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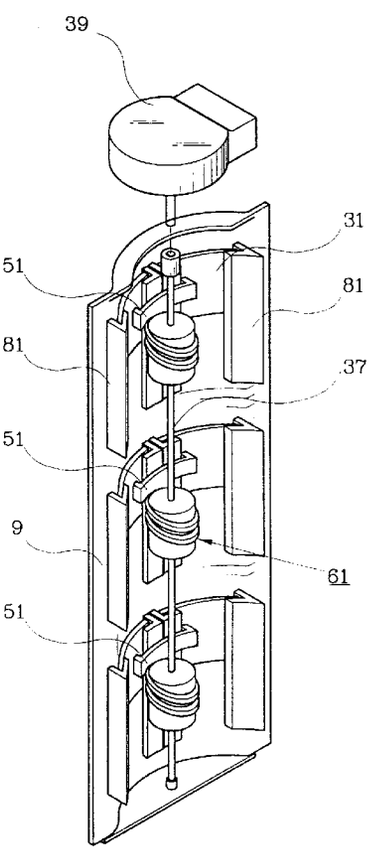
(54) Refrigerator

(57) A refrigerator having means for opening/closing cool air discharge ports (16) through which cool air is supplied into a cooling compartment (3). Shutter members (31) for opening/closing ports (16) in a cool air supply duct (9) are driven by cams (61) rotated by a motor (39). Conversion means convert the rotational movement of the cams into a reciprocal raising and lowering movement of the shutters (31). The ports (16) are opened by the shutter members (31) when the temperature of the compartment (3) is too high, and closed when it is too low. Thus, the amount of the cool air supplied into the compartment (3) can be controlled, and the overcooling of the compartment can be prevented.

FIG.6



EP 0 895 043 A2

Description

[0001] The present invention relates to a refrigerator, and more particularly, to a refrigerator having a device for opening/closing cool air discharge ports through which cool air is supplied into a cooling compartment.

[0002] Generally, refrigerators comprise a cabinet in which there is a freezing compartment and a fresh food compartment. These compartments are separated by a partition wall. 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 by a fan into each cooling compartment through cool air discharge ports opening thereinto.

[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 compartments 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 1-3 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 a freezing and fresh food compartment 2,3 in a cabinet 1, which are separated from each other by a partition wall 5. 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.

[0008] 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 formed in it opening into the fresh food compartment 3. 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.

[0009] A cool air dispersing device 130 is installed in the supply duct 15 which comprises a rotatable vertical shaft 131 with cool air dispersing blades 132 assembled thereon in corresponding to respective cool air discharge ports 16, and a driving motor 135 for rotating the 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.

[0010] In a refrigerator having the above described construction, when the motor 131 rotates the 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 shaft 131 so that the cool air dispersing blades 132 direct cool air to the specific area.

[0011] However, in a conventional refrigerator, the cool air discharge ports 16 are always open so cool air generated by the fresh food compartment evaporator 12b is always supplied into the fresh food compartment 3 irrespective of the temperature of the fresh food compartment 3. As a result, the fresh food compartment 3 can be overcooled. In particular, since a refrigerator generally operates on the basis of the temperature of the freezing compartment 2, the possibility of overcooling of the fresh food compartment 3 always exists. More specifically, the compressor 11 begins to operate when the temperature of the freezing compartment 2 is higher than the temperature set by a user so the freezing compartment evaporator 12a as well as the fresh food compartment evaporator 12b generates the cool air. Accordingly, even though the temperature of the fresh food compartment 3 is lower than the temperature set by the user, the cool air is supplied into the fresh food compartment 3 through the cool air discharge ports 16 so the fresh food compartment 3 may be overcooled.

[0012] It is an object of the present invention to provide a refrigerator capable of opening/closing cool air discharge ports, whereby the amount of the cool air supplied into a fresh food compartment can be controlled and the overcooling of the fresh food compartment is prevented.

[0013] According to the invention, there is provided a refrigerator including a cooling compartment, a heat pump, means for driving cool air provided by the heat pump through an aperture into the cooling compartment

and cool air flow directing means associated with the aperture for directing said cool air characterised in that the aperture has a shutter member associated therewith which is movable in the plane of the aperture by drive means to open and close the aperture.

[0014] In a preferred embodiment the refrigerator comprises a cooling compartment for storing food, a duct plate forming a cool air duct in a rear wall of said cooling compartment, said duct plate having a cool air discharge port opening into the cooling compartment, a shutter member on said duct plate, capable of moving in the planar direction thereof between an open position for opening the cool air discharge port and a close position for closing the cool air discharge port, and means for driving said shutter member so that the cool air discharge port is opened/closed.

[0015] Preferably, the drive means comprises a motor and transmission means for converting the rotational output of the motor to said shutter member into a reciprocating movement. Conveniently, the transmitting means comprises a rotatable shaft coupled to the motor, a cam mounted on said rotatable shaft and rotatable therewith, and conversion means connecting said shutter member with said cam to convert the rotational movement of the cam into a linear elevational/de-elevational movement of said shutter member.

[0016] Preferably, a plurality of apertures or cool air discharge ports are provided, and a plurality of said shutter members are disposed in correspondence therewith.

[0017] According to a preferred embodiment of the present invention the conversion means comprises a horizontal part for connecting a pair of said shutter members with each other, a vertical part extending downwardly from said horizontal part, and a protrusion protruding from said vertical part. A plurality of cams corresponding to the plurality of shutter members have a predetermined phase difference so that elevational positions of the plurality of shutter members are different from each other.

[0018] In another preferred embodiment of the present invention, the conversion means comprises a protrusion extending from the shutter member, the cam having a groove which receives said protrusion.

[0019] The or each shutter member preferably includes guiding means to guide it between its open and closed positions.

[0020] According to still further embodiments of the present invention, the refrigerator can include at least one cool air dispersing blade dispersed adjacent the discharge port for changing the discharge direction of cool air discharged through the cool air discharge port dependent on the angular position thereof and means for rotating said blade. The cool air dispersing blade can comprise at least one vertical dispersing blade capable of rotating with respect to a horizontal axis, and at least one horizontal dispersing blade capable of rotating with respect to a vertical axis.

[0021] Preferably, said driving motor is a stepping motor.

[0022] According to the present invention, the amount of the cool air supplied through the cool air discharge ports can be controlled, and overcooling of the cooling compartment can be prevented. In particular, if the additional cool air dispersing blades are employed, the uniform distribution of the cool air can be realised effectively and the amount of the supplied cool air can be controlled.

[0023] The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a side sectional view of a conventional refrigerator having cool air dispersing blades;
Figure 2 is a partial enlarge sectional view of Figure 1;
Figure 3 is an enlarged exploded perspective view of main elements of Figure 2;
Figure 4 is a side sectional view of a refrigerator according to a first embodiment of the present invention;
Figure 5 is an enlarged exploded perspective view of a device for opening/closing the cool air discharge ports shown in Figure 4;
Figure 6 is a perspective view of the device of Figure 5 in its assembled state;
Figure 7 is an enlarged transverse sectional view of the device of Figure 6;
Figures 8 and 9 are side sectional views of the device of Figure 6;
Figure 10 is an exploded perspective view of the device for opening/closing the cool air discharge ports according to a second embodiment of the present invention;
Figure 11 is a perspective view of the device of Figure 10 in its assembled state;
Figure 12 is an enlarged transverse sectional view of the device of Figure 11;
Figures 13 and 14 are side sectional views of the device of Figure 11;
Figure 15 is an exploded perspective view of the device for opening/closing the cool air discharge ports according to a third embodiment of the present invention;
Figure 16 is a perspective view of the device of Figure 15 in its assembled state;
Figure 17 is a side sectional view of the device of Figure 16;
Figure 18 is a perspective view of the device for opening/closing the cool air discharge ports according to a fourth embodiment of the present invention;
Figure 19 is a partial enlarged transverse sectional view of the device of Figure 18;
Figures 20 and 21 are rear views of the device of Figure 18;
Figure 22 is an exploded perspective view of the

device for opening/closing the cool air discharge ports according to a fifth embodiment of the present invention;

Figure 23 is a perspective view of the device of Figure 22 in its assembled state; and

Figures 24 and 25 are side sectional views of the device of Figure 23.

[0024] Hereinafter, 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 1-3 will be identified with the same reference numerals. The description of the parts which are substantially the same those of the prior art will in general be omitted.

[0025] The refrigerator shown in Figures 4 and 5 is the same as the prior art refrigerator shown in Figures 1-3 and comprises a cabinet 1 providing freezing compartment 2 and a fresh food compartment 3 which are separated by a partition wall 5. The freezing compartment is disposed above the fresh food compartment 3 and both compartments are provided with respective doors 6 and 7. Shelves 8 divide the fresh food compartment 3 into three separate areas namely an upper area, a middle area and a lower area. A special fresh chamber 18 for storing food which requires a specific temperature range is formed in the upper part 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.

[0026] 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. The cool air generated by the evaporators 12a and 12b is supplied into the corresponding cooling compartments 2 and 3 by a freezing compartment fan 13a and a fresh food compartment fan 13b.

[0027] A duct plate 9 is attached on the inner wall plate 23 forming the rear inner wall of the fresh food compartment 3. The duct plate 9 is partially cylindrical in shape so that it protrudes in the form of an arc from the inner wall plate 23 into the fresh food compartment 3 and has cool air discharge ports 16 opening into respective storing areas of the fresh food compartment 3.

[0028] A supply duct 15 and a return duct 17 are provided between the duct plate 9 and the rear wall 4 of the cabinet 1 which are partitioned from each other by a seal plate 25. A duct member 21 for guiding the cool air blown by the fresh food compartment fan 13b downwardly is installed in the supply duct 15. The cool air generated by the fresh food compartment evaporator 12b is blown by the fresh food compartment fan 13b so as to be supplied 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 is installed in the supply duct 15.

[0029] Figures 5 to 7 show the device 30 for opening/closing the cool air discharge ports 16 shown in Figure 4.

[0030] A plurality of shutter members 31 for opening/closing the cool air discharge ports 16 are installed in the supply duct 15. The shutter members 31 are generally planar but bent to correspond to the inner surface of the duct plate 9 which protrudes towards the inner area of the fresh food compartment 3. A pair of discharge ports 16 are provided in each of the upper, middle, and lower parts of the duct plate 9 and a pair of shutter members 31 is associated with each pair of ports 16.

[0031] A drive mechanism 35 for driving the shutter members 31 is mounted in the duct 15 and comprises a motor 39, a shaft 37 and means 51 for converting the rotational movement of the cams 61 into an elevational/de-elevational movement of the shutter members 31.

[0032] The lower end of the rotatable shaft 37 is fitted into a bearing aperture 9g formed in the lower portion of the duct plate 9. The upper end of the shaft 37 is connected to the drive shaft of the motor 39. A stepping motor is preferably used as the motor 39, which is capable of incrementally controlling the angular position thereof.

[0033] Each cam 61 has a cam body 63, and a cam groove 65 around the circumference thereof. The cam body 63 is coaxial with the shaft 37, and is rotated therewith.

[0034] The means 51 comprises a T-shaped member having a horizontal part 53 and a vertical part 55 which extends downwardly from the central part of the horizontal part 53. A shutter member 31 is attached to both side ends of the horizontal part 53. A peg 57 protrudes from the lower end of the vertical part 55 towards the cam 61. The peg 57 engages with the cam groove 65, whereby it is moved up and down along the cam groove 65 while the cam body 63 rotates so the means 51 is elevated/de-elevated by the elevational/de-elevational movement of the peg 57 and the shutter members 31 reciprocate between an open position in which the discharge ports 16 are open to a closed position in which the discharge ports 16 are closed.

[0035] Guide rails 81 for guiding the elevation/de-elevation of the shutter members 31 are mounted on the rear surface of the duct plate 9 at both sides of each discharge port 16, and each one has a recess 83 to slidingly receive the shutter members 31.

[0036] Figures 8 and 9 are side sectional views of the device 30 for opening/closing the cool air discharge ports 16 according to a first embodiment of the present invention having the above-described construction and show the operation of the device 30.

[0037] The motor 39 rotates the shaft 37 according to a control signal received from a microprocessor (not shown). The cams 61 are rotated by the shaft 37, and thereby the pegs 57 are moved up and down so the shutter members 31 connected to the means 51 are raised and lowered.

[0038] The microprocessor senses the temperature of the fresh food compartment with temperature sensors

(not shown) and when the sensed temperature is lower than a temperature set by a user, controls the motor 39 so that the shutter members 31 close the discharge ports 16 as shown in Figure 8. When the sensed temperature is higher than the temperature set by the user, the microprocessor controls the motor 39 so that the shutter members 31 open the discharge ports 16 as shown in Figure 9.

