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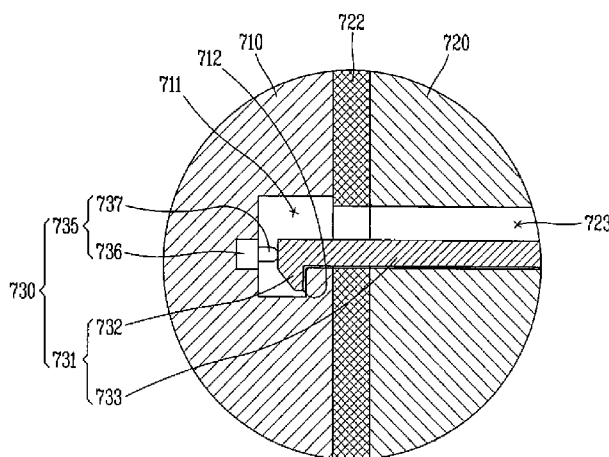
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(54) Title: ICE-FULL STATE DETECTING APPARATUS AND REFRIGERATOR HAVING THE SAME

[Fig. 20]



(57) Abstract: An ice-full state detecting apparatus and a refrigerator having the same are disclosed. The refrigerator including an ice-full state detecting apparatus includes: a refrigerator body including a cooling chamber; a cooling chamber door to open and close the cooling chamber; an ice maker installed at the cooling chamber or at the cooling chamber door; an ice storage container to store ice made by the ice maker; and the ice-full state detecting apparatus to detect an ice-full state of the ice storage container, wherein the ice-full state detecting apparatus includes: a ice-full state detecting sensor to detect an ice-full state of the ice storage container; a sensor heater to heat the ice-full state detecting sensor; a detecting unit to detect whether the ice-full state detecting sensor is in contact with external air; and a controller to control the operation of the sensor heater based on the detection result of the detecting unit. The ice-full state detecting sensor can be restrained from being frosted to thus prevent degradation of detection performance of the ice-full state detecting sensor. In addition, power consumption required for a defrosting operation can be reduced.



Description

ICE-FULL STATE DETECTING APPARATUS AND REFRIGERATOR HAVING THE SAME

Technical Field

- [1] The present invention relates to an ice-full state detecting apparatus and a refrigerator having the same, and more particularly, to an ice-full state detecting apparatus capable of improving the accuracy of detection of an ice-full state and reducing power consumption in detecting an ice-full state.

Background Art

- [2] A refrigerator is a device for refrigerating or freezing food items or the like to keep them fresh in storage. The refrigerator includes an ice maker for making ice and an ice bank or an ice storage container for receiving ice made by the ice maker.
- [3] An ice maker of the related art refrigerator includes a so-called full ice detection lever that detects whether or not ice stored in the ice bank has reached a pre-set level. The ice full detection lever is connected to a controller, and when ice-full state is detected by the full ice detection lever, the controller controls the ice maker to stop an ice making operation.
- [4] The full ice detection lever is generally connected to a spring and rotated downwardly by elastic force of the spring, and as ice within the ice bank increases, the full ice detection lever is upwardly rotated according to the increased level of the ice. When the full ice detection lever is rotated up to a pre-set level or height, it is determined that the ice bank is full.
- [5] However, in the related art, if the full ice detection lever becomes frozen, the mechanical operation of the full ice detection lever is not likely to be performed, and the controller cannot determine whether the ice bank is full. In such faulty state, ice is continuously supplied although the ice bank is full of ice, causing an overflow of ice from the ice container.

Disclosure of Invention

Technical Problem

- [6] Therefore, An object of the invention is to provide an ice-full state detecting apparatus having a structure capable of accurately and stably detecting an ice-full state of ice discharged from an ice maker, and a refrigerator having the same.
- [7] Another object of the invention is to provide an ice-full state detecting apparatus capable of reducing power consumption in detecting an ice-full state, and a refrigerator having the same.

Technical Solution

- [8] To achieve these and other advantages and in accordance with the purpose of the present disclosure, as embodied and broadly described herein, there is provided in one embodiment, a refrigerator having an ice-full state detecting apparatus includes: a refrigerator body including a cooling chamber; a cooling chamber door to open and close the cooling chamber; an ice maker installed at the cooling chamber or at the cooling chamber door; an ice storage container to store ice made by the ice maker; and the ice-full state detecting apparatus to detect an ice-full state of the ice storage container, wherein the ice-full state detecting apparatus includes: a ice-full state detecting sensor to detect an ice-full state of the ice storage container; a sensor heater to heat the ice-full state detecting sensor; a detecting unit to detect whether the ice-full state detecting sensor is in contact with external air; and a controller to control the operation of the sensor heater based on the detection result of the detecting unit.
- [9] The cooling chamber may include a freezing chamber, the cooling chamber door may include a freezing chamber door to open and close the freezing chamber, and the ice maker may be disposed at the freezing chamber door.
- [10] The freezing chamber door may include a case forming a space for accommodating the ice maker and a door to open and close the case, and the detecting unit may detect whether or not the door is open.
- [11] The detecting unit may include a switch turned on or off according to relative movement of the door and the case.
- [12] The switch may be disposed at the case and turned on or off by being pressed by the door.
- [13] Combination portions may be formed at the door and the case such that they are engaged with each other to maintain the door closing the case.
- [14] The switch may be disposed at the engaged position of the combination portions, and turned on or off as the combination portions are engaged.
- [15] The controller may operate the sensor heater when the door is open.
- [16] The controller may stop operation of the sensor heater when the door is closed.
- [17] The ice maker may be disposed at the freezing chamber, and the detecting unit may detect whether or not the freezing chamber door is open.
- [18] The controller may control the sensor heater to operate when the freezing chamber door is open.
- [19] The cooling chamber may include a refrigerating chamber, the cooling chamber door may include a refrigerating chamber door to open and close the refrigerating chamber, and the ice maker may be disposed at the refrigerating chamber door.
- [20] The refrigerating chamber door may include a case providing the ice maker and a receiving space with one side open, and a door for opening and closing the open portion of the case.

- [21] The detecting unit may detect whether or not the door is open.
- [22] The controller may control the sensor heater to operate when the door is open.
- [23] An ice-full state detecting apparatus includes: a case having a receiving space with one side open; a door for opening and closing the open region of the case; an ice-full state detecting sensor for detecting whether or not an ice storage container is full of ice; a sensor heater for heating the ice-full state detecting sensor; a detecting unit whether or not the door is open; and a controller for controlling an operation of the sensor heater based on the detection result of the detecting unit.
- [24] The controller may control the sensor heater to operate when the door is open.
- [25] The controller may control the sensor heater to be stopped when the door is closed.
- [26] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

Advantageous Effects

- [27] As so far described, the ice-full state detecting apparatus and the refrigerator having the same according to the present invention may have one or more of the following advantages.
- [28] For example, because the sensor heater is disposed near the ice detecting sensor, heat generated from the sensor heater can be transferred to the ice detecting sensor. Frost that may be formed on the ice detecting sensor can be removed, so the ice detecting sensor can accurately and stably detect whether ice-full state of ice transferred from the ice maker. As can be appreciated, the sensor heater may prevent the formation of moisture or frost such that frost formation is not a concern.
- [29] Because the extending pipe is formed to surround the receiver and the transmitter of the ice detecting sensor while allowing a detect signal transmitted from the receiver and the transmitter of the ice detecting sensor to pass therethrough and the sensor heater is installed at an outer side of the extending pipe, heat generated from the sensor heater can be effectively transferred to the ice detecting sensor.
- [30] Because the sensor heater accommodating body with the sensor heater wound thereon in the form of coil is applied to the ice detecting sensor, heat generated from the sensor heater can be uniformly transferred to the entire surface of the receiver and the transmitter of the ice detecting sensor.
- [31] Because the sensor heater is applied to the sensor heater accommodating body such that the sensor heater is wound thereon several times in a coil type, the heating value of the sensor heater can be adjusted according to the number of winding the sensor heater. Thus, the heating value of the sensor heater can be easily adjusted according to an environment where the ice detecting sensor is installed, for example, according to an

ambient temperature.

- [32] Because the sensor heater is made of an electroconductive heating material that heats by itself, there is no need to additionally form a heater to defrost the receiver and the transmitter of the ice detecting sensor. The configuration of the ice detecting apparatus can be simplified and its fabrication can be facilitated.
- [33] Because the sensor heater is made of the electroconductive heating material and it covers the receiver and the transmitter of the ice detecting sensor, heat generated from the sensor heater can be uniformly transferred to the entire surface of the receiver and the transmitter.
- [34] Because the sensor heater is made of the electroconductive heating material and it accommodates the receiver and the transmitter of the ice detecting sensor therein, the sensor heater can serve as an extending pipe with respect to the receiver and the transmitter and as a heat supply source for removing frost formed on the receiver and the transmitter. Thus, any additional extending pipe or heater is not required to defrost the receiver and the transmitter, resulting in the simplification of the configuration of the ice detecting apparatus and facilitation of the fabrication.
- [35] The receiver and transmitter of the ice detecting sensor and the sensor heater are disposed in a hermetically enclosed space by the hermetically sealed case, and a front side of the receiver and the transmitter can be inserted into the extending pipe while the body can be exposed to the hermetically enclosed space. Thus, heat generated by the sensor heater can heat air within the hermetically enclosed space, and heat can be transmitted to the receiver and the transmitter through the heated air, increasing the efficiency of heat transmission from the sensor heater to the receiver and the transmitter.
- [36] Because whether or not the door is open or closed with respect to the external case can be detected by the detecting unit, the controller can control the operation of the sensor heater according to the open and closed state of the door. By removing frost formed on the ice detecting sensor or by preventing frost formation, power consumption for performing a defrosting and/or frost prevention operation can be reduced while preventing degradation of detection performance of the ice detecting sensor.
- [37] The ice detecting sensor disposed at the ice maker body detects an ice-full state of ice collected within the ice storage container after being discharged from the ice maker, a phenomenon that a mechanical ice detecting lever or the like for detecting ice-full state is frozen so that it cannot properly detect an ice-full state can be prevented, and whether or not the ice storage container is full of ice can be accurately and stably detected.
- [38] The detection height of the ice-full state detecting sensor corresponds to the height of ice-full state in the ice storage container which has a certain height difference from an upper end of the ice storage container. Thus, whether or not the ice storage container is

full of ice can be accurately detected by the ice-full state detecting sensor.

Brief Description of Drawings

[39] In the drawings:

[40] FIG. 1 is a front perspective view of a refrigerator including an ice-full state detecting apparatus according to a first embodiment;

[41] FIG. 2 is a perspective view of an ice maker of FIG. 1;

[42] FIG. 3 is a vertical sectional view of the ice maker of FIG. 2;

[43] FIG. 4 is an enlarged view of a portion 'A' in FIG. 3;

[44] FIG. 5 is a perspective view showing that the ice-full state detecting apparatus of FIG. 1 detects a state before full ice;

[45] FIG. 6 is a perspective view showing that the ice-full state detecting apparatus of FIG. 1 detects an ice-full state;

[46] FIG. 7 is a perspective view showing an exploded state of an ice-full state detecting sensor of FIG. 5;

[47] FIG. 8 is a sectional view showing a coupled state of the ice-full state detecting sensor of FIG. 7;

[48] FIG. 9 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to a refrigerator including an ice-full state detecting apparatus according to a second embodiment;

[49] FIG. 10 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including an ice-full state detecting apparatus according to the second embodiment;

[50] FIG. 11 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to a refrigerator including an ice-full state detecting apparatus according to a third embodiment;

[51] FIG. 12 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including an ice-full state detecting apparatus according to the third embodiment;

[52] FIG. 13 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to the refrigerator including an ice-full state detecting apparatus according to a fourth embodiment;

[53] FIG. 14 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including the ice-full state detecting apparatus according to the fourth embodiment;

[54] FIG. 15 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to a refrigerator including an ice-full state detecting apparatus according to a fifth embodiment;

- [55] FIG. 16 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including the ice-full state detecting apparatus according to the fifth embodiment;
- [56] FIG. 17 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to the refrigerator including an ice-full state detecting apparatus according to a sixth embodiment;
- [57] FIG. 18 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including the ice-full state detecting apparatus according to the sixth embodiment;
- [58] FIG. 19 is a perspective view showing a front side of a refrigerator including an ice-full state detecting apparatus according to a seventh embodiment;
- [59] FIG. 20 is a sectional view showing a switch pressed in the refrigerator including in the ice-full state detecting apparatus according to the seventh embodiment;
- [60] FIG. 21 is a sectional view showing a switch in FIG. 20 released from the pressed state;
- [61] FIG. 22 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to the refrigerator including an ice-full state detecting apparatus according to an eighth embodiment; and
- [62] FIG. 23 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including the ice-full state detecting apparatus according to the eighth embodiment.

