

DESCRIPTION

Title of Invention

REFRIGERATOR

Technical Field

5 [0001]

The present invention relates to a refrigerator, and more particularly, to the structure of a case and other elements arranged in the refrigerator and configured to store an object to be stored.

10 Background Art

[0002]

There is known a refrigerator including a storage case arranged in a refrigerating compartment so as to be slidable. As a related-art mechanism configured to open and close the storage case, there has been proposed a mechanism provided with rail portions extending in parallel to each other along a front-and-back direction of a refrigerator on an upper surface of a horizontal partition configured to partition a space into a refrigerating compartment and a storage compartment that is arranged below the refrigerating compartment and kept at a temperature within a freezing temperature zone (for example, see Patent Literature 1). Guide portions are formed on the storage case of the refrigerator described in Patent Literature 1 so as to be slidable on the rail portions along the front-and-back direction.

Citation List

25 Patent Literature

[0003]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. Hei 08-193782

30 Summary of Invention

Technical Problem

[0004]

In a case where each of the rail portions is formed into a projection and each of the guide portions is formed into a recessed portion, when a width dimension of the rail portion is larger than a width dimension of the guide portion, the rail portion is not fitted into the guide portion, and does not function as the opening and closing mechanism. In this case, the width dimension of the rail portion and the width dimension of the guide portion are varied during manufacturing processes. Therefore, in consideration of variations in the rail portion and the guide portion caused during manufacture, a preset clearance is secured between the rail portion and the guide portion.

[0005]

However, as the clearance is increased, a width of a gap between the rail portion and the guide portion is increased. Accordingly, when the storage case is moved forward and backward, the storage case is liable to laterally rattle.

[0006]

The present invention has been made to overcome the above-mentioned problem, and has an object to provide a refrigerator capable of preventing a storage case of a sliding type from laterally rattling when the storage case arranged in a storage compartment is moved forward and backward.

Solution to Problem

[0007]

According to one embodiment of the present invention, there is provided a refrigerator, including: a heat insulating box body; a storage compartment formed in the heat insulating box body; a storage case placed in the storage compartment and arranged so as to be movable in a depth direction of the storage compartment; an elastic member fixed on a side of the storage case in the storage compartment, and configured to press the storage case from a first inner surface side of the storage compartment to a second inner side surface side of the storage compartment

opposed to the first inner side surface side; and a support structure arranged below the storage case in the storage compartment, and configured to guide the storage case to travel in the depth direction and to restrain the storage case from moving in a direction of pressing the storage case by the elastic member.

Advantageous Effects of Invention

[0008]

In the refrigerator according to one embodiment of the present invention, owing to action of the elastic member, the storage case is pressed from the first inner side surface side to the second inner side surface side opposed to the first inner side surface side so that the storage case and the support structure come into contact with each other. Thus, lateral movement of the storage case is restrained. Therefore, the refrigerator according to the present invention can prevent the storage case from laterally rattling when the storage case is moved forward and backward.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a schematic front view for illustrating a refrigerator according to an embodiment of the present invention.

[Fig. 2] Fig. 2 is a view for illustrating a refrigerating compartment of the refrigerator according to the embodiment of the present invention seen from a front side of the refrigerator.

[Fig. 3] Fig. 3 is a perspective view for illustrating a storage case, a water tank, and other components of the refrigerator according to the embodiment of the present invention.

[Fig. 4] Fig. 4 is a perspective view for illustrating the refrigerator according to the embodiment of the present invention from which the storage case is dismounted.

[Figs. 5] Figs. 5 are top views for illustrating the storage case and an elastic member of the refrigerator according to the embodiment of the present invention.

[Fig. 6] Fig. 6 is a sectional view taken along the line X-X of Fig. 3.

[Fig. 7] Fig. 7 is a sectional view taken along the line Y-Y of Fig. 3.

[Fig. 8] Fig. 8 is an explanatory view for illustrating a contact state between the elastic member and the storage case of the refrigerator according to the embodiment of the present invention.

5 [Fig. 9] Fig. 9 is a view for illustrating the contact state between the elastic member and the storage case of the refrigerator according to the embodiment of the present invention, specifically, a state in which the elastic member is pulled in a concave portion of the storage case.

10 [Fig. 10] Fig. 10 is a graph for showing a relationship between a reaction force of the elastic member and an elongation amount of the elastic member 8 of the refrigerator according to the embodiment of the present invention.

Description of Embodiments

[0010]

15 Embodiment

Fig. 1 is a schematic front view for illustrating a refrigerator 100 according to an embodiment of the present invention. With reference to Fig. 1, an entire configuration of the refrigerator 100 is described. In the following description, a right side and a left side refer to both sides with respect to a direction from a front surface side to a back side of the refrigerator 100. That is, the right side corresponds to a right side of the drawing sheet of Fig. 1, and the left side corresponds to a left side of the drawing sheet of Fig. 1.

[0011]

[Configuration of Refrigerator 100]

25 The refrigerator 100 includes a refrigerating compartment 1, an ice making compartment 2, a switching compartment 3, a freezing compartment 4, and a vegetable compartment 5 arranged as storage compartments inside a heat insulating box body 100A in the stated order from a top stage. The ice making compartment 2 and the switching compartment 3 are arranged side by side in a lateral direction of the heat insulating box body 100A. Double doors 1A are mounted for the refrigerating

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compartment 1 so as to be openable and closable. A drawer 2A is fitted in the ice making compartment 2 so as to be movable forward and backward in an openable and closable manner. Similarly, a drawer 3A, a drawer 4A, and a drawer 5A are fitted in the switching compartment 3, the freezing compartment 4, and the vegetable compartment 5, respectively.

[0012]

The refrigerating compartment 1 is a storage compartment kept at such a temperature as to refrigerate an object to be stored but not to freeze the object to be stored. The temperature in the refrigerating compartment 1 is controlled within, for example, a cold-storage temperature zone (approximately a range of from 2 degrees C to 5 degrees C). The cold-storage temperature zone is not limited to the above-mentioned range, and may be set to be lower than the above-mentioned range when, for example, a chilled compartment is provided.

