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(54) SHIELDING APPARATUS AND REFRIGERATOR COMPRISING SAME

(57) A shielding apparatus not occupying the refrigerator capacity and capable of accurately controlling the rotation of rotation shielding walls, and a refrigerator comprising the shielding apparatus. The shielding apparatus (70) comprises multiple rotation shielding walls (71) surrounding a fan (47) from an outer side of a radius direction, a shielding wall drive mechanism (60) for driving the rotation shielding walls (71), a position detection means, and a control means (54) for controlling the shielding wall drive mechanism (60). The control means (54) controls, according to the detection result of the position detection means of detecting the position of a rotation plate (73) in the rotation direction, the shielding wall drive mechanism (60).

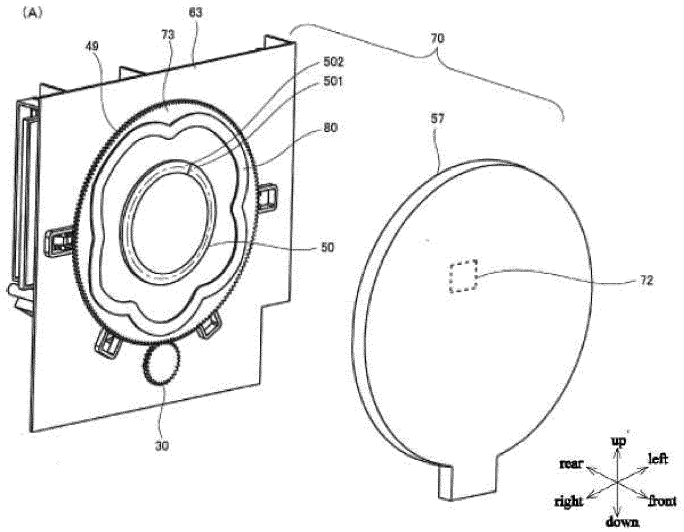

FIG. 9 (A)

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Description

TECHNICAL FIELD

[0001] The present invention relates to a shielding apparatus and a refrigerator having the same, and in particular to a shielding apparatus for properly closing an air passage which communicates a cooling chamber with a storage chamber, and a refrigerator having such a shielding apparatus.

BACKGROUND

[0002] Patent document 1 (JP Patent Publication No. 2013-2664) already discloses a refrigerator using a cooler to cool a plurality of storage chambers.

[0003] FIG. 19 illustrates a refrigerator 100 disclosed in the document. In the refrigerator 100 shown in FIG. 19 are formed a refrigerating chamber 101, a freezing chamber 102 and a vegetable chamber 103. A cooling chamber 104 receiving a cooler 108 is formed on a rear side of the freezing chamber 102. A partitioning wall 105 partitioning the cooling chamber 104 from the freezing chamber 102 is provided with an opening portion 106 through which cold air is supplied to respective storage chambers. In addition, at the opening portion 106 is provided a blower fan 107 that makes cold air flow. A blower cover 110 covering the blower fan 107 is disposed on the side of the freezing chamber 102. An air damper 114 is disposed midway an air passage 109 through which the cold air supplied to the refrigerating chamber 101 circulates.

[0004] Referring to FIG. 20, the blower cover 110 is described in detail. At the blower cover 110 is formed a substantially quadrangular recess 111, and an upper portion of the recess 111 is cut away to from the opening portion 113. Here, in the case where the blower cover 110 covers the blower fan 107, the opening portion 113 of the blower cover 110 is communicated with the air passage 109 on the side of the main body of the refrigerator.

[0005] The refrigerator 100 with the above structure operates in the following manner. First, in the case where the refrigerating chamber 101 and the freezing chamber 102 are cooled simultaneously, the blower cover 110 is made leave the blower fan 107 to open the air damper 114. In this state, the blower fan 107 is made rotate. As such, in the interior of the cooling chamber 104, a portion of cold air cooled by the cooler 108 is sent by an air-blowing force of the blower fan 107 to the freezing chamber 102. In addition, another portion of the cold air is sent via the air passage 109, the air damper 114 and the air passage 109 to the refrigerating chamber 101. Hence, both the freezing chamber 102 and refrigerating chamber 101 are cooled.

[0006] On the other hand, when only the refrigerating chamber 101 is cooled, the blower cover 110 covers the blower fan 107 and the air damper 114 is opened. In this state, the blower fan 107 is used to send the cold air cooled by the cooler 108. When the blower cover 110 is a closed state, the opening portion 113 formed at the upper portion of the blower cover 110 is made communicate with the air passage 109. Hence, the cold air sent by the blower fan 107 is supplied via the opening portion 113, the air damper 114 and the air passage 109 to the refrigerator chamber 101.

[0007] As stated above, with the blower cover 110 formed with the opening portion 113 being used, one cooler 108 is used to cool a plurality of storage chambers at a proper time.

[0008] However, the blower cover 110 needs a space for making an opening/closing action in a front-rear direction. Hence, to enable the blower cover 110 to make the opening/closing action, a larger space is needed in the interior of the refrigerator 100. As a result, an interior volume of the freezing chamber 102 formed in front of the blower cover 110 is pressed, and the space of the freezing chamber 102 for receiving the stored items is limited. Furthermore, a drive sound is generated when a motor is used to drive the blower cover 110 to move in the front-rear direction; when the drive sound is large, the user will feel uncomfortable.

SUMMARY

[0009] An object of the present invention is to provide a shielding apparatus which does not occupy the in-cabinet volume and can accurately control the rotation of rotatable shielding walls, and a refrigerator having the shielding apparatus.

[0010] To achieve the above object, the present invention provides a shielding apparatus for properly closing an air passage for cold air transmission inside of a refrigerator, the shielding apparatus comprising a plurality of rotatable shielding walls that surround a blower fan from outside in a radial direction; a shielding wall drive mechanism for driving the rotatable shielding walls; a position detection device for detecting a position of the rotatable plate in a rotation direction; and a control device for controlling the shielding wall drive mechanism to operate, the control device controlling the shielding wall drive mechanism to operate according to a detection result of the positon detection device. The shielding wall drive mechanism has a rotatable plate formed with an annular sliding groove; a cam formed with a moving shaft engaging with the sliding groove and the cam rotatably connected with the rotatable shielding wall; and a motor for driving the rotatable plate to rotate. Therefore, the control device controls the shielding wall drive mechanism based on the detection result of the position detection device regarding the position of the rotatable plate in the rotation direction, accurately controls the rotation of the rotatable shielding walls, and achieves accurate control of the opening/closing of the air passage in the refrigerator. Furthermore, whatever position of the rotatable plate, an initial position of the rotatable plate can be detected according to the output of the position detection device with-

out need to provide an abutting portion for detecting the initial position. The sliding groove is provided in an annular shape, which simplifies the overall configuration of the device and avoids occurrence of a problem of noise generated accompanying the abutting action.

[0011] Optionally, wherein the position detection device detects a thickness of the rotatable plate that changes in the rotation direction.

[0012] Optionally, wherein the position detection device detects an electrical characteristic value that changes along with the rotation of the rotatable plate.

[0013] Optionally, wherein the position detection device detects a magnetic field that changes along with the rotation of the rotatable plate.

[0014] Optionally, wherein a gear groove is disposed on an entirety of a circumferential edge of the rotatable plate.

[0015] The present invention further provides a refrigerator, comprising: a freezing loop having a cooler for cooling air supplied to a storage chamber through the air passage; a cooling chamber provided with the cooler and formed with an air supply port connected to the storage chamber; a blower fan configured to supply air supplied through the air supply port towards the storage chamber; and the above-described shielding apparatus for closing at least part of the air passage. The refrigerator of the present invention employs a thin-type shielding apparatus having a plurality of rotatable shielding walls that surround the blower fan from the outside in the radial direction, thereby reducing the occupied area and increasing the volume in the storage chamber. Furthermore, the refrigerator can accurately control the rotation of the rotatable shielding walls according to detection result of the position of the rotatable plate, and accurately control the opening/closing of the air passage in the refrigerator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1 is a front view showing the appearance of a refrigerator according to an embodiment of the present invention.

FIG. 2 is a side cross-sectional view showing the internal structure of the refrigerator according to an embodiment of the present invention.

FIG. 3 is an enlarged side cross-sectional view showing the structure nearby a cooling chamber of the refrigerator according to an embodiment of the present invention.

FIG. 4 is an exploded perspective view showing a shielding apparatus according to an embodiment of the present invention.

FIG. 5(A) is a cross-sectional view of the shielding apparatus according to an embodiment of the present invention; FIG. 5(B) is a front view showing a separator.

FIG. 6(A) is an exploded perspective view of the shielding apparatus according to an embodiment of the present invention; FIG. 6(B) is a perspective view showing a cam of the shielding apparatus.

FIG. 7(A) is a partially exploded schematic view of the shielding apparatus according to an embodiment of the present invention; FIG. 7(B) is an exploded schematic view of a cam-receiving structure of the shielding apparatus.

FIG. 8(A) is a view of the shielding apparatus according to an embodiment of the present invention with rotatable shielding walls being viewed from the rear; FIG. 8(B) is a view of the shielding apparatus with a rotatable plate being viewed from the rear.

FIG. 9(A) shows an exploded perspective view when the shielding apparatus according to the embodiment of the present invention adopts a distance sensor as a position detection device; FIG. 9(B) shows a cross-sectional view when the distance sensor detects an angle of the rotatable plate.

FIG. 10 is a perspective view when a resistor is used as a position detection device in the shielding apparatus according to an embodiment of the present invention.

FIG. 11 is a perspective view when a magnetic sensor is used as a position detection device in the shielding apparatus according to an embodiment of the present invention.

FIG. 12 is a block diagram of the refrigerator according to an embodiment of the present invention.

FIG. 13(A) is a view showing a state in which the shielding apparatus according to an embodiment of the present invention is viewed from the rear in Mode 1; FIG. 13(B) is a view of the rotatable plate in Mode 1.

FIG. 14 is a view showing conditions of an air passage when the shielding apparatus according to an embodiment of the present invention is viewed from the rear in Mode 1.

FIG. 15(A) is a view showing a state in which the shielding apparatus according to an embodiment of the present invention is viewed from the rear in Mode 6; FIG. 15(B) is a view of the rotatable plate in Mode 6.

FIG. 16 is a view showing conditions of the air passage when the shielding apparatus according to an embodiment of the present invention is viewed from the rear in Mode 6.

FIG. 17(A) is a view showing a state in which the shielding apparatus according to an embodiment of the present invention is viewed from the rear in Mode 12; FIG. 17(B) is a view of the rotatable plate in Mode 12.

FIG. 18 is a view showing conditions of the air passage when the shielding apparatus according to an embodiment of the present invention is viewed from the rear in Mode 12.

FIG. 19 is an enlarged side view of a refrigerator stated in

BACKGROUND.

[0017] FIG. 20 is a perspective view of a blower cover used in the refrigerator stated in BACKGROUND.

[0018] 10-refrigerator; 11-heat insulating cabinet; 12-housing; 13-liner; 14-heat insulating material; 15-refrigerating chamber; 17-freezing chamber; 18-upper freezing chamber; 19-lower freezing chamber; 20- vegetable chamber; 21, 23, 24, 25-heat insulating door; 26- cooling chamber; 27- air supply port; 28, 38, 39- air return port; 29- refrigerating chamber air supply passage; 30-gear; 31- freezing chamber air supply passage; 33, 34, 341, 342, 343, 344, 345, 346-blowing outlet; 35-opening portion; 37-vegetable chamber return air passage; 40-magnet; 41-magnetic sensor; 42, 43-heat insulation partition wall; 44-compressor; 45-cooler; 46-defrost heater; 47-blower; 48-rotatational connection portion; 49-gear groove; 50-annular protrusion; 501-start point; 502-end point; 51-insertion hole; 52-resistor; 53-rotating shaft; 54-control device; 56-air passage partition wall; 57-cover member; 60-shielding wall drive mechanism; 61,611,612,613,614-cam 62-cam-receiving portion; 63-support base; 64, 68- rotatable connection portion; 65, 66-separator; 67-front cover; 69-pin; 70-shielding apparatus; 71, 711, 712, 713, 714-rotatable shielding wall; 72-distance sensor; 721-transmitting portion; 722-receiving portion; 73-rotatable plate; 74-driving motor; 76, 761, 762, 763, 764-moving shaft; 80-sliding groove; 801 , 802, 803, 804, 805, 806, 807, 808, 809, 8010, 8011, 8012-sliding groove; 811, 812, 813, 814, 815, 816, 817, 818, 819, 8110, 8111, 8122-change points; 83-frame-shaped portion; 85-recess; 86-through hole; 91-temperature sensor; 92-timer; 100-refrigerator; 101-refrigerating chamber; 102-freezing chamber; 103-vegetable chamber; 104-cooling chamber; 105-partition wall; 106-opening portion; 107-blower fan; 108-cooler; 109-air passage; 110-blower cover; 111-recess; 113-opening portion; 114-air damper.

DETAILED DESCRIPTION

[0019] The figures are only for illustrative purposes and cannot be construed as limiting the present invention; in order to better illustrate the embodiments, some parts in the figures may be omitted, enlarged or reduced, and do not represent the size of the actual product; It may be appreciated by those skilled in the art that some well-known structures and their descriptions in the figures may be omitted.

[0020] Hereinafter, a shielding apparatus 70 and a refrigerator 10 according to embodiments of the present invention will be described in detail with reference to figures. In the following depictions, the same parts are designated by the same reference numbers in principle, and repeated depictions will be omitted. Furthermore, in the following depictions, directional terms such as up, down, front, rear, left and right are used properly, but left and right means left and right in a case where the refrigerator 10 is viewed from the rear. Furthermore, in the following depictions, the rotation directions are represented as clockwise and counter-clockwise rotation directions, and these rotation directions indicate directions in the case where the refrigerator 10 is viewed from the rear.

[0021] FIG. 1 illustrates a front view showing a brief structure of the refrigerator 10. As shown in FIG. 1, the refrigerator 10 has a heat insulating cabinet 11 as a main body. A storage chamber for storing food etc. is formed in the interior of the heat insulating cabinet 11. Regarding the storage chamber, the topmost layer is a refrigerating chamber 15, an upper-layer freezing chamber 18 is disposed below the refrigerating camber 15, a lower-layer freezing chamber 19 is disposed below the upper-layer freezing chamber 18, and the bottommost layer is a vegetable chamber 20. In addition, both the upper-layer freezing chamber 18 and lower-layer freezing chamber 19 are storage chambers in a freezing temperature range. In the following depictions, sometimes they are collectedly referred to as freezing chamber 17. Here, the upper-layer freezing chamber 18 may also be divided in a left portion and a right portion, with one portion being used as an ice-making chamber.

[0022] The heat insulating cabinet 11 is open forward, and a heat insulating door 21 is disposed in an openable and closeable manner at openings corresponding to the storage chambers. The refrigerating chamber 15 is divided in two portions in a left-right direction and the two portions are respectively closed by a corresponding heat insulating door 21. An upper end and a lower end of the outer side of the heat insulating door 21 in a widthwise direction are rotatably mounted on the heat insulating cabinet 11. In addition, the heat insulating doors 23, 24, 25 are combined with respective storage chambers, and supported on the heat insulating cabinet 11 in front of the refrigerator 10 in a drawable manner. Specifically, the heat insulating door 23 closes the upper-layer freezing chamber 18, the heat insulating door 24 closes the lower-layer freezing chamber 19, and the heat insulating door 25 closes the vegetable chamber 20.

[0023] FIG. 2 illustrates a side cross-sectional view showing a brief structure of the refrigerator 10. The main body, namely, the heat insulating cabinet 11, of the refrigerator 10 comprises a housing 12 opening forward and made of a steel plate, and an liner 13 which is disposed in the housing 12 with a gap with the housing 12, opens forward and is made of a synthetic resin. A heat insulating material 14 made of foamed polyurethane is filled in the gap between the housing 12 and the liner 13. In addition, the heat insulating door 21 and other heat insulating doors also employ the same heat insulating configuration as the heat insulating cabinet 11.

[0024] The refrigerating chamber 15 and the freezing chamber 17 therebelow are partitioned by a heat insulation partition wall 42. In addition, the upper-layer freezing chamber 18 is communicated with the lower-layer freezing chamber 19 disposed therebelow, and cold air after cooling may refrigerate them simultaneously. Further-

more, the freezing chamber 17 and the vegetable chamber 20 are partitioned by the heat insulation partition wall 43.

[0025] On the back side of the refrigerating chamber 15 is formed a refrigerating chamber air supply passage 29 which is divided by a separator 65 made of a synthetic resin and acts to supply cold air to the refrigerating chamber 15. The refrigerating chamber air supply passage 29 is formed with blowing outlets 33 through which cold air flows into the refrigerating chamber 15.

