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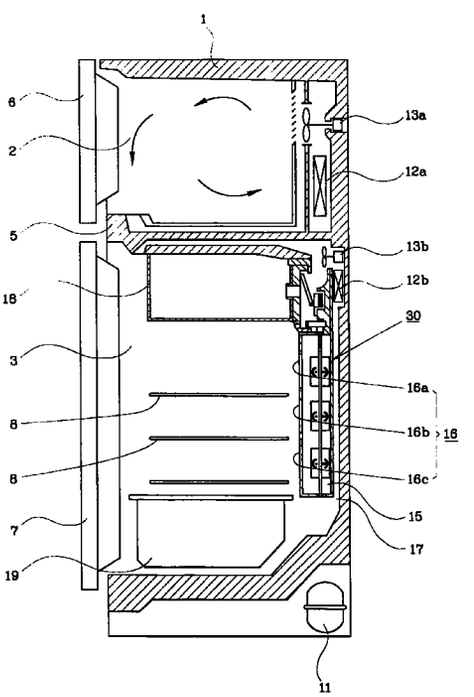
(54) Refrigerator having a cool air dispersing device

(57) A refrigerator haS a cool air dispersing device (30) capable of dispersing cool air horizontally and vertically. Planar cool air dispersing blades (41a, 41b, 41c) direct cool air through apertures (16) into a cooling chamber (3). Each planar blade (41a, 41b, 41c) has at least one auxiliary blade (51) for dispersing cool air vertically. The auxiliary blades (51) are semi-disc-shaped and can have their angles of inclination manually varied.

FIG.5



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Description

[0001] The present invention relates to a refrigerator comprising a cooling compartment, an aperture opening into the compartment, a heat pump and cool air distributing means for supplying cool air generated by the heat pump to the compartment through the aperture.

[0002] Generally, a refrigerator has a cabinet in which there are a freezing compartment and a fresh food compartment. A partition wall separates these compartments. Doors are provided at the front of the freezing and cooling compartments. A cooling system supplies the freezing compartment and the fresh food compartment with cool air and comprises a compressor, a condenser and an evaporator. The cool air generated by the evaporator flows along a supply duct formed at the back of each compartment, and is then supplied into each cooling compartment through cool air discharge ports opening thereinto by a fan.

[0003] In such a conventional refrigerator, however, cool air tends to be supplied into a particular area of the cooling compartment and other areas tend to be less well served. Consequently, a uniform temperature is not maintained throughout the cooling compartment.

[0004] This problem has been addressed by providing cool air discharge ports in the side walls of the cooling compartment as well as in its rear wall. However, there may be still a dead-zone at an edge area which is not supplied with the cool air sufficiently. Furthermore, the ducting required to supply cool air from the sides of the cooling compartment reduces the space available for food and increases the cost of manufacture.

[0005] The problem of adequately distributing cool air in a refrigerator is worse for larger refrigerators.

[0006] Figures 1 though 3 are a side view, a partial enlarged sectional view, and an exploded perspective view of the main elements of a refrigerator having a device for dispersing cool air as disclosed in WO-A-95/27278.

[0007] Referring to Figures 1 to 3, a refrigerator comprises freezing and fresh food compartments 2, 3 in a cabinet 1, which are separated from each other by a partition 5.

[0008] Respective doors 6, 7 are provided for closing the compartments 2, 3. A cooling system, comprising a compressor 11, a condenser (not shown), a freezing compartment evaporator 12a, and a fresh food compartment evaporator 12b, is installed in the cabinet 1. Cool air generated by the evaporators 12a, 12b is supplied to the corresponding compartments 2, 3 by a freezing compartment fan 13a and a fresh food compartment fan 13b respectively.

[0009] A partially cylindrical duct plate 9 is attached to an inner wall plate 23 forming the rear inner wall surface of the fresh food compartment 3. The duct plate 9 has cool air discharge ports 16, opening into the fresh food compartment 3, formed in it. A supply duct 15 and a return duct 17, separated from each other by a seal plate 25, are provided between the duct plate 9 and the rear wall 4 of the cabinet 1. A duct member 21, for guiding downwards cool air blown by the fresh food compartment fan 13b, is installed in the supply duct 15. Cool air generated by the fresh food compartment evaporator 12b is blown by the fresh food compartment fan 13b and then supplied to the fresh food compartment 3 via the supply duct 15 and the cool air discharge ports 16.

[0010] A cool air dispersing device 130 is installed in the supply duct 15. The cool air dispersing device 130 comprises a rotational shaft 131 having a vertical axis, cool air dispersing blades 132 assembled with the rotational shaft 131 in correspondence with respective cool air discharge ports 16, and a driving motor 135 for rotating the rotational shaft 131. Each of the cool air dispersing blades 132 comprises three discs 136, 137, 138 disposed in parallel with each other along the shaft 131, and first and second blade parts 133, 134 disposed between pairs of the discs 136, 137, 138. Each of the blade parts 133, 134 is curved so that its cross-section is loosely S-shaped. The blade parts 133, 134 are bent in opposite directions to each other.

[0011] In a refrigerator having the above-described constitution, when the driving motor 131 rotates the rotational shaft 131 at a low speed, cool air flowing along the supply duct 15 changes its direction along the curved surfaces of the cool air dispersing blades 132, and is directed into the fresh food compartment 3 so as to disperse horizontally. When concentrated cooling in a specific area is needed, the driving motor 135 stops the rotational shaft 131 so that the cool air dispersing blades 132 direct cool air to the specific area. However, since the blade parts 133, 134 of the cool air dispersing device 130 are S-shaped, the left or right sides of the fresh food compartment 3 may not be supplied with the cool air sufficiently and the smooth flow of cool air may be impeded by a vortices in the cool air formed about the cool air discharge ports 16.

[0012] A refrigerator according to the present invention is characterised in that the cool air distributing means comprises a vertical planar blade, rotatable about a vertical axis, and an auxiliary blade mounted to the planar blade and extending normal to a major face thereof.

[0013] Preferably, a further auxiliary blade is mounted to the planar blade and the auxiliary blade extend in opposite directions.

[0014] Preferably, the or each auxiliary blade is semi-disc-shaped.

[0015] Preferably, the angle of inclination of the auxiliary blade or blades can be changed manually.

[0016] Preferably, the or an auxiliary blade has a first projection extending into a hole in the planar blade so as to form a pivot and a second projection extending into a notched slot arcing about the hole, the notches serving to retain the second projection so that a plurality of auxiliary blade inclinations can be selected.

[0017] Embodiments of the present invention will now

be described, by way of example, with reference to Figures 4 to 19 of the accompanying drawings, in which:-

Figure 1 is a side sectional view of a known refrigerator having cool air dispersing blades;
Figure 2 is a partial enlarged sectional view of Figure 1;
Figure 3 is an enlarged exploded perspective view of the main elements of Figure 2;
Figure 4 is a front view of a first refrigerator according to the present invention;
Figure 5 is a side sectional view of Figure 4;
Figure 6 is an enlarged exploded perspective view of the cool air dispersing device shown in Figures 4 and 5;
Figure 7 is an enlarged perspective view of a cool air dispersing blade shown in Figure 6;
Figure 8 is an enlarged perspective view of an auxiliary blade shown in Figure 6;
Figure 9 is an enlarged perspective view of the cool air dispersing blade shown in Figure 7 to which the auxiliary blade shown in Figure 8 is attached;
Figures 10 through 12 are transverse sectional views of the elements of Figure 6 in there assembled state and show the process of dispersing cool air performed by the cool air dispersing device of the first embodiment of the present invention;
Figure 13 is an enlarged exploded perspective view of a cool air dispersing device of a second refrigerator according to the present invention;
Figure 14 is an enlarged perspective view of a cool air dispersing blade shown in Figure 13;
Figure 15 is a enlarged perspective view of an auxiliary blade shown in Figure 14;
Figure 16 is an enlarged perspective view of the cool air dispersing blade shown in Figure 14 to which the auxiliary blade shown in Figure 15 is attached; and
Figures 17 through 19 are transverse sectional views of the elements of Figure 13 in their assembled state and show the process for dispersing cool air performed by the cool air dispersing device according the second embodiment of the present invention.

