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(54) **SHIELDING DEVICE AND REFRIGERATOR HAVING SHIELDING DEVICE**

(57) The present invention aims to provide a shielding device (70, 90) that occupies less volume of storage compartments, and a refrigerator (10, 100). The shielding device (70, 90) is used to properly close air passages (109) for supplying cold air in the refrigerator (10, 100). The shielding device (70, 90) comprises: a plurality of rotatable shielding walls (71, 711, 712, 713, 714) disposed surrounding a blower (47, 107) from radially outside, and shielding wall driving mechanisms (60) configured to drive the rotatable shielding walls (71, 711, 712, 713, 714) to perform the opening or closing action. In addition, the shielding wall driving mechanism (60) has a drive motor (74, 89) serving as a drive source, and a power transmission mechanism such as gears (811, 812, 813, 814, 815, 816, 817) for transmitting the power of the drive motor (74, 89) to the rotatable shielding walls (71, 711, 712, 713, 714).

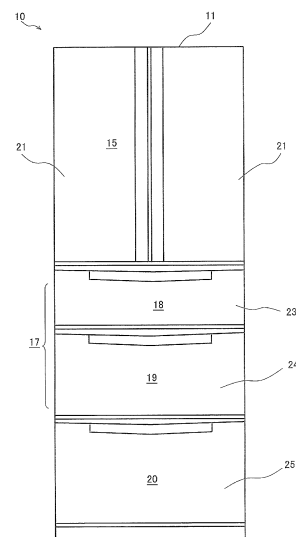


Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a shielding device and a refrigerator having the same, and particularly to a shielding device for properly closing an air passage connecting a cooling chamber with a storage compartment, and a refrigerator having the shielding device.

BACKGROUND

[0002] Conventionally, a refrigerator disclosed in patent document D1 (JP Patent Laid-open 2013-2664) is known in which a plurality of storage compartments are cooled properly by a cooler.

[0003] FIG. 12 illustrates a refrigerator 100 disclosed in D1. 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 accommodating a cooler 108 is formed on an inner side of the freezing compartment 102, an opening portion 106 is formed in a partition wall 105 which partitions the cooling chamber 104 from the freezing compartment 102, and the opening portion 106 is used to supply cold air to each storage compartment. In addition, a blower fan 107 for blowing cold air is disposed at the opening portion 106, and a blower cover 110 for covering the blower fan 107 is disposed on the side of the freezing compartment 102. A damper 114 is disposed in an air passage 109 through which the cold air supplied to the refrigerating compartment 101 flows.

[0004] The blower cover 110 is described in detail with reference to FIG. 13. The blower cover 110 is formed with a recess 111 having a substantially rectangular shape, and an opening portion 113 is formed by notching an upper portion of the recess 111. Here, when the blower cover 110 covers the blower fan 107, the opening portion 113 of the blower cover 110 communicates with the air passage 109 on the side of the main body of the refrigerator.

[0005] During operation of the refrigerator 100 with the above configuration, when the refrigerating compartment 101 and the freezing compartment 102 are cooled simultaneously, the blower cover 110 is separated from the blower fan 107, the damper 114 is opened, and the blower fan 107 rotates in this state. As such, part of the cold air cooled by the cooler 108 in the cooling chamber 104 is blown into the freezing compartment 102 by a blowing force of the blower fan 107. In addition, a remaining part of the cold air is blown into the refrigerating compartment 101 via the air passage 109, the damper 114 and the air passage 109. Thereby, both the freezing compartment 102 and the refrigerating compartment 101 are cooled.

[0006] On the other hand, when only the refrigerating compartment 101 needs to be cooled, the blower fan 107 is covered by the blower cover 110, the damper 114 is

opened, and the blower fan 107 blows the cold air cooled by the cooler 108 in this state. When the blower cover 110 is in a closed state, the opening portion 113 formed in the upper portion of the blower cover 110 communicates with the air passage 109. Therefore, the cold air blown by the blower fan 107 is supplied to the refrigerating compartment 101 via the opening portion 113, the damper 114 and the air passage 109.

[0007] As described above, a plurality of storage compartments can be cooled with one cooler 108 by using the blower cover 110 formed with the opening portion 113.

[0008] However, the blower cover 110 having the abovementioned configuration closes the opening portion 106 of the cooling chamber 104 by moving backward, and opens the opening portion 106 of the cooling chamber 104 by moving forward. In addition, a driving mechanism for driving the blower cover 110 to move in a front-rear direction needs to be disposed.

[0009] The blower cover 110 needs a space for opening and closing operations in the front-rear direction. Therefore, in the interior of the refrigerator 100, a large space is required for opening and closing the blower cover 110. As a result, there occurs the following problem: an internal volume of the freezing compartment 102 formed in front of the blower cover 110 is reduced, and the amount of articles that can be accommodated in the freezing compartment 102 is limited. In addition, a driving sound is generated when the blower cover 110 is moved in the front-rear direction by a motor, and the driving sound might be uncomfortable to the user when it is loud.

SUMMARY

[0010] In view of the above problems, an object of the present invention is to provide a shielding device that does not occupy the internal volume of the refrigerator and exhibits a small driving sound, and a refrigerator having the shielding device.

[0011] In order to achieve the above-mentioned object, an embodiment of the present invention provides a shielding device, wherein the shielding device is configured to close air passages through which cold air is blown in a refrigerator, the shielding device comprising: a plurality of rotatable shielding walls disposed surrounding a blower from radially outside and configured to rotate to open and close the air passages, and a shielding wall driving mechanism configured to drive the rotatable shielding walls to rotate, the shielding wall driving mechanism has a drive source, and a power transmission mechanism for transmitting power from the drive source to the rotatable shielding walls.

[0012] As a further improvement of one embodiment of the present invention, the power transmission mechanism is a gear mechanism disposed between adjacent rotatable shielding walls.

[0013] As a further improvement of one embodiment of the present invention, the plurality of rotatable shield-

ing walls are disposed in a substantially ring shape along an outer circumference of the blower, the power transmission mechanism is a cable passing through the rotatable shielding walls, the cable passes through cable pass-through portions formed on the rotatable shielding walls.

[0014] Another embodiment of the present invention provides a refrigerator, comprising: a freezing circuit having a cooler for cooling air to be supplied through air passages to storage compartments, a cooling chamber formed with an air blowing vent communicated with the storage compartments, the cooler being disposed in the cooling chamber, a blower configured to blow air supplied through the air blowing vent to the storage compartments, and the shielding device as mentioned above at least partially closing the air passages.

[0015] Effects of the present invention are as follows: the miniature of the structure can be achieved by using the rotatable shielding walls around the blower to opening and closing the air passages, thereby reducing the dimensions of the shielding device as a whole in the thickness direction. In addition, the power is transmitted by the power transmission mechanism from a drive source to the rotatable shielding walls, thereby performing the opening and closing operation of the rotatable shielding walls well.

[0016] In addition, in the present invention, the opening and closing operations of a plurality of rotatable shielding walls can be managed by the power transmission mechanism by transmitting the power through a gear mechanism to the rotatable shielding walls.

[0017] In addition, in the present invention, the rotatable shielding walls can be made in an upstanding state by gathering the cable radially to shorten its length, and conversely, the rotatable shielding walls can be made in a horizontally-lying state by releasing and extending the cable.

[0018] In addition, according to the refrigerator of the present invention, the dimensions of the shielding device as a whole in the thickness direction can be reduced, and the effective volume used as the storage compartments can be increased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

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 an internal configuration of the refrigerator according to the embodiment of the present invention.

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

FIG. 4 is a view showing a state after a shielding

device of the refrigerator according to the embodiment of the present invention is assembled, wherein FIG. 4(A) is a perspective view, FIG. 4(B) is a cross-sectional view taken along a section line A-A, and FIG. 4(C) is a schematic view of the configuration of an air passage as viewed from the rear.

FIG. 5 is a view of the shielding device according to the embodiment of the present invention, wherein FIG. 5(A) is a perspective view, and FIG. 5(B) is an exploded perspective view.

FIG. 6 is a view showing the shielding device according to the embodiment of the present invention, wherein FIG. 6(A) is an exploded view of rotatable shielding walls of the shielding device as viewed from the rear, and FIG. 6(B) is a view of a portion where gears mesh with each other.

FIG. 7 is a view showing a fully-closed state of the shielding device according to the embodiment of the present invention, wherein FIG. 7(A) is a view showing the shielding device as viewed from the rear, and FIG. 7(B) is a perspective view showing a front cover after the shielding device is assembled.

FIG. 8 is a view showing a fully-opened state of the shielding device according to an embodiment of the present invention, wherein FIG. 8(A) is a view showing the shielding device as viewed from the rear, and FIG. 8(B) is a perspective view of the front cover after the shielding device is assembled.

FIG. 9 is a view of a shielding device according to another embodiment of the present invention, wherein FIG. 9(A) is a perspective view of the shielding device in a closed state, and FIG. 9(B) is a perspective view of the shielding device in an open state. FIG. 10 is an exploded perspective view of a shielding device according to a further embodiment of the present invention.

FIG. 11 is a view of a shielding device according to a further embodiment of the present invention, wherein FIG. 11(A) is a view of an action of making the shielding device in an open state, and FIG. 11(B) is a view of an action of making the shielding device in a closed state.

FIG. 12 is an enlarged cross-sectional view of a refrigerator according to the background art.

FIG. 13 is a perspective view of a blower cover used in the refrigerator according to the background art.

DETAILED DESCRIPTION

[0020] The figures are only for illustrative purposes and cannot be understood as limiting the present invention; to better illustrate the embodiments, some parts of the figures may be omitted, enlarged or reduced, and do not represent the dimensions of the actual product; those skilled in the art appreciate that some well-known structures in the figures and depictions thereof may be omitted.

[0021] Hereinafter, a shielding device 70 and a refrig-

erator 10 according to embodiments of the present invention will be described in detail based on the figures. In the following depictions, the same component is denoted by the same symbol in principle, and repeated depictions will be omitted. In addition, in the following depictions, directions such as up, down, front, back, left and right are appropriately used, wherein left and right indicate left and right when the refrigerator 10 is viewed from the rear.

[0022] FIG. 1 is a front view of the refrigerator 10 according to the present embodiment showing a schematic structure of the refrigerator 10. As shown in FIG. 1, the refrigerator 10 has a heat-insulating cabinet 11 as a main body, and storage compartments for storing foods and the like are formed in the heat-insulating cabinet 11. As for the storage compartments, the uppermost layer is the refrigerating compartment 15, an upper freezing compartment 18 is below the refrigerating compartment 15, a lower freezing compartment 19 is below the upper freezing compartment 18, and the lowermost layer is a vegetable compartment 20. In addition, the upper freezing compartment 18 and the lower freezing compartment 19 are both storage compartments within a freezing temperature range, and they may be collectively referred to as a freezing compartment 17 in the following depictions. Here, the upper freezing compartment 18 may be partitioned in a left-right direction, and one side may be used as an ice making compartment.

[0023] The front of the heat-insulating cabinet 11 has an opening, the openings corresponding to the above-mentioned storage compartments are each provided with a heat-insulating door 21, and these heat-insulating doors may be opened and closed freely. The refrigerating compartment 15 is divided in the left-right direction and the left and right parts are closed by respective heat-insulating doors 21. Upper and lower ends of the heat-insulating doors 21 on outer sides in a widthwise direction are rotatably mounted on the heat-insulating cabinet 11. In addition, the heat-insulating doors 23, 24 and 25 are integrally assembled with respective storage containers, may be drawn freely along the front of the refrigerator 10, and be supported by the heat-insulating cabinet 11. Specifically, the heat-insulating door 23 closes the upper freezing compartment 18, the heat-insulating door 24 closes the lower freezing compartment 19, and the heat-insulating door 25 closes the vegetable compartment 20.

