

DESCRIPTION

Title of Invention

REFRIGERATOR DOOR AND REFRIGERATOR INCLUDING THE REFRIGERATOR DOOR

5 Technical Field

[0001]

The present invention relates to a refrigerator door, and a refrigerator including the refrigerator door.

Background Art

10 [0002]

(A refrigerator has been proposed in which a control box that controls various devices in the refrigerator is attached to the outside of the outer shell of the refrigerator that is made of a urethane foam or the like (see, for example, Patent Literature 1). In the technique described in Patent Literature 1, a screw with a length of about, for example, 20 mm to 30 mm is fastened into place so that the control box is secured to the outer shell of the refrigerator. To prevent the fastened screw from, for example, sticking in a vacuum thermal insulation provided inside the outer shell of the refrigerator to cause breakage of the vacuum thermal insulation, a part of the vacuum thermal insulation located at the position where the screw is fastened is reduced in thickness by embossing in advance, and a protective member such as a foam material is bonded to that part by use of a double-faced tape.

[0003]

Further, there has been also proposed a refrigerator in which a substrate for controlling various devices in the refrigerator and a case cover for accommodating this substrate are attached inside the housing of the refrigerator that is filled with a foam thermal insulation (see, for example, Patent Literature 2). In the technique according to Patent Literature 2, by providing the case cover, the substrate and the foam thermal insulation are separated from each other, and the substrate is held at a predetermined position.

30 Citation List

Patent Literature

[0004]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2006-105314 (see, for example, Fig. 6)

5 Patent Literature 2: Japanese Unexamined Patent Application Publication No. 2011-58787 (see, for example, Fig. 4)

Summary of Invention

Technical Problem

[0005]

10 Since the technique described in Patent Literature 1 requires the operation
(process of embossing the vacuum thermal insulation to reduce its thickness,
additional time is required for this operation process, resulting in increased
manufacturing cost.

[0006]

15 Further, in the technique described in Patent Literature 1, there are variations in
the position where the vacuum thermal insulation is installed. Thus, that the
protective member, which is to be bonded to the recessed area where the thickness
of the vacuum thermal insulation is reduced by embossing, and the double-faced tape
need to have a large size in comparison to the required area. Consequently, the
20 time required for the assembly process further increases and the number of parts also
(increases, resulting in a further increase in manufacturing cost.

[0007]

Further, another problem with the technique described in Patent Literature 1 is
that reducing the thickness of the vacuum thermal insulation by embossing causes
25 the thermal insulation performance of the refrigerator to decrease in the portion of
reduced thickness.

[0008]

In the technique described in Patent Literature 2, the space inside the case
cover is not filled with the foam thermal insulation. Consequently, the strength of the
30 portion of the door to which the case cover is attached decreases. That is, the

space that is defined by the inside surface of the housing of the refrigerator, and the case cover attached to the inside surface of the housing, and in which the substrate is installed, is partitioned off by the case cover, and this space is not filled with the foam filler. Thus, the strength is decreased in the portion of the refrigerator door to which the case cover is attached.

[0009]

The present invention has been made to address the above-mentioned problems. An object of the present invention is to provide a refrigerator door that makes it possible to minimize an increase in manufacturing cost and a decrease in strength, and a refrigerator including the refrigerator door.

Solution to Problem

[0010]

A refrigerator door according to the present invention includes a door unit accommodating a vacuum thermal insulation, the door unit being filled with a foam thermal insulation, a frame attached to the door unit, the frame being used to movably support the door unit, a securing member to secure the frame to the door unit, a back panel provided inside the door unit, the back panel being attached with the securing member, and a protective member attached to the back panel to be opposed to a distal end side of the securing member projecting toward the door unit. The foam thermal insulation is filled into a gap defined between the protective member and the back panel.

Advantageous Effects of Invention

[0011]

The refrigerator door according to the present invention, which has the configuration above, makes it possible to minimize the increase in manufacturing cost and the decrease in strength.

Brief Description of Drawings

[0012]

[Fig. 1] Fig. 1 is a schematic front view of a refrigerator according to Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a front perspective view of a door body of the refrigerator according to Embodiment 1 of the present invention.

[Fig. 3] Fig. 3 is an exploded rear perspective view of the door body of the refrigerator according to Embodiment 1 of the present invention.

5 [Fig. 4] Fig. 4 is an exploded perspective view of a door unit of the refrigerator according to Embodiment 1 of the present invention.