Mode for the Invention

- [63] A refrigerator including an ice-full state detecting apparatus according to exemplary embodiments of the present invention will now be described with reference to the accompanying drawings.
- [64] FIG. 1 is a front perspective view of a refrigerator including an ice-full state detecting apparatus according to a first embodiment, FIG. 2 is a perspective view of an ice maker of FIG. 1, FIG. 3 is a vertical sectional view of the ice maker of FIG. 2, FIG. 4 is an enlarged view of a portion 'A' in FIG. 3, FIG. 5 is a perspective view showing that the ice-full state detecting apparatus of FIG. 1 detects a state before full ice, FIG. 6 is a perspective view showing that the ice-full state detecting apparatus of FIG. 1 detects an ice-full state, FIG. 7 is a perspective view showing an exploded state of an ice-full state detecting sensor of FIG. 5, and FIG. 8 is a sectional view showing a coupled state of the ice-full state detecting sensor of FIG. 7.
- [65] As shown in FIGs. 1 to 8, the refrigerator including an ice-full state detecting apparatus includes: a refrigerator body 10 having a cooling chamber; a cooling chamber door to open and close the cooling chamber; an ice maker 100 installed at the

cooling chamber or at the cooling chamber door; an ice storage container 180 to store ice made by the ice maker 100; and the ice-full state detecting apparatus to detect an ice-full state of the ice storage container 180, wherein the ice-full state detecting apparatus includes: a ice-full state detecting sensor 120 (in FIG. 7) to detect an ice-full state of the ice storage container 180; a sensor heater 128 (in FIG. 7) to heat the ice-full state detecting sensor 120; a detecting unit 55 to detect whether the ice-full state detecting sensor 120 is in contact with external air; and a controller 50 to control the operation of the sensor heater 128 based on the detection result of the detecting unit 55. Here, the cooling chamber generally refers to a freezing chamber and a refrigerating chamber, and the refrigerator body may be a so-called side-by-side refrigerator including a freezing chamber and a refrigerating chamber disposed in a horizontal direction. The refrigerator body may be a so-called a top freezer refrigerator or a bottom freezer refrigerator including a freezing chamber and a refrigerating chamber disposed in a vertical direction.

[66] In the refrigerator body 10, the refrigerating chamber 11 and the freezing chamber 12 may be formed in a horizontal direction. The refrigerator body 10 may include a refrigerating cycle for providing cold air (i.e., cooling air) to the refrigerating chamber 11 and the freezing chamber 12. The refrigerating cycle mechanism may be configured as a so-called vapor compression type refrigerating cycle including a compressor for compressing a refrigerant, a condenser for condensing the refrigerant after heat is released, an expanding device for decompressing and expanding the refrigerant, and an evaporator for allowing the refrigerator to absorb ambient latent heat so as to be evaporated.

[67] A refrigerating chamber door 13 and a freezing chamber door 14 may be provided at the front of the refrigerating chamber 11 and the freezing chamber 12 to open and close the refrigerating chamber 11 and the freezing chamber 12. A detecting unit 55 for detecting opening of the freezing chamber 14 may be provided within the freezing chamber 12. The detecting unit 55 may be configured as a so-called a contact type switch for detecting closing and opening of the freezing chamber door 14 by being in contact with the freezing chamber door 14. Also, the detecting unit 55 may be configured as a so-called non-contact type switch for detecting closing or opening of the freezing chamber door 14 by the medium of a magnetic force without being in contact with the freezing chamber door 14. The detecting unit 55 is connected to the controller 50 so that it can output a detect signal to the controller 50.

[68] The freezing chamber door 14 may include a dispenser 190 for allowing a user to take ice therefrom without opening the freezing chamber door 14.

[69] The ice maker 100 for making ice may be provided at an upper portion of the dispenser 190. The ice maker 100 may be connected to be controlled by the controller

50 so that it can perform an ice making operation or stop it based on a detection result of the detecting unit 55.

- [70] The ice maker 100 may be provided at an inner side of the freezing chamber 12. When the refrigerator body 10 is formed as the bottom freezer refrigerator, the ice maker 100 may be provided at the refrigerating chamber door. In this case, the refrigerating chamber door may include a case having a space for accommodating the ice maker with one side open and a door for opening and closing the open region of the case. The case and the door cooperatively form an ice making chamber demarcated from the refrigerating chamber therein. The ice making chamber may include a cold air supply flow path to provide cold air of the freezing chamber to the ice making chamber.
- [71] The ice storage container 180 may be provided at a lower portion of the ice maker 100 to store ice dropped after being made in the ice maker 100. A lower portion of the ice storage container 180 communicates with the dispenser 190, so the ice in the ice storage container 180 may be taken out of the dispenser 190.
- [72] The operation regarding the ice maker 100 will now be described in brief.
- [73] After a proper amount of water is supplied to the ice maker 100, cold air is supplied to the ice maker 100. Ice is made by the supplied cooling air in the ice maker 100, separated from the ice maker 100 according to a self-operation of the ice maker 100, and falls into the ice storage container 180 so as to be accommodated therein. The ice accommodated in the ice storage container 180 is supplied by a desired amount by the dispenser 190 whenever the user requires it.
- [74] With reference to FIGs. 2 to 4, the ice maker 100 according to the first embodiment of the present invention is a device for making ice, including a water supply unit 107 to which water is supplied from the exterior, an ice making chamber 104 in which ice is made, an ejector 105 for separating ice made in the ice making chamber 104, and an ice maker body 101 including a plurality of components for rotating the ejector 105.
- [75] A mounting unit 105 is formed behind the ice making chamber 104, by which the ice maker 100 is mounted within the refrigerator. Reference numeral 103 denotes a hole into which a combining protrusion is inserted to allow the mounting unit 104 to be mounted within the refrigerator.
- [76] A rotational shaft extends out of the ice maker body 101. The ejector 105 has portions (or arms) extending outwardly (or radially) from the shaft and rotates according to a rotational movement of the shaft in order to pick up ice.
- [77] A separator 106 is formed at an upper portion of the ice making chamber 104 to allow ice to be picked up by the ejector 105 to be guided and fall into the ice storage container 180.
- [78] The water supply unit 107, the ice making chamber 104, the ejector 105, and the like

are elements for making ice in the ice maker 100, so they can be defined as an ice making unit. Of course, the configuration of the ice making unit is an exemplary one, to which any other elements may be added or some of the elements may be omitted.

[79] An ice making heater 140 is installed at a lower portion of the ice making chamber 104 in order to apply heat to allow the interfaces of ice and an inner surface of the ice making chamber 104 to be separated from each other. The ice making heater 104 may be electrically connected to an external power source within the ice maker body 101.

[80] A heater support 130 may be formed at a lower portion of the ice making heater 140. The heater support 130 may be connected with the ice maker body 101. The heater support 130 may be molded together with the ice maker body 101.

[81] In this embodiment, a sensor disposing unit 110 extends with a certain length in a downward direction from the ice maker body 101. A portion of the heater support 130 extends up to a position corresponding to the sensor disposing unit 110.

[82] A transmitting unit 121 is installed in the sensor disposing unit 110, and a receiving unit 123 is installed at a portion extending from the heater support 130 to correspond to the sensor disposing unit 110. A transmitter 122 and a receiver 124 for transmitting and receiving signals are installed in the transmitting unit 121 and the receiving unit 123 in a facing manner.

[83] Transmitting and receiving signals, the transmitting unit 121 and the receiving unit 123 detect an ice-full state of the ice storage container 180, so they can be defined as an ice-full state detecting sensor 120. As the ice-full state detecting sensor 120, an infrared sensor may be used.

[84] The ice-full state detecting sensor 120 is disposed at the ice maker body 101 and detects a state of ice fully accumulated in the ice storage container 180 after being discharged from the ice maker 100.

[85] Here, the ice-full state detecting sensor 120 may be disposed in the ice storage container 180 at a position corresponding to the height at which ice is fully accumulated.

[86] In detail, as shown in FIGs. 3 and 4, the transmitting unit 121 of the ice-full state detecting sensor 120 extends in a downward direction down to the interior of the ice storage container 180. The transmitter 122 is installed at a lower portion of the transmitting unit 121. The transmitter is disposed at a position corresponding to the height of the ice-full state of the ice storage container 180.

[87] Here, the position of the transmitter 122 has been mentioned, but the receiving unit 123 and the receiver 124 may be formed to correspond to the height of the transmitting unit 121 and the transmitter 122.

[88] With such configuration, the detection height of the ice-full state detecting sensor 120 corresponds to the height of the ice-full state of the ice storage container 180 having a

certain height difference (h) from an upper end 181 of the ice storage container 180. Thus, whether or not the ice storage container 180 is full of ice can be accurately detected by the ice-full state detecting sensor 120.

- [89] The transmitting unit 121 and the receiving unit 123 of the ice-full state detecting sensor 120 are displayed at both sides of an ice discharging outlet, a passage through which ice is discharged from the ice maker body 101. The ice-full state detecting sensor 120 receives and transmits infrared rays, traversing the ice discharging outlet, to detect the ice-full state.
- [90] The ice storage container 180 provides a space for accommodating ice discharged from the ice maker 100 therein.
- [91] A transfer unit 150 is installed at a lower portion of the ice storage container 180. The transfer unit 150 sequentially transfers ice accommodated in the ice storage container 180 from the ice storage container 180, and crushes the ice into an appropriate size.
- [92] In detail, the transfer unit 150 includes a fixed blade 155 fixed in the ice storage container 180, a rotatable blade 151 relatively rotating with respect to the fixed blade 155, a rotational shaft 153 to which the rotational blade 151 is connected, a motor 154 connected to the rotational shaft 153, and a transfer blade 152 for transferring ice.
- [93] The rotatable blade 151 is formed at one side of the rotational shaft 153, and the transfer blade 152 is formed at the other side of the rotational shaft. Thus, when the rotational shaft 153 is rotated, the rotational blade 151 and the transfer blade 152 can be rotated together.
- [94] As the transfer blade 152, a spiral auger may be used.
- [95] Reference numeral 160 is an outlet through which ice is dispensed from the ice storage container 180, and reference numeral 170 is a guide path for guiding ice, which has been dispensed through the outlet 160, to a dispenser 190.
- [96] The operation of the ice maker 100 and the transfer unit 150 will now be described.
- [97] First, water is guided by a water supply pipe of a certain shape so as to be supplied to the water supply unit 107. The supplied water is introduced into the ice making chamber 104, and below-zero cold air is provided in the ice making chamber to freeze water received in the ice making chamber 104.
- [98] After the water within the ice making chamber 104 is completely frozen through the above-described process, the ejector 105 operates by a certain driving mechanism installed in the ice making body 101. Then, the ice frozen in the ice making chamber 104 is picked up.
- [99] Here, before the ejector 105 operates, heat is applied toward the ice making chamber 104 by the ice making heater 140 to allow the ice and the contact surface of the ice making chamber 104 to be separated from each other.

- [100] After the ice is picked up by the ejector 105, it is guided by the separator 106 and then falls into the ice storage container 180 so as to be collected therein.
- [101] The above-described operation is repeatedly performed, and when the ice storage container 180 is full of ice, the ice-full state detecting sensor 120 detects the ice-full state and the operation of the ice maker 100 is stopped.
- [102] Meanwhile, when ice supply to the user via the dispenser 190 is requested, the motor 154 is driven and the rotational shaft 153 connected to the motor 154 is rotated. Then, the rotational blade 151 and the transfer blade 152 are rotated in conjunction.
- [103] As the transfer blade 152 is rotated, ice in a lower portion of the ice storage container 180 is transferred toward the rotational blade 151.
- [104] When the ice guided toward the rotational blade 151 is caught between the rotational blade 151 and the fixed blade 155, it is crushed according to a pushing operation of the rotational blade 151.
- [105] The crushed ice is dispensed through the outlet 160 formed at a lower side of the fixed blade 155. The dispensed ice falls through the guide path 170. The fallen ice is then supplied to the user via the dispenser 190.
- [106] The operation of the refrigerator having the ice-full state detecting apparatus according to the first embodiment of the present invention will now be described with reference to FIGs. 5 and 6.
- [107] First, ice made by the ice maker 100 is discharged and falls into the ice storage container 180. The fallen ice is collected within the ice storage container 180.
- [108] While the ice is continuously collected in the ice storage container 180 until before the ice storage container 180 is full of ice, infrared rays transmitted from the transmitter 122 reach the receiver 124 and the controller (not shown) determines that the ice storage container 180 is not full of ice yet.
- [109] When ice is continuously collected, ice would be filled up to a full ice height of the ice storage container 180. Then, as shown in FIG. 6, infrared rays transmitted from the transmitter 122 is interrupted by the ice, failing to reach the receiver 124, and the controller determines that the ice storage container 180 is full of ice.
- [110] In this embodiment of the present invention, the ice-full state detecting sensor 120 is disposed at the ice maker body 101 and detects full ice collected within the ice storage container 180 after being discharged from the ice maker 100.
- [111] Thus, because the ice-full state detecting sensor 120 can detect whether the ice storage container 180 is full of ice or not, the related art problem of a mechanical ice detecting lever (or the like) not being able to properly detect whether the ice storage container is full or not due to it being frozen or stuck can be avoided. That is, the ice filled state of the ice storage container 180 can be more accurately and stably detected.
- [112] With reference to FIGs. 7 and 8, the ice-full state detecting apparatus of the ice

maker 100 for the refrigerator according to the first embodiment of the present invention includes a ice-full state detecting sensor 120 disposed at the ice maker body 101 and detecting an ice-full state of the ice storage container 180, and a sensor heater 128 for applying heat to the ice-full state detecting sensor 120.