[0039] The amount of cool air discharged through the discharge ports 16 varies according to the elevational position of the shutter members 31. Therefore, if the elevational position of the shutter members 31 is properly adjusted, that is, if the motor 39 is stopped at a predetermined angular position, the amount of the discharged cool air can be controlled.

[0040] According to the present invention, the overcooling of the fresh food compartment 3 can be prevented by opening or closing the discharge ports 16 according to the temperature of the fresh food compartment 3. Furthermore, the proper amount of cool air can be supplied by regulating the degree of opening of the discharge ports 16, whereby it is easy to control the temperature of the fresh food compartment 3.

[0041] Figures 10 to 14 show another device for opening/closing the cool air discharge ports according to a second embodiment of the present invention. In the description of this second embodiment and the following embodiments, the same or similar parts with the parts of the antecedent embodiments will not be described, and will be referred to with the same reference numerals.

[0042] In this second embodiment, the shutter member 31 and the peg 57 are formed together as a single body, and each of the shutter members 31 is slidable in a pair of guide rails 81 to be raised or lowered. The construction of the motor 39, shaft 37 and cams 61 is the same as that of the first embodiment. The peg 57 engages with the cam groove 65 of the cam 61.

[0043] In this embodiment, the operation of the opening/closing device is similar to that of the first embodiment. That is, the cams 61 rotate when the shaft 37 is rotated by the motor 39 as a result of which the pegs 57 and the shutter members 31 are raised or lowered.

[0044] The construction of the shutter member 31 in this embodiment is simple as the horizontal part 53 and vertical part 55 of the first embodiment are not needed, and the number of guide rails 81 is reduced.

[0045] Figures 15 to 17 show a third embodiment of the present invention. The construction of the present embodiment is the same as that of the first embodiment except for the cams 61.

[0046] The cam grooves 65 of the respective cams 61 have a predetermined degree of phase difference from each other. Accordingly, the amount that the respective discharge ports 16 are opened/closed by the corresponding shutter members 31 is different from each other.

[0047] While the shaft 37 is continuously rotated by the motor 39, the discharge ports 16 are opened and closed in turn. Furthermore, the amount of the cool air discharged through a specific discharge port can be greater than that discharged through other discharge ports, by stopping the motor 39 at a specific rotational position thereof. Therefore, it is possible to supply the cool air into a specific area in a concentrated fashion.

[0048] Figures 18 to 21 show a fourth embodiment of the present invention.

[0049] The shutter members 131 are supported by guide rails 145 provided at both sides of respective discharge ports 16 and are capable of being raised or lowered. The sliding of the shutter members 131 is performed by a driving mechanism 135 which includes a motor 139, a rotatable shaft 137, cams 161 and transmission means 151. In the present embodiment, the construction of the driving mechanism 135 is substantially the same as that of the aforementioned embodiments except for the construction of the transmission means 151.

[0050] The transmission means 151 comprises sliding rails 153 which are respectively mounted vertically between the rotatable shaft 137 and the shutter members 131. Sliders 155 are mounted in the sliding rails 135, and bars 157 slide together with respective sliders 155. Each bar 157 passes through a slider 155 and one end is engaged with the cam 161, the other end thereof being fixed to fixed part 133 formed on the shutter member 131. Each sliding rails 153 has a recess for accommodating the slider 155, and is formed with an aperture 152 through which the bar 157 passes.

[0051] The operation of the opening/closing device having the above described construction is the same with that of the aforementioned embodiments. That is, the discharge ports 16 are closed as shown in Figure 20 or opened as shown in Figure 21 by the shutter members 131 on the basis of the temperature in the fresh food compartment 3. Furthermore, as described above, the discharge ports 16 can be partially opened, or opened and closed repeatedly by the continuous rotation of the shaft 137.

[0052] Figures 22 to 25 show the opening/closing device according to a fifth embodiment of the present invention which has the same construction as the first embodiment but with an additional cool air dispersing device.

[0053] More specifically, the opening/closing device has shutter members 271 for opening/closing the discharge ports 16, a motor 239 for driving the shutter members 271, and transmission means 275 for transmitting the power of the motor 239 to the shutter members 271. The transmission means 275 includes a rotatable shaft 231 rotated by the motor 239, cams 263a, 263b and 263c mounted on the shaft 231, and operating mechanism 276 for converting the rotation of the cams 263b and 263c into a linear raising and lowering movement.

[0054] Each of the cams 263a,263b and 263c has a

cam body 264 and a cam groove 265 formed around its circumference.

[0055] The operating mechanism 276 is generally T-shaped and has a horizontal member 277 fixed to the shutter member 271, a vertical part 278 extending downwardly from the horizontal part 277, and a peg 279 formed on the vertical part 278 which engages with the cam groove 265.

[0056] Guide rails 281 are mounted on the rear surface of the duct plate 9 for guiding the raising and lowering of the shutter members 271. The guide rails 281 are disposed at both sides of the respective discharge ports 16 and have recesses 283 to slidingly accommodate the shutter members 271.

[0057] The shutter members 271 are disposed in the discharge ports 16 formed at the middle and lower parts of the duct plate 9, cool air dispersing blades being disposed at the upper discharge port 19.

[0058] The cool air dispersing blades comprise vertical dispersing blades 251 pivoting about a horizontal axis, and a horizontal dispersing blade 291 rotatable about a vertical axis.

[0059] The blade 291 is fitted at the upper part of the shaft 231, and rotates with the shaft 231. Guide plates 293 are fitted to the upper and lower ends of the blade 291 for guiding cool air towards the upper discharge ports 16.

[0060] Each vertical dispersing blade 251 has horizontal rotational shafts 253 at both ends thereof which are fitted into apertures 247 formed in flanges 245 of the duct plate 9 so that the shafts 253 are rotatable upwardly and downwardly. A pivot pin 255 is formed at the rear side of the vertical dispersing blade 255.

[0061] The cam 263a provided at the upper part of the shaft 231 rotates the vertical dispersing blades 251 through a drive mechanism 260 as the shaft 231 rotates. The drive mechanism 260 includes a lever 266 and a link member 261. The lever 266 is formed with a hole 268 which receives supporting shaft 250 projecting from the rear of the duct plate 9. The link member 261 is assembled with the pivot pins 255 of the vertical dispersing blades 251. The protrusion 262 of the link member 261 is inserted into long hole 267 formed on the lever 266, and the protrusion 269 of the lever 266 is inserted into the cam groove 265 of the cam 263a.

[0062] As the shaft 231 is rotated by the driving motor 239, the horizontal dispersing blade 291 rotates. Thus, the cool air supplied into the supply duct 15 is dispersed into the fresh food compartment 3 through the discharge ports 16. In such a situation, the lever 266 moves according to the rotation of the cam 263a, so the link 261 is moved up and down and each vertical dispersing blade 251 reciprocally pivots on the horizontal rotational shaft 253. Therefore, cool air is dispersed by the dispersing blades 251 vertically as well as horizontally by the dispersing blade 291.

[0063] Furthermore, while the shaft 231 is rotating, the shutter members 271 are raised and lowered by the cams 263b and 263c and the operating means 276. Consequently, the operation of the shutter members 271 for opening/closing the discharge ports 16 is performed as illustrated in the first embodiment, along with the operation of the cool air dispersing blades 291 and 251 for dispersing the cool air.

[0064] According to the present embodiment, the opening/closing of the discharge ports 16 and the dispersing of the cool air supplied into the fresh food compartment 3 are performed simultaneously so cool air can be uniformly distributed.

[0065] In the present embodiment, the dispersing of cool air and the opening/closing of the discharge ports 16 is performed at the discharge ports differently from each other. However, the opening/closing and dispersing can be performed in all of the discharge ports 16 simultaneously. For such an operation, the cool air dispersing device as well as the opening/closing device have to be provided in correspondence to the respective discharge ports 16.

[0066] Furthermore, in the present embodiment, the vertical dispersing blades 251 operate in accordance with the horizontal dispersing blade 291. However, they can be driven independently of each other by additional driving means. Moreover, the cool air dispersing device and the opening/closing device can be controlled independently of each other by separate driving means.

[0067] As described above, according to the present invention, the amount of the cool air supplied through the cool air discharge ports can be controlled, and the overcooling of the fresh food compartment can be prevented. In particular, if additional cool air dispersing blades are employed, the uniform distribution of the cool air can be realised effectively, along with the control of the amount of the supplied cool air.

Claims

1. A refrigerator including a cooling compartment (3), a heat pump (11), means for driving cool air produced by the heat pump through an aperture (16) into the cooling compartment (3) and cool air flow directing means (30) associated with the aperture (16) for directing said cool air **characterised in that** the aperture (16) has a shutter member (31) associated therewith which is movable in the plane of the aperture by drive means to open and close the aperture.

2. A refrigerator as claimed in claim 1 characterised in that said drive means comprises a motor (39) and transmission means for converting the rotational output of the motor to said shutter member (31) into a reciprocating movement.

3. A refrigerator as claimed in claim 2 characterised in that transmitting means comprises a rotatable shaft

(37) coupled to said motor (39), a cam (61) mounted on said rotatable shaft (37) and rotatable therewith and conversion means connecting said shutter member with said cam (61) to convert the rotational movement of the cam (61) into a linear elevational/de-elevational movement of said shutter member (31).

4. A refrigerator as claimed in any preceding claim characterised by a plurality of apertures (16) and corresponding shutter members (31).

5. A refrigerator as claimed in claim 4 characterised in that the conversion means is T-shaped and comprises a horizontal part (53) for connecting a pair of said shutter members (31) with each other, a vertical part (55) extending downwardly from said horizontal part (53) and a protrusion (57) extending from said vertical part (55) which is received in a groove (65) in said cam (61).

6. A refrigerator as claimed in claim 4 or claim 5 characterised by a plurality of cams (61) corresponding to the plurality of shutter members (31) which have a predetermined phase difference so that the elevational positions of said plurality of shutter members (31) are different from each other.

7. A refrigerator as claimed in claim 3 characterised in that said conversion means comprises a protrusion (57) extending from the shutter member (31) and the cam (61) has a cam groove (65) which receives said protrusion.

8. A refrigerator as claimed in any preceding claim characterised by means (81) for guiding movement of each shutter member (31) between its open position and closed positions.

9. A refrigerator as claimed in any preceding claim characterised by at least one cool air dispersing blade (251) disposed near the aperture (16) for changing the direction of cool air discharged through the aperture dependent on the angular position thereof and a means (260) for rotating said cool air dispersing blade (251).

10. A refrigerator as claimed in claim 9 characterised in that the cool air dispersing blade (251) comprises at least one vertical dispersing blade (251) capable of rotation with respect to a horizontal axis and at least one horizontal dispersing blade (291) capable of rotation with respect to a vertical axis.

11. A refrigerator as claimed in any of claims 2 to 10 characterised in that the motor (39) is a stepping motor.

12. A refrigerator comprising a cooling compartment for storing food, a duct plate forming a cool air duct in a rear wall of said cooling compartment, said duct plate having a cool air discharge port opening into the cooling compartment, a shutter member on said duct plate capable of moving in the planar direction thereof between an open position for opening the cool air discharge port and a closed position for closing the cool air discharge port and means for driving said shutter member so that the cool air discharge port is opened/closed.