[0024] FIG. 2 is a side cross-sectional view showing the schematic structure of the refrigerator 10. The heat-insulating cabinet 11 as the main body of the refrigerator 10 comprises a housing 12 made of a steel plate with an opening in the front, and a liner 13 made of a synthetic resin, disposed within the housing 12 with a gap between the liner 13 and the housing 12 and having an opening in the front. The gap between the housing 12 and the liner 13 is filled with a heat-insulating material 14 made of foamed polyurethane. In addition, each of the above-mentioned heat-insulating doors 21 employs the same heat-insulating structure as the heat-insulating cabinet

11.

[0025] The refrigerating compartment 15 and the freezing compartment 17 located at the layer therebelow are partitioned by a heat-insulating partition wall 42. In addition, the upper freezing compartment 18 and the lower freezing compartment 19 disposed at the layer therebelow communicate with each other, and the cooled air, namely, the cold air may circulate freely. Furthermore, the freezing compartment 17 and the vegetable compartment 20 are partitioned by a heat-insulating partition wall 43.

[0026] The rear of the refrigerating compartment 15 is partitioned by a partition 65 made of a synthetic resin to form a refrigerating compartment cold air supply passage 29 for supplying cold air to the refrigerating compartment 15. In the refrigerating compartment cold air supply passage 29, air outlets 33 through which cold air flows into the refrigerating compartment 15 are formed. Here, a damper 22 as an air passage opening and closing means can be inserted in the refrigerating compartment cold air supply passage 29. The cold air may be supplied to the refrigerating compartment 15 via the refrigerating compartment cold air supply passage 29 by opening the damper 22. The cold air is not blown to the refrigerating compartment 15 by closing the damper 22.

[0027] A freezing compartment cold air supply passage 31 is formed on an inner side of the refrigerating compartment 17, and cold air cooled by a cooler 45 flows through the freezing compartment cold air supply passage 31 into the freezing compartment 17. A cooling chamber 26 is formed on an inner side behind the freezing compartment cold air supply path 31. A cooler 45 is disposed in the cooling chamber and is an evaporator for cooling air circulating in the refrigerator. The freezing compartment cold air supply passage 31 is a space surrounded by a front cover 67 in the front and a partition 66 in the rear.

[0028] The cooler 45 is connected to a compressor 44, a heat radiator (not shown), and a capillary tube (not shown) as an expansion means via a refrigerant pipe, and is a member constituting a vapor compression type refrigeration cycle circuit.

[0029] FIG. 3 is a side cross-sectional view showing a structure nearby the cooling chamber 26 of the refrigerator 10. The cooling chamber 26 is disposed in an interior of the heat-insulating cabinet 11 and inside the freezing compartment cold air supply passage 31. The cooling chamber 26 and the freezing compartment 17 are partitioned by the partition 66 made of a synthetic resin.

[0030] The freezing compartment cold air supply passage 31 formed in the front of the cooling chamber 26 is a space formed between the cooling chamber 26 and the front cover 67 which made of the synthetic resin and assembled in the front of the cooling chamber 26, and is a passage through which the cold air cooled by the cooler 45 flows into the freezing compartment 17. The front cover 67 is formed with air outlets 34 which are openings through which cold air is blown into the refrigerating com-

partment 17.

[0031] An air return vent 38 for returning air from the freezing compartment 17 to the cooling chamber 26 is formed on a back side of a lower portion of the lower freezing compartment 19. Furthermore, an air return vent 28 is formed below the cooling chamber 26 and communicated with the air return vent 38, and sucks return cold air from respective storage compartments into the cooling chamber 26. The cold air returning through an air return vent 39 (FIG 2) of the vegetable compartment 20 and a vegetable compartment cold air return passage 37 also flows into the air return vent 28.

[0032] In addition, a defrosting heater 46 is disposed below the cooler 45 to melt the frost attached to the cooler 45. The defrosting heater 46 is a resistive heater.

[0033] An air blowing vent 27 is formed in an upper portion of the cooling chamber 26 and is an opening connected to the respective storage compartments. The air blowing vent 27 is an opening into which the cold air cooled by the cooler 45 flows, and enables the cooling chamber 26, the refrigerating compartment cold air supply passage 29 and the freezing compartment cold air supply passage 31 to be communicated with one another. The air blowing vent 27 is provided with a blower 47 that blows cold air to the freezing compartment 17 and the like from the front. In addition, a function of a damper is assumed by a rotatable shielding wall 71 of a shielding device 70 described later, so the damper may be omitted.

[0034] A shielding device 70 is disposed outside the air blowing vent 27 of the cooling chamber 26, to properly close the air passage connected to the air blowing vent 27. The shielding device 70 is covered by the front cover 67 from the front.

[0035] Reference is made to FIG. 4 to illustrate a configuration in which the shielding device 70 for limiting the air passage is assembled. FIG. 4(A) is a perspective view of the partition 66 with the shielding device 70 being assembled, FIG. 4(B) is a cross-sectional view taken along line A-A of FIG. 4(A), and FIG. 4(C) is a view of the configuration of the air passage when the front cover 67 is viewed from the rear.

[0036] Referring to FIG. 4(A), in the partition 66, the air blowing vent 27 penetrating in a thickness direction is formed in an upper portion of the partition 66, and the blower 47 and the shielding device 70 are disposed in front of the air blowing vent 27. Here, the shielding device 70 is hidden by the partition 66. In addition, an opening section 59 formed on an upper end side of the partition 66 is communicated with the refrigerating compartment cold air supply passage 29 shown in FIG. 3.

[0037] Referring to FIG. 4(B), as described above, the freezing compartment cold air supply passage 31 is formed in a space surrounded by the partition 66 and the front cover 67. As described later, the freezing compartment cold air supply passage 31 is divided into a plurality of air passages. In addition, the shielding device 70 and a shielding wall driving mechanism 60 are disposed between the partition 66 and the front cover 67. The shield-

ing device 70 shields the blower 47, and the shielding wall driving mechanism 60 drives the shielding device 70.

[0038] Referring to FIG. 4(C), a plurality of air passages are formed by partitioning an internal space of the front cover 67. Specifically, rib-shaped air passage partition walls 50 and 56 extending rearward from a rear main surface of the front cover 67 are formed. The rear ends of the air passage partition walls 50 and 56 abut against the partition 66 shown in FIG. 4(B).

[0039] Here, the air passage through which the cold air is blown and supplied is divided into a refrigerating compartment cold air supply passage 51, an upper freezing compartment cold air supply passage 52, and a lower freezing compartment cold air supply passage 53 in turn from top. The cold air flowing through the refrigerating compartment cold air supply passage 51 is blown through the opening section 59 to the refrigerating compartment 15 shown in FIG. 2. The cold air flowing through the upper refrigerating compartment cold air supply passage 52 is blown through the air outlet 34 to the upper freezing compartment 18 shown in FIG. 2. The cold air flowing through the lower refrigerating compartment cold air supply passage 53 is blown through the air outlet 34 to the lower freezing compartment 19 shown in FIG. 2. Here, the refrigerating compartment cold air supply passage 51, the upper freezing compartment cold air supply passage 52 and the lower freezing compartment cold air supply passage 53 spread around with the shielding device 70 as a center.

[0040] Reference is made to FIG. 5 to illustrate the configuration of the shielding device 70. FIG. 5(A) is a perspective view showing the shielding device 70, and FIG. 5(B) is an exploded perspective view showing the shielding device 70.

[0041] Referring to FIG. 5(A) and FIG. 5(B), the shielding device 70 has a support base 63, a rotatable shielding wall 71 and a shielding wall driving mechanism 60. The shielding device 70 is a device that shields the air passages of the cold air blown by the blower 47. The air passages connecting the cooling chamber 26 with respective storage compartments are made communicated by making the shielding device 70 in an open state, and, the air passages are cut off by making the shielding device 70 in a closed state.

[0042] Referring to FIG. 5(B), the blower 47 is disposed at a center of the support base 63 by fastening with screws. Although not shown here, the blower 47 has for example a centrifugal fan such as a turbo fan, and a blowing motor that rotates the centrifugal fan, and blows cold air outward in a radial direction.

[0043] The support base 63 is an integrally-formed member made of a synthetic resin, and has a substantially square shape as viewed from the rear. The rotatable shielding wall 71 which is capable of rotate is disposed on each side of the support base 63. A plurality of protrusions 58 are formed by protruding portions of the support base 63 towards the rear side. A cover plate 35 is mounted at the rear ends of the protrusions 58.

[0044] The cover plate 35 is a plate-shaped member having a substantially square shape as viewed from the rear, and is formed with an opening 36 at a center. The cold air entering through the opening 36 is blown around by the blower 47.

[0045] The shield wall driving mechanism 60 drives the rotatable shielding wall 71 to perform an opening or closing action. The shielding wall driving mechanism 60 has a drive motor 74 as a power source, a gear 811 as a power transmission device that transmits the power of the drive motor 74 to the rotatable shielding wall 71, and the like. The specific configuration of the shielding wall driving mechanism 60 will be described later with reference to FIG. 6.

[0046] The drive motor 74 is disposed on at a lower left end side of the support base 63 and configured to generate a drive force for opening and closing the rotatable shielding wall 71.

[0047] The rotatable shielding wall 71 is a rectangular plate-shaped member formed of a synthetic resin, and is formed by the rotatable shielding walls 711-714. The specific configuration of the rotatable shielding wall 71 will be described later with reference to FIG. 6.

[0048] The shielding device 70 will be described in detail with reference to FIG. 6. FIG. 6(A) shows an exploded view of the shielding device 70, and FIG. 6(B) is an enlarged view showing a portion movably connecting the rotatable shielding wall 711 with the rotatable shielding wall 714. In FIG. 6(A), the support base 63 and the blower 47 are covered by the cover plate 35.

[0049] Referring to FIG. 6(A), the rotatable shielding wall 71 is formed by the rotatable shielding walls 711-714. The rotatable shielding wall 71 has long sides along the sides of the support base 63. The rotatable shielding wall 71 is mounted adjacent to the edges of the support base 63 and rotatable about an axis parallel to a plane of the support base 63. The rotatable shielding wall 71 is disposed on paths through which the cold air blown by the blower 47 circulates, and shields respective air passages. In addition, inner edges of the rotatable shielding walls 711-714 are mounted via a rotatable connection portion 64 and can rotate relative to the support base 63.

[0050] The rotatable shielding walls 711-714 are provided with gears such as a gear 811 as a power transmission mechanism for transmitting the power from the drive motor 74. Specifically, a gear 812 and a gear 813 are provided at both ends of the inner side of the rotatable shielding wall 711, and a gear 814 and a gear 815 are provided at both ends of the inner side of the rotatable shielding wall 712. In addition, a gear 816 and a gear 817 are provided at both ends of the inner side of the rotatable shielding wall 713, and a drive shaft 54 and a gear 811 are provided at both ends of the inner side of the rotatable shielding wall 714. The drive shaft 54 is a shaft that is rotated by the drive motor 74.

[0051] The gear 811 of the rotatable shielding wall 714 meshes with the gear 812 of the rotatable shielding wall 711. The gear 813 of the rotatable shielding wall 711

meshes with the gear 814 of the rotatable shielding wall 712. The gear 815 of the rotatable shielding wall 712 meshes with the gear 816 of the rotatable shielding wall 713.

[0052] Referring to FIG. 6(B), the gear 811 of the rotatable shielding wall 714 and the gear 812 of the rotatable shielding wall 711 are configured for example as bevel gears. With this configuration, it is possible to transmit power from the rotatable shielding wall 714 to the rotatable shielding wall 711 in directions that intersect perpendicularly. This configuration is also the same with the gear 813 of the rotatable shielding wall 711 and the gear 814 of the rotatable shielding wall 712, the gear 815 of the rotatable shielding wall 712 and the gear 816 of the rotatable shielding wall 713 shown in FIG. 6(A).

[0053] Reference is made again to FIG. 6 (A) to illustrate the opening or closing action of the shielding device 70. When the drive motor 74 rotates in one direction, the driving force of the drive motor 74 is transmitted to the rotatable shielding wall 711 via the gear 811 and the gear 812, and to the rotatable shielding wall 712 via the gear 813 and the gear 814, and to the rotatable shielding wall 713 via the gear 815 and the gear 816. As a result, the rotatable shielding walls 711-714 simultaneously rotate to a upstanding state, namely, a state in which the rotatable shielding walls perpendicularly intersect with the main surface of the support base 63.