[Fig. 5] Fig. 5 illustrates components such as an inner plate and a protective member of the refrigerator according to Embodiment 1 of the present invention.

10 [Fig. 6] Fig. 6 illustrates the protective member of the refrigerator according to Embodiment 1 of the present invention.

([Fig. 7] Fig. 7 is a horizontal sectional view of the door body of the refrigerator according to Embodiment 1 of the present invention.

Description of Embodiments

[0013]

15 Hereinafter, embodiments of a refrigerator door and a refrigerator including the refrigerator door according to the present invention will be described with reference to the drawings. The drawings below are not intended to limit the present invention to the specific forms illustrated.

[0014]

20 Embodiment 1

(Fig. 1 is a schematic front view of a refrigerator 100 according to Embodiment 1 of the present invention. The refrigerator 100 has a refrigerating compartment 102 that is provided at the uppermost level as a storage compartment for storing food and the like, an ice making compartment 103 and a switching compartment 104 that are
25 provided side by side on the left and right below the refrigerating compartment 102, a freezing compartment 105 that is provided below the ice making compartment 103 and the switching compartment 104, and a vegetable compartment 106 that is provided below the freezing compartment 105. The opening on the front of the refrigerating compartment 102 is covered by a refrigerating compartment door 102a
30 and a refrigerating compartment door 102b, which are rotatably attached by means of

upper and lower hinges, in a manner that allows the opening to be opened and closed. The ice making compartment 103 has an ice making device that automatically makes ice from water supplied from a feed water tank (not illustrated) provided inside the refrigerating compartment 102. The ice making compartment 103 is a storage compartment that can store the ice made by the ice making device in an ice storage case. The switching compartment 104 is a storage compartment whose temperature setting can be switched from a freezing temperature range to a refrigeration temperature range. An operating device 110 is provided on the front of the refrigerating compartment door 102a.

The ice making compartment 103, the switching compartment 104, the freezing compartment 105, and the vegetable compartment 106 are each provided with a door body 1 that is attached to be freely drawn out in a direction perpendicular to the paper surface of Fig. 1. In the following description of Embodiment 1, the door body 1 provided to the vegetable compartment 106 will be described as an example.

[0015]

Fig. 2 is a front perspective view of the door body 1 of the refrigerator 100 according to Embodiment 1 of the present invention. Fig. 3 is an exploded rear perspective view of the door body 1 of the refrigerator 100 according to Embodiment 1 of the present invention. Fig. 4 is an exploded perspective view of a door unit 20 of the refrigerator 100 according to Embodiment 1 of the present invention. The configuration of the door body 1 will be described with reference to Figs. 2 to 4.

The door body 1 has the door unit 20 constituting the outer shell on the front side of the refrigerator 100, and a frame assembly 7 used to movably support the door unit 20 on the refrigerator body.

[0016]

[Door Unit 20]

The door unit 20 has a door outer plate 2 constituting the outer shell of the front side on the refrigerator 100, an upper edge door cap 3 and a lower edge door cap 4 attached at the upper end side and lower end side, respectively, of the door outer plate 2, and an inner plate 5 constituting the outer shell on the inside of the

refrigerator. That is, the door unit 20 has the door outer plate 2, the upper edge door cap 3, the lower edge door cap 4, and the inner plate 5 as its outer shell. In the door unit 20, a vacuum thermal insulation 6 is accommodated in the space defined by the door outer plate 2, the upper edge door cap 3, the lower edge door cap 4, and the inner plate 5, and the door unit 20 is filled with a foam thermal insulation (not illustrated). The door unit 20 is filled with the foam thermal insulation in a state in which the vacuum thermal insulation 6 is accommodated in the space inside the door outer plate 2, the upper edge door cap 3, the lower edge door cap 4, and the inner plate 5. Filling the door unit 20 with the foam thermal insulation improves the thermal insulation property of the refrigerator 100, thus improving the energy-saving efficiency of the refrigerator 100. The improved thermal insulation property realized by filling the door unit 20 with the foam thermal insulation enables a reduction in the thickness of the door unit 20, allowing more space to increase the internal volume of the refrigerator 100. Further, the door unit 20 is provided with protective members 10. Each of the protective members 10 prevents breakage of the vacuum thermal insulation 6 that occurs when, for example, a screw 11 used to connect the door unit 20 and the frame assembly 7 to each other sticks in the vacuum thermal insulation 6.

