

DESCRIPTION

Title of Invention

REFRIGERATOR

Technical Field

5 [0001]

The present invention relates to a refrigerator, and more specifically to a refrigerator having a structure that supports rails provided at the door of a storage compartment.

Background Art

10 [0002]

Various refrigerators including drawer-type doors have been proposed (see, for example, Patent Literature 1). To such a drawer-type door, movable rails are attached, and are movable forwards and backwards. At lower portions of the movable rails, rollers are provided to move over stationary rails fixed to a storage compartment. At upper portions of the movable rails, flanges are provided and supported by support elements rotatably attached to the storage compartment. The stationary rails described in Patent Literature 1 are formed integrally with a partition element that partitions the storage compartment.

[0003]

20 A surface side of a storage container along a lateral direction thereof is tapered.

The surface side of the storage container is located closer to the center of the storage compartment than the support elements in the lateral direction of the storage compartment. Therefore, in the case where the positions of the support elements in the vertical direction are low, an upper portion of the storage container does not need to be located closer to the center of the storage compartment than the support elements in the lateral direction of the storage compartment. In other words, in the case where the positions of the support elements are low in the vertical direction, the upper portion of the storage container may be located above the support elements. Therefore, in the case where the positions of the support elements are low in the vertical direction, it is possible to reduce the degree to which the volume of the storage container is

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decreased. In the refrigerator described in Patent Literature 1, rotatable support elements are located at a lower portion of the storage compartment, and it is therefore possible to reduce the degree to which the volume of the storage container is decreased.

5 Citation List

Patent Literature

[0004]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 11-6683

10 Summary of Invention

Technical Problem

[0005]

15 In the case where stationary rails are formed integrally with a partition element, there is a case where the stationary rails are formed to have a greater thickness than that of the partition element in order to ensure that the stationary rails have a sufficient strength. However, in such a manner, if these parts are formed to have different thickness, it is more likely that a failure will occur in formation of the parts.

[0006]

20 The present invention has been made to solve the above problem, and an object of the invention is to provide a refrigerator that is formed to reduce the degree to which the volume of a storage container is decreased, and also reduce occurrence of a failure in formation of parts.

Solution to Problem

[0007]

25 A refrigerator according to an embodiment of the present invention includes a refrigerator body, a partition element, a door, a first movable rail, a storage container, a first rotary element, a first support element, and a first stationary rail. The refrigerator body includes an inner case. The partition element separates a first storage compartment provided in the inner case and a second storage compartment provided in the inner case and located below the first storage compartment. The door is provided

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to open and close the first storage compartment. The first movable rail is attached to the door. The storage container is provided on the first movable rail. The first rotary element is attached to the first movable rail, and is rotatable. The first support element is provided at the first storage compartment to support the first movable rail. The first stationary rail is provided below the first support element and on an upper surface of the partition element. The first stationary rail is inserted in the partition element such that the first stationary rail and the partition element are provided as a single body.

Advantageous Effects of Invention

[0008]

According to the embodiment of the present invention, by virtue of the above configuration, it is possible to reduce the degree to which the volume of the container is decreased, and also reduce occurrence of a failure in formation of parts.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a perspective view of a refrigerator 1 according to an embodiment.

[Fig. 2A] Fig. 2A is a cross-sectional view of the refrigerator 1 according to the embodiment, which is taken along a height direction and a front-and-back direction of the refrigerator 1.

[Fig. 2B] Fig. 2B is a cross-sectional view of the refrigerator 1 according to the embodiment, which is taken along a direction perpendicular to the cross-section of Fig. 2A.

[Fig. 3A] Fig. 3A is a perspective view of the refrigerator 1 according to the embodiment in the case where a freezer compartment door 7 is drawn out.

[Fig. 3B] Fig. 3B is a top view of a partition element 44 and a stationary rail 43 of the refrigerator 1 according to the embodiment.

[Fig. 3C] Fig. 3C is an explanatory diagram of a freezer compartment 13 of the refrigerator according to the embodiment.

[Fig. 4A] Fig. 4A, (a), is a side view of the freezer compartment door 7 of the freezer compartment 13, the stationary rail 43, a movable rail 40, and a freezer case 60

in the refrigerator 1 according to the embodiment; Fig. 4A, (b,) illustrates a structure for drawing the freezer compartment door 7 inwards in a direction Dr1; and Fig. 4A, (c), illustrates configurations of a first stopper 47A and other elements.

[Fig. 4B] Fig. 4B illustrates the refrigerator 1 according to the embodiment in the case where the freezer compartment door 7 is drawn out.

[Fig. 4C] Fig. 4C illustrates the refrigerator 1 according to the embodiment in the case where the door is further drawn out than in the state illustrated in Fig. 4B.

[Fig. 4D] Fig. 4D is an explanatory diagram of the stationary rail 43 and the vicinity thereof in the refrigerator 1 according to the embodiment.

[Fig. 5A] Fig. 5A is an exploded perspective view of the partition element 44 and the stationary rail 43 in the refrigerator 1 according to the embodiment.

[Fig. 5B] Fig. 5B is a front view of the partition element 44 and the stationary rail 43 in the refrigerator 1 according to the embodiment.

[Fig. 5C] Fig. 5C is a side view of the partition element 44 and the stationary rail 43 in the refrigerator 1 according to the embodiment.