The ice making compartment 2 is a storage compartment in which an ice machine is arranged. Ice made by the ice machine is preserved in the ice making compartment 2. The switching compartment 3 is a storage compartment that enables a temperature zone to be switched in accordance with purposes. A vertical partition laterally partitions a space into the switching compartment 3 and the ice making compartment 2. Further, a lateral partition vertically partitions the space into the refrigerating compartment 1 and the ice making compartment 2, and further vertically partitions the space into the refrigerating compartment 1 and the switching compartment 3. The freezing compartment 4 is a storage compartment in which a temperature is set within a freezing temperature zone. Here, the freezing temperature zone is set to, for example, approximately a range of from -40 degrees C to 0 degrees C. The vegetable compartment 5 is a storage compartment configured mainly to store vegetables. In Fig. 1, the vegetable compartment 5 is arranged below the freezing compartment 4. However, the vegetable compartment 5 may be arranged below the ice making compartment 2 and the switching compartment 3, and the freezing compartment 4 may be arranged below the vegetable compartment 5.

[0013]

The heat insulating box body 100A includes an outer box having an opening formed in a front surface thereof, an inner box fitted in the outer box through the opening of the outer box, and a heat insulating material such as urethane foam filled in a space between the outer box and the inner box. The storage compartments are partitioned in the inner box by partition walls.

[0014]

[Configuration of Refrigerating Compartment 1]

Fig. 2 is a view for illustrating a refrigerating compartment 1 of the refrigerator 100 according to the present embodiment seen from a front side of the refrigerator.

Fig. 2 is an illustration of the refrigerator 100 from which the double doors 1A are dismounted. With reference to Fig. 2, a configuration of the refrigerating compartment 1 is described.

The refrigerating compartment 1 includes a first inner side surface 100A2, a second inner side surface 100A1 opposed to the first inner side surface 100A2, a back surface 100A3, a bottom surface 100A4, and a top surface 100A5. That is, a space in the refrigerating compartment 1 is a rectangular parallelepiped space defined by the double doors 1A, the first inner side surface 100A2, the second inner side surface 100A1 opposed to the first inner side surface 100A2, the back surface 100A3, the bottom surface 100A4, and the top surface 100A5. Further, a storage case 6 and a water tank 15 are arranged in the refrigerating compartment 1.

The storage case 6 is a case arranged in the refrigerating compartment 1. An object to be stored is put on the storage case 6. The storage case 6 is arranged in the refrigerating compartment 1 so as to be slidable and movable in a depth direction (front-and-back direction) of the refrigerating compartment 1. The water tank 15 is a case capable of retaining water. The water tank 15 is a component corresponding to a reservoir case according to the present invention. The reservoir case is not limited to the water tank 15. Water retained in the water tank 15 is supplied into the ice making compartment arranged below the refrigerating compartment 1, and then is changed into ice.

[0015]

In the present embodiment, a case 50 is arranged above the storage case 6 and the water tank 15. Similarly to the storage case 6, the case 50 is arranged so as to be slidable in the front-and-back direction. The case 50 is arranged on a partition member 51 (see Fig. 6). In addition, although detailed description is made later with reference to Fig. 3 and Fig. 4, a partition member 102 is arranged between the storage case 6 and the water tank 15.

[0016]

A plurality of shelves 101, on which an object to be stored and the like can be put, are arranged between the first inner side surface 100A2 and the second inner side surface 100A1. The storage case 6 and the water tank 15 are positioned on a lower side of the first inner side surface 100A2 and the second inner side surface 100A1.

A left end of the top surface 100A5 is connected to an upper end of the first inner side surface 100A2, and a left end of the bottom surface 100A4 is connected to a lower end of the first inner side surface 100A2. The back surface 100A3 is connected to a back end of the first inner side surface 100A2.

A right end of the top surface 100A5 is connected to an upper end of the second inner side surface 100A1, and a right end of the bottom surface 100A4 is connected to a lower end of the second inner side surface 100A1. The back surface 100A3 is connected to a back end of the second inner side surface 100A1.

[0017]

A lower portion of the back surface 100A3 is arranged so as to be opposed to a back portion of the storage case 6 and a back portion of the water tank 15. An upper end of the back surface 100A3 is connected to the top surface 100A5, and a lower end of the back surface 100A3 is connected to the bottom surface 100A4.

The bottom surface 100A4 corresponds to an upper surface of a partition member 7 configured to partition the space into the refrigerating compartment 1 and the switching compartment 3 and to partition the space into the refrigerating compartment 1 and the ice making compartment 2. That is, the refrigerator 100 includes the partition member 7 configured to vertically partition the space into the

refrigerating compartment 1 and the switching compartment 3 and to further vertically partition the space into the refrigerating compartment 1 and the ice making compartment 2. The storage case 6 and the water tank 15 are arranged on the upper surface of the partition member 7. Further, the partition member 102 is also arranged on the upper surface of the partition member 7 (see Fig. 3 and Fig. 4).

The top surface 100A5 is arranged so as to be opposed to the uppermost shelf 101.

[0018]

[Configurations of Partition Member 7, Partition Member 102, and Other Components]

Fig. 3 is a perspective view for illustrating a storage case 6, a water tank 15, and other components of the refrigerator 100 according to the present embodiment. Fig. 4 is a perspective view for illustrating the refrigerator 100 according to the present embodiment from which the storage case 6 is dismounted. Fig. 3 and Fig. 4 are illustrations of a state in which the partition member 51 and other components arranged above the storage case 6 and the water tank 15 are dismounted (see Fig. 6). With reference to Fig. 3 and Fig. 4, description is made of the storage case 6, the water tank 15, the partition member 102, and other members that are components on the partition member 7.

