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(54) Refrigerator

Kühlschrank

Réfrigérateur

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Description

BACKGROUND

[0001] The present disclosure relates to a refrigerator.

[0002] Refrigerators are apparatuses for storing foods at a low temperature in an inner storage space covered by a door. Cool air may be continuously supplied into such a refrigerator to maintain an inner storage space of the refrigerator at a low temperature. The cool air is generated by heat-exchanging with a refrigerant through a refrigeration cycle including compression, condensation, expansion, and evaporation processes. The cool air supplied into the refrigerator may be uniformly transferred into the refrigerator by a convection current thereof to store foods within the refrigerator at a desired temperature.

[0003] An evaporator constituting the refrigeration cycle is provided in a vaporizing chamber to heat-exchange air circulating into the refrigerator with the refrigerant. Since a surface temperature of the evaporator is significantly lower than an indoor temperature, condensed water is generated on the surface of the evaporator while being heat-exchanging with the air circulating into the refrigerator. The condensed water is frozen on the surface of the evaporator or vaporizing chamber to generate frosts. If frosts are accumulated on the surface of the evaporator, heat-exchange efficiency between the evaporator and the air within the refrigerator may be reduced.

[0004] To prevent frosts from being generated on the surface of the evaporator, a technology in which a defrost heater is mounted on a side of the evaporator, or the refrigeration cycle is reversely performed for a predetermined time to melt the frosts generated on the surface of the evaporator may be utilized. The condensed water generated on the surface of the evaporator or the defrost water generated by the melting of the frosts is collected into a drain pan attached to the bottom of the evaporator. Then, the water collected into the drain pan drops onto the bottom of a machine room through a drain hose.

[0005] A defrost sensor assembly for detecting an amount of frosts attached to the evaporator is mounted on a side of the evaporator. In detail, the amount of frosts attached to the evaporator is detected by the defrost sensor assembly, and then, the detected result is transmitted into a control part. Also, the control part determines whether the value transmitted from the defrost sensor assembly reaches a previously inputted defrosting start value. When the transmitted value reaches the defrosting start value, the defrost heater is operated to start a defrosting operation.

EP 1 726 895 A1 presents anti-freeze protection device for chillers, comprising a control circuit connected to ice sensors and local heaters. In the event of formation of ice, the sensors indicate its presence to the control circuit which suspends operation of the chiller, adjusts opening and closing of the expansion valves located at the evaporator inlet, or suspends operation of the chiller compressor only, and if necessary operates the heaters, thus melting the ice into water which is removed by the known means used for removing condensate. DE 27 50 165 A1 discloses a frost detector comprising a piezoelectric element secured on a metal diaphragm and inside an airtight space formed by the diaphragm, a base and a bellows which airtightly and resiliently connects the diaphragm and the base, the base being secured on a fin of a heat exchanger, the piezoelectric element being connected to an oscillation circuit and an oscillation detection circuit; resonance frequency and impedance characteristic of the piezoelectric element being changed by frosting on the outside face of the diaphragm, and the frosting being detected through a change or stopping of the oscillation and resultant output signal by the oscillation detection circuit. When the defrost sensor assembly is mounted on the evaporator, if frosts are generated on a surface of the evaporator, frosts may be generated on a surface of the defrost sensor assembly. When the frosts are generated on the surface of the defrost sensor assembly, the defrost sensor assembly may not precisely detect an amount of frosts generated on the surface of the evaporator. Thus, there is a limitation that the frosts generated on the surface of the evaporator are effectively removed. In refrigerators according to the related art, although a defrost heater for melting frosts attached on the evaporator is provided, a structure for removing frosts attached to the surface of the defrost sensor assembly is not disclosed.

[0006] Also, an existing defrost logic is designed to periodically perform a defrosting operation, irrelevant to an amount of actual attached frosts. Thus, there is a limitation that the defrosting is performed in a state where an amount of attached frosts does not reach a defrosting start time or the defrosting is not properly performed at the defrosting start time. Furthermore, there is a limitation that the defrosting operation is not adequately finished at a defrosting finish time.

SUMMARY

[0007] According to the invention, there is provided a refrigerator having the features of claim 1. Preferred embodiments are defined in dependent claims 2-19.

[0008] Embodiments provide a refrigerator which prevents frosts from being attached to a surface of a defrost sensor assembly mounted on an evaporator to precisely detect an amount of frosts attached to a surface of the evaporator and a controlling method thereof.

[0009] Embodiments also provide a refrigerator which includes a sensor for precisely detecting an amount of frosts attached to an evaporator to adequately start a defrosting operation at a defrosting requirement time and adequately finish the defrosting operation at a defrosting finish time.

[0010] The refrigerator of the invention comprises, in particular, a main body (10) providing a storage space in which foods are stored at a low temperature; a vaporizing

chamber (300) defined in a side of the main body (10); an evaporator (320) received in the vaporizing chamber (300); a sensor module (400) comprising a sensing part (410) received in the vaporizing chamber (300) to detect an amount of frosts attached to the evaporator (320); a control part (500) controlling an operation of the sensor module (400); and a defrost heater (340) removing the frosts attached to the evaporator (320), wherein the sensor module (400) further comprises at least one sensor defrost part (350) removing frosts attached to the sensing part (410).

[0011] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a side sectional view of a refrigerator according to an embodiment.

Fig. 2 is a control block diagram of a refrigerator according to an embodiment.

Fig. 3 is a view illustrating a vaporizing chamber of a refrigerator according to an embodiment.

Fig. 4 is a perspective view of a sensor module according to an embodiment.

Fig. 5 is a plan view of the sensor module.

Fig. 6 is a perspective of a module support according to a first embodiment.

Fig. 7 is a perspective of a module support according to a second embodiment.

Fig. 8 is a perspective of a module support according to a third embodiment.

Fig. 9 is a longitudinal sectional view taken along line A-A' of Fig. 3.

Fig. 10 is a view illustrating a state in which a defrost sensor assembly including a module support is mounted on an evaporator according to a fourth embodiment.

Fig. 11 is a view illustrating a state in which a defrost sensor assembly including a module support is mounted on an evaporator according to a fifth embodiment.

Fig. 12 is a flowchart illustrating a process for controlling a sensor defrost part according to an embodiment.

Fig. 13 is a flowchart illustrating a process for controlling a sensor defrost part according to another embodiment.

Fig. 14 is a perspective view of an evaporator according to another embodiment.

Fig. 15 is a cross-sectional view taken along line E-E' of Fig. 14.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0013] In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific preferred embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is understood that other embodiments may be utilized and that logical structural, mechanical, electrical, and chemical changes may be made without departing from the scope of the invention. To avoid detail not necessary to enable those skilled in the art to practice the invention, the description may omit certain information known to those skilled in the art. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims.

[0014] Hereinafter, specific embodiments for embodying the idea of the present disclosure will be described in detail with reference to the accompanying drawings.

[0015] Fig. 1 is a side sectional view of a refrigerator according to an embodiment.

[0016] Referring to Fig. 1, a refrigerator 1 according to an embodiment includes a main body 10 having a freezing compartment 100 and a refrigerating compartment and a freezing compartment door 20 and a refrigerating compartment door which are rotatably provided on a front surface of the main body 10 to selectively open or close the freezing compartment 100 and the refrigerating compartment, respectively. Also, the freezing compartment 100 and the refrigerating compartment are partitioned by a barrier (not shown).

[0017] A drawer 12 for receiving foods and a shelf 14 for placing foods thereon may be provided in the freezing compartment 100 and the refrigerating compartment. A door basket 22 for receiving foods may be mounted on a back surface of the freezing compartment door 20. According to the type of refrigerator, an ice maker 24 may be mounted inside the freezing compartment 100 or on the back surface of the freezing compartment door 20. Also, ices made in the ice maker 24 are discharged through a duct 25 provided in the freezing compartment door 20 and dispensed to the outside through a dispenser 26 connected to the duct 25. A user may easily receive and withdraw foods by the food storage units 12, 14, and 22. In addition, an inner space of the refrigerator 1 may be efficiently utilized.

[0018] A vaporizing chamber 300 in which an evaporator 320 for heat-exchanging a refrigerant with air to generate cool air is received is defined in a rear side of the freezing compartment 100. The vaporizing chamber 300 is coved by an evaporator cover 120. Also, a cool air duct 110 for guiding the cool air generated in the evaporator 320 is disposed above the evaporator cover 120 to extend vertically. Also, a blower fan 330 is disposed above the evaporator 320 to discharge the cool air gen-

erated in the evaporator 320 into the freezing compartment 100 through a plurality of cool air discharge holes 111 defined in the cool air duct 110.

[0019] A defrost sensor assembly 350 is mounted on the evaporator 320 to detect an amount of frosts attached to a surface of the evaporator 320. A defrost heater 340 for melting the frosts generated on the evaporator 320 or vaporizing chamber 300 is disposed under the evaporator 320.

[0020] Also, a cool air suction hole 311 through which cool air circulating into the freezing compartment 100 is introduced again into the evaporator 320 is disposed under the cool air duct 110. A suction fan for smoothly suctioning the cool air into the vaporizing chamber 300 may be disposed inside the cool air suction hole 311.

[0021] A machine room 19 in which a compressor 191 and a condenser (not shown) constituting a refrigeration cycle is provided is disposed under the refrigerator 1.

[0022] Fig. 2 is a control block diagram of a refrigerator according to an embodiment.

[0023] Referring to Fig. 2, the refrigerator 1 includes a control part 500 for controlling components. The control part 500 controls a memory 510 for storing information required for operating the refrigerator 1, a power supply part 520 for supplying a power into each of the components of the refrigerator 1, a defrost sensor assembly 350 for detecting an amount of frosts attached to the evaporator 320, and a defrost heater driving part 550 for operating the defrost heater 340.