[0054] When the drive motor 74 rotates in a reverse direction, the driving force of the drive motor 74 is transmitted to the rotatable shielding walls 711-714, and the rotatable shielding walls 711-714 simultaneously rotate to a horizontal state, namely, a state in which the rotatable shielding walls are substantially parallel to the support base 63.

[0055] FIG. 7 shows the configuration of the shielding device 70 in a fully closed state. FIG. 7(A) is a view of the shielding device 70 in the fully closed state as viewed from the rear, and FIG. 7(B) is a view of the front cover 67 on which the shielding device 70 in the fully closed state is mounted, as viewed from the rear. The fully closed state refers to a state in which all the air passages for supplying cold air are shielded by the rotatable shielding wall 71.

[0056] Referring to FIG. 7 (A), the driving force of the drive motor 74 is transmitted to the rotatable shielding walls 711-714 through the power transmission mechanism such as the gear 811, so that the rotatable shielding walls 711-714 are in an upstanding state relative to the main surface of the support base 63, namely, a state that the rotatable shielding walls close the air passages communicated with respective storage compartments. In addition, the blower 47 does not rotate in the fully closed state.

[0057] Referring to FIG. 7(B), the shielding device 70 prevents air from flowing from the blower 47 to the outside in the fully closed state. That is, in the fully closed state, all of the shielding device 70 is in the upstanding state, the communication with the air passages for supplying

cold air is cut off, and cold air is not supplied to the refrigerating compartment 15 and the freezing compartment 17 shown in FIG. 2. In addition, during a defrosting process of defrosting the cooler 45 shown in FIG. 2, the shielding device 70 is also in the fully closed state so that

warm air does not flow from the cooling chamber 26 into the refrigerating compartment 15 and the freezing compartment 17.

[0058] FIG. 8 shows the configuration of the shielding device 70 in a fully open state. FIG. 8(A) is a view of the shielding device 70 in the fully opened state as viewed from the rear, and FIG. 8(B) is a view of the front cover 67 on which the shielding device 70 in the fully opened state is mounted, as viewed from the rear. The fully open state refers to a state in which the communication with the air passages for supplying cold air are not shielded by the rotatable shielding wall 71 so that the cold air blown by the blower 47 flows by diffusing around.

[0059] Referring to FIG. 8(A), the shielding device 70, in the fully open state, does not hinder air from flowing from the blower 47 to the outside. That is, in the fully open state, due to the driving force of the drive motor 74, the rotatable shielding walls 711-714 are in a horizontally-lying state in which they lie horizontally substantially parallel to the main surface of the support base 63. Therefore, in the shielding device 70, the cold air blown from the blower 47 is blown to the refrigerating compartment 15 and the freezing compartment 17 without being interfered by the rotatable shielding walls 711-714.

[0060] Referring to FIG. 8(B), the flow resistance can be reduced and the amount of cold air supplied by the blower 47 may be increased by making all the rotatable shielding walls 711-714 included in the shielding device 70 in the horizontally-laying, open state. Specifically, with the rotatable shielding wall 711 being in the open state, cold air is blown to the refrigerating compartment cold air supply passage 51, and the cold air is blown out to the refrigerating compartment 15 shown in FIG. 2 through the refrigerating compartment cold air supply passage 29. In addition, with the rotatable shielding wall 712 and the rotatable shielding wall 714 being in the open state, the cold air is blown to the upper freezing compartment cold air supply passage 52 and then blown out through the air outlet 34 to the upper freezing compartment 18 shown in FIG. 2. In addition, the rotatable shielding wall 713 is in the open state, cold air can be supplied to the freezing compartment 19 (FIG 2) via the lower freezing compartment cold air supply passage 53 and the air outlet 34.

[0061] Here, the rotatable shielding walls 711-714 may also made be in a half-open state. Specifically, it is possible to make the rotatable shielding walls 711-714 in the half-open state by stopping halfway the drive motor 74 as a stepping motor upon transition from the fully closed state shown in FIG. 7(A) to the fully open state shown in FIG. 8(A) as instructed by a control device not shown. The amount of the cold air blown to the freezing compartment 17 can be accurately adjusted by making the

rotatable shielding walls 711-714 in the half-open state.

[0062] In addition, referring to FIG. 2, a damper 22 can be inserted in the refrigerating compartment cold air supply passage 29, and the rotatable shielding wall 711 shown in FIG. 7(A) may be further omitted. That is, the shielding device 70 only has the rotatable shielding wall 712, the rotatable shielding wall 713 and the rotatable shielding wall 714. In addition, the rotatable shielding wall 712, the rotatable shielding wall 713 and the rotatable shielding wall 714 can be in the fully closed state, the fully open state, and the half-open state. A degree of freedom of supplying cold air to the refrigerating compartment 15 and the freezing compartment 17 can be freely adjusted through such a setting.

[0063] Reference is made to FIG. 9 through FIG. 11 to illustrate the configuration of the shielding device 90 in another manner. FIG. 9(A) is a perspective view showing the shielding device 90 in a closed state, FIG. 9(B) is a perspective view showing the shielding device 90 in an open state, and FIG. 10 is an exploded perspective view showing the shielding device 90 in detail. FIG. 11(A) is a view showing a method of making the shielding device 90 in a fully open state, and FIG. 11(B) is a view showing a method of making the shielding device 90 in a fully closed state.

[0064] Referring to FIG. 9(A), the shielding device 90 surrounds the blower 94 from around, and has a plurality of rotatable shielding walls 91 that open and close the air passages. The blower 94 is disposed at a center of a rear surface of the support base 96 having a substantially circular disc shape. An end side of the rotatable shielding wall 91 is rotatably mounted on a periphery of the support base 96 via a rotatable connection portion 93. As an example, twelve rotatable shielding walls 91 are mounted on the periphery of the support base 96. In the closed state, the rotatable shielding walls 91 are in an upstanding state with respect to a main surface of the support base 96. In other words, an annular wall formed by a plurality of rotatable shielding walls 91 is formed on the periphery of the support base 96.

[0065] In addition, the shielding device 90 has a cable 92 serving as a power transmission mechanism that transmits a driving force for opening and closing the rotatable shielding walls 91. Specifically, a cable pass-through portion 95 is formed at an inside end of each rotatable shielding wall 91. The cable 92 passes through the cable pass-through portions 95 of the respective rotatable shielding walls 91, and assumes a substantially ring shape as a whole. Therefore, when a diameter of the ring shape of the cable 92 is reduced by tightening the cable 92, the rotatable shielding walls 91 each rotate from the rotatable connection portion 93 as a starting point until stand up, and are in a upstanding state which the rotatable shielding walls 91 intersect substantially perpendicularly with respect to the main surface of the support base 96. Supply of cold air to respective storage compartments can be stopped by making the shielding device 90 in the closed state as shown in FIG. 7(B).

[0066] FIG. 9(B) shows the shielding device 90 in the fully open state. Here, the respective rotatable shielding walls 91 are in the fully opened state in which they are substantially parallel to the main surface of the support base 96. The rotatable shielding walls 91 can be made in the fully open state by loosening the cable 92 to enlarge the diameter of the ring shape of the cable 92 so that the rotatable shielding walls 92 rotate radially outside until lying horizontally. Cold air can be blown into respective storage compartments by making the shielding device 90 in the fully open state, as shown in FIG. 8(B).

[0067] The specific configuration of the shielding device 90 will be described with reference to the exploded perspective view of FIG. 10. The shielding device 90 has a cover 97, a blower 94, a cable cover 88, rotatable shielding walls 91, a support base 96, a cable-rotating body 86, a cover 99, and a drive motor 89 in turn starting from a rear side.

[0068] The cover 97 has a substantially circular shape, and is formed with an opening portion 82 through which the cold air blown by the blower 94 enters. The cover 97 blocks the blower 94 from the rear side.

[0069] The blower 94, like the above-mentioned blower 47, blows the cold air entering through the opening portion 82 towards outside in a circumferential direction. The blower 94 is mounted on the support base 96 via a blower mounting portion 87.

[0070] The cable cover 88 is formed of a plate material which is in substantially circular ring shape, and protects the cable 92 from the rear, thereby ensuring a space for allowing the cable 92 to move.

[0071] The plurality of rotatable shielding walls 91 are disposed around the blower 94, and rotate to perform actions of opening and closing the air passages distributed around the blower 94.

[0072] The support base 96 is formed of a plate material that is in a substantially ring shape, and is provided with the rotatable shielding walls 91 and the cable 92. The support base 96 is circumferentially formed with rotatable connection portions 98 corresponding to the rotatable connection portions 93 of the rotatable shielding walls 91 (see FIG. 9(A)). The respective rotatable connection portions 93 of the rotatable shielding walls 91 are rotatably connected with the rotatable connection portions 98 of the support base 96. In addition, a section of the cable 92 is fixed on the support base 96. In addition, a groove 85 is formed in an inside portion of the support base 96. The groove 85 is formed elongated in the circumferential direction. An end of the cable 92 is connected to the cable-rotating body 86 via the groove 85.

[0073] The cable-rotating body 86 is formed of a plate material that is in a substantially disc shape, and is disposed in front of the support base 96. The cable-rotating body 86 is connected to the other end of the cable 92. In addition, the cable-rotating body 86 is connected to the drive motor 89 via a gear not shown here. Therefore, when the drive motor 89 rotates in one direction, the cable-rotating body 86 also rotates in the same direction.

Conversely, when the drive motor 89 rotates in a reverse direction, the cable-rotating body 86 also rotates in the reverse direction.

[0074] The cover 99 is made of a plate material having a substantially disc shape and configured to protect the cable-rotating body 86 from the front. The drive motor 89 is mounted on the cover 99.

[0075] The cable 92 has a cable end 921 on one end side and a cable end 922 on the other end side. The cable end 921 is fixed to the rotatable connection portion 98 via a cable fixing portion 84 described later, and the position of the cable end 921 does not change even if the cable-rotating body 86 rotates. The cable end 922 is fixed to the cable-rotating portion 86 via a cable fixing portion 83 described later, and changes positions in the circumferential direction of the cable-rotating body 86 as the cable-rotating body 86 rotates.

[0076] Reference is made to FIG. 11 to illustrate a specific method of opening and closing the rotatable shielding walls 91 by operating the cable 92. FIG. 11(A) shows the shielding device 90 in an open state, and FIG. 11(B) shows the shielding device 90 in a closed state.

[0077] Referring to FIG. 11(A), as described above, one end of the cable 92 is fixed to the support base 96 shown in FIG. 10 via the cable fixing portion 84. The position of the cable fixing portion 84 does not change. On the other hand, the other end of the cable 92 is fixed to the cable-rotating body 86 shown in FIG. 10 via the cable fixing portion 83. As the cable-rotating body 86 rotates, the position of the cable fixing portion 83 moves along the groove 85. Here, when the cable-rotating body 86 rotates counterclockwise driven by the driving force of the drive motor 89 shown in FIG. 10, the cable fixing portion 83 also moves counterclockwise in the groove 85. The cable 92 is then released in the opposite circumferential direction, so the circular ring-shaped cable 92 expands in diameter. In addition, as stated above, the cable 92 runs through the cable pass-through portions 95 of the respective rotatable shielding walls 91. Therefore, the rotatable shielding walls 91 rotate simultaneously until they tilt towards outside and get in in the horizontally-lying state. With the rotatable shielding walls 91 being in the horizontally-lying state, the cold air blown by the air blower 94 by rotating is supplied to the refrigerating compartment 15, the freezing compartment 17 and the vegetable compartment 20 shown in FIG. 2 via the refrigerating compartment cold air supply passage 51, the upper freezing compartment cold air supply passage 52 and the lower freezing compartment cold air supply passage 53 shown in FIG. 8(B).