[0019]

(Partition Member 7)

The partition member 7 forms a lower surface of the refrigerating compartment 1. The partition member 7 is the lateral partition configured to vertically partition the space into the refrigerating compartment 1 and the switching compartment 3 and to further vertically partition the space into the refrigerating compartment 1 and the ice making compartment 2. The partition member 7 includes a placement surface P extending in parallel to a horizontal direction. The storage case 6 and the water tank 15 are placed on the placement surface P. The partition member 102 is formed on the placement surface P so as to be orthogonal to the placement surface P. That is, the partition member 102 is formed so as to be parallel to the first inner side surface

100A2 and the second inner side surface 100A1 of the refrigerating compartment 1.

As illustrated in Fig. 4, a support structure R configured to guide the storage case 6 to move in the front-and-back direction is formed on the placement surface P of the partition member 7. The support structure R includes a rail portion 9A and a rail portion 9B. Each of the rail portion 9A and the rail portion 9B is formed so as to protrude upward, and is formed of a projection extending in parallel to the depth direction. That is, the rail portion 9A and the rail portion 9B protrude from the placement surface P side to the storage case 6 side. In the present embodiment, the support structure R including two rail portions is described, but the present invention is not limited thereto. The support structure R may include a single rail portion, or may include three or more rail portions.

The rail portion 9A is arranged on the first inner side surface 100A2 side, and the rail portion 9B is arranged on the second inner side surface 100A1 side. More specifically, the rail portion 9A is arranged on the partition member 102 side. As described above, the rail portions (the rail portion 9A and the rail portion 9B) are respectively arranged on both end portion sides of the storage case 6 in a width direction (lateral direction) of the storage case 6.

[0020]

(Partition Member 102)

The partition member 102 is a vertical partition configured to partition the space into a side on which the water tank 15 is arranged and a side on which the storage case 6 is arranged. The partition member 102 is arranged so that one surface of the partition member 102 is opposed to the water tank 15 and that an other surface thereof is opposed to the storage case 6. The case 50 is arranged above the partition member 102 (see Fig. 2). An elastic member 8 is fixed to the other surface of the partition member 102. A way of fixing the partition member 102 and the elastic member 8 to each other is not particularly limited. The partition member 102 and the elastic member 8 may be fixed to each other with an adhesive, or may be fixed to each other by an engagement structure formed in the partition member 102 and the elastic member 8. A recessed portion 102A is formed in the partition

member 102 so as to serve as a recess configured to receive the elastic member 8 when the elastic member 8 is bent and deformed. The recessed portion 102A is formed so as to correspond to a position of fixing a fixing portion 8A. The recessed portion 102A is formed so as to be recessed from the storage case 6 side to the partition member 102 side. For example, the recessed portion 102A is formed at a connecting position between the fixing portion 8A and a pressing portion 8B that are described later.

[0021]

[Configurations of Storage Case 6 and Elastic Member 8]

Figs. 5A and 5B are top views for illustrating the storage case 6 and the elastic member 8 of the refrigerator according to the present embodiment. Fig. 6 is a sectional view taken along the line X-X of Fig. 3. Fig. 7 is a sectional view taken along the line Y-Y of Fig. 3. Fig. 5A is an illustration of a state in which the storage case 6 is fully closed and the pressing portion 8B enters into a concave portion 6C3. Similarly to Fig. 5A, Fig. 5B is an illustration of a state in which the pressing portion 8B enters into the concave portion 6C3. In Fig. 5B, an angle $\theta 1$ of the pressing portion 8B of the elastic member 8 and an angle $\theta 2$ of a curved surface 6C1 of the concave portion 6C3 are schematically illustrated. Fig. 7 is an illustration of an open state of the storage case 6. With reference to Figs. 5 to Fig. 7, the storage case 6 and the elastic member 8 are described in detail.

[0022]

(Storage Case 6)

The storage case 6 includes a bottom surface portion 6A forming a bottom surface, a side surface portion 6B connected to a left end of the bottom surface portion 6A, and a side surface portion 6D connected to a right end of the bottom surface portion 6A. Further, the storage case 6 includes a back surface portion 6F connected to a back end of the bottom surface portion 6A, and a front surface portion 6G connected to a front end of the bottom surface portion 6A (see Fig. 3).

[0023]

The bottom surface portion 6A is a plate-like member extending in parallel to a

horizontal plane. A first rib 11 and a second rib 12 protruding downward are formed on a lower surface of the bottom surface portion 6A. The first rib 11 includes a first rib 11A formed at a position corresponding to a formation position of the rail portion 9A, and a first rib 11B formed at a position corresponding to a formation position of the rail portion 9B. The first rib 11 is positioned on the elastic member 8 side with respect to the rail portion 9. The second rib 12 is positioned on a side opposite to the side on which the elastic member 8 is arranged across the rail portion 9 (second inner side surface 100A1 side).

The bottom surface portion 6A of the storage case 6 is positioned so that a formation position of the first rib 11A is matched with the rail portion 9A. Further, the bottom surface portion 6A of the storage case 6 is positioned so that a position between the first rib 11B and the second rib 12 is matched with the rail portion 9B. As described above, the refrigerator 100 includes the rail portion 9, the first rib 11, and the second rib 12. With this configuration, contact between an entire surface of the bottom surface portion 6A and the partition member 7 is avoided, and friction between the bottom surface portion 6A and the partition member 7 is suppressed. Thus, the storage case 6 is smoothly moved in the front-and-back direction.

[0024]

The side surface portion 6B forms a left side surface portion of the storage case 6. The side surface portion 6B is arranged so as to be opposed to the partition member 102 and the elastic member 8 under the state in which the storage case 6 is fully closed. A flange portion 6C protruding from the storage case 6 side to the elastic member 8 side is formed on an upper end of the side surface portion 6B. In the present embodiment, description is made of the flange portion 6C formed to extend from the front surface portion 6G side to the back surface portion 6F side of the storage case 6, but the present invention is not limited thereto. For example, the flange portion 6C may be formed into an uneven shape to extend to the back of the storage case 6.

