 4. As shown in FIG. 4, in the refrigerator according to the present embodiment, the vacuum heat-insulating material 35 of the first freezer door 21 extends to the vicinity of the left end of the first freezer door 21 so as to overlap a tip of the vacuum heat-insulating material 95 of the left plate portion 9, the tip extending toward the first freezer door 21, when viewed from the door outer plate 31 in FIG. 3. Therefore, in the temperature range of the refrigerator according to the present embodiment, the temperature range for water condensation, which is between the temperature 22.6 degrees C indicated by the sign "a" and the temperature 16.8 degrees C indicated by the sign "b", resides in the corner where the vacuum heat-insulating material 35 of the first freezer door 21 exists. Thus, the temperature range for water condensation at the corner lies within the vacuum heat-insulating material 35. That is, the temperature range for water condensation is closed within the vacuum heat-insulating material 35, thereby having no possibility of water condensation at the corner.

[0023] In the above-configured refrigerator according to the present embodiment, the vacuum heat-insulating material 35 of the first freezer door 21 is put between the door outer plate 31 and the door inner plate 33 and extends to the vicinity of the left end of the first freezer door 21. The vacuum heat-insulating material 35 extends over the tip, which extends toward the first freezer door 21, of the vacuum heat-insulating material 95 of the left plate portion 9, so as to overlap the tip when viewed from the door outer plate 31 in FIG. 3. Thereby, it is possible to enhance heat insulation performance in the vicinity of the left end of the first freezer door 21 and prevent the occurrence of water condensation in the vicinity of the left end of the first freezer door 21 since the temperature range for water condensation is closed within the vacuum heat-insulating material 35.

[0024] It is noted that the sentence "extend over the tip, which extends toward the first freezer door 21, of the vacuum heat-insulating material 95 of the left plate portion 9 so as to overlap the tip when viewed from the door outer plate 31 in FIG. 3" means that "the vacuum heat-insulating material 35 of the first freezer door 21 has its left end extending to an outer side (a side of the left end of the first freezer door 21) with respect to the center position of the gasket mounting portion 49 of the gasket 41 for example by 3 mm or more". Thereby, it is possible to enhance the heat insulation performance and prevent the occurrence of water condensation in the vicinity of the left end of the first freezer door 21.

[0025] Furthermore, in a case of having the expanded heat-insulating material 37 (expanded polystyrene or the like) within the throat portion 43 which works as a cold air leak prevention portion, it is expected to enhance the heat insulation performance in the vicinity of the left end of the first freezer door 21 by making the vacuum heat-insulating material 35 extending outside of the expanded heat-insulating material 37 of the throat portion 43.

[0026] Moreover, by making the left end of the first freezer door 21 of the vacuum heat-insulating material 35 extending to the outer side with respect to the center position of the gasket mounting portion 49 (the side of the left end of the first freezer door 21), it is possible to increase the coverage of the vacuum heat-insulating material with respect to the size of a front view, that is the size viewed from the front of the heat-insulating case 3. Therefore, it is possible to enhance the heat insulation performance at the corner of the first freezer door 21 which opposes to the front end of the left plate portion 9. As a result, it is possible to enhance the heat insulation performance of the refrigerator 1 and prevent water condensation.

[0027] It is noted that the present embodiment describes the structure of the corner of the first freezer door 21 which opposes to the front end of the left plate portion 9. The corners of the refrigerator doors 15 and 15, the crisper door 17, the ice-making room door 19, the second freezer door 23, which oppose to the front end of the left plate portion 9, and the corners of the refrigerator doors 15 and 15, the crisper door 17, the ice-making room door 19, the second freezer door 23, which oppose to the front end of the right plate portion 11, also have a similar structure.

[0028] In the present embodiment, the refrigerator 1 has the top plate portion 5, the bottom plate portion 7, the left plate portion 9, the right plate portion 11, and the back plate portion 13 provided separately. These plates are joined together to constitute the heat-insulating case 3 of the refrigerator 1. That is, a plurality of outer box plate members which constitutes the outer box of the heat-insulating case 3 is provided separately. However, the present embodiment is not limited to this. The plurality of outer box plate members may be provided as one body to form the outer box as one plate. Similarly, a plurality of inner box plate members which constitutes the inner box of the heat-insulating case 3 is provided separately. However, the present embodiment is not limited to this. The plurality of inner box plate members may be provided as one body to form the inner box as one plate.