[0024] The defrost sensor assembly 350 detects an amount of frosts attached to the evaporator 320, and the control part 500 determines an operation of the defrost heater 340 by comparing the amount of attached frosts detected by the defrost sensor assembly 350 with a previously inputted reference value. That is, the control part 500 determines defrosting start and finish times of the defrost heater 340 for removing the frosts attached to the vaporizing chamber 300 or the evaporator 320. Anything may be used for the defrost sensor assembly 350 when one can detect an amount of frosts attached to the evaporator 320. For example, an infrared sensor may be used as the defrost sensor assembly 350.

[0025] In detail, the infrared sensor includes a light emitting part for emitting infrared rays and a light receiving part for detecting an amount of infrared rays emitted from the light emitting part and then reflected by the frosts. Thus, an amount of attached frosts may be detected according to an amount of reflected infrared rays detected by the light receiving part.

[0026] An amount of attached frosts depending on an amount of received infrared rays and a sensing period of the defrost sensor depending on the amount of attached frosts may be stored in the memory 510 in a look-up table form. Thus, an actually detected value detected by the frost sensor assembly 350 is compared with the look-up table to extract an amount of attached frosts. As a result, the sensing period of the frost sensor assembly 350 may be reset.

[0027] The defrost heater driving part 550 is connected to the defrost heater 340. When the defrost heater driving part 550 receives a driving signal from the control part 500, the defrost heater driving part 550 operates the defrost heater 340 to melt the frosts generated on the evaporator 320.

[0028] The control part 500 controls a sensing operation of the defrost sensor assembly 350 according to the sensing period stored in the memory 510. Also, the control part 500 transmits a driving command into the defrost heater driving part 550 by comparing the value detected by the defrost sensor assembly 350 with the defrosting start value stored in the memory 510.

[0029] Fig. 3 is a view illustrating the vaporizing chamber of the refrigerator according to an embodiment.

[0030] Referring to Fig. 3, the evaporator 320 may be disposed in the vaporizing chamber 300, and the defrost heater 340 may be disposed under the evaporator 320. A dryer 310 for removing moisture and impurities contained in the refrigerant may be connected to an upper portion of the evaporator 320. In current embodiment, the evaporator 320 may have a structure in which the refrigerant is introduced from an upper side.

[0031] The evaporator 320 includes a refrigerant tube 322 through which the refrigerant flows and heat exchange fins 325 for more smoothly heat-exchanging air passing through the evaporator 300 with the refrigerant. The refrigerant tube 322 forms a winding meander line. The refrigerant flows along the refrigerant tube 322. As shown in Fig. 3, the refrigerant tube 322 may be doubly or multiply arranged to be spaced apart from each other in front and rear directions. A temperature sensor (not shown) for measuring a temperature of the refrigerant flowing into the evaporator 320 may be disposed on the dryer 310 or an inlet of the refrigerant tube 322.

[0032] Frames 324 may be disposed on both sides of the evaporator 320, i.e., bent portions of the refrigerant tube 322. Both ends of the refrigerant tube 322 are fixed to the frames 324, respectively. Each of the frames 324 has a vertically long length corresponding to a vertical length of the evaporator 320. Also, the frame 324 is mounted on an inner side surface of the vaporizing chamber 300 so that the evaporator 320 is fixed and mounted on the inner side surface of the vaporizing chamber 300.

[0033] The plurality of heat exchange fins 325 are coupled to the evaporator 320. The heat exchange fins 325 may increase a surface area of the evaporator 320 to improve heat exchange efficiency between air within the vaporizing chamber 300 and the refrigerant passing through the evaporator 320. Each of the heat exchange fins 325 may be formed of aluminum having superior thermal conductivity.

[0034] The defrost sensor assembly 350 may be mounted on the evaporator 320. The defrost sensor assembly 350 detects an amount of frosts attached to the evaporator 320 to transmit the detected value into the control part 350. The defrost sensor assembly 350 include a sensor module 400 (see Fig. 4) using infrared

rays and a module support 360 (see Fig. 6) on which the sensor module 400 is seated.

[0035] Hereinafter, structures of the sensor module 400 and the module support 360 will be described in detail with reference to the accompanying drawings.

[0036] Fig. 4 is a perspective view of a sensor module according to an embodiment. Fig. 5 is a plan view of the sensor module.

[0037] Referring to Figs. 4 and 5, the sensor module 400 according to an embodiment includes a base 401, a sensing part 410, a support 420, and a sensor defrost part 430.

[0038] The sensing part 410, the support 420, and the sensor defrost part 430 may be mounted on the base 401.

[0039] The support 420 supports the sensing part 410 to be installed on the base 401. For example, a hole having a shape corresponding to that of the sensing part 410 is defined in the support 420. The sensing part 410 may be inserted through the hole. The support 420 may be integrated with the base 401 or separately manufactured with respect to the base 401. The support 420 may be manufactured using a material having high thermal conductivity. Also, the base 401 may be a circuit board on which the sensing part 410 and the sensor defrost part 430 are mounted.

[0040] The sensing part 410 is coupled to the support 420 and thus seated on the base 401. The sensing part 410 may be provided in one or plurality. Also, each of the sensing parts 410 includes a light emitting part for emitting infrared rays and a light receiving part for receiving emitted from the light emitting part and then reflected by the frosts.

[0041] The sensor defrost part 430 may be mounted on the base 401. The sensor defrost part 430 may contact at least one side of the support 420 or be disposed spaced a predetermined distance from the support 420. The sensor defrost part 430 may be disposed close to the sensing part 410. For example, the sensor defrost part 430 may be disposed adjacent to the sensing part 410 under the support 420. The sensor defrost part 430 includes a resistor which emits heat when a power is applied thereto. The sensor defrost part 430 may be provided in plurality according to a heating value of the resistor to improve an effect for defrosting frosts attached to the sensing part 410.

[0042] A power is applied to the sensor defrost part 430 according to a preset period. Thus, heat generated in the resistor disposed in the sensor defrost part 430 melts the frosts attached to the sensing part 410. In a case where the support 420 on which the sensing part 410 is mounted is manufactured using a material having high thermal conductivity, heat generated in the resistor of the sensor defrost part 430 may be effectively transmitted into the sensing part 410. Here, a voltage or current applied to the resistor may be adjusted to adjust a heating value. Also, circuits of the resistor may be simply designed to minimize power consumption of the resistor. As described above, since a power is applied to the sensor defrost part 430 according to the preset period to transmit heat into the sensing part 410, it may prevent frosts from being attached to a surface of the sensing part 410. Thus, the sensing part 410 may precisely detect an amount of frosts attached to the surface of the evaporator 320.

[0043] Fig. 6 is a perspective of a module support according to a first embodiment.

[0044] Referring to Fig. 6, a module support 360 according to the first embodiment includes a body 361 on which a sensor module 400 is mounted and a leg 362 extending downward from an edge of the body 361.

[0045] In detail, the leg 362 is mounted on an evaporator 320. That is, the leg 362 may be mounted on a refrigerant tube 322 of the evaporator 320 to fix the body 361 to the evaporator 320. Also, a tube holder 363 is disposed on the leg 362. The tube holder 363 protrudes from the leg 362 to surround an outer surface of the refrigerant tube 322.

[0046] Fig. 7 is a perspective of a module support according to a second embodiment.

[0047] Referring to Fig. 7, a module support 360 according to the second embodiment has the same structure as that of the module support 360 according to the first embodiment in that the module support 360 includes a body 361 and a leg 362. However, the module support 360 according to the second embodiment is different from that according to the first embodiment in that the module support 360 is fixed to a refrigerant tube.

[0048] In detail, a bracket 364 having the same length as the leg 362 may be coupled to one surface of the leg 362. Also, a recess portion having a semicircular shape is defined in each of the leg 362 and the bracket 364. When the bracket 364 is closely attached to the leg 362, the recess portions form one cylindrical hole 365.

[0049] To fix the module support 360 to the refrigerant tube of an evaporator 320, the refrigerant tube may be placed first in the recess portion defined in the leg 362. In this state, when the bracket 363 is closely attached to the leg 362, the refrigerant tube passes through the hole 365. Then, when the bracket 363 is coupled to the leg 362 using a coupling member such as a screw, the module support 360 is fixed to the refrigerant tube.

[0050] Fig. 8 is a perspective of a module support according to a third embodiment.

[0051] Referring to Fig. 8, a module support 360 according to the third embodiment has the same structure as those of the module supports 360 according to the foregoing embodiments in that the module support 360 includes a body 361 and a leg 362. However, the module support 360 according to the third embodiment is different from those according to the foregoing embodiments in a coupling structure of a refrigerant tube.

[0052] In detail, a plurality of holes 366 pass through the leg 362. The holes 366 pass from one side surface of the leg 362 toward the other side surface, and the refrigerant tube of the evaporator 320 passes through the holes 366. In this state, the refrigerant tube is ex-

panded so that the refrigerant tube is tight in the holes 366. Thus, the module support 360 is fixed and mounted on the evaporator 320 without being shaken.

[0053] Fig. 9 is a longitudinal sectional view taken along line A-A' of Fig. 3.

[0054] Referring to Fig. 9, the sensor module 400 is mounted on the body 361 of the module support 360.

[0055] In detail, a recess portion on which the base 401 of the sensor module 400 is seated is defined in a bottom surface of the body 361. Thus, when the sensor module 400 is seated on the recess portion, the sensing part 410 is oriented to the extension direction of the leg 362. That is, when the defrost sensor assembly 350 is mounted on the evaporator 320, the sensing part 410 emits infrared rays toward a lower side of the evaporator 320.

[0056] In the state where the base 401 is seated on the recess portion of the body 351, a molding solution is injected into the recess portion to form a waterproof layer 367. In detail, the waterproof layer 367 includes a resin solution. The waterproof layer 367 may have a thickness enough to expose the sensing part 410 to the outside. Particularly, the waterproof layer 367 may have a thickness less than a value subtracting a thickness C of the base 401 from a depth D of the recess portion. This is done for a reason in which it prevents condensed water generated on top and side surfaces of the body 361 from flowing into the sensing part 410 along the waterproof layer 367.

[0057] Fig. 10 is a view illustrating a state in which a defrost sensor assembly including a module support is mounted on an evaporator according to a fourth embodiment.