The flange portion 6C includes the concave portion 6C3 into which at least a part of the elastic member 8 enters when the storage case 6 is fully closed, a convex

portion 6C4 connected to the concave portion 6C3, and a contact portion 6C5 connected to the convex portion 6C4.

The concave portion 6C3 is formed in a front portion of the storage case 6, and is formed so as to be recessed from the elastic member 8 side to the side surface portion 6B side. When the storage case 6 is fully closed, the pressing portion 8B of the elastic member 8 to be described later enters into the concave portion 6C3. The concave portion 6C3 has a smoothly curved surface. Specifically, the curved surface 6C1 smoothly curved from a bottom of a hollow of the concave portion 6C3 to the convex portion 6C4 is formed in the concave portion 6C3 so as to conform to a shape of the elastic member 8. The curved surface 6C1 extends obliquely from the side surface portion 6B side to the elastic member 8 side as extending from the front surface portion 6G side to the back surface portion 6F side of the storage case 6.

Further, a curved surface 6C2 smoothly curved from the bottom of the hollow of the concave portion 6C3 to the front surface portion 6G side of the storage case 6 is formed in the concave portion 6C3 so as to conform to the shape of the elastic member 8. Here, the bottom of the hollow refers to a deepest portion of the concave portion 6C3 recessed from the elastic member 8 side to the side surface portion 6B. [0025]

The side surface portion 6D forms a right side surface portion of the storage case 6. The side surface portion 6B is arranged so as to be opposed to the second inner side surface 100A1 under the state in which the storage case 6 is fully closed (see Fig. 2). A flange portion 6E protruding from the storage case 6 side to the second inner side surface 100A1 side is formed on an upper end of the side surface portion 6D.

[0026]

A lower end of the back surface portion 6F is connected to the bottom surface portion 6A. A left end of the back surface portion 6F is connected to a back end of the side surface portion 6B, and a right end of the back surface portion 6F is connected to a back end of the side surface portion 6D.

A lower end of the front surface portion 6G is connected to the bottom surface

portion 6A. A left end of the front surface portion 6G is connected to a front end of the side surface portion 6B, and a right end of the front surface portion 6G is connected to a front end of the side surface portion 6D. For example, a handle or another member to be gripped by a user is formed on the front surface portion 6G.

5 [0027]

(Elastic Member 8)

The elastic member 8 is a blade spring integrally including the fixing portion 8A and the pressing portion 8B. The fixing portion 8A is fixed in the refrigerating compartment 1. The pressing portion 8B is positioned on the storage case 6 side with respect to the fixing portion 8A, and is configured to press the storage case 6 from the first inner side surface 100A2 side to the second inner side surface 100A1 side.

The fixing portion 8A is a flat-plate-like member. One end of the fixing portion 8A is connected to the pressing portion 8B. The fixing portion 8A is fixed on the other surface of the partition member 102. The fixing position of the fixing portion 8A is not limited thereto. The fixing position of the fixing portion 8A may be determined in accordance with an arrangement position of the storage case 6. For example, when the refrigerator 100 does not include the partition member 102 and the side surface portion 6B of the storage case 6 is opposed to the first inner side surface 100A2, the fixing portion 8A is fixed on the first inner side surface 100A2.

20 [0028]

In a horizontal sectional view, the pressing portion 8B is formed into an arc shape protruding to the side surface portion 6B side of the storage case 6. The pressing portion 8B comes into contact with and presses the flange portion 6C under a state in which the storage case 6 is open, and the pressing portion 8B enters into the concave portion 6C3 under the state in which the storage case 6 is fully closed. In the present embodiment, description is made of a mode in which a gap S is defined between the concave portion 6C3 of the flange portion 6C and the pressing portion 8B of the elastic member 8 and no contact is established therebetween under the state in which the storage case 6 is fully closed. The gap S is defined so that the

elastic member 8 is in a natural length state under the state in which the storage case 6 is fully closed. With this configuration, creep deformation of the elastic member 8 is prevented.

[0029]

5 The pressing portion 8B is arranged so that a distal end 8C of the pressing portion 8B is held in contact with the partition member 102. Thus, although a root portion (fixing portion 8A) of the elastic member 8 is fixed to the partition member 102, movement of the pressing portion 8B is restrained by bringing also the distal end 8C into abutment against the partition member 102.

10 With this structure, dimension fluctuations and assembly fluctuations of the refrigerator 100 are absorbed using flexibility of the blade spring. Further, with this structure, during mounting and dismounting of the storage case 6, the elastic member 8 is prevented from being deformed to an excessive degree to cause plastic deformation of the root portion (fixing portion 8A) of the elastic member 8.

15 [0030]

[Description of Operation]

Fig. 8 is an explanatory view for illustrating a contact state between the elastic member 8 and the storage case 6 of the refrigerator 100 according to the present embodiment. Fig. 9 is a view for illustrating the contact state between the elastic member 8 and the storage case 6 of the refrigerator 100 according to the present embodiment, specifically, a state in which the elastic member 8 is pulled in the concave portion 6C3 of the storage case 6. Fig. 8 and Fig. 9 are views for illustrating the elastic member 8 and other components seen from a direction indicated by the arrow A of Fig. 3. With reference to Fig. 8 and Fig. 9, opening and closing operation of the storage case 6 of the refrigerator 100 is described.

25 [0031]

Fig. 8 is an illustration of a state in which the storage case 6 is pulled out to the front side.

As illustrated in Fig. 8, under a state in which the contact portion 6C5 of the flange portion 6C and the pressing portion 8B of the elastic member 8 are held in

contact with each other, the storage case 6 is pressed in a direction indicated by the arrow AR of Fig. 8. Thus, the storage case 6 is moved in the direction indicated by the arrow AR until the rail portion 9 provided on the partition member 7 and the first rib 11 of the storage case 6 come into contact with each other. When the rail portion 9 and the first rib 11 come into contact with each other, the storage case 6 cannot be moved in the direction indicated by the arrow AR. Meanwhile, the storage case 6 remains pressed by the pressing portion 8B of the elastic member 8 in the direction indicated by the arrow AR so that the storage case 6 is less liable to move in a direction opposite to the direction indicated by the arrow AR. Thus, under a state in which the contact portion 6C5 and the pressing portion 8B are held in contact with each other, the storage case 6 is prevented from laterally rattling.