[0029] Some of embodiments according to the present invention are described, but these embodiments are provided as examples and do not mean to limit the scope of the invention. It is possible to implement these new embodiments as other various embodiments and perform various omissions, replacements, and modifications within the range of the gist of the invention. These embodiments and their modifications are included in the scope and the gist of the invention, and included in the

scope of the invention described in claims and its equivalent.

Claims

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1. A refrigerator comprising:

a refrigerator body configured as a heat-insulating case by putting a vacuum heat-insulating material between an inner box and an outer box thereof; and
 a door for opening and closing a front opening portion of the heat-insulating case,
 wherein the door has a vacuum heat-insulating material put between an inner plate and an outer plate thereof, and
 wherein an end of the vacuum heat-insulating material of the door, which is positioned at a side of a side wall of the heat-insulating case, extends to an outer side with respect to an inner plate surface of the side wall.

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2. The refrigerator according to claim 1, wherein the end of the vacuum heat-insulating material of the door, which is positioned at the side of the side wall of the heat-insulating case, extends to an outer side with respect to the center of an insertion portion which is for mounting a gasket on an end of the door.

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3. The refrigerator according to claim 2, wherein an ear part formed around the vacuum heat-insulating material of the door is folded toward the vacuum heat-insulating material, and a tip of the folded ear part is positioned at an inner side with respect to the center of the insertion portion which is for mounting the gasket on the end of the door.

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4. The refrigerator according to one of claims 1 to 3, wherein the door has a protruding portion that extends to an inner side of the refrigerator, and the protruding portion has heat insulation properties.

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5. The refrigerator according to one of claims 1 to 4, wherein the door is provided with a cold air leak prevention portion that extends to an inner side of the refrigerator for preventing cold air from leaking through the door, and the end of the vacuum heat-insulating material of the door, which is positioned at the side of the side wall of the heat-insulating case, extends to an outer side with respect to the cold air leak prevention portion.