FIG.1
(PRIOR ART)

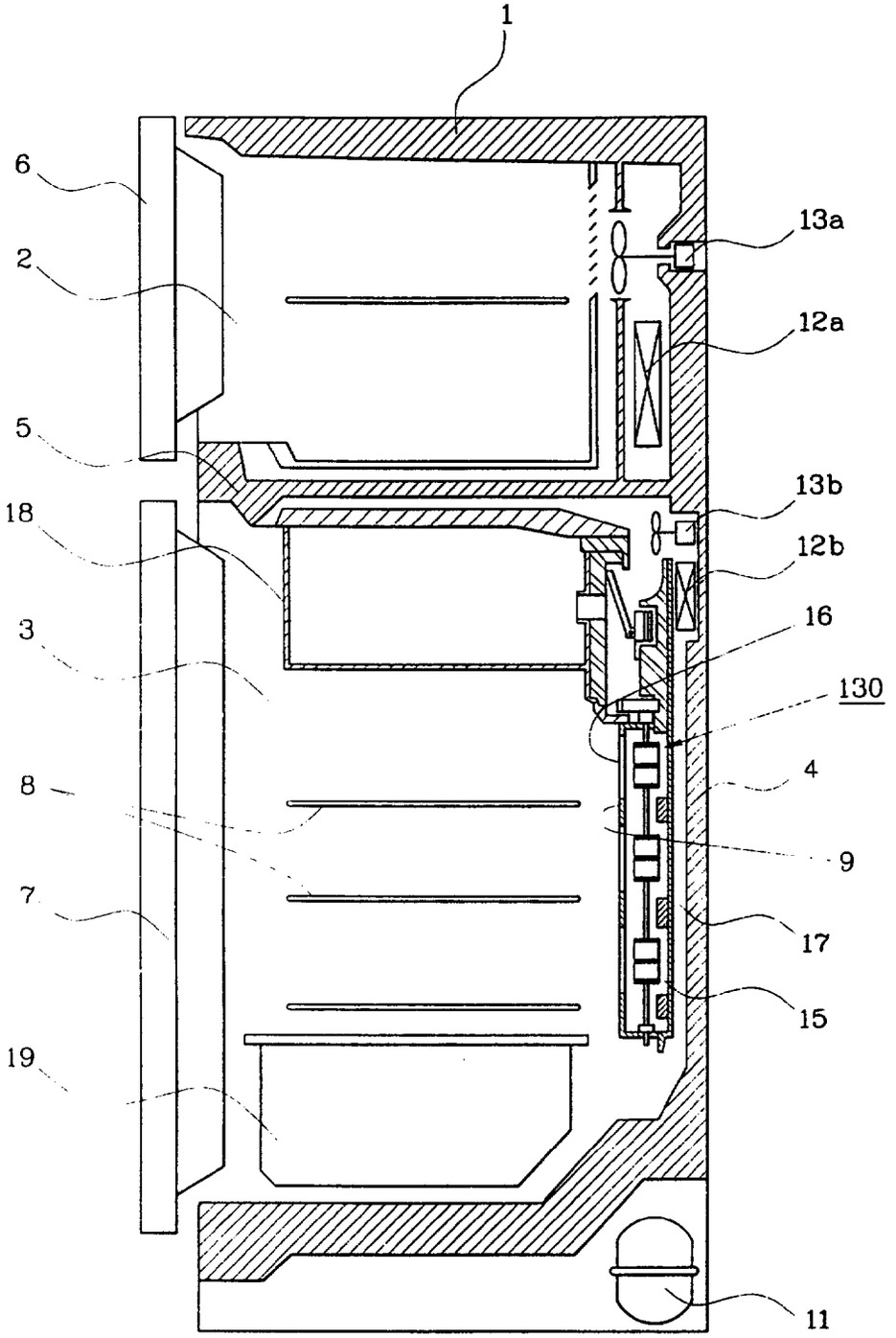


FIG.2
(PRIOR ART)

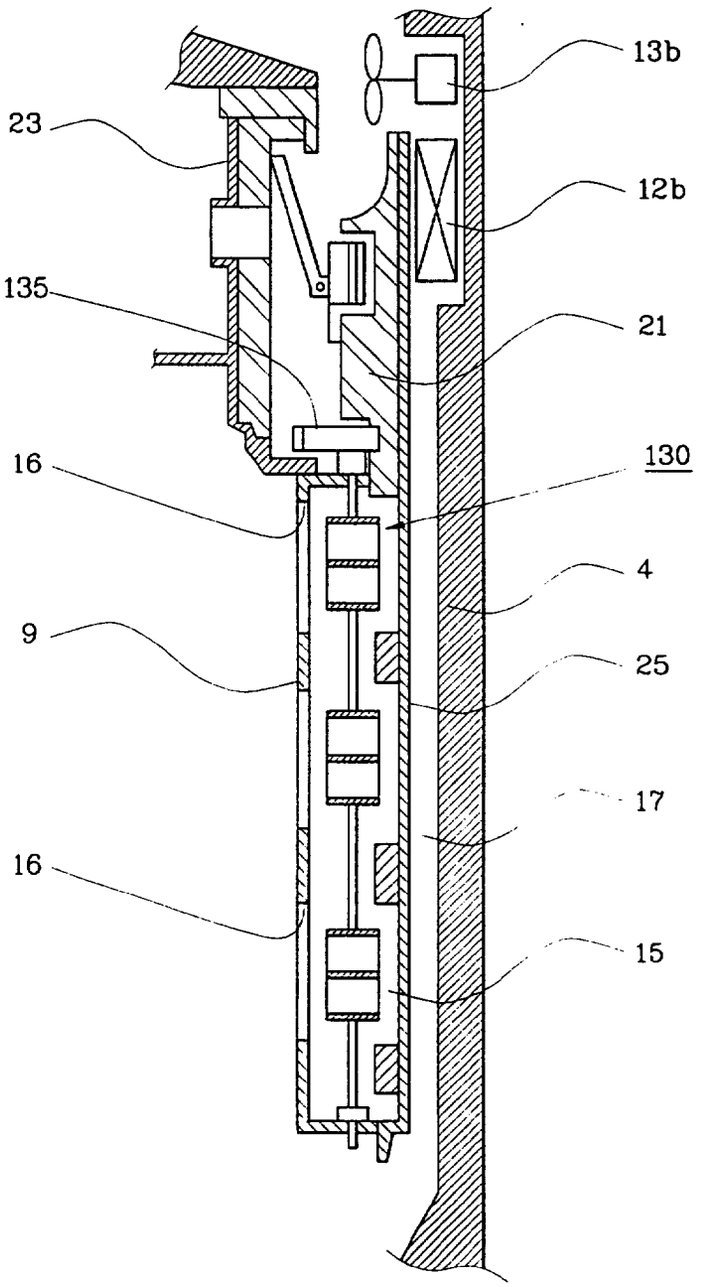


FIG.3
(PRIOR ART)

