(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 896 369 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
20.10.2021 Bulletin 2021/42

(21) Application number: **19895386.1**

(22) Date of filing: **04.12.2019**

(51) Int Cl.:
F25D 17/06 *(2006.01)*

(86) International application number:
PCT/CN2019/123013

(87) International publication number:
WO 2020/119550 (18.06.2020 Gazette 2020/25)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **10.12.2018 JP 2018231166**

(71) Applicants:
- **Qingdao Haier Refrigerator Co., Ltd**
  Qingdao, Shandong 266101 (CN)
- **Haier Smart Home Co., Ltd.**
  Qingdao, Shandong 266101 (CN)
- **Aqua Co., Ltd**
  Chiyoda-ku
  Tokyo 100-0005 (JP)

(72) Inventors:
- **TATENO, Takaya**
  Tokyo 103--0012 (JP)
- **TOYOSHIMA, Masashi**
  Tokyo 103--0012 (JP)
- **KOMATSU, Hazime**
  Tokyo 103--0012 (JP)

(74) Representative: **Lavoix**
Bayerstraße 83
80335 München (DE)

(54) REFRIGERATOR

(57) A refrigerator (10) capable of reducing operation noises generated by opening and closing operations of a fan cover. A shielding device (60) of the refrigerator (10) comprises the fan cover (61) covering a blower fan (50) from the outer side of a cooling chamber (23), a drive shaft (62) driving the fan cover (61) to open or close, and an electric motor (93) rotating the drive shaft (62). A control device (70) performs a closing operation for closing an air passage by rotating the drive shaft (62) in one direction to cause the fan cover (61) to approach the fan (50); and the control device performs an opening operation for opening the air passage by rotating the drive shaft (62) in another direction to cause the fan cover (61) to move away from the blower fan (50). Moreover, the control device (70) performs, during a termination period of the closing operation or opening operation, a silence operation to reduce operation noises caused by the operation of the electric motor (93).

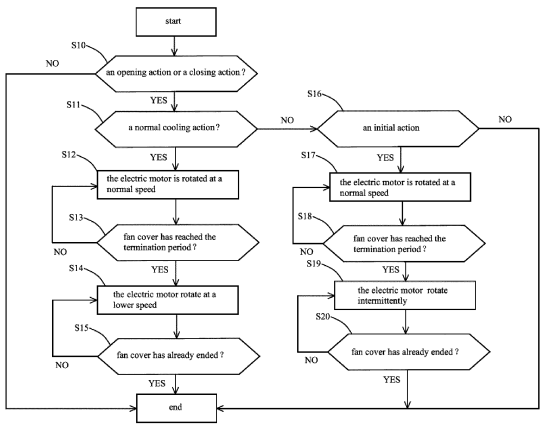

FIG. 8

EP 3 896 369 A1

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 block 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.

(Prior art document)

(Patent document)

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

[0004] FIG. 14 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. 15. 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. 14, 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 the refrigerator 100 having the above structure, there exists a problem that a large action sound is generated along with the opening/closing action of the fan cover 110.

[0010] Specifically, referring to FIG. 14, when the fan cover 110 performs a closing action for the opening 106, the fan cover 110 is moved rearward by a driving force of an electric motor not shown in the figure here. At this time, when a rear end of the fan cover 110 abuts against the partition wall 105, a large action sound might be generated.

[0011] In addition, when the fan cover 110 performs an opening action for the opening 106, the fan cover 110 is moved forward by the driving force of the electric motor. When a front end of the fan cover 110 abuts against another member, a large action sound might be generated accompanying the abutment.

[0012] Furthermore, when the closing act is applied to the fan cover 110, an overstep action further rotating the electric motor is sometimes further performed after the rear end of the fan cover 110 abuts against the partition wall 105. Upon the overstep, parts configured around the fan cover 110 resonates with the electric motor, thereby causing an issue that a large noise will be generated. The issue occurs when the fan cover 110 performs an opening action.

[0013] In view of the above, it is necessary to improve the existing refrigerators to solve the above problem.

SUMMARY

[0014] An object of the present invention is to provide a refrigerator capable of reducing an action sound generated accompanying an opening and closing action of the fan cover.

[0015] To achieve the above-mentioned objects, the present invention provides a refrigerator comprising a cooler of a freezing loop, the cooler being configured to cool air supplied via an air supply passageway to a storage chamber; a cooling chamber equipped with the cooler and formed with an air supply port communicated with

the storage chamber; a blower fan configured to feed the air supplied through the air supply port to the storage chamber; a shielding device at least partially blocking the air supply port; and a control device configured to control acts of the freezing loop, the blower fan and the shielding device, the shielding device comprises: a fan cover configured to cover the blower fan from the outside of the cooling chamber; a drive shaft configured to drive the fan cover to open and close; a screw mechanism formed between the drive shaft and the fan cover; and an electric motor configured to rotate the drive shaft, the control device causes the fan cover to approach the blower fan by rotating the drive shaft in one direction, to perform a closing action to close the air passageway, the control device moves the fan cover away from the blower fan by rotating the drive shaft in another direction, to perform an opening action of opening the air passageway, the control device performs a silent action during a termination period of the closing action or the opening action, the silent action reducing the action sound caused by the action of the electric motor.

[0016] Thus, according to the refrigerator of the present invention, when the closing action or the opening action of the fan cover is performed, the noise generated from the shielding device can be reduced by performing the silent action during the termination period thereof.

[0017] As a further improvement of the present invention, the silent action is an action of making a rotation speed of the electric motor become a low speed.

[0018] Thus, according to the refrigerator of the present invention, the noise generated from the shielding device can be reduced by making the rotation speed of the electric motor become a low speed during the termination period.

[0019] As a further improvement of the present invention, in the silent action, the rotation speed of the electric motor is made become be half or less of a normal opening and closing action.

[0020] Thus, according to the refrigerator of the present invention, the noise generated from the shielding device can be further reduced by making the rotation speed of the electric motor half or less during the termination period.

[0021] As a further improvement of the present invention, the silent action is an action of making the electric motor rotate intermittently.

[0022] Thus, according to the refrigerator of the present invention, when the closing action or opening action of the fan cover is performed, the noise generated from the shielding device can be reduced by making the electric motor act intermittently during the termination period.

[0023] As a further improvement of the present invention, during a cooling operation, the control device makes the rotation speed of the electric motor become a low speed during the termination period of the closing action or the opening action, to achieve the silent action, during performing the initial action, the control device makes the electric motor rotate intermittently during the termination period of the closing action or the opening action to achieve the silent action.

[0024] Thus, according to the refrigerator of the present invention, when the fan cover is opened and closed during the normal cooling operation of the refrigerator, the noise generated from the shielding device can be reduced by making the electric motor run at a low speed during the termination period. In addition, when the initial action for detecting the position of the fan cover is performed, the action sound generated accompanying the initial action is reduced by making the electric motor rotate intermittently during the termination period of the closing action or the opening action.

[0025] An advantageous effect of the present invention is that when the refrigerator of the present invention performs the closing action or opening action of the fan cover, the noise generated from the shielding device can be reduced by performing a silent action during the termination period thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

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 (A) is a cross-sectional view of an opening action of the shielding device.

FIG. 9 (B) is a cross-sectional view of a closing action of the shielding device.

FIG. 10 is a graph showing a relationship between the number of steps and a rotation speed of an electric motor when a lower-speed action is performed as a silent action in the opening/closing action of the shielding device of the refrigerator according to the present invention.

FIG. 11(A) to FIG. 11(B) are graphs showing characteristics when an intermittent action is performed

as a silent action in the opening/closing action of the shielding device of the refrigerator according to the present invention, wherein FIG. 11(A) shows a relationship between the number of steps and the rotation speed of the electric motor, and FIG. 11(B) shows a relationship between an elapsed time and the rotation speed of the electric motor.

FIG. 12 (A) to FIG. 12 (B) are graphs showing an effect of the shielding device according to the present invention, wherein FIG. 12(A) shows a magnitude of an action sound accompanying an overstep action of a shielding device according to an embodiment of the present invention, and FIG. 12(B) shows a magnitude of an action sound accompanying an overstep action of the shielding device according to the present invention.

FIG. 13(A) to FIG. 13(B) are graphs showing the effect of the shielding device according to the present invention, wherein FIG. 13(A) is a graph showing the magnitude of the action sound accompanying the opening/closing action of the shielding device according to a comparative example, and FIG. 13(B) is a graph showing the magnitude of the action sound accompanying the opening/closing action of the shielding device according to the present invention.

FIG. 14 is a side sectional view of a conventional refrigerator described in the Background Art.

FIG. 15 is a perspective view of a fan cover used in a conventional refrigerator described in the Background Art.

[0027] Parts designated by reference numerals

10 refrigerator

12 Heat-insulating cabinet

121 outer box

122 inner box

123 heat-insulating material

13 Refrigerating compartment

14 Ice-making room

141 Freezing compartment

15 Upper freezing compartment

16 Lower freezing compartment

17 Vegetable compartment

18 Heat-insulating door

181 Heat-insulating door

182 Heat-insulating door

19 Heat-insulating door

20 Heat-insulating door

21 Heat-insulating door

22 Heat-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 port

33 Air return port

34 Air return port

35 Partition member

36 Air supply port

37 Partition member

38 Heat-insulating partition wall

39 Heat-insulating 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 Drive 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

[0028] In order 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.

[0029] 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.

[0030] 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.

[0031] 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.

[0032] 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.

[0033] 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.

[0034] 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.

[0035] 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.

[0036] 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.

[0037] 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.

[0038] 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.

[0039] 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.

[0040] 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.

[0041] 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.

[0042] 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.

[0043] 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 com-

partment 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.

[0044] 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. A surface of the fan cover 61 facing the blower fan 50 is formed into a substantially concave shape. Thereby, the fan cover 61 can 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.

[0045] Furthermore, the fan cover 61 is driven by a drive shaft 62 disposed on the side of the partition member 45 to move in a front-rear direction. Specifically, during the opening action, the electric motor 93 and the drive shaft 62 rotate in one direction based on an instruction from the control device 70 described later, so that the fan cover 61 moves in a direction away from the blower fan 50, i.e., moves forward. As a result, the air supply port 36 will not be shielded, and an air passageway for cold air is formed between the fan cover 61 and the partition member 45. Thereby, 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.