[0078] Reference is made to FIG. 11(B) to illustrate a method of making the rotatable shielding walls 91 in the closed state. First, driven by the driving force of the drive motor 89 shown in FIG. 10, the cable-rotating body 86 rotates in the reverse direction, namely, in the clockwise direction. Upon doing so, the cable fixing portion 83 at a point where the cable-rotating body 86 is connected with the cable 92 also moves clockwise inside the groove 85.

As a result, the ring-shaped cable 92 is reduced in diameter, and the respective rotatable shielding walls 91 rotate simultaneously to stand up with respect to the main surface of the shielding device 90. As a result, the respective rotatable shielding walls 91 are in a closed state in which they stand up and surround the blower 94 from around. When the shielding device 90 is in the closed state, the cold air is not blown to the respective storage compartments shown in FIG. 2.

[0079] In the shielding device 90, the rotatable shielding walls 91 can be made in the open state expanding the diameter of the ring-shaped cable 92, and be made in the closed state by reducing the diameter. Therefore, the opening and closing operation of the shielding device 90 can be achieved with a simple configuration. In addition, the shielding device 90 performs the opening and closing operation in a diameter direction of the blower 94 and does not move in the axial direction of the blower 94, namely, in a depth direction of the refrigerator 10. Therefore, the volume occupied by the shielding device 90 can be reduced in the depth direction of the refrigerator 10, and the effective volume used as the storage compartments can be increased.

[0080] Here, the rotatable shielding devices 90 can also be made in a half-open state. Specifically, it is possible to make the rotatable shielding walls 91 in the half-open state by stopping halfway the drive motor 89 as a stepping motor upon transition from the fully closed state shown in FIG. 9(A) to the fully open state shown in FIG. 9(A) as instructed by a control device not shown. The amount of the cold air blown to the freezing compartment 17 can be accurately adjusted by making the rotatable shielding walls 91 in the half-open state.

[0081] In addition, referring to FIG. 2, a damper 22 can be inserted in the refrigerating compartment cold air supply passage 29, and the rotatable shielding walls 91 at an upper end portion shown in FIG. 9(A) can be further omitted. In addition, the rotatable shielding walls 91 can be in the fully closed state, the fully open state and the half-open state. A degree of freedom of supplying cold air to the refrigerating compartment 15 and the freezing compartment 17 can be freely adjusted through such a setting.

[0082] The present invention is not limited to the above embodiments, and various variations can be implemented without departing from the scope of the spirit of the present invention. In addition, the above embodiments can be combined with one another.

Description of Reference Signs

[0083]

10 refrigerator
11 Heat-insulating cabinet
12 housing
13 Liner
14 heat-insulating material

15 Refrigerating compartment
17 Freezing compartment
18 Upper freezing compartment
19 Lower freezing compartment
20 Vegetable compartment
21 Heat-insulating door
22 Damper
23 Heat-insulating door
24 Heat-insulating door
25 Heat-insulating door
26 Cooling chamber
27 Air blowing vent
28 Air return vent
29 Refrigerating compartment cold air supply passage
31 Freezing compartment cold air supply passage
33 Air outlet
34 Air outlet
35 Cover plate
36 Opening
37 Vegetable compartment cold air return passage
38 Air return vent
39 Air return vent
42 Heat-insulating partition wall
43 Heat-insulating partition wall
44 Compressor
45 Cooler
46 Defrosting heater
47 Blower
50 Air passage partition wall
51 Refrigerating compartment cold air supply passage
52 Upper freezing compartment cold air supply passage
53 Lower freezing compartment cold air supply passage
54 Drive shaft
56 Air passage partition wall
58 protrusion
59 Opening section
60 Shielding wall driving mechanism
63 Support base
64 Rotatable connection portion
65 Partition
66 Partition
67 Front cover
70 Shielding device
71, 711, 712, 713, 714 Rotatable shielding wall
74 drive motor
811, 812, 813, 814, 815, 816, 817 gear
82 Opening section
83 Cable fixing portion
84 Cable fixing portion
85 Groove
86 Cable-rotating body
87 Blower mounting portion
88 Cable cover
89 Drive motor

90 Shielding device
 91 Rotatable shielding wall
 92 cable
 921 Cable end
 922 Cable end
 93 Rotatable connection portion
 94 Blower
 95 Cable pass-through portion
 96 Support base
 97 Cover
 98 Rotatable connection portion
 99 Cover
 100 Refrigerator
 101 Refrigerating compartment
 102 Freezing compartment
 103 Vegetable compartment
 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 Damper

the cable passes through cable pass-through portions formed on the rotatable shielding walls.

4. A refrigerator, wherein the refrigerator comprises:

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a freezing circuit having a cooler for cooling air to be supplied through air passages to storage compartments,

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a cooling chamber formed with an air blowing vent communicated with the storage compartments, the cooler being disposed in the cooling chamber,

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a blower configured to blow air supplied through the air blowing vent to the storage compartments, and

the shielding device according to any of claims 1-3 at least partially closing the air passages.

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Claims

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1. A shielding device, wherein the shielding device is configured to close air passages through which cold air is blown in a refrigerator, the shielding device comprising:

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a plurality of rotatable shielding walls disposed surrounding a blower from radially outside and configured to rotate to open and close the air passages, and

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a shielding wall driving mechanism configured to drive the rotatable shielding walls to rotate, the shielding wall driving mechanism has a drive source, and a power transmission mechanism for transmitting power from the drive source to the rotatable shielding walls.

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2. The shielding device according to claim 1, wherein the power transmission mechanism is a gear mechanism disposed between adjacent rotatable shielding walls.

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3. The shielding device according to claim 1, wherein

the plurality of rotatable shielding walls are disposed in a substantially ring shape along an outer circumference of the blower, the power transmission mechanism is a cable passing through the rotatable shielding walls,