[0026] On the rear side of the freezing chamber 17 is formed a freezing chamber air supply passage 31 which enables cold air cooled by a cooler 45 to flow towards the freezing chamber 17. A cooling chamber 26 is formed on the rear side of the freezing chamber air supply passage 31. In the interior of the cooling chamber 26 is configured an air evaporator, namely, cooler 45 for cooling air circulating in the cabinet. The freezing chamber air supply passage 31 is a space enclosed by a front cover 67 and a separator 66 respectively from front and rear.

[0027] The cooler 45 is connected with a compressor 44, an unshown radiator and an unshown expansion unit, namely, a capillary tube via a refrigerant pipe, to constitute a vapor compression-type freezing loop.

[0028] FIG. 3 is a side cross-sectional view showing a structure nearby a cooling chamber 26 of the refrigerator 10. The cooling chamber 26 is located in the interior of the heat insulating cabinet 11 and disposed on the rear side of the freezing chamber air supply passage 31. The cooling chamber 26 and the freezing chamber 17 are separated by the separator 66 made of a synthetic resin.

[0029] A space formed by the freezing chamber air supply passage 31 in front of the cooling chamber 26 and located between the cooling chamber 26 and the front cover 67 assembled in front and made of a synthetic resin forms an air passage through which the cold air cooled by the cooler 45 flows to the freezing chamber 17. The front cover 67 is formed with openings, namely, blowing outlets 34, through which the cold air is blown to the freezing chamber 17.

[0030] On the back side of the lower portion of the lower-layer freezing chamber 19 is formed an air return portion 38 allowing air to return from the freezing chamber 17 to the cooling chamber 26. Furthermore, in a lower portion of the cooling chamber 26 is formed an air return port 28 communicated with the air return port 38 and configured to suck the return cold air from the respective storage chambers into the interior of the cooling chamber 26. The cold air returned through an air return port 39 (see FIG. 2) of the vegetable chamber 20 and the vegetable chamber return air passage 37 also flows into the air return port 28.

[0031] In addition, below the cooler 45 is disposed a defrost heater 46 as a defrosting unit for melting and removing defrost adhered to the cooler 45. The defrost heater 46 is a resistance heating heater.

[0032] In the upper portion of the cooling chamber 26, there is formed an air supply port 27 which is an opening connected to each storage chamber. The air supply port 27 is an opening through which cold air cooled by the cooler 45 flows, and communicates the cooling chamber 26 with the refrigerating chamber air supply passage 29 and the freezing chamber air supply passage 31. A blower fan 47 for sending cold air toward the freezing chamber 17 and the like is arranged at the position of the air supply port 27.

[0033] On the outside of the air supply port 27 of the cooling chamber 26 is disposed a shielding apparatus 70 for properly closing the air passage connected from the air supply port 27. The shielding apparatus 70 is covered by a front cover 67 from the front.

[0034] Here, although not shown in FIG. 3, an air damper may be installed in the refrigerating chamber air supply passage 29. Through such an arrangement, the shielding apparatus 70 and the air damper can be used to properly deliver cold air to each storage chamber.

[0035] FIG. 4 illustrates an exploded perspective view of the front cover 67, the shielding apparatus 70 and the separator 66. The shielding apparatus 70 is arranged between the front cover 67 and the separator 66.

[0036] The shielding apparatus 70 comprises a cover member 57, a rotatable plate 73 and a support base 63. The cover member 57 is a member that closes the rotatable plate 73 from the front, and has a substantially circular shape when viewed from the front. The rotatable plate 73 is a substantially disc-shaped member that is rotatable to open and close the shielding apparatus 70, and is mounted rotatable relative to the support base 63. The support base 63 is composed of a synthetic resin plate formed in a given shape, and various components constituting the shielding apparatus 70 are mounted on the support base 63. In addition, the support base 63 is embedded into an opening portion 35 in an upper portion of of the front cover 67. The construction of the shielding apparatus 70 will be described in further detail below with reference to FIG. 6.

[0037] FIG. 5(A) is a cross-sectional view of the separator 66 and the front cover 67 in which partial structure of the shielding apparatus 70 is embedded. As described above, a space surrounded by the separator 66 and the front cover 67 is formed as the freezing chamber air supply passage 31. The freezing chamber air supply passage 31 is divided into a plurality of air passages. In addition, the shielding apparatus 70 and a shielding wall drive mechanism 60 are arranged between the separator 66 and the front cover 67. The blower fan 47 is disposed in the shielding apparatus 70, and the shielding wall drive mechanism 60 drives the shielding apparatus 70. The structure of the shielding apparatus 70 and the shielding wall drive mechanism 60 will be further described with reference to FIG. 6.

[0038] FIG. 5(B) is a schematic view of the separator 66 viewed from the front. The blowing outlet 34 on the separator 66 specifically includes a blowing outlet 341 to a blowing outlet 346. The blowing outlet 341 and the blowing outlet 342 are formed at an upper end of the separator

66, the blowing outlet 343 and the blowing outlet 344 are formed at a center of the separator 66 in a vertical direction, and the blowing outlet 345 and blowing outlet 346 are formed at a lower end of the separator 66.

[0039] In addition, the separator 66 is formed with a rib-shaped air passage partition wall 56 protruding forward. A front end of the air passage partition wall 56 abuts against the front cover 67. The air passage partition wall 56 finely divides the aforementioned freezing chamber air supply passage 31 into a plurality of air passages.

[0040] Referring to FIG. 6, the structure of the shielding apparatus 70 will be described. FIG. 6(A) is an exploded perspective view of the shielding apparatus 70, and FIG. 6(B) is a perspective view of a cam 61.

[0041] Referring to FIG. 6(A), the shielding apparatus 70 comprises a rotatable shielding wall 71, the support base 63, the cover member 57 and the shielding wall drive mechanism 60.

[0042] The shielding apparatus 70 is a device that shields the air passage of the cold air blown by the blower fan 47. The air passage connecting the cooling chamber 26 with each storage chamber is communicated by making the shielding apparatus 70 in an open state, and the air passage is blocked by making the shielding apparatus 70 in a closed state.

[0043] The blower fan 47 is arranged at the center of a rear surface of the support base 63 via fastening means such as screws. The bower fan 47 for example comprise a centrifugal fan such as a turbo fan, and a blower motor that rotates the centrifugal fan to blow air radially outward.

[0044] The rotatable shielding wall 71 is a plate-shaped member made of rectangular synthetic resin, and has a long side along a tangential direction of an outer edge of the rotatable plate 73. A rear side of the rotatable shielding wall 71 is rotatably mounted near a peripheral edge of the support base 63. A plurality of rotatable shielding walls 71 are arranged, specifically, four rotatable shielding walls 71 are arranged. The rotatable shielding wall 71 is arranged on a path through which the cold air blown by the blower fan 47 flows, and properly shields the air passage.

[0045] A frame-shaped portion 83 is adjoined to a rotation center, namely, a base end, of the rotatable shielding wall 71. The frame-shaped portion 83 is disposed along the outer periphery of the rotatable shielding wall 71 in an upstanding state. The frame-shaped portions each 83 are formed by a frame-shaped synthetic resin, and disposed on a rear surface of the support base 63 in a manner of surrounding the blower fan 71. The frame-shaped portions 83 are configured corresponding to the rotatable shielding walls 71, and the air passages will be closed in a way that the rotatable shielding walls 71 close the openings of the frame-shaped portions 83.

[0046] The shielding wall drive mechanism 60 that performs the opening/closing operation of the rotatable shielding wall 71 includes the rotatable plate 73, the cam 61, and a drive motor 74 that rotates the rotatable plate 73. Here, the drive motor 74 is not shown.

[0047] The rotatable plate 73 has a substantially disc shape when viewed from the rear, and is rotatably arranged on the front surface side of the support base 63. The rotatable plate 73 is formed with a sliding groove 80 for rotating the rotatable shielding wall 71. The sliding groove 80 is formed as a bottomed groove surrounded by ribs on the rear surface of the rotatable plate 73. As described later, the rotatable plate 73 is driven to rotate by a drive motor so that the rotatable shielding wall 71 performs the opening/closing operation.

[0048] A gear groove 49 for transmitting the driving force from the motor is formed on the edge of the rotatable plate 73. In the present embodiment, the gear groove 49 is formed at the entire circumference of the rotatable plate 73.

[0049] The cover member 57 is a plate-shaped member that covers the rotatable plate 73 from the front, is formed slightly larger than the rotatable plate 73, and has a substantially circular shape when viewed from the front.

[0050] In the cover member 57 is arranged a position detection device, namely, a distance sensor 72 that detects the position of the rotatable plate 73 in the rotation direction. The distance sensor 72 will be described later with reference to FIG. 9.

[0051] Referring to FIG. 6(B), the cam 61 is a flat rectangular parallelepiped member made of synthetic resin. A rotational connection portion 48 is formed by making a left end of the cam 61 protrude rearward. A hole portion for insertion of a pin 69 to be described later is formed at the rotatable connection portion 48. In addition, a moving shaft 76 protruding in a substantially cylindrical shape is formed from a front surface of a right end side of the cam 61. The moving shaft 76 engages with the sliding groove 80 of the rotatable plate 73, and in use, the moving shaft 76 slides relative to the sliding groove 80. To enable the sliding, the diameter of the moving shaft 76 is set to be the same as the width of the sliding groove 80 in a radial direction or slightly smaller than the width of the sliding groove 80.

[0052] Reference is made to FIG. 7 to describe the relevant structures of the rotatable shielding wall 71, the support base 63 and the cam 61. FIG. 7(A) is an exploded perspective view of the rotatable shielding wall 71, the support base 63 and the cam 61 as viewed from the left rear. FIG. 7(B) is an exploded perspective view of a rotational connection portion 68 and the cam 61 as viewed from the left front.

[0053] Referring to FIG. 7(A), the rotatable shielding wall 71 is provided with a rotational connection portion 68 obliquely protruding from the base end of the rotatable shielding wall 71. The rotational connection portion 68 is formed with a hole through which the pin 69 can be inserted. In addition, a rotational connection portion 64 protruding in a substantially cylindrical shape is formed at a front end of each of an upper side and a lower side of the rotatable shielding wall 71. The rotational connection portion 64 is inserted into a cylindrical recess 85 formed in the inner wall of the frame-shaped portion 83. With

such a structure, the rotatable shielding wall 71 is arranged on the support base 63 in a rotatable state.

[0054] The support base 63 is provided with a rectangular through hole 86. The rotational connection portion 68 of the rotatable shielding wall 71 is inserted into the through hole 86 from the rear. The rotational connection portion 48 of the cam 61 is inserted into the through hole 86 from the front. The pin 69 is inserted into the hole of the rotational connection portion 68 of the rotatable shielding wall 71 and the hole of the rotational connection portion 48 of the cam 61. With such a structure, the rotatable shielding wall 71 and the cam 61 are rotatably connected with the support base 63 in between.

[0055] Referring to FIG. 7(B), a cam receiving portion 62 is formed on the front surface of the support base 63. The cam receiving portion 62 is a rectangular area surrounded by ribs, and the aforementioned through hole 86 is formed in the cam receiving portion 62. The cam 61 is received and slides in the cam receiving portion 62. A direction in which the cam 61 slides in the cam receiving portion 62 is a left-right direction, in other words, in a radial direction of the rotatable plate 73 shown in FIG. 6(A).

[0056] With the above configuration, when the drive motor drives the rotatable plate 73 to rotate, the moving shaft 76 slides in the sliding groove 80. As a result, the cam 61 slides in the cam receiving portion 62. By sliding the cam 61, the rotatable shielding wall 71 can be rotated about the pin 69. Specifically, with the cam 61 sliding toward the peripheral edge of the support base 63, the rotatable shielding wall 71 rotates in an upstanding state with the rotational connection portion 64 as a center of rotation, and the rotatable shielding wall 71 becomes a state orthogonal and perpendicular to a main surface of the support base 63. On the other hand, with the cam 61 sliding toward the center of the support base 63, the rotatable shielding wall 71 rotates in a horizontal state with the rotational connection portion 64 as a center of rotation, and the rotatable shielding wall 71 becomes a state substantially parallel to the main surface of the support base 63.

[0057] Therefore, if the sliding groove 80 is formed on the peripheral edge side of the rotatable plate 73, the rotatable shielding wall 71 can be made in a closed state. Conversely, if the sliding groove 80 is formed near the center of the rotatable plate 73, the rotatable shielding wall 71 can be made in an open state. Using this principle, the open or closed state of the rotatable shielding wall 71 can be arbitrarily set by a meandering design of the shape of the sliding groove 80. Thus, the rotatable shielding wall 71 can be made in a fully open state or a fully closed state without using a complicated structure.

[0058] FIG. 8(A) is a view of the rotatable shielding walls 711 of the shielding apparatus 70 as viewed from the rear. The shielding apparatus 70 has a rotatable shielding wall 711 to a rotatable shielding wall 714 which are collectively referred to as the rotatable shielding wall 71. The rotatable shielding wall 711 to the rotatable shielding wall 714 have a rectangular shape having long sides that are substantially parallel to the tangential direction of the rotatable plate 73. In addition, the rotatable shielding wall 711 to the rotatable shielding wall 714 are rotatably mounted on the peripheral edge portion of the support base 63 shown in FIG. 7(A).

[0059] The base end of the rotatable shielding wall 711 is rotatably connected to the cam 611 formed with the moving shaft 761. Similarly, the base end of the rotatable shielding wall 712 is rotatably connected to the cam 612 formed with the moving shaft 762. The base end of the rotatable shielding wall 713 is rotatably connected to the cam 613 formed with the moving shaft 763. In addition, the base end of the rotatable shielding wall 714 is rotatably connected to the cam 614 formed with the moving shaft 764.

[0060] Referring to FIG. 8(B), the rotatable plate 73 is a steel plate or a synthetic resin plate formed into a substantially disc shape, and is formed with the sliding groove 80 for implementing the opening/closing operation of the rotatable shielding wall 711.

[0061] The gear groove 49 is formed in the entire area of the circumference of the rotatable plate 73. The gear 30 meshes with the gear groove 49 so that the rotatable plate 73 is rotated based on a torque of the drive motor 74.

[0062] The sliding groove 80 is formed in a substantially annular shape near the outer peripheral edge of the rotatable plate 73. Furthermore, the shape of the sliding groove 80 when the rotatable plate 73 is viewed from the rear is not a perfect circle shape, but a meandering shape curved and extended along the circumferential direction of the rotatable plate 73. Specifically, the sliding groove 80 consists of sliding grooves 801 to 8012 in a clockwise direction. The sliding groove 801 curves radially outward in the clockwise direction. The sliding groove 802 extends substantially parallel to the circumferential direction. The sliding groove 803 curves radially inward in the clockwise direction. The sliding groove 804 curves radially outward in the clockwise direction. The sliding groove 805 curves radially inward in the clockwise direction. The sliding groove 806 curves radially outward in the clockwise direction. The sliding groove 807 curves radially inward in the clockwise direction. The sliding groove 808 curves radially outward in the clockwise direction. The sliding groove 809 curves radially inward in the clockwise direction. The sliding groove 8010 curves radially outward in the clockwise direction. The sliding groove 8011 extends substantially parallel to the circumferential direction. The sliding groove 8012 curves radially inward in the clockwise direction.

[0063] The sliding groove 80 is provided with change points at which the curved shape of the sliding groove 80 changes. Specifically, a change point 812 is provided between the sliding groove 801 and the sliding groove 802, and a change point 813 is provided between the sliding groove 802 and the sliding groove 803. In addition, a change point 814 is provided between the sliding groove 803 and the sliding groove 804, and a change

point 815 is provided between the sliding groove 804 and the sliding groove 805. In addition, a change point 816 is provided between the sliding groove 805 and the sliding groove 806, and a change point 817 is provided between the sliding groove 806 and the sliding groove 807. In addition, a change point 818 is provided between the sliding groove 807 and the sliding groove 808, and a change point 819 is provided between the sliding groove 808 and the sliding groove 809. In addition, a change point 8110 is provided between the sliding groove 809 and the sliding groove 8010, and a change point 8111 is provided between the sliding groove 8010 and the sliding groove 8011. In addition, a change point 8112 is provided between the sliding groove 8011 and the sliding groove 8012, and a change point 811 is provided between the sliding groove 8012 and the sliding groove 801.

[0064] The change point 812, change point 813, change point 815, change point 817, change point 819, change point 8111 and change point 812 are arranged on the radially outer side of the rotatable plate 73. On the other hand, the change point 811, the change point 814, the change point 816, the change point 818 and the change point 8110 are arranged on the radially inner side of the rotatable plate 73.

[0065] By arranging the moving shafts 761 to 764 at the change points 811 to 8112, the rotatable shielding walls 711 to 714 can be set to a given opening/closing mode. Here, by setting an angular interval θ at which the change points are separated from one another to 30 degrees, a total of 12 types of opening/closing modes from the rotatable shielding wall 711 to the rotatable shielding wall 714 are achieved, as described later.

