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(54) **REFRIGERATOR**

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RÉFRIGÉRATEUR

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Description

TECHNICAL FIELD

[0001] The present invention relates to a refrigerator for cooling and storing foods in a storage chamber, and particularly to a refrigerator using a shielding device to properly occlude an air passageway communicated with the storage chamber.

BACKGROUND

[0002] In the prior art, there is already a refrigerator using a cooler to properly cool a plurality of storage chambers as disclosed in patent document 1. Another example is disclosed in WO2018/103652.

(Prior art document)

(Patent document)

[0003] Patent document 1: Japanese Public Patent No. 2013-2664

[0004] FIG. 11 schematically shows a refrigerator 100 disclosed in the patent document. In the refrigerator 100 shown in the figure, a refrigerating compartment 101, a freezing compartment 102, and a vegetable compartment 103 are formed from top to bottom. A cooling chamber 104 for receiving a cooler 108 is formed inside the freezing compartment 102, and a partition wall 105 that partitions the cooling chamber 104 from the freezing compartment 102 is formed with an opening 106 for supplying cold air to each storage chamber. In addition, the opening 106 is provided with a blower fan 107 that sends out cold air, and a fan cover 110 covering the blower fan 107 is located in the freezing compartment 102. An air damper 114 is provided at a middle portion of an air passageway 109 through which the cold air supplied to the refrigerating compartment 101 circulates.

[0005] The fan cover 110 will be described in detail with reference to FIG. 12. A recess 111 having a substantially quadrangular shape is formed in the fan cover 110, and the fan cover 110 is formed with an opening 113 obtained by partially cutting out an upper portion of the recess 111. Here, in a case where the fan cover 110 covers the blower fan 107, the opening 113 of the fan cover 110 communicates with the air passageway 109 on the side of the refrigerator body.

[0006] The refrigerator 100 configured above operates as follows. Referring to FIG. 11, first, in a case where refrigerating compartment 101 and the freezing compartment 102 are both cooled, the fan cover 110 is separated from the blower fan 107, the air damper 114 is opened, and the blower fan 107 is rotated in this state. As such, part of the cold air cooled by the cooler 108 in the cooling chamber 104 is sent to the freezing chamber 102 based on a blowing force of the blower fan 107. In addition, the remaining part of the cold air is sent to the refrigerating compartment 101 via the air passageway 109, the air damper 114, and the air passageway 109. Thereby, both the freezing compartment 102 and the refrigerating compartment 101 are cooled.

[0007] On the other hand, when only the refrigerating compartment 101 is cooled, the blower fan 107 is covered with the fan cover 110, the air damper 114 is opened, and in this state, the blower fan 107 sends out cold air cooled by the cooler 108. When the fan cover 110 is in a closed state, the opening 113 formed at the upper portion of the fan cover 110 communicates with the air passageway 109. As a result, the cold air sent by the blower fan 107 is supplied to the refrigerating compartment 101 via the opening 113, the air damper 114 and the air passageway 109.

[0008] As stated above, with the fan cover 110 formed with the opening 113 being used, a plurality of storage chambers can be properly cooled with one cooler 108.

[0009] However, in an air blowing structure in the existing refrigerator, it might become difficult to open and close the fan cover 110 since a driving mechanism for driving the fan cover 110 is frozen.

[0010] Specifically, in the refrigerator 100, when the refrigerating compartment 101 stores a high-temperature and high-humidity article such as a hot pot, the moisture emitted from the article reaches the cooling chamber 104 via a return air passageway (not shown). In addition, as described above, the fan cover 110 and its driving mechanism are disposed nearest to the cooling chamber 104. Therefore, if the moisture adheres to the driving mechanism for driving the fan cover 110 and freezes, the fan cover 110 cannot be opened and closed, and the opening and closing of the air passageway of the fan cover 110 cannot be controlled. In addition, if a heater is arranged near the fan cover 110 for heating to prevent the fan cover 110 from freezing, the structure of the refrigerator 100 will become complicated and the manufacturing cost will increase. Furthermore, since the heater consumes electrical power, there also arises a problem that the operating cost of the refrigerator 100 increases.

[0011] In view of the above, it is necessary to improve the existing refrigerators to solve the above problems.

SUMMARY

[0012] An object of the present invention is to provide a refrigerator capable of preventing a mechanism driving the fan cover from freezing by simple control.

[0013] To achieve the above-mentioned objects, the present invention provides a refrigerator according to claim 1.

[0014] Thus, according to the refrigerator of the present invention, in a case where the storage chamber becomes a given environment, the electric motor driving the driving shaft to rotate is decelerated to increase the torque of the electric motor and prevent the screw mechanism from becoming rigid due to freezing.

[0015] As a further improvement of the present invention, in a case where a door for closing the storage chamber is opened and closed, the control device controls the electric motor to decelerate according to the environment in the storage chamber.

[0016] Thus, according to the refrigerator of the present invention, since the electric motor is decelerated corresponding to the environment in the storage chamber only when the user opens and closes the door to place the article into the storage chamber, it is possible to prevent the malfunction of the refrigerator from being mistakenly detected as a change of the environment in the storage chamber.

[0017] In the present invention, the refrigerator further comprises: a temperature sensor configured to measure a temperature in the storage chamber; and a timer configured to measure a time period in which the freezing loop cools the storage chamber, in a case where the temperature in the storage chamber measured by the temperature sensor becomes above a given temperature, or in a case where a continuous operation duration of the freezing loop measured by the timer is above a given duration, the control device decelerates the electric motor.

[0018] Thus, according to the refrigerator of the present invention, in a case where the temperature in the storage chamber changes greatly, or where the continuous operation duration of the freezing loop is long, the control device judges that a high-temperature article that raises the temperature of the storage chamber is placed in the storage chamber, and increases the torque by reducing the rotation speed of the electric motor to prevent the driving shaft from freezing.

[0019] As a further improvement of the present invention, the control device decelerates the electric motor within two cycle periods after defrost processing is completed.

[0020] Thus, according to the refrigerator of the present invention, although the action sound increases since the electric motor decelerates, the time period in which noise is generated can be shortened by limiting the time period in which the electric motor is decelerated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

FIG. 1 is a front view of a refrigerator according to the present invention.

FIG. 2 is a cross-sectional view of the refrigerator according to the present invention.

FIG. 3 is a schematic diagram of an air passageway of the refrigerator according to the present invention.

FIG. 4 is a side cross-sectional view of the vicinity of a cooling chamber in a state that a fan cover of the refrigerator according to the present invention is opened.

FIG. 5 is a side cross-sectional view of the vicinity of the cooling chamber in a state that the fan cover of the refrigerator according to the present invention is closed.

FIG. 6 is an exploded perspective view of a shielding device of the refrigerator according to the present invention.

FIG. 7 is a block diagram of a connection structure of the refrigerator according to the present invention.

FIG. 8 is a flowchart of an operation method of the refrigerator according to the present invention.

FIG. 9 is a graph showing a relationship between a driving frequency and a torque of a stepping electric motor of the refrigerator according to the present invention.

FIG. 10(A) through FIG. 10(C) are schematic diagrams of the operation of the refrigerator according to the present invention, wherein FIG. 10(A) is a flowchart of step S20, FIG. 10(B) is a diagram including a case where a period from the start of a compressor to next start is included in an abnormity detection period, and FIG. 10(C) is a diagram including a case where a period from the stop of the compressor to next stop is included in the abnormity detection period.

FIG. 11 is a side sectional view of a conventional refrigerator described in the Background Art.

FIG. 12 is a perspective view of a fan cover used in a conventional refrigerator described in the Background Art.

Parts designated by reference numerals

[0022]

10 refrigerator
12 Heat insulating cabinet
121 outer box
122 inner box
123 thermal insulation
13 Refrigerating compartment
14 Ice-making room
141 Freezing compartment
15 Upper freezing compartment
16 Lower freezing compartment
17 Vegetable compartment
18 Thermally insulating door
181 Thermally insulating door
182 Thermally insulating door
19 Thermally insulating door
20 Thermally insulating door
21 Thermally insulating door
22 Thermally insulating door
23 Cooling chamber
24 Refrigerating compartment air supply passageway
25 Freezing compartment air supply passageway
26 Vegetable compartment air supply passageway
27 Air outlet
28 Air outlet

30 Air outlet
31 Air return vent
33 Air return vent
34 Air return vent
35 Partition member
36 Air supply port
37 Partition member
38 Insulated partition wall
39 Insulated partition wall
41 Compressor
42 Cooler
43 Defrost heater
44 Refrigerating compartment air damper
45 Partition member
50 blower fan
52 Fan
60 Shielding device
61 Fan cover
62 Driving shaft
621 trunk
63 Support base
64 Storage chamber side cover
65 recess
66 Guide pin
67 Guide hole
69 Cooling chamber side cover
70 control device
76 Partition member support
77 Blower fan support
78 Through hole
79 Flange
80 main face
801 Opening
81 Side
82 Opening
86 Shaft support
91 temperature sensor
92 Timer
93 Electric motor
100 refrigerator
101 Refrigerating compartment
102 Freezing compartment
103 Vegetable compartment
104 Cooling chamber
105 Division wall
106 Opening
107 Air supply fan
108 Cooler
109 Air passageway
110 Fan cover
111 Recess
113 Opening
114 Air damper.

DETAILED DESCRIPTION

[0023] To make the objectives, technical solutions and advantages of the present invention clearer, the present invention will be described in detail below with reference to the figures and specific embodiments.

[0024] Hereinafter, the refrigerator 10 according to embodiments of the present invention will be described in detail based on the figures. In the following description, the same components are denoted by the same reference numerals in principle, and repeated depictions are omitted. Furthermore, although directions such as up, down, front, back, left and right are used as appropriate in the following description, left and right indicate the left and right when the refrigerator 10 is viewed from the front.

[0025] FIG. 1 is a schematic diagram of a front face of the refrigerator 10 according to an embodiment of the present invention. As shown in FIG. 1, the refrigerator 10 according to the present embodiment comprises a heat-insulating cabinet 12 as a main body, and a storage chamber for storing foods is formed in an interior of the heat-insulating cabinet 12. Regarding the storage chamber, the uppermost layer is a refrigerating compartment 13, a left side of a lower layer is an ice-making compartment 14 and a right side of the lower layer is an upper-layer freezing compartment 15, a further lower layer is a lower-layer freezing compartment 16, and the lowermost layer is the vegetable compartment 17. In addition, the ice-making compartment 14, the upper-layer freezing compartment 15 and the lower-layer freezing compartment 16 are all storage chambers in a freezing temperature range. In the following depictions, they may be collectively referred to as a freezing compartment 141 as appropriate.

[0026] A front face of the heat-insulating cabinet 12 is opened. At openings corresponding to the storage chambers are respectively provided heat-insulating doors 18-22 which can be opened and closed freely. A heat-insulating door 181 and a heat-insulating door 182 divide and block a front face of the refrigerating compartment 13, and are supported by the heat-insulating cabinet 12 in a freely rotatable manner. In addition, the heat-insulating door 19 to the heat-insulating door 22 are respectively integrally combined with storage containers, and are supported by the heat-insulating cabinet 12 in a way that the combinations can be freely drawn toward the front of the refrigerator 10. Specifically, the heat-insulating door 19 blocks the ice-making compartment 14, the heat-insulating door 20 blocks the upper-layer freezing compartment 15, the heat-insulating door 21 blocks the lower-layer freezing compartment 16, and the heat-insulating door 22 blocks the vegetable compartment 17.

[0027] FIG. 2 is a side cross-sectional view showing the schematic configuration of the refrigerator 10. As shown in FIG. 2 through FIG. 5, solid arrows indicates flow directions of cold air circulating in the compartments. As shown in FIG. 2, the heat-insulating cabinet 12 as the main body of the refrigerator 10 comprises an outer box 121 made of a steel plate with an open front, an inner box 122 disposed in the outer box 121 with a gap, having an opening in the front and made of a synthetic resin, and a heat-insulating material 123 made of foamed polyurethane filled and foamed in the gap between the outer box 121 and the inner box 122. In addition, the above-mentioned heat-insulating doors 18 and so on also employ the same heat-insulating configuration as the heat-insulating cabinet 12.

