



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

(43) Date of publication:  
**19.10.2011 Bulletin 2011/42**

(51) Int Cl.:  
**F24F 1/00 (2011.01) F24F 13/00 (2006.01)**

(21) Application number: **09835261.0**

(86) International application number:  
**PCT/KR2009/007699**

(22) Date of filing: **23.12.2009**

(87) International publication number:  
**WO 2010/074495 (01.07.2010 Gazette 2010/26)**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR  
HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL  
PT RO SE SI SK SM TR**

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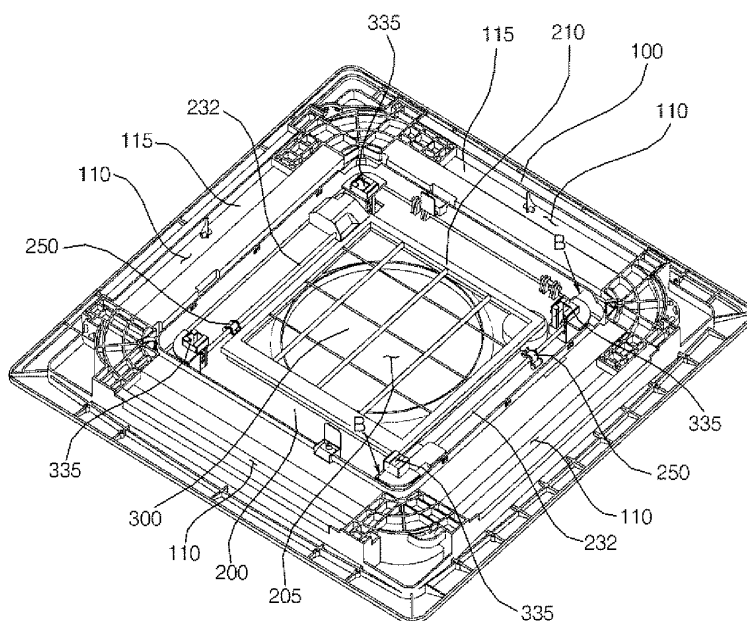
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(54) **CEILING-MOUNTED AIR CONDITIONER**

(57) A ceiling-mounted air conditioner is provided. The ceiling-mounted air conditioner includes an intake panel, which has an air intake, a door panel, which can be lifted up to and down from the intake panel, and a plurality of elevation driving units, which are disposed on

the intake panel and apply driving force to the door panel so as for the door panel to be lifted up and down and thus to open or shut the air intake of the intake panel. Therefore, it is possible to improve the exterior appearance of the ceiling-mounted air conditioner and facilitate the design of the ceiling-mounted air conditioner.

FIG. 3



## Description

### [Technical Field]

**[0001]** The present invention relates to a ceiling-mounted air conditioner, and more particularly, to a ceiling-mounted air conditioner which includes an elevation unit for generating and applying driving force to a door panel so as for the door panel to open or shut an air intake formed through an intake panel.

### [Background Art]

**[0002]** Most conventional ceiling-mounted air conditioners include an indoor unit mounted at the ceiling of a room and performing refrigeration, an outdoor unit performing heat dissipation and condensation, and a refrigerant tube connecting the indoor unit and the outdoor unit.

**[0003]** However, the air intakes of the conventional ceiling-mounted air conditioners are always open even when the ceiling-mounted air conditioners do not operate, and may thus disfigure the appearance of the ceiling-mounted air conditioners.

### [Disclosure]

### [Technical Problem]

**[0004]** The present invention provides a ceiling-mounted air conditioner in which an air intake is configured to be open only when the ceiling-mounted air conditioner operates, and can thus contribute to the beauty of the ceiling-mounted air conditioner.

**[0005]** The present invention also provides a ceiling-mounted air conditioner in which an elevation unit for elevating a door panel is disposed at an intake panel and generates and applies driving force to the door panel so as for the door panel to be lifted up or down and thus to open or shut an air intake of the intake panel.

### [Technical Solution]

**[0006]** According to an aspect of the present invention, there is provided a ceiling-mounted air conditioner including a main body which has an open bottom so as to draw air thereinto through the open bottom; a door panel which is lifted up and down below the main body and thus opens or shuts the open bottom of the main body; and a plurality of elevation devices which lift up or down the door panel, wherein each of the elevation devices includes a plurality of moving elements, which are fixed onto the top surface of the door panel and are in engagement with the door panel so as to be able to lift up or down the door panel, a plurality of rotation elements, which are disposed in the main body and lift up or down the door panel by being placed in contact with the moving elements, a shaft, which is connected between the rotation elements, and a shaft driving unit, which is connected to one of the ro-

tation elements and applies rotation force to the shaft so as for the shaft to be able to rotate.