[0058] Referring to Fig. 10, a module support 370 according to the fourth embodiment has the same structure as those of the module supports 400 according to the foregoing embodiments in that a sensor module 400 is mounted on a bottom surface of a module support 370. However, the module support 360 according to the fourth embodiment is different from those according to the foregoing embodiments in a configuration and mounted position of the module support 37.

[0059] In detail, the module support 370 according to the fourth embodiment may be fixed to a frame 324 of an evaporator 320. The module support 370 includes a stepped portion on which a sensor module 400 is mounted and fixed parts extending horizontally from both ends of the stepped portion and respectively fixed to frames 324.

[0060] Fig. 11 is a view illustrating a state in which a defrost sensor assembly including a module support is mounted on an evaporator according to a fifth embodiment.

[0061] Referring to Fig. 11, the defrost sensor assembly 350 according to an embodiment may be fixed to a wall of the vaporizing chamber by the module support 380 according to the fifth embodiment.

[0062] In detail, the wall of the vaporizing chamber 300 includes an inner case of the refrigerator, i.e., a rear wall of the vaporizing chamber 300 and an evaporator cover 120 partitioning the vaporizing chamber 300 from the freezing compartment.

[0063] In more detail, the defrost sensor assembly 350 may be disposed between a top surface of the evaporator 320 and the blower fan 330. The module support 380 may have a housing shape with a bottom surface opened. The sensor module 400 may be mounted inside the module support 380 so that a sensing part 410 is oriented downward, like the foregoing embodiments. Also, a coupling end may be disposed on each of both ends of the module support 380 so that a coupling member passes through the coupling end and is inserted into the wall of the vaporizing chamber 300.

[0064] Fig. 12 is a flowchart illustrating a process for controlling a sensor defrost part according to an embodiment.

[0065] The current embodiment is characterized in that the sensor defrost part is periodically turned on and off to prevent frosts from being generated on the sensor defrost part.

[0066] Referring to Fig. 12, a control part 500 determines whether the sensor defrost part 430 reaches a preset heating period (S1). Then, when it is determined that the sensor defrost part 430 reaches the heating period, a power is applied to the sensor defrost part 430 (S2). When the power is applied to the sensor defrost part 430, the control part 500 determines whether a power apply time reaches a preset heating time (S3). When the power apply tine reaches the preset heating time, the control part 500 cuts off the power applied into the sensor defrost part 430 (S4).

[0067] Fig. 13 is a flowchart illustrating a process for controlling a sensor defrost part according to another embodiment.

[0068] The current embodiment is characterized in that when a defrosting time arrives to start an operation of a sensor module 400, a power is applied to a sensor defrost part 430 to defrost an evaporator 320 and the sensor module 400 at the same time.

[0069] Referring to Fig. 13, a control part 500 determines whether to reach a sensing period for detecting an amount of frosts attached to an evaporator 320 according to a preset controlling method (S10). Here, the sensing period may be set so that a next detection time is decided by a predetermined time interval regardless of an amount of frosts detected at the present time. Also, the sensing period may be set so that a next detection time is varied according to an amount of frosts detected at the present time.

[0070] In detail, when the control part 500 determines that the sensing period reaches a defrost amount detection period by the sensor module 400, a power is applied to the sensing part 410 and the sensor defrost part 430 (S11) . Here, a power apply time into the sensor defrost part 430, i.e., the heating time and the sensing time of the sensing part 410 may be differently set. Thus, al-

though the power is applied into the sensing part 410 and the sensor defrost part 430 at the same time, the heating time by the sensor defrost part 430 and the sensing time of the sensing part 410 may be differently set, and thus, power cut-off times may be different. Hereinafter, a case in which the heating time of the sensor defrost part 430 is shorter than the sensing time of the sensing part 410 will be described as an example.

[0071] Thus, the control part 500 determines whether the heating time of the sensor defrost part 430 elapses (S12). When it is determined that the heating time elapses, the power applied into the sensor defrost part 430 is cut off (S13). Also, the control part 410 determines whether the sensing time of the sensing part 410 elapses (S14). When it is determined that the sensing time elapses, the power applied into the sensing part 410 is cut off (S15).

[0072] According to the above-described controlling method, it may prevent frosts from being attached to the sensor module 400. Thus, the sensor module 400 may precisely detect an amount of frosts attached to the surface of the evaporator 320.

[0073] Fig. 14 is a perspective view of an evaporator according to another embodiment. Fig. 15 is a cross-sectional view taken along line E-E' of Fig. 14.

[0074] Referring to Figs. 14 and 15, the current embodiment is characterized in that a defrost heater 340 contact along an outer surface of a refrigerant tube 322.

[0075] In detail, a recess portion 321 for receiving the defrost heater 340 is defined in any position of the outer surface of the refrigerant tube 322. The recess portion 321 is lengthily defined in a length direction of the refrigerant tube 322. As shown in Figs. 14 and 15, since the most outer surface of the defrost heater 340 contacts a surface of the refrigerant tube 322, heat transfer efficiency may be significantly improved when compared to a structure in which the defrost heater 340 is mounted under an evaporator or at a position spaced forward or backward from the refrigerant tube 322. That is, a contact area between the refrigerant tube 322 and the defrost heater 340 may be increased to improve the heat transfer efficiency due to heat conduction. Thus, frosts attached to the refrigerant tube 322 may be effectively removed.

[0076] Here, a distance f from a center of the refrigerant tube 322 to an outer surface of the defrost heater 340 exposed to the outside may be equal to or less than an outer diameter of the refrigerant tube 322 to maximize the contact area therebetween.

[0077] Also, the present disclosure is not limited to the number of defrost heater. For example, a plurality of defrost heaters 340 may be mounted on the outer surface of the refrigerant tube 322. For example, the defrost heaters 340 arranged in two or more lines may be mounted on positions spaced apart from each other of the outer surface of the refrigerant tube 322.

[0078] According to the coupling structure of the defrost heater 340 according to the foregoing embodiments, the defrost heater 340 may be directly attached to the refrigerant tube 322, and the most outer surface of the defrost heater 340 contact the refrigerant tube 322 to improve defrosting efficiency. In addition, since the defrost heater 340 does not protrude from the outer surface of the refrigerant tube 322, a flow resistance of cool air passing through the evaporator 320 may be minimized.

[0079] In the refrigerator according to the foregoing embodiments, it may prevent frosts from being attached to the surface of the defrost sensor to precisely detect an amount of frosts attached to the surface of the evaporator, thereby improving the operation and cooling efficiency of the refrigerator.

[0080] Also, the defrosting operation may adequately start at the defrosting requirement time, and the defrosting operation may be immediately finished when the defrosting is completed. Thus, power consumption of the refrigerator may be reduced to improve the cooling efficiency of the refrigerator.

[0081] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the scope of the invention, as defined by the appended claims.

Claims

1. A refrigerator comprising:

a main body (10) providing a storage space in which foods are stored at a low temperature;
a vaporizing chamber (300) defined in a side of the main body (10);
an evaporator (320) received in the vaporizing chamber (300);
a sensor module (400) comprising a sensing part (410) received in the vaporizing chamber (300) to detect an amount of frost attached to the evaporator (320), wherein the sensor part (410) comprises a light emitting part emitting infrared rays and a light receiving part receiving the infrared rays which are emitted from the light emitting part and then reflected by the frost attached to the evaporator (320);
a control part (500) controlling an operation of the sensor module (400); and
a defrost heater (340) removing the frost attached to the evaporator (320),
wherein the sensor module (400) further comprises at least one sensor defrost part (430) generating heat to melt and remove frost attached to the sensing part (410).

2. The refrigerator according to claim 1, further comprising at least one module support (360, 370, 380) supporting the sensor module (400).

3. The refrigerator according to claim 2, wherein the

sensor module (400) further comprises:

a support (420) supporting the sensing part (410); and
a base (401) on which the support (420) and the sensor defrost part (430) are placed.

4. The refrigerator according to claim 3, wherein the module support (360) comprises:

a body (361) having a recess or stepped portion in which the base (401) is placed; and
at least one leg (362) extending from an edge of the body (361) and fixed to a refrigerant tube (322) of the evaporator (320).

5. The refrigerator according to claim 4, further comprising a holder (363) protruding from one surface of the leg (362) to surround the refrigerant tube (322).

6. The refrigerator according to claim 4, further comprising a bracket (364) closely attached to one surface of the leg (362),
wherein recess portions are defined in the one surface of the leg (362) and one surface of the bracket (364) closely attached to the one surface of the leg (362), respectively, and
when the bracket (364) is closely attached to the leg (362), the recess portions are coupled to each other to define a hole (365) through which the refrigerant tube (322) passes.

7. The refrigerator according to claim 4, further comprising a hole (366) passing through both sides surfaces of the leg (362) so that the refrigerant tube (322) passes.

8. The refrigerator according to claim 4, further comprising a waterproof layer (367) formed by injecting a molding solution into a top surface of the base (401) in a state where the base (401) is placed on the recess or stepped portion.

9. The refrigerator according to claim 8, wherein the waterproof layer (367) has a thickness less than a value subtracting a thickness of the base (401) from a thickness of the recess or stepped portion.

10. The refrigerator according to claim 2, wherein the module supports (360, 370) are fixed to a refrigerant tube (322) of the evaporator (320) or a frame (324) supporting the refrigerant tube (322).

11. The refrigerator according to claim 2, wherein the module support (380) is mounted on any position corresponding to an upper side of the evaporator (320) on a well defining the vaporizing chamber (300).

12. The refrigerator according to claim 1, wherein the sensor defrost part (430) comprises a resistor in which a power is applied to generate heat, and
the sensor defrost part (430) is disposed at a position close to the sensing part.

13. The refrigerator according to claim 1, wherein the defrost heater (340) extends along a refrigerant tube (322) in a state where the defrost heater (340) contacts the refrigerant tube (322) of the evaporator (320).

14. The refrigerator according to claim 13, wherein one or plurality of recess portions (321) in which the defrost heater (340) is received is defined in an outer surface of the refrigerant tube (322).