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FIG. 1

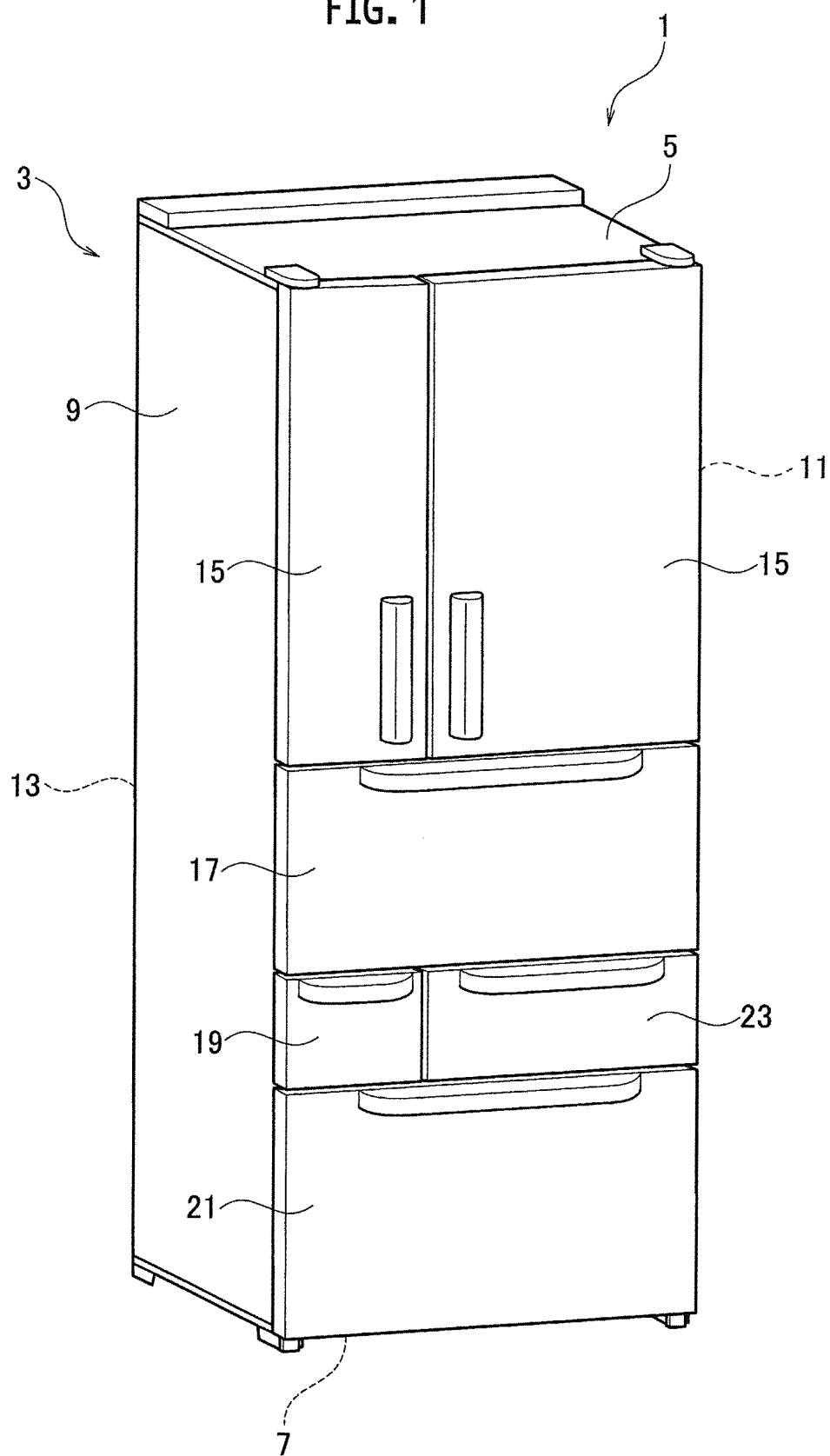