[0046] In addition, as shown in FIG. 5, in the closing action, the electric motor 93 and the drive shaft 62 rotate in the other direction based on an instruction from the control device 70 described later, so that the fan cover 61 moves in a direction closer to the blower fan 50, i.e., moves backward. As a result, the air supply port 36 is blocked, and the air passageway through which cold air flows in the upper-layer freezing compartment 15 is blocked. On the other hand, in this state, through the opening formed in the upper portion of the fan cover 61, the cold air is sent out through the refrigerating compartment air supply passageway 24 to the refrigerating compartment 13.

[0047] 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.

[0048] 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.

[0049] 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.

[0050] 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 drive 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 drive 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.

[0051] 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.

[0052] The support base 63 is formed with a substan-

tially 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.

[0053] 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.

[0054] 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.

[0055] The support base 63 is mounted with a drive shaft 62 for moving the fan cover 61 in the front-rear direction. The drive shaft 62 is rotatably supported by a shaft support portion 86 formed on the support base 63.

[0056] The drive 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 drive 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 drive shaft 62. In addition, an electric motor 93 (not shown) is built in the shaft support portion 86 of the support base 63, and the drive shaft 62 rotates by a predetermined angle based on the driving force of the electric motor 93. If the drive 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 drive 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.

[0057] 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.

[0058] 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.

[0059] 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.

[0060] 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.

[0061] The compressor 41 compresses a refrigerant used in the freezing loop in accordance with an instruction from the control device 70 as described above.

[0062] 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.

[0063] The electric motor 93 rotates the drive 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.

[0064] 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.

[0065] 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.

[0066] Based on FIG. 8, FIG. 9, FIG. 10 and FIGS. 11(A) and 11(B), referring to the above-mentioned figures, a control method for reducing an action sound accompanying the opening and closing operation of the fan cover 61 will be described in the present embodiment. FIG. 8 is a flowchart showing a method of controlling the opening and closing of the fan cover 61. FIG. 9(A) is a cross-sectional view showing the shielding device 60 upon completion of the opening act, and FIG. 9(B) is a cross-sectional view showing the shielding device 60 upon completion of the closing action. FIG. 10 is a graph showing a relationship between the number of steps and the rotation speed of the electric motor 93. FIG. 11(A) is a graph showing the number of steps and the number of revolutions of the electric motor 93 in a case where the opening and closing action of the fan cover 61 is performed. FIG. 11(B) is a graph showing a relationship between an operation time and the number of revolutions of the electric motor 93 in an intermittent action.

[0067] First, the outline of the control method of the present embodiment will be described. As described with reference to FIG. 5, when the closing action of blocking

the air passageway with the fan cover 61 is performed, the electric motor 93 is used to rotate the drive shaft 62 in one direction, and the fan cover 61 is moved backward. The peripheral edge portion of the fan cover 61 abuts against the partition member 35 around the air supply port 36, and an air passageway connected to the freezing compartment air supply passageway 25 from the air supply port 36 is shielded. At this time, when the fan cover 61 abuts against the partition member 35, a loud abutting sound may occur, and the user may feel uncomfortable with the abutting sound. In addition, when the electric motor 93 is operating, noise might also occur due to the resonance of members provided around the electric motor 93.

[0068] To this end, in the present embodiment, a silent action is performed during a termination period of the closing operation of the fan cover 61.

[0069] Here, the termination period refers to a period from just before the fan cover 61 abuts against another member until the electric motor 93 stops during the opening and closing action of the fan cover 61. Therefore, in the case of performing an overstepping action described later, the termination period refers to a period from immediately before the fan cover 61 abuts against another member to the end of the overstepping action. As an example, referring to FIG. 10, in a case where the opening and closing act is 1940 steps as a whole, the period from step 0 to step 1750 is a period in which the normal opening and closing action is performed, and the period from step 1751 to step 1940 is the termination period.

[0070] In addition, as the silent action, there are a low-speed action described later with reference to FIG. 10 and an intermittent action described later with reference to FIGS. 11(A) and 11(B). By performing the silent action, it is possible to reduce the action sound generated by the rotation of the electric motor 93, and to reduce the discomfort felt by the user.

[0071] In addition, this matter is also the same in the opening action of the fan cover 61 shown in FIG. 4. That is, by rotating the electric motor 93 and the drive shaft 62 in a direction opposite to the above, the fan cover 61 is moved away from the blower fan 50 so that the air passageway becomes an opened state. The following silent action is performed to reduce the noise generated at this time.

[0072] Referring to FIG. 8, specifically, first, in step S10, the control device 70 judges whether the fan cover 61 is performing an opening action or a closing action. If the fan cover 61 is performing an opening action or a closing action, that is, if step S10 is "YES", the control device 70 turns to step S11. On the other hand, if the fan cover 61 is not performing an opening action or a closing action, that is, if step S10 is "NO", the control device 70 ends without performing the silent action.

[0073] In step S11, the control device 70 judges whether a normal cooling action is being performed. Here, the normal cooling action refers to an action that, referring to FIG. 2, based on the instruction of the control device 70, the blower fan 50 sends the cold air inside the cooling chamber 23 cooled by the cooler 42 to each storage chamber, thereby cooling each storage chamber to a given cooling temperature range.

[0074] If the normal cooling action is being performed, that is, if step S11 is "YES", the control device 70 proceeds to step S12. On the other hand, if the normal cooling action is not performed, that is, if step S11 is "NO", the control device 70 proceeds to step S16.

[0075] In step S12 through step S15, the control device 70 performs a low-speed action as the aforementioned silent action.

[0076] Specifically, first, in step S12, the electric motor 93 is rotated at a normal speed, so that the fan cover 61 is moved at a relatively high speed.

[0077] Here, the rotation speed of the electric motor will be described with reference to the graph of FIG. 10. In the present embodiment, the opening and closing action of the fan cover 61 comprises a normal opening and closing action and a low-speed action during the termination period. The normal opening and closing action in step S12 is, for example, an action in the period from step 0 to step 1,750, and the number of revolutions of the electric motor 93 is set to 500 PPS. The opening and closing action of the fan cover 61 can be performed quickly by setting the rotation speed of the electric motor 93 in the normal opening and closing action to 500 PPS.

[0078] In step S13, the control device 70 judges whether the fan cover 61 has reached the termination period. Specifically, referring to FIG. 10, if the number of steps of the electric motor 93 reaches 1750 steps, the control device 70 judges that the fan cover 61 has reached the termination period. On the other hand, if the number of steps of the electric motor 93 is 1750 steps or less, the control device 70 judges that the fan cover 61 has not reached the termination period.

[0079] If the fan cover 61 reaches the termination period, that is, if step S13 is "YES", the control device 70 turns to step S14. On the other hand, if the fan cover 61 has not reached the termination period, that is, if step S13 is "NO", the control device 70 returns to step S12 to rotate the electric motor 93 at a normal speed, and continues to perform the normal opening and closing action of the fan cover 61.

[0080] In step S14, during the termination period of the opening and closing action, the electric motor 93 is made rotate at a lower speed. Referring to FIG. 10, the low-speed action as the silent operation here is, for example, an action during the period from step 1751 to step 1940. In addition, the rotation speed of the electric motor 93 in the low-speed action is set to half or less of the rotation speed of the electric motor 93 in the normal opening and closing action, for example, 250 PPS. By reducing the number of revolutions of the electric motor 93, it is possible to suppress the resonance of the fan cover 61 and surrounding members thereof due to vibration generated by the electric motor 93, and to suppress the generation of a large action noise.

[0081] In step S15, the control device 70 judges whether the opening action or the closing action of the fan cover 61 has ended.

[0082] Step S15 will be described with reference to FIG. 9. Referring to FIG. 9(A), in the opening action of the fan cover 61, the screw groove of the fan cover 61 moves to the end of the thread of the drive shaft 62, so that the opening action ends. Alternatively, it may be arranged that the front end of the fan cover 61 abuts against the support base 63, so that the opening action ends. In this state, the air passageway from the blower fan 50 to the freezing compartment 141 is not closed by the fan cover 61, and becomes an open state.

[0083] Referring to FIG. 9(B), in the closing action of the fan cover 61, a rear end portion of the fan cover 61 is made contact the partition member 35, so that the closing action ends. In this state, the air passageway from the blower fan 50 to the freezing compartment 141 is closed by the fan cover 61.

[0084] If the fan cover 61 abuts against another member, that is, if step S15 is "YES", the control device 70 stops the electric motor 93 and ends the opening and closing action of the fan cover 61. On the other hand, if the fan cover 61 does not abut against another member, that is, if step S15 is "NO", the control device 70 returns to step S14 to enable the electric motor 93 to rotate at a low speed and continue the opening and closing action of the fan cover 61.

[0085] Here, the situation of performing an overstepping action will be described. Referring to FIG. 10, the fan cover 61 abuts against another member, for example, the number of steps of electric motor reaches 1840 steps. From step 1750 to step 1840, the control device 70 causes the fan cover 61 to perform a silent action while performing the opening and closing action. After that, from step 1841 to step 1940, the control device 70 performs an overstep action of further rotating the electric motor 93 in the same direction so far, in a state that the fan cover 61 abuts against another member. If the number of steps of the electric motor reaches 1940 steps, the control device 70 stops the electric motor 93. The fan cover 61 can be opened and closed more reliably by performing the overstep action.

[0086] In step S16 to step S20, an intermittent action is performed as the aforementioned silent action.

[0087] Specifically, first, in step S16, the control device 70 judges whether an initial action has been performed. Here, the initial action refers to an action of recognizing the position of the fan cover 61 by moving the fan cover 61 to a front end or a rear end with reference to FIG. 5. For example, the initial action is performed when the refrigerator 10 is powered on.

[0088] If the initial action has been performed, that is, if step S16 is "YES", the control device 70 turns to step S17. On the other hand, if the initial action has not been performed, that is, if step S16 is "NO", the control device 70 completes the action.

[0089] In step S17, by rotating the electric motor 93 at a normal speed, the blower cover 61 is moved at a relatively high speed. Here, as in step S12 described above, during the period from step 0 to step 1750, the number of revolutions of the electric motor 93 is set to 500 PPS.