**[0007]** The ceiling-mounted air conditioner may also include an intake panel which is disposed at the bottom of the main body and has an air intake in the middle, the air intake forming part of the open bottom of the main body; and an outlet panel which is disposed at the bottom of the main body and includes a plurality of air outlets formed along the boundaries thereof and having heat-exchanged air ejected therefrom, wherein the rotation elements, the shaft and the shaft driving unit are installed on the intake panel.

**[0008]** The ceiling-mounted air conditioner may include a plurality of shaft driving units, which are disposed on a pair of opposite sides of the door panel.

**[0009]** The shaft driving unit may include a motor, which is arranged in parallel with the shaft so that a rotation axis thereof can be parallel to the rotation axis of the shaft, and a connecting element, which is connected to the rotation axis of the motor and the shaft.

**[0010]** The connecting element may include a motor gear, which is connected to the rotation axis of the motor, and a shaft gear, which engages with the motor gear and is connected to the shaft so as to be able to rotate the shaft.

**[0011]** The rotation elements may include pinion gears whose rotation axis coincides with a rotation axis of the shaft, and the moving elements may include rack gears which engage with the pinion gears and are lifted up and down on the pinion gears.

**[0012]** The elevation device may also include a motor cover, which is disposed on the intake panel, surrounds the shaft driving unit and part of the circumferential surface of the shaft and supports the shaft so as to be able to rotate.

**[0013]** The elevation device may also include a shaft bracket, which is disposed on the intake panel, surrounds part of the circumferential surface of the shaft, and supports the shaft so as to be able to rotate.

**[0014]** The shaft driving unit may be disposed near one of the rotation elements, and the shaft bracket is disposed near another one of the rotation elements.

**[0015]** The intake panel may include a hook groove, and a first end portion of the shaft bracket is inserted into the hook groove.

**[0016]** The intake panel may also include a screw coupling unit, which is formed on one side of the hook groove, and a second end portion of the shaft bracket is coupled to the screw coupling unit by a screw.

### [Advantageous Effects]

**[0017]** The ceiling-mounted air conditioner according to the ceiling-mounted air conditioner includes an intake panel, which has an air intake, a door panel, which can be lifted up to and down from the intake panel, and a plurality of elevation driving units, which are disposed on the intake panel and apply driving force to the door panel

so as for the door panel to be lifted up and down and thus to open or shut the air intake of the intake panel. Therefore, it is possible to improve the exterior appearance of the ceiling-mounted air conditioner and facilitate the design of the ceiling-mounted air conditioner.

[Brief Description of the Drawings]

[0018]

FIG. 1 illustrates a perspective view of a ceiling-mounted air conditioner according to an exemplary embodiment of the present invention;  
FIGS. 2A and 2B illustrate cross-sectional views taken along line A-A of FIG. 1;  
FIG. 3 illustrates a perspective view of an outlet panel and an intake panel shown in FIG. 1;  
FIGS. 4A and 4B illustrate exploded perspective views taken along line B-B of FIG. 3;  
FIG. 5 illustrates a perspective view of the intake panel shown in FIGS. 4A and 4B; and  
FIG. 6 illustrates a cross-sectional view of the coupling between a shaft and a shaft bracket shown in FIG. 1.

[Best Mode]

[0019] The present invention will hereinafter be described more fully with reference to the accompanying drawings, in which exemplary embodiments of the invention are shewn.

[0020] FIG. 1 illustrates a perspective view of a ceiling-mounted air conditioner according to an exemplary embodiment of the present invention. Referring to FIG. 1, the ceiling-mounted air conditioner may include a main body 10 disposed between a ceiling 1 and a ceiling finishing material 2.

[0021] The main body 10 may have an open bottom. Thus, an air-blowing fan 5, which draws indoor air into the main body 10 and discharges the air, a heat exchanger 7, which exchanges heat with the indoor air, may be installed in the main body 10, as shown in FIG. 2A.

[0022] More specifically, the main body 10 may be formed as a square or rectangular box having an open bottom, and may thus be able to accommodate the air-blowing fan 5 and the heat exchanger 7 therein.

[0023] An outlet panel 100 may be installed at the bottom of the main body 10, and may be on a level with the ceiling finishing material 2. The outlet panel 100 may hide the bottom of the main body 10 from view. The outlet panel 100 may have an opening 105 in the middle, and may thus accommodate an intake panel 200 therein. The outlet panel 100 may include a plurality of air outlets 110 which are formed along the boundaries of the outlet panel 100 and discharge air processed in the main body 10.

[0024] The outlet panel 100 may be formed as a rectangular frame, conforming to the shape of the bottom of the main body 10, and may thus be able to effectively

hide the bottom of the main body 10 from view.

[0025] FIGS. 2A and 2B illustrate cross-sectional views taken along line A-A of FIG. 1,

FIG. 3 illustrates a perspective view of the outlet panel 100 and the intake panel 200, FIGS. 4A and 4B illustrate exploded perspective views taken along line B-B of FIG. 3, FIG. 5 illustrates a perspective view of the intake panel 200, and FIG. 6 illustrates a cross-sectional view of the coupling between a shaft 232 and a shaft bracket 250 shown in FIG. 1.

