DESCRIPTION

Title of Invention

REFRIGERATOR

Technical Field

[0001]

The present disclosure relates to a refrigerator provided with an ice-making compartment that is configured to generate and store ice.

Background Art

[0002]

In automatic ice-making systems used in known refrigerators, a water supply tank that supplies water to an ice maker is often located in a refrigerator compartment set in a refrigerating temperature range (0 to 6 degrees C) in order to both preserve water for a long period of time and prevent water from freezing. In this case, a refrigerator provided with a water supply tank being embedded in a floor surface of the refrigerator compartment has been proposed so as to secure a storage capacity of the refrigerator compartment (see Patent Reference 1, for example).

[0003]

The water supply tank is located in front of the refrigerator compartment to make it easier for a user to take out the water supply tank. The ice maker and the water supply tank are placed close to each other for the purpose of reducing the length of a water supply route as short as possible. Furthermore, if the water supply tank and the ice maker are placed side by side in a width direction, a storage capacity of the adjacent storage compartment is reduced due to an increase in width dimension of the ice-making compartment. For this reason, a configuration in which the ice maker is placed behind the water supply tank has been proposed.

Citation List

Patent Literature

[0004]

Patent Literature 1: Japan Patent No. 3102841

Summary of Invention

Technical Problem

[0005]

However, in a configuration where the ice maker is located behind the water supply tank, a problem arises that the ice maker in the ice-making compartment cannot be removed in a forward direction and hence cannot be cleaned by common users.

[0006]

Embodiments of the present disclosure seek to provide a refrigerator in which an ice maker can be easily removed while securing a storage capacity of a storage compartment.

[0007]

A refrigerator according to one embodiment of the present disclosure is a refrigerator comprising: an insulating box body; a refrigerator compartment provided in the insulating box body; an ice-making compartment provided in the insulating box body and located below the refrigerator compartment; a freezer compartment provided in the insulating box body and located adjacent to the ice-making compartment; a first insulating partition configured to divide the refrigerator compartment and the ice-making compartment, the first insulating partition forming at least part of a floor surface of the refrigerator compartment, and having a storage section that is recessed below the floor surface; a second insulating partition configured to divide the ice-making compartment and the freezer compartment; a third insulating partition configured to divide the refrigerator compartment and the freezer compartment, the third insulating partition forming at least part of the floor surface of the refrigerator compartment; a water supply tank accommodated in the storage section and is configured to supply water used in ice making in the ice-making compartment; and an ice maker arranged in the ice-making compartment and is configured to generate ice from the water supplied from the water supply tank, wherein the water supply tank and the ice maker are arranged at a position where they do not overlap in a front view, the water supply tank and the ice maker are arranged at a position where at least part of them overlap in a top view, the first insulating partition, the second insulating partition, and

the third insulating partition are filled with different insulating materials, and the ice maker is configured to be inserted and removed by a back-and-forth movement.

A refrigerator according to another embodiment of the present disclosure is refrigerator comprising: an insulating box body including a refrigerator compartment and an ice-making compartment; a first insulating partition configured to divide the refrigerator compartment and the ice-making compartment, the first insulating partition forming at least part of a floor surface of the refrigerator compartment, and having a storage section that is recessed below the floor surface; a water supply tank accommodated in the storage section and is configured to supply water used in ice making in the ice-making compartment; and an ice maker provided in the ice-making compartment and is configured to generate ice from the water supplied from the water supply tank, wherein the ice-making compartment is provided below the refrigerator compartment, the water supply tank and the ice maker are arranged at respective positions where the water supply tank and the ice maker do not overlap each other as viewed in a front view, the water supply tank and the ice maker are arranged at respective positions where the water supply tank and of the ice maker at least partially overlap each other as viewed in a top view, the ice maker is configured to be inserted and removed by a back-and-forth movement, the insulating box body includes an outer box, an inner box, and an insulating material filled between the outer box and the inner box, the insulating box body has a fill port from which the insulating material is filled, and the fill port is provided at a position where the fill port overlaps the first insulating partition in a height direction as viewed in a side view and is located in a side surface of the insulating box body on a side where the ice-making compartment is provided.

Advantageous Effects of Invention

[0008]

According to one embodiment of the refrigerator of the present disclosure, a first insulating partition has a storage section that stores a water supply tank, and the water supply tank and the ice maker are arranged such that they do not overlap in a front view

but they partially overlap in a top view, whereby removal of the ice maker can be facilitated while securing a storage capacity of the storage compartment.

[0009]

Brief Description of Drawings

[Fig. 1] Fig. 1 is a front view of a refrigerator according to Embodiment 1.

[Fig. 2] Fig. 2 is a schematic diagram of the refrigerator illustrated in Fig. 1 with illustration of a door being omitted.

[Fig. 3] Fig. 3 is a schematic cross-sectional view of a peripheral area of an ice-making compartment of the refrigerator according to Embodiment 1.

[Fig. 4] Fig. 4 is a perspective view of a handle and an ice-making tray of the ice maker according to Embodiment 1.

[Fig. 5] Fig. 5 is a perspective bottom view illustrating the ice maker, a gear box and a frame according to Embodiment 1, and is a perspective bottom view showing a state where the ice maker is attached to the gear box and attached in the frame.

[Fig. 6] Fig. 6 is a perspective view illustrating the ice maker, the gear box and the frame according to Embodiment 1, and is a perspective bottom view showing a state where the ice maker is removed from the gear box.

[Fig. 7] Fig. 7 is a schematic perspective view of each of the ice maker, a water supply tank and a water supply pipe according to Embodiment 1.

[Fig. 8] Fig. 8 is an exploded perspective view showing one example of a configuration of the water supply pump according to Embodiment 1.

[Fig. 9] Fig. 9 is a schematic top view of the ice maker, the water supply tank and the water supply pipe according to Embodiment 1.

[Fig. 10] Fig. 10 is a schematic cross-sectional diagram of the ice maker and a first insulating partition according to Embodiment 1.