55

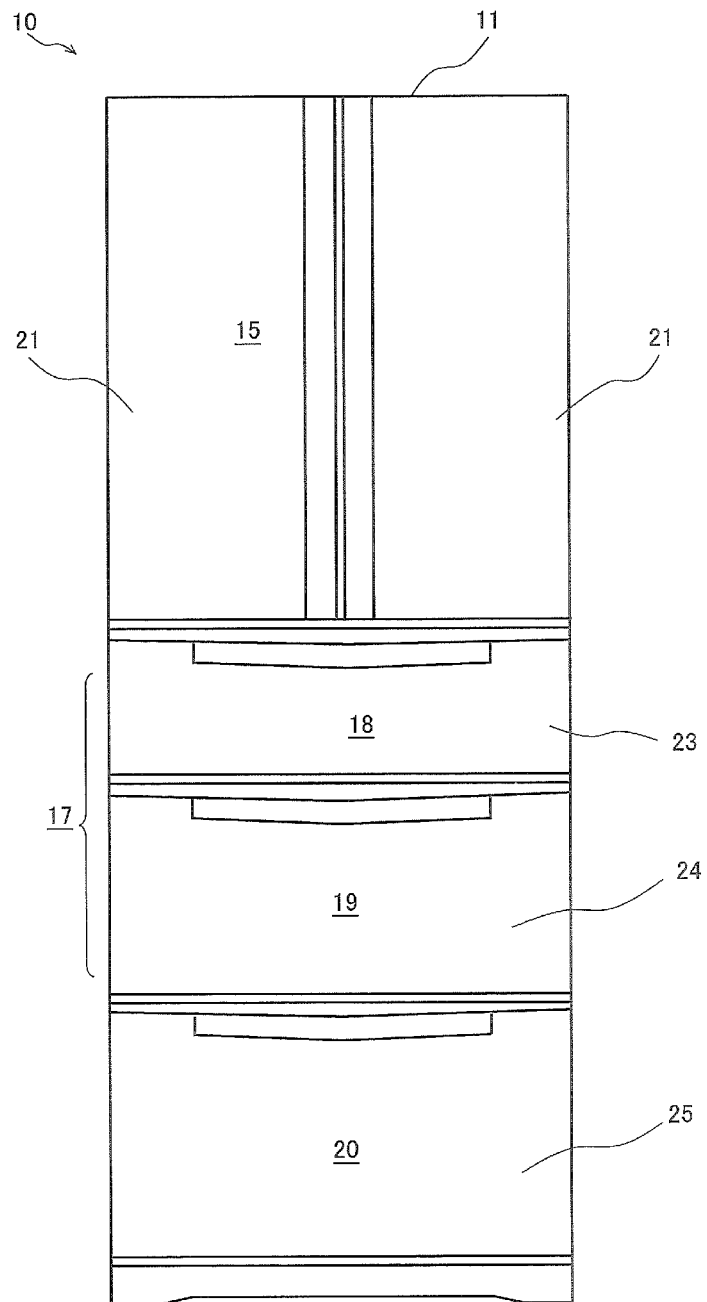


Fig. 1

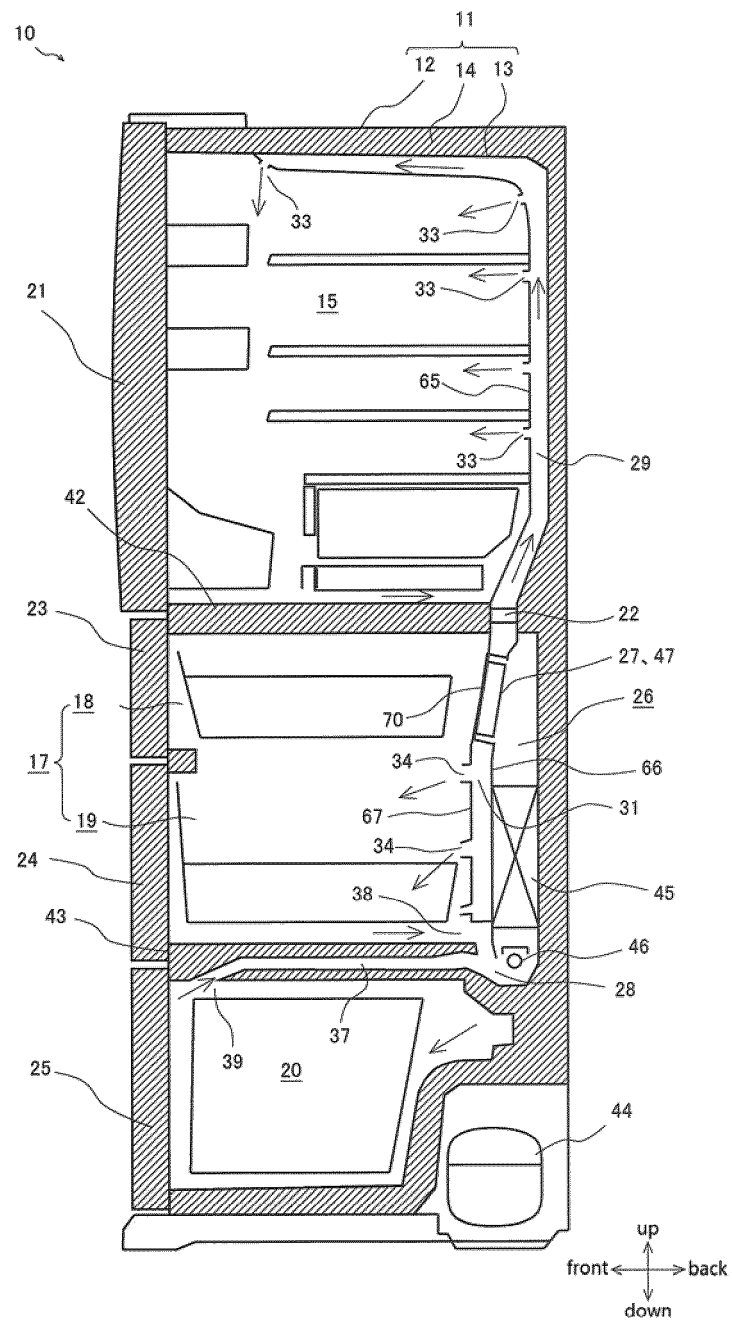


Fig. 2

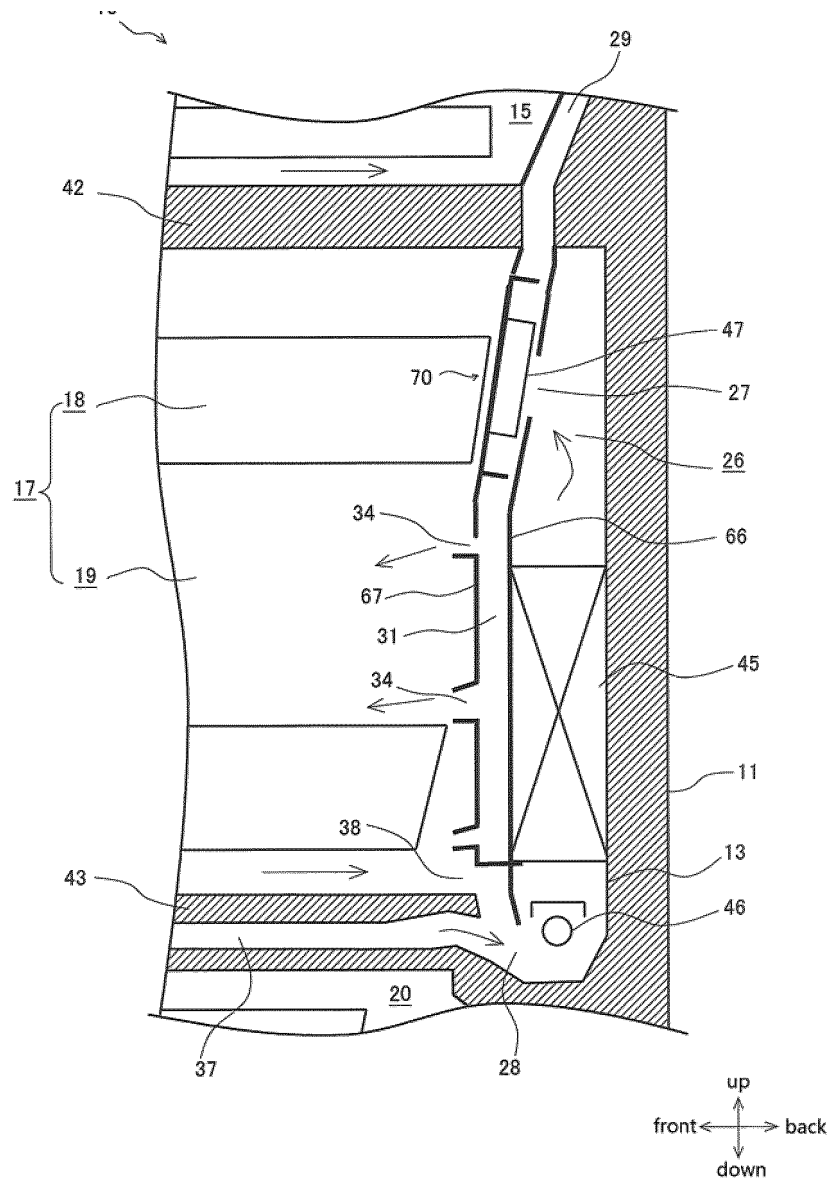


Fig. 3

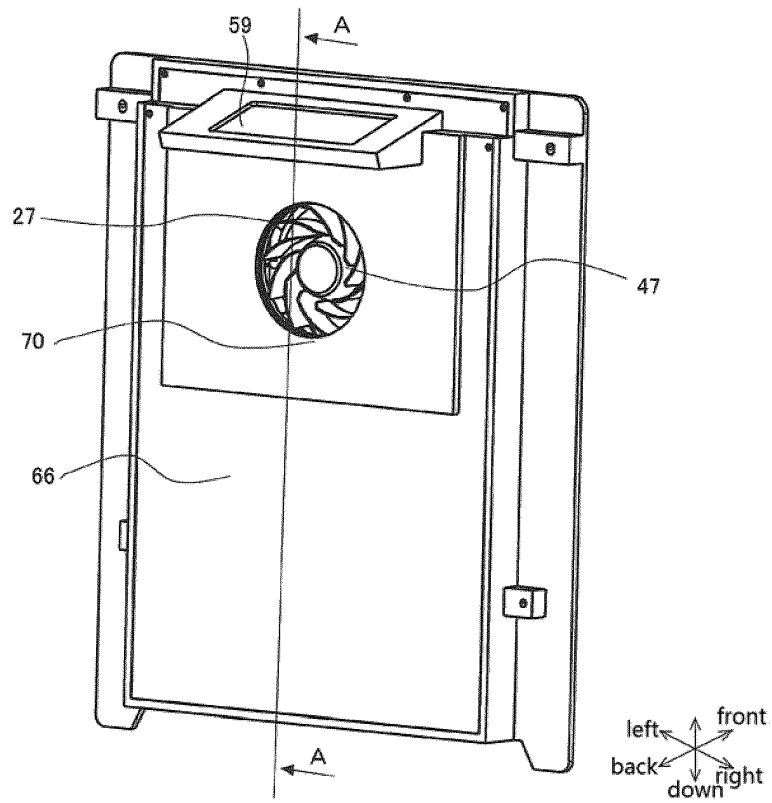


Fig. 4(A)

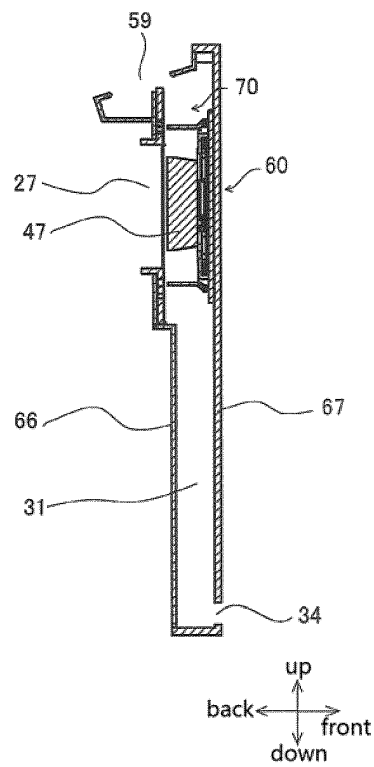


Fig. 4(B)

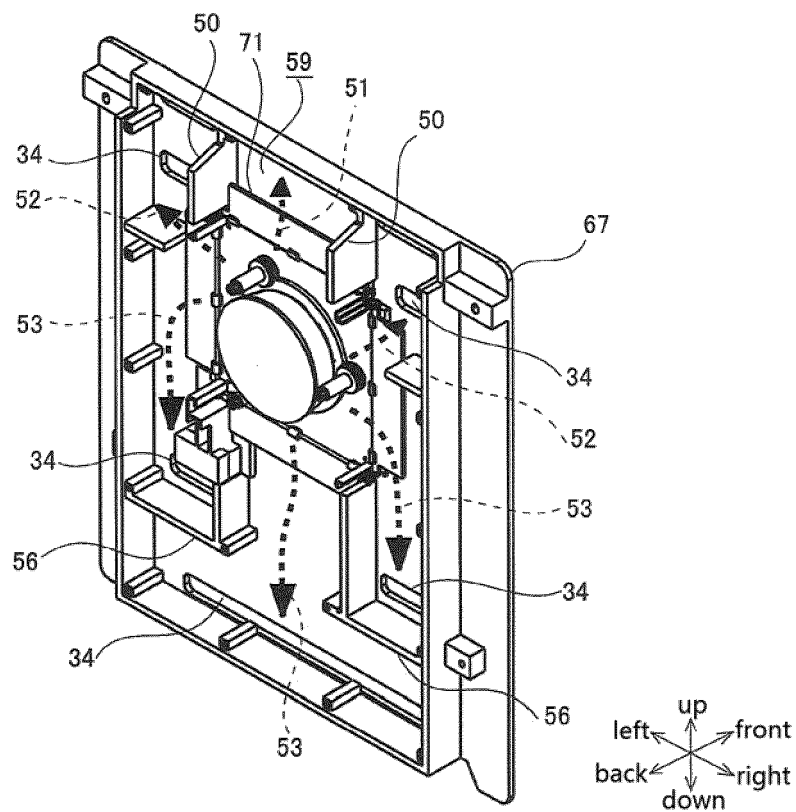


Fig. 4(C)

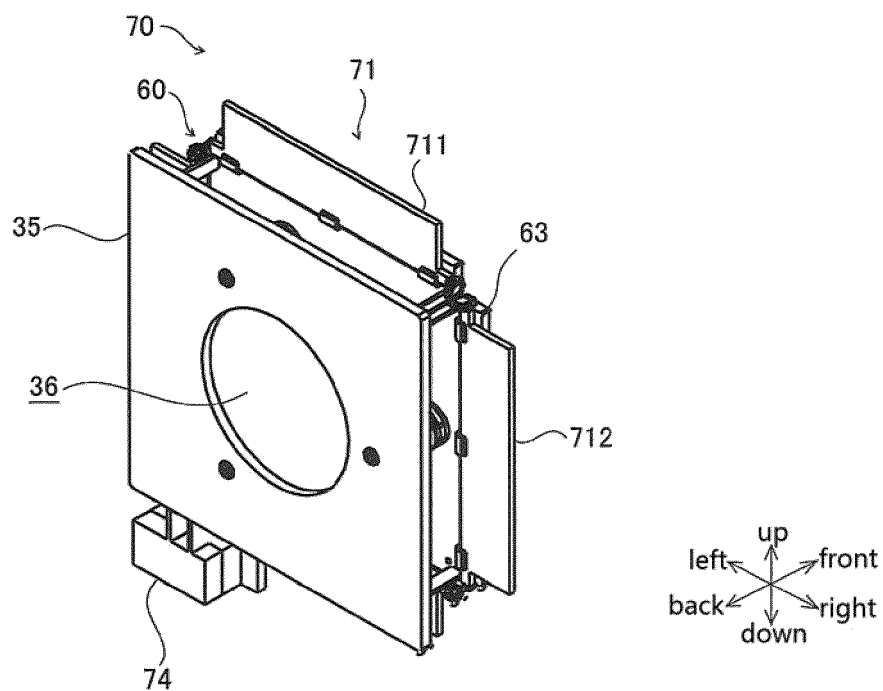


Fig. 5(A)

