

DESCRIPTION

Title of Invention

REFRIGERATOR

5 Technical Field

[0001]

The present invention relates to a refrigerator having an automatic ice making function.

Background Art

10 [0002]

Hitherto, a refrigerator having an automatic ice making function includes a water tank for storing water to be supplied to an ice tray. Further, such a refrigerator includes a water supply pump configured to draw the water from the water tank and a motor configured to drive the water supply pump, in order to achieve automatic ice making.

15 That is, the refrigerator automatically makes ice by sending the water from the water tank to the ice tray with the use of the water supply pump and the power of the motor.

[0003]

When the drive time of the water supply pump is fixed and a water amount in the water tank is decreased, a water supply amount to the ice tray is generally decreased as well. Some related-art refrigerators accordingly change the drive time of a water supply pump depending on how many times water is supplied, in order to stabilize a water supply amount to an ice tray. Further, there is also known a refrigerator configured to adjust the drive time of a water supply pump depending on a remaining water amount in a water tank, thereby controlling the amount of water to be sent to an ice tray (for example, see Patent Literature 1). The refrigerator of Patent Literature 1 is configured to detect a water level in the water tank using an optical water level sensor and determine water supply time depending on the detected water level.

25 [0004]

In addition, there is also a related-art refrigerator including a weight sensor on the bottom surface of a water tank. The weight sensor detects the water tank's own weight

and the weight of water in the water tank (for example, see Patent Literature 2). The refrigerator of Patent Literature 2 is configured to determine that water is in the water tank when a detection value by the weight sensor is larger than a predetermined value, and determine that no water is in the water tank when the detection value by the weight sensor is equal to or smaller than the predetermined value.

Citation List

Patent Literature

[0005]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2013-190116

Patent Literature 2: Japanese Unexamined Patent Application Publication No. 2007-85566

Summary of Invention

Technical Problem

[0006]

In the configuration in which the drive time of the water supply pump is changed depending on how many times water is supplied, however, it is premised that the water tank filled with water is placed, and if this premise is not established, the water supply amount to the ice tray varies from water supply to water supply. As a result, an unstable number of ice cubes with unstable sizes are made. Further, the case in which the drive time of the water supply pump is adjusted depending on the water level in the water tank as in Patent Literature 1 has a problem that the water supply amount differs between products even at the same water level due to the influences of variations in output and resistance value of a motor as well as a variation in diameter of a water supply route. In addition, the refrigerator of Patent Literature 2 only uses the detection value by the weight sensor to determine whether or not to perform the ice making operation, and still has the problem that the size and number of made ice cubes change depending on the state of the water amount in the water tank.

[0007]

The present invention has been made in order to solve the problem as described

above, and has an object to provide a refrigerator configured to stabilize a water supply amount to an ice tray independently of a water amount in a water tank, thereby preventing variations in size and number of made ice cubes.

Solution to Problem

5 [0008]

According to one embodiment of the present invention, there is provided a refrigerator, including: a water tank, which is placed in a refrigeration temperature zone; an ice tray, in which ice is produced; a water supply pump, which is configured to supply water in the water tank to the ice tray; a weight detection unit configured to detect a
10 value corresponding to a weight of the water tank; and a control unit, which is configured to acquire a detection value detected by the weight detection unit, to thereby control drive of the water supply pump, the control unit being configured to: calculate a water supply stop threshold using the detection value by the weight detection unit before water supply and a set value corresponding to a water supply amount to the ice
15 tray; drive the water supply pump; and stop the drive of the water supply pump when the detection value by the weight detection unit reaches the water supply stop threshold.

Advantageous Effects of Invention

[0009]

20 According to the one embodiment of the present invention, after driving the water supply pump, the control unit stops the drive of the water supply pump when the detection value by the weight detection unit reaches the water supply stop threshold, and hence the water supply amount to the ice tray for one water supply can be kept constant. As a result, the water supply amount to the ice tray can be stabilized
25 independently of the water amount in the water tank, and variations in size and number of made ice cubes can therefore be prevented.

Brief Description of Drawings

[0010]

[Fig. 1] Fig. 1 is a front view for illustrating a state in which the door of each
30 compartment of a refrigerator according to Embodiment 1 of the present invention is

removed.

[Fig. 2] Fig. 2 is a front view for illustrating a state in which the door of each compartment of the refrigerator according to Embodiment 1 of the present invention is closed.

5 [Fig. 3] Fig. 3 is a schematic cross-sectional view for illustrating the cross section of the refrigerator of Fig. 2 along the side surface of the refrigerator, which is a water tank-side cross section.

[Fig. 4] Fig. 4 is a schematic cross-sectional view for illustrating the configuration of an automatic ice maker included in the refrigerator of Fig. 2.

10 [Fig. 5] Fig. 5 is an explanatory view of a mechanism for detecting water in a water tank with the use of a weight detection unit of Fig. 4.

[Fig. 6] Fig. 6 is a control block diagram of the refrigerator of Fig. 2.

[Fig. 7] Fig. 7 is a schematic view for illustrating an example of a water amount in the water tank.

15 [Fig. 8] Fig. 8 is a relationship graph of the water amount in the water tank and the resistance value of the weight detection unit.

[Fig. 9] Fig. 9 is a relationship graph of the water amount in the water tank and an output current value of the weight detection unit.

20 [Fig. 10] Fig. 10 is a diagram of an example of a water amount conversion table in which the water amount in the water tank and the resistance value of the weight detection unit are associated with each other.

[Fig. 11] Fig. 11 is a diagram of an example of a size change table in which an ice size and a resistance variation value $\Delta\Omega$ are associated with each other.

25 [Fig. 12] Fig. 12 is a schematic view for exemplifying a water amount indication by a notification unit of Fig. 2, which is observed when the water amount in the water tank is sufficient.

[Fig. 13] Fig. 13 is a schematic view for exemplifying a water amount indication by the notification unit of Fig. 2, which is observed when the water amount in the water tank is insufficient.

30 [Fig. 14] Fig. 14 is a schematic view for exemplifying a water amount indication by

the notification unit of Fig. 2, which is observed when a control unit determines that there is an abnormality.

[Fig. 15] Fig. 15 is a flow chart for illustrating the operation of the refrigerator according to Embodiment 1.

5 [Fig. 16] Fig. 16 is a diagram of an example of a variation value conversion table in which the resistance value and the resistance variation value are associated with each other.

[Fig. 17] Fig. 17 is a relationship graph of a water supply amount to an ice tray and the water amount in the water tank when the drive time of a water supply pump is fixed as in the related-art configuration.

10 [Fig. 18] Fig. 18 is a relationship graph of the water supply amount to the ice tray and the number of times of ice making when the drive time of the water supply pump is fixed as in the related-art configuration.

[Fig. 19] Fig. 19 is a schematic view for illustrating the state of water supply to the ice tray in the related-art configuration when the water amount in the water tank is large.

[Fig. 20] Fig. 20 is a schematic view for illustrating the state of water supply to the ice tray in the related-art configuration when the water amount in the water tank is small.

15 [Fig. 21] Fig. 21 is a schematic view for illustrating the arrangement of parts near a weight detection unit of a refrigerator according to Embodiment 2 of the present invention.