[Fig. 11] Fig. 11 is a schematic cross-sectional diagram of the water supply tank and the ice maker according to Embodiment 1.

[Fig. 12] Fig. 12 is a schematic cross-sectional diagram of a refrigerator compartment according to Embodiment 1.

[Fig. 13] Fig. 13 is a schematic cross-sectional diagram of a peripheral area of the ice-making compartment of a refrigerator according to Embodiment 2.

Description of Embodiments

[0010]

Embodiments will be described below with reference to the drawings. In each figure, those with the same symbol are the same or equivalent components. This is applied to the entire description. Shapes of the components shown in the entire description are given only for exemplary purposes and are not restrictive. Furthermore, in the following drawings, the size relationships of the components may differ from those of the actual ones.

[0011]

Embodiment 1

Fig. 1 is a front view of the refrigerator 1 according to Embodiment 1, and Fig. 2 is a schematic diagram of the refrigerator 1 illustrated in Fig. 1 with illustration of a door being omitted. The positional relationship (vertical relationship, for example) of the components in the specification is, in principle, a positional relationship when the refrigerator 1 is installed in a usable state. To clarify the correspondence between the following drawings, including Figs. 1 and 2, the coordinate system is defined as follows. The left-to-right direction of the refrigerator 1 is defined as an X axis, the up-down direction of the refrigerator 1 is defined as a Y axis, and the front-back direction of the refrigerator 1 is defined as a Z axis in a front view of the refrigerator 1. Usually, the XY and ZY planes are vertical planes and the XZ plane is a horizontal plane. In the following explanation, the X-axis direction is referred to as a "left-right direction" or a "width direction", the Y-axis direction is referred to as an "up-down direction" or a "height direction", and the Z-axis direction is referred to as a "front-back direction" or a "depth direction".

[0012]

(Configuration of Refrigerator 1)

As illustrated in Figs. 1 and 2, the refrigerator 1 according to the present embodiment is provided with an insulating box body 2 that is open at the front and has a

storage space 3 being formed inside. The insulating box body 2 includes an outer box 2a that is made of steel plate and forming an outer contour, an inner box 2b made of thin-walled hard resin such as ABS resin and is placed inside the outer box 2a, and an insulating material 2c such as rigid urethane foam (urethane foam) filled between the outer box 2a and the inner box 2b.

[0013]

A storage space 3 formed inside the insulating box body 2 is divided into a plurality of storage compartments for storing food by a plurality of partitioning sections. The refrigerator 1 of the present embodiment includes, as the plurality of storage compartments, a refrigerator compartment 100, a first freezer compartment 200, an ice-making compartment 300, a vegetable compartment 400, and a second freezer compartment 500. The refrigerator compartment 100 is located at a top shelf, and below the refrigerator compartment 100, the first freezer compartment 200 and the ice-making compartment 300 are located such that they are adjacent to each other in the width direction. The vegetable compartment 400 is located below the first freezer compartment 200 and the ice-making compartment 300, and the second freezer compartment 500 is located below the vegetable compartment 400 and is located at bottom. The first freezer compartment 200 may be a temperature switching compartment.

[0014]

An opening formed at a front of the refrigerator compartment 100 is provided with a double swing-type left door 11a and a double swing-type right door 11b each configured to open and close the opening. Openings formed at the front of the first freezer compartment 200, the ice-making compartment 300, the vegetable compartment 400, and the second freezer compartment 500 are provided with a second freezer compartment door 12, an ice-making compartment door 13, a vegetable compartment door 14, and a first freezer compartment door 15, respectively. These doors are withdrawable and serve to open and close the openings. The left door 11a of the refrigerator compartment 100 is provided with an operation section 10 configured to

allow a user to perform operations such as temperature settings for each storage compartment.

[0015]

The refrigerator compartment 100 is set in a refrigerating temperature zone (about 3 degrees C, for example). The first freezer compartment 200 is set in a first freezing temperature zone (about -18 degrees C, for example) or a soft freezing temperature zone (about -7 degrees C, for example). The ice-making compartment 300 is set in a second freezing temperature zone (about -18 degrees C, for example). The vegetable compartment 400 is set to be cooled in a refrigerating temperature zone (about 6 degrees C, for example). The second freezer compartment 500 is set in a third freezing temperature zone (about -18 degrees C, for example).

[0016]

A first insulating partition 30 is installed between the refrigerator compartment 100 and the ice-making compartment 300 and the first freezer compartment 200. Between the ice-making compartment 300 and the first freezer compartment 200, the first insulating partition 30 and a second insulating partition 31 provided below the first insulating partition 30 are installed. A fourth insulating partition 32a is installed between the ice-making compartment 300, the first freezer compartment 200 and the vegetable compartment 400. A fifth insulating partition 32b is installed between the vegetable compartment 400 and the second freezer compartment 500.

[0017]

The first insulating partition 30 separates the refrigerator compartment 100 from the ice-making compartment 300 and forms a floor surface 100a of the refrigerator compartment 100. The first insulating partition 30 has a water supply tank storage section 30a that is a concave-shaped storage space recessed below the floor surface 100a of the refrigerator compartment 100. The water supply tank storage section 30a is covered by the first insulating partition 30 and faces the refrigerator compartment 100. The temperature of the water supply tank storage section 30a is maintained in the refrigerator compartment temperature zone, for example.

[0018]

On a rear side of each storage compartment, a cooling mechanism 81 that supplies cold air to each storage compartment and a controller 82 configured to control various sections of the refrigerator 1 are provided. Each storage compartment is provided with an internal temperature sensor (not illustrated) configured to detect the temperature inside each storage compartment. Each internal temperature sensor is a thermistor, for example, and a measured temperature is transmitted to the controller 82.