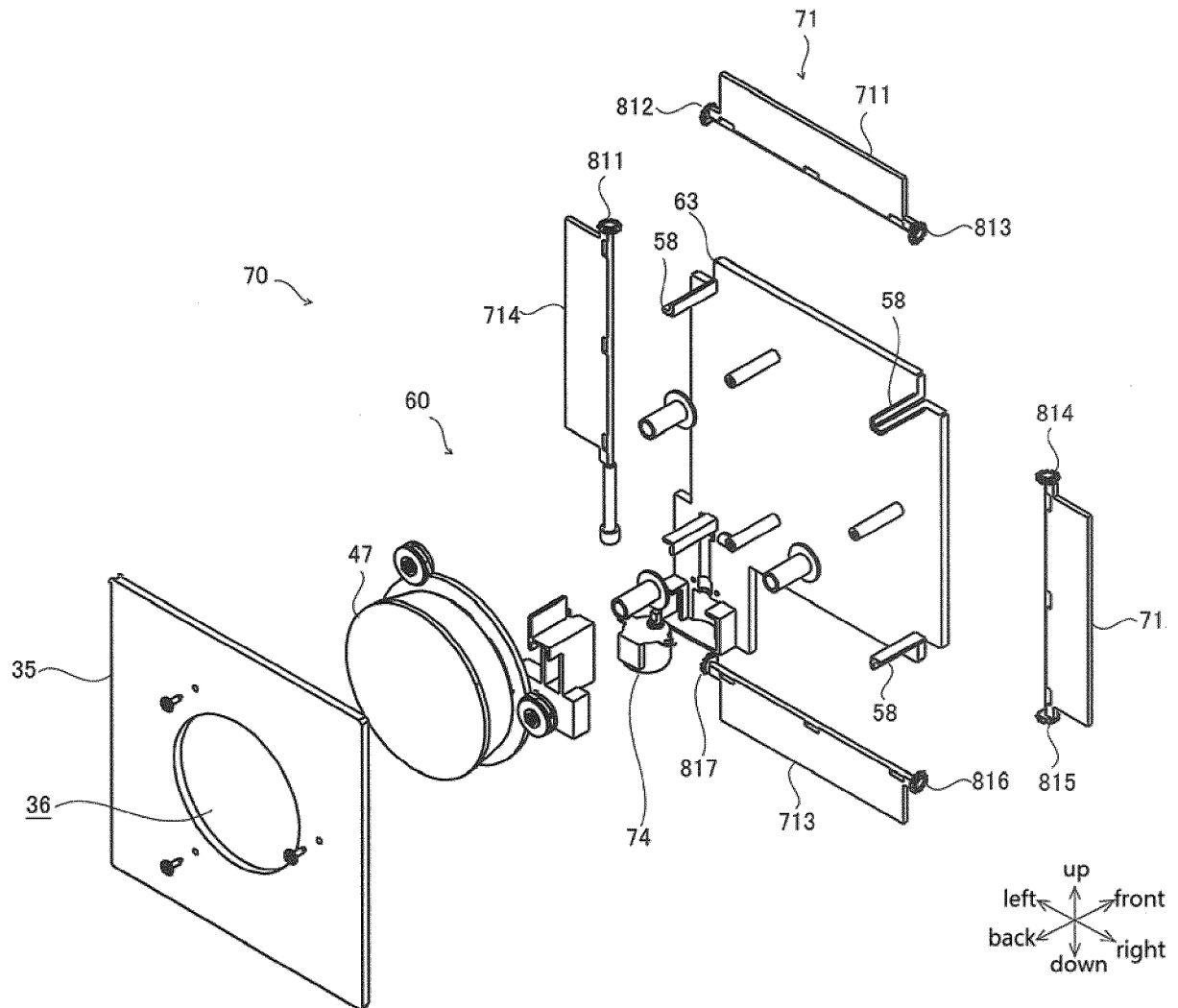


Fig. 5(B)

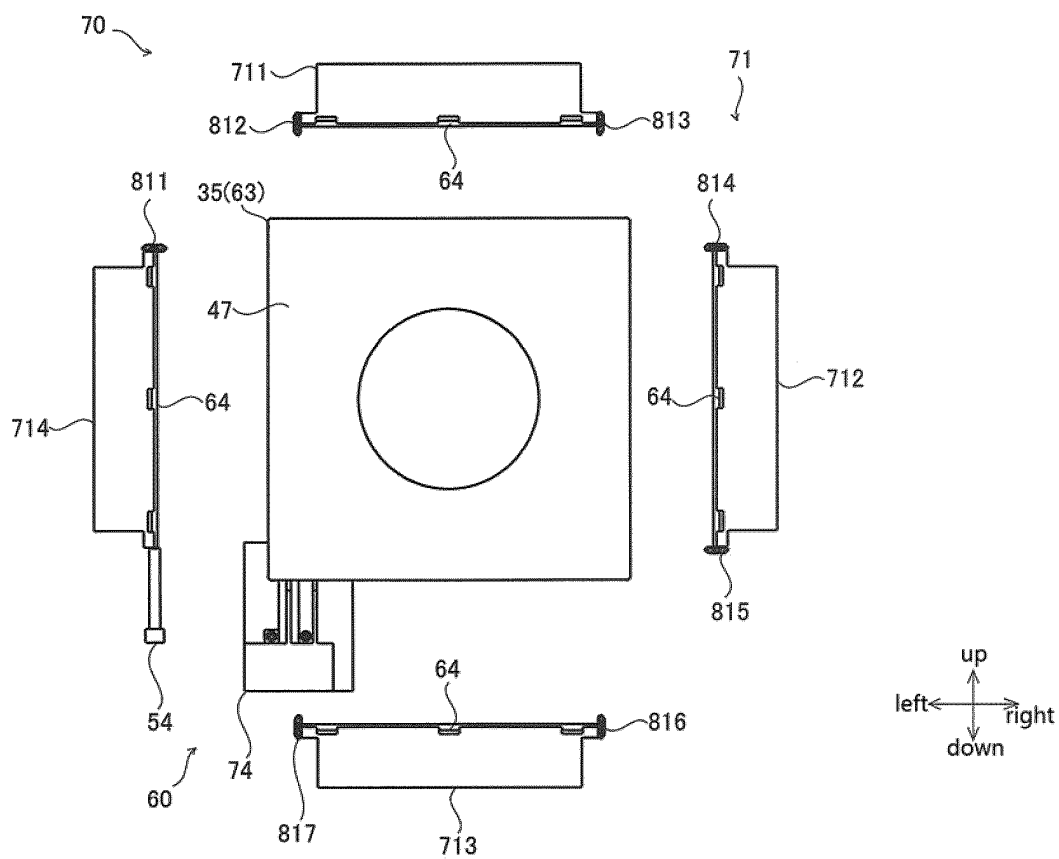


Fig. 6(A)

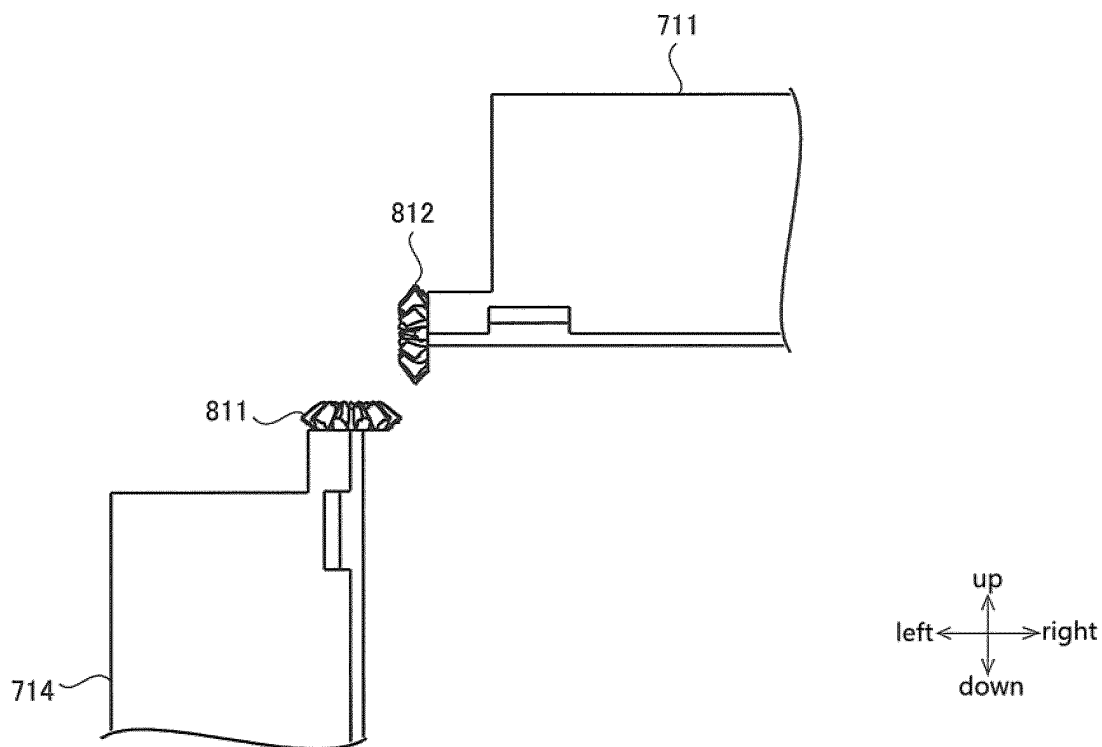


Fig. 6(B)

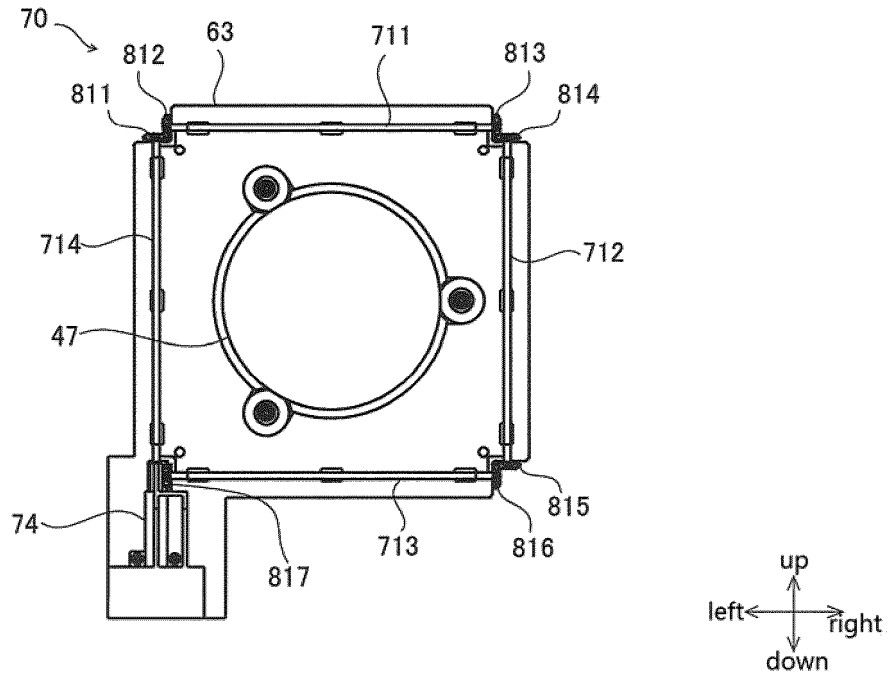


Fig. 7(A)

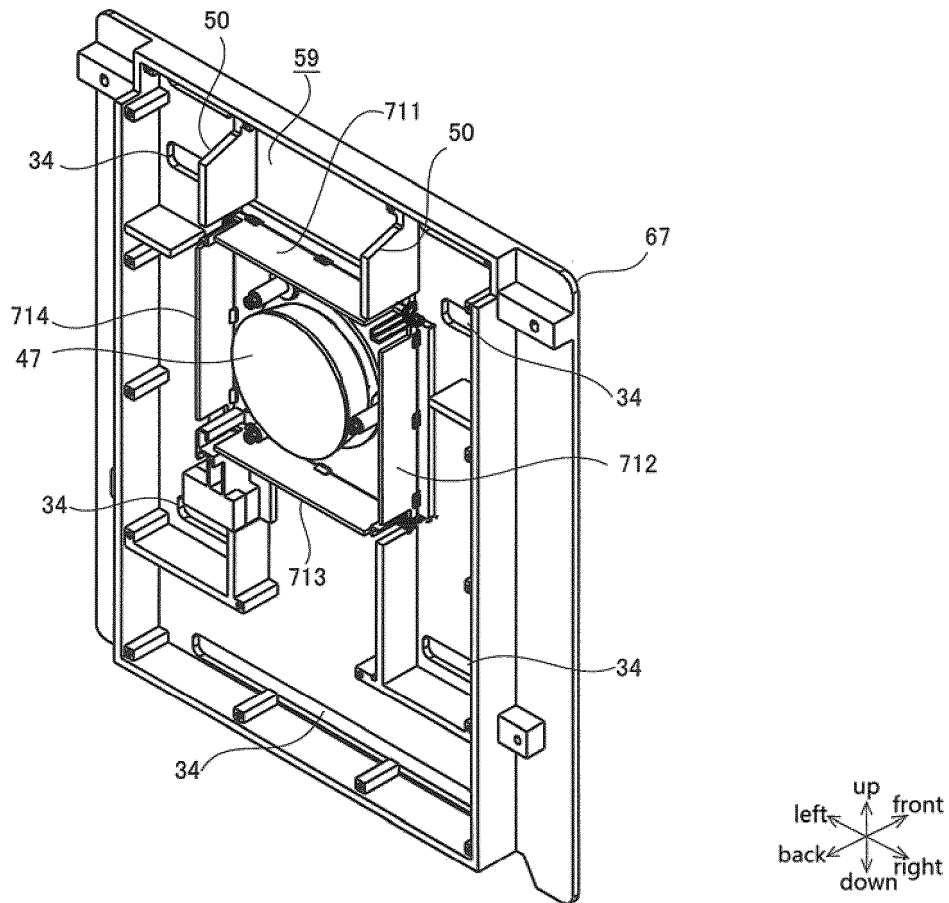


Fig. 7(B)