[0066] A specific example of the position detection device that detects the position of the rotatable plate 73 of the shielding apparatus 70 in the rotation direction will be described with reference to FIG. 9 through FIG. 11. FIG. 9 shows an example in which a distance sensor 72 is used as the position detection device, FIG. 10 shows an example in which a resistor 52 is used as the position detection device, and FIG. 11 shows an example in which a magnetic sensor 41 is used as the position detection device.

[0067] Referring to FIG. 9, there is shown an example in which the distance sensor 72 is used as the position detection device. FIG. 9(A) shows the shielding apparatus 70 using the distance sensor 72, and FIG. 9(B) is a cross-sectional view when an annular protrusion 50 shown in FIG. 9(A) is linearly deployed and sectioned.

[0068] Referring to FIG. 9(A), the annular protrusion 50 is formed by making a front center portion of the rotatable plate 73 protrude forward in an annular shape. The annular protrusion 50 changes in height in the circumferential direction. In addition, when viewed from the front, the distance sensor 72 is arranged on the rear surface of the cover member 57 overlapping the annular protrusion 50. The distance sensor 72 emits an electromagnetic wave or acoustic wave toward a front portion of the annular protrusion 50 and receives the electromagnetic wave or acoustic wave reflected from the front portion of the annular protrusion 50. Thus, the distance between the front surface of the annular protrusion 50 and the distance sensor 72, namely, the height of the annular protrusion 50, can be detected as described below.

[0069] Referring to FIG. 9(B), the annular protrusion 50 has a start point 501 and an end point 502 that are adjacent to each other, and the protrusion height of the annular protrusion 50 gradually increases from the start point 501 to the end point 502.

[0070] In addition, the distance sensor 72 has a transmitting portion 721 and a receiving portion 722. The transmitting portion 721 generates the electromagnetic wave or acoustic wave toward an upper surface of the annular protrusion 50. The receiving part 722 receives the electromagnetic wave or acoustic wave reflected from the upper surface of the annular protrusion 50. Thus, a distance from the front surface of the annular protrusion 50 to the distance sensor 72 can be calculated by measuring the time from transmission to reception of the distance sensor 72, that is, the thickness of the annular protrusion 50 can be calculated. In addition, as described above, regarding the thickness of the annular protrusion 50, the start point 501 is the thinnest, and the end point 502 is the thickest. Thus, the position of the rotatable plate 73 in the rotation direction, namely, a rotation angle of the rotatable plate 73 can be detected by measuring the thickness of the annular protrusion 50.

[0071] A case where the resistor 52 is used as the position detection device will be described with reference to FIG. 10. FIG. 10 is an exploded perspective view of the shielding apparatus 70 using the resistor 52 as the position detecting device.

[0072] The resistor 52 has a rotating shaft 53 rotatably provided. A rear end of the rotating shaft 53 is inserted into an insertion hole 51 formed in the central portion of the rotatable plate 73. The insertion hole 51 has a substantially semicircular shape, and the rotating shaft 53 also has a substantially semicircular shape. Therefore, when the rotatable plate 73 rotates, the rotating shaft 53 also rotates simultaneously. In addition, the resistor 52 is a variable resistor whose resistance value changes with the rotation of the rotating shaft 53. Thus, the position of the rotatable plate 73 in the rotation direction can be detected by measuring the resistance value of the resistor 52.

[0073] In addition, although the rotation angle of the rotatable plate 73 is detected here based on the resistance value detected by the resistor 52, the rotation angle of the rotatable plate 73 can also be detected based on electrical characteristic values other than the resistance value, such as a current value.

[0074] A case where the magnetic sensor 41 is used as the position detection device will be described with reference to FIG. 11. FIG. 11 is an exploded perspective view of the shielding apparatus 70 using the magnetic sensor 41 as the position detection device.

[0075] A magnet 40 is arranged at the center of the

rotatable plate 73. The magnet 40 magnetizes an N pole and an S pole in a given pattern in the circumferential direction. The magnet 40 rotates together with the rotatable plate 73.

[0076] In addition, a magnetic sensor 41 is arranged on the rear of the cover member 57 and at a position overlapping or in the vicinity of the magnet 40 as viewed from the front. The magnetic sensor 41 detects the position of the magnet 40 in the rotation direction by detecting the magnetic field generated from the magnet 40.

[0077] In an in-use state of the shielding apparatus 70, if the rotatable plate 73 rotates, the magnet 40 also rotates together. As the magnet 40 rotates, the magnetic field generated from the magnet 40 changes. The position of the rotatable plate 73 in the rotation direction can be detected by detecting the change in the magnetic field by the magnetic sensor 41.

[0078] The connection structure of the refrigerator 10 will be described with reference to the block diagram of FIG. 12. The refrigerator 10 has a control device 54, a temperature sensor 91, a timer 92, a distance sensor 72, a compressor 44, a blower fan 47, a drive motor 74 and a defrost heater 46. The temperature sensor 91, the timer 92 and the distance sensor 72 are connected to an input side terminal of the control device 54. The compressor 44, the blower fan 47, the drive motor 74 and the defrost heater 46 are connected to an output side terminal of the control device 54.

[0079] The control device 54 is for example a CPU and controls the compressor 44 based on input information from the temperature sensor 91, thereby controlling the cooling operation of the refrigerator 10. In addition, the control device 54 controls the shielding wall drive mechanism 60 based on the input information from the distance sensor 72 to control the opening and closing of the rotatable shielding wall 71.

[0080] The temperature sensor 91 is disposed in the refrigerating chamber 15, the freezing chamber 17 and the vegetable chamber 20, respectively, and transmits information indicating the temperature in the storage chambers to the control device 54.

[0081] The timer 92 measures a cooling time for cooling the refrigerating chamber 15, the freezing chamber 17 and the vegetable chamber 20, and an operation time of the defrost heater 46, and transmits information indicating the respective time to the control device 54.

[0082] As shown in FIG. 9, the distance sensor 72 detects the position, namely, a rotation angle, of the rotatable plate 73 in the rotation direction by measuring the distance from the annular protrusion 50 of the rotatable plate 73. Instead of the distance sensor 72, the resistor 52 shown in FIG. 10 and the magnetic sensor 41 shown in FIG. 11 may be used.

[0083] The compressor 44, by following an instruction from the control device 54, compresses the refrigerant used in the refrigeration loop.

[0084] The blower fan 47, by following the instruction from the control device 54, blows the cold air cooled by the cooler 45 of the refrigeration loop toward each storage chamber.

[0085] The drive motor 74, by following the instruction from the control device 54 , drives the rotatable plate 73 of the shielding apparatus 70 to rotate by a given angle. A stepping motor may be used as the drive motor 74, for example.

[0086] The defrost heater 46 is energized in accordance with the instruction from the control device 54 to heat the air in the cooling chamber 26.

[0087] Hereinafter, reference is made to FIG. 13 through FIG. 18 to illustrate that the rotatable plate 73 of the shielding apparatus 70 is made rotate in units of 30 degrees so that the rotatable shielding walls 711 to 714 are opened or closed to open or close the air passages and perform a switching action. In the following description, only the radial direction and the circumferential direction of the rotatable plate 73 are referred to as the radial direction and the circumferential direction. In addition, in the following description, the open or closed state of the rotatable shielding wall 711 and the like is switched from mode 1 to mode 12 by rotating the rotatable plate 73 clockwise in units of 30 degrees. That is, in the present embodiment, the opening/closing of the rotatable shielding walls 711 to 714 is controlled by setting an allocated angle of the rotatable plate 73 to 30 degrees and by rotating the rotatable plate 73 in units of 30 degrees. Here, the allocated angle is set to a divisor of 360 degrees, for example, 60 degrees or 120 degrees may be used.

[0088] Specifically, among Mode 1 to Mode 12, Mode 1, Mode 6, and Mode 12 are illustrated. Mode 1 is shown in FIG. 13 and FIG. 14, Mode 6 is shown in FIG. 15 and FIG. 16, and Mode 12 is shown in FIG. 17 and FIG. 18.

[0089] FIG. 13 and FIG. 14 show Mode 1 in which all the rotatable shielding walls 71 are made in an open state. FIG. 13(A) is a view of the shielding apparatus 70 in this state as viewed from the rear, FIG. 13(B) is a view of the rotatable plate 73 in this state as viewed from the rear, and FIG. 14 is a view of the air passage in this state as viewed from the rear.

[0090] Referring to FIG. 13(A), in Mode 1, the rotatable shielding wall 711 to the rotatable shielding wall 714 are all in an open state. The blower fan 47 can be used to send the cold air to the refrigerating chamber 15 and the freezing chamber 17 by setting the open state.

[0091] Referring to FIG. 13(B), in this state, the moving shafts such as the moving shaft 761 are disposed radially inside. Specifically, the moving shaft 761 is disposed at the change point 814 of the sliding groove 80, and the moving shaft 762 is disposed at the change point 816 of the sliding groove 80. In addition, the moving shaft 763 is disposed at the change point 818 of the sliding groove 80, and the moving shaft 764 is disposed at the change point 8110 of the sliding groove 80. As a result, the rotatable shielding wall 711 to the rotatable shielding wall 714 get into the open state.

[0092] Referring to FIG. 14, when the shielding appa-

ratus 70 is in the state shown in FIG. 13, the cold air is not shielded by the shielding apparatus 70, the cold air is blown toward the blowing outlet 341 to the blowing outlet 346, and the cold air is blown out through the blowing outlet 341 to the blowing outlet 346 into the entire area of the freezing chamber 17.

[0093] Here, the state in which the rotatable plate 73 is in Mode 1 can be detected by the control device 54 based on the output of the distance sensor 72 shown in FIG. 9. Similarly, the states of Mode 6 and Mode 12 described later can also be detected.

[0094] Referring to FIG. 13(A), when the mode is transitioned from Mode 1 shown in FIG. 13 to Mode 6 shown in FIG. 15, the control device 54 controls the drive motor 74 to operate to rotate the rotatable plate 73 via the gear 30. In addition, the control device 54 measures the rotation angle of the rotatable plate 73 through the distance sensor 72, and accurately controls the rotation position of the rotatable plate 73.

[0095] Referring to FIG. 13(B), when the mode is transitioned from Mode 1 shown in FIG. 13 to Mode 6 shown in FIG. 15, the rotatable plate 73 is rotated clockwise by 150 degrees as indicated by the solid line arrow. Alternatively, the rotatable plate 73 is rotated counterclockwise by 210 degrees as indicated by the dashed line arrow.

[0096] In the present embodiment, the gear groove 49 is formed on the entire circumference of the outer edge of the rotatable plate 73, and the rotation angle of the rotatable plate 73 is detected by the distance sensor 72. Accordingly, when the rotatable plate 73 is rotated to change the opening/closing mode of the rotatable shielding wall 71, the rotatable plate 73 can be accurately rotated in both the clockwise rotation and the counterclockwise rotation.

[0097] FIG. 15 and FIG. 16 show Mode 6 in which only the rotatable shielding wall 712 disposed at the lower right side is set to the open state. FIG. 15(A) is a view of the shielding apparatus 70 in this state as viewed from the rear, FIG. 15(B) is a view of the rotatable plate 73 in this state as viewed from the rear, and FIG. 16 is a view of the air passage in this state as viewed from the rear.

[0098] Referring to FIG. 15 (A), in Mode 6, the rotatable shielding wall 711, the rotatable shielding wall 713 and the rotatable shielding wall 714 are set to the closed state, and only the rotatable shielding wall 712 is set to the open state. With the open/closed state being set, the blower fan 47 can send cold air to the lower right portion of the freezing chamber 17.

[0099] Referring to FIG. 15(B), in this state, the moving shaft 761, the moving shaft 763 and the moving shaft 764 are arranged radially outside, and the moving shaft 762 is arranged radially inside. Specifically, the moving shaft 761 is arranged at the change point 8111 of the sliding groove 80, and the moving shaft 762 is arranged at the change point 811 of the sliding groove 80. In addition, the moving shaft 763 is arranged at the change point 813 of the sliding groove 80, and the moving shaft 764 is arranged at the change point 815 of the sliding groove 80. Thereby, only the rotatable shielding wall 712 is set to the open state, and the rotatable shielding wall 711, the rotatable shielding wall 713 and the rotatable shielding wall 714 are set to the closed state.

[0100] Referring to FIG. 16, when the shielding apparatus 70 is in Mode 6, the rotatable shielding wall 711, the rotatable shielding wall 713 and the rotatable shielding wall 714 shield the cold air, and on the other hand, the rotatable shielding wall 712 does not shield the cold air. Therefore, cold air is blown toward the lower right side. Specifically, after being sent towards the blowing outlet 344 and the blowing outlet 346, the cold air is blown out through the outlets to the freezing chamber 17.

[0101] Referring to FIG. 15(B), when the mode is transitioned from Mode 6 shown in FIG. 15 to Mode 12 shown in FIG. 17, the rotatable plate 73 is rotated counterclockwise by 180 degrees as indicated by the solid line arrow. Alternatively, the rotatable plate 73 is rotated clockwise by 180 degrees as indicated by the dashed line arrow.

[0102] FIG. 17 and FIG. 18 show Mode 12 in which all the rotatable shielding walls such as rotatable shielding wall 714 are set to the closed state. FIG. 17(A) is a view of the shielding apparatus 70 in this state as viewed from the rear, FIG. 17(B) is a view of the rotatable plate 73 in this state as viewed from the rear, and FIG. 18 is a view of the air passage in this state as viewed from the rear.

[0103] Referring to FIG. 17(A), in Mode 12, the rotatable shielding wall 711, the rotatable shielding wall 712, the rotatable shielding wall 713 and the rotatable shielding wall 714 are set in the closed state. With the closed state being set, the air supply path from the blower fan 47 is closed, so that the cooling chamber 26 and the freezing chamber 17 shown in FIG. 3 are in an isolated state.

[0104] Referring to FIG. 17(B), in this state, the moving shaft 761, the moving shaft 762, the moving shaft 763 and the moving shaft 764 are arranged radially outside. Specifically, the moving shaft 761 is arranged at the change point 815 of the sliding groove 80, and the moving shaft 762 is arranged at the change point 817 of the sliding groove 80. In addition, the moving shaft 763 is arranged at the change point 819 of the sliding groove 80, and the moving shaft 764 is arranged at the change point 8111 of the sliding groove 80. In this way, the rotatable shielding wall 711, the rotatable shielding wall 712, the rotatable shielding wall 713 and the rotatable shielding wall 714 are in the closed state.

[0105] Referring to FIG. 18, when the shielding apparatus 70 is in Mode 12, the rotatable shielding wall 711, the rotatable shielding wall 712, the rotatable shielding wall 713 and the rotatable shielding wall 714 shield cold air. Therefore, the cold air is not sent to the blowing outlets such as the blowing outlet 342.

[0106] Referring to FIG. 15(B), when the mode is transitioned from Mode 12 shown in FIG. 17 to Mode 1 shown in FIG. 13, the rotatable plate 73 is rotated counterclockwise by 330 degrees as indicated by the solid lie arrow.

Alternatively, the rotatable plate 73 is rotated clockwise by 30 degrees as indicated by the dashed line arrow.

[0107] Here, the rotation angle of the rotatable plate 73 is detected by the distance sensor 72 shown in FIG. 9(A). Therefore, the control device 54 controls the rotatable plate 73 to rotate in a direction with a less stroke, i.e., rotate in a clockwise rotation direction indicated by a dashed line, based on the position detection of the rotatable plate 73. In this way, the action amount and action time of the shielding apparatus 70 when the open/closing mode is altered can be reduced.

[0108] The action of the shielding apparatus 70 is described above.

[0109] In the present embodiment, referring to FIG. 6, the opening/closing action of the rotatable shielding wall 71 is performed by the rotation of the rotatable plate 73. Therefore, the shielding apparatus 70 can be made thinner as compared with the technique described in the above BACKGROUND. Therefore, referring to FIG. 2, the volume of the freezer chamber 17 in front of the shielding apparatus 70 is increased.

[0110] Furthermore, according to the present embodiment, as shown in FIG. 8(B), the sliding groove 80 is substantially provided in an annular shape, and the moving shafts 761 to 764 engage with the sliding groove 80. Then, the rotatable plate 73 is rotated so that the moving shafts 761 to 764 slide in the sliding groove 80 and slide in the radial direction of the rotatable plate 73. When the moving shaft 761 to the moving shaft 764 slide, the cams 611 to 614 also slide. As a result, the rotatable shielding walls 711 to 714 are opened and closed.

[0111] The plurality of moving shafts 761 to 764 engage with one sliding groove 80 to slide, so the sliding distance of the moving shafts 761 to 764 in the sliding groove 80 can be increased. Therefore, the sliding groove 80 can be bent smoothly in the circumferential direction, a pressure generated by the moving shafts 761 to 764 upon sliding in the sliding groove 80 is reduced, and the opening/closing action of the rotatable shielding wall 711 can be performed smoothly.