Description of Embodiments

[0011]

Embodiment 1

25 Fig. 1 is a front view for illustrating a state in which the door of each compartment of a refrigerator according to Embodiment 1 of the present invention is removed. Fig. 2 is a front view for illustrating a state in which the door of each compartment of the refrigerator according to Embodiment 1 of the present invention is closed. Fig. 3 is a schematic cross-sectional view for illustrating the cross section of the refrigerator of Fig. 2 along the side surface of the refrigerator, which is a water tank-side cross section.

30 Fig. 4 is a schematic cross-sectional view for illustrating the configuration of an

automatic ice maker included in the refrigerator of Fig. 2. Fig. 5 is an explanatory view of a mechanism for detecting water in a water tank with the use of a weight detection unit of Fig. 4. Fig. 6 is a control block diagram of the refrigerator of Fig. 2. The overall configuration of the refrigerator of Embodiment 1 is described with reference to Fig. 1 to Fig. 6.

[0012]

As illustrated in Fig. 1, the refrigerator 100 includes a refrigerator compartment 101, an ice making compartment 102, a convertible compartment 103, a freezer compartment 104, and a vegetable compartment 105. Further, the refrigerator 100 includes a water tank 10 that is mounted on the floor surface of the refrigerator compartment 101. The water tank 10 is mounted inside the refrigerator compartment 101 in a refrigeration temperature zone so that water stored therein is not frozen.

[0013]

As illustrated in Fig. 2, the refrigerator 100 includes, on its front side, a refrigerator door 111 for opening and closing the refrigerator compartment 101, an ice making compartment door 112 for opening and closing the ice making compartment 102, a freezer compartment door 114 for opening and closing the freezer compartment 104, and a vegetable compartment door 115 for opening and closing the vegetable compartment 105.

[0014]

Further, the refrigerator 100 includes an operation panel unit 90. The operation panel unit 90 includes an operation unit 91 including a plurality of operation buttons configured to receive input operation related to temperature adjustment of each compartment and various settings, and a notification unit 92 configured to output the temperature of each compartment or other types of information. The operation unit 91 receives mode setting that is made by a user, for example. The operation unit 91 includes, as the plurality of operation buttons, for example, a water supply amount change button for changing the setting of a water supply amount Q to an ice tray 70, and a correction button for calibration of a weight detection unit 60. The water supply amount Q to the ice tray 70 refers to the amount of water that is supplied to the ice tray

70 by one water supply, and is also simply referred to as the "water supply amount Q" in the following description. In the example of Fig. 2, the refrigerator door 111 is provided with the operation panel unit 90. Further, in the example of Fig. 2, the notification unit 92 includes a liquid crystal panel, for example, and displays various kinds of information.

[0015]

As illustrated in Fig. 3, the refrigerator 100 includes an ice storage case 106 that is arranged in the ice making compartment 102. Further, the refrigerator 100 includes a control board 20 responsible for the control of the entire refrigerator 100. An electrical wire 30 is connected to the control board 20.

[0016]

As illustrated in Fig. 4, the refrigerator 100 includes an automatic ice maker 40 configured to automatically make ice using water in the water tank 10. The automatic ice maker 40 includes the water tank 10, a tank pipe 13, a water supply port 14, a water supply pump 50, a water supply pipe 51, the pressure-sensitive weight detection unit 60, the ice tray 70, an ice making gearbox 71, a stored ice detection lever 72, and a tank floor portion 80. Reference symbol Ws represents the water surface of the water stored in the water tank 10.

[0017]

The tank pipe 13 is coupled to the water supply pump 50. The water supply port 14 has one opening portion coupled to the tank pipe 13, and an other opening portion coupled to the water supply pipe 51. The tank pipe 13 and the water supply port 14 are provided inside the water tank 10. The water supply pump 50 draws the water in the water tank 10, and sends the drawn water to the water supply port 14 through the tank pipe 13. The water sent to the water supply port 14 is supplied to the ice tray 70 through the water supply pipe 51, which is coupled to the water supply port 14. The water supply amount Q to the ice tray 70 changes depending on a drive time T of the water supply pump 50 and a water amount M in the water tank 10. The water amount M in the water tank 10 is also simply referred to as the "water amount M" in the following description.

[0018]

The weight detection unit 60 is provided in order to keep the water supply amount Q to the ice tray 70 constant independently of the water amount M in the water tank 10. The weight detection unit 60 is arranged in a floor surface 80a just below the water tank 10. The weight detection unit 60 is connected to the electrical wire 30. That is, the weight detection unit 60 is connected to the control board 20 via the electrical wire 30.

[0019]

The ice making gearbox 71 is a device configured to twist the ice tray 70 so that ice made in the ice tray 70 falls into the ice making compartment 102. The stored ice detection lever 72 detects whether the amount of ice stored in the ice making compartment 102 is equal to or larger than a predetermined amount. The stored ice detection lever 72 is hung on the ice storage case 106 of the ice making compartment 102. The refrigerator 100 is configured to prevent the ice making gearbox 71 from entering ice separation operation when the stored ice detection lever 72 is brought into contact with ice in the ice storage case 106 and does not lower beyond a predetermined position. With this configuration, the refrigerator 100 prevents ice from filling up the ice making compartment 102 to spill out thereof.

[0020]

The tank floor portion 80 is made of materials including a heat insulating material, and is arranged between the water tank 10 and the ice tray 70. The tank floor portion 80 is provided for separation between the refrigerator compartment 101 in the refrigeration temperature zone and the ice making compartment 102 in a freezing temperature zone. The floor surface 80a of the tank floor portion 80 is made of resin, for example.

[0021]

On the bottom surface of the water tank 10, a first protruding portion 11 and a second protruding portion 12 for supporting the water tank 10 are provided. The first protruding portion 11 and the second protruding portion 12 are formed to partly protrude downward from the bottom surface of the water tank 10. The first protruding portion 11 is provided near the front-side end portion of the water tank 10, and the second

protruding portion 12 is provided near the rear-side end portion of the water tank 10.

[0022]

In a region of the floor surface 80a that is located just under the second protruding portion 12, the weight detection unit 60, which detects a value corresponding to the weight of the water tank 10, is mounted. A bottom surface 12a of the second protruding portion 12 is very small as compared to the entire bottom surface of the water tank 10, and hence the second protruding portion 12 is regarded as being in point contact with the weight detection unit 60. The automatic ice maker 40 is configured so that the bottom surface 12a of the second protruding portion 12 comes into abutment against the weight detection unit 60, and a pressure that is applied from the water tank 10 to the weight detection unit 60 can thus be increased. The detection sensitivity of the weight detection unit 60, which performs detection based on a variation in water amount M in the water tank 10, can therefore be enhanced.

[0023]

Now, the arrangement relationship between the first protruding portion 11 and the second protruding portion 12 and the detection accuracy of the weight detection unit 60 are described referring to Fig. 5 with the width of the water tank 10 in its front and rear direction being referred to as a tank width L, and a distance from the inner surface of the first protruding portion 11 to the inner surface of the second protruding portion 12 being referred to as a protrusion-to-protrusion distance L_a .

[0024]

The sensitivity of the weight detection unit 60 can be enhanced when the first protruding portion 11 and the second protruding portion 12 are arranged so that the protrusion-to-protrusion distance L_a takes the smallest possible value, because when a rotation moment about the first protruding portion 11 is considered, a moment that acts on the second protruding portion 12 is large with the small protrusion-to-protrusion distance L_a .