[0019]

The cooling mechanism 81 has a refrigerant circuit including a compressor and a chiller, an air passage that propagates cold air supplied from the refrigerant circuit to each storage compartment, and a damper provided in the air passage. The controller 82 includes a processor, such as a CPU, or a memory such as a RAM, a ROM and flash memory. The controller 82 controls the cooling mechanism 81 to cool each storage compartment based on detection signals from each sensor of the refrigerator 1 and setting information input through the operation section 10.

[0020]

(Configuration of Ice-making Compartment 300)

Next, the configuration of a peripheral area of the ice-making compartment 300 of the present embodiment will be described in detail. Fig. 3 is a schematic cross-sectional view of a peripheral area of the ice-making compartment 300 of the refrigerator 1 according to Embodiment 1. Fig. 3 is a view taken by cutting the peripheral area of the ice-making compartment 300 along the XY plane and is viewed from the front. As illustrated in Fig. 3, the ice maker 20 that generates ice and an ice storage case 21 that stores ice generated by the ice maker 20 are arranged in the ice-making compartment 300. The ice storage case 21 is located below the ice maker 20.

[0021]

The water supply tank storage section 30a formed of the first insulating partition 30 is located on the right side of the ice maker 20 and above the ice storage case 21. The water supply tank 22 is stored in the water supply tank storage section 30a. The water supply tank 22 is a tank configured to store water to be sent to the ice maker 20. A water supply pipe 61 is connected to the water supply tank 22. The water supply

pipe 61 is arranged such that it penetrates the water supply tank storage section 30a and supplies water from the water supply tank 22 to the ice maker 20.

[0022]

As described above, in the present embodiment, since the water supply tank 22 is stored in the first insulating partition 30, a storage capacity of the refrigerator compartment 100 can be increased. For example, as illustrated in Fig. 3, a refrigerator compartment case 23 is located on a floor surface 100a of the refrigerator compartment 100. In this case, if the water supply tank 22 is arranged on an upper surface of the first insulating partition 30, i.e., on the floor surface 100a of the refrigerator compartment 100, and beside the refrigerator compartment case 23, a width dimension of the refrigerator compartment case 23 has to be reduced. In contrast, in the present embodiment, a storage capacity of the refrigerator compartment 100 and a dimension of the refrigerator compartment case 23 are not affected by the water supply tank 22.

[0023]

The ice maker 20 is arranged at a position where a front projection plane of the ice maker 20 does not overlap the water supply tank 22 and the first insulating partition 30 that forms the water supply tank storage section 30a. In other words, the ice maker 20 is arranged at a position where it does not overlap the water supply tank 22 and the first insulating partition 30 in a front view of the refrigerator 1. Due to this arrangement, a user can insert and remove the ice maker 20 by a back-and-forth movement while avoiding contact of the ice maker 20 with the water supply tank 22 or the first insulating partition 30. This allows a user to easily remove the ice maker 20 from the ice-making compartment 300 and wash, whereby the ice maker 20 can be kept clean.

[0024]

The ice maker 20 and the water supply tank 22 are arranged at a position where they partially overlap in a top view of the refrigerator 1. This allows an upper space of the ice maker 20 to be utilized as a space in which the water supply tank 22 is arranged, and also makes it possible to increase a water storage capacity of the water supply tank 22. Further, since a storage capacity of the water supply tank 22 can be secured without increasing a width dimension of the ice-making compartment 300, a storage

capacity of the adjacent first freezer compartment 200 can also be secured. In other words, by arranging the ice maker 20 and the water supply tank 22 as in the present embodiment, a storage capacity of each of the refrigerator compartment 100 and the first freezer compartment 200 can be secured, and the ice maker 20 can be easily inserted and removed.

[0025]

The insulating box body 2 has a fill port 33 through which the insulating material 2c is injected. The first insulating partition 30 has an outer contour section 30b that forms a surface of the first insulating partition 30, and an interior of the outer contour section 30b is filled with the insulating material 2c. The insulating material 2c injected through the fill port 33 of the insulating box body 2 is filled between the outer box 2a and inner box 2b, and flows into the outer contour section 30b through an injection opening 9a of the inner box 2b and an injection opening 9b of the outer contour section 30b provided at a joint 8a of the first insulating partition 30 and the inner box 2b. This allows the insulating material 2c to be filled in the outer contour section 30b of the first insulating partition 30. As illustrated in Fig. 3, the injection opening 9a of the inner box 2b and the injection opening 9b of the outer contour section 30b are provided at the same position.

[0026]

When rigid urethane foam is used as the insulating material 2c, for example, at a position far away from the fill port 33, it takes time for rigid urethane foam to be filled, and during a period of time until rigid urethane foam reaches the position, hardness of rigid polyurethane foam increases, making it difficult for rigid urethane foam to flow. Furthermore, rigid urethane foam is difficult to flow in narrow or bended parts of flow passages. Therefore, it is desirable that bended parts in the first insulating partition 30 be located close to the fill port 33. For example, it is desired that the fill port 33 and the bended parts 66a, 66b, 66c and 66d of the water supply tank storage section 30a be located close to each other.

[0027]

In the refrigerator 1 of the present embodiment, as illustrated in Fig. 3, the fill port 33 and the first insulating partition 30 are provided at a position where they overlap in the height direction in a side view of the refrigerator 1. The fill port 33 and the water supply tank storage section 30a are provided at a position where they overlap in the depth direction in a side view of the refrigerator 1. This arrangement of the fill port 33 makes it easier to fill the insulating material 2c in the water supply tank storage section 30a, which has a complex shape, and improves insulation performance of the first insulating partition 30, as well as the strength and the productivity of the refrigerator 1.