[0026] Referring to FIGS. 2A through 5, a plurality of wind vanes 115 may be installed in their respective air outlets 110. The wind vanes 115 may open or shut their respective air outlets 110 by rotating by a predetermined angle, and may adjust the direction of flow of air discharged from the air outlets 110.

[0027] Referring to FIGS. 3 and 5, the intake panel 200 may be installed inside the outlet panel 100 so as to shut the opening 105 of the outlet panel 100.

[0028] The intake panel 200 may have an air intake 205 in the middle, and may thus allow indoor air to be drawn into the main body 10. A purification filter 210 may be disposed above the air intake 205 and may filter out impurities in the air drawn into the main body 10. A purification filter installation unit 215 may be formed on the top surface of the intake panel 200 so as for the purification filter 210 to be installed on the intake panel 200.

[0029] The air intake 205 of the intake panel 200 may contribute to part of the open bottom of the main body 10. That is, the inlet panel 200 may be installed in the opening 105 of the outlet panel 100, and the air intake 205 of the intake panel 200 may contribute to part of the open bottom of the main body 10.

[0030] The air intake 205 of the intake panel 200 may be formed as a circle and may thus allow indoor air to be drawn into the center of the main body 10. The intake panel 200 may not only provide room for the installation of the purification filter 210, but also serve as an orifice for adjusting the amount and speed of air drawn into the main body 10.

[0031] However, the air intake 205 may not necessarily have to be formed as a circle. That is, the air intake 205 may be formed in various shapes other than a circular shape.

[0032] Referring to FIGS. 3 and 5, the ceiling-mounted air conditioner may also include a plurality of elevation driving units 230 which are disposed on the top surface of the intake panel 200 and apply driving force to a door panel 300 so as for the door panel 300 to be lifted up or down.

[0033] More specifically, the elevation driving units 230 may be a predetermined distance apart from each other. In this exemplary embodiment, two elevation driving units 230 may be disposed along a pair of opposite sides of the intake panel 200.

[0034] Each of the elevation driving units 230 may include a motor 231, which is disposed on the intake panel 200, a shaft 232, which is arranged in line with the rotation

axis of the motor 231, a connecting element 233 which connects the motor 231 and the shaft 232 and thus allows the shaft 232 to rotate along with the motor 231, and a plurality of rotation elements 234, which are installed at either end of the shaft 232 and can rotate the shaft 232.

**[0035]** Two motors 231 may be disposed on a pair of opposite sides of the intake panel 200. Two shafts 232 may be disposed on the opposite sides of the intake panel 200 where the two motors 231 are disposed, and may be isolated from each other.

**[0036]** For convenience, the motors 231 and the connecting elements 233 will hereinafter be collectively referred to as shaft driving units 230'.

**[0037]** It is important to precisely control the motors 231 because the rotation speed of the motors 231 affects the elevation of the door panel 300. That is, if the motors 231 have different rotation speeds, the door panel 300 may not be able to be uniformly elevated, and may thus adversely affect the exterior appearance of the ceiling-mounted air conditioner.

**[0038]** Each of the shaft driving units 230' including a motor 231 and a connecting element 233 may be disposed between a pair of rotation elements 234, which are provided near either end of a shaft 232, and may be connected to the shaft 232. More specifically, the shafts 232 may be aligned in parallel with the rotation axes of the motors 231, and may be connected mechanically to the motors 231 by the connecting elements 233. Each of the connecting elements 233 may include a motor gear 233A, which is connected to the rotation axis of a corresponding motor 231, and a shaft gear 233B, which engages with the motor gear 233A and rotates a corresponding shaft 232 by rotating along with the motor gear 233A.

**[0039]** Since each of the shaft driving units 230' is disposed between a plurality of rotation elements 234, there is no need to provide additional room for the installation of the shaft driving units 230', and thus, the facilitation of the design of the intake panel 200 may be maximized.

**[0040]** The ceiling-mounted air conditioner may include a plurality of motor covers 237, which are disposed on the intake panel 200. The motor covers 237 may surround the shaft driving units 230' and parts of the circumferential surfaces of the shafts 232, and may support the shafts 232 to be able to rotate.

**[0041]** The ceiling-mounted air conditioner may also include a plurality of shaft brackets 250, which are disposed on the intake panel 200. The shaft brackets 250 may surround parts of the circumferential surfaces of the shafts 232, which extend horizontally or vertically on the intake panel 200 and are capable of rotating, and may support the shafts 232 to be able to rotate.

**[0042]** Referring to FIG. 6, the ceiling-mounted air conditioner may also include a plurality of hook grooves 255, which are formed through the intake panel 200. First end portions 250A of the shaft brackets 250 may be inserted into the hook grooves 255. Second end portions 250B of the shaft brackets 250 may be coupled to screw coupling

portions 256 formed on the intake panel 200 by coupling elements 260 such as screws. Thus, the shaft brackets 250 can be fixed onto the intake panel 200.