FIG. 2

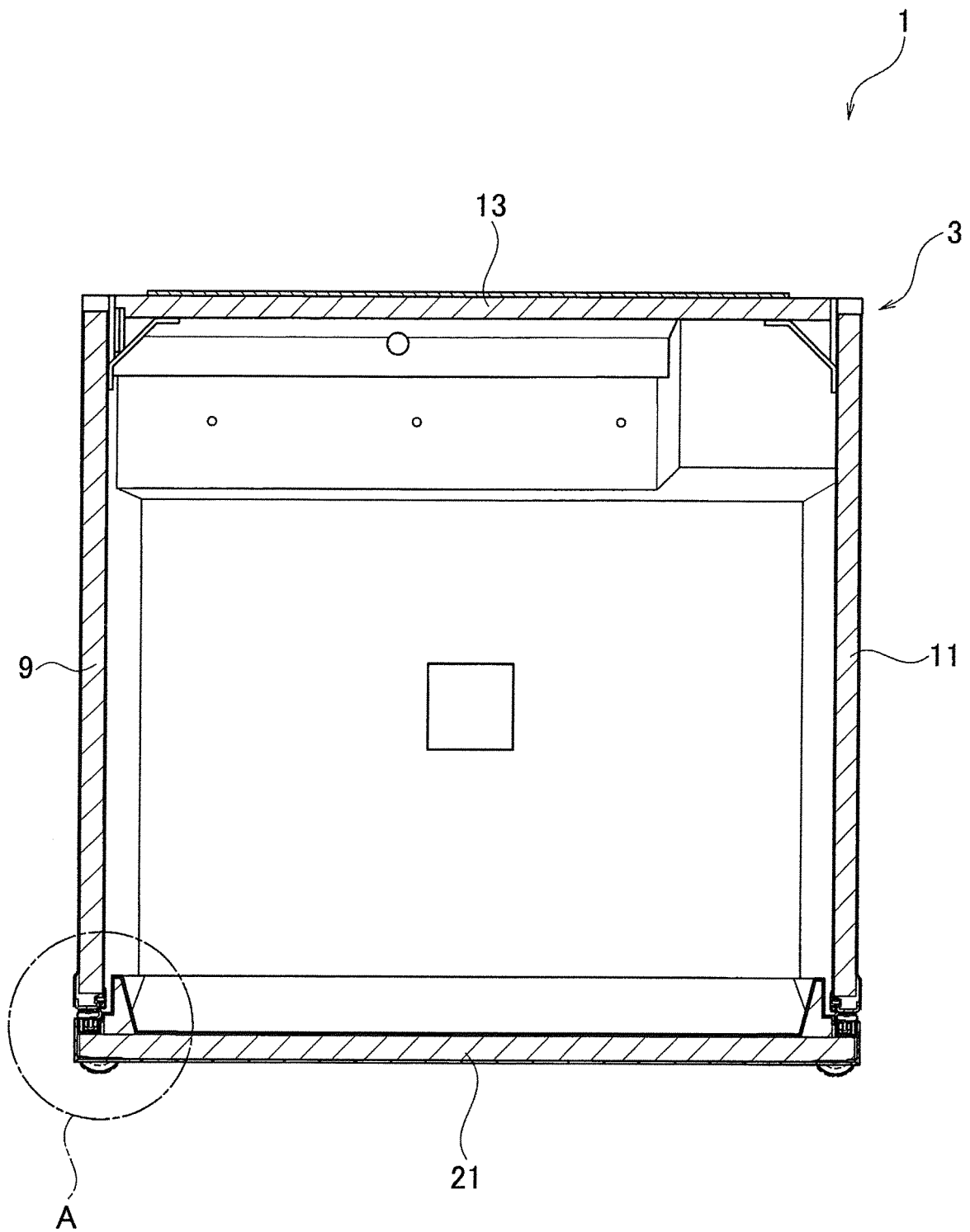


FIG. 3

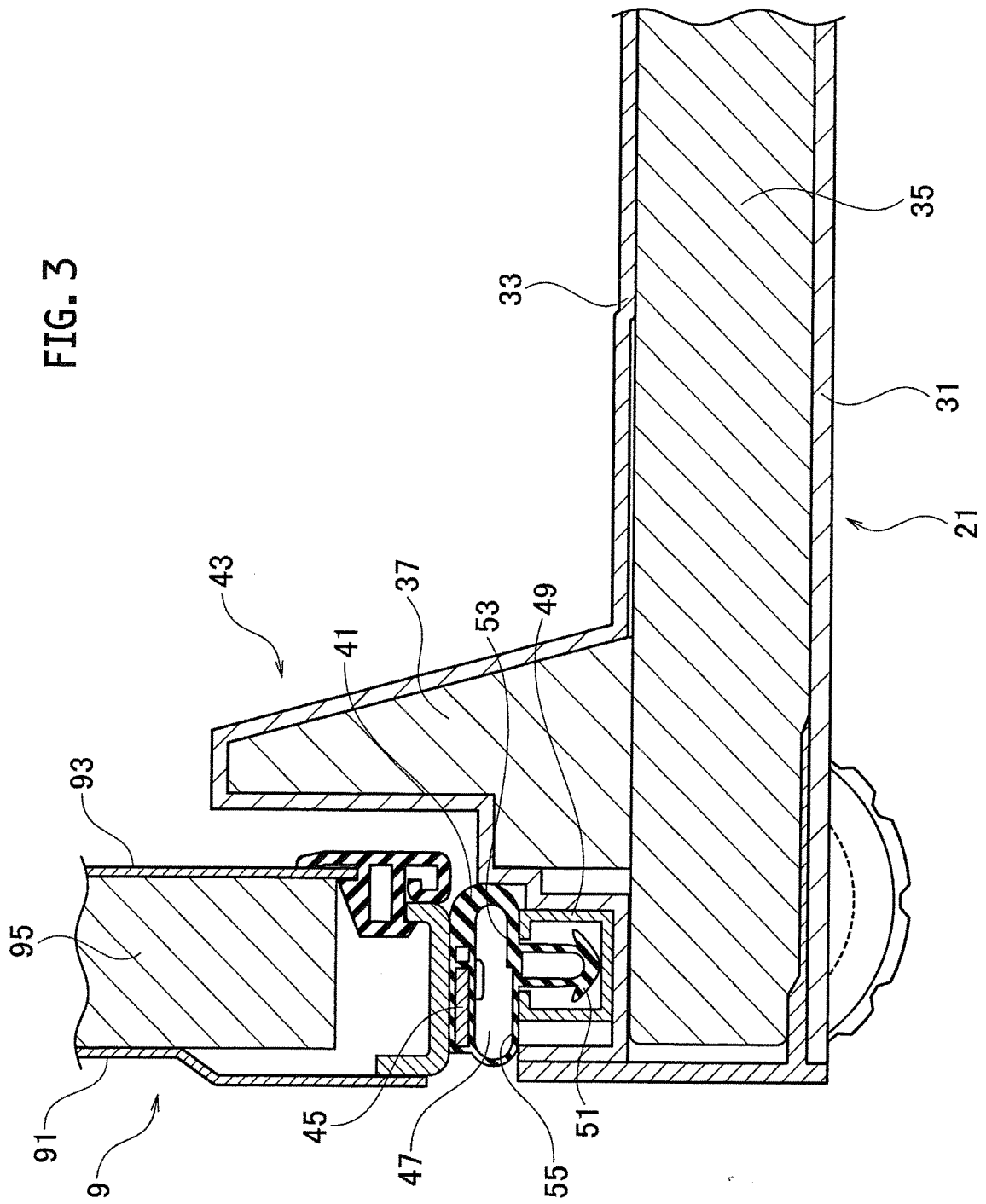