[0090] In step S18, the control device 70 judges whether the fan cover 61 has reached the termination period. Specifically, referring to FIG. 11(A), when the number of steps of the electric motor 93 reaches 1750 steps, the control device 70 judges that the electric motor 93 has reached the termination period.

[0091] If the fan cover 61 reaches the termination period, that is, if step S18 is "YES", the control device 70 turns to step S19. On the other hand, if the fan cover 61 has not reached the termination period, that is, if step S18 is "NO", the control device 70 returns to step S17 of rotating the electric motor 93 at the normal speed, and continuing the normal opening and closing action of the fan cover 61.

[0092] In step S19, the electric motor 93 is made rotate intermittently during the termination period of the opening and closing action. This intermittent action will be described with reference to FIG. 11(A) and FIG. 11(B).

[0093] As shown in FIG. 11(A), here, the normal opening and closing action is performed from step 0 to step 1750, and the intermittent action is performed from step 1751 to step 1940.

[0094] As shown in FIG. 11(B), in the intermittent action, the electric motor 93 rotates intermittently at a given time interval. Specifically, after the electric motor 93 rotates at 500 PPS for 10 steps, the electric motor 93 stops for 10 msec. In step S19, the intermittent action is performed repeatedly. By performing this intermittent operation, it is possible to suppress the resonance of the fan cover 61 and surrounding members thereof due to vibration generated by the electric motor 93, and to suppress the generation of a large action noise.

[0095] In step S20, the control device 70 judges whether the opening action or the closing action of the fan cover 61 has already ended. In step S20, the same action as the above-mentioned step S15 is performed.

[0096] If the opening action or closing action of the fan cover 61 ends, that is, if the step S20 is "YES", the control device 70 stops the electric motor 93 and ends the opening and closing action of the fan cover 61. On the other hand, if the opening action or closing action of the fan cover 61 has not ended, i.e., if step S20 is "NO", the control device 70 returns to step S19 to make the electric motor 93 rotate intermittently and continue the opening and closing action of the fan cover 61 .

[0097] The above is the depictions of the action of the refrigerator 10 according to the present embodiment.

[0098] Hereinafter, the effect of the refrigerator 10 according to the above-mentioned present embodiment will be described.

[0099] In the present embodiment, during the termination period, the action sound generated upon the overstep action can be reduced. This effect will be described with reference to FIG. 12(A) and FIG. 12(B). In FIG. 12(A)

and FIG. 12(B), a horizontal axis represents an elapsed time, and a vertical axis represents a magnitude of the action sound. Furthermore, in FIG. 12(A) and FIG. 12(B), the magnitude of the action sound measured in the back is shown with a solid line, and the magnitude of the action sound measured in the front is shown with a dotted line.

[0100] FIG. 12(A) shows the action sound generated when the overstep action is performed without the silent action. It is apparent from this figure a maximum action sound of about 35dB is produced accompanying the overstep action.

[0101] FIG. 12(B) shows a case where the overstep action is performed while the intermittent action is performed as the above-mentioned silent action. It is apparent from this figure a maximum action sound of about 25dB is produced accompanying the overstep action.

[0102] As known from the above depictions, the action sound caused by the overstep action can be reduced by about 5dB to 15dB by performing intermittent action as the silent action. Thereby, the user's comfort when the refrigerator 10 is performing a cooling operation can be improved.

[0103] An effect of the refrigerator 10 will be further detailed with reference to FIG. 13. FIG. 13(A) shows the action sound generated by the shielding device 60 in a case where the silent action is not performed, i.e., a case where the rotation speed of the electric motor 93 is not reduced during the termination period of the opening and closing action of the fan cover 61. FIG. 13(B) shows the action sound generated from the shielding device 60 when the low-speed action or the intermittent action is performed during the termination period of the opening and closing action of the fan cover 61. Here, the shielding device 60 continuously performs the opening and closing action, and the action sound generated by the opening and closing action is measured in the vicinity of the shielding device 60. In the graphs shown in FIG. 13(A) and FIG. 13(B), the horizontal axis represents the elapsed time, and the vertical axis represents the magnitude of the action sound generated by the shielding device 60.

[0104] Referring to FIG. 13(A), in a comparative example in which the silent action is not performed, the action sound becomes a maximum value upon completion of the opening and closing action, and specifically, the action sound of 50 to 60 dB is generated. Here, dotted-line circles surround peaks of the generated sound. Regarding this, it is believed that the reason is that during the termination period of the opening and closing action, a resonance phenomenon occurs between the electric motor and its surrounding components.

[0105] Referring to FIG. 13(B), a maximum value of the action sound generated by the shielding device 60 of the present invention is 40 dB to 50 dB. As a result, as compared with the comparative example shown in FIG. 13(A), in the present embodiment, the action sound is reduced. In this regard, it is believed that the reason is that during the termination period of the opening and closing action, the resonance phenomenon between the electric motor and its surrounding components is prevented by performing the silent action.

[0106] The present invention is not limited to the above-mentioned embodiment, and various modifications can be implemented without departing from the scope of the spirit of the present invention.

[0107] For example, referring to FIG. 8, in step S15 and step S20, if the fan cover 61 abuts against another member, the opening and closing action is completed. However, it is also possible that the overstep action of making the electric motor 93 rotate is performed after the fan cover 61 abuts against another member. The opening and closing action can be performed more reliably by performing the overstep action. Thereby, the air passageway can be opened and closed reliably in the normal cooling action, and the initial position of the fan cover 61 can be accurately detected in the initial action.

[0108] In addition, as described above, the low-speed action is performed as the silent action in the case of the normal cooling operation, and the intermittent action is performed as the silent action in the case of the initial action. However, it is also possible to perform the intermittent action as the silent action in the case of normal cooling operation, and perform the low-speed operation as the silent action in the case of the initial action.

[0109] 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 spirit and scope of the technical solutions of the present invention.

Claims

1. A refrigerator, wherein the refrigerator comprises:

a cooler of a freezing loop, the cooler being configured to cool air supplied via an air supply passageway to a storage chamber;
a cooling chamber equipped with the cooler and formed with an air supply port communicated with the storage chamber;
a blower fan configured to feed the air supplied through the air supply port to the storage chamber;
a shielding device at least partially blocking the air supply port; and
a control device configured to control acts of the freezing loop, the blower fan and the shielding device,
the shielding device comprises: a fan cover configured to cover the blower fan from the outside of the cooling chamber; a drive shaft configured to drive the fan cover to open and close; a screw

mechanism formed between the drive shaft and the fan cover; and an electric motor configured to rotate the drive shaft,
the control device causes the fan cover to approach the blower fan by rotating the drive shaft in one direction, to perform a closing action to close the air passageway,
the control device moves the fan cover away from the blower fan by rotating the drive shaft in another direction, to perform an opening action of opening the air passageway,
the control device performs a silent action during a termination period of the closing action or the opening action, the silent action reducing the action sound caused by the action of the electric motor.

2. The refrigerator according to claim 1, wherein the silent action is an action of making a rotation speed of the electric motor become a low speed.

3. The refrigerator according to claim 2, wherein in the silent action, the rotation speed of the electric motor is made become be half or less of a normal opening and closing action.

4. The refrigerator according to claim 1, wherein the silent action is an action of making the electric motor rotate intermittently.

5. The refrigerator according to claim 1, wherein during a cooling operation, the control device makes the rotation speed of the electric motor become a low speed during the termination period of the closing action or the opening action, to achieve the silent action,
upon performing the initial action, the control device makes the electric motor rotate intermittently during the termination period of the closing action or the opening action to achieve the silent action.

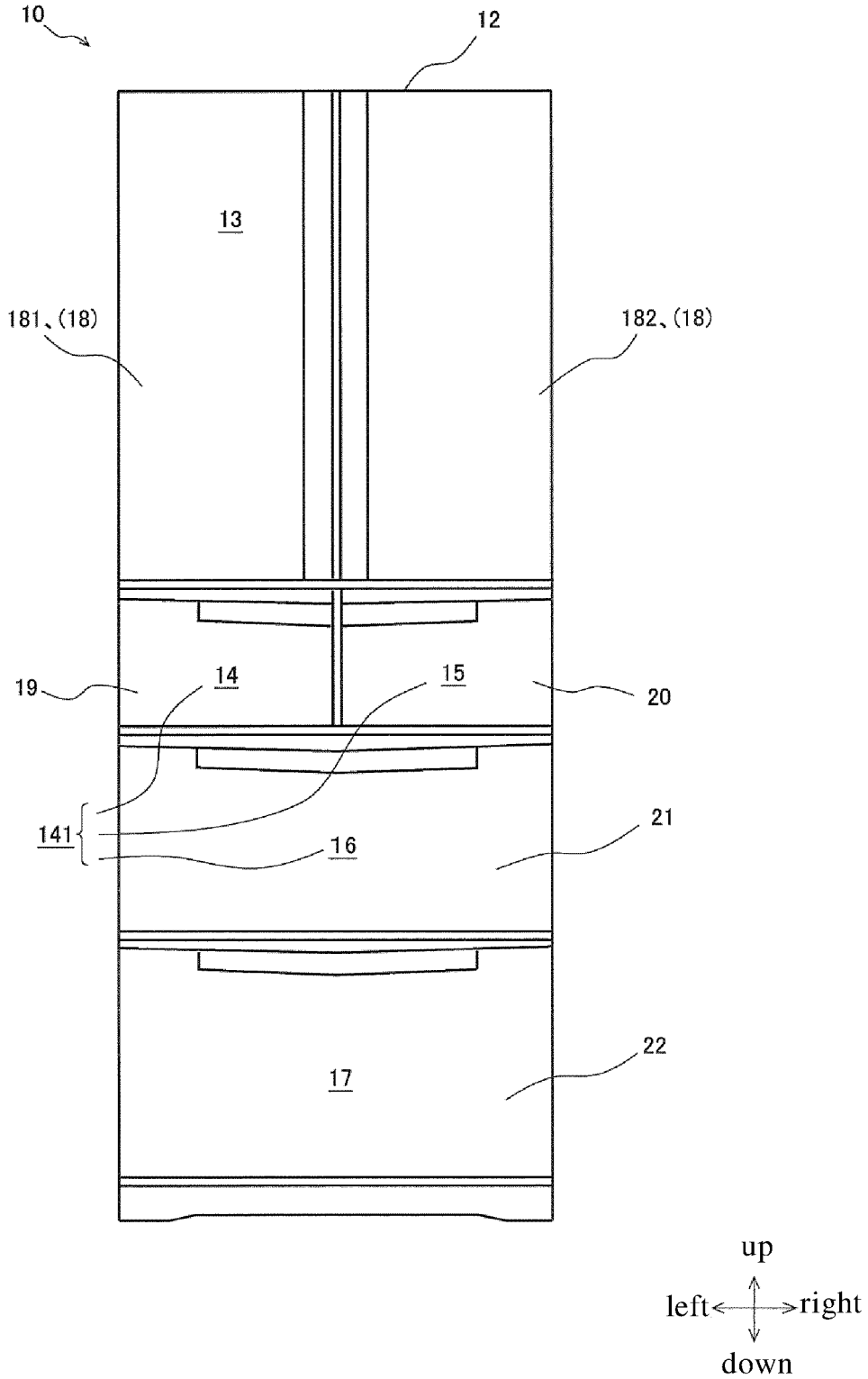
10
12
13
181、(18)
182、(18)
19
14
15
20
141
16
21
17
22
up
left
right
down