[0028]

The fill port 33 is provided at a position where it overlaps the injection opening 9a of the inner box 2b and the injection opening 9b of the outer contour section 30b of the first insulating partition 30 in a side view of the refrigerator 1. However, the position of the fill port 33 is not limited to the left side surface of the outer box 2a as illustrated in Fig. 3, but can be provided at the rear side surface, front or back of the left side surface or the right side surface of the outer box 2a at a position where the fill port 33 and the first insulating partition 30 overlap in the height direction. For example, the fill port 33 may be provided at a position where it overlaps the injection opening 9c on the right side of the inner box 2b illustrated in Fig. 3 and the injection opening 9d on the right side surface of the outer contour section 30b of the first insulating partition 30 in a side view of the refrigerator 1. Alternatively, the fill port 33 may be provided at two or more of the above-mentioned multiple locations.

[0029]

A heater 34 is installed in the first insulating partition 30 that forms the water supply tank storage section 30a. The heater 34 is installed in a bottom section 30c of the first insulating partition 30, which forms a bottom surface of the water supply tank storage section 30a. The water supply tank 22 is positioned above the heater 34. The heater 34 is attached to the bottom section 30c by aluminum tape or other means. The heater 34 generates heat by being energized by the controller 82. This allows the water supply tank 22 to be heated and heat transfer from the water supply tank 22 to the ice-making compartment 300 or the first freezer compartment 200 to be

compensated by the heat from the heater 34, thereby suppressing freezing of the water in the water supply tank 22. This allows the refrigerator 1 of the present embodiment to reduce the insulation thickness of the first insulating partition 30 as compared to a case where the heater 34 is not provided, thereby increasing a storage capacity of the ice-making compartment 300 or the first freezer compartment 200.

[0030]

The controller 82 may change an energization rate of the heater 34 according to the temperature setting of any of the refrigerator compartment 100, the first freezer compartment 200, and the ice-making compartment 300. For example, the controller 82 sets an energization rate of the heater 34 in such a manner that, the lower the set temperature in each storage compartment is, the higher the energization rate of the heater 34 will be. This allows the amount of heat input to the water supply tank 22 to be adjusted according to the ambient temperature environment.

[0031]

The second insulating partition 31 is provided so as to contact a lower surface 30d of the bottom section 30c of the first insulating partition 30 and contact an upper surface 32a1 of the fourth insulating partition 32a. The second insulating partition 31 is filled with an insulating material 2d, which is made of a material different from the insulating material 2c. In this way, the ice-making compartment 300 and the first freezer compartment 200 are divided by a side surface section 30e of the first insulating partition 30 and the second insulating partition 31 located below the side surface section 30e. In Fig. 3, the side surface section 30e of the first insulating partition 30 forms a right side surface of the water supply tank storage section 30a, and is a portion provided between the water supply tank storage section 30a and the first freezer compartment 200.

[0032]

Ice grains are assumed to be stored in the ice-making compartment 300, and fresh or frozen food is assumed to be stored in the first freezer compartment 200. Therefore, the ice-making compartment 300 may generally have a smaller storage capacity than that of the first freezer compartment 200 and is desirably narrow in width

direction. The dimension in width dimension of the ice-making compartment 300 is determined by the position of the second insulating partition 31. For example, if the second insulating partition 31 is located so as to be spaced away from the water supply tank storage section 30a to thereby separate the ice-making compartment 300 from the first freezer compartment 200, the dimension in width direction of the ice-making compartment 300 becomes unnecessarily large.

[0033]

In the present embodiment, the water supply tank storage section 30a of the first insulating partition 30 and the second insulating partition 31 are arranged such that they overlap vertically one on top of the other. In other words, the water supply tank storage section 30a and the second insulating partition 31 are located at a position where they overlap in a top view. Due to such an arrangement of the second insulating partition 31, the dimension in width direction of the ice-making compartment 300 can be reduced, whereby an area where the first freezer compartment 200 is accommodated can be increased.

[0034]

(Configuration of Ice Maker 20)

Next, the configuration of the ice maker 20 will be described. Fig. 4 is a perspective view of the handle 51 and the ice-making tray 50 of the ice maker 20 according to Embodiment 1. After filling the water supply tank 22 with water, the ice maker 20 automatically performs ice-making steps including water supply, ice making, and ice separation until the water in the water supply tank 22 cannot be discharged any more or until fullness of ice is detected in the ice storage case 21 of the ice-making compartment 300.

[0035]

As illustrated in Fig. 4, the ice maker 20 has the handle 51, which a user grips when removing the ice maker 20 from the ice-making compartment 300, and the ice-making tray 50, which divides and stores the water supplied from the water supply tank 22. The ice-making tray 50 has a plurality of recesses 50a for dividing water. The ice-making tray 50, with the ice maker 20 being installed in the ice-making compartment

300, has a dimension that is large in depth direction as compared with that in width direction.

[0036]

Since the ice-making tray 50 has a dimension that is large in depth direction as compared with that in width direction, the amount of water that can be stored at one time can be increased while controlling the width dimension of the ice maker 20. This makes it possible to make more ice at one time without making the width dimension of the ice-making compartment 300 larger than necessary.

[0037]

Fig. 5 is a perspective bottom view illustrating the ice maker 20, the frame 53, and the gear box 54 according to Embodiment 1. Fig. 5 illustrates a state in which the ice maker 20 is attached to the gear box 54 and attached in the frame 53. Fig. 6 is a perspective view of the ice maker 20, the frame 53 and the gear box 54 according to Embodiment 1. Fig. 6 illustrates a state in which the ice maker 20 is removed from the gear box 54. As illustrated in Figs. 5 and 6, the ice maker 20 includes the ice-making tray 50, the handle 51, the frame 53, the gear box 54 and the ice storage detection lever 56.

[0038]

The frame 53 forms a contour of the ice maker 20 and, as illustrated in Figs. 5 and 6, is L-shaped in a side view and is in a rectangular frame in a top view. The frame 53 holds the ice-making tray 50 and the handle 51, and an upper surface portion thereof is attached to a ceiling of the ice-making compartment 300. The gear box 54 is arranged on the rear side of the frame 53. The gear box 54 is a device configured to rotate the ice-making tray 50 to cause the ice produced by the ice-making tray 50 to fall into the ice storage case 21.