[0018] Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings. Parts that are the same as or similar to parts shown in Figures 1 through 3 will be identified with the same reference numerals. The description of the parts, which are substantially the same as those of the prior art, will be omitted.

[0019] Referring to Figures 4 and 5, a refrigerator according to the present invention comprises a freezing compartment 2 and a cooling compartment 3 in a cabinet 1. The compartments 2, 3 are separated by a horizontal partition. Doors 6, 7 are provided respectively for the compartments 2, 3. Shelves 8 for supporting food are provided in the fresh food compartment 3 and divide it into three areas one above another. A special fresh chamber 18 for storing food that requires a specific temperature range is formed at the top of the fresh food compartment 3 and a vegetable chamber 19 for storing vegetables is formed at the bottom of the fresh food compartment 3. A heat pump, comprising a compressor 11, a condenser (not shown), a freezing compartment evaporator 12a, and a fresh food compartment evaporator 12b, is installed in the cabinet 1. Cool air generated by the evaporators 12a, 12b is supplied into the corresponding cooling compartments 2, 3 by the freezing compartment fan 13a and the fresh food compartment fan 13b. A supply duct 15 and a return duct 17 are provided at the back of the fresh food compartment 3. The cool air generated by the fresh food compartment evaporator 12b is driven by the fresh food compartment fan 13b into the fresh food compartment 3 via the supply duct 15 and the cool air discharge ports 16. A device 30 for dispersing the cool air vertically is installed in the supply duct 15.

[0020] First and second temperature sensors 9a, 9b are installed in the fresh food compartment 3. The first temperature sensor 9a is installed in the left upper part of the fresh food compartment 3 and the second temperature sensor 9b is installed in the right lower part of the fresh food compartment 3.

[0021] Referring to Figures 6 to 9, the cool air dispersing device 30 comprises a vertical rotational shaft 31 disposed in the supply duct 15, a plurality of cool air dispersing blades 41a, 41b, 41c on the rotational shaft 31, a plurality of auxiliary blades 51 on the faces of respective dispersing blades 41a, 41b, 41c, and a driving motor 35 for rotating the rotational shaft 31.

[0022] The upper end 33 of the rotational shaft 31 is coupled to the shaft 36 of the driving motor 35 and its lower end 34 is received in a supporting hole 29 formed in a lower flange 28 of the duct plate 27. Thus, the rotational shaft 31 is supported so as to be capable of rotating. The driving motor 31 is a stepping motor, so the angular position of the rotational shaft 31 can be controlled.

[0023] In the present embodiment, three discharge ports 16a, 16b, 16c are provided on the duct plate 27 one above another and three dispersing blades 41a, 41b, 41c are associated with respective discharge ports 16a, 16b and 16c. The dispersing blades 41a, 41b, 41c rotate together with the rotational shaft 31. The dispersing blades 41a, 41b, 41c control the discharge horizontal direction of cool air discharging through the discharge ports 16.

[0024] The dispersing blades 41a, 41b, 41c are rectangular plates. The rotational shaft 31 extends along the vertical centreline of each of the dispersing blades 41a, 41b, 41c. Thus, each of the dispersing blades 41a, 41b, 41c is divided into a pair of blade parts 43a, 43b separated by the rotational shaft 31.

[0025] The auxiliary blades 51 are disposed so as to

protrude from the planes of the blade parts 43a, 43b. The auxiliary blades 51 are semi-disc-shaped, as shown in Figure 8, and each has a pair of installation pins 55. Screws 59 are received axially within respective installation pins 55.

[0026] A pair of fixing holes 45, 47 are formed in each of the blade parts 43a, 43b of the dispersing blades 41a, 41b, 41c. The installation pins 55 of the auxiliary blades 51 are inserted into the fixing holes 45, 47. After the installation pins 55 of the auxiliary blade 51 have been inserted into the Fixing holes 45, 47, the screws 59 are screwed into the installation pins 55 to hold the auxiliary blades 51 on the dispersing blades 41a, 41b, 41c.

[0027] The radially outer fixing holes 47 are elongate and arc around respective inner fixing holes 45. Thus, the auxiliary blade 51 can pivot about the inner fixing hole 45. Notches 49a, 49b, 49c are formed at the upper, middle, and lower parts of the outer fixing holes 47. The installation pins 55 can be selectively located in the notches 49a, 49b and 49c so that the angles of the auxiliary blades can be selectively fixed. The auxiliary blades 51 control the discharge direction of cool air discharging through the discharge ports 16 vertically according to the rotational position thereof.

[0028] In the present embodiment, one auxiliary blade 51 is installed on each of the blade parts 43a, 43b so that two auxiliary blades 51 are disposed oppositely to each other on one dispersing blade.

[0029] The operation of the first refrigerator according to the present invention will now be described.

[0030] Referring to Figures 10 and 12, while the rotational shaft 31 is continuously rotated by the driving motor 35, when the dispersing blades 41a, 41b, 41c are positioned as shown in Figure 10, cool air in the supply duct 15 is discharged forwards. When the dispersing blades 41a, 41b, 41c are rotated to the left or to the right as shown in Figures 11 and 12 respectively, cool air in the supply duct 15 is discharged leftwards or rightwards.

[0031] Since the horizontal discharge direction of cool air is continuously changing according to the rotational position of the dispersing blades 41a, 41b, 41c, cool air is dispersed into the fresh food compartment 3 uniformly. Furthermore, since the dispersing blades 41a, 41b, 41c are planar plates, vortices are not caused by the rotation of the dispersing blades 41a, 41b, 41c.

[0032] If a concentrated supply of cool air to a specific area, such as a left or right area, is required, concentrated cooling can be realized by stopping the driving motor 35 when the dispersing blades 41a, 41b, 41c are directed to the specific area. In this a situation, a control part, which is not shown, drives the driving motor 35 on the basis of the temperature in the fresh food compartment 3 sensed by the temperature sensors 9a, 9b. That is, when a rise in temperature of in specific area in the fresh food compartment 3 is detected by the temperature sensors 9a, 9b, the control part stops the rotational shaft 31 so that the cool air is guided by the dispersing blades 41a, 41b, 41c toward the specific area. Thus, the specific area is cooled in a concentrated manner, and the temperature in the fresh food compartment 3 becomes uniform quickly.

[0033] A user can control the vertical discharge direction of cool air by changing the angular position of the auxiliary blades 51 manually. While the auxiliary blades 51 are tilted and the rotational shaft 31 is rotating continuously, cool air is dispersed vertically. If, however, the rotational shaft 31 is stopped, concentrated cooling of a specific area in the vertical direction is performed.

[0034] Referring to Figures 13 to 19, in the cool air dispersing device 60 of a second refrigerator according to the present invention, the constructions of the driving motor 35, the rotational shaft 31, and the dispersing blades 41a, 41b and 41c are the same as those in the above-described first embodiment.

[0035] In the present embodiment, a pair of auxiliary blades 71, 72 are assembled on both sides of the blade parts 43a, 43b. The auxiliary blades 71, 72 are semi-disc-shaped like those of the first embodiment.

