(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 617 154 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.01.2006 Bulletin 2006/03

(51) Int Cl.:
F24F 7/007 *(2006.01)* ***F24F 1/00*** *(2006.01)*

(21) Application number: **05250099.8**

(22) Date of filing: **11.01.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR LV MK YU

(30) Priority: **14.07.2004 KR 2004054836**

(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.**
Suwon-si, Gyeonggi-Do 442-742 (KR)

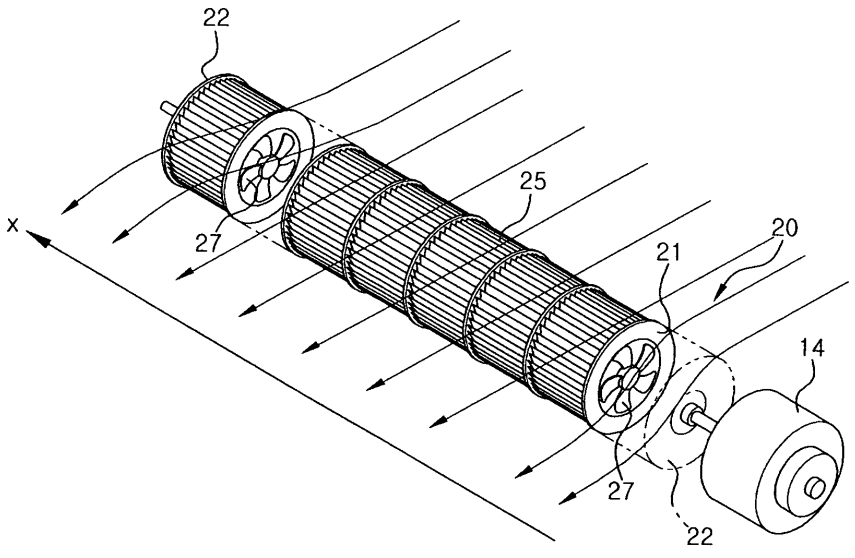
(72) Inventors:
- **Na, Seon Uk**
  Yongin-City, Gyeonggi-Do (KR)
- **Yoon, Seok Tae**
  Anyang-City, Gyeonggi-Do (KR)
- **Lee, Jun Hwa**
  Anyang-City, Gyeonggi-Do (KR)

(74) Representative: **Grey, Ian Michael et al**
Venner Shipley LLP
20 Little Britain
London EC1A 7DH (GB)

(54) Blowing fan and air conditioner

(57) The invention discloses a fan assembly comprising a rotatably mounted cross flow fan for blowing air in a direction substantially perpendicular to the axis of rotation of the cross flow fan, blowing members associated with the cross flow fan operable to blow air in an axial direction towards each end of the cross flow fan.

FIG. 4



EP 1 617 154 A2

Description

[0001] The present invention relates to a fan assembly comprising a rotatably mounted cross-flow fan for blowing air in a direction substantially perpendicular to the axis of rotation of the cross-flow fan.

[0002] Air conditioners are known and are generally used for maintaining the temperature, humidity and cleanliness of the air within an enclosed space. The air conditioner mainly serves to constantly maintain a specified environmental state of an enclosed space, for example cooling a room in summer and heating a room in winter.

[0003] An air conditioner is usually comprised of two units, one installed outdoors and another installed indoors. Japanese patent No. 2001-201078 discloses an indoor unit of a conventional air conditioner. As shown in Figure 2, such an indoor unit comprises a heat exchanger (not shown) installed in a housing 2, and a blowing device for assisting heat exchange between the heat exchanger (not shown) and the surrounding air.

[0004] The blowing device includes a motor 5 and a cross flow fan 4 rotated by the motor, and an air inlet 4a and outlet 4b which are formed through the housing 2 for the intake and exhaust of the air from, and to, the surrounding environment respectively. When the motor 5 is driven, the cross flow fan 4 rotates so that air is inhaled into the unit in a direction perpendicular to a rotary shaft of the cross flow fan 4 through the inlet 4a and is subsequently discharged from the unit through the outlet 4b.

[0005] Figure 1 illustrates another conventional indoor unit of an air conditioner. As shown in Figure 1, the flow velocity of air blown from a region towards each end of the cross flow fan 4 is low whereas the flow velocity and flow rate of air passing through the central portion of the cross flow fan 4 between the end regions is much higher. Accordingly, the cross flow fan 4 of the above conventional air conditioner has the disadvantage that air inversely flows back towards each ends of the cross flow fan 4 which results in the generation of noise.