[0017]

(Door Outer Plate 2)

The door outer plate 2 is a sheet metal that is provided with the upper edge door cap 3 at the upper end side, and is provided with the lower edge door cap 4 at the lower end side. The inner plate 5 is provided at a position opposite to the door outer plate 2 with the foam thermal insulation and the vacuum thermal insulation 6 therebetween. A handle part 2A is provided at the upper end side of the door outer plate 2 to allow the user to draw out or close the door body 1. Figs. 2 to 4 illustrate an example of the door outer plate 2 that has a gently curved shape in horizontal section to project from the rear side of the refrigerator 100 toward the front side.

[0018]

(Upper Edge Door Cap 3 and Lower Edge Door Cap 4)

The upper edge door cap 3 is provided at the upper end side of the door outer plate 2 to extend in a horizontal direction of the refrigerator 100. The lower edge door cap 4 is provided at the lower end side of the door outer plate 2 to extend in the horizontal direction of the refrigerator 100. While Embodiment 1 is directed to an example of the door unit 20 provided with two door caps, that is, the upper edge door cap 3 and the lower edge door cap 4, the present invention is not limited to this example. A door cap may be provided at either one of the upper and lower edges of the door unit 20, or a door cap may be provided at each of the four edges, that is, the upper, lower, left, and right edges of the door unit 20.

[0019]

(Inner Plate 5)

The inner plate 5 is opposed to the door outer plate 2 with the foam thermal insulation and the vacuum thermal insulation 6 therebetween. The upper edge door cap 3 is located at the upper side of the inner plate 5, and the lower edge door cap 4 is located at the lower side of the inner plate 5. The inner plate 5 has a planar part 5A that abuts against the vacuum thermal insulation 6, and recesses 5a provided to be recessed in a direction from the front side of the refrigerator 100 toward the rear side with respect to the planar part 5A. As illustrated in Fig. 3, when viewed from the rear side of the door unit 20, the planar part 5A is a portion corresponding to a recess provided in the inner plate 5. A total of two recesses 5a are provided, one at the left and one at the right of the inner plate 5. The two recesses 5a are each provided with two projections 5b that project from the rear side of the refrigerator 100 toward the front side. Each of the projections 5b serves as a guide (locator) at the time of attaching a back panel 8 described later to the inner plate 5.

[0020]

Each of the back panels 8, to which each of the protective members 10 is to be attached, is provided in the recess 5a. Each of the back panels 8 is used to attach a frame 7b1 and a frame 7b2 to the inner plate 5. More specifically, each of the back panels 8 is secured to the inner plate 5 with a screw 9 to support the protective

member 10. Further, each of screws 11 for securing the frame assembly 7 to the door unit 20 is fastened to the back panel 8.

The distal end side of each of the screw 9 and the screws 11 sticks out from the back panel 8 by, for example, about 3 mm to 30 mm. That is, the screw 9 and the screws 11 are connected to the back panel 8 and penetrate the back panel 8. The back panel 8 supports the protective member 10 to ensure that the distal end side of each of the screw 9 and the screws 11 does not damage the vacuum thermal insulation 6 accommodated in the door unit 20.

[0021]

Each of back panel flange parts 8a is provided at the upper end side and lower end side of the back panel 8. Each of the back panel flange parts 8a has a width substantially equal to the width in the horizontal direction of the back panel 8. A portion of each of the back panel flange parts 8a is extended orthogonally to the inner plate 5, and then, from this extended portion, each of the back panel flange parts 8a is extended in parallel to a planar part 10g. Thus, the portion of the back panel 8 that is provided with each of the back panel flange parts 8a has a cranked shape in longitudinal section. As the protective member 10 is fitted in the back panel flange parts 8a, the protective member 10 is supported on the back panel 8. The back panel 8 is provided with a plurality of screw securing holes 8b to which the screws 11 are to be connected, and a hole 8c that is a screw securing hole to which the screw 9 is to be connected.

[0022]

(Protective Member 10)

The protective member 10 prevents the screws 11, which are used to secure the frame assembly 7 to the door unit 20, from damaging and breaking the vacuum thermal insulation 6. The protective member 10 has the planar part 10g with one side being opposed to the back panel 8 and the other side abutting against the vacuum thermal insulation 6, openings 10f1, openings 10f2, and openings 10f3 that are provided at the upper side and lower side of the planar part 10g, and a boss part 10a and four boss parts 10d that are provided on one side of the planar part 10g.