[0036] One auxiliary blade 71 has a pair of installation pins 75, and the other auxiliary blade 72 has a pair of installation holes 76 which receive the installation pins 75. After one auxiliary blade 71 is inserted into the fixing holes 45, 47 of a blade part 43a, 43b, the other auxiliary blade 72 is coupled with the first by inserting the installation pins 75 into the installation holes 76. Consequently, auxiliary blades 71, 72 are installed on both sides of the blades part 43a, 43b.

[0037] The operation of the cool air dispersing device 60 according to the present embodiment is the same as that of the first embodiment. That is, while the rotational shaft 31 is rotating continuously, the horizontal and vertical dispersing of cool air is performed by the dispersing blades 41a, 41b, 41c and auxiliary blades 71, 72. Furthermore, while the rotational shaft 31 is stopped, concentrated cooling of a specific area in the horizontal and vertical directions is performed.

[0038] As described above, according to the present invention, a stable cool air flow and a uniform distribution of cool air in horizontal and vertical directions can be achieved without vortices being formed in the cool air flow near the cool air discharge ports.

[0039] Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation.

Claims

1. A refrigerator comprising a cooling compartment (3), an aperture (16) opening into the compartment (3), a heat pump and cool air distributing means (30) for supplying cool air generated by the heat pump to the compartment (3) through the aperture (16),
characterised in that the cool air distributing

means (30) comprises a vertical planar blade (41a, 41b, 41c), rotatable about a vertical axis, and an auxiliary blade (51; 71) mounted to the planar blade (41a, 41b, 41c) and extending normal to a major face thereof.

2. A refrigerator according to claim 1, wherein a further auxiliary blade (72) is mounted to the planar blade (41a, 41b, 41c) and the auxiliary blades (71, 72) extend in opposite directions.

3. A refrigerator according to claim 1 or 2, wherein the or each auxiliary blade (51; 71, 72) is semi-disc-shaped.

4. A refrigerator according to claim 1 or 2, wherein the angle of inclination of the auxiliary blade or blades (51; 71, 72) can be changed manually.

5. A refrigerator according to claim 4, wherein the or an auxiliary blade (51; 71, 72) has a first projection (55; 75) extending into a hole (45) in the planar blade (41a, 41b, 41c) so as to form a pivot and a second projection (55; 75) extending into a notched slot (47) arcing about the hole (45), the notches (49a, 49b, 49c) of the slot (47) serving to retain the second projection (55; 75) so that a plurality of auxiliary blade inclinations can be selected.

6. A refrigerator comprising: a duct plate being installed on a side wall of a cooling compartment, said duct plate for forming a cool air duct in said side wall, said duct plate having a plurality of cool air discharge ports opened into said cooling compartment; a rotational shaft being disposed vertically in said cool air duct; a plurality of cool air dispersing blades of planar plate shape being assembled with said rotational shaft, said dispersing blades for controlling a discharge direction of cool air discharged through said discharge ports according to a rotational direction thereof; at least one auxiliary blade assembled with said dispersing blades, said auxiliary blade protruding from a plane of said dispersing blade; and a means for rotating said dispersing blades.

7. The refrigerator as claimed in claim 6, wherein said auxiliary blade is formed into a semi-disc shape.

8. The refrigerator as claimed in claim 7, wherein said auxiliary blade has a pair of installation pins, and said dispersing blade is formed with a pair of holes assembled with said installation pins.

9. The refrigerator as claimed in claim 8, wherein one of said holes is a long hole having a shape of an arc formed around the other hole, whereby tilt of said auxiliary blade can be controlled.

10. The refrigerator as claimed in claim 9, wherein at least one hooking recess for hooking said installation pin inserted into said long hole is formed at a part of said long hole.

11. The refrigerator as claimed in claim 10, wherein said recesses are respectively formed at both end parts and a central part of said long hole.

12. The refrigerator as claimed in claim 9, wherein said rotational shaft is assembled at a central area of said dispersing blade, whereby said dispersing blade has two blade parts disposed at both sides of said rotational shaft.

13. The refrigerator as claimed in claim 12, wherein one auxiliary blade is installed on each of said blade parts so that two auxiliary blades are disposed oppositely to each other on one dispersing blade.

14. The refrigerator as claimed in claim 12, wherein two auxiliary blades are installed on both sides of every blade part.

15. The refrigerator as claimed in claim 6, wherein said rotating means is a stepping motor.

FIG. 1
(PRIOR ART)

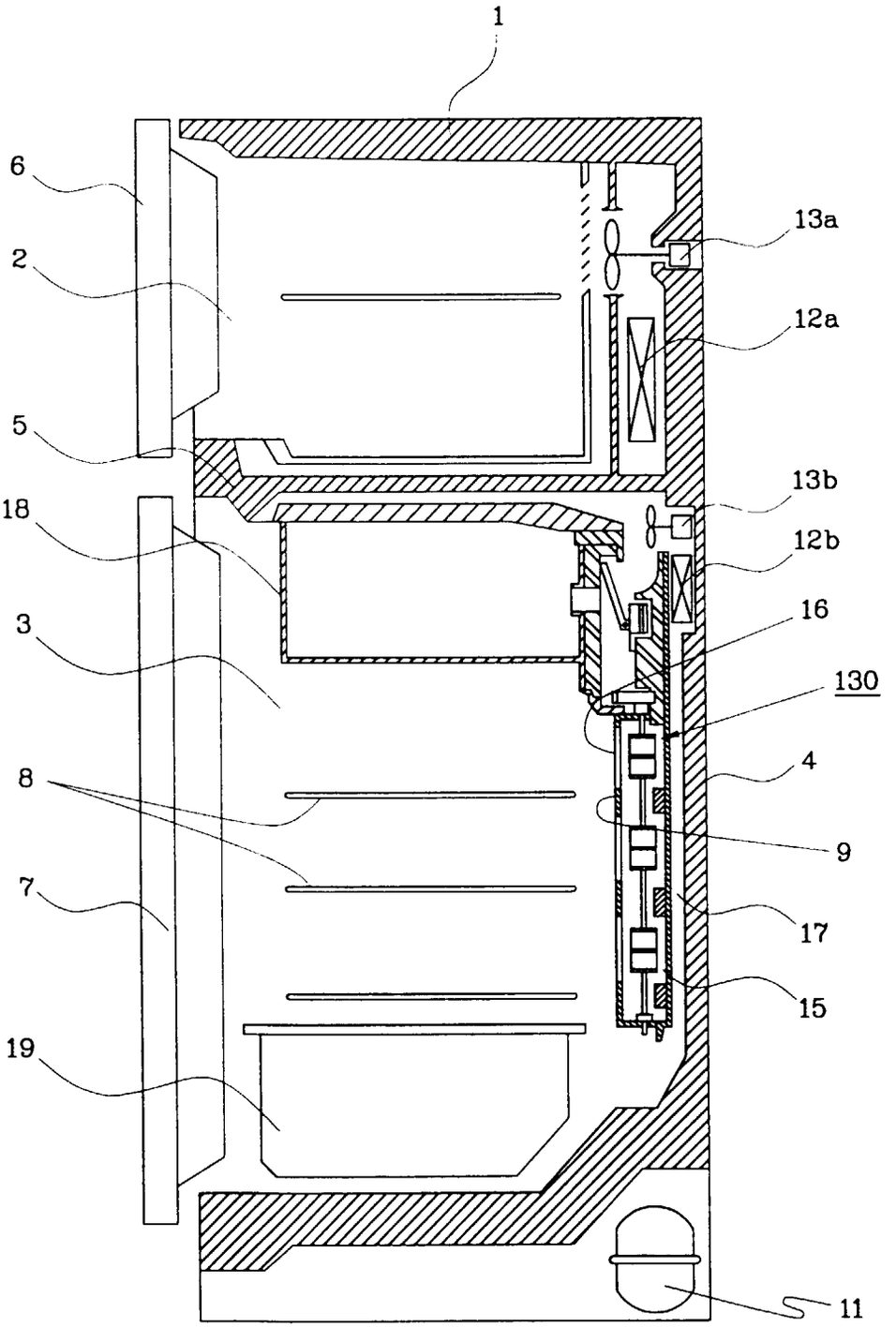

FIG.2
(PRIOR ART)