[0032]

Fig. 9 is an illustration of a state before the storage case 6 is pushed into the back side and is fully closed.

As illustrated in Fig. 9, under a state in which the curved surface 6C1 of the concave portion 6C3 of the flange portion 6C and the pressing portion 8B of the elastic member 8 are held in contact with each other, the storage case 6 is pressed in a direction indicated by the arrow AR3 of Fig. 9. Here, the arrow AR3 schematically indicates, with a vector, a force of pressing the storage case 6 by the elastic member 8, and the arrow AR3 can be seen as decomposition of a force having a component in the front-and-back direction (arrow AR1) and a component in the lateral direction (arrow AR2). The component of the force corresponding to the arrow AR1 is a component exerted so as to pull in the storage case 6. Meanwhile, the component of the force corresponding to the arrow AR2 is a component exerted so as to press the storage case 6 to the second inner side surface 100A1 side.

When a user closes the storage case 6, the storage case 6 is pulled into the back side of the refrigerating compartment 1 owing to the component of the force corresponding to the arrow AR1. Thus, operability of a user is enhanced. Further, for the same reason as that described with reference to Fig. 8, lateral rattling of the storage case 6 is prevented owing to the component of the force corresponding

to the arrow AR2.

[0033]

[Regarding Spring Constant of Elastic Member 8]

Fig. 10 is a graph for showing a relationship between a reaction force and an elongation amount of the elastic member 8 of the refrigerator 100 according to the present embodiment. With reference to Fig. 10, a method of determining a spring constant of the elastic member 8 is described.

[0034]

When the elastic member 8 has a smaller spring constant, fluctuations in a reaction force applied by the elastic member 8 to the storage case 6 can be reduced even when there are dimension fluctuations of various components. However, when the elastic member 8 has an extremely small elastic force, a large stroke amount is needed, thus leading to reduction in storage capacity.

[0035]

For example, it is assumed that a strong spring having a large spring constant and a weak spring having a small spring constant as shown in the graph of Fig. 10 are prepared. When a maximum displacement amount of each spring fluctuates in a range of about 1 (mm) because of accumulation of dimension fluctuations of a product, the strong spring exerts a reaction force of from 12 (N) to 16 (N) (see sections "a" and "c" in Fig. 10). In contrast, the weak spring exerts the reaction force of from 8 (N) to 10 (N), in other words, a fluctuation range of the reaction force of the weak spring is small (see sections "b" and "d" in Fig. 10). However, in order to obtain the same reaction force of 8 (N), the strong spring requires a displacement amount of 3 (mm), whereas the weak spring requires a displacement amount of 5 (mm).

[0036]

Accordingly, a securable stroke amount of the elastic member 8 is calculated based on a mounting position of the elastic member 8 and a shape of the storage case 6. Then, in accordance with the stroke amount, the elastic member 8 is designed so as to have a spring constant capable of applying a pressing force

necessary for prevention of lateral rattling of the storage case 6.

[0037]

[Effects of This Embodiment]

The refrigerator 100 according to the present embodiment includes: the heat
5 insulating box body 100A; the storage compartment (refrigerating compartment 1)
formed in the heat insulating box body 100A; the storage case 6 placed in the storage
compartment and arranged to be movable in the depth direction of the storage
compartment; the elastic member 8 fixed on a side of the storage case 6 in the
storage compartment, and configured to press the storage case 6 from the first inner
10 side surface 100A2 side of the storage compartment to the second inner side surface
100A1 side opposed to the first inner side surface 100A2 side; and the support
structure R arranged below the storage case 6 in the storage compartment, and
configured to guide the storage case 6 to travel in a direction parallel to the depth
direction and to restrain the storage case 6 from moving in a direction of pressing the
15 storage case 6 by the elastic member 8. With this configuration, owing to action of
the elastic member 8, the storage case 6 is pressed to the second inner side surface
100A1 side. When the storage case 6 is pressed to the second inner side surface
100A1 side, the storage case 6 is moved to the second inner side surface 100A1 side
in a case where the storage case 6 leans to the first inner side surface 100A2 side.
20 Then, the storage case 6 and the support structure R come into contact with each
other so that movement of the storage case 6 is restrained. That is, the storage
case 6 cannot be further moved to the second inner side surface 100A1 side because
the storage case 6 is moved to the second inner side surface 100A1 side and comes
into contact with the support structure R. However, conversely, the storage case 6 is
25 also less liable to move to the first inner side surface 100A2 side owing to the reaction
force exerted by the elastic member 8 as elastic action. Therefore, the storage case
6 is less liable to move in the lateral direction while moving in the front-and-back
direction. That is, the refrigerator 100 according to the present embodiment can
prevent the storage case 6 from laterally rattling when the storage case 6 of a sliding
30 type is pulled out and when the storage case 6 is closed.

[0038]

The larger a clearance between the first rib 11 and the rail portion 9 corresponding to the support structure R or between the second rib 12 and the rail portion 9 is, the more easily fluctuations in manufacture are tolerated, and a manufacturer more easily manages products. The related-art refrigerator has such a disadvantage that lateral rattling of the storage case 6 is increased as the clearance is increased. However, the refrigerator 100 according to the present embodiment overcomes the disadvantage.

[0039]

It is conceivable to adopt a way of reducing lateral rattling of the storage case 6 by reducing the clearance between the rail portion 9 and the first rib 11 or between the rail portion 9 and the second rib 12. However, this way requires reduction in fluctuations in manufacture, and hence increases manufacturing cost for, for example, management of a step of manufacturing the storage case 6 and other components. In the refrigerator 100 according to the present embodiment, it is not necessary to forcibly reduce the clearance unlike the above-mentioned way. Thus, the refrigerator 100 according to the present embodiment can prevent the storage case 6 from laterally rattling while avoiding increase in manufacturing cost.