Further, the protective member 10 has flange parts 10c provided at each of the upper end side and lower end side of the planar part 10g, claw parts 10b provided at positions on the flange parts 10c where the openings 10f2 are provided, and claw parts 10b provided at positions on the flange parts 10c where the openings 10f3 are provided. A detailed configuration of the protective member 10 will be described later with reference to Figs. 5 and 6.

[0023]

(Frame Assembly 7)

The frame assembly 7, which is attached to the door unit 20, supports the door unit 20 in such a way that the door unit 20 is able to freely move to open and close the storage compartment (the vegetable compartment 106). When viewed from the front side of the refrigerator 100, the frame assembly 7 has the frame 7b1 attached to the right side of the door unit 20, the frame 7b2 attached to the left side of the door unit 20, and a connection member 7c that connects the frame 7b1 and the frame 7b2 to each other. One end side of the connection member 7c is connected to the frame 7b1, and the other end side is connected to the frame 7b2.

[0024]

The frame 7b1 and the frame 7b2 support a case (not illustrated) located between the frame 7b1 and the frame 7b2 and on which a stored item or the like is placed. One end side of the frame 7b1 is secured to the door unit 20 with the screws 11, and the other end side of the frame 7b1 is provided with a rotating shaft 7a1. Similarly to the frame 7b1, one end side of the frame 7b2 is secured to the door unit 20 with the screws 11, and the other end side of the frame 7b2 is provided with a rotating shaft 7a2. Thus, when the user grips a handle 2A, and moves the door body 1 forward and backward with respect to the refrigerator 100, the rotating shaft 7a1 and the rotating shaft 7a2 move on rails (not illustrated) provided in the vegetable compartment 106. That is, because the frame assembly 7 is provided with the frame 7b1 and the frame 7b2, and the rotating shaft 7a1 and the rotating shaft 7a2, the door body 1 can be slid forward and backward with respect to the

vegetable compartment 106. The frame 7b1 and the frame 7b2 each can be formed by, for example, bending a sheet metal.

[0025]

[Detailed Configuration of Protective Member 10]

5 Fig. 5 illustrates components such as the inner plate 5 and the protective member 10 of the refrigerator 100 according to Embodiment 1 of the present invention. Fig. 6 illustrates the protective member 10 of the refrigerator 100 according to Embodiment 1 of the present invention. A detailed configuration of the protective member 10 will be described below with reference to Figs. 5 and 6.

10 The shape of the protective member 10 is vertically and horizontally symmetric about the position where the boss part 10a described later is provided. The protective member 10 is attached to the back panel 8 in such a way that the protective member 10 is opposed to the distal end sides projecting toward the door unit 20 of the screws 11 that are securing members. A gap P (see Fig. 7) to be filled with the foam thermal insulation is defined between the protective member 10 and the back panel 8. The protective member 10 is made of, for example, resin.

15 [0026]

One side of the planar part 10g faces the screw 9 and the screws 11 penetrating and projecting from the back panel 8, thus preventing the distal end side of each of the screw 9 and the screws 11 from, for example, sticking in the vacuum thermal insulation 6. More specifically, the planar part 10g is provided at a predetermined spacing T (see Fig. 7) from the back panel 8 to define the gap P (see Fig. 7).

20 In the planar part 10g, the opening 10f1, the opening 10f2, and the opening 10f3 are provided at the side of the planar part 10g where the flange part 10c on the upper side is provided, and the opening 10f1, the opening 10f2, and the opening 10f3 are also provided at the side of the planar part 10g where the flange part 10c on the lower side is provided.

25 A cutout 10e is each provided at the side edges of the planar part 10g. More specifically, the planar part 10g is provided with the cutouts 10e so that the width in

the horizontal direction of the planar part 10g is smaller in the portion located between the flange part 10c on the upper side and the flange part 10c on the lower side, than in each of the portions where the flange parts 10c are provided. Similarly to the openings 10f1, the openings 10f2, and the openings 10f3, the cutouts 10e are provided for the purpose of facilitating supply of the foam thermal insulation to the gap P (see Fig. 7) between the planar part 10g and the back panel 8.