FIG. 1

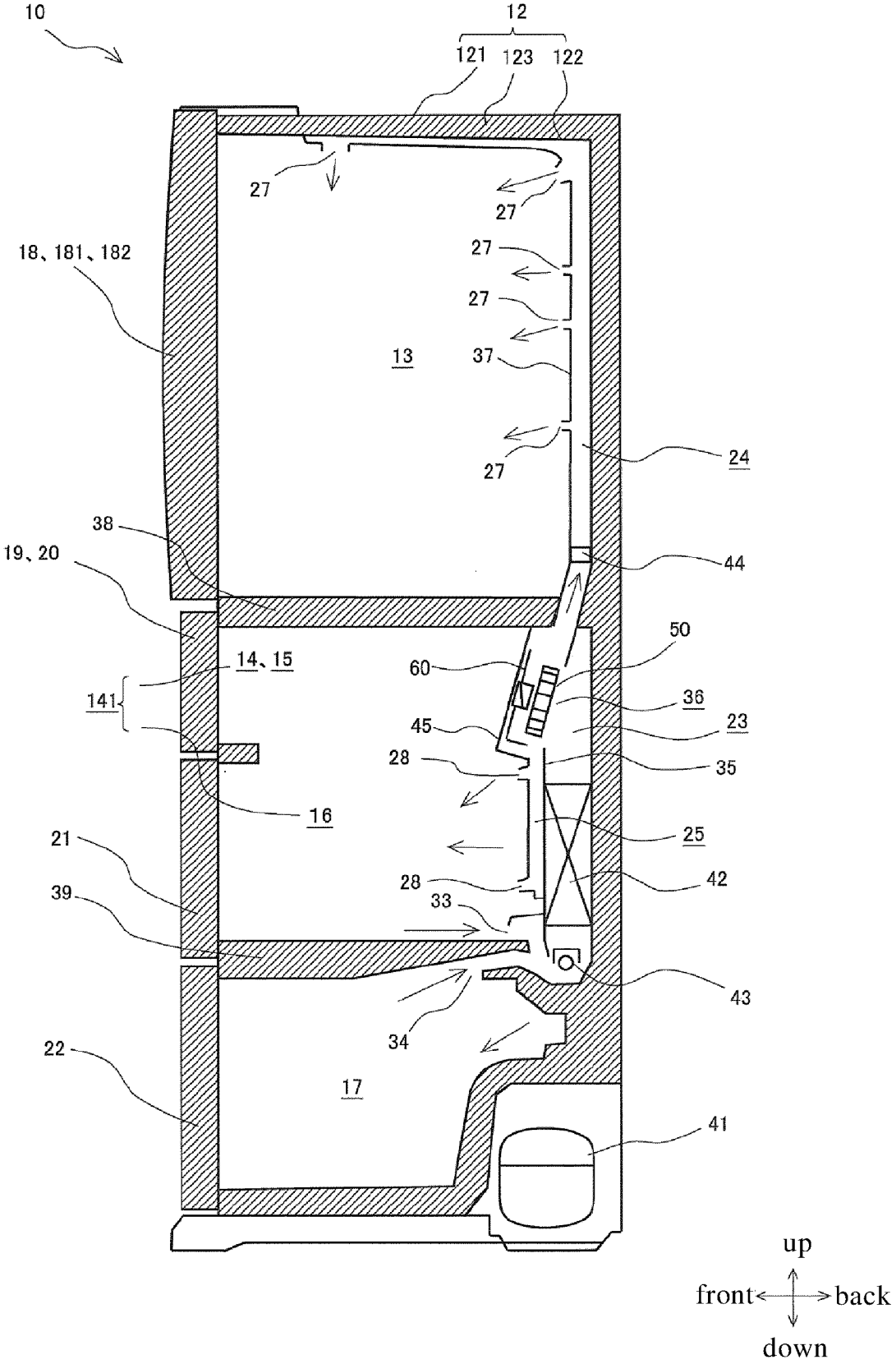
10
12
121
123
122
27
27
27
27
27
27
18、181、182
13
37
24
38
19、20
44
50
14、15
60
36
141
45
23
28
35
16
25
21
28
42
39
33
43
34
22
17
41
up
front
back
down

FIG. 2

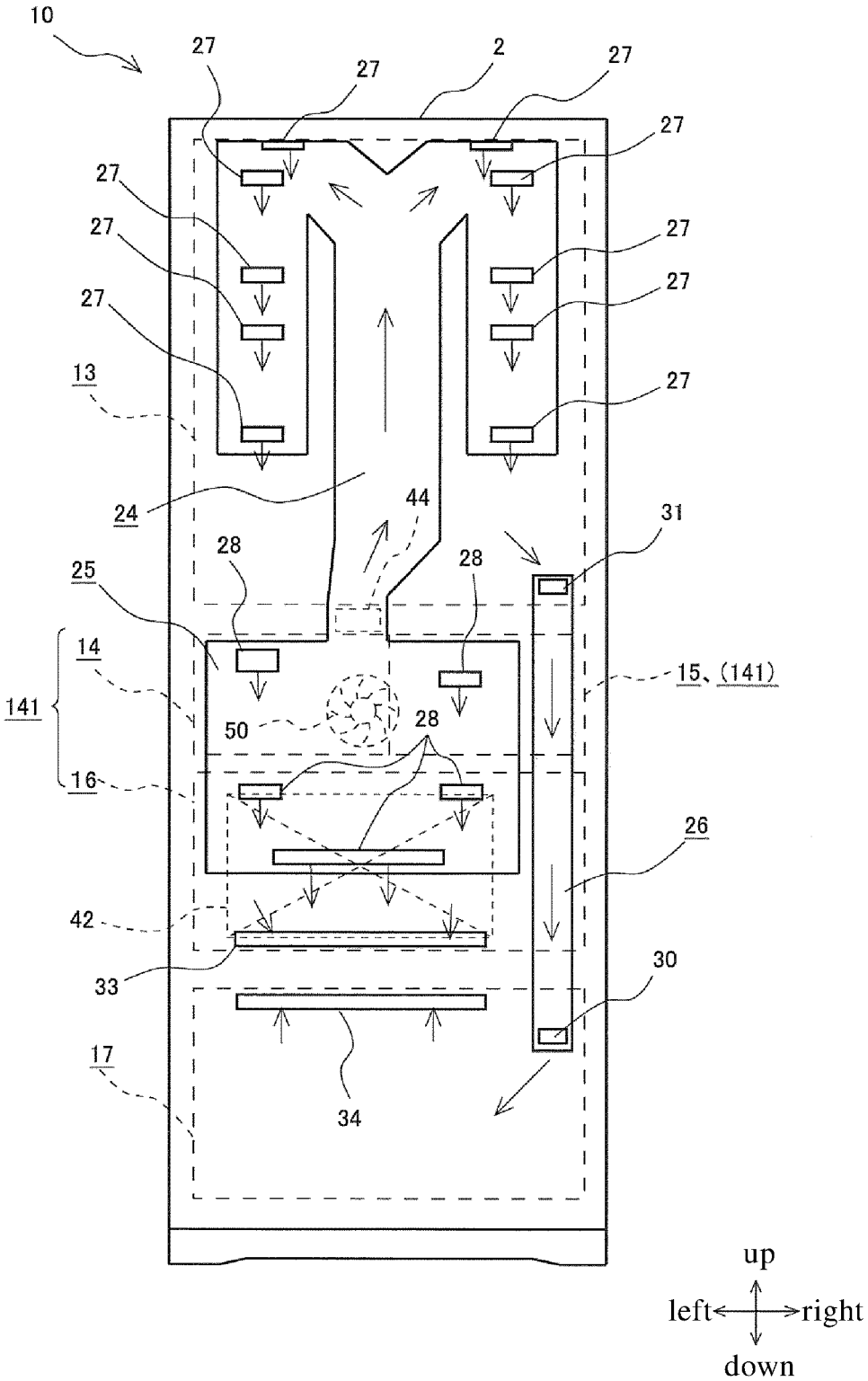
10
27
27
2
27
27
27
27
27
27
27
27
27
13
24
44
31
28
28
25
14
141
15、(141)
50
28
16
26
42
33
30
17
34
up
left
right
down