[0040]

The refrigerator includes a cooler and other devices, and hence components of the refrigerator are liable to thermally shrink. Accordingly, a size of the gap between the rail portion 9 and the first rib 11 or between the rail portion 9 and the second rib 12 may differ between a normal temperature condition and an operation condition. That is, lateral rattling of the storage case 6 is small under the normal temperature condition, but lateral rattling may increase under the operation condition.

In the refrigerator 100 according to the present embodiment, even when the gap is increased under the operation condition because of action of the elastic member 8, the storage case 6 is pressed onto the support structure R so that the storage case 6 and the support structure R come into contact with each other. Thus, the storage case 6 can be prevented from laterally rattling due to the gap.

[0041]

The elastic member 8 of the refrigerator 100 according to the present embodiment includes: the fixing portion 8A fixed in the storage compartment; and the pressing portion 8B positioned on the storage case 6 side with respect to the fixing portion 8A and configured to press the storage case 6 from the first inner side surface 100A2 side to the second inner side surface 100A1 side. The storage case 6 includes the concave portion 6C3 formed in the side surface portion 6B on the side on which the elastic member 8 is arranged, and the contact portion 6C5 that is formed on the side surface portion 6B at a position back from the concave portion 6C3, and comes into contact with the pressing portion 8B to be pressed onto the pressing portion 8B when the storage case 6 is moved. The pressing portion 8B enters into the concave portion 6C3.

That is, the concave portion 6C3 is formed in a front portion of the storage case 6, and the contact portion 6C5 is formed on a back portion of the storage case 6.

With this configuration, when the storage case 6 is pulled out to the front side (when the storage case 6 is open), the elastic member 8 and the contact portion 6C5 come into contact with each other, and the elastic member 8 shrinks. Meanwhile, when the storage case 6 is fully closed, the elastic member 8 enters into the concave portion 6C3, and the elastic member 8 is released from shrinkage.

Here, normally, during use of the refrigerator 100, a time period when the storage case 6 is fully closed is longer than a time period when the storage case 6 is pulled out. Therefore, the refrigerator 100 according to the present embodiment releases the elastic member 8 when the storage case 6 is fully closed, thereby being capable of preventing creep deformation of the elastic member 8. Thus, the storage case 6 can be further prevented from laterally rattling due to loss of elasticity of the elastic member 8, and reliability of the refrigerator 100 can be enhanced.

[0042]

In a horizontal sectional view, the pressing portion 8B of the refrigerator 100 according to the present embodiment is formed into an arc shape protruding to the side surface portion 6B side of the storage case 6, and the concave portion 6C3 is

formed into a concave shape so as to conform to the shape of the pressing portion 8B. Specifically, the elastic member 8 is formed of a blade spring. Further, in a horizontal sectional view, the pressing portion 8B of the elastic member 8 has a curved surface that is formed into an arc shape protruding to the side surface portion 6B side, and is smoothly curved so as to protrude to the side surface portion 6B side. The curved surface includes a curved surface extending from the second inner side surface 100A1 side to the first inner side surface 100A2 side as extending to the fixing portion 8A side from an apex protruding most to the storage case 6 side. The concave portion 6C3 has a curved surface (the curved surface 6C1 and the curved surface 6C2) conforming to the curved surface of the pressing portion 8B. Therefore, when the storage case 6 is closed and then the pressing portion 8B and the concave portion 6C3 come into contact with each other, the curved surface of the pressing portion 8B and the curved surface of the concave portion 6C3 come into contact with each other, with the result that a force of pulling the storage case 6 in a closing direction is generated (see Fig. 9). This structure can assist a force of closing the storage case 6 by a user, and can enhance operability.

Further, the elastic member 8 is formed of a blade spring. Accordingly, bulkiness can be avoided, and a limited space in the refrigerating compartment 1 can be effectively used. Further, the elastic member 8 is not formed by adopting a complicated mechanism, but formed of a blade spring. Thus, manufacturing cost can be reduced. Further, even when the elastic member 8 is broken, the elastic member 8 can be repaired easily. Consequently, repairing cost can be also reduced.

[0043]

Here, as illustrated in Fig. 5B, $\theta 1$ represents a largest angle of the curved surface 6C1. Specifically, the angle $\theta 1$ is a maximum angle formed between a front-and-back direction DR of the storage case 6 and a tangent line of the curved surface 6C1. Meanwhile, as illustrated in Fig. 5B, $\theta 2$ represents a largest angle of the pressing portion 8B of the elastic member 8 to be described later. Specifically, the angle $\theta 2$ is a maximum angle formed between the front-and-back direction DR of the

storage case 6 and a tangent line of the curved surface of the pressing portion 8B.

In the present embodiment, the angle $\theta 2$ is larger than the angle $\theta 1$. With this configuration, the force of closing the storage case 6 is applied more appropriately.

[0044]

5 In a case of adopting such a structure (recessed structure) that the entire storage case 6 falls down when the storage case 6 is fully closed, the structure can also assist a force of closing the storage case 6 by a user. However, when an amount of the stored objects put in the storage case 6 is large, load applied to the storage case 6 is increased. Consequently, a large force is needed to pull out the storage case 6, and opening and closing operation is not easily performed. Further, when the recessed structure is formed in a lateral partition, an adiabatic thickness is locally reduced. Thus, a surface temperature of the recessed structure is reduced due to an influence of the temperature of the storage compartment arranged below the refrigerating compartment 1, the temperature being kept at a temperature within the freezing temperature zone, which may result dew condensation on a surface of the recessed structure on the refrigerating compartment side. Further, when the storage case 6 falls into a recessed portion and comes out of the recessed portion, the storage case 6 is vertically moved. Thus, the storage case 6 may hit against a component (a partition or other components) arranged above the storage case 6 so that the storage case 6 and the component may be flawed and externally damaged. Further, when a clearance is formed so as to prevent the storage case 6 from hitting against the component arranged above the storage case 6, a dead capacity is required. In addition, there are problems in that garbage and spilled liquid in the refrigerator are accumulated in the recessed structure, and that it is difficult to clean the recessed structure.