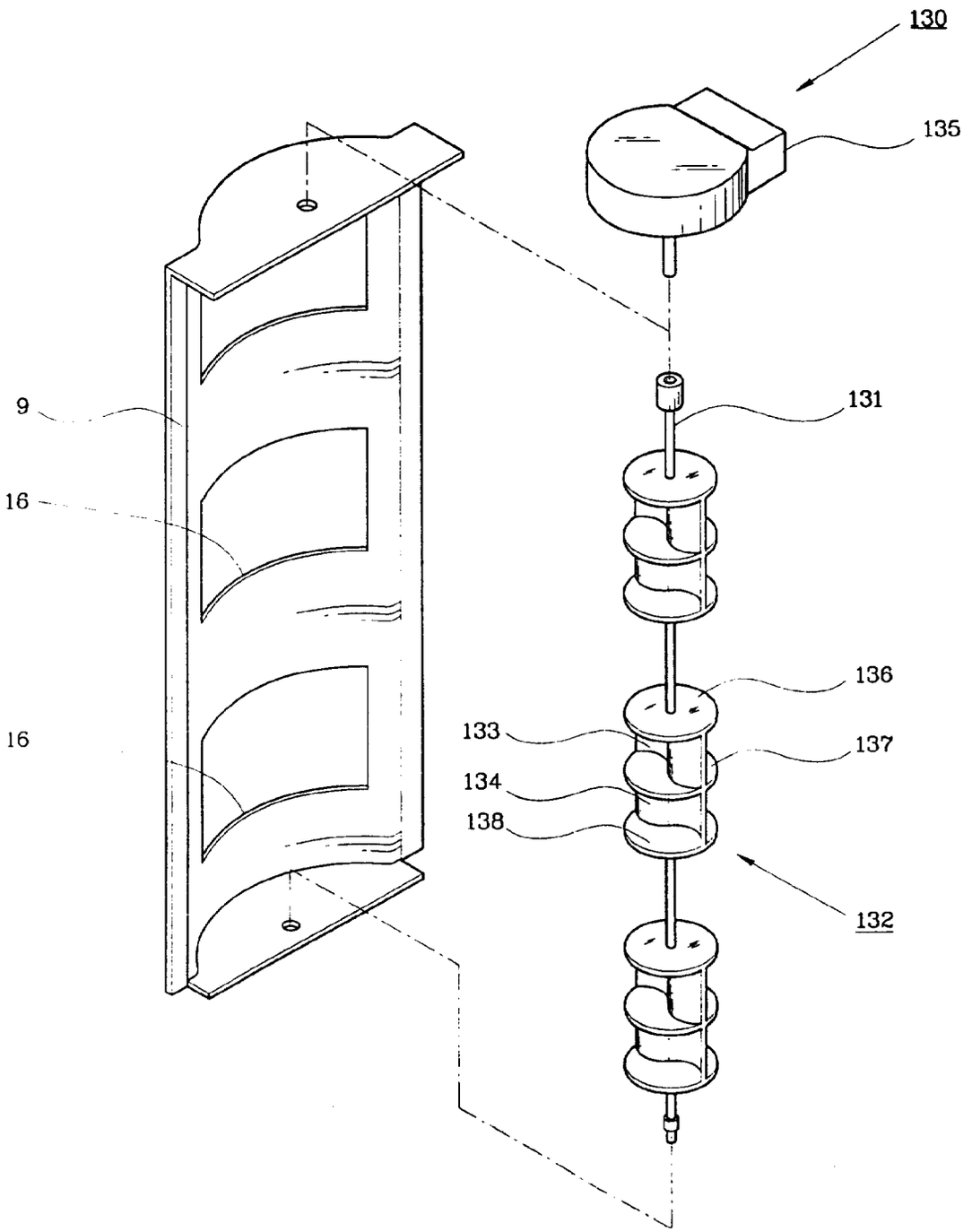


FIG.4

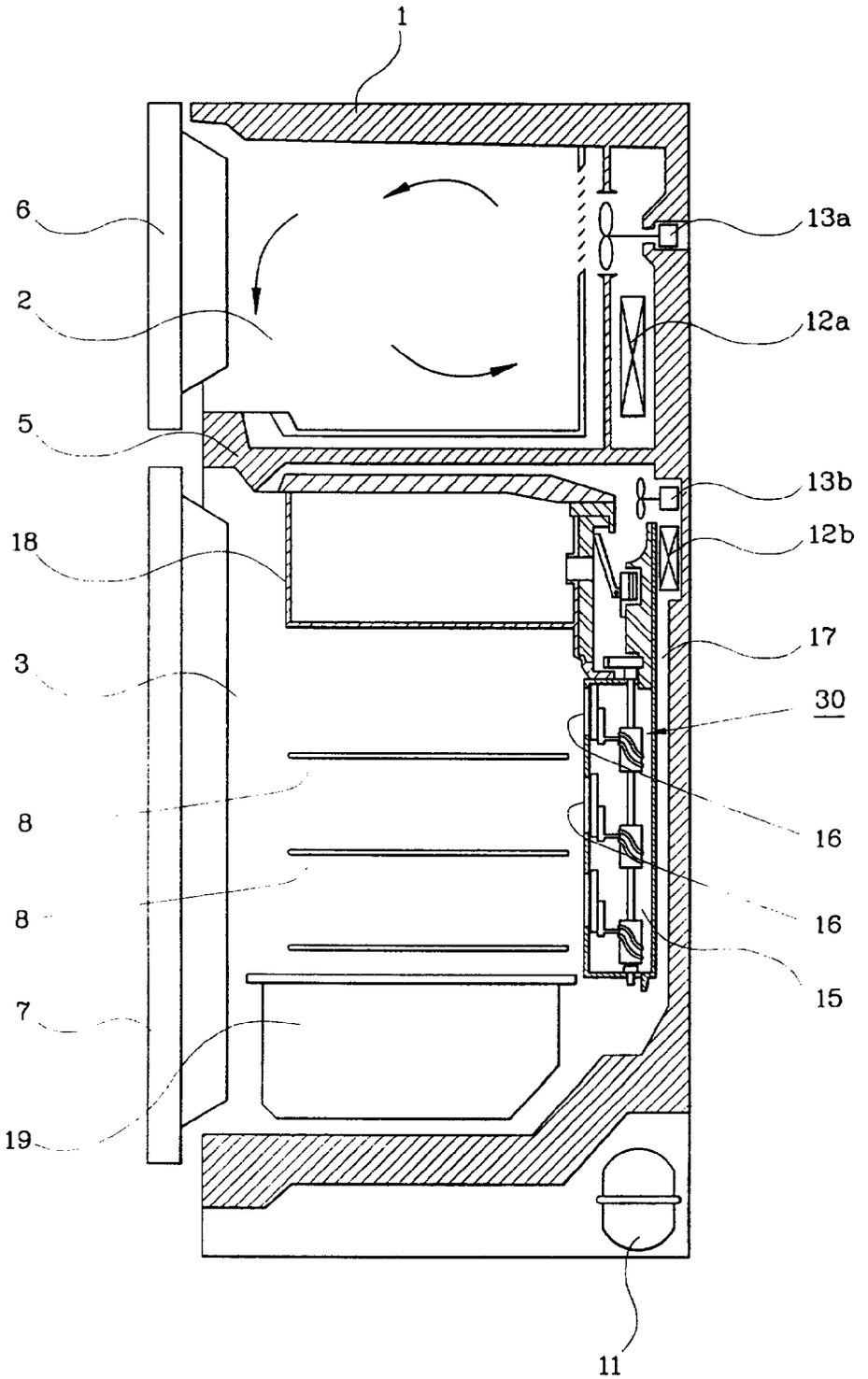


FIG.5

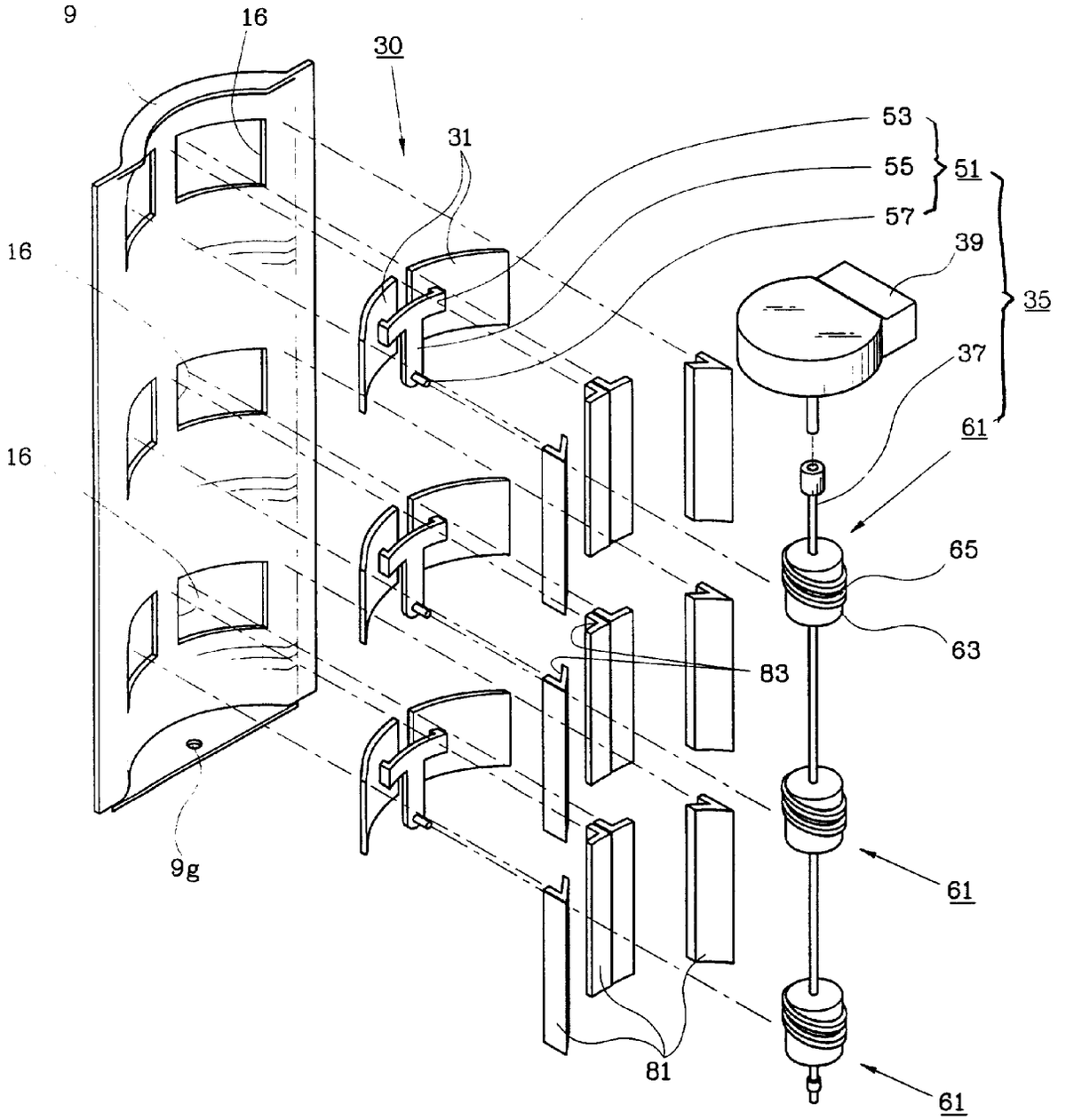


FIG.6

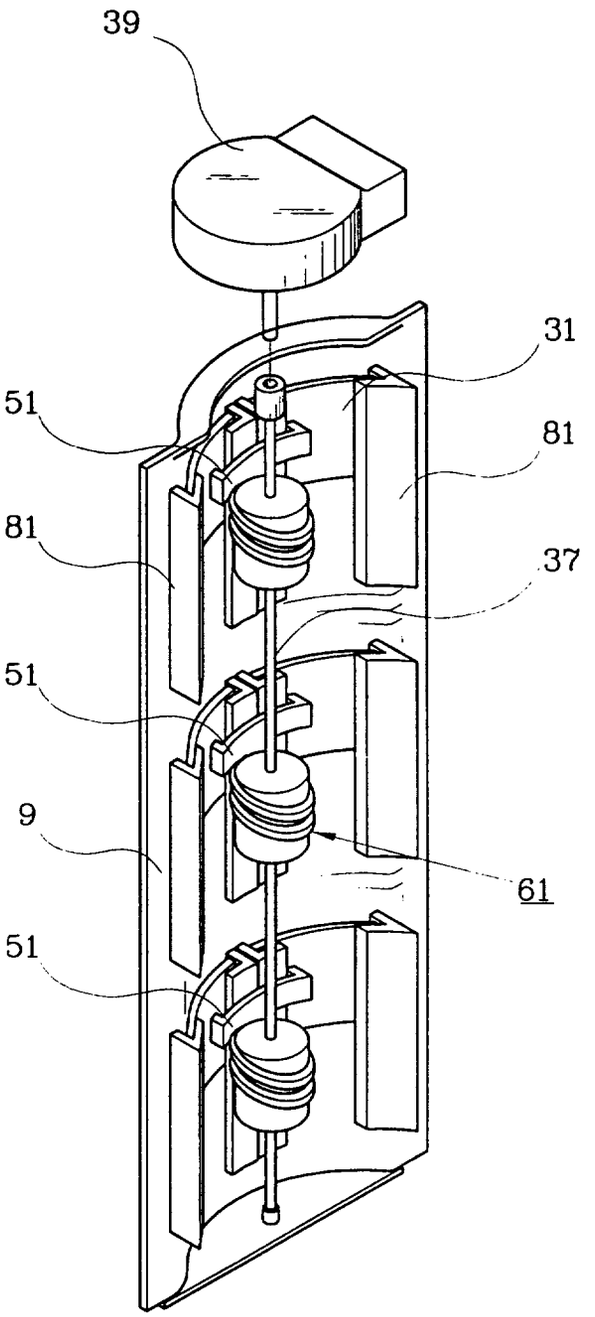


FIG.7