[0025]

Specifically, for example, when the first protruding portion 11 is provided at the leading edge of the water tank 10 and the second protruding portion 12 is provided at a

location away from the first protruding portion 11 by the protrusion-to-protrusion distance L_a , a rotating system that acts around the first protruding portion 11 has a balanced relationship between the second protruding portion 12 and the center of gravity of the water tank 10. In this case, a force that acts on the weight detection unit 60, and a reaction force that acts on the second protruding portion 12 have the same value, and hence are represented by the same reference symbol " N_a ". Further, the center of gravity of the water tank 10 is located at the center of the water tank 10 in its right and left direction. To the center of gravity of the water tank 10, a force obtained by adding the weight of the water tank 10 itself and the weight of water in the water tank 10 together is applied, but only the water amount M in the water tank 10 is herein considered.

[0026]

Due to the above-mentioned balanced relationship, the reaction force N_a that acts on the second protruding portion 12, the protrusion-to-protrusion distance L_a , and the tank width L have a relationship of " $N_a L_a - ML/2 = 0$ ". That is, the force N_a that acts on the weight detection unit 60 can be expressed as " $N_a = ML/(2L_a)$ ", and hence it is understood that as the protrusion-to-protrusion distance L_a is reduced, the force N_a that acts on the weight detection unit 60 is increased.

[0027]

In this case, the water amount M before water supply is represented by M_0 , and the water amount M after water supply is represented by M_1 . Then, a difference ΔN_a between forces that are applied to the weight sensor before and after water supply is calculated by " $\Delta N_a = (M_0 - M_1)L/(2L_a)$ ". $M_0 - M_1$ is a constant representing the water supply amount Q to the ice tray 70 for one water supply, and as the value of $L/(2L_a)$ is increased, that is, as the protrusion-to-protrusion distance L_a is reduced, a variation in ΔN_a is increased.

[0028]

Because of the above, the first protruding portion 11 and the second protruding portion 12 in Embodiment 1 are arranged on the bottom surface of the water tank 10 so that the protrusion-to-protrusion distance L_a takes the smallest possible value. Thus,

even when the water amount M changes only slightly, the weight detection unit 60 can detect a value corresponding to the weight of the water tank 10 with high accuracy.

[0029]

5 The first protruding portion 11 may be formed to have a certain length in the right and left direction of the water tank 10 so as to support the water tank 10 in a well-balanced manner. Further, two or more first protruding portions 11 may be provided on the bottom surface of the water tank 10. For example, when two first protruding portions 11 are provided on the bottom surface of the water tank 10, one first protruding portion 11 may be provided at the left-side end portion, and an other first protruding
10 portion 11 may be provided at the right-side end portion.

[0030]

In the examples of Fig. 4 and Fig. 5, the first protruding portion 11 and the second protruding portion 12 have L shapes in cross section, but the present invention is not limited thereto. For example, the first protruding portion 11 and the second protruding
15 portion 12 may have protruding shapes that protrude near their center portions.

[0031]

Further, as illustrated in Fig. 6, the refrigerator 100 includes a heater 10a for preventing the water in the water tank 10 from being frozen, a tank detection unit 62 configured to detect whether or not the water tank 10 is placed at a right position, and a
20 door opening/closing detection unit 63 configured to detect whether a door of a compartment in which the water tank 10 is housed is opened or closed. In Embodiment 1, the door of the compartment in which the water tank 10 is housed corresponds to the refrigerator door 111 of the refrigerator compartment 101.

[0032]

25 The weight detection unit 60 includes a load cell 61 having a function of converting a force that is externally applied thereto to an electrical signal. The control board 20 includes a control unit 21 configured to acquire a detection value detected by the weight detection unit 60, thereby controlling the drive of the water supply pump 50, and a storage unit 22 configured to store information that is used by the control unit 21
30 for calculation or other types of processing.

[0033]

The control unit 21 transmits or receives data to or from the weight detection unit 60. The control unit 21 calculates a water supply stop threshold using the detection value by the weight detection unit 60 before water supply and a set value corresponding to the water supply amount Q to the ice tray 70. Further, the control unit 21 drives the water supply pump 50, and stops the drive of the water supply pump 50 when the detection value by the weight detection unit 60 reaches the water supply stop threshold. In this case, the set value corresponding to the water supply amount Q to the ice tray 70 in Embodiment 1 is the water supply amount Q to the ice tray 70 for one water supply that is determined depending on the ice size set by the user.

[0034]

The control unit 21 controls the notification unit 92 to output information indicating a placement error of the water tank 10 when the refrigerator door 111 is closed before the tank detection unit 62 detects that the water tank 10 is placed. In this way, the user can be notified that the water tank 10 is not placed or the water tank 10 is not correctly placed.

[0035]

The storage unit 22 of the refrigerator 100 stores in advance an initial output value that is a value output by the weight detection unit 60 under a state in which no water is in the water tank 10. The initial output value is information indicating the weight of the water tank 10 itself. A value corresponding to the water amount M can be obtained by subtracting the initial output value from a value output by the weight detection unit 60 under a state in which water is in the water tank 10. The initial output value is also used for creating data related to the water amount M. In short, the control unit 21 obtains the water amount M based on the initial output value.

[0036]

Further, the control unit 21 executes, when the user operates one of the plurality of operation buttons included in the operation unit 91, control corresponding to the content of the operation. Specifically, the operation unit 91 is configured to transmit, when the user presses one of the plurality of operation buttons included in the operation

unit 91, a signal corresponding to the pressed operation button to the control unit 21.

[0037]

For example, the control unit 21 controls, when the operation unit 91 receives operation input through the water supply amount change button, the drive of the water supply pump 50 depending on the content of the input operation, thereby adjusting the water supply amount Q to the ice tray 70. Hence, the user can change the setting of ice size by operating the water supply amount change button of the operation unit 91.

[0038]

Incidentally, when the detection value by the weight detection unit 60 has an error due to a change in weight detection unit 60 over time, the accuracy of water supply control that is executed by the control unit 21 drops. In this regard, the control unit 21 has a calibration function of correcting an error due to a change in weight detection unit 60 over time when the operation unit 91 receives operation input through the correction button.

[0039]

For example, when the user places the empty water tank 10 and presses the correction button, the control unit 21 applies a certain voltage V to the load cell 61. The control unit 21 then updates the various kinds of information in the storage unit 22 using an output current value I as a reference. The output current value I is output from the load cell 61. Thus, the refrigerator 100 can stably maintain the accuracy of water supply control that is executed by the control unit 21. However, errors due to consumption of other parts, for example, can also be corrected by the calibration function of the control unit 21.

[0040]

The calibration function of the control unit 21 is used for correcting an error from the initial set value in shipping, for example, and the correction button is preferably pressed when the water tank 10 is empty. For this reason, the control unit 21 may be configured to control the notification unit 92 to output information indicating that the water tank 10 is required to be empty, when the correction button is pressed.

[0041]

Fig. 7 is a schematic view for illustrating an example of the water amount M in the water tank 10. Fig. 8 is a relationship graph of the water amount M in the water tank 10 and a resistance value Ω of the weight detection unit 60. Fig. 9 is a relationship graph of the water amount M in the water tank 10 and the output current value I of the weight detection unit 60. Fig. 10 is a diagram of an example of a water amount conversion table in which the water amount M in the water tank 10 and the resistance value Ω of the weight detection unit 60 are associated with each other.