15. The refrigerator according to claim 14, wherein a distance (f) from a center of the refrigerant tube (322) to the outer surface of the defrost heater (340) exposed to the outside is equal to or less than an outer diameter (F) of the refrigerant tube (322).

16. The refrigerator according to claim 1, wherein the sensor defrost part (430) is operated for a preset time according to a preset period to melt the frosts attached to the sensing part (410).

17. The refrigerator according to claim 16, wherein an operation period of the sensor defrost part (430) and an operation period of the sensing part (410) are independent from each other.

18. The refrigerator according to claim 1, wherein a power is applied to the sensor defrost part (430) at an operation time of the sensing part (410).

19. The refrigerator according to claim 18, wherein a heating time of the sensor defrost part (430) is different from a sensing time of the sensing part (410).

Patentansprüche

1. Kühlschrank, der Folgendes umfasst:

einen Hauptkörper (10), der einen Vorratsraum bereitstellt, in dem Lebensmittel bei einer niedrigen Temperatur gelagert werden;
eine Verdampfungskammer (300), die auf einer Seite des Hauptkörpers (10) definiert ist;
einen Verdampfer (320), der in der Verdampfungskammer (300) untergebracht ist;
ein Sensormodul (400), das ein Messelement (410) umfasst, das in der Verdampfungskammer (300) untergebracht ist, um eine Menge an Reif zu detektieren, der an dem Verdampfer (320) haftet, wobei

das Messelement (410) ein Leuchtelement, das Infrarotstrahlen ausstrahlt, und ein Lichtempfangselement, das die Infrarotstrahlen empfängt, die von dem Leuchtelement ausgestrahlt und dann an Reif, der an dem Verdampfer (320) haftet, reflektiert werden, umfasst;
ein Steuerteil (500), das einen Betrieb des Sensormoduls (400) steuert; und
ein Abtauheizelement (340), das den Reif entfernt, der an dem Verdampfer (320) haftet,
wobei das Sensormodul (400) ferner wenigstens ein Sensorabtauelement (430) umfasst, um Wärme zu erzeugen, um Reif, der an dem Messelement (410) haftet, zu schmelzen und zu entfernen.

2. Kühlschrank nach Anspruch 1, der ferner wenigstens eine Modulhalterung (360, 370, 380) umfasst, die das Sensormodul (400) hält.

3. Kühlschrank nach Anspruch 2, wobei das Sensormodul (400) ferner Folgendes umfasst:

eine Halterung (420), die das Messelement (410) hält; und
eine Basis (401), auf der die Halterung (420) und das Sensorabtauelement (430) angeordnet sind.

4. Kühlschrank nach Anspruch 3, wobei die Modulhalterung (360) Folgendes umfasst:

einen Körper (361), der eine Vertiefung oder einen gestuften Abschnitt aufweist, in dem die Basis (401) angeordnet ist; und
wenigstens ein Bein (362), das sich von einer Kante des Körpers (361) erstreckt und an einer Kühlmittelleitung (322) des Verdampfers (320) fixiert ist.

5. Kühlschrank nach Anspruch 4, der ferner eine Halterung (363) umfasst, die von einer Oberfläche des Beins (362) so vorsteht, dass sie die Kühlmittelleitung (322) umgibt.

6. Kühlschrank nach Anspruch 4, der ferner eine Stütze (364) umfasst, die direkt an einer Oberfläche des Beins (362) festgemacht ist,
wobei in der einen Oberfläche des Beins (362) und einer Oberfläche der Stütze (364), die direkt an der einen Oberfläche des Beins (362) befestigt ist, jeweils vertiefte Abschnitte definiert sind, und
wobei dann, wenn die Stütze (364) direkt an dem Bein (362) befestigt ist, die vertieften Abschnitte so miteinander gekoppelt sind, dass sie ein Loch (365) definieren, durch das die Kühlmittelleitung (322) verläuft.

7. Kühlschrank nach Anspruch 4, der ferner ein Loch (366) umfasst, das so durch beide seitliche Oberflächen des Beins (362) verläuft, dass die Kühlmittelleitung (322) hindurch gelangt.

8. Kühlschrank nach Anspruch 4, der ferner eine wasserfeste Schicht (367) umfasst, die durch Einspritzen einer Spritzgießlösung in eine obere Oberfläche der Basis (401) in einem Zustand, in dem die Basis (401) auf der Vertiefung oder dem gestuften Abschnitt angeordnet ist, gebildet wird.

9. Kühlschrank nach Anspruch 8, wobei die wasserfeste Schicht (367) eine Dicke aufweist, die weniger als ein Wert beträgt, der durch Subtraktion einer Dicke der Basis (401) von einer Dicke der Vertiefung oder des gestuften Abschnitts erhalten wird.

10. Kühlschrank nach Anspruch 2, wobei die Modulhalterungen (360, 370) an einer Kühlmittelleitung (322) des Verdampfers (320) oder an einem Rahmen (324), der die Kühlmittelleitung (322) hält, fixiert sind.

11. Kühlschrank nach Anspruch 2, wobei die Modulhalterung (380) an einer Position, die einer oberen Seite des Verdampfers (320) an einer Wand, die die Verdampfungskammer (300) definiert, entspricht, angebracht ist.

12. Kühlschrank nach Anspruch 1, wobei das Sensorabtauelement (430) einen Widerstand umfasst, an den eine Spannung angelegt wird, um Wärme zu erzeugen, und
das Sensorabtauelement (430) an einer Position direkt an dem Messelement angeordnet ist.

13. Kühlschrank nach Anspruch 1, wobei das Abtauheizelement (340) in einem Zustand, in dem das Abtauheizelement (340) mit der Kühlmittelleitung (322) des Verdampfers (320) in Kontakt ist, entlang einer Kühlmittelleitung (322) verläuft.

14. Kühlschrank nach Anspruch 13, wobei eine oder mehrere vertiefe Abschnitte (321), in denen das Abtauheizelement (340) untergebracht ist, in einer äußeren Oberfläche der Kühlmittelleitung (322) definiert ist.

15. Kühlschrank nach Anspruch 14, wobei ein Abstand (f) von einem Mittelpunkt der Kühlmittelleitung (322) zu einer äußeren Oberfläche des Abtauheizelements (340), das zur Außenseite freiliegt, gleich groß wie oder kleiner als ein Außendurchmesser (F) der Kühlmittelleitung (322) ist.

16. Kühlschrank nach Anspruch 1, wobei das Sensorabtauelement (430) für eine festgelegte Zeit in Übereinstimmung mit einer festgelegten Zeitspanne be-

trieben wird, um den Reif, der an dem Messelement (410) haftet, zu schmelzen.

17. Kühlschrank nach Anspruch 16, wobei eine Betriebszeitspanne des Sensorabtauelements (430) und eine Betriebszeitspanne des Messelements (410) unabhängig voneinander sind.

18. Kühlschrank nach Anspruch 1, wobei in einer Betriebszeit des Messelements (410) eine Spannung an das Sensorabtauelement (430) angelegt wird.

19. Kühlschrank nach Anspruch 18, wobei sich eine Heizzeit des Sensorabtauelements (430) von einer Messzeit des Messelements (410) unterscheidet.

Revendications

1. Réfrigérateur comprenant :

un corps principal (10) fournissant un espace de stockage dans lequel les aliments sont stockés à basse température ;
une chambre de vaporisation (300) définie dans un côté du corps principal (10) ;
un évaporateur (320) reçu dans la chambre de vaporisation (300) ;
un module capteur (400) comprenant une partie de détection (410) reçue dans la chambre de vaporisation (300) pour détecter une quantité de givre adhérant sur l'évaporateur (320) ;
dans lequel
la partie de détection (410) comprend une partie émettrice de lumière émettant des rayons infrarouges et une partie réceptrice de lumière recevant les rayons infrarouges qui sont émis par la partie émettrice de lumière et ensuite réfléchis par le givre adhérant sur l'évaporateur (320).
une partie de commande (500) commandant un fonctionnement du module capteur (400) ; et
un élément chauffant de dégivrage (340) enlevant le givre adhérant sur l'évaporateur (320),
dans lequel le module de capteur (400) comprend en outre au moins une partie de dégivrage de capteur (430) générant de la chaleur pour faire fondre et enlever le givre adhérant sur la partie de capteur (410).

2. Réfrigérateur selon la revendication 1, comprenant en outre au moins un support de module (360, 370, 380) supportant le module capteur (400).

3. Réfrigérateur selon la revendication 2, dans lequel le module capteur (400) comprend en outre :

un support (420) supportant la partie de détection (410) ; et
une base (401) sur laquelle sont placés le support (420) et la partie de dégivrage de capteur (430).

4. Réfrigérateur selon la revendication 3, dans lequel le support de module (360) comprend :

un corps (361) ayant un évidement ou une partie en gradin dans lequel/dans laquelle la base (401) est placée ; et
au moins une branche (362) s'étendant à partir d'un bord du corps (361) et fixée sur un tube réfrigérant (322) de l'évaporateur (320).

5. Réfrigérateur selon la revendication 4, comprenant en outre un support (363) qui se projette depuis une surface de la branche (362) pour entourer le tube réfrigérant (322).

6. Réfrigérateur selon la revendication 4, comprenant en outre un support (364) étroitement lié à une surface de la branche (362),
dans lequel des parties évidées sont définies dans ladite une surface de la branche (362) et une surface du support (364) étroitement liées à l'une desdites surfaces de la branche (362), respectivement, et
lorsque le support (364) est étroitement lié à la branche (362), les parties évidées sont couplées l'une à l'autre pour définir un trou (365) à travers lequel passe le tube réfrigérant (322).

7. Réfrigérateur selon la revendication 4, comprenant en outre un trou (366) passant à travers les deux surfaces latérales de la branche (362) de sorte que le tube réfrigérant (322) passe à travers celui-ci.