[113] The ice-full state detecting sensor 120 includes the transmitting unit 121 and the receiving unit 123. Hereafter, only the transmitting unit 121 will be described, as such description of the transmitting unit 121 is also similarly applicable to the receiving unit 123.

[114] A transmitter insertion hole 126 is formed at the transmitting unit 121 to allow the transmitter 122 to be inserted therein. A sensor heater mounting recess 125 is formed near the transmitter insertion hole 126 to allow the sensor heater 128 to be mounted therein.

[115] The transmitter insertion hole 126 is formed to penetrate the transmitting unit 121 in a horizontal direction, and the sensor heater mounting recess 125 may be formed on a rear surface of the transmitting unit 121, namely, at the side facing a circuit unit 127. The sensor heater mounting recess 125 may be formed to be long in a vertical direction.

[116] The transmitting unit 121 supports the transmitter 122 and the sensor heater 128, and may be made of a plastic material to transfer heat of the sensor heater 128 to the transmitter 122.

[117] The transmitting unit 121 allows a detect signal of the transmitter 122 to be transmitted therethrough and protects the transmitter 122 against an external material, and in this sense, the transmitting unit 121 may be defined as a sensor cover.

[118] The sensor heater 128 may be formed as a thin plate-like heater to make the ice-full state detecting sensor simple.

[119] With such configuration, heat generated from the sensor heater 128 can be transferred to the transmitter 122 via the transmitter 121 and/or the circuit unit 127 to remove frost that may be formed on the transmitter 122. Thus, the ice-full state detecting sensor 120 can accurately detect whether ice is full or not.

[120] In addition, heat generated by the sensor heater 128 may be transferred to the transmitter 122 only via the transmitting unit 121, or in order to improve heat transmission efficiency, heat generated by the sensor heater 128 may be transferred to the transmitter 122 via both the transmitting unit 121 and the circuit unit 127.

[121] Here, the sensor heater 128 may be configured to be electrically connected with an ice making circuit unit (not shown) within the ice maker body 101 via the circuit unit 127 to which the transmitter 122 is connected, or the sensor heater 128 may be configured to be electrically connected directly with the ice making circuit unit.

[122] Some other embodiments of the present invention will now be described with

reference to the drawings. In the following description, any contents and explanations that have already been made for the first embodiment will be omitted for the sake of brevity.

- [123] FIG. 9 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to a refrigerator including an ice-full state detecting apparatus according to a second embodiment of the present invention, and FIG. 10 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including an ice-full state detecting apparatus according to the second embodiment of the present invention.
- [124] With reference to FIGs. 9 and 10, the ice-full state detecting apparatus of the ice maker 100 of the refrigerator according to the second embodiment of the present invention includes an ice-full state detecting sensor 220 including a transmitting unit 221 and a sensor heater 228 applying heat to the ice-full state detecting sensor 220.
- [125] An extending pipe 223 is formed to extend with a certain length on the side of the transmitting unit 221 that faces a circuit unit 227. The extending pipe 223 includes a transmitter insertion hole 226 in which a transmitter 222 can be insertedly positioned. The transmitter insertion hole 226 may be formed in a horizontal direction of the transmitting unit 221.
- [126] The sensor heater 228 is combined on a portion of the transmitting unit 221 near the extending pipe 223. The sensor heater 228 may be combined with the transmitting unit 221 by a tape or other combining unit.
- [127] The extending pipe 223 allows a detect signal transmitted from the transmitter 222 to pass therethrough, and covers the transmitter 222. Because the sensor heater 228 is installed at the outer side of the extending pipe 223, heat generated from the sensor heater 228 can be transmitted to the transmitter 222 via the transmitting unit 221 and the extending pipe 223. Accordingly, frost that may be formed on the transmitter 222 can be removed, and thus, the ice-full state detecting sensor 220 can accurately detect an ice-full state.
- [128] Reference numeral 224 denotes a hermetically sealed case and combined with the transmitting unit 221 to form a hermetically enclosed space. The transmitter 222 and the sensor heater 228 are disposed in the hermetically enclosed space so as to be protected.
- [129] FIG. 11 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to a refrigerator including an ice-full state detecting apparatus according to a third embodiment of the present invention, and FIG. 12 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including the ice-full state detecting apparatus according to the third embodiment of the present invention.

- [130] With reference to FIGs. 11 and 12, the ice-full state detecting apparatus of the ice maker 100 of the refrigerator according to the third embodiment of the present invention includes an ice-full state detecting sensor 320 including a transmitting unit 321, and a sensor heater 328 applying heat to the ice-full state detecting sensor 320.
- [131] Reference numeral 324 denotes a hermetically sealed case and combined with the transmitting unit 321 to form a hermetically enclosed space.
- [132] An extending pipe 323 is formed to extend with a certain length on the side of the transmitting unit 321 that faces a circuit unit 327. The extending pipe 323 includes a transmitter insertion hole 326 in which a transmitter 322 can be insertedly positioned. The transmitter insertion hole 326 may be formed in a horizontal direction of the transmitting unit 321.
- [133] A rear surface portion of the transmitter 322 penetrates the circuit unit 327.
- [134] A sensor heater receiving body 330 is disposed between the end of the extending pipe 323 and the circuit unit 327. In this embodiment, the sensor heater 328 covers in a coil type the periphery of the transmitter 322. Specifically, the sensor heater 328 is wound on the sensor heater receiving body 330.
- [135] The sensor heater receiving body 330 includes a flange 331, a transmitter penetrating hole 332, and a wound portion 333.
- [136] The wound portion 333 is where the sensor heater 328 is wound several times. The flange 331 is formed at both ends of the wound portion 333, having a diameter larger than that of the wound portion 333, so that the sensor heater 328 wound on the wound portion 333 may not be released. The transmitter penetrating hole 332 allows the transmitter 322 to pass therethrough. After passing through the transmitter penetrating hole 332, a front surface portion of the transmitter 322 is inserted into the transmitter insertion hole 326 of the extending pipe 323.
- [137] Thus, because the sensor heater 328 is wound in the coil form on the sensor heater receiving body 330 in which the transmitter 322 is insertedly positioned therein, heat generated from the sensor heater 328 can be uniformly transferred to the entire screen of the transmitter 322. Accordingly, frost that may be formed on the transmitter 322 may be removed, the ice-full state detecting sensor 320 can accurately detect an ice-full state.
- [138] FIG. 13 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to a refrigerator including an ice-full state detecting apparatus according to a fourth embodiment of the present invention, and FIG. 14 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including an ice-full state detecting apparatus according to the fourth embodiment of the present invention.
- [139] With reference to FIGs. 13 and 14, the ice-full state detecting apparatus of the ice

maker 100 of the refrigerator according to the fourth embodiment of the present invention includes an ice-full state detecting sensor 420 including a transmitter 421, and a sensor heater 440 applying heat to the ice-full state detecting sensor 420.

[140] Reference numeral 424 denotes a hermetically sealed case and combined with the transmitting unit 421 to form a hermetically enclosed space.

[141] An extending pipe 423 is formed to extend with a certain length on the side of the transmitting unit 421 that faces a circuit unit 427. The extending pipe 423 includes a transmitter insertion hole 426 in which a transmitter 422 can be insertedly positioned.

[142] The sensor heater 440 is installed between the end of the extending pipe 423 and the circuit unit 427.

[143] The sensor heater 440 may be made of an electroconductive heating material, for example, a polymer material, that can simultaneously transfer electricity and heat. When power is applied to the sensor heater 440, it is heated. The heat generated by the sensor heater 440 may be transferred to the transmitter 422.

[144] The sensor heater 440 includes a body 441, a power connection terminal 442 extending from the body 441 and connected with a power source, and transmitter penetrating hole 443 penetratingly formed in the body 441.

[145] The transmitter penetrating hole 443 allows the transmitter 422 to pass therethrough. After passing through the transmitter penetrating hole 432, a front surface portion of the transmitter 422 is inserted into the transmitter insertion hole 426 of the extending pipe 423.

[146] Because the sensor heater 440 is made of an electroconductive heating material that can generate heat by itself, it is not necessary to additionally form a heater to defrost the transmitter 422. Thus, the configuration of the ice-full state detecting apparatus can be simplified and the fabrication of the ice-full state detecting apparatus can be facilitated.

[147] In addition, because the sensor heater 440 covers the transmitter 422, heat generated by the sensor heater 440 can be uniformly transferred to the entire surface of the transmitter 422. Accordingly, frost that may be formed on the transmitter 422 can be removed, and thus, the ice-full state detecting sensor 420 can accurately detect an ice-full state.

[148] FIG. 15 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to a refrigerator including an ice-full state detecting apparatus according to a fifth embodiment of the present invention, FIG. 16 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including an ice-full state detecting apparatus according to the fifth embodiment of the present invention.

[149] With reference to FIGs. 15 and 16, the ice-full state detecting apparatus of the ice

maker 100 of the refrigerator according to the fifth embodiment of the present invention includes an ice-full state detecting sensor 520 including a transmitter 521, and a sensor heater 528 applying heat to the ice-full state detecting sensor 520.

[150] Reference numeral 524 denotes a hermetically sealed case.

[151] The sensor heater 528 may be made of an electroconductive heating material. When power is applied to the sensor heater 528, the sensor heater 528 is heated, and the heat generated by the sensor heater 528 can be transferred to the transmitter 522.

[152] The sensor heater 528 includes a transmitter insertion hole 529. The sensor heater 528 has a tubular shape longer by a certain length than the transmitter 522. The transmitter 522 is inserted into the transmitter insertion hole 529. Inserted in the transmitter insertion hole 529 overall, the transmitter 522 is positioned within the sensor heater 528.

[153] With such a configuration, the sensor heater 528 serves as an extending pipe in which the transmitter 522 is inserted and protected therein, and also serves as a heat supply source for defrosting the transmitter 522. Thus, it is not necessary to additionally configure a heater for defrosting the transmitter 522 as well as an extending pipe. Therefore, the configuration of the ice-full state detecting apparatus can be more simplified and the fabrication of the ice-full state detecting apparatus can be further facilitated.

[154] In addition, because the sensor heater 528 covers the transmitter 522, heat generated from the sensor heater 528 can be uniformly transferred to the entire surface of the transmitter 522. Thus, the transmitter can be defrosted, and accordingly, the ice-full state detecting sensor 520 can accurately detect an ice-full state.

[155] Here, the sensor heater 528 may be electrically connected with an ice making circuit unit via the circuit unit 527 within the ice maker body 101 via the circuit unit 527, or may be directly electrically connected with the ice making circuit unit.

[156] FIG. 17 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to a refrigerator including an ice-full state detecting apparatus according to a sixth embodiment of the present invention, and FIG. 18 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including an ice-full state detecting apparatus according to the sixth embodiment of the present invention.

[157] With reference to FIGs. 17 and 18, the ice-full state detecting apparatus of the ice maker 100 of the refrigerator according to the sixth embodiment of the present invention includes an ice-full state detecting sensor 620 including a transmitting unit 621, and a sensor heater 628 applying heat to the ice-full state detecting sensor 620.

[158] Reference numeral 624 denotes a hermetically sealed case. The hermetically sealed case 624 is combined with the transmitting unit 621 to hermetically seal the transmitter

622 and the sensor heater 628.

[159] The sensor heater 628 may be a panel heater.

[160] An extending pipe 623 is formed to extend with a certain length on the side of the transmitting unit 621 that faces a circuit unit 627. The extending pipe 623 includes a transmitter insertion hole 626 in which a front surface portion of the transmitter 622 can be insertedly positioned. The transmitter insertion hole 626 may be formed in a horizontal direction of the transmitting unit 221.

[161] A rear surface portion of the transmitter 622 penetrates the circuit unit 627.

[162] With such a configuration, the sensor heater 628 is disposed in the hermetically enclosed space of the hermetically sealed case 624, and only the front surface portion of the transmitter 622 is inserted in the extending pipe 623 and its body is exposed to the hermetically enclosed space. Accordingly, heat generated by the sensor heater 628 can heat air in the hermetically enclosed space and heat can be transferred to the transmitter 622 through the heated air. With this method, the efficiency of heat transfer from the sensor heater 628 to the transmitter 622 can be improved.

[163] FIG. 19 is a front perspective view of a refrigerator including an ice-full state detecting apparatus according to a seventh embodiment of the present invention, FIG. 20 is a sectional view showing a switch pressed in the refrigerator including the ice-full state detecting apparatus according to the seventh embodiment of the present invention, and FIG. 21 is a sectional view showing a switch in FIG. 20 released from a pressed state.