[0027]

The opening 10f1, the opening 10f2, and the opening 10f3 are provided at the side where the flange part 10c is provided. The opening 10f1 is provided between the opening 10f2 and the opening 10f3. The opening 10f2 is located on the left side of the opening 10f1 as viewed from the front side of the refrigerator 100, and the opening 10f3 is located on the right side of the opening 10f1 as viewed from the front side of the refrigerator 100. The openings 10f1, the openings 10f2, and the openings 10f3 are provided to ensure that, upon filling the door unit 20 with the foam thermal insulation, the foam thermal insulation is easily supplied to the space (gap P) between the planar part 10g and the back panel 8. The opening 10f2 and the opening 10f3 on the upper side each have the claw part 10b provided at its upper side, and the opening 10f2 and the opening 10f3 on the lower side each have the claw part 10b provided at its lower side. The opening 10f2 and the opening 10f3 each also serve as a press cut hole for forming the claw part 10b. While Figs. 5 and 6 illustrate a case in which two openings 10f1, two openings 10f2, and two openings 10f3, that is, a total of six openings are provided, the present invention is not limited to this example. The number of openings may be either less than six or more than six. Further, while Figs. 5 and 6 illustrate a case in which the opening 10f1 is larger than the opening 10f2 and the opening 10f3, the present invention is not limited to this example. Each of these openings may have the same size.

[0028]

The boss part 10a is a portion into which the portion of the screw 9 projecting from the back panel 8 is inserted. That is, in a state in which the screw 9 is inserted in the boss part 10a, the periphery of the portion of the screw 9 that projects from the

back panel 8 is surrounded by the boss part 10a, thus preventing the screw 9 from
damaging the vacuum thermal insulation 6. The boss part 10a is provided on one
side of the planar part 10g, at the vertically and horizontally central portion of the
planar part 10g. The boss part 10a is provided to project from one side of the planar
part 10g toward the back panel 8. The boss part 10a is provided on one side of the
planar part 10g, and has the function of preventing deformation of the planar part 10g
toward the back panel 8. In addition to preventing breakage of the protective
member 10 itself, preventing the deformation as described above also makes it
possible to prevent the protective member 10 from being deformed and coming into
contact with the vacuum thermal insulation 6 causing damage to the vacuum thermal
insulation 6.

[0029]

Similarly to the boss part 10a, the boss parts 10d are also provided on one side
of the planar part 10g. The boss part 10d is provided in each of four locations on the
planar part 10g around the boss part 10a at the center. More specifically, the two
boss parts 10d on the upper side are located below the positions on the planar part
10g where the opening 10f2 and the opening 10f3 are provided, and the two boss
parts 10d on the lower side are located above the positions on the planar part 10g
where the opening 10f2 and the opening 10f3 are provided. Unlike the boss part
10a, the boss part 10d is not a portion into which a securing member such as the
screw 9 is inserted but has the function of preventing deformation of the planar part
10g toward the back panel 8. In addition to preventing breakage of the protective
member 10 itself, preventing the deformation as described above also makes it
possible to prevent the protective member 10 from being deformed and coming into
contact with the vacuum thermal insulation 6 causing damage to the vacuum thermal
insulation 6.

[0030]

While Figs. 5 and 6 illustrate, by way of example, a case in which four boss
parts 10d are provided, the number of boss parts 10d is not limited to this example.
However, disposing the boss part 10d in each of the four locations as illustrated in

Figs. 5 and 6 allows deformation of the planar part 10g to be prevented uniformly. Further, in a state in which the protective member 10 is attached to the back panel 8, the boss part 10a and the boss parts 10d may project toward the back panel 8 until these boss parts come into abutment against the back panel 8, or may not abut against the back panel 8. Making these boss parts abut against the back panel 8 makes it possible to further prevent deformation of the protective member 10.

[0031]

The flange part 10c is provided at each of the upper end side and lower end side of the planar part 10g. The flange part 10c has a cranked shape when the portion where the flange part 10c is provided is viewed in longitudinal section. That is, a portion of the flange part 10c is extended toward the back panel 8 orthogonally to the upper end side of the planar part 10g, and then, from this extended portion, the flange part 10c is extended in parallel to the planar part 10g. In a state in which the protective member 10 is attached to the back panel 8, the flange parts 10c and the back panel flange parts 8a abut against each other. The flange part 10c on the upper side and the flange part 10c on the lower side are each provided with two claw parts 10b.

The flange part 10c is also provided with the opening 10f1, the opening 10f2, and the opening 10f3. That is, the opening 10f1, the opening 10f2, and the opening 10f3 are provided not only in the planar part 10g but also extend over to the flange part 10c.