[0028] The refrigerating compartment 13 and the freezing compartment 141 located at a lower layer thereof are partitioned by a heat-insulating partition wall 38. The ice-making compartment 14 and the upper-layer freezing compartment 15 inside the freezing compartment 141 are partitioned by a partition wall not shown. In addition, the ice-making compartment 14 and the upper-layer freezing compartment 15 are communicated with the lower-layer freezing compartment 16 therebelow in a way that the cold air can circulate freely. Furthermore, the freezing compartment 141 and the vegetable compartment 17 are partitioned by a heat-insulating partition wall 39.

[0029] In a rear of the refrigerating compartment 13 is formed a refrigerating compartment air supply passageway 24 partitioned by a partition member 37 made of a synthetic resin and supplying cold air to the refrigerating compartment 13. The partition member 37 is formed with air outlets 27 through which cold air is blown out to the refrigerating compartment 13. In addition, a refrigerating compartment air damper 44 is provided in the refrigerating compartment air supply passageway 24. The refrigerating compartment air damper 44 is a freely openable and closable air damper driven by an electric motor or the like, and is used to control a flow of cold air supplied to the refrigerating compartment 13 and appropriately maintain the temperature in the refrigerating compartment 13.

[0030] In the rear of the freezing compartment 141, a freezing compartment air supply passageway 25 enabling cold air cooled by a cooler 42 to flow to the freezing compartment 141 is formed. A cooling chamber 23 is formed in the further rear of the freezing compartment air supply passageway 25, and the cooler 42 as an evaporator for cooling the cold air circulating in the compartment is disposed in the cooling chamber 23.

[0031] The cooler 42 is connected to a compressor 41, a condenser (not shown), and an expansion unit such as a capillary tube (not shown) through a refrigerant pipe, to constitute a vapor compression type refrigeration cycle circuit.

[0032] FIG. 3 is a front view showing the schematic configuration of the air supply passageway of the refrigerator 10. As shown in FIG. 3, the refrigerator 10 comprises a vegetable compartment air supply passageway 26 connecting the refrigerating compartment 13 with the vegetable compartment 17. As a result, the cold air supplied to the refrigerating compartment 13 flows into the vegetable compartment air supply passageway 26 through an air return port 31 formed in a lower portion of the refrigerating compartment 13 and is blown out through the air outlet 30 and supplied to the vegetable compartment 17. As shown in FIG. 2, an air return port 34 connected to a lower portion of the cooling chamber 23 is formed in the vegetable compartment 17, and the cold air in the vegetable compartment 17 flows through the air return port 34 to the lower portion of the cooling chamber 23.

[0033] FIG. 4 and FIG. 5 are side cross-sectional views showing the configuration near the cooling chamber 23 of the refrigerator 10. FIG. 4 shows a state in which the fan cover 61 is opened, and FIG. 5 shows a state in which the fan cover 61 is closed.

[0034] As shown in FIG. 4, the cooling chamber 23 is disposed inside the freezing compartment air supply passageway 25 in the interior of the heat-insulating cabinet 12. The cooling chamber 23 is separated from the freezing compartment air supply passageway 25 or the freezing compartment 141 by a partition member 35 made of a synthetic resin. That is, the cooling chamber 23 is a space sandwiched by the inner box 122 and the partition member 35.

[0035] The freezing compartment air supply passageway 25 formed in front of the cooling chamber 23 is a space formed between the partition member 35 and a partition member 45 assembled in the front thereof, and becomes the air supply passageway through which the cold air cooled by the cooler 42 flows. An upper portion of the freezing compartment air supply passageway is connected to the refrigerating compartment air supply passageway 24.

[0036] The partition member 45 is formed with openings, namely, air outlets 28, through which cold air is blown into the freezing chamber 141. An air return port 33 for returning cold air from the freezing compartment 141 to a lower portion of the cooling chamber 23 is formed on the back of the lower portion of the lower-layer freezing compartment 16.

[0037] In addition, below the cooler 42, a defrosting heater 43 is provided as a defrosting unit that melts and removes the frost attached to the cooler 42. The defrost heater 43 is a resistive heating type heater.

[0038] The partition member 35 in the upper portion of the cooling chamber 23 is formed with an opening, namely, an air supply port 36, connected to the freezing compartment air supply passageway 25. A blower fan 50 for sending cold air to the freezing compartment 141 is disposed in front of the air supply port 36. The blower fan 50 is a centrifugal blower fan including a fan 52.

[0039] A shielding device 60 having a movable fan cover 61 is disposed in front of the blower fan 50. The fan cover 61 is close to the blower fan 50 from the side of the freezing compartment air supply passageway 25 to at least partially cover the blower fan 50 and the air supply port 36.

[0040] Furthermore, the fan cover 61 is driven by a driving shaft 62 disposed on the side of the partition member 45 to move in a front-rear direction. As the fan cover 61 moves forward and separates from the blower fan 50, an air passageway for cold air is formed between the fan cover 61 and the partition member 45. As a result, the cold air cooled by the cooler 42 is sent out by the blower fan 50 and supplied to the refrigerating compartment 13, the freezing compartment 141 and the vegetable compartment 17.

[0041] On the other hand, as shown in FIG. 5, as the blower fan 50 moves rearward and approaches the blower fan 50 so that the fan cover 61 covers the flower fan 50, an air supply port 36 is occluded, and an air passageway through which cold air flows to the freezing compartment 61 at the upper layer is shielded. On the other hand, in this state, the cold air is sent into the refrigerating compartment 13 through a refrigerating compartment air supply passageway 24 through an opening formed in the upper portion of the fan cover 61.

[0042] A surface of the fan cover 61 facing the blower fan 50 is formed into a substantially concave shape. Thereby, the fan cover 61 cannot block the air supply port 36 without contacting the fan 52 of the blower fan 50 disposed in front of the air supply port 36.

[0043] The opening and closing acts of the shielding device 60 described above are controlled by a control device 70 described later. For example, upon a defrosting operation to remove frost attached to the cooler 42, the fan cover 61 is closed as shown in FIG. 5.

[0044] As described above, in the refrigerator 10, the cold air sent by the blower fan 50 is sent to the refrigerating compartment 13, the freezing compartment 141 and the vegetable compartment 17. In addition, the cold air after cooling the refrigerating compartment 13, the freezing compartment 141 and the vegetable compartment 17 returns to the cooling chamber 23 via an air return passageway. As a result, the moisture contained in the items stored in the refrigerating compartment 13, the freezing compartment 141 and the vegetable compartment 17 returns to the cooling chamber 23 and then adheres to the cooler 42 to form frost. If the frost formation is intensified, air supply and heat exchange in the cooling chamber 23 will be hindered, so the defrosting operation is performed. In the defrosting operation, the control device 70 described later stops the compressor 41 and the blower fan 50, blocks the air supply port 36 and the fan cover 61, closes the refrigerating compartment air damper 44, and energizes the defrost heater 43. Thereby, the interior of the cooling chamber 23 becomes warm, and the frost adhered to the cooler 42 melts.

[0045] If the defrosting of the cooler 42 is completed, the control device 70 described later stops energizing the defrost heater 43, starts the compressor 41, and starts the cooling performed by the refrigeration loop. Then, after detecting that the cooler 42 and the cooling chamber 23 are cooled to a predetermined temperature or after a predetermined time elapses in a timer, as shown in FIG. 4, the control device 70 opens the fan cover 61 and starts the operation of the blower fan 50. In this way, the cooling operation can be restarted.

[0046] Here, since the shielding device 60 is disposed at the nearest position of the cooling chamber 23, if the above-mentioned moisture adheres to the shielding device 60, a driving mechanism of the shielding device 60 may freeze, so that the opening and closing acts can no longer be performed. In the present embodiment, as described later, in a case where the driving mechanism of the shielding device 60 is likely to freeze, the drive mechanism of the shielding device 60 is prevented from becoming difficult to operate by increasing a torque of an electric motor for driving the shielding device 60.

[0047] The structure of the above-mentioned shielding device 60 will be described with reference to FIG. 6. FIG. 6 is an exploded perspective view of the shielding device 60 as viewed from the upper rear side.

[0048] The shielding device 60 comprises: a fan cover 61 that blocks the blower fan 50 in a freely openable and closable manner from the outside of the cooling chamber 23; a driving shaft 62 that drives the fan cover 61 from a side opposite to the cooling chamber 23; and a support base 63 that not only supports the blower fan 50, but also supports the fan cover 61 and the driving shaft 62 freely slidably. The shielding device 60 is disposed between a storage chamber side cover 64 which is a part of the partition member 45 for partitioning the freezing compartment 141, and a cooling chamber side cover 69 which is a part of the partition member 35 for partitioning the freezing compartment air supply passageway 25. In addition, the shielding device 60 is mounted behind the storage chamber side cover 64 which is a part of the partition member 45. Specifically, a recess 65 recessed toward the front is formed on the rear of of the partition member 45, and the shielding device 60 is accommodated in the recess 65.

[0049] The fan cover 61 is a cover-shaped member capable of appropriately blocking the blower fan 50 and comprises a main surface portion 80 and a side surface portion 81 erected rearward from a peripheral edge portion of the main surface portion 80. The side surface portion 81 is erected from side peripheral edges and a lower peripheral edge of the main surface portion 80, and the side surface portion 81 is not erected from an upper peripheral edge of the main surface portion 80. An opening 82 is formed at an upper end portion of the fan cover 61. Accordingly, even though the blower fan 50 is blocked by the fan cover 61, cold air can be sent to the refrigerating compartment 13 through the opening 82. In addition, a guide hole 67 fitted with a guide pin 66 of the support base 63 described later is disposed on the outside of the side surface portion 81. In addition, an opening 801 is formed near a center of the main surface portion 80 of the fan cover 61, and the opening 801 is a through screw hole being in a substantially circular shape and having a screw groove formed inside.

[0050] The support base 63 is formed with a substantially cylindrical guide pin 66 that slidably supports the fan cover 61 in the front-rear direction. Two guide pins 66 are provided here, and respectively extend rearward from a main surface of the support base 63 in substantially parallel to a rotation axis of the fan 52. The fan cover 61 is formed with guide holes 67 into which the guide pins 66 are freely slidably fitted.

[0051] Three blower fan support portions 77 are vertically erected rearward from the main surface of the support base 63. The blower fan support portion 77 has a cylindrical shape, and its rear end runs through a through hole 78 formed on the main surface of the fan cover 61 and abuts on a front surface of a flange portion 79 of the blower fan 50. The blower fan support portion 77 and the flange portion of the blower fan 50 are fastened by fastening means, such as a screw.

[0052] In addition, two partition member support portions 76 are vertically erected rearward from a lower portion of the main surface of the support base 63. A rear end of the partition member support portion 76 abuts against the cooling chamber side cover 69 of the partition member 35, and is fastened with the cooling chamber side cover 69 by a screw.

[0053] The support base 63 is mounted with the driving shaft 62 for moving the fan cover 61 in the front-rear direction. The driving shaft 62 is rotatably supported by a shaft support portion 86 formed on the support base 63.

[0054] The driving shaft 62 has a trunk 621 formed in a cylindrical shape, and a thread not shown here is formed in a spiral shape on the outer surface of the trunk 621. The thread of the trunk 621 of the driving shaft 62 is threadedly engaged with the screw groove of the opening 801 of the fan cover 61. That is, a screw mechanism is formed between the fan cover 61 and the driving shaft 62. In addition, a stepping electric motor (not shown) is built in a support base 63, and the driving shaft 62 is rotated by a predetermined angle by the driving force of the stepping electric motor. If the driving shaft 62 is rotated in one direction, the fan cover 61 will approach the blower fan 50, and as shown in FIG. 5, the air passageway will become a closed state. On the other hand, if the electric motor rotates the driving shaft 62 in the other direction, the fan cover 61 will move away from the blower fan 50, and as shown in FIG. 4, the air passageway will become an open state.

