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 body 1, 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 project 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 the recess 5a 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

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 20A, 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]

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.

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.

[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).

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.

A cutout 11e 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

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 frame assembly 7 and the inner plate 5 are 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.

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 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 11e cutout 20 door unit 20A handle 100 refrigerator 102 refrigerating compartment 102a refrigerating compartment door 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

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

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]

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.

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.

[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).

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.

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

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.

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 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 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