[0042]

Now, a relationship between the water amount M and the electrical resistance value Ω of the load cell 61, and a relationship between the water amount M and the output current value I that flows when the certain voltage V is applied to the load cell 61 are described on the assumption that the water amount M in the water tank 10 is discretely decreased due to water supply to the ice tray 70 in the order of $M_0 \rightarrow M_1 \rightarrow M_2 \rightarrow M_3$ as in the example of Fig. 7. The electrical resistance value Ω of the load cell 61 is also simply referred to as the "resistance value Ω " in the following description. The water amount M shown in Fig. 8 and Fig. 9 corresponds to Fig. 7. The water amount M has a relationship of " $M_0 > M_1 > M_2 > M_3$ ", the resistance value Ω has a relationship of " $\Omega_0 > \Omega_1 > \Omega_2 > \Omega_3$ ", and the output current value I has a relationship of " $I_0 < I_1 < I_2 < I_3$ ".

[0043]

The resistance value Ω varies when the weight of the water tank 10 is applied to the load cell 61. As the water amount M in the water tank 10 comes closer to the maximum, a pressure that is applied to the load cell 61 is increased, and the resistance value Ω is accordingly increased. When the water amount M in the water tank 10 is small, on the other hand, the pressure that is applied to the load cell 61 is small, and the resistance value Ω is accordingly small. That is, as shown in Fig. 8, as the water amount M is decreased in the order of $M_0 \rightarrow M_1 \rightarrow M_2 \rightarrow M_3$, the resistance value Ω is decreased in the order of $\Omega_0 \rightarrow \Omega_1 \rightarrow \Omega_2 \rightarrow \Omega_3$.

[0044]

When the certain voltage V is applied to the load cell 61 at the time of start of

water supply, the output current value I corresponding to the voltage V is obtained.

From the above-mentioned relationship between the pressure and the resistance value Ω , the output current value I to be obtained is small when the water amount M in the water tank 10 is close to the maximum, and the output current value I to be obtained is large when the water amount M in the water tank 10 is close to zero. Specifically, as shown in Fig. 9, as the water amount M in the water tank 10 is decreased in the order of $M_0 \rightarrow M_1 \rightarrow M_2 \rightarrow M_3$, the output current value I to be obtained is increased in the order of $I_0 \rightarrow I_1 \rightarrow I_2 \rightarrow I_3$.

[0045]

From the relationship as described above, the refrigerator 100 can linearly detect the water amount M in the water tank 10 by the weight detection unit 60. The control unit 21 can thus obtain the water amount M in real time based on the detection value by the weight detection unit 60.

[0046]

More specifically, the storage unit 22 has stored therein table information in which the detection value by the weight detection unit 60 and the water amount M in the water tank 10 are associated with each other. In Embodiment 1, the storage unit 22 has stored therein a water amount conversion table that is table information in which the water amount M and the resistance value Ω are associated with each other. In the water amount conversion table, for example, as shown in Fig. 10, Ω_0 , Ω_1 , Ω_2 , and Ω_3 each of which is the resistance value Ω are associated with M_0 , M_1 , M_2 , and M_3 each of which is the water amount M . However, the present invention is not limited to the example of Fig. 10, and the number of resistance values Ω and the number of water amounts M , which are stored in the water amount conversion table in an associated manner, take any value depending on the capacity of the water tank 10 and the setting of ice size. The control unit 21 checks the detection value by the weight detection unit 60 against the water amount conversion table, thereby obtaining the water amount M . Further, the control unit 21 controls the notification unit 92 to output information on the obtained water amount M .

[0047]

Further, the control unit 21 applies the certain voltage V to the load cell 61 before the start of the water supply operation, thereby acquiring the output current value I_0 that is the detection value by the weight detection unit 60. Then, the control unit 21 obtains, as the water supply stop threshold for determining the completion of water supply, the output current value I_1 that is the detection value by the weight detection unit 60 when water supply is stopped based on the output current value I_0 , which is the detection value by the weight detection unit 60 before the start of water supply.

[0048]

Specifically, the control unit 21 obtains the resistance value Ω before the start of water supply from the output current value I_0 , which is the detection value by the weight detection unit 60 before the start of water supply, and the voltage V that is applied to the load cell 61, and checks the obtained resistance value Ω against the water amount conversion table, thereby obtaining the current water amount M . Further, the control unit 21 subtracts the water supply amount Q from the current water amount M , thereby calculating a post-water supply water amount. In addition, the control unit 21 checks the calculated post-water supply water amount against the water amount conversion table to read out the resistance value Ω , and obtains, as the water supply stop threshold, the output current value I_1 based on the read-out resistance value Ω and the voltage V . At this time, the control unit 21 drives the water supply pump 50, and continuously observes a change in value output from the weight detection unit 60 during water supply. Then, the control unit 21 stops the drive of the water supply pump 50 when the detection value by the weight detection unit 60 reaches the water supply stop threshold.

[0049]

In addition, the control unit 21 controls the drive of the heater 10a, the drive of the water supply pump 50, and output to the notification unit 92 depending on the content of operation that is received by the operation panel unit 90 and the detection value by the weight detection unit 60, for example.

[0050]

The control unit 21 supplies electric power to the heater 10a, thereby controlling

the temperature of water in the water tank 10 to 0 degrees C or higher. That is, the control unit 21 controls the temperature of water in the water tank 10 so that the water temperature reaches the lowest temperature at which the water is not frozen. Heat capacity differs depending on the water amount M in the water tank 10, and hence an appropriate power supply rate differs depending on the water amount M. In this regard, the storage unit 22 has stored therein power supply rate correspondence information that is table information in which the water amount M and an appropriate heater power supply rate are associated with each other. Hence, the control unit 21 can set an appropriate heater power supply rate by checking the water amount M against the power supply rate correspondence information, which can lead to a reduction in power consumption.

[0051]

Incidentally, when the water amount M in the water tank 10 is small, as compared to the case in which the water tank 10 is filled with water, the temperature of the water tends to decrease, and hence there is a risk that the water in the water tank 10 is frozen. The control unit 21 is accordingly configured to change the power supply rate for the antifreeze heater 10a depending on the water amount M. As a result, according to the refrigerator 100, it is possible to reduce excess heat generation while preventing the water in the water tank 10 from being frozen.

[0052]

Further, the storage unit 22 has stored therein an ice makable water amount M_3 that the control unit 21 refers to when determining whether or not ice can be made with the current water amount M. The control unit 21 has a function of determining whether or not the current water amount M is equal to or larger than the ice makable water amount M_3 . In the case of a normal state in which the current water amount M is equal to or larger than the ice makable water amount M_3 , the control unit 21 controls the notification unit 92 to output information indicating the current water amount M. In the case where the current water amount M is not equal to or larger than the ice makable water amount M_3 , the control unit 21 controls the notification unit 92 to output information indicating that the water amount M is insufficient.

