DESCRIPTION

Title of Invention

REFRIGERATOR

Technical Field

[0001]

The present invention relates to refrigerators, and in particular, relates to ear folding for a vacuum thermal insulator to be included in a refrigerator.

Background Art

[0002]

Home appliances are strongly required to achieve energy saving. For refrigerators, for example, a space defined between an outer case and an inner case of a refrigerator is filled with heat insulating foam, thereby preventing leakage of cold air from the refrigerator and entry of heat into the refrigerator. To further achieve energy saving in the refrigerators, there is an increasing demand for heat insulating materials having excellent thermal insulation performance.

[0003]

For example, a recently developed refrigerator has a structure in which a space defined between an outer case and an inner case of the refrigerator is filled with not only heat insulating foam but also a vacuum thermal insulator. This structure is made such that the space receiving the vacuum thermal insulator is filled with the heat insulating foam supplied through an injection port located in a rear surface of the refrigerator. The refrigerator can provide reliable thermal insulation. The vacuum thermal insulator is formed by inserting a core, serving as a spacer, into an enclosure having gas barrier properties, depressurizing the enclosure in, for example, a compression manner, and sealing the enclosure.

[0004]

In this case, for example, the core of the vacuum thermal insulator is shaped to fit in a space. A peripheral portion of the enclosure is subjected to, for example, welding, so that air does not enter the enclosure after the depressurization. The

The refrigerator 100 according to Embodiment 1 includes a refrigerant circuit (refrigeration cycle apparatus) to cool spaces inside the storage compartments. The refrigerant circuit includes a cooler 14, a compressor 15, a condenser, and a capillary tube, which are connected by pipes. Fig. 2 illustrates the cooler 14 and the compressor 15. The compressor 15 sucks refrigerant, compresses the refrigerant into a high temperature, high pressure state, and discharges the refrigerant. The condenser allows the refrigerant to dissipate heat such that the refrigerant condenses and liquefies. In Embodiment 1, a radiating pipe 16, which will be described later, functions as a condenser. The capillary tube (capillary), serving as an expansion device, reduces the pressure of the refrigerant passing through the capillary tube to expand the refrigerant. The cooler 14 allows the refrigerant to exchange heat with air such that the refrigerant evaporates and gasifies. The air cooled by the cooler 14 is delivered to the storage compartments by a fan (not illustrated). The volume of cold air (or the volume of air) delivered to each storage compartment is regulated by a motor-driven opening-closing damper (not illustrated) disposed in an air passage between the cooler 14 and the storage compartment.

[0017]

For the refrigerant circulated in the refrigeration cycle apparatus, isobutane (R600a) is used in Embodiment 1. Although any other refrigerant may be used, isobutane has advantages in that, for example, it does not destroy the ozone layer when wasted and has low global warming potential.

[0018]

As illustrated in Fig. 2, a control board 13, serving as a controller, controls a temperature in each of the storage compartments and a rotation speed of the compressor 15 in the refrigerator 100, for example. The control board 13 is disposed in upper rear part of the refrigerator main body 1.

[0019]

Fig. 3 is a diagram explaining the configuration of a refrigerator box 1a in Embodiment 1 of the present invention. The refrigerator box 1a includes an outer case 20, serving as a shell of the refrigerator main body 1, and an inner case 30 that

As illustrated in Fig. 13, in first paths in the side of the refrigerator 100, the polyurethane foam liquid raw material flows from a rear surface of the refrigerator 100 to the front surface thereof, flows to central part of the refrigerator 100 in the front surface, and then foams such that the space is filled with the heat insulating foam 40. In second paths, the polyurethane foam liquid raw material flows to central part of the refrigerator 100 in the rear surface of the refrigerator 100, flows from the rear surface of the refrigerator 100 to the front surface thereof, and then foams such that the space is filled with the heat insulating foam 40.

[0041]

For example, if the unfixed portion 49 is filled with the heat insulating foam 40 before the air between the ear 46 and the vacuum thermal insulator main body 47 is released, the air would be trapped between the ear 46 and the vacuum thermal insulator main body 47. For this reason, it is preferred that the unfixed portion 49 be located in a position corresponding to the last portion (space) to be filled with the heat insulating foam 40. In Embodiment 1, as described above, the unfixed portion 49 is formed in the middle part of the vacuum thermal insulator 41 in the longitudinal direction of the vacuum thermal insulator 41 such that the unfixed portion 49 is located adjacent to the front surface of the refrigerator 100. This location is the farthest position from the injection ports 23a and 23c. Forming the unfixed portion 49 allows the air between the ear 46 and the vacuum thermal insulator main body 47 to escape.

[0042]

Fig. 14 is a diagram illustrating a positional relationship between the vacuum thermal insulator 41 adjacent to the rear surface and the injection ports 23 in Embodiment 1 of the present invention. As illustrated in Fig. 14, for example, two unfixed portions 49 of the ear 46 are formed in the vacuum thermal insulator 41 to be fixed adjacent to the rear surface on the basis of the fill paths for the heat insulating foam 40. In the vacuum thermal insulator 41 in Embodiment 1, the unfixed portions 49 of the vacuum insulator 41 are located so as to correspond to the midpoint

CLAIMS

[Claim 1]

A refrigerator including a vacuum thermal insulator, the vacuum thermal insulator comprising:

a core; and

an enclosure containing the core and having a depressurized inside,

the refrigerator including an inner case and an outer case constituting a refrigerator box,

the vacuum thermal insulator including inside a main body portion in which the core is contained and a peripheral portion in which the core is not disposed, and

the peripheral portion including

a fixed portion that is folded over the main body portion and fixed to the main body portion and

an unfixed portion that is not fixed to the main body portion,

the inner case having a spacer configured to hold the unfixed portion of the peripheral portion.

[Claim 2]

A refrigerator including a vacuum thermal insulator, the vacuum thermal insulator comprising:

a core; and

an enclosure containing the core and having a depressurized inside,

the refrigerator including an inner case and an outer case,

the vacuum thermal insulator including inside a main body portion in which the core is contained and a peripheral portion in which the core is not disposed,

the peripheral portion including

a fixed portion that is folded over the main body portion, and fixed to the main body portion and

an unfixed portion that is not fixed to the main body portion,

the outer case having injection ports for injecting a foam thermal insulation material filled between the outer case and the inner case at two or more positions,

two injection ports of the injection ports being provided at two positions in a height direction of the refrigerator, the vacuum thermal insulator having the unfixed portion at a position substantially in a midpoint between the two injection ports.

[Claim 3]

The refrigerator of claim 1 or 2,

wherein the vacuum thermal insulator has a surface with the folded peripheral portion is disposed in a space between the outer case and the inner case constituting the refrigerator box such that the surface with the folded peripheral portion faces the inner case.

[Claim 4]

The refrigerator of claim 3 as dependent on claim 2, wherein the inner case includes a spacer configured to hold the unfixed portion of the peripheral portion.

[Claim 5]

The refrigerator of claim 3 as dependent on claim 1, wherein the outer case has injection ports for injecting a foam thermal insulation material filled between the outer case and the inner case at two or more positions.

[Claim 6]

The refrigerator of claim 5, wherein

two injection ports of the injection ports are provided at two positions in a height direction of the refrigerator, and

the vacuum thermal insulator has the unfixed portion located at a position substantially in a midpoint between the two injection ports.

[Claim 7]

The refrigerator of claim 5, wherein

two injection ports of the injection ports are provided at two positions in a width direction of the refrigerator, and

the vacuum thermal insulator has the unfixed portion located at a position substantially in a midpoint between the injection ports at the two positions.