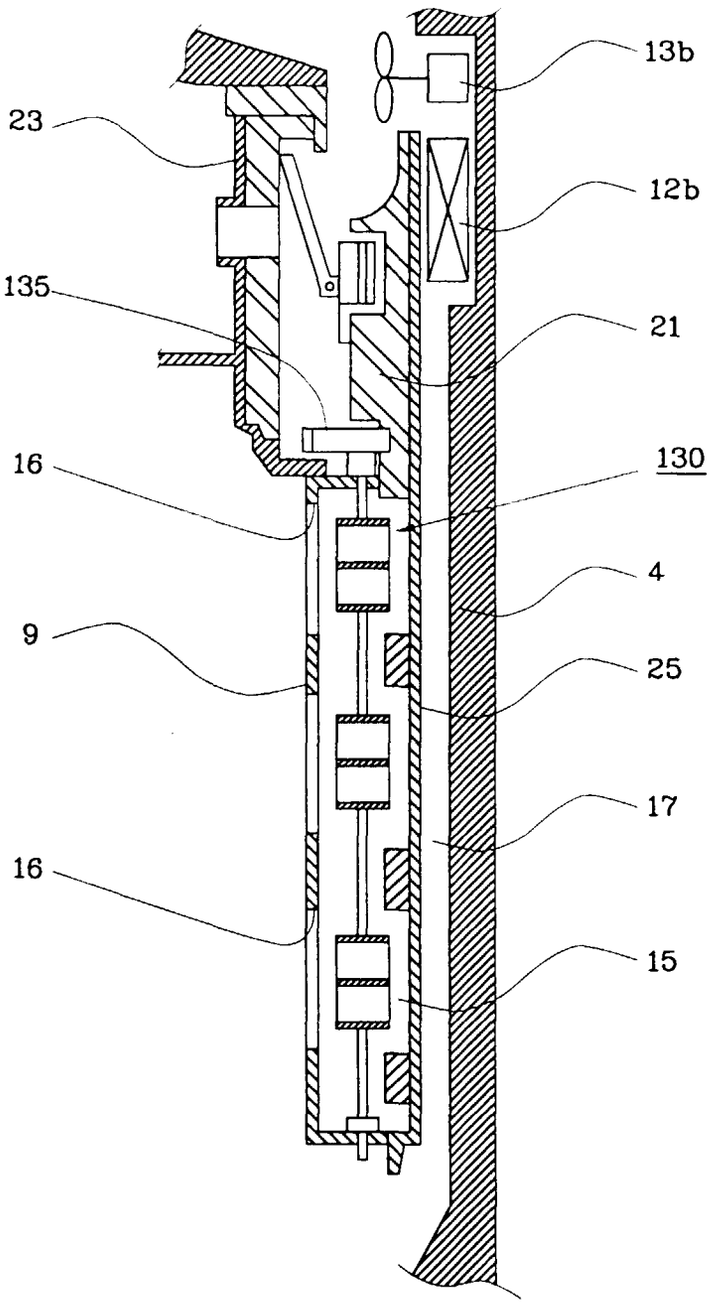

FIG.3
(PRIOR ART)