[Fig. 5D] Fig. 5D is an explanatory diagram of the stationary rail 43, the movable rail 40, a rotary element 42, and a support element 41 in the refrigerator 1 according to the embodiment.

[Fig. 6A] Fig. 6A is a cross-sectional view of a vacuum heat insulator HI1 and a foam heat insulator HI2 of the partition element 44 in the refrigerator 1 according to the embodiment.

[Fig. 6B] Fig. 6B is an explanatory drawing of a vacuum heat insulator HI3 and a foam heat insulator HI4 of a partition element 45 in the refrigerator 1 according to the embodiment.

[Fig. 7A] Fig. 7A illustrates modification 1 of the refrigerator 1 according to the embodiment.

[Fig. 7B] Fig. 7B illustrates modification 2 of the refrigerator 1 according to the embodiment.

Description of the embodiments

[0010]

The embodiment of the present invention will be described below with reference to the drawings. In the figures including Fig. 1, which will be referred to below, the positional relationship between components may be different from the actual one. It should be noted that in each of the figures including Fig. 1, components which are the same as or equivalent to those in a previous figure or figures are denoted by the same reference signs. The same is true of the entire text of the specification. Furthermore, the configurations of components described throughout the specification are mere examples of actual configurations of the components, that is, the configurations of the components are not limited to those described in the specification.

[0011]

Embodiment

Fig. 1 is a perspective view of a refrigerator 1 according to the embodiment.

Fig. 2A is a cross-sectional view of the refrigerator 1 according to the embodiment, which is taken along a height direction of the refrigerator 1 and a front-and-back direction of the refrigerator 1, which is a direction from one of front and back sides of the refrigerator 1 toward the other.

Fig. 2B is a cross-sectional view of the refrigerator 1 according to the embodiment, which is taken along a direction perpendicular to the cross-section of Fig. 2A.

Fig. 2B does not depict shelves 50 on which articles are placed or a freezer case 60 that accommodates an article to be preserved.

[0012]

A direction Dr1 is the front-and-back direction of the refrigerator 100.

A direction Dr2 is a lateral direction of the refrigerator 100.

A direction DR3 is the height direction of the refrigerator 100.

[0013]

[Outline of Refrigerator 1]

A refrigerator 1 includes a housing 2 in which a storage compartment is provided. The storage compartment stores articles. The housing 2 includes an outer case 2t1 and an inner case 2t2. Between the outer case 2t1 and the inner case 2t2, a foam

heat insulator or another heat insulation material is provided. Also, in the housing 2, a refrigerator compartment 10, an ice-making compartment 11, a versatile compartment 12, a freezer compartment 13, and a vegetable compartment 14 are provided.

Hereinafter, one or more of the refrigerator compartment 10, the ice-making
5 compartment 11, the versatile compartment 12, the freezer compartment 13, and the vegetable compartment 14 will be sometimes referred to also as a storage compartment as a matter of convenience. The housing 2 includes a rail 80A and a rail 80B, which are provided to support shelves 50. The rail 80A and the rail 80B face each other.

[0014]

10 At the front of the refrigerator compartment 10, a refrigerator compartment door 3 and a refrigerator compartment door 4 are provided; at the front of the ice-making compartment 11, an ice-making compartment door 5 is provided; at the front of the versatile compartment 12, a versatile compartment door 6 is provided; at the freezer compartment 13, a freezer compartment door 7 is provided; and at the front of the
15 vegetable compartment 14, a vegetable compartment door 8 is provided. The freezer compartment door 7 corresponds to a door of the present invention; the freezer compartment 13 corresponds to a first storage compartment of the present invention; and the vegetable compartment 14 is a second storage compartment of the present invention.

20 Furthermore, the housing 2 includes a refrigerator compartment duct 30, a vegetable compartment duct 31, and a versatile compartment duct 32. The refrigerator compartment door 3 and the refrigerator compartment door 4 are double doors. At the outer surface of the refrigerator compartment door 3, an operation panel 9 is provided. The ice-making compartment door 5, the versatile compartment door 6, the freezer
25 compartment door 7, and the vegetable compartment door 8 are drawer-type doors.

[0015]

In the refrigerator compartment 10, a plurality of door pockets 10C are provided to allow articles to be placed therein, and to store the articles when the refrigerator compartment door 3 and the refrigerator compartment door 4 are closed. The door
30 pockets 10C are attached to the refrigerator compartment door 3 and the refrigerator

compartment door 4. In the refrigerator compartment 10, a slider-type case 10A and a slider-type case 10B located below the case 10A are provided.

[0016]

In the ice-making compartment 11, an ice-making device (not illustrated) and an ice-making case (not illustrated) are provided. The ice-making device is a device which makes ice. The ice-making case is a case which stores the made ice. In the versatile compartment 12, a versatile compartment case 12A in which an article to be stored is placed is provided. In the versatile compartment 12, a cold storage temperature zone can be switched to various temperature zones such as a freezing temperature zone (for example, approximately -18 degrees C), a refrigeration temperature zone (for example, approximately 3 degrees C), a chilling temperature zone (for example, approximately 0 degrees C), and a soft freezing temperature zone (for example, -7 degrees C).