[0032]

The claw part 10b is to be fitted to the back panel flange part 8a of the back panel 8, and is used to secure the protective member 10 and the back panel 8 to each other. That is, the protective member 10 is not only connected with the screw 9 but also secured at a position opposite to the back panel 8 as the claw parts 10b are fitted to the back panel flange parts 8a. One of the claw parts 10b on the upper side is provided above a position where the opening 10f2 is provided in the flange part 10c located on the upper side. The other one of the claw parts 10b on the upper side is provided above a position where the opening 10f3 is provided in the flange part 10c

located on the upper side. One of the claw parts 10b on the lower side is provided below a position where the opening 10f2 is provided in the flange part 10c located on the lower side. The other one of the claw parts 10b on the lower side is provided below a position where the opening 10f3 is provided in the flange part 10c located on the lower side.

[0033]

While Embodiment 1 is directed to a case in which the claw parts 10b and the back panel flange parts 8a are provided as units for securing the protective member 10 and the back panel 8 to each other, the present invention is not limited to this example. A fitting engagement mechanism having other shapes may be adopted as well.

[0034]

[Screw 9, Screw 11, Vacuum Thermal Insulation 6, and Other Components]

Fig. 7 is a horizontal sectional view of the door body 1 of the refrigerator 100 according to Embodiment 1 of the present invention. Referring to Fig. 3 mentioned above in addition to Fig. 7, the configuration including the positions of the screw 9 and the screws 11 will be described below.

The back panel 8 of the door unit 20 and the frame 7b2 of the frame assembly 7 are fastened to each other with three screws 11. Similarly, although not illustrated in Fig. 7, other three screws 11 are fastened to the frame 7b1 (see Fig. 3).

[0035]

The screw 9, which corresponds to a back panel securing member, is used to secure the back panel 8 to a predetermined position inside the door unit 20. The screw 9 first penetrates a hole (not illustrated) in the inner plate 5 and the hole 8c (see Fig. 5) in the back panel 8 while the inner plate 5 and the back panel 8 are held between the screw neck of the screw 9 and the protective member 10. Then, the screw 9 is fastened to the boss part 10a of the protective member 10. That is, the screw neck of the screw 9 is pressed against the inner plate 5, and the distal end side of the screw 9 is fastened to the boss part 10a. In a state in which the screw 9 is inserted in the boss part 10a, the portion of the screw 9 projecting from the back

panel 8 is opposed to the planar part 10g at its distal end side, and the periphery of this projecting portion is surrounded by the boss part 10a, thus preventing the screw 9 from damaging the vacuum thermal insulation 6.

The screw 9 also has the function of locating the protective member 10 and the back panel 8 with respect to each other. That is, the worker who manufactures the refrigerator 100 first inserts the screw 9 into the boss part 10a to locate the protective member 10 with respect to the back panel 8. Then, the claw parts 10b and the back panel flange parts 8a are fitted to each other to thereby secure the protective member 10 and the back panel 8 to each other.

[0036]

The screw 11, which corresponds to a securing member, is used to attach the frame assembly 7 to the inner plate 5. The screw 11 first penetrates a hole 7B2 in the frame assembly 7 and a hole 5c in the inner plate 5 while the frame assembly 7 and the inner plate 5 are held between the screw neck of the screw 11 and the back panel 8. Then, the screw 11 is fastened to the screw securing hole 8b of the back panel 8. That is, the screw necks of the screws 11 are pressed against the frame 7b1 and the frame 7b2, and the distal ends of the screws 11 are fastened to the back panel 8, and thus the inner plate 5 is held between the frame 7b1 and the frame 7b2 and the back panel 8.

The distal end of the screw 11 sticks out from the back panel 8 toward the foam thermal insulation (toward the space between the protective member 10 and the back panel 8). That is, unlike the screw 9, the screw 11 is not accommodated in the boss part 10a. However, the planar part 10g of the protective member 10 is disposed at a position opposite to the distal end of the screw 11, thus preventing the distal end of the screw 11 from damaging the vacuum thermal insulation 6.

[0037]

The vacuum thermal insulation 6 is provided while abutting against the recesses 5a, and the spacing between the vacuum thermal insulation 6 and the planar parts 10g of the protective members 10 correspond to the spacing between the abutment surface of the recesses 5a and the planar parts 10g. As illustrated in Fig.

7, the planar part 10g of the protective member 10 is provided at a predetermined spacing S from the vacuum thermal insulation 6. The spacing S is set by taking deformation of the vacuum thermal insulation 6 into consideration. For example, the spacing S may be set to about several millimeters. Depending on the shape of the inner plate 5, the shape of the vacuum thermal insulation 6, and the like, the spacing S may be set to about 0 mm to 30 mm.