**[0043]** Since the shaft brackets 250 support the shafts 232 so as to be able to rotate, portions of the shaft brackets 250 that directly contact the shafts 232 and can thus be supported by the shafts 232 may be configured to be supported by bearings.

**[0044]** The shaft driving units 230' and the shaft brackets 250 may be disposed on opposite sides of the shafts 232 and may thus be able to properly support the shafts 232 and allow the shafts 232 to rotate uniformly.

**[0045]** When turned on with the use of, for example, a remote control, the motors 231 may rotate. As a result, the connecting elements 233 may rotate, and the shafts 232 may rotate about their rotation axes. Then, the rotation elements 234 may rotate accordingly.

**[0046]** The door panel 300 may be able to be lifted up or down and thus to open or shut the air intake 205 of the intake panel 200.

**[0047]** More specifically, referring to FIGS. 4A and 4B, when lifted up, the door panel 300 may be placed in contact with the bottom of the intake panel 200. On the other hand, when lifted down, the door panel 300 may open the air intake 205 of the intake panel 200, and may thus guide indoor air into the main body 10 through the air intake 205.

**[0048]** Referring to FIG. 4B, the ceiling-mounted air conditioner may also include a plurality of moving elements 335, which are installed on the door panel 300. The moving elements 335 extend vertically, and may be lifted up or down in accordance with the rotation of the rotation elements 234.

**[0049]** The moving elements 335 may be coupled onto the top surface of the door panel 300, and may lift up or down the door panel 300.

**[0050]** Given that the moving elements 335 are used along with the elevation driving units 230 to lift up or down the door panel 300, each of the moving elements 335 and each of the elevation driving units 230 (including a motor 231, a shaft 232, a connecting element 233 and a plurality of rotation elements 234) will hereinafter be collectively referred to as elevation devices 400.

**[0051]** The ceiling-mounted air conditioner may also include a plurality of elevation guide holes 240, which are formed through the intake panel 200 so that the moving elements 335 can be lifted up or down through the elevation guide holes 240.

**[0052]** The rotation elements 234 may be pinion gears, which rotate about the axes of their respective shafts 232, and the moving elements 335 may be rack gears which engage with the pinion gears.

**[0053]** The operation of the ceiling-mounted air conditioner will hereinafter be described in detail.

**[0054]** Referring to FIG. 2A, when the ceiling-mounted air conditioner is turned on by a remote control, a controller (not shown) of the ceiling-mounted air conditioner may drive the air-blowing fan 5 and the heat exchanger 7.

**[0055]** The controller may also drive the motors 231 so that the shafts 232 can rotate in a first direction. As a result, the rotation elements 234 may also rotate, and thus, the moving elements 335, which are in gear engagement with the rotation elements 234, may be lifted down through the elevation guide holes 240 so that the door panel 300 can be lifted down.

**[0056]** When the door panel 300 is lifted down, the air intake 205 of the intake panel 200 may be opened, and thus, indoor air may be drawn into the main body 10 through the air intake 205 by the air-blowing fan 5. The indoor air drawn into the main body 10 may be processed by the heat exchanger 7, and the processed air may be ejected from the main body 100 through the air outlets 110 of the outlet panel 100.

**[0057]** Referring to FIG. 2B, when the ceiling-mounted air conditioner is turned off by a remote control, the controller may terminate the operations of the air-blowing fan 5 and the heat exchanger 7.

**[0058]** In addition, the controller 180 may drive the motors 231 so that the shafts 232 can rotate in a second direction, which is opposite to the first direction. As a result, the rotation elements 234 may also rotate, and thus, the moving elements 335, which are in gear engagement with the rotation elements 234, may be lifted up through the elevation guide holes 240 so that the door panel 300 can be lifted up.

**[0059]** Then, the door panel 300 may be placed in contact with the bottom of the intake panel 200, and may shut the air intake 205 of the intake panel 200. Therefore, the ceiling-mounted air conditioner may appear as if part of the ceiling finishing material 2, and the exterior appearance of the ceiling-mounted air conditioner may be improved.

**[0060]** While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

## Claims

### 1. A ceiling-mounted air conditioner comprising:

a main body which has an open bottom so as to draw air thereinto through the open bottom;  
a door panel which is lifted up and down below the main body and thus opens or shuts the open bottom of the main body; and  
a plurality of elevation devices which lift up or down the door panel,  
wherein each of the elevation devices includes a plurality of moving elements, which are fixed onto the top surface of the door panel and are in engagement with the door panel so as to be

able to lift up or down the door panel, a plurality of rotation elements, which are disposed in the main body and lift up or down the door panel by being placed in contact with the moving elements, a shaft, which is connected between the rotation elements, and a shaft driving unit, which is connected to one of the rotation elements and applies rotation force to the shaft so as for the shaft to be able to rotate.