In the freezer compartment 13, a freezer case 13A and the freezer case 60 are provided. The freezer case 13A is a case in which an article to be stored is placed, and the freezer case 60 is located under the freezer case 13A. The freezer case 60 corresponds to a storage container of the present invention. Furthermore, in the vegetable compartment 14, a vegetable compartment case 14A and a vegetable compartment case 14B are provided. In the vegetable compartment case 14A and the vegetable compartment case 14B, articles are stored. The freezer case 60 is made of resin. The freezer case 60 is shaped in such a way as to increase in width from the bottom toward the top. That is, side surfaces of the freezer case 60 are inclined. This is intended to enable the freezer case 60 to be easily removed from a mold after the freezer case 60 is formed.

[0017]

In the housing 2 of the refrigerator 1, a compressor 20 and a heat exchanger 21 are provided. The compressor 20 compresses refrigerant, and the heat exchanger 21 operates as an evaporator. The compressor 20 is located in a machine compartment 15 provided at a bottom portion of the housing 2. The heat exchanger 21 serves as a cooler in the refrigerator 1, and is located above the compressor 20. Furthermore,

although it is not illustrated, the refrigerator 1 is provided with, for example, a radiating pipe serving as a radiator and a pressure-reducing mechanism which reduces the pressure of refrigerant. The refrigerator 1 includes a refrigeration cycle system in which the compressor 20, the radiating pipe, the pressure reducing mechanism, and the heat exchanger 21 are connected. As the pressure-reducing mechanism, for example, a capillary tube can be used.

[0018]

In the housing 2 of the refrigerator 1, a cooling fan 22 is provided. The cooling fan 22 supplies air (cold air) cooled in the heat exchanger 21 to various compartments such as the refrigerator compartment 10. The cooling fan 22 is located above the heat exchanger 21. Cold air from the cooling fan 22 is supplied via the refrigerator compartment duct 30 and the versatile compartment duct 32 to the refrigerator compartment 10, the ice-making compartment 11, the versatile compartment 12, and the freezer compartment 13. It should be noted that the vegetable compartment 14 is supplied with cold air via a return air passage (not illustrated) through which cold air in the refrigerator compartment 10 passes. Cold air in the vegetable compartment 14 is returned to the heat exchanger 21 via the vegetable compartment duct 31.

[0019]

In addition, although it is not illustrated, the refrigerator 1 is provided with a temperature sensor that detects the temperature of a storage compartment, and a controller that controls the rotation speed of the cooling fan 22 and the opening and closing of each of a refrigerator compartment damper 24 and a versatile compartment damper 23. The temperature sensor may be, for example, a thermistor. The controller controls the operation, stopping, rotation speed and other operating conditions of the compressor 20. The controller is, for example, a control board on which a microcomputer, etc., are mounted.

[0020]

[Regarding Freezer Compartment 13]

Fig. 3A is a perspective view of the refrigerator 1 according to the embodiment in the case where the freezer compartment door 7 is drawn out.

Fig. 3B is a top view of a partition element 44 and stationary rails 43 of the refrigerator according to the embodiment.

Fig. 3C is an explanatory diagram of the freezer compartment 13 of the refrigerator according to the embodiment.

5 In Fig. 3A, depiction of the freezer case 60 and the freezer case 13A is omitted. Also, in Fig. 3A, a support element 41 and a rotary element 42 are depicted as a matter of convenience; however, actually, they are hidden by a movable rail 49.

[0021]

10 The refrigerator 100 includes the freezer compartment door 7, a pair of movable rails 40 attached to the freezer compartment door 7, a pair of support elements 41 that support the movable rails 40, and a pair of stationary rails 43 that support the movable rails 40. The refrigerator 100 also includes a partition element 45 that separates each of the ice-making compartment 11 and the versatile compartment 12 and the freezer compartment 13 from each other and the partition element 44 that separates the freezer compartment 13 and the vegetable compartment 14 from each other. The refrigerator 15 100 further includes a reinforcing element 46. One of ends of the reinforcing element 46 is provided at one of the movable rails 40, and the other end is provided at the other movable rail 40. The pair of movable rails 40 corresponds to a first movable rail and a second movable rail of the present invention. The pair of support elements 41 20 corresponds to a first support element and a second support element of the present invention. The pair of stationary rails 43 corresponds to a first stationary rail and a second stationary rail of the present invention. The reinforcing element 46 corresponds to a first reinforcing element of the present invention.

[0022]

25 A front portion of the freezer compartment door 7 is a design surface. The freezer compartment door 7 is provided to open and close the freezer compartment 13. The user moves the freezer compartment door 7 forwards or backwards to open or close the freezer compartment 13. The pair of movable rails 40 are attached to a back portion of the freezer compartment door 7. The movable rails 40 are attached to the 30 freezer compartment door 7 by fixing means such as screws.

[0023]

The movable rails 40 are provided parallel to the direction Dr1. The movable rails 40 are movable in the direction Dr1 and in an opposite direction to the direction Dr1. The movable rails 40 are supported by the respective support elements 41. The rotary elements 42 are attached to the respective movable rails 40. To be more specific, the refrigerator 1 includes a pair of rotary elements 42. The pair of rotary elements 42 corresponds to a first rotary element and a second rotary element of the present invention. As the freezer compartment door 7 is drawn out, the rotary elements 42 are rolled on the stationary rails 43. Thereby, the user can more easily draw out the freezer compartment door 7. Front end portions of the movable rails 40 are attached to the freezer compartment door 7, and rear end portions of the movable rails 40 are attached to the respective rotary elements 42. The reinforcing element 46 is provided at the movable rails 40. The freezer case 60 is placed on the movable rails 40. That is, the movable rails 40 support the freezer case 60. The freezer case 60 can be freely detached from the movable rails 40, and the user can thus easily clean the freezer case 60.