[0053]

In this case, even when the water amount M in the water tank 10 is equal to or larger than the ice makable water amount M_3 , it is assumed that the placement state of the water tank 10 or the states of peripheral parts are abnormal if the detection value by the weight detection unit 60 does not reach the water supply stop threshold after a certain time has elapsed since the start of water supply. Hence, the control unit 21 has a function of determining whether or not the drive time T of the water supply pump 50 has reached a drive limit time T_0 before the detection value by the weight detection unit 60 reaches the water supply stop threshold. Then, when the drive time T of the water supply pump 50 reaches the drive limit time T_0 while the detection value by the weight detection unit 60 does not reach the water supply stop threshold, the control unit 21 controls the notification unit 92 to output information indicating the occurrence of error.

[0054]

Fig. 11 is a diagram of an example of a size change table in which the ice size and the resistance variation value $\Delta\Omega$ are associated with each other. The resistance variation value $\Delta\Omega$ herein means a variation amount of the resistance value Ω that indicates how much the resistance value Ω is decreased for one water supply to the ice tray 70. The storage unit 22 has stored therein the size change table.

[0055]

The operation unit 91 is configured so that the user can select and set a plurality of ice sizes in a stepwise manner. That is, the ice size is set by the user operating the water supply amount change button of the operation unit 91. The storage unit 22 has stored therein the size change table that is table information in which a plurality of ice sizes that are settable by the user and the resistance variation value $\Delta\Omega$ are associated with each other. After driving the water supply pump 50, the control unit 21 reads out, from the size change table, the resistance variation value $\Delta\Omega$ corresponding to the ice size set by the user. Further, the control unit 21 stops the water supply pump 50 when the resistance value Ω , which is obtained from the detection value by the weight detection unit 60, varies by the read-out resistance variation value $\Delta\Omega$.

[0056]

When the user who wants ice as soon as possible sets a small ice size by the operation unit 91, for example, the control unit 21 performs control to decrease the water supply amount Q to meet the content set by the user. Consequently, the ice size per one ice cube can be decreased. When the user who wants large ice sets a large ice size by the operation unit 91, on the other hand, the control unit 21 performs control to increase the water supply amount Q . Consequently, the ice size per one ice cube can be increased.

[0057]

In order for the related-art refrigerator to meet a need of a user for size change of ice, it is required that the refrigerator be provided with a plurality of ice trays with different sizes. That is, a user who uses the related-art refrigerator changes the ice tray when wanting to change an ice size. This leads to labor to put away ice trays not in use and requires a space for storing such ice trays.

[0058]

In contrast to this, in the refrigerator 100, the resistance variation value $\Delta\Omega$ is given to the storage unit 22 in advance, and hence the control unit 21 can change the ice size by referring to the storage unit 22 based on a mode set by the user, and adjusting the drive time T of the water supply pump 50. This means that ice with a size that matches with the user's demand can be made without replacement of the ice tray 70.

[0059]

In the example of Fig. 11, the ice size and the resistance variation value $\Delta\Omega$ are associated with each other on a one-to-one basis, but the present invention is not limited thereto. The size change table may have stored therein a plurality of resistance variation values $\Delta\Omega$, each of which corresponds to the water amount M in the water tank 10, for each ice size. In this case, the control unit 21 may specify the resistance variation value $\Delta\Omega$ based on an ice size set by the user and the current water amount M in the water tank 10.

[0060]

Fig. 12 is a schematic view for exemplifying a water amount indication by the

notification unit 92 of Fig. 2, which is observed when the water amount M in the water tank 10 is sufficient. Fig. 13 is a schematic view for exemplifying a water amount indication by the notification unit 92 of Fig. 2, which is observed when the water amount M in the water tank 10 is insufficient. Fig. 14 is a schematic view for exemplifying a water amount indication by the notification unit 92 of Fig. 2, which is observed when the control unit 21 determines that there is an abnormality. With reference to Fig. 12 to Fig. 14, there are described contents that are displayed by the notification unit 92 depending on the water amount M in the water tank 10, for example. In the examples of Fig. 12 to Fig. 14, the notification unit 92 is configured to display a tank remaining water amount that indicates the remaining water amount in the water tank 10.

[0061]

In the normal state, in which the current water amount M is equal to or larger than the ice makable water amount M_3 , the control unit 21 controls the notification unit 92 to display the information indicating the current water amount M . The control unit 21 controls the notification unit 92 to display an indicator corresponding to the water amount M as illustrated in Fig. 12, for example. In the example of Fig. 12, the water amount M in the water tank 10 is the maximum.

[0062]

Further, when determining that the water amount M is smaller than the ice makable water amount M_3 , the control unit 21 controls the notification unit 92 to display the information indicating that the water amount M is insufficient. The information indicating that the water amount M is insufficient is displayed by a method as illustrated in Fig. 13, for example. That is, a technique that causes the notification unit 92 to perform display in a flashing manner can be employed. In this way, the fact that the water amount M in the water tank 10 is insufficient can be noticed by the user. In Fig. 13, the control unit 21 controls the notification unit 92 to perform display in a flashing manner when the tank remaining water amount is the smallest.

[0063]

In addition, the control unit 21 determines that there is an abnormality when the drive time T of the water supply pump 50 has reached the drive limit time T_0 while the

detection value by the weight detection unit 60 has not reached the water supply stop threshold, and controls the notification unit 92 to display the information indicating the occurrence of error. The information indicating the occurrence of error is displayed by a method as illustrated in Fig. 14, for example. That is, a technique that causes the notification unit 92 to perform display in a flashing manner can be employed. In this way, the user can be prompted to check the water tank 10 and the peripheral parts. In Fig. 14, the control unit 21 controls the notification unit 92 to perform display in a flashing manner when the tank remaining water amount is the largest so that this case is distinguished from the case of showing the information indicating that the water amount M is insufficient.

[0064]

In the examples of Fig. 12 to Fig. 14, the control unit 21 controls the notification unit 92 to display the water amount M in 5 levels, but the present invention is not limited thereto. The number of levels that indicate the water amount M can be changed depending on the capacities of the water tank 10 and the ice tray 70, for example. Further, a method of showing the water amount M is not limited to the indicator, and the control unit 21 may control the notification unit 92 to display a digital value corresponding to the water amount M, for example.

[0065]

In addition, in the examples of Fig. 2 and Fig. 12 to Fig. 14, the notification unit 92 displays the various kinds of information, but the present invention is not limited thereto. The notification unit 92 may include, for example, a sound speaker or a buzzer, and make notifications of the various kinds of information to outside the refrigerator by sounds or beep sounds. Further, the notification unit 92 may be configured to have the function of displaying the various kinds of information, and the function of making notifications of various kinds of information by sounds or beep sounds.

[0066]

Fig. 17 is a relationship graph of the water supply amount Q to the ice tray 70 and the water amount M in the water tank 10 when the drive time T of the water supply pump 50 is fixed as in the related-art configuration. Fig. 18 is a relationship graph of

the water supply amount Q to the ice tray 70 and the number of times of ice making n when the drive time T of the water supply pump 50 is fixed as in the related-art configuration. Fig. 19 is a schematic view for illustrating the state of water supply to the ice tray 70 in the related-art configuration when the water amount M in the water tank 10 is large. Fig. 20 is a schematic view for illustrating the state of water supply to the ice tray 70 in the related-art configuration when the water amount M in the water tank 10 is small.