### 2. The ceiling-mounted air conditioner of claim 1, further comprising:

an intake panel which is disposed at the bottom of the main body and has an air intake in the middle, the air intake forming part of the open bottom of the main body; and  
an outlet panel which is disposed at the bottom of the main body and includes a plurality of air outlets formed along the boundaries thereof and having heat-exchanged air ejected therefrom, wherein the rotation elements, the shaft and the shaft driving unit are installed on the intake panel.

### 3. The ceiling-mounted air conditioner of claim 1, wherein the ceiling-mounted air conditioner includes a plurality of shaft driving units, which are disposed on a pair of opposite sides of the door panel.

### 4. The ceiling-mounted air conditioner of claim 1, wherein the shaft driving unit includes a motor, which is arranged in parallel with the shaft so that a rotation axis thereof can be parallel to the rotation axis of the shaft, and a connecting element, which is connected to the rotation axis of the motor and the shaft.

### 5. The ceiling-mounted air conditioner of claim 4, wherein the connecting element includes a motor gear, which is connected to the rotation axis of the motor, and a shaft gear, which engages with the motor gear and is connected to the shaft so as to be able to rotate the shaft.

### 6. The ceiling-mounted air conditioner of claim 1, wherein the rotation elements include pinion gears whose rotation axis coincides with a rotation axis of the shaft, and the moving elements include rack gears which engage with the pinion gears and are lifted up and down on the pinion gears.

### 7. The ceiling-mounted air conditioner of claim 2, wherein the elevation device further includes a motor cover, which is disposed on the intake panel, surrounds the shaft driving unit and part of the circumferential surface of the shaft and supports the shaft so as to be able to rotate.

8. The ceiling-mounted air conditioner of claim 7, wherein the elevation device further includes a shaft bracket, which is disposed on the intake panel, surrounds part of the circumferential surface of the shaft, and supports the shaft so as to be able to rotate. 5
9. The ceiling-mounted air conditioner of claim 8, wherein the shaft driving unit is disposed near one of the rotation elements, and the shaft bracket is disposed near another one of the rotation elements. 10
10. The ceiling-mounted air conditioner of claim 9, wherein the intake panel includes a hook groove, and a first end portion of the shaft bracket is inserted into the hook groove. 15
11. The ceiling-mounted air conditioner of claim 10, wherein the intake panel further includes a screw coupling unit, which is formed on one side of the hook groove, and a second end portion of the shaft bracket is coupled to the screw coupling unit by a screw. 20