[0006] In an attempt to solve the aforementioned problems, the indoor unit 1 of the air conditioner, as shown in Figure 2, has been developed in which backflow prevention panels 6 are installed at each ends of the outlet 4b to prevent backflow of air and reduce the noise generated. However, these backflow prevention panels 6 have the disadvantage that they reduce the utility of space within the air conditioning unit and increase its overall size.

[0007] As the backflow prevention panels 6 reduce the width of the outlet 4b, to obtain a designated width for the outlet 4b, the cross flow fan 4, as shown in Figure 2, must be proportionally larger than that of the cross flow fan which is not provided with backflow prevention panels 6 as shown in Figure 4. Accordingly, a cross flow fan 4 with backflow prevention panels 6 requires the motor 5 to supply a greater rotary force, thereby increasing production and maintenance costs.

[0008] The present invention seeks to provide a system which overcomes or substantially alleviates the problems discussed above.

[0009] A fan assembly according to the present invention is characterised by blowing members associated with the cross flow fan operable to blow air in an axial direction towards each end of the cross flow fan.

[0010] In a preferred embodiment, the fan assembly comprises a pair of blowing members, each blowing member being disposed within the cross flow fan spaced from either end thereof.

[0011] Advantageously, each blowing member comprises an axial flow fan mounted coaxially with the cross flow fan.

[0012] Preferably, the cross flow fan may include support plates having a flat disk-shaped structure provided with an opening, and vanes installed on the surface of each of the support plates in a radial manner.

[0013] Each of the blowing members may preferably be installed in the opening.

[0014] Embodiments of the present invention will now be described, by way of example only, with reference to Figures 3 to 7 of the accompanying drawings, in which:

Figure 1 shows a schematic view of an indoor unit of a conventional air conditioner;
Figure 2 shows a schematic view of an indoor unit of another conventional air conditioner;
Figure 3 shows an exploded perspective view of an indoor unit of an air conditioner in accordance with the present invention;
Figure 4 shows a perspective view of a blowing fan of the air conditioner in accordance with the present invention;
Figures 5 and 6 show perspective views of impeller units of the blowing fan of the air conditioner in accordance with the present invention; and
Figure 7 shows a graph illustrating the distribution of flow velocity of air blown by the blowing fan in accordance with the present invention.

[0015] Referring now to the drawings, there is shown in Figure 3 an air conditioner having an indoor unit 10 in accordance with the present invention comprising a heat exchanger 12 installed in a space formed by a front panel 11 a and a rear panel 11 b. The heat exchanger 12 exchanges heat between the air and a refrigerant circulating according to a refrigerating cycle. A blowing device for assisting the above heat exchange includes a blowing fan 20 and a motor 14.

[0016] A filter 18 and a suction grill 17 are installed on the front surface of the front panel 11a, and an outlet 15 is formed through the lower part of the front panel 11a. Accordingly, when the blowing device is driven, air, inhaled into the indoor unit 10 through the suction grill 17, passes through the heat exchanger 12 and the blowing fan 20, and is then discharged through the outlet 15.

[0017] As shown in Figure 4, the blowing fan 20 en-

compasses a cross flow fan, the direction of rotation being perpendicular to the direction in which air is blown. A plurality of vanes 25 are disposed in a radial manner about the rotary shaft of the blowing fan 20. A plurality of support plates 21 for supporting the vanes 25 are disposed in a longitudinal direction along the rotary shaft.

[0018] End support plates 22 are respectively installed on both ends of the blowing fan 20. A circular opening 21a, as shown in Figure 5, is formed through the central portion of each of the support plates 21, but the circular opening 21a is not formed through each of the end support plates 22. The rotary shaft, accommodated by a bushing or connected to the motor 14, is installed on the end support plates 22.

[0019] Axial flow fans 27 are respectively installed on the support plates 21 next to both end support plates 22. When the blowing fan 20 is rotated by the motor 14, the axial flow fans 27 push air toward both ends of the blowing fan 20.

[0020] As shown in Figures 5 and 6, the blowing fan 20 is produced by connecting a plurality of impeller units 23a and 23b in series. The first impeller unit 23a, as shown in Figure 5, includes the disk-shaped support plate 21 provided with the opening 21a formed through the central portion thereof, and a plurality of the vanes 25 disposed in the radial manner on the surface of the support plate 21 about the rotary shaft. In the second impeller unit 23b, as shown in Figure 6, the end of the axial flow fan 27 is attached to the edge of the opening 21a of the support plate 21.