[0067]

When the drive time T of the water supply pump 50 is fixed, that is, when water supply time is fixed, and the water amount M in the water tank 10 is reduced, the water supply amount Q to the ice tray 70 is generally decreased as shown in Fig. 17. That is, as the water amount M in the water tank 10 is decreased in the order of $M_0 \rightarrow M_1 \rightarrow M_2 \rightarrow M_3$, the water supply amount Q to the ice tray 70 is decreased in the order of $Q_0 \rightarrow Q_1 \rightarrow Q_2 \rightarrow Q_3$. When the water amount M in the water tank 10 is large, for example, when the water amount M is M_0 , ice cubes with a uniform size are made as illustrated in Fig. 19.

[0068]

Fig. 18 is a graph for showing an example of a relationship between the water supply amount Q when the drive time T of the water supply pump 50 is fixed, and the number of times of ice making n . As shown in Fig. 18, as the number of times of ice making n is increased, the water amount M in the water tank 10 is decreased, and the water supply amount Q is accordingly decreased. In particular, the water supply amount Q is significantly reduced at tenth water supply and thereafter because the water level in the water tank 10 is located below the water supply pump 50, and air enters the water supply pump 50, with the result that water is not satisfactorily supplied to the ice tray 70. Because of this, when the water amount M in the water tank 10 is small, the amount of water that is supplied to one section of the ice tray 70 is decreased or water is not filled into all sections as illustrated in Fig. 20. This may lead to a situation in which ice cubes with different sizes are made or the number of cubes is decreased.

[0069]

The refrigerator 100 in Embodiment 1 is accordingly configured so that, after driving the water supply pump 50, the control unit 21 stops the drive of the water supply pump 50 when the detection value by the weight detection unit 60 reaches the water supply stop threshold. As a result, according to the refrigerator 100, the water supply amount Q can be kept constant, and it is therefore possible to stabilize the water supply amount Q independently of the water amount M in the water tank 10, thereby preventing variations in size and number of made ice cubes.

[0070]

The control unit 21 can be implemented by a circuit device or other types of hardware configured to achieve each function described above, or can be implemented by software that is executed on a microcomputer, for example, a DSP or an arithmetic device, for example, a CPU. Further, the storage unit 22 includes a hard disk drive (HDD) or a flash memory, for example.

[0071]

Fig. 15 is a flow chart for illustrating the operation of the refrigerator 100 according to Embodiment 1. With reference to Fig. 15, control operation that is executed by the control unit 21 of the refrigerator 100 is described.

[0072]

First, the control unit 21 determines whether or not the refrigerator is in an ice making mode (Fig. 15: Step S101). When the refrigerator is not in the ice making mode (Fig. 15: Step S101/No), the control unit 21 waits until the refrigerator enters the ice making mode. When the refrigerator is in the ice making mode (Fig. 15: Step S101/Yes), on the other hand, the control unit 21 determines whether or not an ice making start condition is satisfied. The ice making start condition includes, for example, a condition that the amount of ice stored in the ice making compartment 102 is not equal to or larger than a predetermined amount. The ice making disclosure condition can, however, be set by the user as appropriate depending on the usage conditions of the refrigerator 100 (Fig. 15: Step S102).

[0073]

When the ice making start condition is not satisfied (Fig. 15: Step S102/No), the control unit 21 returns to Step S101. When the ice making start condition is satisfied (Fig. 15: Step S102/Yes), on the other hand, the control unit 21 acquires the output current value I_0 , which is a detection value, from the weight detection unit 60, thereby obtaining the resistance value Ω . Then, the control unit 21 checks the obtained resistance value Ω against the water amount conversion table, thereby obtaining the current water amount M in the water tank 10 (Fig. 15: Step S103).

[0074]

Next, the control unit 21 determines whether or not the current water amount M is equal to or larger than the ice makable water amount M_3 (Fig. 15: Step S104). When the current water amount M is not equal to or larger than the ice makable water amount M_3 (Fig. 15: Step S104/No), the control unit 21 controls the notification unit 92 to output the information indicating that the water amount M is insufficient (Fig. 15: Step S105), and returns to Step S101.

[0075]

In the normal state in which the current water amount M is equal to or larger than the ice makable water amount M_3 (Fig. 15: Step S104/Yes), on the other hand, the control unit 21 selects and reads out the water supply amount Q corresponding to a mode set by the user, from the water supply amounts Q stored in the storage unit 22. Next, the control unit 21 subtracts the read-out water supply amount Q from the current water amount M , thereby calculating the post-water supply water amount that is the water amount M at the time of completion of water supply to the ice tray 70. Then, the control unit 21 converts the calculated post-water supply water amount to the water supply stop threshold. Specifically, the control unit 21 checks the calculated post-water supply water amount against the water amount conversion table in the storage unit 22 to read out the resistance value Ω corresponding to the post-water supply water amount. The control unit 21 then obtains the output current value I_1 as the water supply stop threshold from the read-out resistance value Ω . At this time, the control unit 21 controls the notification unit 92 to output the information indicating the current water amount M (Fig. 15: Step S106).

[0076]

Further, the control unit 21 starts the drive of the water supply pump 50, and at the same time, starts the counting of the drive time T of the water supply pump 50 (Fig. 15: Step S107). Then, the control unit 21 continuously observes the detection value by the weight detection unit 60, and determines whether or not the detection value by the weight detection unit 60 has reached the water supply stop threshold (Fig. 15: Step S108).

[0077]

When the detection value by the weight detection unit 60 has not reached the water supply stop threshold (Fig. 15: Step S108/No), the control unit 21 determines whether or not the drive time T of the water supply pump 50 has reached the drive limit time T_0 (Fig. 15: Step S109). When the drive time T of the water supply pump 50 has not reached the drive limit time T_0 (Fig. 15: Step S109/No), the control unit 21 returns to Step S108.

[0078]

When the drive time T of the water supply pump 50 has reached the drive limit time T_0 (Fig. 15: Step S109/Yes), on the other hand, the control unit 21 determines that there is an abnormality, and controls the notification unit 92 to output the information indicating the occurrence of error. That is, when the detection value by the weight detection unit 60 does not reach the target value even after the drive limit time T_0 has elapsed, the control unit 21 controls the notification unit 92 to output the information indicating the occurrence of error, thereby prompting the user to check the water tank 10 and its peripheral parts (Fig. 15: Step S110).

[0079]

When the detection value by the weight detection unit 60 has reached the water supply stop threshold while the drive time T of the water supply pump 50 has not reached the drive limit time T_0 (Fig. 15: Step S108/Yes), the control unit 21 stops the drive of the water supply pump 50, and at the same time, stops the counting of the drive time T of the water supply pump 50 (Fig. 15: Step S111).

[0080]

In the above description of operation, the control operation that is executed by the control unit 21 is described in the order of reference symbols illustrated in Fig. 15, but the present invention is not limited thereto. Specifically, for example, the control unit 21 may execute the processing of from Step S104 to Step S107 at the same time.