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FIG. 1

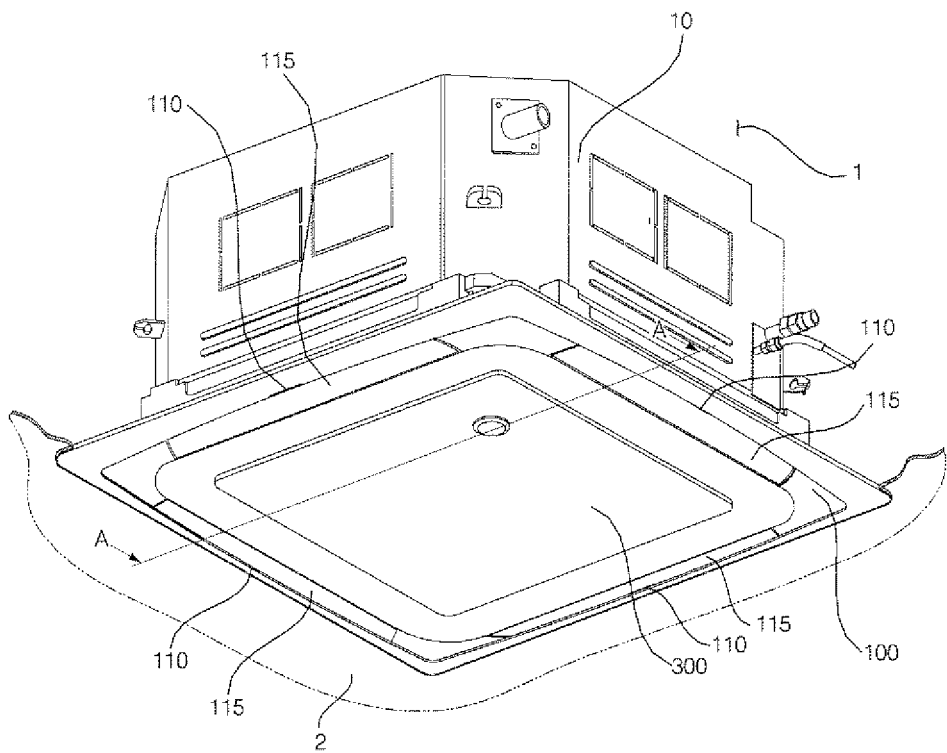


FIG. 2a

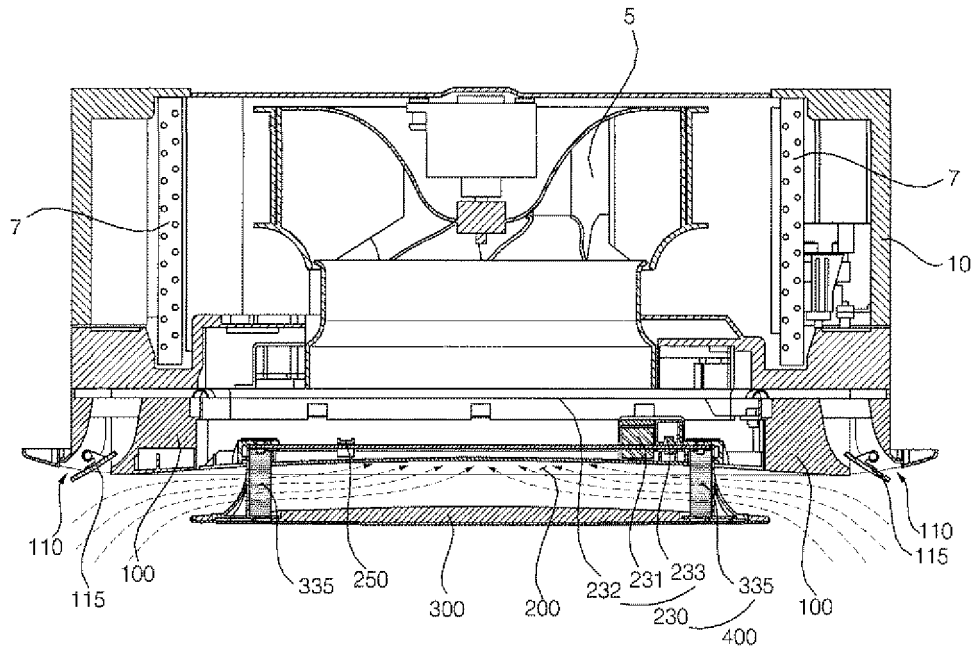