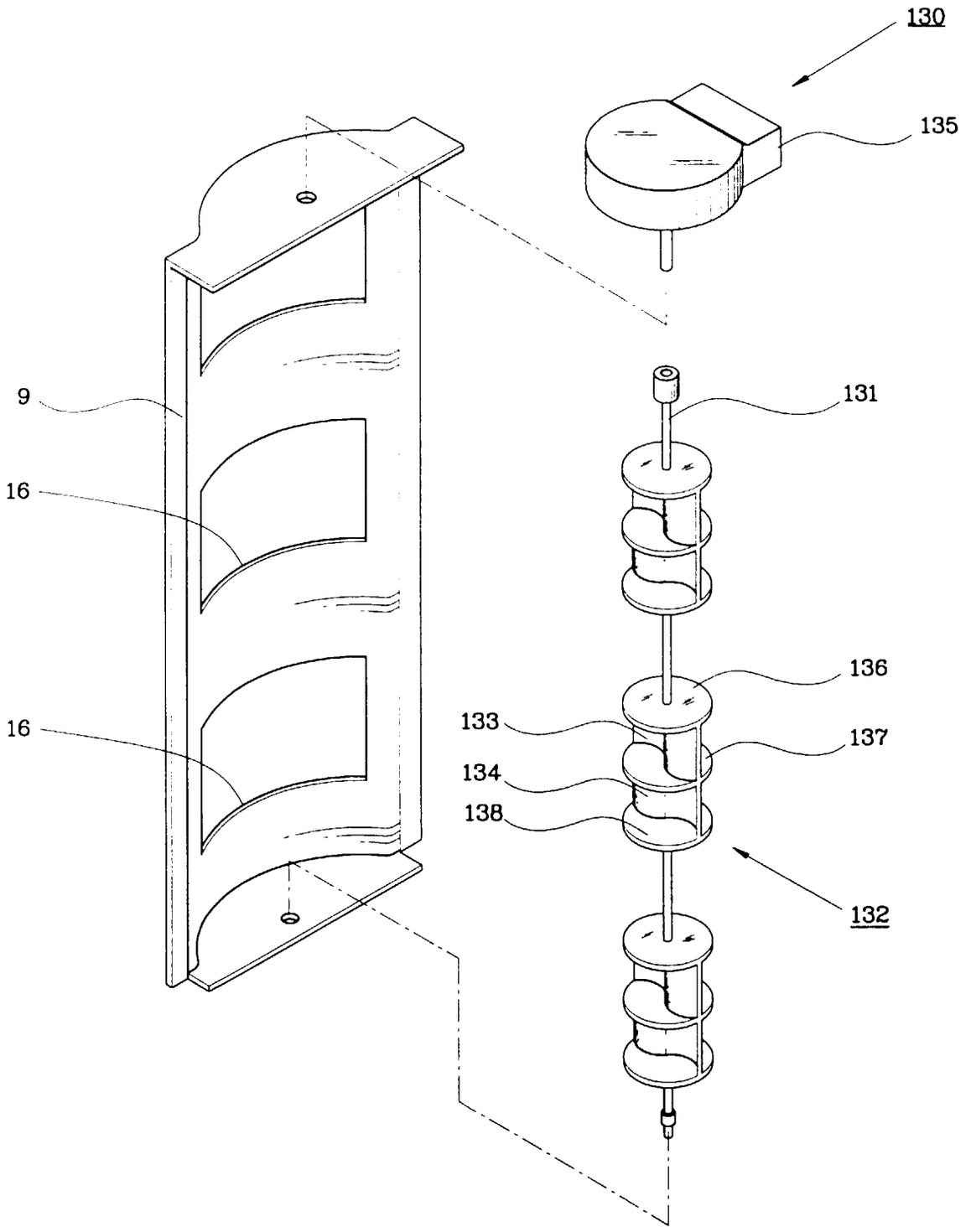

FIG.4

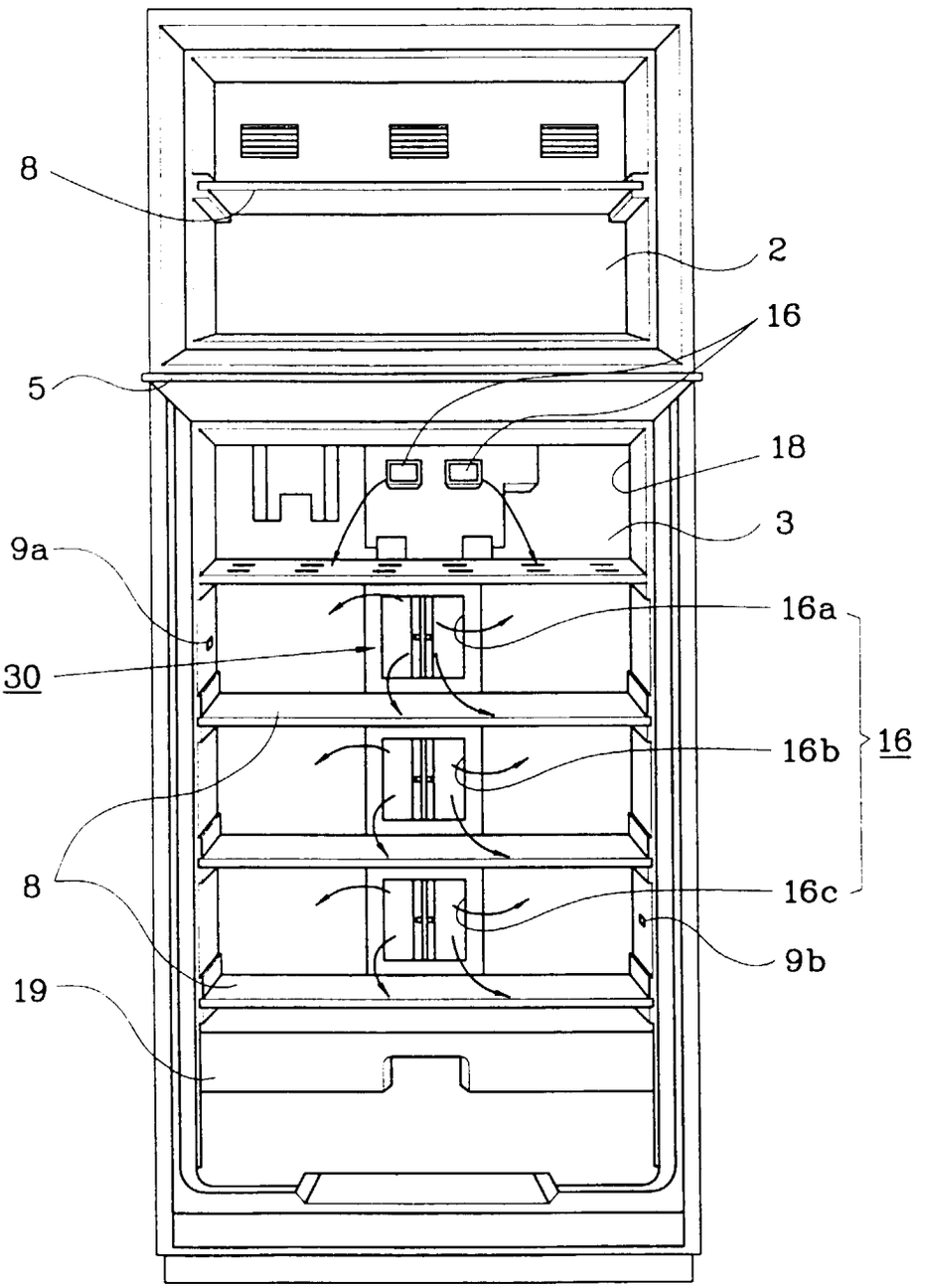

FIG.5

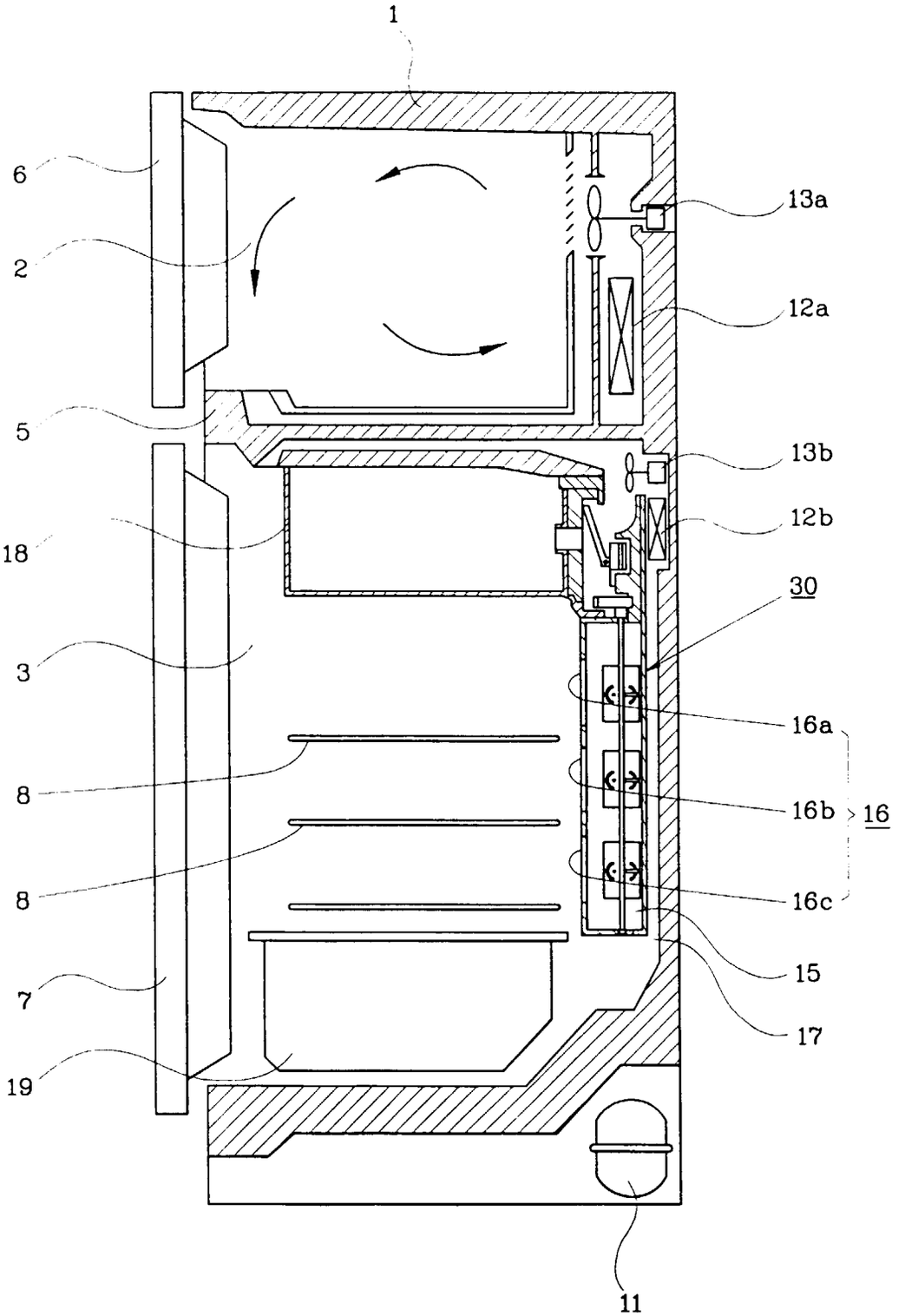

FIG.6

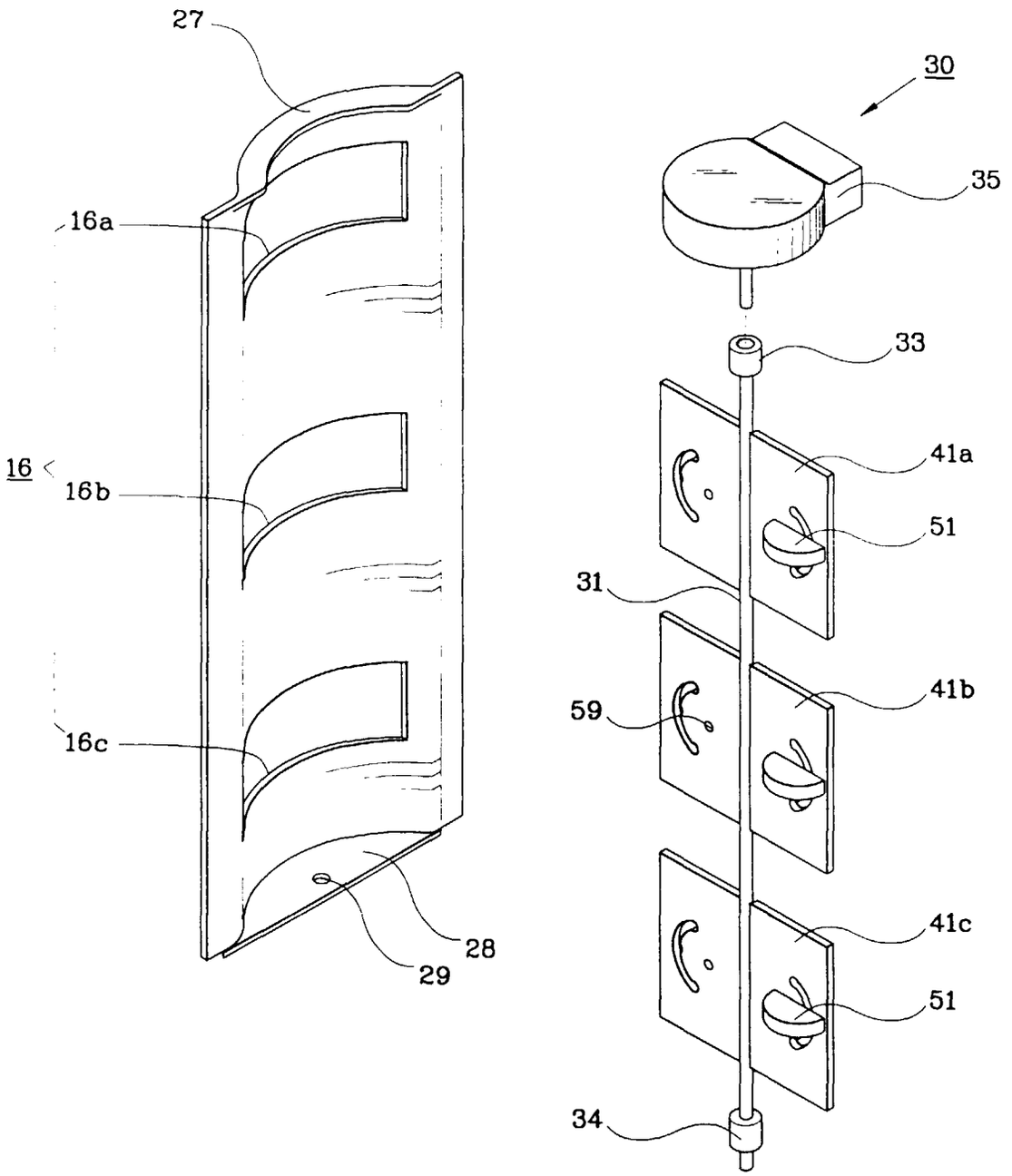

FIG.7