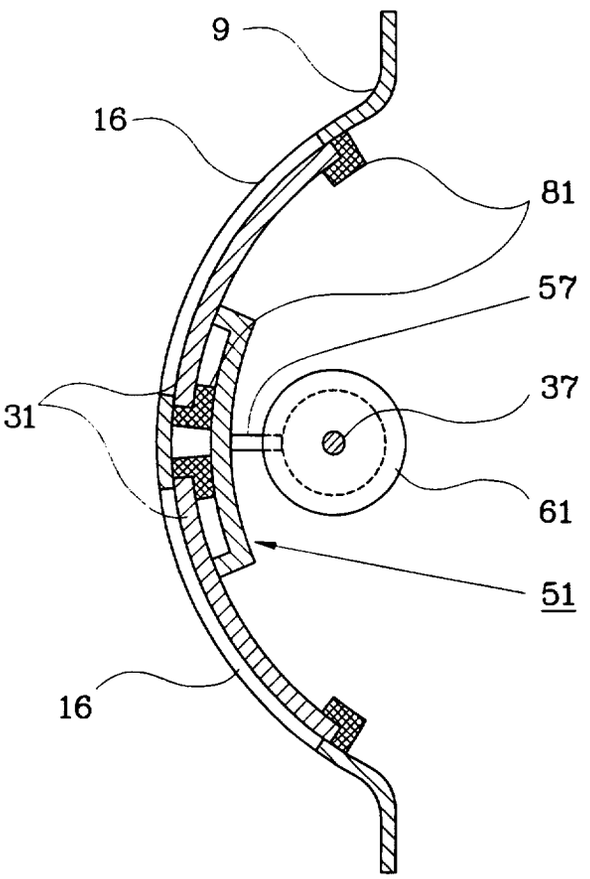


FIG.8

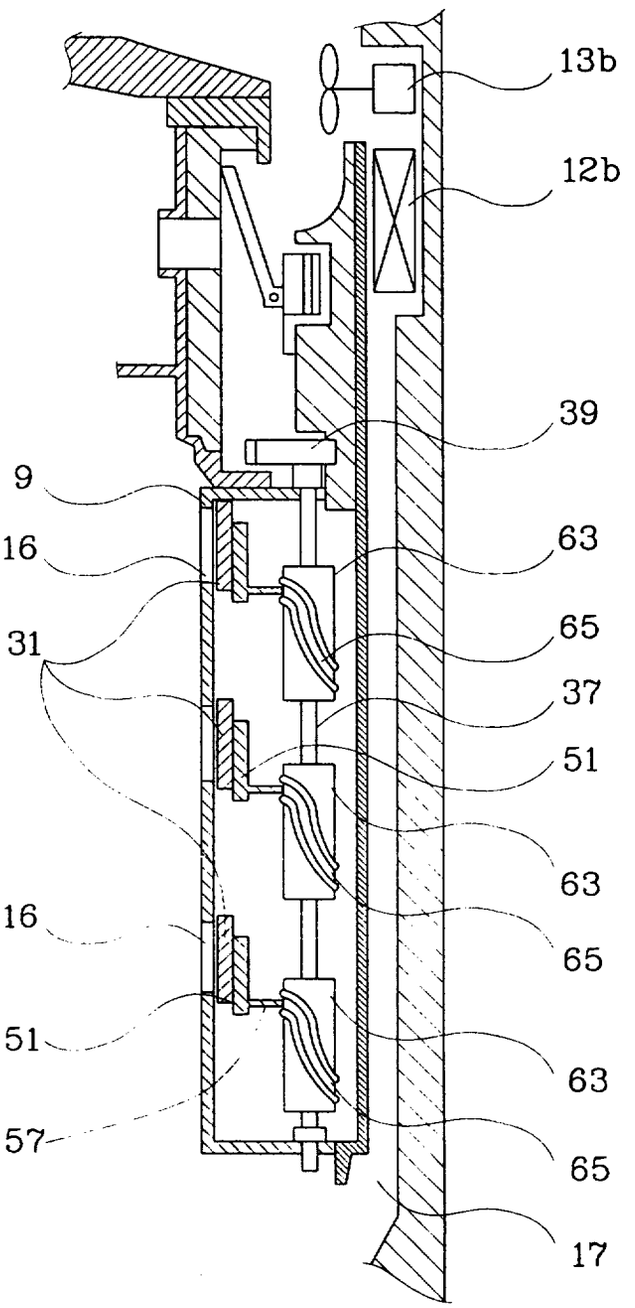


FIG.9

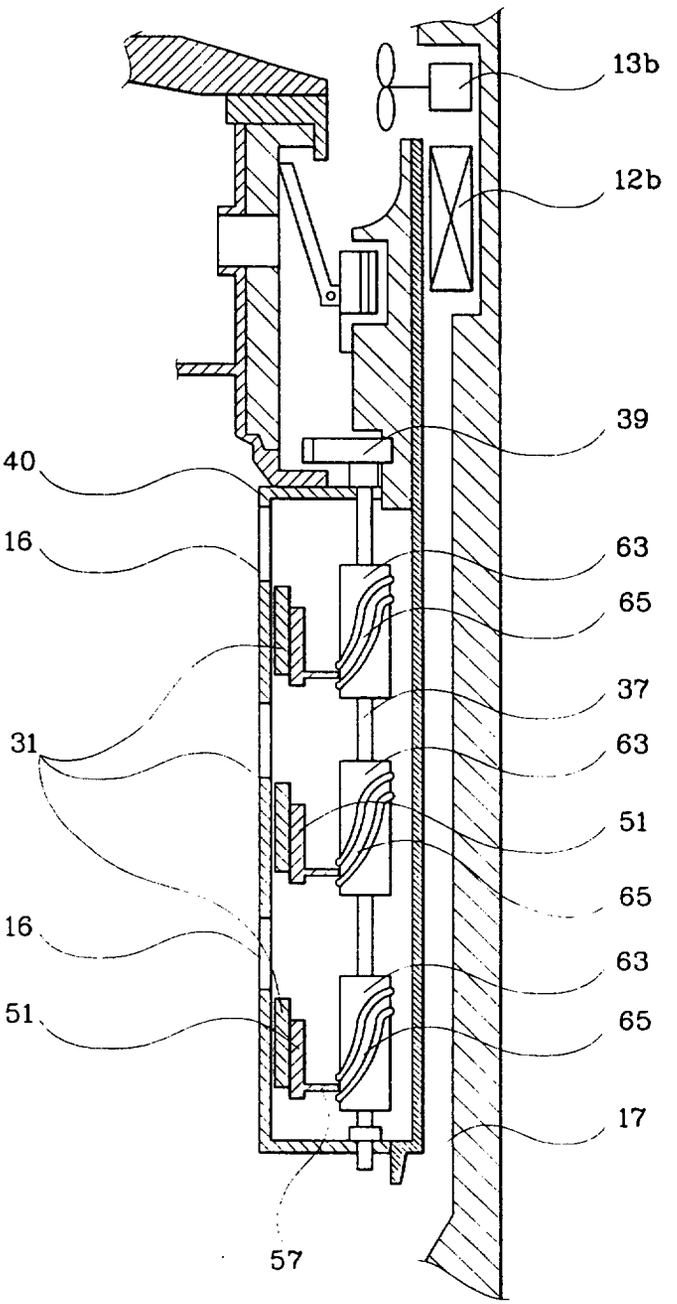


FIG.10

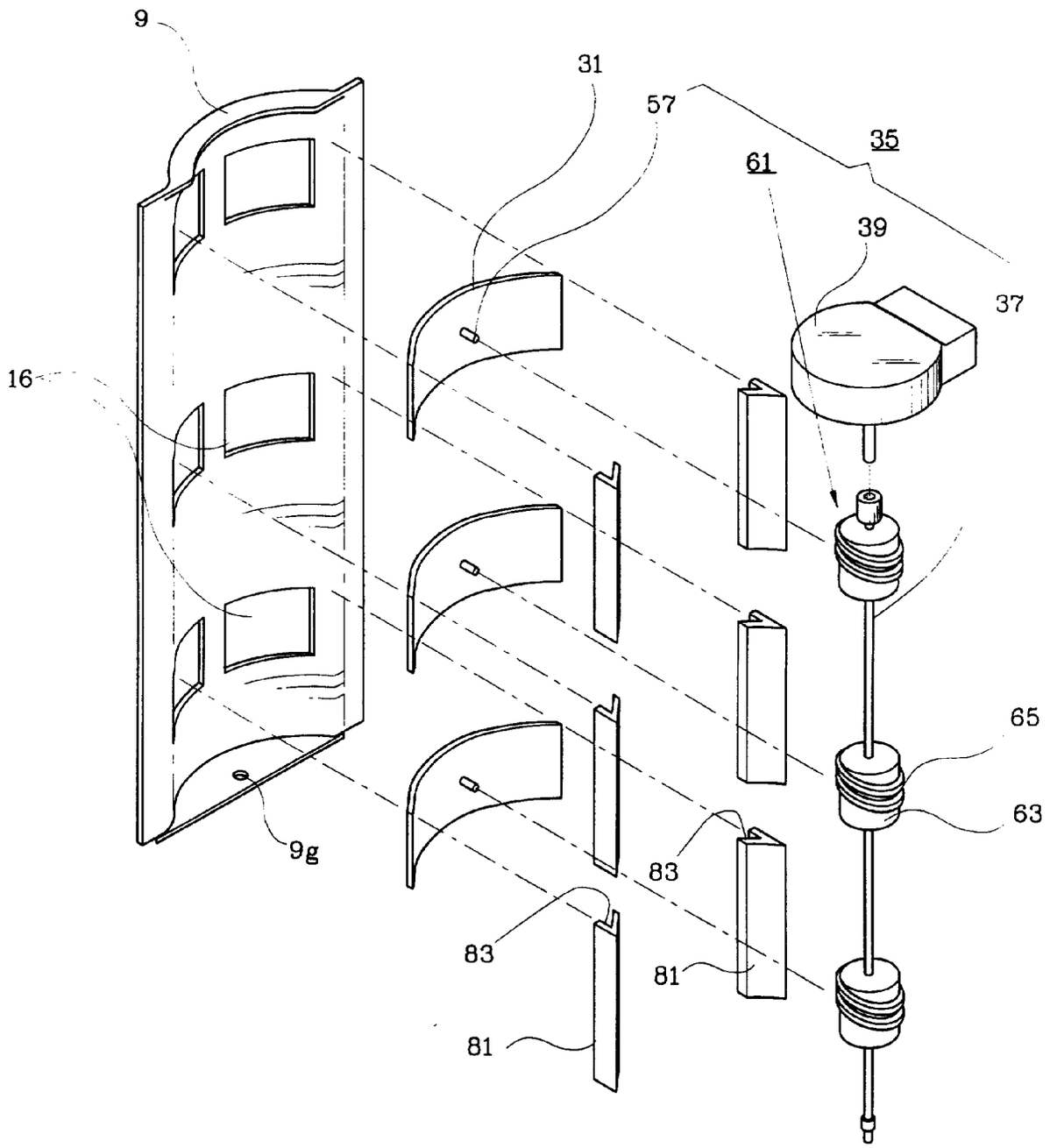