[0055] As described above, the blower fan 50 is disposed at a position covering the air supply port 36 and is configured closer to the front side, namely, the side of the freezing compartment 141, than the air supply port 36. The blower fan 50 can employ a centrifugal blower fan that sends out cold air in the centrifugal direction and specifically can employ a vortex fan.

[0056] The connection structure of the refrigerator 10 will be described with reference to the block diagram of FIG. 7. The refrigerator 10 has a control device 70 as a CPU, a temperature sensor 91, a timer 92, a compressor 41, a blower fan 50, an electric motor 93, a refrigerating compartment air damper 44, and a defrost heater 43. The temperature sensor 91 and the timer 92 are connected to an input side terminal of the control device 70. The compressor 41, the blower fan 50, the electric motor 93, the refrigerating compartment air damper 44 and the defrost heater 43 are connected to an output side terminal of the control device 70.

[0057] The temperature sensor 91 is arranged in the refrigerating compartment 13, the freezing compartment 141 and the vegetable compartment 17, respectively, and transmits information indicating the temperature in these storage chambers to the control device 70.

[0058] The timer 92 measures a cooling duration for cooling the refrigerating compartment 13, the freezing compartment 141 and the vegetable compartment 17, an operating duration of the defrost heater 43, and transmits information indicating the durations to the control device 70.

[0059] The compressor 41 compresses a refrigerant used in the freezing loop in accordance with an instruction from the control device 70 as described above.

[0060] The blower fan 50 sends out the cold air cooled by the cooler 42 of the freezing loop to each storage chamber in accordance with an instruction from the control device 70 as described above.

[0061] The electric motor 93 rotates the driving shaft 62 of the shielding device 60 by a predetermined angle in accordance with the instruction from the control device 70. The electric motor 93, for example, employs a stepping electric motor.

[0062] The refrigerating compartment air damper 44 appropriately blocks the cold air sent to the refrigerating compartment air supply passageway 24 in accordance with the instruction from the control device 70.

[0063] The defrost heater 43 is energized in accordance with the instruction from the control device 70 to warm the air in the cooling chamber 23.

[0064] Based on the flowchart shown in FIG. 8 and with reference to the above-mentioned figures, description will be given to a method of preventing freezing of the shielding device 60 when the environment of the storage chamber becomes an abnormal state during the cooling operation of the refrigerator 10.

[0065] In the present embodiment, first, an outline of a method of preventing the shielding device 60 from freezing will be described. It is considered that the user accommodates a to-be-stored high-temperature and high-humidity article in the refrigerating compartment 13 upon using the refrigerator 10. The to-be-stored high-temperature and high-humidity article is, for example, hot pot, soup or the like which is still hot. In this case, referring to FIG. 2, the moisture emitted from the high-temperature and high-humidity article reaches the cooling chamber 23 via the vegetable compartment air supply passageway 26, the vegetable compartment 17 and an air return vent 34. As described above, since the shielding device 60 is adjacent to the air supply port 36 of the cooling chamber 23, if the moisture adheres to the shielding device 60 and freezes, the opening and closing act of the shielding device 60 might be hindered. Specifically, referring to FIG. 6, a screw mechanism composed of a screw thread formed around a trunk 621 of a driving shaft 62 and a screw groove formed in an opening 801 of the fan cover 61 might freeze and become rigid. For this reason, in the present embodiment, if high-temperature and high-humidity article is accommodated in the refrigerating compartment 13, the state will be detected as an abnormal state, and the torque is increased by reducing the rotation speed of the electric motor driving the shielding device 60 to prevent the screw mechanism of the shielding device 60 from freezing and becoming rigid. The control method will be described in detail below.

[0066] First, in step S10, the control device 70 judges whether a temperature in the freezing compartment 141 measured by a temperature sensor 91 is -5°C or less. If the temperature in the freezing compartment 141 is -5°C or less, i.e., if step S10 is "YES", the control device 70 will transfer to step S11 described later to judge whether the refrigerator 10 is in an abnormal state. On the other hand, if the temperature in the freezing compartment 141 is higher than -5°C, i.e., step S10 is "NO", the control device 70 turns to step S31 to continue the cooling operation of the freezing compartment 141 by making the compressor 41 work.

[0067] In step S11, judgement is made as to whether the compressor 41 is in an ON state. In the present embodiment, after a thermally insulating door 18 for closing the refrigerating compartment 13 is opened or closed, whether the condition in the refrigerating compartment 13 is abnormal is determined after one cycle period. Here, the term "one cycle period" refers to a period from the ON state of the compressor 41 to the next ON state, or a period from an OFF state of the compressor 41 to the next OFF state. In addition, when the one cycle period is one hour, it is possible to, by confirming time to ensure the one-hour cycle period, reliably detect the state in which the high-temperature and high-humidity article is placed in the refrigerating compartment 13 is the abnormal state.

[0068] When the compressor 41 is in the ON state, i.e., when the step S11 is "YES", the control device 70 turns to the step S12 to judge whether the thermally insulating door 18 is opened and closed. Since the user opens or closes the thermally insulating door 18 upon placing the article in the refrigerating room 13, whether the article is placed in the refrigerating compartment 13 can be judged by judging the opening and closing of the thermally insulating door 18.

[0069] In a case where there is a possibility that the article is placed into the refrigerating compartment 13 due to the opening and closing of the thermally insulating door 18, i.e., in a case where step S12 is "YES", the control device 70 sets a flag F1 to 1 in step S13. The flag F1 is a flag indicating that the thermally insulating door 18 is opened and closed when the compressor 41 is in the ON state. On the other hand, when the thermally insulating door 18 is not opened or closed, i.e., in a case where step S12 is "NO", the control device 70 does not set the flag F1 to 1 because the article is not placed in the refrigerating compartment 13 and keeps flag F1 0 unchanged, and the process turns to step S14.

[0070] In step S14, the control device 70 judges whether a flag F2 is not set to 1. The flag F2 is set to 1 in a case where the thermally insulating door 18 is opened and closed and the compressor 41 is in the OFF state, and is set to 0 when not in this case.

[0071] When the flag F2 is not 1, that is, when the step S14 is "YES", since one cycle period of the compressor 41 has not elapsed, the process transfer to step S15 to continue the detection of the abnormal state.

[0072] On the other hand, when the flag F2 is 1, that is, when the step S14 is "NO", the thermally insulatng door 18 is opened and closed when the compressor 41 is in the OFF state. Therefore, the control device 70 performs abnormality detection until next time when the compressor 41 reverses from the OFF state to the ON state.

[0073] Therefore, the control device 70 does not continue to detect the abnormal state of the environment in the cabinet after step S16, and returns to step S10.

[0074] In step S15, the control device 70 judges whether the flag F1 is set to 1. If the flag F1 is set to 1, i.e., in a case where S15 is "YES", since the thermally insulating door 18 is opened and closed, there is a possibility that a high-temperature article exists in the refrigerating compartment 13, so the process turns to step S16. On the other hand, if the flag F1 is not set to 1, i.e., in a case where S15 is "NO", since the thermally insulating door 18 is not opened and closed and a high-temperature article does not exist in the refrigerating compartment 13, the abnormal state is not detected and the process returns to step S10.

[0075] In step S16, the control device 70 judges whether a temperature rise in the refrigerating compartment 13 is 6°C or more before and after step S12, that is, before and after the thermally insulating door 18 is opened and closed. If the temperature rise in the refrigerating compartment 13 is 6°C or more, it can be judged that a high-temperature article such as hot pot have already been placed in the refrigerating compartment 13. If the temperature rise in the refrigerating compartment 13 is 6°C or more, that is, if step S16 is "YES", the control device 70 detects an abnormal state in step S18. On the other hand, if the temperature rise in the refrigerating compartment 13 is less than 6°C, i.e., if step S16 is "NO", the control device 70 turns to to step S17.

[0076] In step S17, the control device 70 judges whether the cooling operation duration of the refrigerating compartment 13 by operating the compressor 41 and the flower fan 50 is more than 30 minutes. Through such a judgment, it can be judged that a high-temperature article is accommodated in the refrigerating compartment 13 and a long time period is spent in cooling the refrigerating compartment 13. If the cooling operation duration is more than 30 minutes, i.e., if step S17 is "YES", the control device 70 judges that there is a high-temperature article in the refrigerating compartment 13, and detects an abnormal state in step S18. On the other hand, if the cooling operation duration is less than 30 minutes, i.e., if step S17 is "NO", the control device 70 judges that there is no high-temperature article in the refrigerating compartment 13, does not detect the abnormal state, proceeds to step S21.

[0077] On the other hand, in the case where step S11 is "NO", i.e., in a case where the compressor 41 is in the OFF state, the control device 70 proceeds to step S24; when the compressor 41 is in the OFF state, the method identical with the method from step S12 to step S17 is employed to detect the abnormal state.

[0078] Specifically, when the compressor 41 is in the OFF state, i.e., when the step S11 is "NO", the control device 70 turns to the step S24 to judge whether the thermally insulating door 18 is opened and closed.

[0079] In a case where there is a possibility that an article is placed in the refrigerating compartment 13 due to the opening and closing of the thermally insulating door 18, i.e., in a case where step S24 is "YES", the control device 70 sets the flag F2 to 1 in step S25. On the other hand, when the thermally insulating door 182 is not opened or closed, i.e., when step S24 is "NO", since the article is not placed in the refrigerating compartment 13, the control device 70 does not set the flag F2 to 1, keeps the flag F2 0 unchanged, and the process proceeds to step S26.

[0080] In step S26, the control device 70 judges whether the flag F1 is not set to 1. As described above, the flag F1 is set to 1 when the thermally insulating door 18 is opened and closed and the compressor 41 is in the ON state, and is set to 0 when not in this case.

[0081] When the flag F1 is not 1, that is, when the step S26 is "YES", since one cycle period of the compressor 41 has not elapsed, the process turns to step S27 to continue the detection of the abnormal state. On the other hand, when the flag F1 is 1, in other words, when step S26 is "NO", which means that the thermally insulating door 18 is opened and closed when the compressor 41 is in the ON state, the abnormality detection is performed until next time when the compressor 41 reverses from the ON state to the OFF state. Therefore, the control device 70 does not continue the detection of the abnormal state after step S27, but turns to step S21. As such, the control device 70 detects the abnormal state from the ON state of the compressor 41 until next ON state, or from the OFF state of the compressor 41 until next OFF state.

[0082] In step S27, the control device 70 judges whether the flag F2 is set to 1. If the flag F2 is set to 1, that is, if step S27 is "YES", since the thermally insulating door 18 is opened and closed and there is a possibility that a high-temperature article exists in the refrigerating compartment 13, the process turns to step S28. On the other hand, if the flag F2 is not set to 1, that is, if step S27 is "NO", since the thermally insulating door 18 is not opened and closed and a high-temperature article does not exist in the refrigerating compartment 13, the abnormal state is not detected, and the process turns to step S21.

[0083] In step S28, the control device 70 judges whether a temperature rise in the refrigerating compartment 13 is 6°C or more before and after the opening and closing of the thermally insulating door 18. If the temperature rise in the refrigerating compartment 13 is 6°C or more, that is, if step S28 is "YES", the control device 70 detects the abnormal state in step S 18. On the other hand, if the temperature rise in the refrigerating compartment 13 is less than 6°C, that is, if step S28 is "NO", the control device 70 turns to step S29.

[0084] In step S29, the control device 70 judges whether a duration for cooling the refrigerating compartment 13 by operating the compressor 41 and the flower fan 50 is more than 30 minutes. If the operation duration is more than 30 minutes, i.e., if step S29 is "YES", the control device 70 judges that there is a high-temperature article in the refrigerating compartment 13, and detects an abnormal state in step S18. On the other hand, if the operation duration is less than 30 minutes, i.e., if step S29 is "NO", the control device 70 judges that there is no high-temperature article in the refrigerating compartment 13, does not detect the abnormal state, and turns to step S21.