[0024]

The freezer compartment 13 is defined by the partition element 44, the partition element 45, the inner case 2t2, etc. The freezer compartment 13 is surrounded by a first surface 2A of the inner case 2t2, a second surface 2B of the inner case 2t2, an upper surface 44A of the partition element 44, and a lower surface 45B of the partition element 45. The first surface 2A and the second surface 2B face each other. The first surface 2A and the second surface 2B are orthogonal to the direction Dr2. One of the stationary rails 43 is fixed to the first surface 2A, and the other is fixed to the second surface 2B.

[0025]

One of ends of the reinforcing element 46 is provided at one of the movable rails 40, and the other is provided at the other movable rail 40. The reinforcing element 46 and the movable rails 40 may or may not be fixed to each other. The reinforcing element 46 is provided to reduce sagging of the freezer case 60. The reinforcing

element 46 is a plate-like element. To be more specific, when an article to be stored is placed in the freezer case 60, there is a case where the freezer case 60 is sagged because of the weight of the article. Since the reinforcing element 46 is provided at the movable rails 40, the total area of components that support the freezer case 60 includes not only the areas of the movable rails 40 but the area of the reinforcing element 46. By virtue of this configuration, it is possible to reduce sagging of the freezer case 60, thus avoiding damage or breakage of the freezer case 60.

[0026]

Fig. 4A, (a), is a side view of the freezer compartment door 7 of the freezer compartment 13, the stationary rail 43, the movable rail 40, and the freezer case 60 in the refrigerator 1 according to the embodiment. Fig. 4A, (b), illustrates a structure for drawing the freezer compartment door 7 inwards in the direction Dr1. Fig. 4A, (c), illustrates configurations of a first stopper 47A and other elements.

Fig. 4B illustrates the refrigerator 1 according to the embodiment in the case where the freezer compartment door 7 is drawn out.

Fig. 4C illustrates the refrigerator 1 according to the embodiment in the case where the door is further drawn out than in the state as illustrated in Fig. 7A.

Fig. 4D is an explanatory diagram of the stationary rail 43 and the vicinity thereof in the refrigerator 1 according to the embodiment.

[0027]

The movable rails 40 each include a catching portion 40C that contacts the support element 41. The catching portion 40C includes an inclined surface portion 47C as illustrated in Fig. 4A, (b), the first stopper 47A and a second stopper 47B as illustrated in Fig. 4A, (c). The inclined surface portion 47C is inclined downwards to the direction Dr1. Because of this configuration, when the freezer compartment door 7 is moved to close the freezer compartment 13, it is drawn. Thus, the user can more easily move the freezer compartment door 7 when closing the freezer compartment door 7. Furthermore, because of the presence of the inclined surface portion 47C in the refrigerator 1, it is possible to prevent the freezer compartment from being unintentionally opened. Furthermore, when the freezer compartment door 7 is drawn

from the freezer compartment 13, the support element 41 and the first stopper 47A come into contact with each other. The state at this time is depicted in Fig. 4B. When the freezer compartment door 7 is further drawn out from the freezer compartment 13, the support element 41 and the second stopper 47B come into contact with each other.

5 The state at this time is depicted in Fig. 4C.

[0028]

The support elements 41 are provided on a front side of the freezer compartment 13. That is, when the freezer compartment 13 is sealed by the freezer compartment door 7, the support elements 41 are located close to a rear surface portion of the freezer compartment door 7. Also, the support elements 41 are provided on a lower side of the freezer compartment 13. One of the support elements 41 is fixed to the first surface 2A, and the other is fixed to the second surface 2B.

[0029]

The stationary rails 43 are provided on the partition element 44. Lower portions of the stationary rails 43 are in contact with the partition element 44. One of the stationary rails 43 is in contact with and fixed to the first surface 2A of the inner case 2t2, and the other is in contact with and fixed to the second surface 2B of the inner case 2t2. The stationary rails 43 are located below the support elements 41. Also, one of the stationary rails 43 is located between an associated one of the movable rails 40 and the first surface 2A, and the other stationary rail 43 is located between the other of the movable rails 40 and the second surface 2B. The rotary elements 42 are rotated on the respective stationary rails 43. The stationary rails 43 are parallel to the direction Dr1. Each of the stationary rail 43 is partially inserted into the partition element 44. A detailed configuration of the stationary rails 43 and other components will be described later with reference to Figs. 5A to 5D.

[0030]

The partition element 44 separates the freezer compartment 13 and the vegetable compartment 14. The partition element 44 includes the upper surface 44A and a lower surface 44B. The upper surface 44A faces the freezer compartment 13,

and the lower surface 44B faces the vegetable compartment 14. The stationary rails 43 are provided at the partition element 44.

The partition element 45 separates each of the ice-making compartment 11 and the versatile compartment 12 and the vegetable compartment 14. The partition element 45 includes an upper surface 45A and the lower surface 45B. The upper surface 45A faces the ice-making compartment 11 and the versatile compartment 12, and the lower surface 45B faces the freezer compartment 13.

[0031]

[Detailed Description of Stationary Rail 43 and Other Components]

Fig. 5A is an exploded perspective view of the partition element 44 and the stationary rail 43 in the refrigerator 1 according to the embodiment.

Fig. 5B is a front view of the partition element 44 and the stationary rail 43 in the refrigerator 1 according to the embodiment.