[164] With reference to FIGs. 19 to 21, the refrigerator 10 including the ice-full state detecting apparatus includes the refrigerator body 10 having the refrigerating chamber 13 and the freezing chamber 14, the refrigerating chamber door 13 and the freezing chamber door 14 for opening and closing the refrigerating chamber 11 and the freezing chamber 12, and the ice maker 100, the ice storage container 180 and the dispenser 190 installed at the refrigerating chamber door 14. The refrigerator body 10 includes an ice making space forming case 710 provided to accommodate the ice maker 100, the ice storage container 180 and the dispenser 190 therein and form a space hermetically sealed against the exterior, and an ice making space door 720.

[165] The ice making space forming case 710 is installed at the freezing chamber door 14 to cover the ice maker 100, the ice storage container 180 and the dispenser 190 installed at the freezing chamber door 14. A portion of the ice making space forming case 710 is open to allow an access from the exterior to the interior.

[166] The ice making space door 720 opens and closes the opened portion of the ice making space forming case 710.

[167] The ice maker 100 includes the ice-full state detecting sensor 120 to detect whether or not the ice storage container 180 is full of ice, and the sensor heater 128 to apply

heat to remove frost formed on the ice-full state detecting sensor 120.

[168] Here, the ice-full state detecting sensor 120 and the sensor heater 128 according to the first embodiment of the present invention are applied to the ice maker 100, but those ice-full state detecting sensors and sensor heaters according to other embodiments of the present invention can be also applicable.

[169] A detecting unit 730 detects whether or not the ice making space door 720 is open or closed with respect to the ice making space forming case 710. The detecting unit 730 may be connected to the controller 50 to output a detect signal. When the ice making space door 720 is open, the ice-full state detecting sensor 120 may be frosted by external air of a relatively high temperature. Then, the ice-full state detecting sensor 120 may not properly operate. The sensor heater 128 is connected to the controller 50, and when the ice making space door 720 is open, the controller 50 controls the sensor heater 128 to restrain generation of frost on the ice-full state detecting sensor 120 or perform defrosting.

[170] Thus, in this embodiment, the opening and closing of the ice making space door 720 is detected by the detecting unit 730, and a controller may control the operation of the sensor heater 128 according to whether or not the ice making space door 720 is open or closed as detected by the detecting unit 730.

[171] Namely, when the ice making space door 720 is open, the controller operates the sensor heater 128 to remove frost generated on the sensor heater 128. When the ice making space door 720 is closed, the controller stops the operation of the sensor heater 128.

[172] In this manner, the operation of the sensor heater 128 is controlled according to whether or not the ice making space door 720 is open or closed, whereby the ice-full state detecting sensor 120 can be defrosted to thus prevent degradation of the detecting performance of the ice-full state detecting sensor 120 and reduce power consumption for performing the defrosting operation.

[173] The configuration of the detecting unit 730 will now be described.

[174] The detecting unit 730 includes a switch 735 which is turned on or off according to a relative movement of the ice making space door 720 and the ice making space forming case 710, and a stopping hook 731 to press the switch 735 to turn on or off the switch 735.

[175] In this embodiment, the switch 735 is disposed in a space formed in the ice making space forming case 710, and the stopping hook 731 is disposed at the ice making space door 720.

[176] The switch 735 includes a pressed portion 737 that may be moved when pressed by the stopping hook 731, and a switch body 736 including a circuit to be turned on or off according to whether or not the pressed portion 737 is moved.

- [177] The stopping hook 731 includes a connection portion 733 formed along a hole 723 penetratingly formed in the ice making space door 720, and a head portion 732 formed at the end of the connection portion 733. The head portion 732 may be caught at a portion of the ice making space forming case 710 to press the pressed portion 737, to allow the ice making space door 720 to be fixed.
- [178] Here, the stopping hook 731 and the portion of the ice making space forming case 710 where the stopping hook 731 is caught are engaged with each other to maintain the ice making space forming case 710 in a closed state, which can be defined as stopping units. The switch 735 is disposed at the portion where the stopping units are engaged with each other, and the switch 735 may be turned on or off according to engagement of the stopping units.
- [179] Reference numeral 722 denotes a hermetically sealed member for hermetically sealing the ice making space forming case 710 and the ice making space door 720.
- [180] The operation of the detecting unit 730 will now be described.
- [181] As shown in FIG. 20, when the stopping hook 731 is caught by the portion of the ice making space forming case 710, the ice making space forming case 710 is closed by the ice making space door 720.
- [182] At this time, the pressed portion 737 of the switch 735 is pressed by the stopping hook 731, and accordingly, the switch 735 is turned off. Then, the controller does not operate the sensor heater 128, or if the sensor heater 128 is being operated, the controller stops the operation of the sensor heater 128.
- [183] Thereafter, when the ice making space door 720 is rotated to open the opened portion of the ice making space forming case 710, the engaged state of the stopping hook 731 and the portion of the ice making space forming case 710 is released.
- [184] At this time, the pressing of the stopping hook 731 to the pressed portion 737 is released, the pressed portion 737 is moved by an operation of a spring or the like installed therein, and accordingly, the switch 735 is turned on. Then, the controller operates the sensor heater 128.
- [185] Of course, the ON/OFF operation states of the switch 735 may be implemented to be opposite to those in the above description.
- [186] Here, the ice making space forming case 710 and the ice making space door 720 are disposed in the space formed by the case and the door 13 and 14 of the refrigerator 10, and the detecting unit 730 detects whether or not the ice making space forming case 710 is open or closed by the ice making space door 720, but the present invention is not limited thereto.
- [187] Namely, the detecting unit 730 may be configured to detect whether or not the case of the refrigerator 10 is open or closed by the doors 13 and 14, and accordingly, the operation of the sensor heater 128 may be controlled.

- [188] Of course, the detecting unit 730 may be configured to detect both whether or not the case of the refrigerator 10 is open or closed by the doors 13 and 14 and whether or not the ice making space forming case 710 is open or closed by the ice making space door 720.
- [189] Portions of the case and the ice making space forming case 710 of the refrigerator are open, and the doors 13 and 14 and the ice making space door 720 of the refrigerator 10 open and close the opened portions of the case and the ice making space forming case 710 of the refrigerator 10.
- [190] In this aspect, the case and the ice making space forming case 710 of the refrigerator 10 may be defined as external cases, while the doors 13 and 14 and the ice making space door 720 may be defined as doors for opening and closing the opened portions of the external cases.
- [191] FIG. 22 is a perspective view showing an exploded state of an ice-full state detecting sensor applied to a refrigerator including an ice-full state detecting apparatus according to an eighth embodiment of the present invention, and FIG. 23 is a sectional view showing a coupled state of the ice-full state detecting sensor applied to the refrigerator including the ice-full state detecting apparatus according to the eighth embodiment of the present invention.
- [192] With reference to FIGs. 22 and 23, an ice-full state detecting sensor 820 according to the eighth embodiment of the present invention includes a transmitting unit 821, a transmitter 822 and a circuit unit 827. The description for the transmitting unit 821 can be applied in the same manner to a receiving unit of the ice-full state detecting sensor 820.
- [193] The transmitting unit 821 has a box-like shape and includes a transmitter insertion hole 829 formed at one side thereof. The transmitter insertion hole 829 has such a shape that a portion of a rear surface of the transmitting unit 821 is recessed in a forward direction. Namely, the transmitter insertion hole 829 is not formed to penetrate the transmitting unit 821, with its front side closed off. Here, the transmitting unit 821 may be configured as a light-transmissive member to allowing a signal of the transmitter 822 to pass therethrough. In addition, the transmitting unit 821 may be made of a synthetic resin irrespective of signal passing and a transmissive window may be formed as a light transmissive member only at a region of the transmitter 822 where a signal is allowed to pass through.
- [194] The transmitter 822 connected to the circuit unit 827 is inserted into the transmitter insertion hole 829.
- [195] The portions of the transmitting unit 821, other than the portion where the transmitter insertion hole 829 is formed, may be formed overall in a recessed manner except for the edge (or boundary) portions of the transmitting unit 821. The recessed portions,

excluding the edge portions of the transmitting unit 821, are formed such that they do not penetrate the transmitting unit 821 with its front side being blocked or closed off.

[196] A sensor heater 828 is formed at the recessed portion, excluding the edge portions of the transmitting unit 821. The sensor heater 828 can remove moisture that may exist on the surface of the transmitting unit 821 corresponding to the front portion of the transmitter insertion hole 829. Thus, signals transmitted by the transmitter 822 can be transmitted without being interfered with by moisture possibly existing on the surface of the transmitting unit 821, accurate detection can be possibly performed.

[197] In addition, because the sensor heater 828 is installed at the recessed portion, a space for accommodating an electric wire for connecting the sensor heater 828 and a power source can be provided.

[198] A molding solution is injected into the recessed portion, excluding the edge portions of the transmitting unit 821, namely, into the portion where the sensor heater 828 is installed. The molding solution hardens to hermetically seal the interior of the ice-full state detecting sensor so that external moisture cannot be infiltrated into the circuit unit 827, the transmitter 822 or the like.

[199] In this embodiment, because the transmitter 822 is insertedly positioned in the transmitter insertion hole 829, although the molding solution is injected into the portion where the sensor heater 828 is attached, the molding solution cannot be infiltrated into the transmitter 822. In particular, because the transmitter insertion hole 829 is closed, infiltration of the molding solution from the front surface portion of the transmitter 822 can be prevented. Thus, light diffusion at the transmitter 822 can be prevented, and thus, accurate detection can be performed.

[200] In addition, because the transmitter is inserted into the transmitter insertion hole 829, the transmitter 822 is covered, and the transmitter 822 and the transmitting unit 821 can be aligned in their position relation without performing any additional process. Therefore, the fabrication of the ice-full state detecting sensor 820 can be facilitated.

[201] A plurality of coupling hooks 823 and 824 are formed on the transmitting unit 821, and a plurality of hook coupling holes 825 and 826 are formed on the circuit unit 827 and combined with the plurality of coupling hooks 823 and 824. Because the coupling hooks 823 and 824 are combined with the hook coupling holes 825 and 826, the transmitting unit 821 and the circuit unit 827 can be easily and firmly combined, and the transmitter 822 and the transmitting unit 821 can be more easily aligned in their position relation.

[202] The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present disclosure. The present teachings can be readily applied to other types of apparatuses. This description is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations

will be apparent to those skilled in the art. The features, structures, methods, and other characteristics of the exemplary embodiments described herein may be combined in various ways to obtain additional and/or alternative exemplary embodiments.

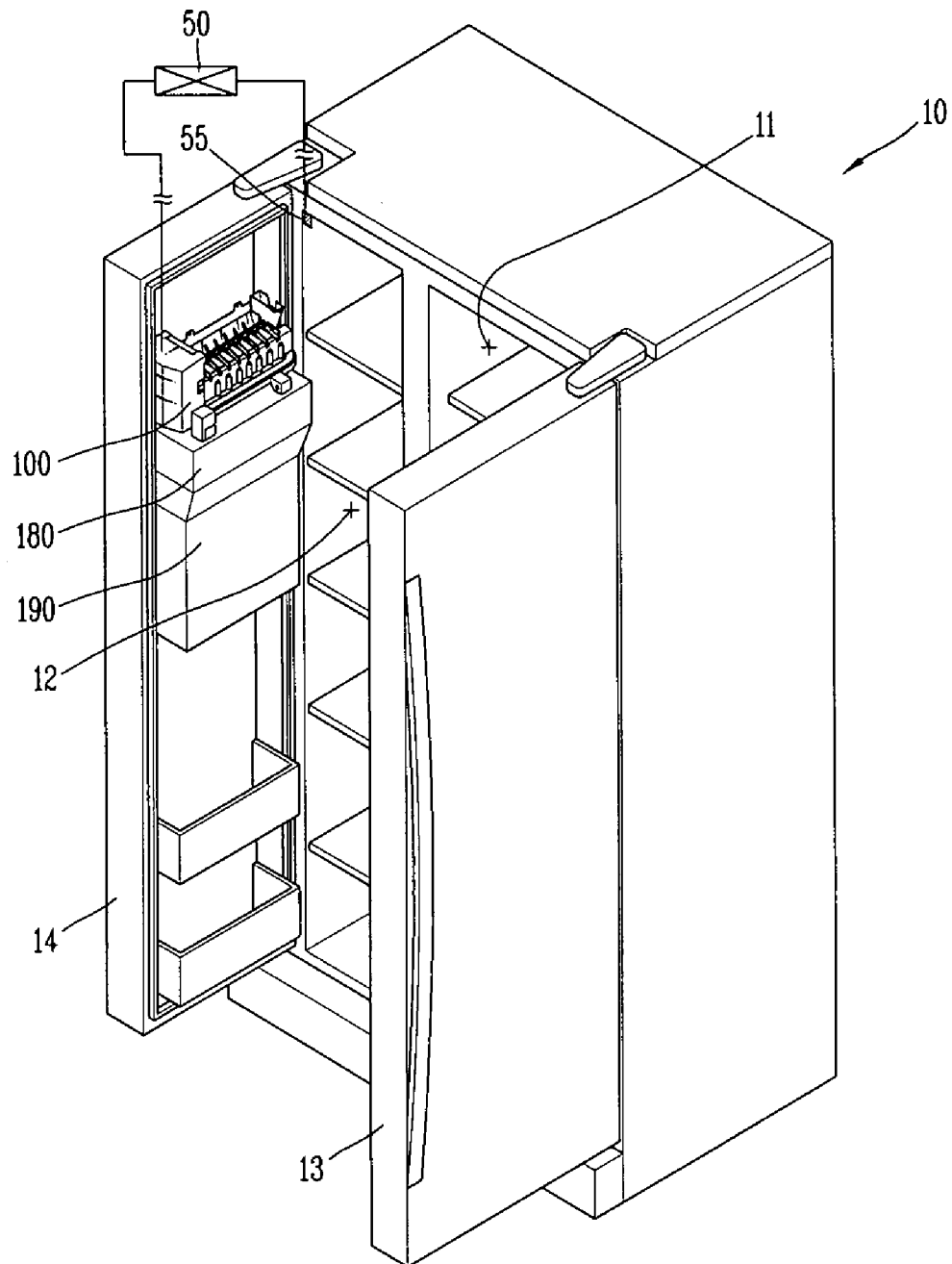
[203] As the present features may be embodied in several forms without departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