FIG. 3

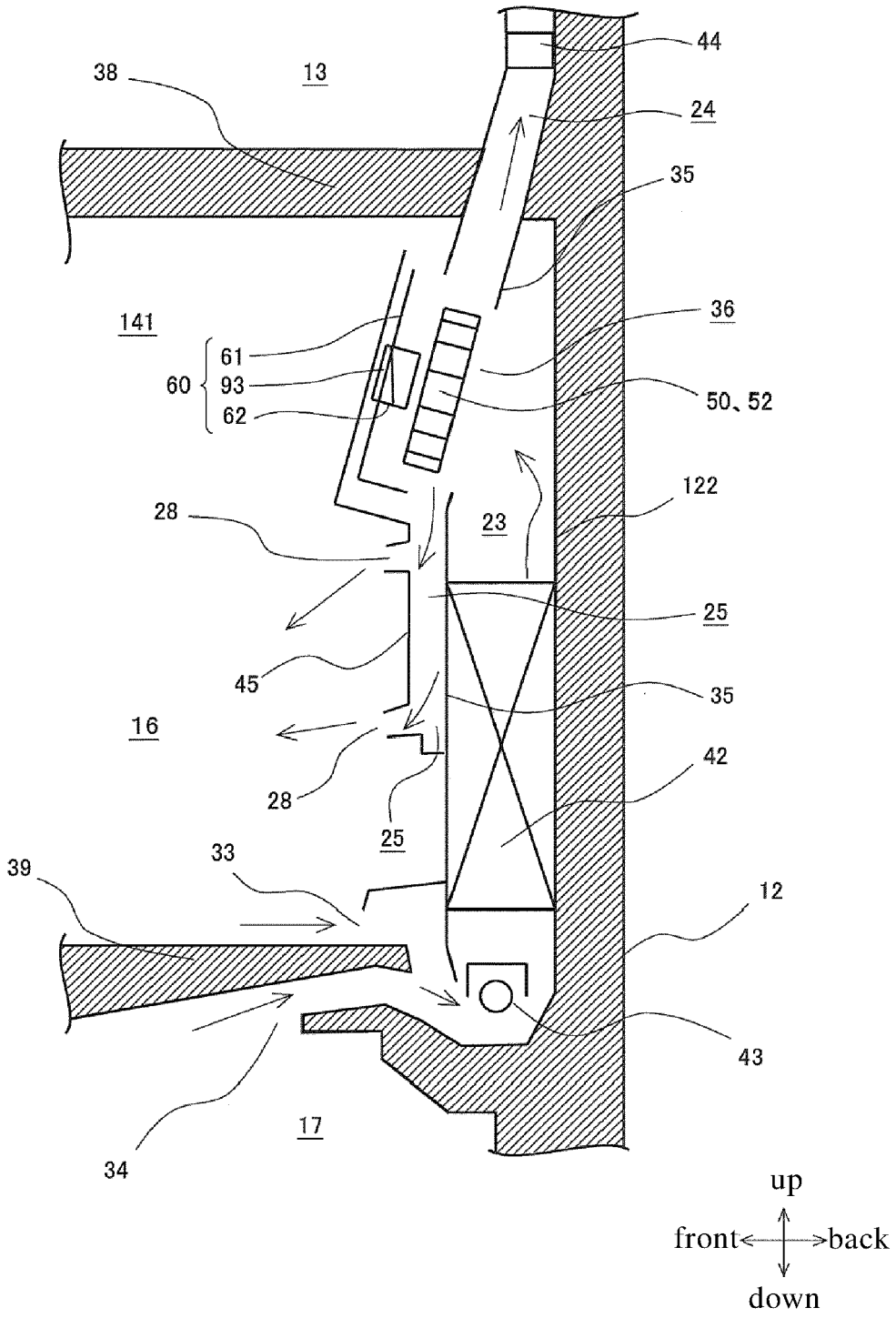
38
13
44
24
35
141
36
61
60
93
62
50、52
122
28
23
25
45
35
16
42
28
25
33
39
12
43
17
34
up
front
back
down

FIG. 4

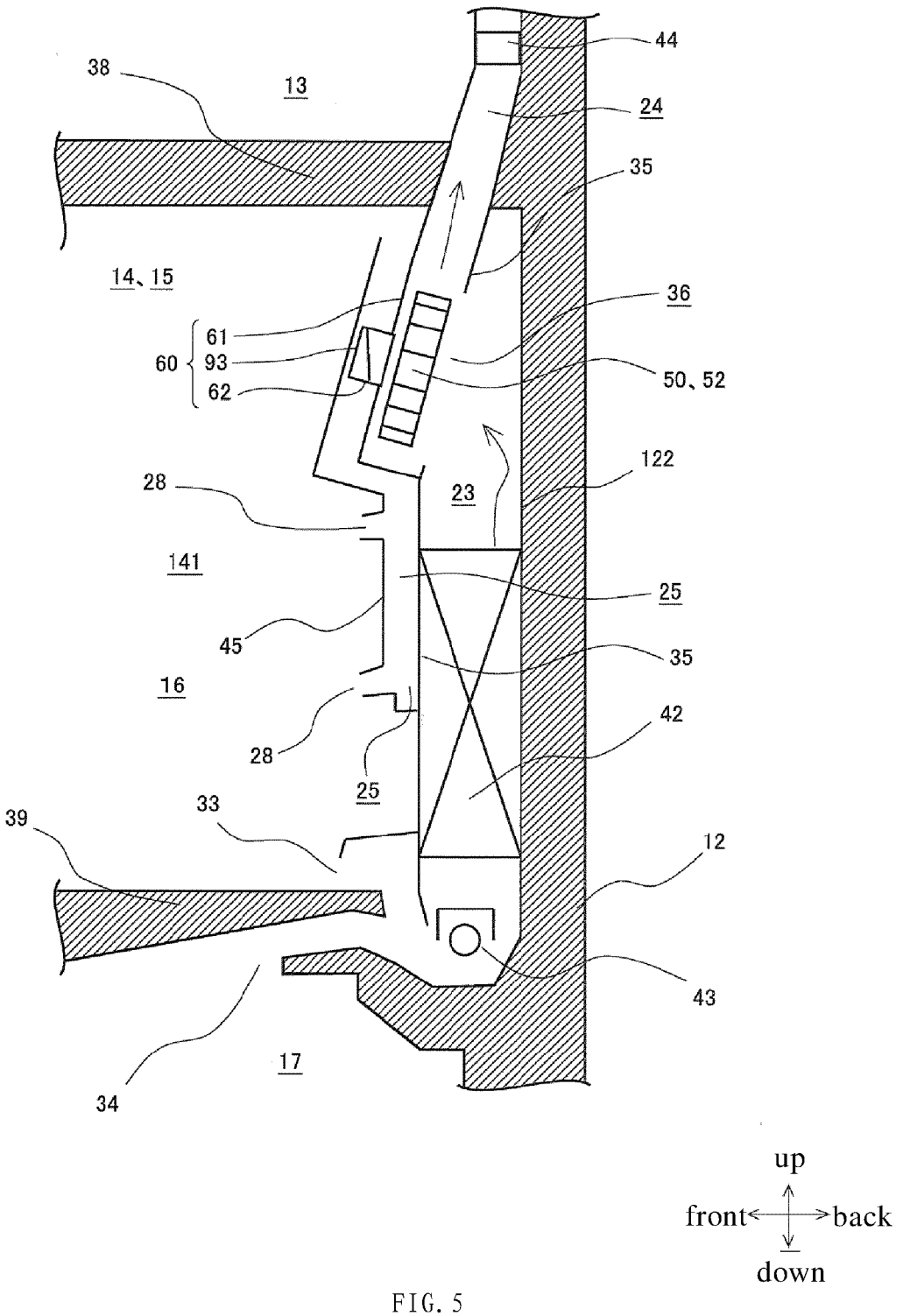
44
38
13
24
35
14、15
36
61
60
93
62
50、52
122
28
23
141
25
45
35
16
42
28
25
33
39
12
43
17
34
up
front
back
down

FIG. 5

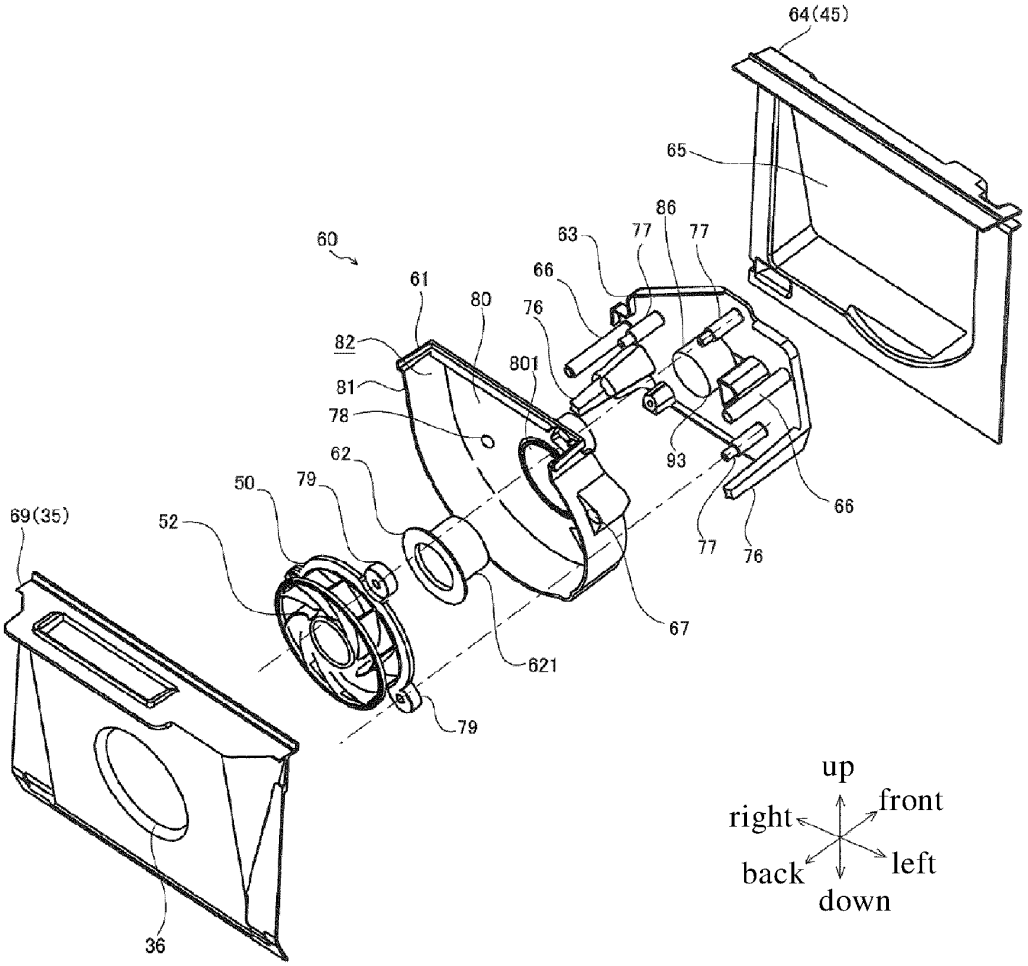
64(45)
65
86
63
77
77
60
61
66
80
76
82
801
81
78
62
93
66
50
79
77
76
69(35)
52
67
621
79
36
up
front
right
left
back
down