FIG .11

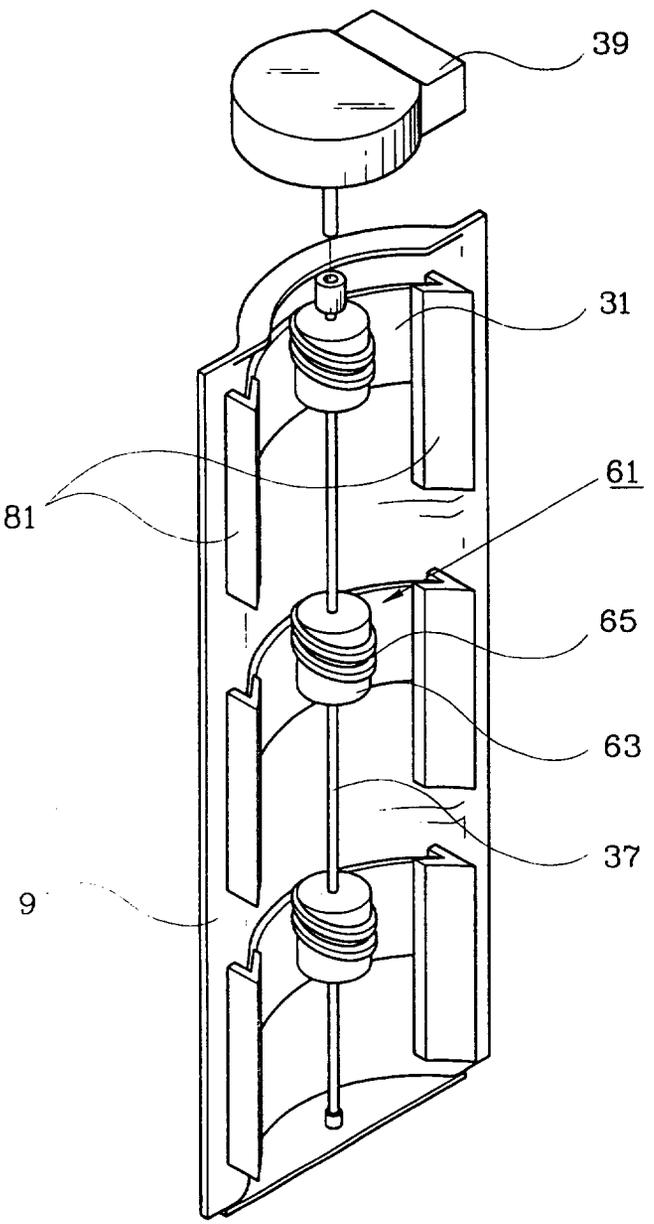


FIG .12

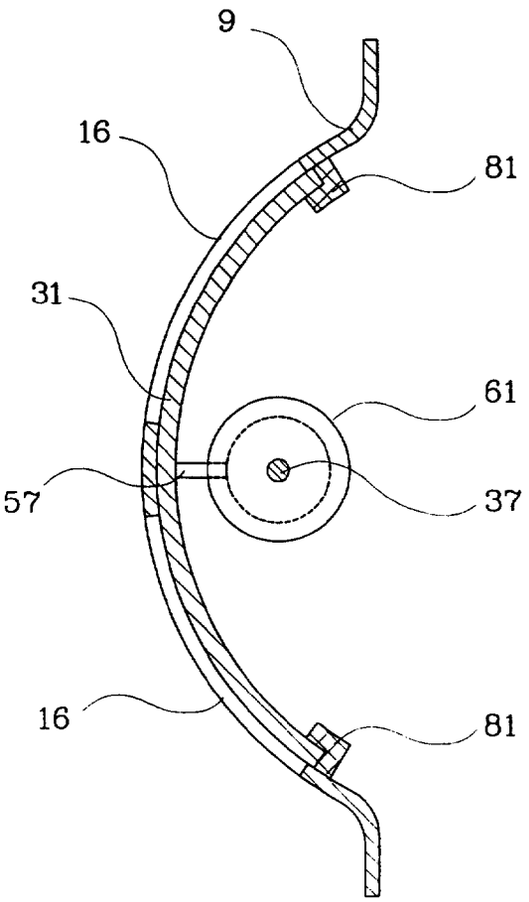


FIG .13

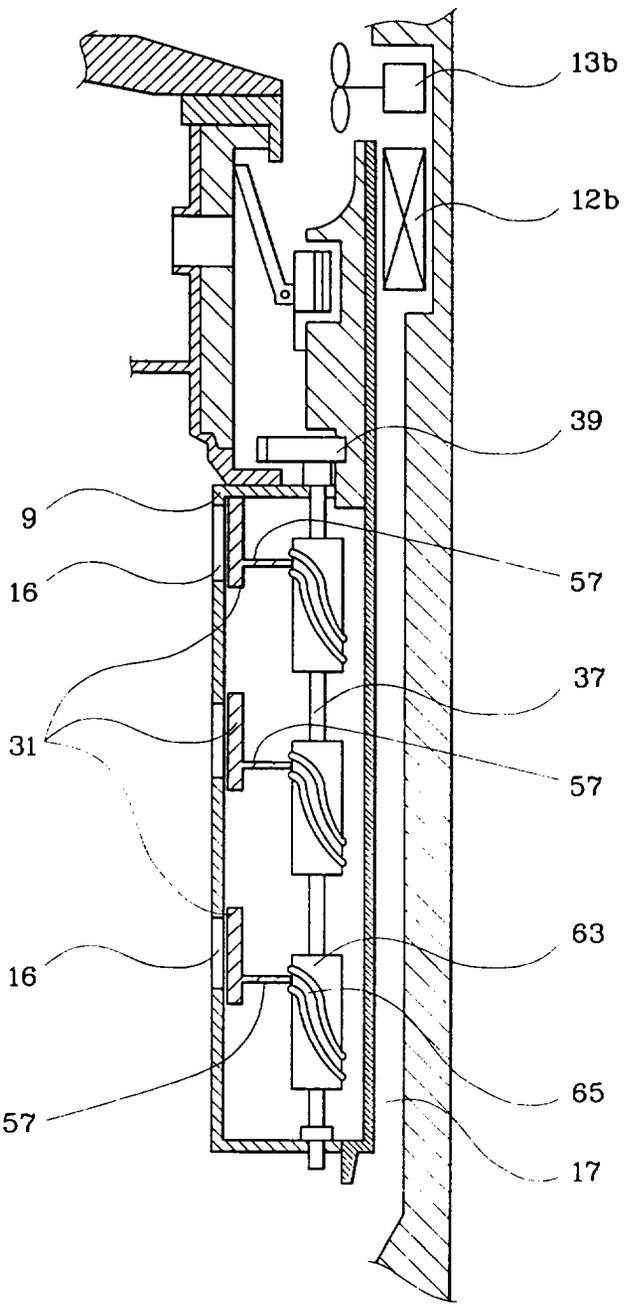


FIG .14

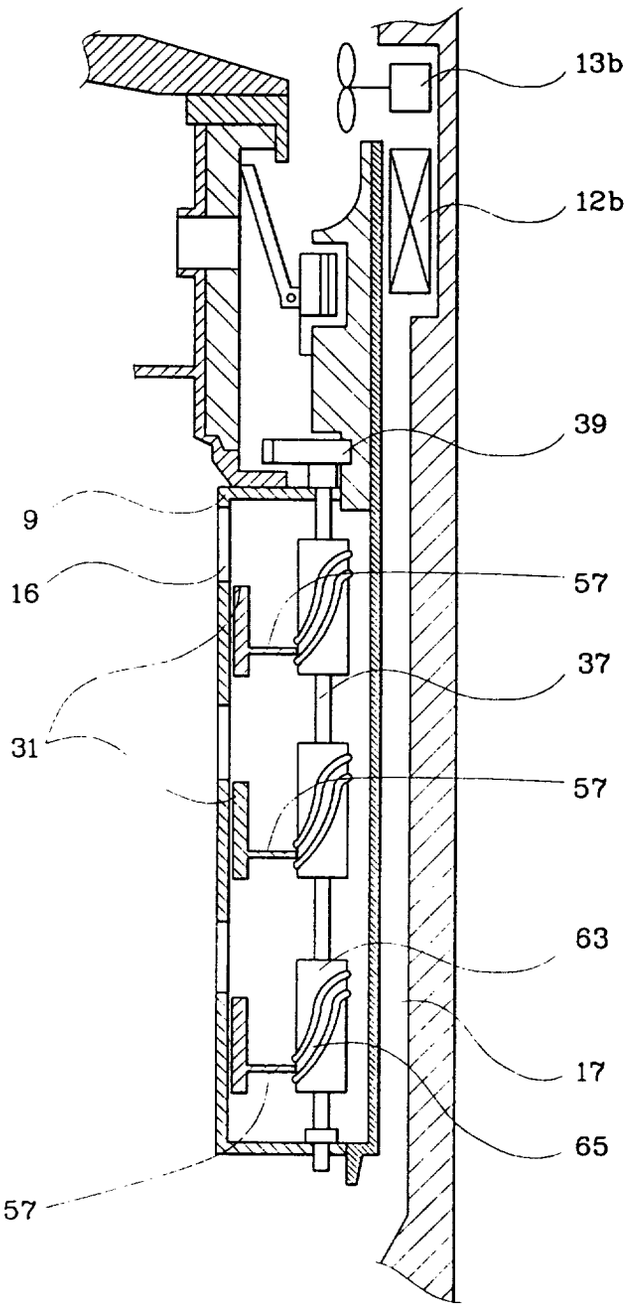