Claims

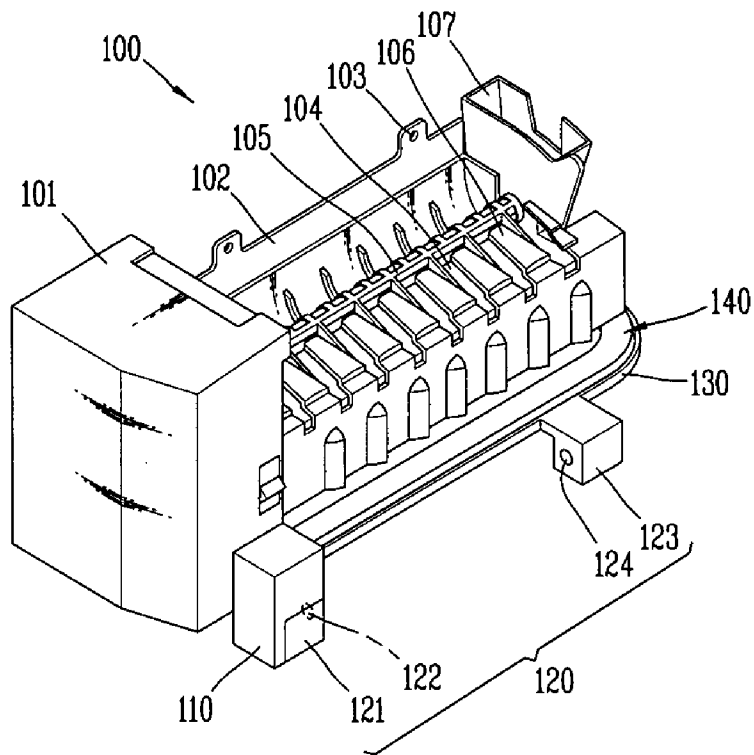
- [1] A refrigerator including an ice-full state detecting apparatus, comprising:
a refrigerator body including a cooling chamber;
a cooling chamber door to open and close the cooling chamber;
an ice maker installed at the cooling chamber or at the cooling chamber door;
an ice storage container to store ice made by the ice maker; and
the ice-full state detecting apparatus to detect an ice-full state of the ice storage container,
wherein the ice-full state detecting apparatus comprises:
a ice-full state detecting sensor to detect an ice-full state of the ice storage container;
a sensor heater to heat the ice-full state detecting sensor;
a detecting unit to detect whether the ice-full state detecting sensor is in contact with external air; and
a controller to control the operation of the sensor heater based on the detection result of the detecting unit.
- [2] The refrigerator of claim 1, wherein the cooling chamber comprises a freezing chamber, the cooling chamber door comprises a freezing chamber door to open and close the freezing chamber, and the ice maker is disposed at the freezing chamber door.
- [3] The refrigerator of claim 2, wherein the freezing chamber door comprises a case forming a space for accommodating the ice maker and a door to open and close the case, and the detecting unit detects whether or not the door is open.
- [4] The refrigerator of claim 3, wherein the detecting unit comprises a switch turned on or off according to relative movement of the door and the case.
- [5] The refrigerator of claim 4, wherein the switch is disposed at the case and turned on or off by being pressed by the door.
- [6] The refrigerator of claim 4, wherein combination portions are formed at the door and the case such that they are engaged with each other to maintain the door closing the case.
- [7] The refrigerator of claim 6, wherein the switch is disposed at a portion where the combination portions are engaged, and turned on or off as the combination portions are engaged.
- [8] The refrigerator of claim 3, wherein the controller operates the sensor heater when the door is open.
- [9] The refrigerator of claim 8, wherein the controller stops operation of the sensor heater when the door is closed.

- [10] The refrigerator of claim 2, wherein the ice maker is disposed at the freezing chamber, and the detecting unit detects whether or not the freezing chamber door is open.
- [11] The refrigerator of claim 10, wherein the controller controls the sensor heater to operate when the freezing chamber door is open.
- [12] The refrigerator of claim 1, wherein the cooling chamber comprises a refrigerating chamber, the cooling chamber door comprises a refrigerating chamber door to open and close the refrigerating chamber, and the ice maker is disposed at the refrigerating chamber door.
- [13] The refrigerator of claim 12, wherein the refrigerating chamber door comprises a case providing the ice maker and a receiving space with one side open, and a door for opening and closing the open portion of the case.
- [14] The refrigerator of claim 13, wherein the detecting unit may detect whether or not the door is open.
- [15] The refrigerator of claim 14, wherein the controller controls the sensor heater to operate when the door is open.
- [16] An ice-full state detecting apparatus comprising:
a case having a receiving space with one side open;
a door for opening and closing the open region of the case;
an ice-full state detecting sensor for detecting whether or not an ice storage container is full of ice;
a sensor heater for heating the ice-full state detecting sensor;
a detecting unit whether or not the door is open; and
a controller for controlling an operation of the sensor heater based on the detection result of the detecting unit.
- [17] The apparatus of claim 16, wherein the controller controls the sensor heater to operate when the door is open.
- [18] The apparatus of claim 17, wherein the controller controls the sensor heater to be stopped when the door is closed.

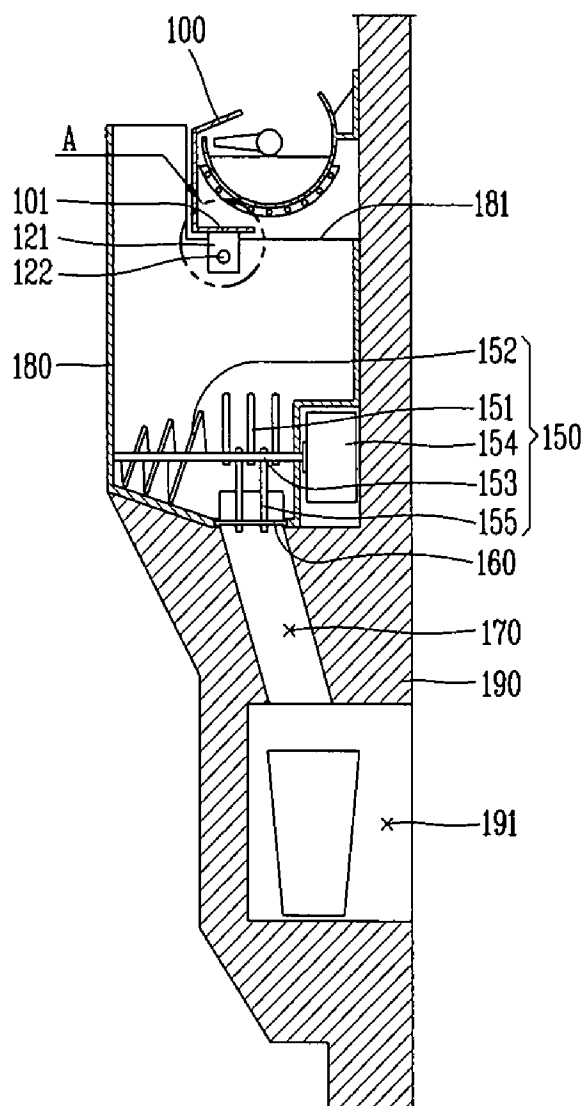
[Fig. 1]



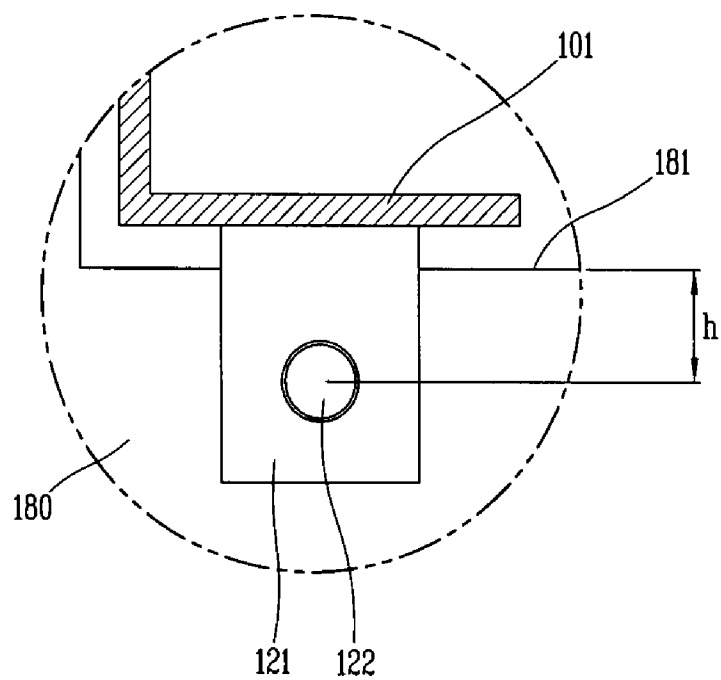
[Fig. 2]



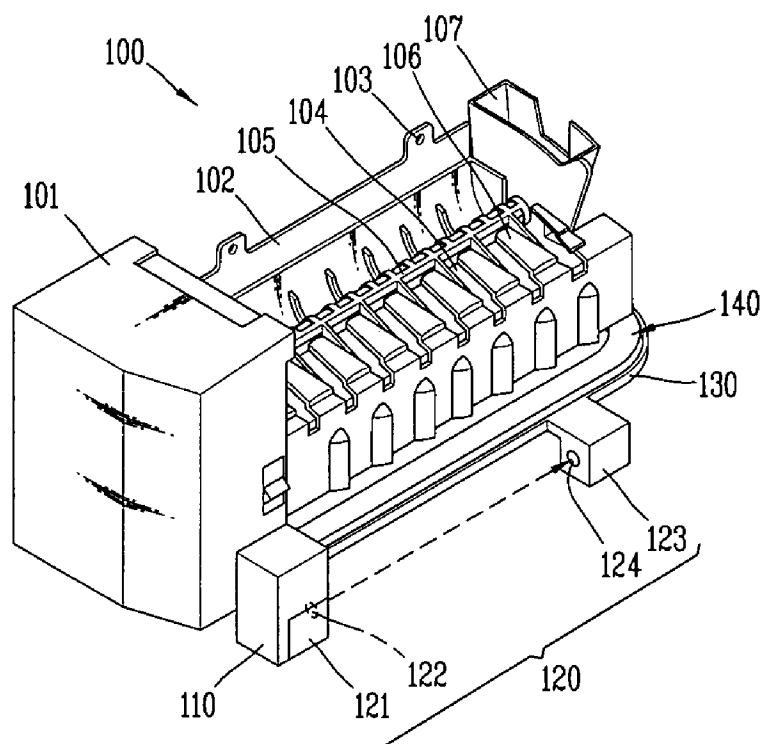
[Fig. 3]