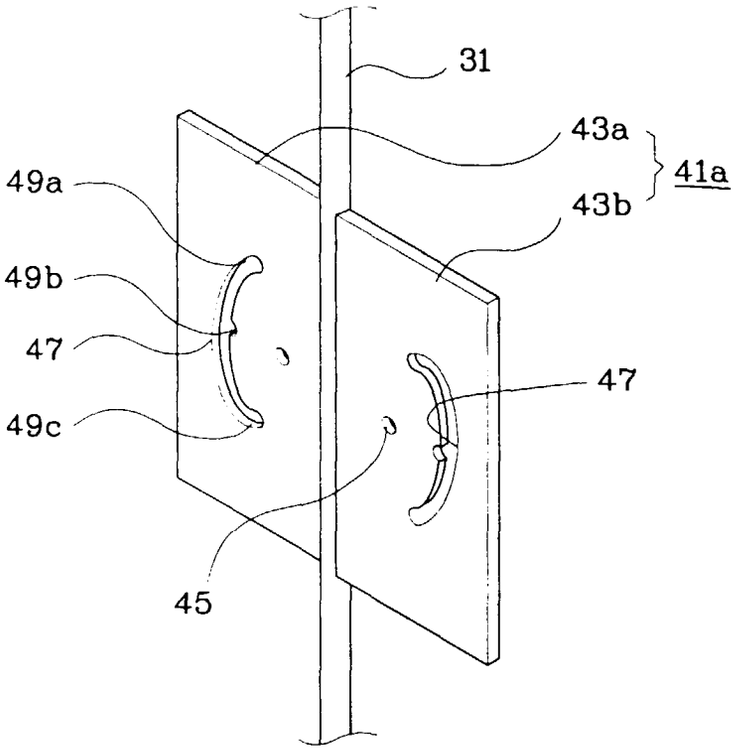

FIG.8

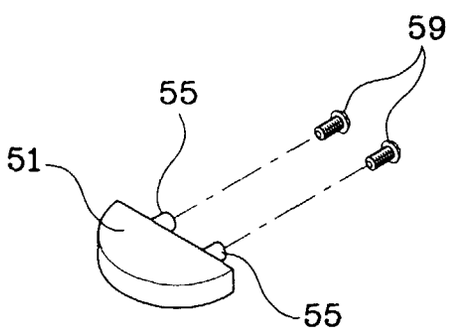

FIG.9

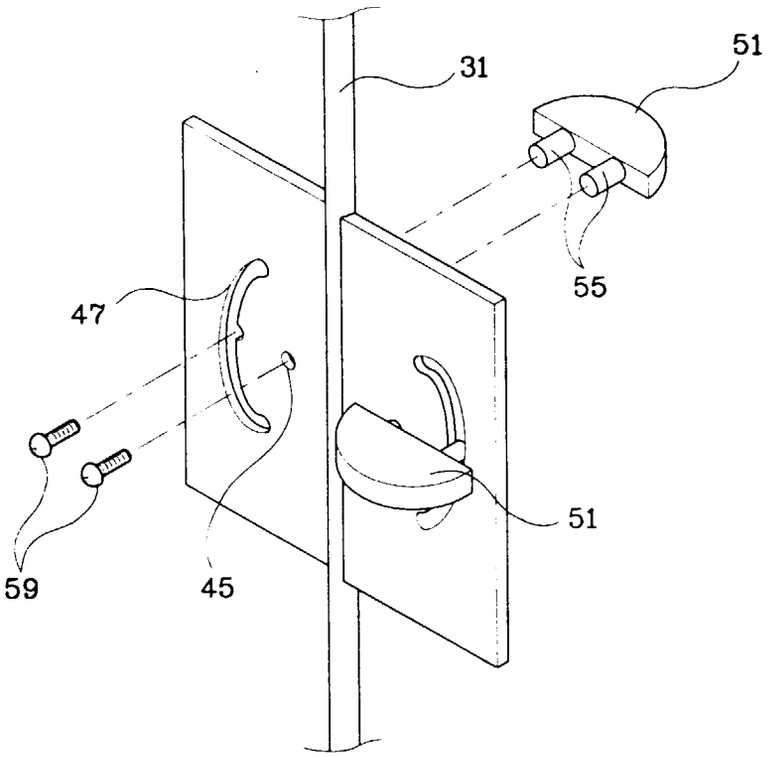

FIG.10

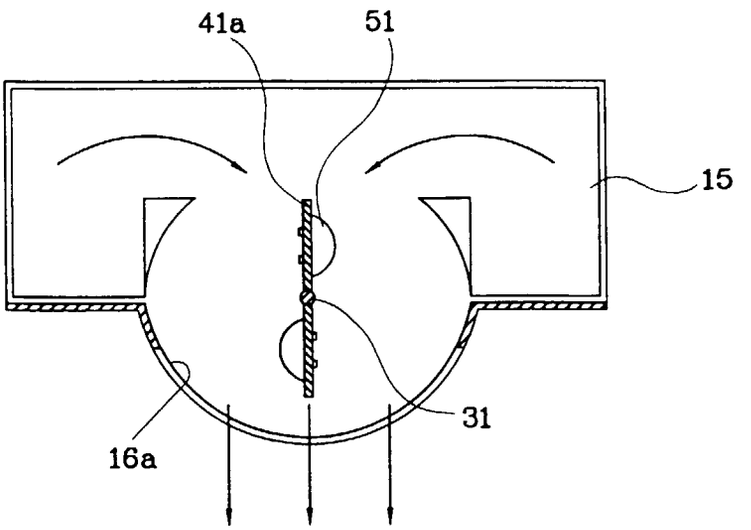

FIG .11