FIG .15

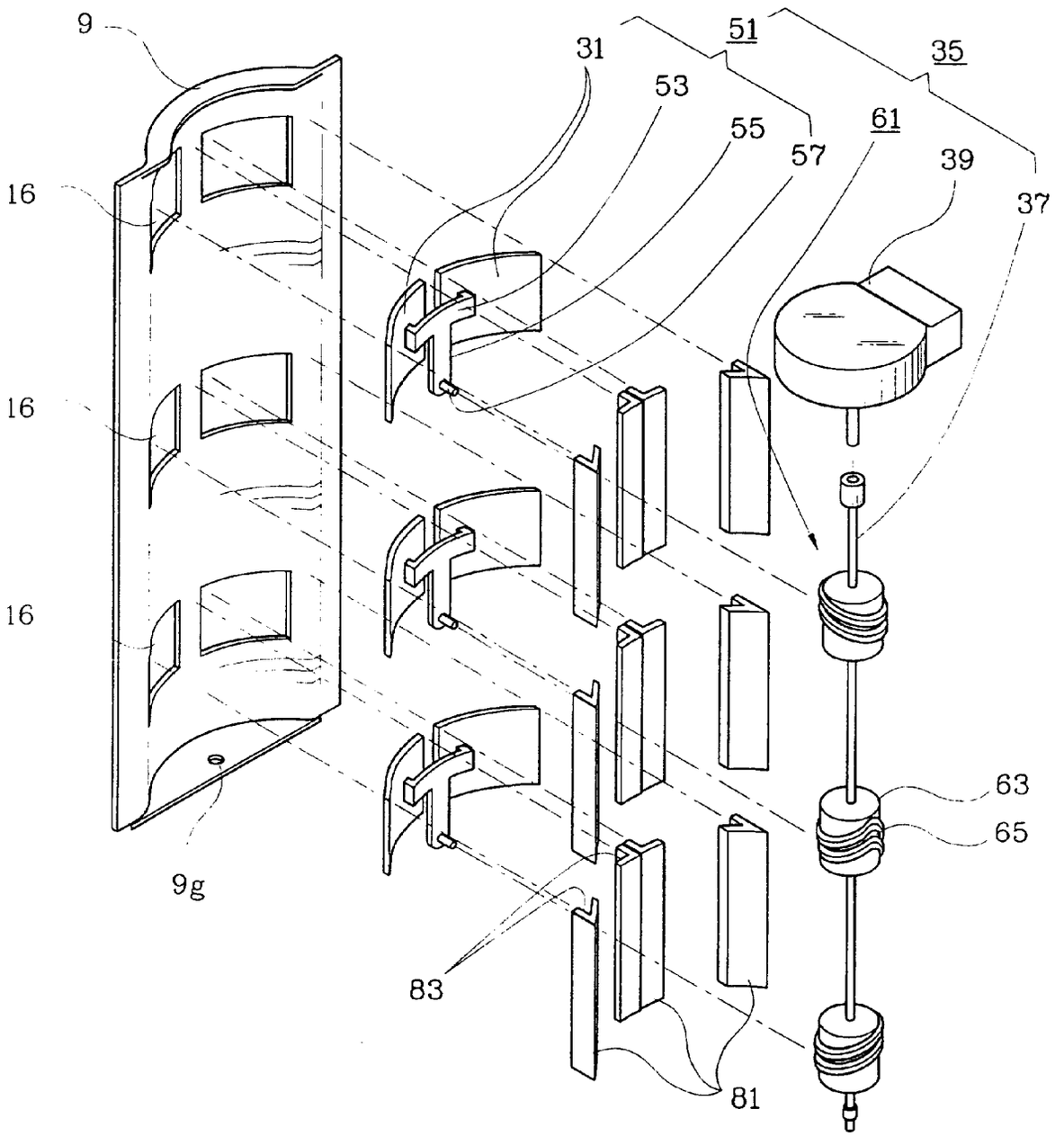


FIG.16

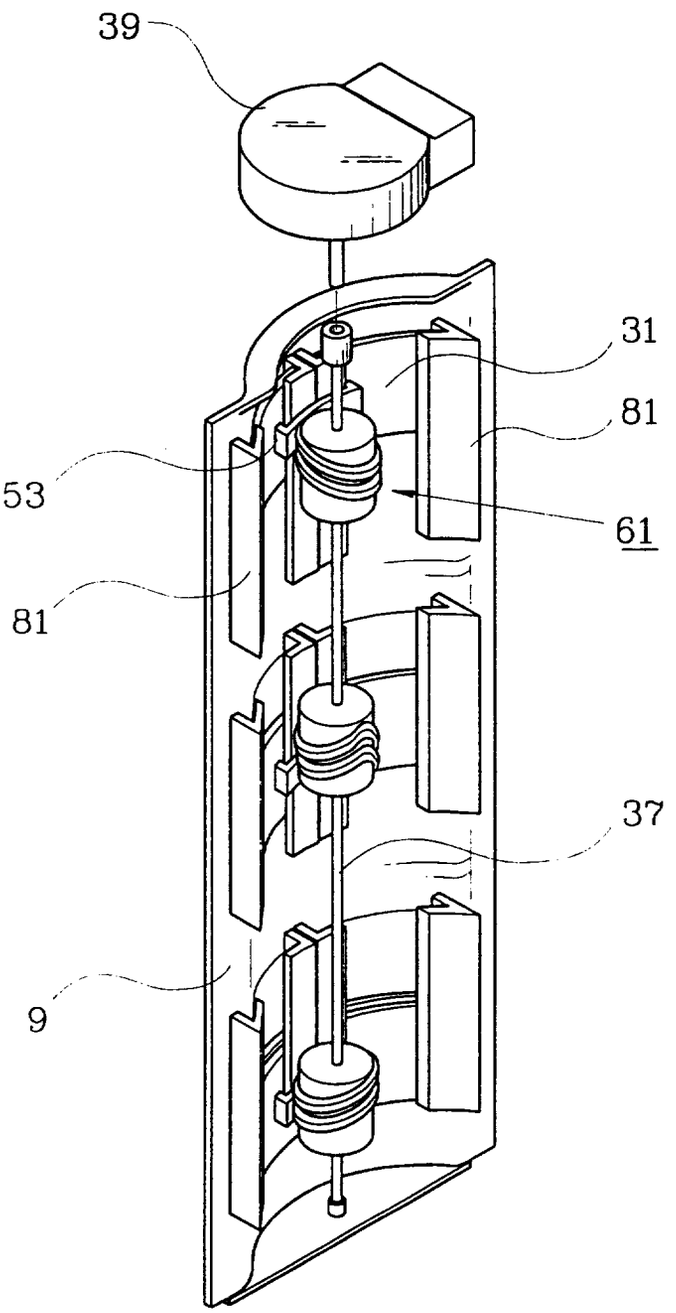


FIG.17

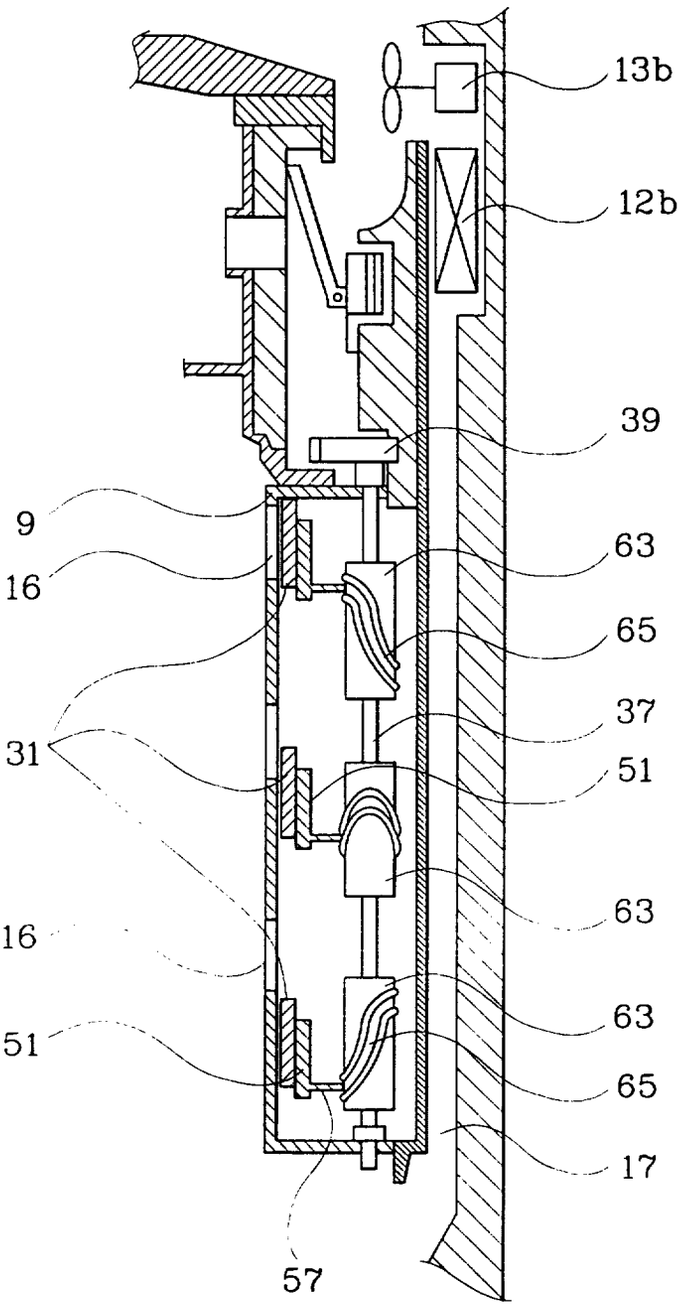
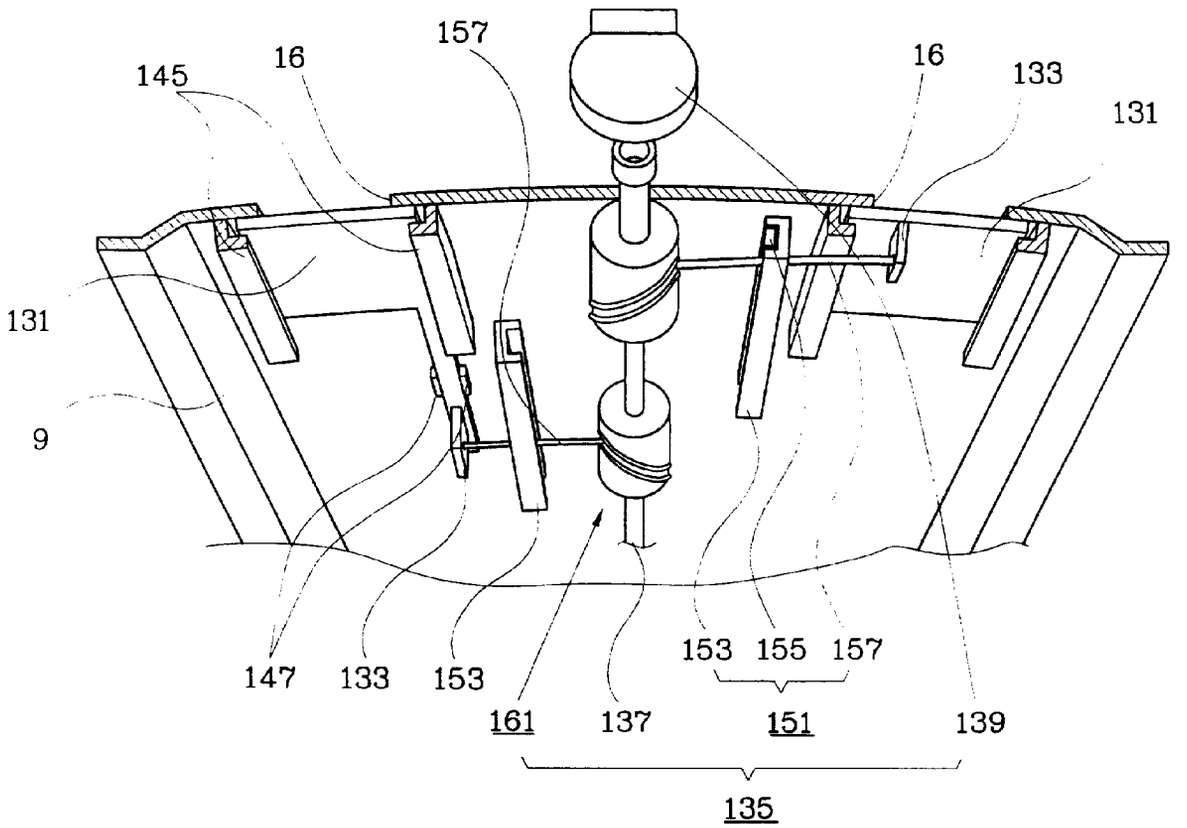