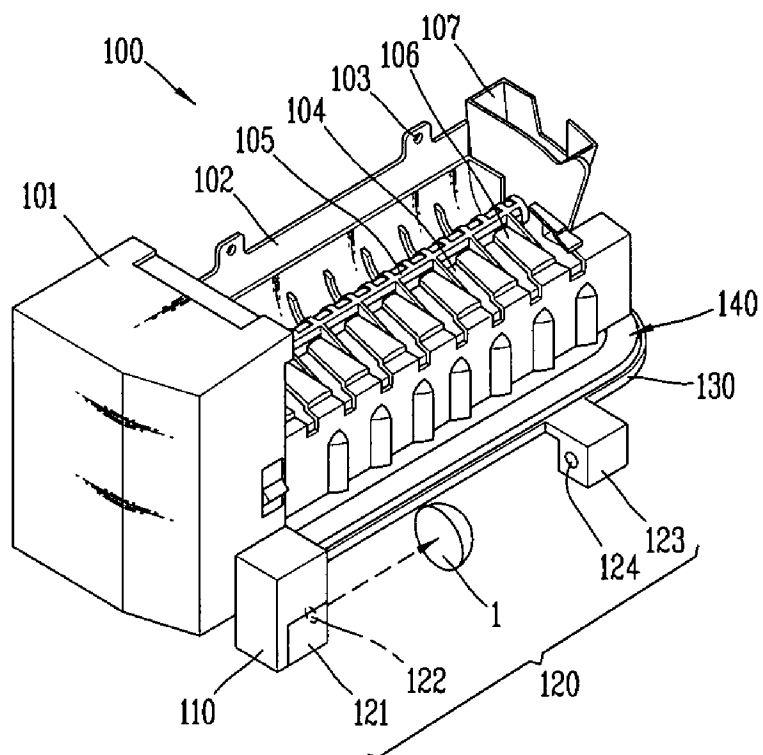
[Fig. 4]



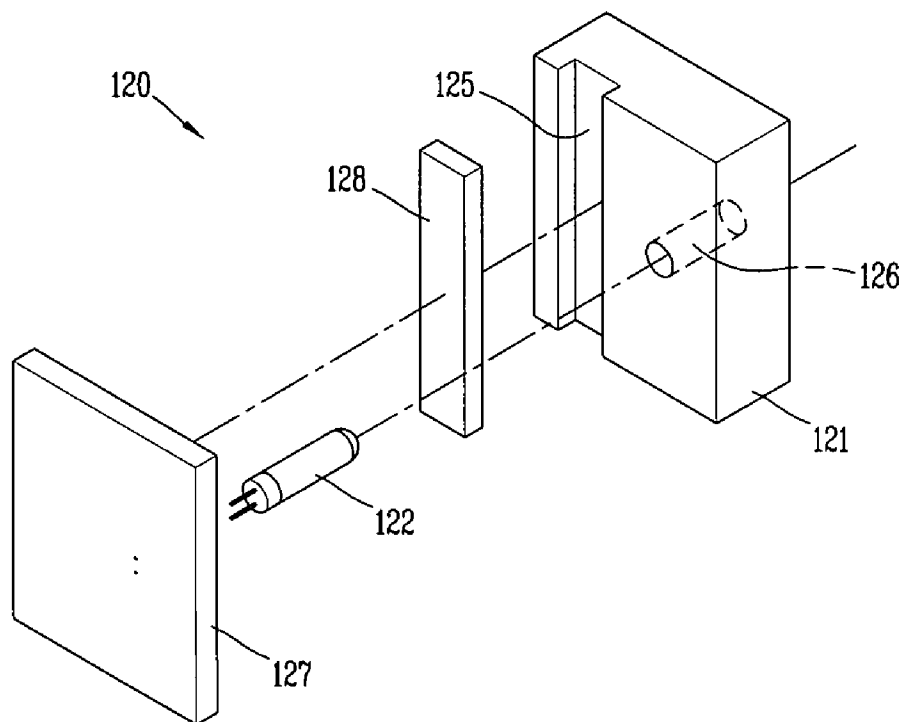
[Fig. 5]



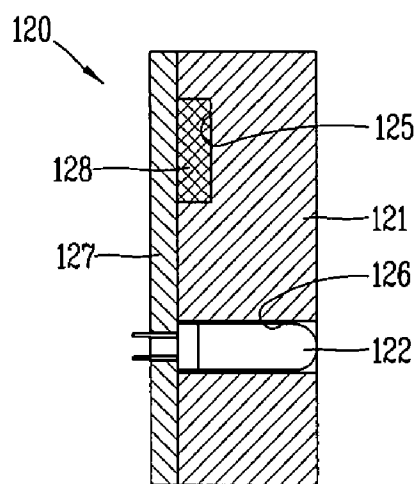
[Fig. 6]



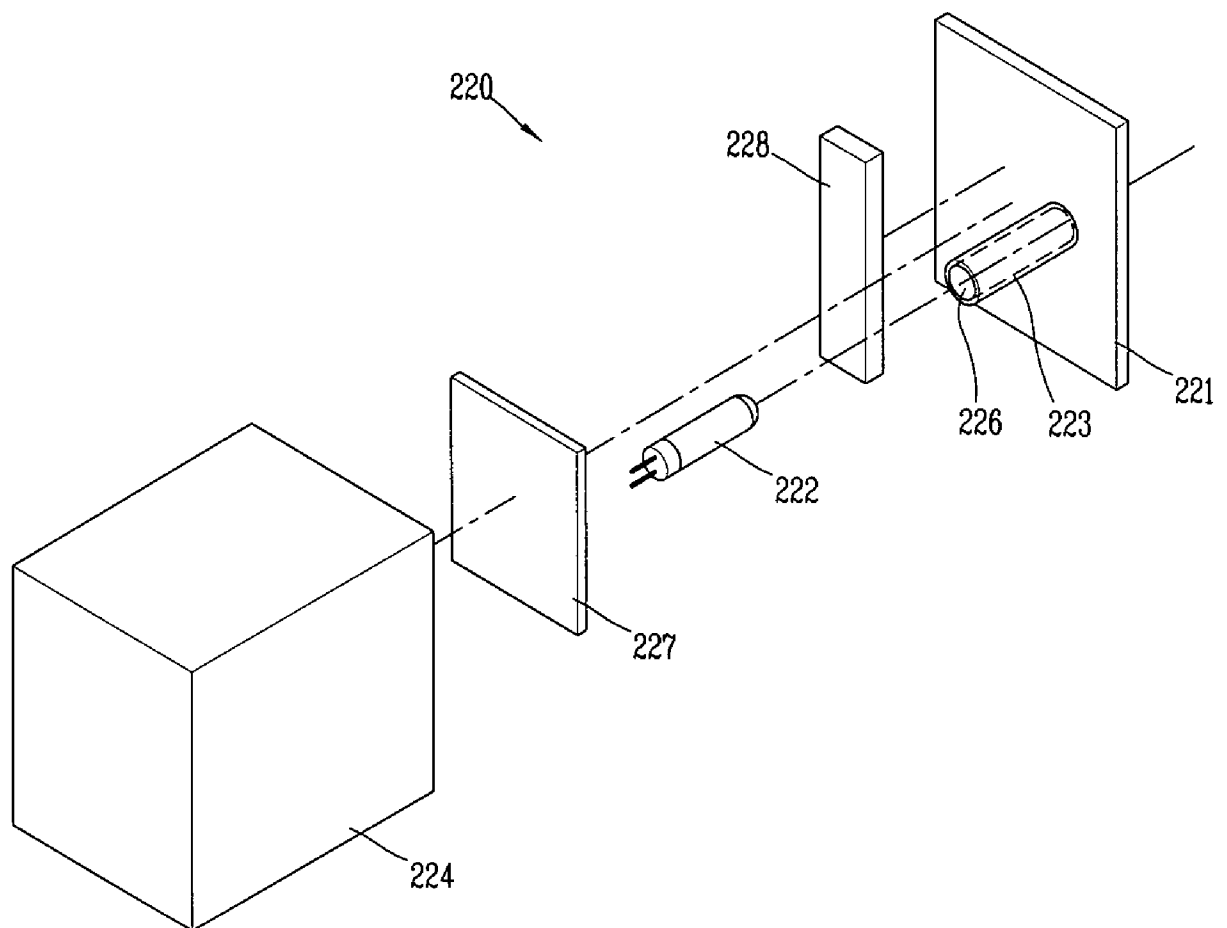
[Fig. 7]



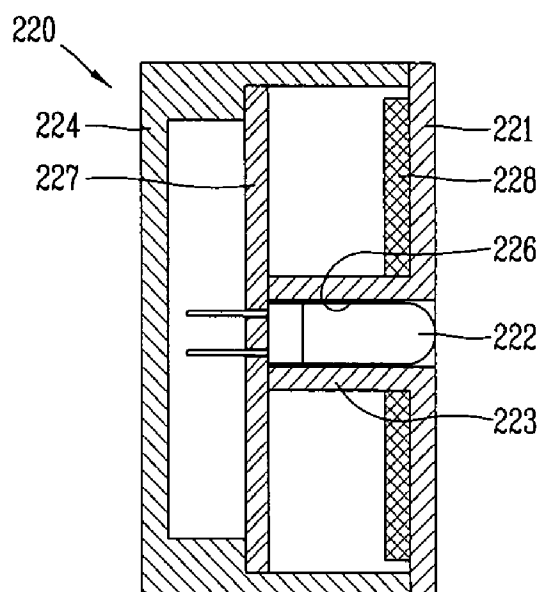
[Fig. 8]



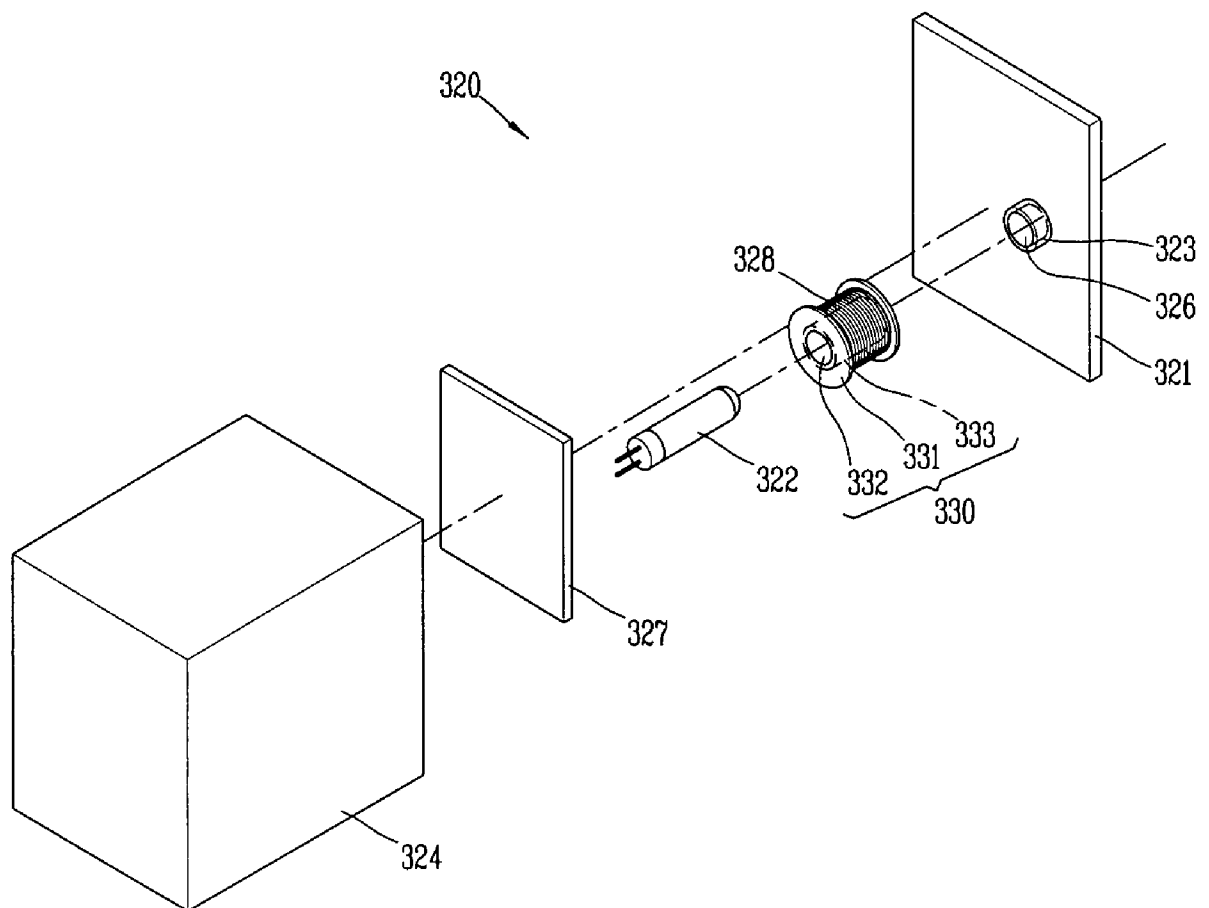
[Fig. 9]