[0112] According to the shielding apparatus 70 according to the present embodiment, the opening/closing mode of the rotatable shielding walls 711 to 714 can be achieved in various manners by simple control of rotating the shielding apparatus 70 by a given angle. Specifically, 12 types of open/closed modes can be achieved in units of 30 degrees. Therefore, it is possible to realize multiple cold air supply manners and properly supply cold air according to cooling conditions in the interior of the freezing chamber 17.

[0113] Furthermore, while the position of the rotatable plate 73 in the rotation direction is detected by the position detection device such as the distance sensor 72 shown in FIG. 9 to FIG. 11, the shielding apparatus 70 can rotate the rotatable plate 73. In this way, the open/closed mode of the rotatable shielding walls 711 to 714 can be accurately controlled.

[0114] In addition, as shown in FIG. 17(B), the gear groove 49 is formed in the entire area of the outer edge of the rotatable plate 73. Thus, the rotatable plate 73 can be rotated in both the clockwise direction and the counterclockwise direction to alter the open/closed mode of the rotatable shielding walls 711 to 714. When the rotatable plate 73 is rotated, the time and action amount for altering the open/closed mode can be reduced by selecting one rotation manner with a small rotation angle from the clockwise rotation and the counterclockwise rotation.

[0115] The present invention is not limited to the above embodiments. In addition, various modifications can be implemented without departing from the spirit and scope of the present invention.

Claims

1. A shielding apparatus for properly closing an air passage for cold air transmission inside of a refrigerator, wherein the shielding apparatus comprises:

   a plurality of rotatable shielding walls that surround a blower fan from outside in a radial direction;
   a shielding wall drive mechanism for driving the rotatable shielding walls; and
   a control device for controlling the shielding wall drive mechanism,
   the shielding wall drive mechanism comprises: a rotatable plate formed with an annular sliding groove; a cam formed with a moving shaft engaging with the sliding groove and the cam rotatably connected with the rotatable shielding wall; and a motor for driving the rotatable plate to rotate,
   the shielding apparatus further comprises a position detection device for detecting a position of the rotatable plate in a rotation direction,
   the control device controls the shielding wall drive mechanism to operate according to a detection result of the positon detection device.

2. The shielding apparatus according to claim 1, wherein
   the position detection device detects a thickness of the rotatable plate that changes in the rotation direction.

3. The shielding apparatus according to claim 1, wherein
   the position detection device detects an electrical characteristic value that changes along with the rotation of the rotatable plate.

4. The shielding apparatus according to claim 1, wherein
   the position detection device detects a magnetic field that changes along with the rotation of the rotatable

plate.

5. The shielding apparatus according to claim 1, wherein
a gear groove is disposed on an entirety of a circumferential edge of the rotatable plate.

6. A refrigerator, wherein the refrigerator comprises:

a freezing loop having a cooler for cooling air supplied to a storage chamber through an air passage;
a cooling chamber provided with the cooler and formed with an air supply port connected to the storage chamber;
a blower fan configured to supply air supplied through the air supply port towards the storage chamber; and
the shielding apparatus for closing at least part of the air passage according to any of claims 1-5.

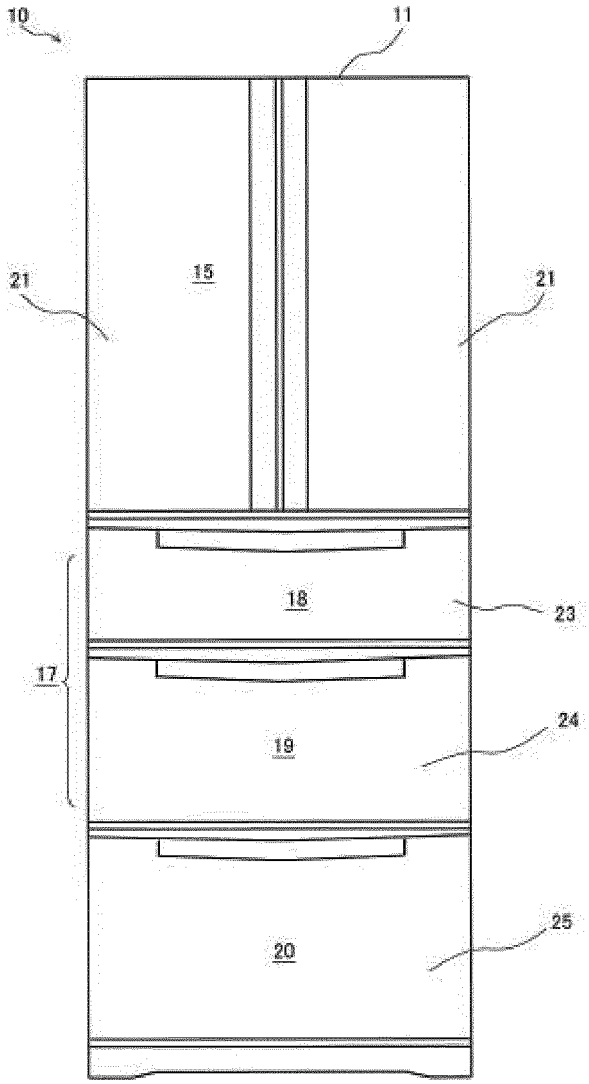


FIG. 1

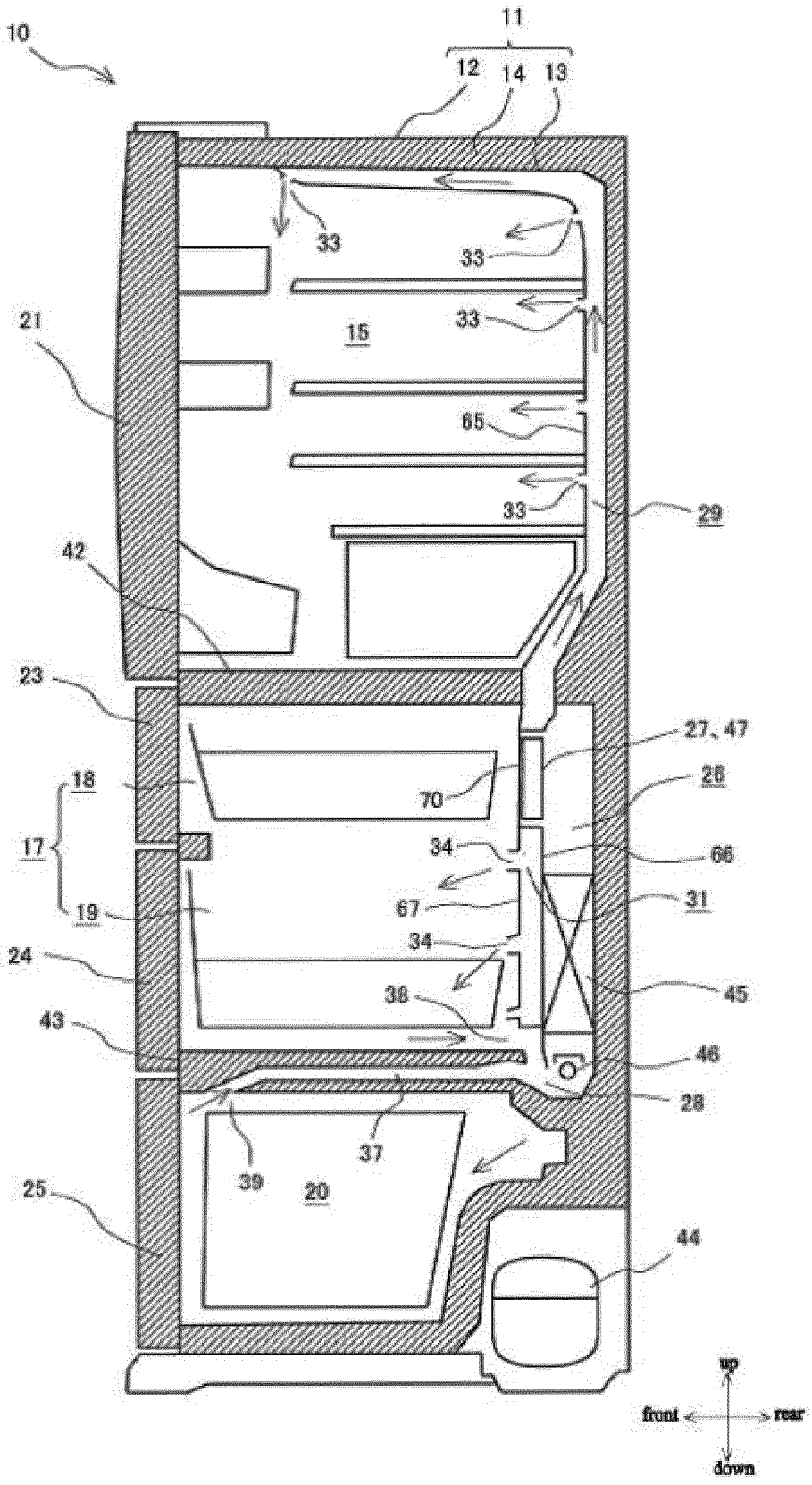
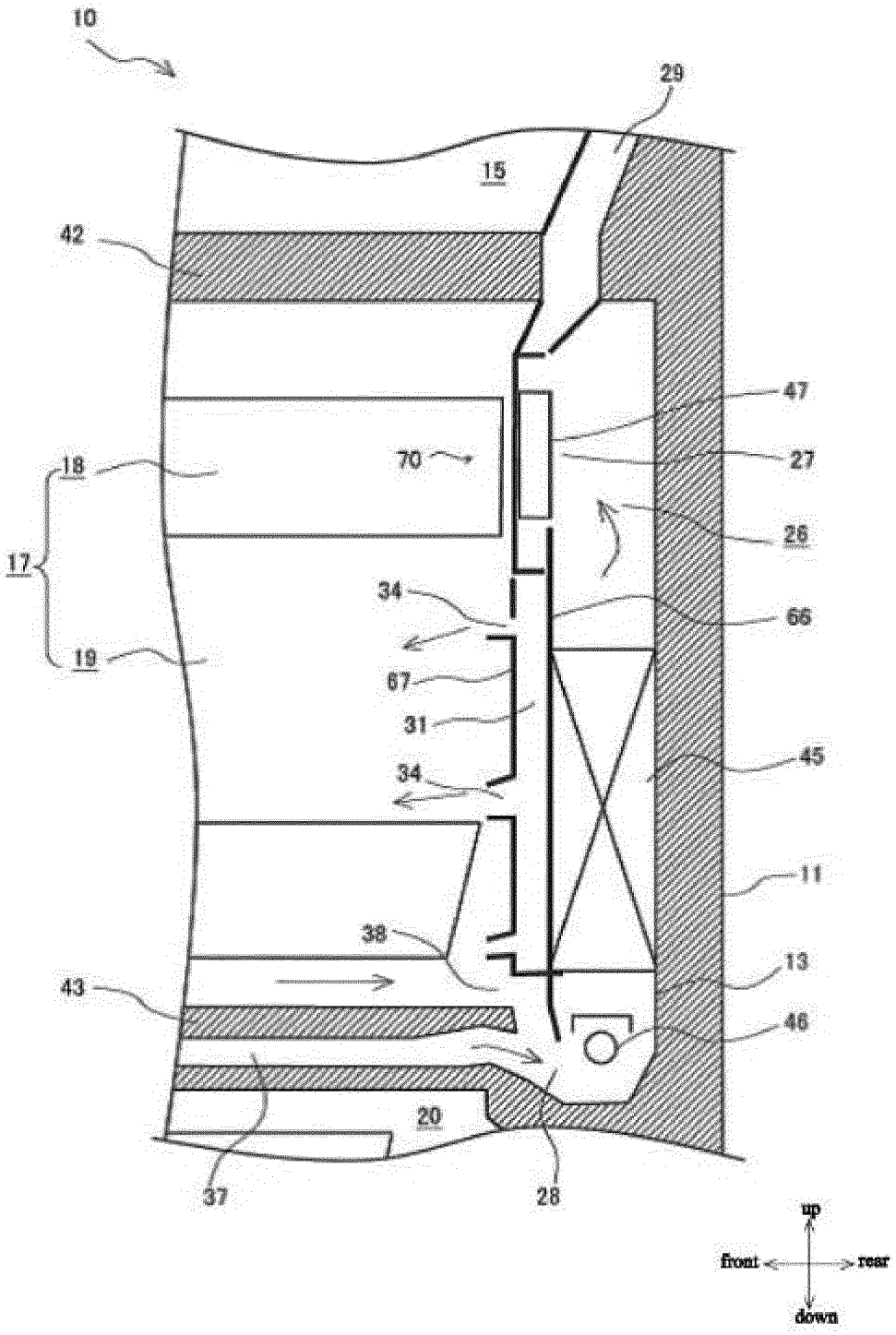

10
11
12
14
13
33
33
33
21
15
65
33
29
42
23
27、47
18
70
26
17
34
66
19
67
31
34
24
38
45
43
46
28
37
39
20
25
44
up
front
rear
down

FIG. 2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29
15
42
47
70
18
27
17
26
34
66
19
67
31
45
34
11
38
13
43
46
20
37
28
up
front
rear
down

FIG. 3

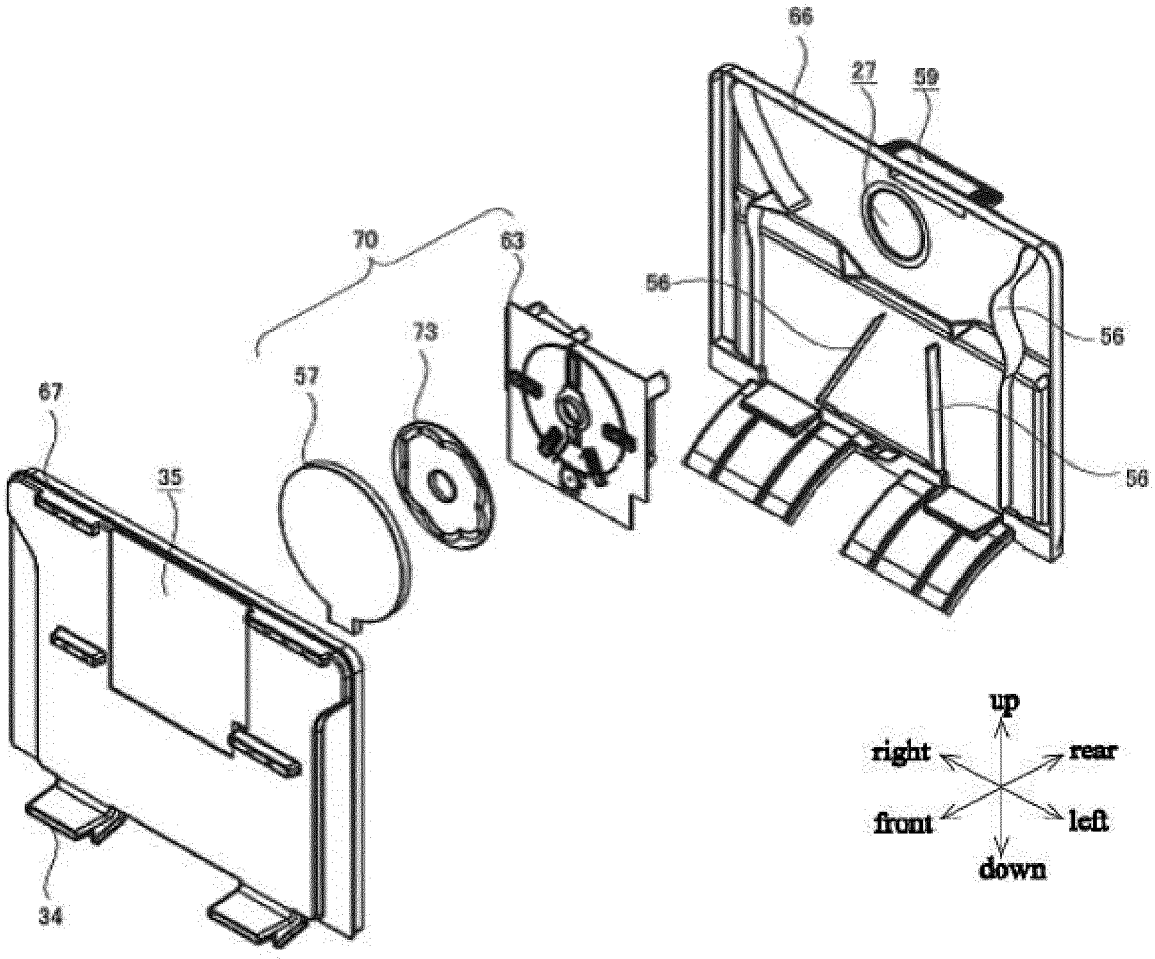
66
27
59
70
63
56
56
73
57
67
35
56
34
up
right
rear
front
left
down