Fig. 5C is a side view of the partition element 44 and the stationary rail 43 in the refrigerator 1 according to the embodiment.

Fig. 5D is a diagram for explaining the stationary rail 43, the movable rail 40, the rotary element 42 and the support element 41 in the refrigerator 1 according to the embodiment.

Fig. 5D, (a), is a cross-sectional view of the stationary rail 43, the movable rail 40, the rotary element 42, and the support element 41, and Fig. 5D, (b), is a cross-sectional view of the movable rail 40 and the rotary element 42.

[0032]

Each of the movable rails 40 includes a placement portion 40A, a wall portion 40B, and the catching portion 40C.

The freezer case 60 is placed on the placement portions 40A. The placement portions 40A are flat plate elements. The placement portions 40A are rectangular. The longitudinal direction of each of the placement portions 40A coincides with the direction Dr1, and the width direction of each placement portion 40A, i.e., a direction along the short side of each placement portion 40A, coincides with the direction Dr2. The reinforcing element 46 is provided on the placement portions 40A (see Fig. 3A).

The wall portions 40B connect to respective end portions of the placement portions 40A, which extend parallel to the longitudinal direction of the placement portions 40A.

Each of the wall portions 40B connects to a placement portion 40A and a catching portion 40C. A lower end portion of each wall portion 40B connects to the placement portion 40A, and an upper end portion of each wall portion 40B connects to the catching portion 40C. Each wall portion 40B is provided between the freezer case 60 and a stationary rail 43.

Each of the catching portions 40C is supported by a support element 41. Each catching portion 40C is formed in the shape of a flange. Each catching portion 40C is located at a higher position than the placement portion 40A and the wall portion 40B. Each catching portion 40C is also located at a higher position than a rotary element 42 and a stationary rail 43. Each catching portion 40C is provided with a first stopper 47A, a second stopper 47B, and an inclined surface portion 47C, as described above.

[0033]

The support elements 41 each include a shaft 41A and a roller 41B.

The shaft 41A supports the roller 41B in such a way as to allow the roller 41B to rotate. The shaft 41A of one of the support elements 41 connects to the first surface 2A of the inner case 2t2, and the shaft 41A of the other support element 41 connects to the second surface 2B of the inner case 2t2.

The roller 41B is rotatably provided at the shaft 41A. The roller 41B is in contact with the catching portion 40C. As the movable rail 40 is moved parallel to the direction Dr1, the roller 41B is rotated. Thereby, the support element 41 not only supports the movable rail 40 but enables the user to more easily move the freezer compartment door 7.

[0034]

The rotary elements 42 each include a shaft 42A and a roller 42B.

The shaft 42A supports the roller 42B in such a manner to allow the roller 42B to rotate. The shaft 42A is attached to a movable rail 40. For example, the shaft 42A is attached to the wall portion 40B of the movable rail 40.

The roller 42B is rotatably supported by the shaft 42A. The roller 42B is in contact with a stationary rail 43. When the movable rail 40 is moved parallel to the direction Dr1, the roller 42B is rotated. Thereby, the user can more easily move the freezer compartment door 7.

5 [0035]

Part of the stationary rail 43 is inserted into the partition element 44. The stationary rail 43 may be inserted into the partition element 44 by press fitting. The part of the stationary rail 43 inserted into the partition element 44 may be coupled to the partition element 44. As a structure for coupling the stationary rail 43 to the partition
10 element 44, for example, a claw structure may be applied. The stationary rail 43 is removable from the partition element 44. Therefore, for example, even if the stationary rail 43 is broken, it can be replaced by a new one. Furthermore, the stationary rail 43 and the partition element 44 are separate components. However, when the stationary rail 43 is attached to the partition element 44, they are provided as a single body.

15 [0036]

The stationary rail 43 includes a bottom portion 43A, a lower portion 43B, an upper portion 43C, a contact surface portion 43D, a guide portion 43E, and a rear portion 43F. The refrigerator 1 includes a pair of stationary rails 43. This means that the refrigerator 1 includes a pair of bottom portions 43A, a pair of lower portions 43B, a
20 pair of upper portions 43C, a pair of contact surface portions 43D, a pair of guide portions 43E, and a pair of rear portions 43F. The pair of lower portions 43B corresponds to a first lower portion and a second lower portion of the present invention.

[0037]

The bottom portions 43A support an article stored in the freezer case 60, the
25 freezer cases 60, the movable rails 40, and the rotary elements 42. That is, the bottom portions 43A bear the weights of the article stored in the freezer case 60, the freezer case 60, the movable rails 40, and the rotary elements 42. The bottom portions 43A are located in contact with the upper surface 44A of the partition element 44. Each of the bottom portions 43A connects to a contact surface portion 43D. Each bottom
30 portion 43A includes a supporting surface 43A1 and a bottom surface 43A2. An upper

surface of each bottom portion 43A corresponds to the supporting surface 43A1. On the supporting surface 43A1, the roller 42B of a rotary element 42 is moved. The bottom surface 43A2 is in contact with the upper surface 44A of the partition element 44. The refrigerator 1 includes a pair of supporting surfaces 43A1. The pair of supporting surfaces 43A1 correspond to a first supporting surface and a second supporting surface of the present invention.