[0038]

[Assembly and Other Processes]

After the back panel 8 is secured in place with the screw 9, the inner plate 5 with the protective member 10 fitted with the back panel 8, and the vacuum thermal insulation 6 are adhered and secured to each other by means of an adhesive substance such as a double-faced tape. That is, as illustrated in Fig. 7, for example, the planar part 5A of the inner plate 5 and the vacuum thermal insulation 6 are adhered to each other. After the vacuum thermal insulation 6 and the inner plate 5 are adhered to each other, the door outer plate 2 that is a sheet metal, the upper edge door cap 3, and the lower edge door cap 4 are attached. Then, the foam thermal insulation is filled into the internal space defined by the inner plate 5, the door outer plate 2, the upper edge door cap 3, and the lower edge door cap 4. The foam thermal insulation to be filled into the internal space is distributed across the internal space except the portion of the vacuum thermal insulation 6. That is, the protective member 10 is provided with the cutouts 10e, the openings 10f1, the openings 10f2, and the openings 10f3, which allows the foam thermal insulation to readily flow also into the gap P (see Fig. 7) that is the space between the protective member 10 and the back panel 8.

[0039]

[Advantageous Effects of Refrigerator 100 According to Embodiment 1]

The refrigerator 100 according to Embodiment 1 adopts a configuration in which the screw 9 and the screws 11, which stick out from the inner plate 5 toward the vacuum thermal insulation 6, are protected by the boss part 10a and the planar part 10g of the protective member 10 so that these screws do not damage the vacuum

thermal insulation 6. This configuration makes it possible to prevent breakage of the vacuum thermal insulation 6.

[0040]

In the refrigerator 100 according to Embodiment 1, the protective member 10 can be provided to the door unit 20 by fitting the claw parts 10b of the protective member 10 to the back panel flange parts 8a of the back panel 8. Thus, there is no need for the operation process of embossing the vacuum thermal insulation 6 to reduce its thickness, thus making it possible to minimize an increase in manufacturing cost, and also minimize a decrease in thermal insulation performance due to reduced thickness.

[0041]

In the refrigerator 100 according to Embodiment 1, spacing is provided between the protective member 10 and the back panel 8, which allows the foam thermal insulation to flow into the space between the protective member 10 and the back panel 8, thus minimizing a decrease in the strength of the portion of the door body 1 where the protective member 10 is provided. Further, the protective member 10 is provided with the cutouts 10e, the openings 10f1, the openings 10f2, and the openings 10f3, which provide more routes for inflow of the foam thermal insulation, thus further facilitating flow of the foam thermal insulation into the space between the protective member 10 and the back panel 8. This configuration further minimizes a decrease in the strength of the door body 1 of the refrigerator 100.

[0042]

While Embodiment 1 above is directed to the case in which the screw 9 and the screws 11 are used as securing members, the present invention is not limited to this example. A nail, a bolt, or the like may be used instead to obtain advantageous effects similar to those of the refrigerator 100 according to Embodiment 1.

[0043]

Embodiment 2

In Embodiment 1 described above, the back panel flange part 8a is each provided at the upper end and lower end of the back panel 8. Further, the protective

member 10 is attached to the back panel 8 by fitting the claw part 10b, which is provided in two locations at each of the top and bottom of the protective member 10, into place. In this regard, the flowability of the foam thermal insulation depends on factors such as its material, density, and door geometry. Thus, to improve the flowability of the foam thermal insulation, the back panel 8 described in Embodiment 1 may be rotated by 90 degrees while being oriented in parallel to the inner plate 5, and then the back panel 8 may be secured to the inner plate 5 in that state. That is, the back panel flange part 8a is each located at the right side end and the left side end of the back panel 8.

[0044]

The back panel 8 may have the back panel flange part 8a each provided both at the upper side end and lower side end of the back panel 8 and at the right side end and left side end of the back panel 8. If the back panel 8 is rotated by 90 degrees to improve the flowability of the foam thermal insulation, the back panel 8 may be configured to allow the protective member 10 to be attached to the back panel 8 even when the back panel flange parts 8a are provided not only at the top and bottom but also at the left and right of the back panel 8. That is, the back panel 8 may be configured so that a first back panel flange part is each provided at its upper side end and lower side end, and a second back panel flange part is each provided at its right side end and left side end. In this case, the protective member 10 may be attached to the back panel 8 in such a way that the claw part 10b is each located at the top and the bottom, or the protective member 10 may be attached to the back panel 8 after being rotated by 90 degrees. This configuration obviates the need for unnecessarily creating a new mold, thus minimizing mold investment. Further, assembly of the protective member 10 is easy as in Embodiment 1, and since the back panel flange part 8a is each provided in four locations, the abutment surface at the fronts and backs of the flanges against the foam thermal insulation increases, thus enabling fabrication of the door body 1 and the refrigerator 100 that have high strength.