FIG. 6

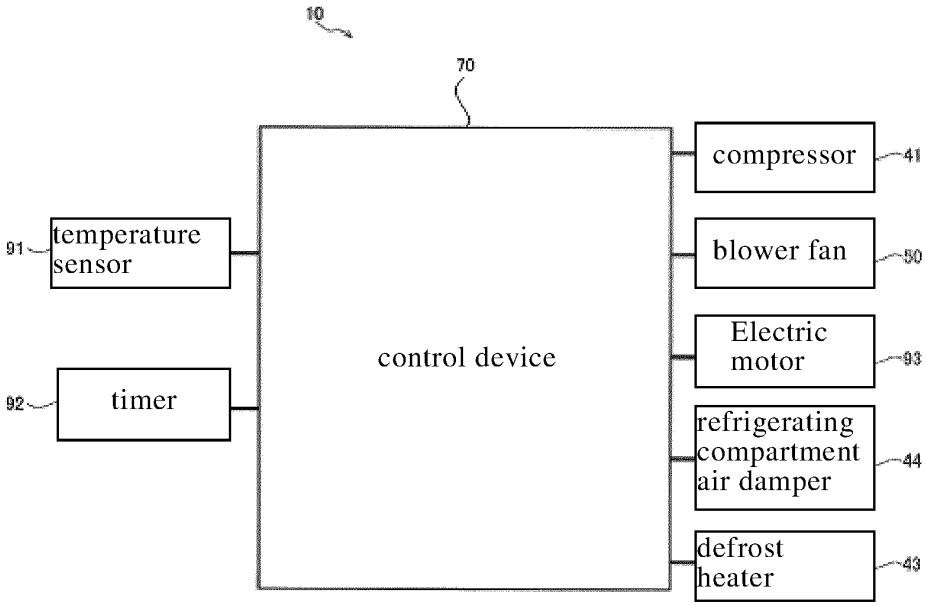
10
70
compressor
41
temperature sensor
91
blower fan
50
control device
Electric motor
93
timer
92
refrigerating compartment air damper
44
defrost heater
43

FIG. 7

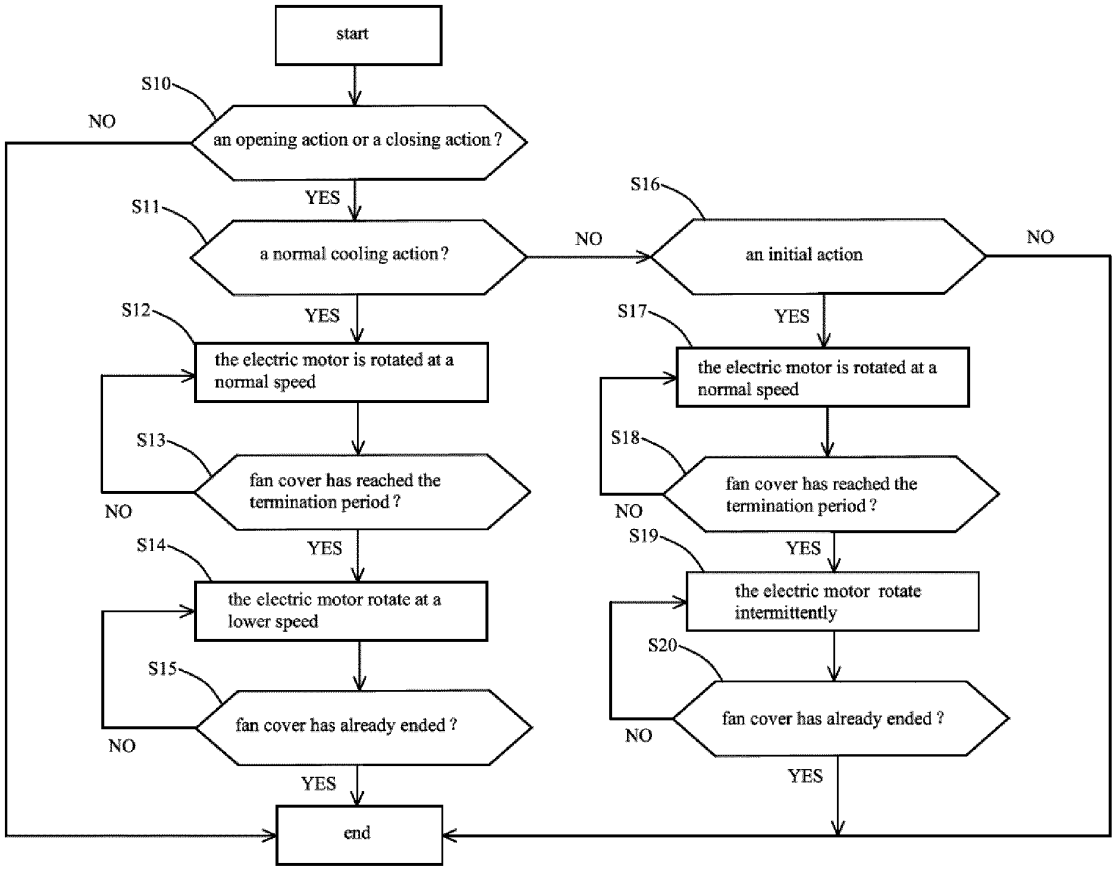
start
S10
NO
an opening action or a closing action ?
YES
S11
a normal cooling action ?
NO
S16
an initial action
NO
YES
S12
the electric motor is rotated at a normal speed
S13
fan cover has reached the termination period ?
NO
YES
S14
the electric motor rotate at a lower speed
S15
fan cover has already ended ?
NO
YES
end
YES
S17
the electric motor is rotated at a normal speed
S18
fan cover has reached the termination period ?
NO
YES
S19
the electric motor rotate intermittently
S20
fan cover has already ended ?
NO
YES

FIG. 8

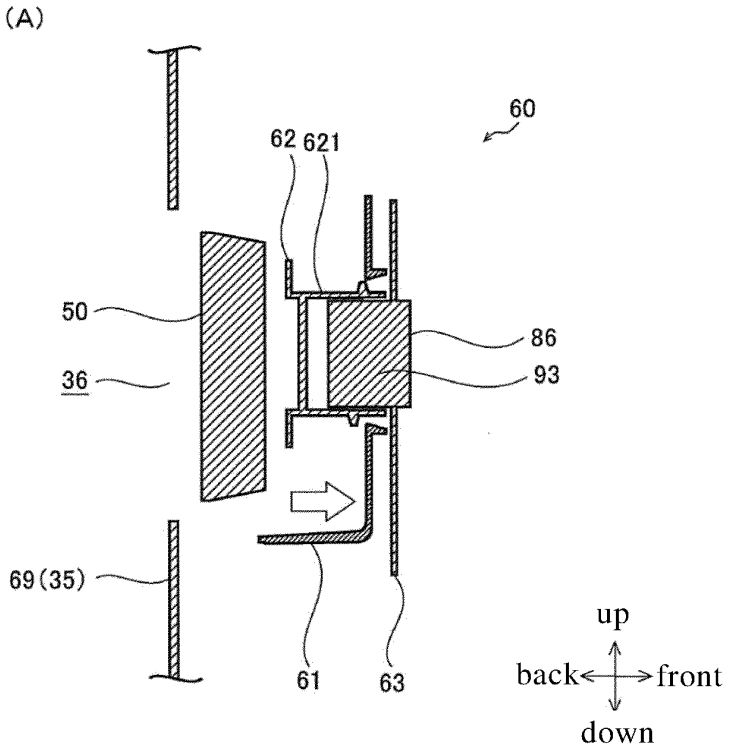
(A)
60
62
621
50
36
86
93
69(35)
61
63
up
back
front
down

FIG. 9 (A)

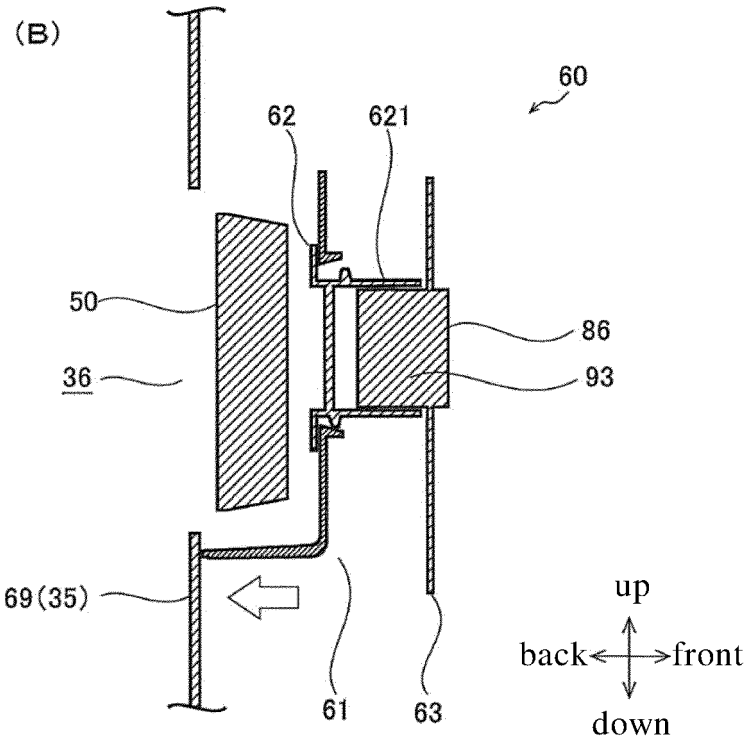
(B)
60
62
621
50
86
36
93
69(35)
61
63
up
back
front
down

FIG. 9 (B)