[0085] After detecting the abnormal state in step S18, the control device 70 judges in step S19 whether the temperature in the refrigerating compartment 13 has reached a power-off point. Here, the power-off point is a temperature at which the refrigerating compartment 13 is sufficiently cooled to stop the compressor 41 of the freezing loop. If the temperature inside the refrigerating compartment 13 reaches the power-off point, that is, if step S19 is "YES", since the article accommodated in the refrigerating compartment 13 is sufficiently cooled, the control device 70 cancels the abnormal state in step S20, sets the flag F1 to 0 and sets the flag F2 to 0. The method of resetting the flags F1 and F2 will be described later with reference to FIG. 10. On the other hand, if the temperature in the refrigerating compartment 13 has not reached the power-off point, that is, if step S19 is "NO", since the refrigerating compartment 13 is not sufficiently cooled, the control device 70 returns to step S10 to continue the cooling operation.

[0086] In step S21, the control device 70 confirms whether it is within two cycle periods after the defrosting operation is performed. If it is within two cycle periods, i.e., if step S21 is "YES", the control device 70 turns to step S22 to perform an act upon abnormity. On the other hand, if it is not within two cycle periods, that is, if step S21 is "NO", the control device 70 does not perform an act upon abnormity and returns to step S10.

[0087] Through the judgement in step S21, in the case of the abnormal state, the control device 70 can continuously perform the torque enhancement in step S23 described later for more than one cycle period. Therefore, the effect of preventing the driving shaft 62 and the fan cover 61 from freezing becomes greater.

[0088] In addition, in the following step S23, an electric motor 93 is decelerated to prevent freezing. However, if the electric motor 93 is decelerated, the sound of electric motor becomes louder. For this reason, the time during which the sound of electric motor becomes louder can be limited by limiting the period during which the electric motor 93 is decelerated to within two cycle periods,.

[0089] In step S22, the control device 70 judges whether the abnormal state is detected in the above-mentioned step S18. If the abnormal state is detected, that is, if step S22 is "YES", the control device 70 turns to step S23. On the other hand, if the abnormal state is not detected, that is, if step S22 is "NO", the control device 70 turns to step S30.

[0090] In step S23, the control device 70 decelerates a driving speed of the electric motor 93 that drives the shielding device 60 to open and close. For example, the control device 70 changes the driving speed of the electric motor 93 from 500 PPS to 150 PPS. In this way, it is possible to prevent the shielding device 60 from being inoperable due to the above-mentioned freezing.

[0091] Specifically, a portion of the moisture circulating inside the refrigerator 10 due to the accommodation of high-temperature and high-humidity article in the refrigerating compartment 13 adheres between the trunk 621 of the driving shaft 62 and the opening 801 of the fan cover 61 shown in FIG. 6. If the adhered moisture freezes, the screw mechanism formed between the trunk 621 and the opening 801 becomes rigid. As a result, even if the electric motor 93 is rotated based on the instruction of the control device 70, the stiffened driving shaft 62 cannot be rotated, and it is possible that the fan cover 61 cannot be moved in the front-rear direction.

[0092] For this reason, in step S23, the control device 70 reduces the driving speed of the electric motor 93 of the stepping electric motor to 150 PPS.

[0093] FIG. 9 is a graph showing a relationship between a driving frequency and a torque of a stepping electric motor.

[0094] A horizontal axis represents the driving frequency of the stepping electric motor, and a vertical axis represents the torque of the stepping electric motor. As is clear from the figure, the driving frequency and torque have a negative correlation. If the driving frequency is reduced, the torque becomes larger. As in the present embodiment, when the driving frequency is reduced from 500 PPS to 150 PPS, the torque of the electric motor 93 can be increased from approximately 20N to approximately 30N.

[0095] Accordingly, by reducing the driving frequency of the electric motor 93 to 150 PPS in step S23, the torque of the electric motor 93 can be increased to approximately 1.5 times. Therefore, referring to FIG. 6, even if there is some moisture between the trunk 621 of the driving shaft 62 and the opening 801 of the fan cover 61, the driving shaft 62 can be rotated with a large torque of the electric motor 93 to prevent the driving shaft 62 from becoming stiff due to freezing.

[0096] On the other hand, if the abnormal state is not detected, that is, if step S22 is "NO", the driving shaft 62 is not likely to freeze, so the driving frequency of the electric motor 93 is maintained at a high speed at 500 PPS.

[0097] Here, reference is made to FIGS. 10(A) through FIG. 10(C) to describe in detail the step S20 of resetting the flags, namely, F1 and F2, used for setting the abnormity detection period. FIG. 10(A) is a flowchart showing step S20 in detail, FIG. 10(B) is a diagram showing a case where a period from the start of the compressor 41 until the next start is included in the abnormality detection period, and FIG. 10(C) is a diagram showing a case where a period from the stop of the compressor 41 to the next stop is included in the abnormality detection period.

[0098] Referring to FIG. 10(A), the step S20 of resetting F1 and F2 comprises step S2001 to step S2012.

[0099] In step S2001, the control device 70 judges whether the compressor 41 switches from the OFF state to the ON state, that is, whether the compressor 41 is started. If the compressor 41 switches from the OFF state to the ON state, that is, if the step S2001 is "YES", the control device 70 turns to the step S2002. On the other hand, if the compressor 41 does not switch from the OFF state to the ON state, that is, is step S2001 is "NO", the control device 70 turns to step S2007.

[0100] In step S2002, the control device 70 judges whether F2 is set to 1. If F2 is set to 1, that is, if step S2002 is "YES", the control device 70 turns to step S2003. On the other hand, if F2 is not set to 1, that is, if step S2002 is "NO", the control device 70 turns to step S21. As described above, the flag F2 is set to 1 when the thermally insulating door 18 is opened and closed and the compressor 41 is in the OFF state, and is set to 0 when not in this case.

[0101] In step S2003, the control device 70 confirms whether a compressor power-on count is 1. The so-called compressor power-on count is a flag indicating that the compressor 41 starts after the user opens the door. If the compressor 41 starts after the user opens the door, the compressor power-on count is set to 1, otherwise, the compressor power-on count is set to 0. If the compressor power-on count is 1, i.e., if step S2003 is "YES", the control device 70 turns to step S2005. On the other hand, if the compressor power-on count is not 1, i.e., if step S2003 is "NO", the control device 70 turns to step S2004.

[0102] In step S2004, the control device 70 sets the compressor power-on count to 1.

[0103] In step S2005, since the abnormality detection period ends, the control device 70 sets the compressor power-on count to 0. Furthermore, in step S2006, the control device 70 resets by setting F2 to 0.

[0104] Referring to FIG. 10(B), with step S2001 to step S2006 being performed, a period from the time when the thermally insulating door 18 is opened and closed to place foods until completion of two times of start of the compressor 41 is taken as the abnormality detection period.

[0105] In step S2007, the control device 70 judges whether the compressor 41 has switched from the ON state to the OFF state, i.e., whether the compressor 41 stops. If the compressor 41 switches from the ON state to the OFF state, i.e., if step S2007 is "YES", the control device 70 turns to step S2008. On the other hand, if the compressor 41 does not switch from the ON state to the

OFF state, i.e., if step S2007 is "NO", the control device 70 turns to step S21.

[0106] In step S2008, the control device 70 judges whether F1 is set to 1. If F1 is set to 1, i.e., if step S2008 is "YES", the control device 70 turns to step S2009. On the other hand, if F1 is not set to 1, i.e., if step S2008 is "NO", the control device 70 turns to step S21. As described above, the flag F1 is a flag indicating that the thermally insulating door 18 is opened and closed when the compressor 41 is in the ON state.

[0107] In step S2009, the control device 70 judges whether a compressor power-off count is 1. The so-called compressor power-off count is a flag indicating that the compressor 41 stops (switches from the ON state to the OFF state) after the user opens the thermally insulating door 18. If the compressor 41 stops after the user opens the thermally insulating door 18, the compressor power-off count is set to 1, otherwise, the compressor power-off count is set to 0. If the compressor power-off count is 1, i.e., if step S2009 is "YES", the control device 70 turns to step S2011. On the other hand, if the compressor power-off count is not 1, i.e., if step S2009 is "NO", the control device 70 turns to step S2010.

[0108] In step S2010, the control device 70 sets the compressor power-off count to 1.

[0109] In step S2011, since the abnormality detection period ends, the control device 70 sets the compressor power-off count to 0. Furthermore, in step S2012, the control device 70 resets by setting F1 to 0.

[0110] With reference to FIG. 10(C), with step S2007 to step S2012 being performed, a period from the time when the thermally insulating door 18 is opened and closed to place foods until completion of two times of stop of the compressor 41 is taken as the abnormality detection period.

[0111] What is described above is the method of preventing the driving shaft 62 from freezing during the cooling operation of the refrigerator 10.

[0112] The above embodiments are only intended to illustrate the technical solutions of the present invention and not to limit them. Although the present invention has been described in detail with reference to the preferred embodiments, those having ordinary skill in the art should understand that the technical solutions of the present invention may be modified or equivalently replaced, without departing from the scope of the technical solutions of the present invention,

Claims

1. A refrigerator (100), wherein the refrigerator comprises:

    a cooler (42) in a freezing loop, the cooler (42) being configured to cool air supplied via an air supply passageway to a storage chamber (13, 14, 15 16, 17);
    a cooling chamber (23) equipped with the cooler (42) and formed with an air supply port (36) communicated with the storage chamber (13, 14, 15 16, 17);
    a blower fan (50) configured to feed the air supplied through the air supply port to the storage chamber (13, 14, 15 16, 17);
    a shielding device (60) at least partially occluding the air supply port (36); and
    a control device (70) configured to control acts of the freezing loop, the blower fan (50) and the shielding device (60),
    the shielding device (60) comprises:

        a fan cover (61) configured to cover the blower fan (50) from an outside of the cooling chamber (23);
        a driving shaft (62) configured to drive the fan cover (61) to open and close;
        a screw mechanism formed between the driving shaft (62) and the fan cover (61); and
        an electric motor configure to rotate the driving shaft (62),
        in a case an environment in the storage chamber (13, 14, 15 16, 17) is in an abnormal state, the control device (70) decelerates the electric motor (93);
        characterized in that the refrigerator (10) further comprises:

            a temperature sensor (91) configured to measure a temperature in the storage chamber (13, 14, 15 16, 17); and
            a timer (92) configured to measure a time period in which the freezing loop cools the storage chamber (13, 14, 15 16, 17),
            in a case where the temperature in the storage chamber (13, 14, 15 16, 17) measured by the temperature sensor (91) becomes above a given temperature, or in a case where a continuous operation duration of the freezing loop measured by the timer (92) is above a given duration, the control device (70) decelerates the electric motor (93).

2. The refrigerator according to claim 1, wherein in a case where a door for closing the storage chamber ((13, 14, 15 16, 17) is opened and closed, the control device (70) controls the electric motor to decelerate according to the environment in the storage chamber (13, 14, 15 16, 17).

3. The refrigerator according to claim 1, wherein the control device (70) decelerates the electric motor (93) within two cycle periods after defrost processing is completed.