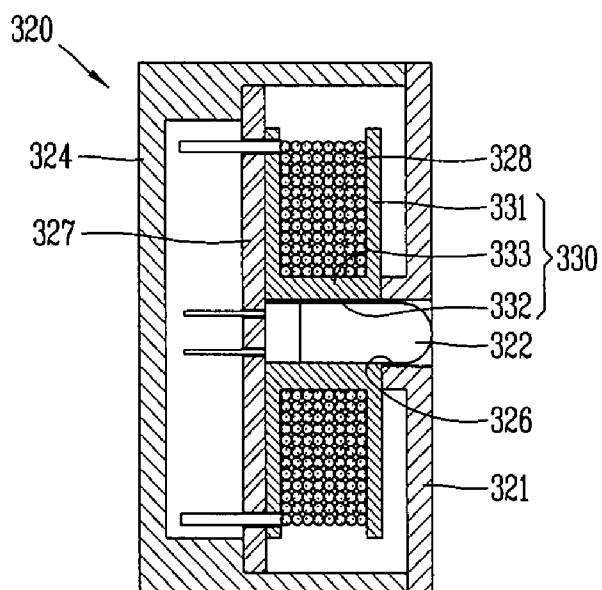
[Fig. 10]



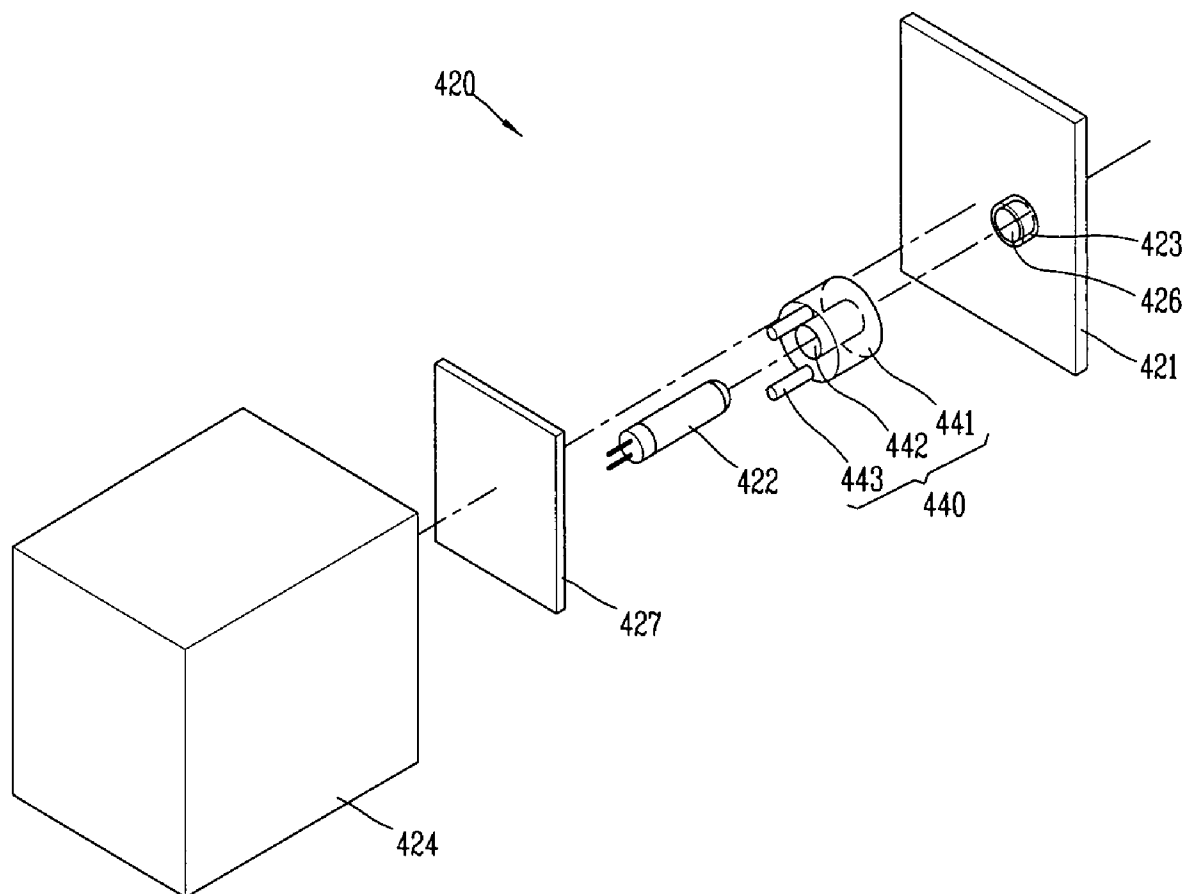
[Fig. 11]



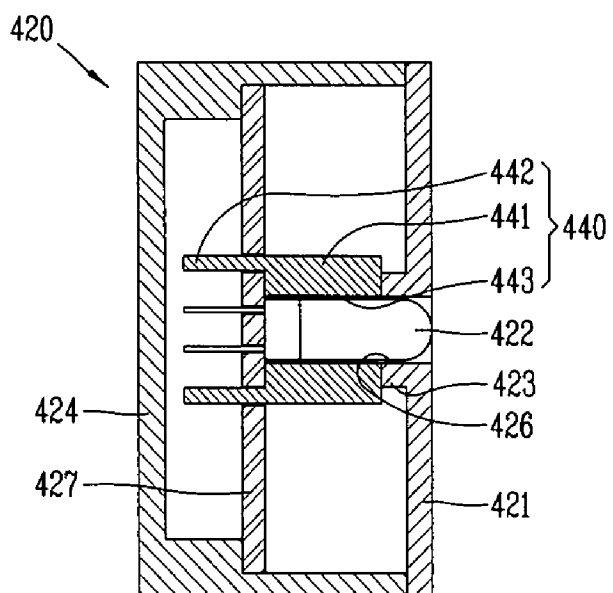
[Fig. 12]



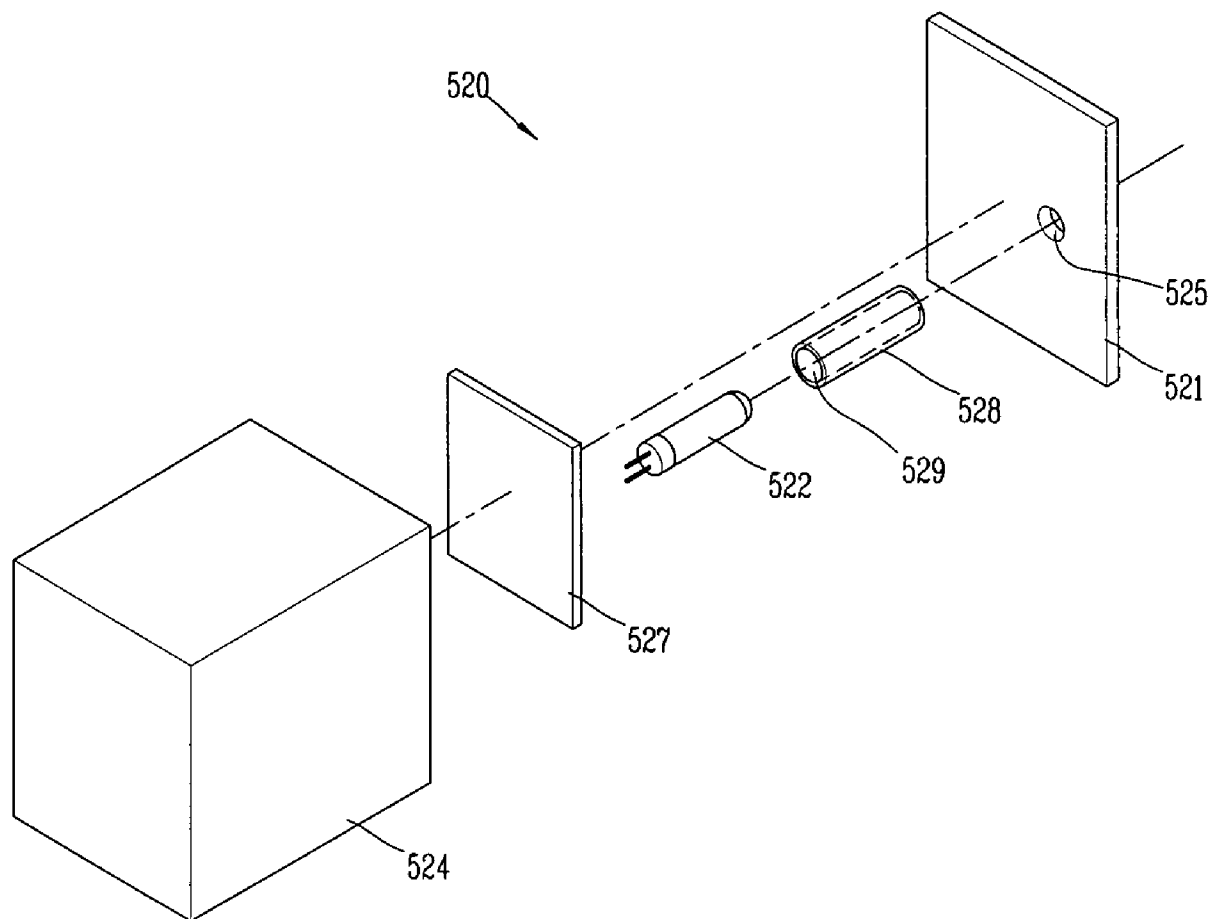
[Fig. 13]



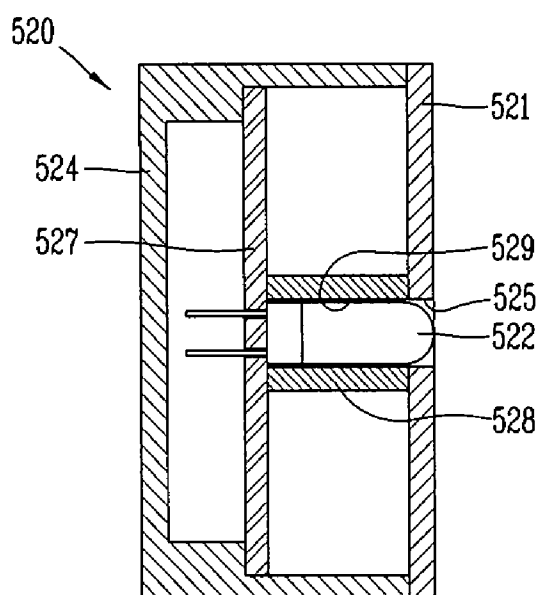
[Fig. 14]



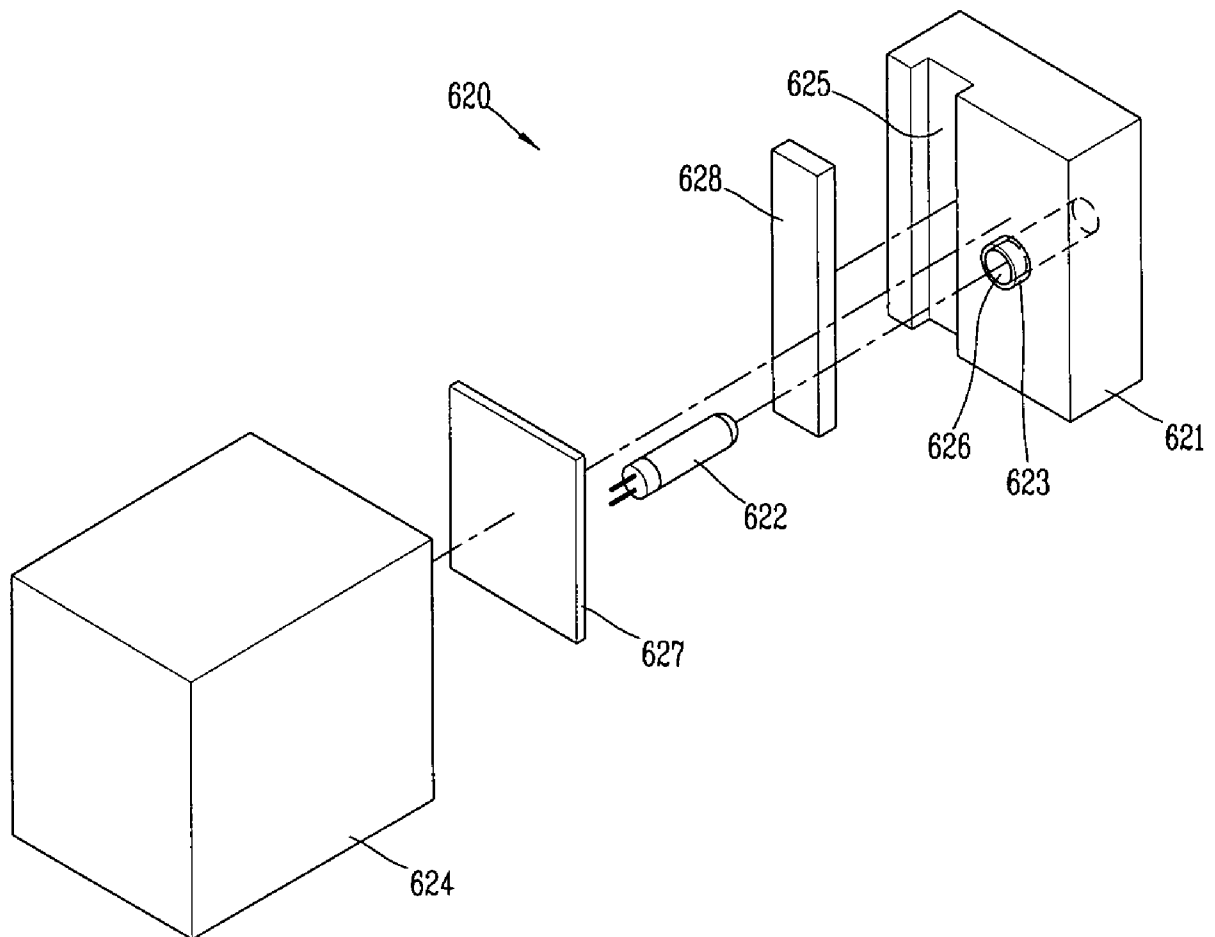
[Fig. 15]