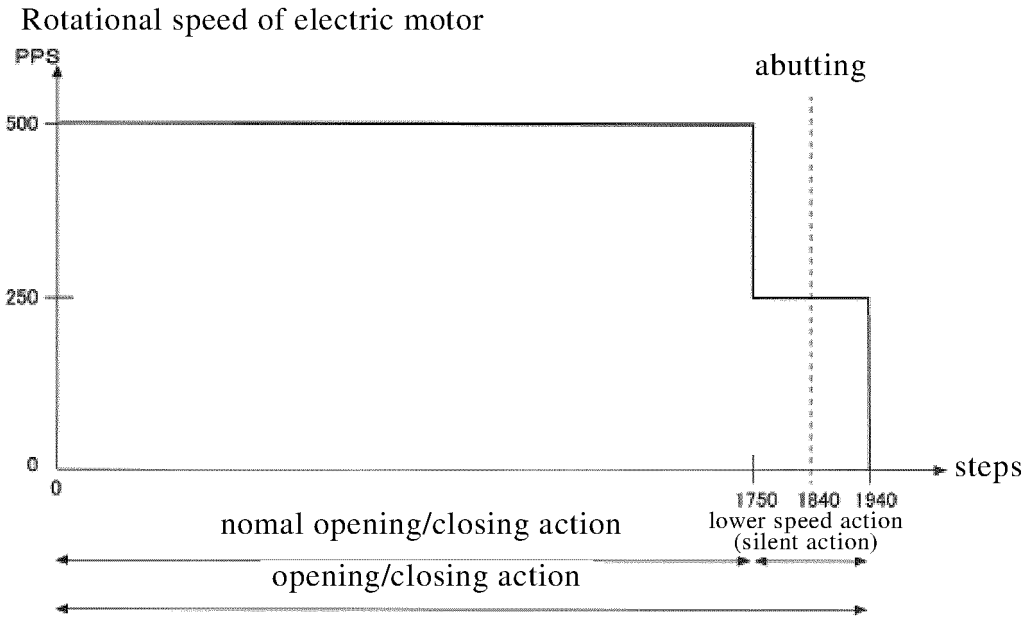
Rotational speed of electric motor
PPS
500
250
0
0
abutting
steps
1750
1840
1940
lower speed action
(silent action)
nomal opening/closing action
opening/closing action

FIG. 10

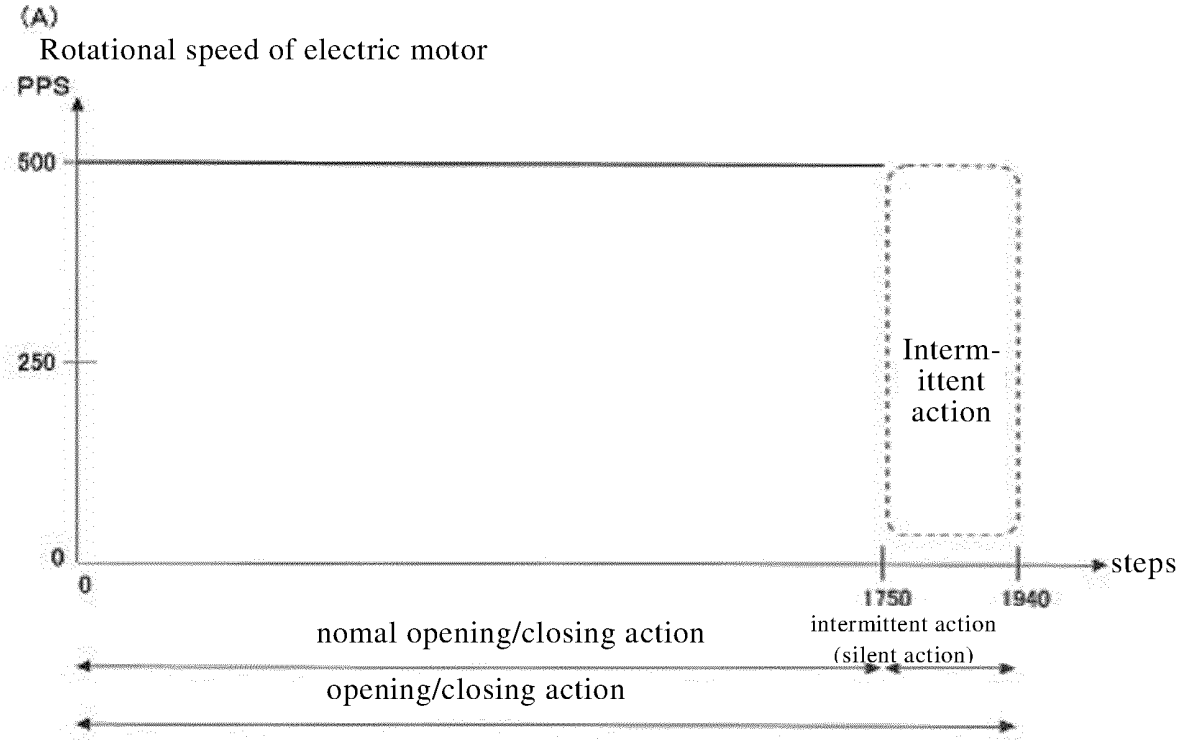

FIG. 11 (A)

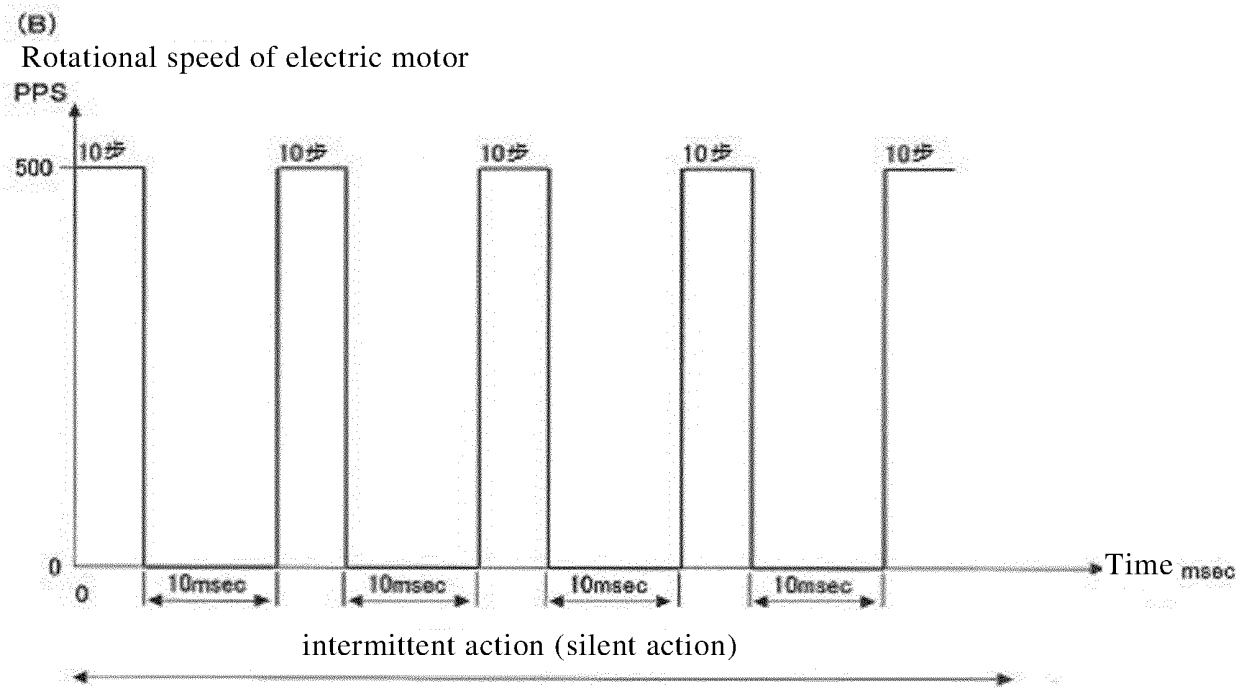

FIG. 11 (B)

(A)

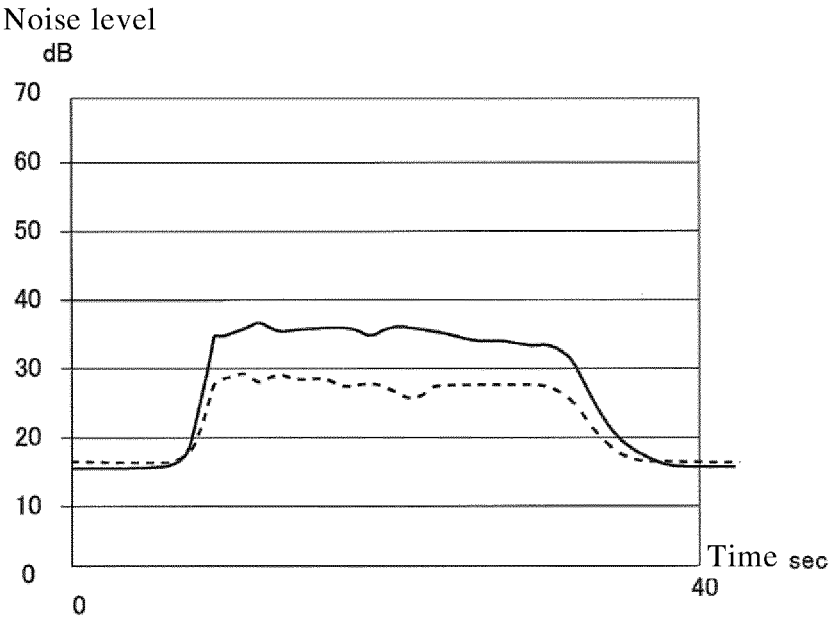

FIG. 12 (A)

(B)