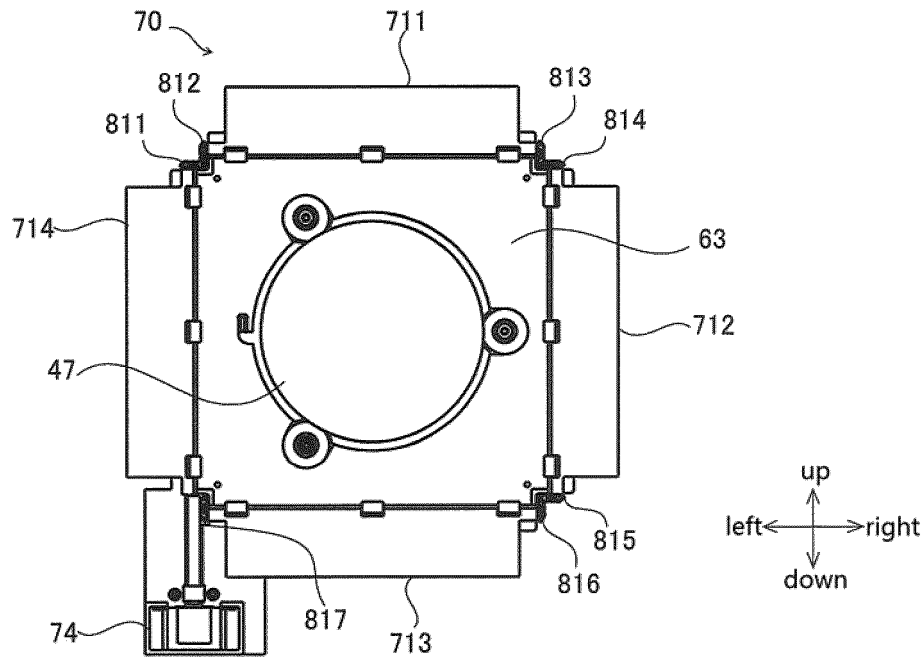


Fig. 8(A)

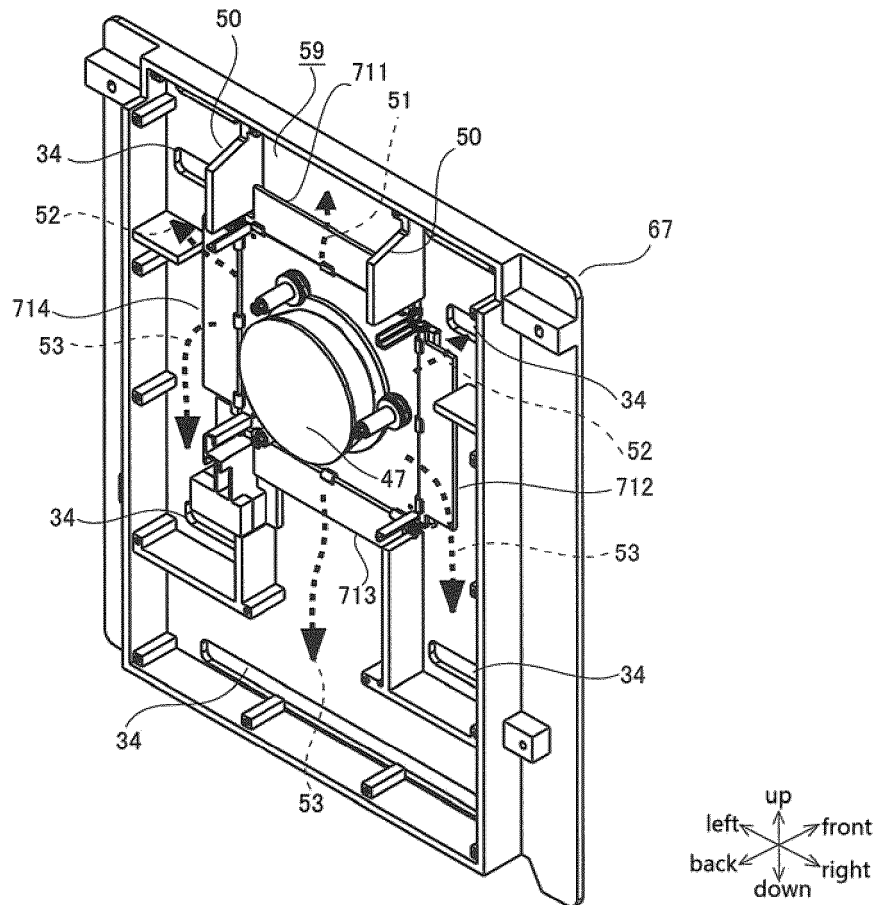


Fig. 8(B)

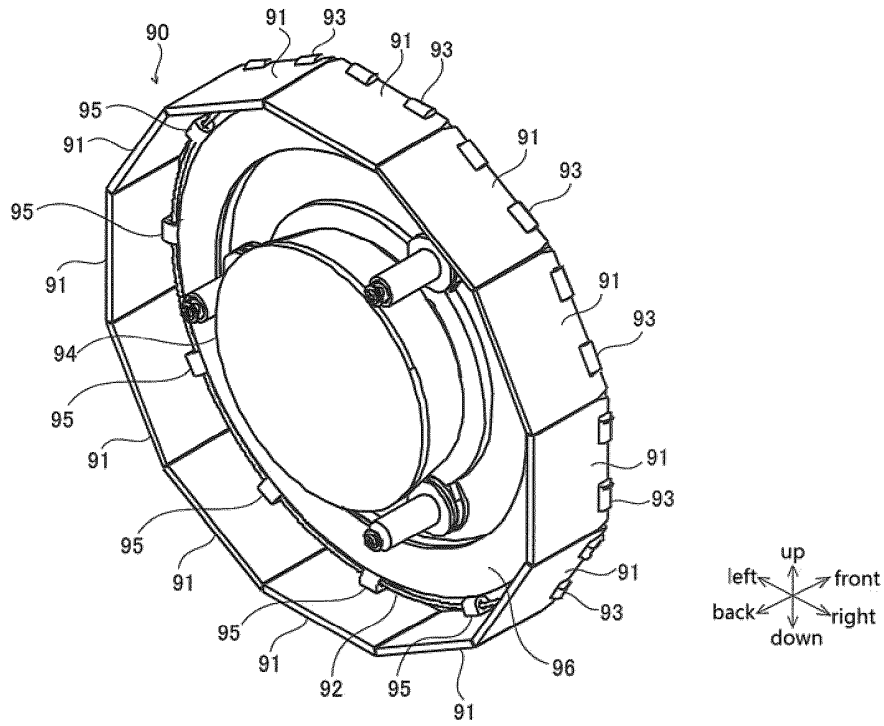


Fig. 9(A)

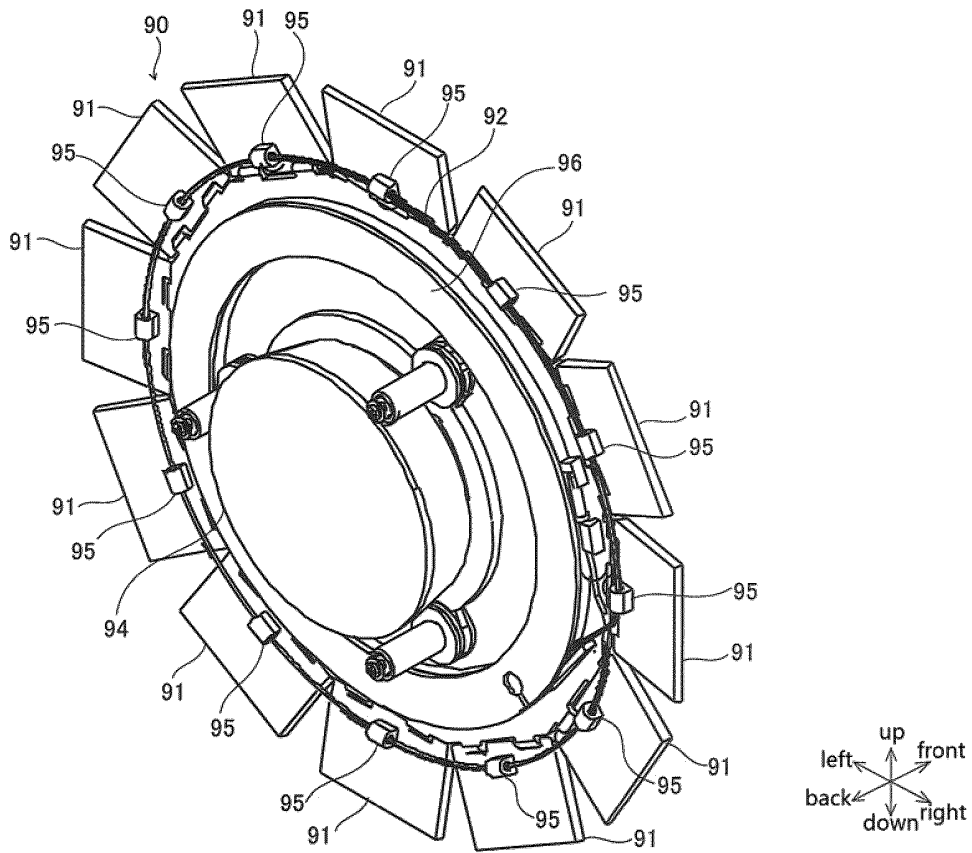


Fig. 9(B)