FIG. 2b

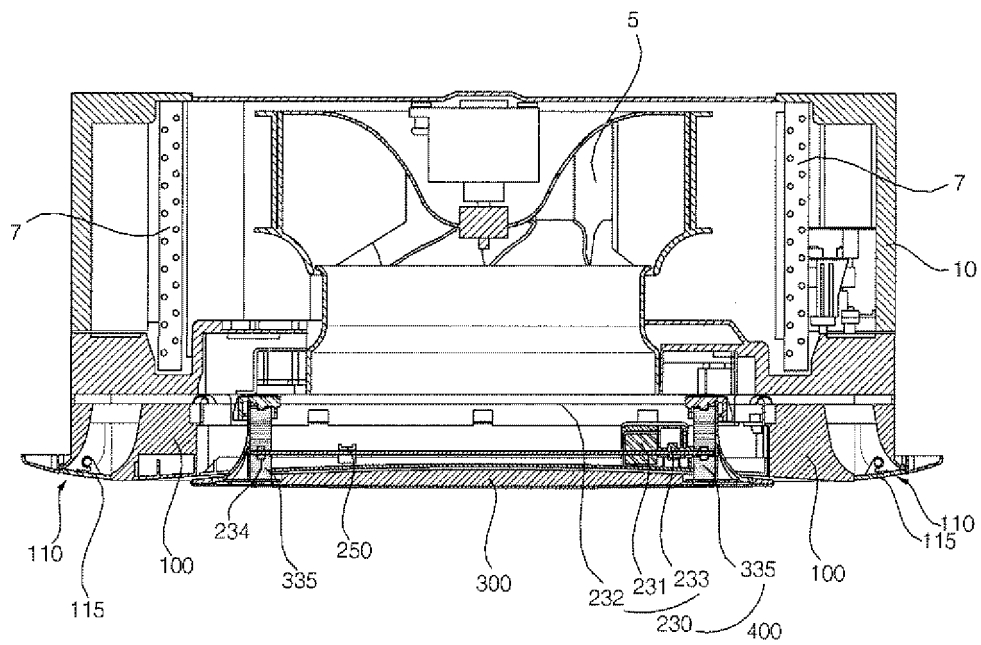




FIG. 3

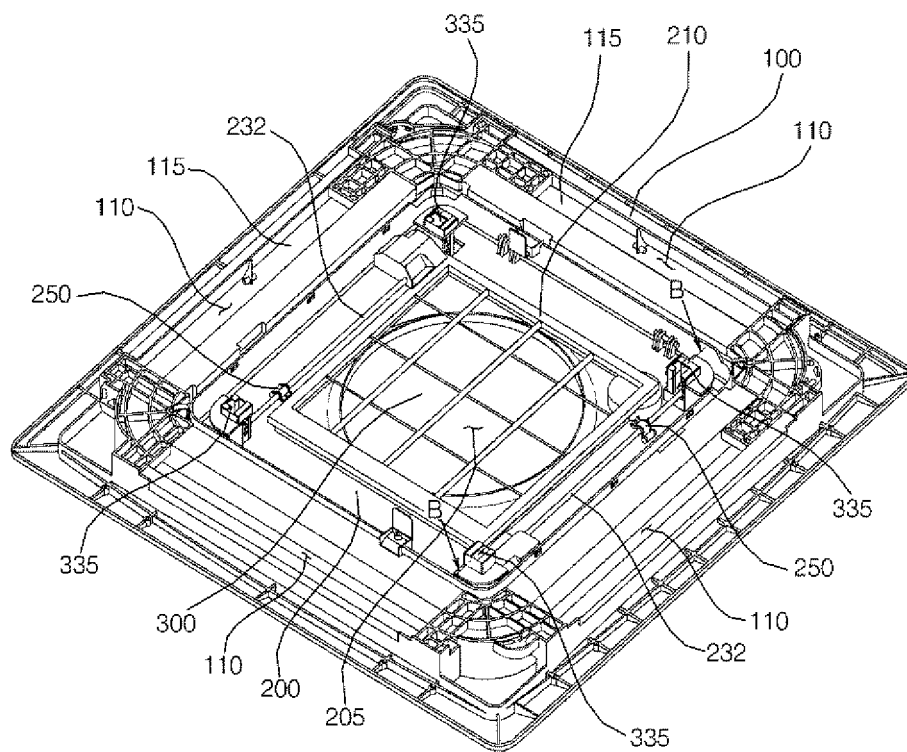


FIG. 4a