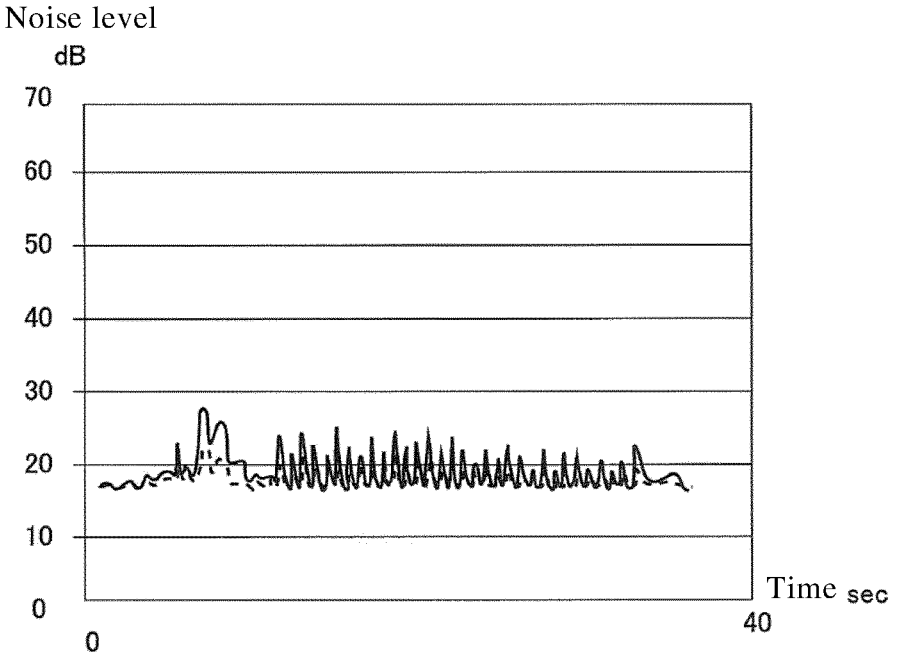

FIG. 12 (B)

(A)

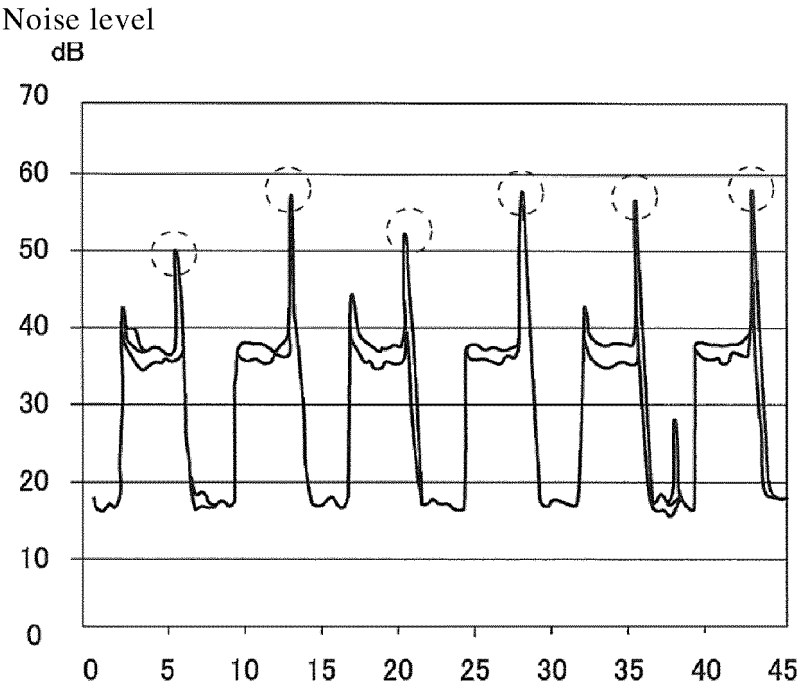

FIG. 13 (A)

(B)

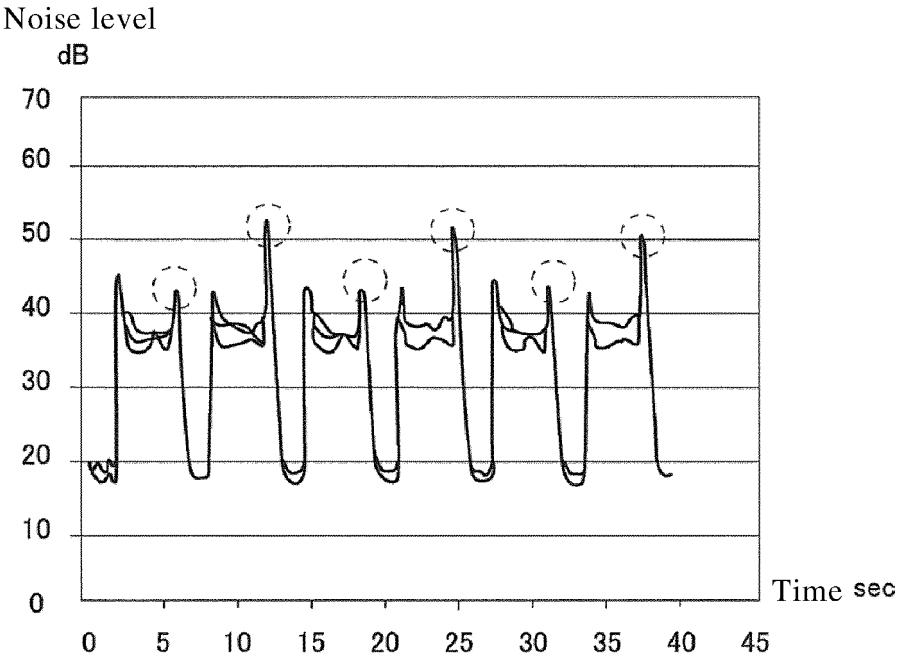

FIG. 13 (B)

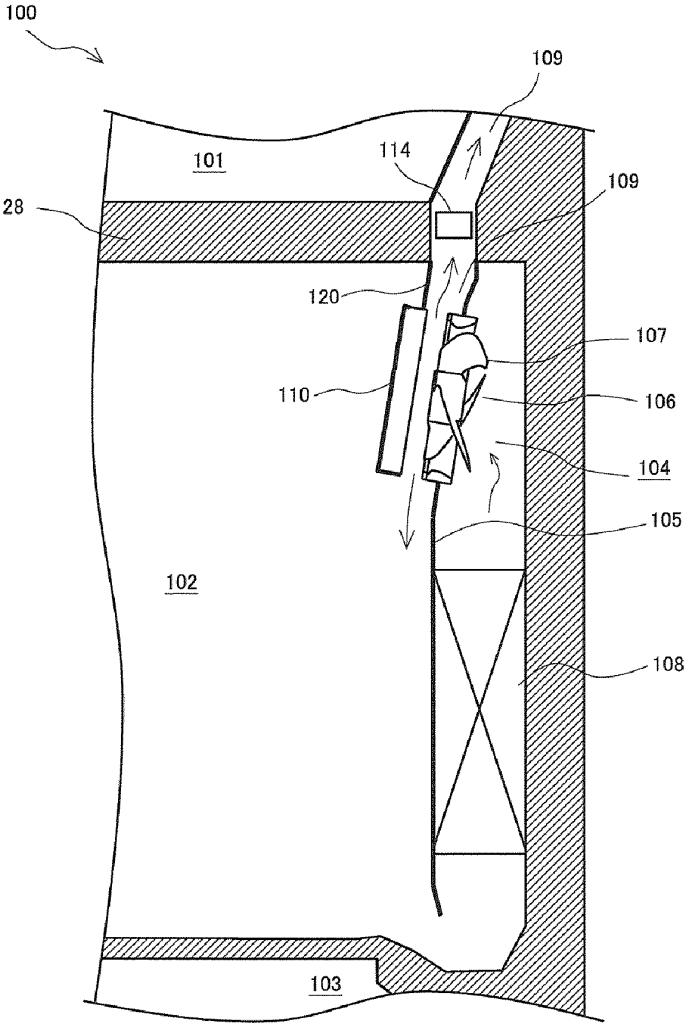
100
109
101
114
109
28
120
107
110
106
104
105
102
108
103

FIG. 14

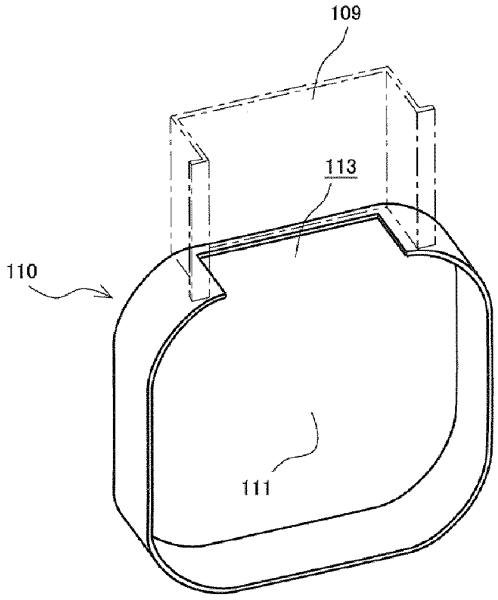
109
113
110
111

FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/123013

A. CLASSIFICATION OF SUBJECT MATTER

F25D 17/06(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F25D17 F25D11

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, CNTXT, CNKI, DWPI: 风机罩 风扇罩 风门 电机 电动机 马达 音 速 fan blower cover damper electromotor motor noise sound speed

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 106247741 A (QINGDAO HAIER CO., LTD. et al.) 21 December 2016 (2016-12-21) description, paragraphs [0026]-[0063] and figures 1-6B	1-5
A	CN 104879984 A (QINGDAO HAIER CO., LTD.) 02 September 2015 (2015-09-02) entire document	1-5
A	CN 104896828 A (QINGDAO HAIER CO., LTD.) 09 September 2015 (2015-09-09) entire document	1-5
A	JP 2013002664 A (HITACHI APPLIANCES, INC.) 07 January 2013 (2013-01-07) entire document	1-5
A	JP 05264155 A (MITSUBISHI ELECTRIC CORPORATION) 12 October 1993 (1993-10-12) entire document	1-5

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 January 2020	**27 February 2020**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China**	
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/123013

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	106247741	A	21 December 2016	WO	2018010394	A1	18 January 2018
CN	104879984	A	02 September 2015	CN	104879984	B	23 March 2018
CN	104896828	A	09 September 2015	CN	104896828	B	02 February 2018
				CN	108518909	A	11 September 2018
JP	2013002664	A	07 January 2013		None		
JP	05264155	A	12 October 1993	JP	2827673	B2	25 November 1998
				JP	H05264155	A	12 October 1993

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2013002664 A **[0003]**