Patentansprüche

1. Kühlschrank (100), wobei der Kühlschrank Folgendes umfasst:

   einen Kühler (42) in einem Gefrierkreislauf, wobei der Kühler (42) konfiguriert ist, um Luft zu kühlen, die über einen Luftzufuhrkanal einer Speicherkammer (13, 14, 15, 16, 17) zugeführt wird;
   eine Kühlkammer (23), die mit dem Kühler (42) ausgestattet und mit einer Luftzufuhröffnung (36) versehen ist, die mit der Speicherkammer (13, 14, 15, 16, 17) verbunden ist;
   ein Gebläselüfter (50), der konfiguriert ist, um die über die Luftzufuhröffnung zugeführte Luft in die Speicherkammer (13, 14, 15, 16, 17) zu leiten;
   eine Abschirmvorrichtung (60), die die Luftzufuhröffnung (36) zumindest teilweise verschließt; und
   eine Steuervorrichtung (70), die konfiguriert ist, um Funktionen des Gefrierkreislaufs, des Gebläselüfters (50) und der Abschirmvorrichtung (60) zu steuern,
   wobei die Abschirmvorrichtung (60) Folgendes umfasst:

      eine Gebläseabdeckung (61), die konfiguriert ist, um den Gebläselüfter (50) von der Außenseite der Kühlkammer (23) abzudecken;
      eine Antriebswelle (62), die konfiguriert ist, um die Lüfterabdeckung (61) zum Öffnen und Schließen anzutreiben;
      einen Schraubmechanismus, der zwischen der Antriebswelle (62) und der Lüfterabdeckung (61) gebildet ist; und
      einen Elektromotor, der konfiguriert ist, um die Antriebswelle (62) zu drehen,
      wenn die Umgebung in der Speicherkammer (13, 14, 15, 16, 17) in einem anormalen Zustand ist, verzögert die Steuereinrichtung (70) den Elektromotor (93);
      dadurch gekennzeichnet, dass der Kühlschrank (10) ferner Folgendes umfasst:

         einen Temperatursensor (91), der konfiguriert ist, um eine Temperatur in der Speicherkammer (13, 14, 15, 16, 17) zu messen; und
         einen Zeitgeber (92), der konfiguriert ist, um eine Zeitspanne zu messen, in der der Gefrierkreislauf die Speicherkammer (13, 14, 15, 16, 17) kühlt,
         wenn die von dem Temperatursensor (91) gemessene Temperatur in der Speicherkammer (13, 14, 15, 16, 17) eine bestimmte Temperatur überschreitet, oder wenn die vom Zeitgeber (92) gemessene Dauer des Dauerbetriebs der Gefrierschleife eine bestimmte Dauer überschreitet, verzögert die Steuervorrichtung (70) den Elektromotor (93).

2. Kühlschrank nach Anspruch 1, wobei in einem Fall, in dem eine Tür zum Schließen der Speicherkammer (13, 14, 15, 16, 17) geöffnet und geschlossen wird, die Steuervorrichtung (70) den Elektromotor steuert, um abhängig von der Umgebung in der Speicherkammer (13, 14, 15, 16, 17) zu verzögern.

3. Kühlschrank nach Anspruch 1, wobei die Steuervorrichtung (70) den Elektromotor (93) innerhalb von zwei Zyklusperioden nach Abschluss des Abtauvorgangs verzögert.

Revendications

1. Réfrigérateur (100), dans lequel le réfrigérateur comprend :

   un refroidisseur (42) dans une boucle de congélation, le refroidisseur (42) étant configuré pour refroidir l'air fourni par un passage d'alimentation en air à une chambre de stockage (13, 14, 15, 16, 17) ;
   une chambre de refroidissement (23) équipée du refroidisseur (42) et dotée d'un orifice d'alimentation en air (36) communiquant avec la chambre de stockage (13, 14, 15, 16, 17) ;
   un ventilateur (50) configuré pour fournir l'air fourni par l'orifice d'alimentation en air à la chambre de stockage (13, 14, 15, 16, 17) ;
   un dispositif de protection (60) obstruant au moins partiellement l'orifice d'alimentation en air (36) ; et
   un dispositif de commande (70) configuré pour commander les actions de la boucle de congélation, du ventilateur (50) et du dispositif de protection (60),
   le dispositif de protection (60) comprend :

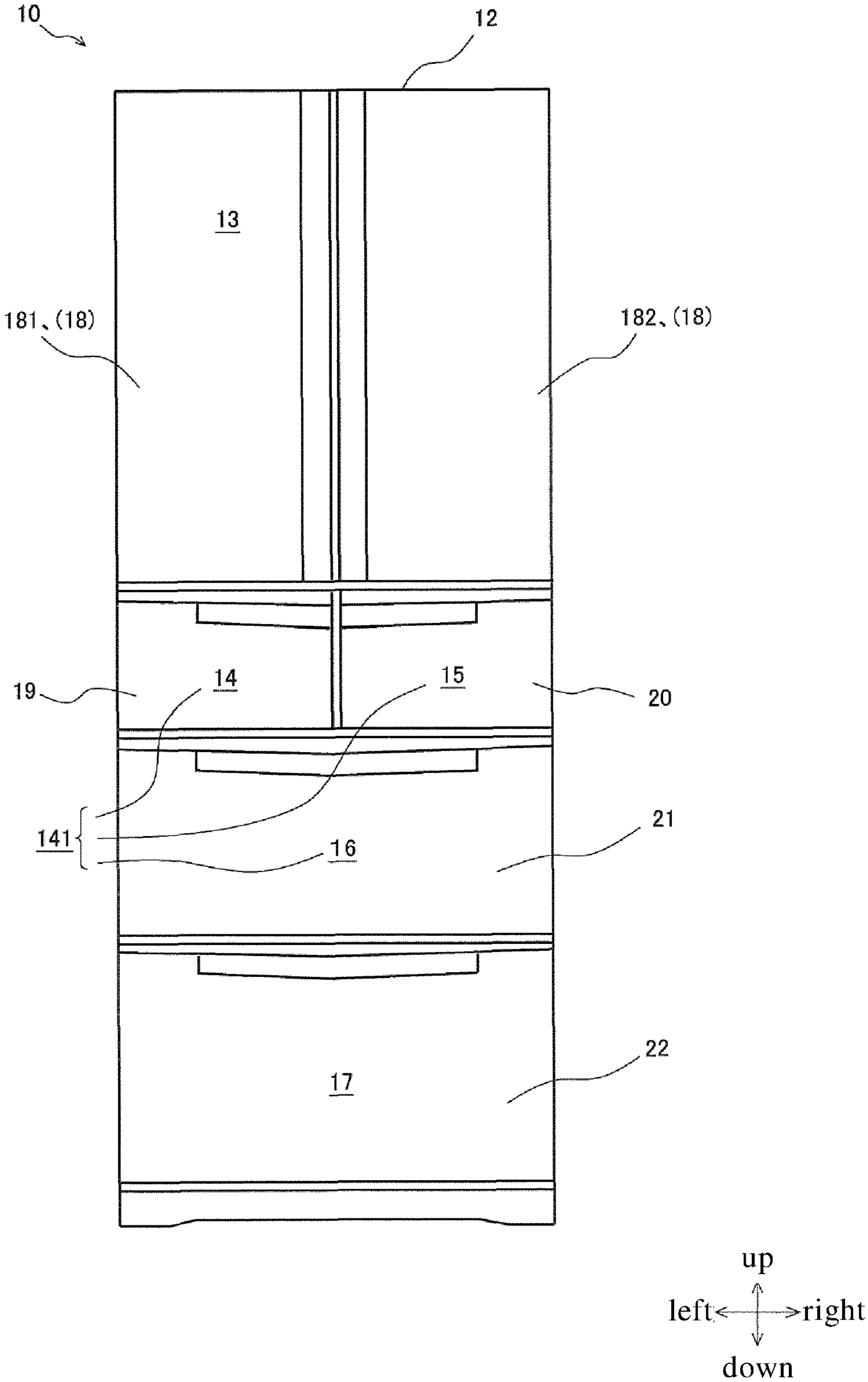
      un couvercle de ventilateur (61) configuré pour recouvrir le ventilateur (50) depuis l'extérieur de la chambre de refroidissement (23) ;
      un arbre d'entraînement (62) configuré pour entraîner l'ouverture et la fermeture du couvercle de ventilateur (61) ;
      un mécanisme à vis formé entre l'arbre d'entraînement (62) et le couvercle de ventilateur (61) ; et
      un moteur électrique configuré pour faire

tourner l'arbre d'entraînement (62), dans un cas où l'environnement dans la chambre de stockage (13, 14, 15, 16, 17) est anormal, le dispositif de commande (70) décélère le moteur électrique (93) ; **caractérisé en ce que** le réfrigérateur (10) comprend en outre :

un capteur de température (91) configuré pour mesurer une température dans la chambre de stockage (13, 14, 15, 16, 17) ; et
une minuterie (92) configurée pour mesurer une période de temps pendant laquelle la boucle de congélation refroidit la chambre de stockage (13, 14, 15, 16, 17),
dans un cas où la température dans la chambre de stockage (13, 14, 15, 16, 17) mesurée par le capteur de température (91) devient supérieure à une température donnée, ou dans un cas où la durée de fonctionnement continu de la boucle de congélation mesurée par la minuterie (92) est supérieure à une durée donnée, le dispositif de commande (70) décélère le moteur électrique (93).

2. Réfrigérateur selon la revendication 1, dans lequel dans un cas où une porte de fermeture de la chambre de stockage (13, 14, 15, 16, 17) est ouverte et fermée, le dispositif de commande (70) commande au moteur électrique de décélérer en fonction de l'environnement dans la chambre de stockage (13, 14, 15, 16, 17).

3. Réfrigérateur selon la revendication 1, dans lequel le dispositif de commande (70) décélère le moteur électrique (93) dans les deux périodes de cycle après l'achèvement du processus de dégivrage.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12
13
181、(18)
182、(18)
19
14
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141
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22
up
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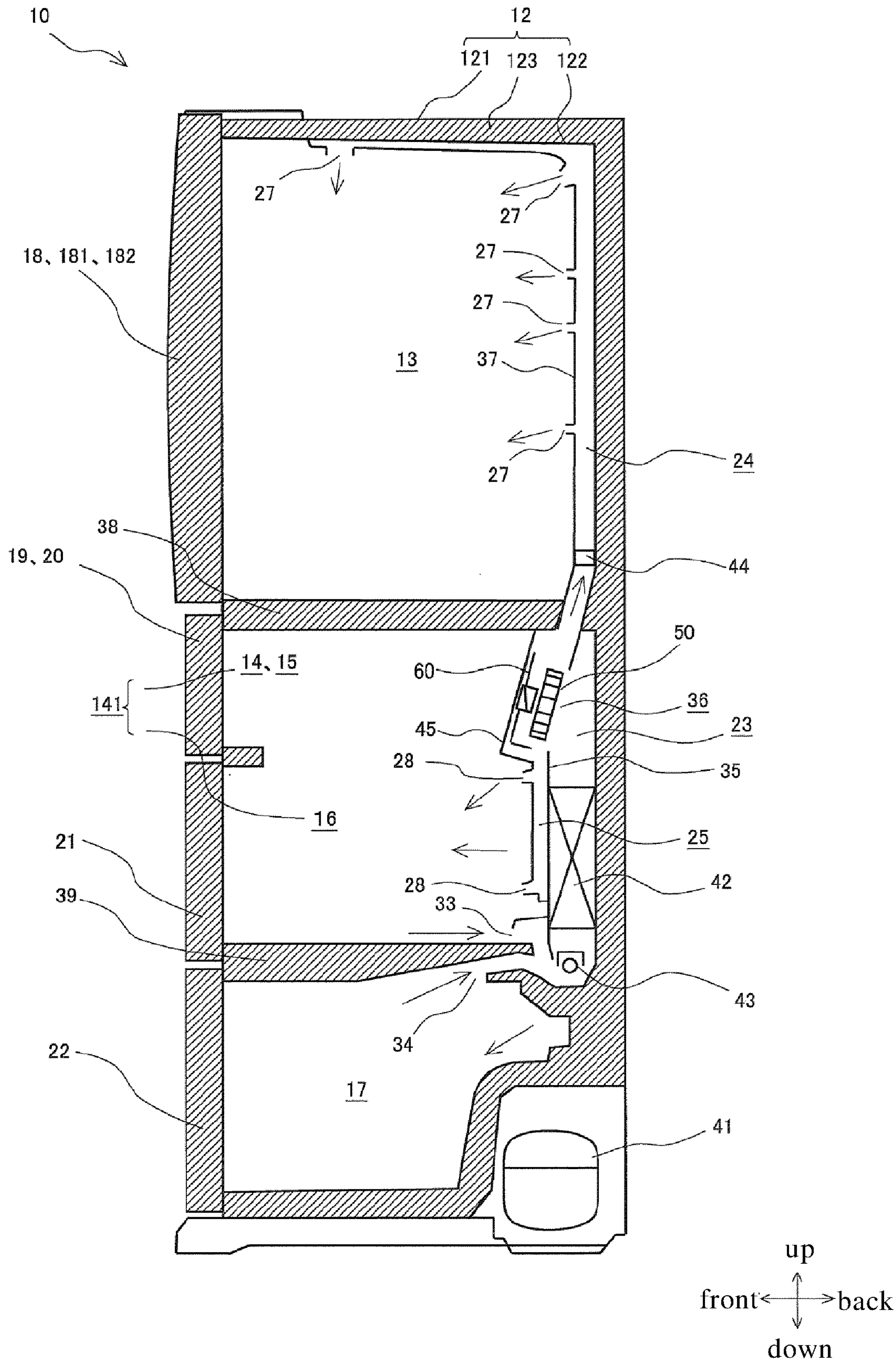
down