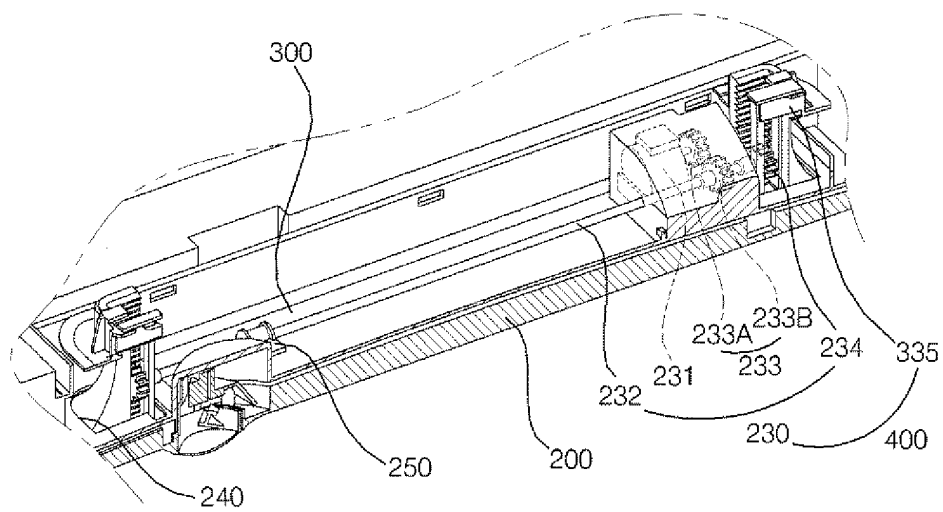


FIG. 4b

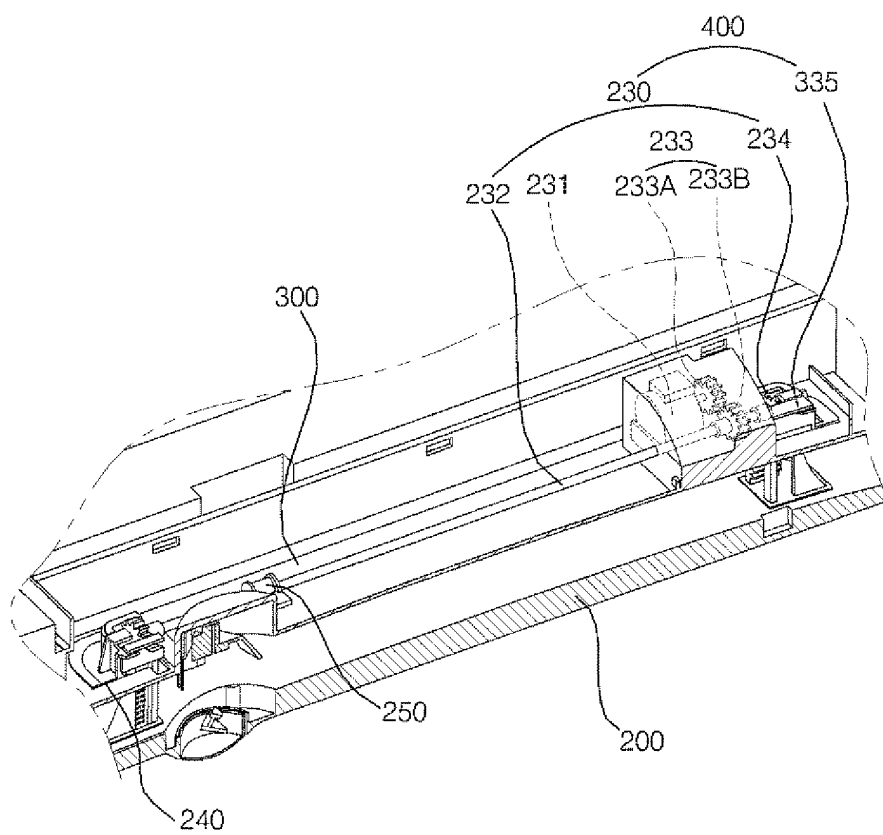


FIG. 5

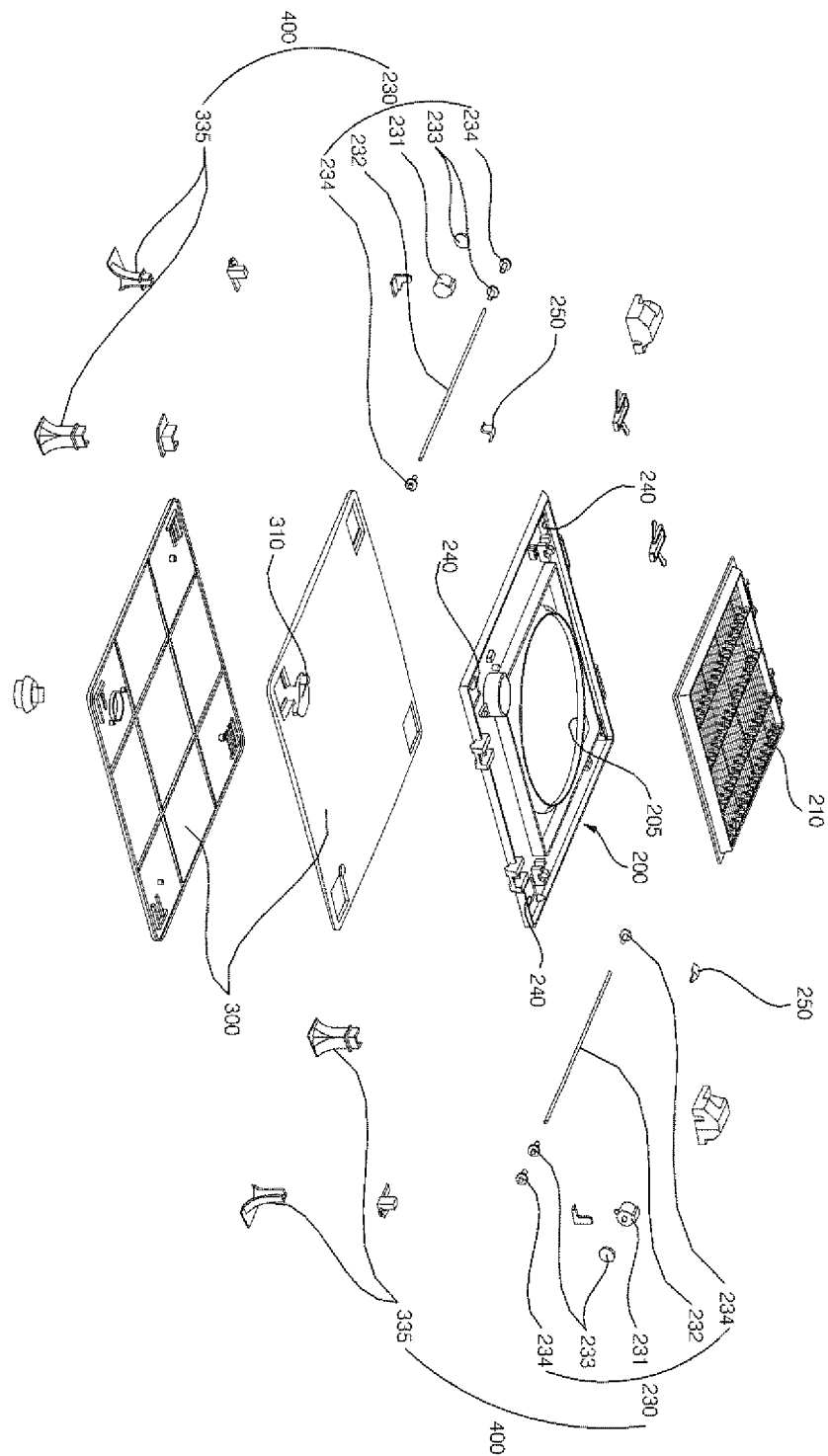


FIG. 6