FIG. 4

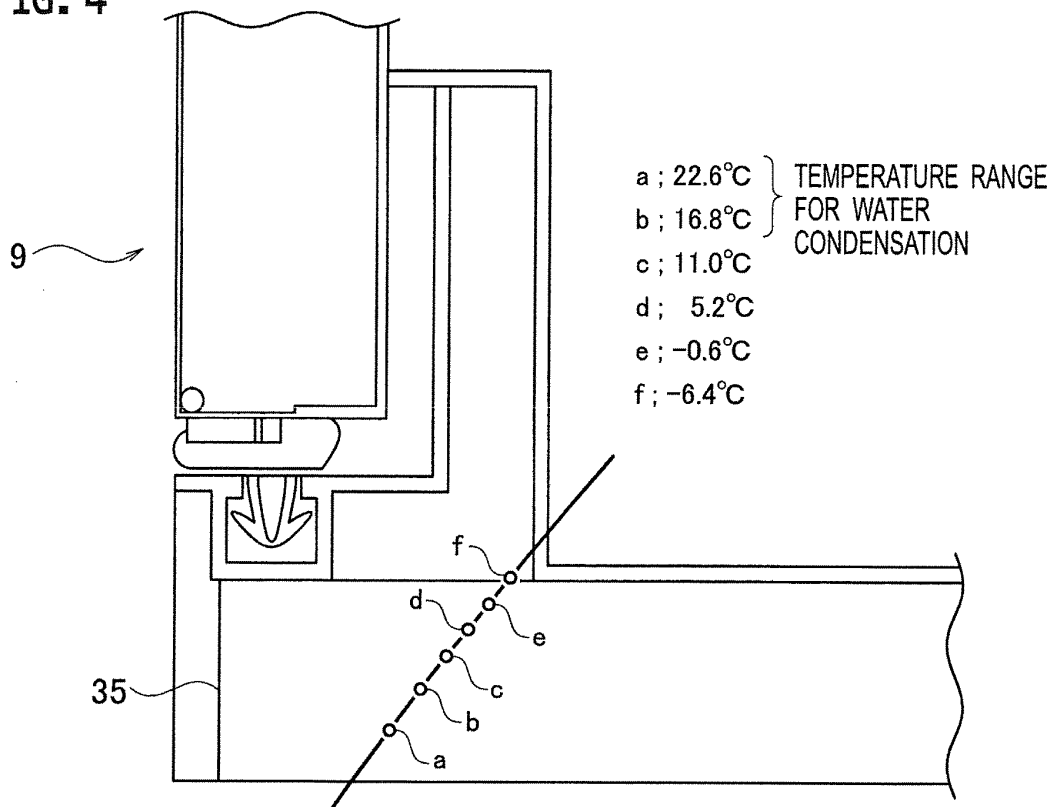
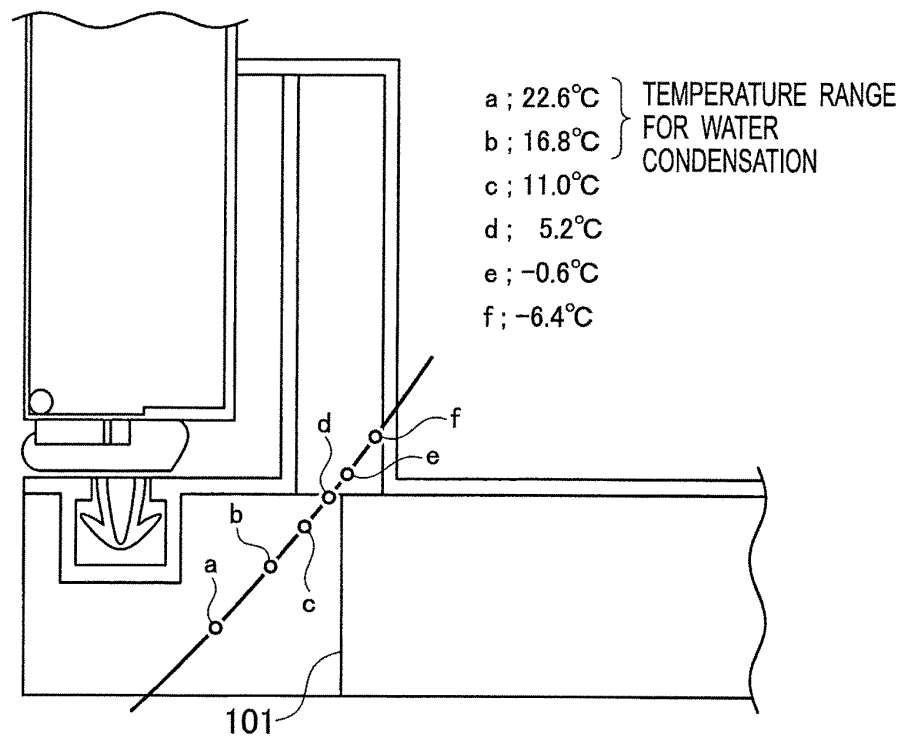