8. Réfrigérateur selon la revendication 4, comprenant en outre une couche imperméable (367) formée par injection d'une solution de moulage dans une surface supérieure de la base (401) dans un état dans lequel la base (401) est placée sur l'évidement ou la partie en gradin.

9. Réfrigérateur selon la revendication 8, dans lequel la couche imperméable (367) a une épaisseur inférieure à une valeur obtenue en soustrayant une épaisseur de la base (401) d'une épaisseur de l'évidement ou de la partie en gradin.

10. Réfrigérateur selon la revendication 2, dans lequel les supports de module (360, 370) sont fixés sur un tube de réfrigérant (322) de l'évaporateur (320) ou sur un cadre (324) supportant le tube de réfrigérant (322).

11. Réfrigérateur selon la revendication 2, dans lequel le support de module (380) est monté sur une position quelconque correspondant à un côté supérieur

de l'évaporateur (320) sur un puits définissant la chambre de vaporisation (300).

12. Réfrigérateur selon la revendication 1, dans lequel la partie de dégivrage de capteur (430) comprend une résistance dans laquelle une puissance est appliquée pour générer de la chaleur, et
la partie de dégivrage de capteur (430) est disposée à une position proche de la partie de détection.

13. Réfrigérateur selon la revendication 1, dans lequel l'élément chauffant de dégivrage (340) s'étend le long d'un tube de réfrigérant (322) dans un état dans lequel l'élément chauffant de dégivrage (340) est en contact avec le tube de réfrigérant (322) de l'évaporateur (320).

14. Réfrigérateur selon la revendication 13, dans lequel une ou plusieurs parties d'évidement (321) dans laquelle/lesquelles est reçu l'élément chauffant de dégivrage (340) est/sont défini(e)s dans une surface extérieure du tube de réfrigérant (322).

15. Réfrigérateur selon la revendication 14, dans lequel une distance (f) d'un centre du tube de réfrigérant (322) à la surface extérieure de l'élément chauffant de dégivrage (340) exposée vers l'extérieur est égale ou inférieure à un diamètre extérieur (F) du tube de réfrigérant (322).

16. Réfrigérateur selon la revendication 1, dans lequel la partie de dégivrage du capteur (430) est utilisée pendant une durée prédéfinie selon une période prédéfinie pour faire fondre le givre adhérant sur la partie de détection (410).

17. Réfrigérateur selon la revendication 16, dans lequel une durée de fonctionnement de la partie de dégivrage du capteur (430) et une durée de fonctionnement de la partie de détection (410) sont indépendantes l'une de l'autre.

18. Réfrigérateur selon la revendication 1, dans lequel un courant est appliqué à la partie de dégivrage du capteur (430) pendant un temps de fonctionnement de la partie de détection (410).

19. Réfrigérateur selon la revendication 18, dans lequel un temps de chauffage de la partie de dégivrage de capteur (430) est différent d'un temps de détection de la partie de détection (410).

FIG.1

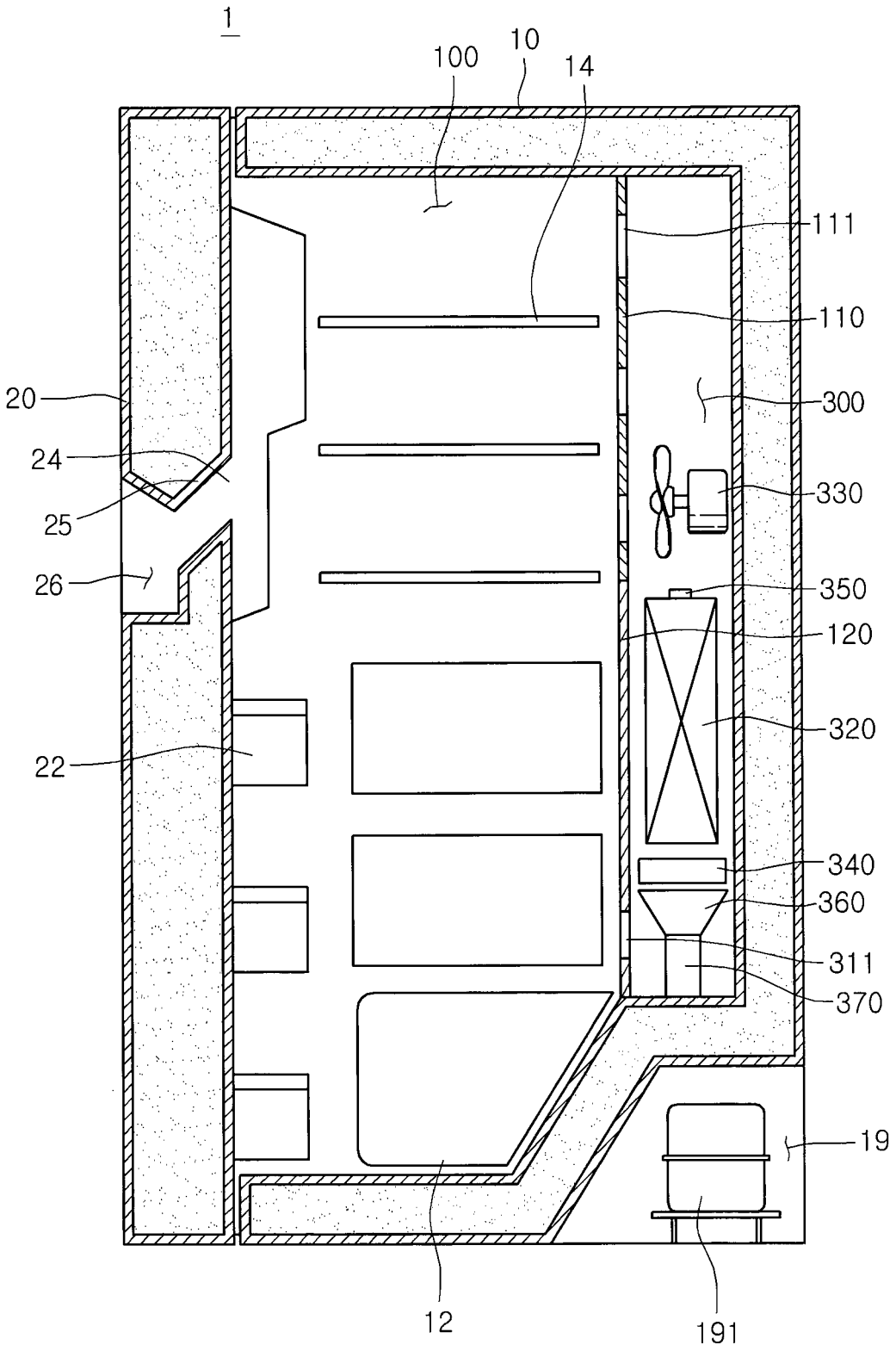

1
100
10
14
111
110
300
330
350
120
320
340
360
311
370
19
20
24
25
26
22
12
191

FIG.2

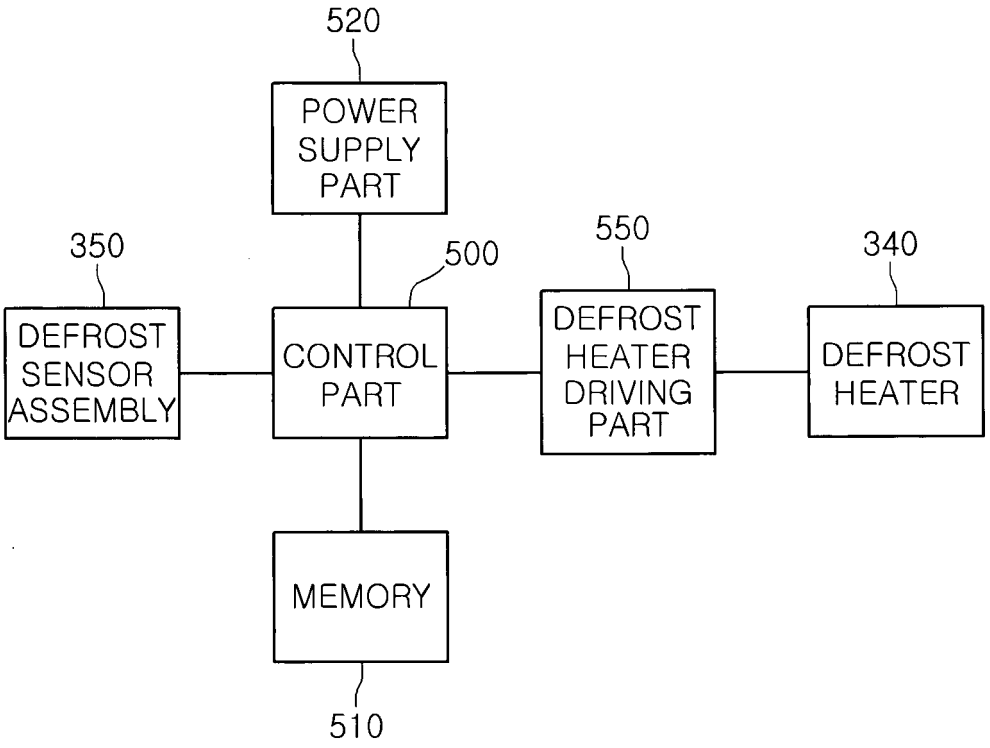

520
POWER SUPPLY PART
350
500
550
340
DEFROST SENSOR ASSEMBLY
CONTROL PART
DEFROST HEATER DRIVING PART
DEFROST HEATER
MEMORY
510