[0081]

As described above, in the refrigerator 100 in Embodiment 1, after driving the water supply pump 50, the control unit 21 stops the drive of the water supply pump 50 when the detection value by the weight detection unit 60 reaches the water supply stop threshold. Specifically, after converting the value output from the weight detection unit 60 to the water amount M , the control unit 21 calculates the post-water supply water amount by subtracting the water supply amount Q stored in the storage unit 22 from the water amount M , and drives the water supply pump 50 until the weight detection unit 60 outputs a value corresponding to the post-water supply water amount. As a result, according to the refrigerator 100, the water supply amount Q can be kept constant, and it is therefore possible to stabilize the water supply amount Q independently of the water amount M in the water tank 10, thereby preventing variations in size and number of made ice cubes.

[0082]

<Modification Example>

Fig. 16 is a diagram of an example of a variation value conversion table in which the resistance value Ω and the resistance variation value $\Delta\Omega$ are associated with each other. The resistance variation value $\Delta\Omega$ herein means a variation amount of the resistance value Ω that indicates how much the resistance value Ω is decreased for one water supply to the ice tray 70. The resistance variation value $\Delta\Omega$ corresponds to the set value corresponding to the water supply amount Q to the ice tray 70. Specifically, in the refrigerator 100 according to a modification example of Embodiment 1, the variation value conversion table, which is exemplified as in Fig. 16, is stored in the storage unit 22. Thus, the control unit 21 can refer to the variation value conversion table in the storage unit 22 based on the output current value I_0 , which is the detection value by the weight detection unit 60 before the start of water supply, thereby obtaining

the output current value I_1 , which is the water supply stop threshold.

[0083]

More specifically, the control unit 21 obtains the current resistance value Ω from the output current value I_0 , and checks this resistance value Ω against the variation value conversion table, thereby reading out the resistance variation value $\Delta\Omega$ corresponding to the current resistance value Ω . Then, the control unit 21 subtracts the read-out resistance variation value $\Delta\Omega$ from the current resistance value Ω , thereby obtaining the output current value I_1 , which is the water supply stop threshold, from the value after the subtraction. In this way, the control unit 21 continuously drives the water supply pump 50 until the detection value by the weight detection unit 60 reaches the water supply stop threshold, and stops the drive of the water supply pump 50 at the time when the detection value by the weight detection unit 60 reaches the water supply stop threshold.

[0084]

The variation value conversion table may be table information in which the output current value I and a current variation value ΔI are associated with each other. The current variation value ΔI is a variation amount of the output current value I that indicates how much the output current value I is increased for one water supply to the ice tray 70. In this case, the current variation value ΔI corresponds to the set value corresponding to the water supply amount Q to the ice tray 70. That is, the set value corresponding to the water supply amount Q to the ice tray 70 is a value indicating a change amount of the detection value by the weight detection unit 60 that depends on the water supply amount to the ice tray 70. Then, the control unit 21 can obtain the water supply stop threshold by subtracting the set value corresponding to the water supply amount to the ice tray 70 from the detection value by the weight detection unit 60 before water supply.

[0085]

As described above, the refrigerator 100 according to the modification example of Embodiment 1 is also configured so that, after driving the water supply pump 50, the control unit 21 stops the drive of the water supply pump 50 when the detection value by

the weight detection unit 60 reaches the water supply stop threshold. As a result, according to the refrigerator 100, the water supply amount Q can be kept constant, and it is therefore possible to stabilize the water supply amount Q independently of the water amount M in the water tank 10, thereby preventing variations in size and number of made ice cubes.

[0086]

Further, the refrigerator 100 of Embodiment 1 employs the configuration in which only the second protruding portion 12 is in contact with the weight detection unit 60, which is buried in the floor just below the water tank 10. Hence, according to the refrigerator 100, a pressure that is applied to the weight detection unit 60 can be increased, and the sensitivity of the weight detection unit 60 for an increase and decrease in water in the water tank 10 can therefore be enhanced.

[0087]

In addition, the control unit 21 of Embodiment 1 has the function of detecting the state in which the water tank 10 is empty or the state in which the remaining water amount is insufficient. Hence, in the ice making mode, the control unit 21 can notify the user of the information indicating that the water amount M is insufficient, via the notification unit 92. In this way, the user can be prompted to pour water into the water tank 10. In addition, the control unit 21 of Embodiment 1 can supply electric power to the heater 10a at a power supply rate that is suitable for a heat capacity corresponding to the remaining water amount in the water tank, which can lead to a reduction in power consumption.

[0088]

Further, when the remaining water amount in the water tank 10 is small, as compared to the case in which the water tank 10 is filled with water, the temperature of the water tends to decrease, and hence there is a risk that the water in the water tank 10 is frozen. In this regard, the refrigerator 100 of Embodiment 1 changes the power supply rate for the antifreeze heater 10a depending on the remaining water amount in the water tank 10, and it is therefore possible to reduce excess heat generation while preventing the water in the water tank 10 from being frozen.

[0089]

Embodiment 2

Fig. 21 is a schematic view for illustrating the arrangement of parts near a weight detection unit of a refrigerator according to Embodiment 2 of the present invention.

5 The refrigerator 100 in Embodiment 1 described above employs the configuration in which the weight detection unit 60 is attached to the floor surface 80a of the tank floor portion 80, which is made of resin, for example. Because of this, the detection accuracy of the weight detection unit 60 cannot be sufficiently high depending on the thickness and hardness of the floor surface 80a, which may lead to a difficulty in
10 detecting the weight M. Further, it is assumed that it may not be easy to replace the weight detection unit 60 in service.

[0090]

In view of the above, the refrigerator in Embodiment 2 is configured so that the detection accuracy of the weight detection unit is improved, and the weight detection
15 unit is easily replaced. Components equivalent to those of Embodiment 1 described above are denoted by the same reference symbols, and description thereof is omitted.

[0091]

As illustrated in Fig. 21, the refrigerator 100 in Embodiment 2 includes a tank floor portion 180, a separate floor member 181, a sensor reception portion 182, and a cover
20 183. The tank floor portion 180 is made of materials including a heat insulating material, and supports the water tank 10. The separate floor member 181 is removable with respect to the tank floor portion 180, and has a groove at a location at which the weight detection unit 60 is mounted. The separate floor member 181 is formed to be fitted into the tank floor portion 180. The sensor reception portion 182 is
25 fixed at the center portion of the groove of the separate floor member 181, and supports the weight detection unit 60. The cover 183 is fitted into groove portions formed between the groove in the separate floor member 181 and the outer periphery of the sensor reception portion 182, and covers the weight detection unit 60. In short, the weight detection unit 60 is mounted inside the separate floor member 181, which is a
30 separate part that is removable from the tank floor portion 180.

[0092]

Waterproof ribs (not shown) for preventing water from entering the weight detection unit 60 are provided on the upper portion of the sensor reception portion 182 and the lower portion of the cover 183 so that the entrance of water from a space
5 between the sensor reception portion 182 and the cover 183 is prevented.

[0093]

As described above, in the refrigerator 100 in Embodiment 2, the weight detection unit 60 is not attached to the floor surface 180a of the tank floor portion 180, but instead, the weight detection unit 60 is provided in the upper region of the separate floor
10 member 181, which is fitted into the tank floor portion 180. Further, the upper portion of the weight detection unit 60 is covered with the cover 183. The second protruding portion 12 is arranged so that the bottom surface 12a is in abutment against the cover 183, and the weight of the water tank 10 is thus directly transmitted to the weight detection unit 60. As a result, also according to the refrigerator 100 in Embodiment 2,
15 the water supply amount to the ice tray 70 for one water supply can be kept constant, and it is therefore possible to stabilize the water supply amount to the ice tray 70 independently of the water amount M in the water tank 10, thereby preventing variations in size and number of made ice cubes. That is, in the structure of the refrigerator 100, a load is directly applied to the weight detection unit 60 without attenuating the weight of
20 the weight detection unit 60, and the sensitivity of the weight detection unit 60 can therefore be enhanced.