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/081282

A. CLASSIFICATION OF SUBJECT MATTER

F25D23/06(2006.01)i, F25D23/08(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, F25D23/08

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2013
Kokai Jitsuyo Shinan Koho	1971-2013	Toroku Jitsuyo Shinan Koho	1994-2013

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 193036/1982 (Laid-open No. 98287/1984) (Hitachi, Ltd.), 03 July 1984 (03.07.1984), entire text; all drawings (particularly, specification, page 4, line 13 to page 6, line 14; fig. 2) (Family: none)	1, 4
Y		2, 5

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

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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/

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

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/081282

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	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 176622/1982 (Laid-open No. 80685/1984) (Hitachi, Ltd.), 31 May 1984 (31.05.1984), entire text; all drawings (particularly, specification, page 3, line 14 to page 4, line 14; fig. 3 to 5) (Family: none)	1 2, 5
X Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 38811/1980 (Laid-open No. 141989/1981) (Hitachi, Ltd.), 27 October 1981 (27.10.1981), entire text; all drawings (particularly, specification, page 3, line 5 to page 4, line 2; fig. 2, 3) (Family: none)	1 2, 5
X Y	JP 2004-340194 A (Toshiba Corp.), 02 December 2004 (02.12.2004), entire text; all drawings (particularly, paragraphs [0025] to [0029]; fig. 2, 3) (Family: none)	1 2, 5
Y	WO 2011/058678 A1 (Toshiba Corp.), 19 May 2011 (19.05.2011), entire text; all drawings (particularly, paragraphs [0021] to [0025], [0029]; fig. 4, 8) & JP 2011-102679 A & CN 102725602 A & TW 201116790 A	2, 5
A	JP 2011-122739 A (Toshiba Corp.), 23 June 2011 (23.06.2011), entire text; all drawings (particularly, fig. 8) & CN 201852403 U	3
A	JP 2005-331000 A (Hitachi Home & Life Solution, Inc.), 02 December 2005 (02.12.2005), entire text; all drawings & KR 10-2006-0042183 A & CN 1699818 A	3

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