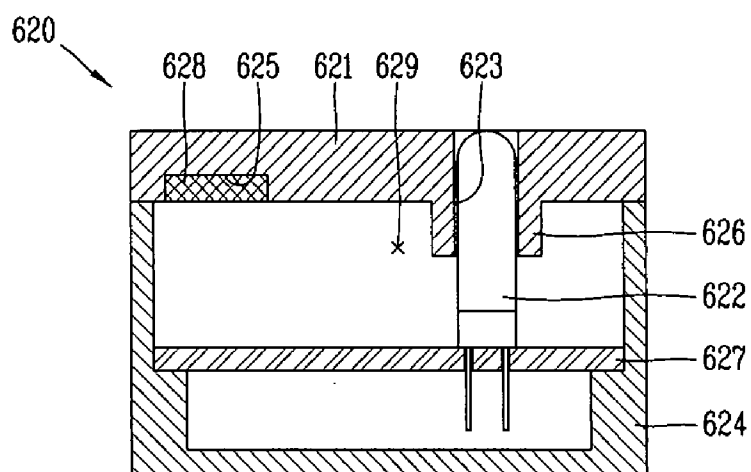
[Fig. 16]



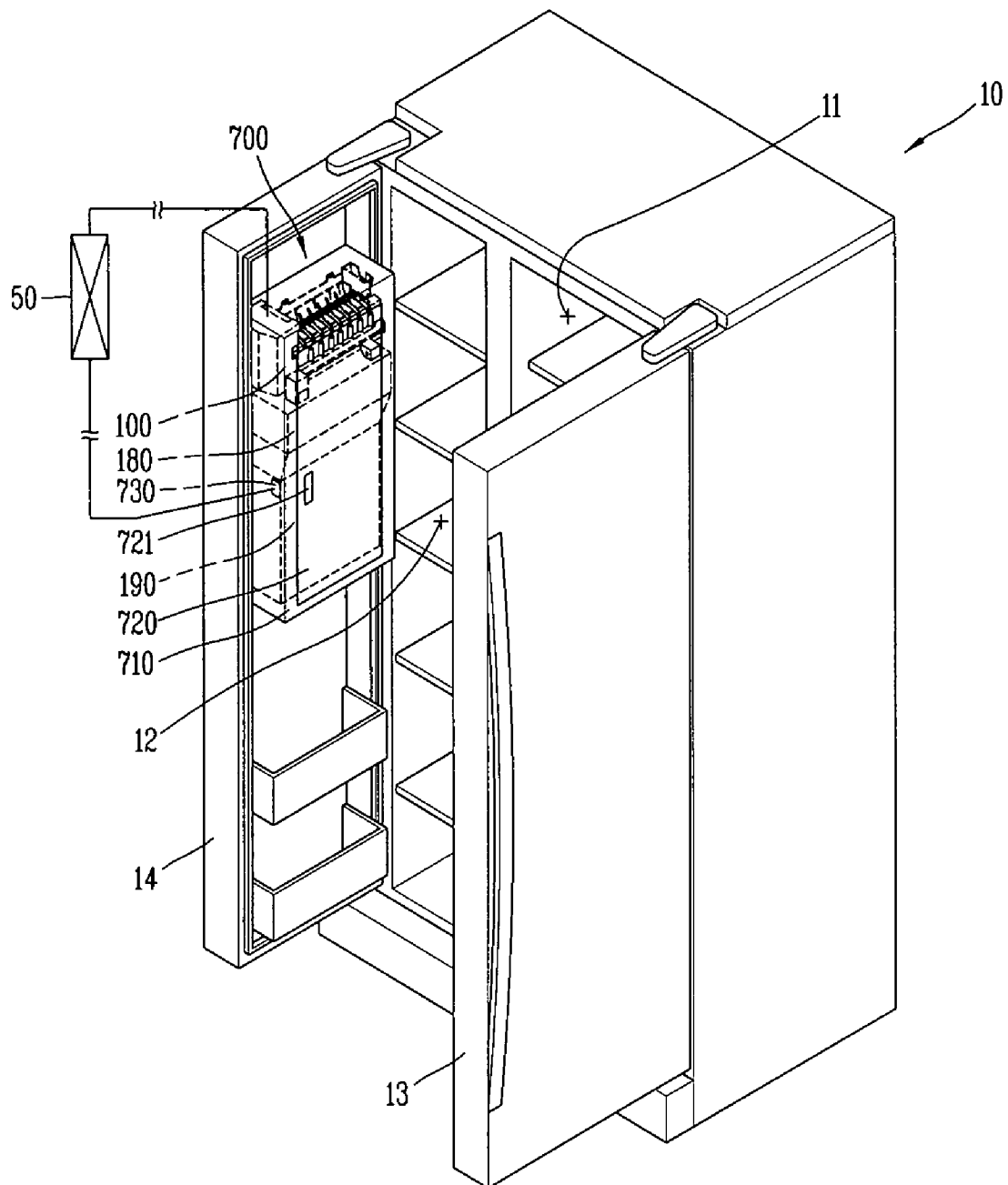
[Fig. 17]



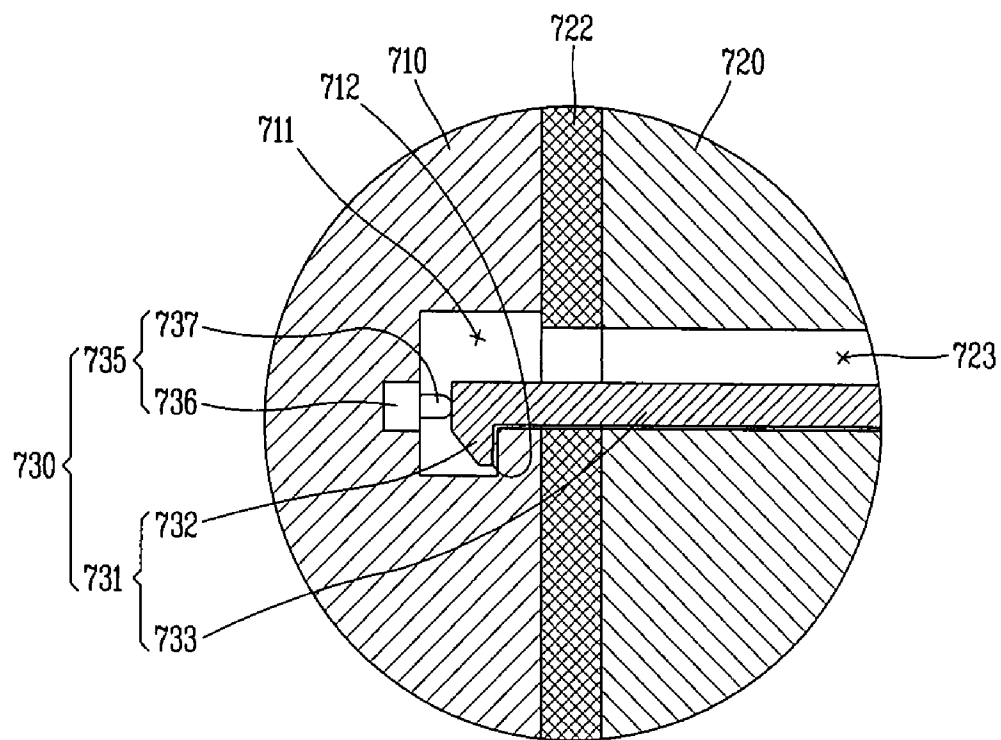
[Fig. 18]



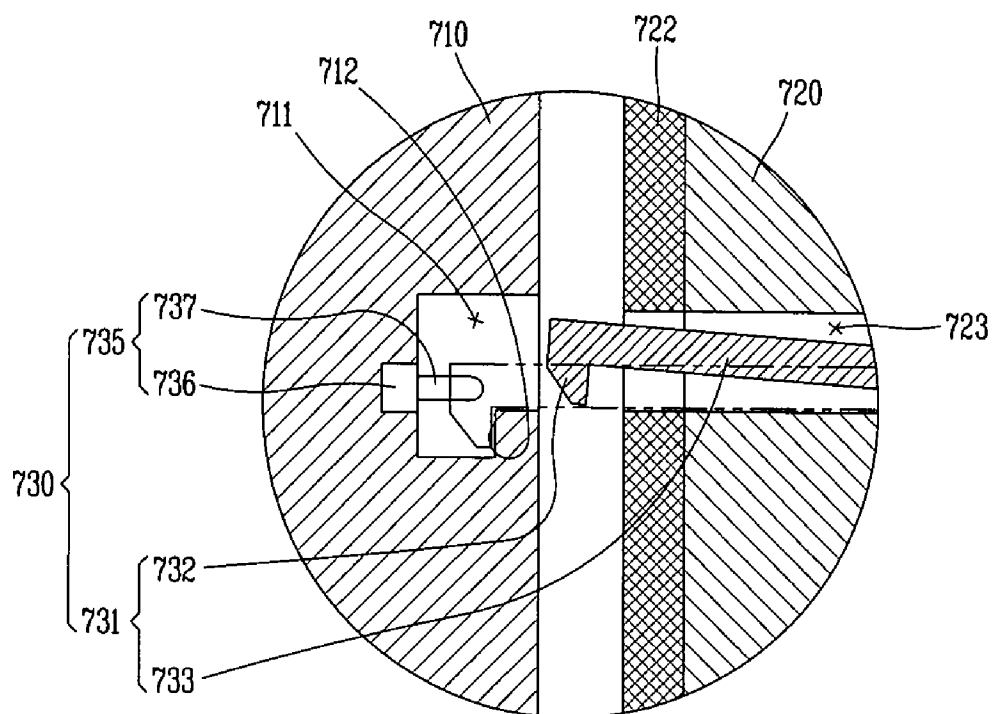
[Fig. 19]



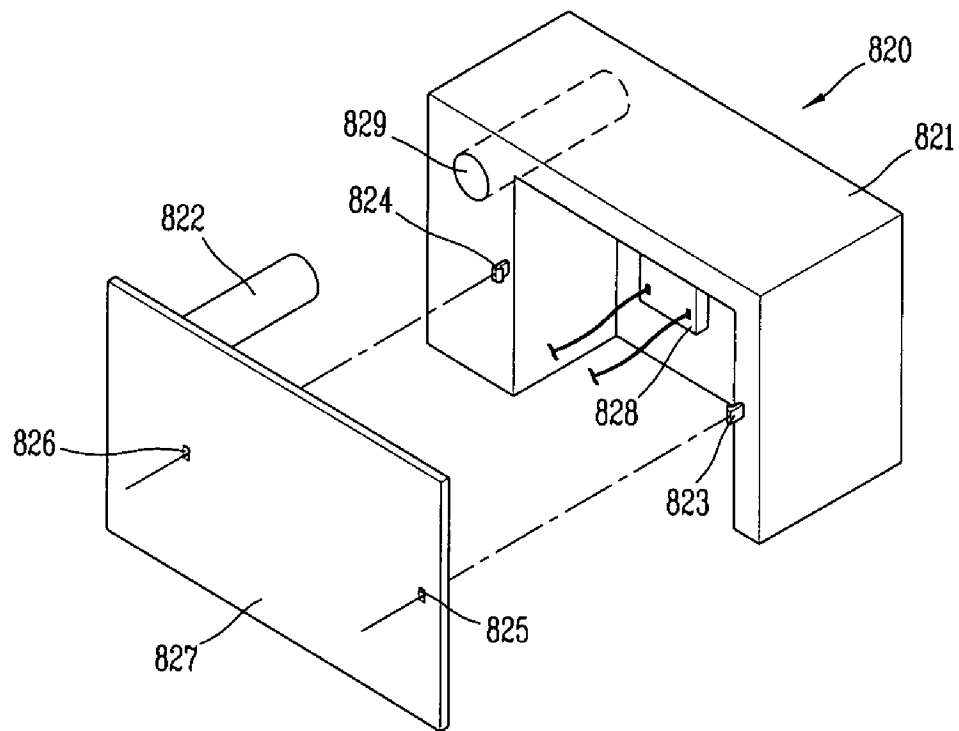
[Fig. 20]



[Fig. 21]



[Fig. 22]



[Fig. 23]