[0039]

The ice-making tray 50 is designed to produce multiple pieces of ice at a time, in which each piece of the multiple pieces of ice being capable of being produced from about 10 cc of water, for example. Therefore, the interior thereof is partitioned into two rows on the left and right in the depth direction of the refrigerator 1. In the example of

the present embodiment, the ice-making tray 50 has 12 recesses 50a, i.e. two rows on the left and right and six rows in the front and back, so that 12 pieces of ice can be generated at a time.

[0040]

One end of the ice-making tray 50 has a convex portion that is inserted into a through hole formed in a side surface portion of the handle 51. A recess is formed in the other end of the ice-making tray 50 into which the rotational axis 54a of the gear box 54 is fitted. The ice-making tray 50 is provided inside of an interior portion that is enclosed by the handle 51, the frame 53, and the gear box 54, and is axially supported at both ends by the handle 51 and the gear box 54. As a result, the ice-making tray 50 can rotate around a rotational axis 54a.

[0041]

The ice produced in the ice-making tray 50 is separated by rotation of the ice-making tray 50 by the gear box 54, and the separated ice drops onto the ice storage case 21. Specifically, when the gear box 54 rotates the ice-making tray 50, a stopper receiving section provided in the ice-making tray 50 is caught by a stopper section of the frame 53. Then, since the gear box 54 further continues to rotate the ice-making tray 50, the ice-making tray 50 can be twisted, whereby ice is separated from the ice-making tray 50.

[0042]

The ice storage detection lever 56 is provided to detect whether the ice storage case 21 is full and then to determine whether the ice can be made continuously. The ice storage detection lever 56 is attached to a side surface of the gear box 54, as illustrated in Figs. 5 and 6. When the ice storage detection lever 56 contacts the ice in the ice storage case 21 when it is in a lowered state, it is detected that the ice storage case 21 is full and is determined that further ice making is impossible.

[0043]

The ice maker 20 may further be provided with an ice-making tray temperature sensor that measures a temperature of ice in the ice-making tray 50. The ice-making tray temperature sensor is a thermistor, for example, and is covered by a temperature

sensor cover and attached in close contact to a lower surface of the ice-making tray 50. A temperature measured by the ice-making tray temperature sensor is transmitted to the controller 82. The controller 82 controls the gear box 54 according to a temperature measured by the ice-making tray temperature sensor.

[0044]

(Configuration of Water Supply Tank)

Next, the configuration of the water supply tank 22 is described. Fig. 7 is a schematic perspective view of each of the ice maker 20, the water supply tank 22 and the water supply pipe 61 according to Embodiment 1. Fig. 7 shows an exploded diagram of each of the ice maker 20, the water supply tank 22, and the water supply pipe 61.

[0045]

As illustrated in Fig. 7, the water supply tank 22 has a water storage container 58 formed in a box shape with an opening on a top surface, a water supply pump 59 located inside the water storage container 58, a filter 60 attached to the front of the water supply pump 59, and a water supply tank lid 24.

[0046]

As illustrated in Fig 7, the water storage container 58 has four corners in a top view. In the vicinity of one of the four corners of the water storage container 58, a drain outlet port 62 to which the water supply pipe 61 is connected is formed. The remaining three corners are formed in a shape that has a rounded inner circumference, that is, the so-called "R" shape.

[0047]

Fig. 8 is an exploded perspective view showing an example of a configuration of the water supply pump 59 according to Embodiment 1. The water supply pump 59 is provided so as to send water out from the water storage container 58 to the ice-making tray 50. As illustrated in Fig. 8, the water supply pump 59 includes a pump cover 59a provided with a water supply port 63, a propeller 59b including a magnet in its inside and a pump case 59c. These are combined to form the water supply pump 59. In the

water supply pump 59, the propeller 59b rotates as a magnet attached to an external pump motor (not illustrated) rotates.

[0048]

The pump case 59c is provided with a drainage pipe 65 that extends upward. The drainage pipe 65 is provided such that it extends from a vicinity of an end portion in the left-right direction of the pump case 59c in a direction tangential to the direction of rotation of the propeller 59b.

[0049]

The drainage pipe 65 is configured such that it extends upward and vertically from the pump case 59c, bends at a height of a full water line of the water supply tank 22 and extends along a wall surface of the water storage container 58. One end of the drainage pipe 65 is connected to a drain outlet port 62 of the water storage container 58. When the propeller 59b rotates in the forward direction, the drainage pipe 65 distributes water that is taken from the water supply port 63 and is staying in the water storage container 58 to distribute to the drain outlet port 62.

[0050]

Referring back to Fig. 7, the water supply pipe 61 serves as a water supply route for supplying water in the water storage container 58 to the ice-making tray 50. The water supply pipe 61 is configured independently from the water supply tank 22, and is detachably attached to the water supply tank 22. As illustrated in Fig. 7, the water supply pipe 61 has an inlet port 61a into which water from the water storage container 58 flows, an outlet port 61b that allows water to flow out to the ice-making tray 50, and a pathway section 61c that connects the inlet port 61a and the outlet port 61b.

[0051]

Fig. 9 is a schematic top view of the ice maker 20, the water supply tank 22, and the water supply pipe 61 according to Embodiment 1. As illustrated in Fig. 9, the outlet port 61b of the water supply pipe 61 is located rearward relative to the inlet port 61a. In other words, the pathway section 61c of the water supply pipe 61 is arranged so as to extend diagonally backward from the inlet port 61a. The outlet port 61b of the water supply pipe 61 is positioned to overlap with the ice-making tray 50 in a top view. As a

result, water passing through the water supply pipe 61 is discharged from the top of the ice maker 20 with a velocity component equal to a velocity component in the longitudinal direction (depth direction of the refrigerator 1). By arranging the water supply pipe 61 and the ice-making tray 50 in this way, it is possible to prevent quality defects such as water splashing from the ice maker 20 and falling into the ice storage case 21, causing the stored ice to stick together.