[0094]

Further, in the refrigerator 100 in Embodiment 2, the weight detection unit 60 is provided in the separate floor member 181, which is a separate part independent of the
25 tank floor portion 180, and hence the weight detection unit 60 can be easily replaced when some troubles occur in the weight detection unit 60, for example. This can lead to an improvement in service. In terms of easy replacement of the weight detection unit 60, the weight detection unit 60 may be directly provided in the separate floor member 181 without the sensor reception portion 182 and the cover 183. Other effects
30 are the same as those in Embodiment 1 described above.

[0095]

The above-mentioned embodiments are suitable specific examples of the refrigerator, and the technical scope of the present invention is not limited to those embodiments. For example, the refrigerator 100 includes the first protruding portion 11 and the second protruding portion 12 in the front and rear regions of the water tank 10 in order to improve the detection accuracy of the weight detection unit 60. Specifically, the second protruding portion 12 is provided in the rear region of the water tank 10 so that when the first protruding portion 11, which is a front-side leg, is used as an axis, moment about the leg is the maximum, and the maximum weight is thus applied to the weight detection unit 60. As long as certain detection accuracy can be achieved, however, the water tank 10 may be formed without the first protruding portion 11 or with none of the first protruding portion 11 and the second protruding portion 12.

[0096]

Further, in the example of each Embodiment, the refrigerator 100 including the compartments in the five temperature zones is represented, but the present invention is not limited thereto. The refrigerator 100 is only required to include the water tank 10 and the automatic ice maker 40, and the number of compartments and compartment shapes, for example, may be changed as appropriate. In addition, the water amount conversion table may be table information in which the water amount M in the water tank 10 and the output current value I are associated with each other.

Reference Signs List

[0097]

10	water tank	10a	heater	11	first protruding portion	12	second protruding portion
12a	bottom surface	13	tank pipe	14	water supply port		
20	control board	21	control unit	22	storage unit	30	electrical wire
40	automatic ice maker	50	water supply pump	51	water supply pipe	60	weight detection unit
61	load cell	62	tank detection unit	63	door opening/closing detection unit	70	ice tray
71	ice making gearbox	72	stored ice detection lever	80, 180	tank floor portion	80a, 180a	floor surface
90	operation panel unit	91	operation unit	92	notification unit	100	refrigerator

101 refrigerator compartment 102 ice making compartment 103 convertible
compartment 104 freezer compartment 105 vegetable compartment 106
ice storage case 111 refrigerator door 112 ice making compartment door 114
freezer compartment door 115 vegetable compartment door 181 separate
5 floor member 182 sensor reception portion 183 cover L tank width La
protrusion-to-protrusion distance M_3 ice makable water amount $\Delta\Omega$ resistance
variation value Ω resistance value

CLAIMS

[Claim 1]

A refrigerator, comprising:

a water tank placed in a refrigeration temperature zone;

an ice tray in which ice is produced;

a water supply pump configured to supply water in the water tank to the ice tray;

a weight detection unit configured to detect a value corresponding to a weight of the water tank; and

a control unit configured to acquire a detection value detected by the weight detection unit, to thereby control drive of the water supply pump,

the control unit being configured to

obtain a water supply stop threshold using the detection value by the weight detection unit before water supply and a water supply amount to the ice tray,

drive the water supply pump, and

stop the drive of the water supply pump when the detection value by the weight detection unit reaches the water supply stop threshold.

[Claim 2]

The refrigerator of claim 1, wherein the weight detection unit is configured to convert a force externally applied thereto to an electrical signal.

[Claim 3]

The refrigerator of claim 2,

wherein the weight detection unit is configured to output, as the detection value, a current value corresponding to a voltage applied by the control unit to the control unit, and

wherein the water supply stop threshold comprises the current value.

[Claim 4]

The refrigerator of any one of claims 1 to 3, wherein the control unit is configured to use, as the water supply amount to the ice tray, a set value indicating a change amount of the detection value by the weight detection unit.

[Claim 5]

The refrigerator of claim 4, wherein the control unit is configured to subtract the set value from the detection value by the weight detection unit before water supply to obtain the water supply stop threshold.

5 [Claim 6]

The refrigerator of any one of claims 1 to 3, further comprising a storage unit storing therein the water supply amount to the ice tray and table information in which the detection value by the weight detection unit and a water amount in the water tank are associated with each other,

10 wherein the control unit is configured to check the detection value by the weight detection unit against the table information to obtain the water amount in the water tank, to thereby obtain the water supply stop threshold based on a value obtained by subtracting the water supply amount to the ice tray in the storage unit from the water amount.

15 [Claim 7]

The refrigerator of claim 6, further comprising a notification unit configured to output various kinds of information,

wherein the control unit is configured to control the notification unit to output information on the water amount obtained by checking the detection value by the weight detection unit against the table information.

20

[Claim 8]

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

a notification unit configured to output various kinds of information; and

a storage unit storing therein table information in which the detection value by

25 the weight detection unit and a water amount in the water tank are associated with each other,

wherein the control unit is configured to

check the detection value by the weight detection unit against the table information to obtain the water amount in the water tank, and

control the notification unit to output information on the obtained water amount.

[Claim 9]

The refrigerator of claim 7 or 8, further comprising a tank detection unit
5 configured to detect whether or not the water tank is placed,

wherein the control unit is configured to control the notification unit to output information indicating a placement error of the water tank when a door of a compartment for storing the water tank is closed before the tank detection unit detects that the water tank is placed.

10 [Claim 10]

The refrigerator of any one of claims 1 to 9, wherein the water tank has a protruding portion that is provided on a bottom surface of the water tank, and comes into abutment against the weight detection unit.

[Claim 11]

15 The refrigerator of any one of claims 1 to 10, further comprising:
a tank floor portion for supporting the water tank; and
a separate floor member formed to be fitted into the tank floor portion,
wherein the weight detection unit is provided in the separate floor member.

[Claim 12]

20 The refrigerator of any one of claims 1 to 11, further comprising an operation unit including a water supply amount change button for changing setting of the water supply amount to the ice tray,

wherein the control unit is configured to adjust, when the operation unit receives operation input through the water supply amount change button, the water
25 supply amount to the ice tray depending on a content of the input operation.

[Claim 13]

The refrigerator of claim 12, wherein the control unit is configured to receive operation for selecting and setting an ice size from a plurality of ice sizes through the water supply amount change button.

[Claim 14]

The refrigerator of any one of claims 1 to 11, further comprising an operation unit configured to receive setting of an ice size,

wherein the control unit is configured to adjust the water supply amount to the ice tray depending on the ice size set in the unit.

[Claim 15]

The refrigerator of any one of claims 12 to 14,

wherein the operation unit includes a correction button for calibration of the weight detection unit, and

wherein the control unit has a function of correcting an error generated in the detection value by the weight detection unit when the operation unit receives operation input through the correction button.