FIG. 1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14、15
60
141
36
23
45
35
28
16
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21
42
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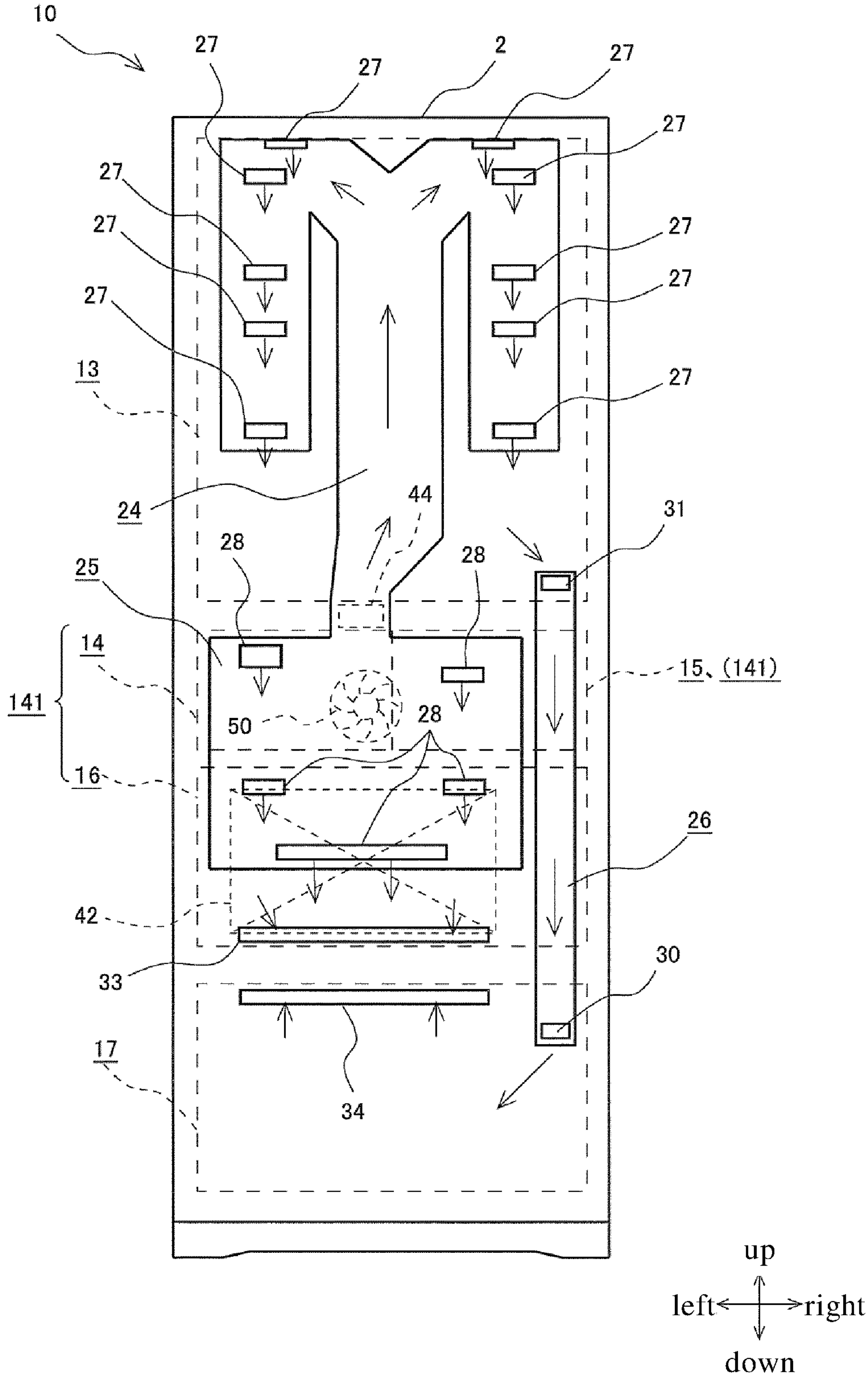
39
33
43
34
17
22
41
up
front
back
down

FIG. 2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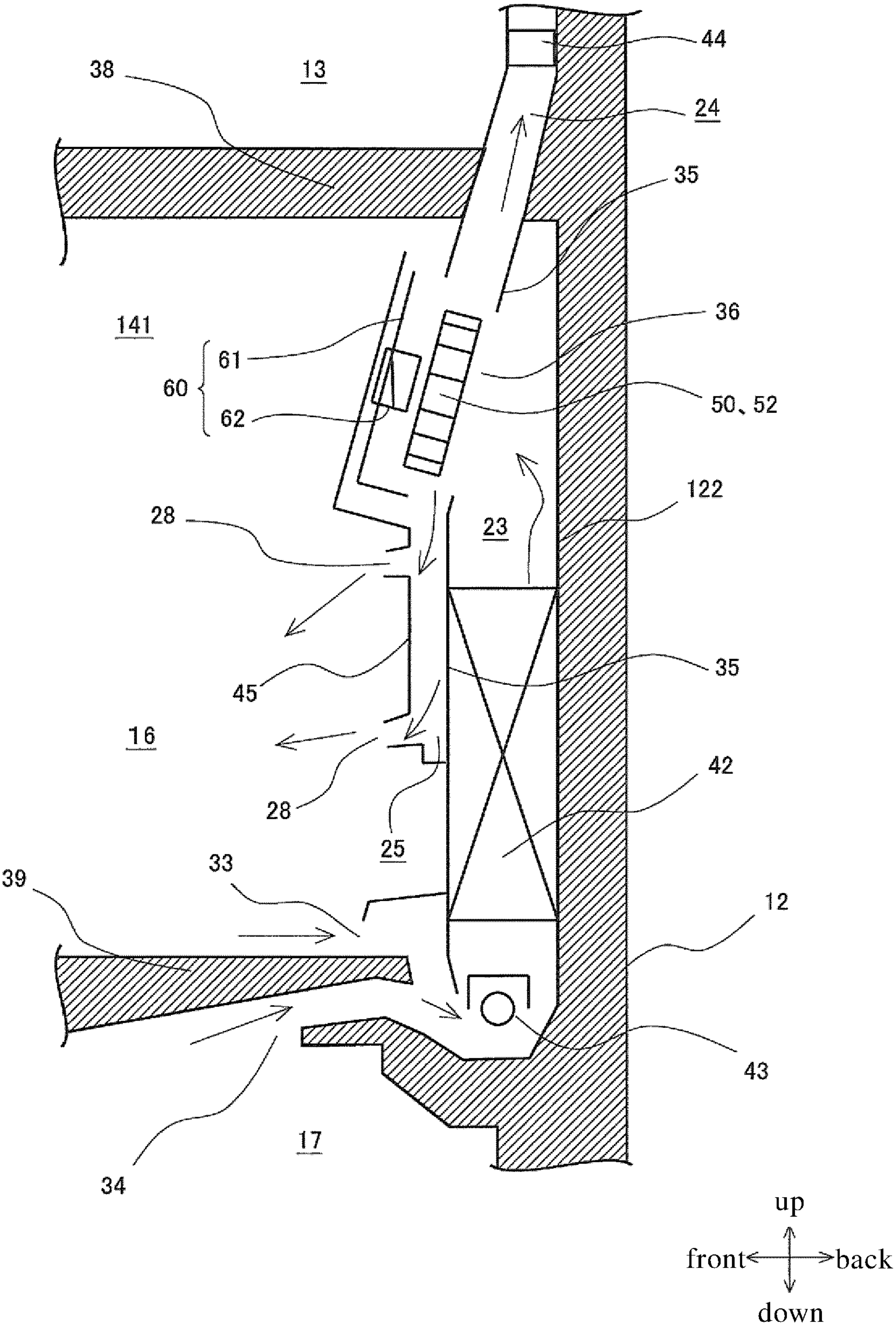
30
17
34
up
left
right
down

FIG. 3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50、52
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122
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35
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16
28
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25
33
12
39
43
17
34
up
front
back
down

FIG. 4

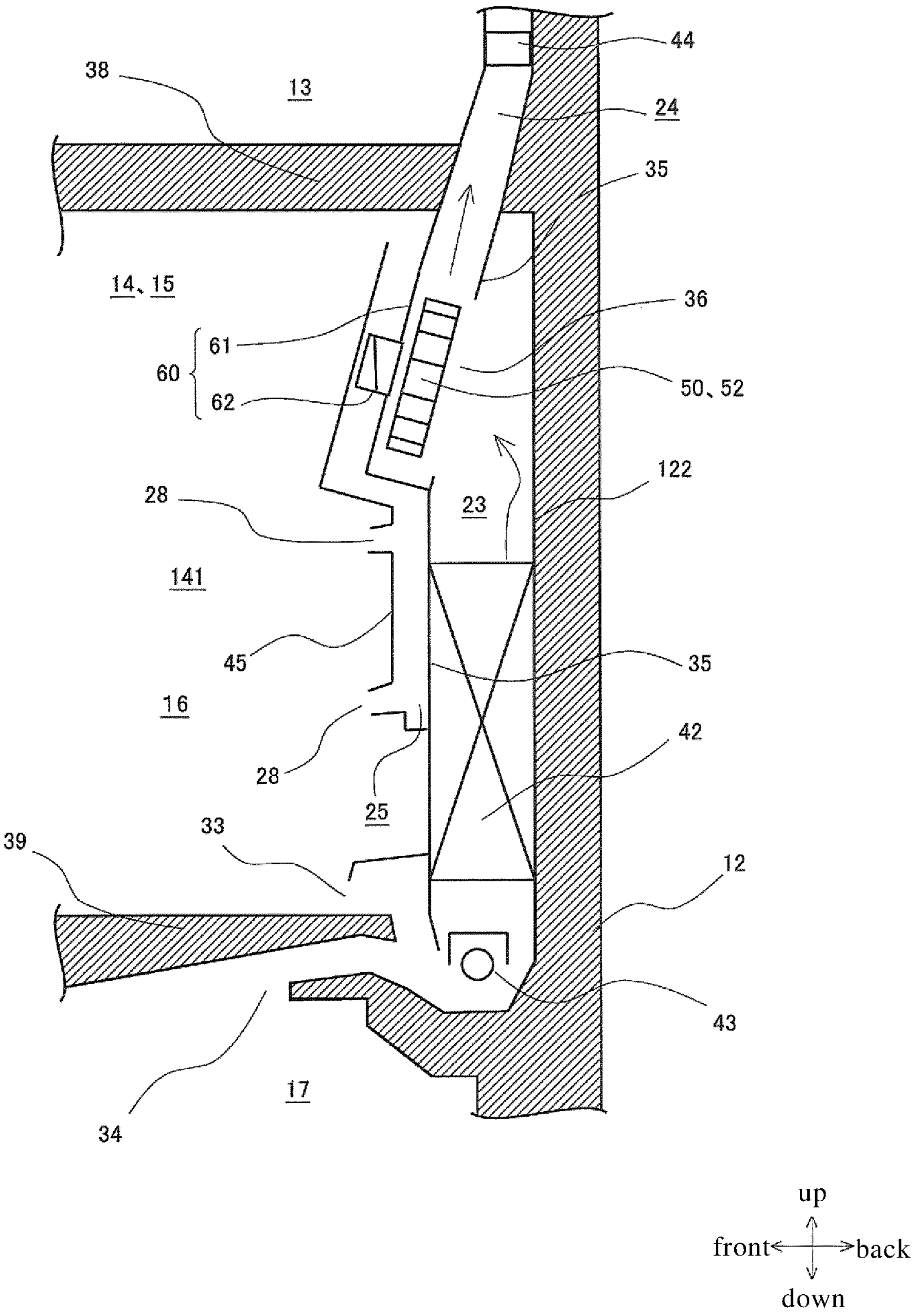
44
13
38
24
35
14、15
36
61
60
62
50、52
122
28
23
141
45
35
16
42
28
25
33
39
12
43
34
17
up
front
back
down