FIG. 4

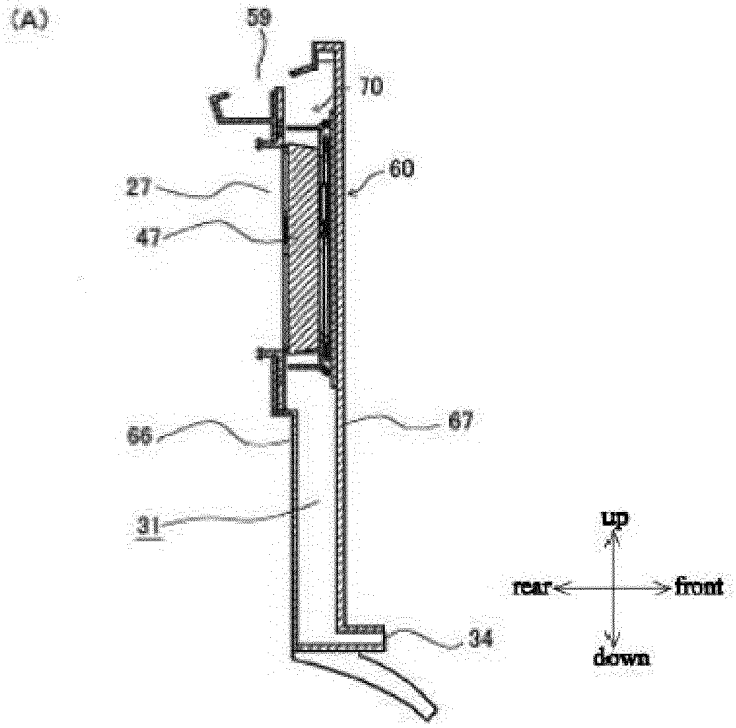
(A)
59
70
60
27
47
66
67
31
34
up
rear
front
down

FIG. 5 (A)

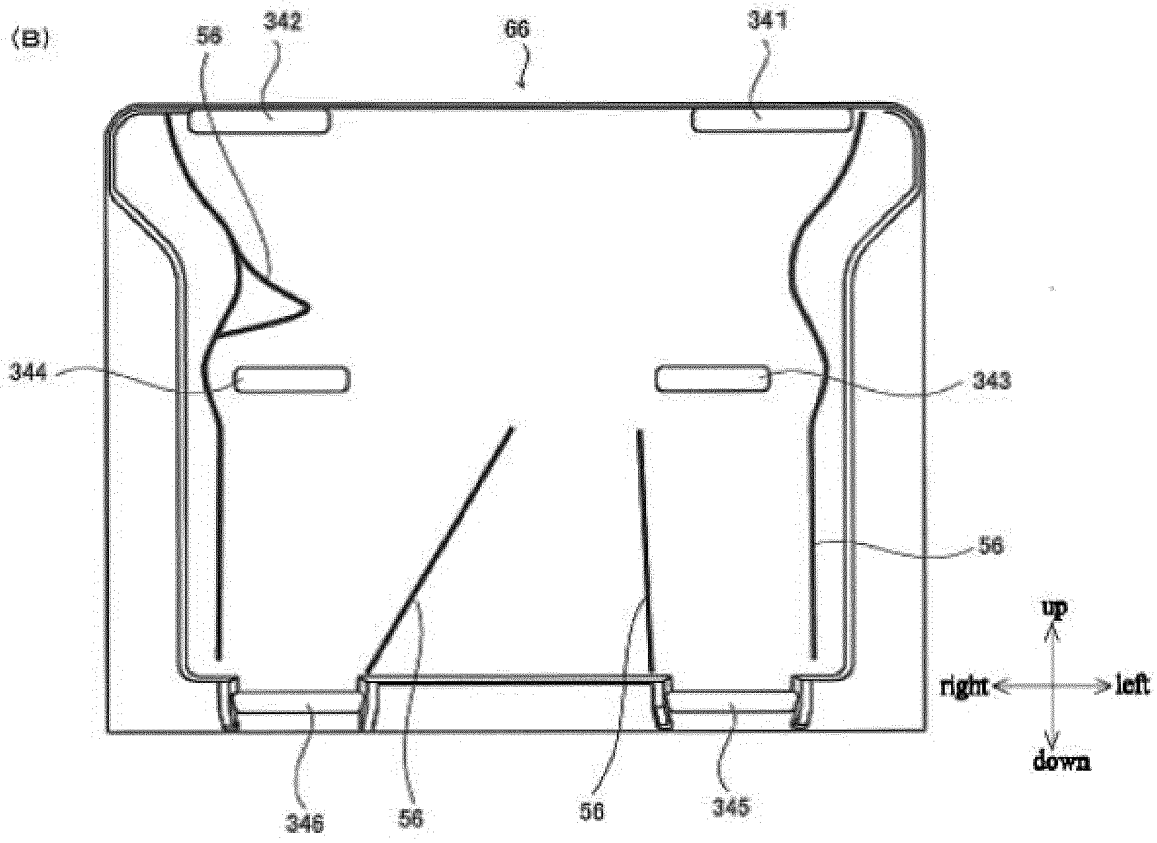
(B)
56
342
66
341
344
343
56
346
56
56
345
up
right
left
down

FIG. 5 (B)

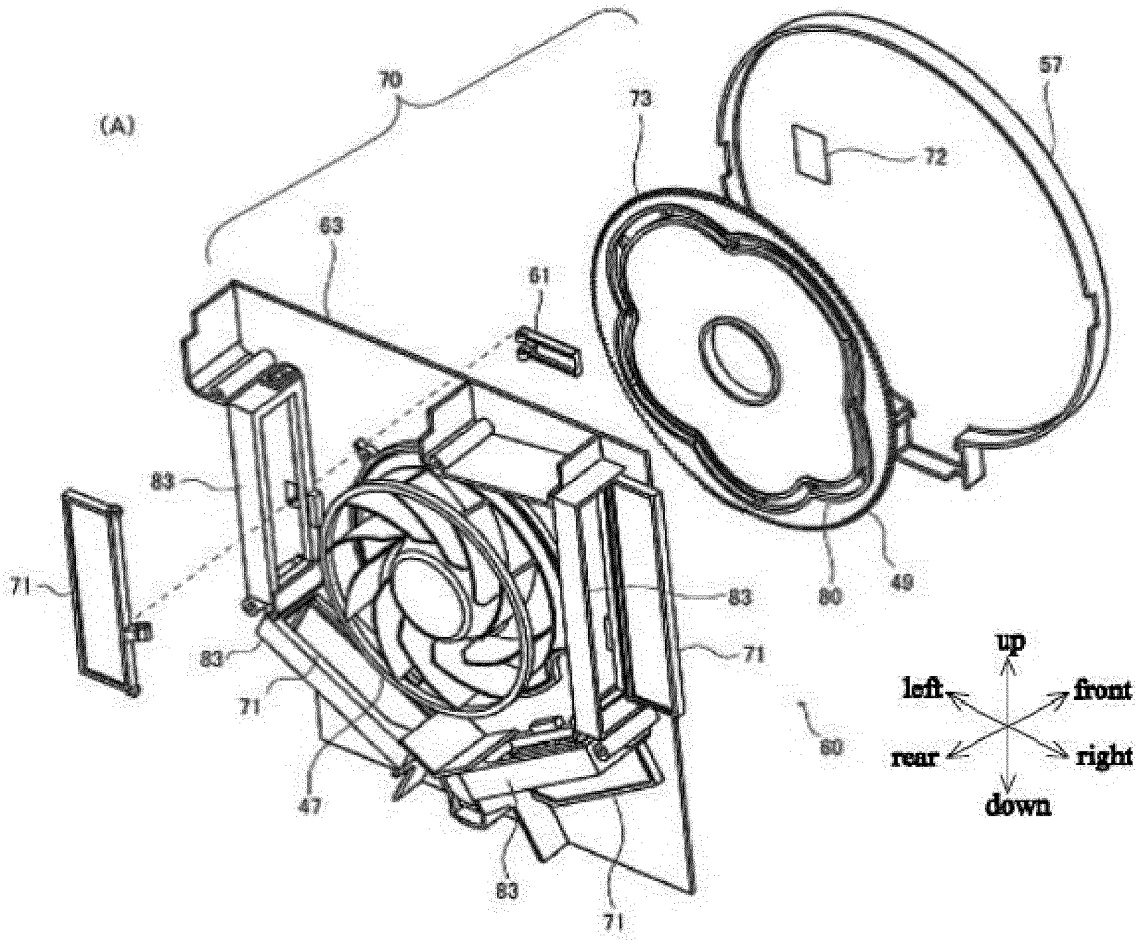

FIG. 6 (A)

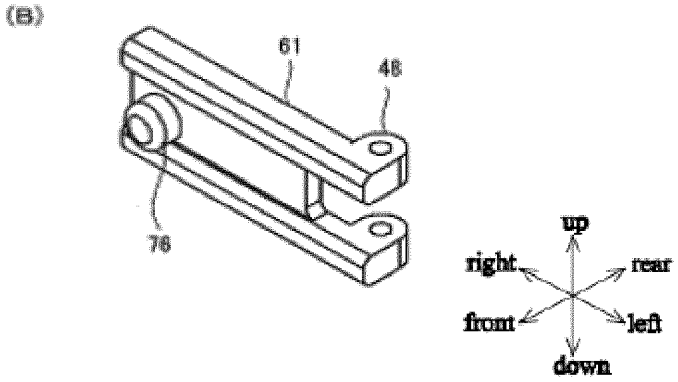

FIG. 6 (B)

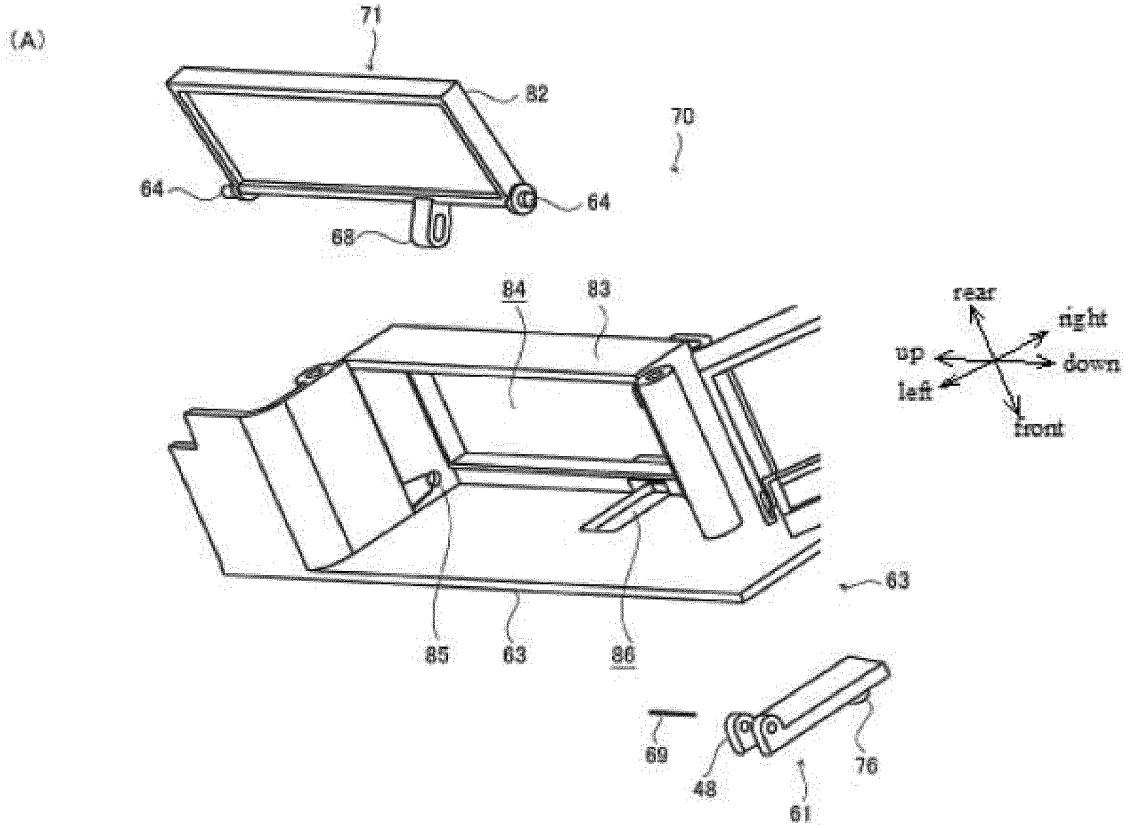
(A)
71
82
70
64
64
68
84
83
rear
right
up
down
left
front
63
85
63
86
69
48
76
61

FIG. 7 (A)

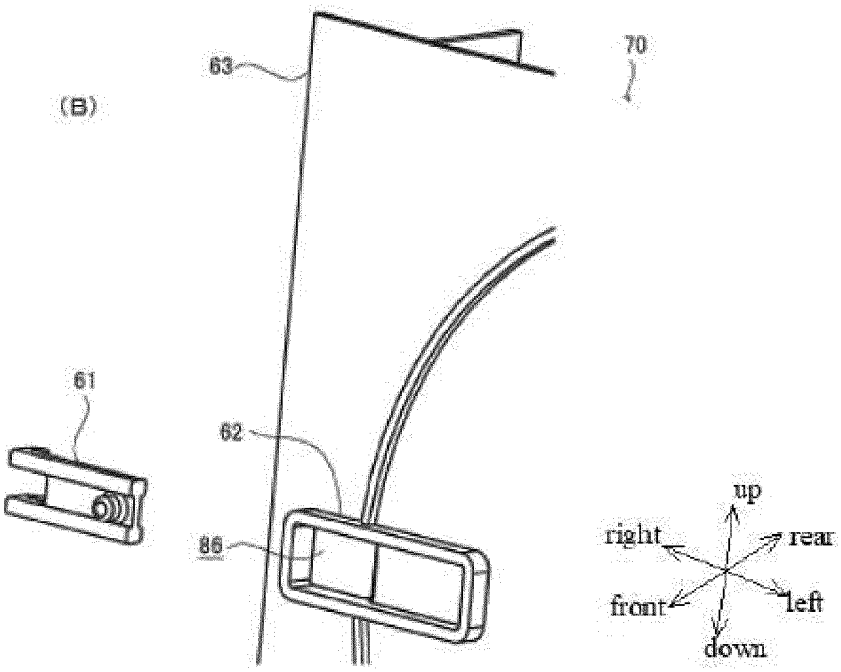
(B)
63
70
61
62
86
up
right
rear
front
left
down

FIG. 7 (B)

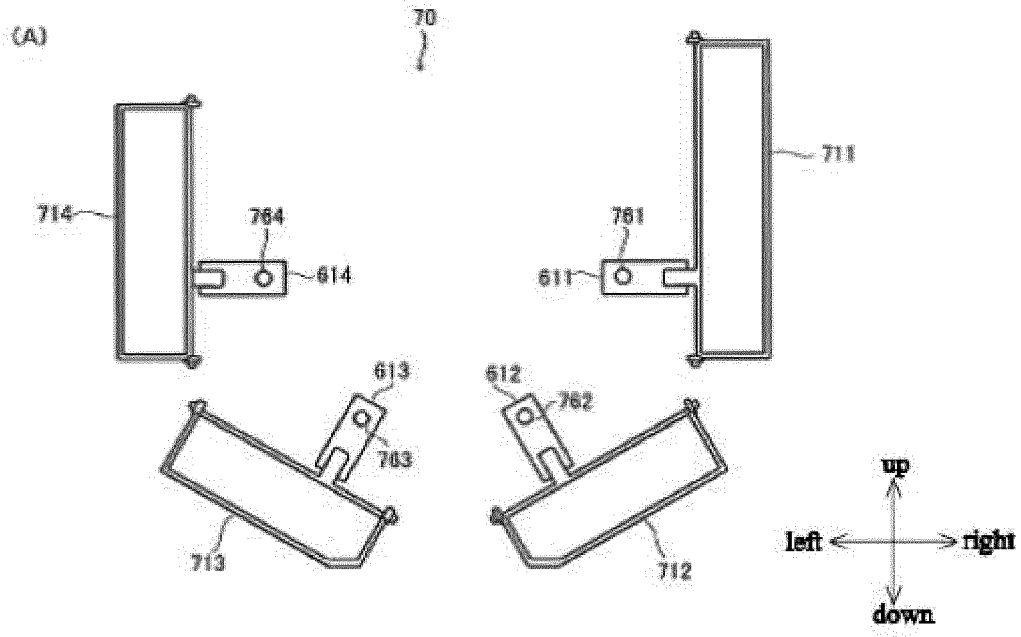
(A)
70
711
714
764
614
761
611
613
612
762
763
713
712
up
left
right
down

FIG. 8 (A)