25 The refrigerator 100 according to the present embodiment adopts the concave portion 6C3, and the recessed structure is not recessed vertically but recessed laterally. Accordingly, the refrigerator 100 is less liable to have such problems that opening and closing operation is not easily performed, that dew condensation occurs, that the storage case 6 and the component are flawed and externally damaged, that

the dead capacity is required, and that it is difficult to clean the recessed structure.

[0045]

The contact portion 6C5 of the refrigerator 100 according to the present embodiment includes the convex portion 6C4 that is formed on a portion connected to the concave portion 6C3 and protrudes to the elastic member 8 side. With this configuration, when a user closes the pulled-out storage case 6, the user can perceive by feeling through hand that the storage case 6 is fully closed. Further, the storage case 6 can be fully closed more reliably. Thus, the fully-closed storage case 6 can be prevented from being unintentionally moved to the front side to be opened. Therefore, for example, when the storage case 6 is used as the chilled compartment, leakage of chilled air in the storage case 6 can be avoided.

[0046]

In the refrigerator 100 according to the present embodiment, the gap S is defined between the concave portion 6C3 and the pressing portion 8B so as to prevent contact between the concave portion 6C3 and the pressing portion 8B under the state in which the storage case 6 is fully closed and the pressing portion 8B enters into the concave portion 6C3. With this configuration, the elastic member 8 is in a natural length state when the storage case 6 is fully closed. Thus, creep deformation of the elastic member 8 can be prevented more reliably. Therefore, the storage case 6 can be further prevented from laterally rattling due to loss of elasticity of the elastic member 8.

[0047]

In the refrigerator 100 according to the present embodiment, the support structure R includes the rail portion 9 that is formed on a placement surface for the storage case 6 in the storage compartment to extend in parallel to the depth direction and protrude from the placement surface side to the storage case 6 side. The storage case 6 includes the first rib 11 that is formed on the bottom surface portion 6A to extend in parallel to the depth direction and protrude to the rail portion 9 side along a side surface of the rail portion 9 on the side on which the elastic member 8 is arranged. With this configuration, when the storage case 6 is pressed to the second

inner side surface 100A1 side owing to action of the elastic member 8, the storage case 6 is moved to the second inner side surface 100A1 side until the first rib 11 and the rail portion 9 come into contact with each other. After the first rib 11 and the rail portion 9 come into contact with each other, the storage case 6 is not further moved to the second inner side surface 100A1 side, and is also less liable to move to the elastic member 8 side due to the elastic force of the elastic member 8. That is, while the storage case 6 of a sliding type is moved forward and backward, the storage case 6 can be prevented from laterally rattling.

[0048]

In the refrigerator 100 according to the present embodiment, the storage case 6 includes the second rib 12 that is formed on the bottom surface portion 6A to extend in parallel to the depth direction and protrude to the rail portion 9 side along a side surface of the rail portion 9 opposite to the side on which the first rib 11 is arranged. With this configuration, both sides of the rail portion 9 are guided. Therefore, even when a force exceeding the elastic force of the elastic member 8 is applied to the side on which the elastic member 8 is arranged when the storage case 6 is moved forward and backward, the storage case 6 can be prevented from moving to the elastic member 8 side (first inner side surface 100A2 side).

[0049]

The refrigerator 100 according to the present embodiment further includes the partition member 102 that is arranged on the placement surface for the storage case 6 and between the storage case 6 and the reservoir case (for example, the water tank 15) arranged beside the storage case 6, and is configured to partition the space into the side on which the reservoir case is arranged and the side on which the storage case 6 is arranged. The elastic member 8 is fixed to the partition member 102. As described above, the refrigerator 100 according to the present embodiment is not limited to the configuration fixing the elastic member 8 directly to a side surface of the refrigerating compartment 1. That is, it is not always necessary to fix the elastic member 8 to the first inner side surface 100A2 or another surface or the like, and the elastic member 8 may be fixed to a component (partition member 102) configured to

partition a space in the refrigerating compartment 1. Even in this configuration or in the configuration fixing the elastic member 8 to the first inner side surface 100A2 or another surface or the like of the refrigerating compartment 1, the storage case 6 can be prevented from laterally rattling when the storage case 6 of a sliding type is moved forward and backward.

[0050]

In the refrigerator 100 according to the present embodiment, the recessed portion 102A is formed in the partition member 102 in front of the position of fixing the elastic member 8, and serves as the recess configured to receive the elastic member 8 when the elastic member 8 comes into contact with the storage case 6 and then bends. Thus, there can be avoided interference between the elastic member 8 and a component (vertical partition) to which the elastic member 8 is fixed, and there can be avoided damage of the component to which the elastic member 8 is fixed.

Further, when the elastic member 8 bends, the elastic member 8 is received in the recess. Accordingly, the storage case 6 is smoothly pulled out in the front-and-back direction.

[0051]

The storage compartment of the refrigerator 100 according to the present embodiment is the refrigerating compartment 1. The storage case 6 is arranged on a bottom of the refrigerating compartment 1. For example, the storage case 6 can be used as the chilled compartment.

[0052]

The refrigerator 100 according to the present embodiment may include no gap S, and the concave portion 6C3 of the flange portion 6C and the pressing portion 8B of the elastic member 8 may be held in contact with each other. The refrigerator 100 includes at least the concave portion 6C3. Accordingly, even when the elastic member 8 is not restored to a natural length, load on the elastic member 8 can be lessened in some degree, and creep deformation can be prevented.

[0053]

As the refrigerator 100 according to the present embodiment, the refrigerator

100 including the case 50 is described, but the present invention is not limited thereto.