[0038]

At each of the stationary rails 43, the lower portion 43B is provided as a projection provided at each stationary rail 43. The lower portion 43B is located at a lower position than the bottom portion 43A. The lower portion 43B is inserted into a recess 44C. The lower portion 43B connects to a lower end of the contact surface portion 43D. At each stationary rail 43, two lower portions 43B are arranged in the direction Dr1; however, the number of lower portions 43B is not limited to two, that is, one lower portion 43B or three or more lower portion 43B may be provided. The lower portion 43B may be press-fitted in the recess 44C, or may be coupled to the recess 44C. Since the refrigerator 1 includes the stationary rails 43, the refrigerator 1 includes a pair of recesses 44C. The pair of recesses 44C corresponds to a first recess and a second recess of the present invention.

[0039]

The upper portion 43C is provided with a plurality of holes which allow respective fixing elements 48 to be inserted thereinto. The fixing elements 48 are inserted into the upper portion 43C, and end portions of the fixing elements 48 are connected to the inner case 2t2. The fixing elements 48 are, for example, screws. Although the following description is made with respect to the case where three fixing elements 48 are provided and three holes are provided in the upper portion 43C, the number of fixing elements 48 and that of holes provided in the upper portion 43C are not limited to three. The upper portion 43C is located at a higher position than the bottom portion 43A and the lower portion 43B. Also, the position of the upper portion 43C is higher than those of the contact surface portion 43D and the guide portion 43E. The upper portion 43C

is, together with the contact surface portion 43D, in contact with the inner case 2t2.

The upper portion 43C connects to an upper end of the contact surface portion 43D.

[0040]

If the fixing elements 48 were provided at the contact surface portion 43D, the
5 fixing elements 48 and the rotary elements 42 could interfere with each other. Since
the fixing elements 48 are provided at the upper portion 43C in the refrigerator 1, the
above interference can be avoided. The upper portion 43C connects to the contact
surface portion 43D.

The contact surface portion 43D includes a surface facing the rotary element 42,
10 and a contact surface that contacts the inner case 2t2. Since the contact surface
portion 43D is in surface contact with the inner case 2t2, the stationary rail 43 can be
firmly fixed to the inner case 2t2.

[0041]

The guide portion 43E faces the bottom portion 43A. The guide portion 43E
15 restrict upward movement of the rotary element 42. The guide portion 43E is located
at a higher position than the rotary element 42. The guide portion 43E is connected to
the contact surface portion 43D.

[0042]

The rear portion 43F connects to a rear end portion of the bottom portion 43A,
20 and to a rear end portion of the guide portion 43E. The rear portion 43F is a rearmost
portion of the stationary rail 43.

[0043]

[Regarding Partition Elements 44 and 45]

Fig. 6A is a cross-sectional view of a vacuum heat insulator HI1 and a foam heat
25 insulator HI2 of the partition element 44 in the refrigerator 1 according to the
embodiment.

Fig. 6B is an explanatory drawing of a vacuum heat insulator HI3 and a foam heat
insulator HI4 of the partition element 45 in the refrigerator 1 according to the
embodiment.

30 [0044]

The partition element 44 includes a first surface portion 44a and a second surface portion 44b. The first surface portion 44a includes a contact portion 44a1 and peripheral portions 44a2. The partition element 44 includes the recess 44C which allows the lower portion 43B to be inserted thereinto.

5 In the first surface portion 44a, the recesses 44C are provided. In the embodiment, since the number of lower portions 43B is two, the number of recesses 44C is also two. The first surface portion 44a includes the upper surface 44A of the partition element 44. The first surface portion 44a can be formed of resin. The recesses 44C are provided parallel to the stationary rails 43.

10 The contact portion 44a1 is part of the first surface portion 44a that contacts the vacuum heat insulator HI1. The peripheral portions 44a2 are part of the first surface portion 44a that are located at the periphery of the contact portion 44a1 and are not in contact with the vacuum heat insulator HI1. The recesses 44C are provided in the peripheral portion 44a2 of the first surface portion 44a.

15 [0045]

The second surface portion 44b is located at a lower position than the first surface portion 44a. The second surface portion 44b includes the lower surface 44B of the partition element 44.

[0046]

20 The vacuum heat insulator HI1 and the foam heat insulator HI2 are provided between the first surface portion 44a and the second surface portion 44b. The vacuum heat insulator HI1 is provided in contact with the first surface portion 44a, and the foam heat insulator HI2 is provided around and under the vacuum heat insulator HI1. The vacuum heat insulator HI1 is in contact with the first surface portion 44a. By virtue of
25 this configuration, it is possible to more effectively reduce the amount of transmission of cooling energy of the freezer compartment 13 to the vegetable compartment 14. Furthermore, the recesses 44C are provided in the peripheral portions 44a2 of the first surface portion 44a. It is therefore possible to prevent interference between the recesses 44C and the vacuum heat insulator HI1 and thus prevent breakage or damage
30 of the vacuum heat insulator HI1, which would occur because of the interference.

[0047]

The partition element 45 includes a third surface portion 45a and a fourth surface portion 45b. The third surface portion 45a includes the upper surface 45A. The fourth surface portion 45b includes the lower surface 45B. Also, the partition element 45 is provided with the vacuum heat insulator HI3 and the foam heat insulator HI4. That is, the vacuum heat insulator HI3 and the foam heat insulator HI4 are provided between the third surface portion 45a and the fourth surface portion 45b. The vacuum heat insulator HI3 is provided in contact with the fourth surface portion 45b, and the foam heat insulator HI4 is provided around and on the vacuum heat insulator HI3. The vacuum heat insulator HI3 is provided in contact with the fourth surface portion 45b. By virtue of this configuration, it is possible to more effectively reduce the amount of transmission of cooling energy of the freezer compartment 13 to the versatile compartment 12.