FIG. 5

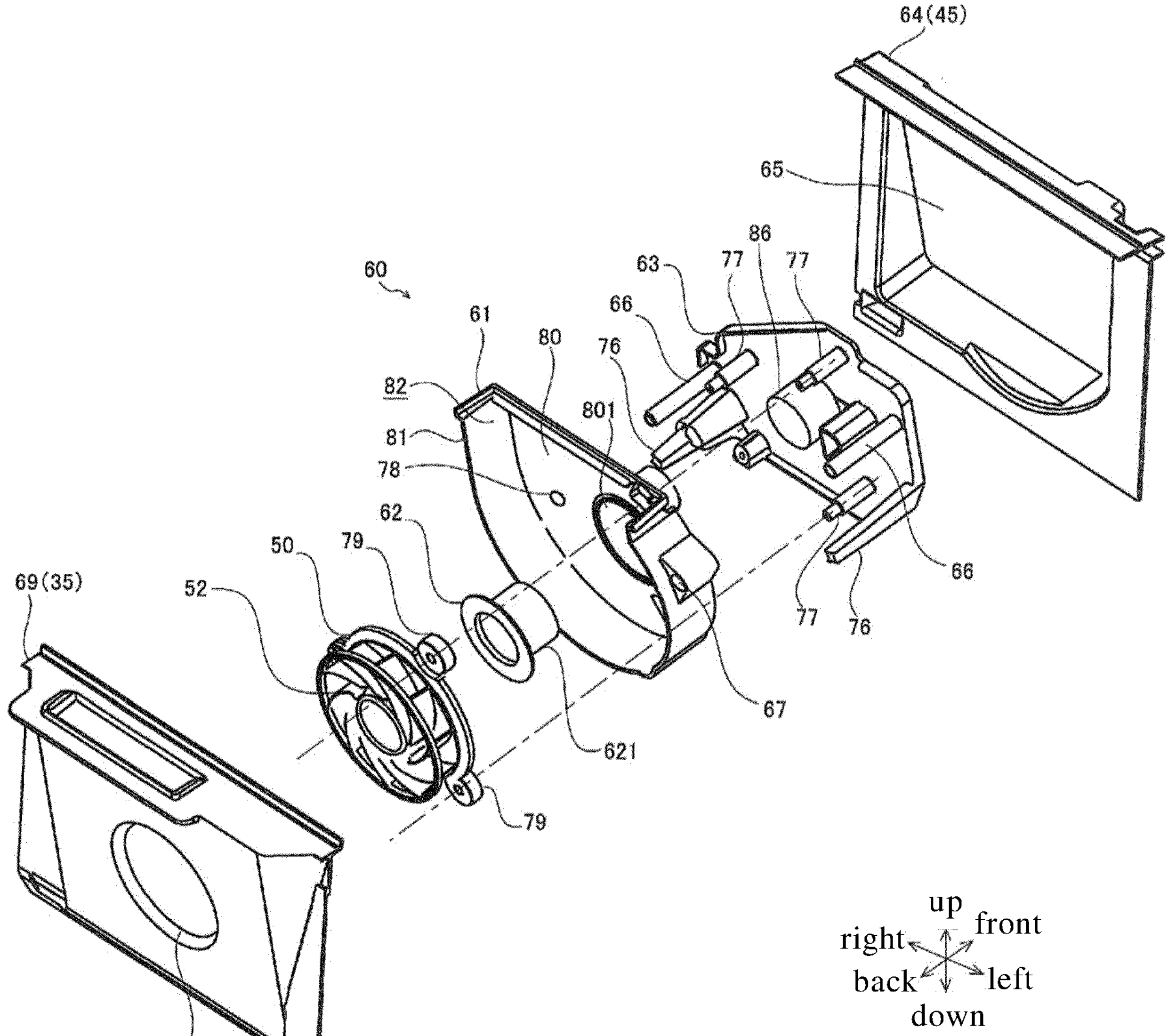
64(45)
65
86
77
77
63
60
66
61
80
76
82
801
81
78
62
79
50
69(35)
52
66
77
76
67
621
79
36
up
front
right
back
left
down

FIG. 6

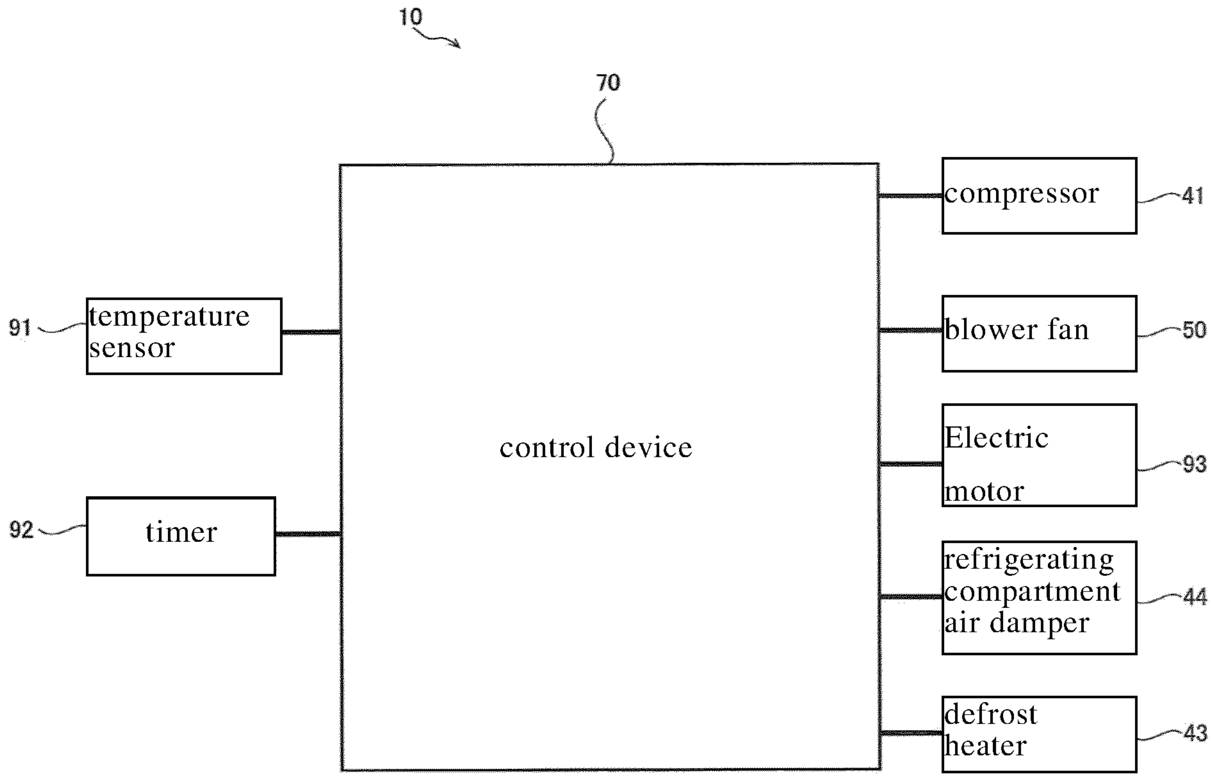
10
70
control device
temperature sensor
91
timer
92
compressor
41
blower fan
50
Electric motor
93
refrigerating compartment air damper
44
defrost heater
43

FIG. 7

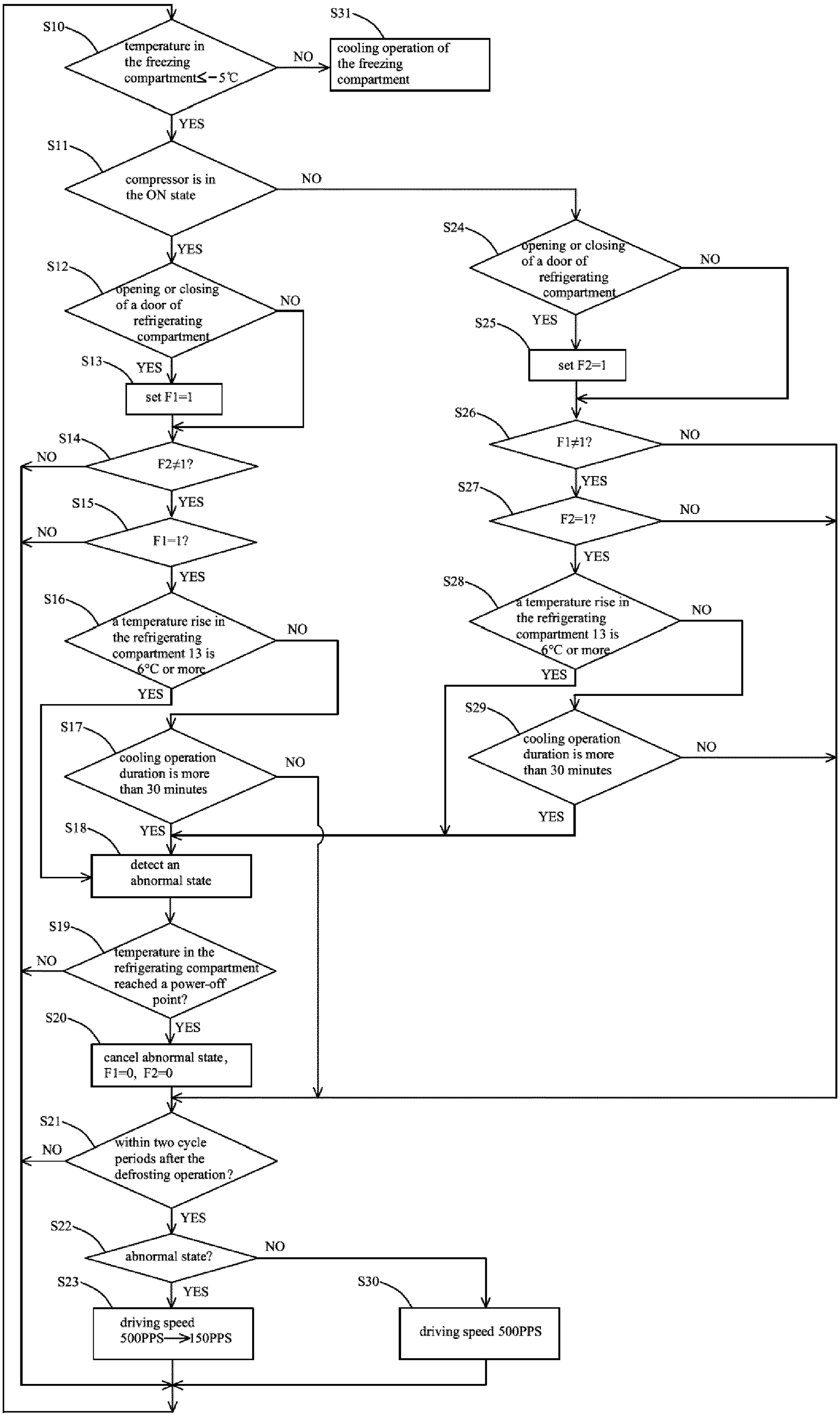
S10
temperature in the freezing compartment≤−5℃
NO
S31
cooling operation of the freezing compartment
YES
S11
compressor is in the ON state
NO
YES
S12
opening or closing of a door of refrigerating compartment
NO
S13
YES
set F1=1
S24
opening or closing of a door of refrigerating compartment
NO
S25
YES
set F2=1
S26
F1≠1?
NO
YES
S27
F2=1?
NO
YES
S28
a temperature rise in the refrigerating compartment 13 is 6°C or more
NO
YES
S29
cooling operation duration is more than 30 minutes
NO
YES
S14
NO
F2≠1?
YES
S15
NO
F1=1?
YES
S16
a temperature rise in the refrigerating compartment 13 is 6°C or more
NO
YES
S17
cooling operation duration is more than 30 minutes
NO
S18
YES
detect an abnormal state
S19
NO
temperature in the refrigerating compartment reached a power-off point?
S20
YES
cancel abnormal state, F1=0, F2=0
S21
NO
within two cycle periods after the defrosting operation?
YES
S22
abnormal state?
NO
S23
YES
driving speed 500PPS⟶150PPS
S30
driving speed 500PPS