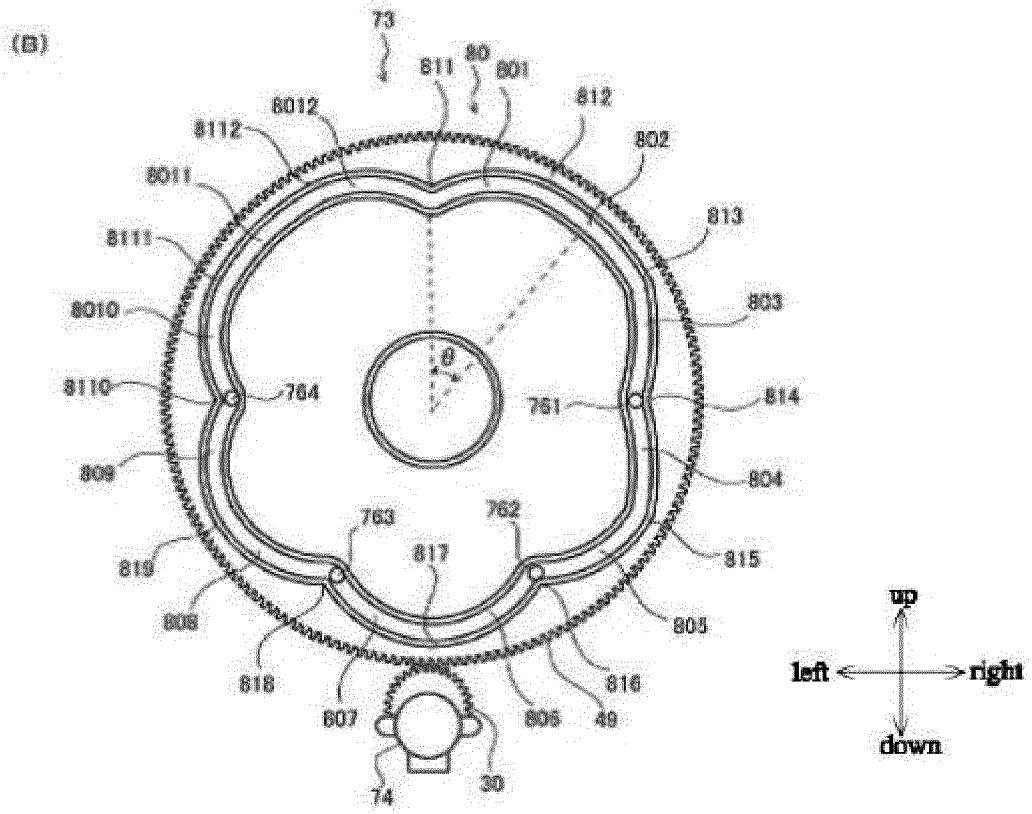
(B)
73
811
80
801
812
8012
8112
802
8011
813
8111
803
8010
θ
8110
764
761
814
809
804
763
762
819
817
815
808
805
818
816
807
806
49
74
30
up
left
right
down

FIG. 8 (B)

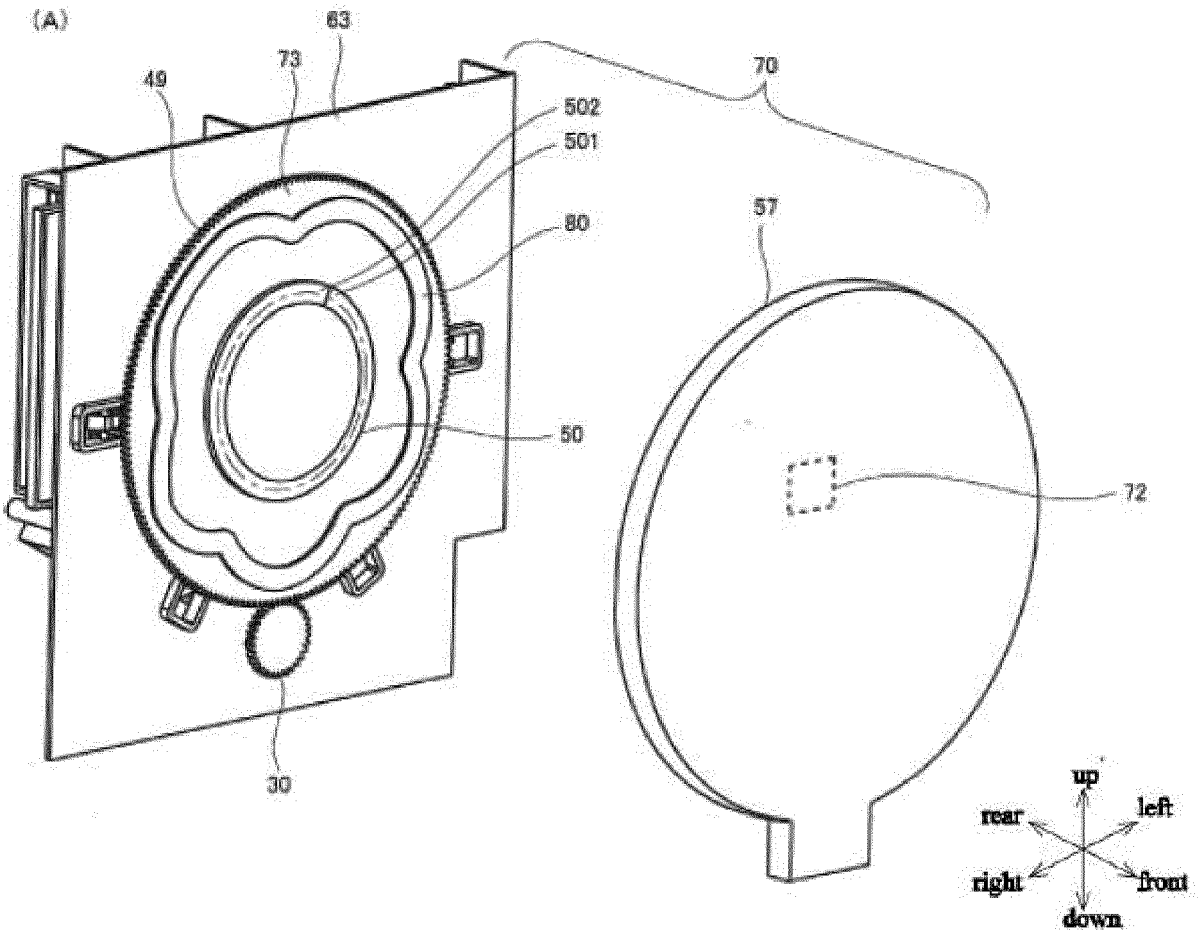
(A)
63
73
49
70
502
501
80
57
50
72
30
up
rear
left
right
front
down

FIG. 9 (A)

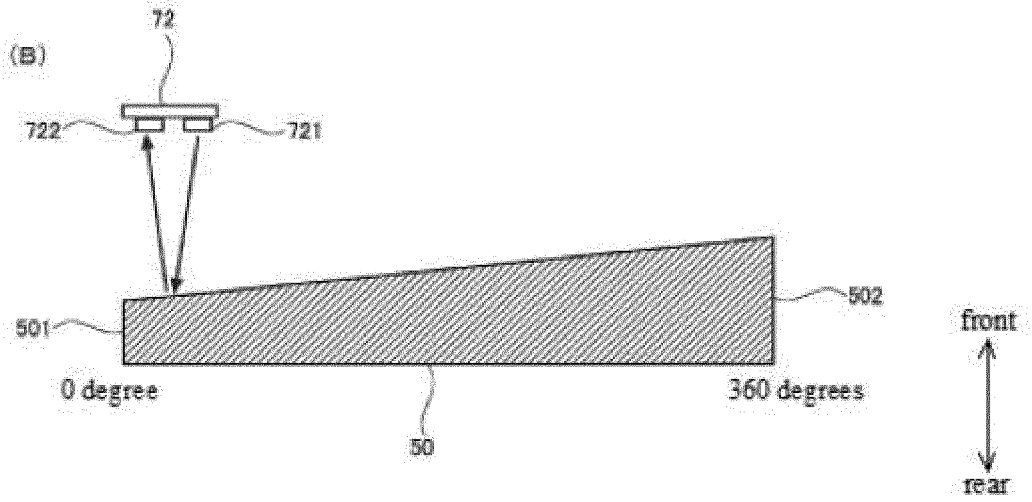
(B)
72
722
721
501
502
0 degree
360 degrees
50
front
rear

FIG. 9 (B)

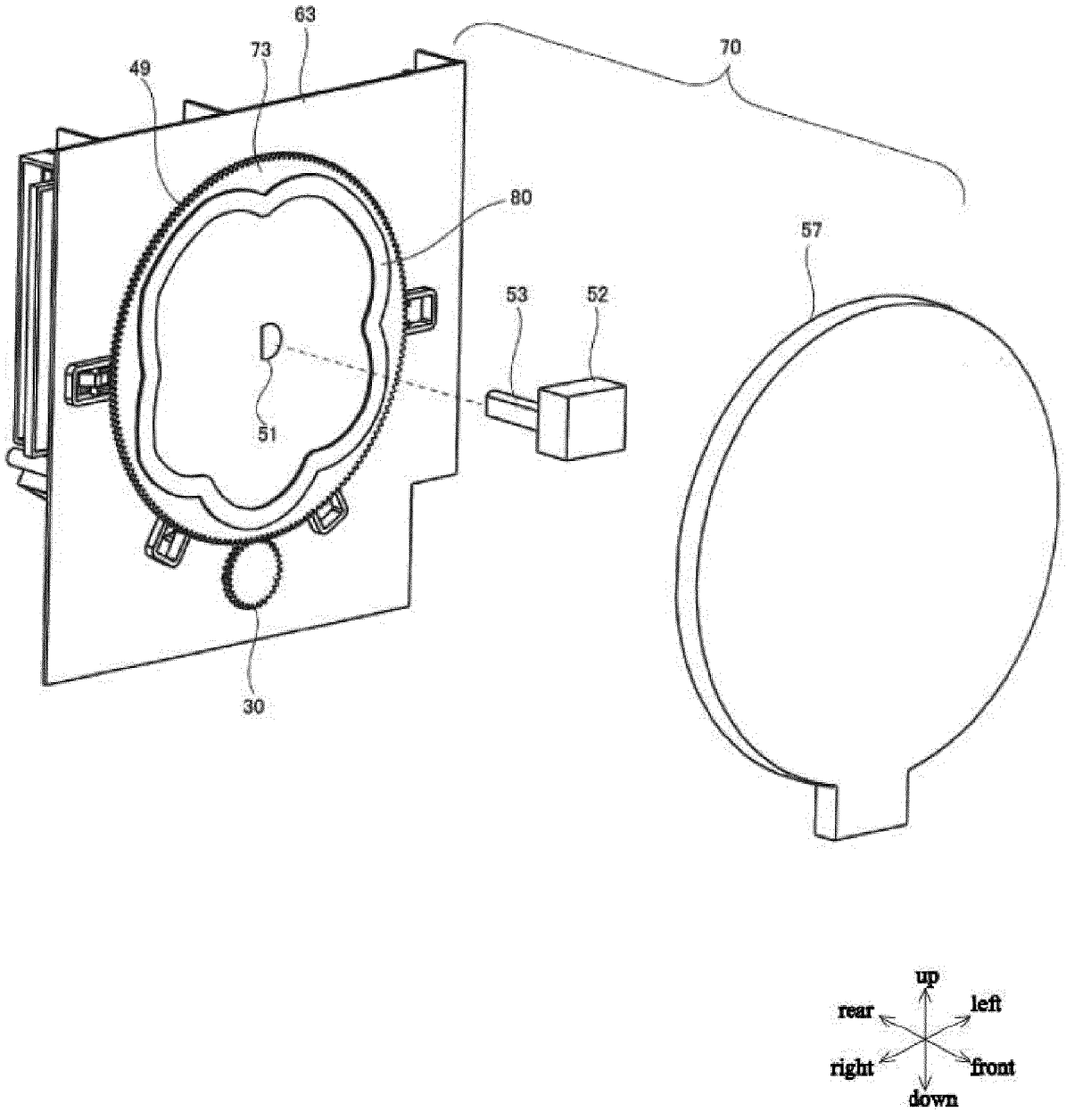

FIG. 10

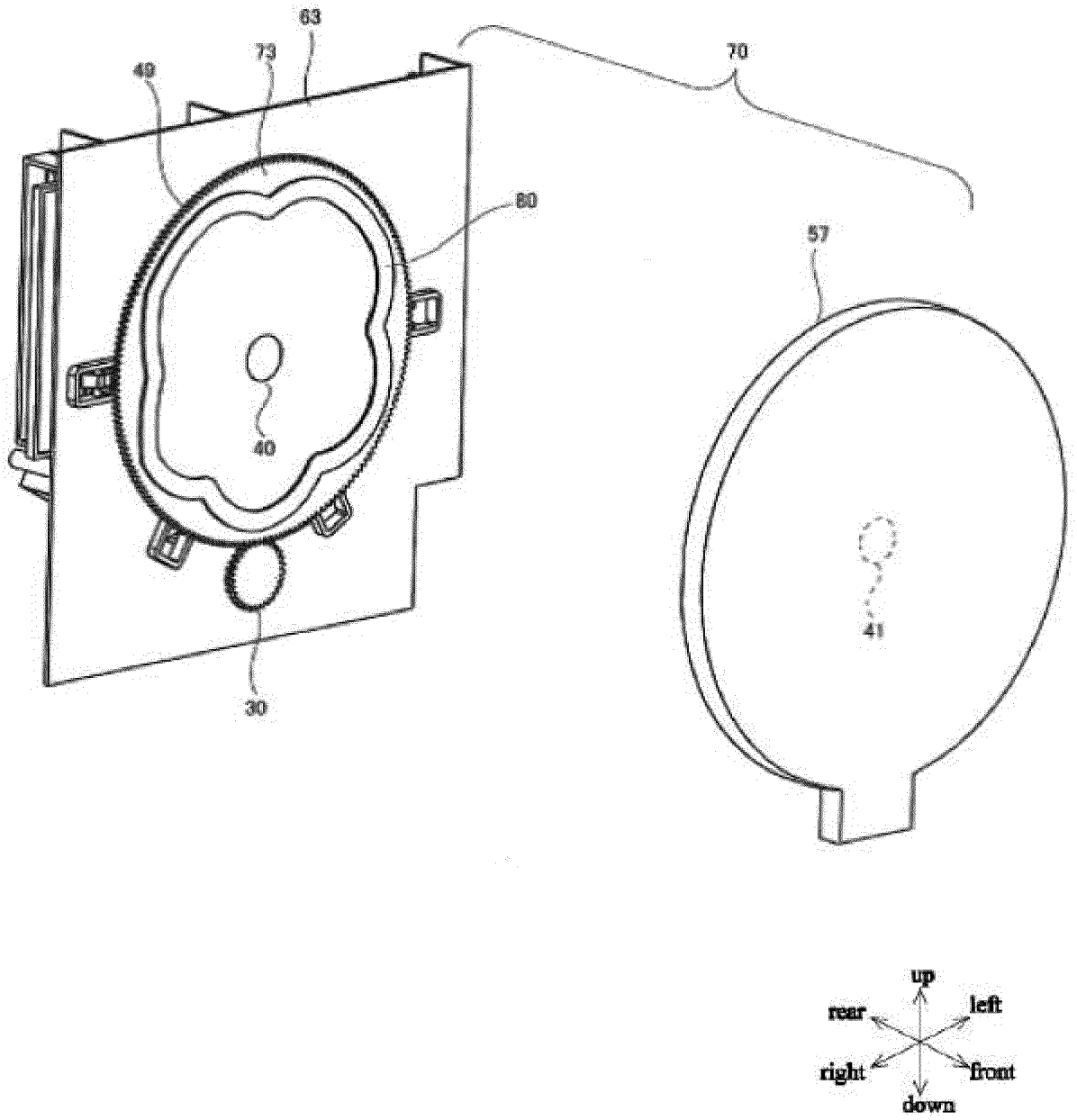

FIG. 11

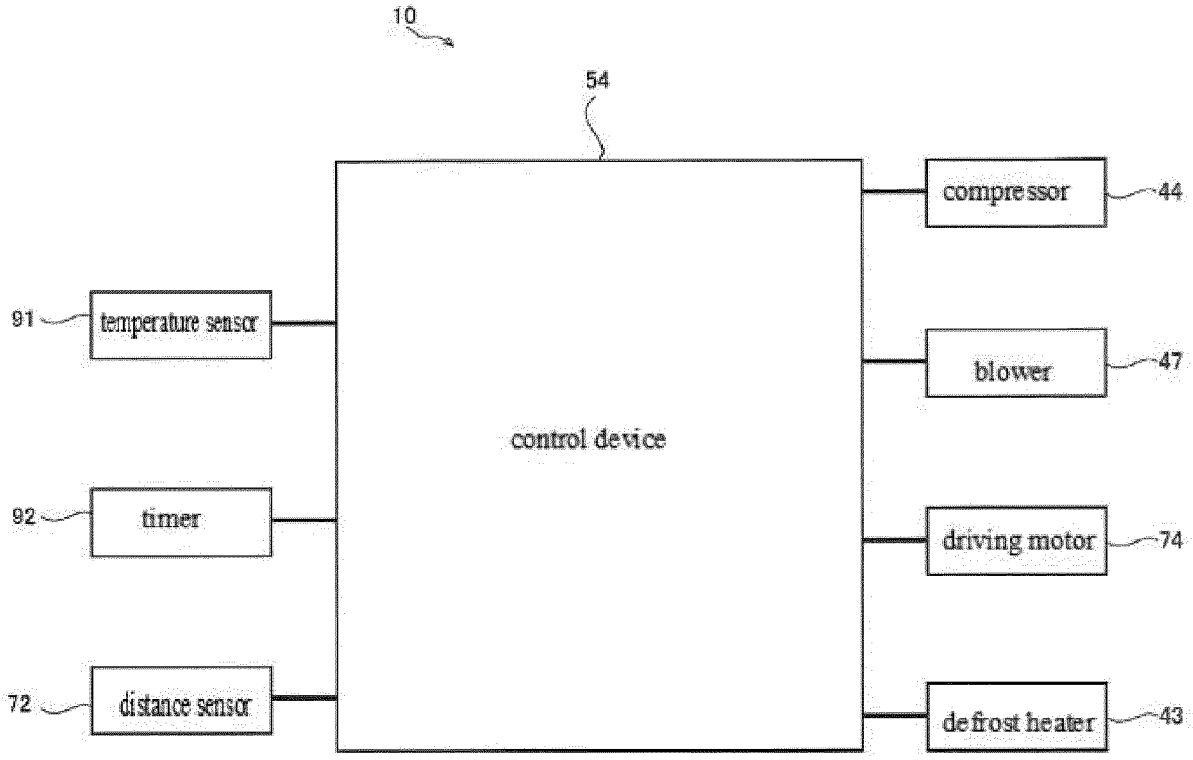
10
54
compressor
44
91
temperature sensor
blower
47
control device
92
timer
driving motor
74
72
distance sensor
defrost heater
43