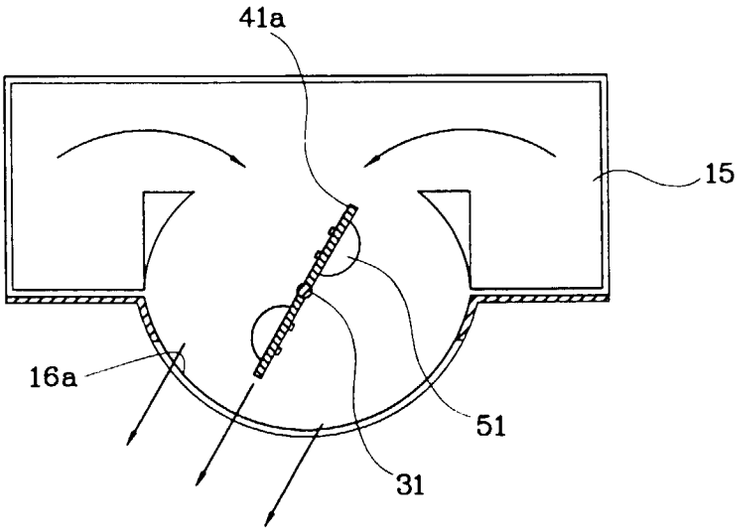

FIG .12

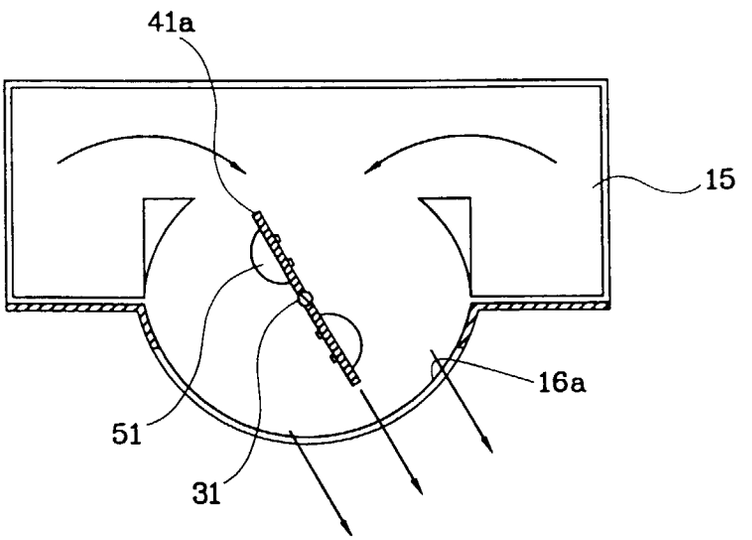

FIG .13

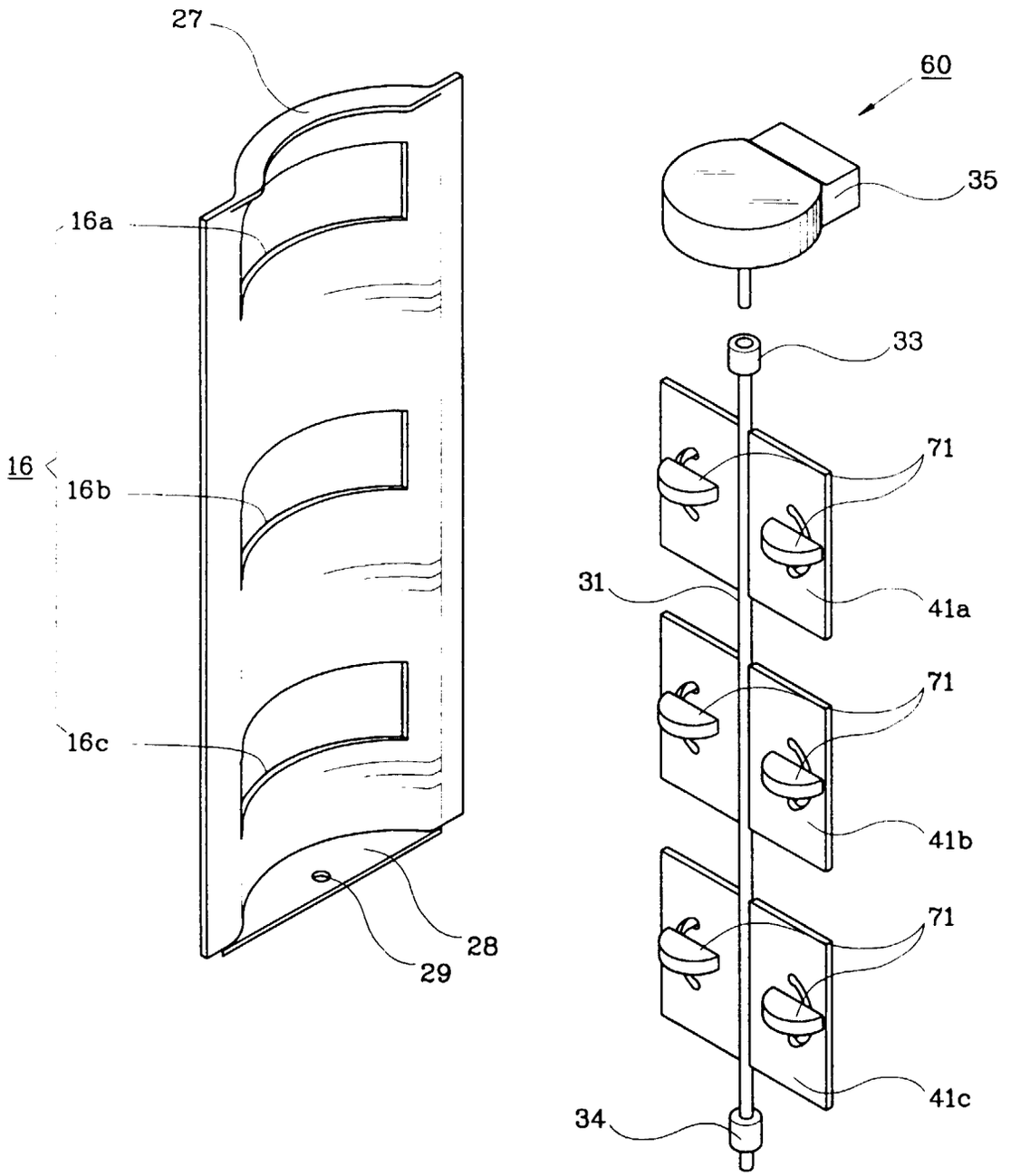

FIG .14

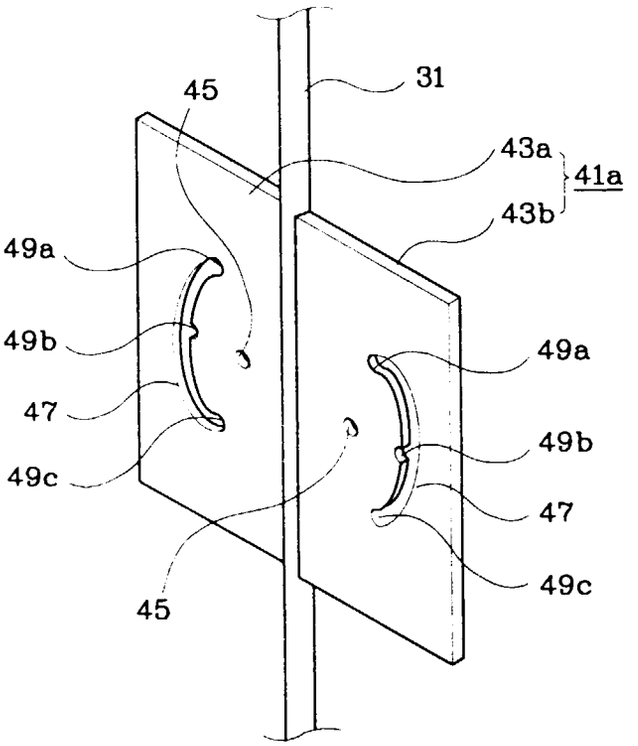

FIG .15