FIG. 8

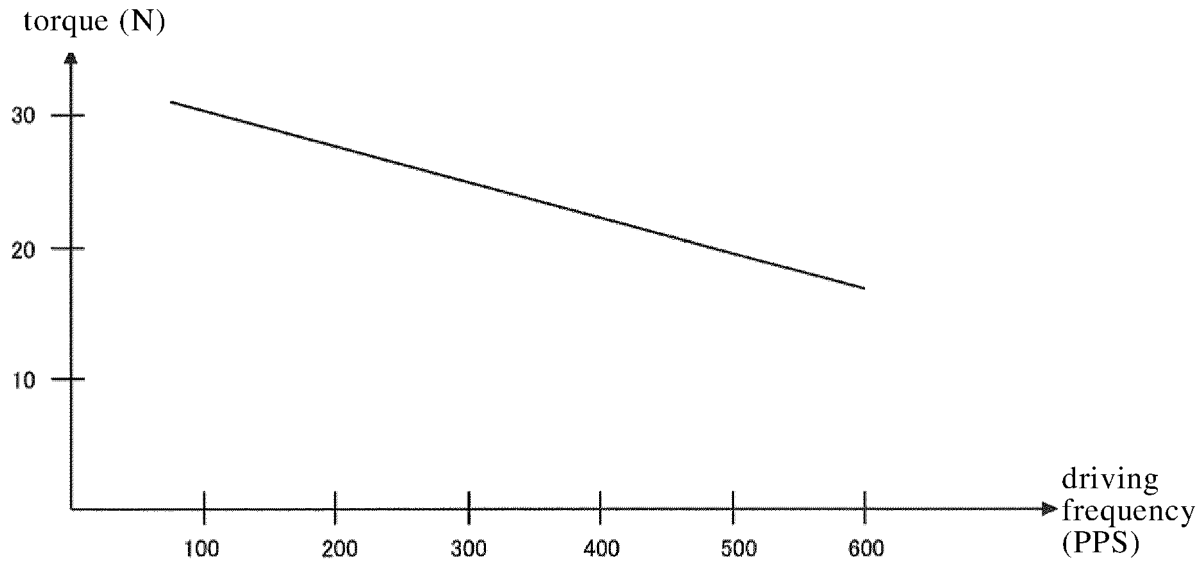
torque (N)
30
20
10
100
200
300
400
500
600
driving frequency (PPS)

FIG. 9

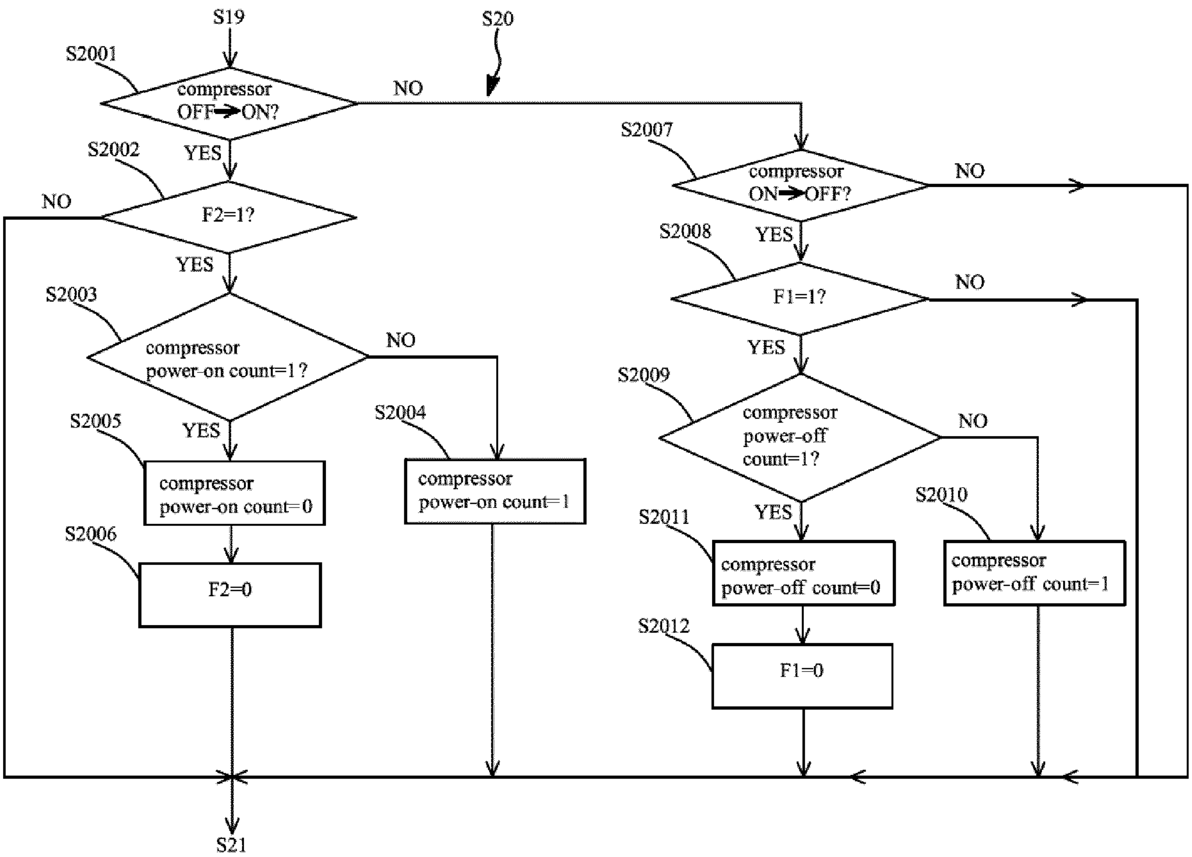
S19
S20
S2001
compressor OFF→ON?
NO
YES
S2002
F2=1?
NO
YES
S2003
compressor power-on count=1?
NO
YES
S2004
compressor power-on count=1
S2005
compressor power-on count=0
S2006
F2=0
S2007
compressor ON→OFF?
NO
YES
S2008
F1=1?
NO
YES
S2009
compressor power-off count=1?
NO
YES
S2010
compressor power-off count=1
S2011
compressor power-off count=0
S2012
F1=0
S21

FIG. 10 (A)

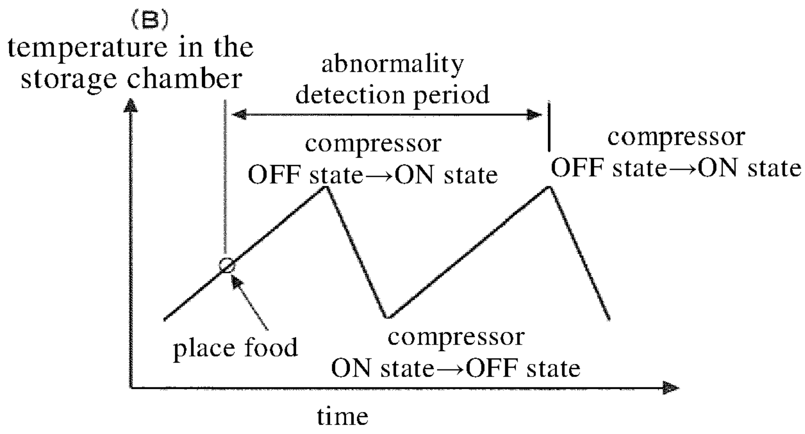

FIG. 10 (B)

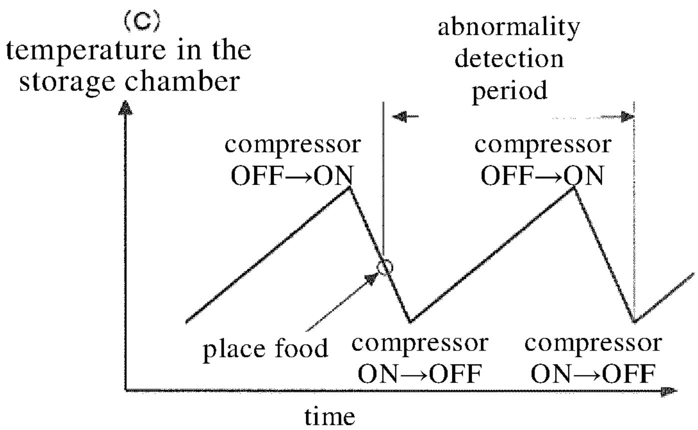

FIG. 10 (C)

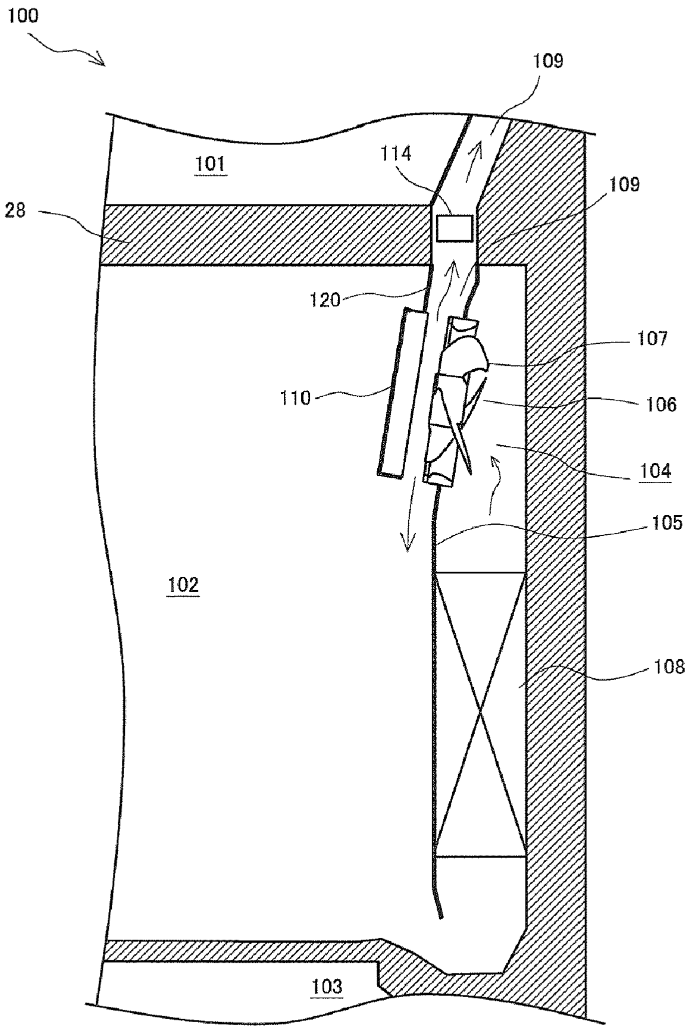
100
109
101
114
109
28
120
107
110
106
104
105
102
108
103

FIG. 11

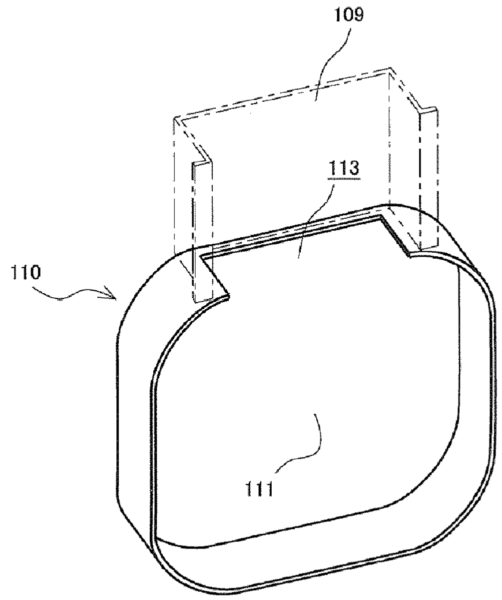
109
113
110
111

FIG. 12

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2018103652 A **[0002]**
- JP 2013002664 A **[0003]**