[0052]

Fig. 10 is a schematic cross-sectional diagram of the ice maker 20 and the first insulating partition 30 according to Embodiment 1. Fig. 10 shows a state in which the center in a width direction of the ice-making tray 50 is cut along the ZY plane. As illustrated in Fig. 10, behind the gear box 54 of the ice maker 20, a windway guide section 69 is provided. The windway guide section 69 is a wind passage that is connected to the cooling mechanism 81 and sends cold air generated by the cooling mechanism 81 to the ice-making tray 50 via the inside of the frame 53.

[0053]

The ceiling surface of the frame 53 has a slope 74 that extends diagonally upward from the back to the front. A temperature sensor 73 is provided on the slope 74. The temperature sensor 73 is, for example, an infrared sensor. The temperature sensor 73 measures a temperature of each of the four front recesses 50a of the ice-making tray 50 and transmits an average value to the controller 82. The temperature sensor 73 detects whether water has been supplied to the four front recesses 50a of the ice-making tray 50, whether ice making has been complete, or other matters. The temperature sensor 73 is fixed to the frame 53 obliquely relative to the longitudinal direction of the ice maker 20 so as to include the front four recesses 50a as an infrared detection range. The temperature sensor 73 measures a temperature of each the four front recesses 50a, which have a slower ice making rate than the rear recesses 50a. As one example, if the temperature of each of the front four recesses 50a detected by the temperature sensor 73 is below a predetermined temperature (-10 degrees C) for a predetermined period (100 minutes) or longer, the controller 82, which receives a temperature transmitted from the temperature sensor 73, determines that the ice

making in the ice-making tray 50 has been complete and then activates the gear box 54. The activated gear box 54 rotates the ice-making tray 50 to thereby separate the ice from the ice-making tray 50. The ice separated from the ice-making tray 50 drops onto the ice storage case 21.

[0054]

Although not illustrated Fig. 10, hooks are provided on a ceiling surface of the ice-making compartment 300 formed by the first insulating partition 30, and the frame 53 is fixed to the ceiling surface of the ice-making compartment 300 by assembling hooks provided on a side surface in depth direction of the frame 53 to the hooks provided on the ceiling surface of the first insulating partition 30.

[0055]

Fig. 11 is a schematic cross-sectional diagram of the water supply tank 22 and the ice maker 20 according to Embodiment 1. Fig. 11 illustrates a state in which the water supply tank 22 and the ice maker 20 are cut along the XY plane at a position in front of the water supply pipe 61. More specifically, the position of the cross section in Fig. 11 is a position passing through a bottom surface of the recess 50a in a second row from the front of the ice-making tray 50.

[0056]

The water supply pipe 61 penetrates the first insulating partition 30 and runs between the ice maker 20 and the water supply tank 22. The outlet port 61b of the water supply pipe 61 is positioned on the left side and diagonally downward relative to the inlet port 61a in a front view of the refrigerator 1.

[0057]

As illustrated in Figs. 9 and 11, the water supply pipe 61 is arranged such that water supplied from the outlet port 61b hits a slope 50b. Among the plurality of recesses 50a of the ice-making tray 50, the slope 50b is provided in a recess 50a which is positioned at a second row from the front and near the water supply pipe 61. By setting a landing point of the water supplied from the outlet port 61b to the tray to be the recess 50a near the water supply pipe 61, and leaving a distance equivalent to a length of one recess from a right end of the ice-making tray 50, water supplied from the outlet

port 61b can be prevented from spilling out from the ice-making tray 50. In Fig. 11, in the first insulating partition 30, an upper surface section 70 and a lower surface section 71 are combined to form the outer contour 72, and an inner space thereof is filled with the insulating material 2c.

[0058]

As illustrated in Fig. 11, in an interior of the water storage container 58, steps are formed. Specifically, a first step section 58a, of which the depth of water is shallow when water is stored, and a second step section 58b provided in adjacent to the first step section 58a and of which the depth of water is deeper than the first step section 58a, are formed. The second step section 58b is formed in the water storage container 58 such that it is adjacent to the first step section 58a in the left-to-right direction. As will be described in detail later, a water supply pump 59 is positioned in the second step section 58b so that, in the front-back direction, it is in contact with a wall surface of the water storage container 58. The first step section 58a is formed such that it is higher than a water supply port 63 of the water supply pump 59 arranged in the second step section 58b.

[0059]

The first step section 58a is formed so as to incline downward toward the second step section 58b so that water on the first step section 58a flows into the second step section 58b. For example, the first step section 58a is formed so as to incline downward by about 7 degrees relative to the horizontal direction.

[0060]

The first step section 58a is formed so that a bottom surface thereof inclines downward from one wall surface of the water storage container 58 to the other opposing wall surface. In this case, the one wall surface of the water storage container 58 is a wall surface that the water supply pump 59, which is located in the second step section 58b, contacts.

[0061]

The width in the left-right direction of the second step section 58b is formed taking into account the width in the left-to-right direction of the water supply pump 59 so

as to allow the water supply pump 59 to be positioned. The second step section 58b is formed so that a part of a bottom surface thereof inclines upward from one wall surface to the other opposing wall surface of the water storage container 58, where the water supply pump 59 is arranged. A remaining portion of the bottom surface of the second step section 58b is a portion where the water supply pump 59 is arranged. In other words, the bottom surface of the second step section 58b, excluding a portion where the water supply pump 59 is arranged, is formed such that it inclines upward as it moves away from the water supply pump 59.

[0062]

With the first step section 58a and the second step section 58b being formed in this manner, in the water storage container 58, a continuous surface is formed by the lowest bottom surface of the first step section 58a and the highest bottom surface of the second step section 58b.