The refrigerator 100 may include no case 50.

[0054]

As the support structure R of the refrigerator 100 according to the present
5 embodiment, the support structure R formed into a straight shape is described, but
the present invention is not limited thereto. For example, the support structure R
may be shaped so as to be spaced intermittently.

[0055]

As the refrigerator 100 according to the present embodiment, description is
10 made of the refrigerator 100 including the rail portion 9 having the protruding structure
and including the storage case 6 having the recessed structure, but the present
invention is not limited thereto. For example, the rail portion 9 may have the
recessed structure, and the storage case 6 may have the protruding structure. In
this case, one or a plurality of recessed portions extending in the front-and-back
15 direction may be formed in the partition member 7, and one or a plurality of
projections to be fitted into the one or the plurality of recessed portions may be
formed on the bottom surface portion 6A of the storage case 6. In this case,
because of adoption of the recessed structure, dew condensation may occur due to
an influence of cold air in the ice making compartment 2 or other compartments, and
20 it may be difficult to clean the recessed structure. However, the storage case 6 can
be prevented from laterally rattling when the storage case 6 of a sliding type is moved
forward and backward.

Reference Signs List

25 [0056]

1 refrigerating compartment 1A double doors 2 ice making compartment
2A drawer 3 switching compartment 3A drawer 4 freezing
compartment 4A drawer 5 vegetable compartment 5A drawer 6
storage case 6A bottom surface portion 6B side surface portion
30 6C flange portion 6C1 curved surface 6C2 curved surface 6C3

concave portion 6C4 convex portion 6C5 contact portion 6D side
surface portion 6E flange portion 6F back surface portion 6G front surface
portion 7 partition member 8 elastic member 8A fixing portion 8B
pressing portion 8C distal end 9 rail portion 9A rail portion 9B rail
5 portion 11 first rib 11A first rib 11B first rib 12 second rib 15
water tank 50 case 51 partition member 100 refrigerator 100A heat
insulating box body 100A1 second inner side surface 100A2 first inner
side surface 100A3 back surface 100A4 bottom surface 100A5 top surface
101 shelf 102 partition member 102A recessed portion AR arrow
AR1 arrow AR2 arrow AR3 arrow P placement surface R support
10 structure S gap

CLAIMS

[Claim 1]

A refrigerator, comprising:

a heat insulating box body;

5 a storage compartment formed in the heat insulating box body;

a storage case placed in the storage compartment and arranged so as to be movable in a depth direction of the storage compartment;

an elastic member fixed on a side of the storage case in the storage compartment, and configured to press the storage case from a first inner side surface side of the storage
10 compartment to a second inner side surface side of the storage compartment opposed to the first inner side surface side; and

a support structure arranged below the storage case in the storage compartment, and configured to guide the storage case to travel in the depth direction and to restrain the storage case from moving in a direction of pressing the storage case by the elastic member.

15 [Claim 2]

The refrigerator of claim 1, wherein

the elastic member includes

a fixing portion fixed in the storage compartment, and

a pressing portion positioned on the storage case side with respect to the fixing
20 portion, and configured to press the storage case from the first inner side surface side to the second inner side surface side, and

the storage case includes

a concave portion into which the pressing portion enters, the concave portion being
25 formed in a side surface portion of the storage case on a side on which the elastic member is arranged, and

a contact portion formed on the side surface portion at a position back from the concave portion, and configured to come into contact with the pressing portion to be pressed onto the pressing portion when the storage case is moved.

[Claim 3]

30 The refrigerator of claim 2, wherein,

in a horizontal sectional view, the pressing portion has an arc shape protruding to the side

surface portion side of the storage case, and

the concave portion is formed into a concave shape conforming to a shape of the pressing portion.

[Claim 4]

5 The refrigerator of claim 2 or 3, wherein the contact portion comprises a convex portion that is formed on a portion connected to the concave portion and protrudes to the elastic member side.

[Claim 5]

10 The refrigerator of any one of claims 2 to 4, wherein the refrigerator has a gap defined between the concave portion and the pressing portion to prevent contact between the concave portion and the pressing portion under a state in which the storage case is fully closed and the pressing portion enters into the concave portion.

[Claim 6]

15 The refrigerator of any one of claims 1 to 5, wherein the support structure includes a rail portion that is formed on a placement surface for the storage case in the storage compartment to extend in parallel to the depth direction and protrude from the placement surface side to the storage case side, and

20 the storage case includes a first rib that is formed on a bottom surface of the storage case to extend to the depth direction and protrude to the rail portion side along a side surface of the rail portion on the side on which the elastic member is arranged.

[Claim 7]

25 The refrigerator of claim 6, wherein the storage case comprises a second rib that is formed on the bottom surface of the storage case to extend to the depth direction and protrude to the rail portion side along a side surface of the rail portion opposite to a side on which the first rib is arranged.

[Claim 8]

30 The refrigerator of any one of claims 1 to 7, comprising:
a reservoir case arranged beside the storage case and on a placement surface for the storage case; and
a partition member arranged between the reservoir case and the storage case, and partitioning a space in the storage compartment into a side on which the reservoir case is

arranged and a side on which the storage case is arranged,
wherein the elastic member is fixed to the partition member.

[Claim 9]

5 The refrigerator of claim 8, wherein the partition member comprises a recessed portion
that is formed at a position in front, in the depth direction, of a position of fixing the elastic
member, and form a clearance configured to receive the elastic member when the elastic member
comes into contact with the storage case and bends.

[Claim 10]

10 The refrigerator of claim 8 or 9, wherein
the partition member is a vertical partition arranged between the first inner side surface
and the second inner side surface.

[Claim 11]

The refrigerator of any one of claims 1 to 7, wherein
the elastic member is fixed to the first inner side surface.

15 [Claim 12]

The refrigerator of any one of claims 1 to 11, wherein
the storage compartment comprises a refrigerating compartment, and
the storage case is arranged on a bottom of the refrigerating compartment.