Reference Signs List

[0045]

1 door body 2 door outer plate 2A handle part 3 upper edge door
cap 4 lower edge door cap 5 inner plate 5A planar part 5a recess 5b
projection 5c hole 6 vacuum thermal insulation 7 frame assembly 7B2
hole 7a1 rotating shaft 7a2 rotating shaft 7b1 frame 7b2 frame 7c
5 connection member 8 back panel 8a back panel flange part 8b screw
securing hole 8c hole 9 screw 10 protective member 10a boss part 10b
claw part 10c flange part 10d boss part 10e cutout 10f1 opening 10f2
opening 10f3 opening 10g planar part 11 screw 20 door unit 100
refrigerator 102 refrigerating compartment 102a refrigerating compartment door
10 102b refrigerating compartment door 103 ice making compartment 104
switching compartment 105 freezing compartment 106 vegetable compartment
110 operating device P gap S spacing T spacing

CLAIMS

[Claim 1]

A refrigerator door comprising:

a door unit accommodating a vacuum thermal insulation between a door outer plate and an inner plate, the door unit being filled with a foam thermal insulation;

a frame attached to the inner plate of the door unit, the frame supporting the door unit such that the door unit is movable with respect to a refrigerator body;

a back panel provided inside the door unit, the back panel being secured to the inner plate;

a securing unit configured to secure the frame to the back panel through the inner plate; and

a protective member provided inside the door unit, the protective member being attached to the back panel and provided between the vacuum thermal insulation and the back panel,

the foam thermal insulation being filled into a gap defined between the protective member and the back panel.

[Claim 2]

The refrigerator door of claim 1,

wherein the protective member includes

a planar part provided at a predetermined spacing from the back panel, the planar part defining the gap between the back panel and itself,

a flange part provided to the planar part, and

a claw part provided to the flange part, the claw part being fitted to the back panel, and

wherein the planar part has

a one side being opposed to the back panel and a distal end side of the securing unit projecting toward inside the door unit, and

an other side being opposed to the vacuum thermal insulation.

[Claim 3]

The refrigerator door of claim 2, wherein the protective member includes
a cutout provided at a side edge of the planar part, and
an opening provided to at least one of an upper end side and a lower end side
5 of the planar part.

[Claim 4]

The refrigerator door of claim 2 or 3, wherein the back panel includes at least
one back panel flange part located opposite to the flange part of the protective
member, the back panel being fitted with the claw part.

10 [Claim 5]

The refrigerator door of claim 4,
wherein the at least one back panel flange part includes a first back panel
flange part and a second back panel flange part,
wherein the back panel includes
15 the first back panel flange part each provided at an upper end side and a
lower end side of the back panel, and
the second back panel flange part each provided at a right end side and
a left end side of the back panel, and
wherein the claw part of the protective member is fitted to the first back panel
20 flange part or the second back panel flange part.

[Claim 6]

The refrigerator door of any one of claims 1 to 5,
wherein the back panel is secured by a back panel securing member, the back
panel securing member being inserted into the inner plate of the door unit and
25 fastened at a distal end side to the protective member,
wherein the inner plate of the door unit and the back panel each include a hole
inserted by the back panel securing member, and
wherein the protective member includes a boss part to fasten the back panel
securing member.

[Claim 7]

The refrigerator door of any one of claims 1 to 6, wherein the vacuum thermal insulation is accommodated in the door unit so as to be located at a front side of the protective member.

5 [Claim 8]

The refrigerator door of any one of claims 1 to 7,
wherein the door outer plate constitutes an outer shell on a front side of the door unit, and

10 wherein the inner plate constitutes an outer shell on an inside surface of the door unit.

[Claim 9]

The refrigerator door of any one of claims 1 to 8,
wherein the securing unit comprises a screw which secures the frame to the back panel through the inner plate.

15 [Claim 10]

A refrigerator comprising the refrigerator door of any one of claims 1 to 9.