[0063]

In the example illustrated in Fig. 11, in the water storage container 58, the first step section 58a is formed on the left side and a second step section 58b is formed on the right side of the first step section 58a. The first step section 58a inclines downward toward the second step section 58b which is adjacent to the first step section 58a on the right side. The first step section 58a is formed so as to incline downward from the rear side to the front side. The second step section 58b is formed with a part of the bottom surface thereof inclining upward from the rear side wall to the front side wall of the water storage container 58. A continuous surface is formed by a lowest bottom surface on the front side of the first step section 58a and a highest bottom surface on the front side of the second step section 58b.

[0064]

Fig. 12 is a schematic cross-sectional diagram of the refrigerator compartment 100 according to Embodiment 1. Fig. 12 illustrates the refrigerator compartment 100 cut along the XZ plane and viewed from the top. Fig. 12 illustrates the floor surface 100a of the refrigerator compartment 100, a water supply tank lid 24 installed in the

water supply tank storage section 30a provided on the floor surface 100a, and the refrigerator compartment case 23 installed on the floor surface 100a.

[0065]

As illustrated in Fig. 12, in a front view of the refrigerator 1, the water supply tank 22 is positioned such that it overlaps the left door 11a of the refrigerator compartment 100 and does not overlap the right door 11b of the refrigerator compartment 100. The water supply tank 22 is positioned near the center in the width direction of the refrigerator compartment 100.

[0066]

Since the water supply tank 22 overlaps the left door 11a and does not overlap the right door 11b in a front view of the refrigerator 1, a user can open only the left door 11a to take out the water supply tank 22, making it easier to insert and remove the water supply tank 22 for cleaning. In addition, the water supply tank 22 is located near the center in the width direction of the refrigerator compartment 100, which allows a user standing in front of the refrigerator 1 to insert and remove the water supply tank 22 while reducing a rotation angle when the left door 11a is opened, whereby the operability of the refrigerator 1 can be further improved.

[0067]

In the present embodiment, the water supply tank 22 overlaps the left door 11a of the refrigerator compartment 100 and does not overlap the right door 11b of the refrigerator compartment 100 in a front view of the refrigerator 1, but the position of the water supply tank 22 is not limited to this. For example, the water supply tank 22 may be positioned such that, in a front view of the refrigerator 1, it overlaps the right door 11b and does not overlap the left door 11a. In this case, the ice-making compartment 300 is provided so that it is adjacent to the first freezer compartment 200 on the right side.

[0068]

As illustrated in Fig. 12, the fill port 33 through which the insulating material 2c is injected is provided in the outer box 2a of the insulating box body 2 at a position where it overlaps the first insulating partition 30 and the water supply tank 22 in a side view of the refrigerator 1. This allows injection of the insulating material 2c with a higher flow

velocity into the water supply tank storage section 30a of the first insulating partition 30, as compared to a case where the fill port 33 is located at a position where it does not overlap the water supply tank 22 (at the rear side of the outer box 2a, for example). This structure improves the filling property of the insulating material 2c in the water supply tank storage section 30a, which has a bended shape. In other words, by arranging the fill port 33 in such a way, insulation property of the first insulating partition 30 is improved, whereby insulation performance of the refrigerator 1 can be enhanced.

[0069]

Embodiment 2

Fig. 13 is a schematic cross-sectional diagram of a peripheral area of the ice-making compartment 300 in the refrigerator 1 of Embodiment 2. Fig. 13 is a view of the refrigerator 1 taken by cutting the refrigerator 1 along the XY plane and viewed from the front. As compared with Embodiment 1, the refrigerator 1 according to Embodiment 2 differs in structure of insulating partitions placed between the refrigerator compartment 100 and the ice-making compartment 300 and between the refrigerator compartment 100 and the first freezer compartment 200. The other configuration of the refrigerator 1 according to Embodiment 2 is the same as that of Embodiment 1.

[0070]

The insulating partition between the refrigerator compartment 100 and the ice-making compartment 300 is formed by the first insulating partition 30 in an area from one side surface of the inner box 2b (left side surface in Fig. 13) to the water supply tank storage section 30a. Then, in an area from the side surface of the first insulating partition 30 to the other side surface of the inner box 2b (right side surface in Fig. 13), the insulating partition is formed by a third insulating partition 67. That is, the first insulating partition 30 and the third insulating partition 67 each forms a part of the floor surface 100a of the refrigerator compartment 100.

[0071]

As in Embodiment 1, the refrigerator 1 according to Embodiment 2 is provided with the second insulating partition 31 that divides the ice-making compartment 300 and the first freezer compartment 200 below the water supply tank storage section 30a. An

interior of the third insulating partition 67 is filled with a material similar to the insulating material 2c used in the insulating box body 2. Meanwhile, an interior of the first insulating partition 30 is filled with an insulating material 2e, which is made of a material different from that of the insulating material 2c and the insulating material 2d of the second insulating partition 31.

[0072]

In this refrigerator 1 according to the present embodiment, as the insulating material 2c of the third insulating partition 67 and the insulating box body 2, which each secures an insulation thickness above a certain level and are tend to have a linear shape, urethane foam (rigid urethane foam), etc., which has high insulation performance but is difficult to fill, is used. On the other hand, for the insulating material 2e of the first insulating partition 30, which must follow the shape of the water supply tank 22 and has bended parts 66a, 66b, 66c, and 66d, polystyrene foam is used, which has slightly lower insulation performance than rigid urethane foam but has high molding property. Since the temperature difference between the ice-making compartment 300 and the first freezer compartment 200 is small, polypropylene, which has a smaller specific gravity and a higher strength as compared with other resins, is used as the insulating material 2d of the second insulating partition 31. By using different materials for the insulation of the first through third insulating partitions in this way, the insulation performance and productivity of the refrigerator 1 can be achieved at the same time. The materials are not limited to these, and urethane foam may also be used as the insulation material for the first through third insulating partitions, giving priority to insulation performance.