[0048]

[Advantages of Embodiment]

The refrigerator 1 includes the partition element 44 and the stationary rail 43 that is separate from the first surface portion 44a of the partition element 44. Therefore, even if the first surface portion 44a and the stationary rail 43 are formed of resin having different thickness, since the first surface portion 44a and the stationary rail 43 are formed separately, it is possible to avoid occurrence of a failure in formation of the partition element 44 and a failure in formation of the stationary rail 43.

[0049]

The stationary rail 43 is provided on the partition element 44. That is, the stationary rail 43 is located at a lower portion of the freezer compartment 13. Therefore, an upper portion 60A (see Fig. 4D) of the freezer case 60 does not need to be provided closer to the center of the freezer compartment 13 in the direction Dr2 than the stationary rail 43. That is, the upper portion 60A of the freezer case 60 may be located above the stationary rail 43. Thus, in the refrigerator 1, the width of the freezer case 60 in a direction parallel to the direction Dr2 can be increased, and the degree to which the volume of the freezer case 60 is decreased can be reduced.

[0050]

[Modification 1]

Fig. 7A illustrates modification 1 of the refrigerator 1 according to the embodiment.

5 The refrigerator 1 of modification 1 includes a reinforcing element 46B and a reinforcing element 46C in addition to the reinforcing element 46. The reinforcing element 46B corresponds to a second reinforcing element of the present invention. The reinforcing element 46C corresponds to a third reinforcing element of the present invention. One of ends of the reinforcing element 46B is provided at one of the
10 movable rails 40, and the other is provided at the other movable rail 40. The reinforcing element 46B is located closer to the freezer compartment door 7 than the reinforcing element 46. The reinforcing element 46B is a plate-like element. One of ends of the reinforcing element 46C is provided at the reinforcing element 46, and the other is provided at the reinforcing element 46B. The reinforcing element 46C is also a
15 plate-like element. The reinforcing element 46B may or may not be fixed to the movable rail 40. The reinforcing element 46C may or may not be fixed to the reinforcing element 46 and the reinforcing element 46B.

 Since the refrigerator 1 of modification 1 includes the reinforcing element 46B and the reinforcing element 46C in addition to the reinforcing element 46, the total area of
20 components supporting the freezer compartment case 60 can be further increased. By virtue of this configuration, it is possible to further reduce sagging of the freezer compartment case 60, and thus avoid breakage or damage of to the freezer compartment case 60.

[0051]

25 [Modification 2]

Fig. 7A illustrates modification 2 of the refrigerator 1 according to the embodiment.

 In the embodiment, the stationary rail 43 includes the plurality of lower portions 43B. By contrast, in the refrigerator 1 of modification 2, the stationary rail 43 includes a
30 single lower portion 430B. The lower portion 430B has a greater length in a direction

the direction Dr1 than the length of the lower portion 43B in the direction parallel to direction Dr1. Also, in the direction parallel to the direction Dr1, a recess 440C is provided to have a length corresponding to the above length of the lower portion 430B. With respect to the length of the lower portion 430B, it suffices that the lower portion 430B is set to have a length in the direction parallel to the direction Dr1 that is greater than or equal to, for example, two-thirds of the length of the stationary rail 43 in the direction parallel to the direction Dr1. Also, the refrigerator 1 of modification 2 can obtain the same advantage as that of the refrigerator 1 according to the embodiment.

Reference Signs List

[0052]

1 refrigerator 2 housing 2A first surface 2B second surface 2t2 inner case 3 refrigerator compartment door 4 refrigerator compartment door 5 ice-making compartment door 6 versatile compartment door 7 freezer compartment door 8 vegetable compartment door 9 operation panel 10 refrigerator compartment 10A case 10B case 10C door pocket 11 ice-making compartment 12 versatile compartment 12A versatile compartment case 13 freezer compartment 13A freezer case 14 vegetable compartment 14A vegetable compartment case 14B vegetable compartment case 15 machine compartment 20 compressor 21 heat exchanger 22 cooling fan 23 versatile compartment damper 24 refrigerator compartment damper 30 refrigerator compartment duct 31 vegetable compartment duct 32 versatile compartment duct 40 movable rail 40A placement portion 40B wall portion 40C catching portion 41 support element 41A shaft 41B roller 42 rotary element 42A shaft 42B roller 43 stationary rail 43A bottom portion 43A1 supporting surface 43A2 bottom surface 43B lower portion 43C upper portion 43D contact surface portion 43E guide portion 43F rear portion 44 partition element 44A upper surface 44B lower surface 44C recess 44a first surface portion 44a1 contact portion 44a2 peripheral portion 44b second surface portion 45 partition element 45A upper surface 45B lower surface 45a third surface portion 45b fourth surface portion 46 reinforcing element 46B reinforcing

element 46C reinforcing element 47A first stopper 47B second stopper 47C
inclined surface portion 48 fixing element 50 shelf 60 freezer case 80A rail
80B rail 100 refrigerator 430B lower portion 440C recess HI1 vacuum
heat insulator HI2 foam heat insulator HI3 vacuum heat insulator HI4 foam
5 heat insulator

CLAIMS

[Claim 1]

A refrigerator comprising:

a refrigerator body including an inner case;

5 a partition element configured to separate a first storage compartment and a second storage compartment, the first storage compartment being provided in the inner case, the second storage compartment being provided in the inner case and located below the first storage compartment;

a door configured to open and close the first storage compartment;

10 a first movable rail attached to the door;

a storage container provided on the first movable rail;

a first rotary element attached to the first movable rail, the first rotary element being rotatable;

15 a first support element provided at the first storage compartment to support the first movable rail; and

a first stationary rail provided below the first support element and on an upper surface of the partition element,

wherein the first stationary rail is inserted in the partition element such that the first stationary rail and the partition element are provided as a single body.