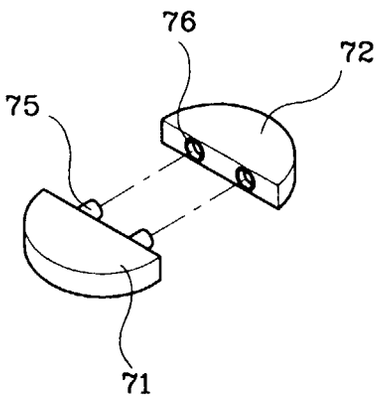

FIG .16

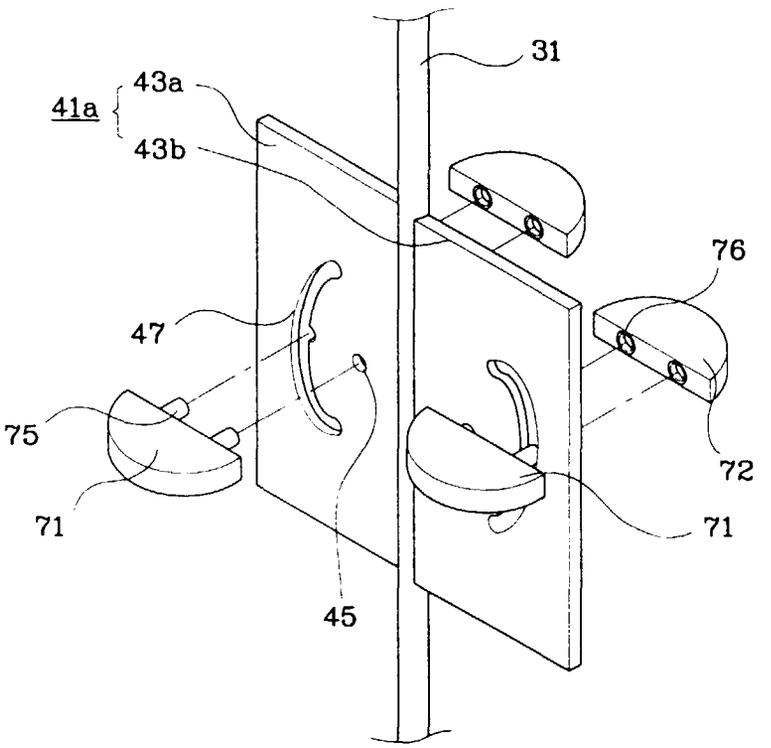

FIG .17

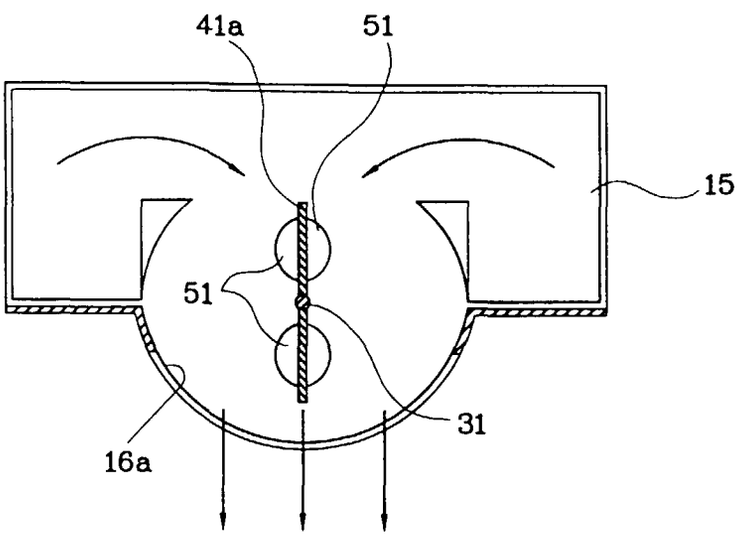

FIG .18

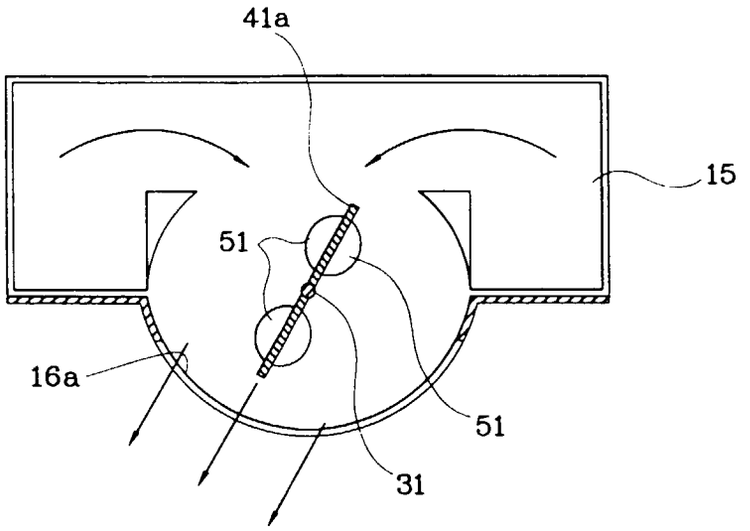

FIG .19