FIG. 12

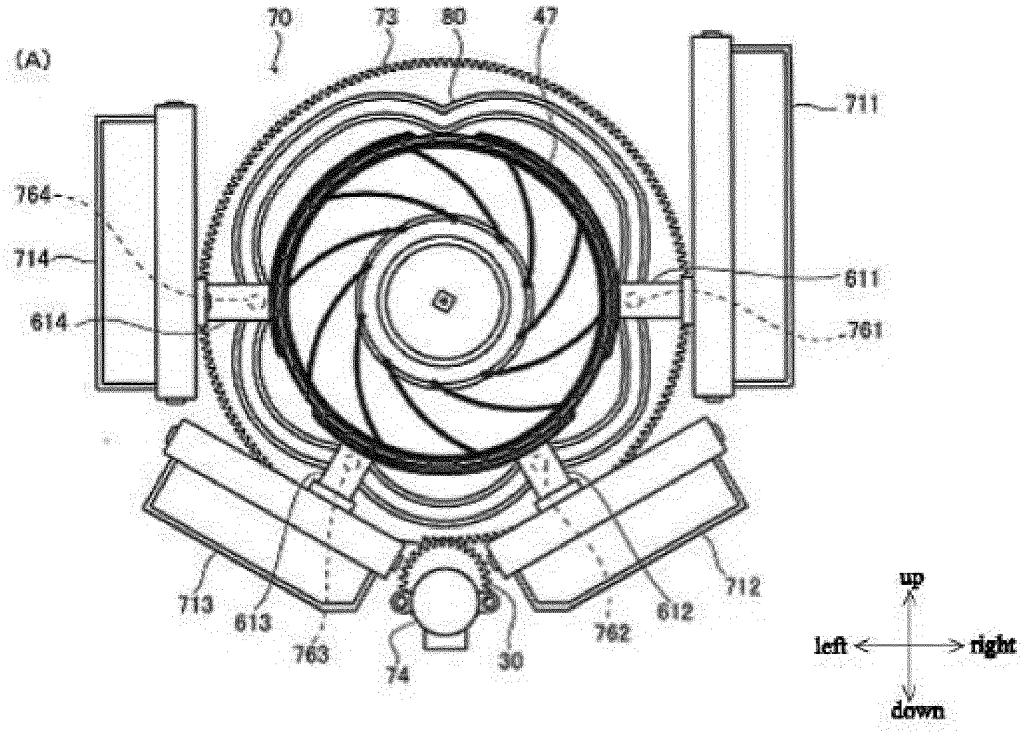

FIG. 13 (A)

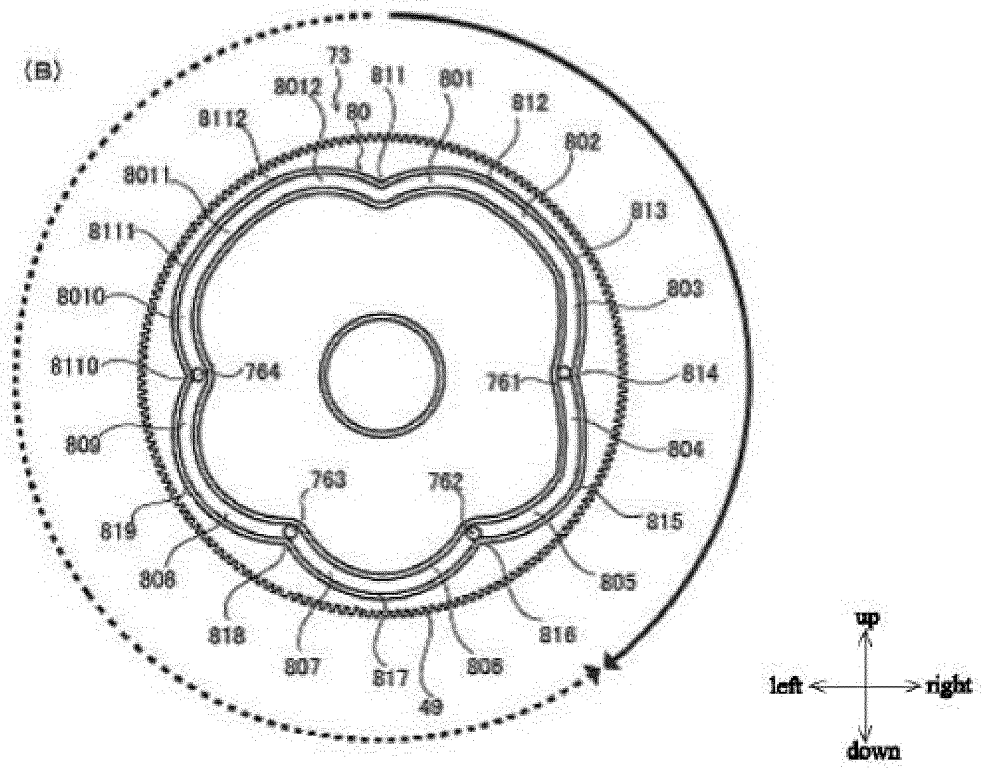

FIG. 13 (B)

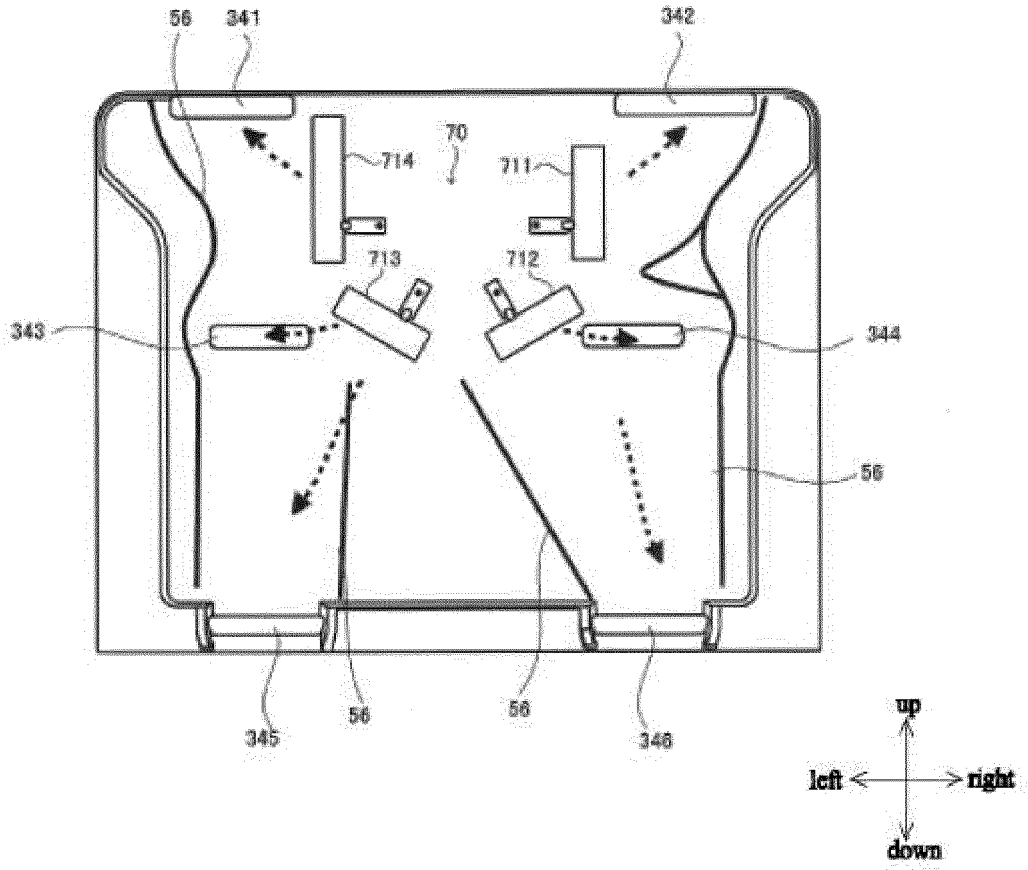
56
341
342
70
714
711
713
712
343
344
56
345
56
56
346
up
left
right
down

FIG. 14

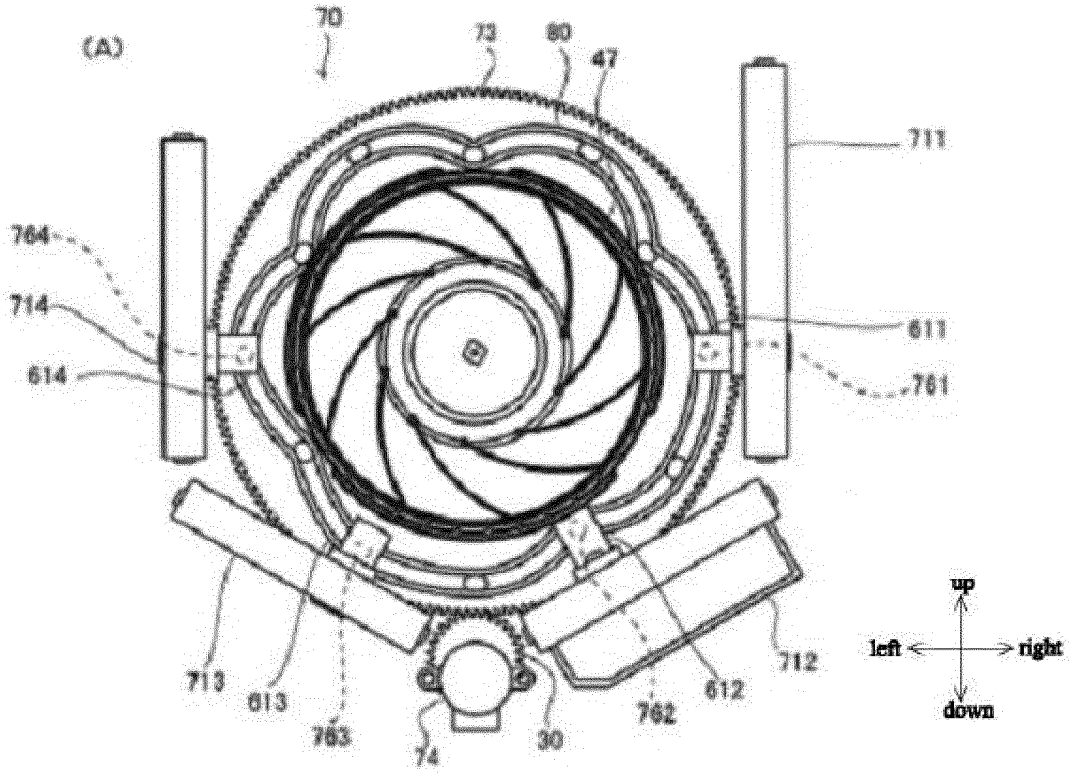
(A)
70
73
80
47
711
764
714
614
611
761
713
613
763
74
30
762
612
712
up
left
right
down

FIG. 15 (A)

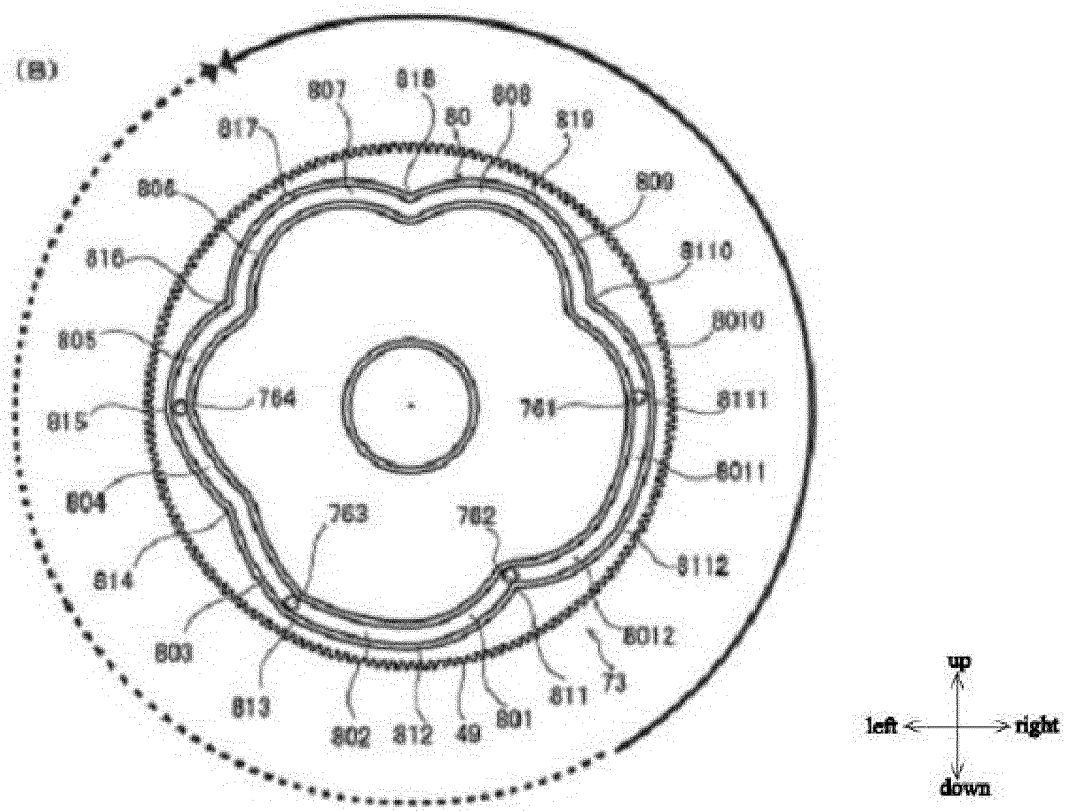
(B)
807
818
808
817
80
819
806
809
816
8110
8010
805
764
761
8111
815
8011
804
763
762
8112
814
8012
803
811
73
813
802
812
49
801
up
left
right
down

FIG. 15 (B)