FIG .18


157
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135

FIG .19

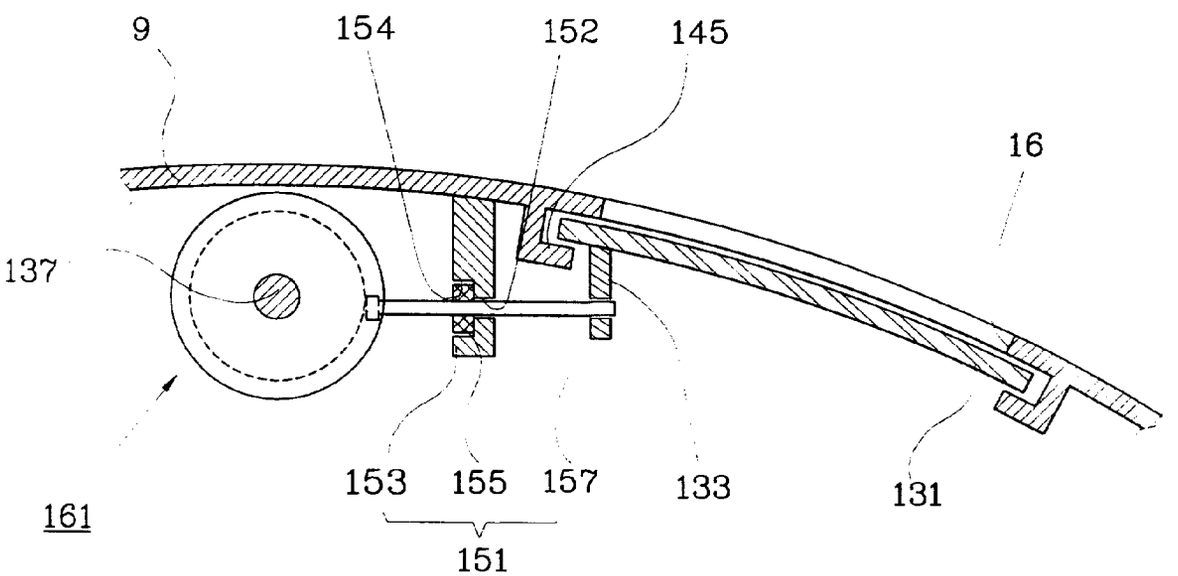


FIG.20

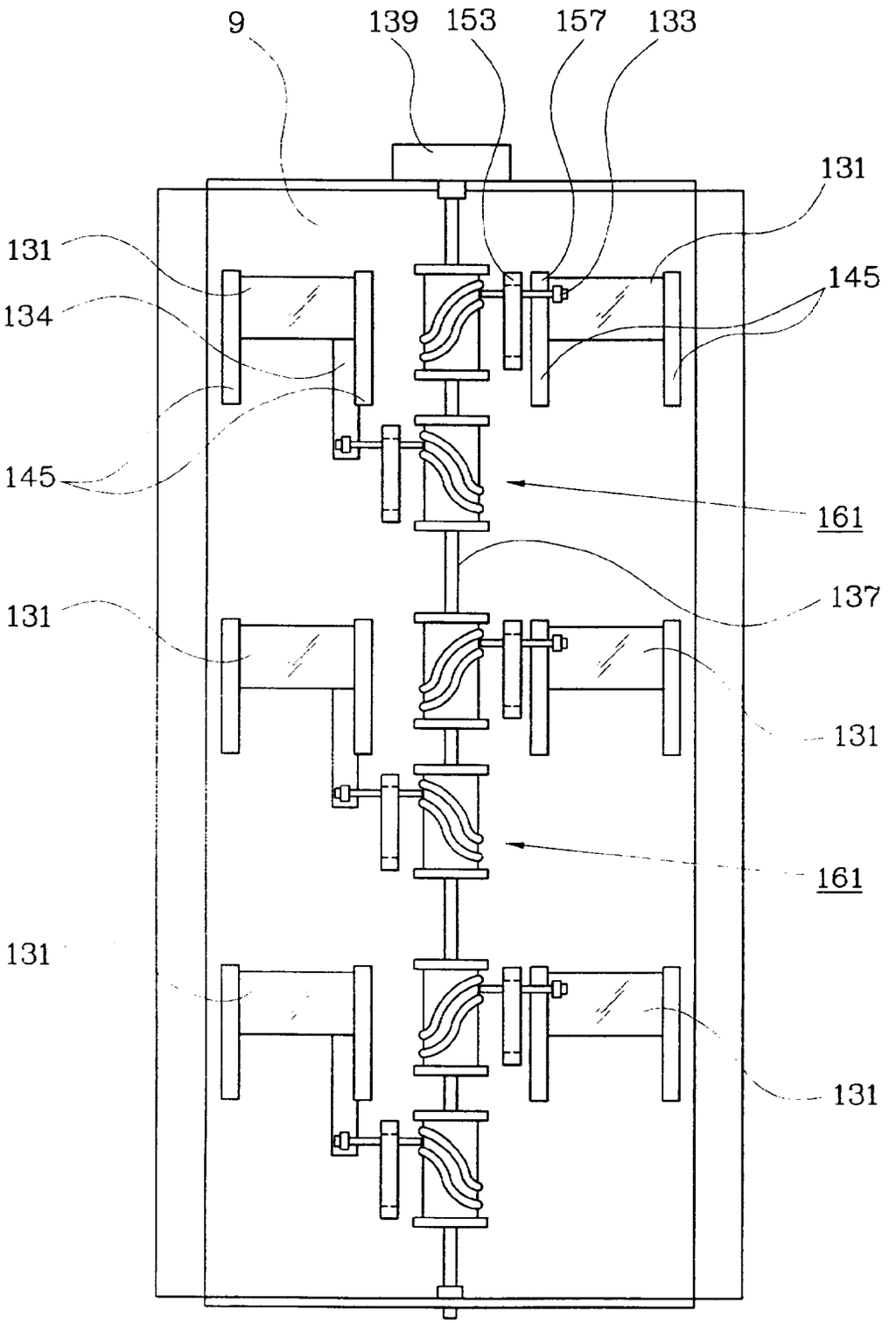


FIG.21

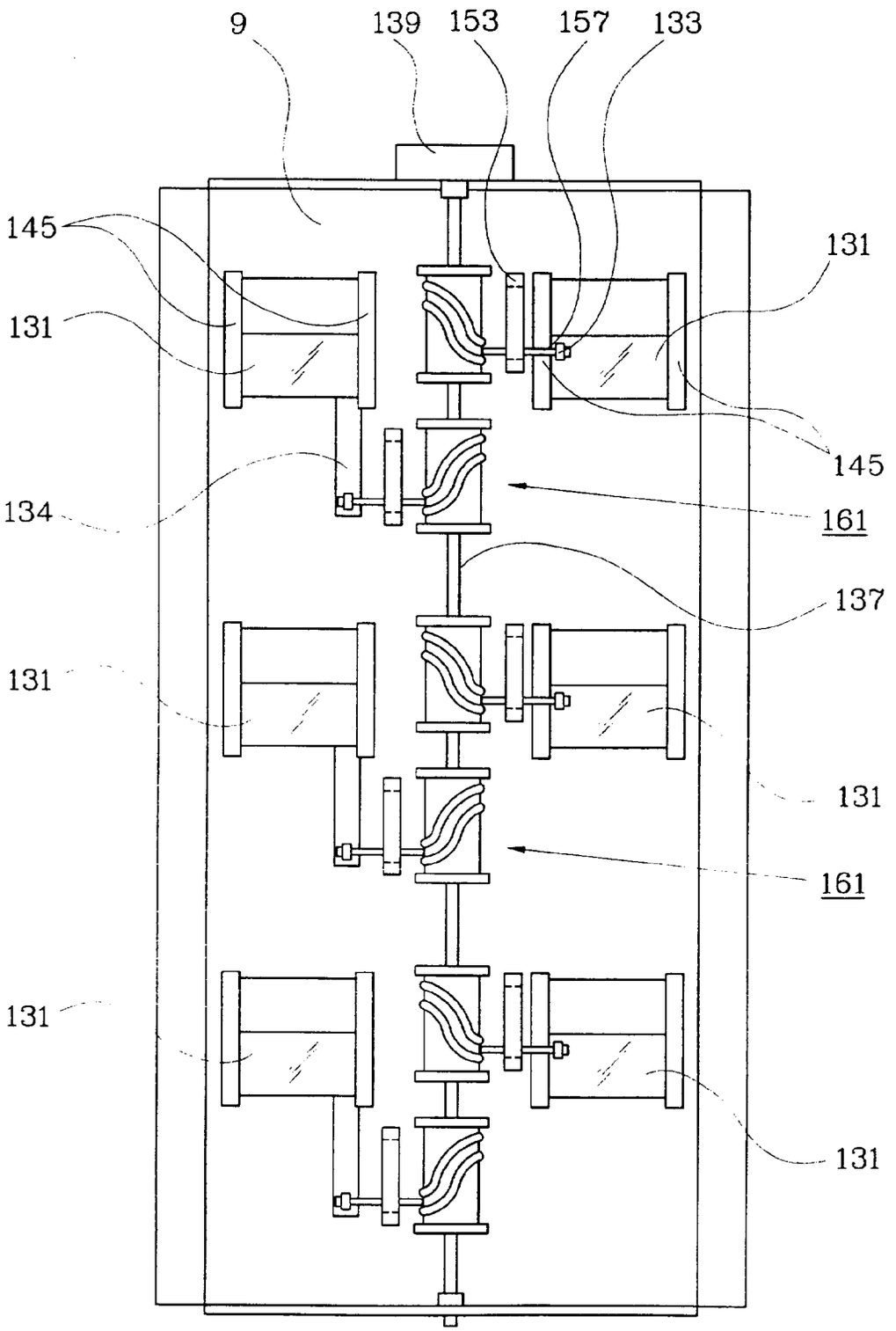
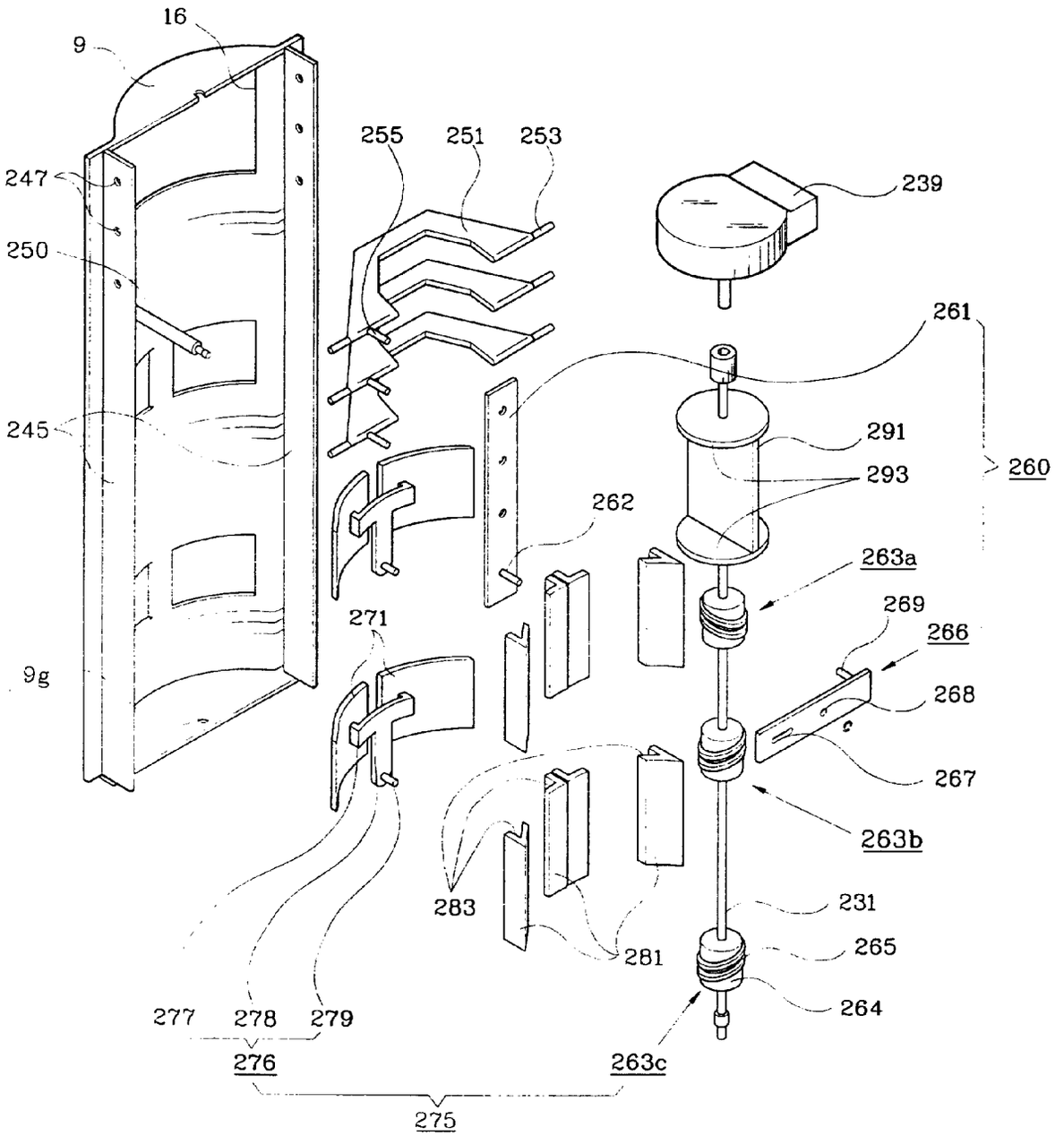


FIG.22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263b
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283
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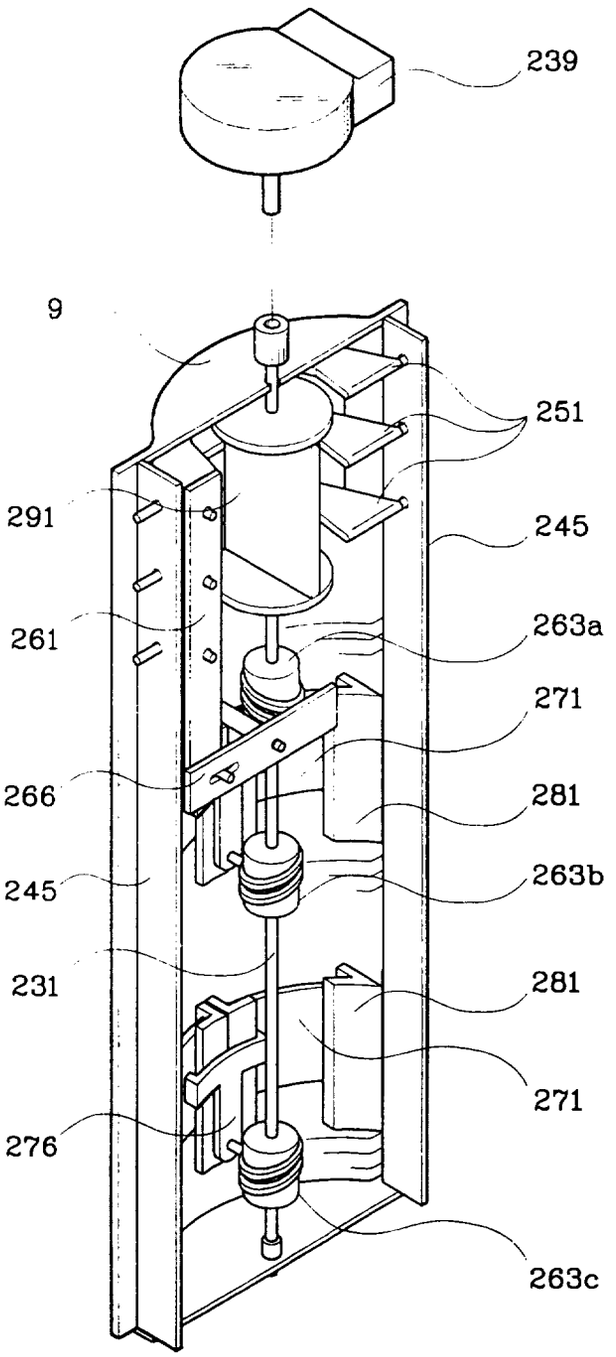
231
265
264
277
278
279
276
263c
275

FIG.23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263b
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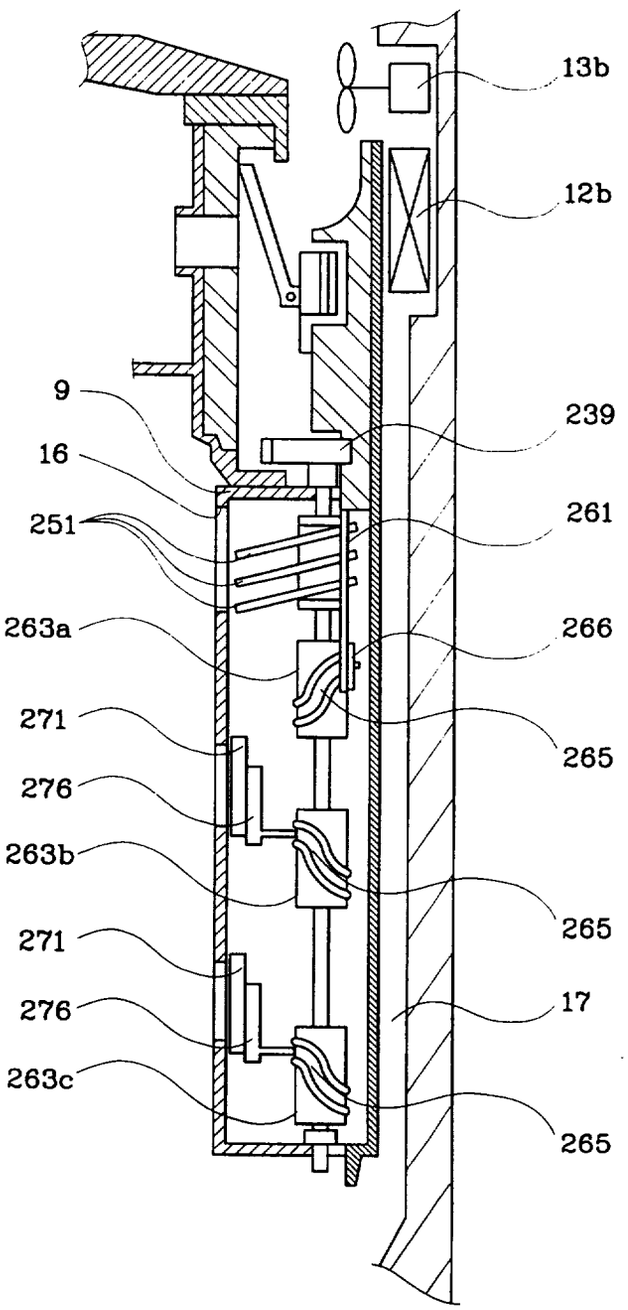
263c

FIG.24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261
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263a
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276
263b
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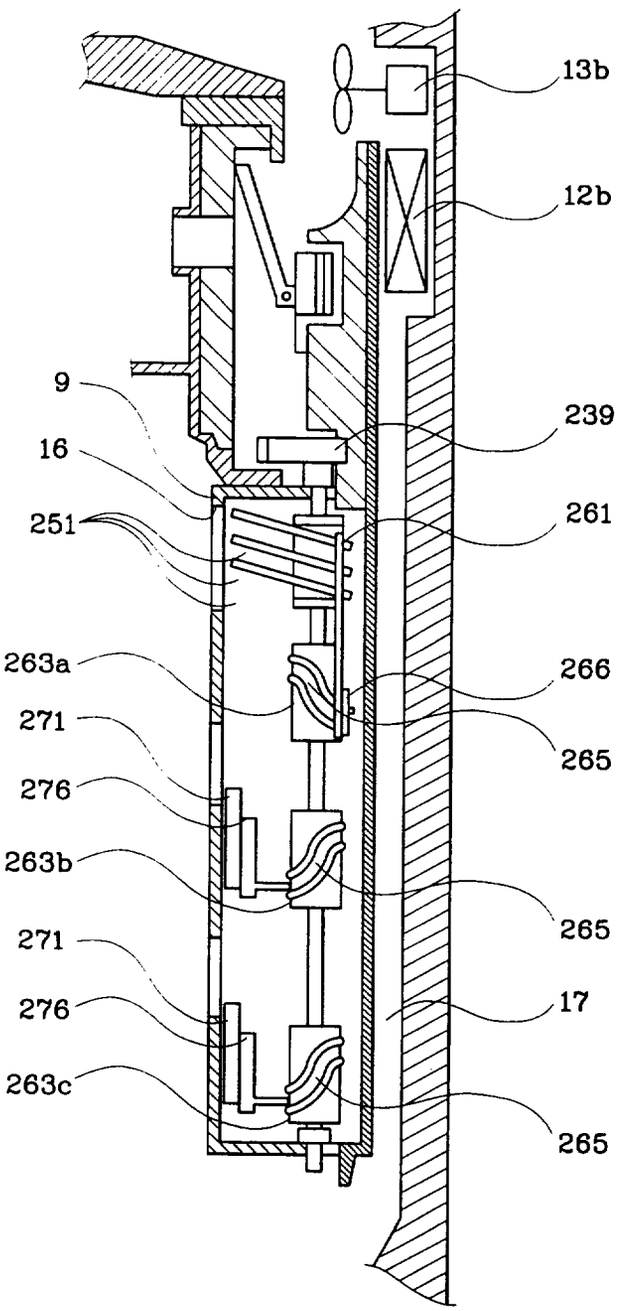
271
17
276
263c
265

FIG.25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