FIG.3

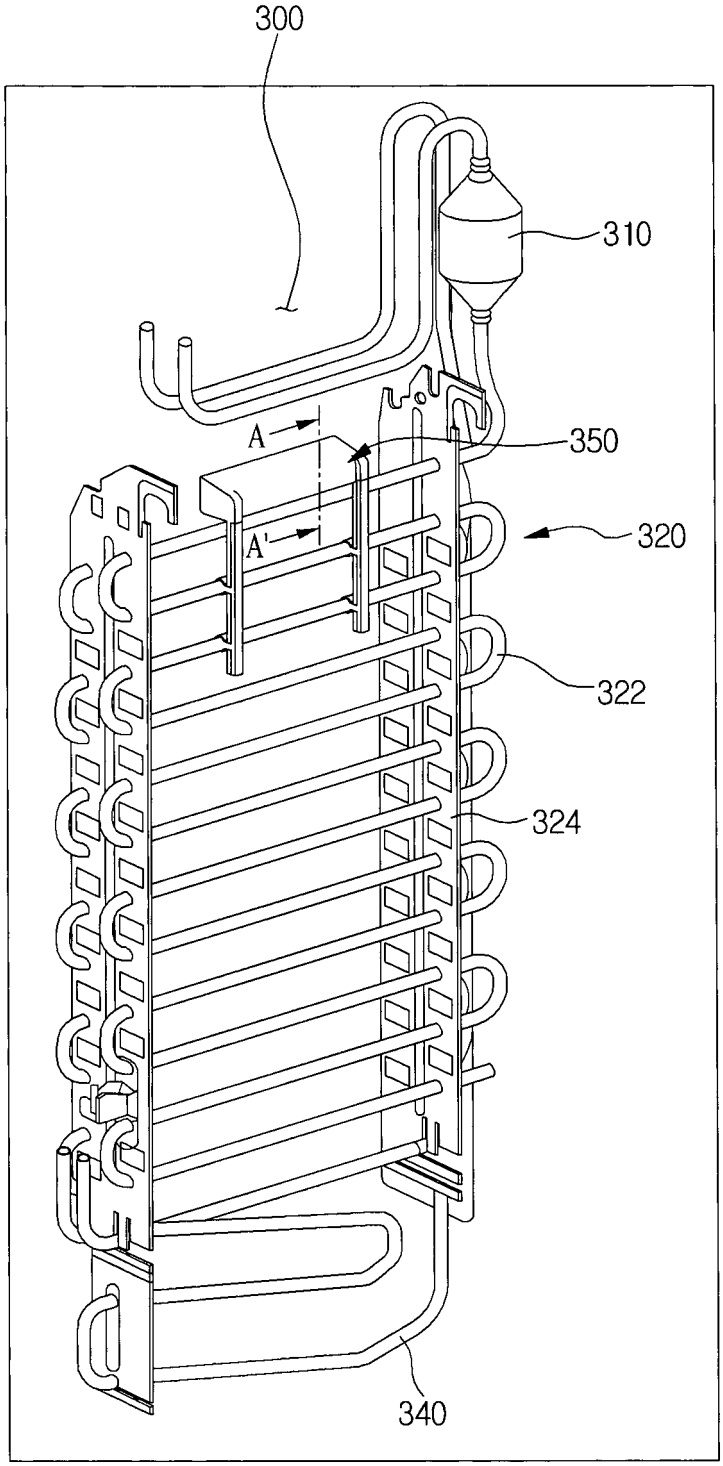


FIG.4

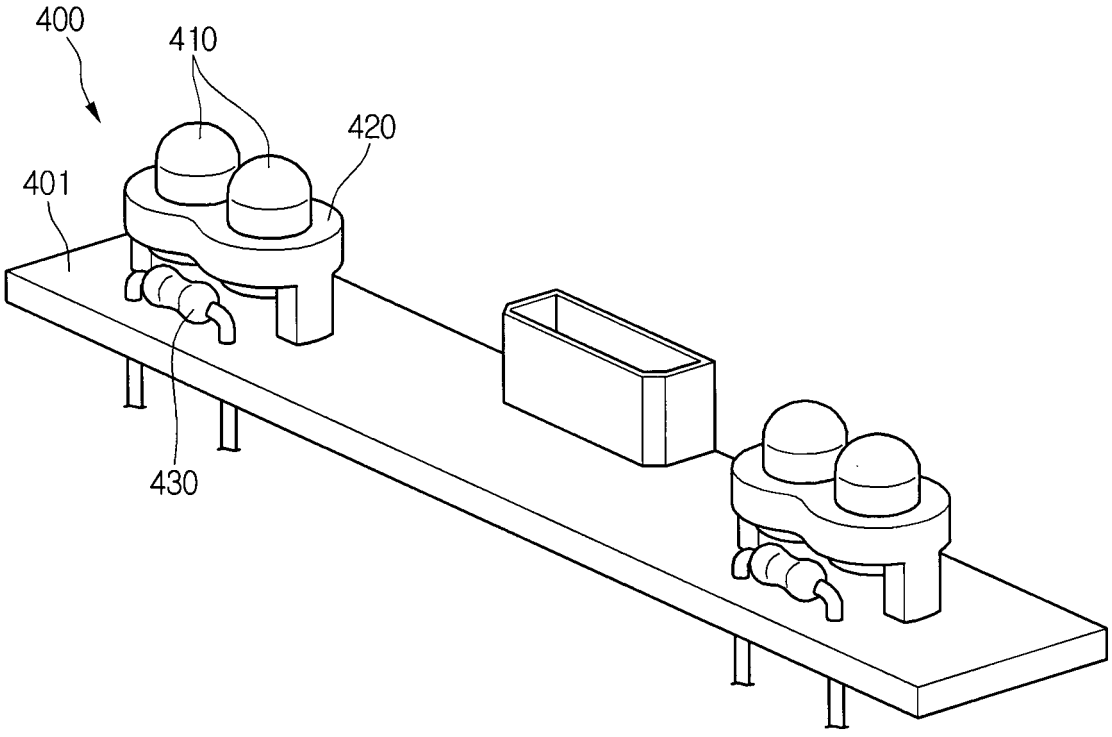


FIG.5

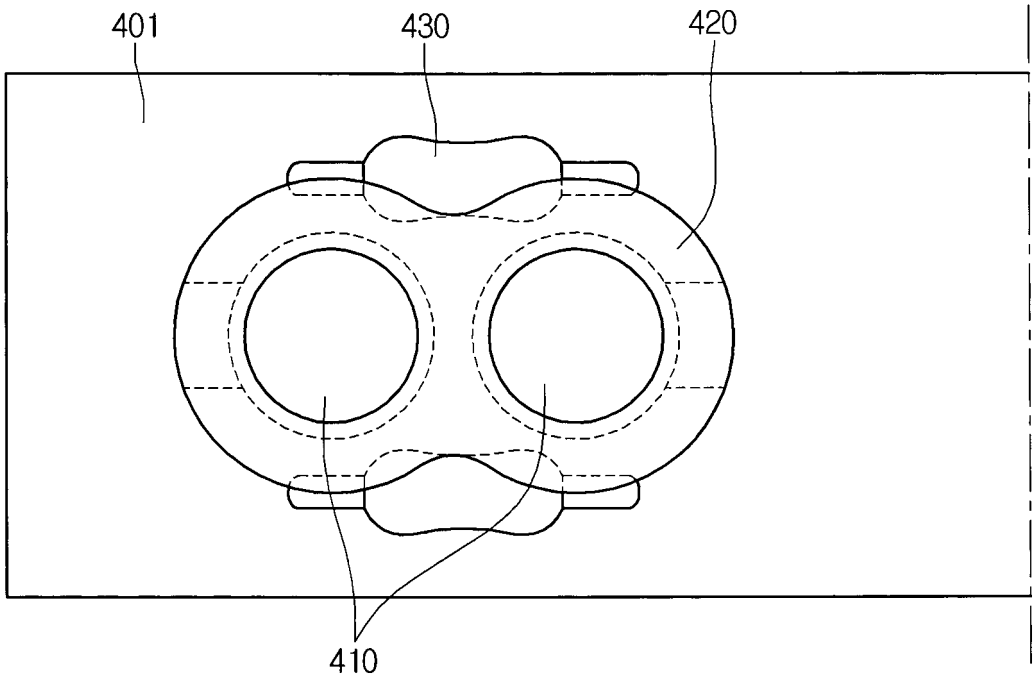


FIG.6

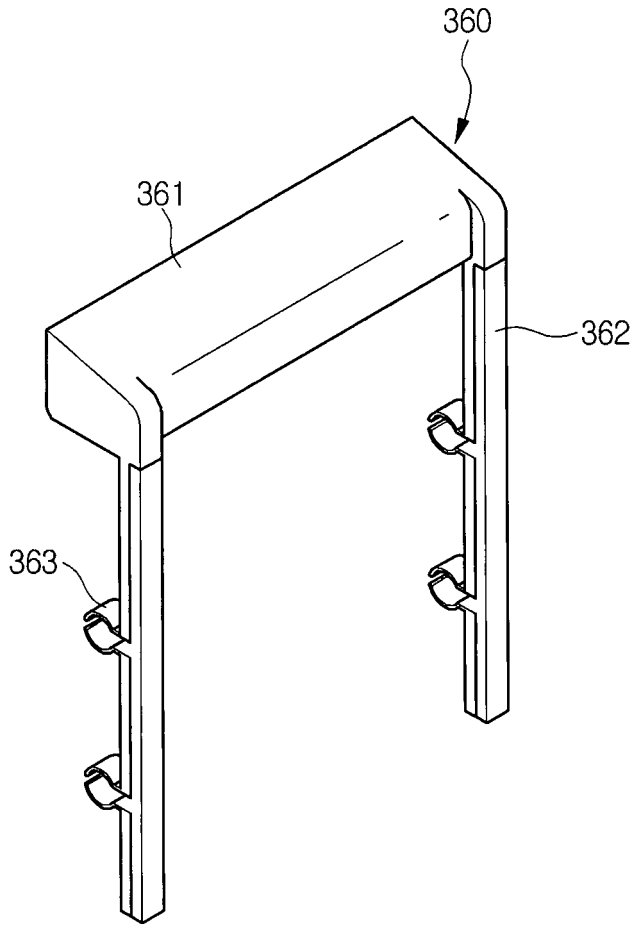


FIG.7

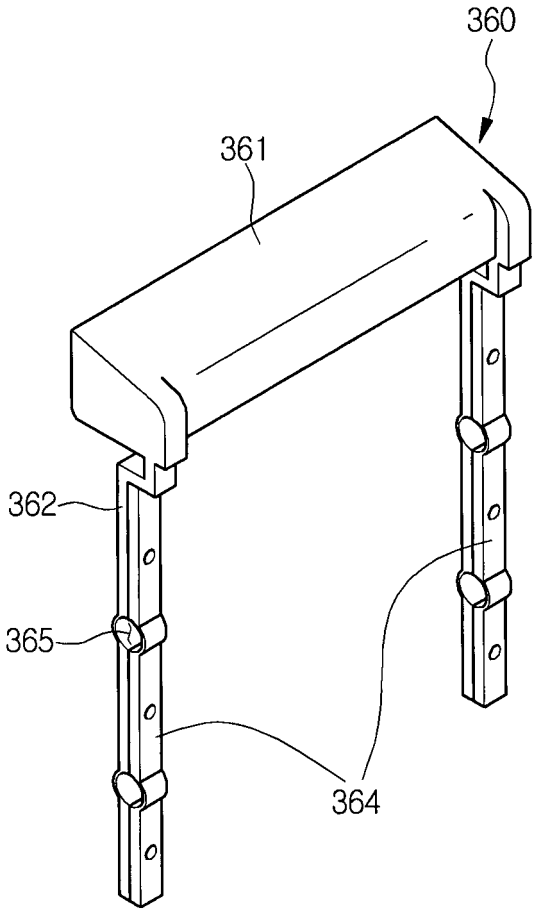


FIG.8

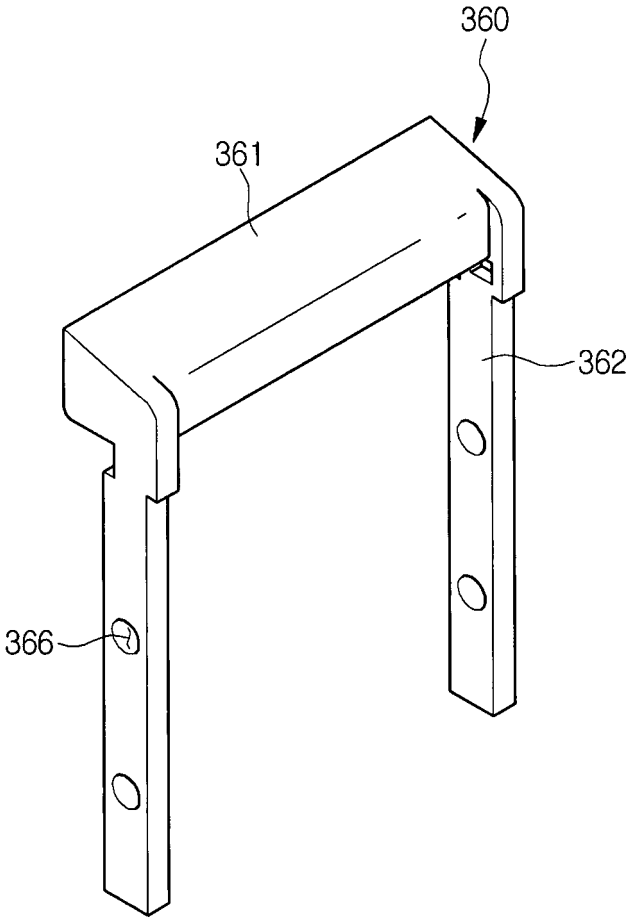


FIG.9

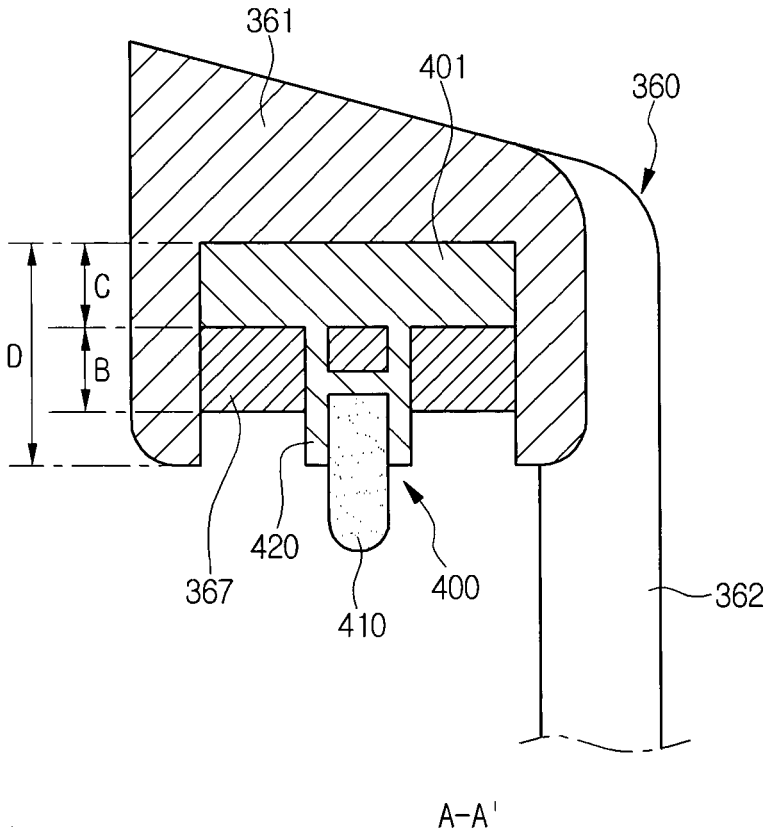


FIG.10

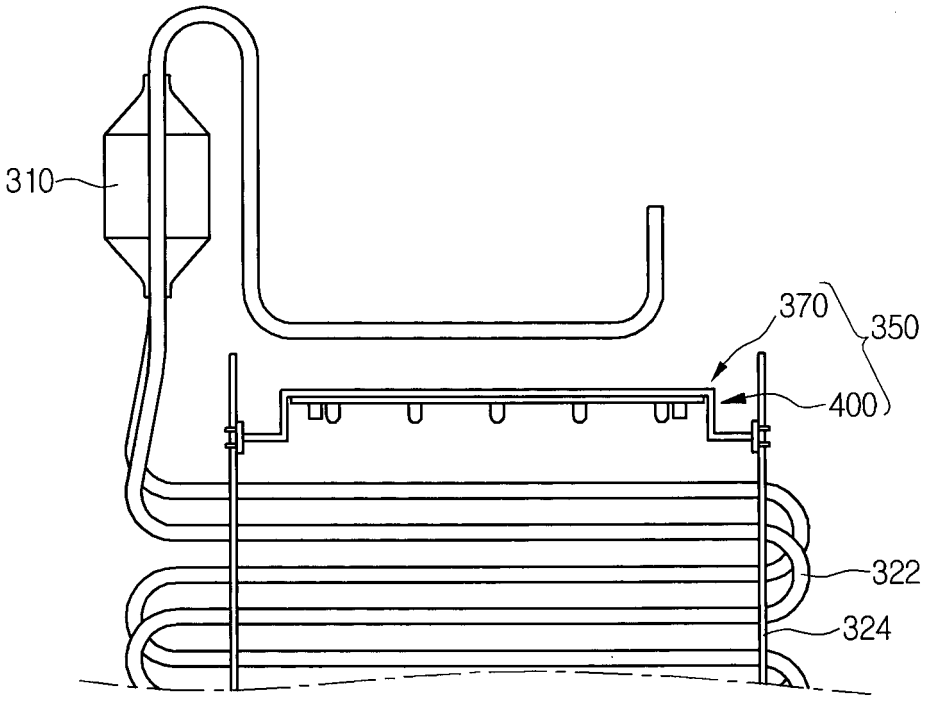