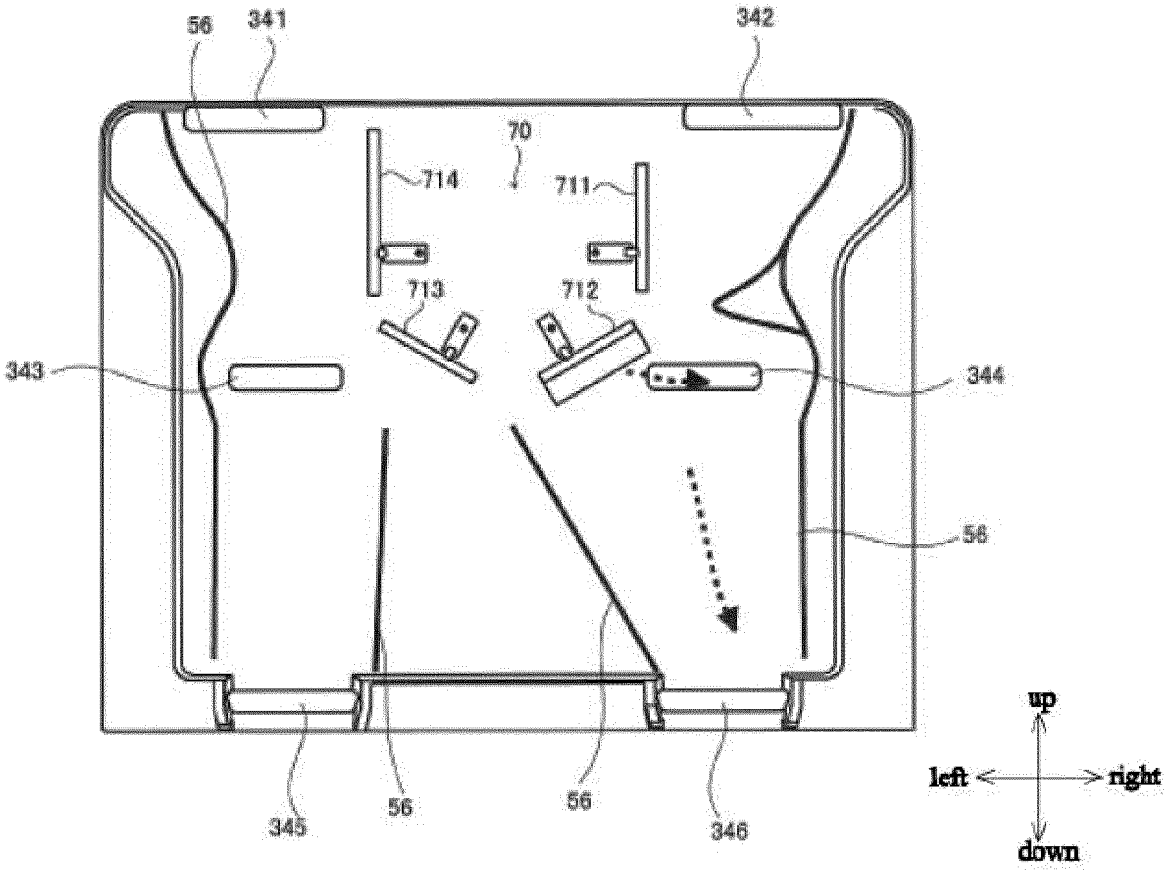

FIG. 16

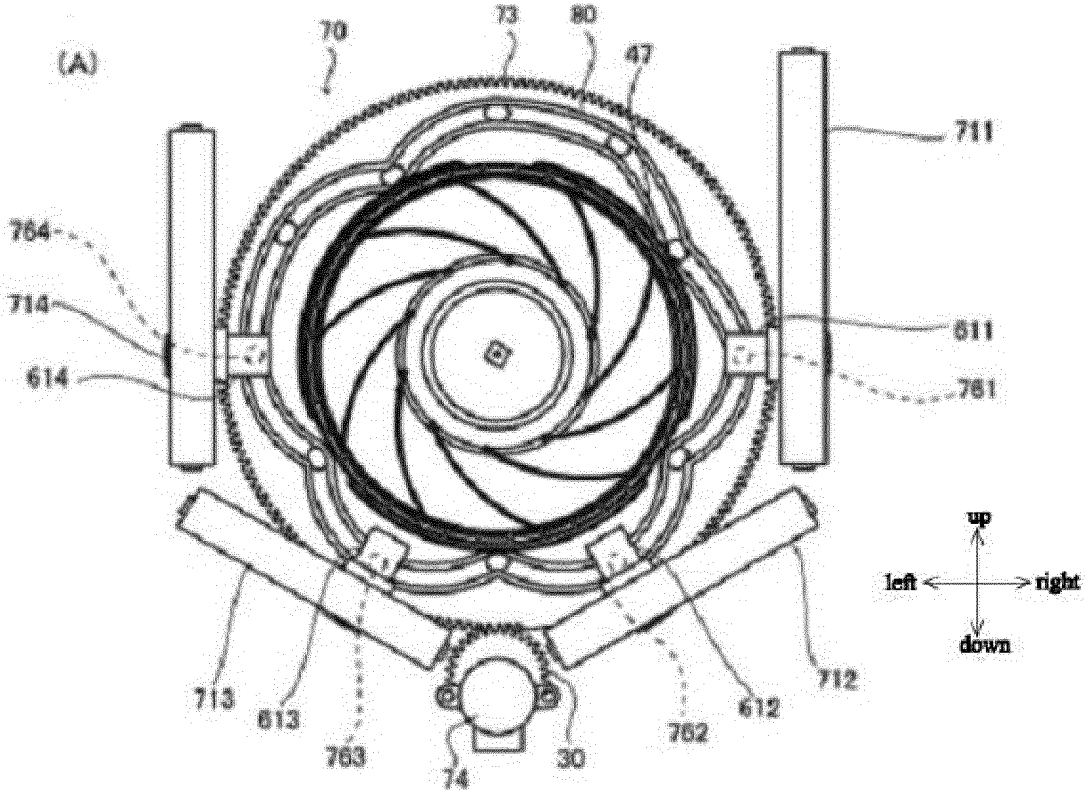
(A)
70
73
80
47
711
764
714
614
811
781
712
713
613
763
74
30
762
612
up
left
right
down

FIG. 17 (A)

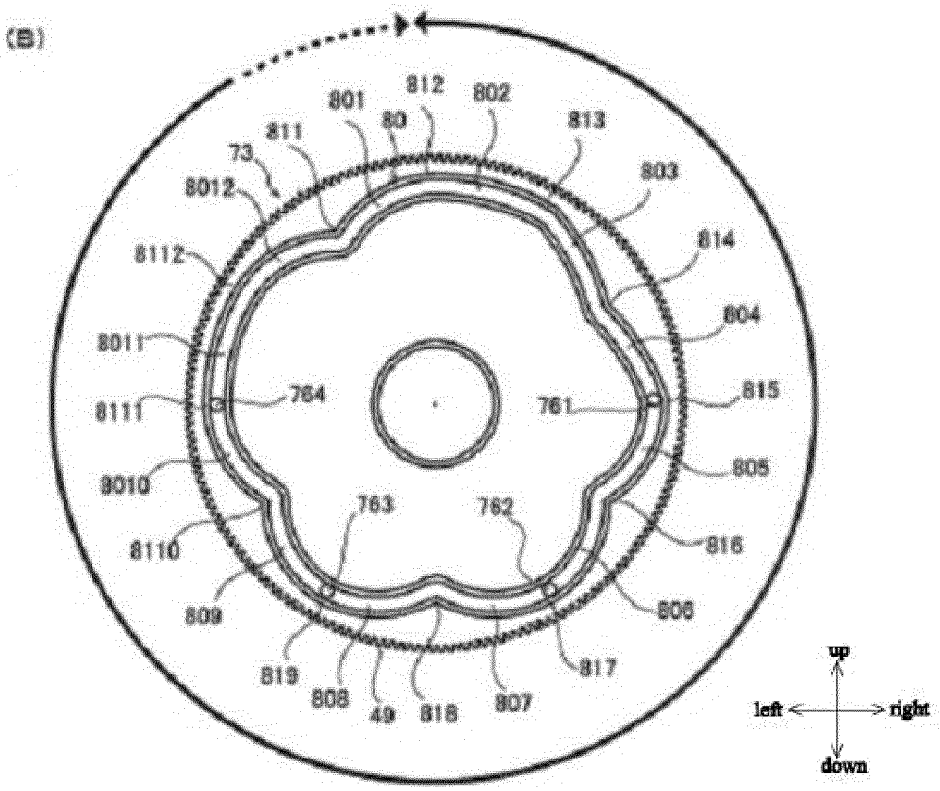
(B)
801
812
802
811
80
813
73
803
8012
814
8112
804
8011
764
761
815
8111
805
8010
763
762
816
8110
809
806
819
817
808
49
818
807
up
left
right
down

FIG. 17 (B)

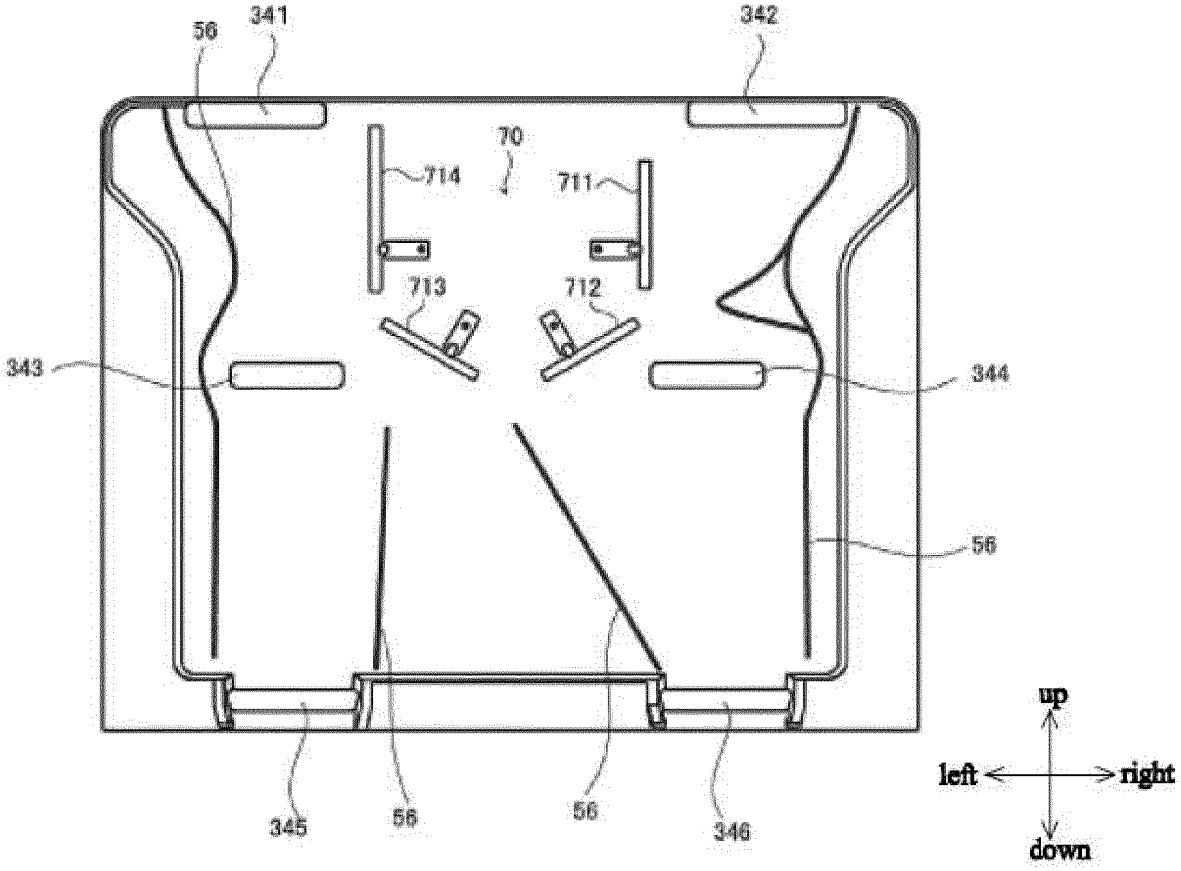

FIG. 18

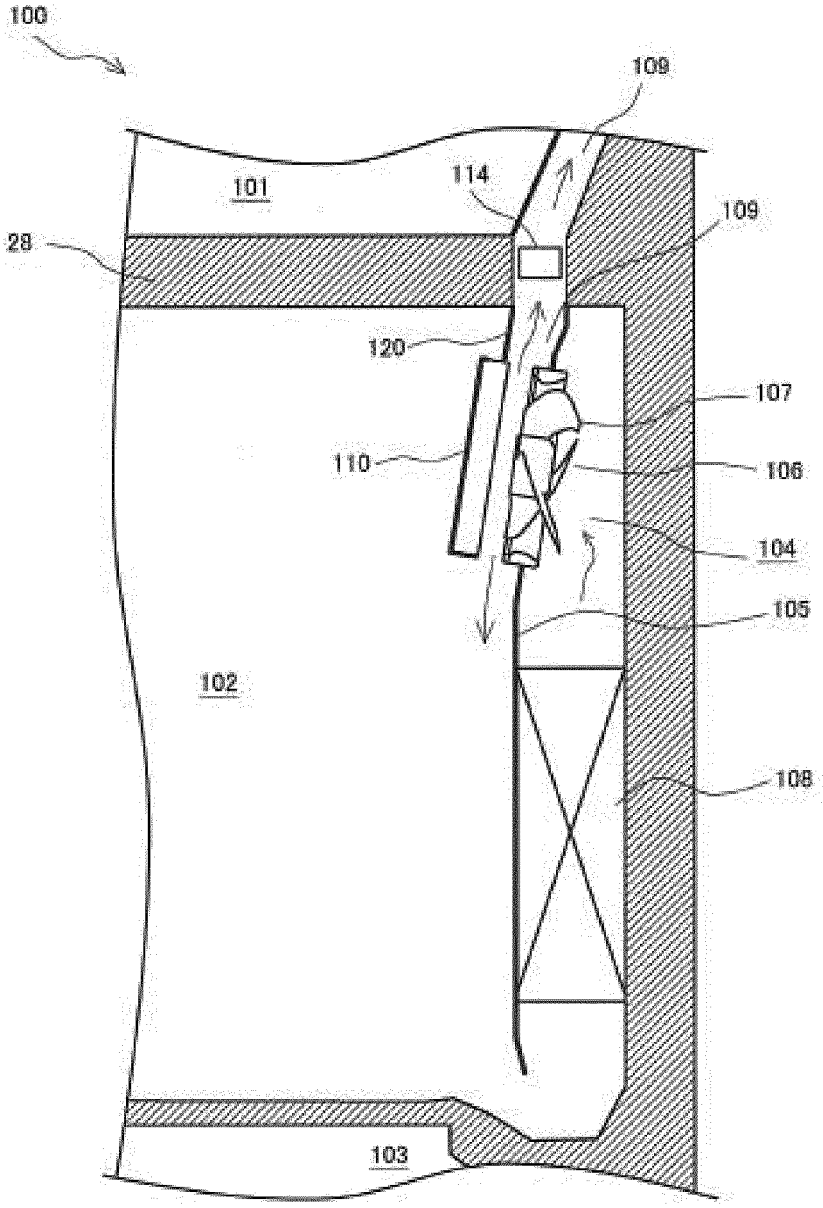

FIG. 19

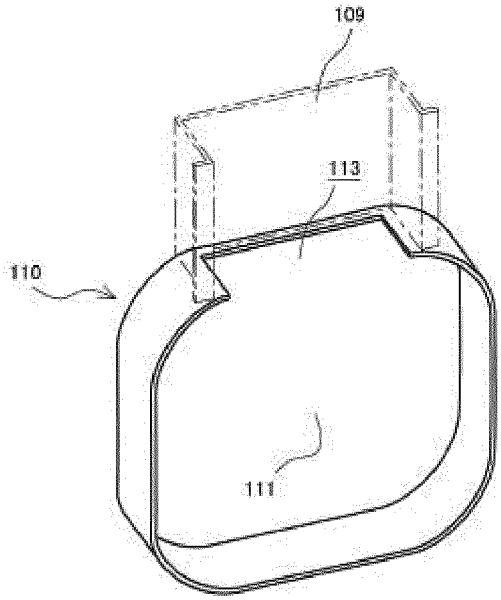

FIG. 20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/123489

A. CLASSIFICATION OF SUBJECT MATTER

F25D 17/08(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)

F25D

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; DWPI; SIPOABS: 风路, 档板, 挡板, 风门, 滑轨, 滑槽, baffle, damp, flap, rail, track,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP H09318226 A (SANKYO SEIKI SEISAKUSHO K.K.) 12 December 1997 (1997-12-12) description, paragraph 0059, and figures 21 and 23	1-6
Y	CN 108302875 A (QINGDAO HAIER CO., LTD.) 20 July 2018 (2018-07-20) description, paragraph 0048, and figure 2	1-6
Y	JP H10122723 A (MIYAMAE K.K.) 15 May 1998 (1998-05-15) description, paragraphs 0004-0005 and 0016-0017, and figures 4-8	1-6
A	JP H09303936 A (SANYO ELECTRIC CO.) 28 November 1997 (1997-11-28) entire document	1-6
A	CN 106766569 A (JIANGSU LEILI MOTOR CO., LTD.) 31 May 2017 (2017-05-31) entire document	1-6

☐ 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
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"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
10 February 2020	**21 February 2020**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration** **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing** **100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/123489

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
JP	H09318226	A	12 December 1997	JP	3314910	B2	19 August 2002
CN	108302875	A	20 July 2018	WO	2019129072	A1	04 July 2019
JP	H10122723	A	15 May 1998		None		
JP	H09303936	A	28 November 1997		None		
CN	106766569	A	31 May 2017		None		

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2013002664 A **[0002]**