20 [Claim 2]

The refrigerator of claim 1,

wherein the partition element includes a first recess, and

25 wherein the first stationary rail includes a first supporting surface and a first lower portion, the first supporting surface supporting the first rotary element, the first lower portion being located at a lower position than the first supporting surface and inserted in the first recess of the partition element.

[Claim 3]

The refrigerator of claim 2, further comprising:

a vacuum heat insulator provided at the partition element,

wherein the partition element includes a first surface portion that includes the first recess and the upper surface,

wherein the first storage compartment is a freezer compartment,

wherein a temperature zone of the second storage compartment is higher than a temperature zone of the first storage compartment,

wherein the vacuum heat insulator is in contact with the first surface portion,

wherein the first surface portion includes a contact portion and a peripheral portion, the contact portion being part of the first surface portion that contacts the vacuum heat insulator, the peripheral portion being part of the first surface portion that is located at a periphery of the contact portion and not in contact with the vacuum heat insulator, and

wherein the first recess is located in the peripheral portion.

[Claim 4]

The refrigerator of claim 2 or 3, further comprising:

a fixing element configured to fix the first stationary rail to the inner case, wherein the first stationary rail further includes a first upper portion which is located above the first supporting surface and the first lower portion and in contact with the inner case, and

wherein the fixing element is connected to the first upper portion.

[Claim 5]

The refrigerator of claim 4,

wherein the first stationary rail further includes a contact surface portion and a bottom portion, the contact surface portion being in contact with the inner case, the bottom portion including a bottom surface and the first supporting surface, the bottom surface being in contact with the upper surface of the partition element, the first supporting surface supporting the first rotary element,

wherein the first lower portion connects to a lower end of the contact surface portion and is located at a lower position than the bottom portion, and

wherein the first upper portion connects to an upper end of the contact surface portion.

[Claim 6]

The refrigerator of any one of claims 1 to 5, further comprising:

a second movable rail on which the storage container is provided, the second movable rail being attached to the door and parallel to the first movable rail;

5 a second rotary element attached to the second movable rail, the second rotary element being rotatable;

a second support element provided at the first storage compartment to support the second movable rail; and

10 a second stationary rail located below the second support element, the second stationary rail being provided on the upper surface of the partition element and parallel to the first stationary rail,

wherein the partition element includes a second recess provided parallel to the second stationary rail, and

15 wherein the second stationary rail includes a second supporting surface and a second lower portion, the second supporting surface supporting the second rotary element, the second lower portion being located at a lower position than the second supporting surface and inserted in the second recess of the partition element.

[Claim 7]

The refrigerator of claim 6, further comprising:

20 a first reinforcing element formed in a shape of a plate, the first reinforcing element having ends one of which is provided at the first movable rail and the other of which is provided at the second movable rail.

[Claim 8]

The refrigerator of claim 7, further comprising:

25 a second reinforcing element formed in a shape of a plate and having ends one of which is provided at the first movable rail and the other of which is provided at the second movable rail, the second reinforcing element being located closer to the door than the first reinforcing element; and

a third reinforcing element formed in a shape of a plate, the third reinforcing element having ends one of which is provided at the first reinforcing element and the other of which is provided at the second reinforcing element.

[Claim 9]

- 5 A refrigerator comprising:
- a refrigerator body including an inner case;
- a partition element configured to separate a first storage compartment and a second storage compartment, the first storage compartment being provided in the inner case, the second storage compartment being provided in the inner case and located
- 10 below the first storage compartment;
- a vacuum heat insulator provided at the partition element;
- a door configured to open and close the first storage compartment;
- a first movable rail attached to the door;
- a storage container provided on the first movable rail;
- 15 a first rotary element attached to the first movable rail, the first rotary element being rotatable;
- a first support element provided at the first storage compartment to support the first movable rail; and
- a first stationary rail located below the first support element and provided on an
- 20 upper surface of the partition element,
- wherein the first storage compartment is a freezer compartment;
- wherein a temperature zone of the second storage compartment is higher than a temperature zone of the first storage compartment,
- wherein the partition element includes a first surface portion, the first surface
- 25 portion including a first recess and the upper surface,
- wherein the first stationary rail includes a first supporting surface and a first lower portion, the first supporting surface supporting the first rotary element, the first lower portion being located at a lower position than the first supporting surface and inserted in the first recess of the partition element,
- 30 wherein the vacuum heat insulator is in contact with the first surface portion,

wherein the first surface portion includes a contact portion and a peripheral portion, the contact portion being part of the first surface portion that contacts the vacuum heat insulator, the peripheral portion being part of the first surface portion that is located at a periphery of the contact portion and is not in contact with the vacuum heat insulator, and

wherein the first recess is located in the peripheral portion.