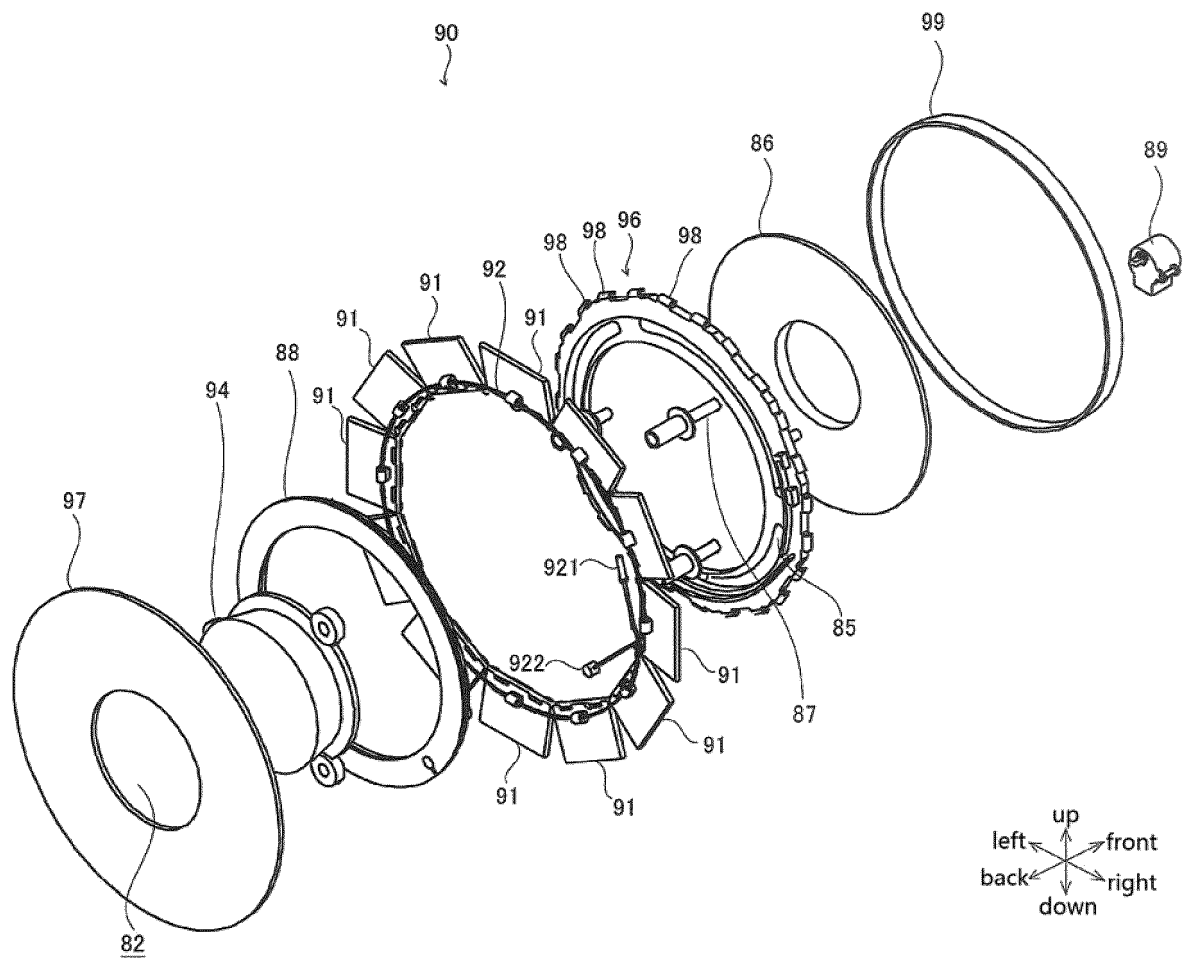


Fig. 10

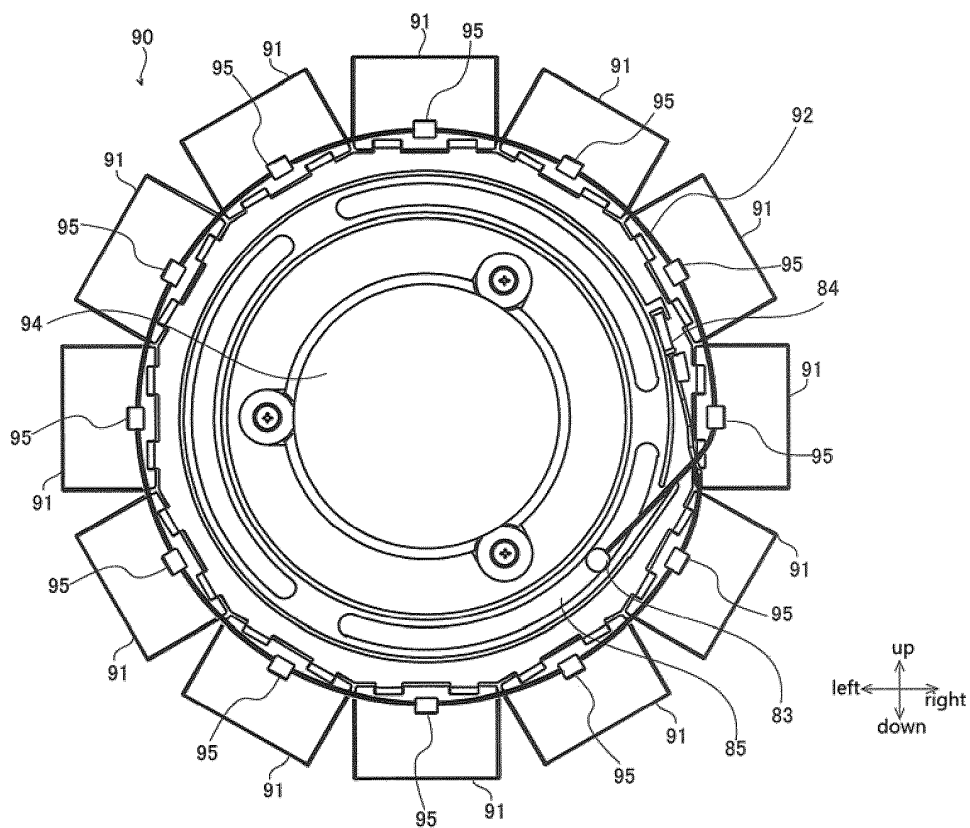


Fig. 11(A)

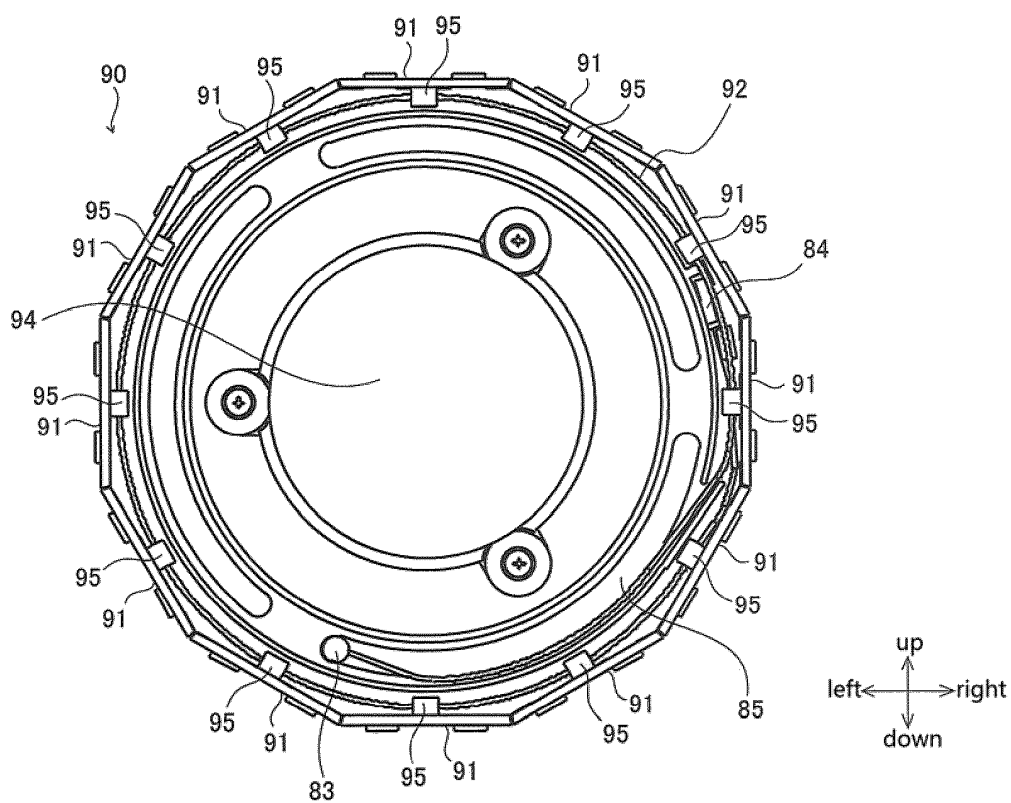


Fig. 11(B)

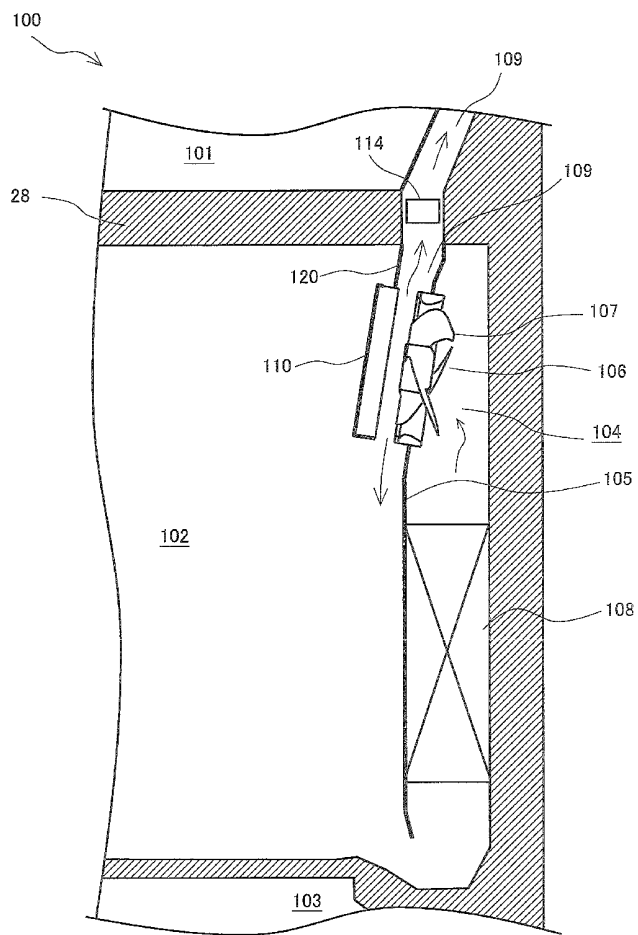


Fig. 12

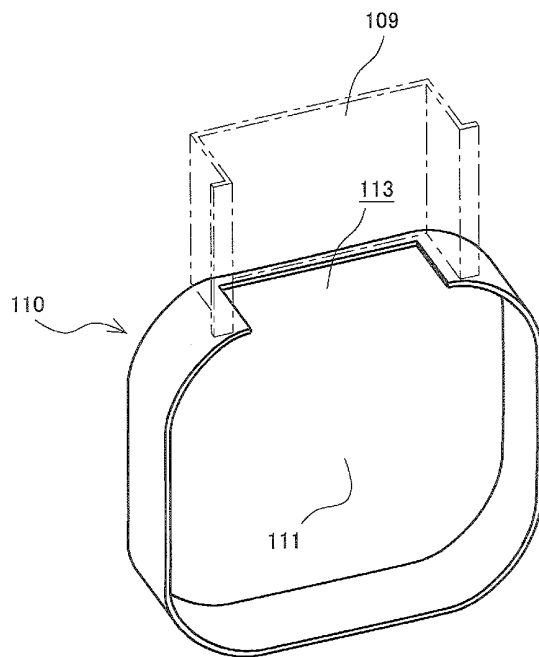


Fig. 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/089787

5	A. CLASSIFICATION OF SUBJECT MATTER		
	F25D 17/06(2006.01)i; F25D 11/02(2006.01)i		
	According to International Patent Classification (IPC) or to both national classification and IPC		
10	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		
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNABS, CNTXT, CNKI, DWPI, SIPOABS; 风机, 风扇, 送风, 出风, 风门, 挡板, 档板, 盖, 传动, 驱动, fan, supply+, air, outlet, baffle, damper, door, cover, transmit+, transmission, driv+		
	C. DOCUMENTS CONSIDERED TO BE RELEVANT		
20	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	X	CN 108302872 A (QINGDAO HAIER CO., LTD.) 20 July 2018 (2018-07-20) description, paragraphs [0034]-[0061], and figures 1-11	1-4
	X	CN 108332489 A (QINGDAO HAIER CO., LTD.) 27 July 2018 (2018-07-27) description, paragraphs [0034]-[0061], and figures 1-11	1-4
25	A	CN 109751816 A (QINGDAO HAIER CO., LTD.) 14 May 2019 (2019-05-14) entire document	1-4
	A	JP 2007155146 A (NIDEC SANKYO CORP.) 21 June 2007 (2007-06-21) entire document	1-4
30	A	US 2017227276 A1 (PEARSON, J.E. et al.) 10 August 2017 (2017-08-10) entire document	1-4
35	☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
40	* 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		
45			
50	Date of the actual completion of the international search 29 June 2020		Date of mailing of the international search report 14 July 2020
55	Name and mailing address of the ISA/CN China National Intellectual Property Administration (ISA/CN) No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088 China		Authorized officer
	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/CN2020/089787

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		CN 108302872 B	21 April 2020
CN 108332489 A	27 July 2018	WO 2019129246 A1	04 July 2019
CN 109751816 A	14 May 2019	None	
JP 2007155146 A	21 June 2007	None	
US 2017227276 A1	10 August 2017	US D798346 S	26 September 2017

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

REFERENCES CITED IN THE DESCRIPTION

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