FIG.11

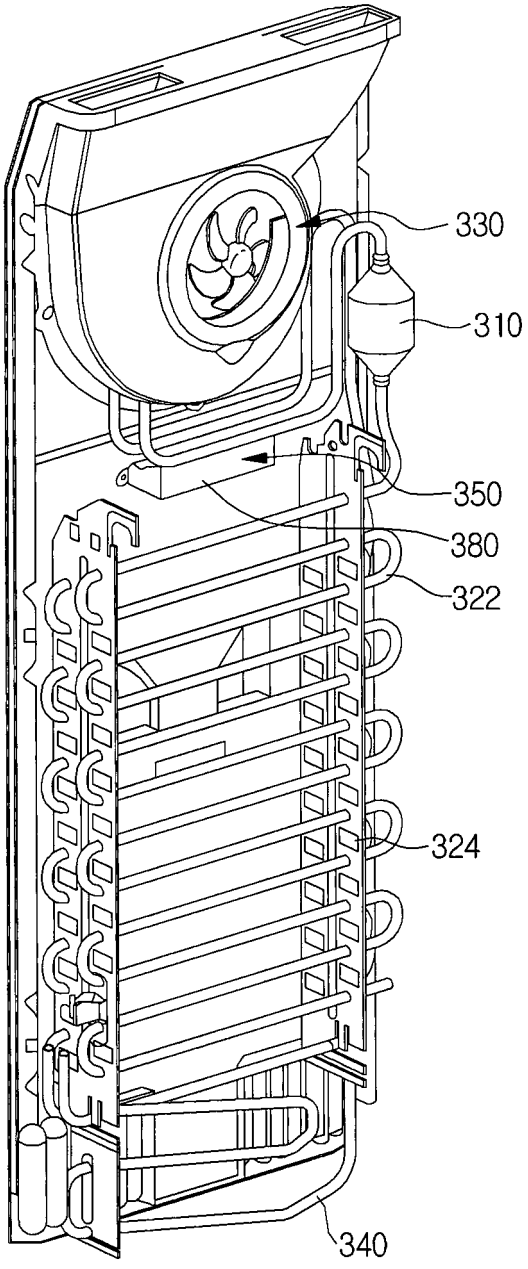


FIG.12

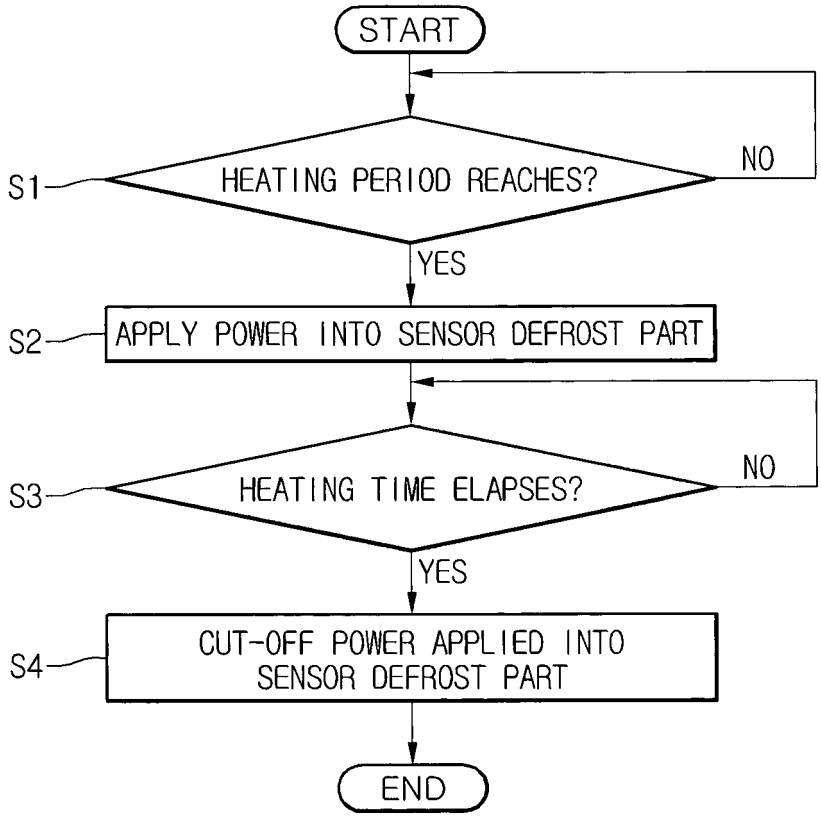

START
S1
HEATING PERIOD REACHES?
NO
YES
S2
APPLY POWER INTO SENSOR DEFROST PART
S3
HEATING TIME ELAPSES?
NO
YES
S4
CUT-OFF POWER APPLIED INTO SENSOR DEFROST PART
END

FIG.13

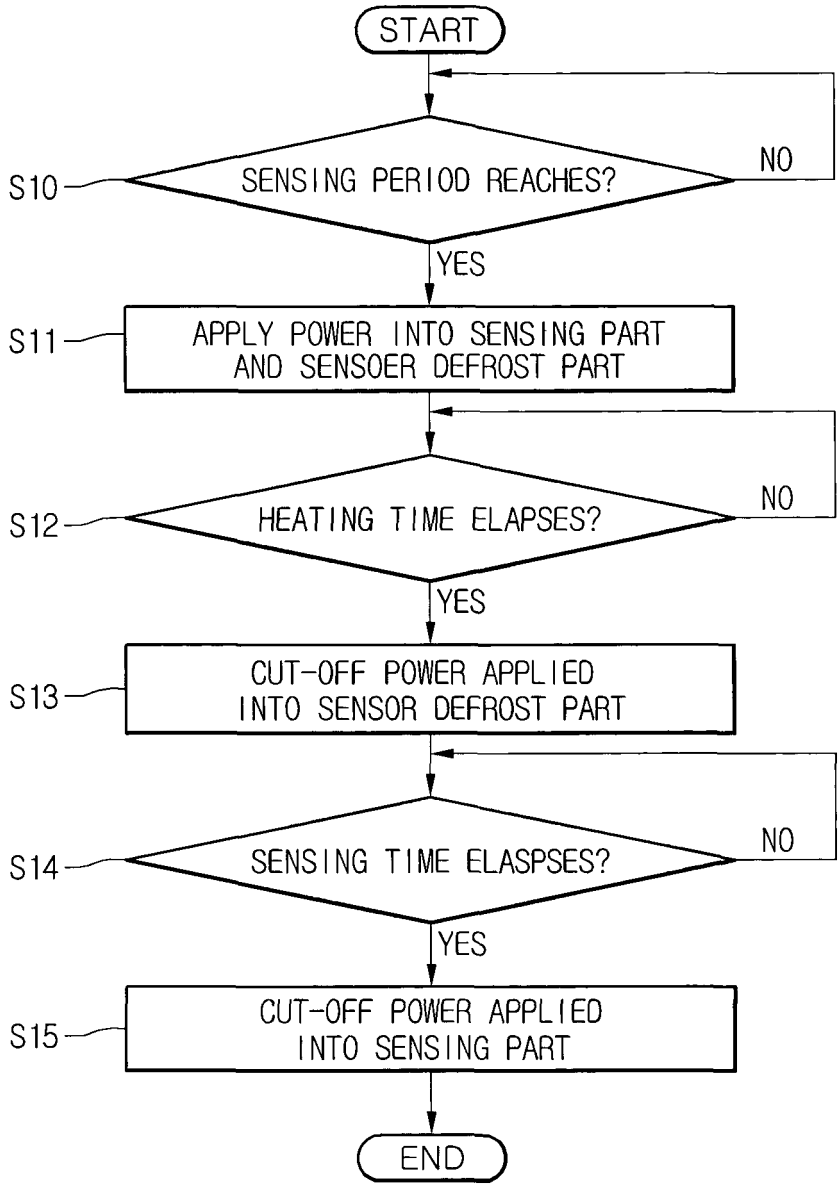

START
S10
SENSING PERIOD REACHES?
NO
YES
S11
APPLY POWER INTO SENSING PART AND SENSOER DEFROST PART