[0073]

The embodiments are as described above. The present disclosure is not limited to the above-mentioned embodiments, but can be varied or combined to an extent that it does not deviate from the gist of the disclosure. For example, the arrangement of each storage compartment is not limited to the arrangement in the above-mentioned embodiments, but may be arranged in a manner other than that of the above-mentioned embodiments. The number of compartments and the temperature of each

compartment are also not limited to the examples of the above-mentioned embodiments.

[0074]

In the above-mentioned embodiments, the water supply tank storage section 30a is configured to be covered by the first insulating partition 30. However, this is not restrictive. For example, the upper surface of the water supply tank storage section 30a may be open and communicated with the refrigerator compartment 100.

Reference Signs List

[0075]

1: refrigerator, 2: insulating box body, 2a: outer box, 2b: inner box, 2c, 2d, 2e: insulating material, 3: storage space, 8a: joint, 9a, 9b, 9c, 9d: injection opening, 10: operation sections, 11a: left door, 11b: right door, 12: second freezer compartment door, 13: ice-making compartment door, 14: vegetable compartment door, 15: first freezer compartment door, 20: ice maker, 21: ice storage case, 22: water supply tank, 23: refrigerator compartment case, 24: water supply tank lid, 30: first insulating partition, 30a: water supply tank storage section, 30b: outer contour section, 30c: bottom section, 30d: lower surface, 30e: side surface section, 31: second insulating partition, 32a: fourth insulating partition, 32a1: upper surface, 32b: fifth insulating partition, 33: fill port, 34: heater, 50: ice-making tray, 50a: recess, 50b: slope, 51: handle, 53: frame, 54: gear box, 54a: rotational axis, 56: ice storage detection lever, 58: water storage container, 58a: first step section, 58b: second step section, 59: water supply pump, 59a: pump cover, 59b: propeller, 59c: pump case, 60: filter, 61: water supply pipe, 61a: inlet port, 61b: outlet port, 61c: pathway section, 62: drain outlet port, 63: water supply port, 65: drainage pipe, 66a, 66b, 66c, 66d: bended part, 67: third insulating partition, 69: windway guide section, 70: upper surface section, 71: lower surface section, 72: outer contour, 73: temperature sensor, 74: slope, 81: cooling mechanism, 82: controller, 100: refrigerator compartment, 100a: floor surface, 200: first freezer compartment, 300: ice-making compartment, 400: vegetable compartment, 500: second freezer compartment

CLAIMS

[Claim 1]

A refrigerator comprising:

an insulating box body;

a refrigerator compartment provided in the insulating box body;

an ice-making compartment provided in the insulating box body and located below the refrigerator compartment;

a freezer compartment provided in the insulating box body and located adjacent to the ice-making compartment;

a first insulating partition configured to divide the refrigerator compartment and the ice-making compartment, the first insulating partition forming at least part of a floor surface of the refrigerator compartment, and having a storage section that is recessed below the floor surface;

a second insulating partition configured to divide the ice-making compartment and the freezer compartment;

a third insulating partition configured to divide the refrigerator compartment and the freezer compartment, the third insulating partition forming at least part of the floor surface of the refrigerator compartment;

a water supply tank accommodated in the storage section and is configured to supply water used in ice making in the ice-making compartment; and

an ice maker arranged in the ice-making compartment and is configured to generate ice from the water supplied from the water supply tank,

wherein

the water supply tank and the ice maker are arranged at a position where they do not overlap in a front view,

the water supply tank and the ice maker are arranged at a position where at least part of them overlap in a top view,

the first insulating partition, the second insulating partition, and the third insulating partition are filled with different insulating materials, and

the ice maker is configured to be inserted and removed by a back-and-forth movement.

[Claim 2]

The refrigerator of claim 1, wherein

the second insulating partition is provided below the storage section, and is in contact with the storage section.

[Claim 3]

The refrigerator of claim 1 or 2, further comprising a water supply pipe configured to supply water from the water supply tank to the ice maker, wherein

the water supply pipe includes an inlet port through which the water flows in from the water supply tank, an outlet port from which the water flows out to the ice maker, and a pathway section which connects the inlet port and the outlet port,

the outlet port of the water supply pipe is arranged at a position where it overlaps the ice maker in a top view, and

the pathway section of the water supply pipe is arranged such that it extends diagonally backward in a top view.

[Claim 4]

The refrigerator of any one of claims 1 to 3, wherein the insulating box body includes an outer box, an inner box and an insulating material filled between the outer box and the inner box,

the insulating box body includes a fill port from which the insulating material is filled,

the fill port is arranged at a position where it overlaps the first insulating partition in a height direction in a side view.

[Claim 5]

The refrigerator of claim 4, wherein the fill port is arranged on a side surface of the insulating box body on a side where the ice-making compartment is provided.

[Claim 6]

A refrigerator comprising:

an insulating box body including a refrigerator compartment and an ice-making compartment;

a first insulating partition configured to divide the refrigerator compartment and the ice-making compartment, the first insulating partition forming at least part of a floor surface of the refrigerator compartment, and having a storage section that is recessed below the floor surface;

a water supply tank accommodated in the storage section and is configured to supply water used in ice making in the ice-making compartment; and

an ice maker provided in the ice-making compartment and is configured to generate ice from the water supplied from the water supply tank,

wherein

the ice-making compartment is provided below the refrigerator compartment,

the water supply tank and the ice maker are arranged at respective positions where the water supply tank and the ice maker do not overlap each other as viewed in a front view,

the water supply tank and the ice maker are arranged at respective positions where the water supply tank and of the ice maker at least partially overlap each other as viewed in a top view,

the ice maker is configured to be inserted and removed by a back-and-forth movement,

the insulating box body includes an outer box, an inner box, and an insulating material filled between the outer box and the inner box,

the insulating box body has a fill port from which the insulating material is filled, and

the fill port is provided at a position where the fill port overlaps the first insulating partition in a height direction as viewed in a side view and is located in a side surface of the insulating box body on a side where the ice-making compartment is provided.