S12
HEATING TIME ELAPSES?
NO
YES
S13
CUT-OFF POWER APPLIED INTO SENSOR DEFROST PART
S14
SENSING TIME ELASPSES?
NO
YES
S15
CUT-OFF POWER APPLIED INTO SENSING PART
END

FIG.14

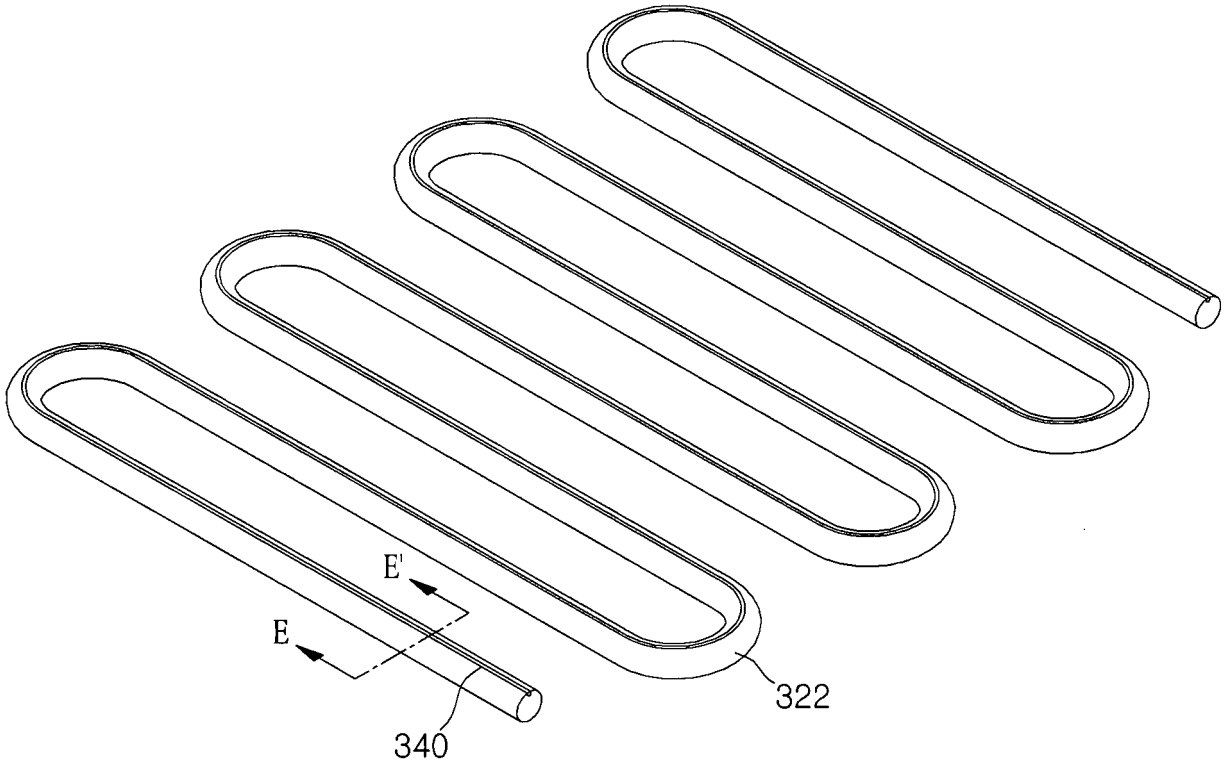
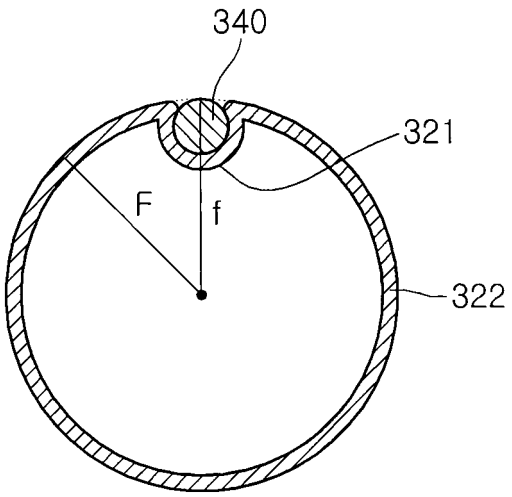


FIG.15



REFERENCES CITED IN THE DESCRIPTION

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- DE 2750165 A1 **[0005]**