[0021] Accordingly, in order to produce the blowing fan 20 of the present invention, the first impeller units 23a and the second impeller units 23b are disposed in series, and are then connected by, but not limited to, a method such as ultrasonic welding.

[0022] When the blowing fan 20, as described above, in accordance with the present invention, is rotated by driving the motor 14, as shown in Figure 4, air is discharged in a direction perpendicular to the rotary shaft by the vanes 25. Since the axial flow fans 27 push the air toward both ends of the blowing fan 20, the blowing fan 20, which includes the axial flow fans 27, allows the air discharged toward both ends of the blowing fan 20 to have a flow velocity and flow rate higher than that of a blowing fan, which does not include the axial flow fan and so a more even distribution of flow velocity across the width of the cross flow fan is achieved.

[0023] Figure 7 is a graph illustrating the effects of the axial flow fan 27. The horizontal axis of the graph represents the variation of flow velocity of the air passing through individual points along the length of the outlet 15, wherein one end of the outlet 15 is set to the starting point and the other end of the outlet 15 is set to point 100. Here, the curve expressed by a solid line represents the distribution of flow velocity of the air of the blowing fan in which the axial flow fan 27 is not installed, and the curve expressed by a dotted line represents the distribution of flow velocity of the air of the blowing fan 20 of the present invention in which the axial flow fans 27 are installed to push air towards both ends of the blowing fan 20.

[0024] Comparatively, the central portion of the curve expressed by the dotted line has a flow velocity lower than that of the central portion of the curve expressed by the solid line, but the end portions of the curve expressed by the dotted line have a flow velocity higher than that of the end portions of the curve expressed by the solid line. Further, the mean flow velocity of the air of the curve expressed by the dotted line representing the distribution of flow velocity of the air of the blowing fan 20 of the present invention in which the axial flow fans 27 are installed, is higher than that of the curve expressed by the solid line representing the distribution of flow velocity of the air of the blowing fan in which the axial flow fan 27 is not installed by 5.4%.

[0025] As apparent from the above description, the present invention provides a blowing fan, which prevents noise and back flow of air without an additional structure installed outside the blowing fan and without increasing its overall size.

[0026] Further, the blowing fan of the present invention prevents the width of an outlet from being reduced such as by the presence of a backflow prevention panel, and therefore does not require a comparative increase in the size of the fan to enable a similar performance thereby preventing the increase of production costs.

[0027] Although an embodiment of the invention has been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles of the invention, the scope of which is defined in the claims and their equivalents and the foregoing description should be regarded as a description of a preferred embodiment only.

Claims

1. A fan assembly comprising a rotatably mounted cross flow fan for blowing air in a direction substantially perpendicular to the axis of rotation of the cross flow fan **characterised by** blowing members associated with the cross flow fan operable to blow air in an axial direction towards each end of the cross flow fan.

2. A fan assembly according to claim 1 comprising a pair of blowing members, each blowing member being disposed within the cross flow fan spaced from either end thereof.

3. A fan assembly according to claim 1 or claim 2 wherein each blowing member comprises an axial flow fan mounted coaxially with the cross flow fan.

4. An air conditioning unit incorporating a fan assembly

according to any preceding claim.

5. A blowing fan comprising a cross flow fan and blowing members for pushing air, having passed through the cross flow fan, toward ends of the cross flow fan.

6. The blowing fan according to claim 5 wherein the blowing members are axial flow fans.

7. The blowing fan according to claim 5 wherein the blowing members are formed integrally with the cross flow fan.

8. The blowing fan according to claim 7 wherein the blowing members are respectively installed at portions separated from both ends of the cross flow fan by a designated interval.

9. The blowing fan according to claim 5 wherein the cross flow fan includes support plates having a flat disk-shaped structure provided with an opening and vanes installed on the surface of each of the support plates in a radial manner.

10. The blowing fan according to claim 9 wherein each of the blowing members is installed in the opening.

11. An air conditioner having a blowing device comprising a cross flow fan and blowing members for pushing air, having passed through the cross flow fan, toward ends of the cross flow fan.

12. The air conditioner according to claim 11 wherein the blowing device is installed in an indoor unit.

FIG. 1

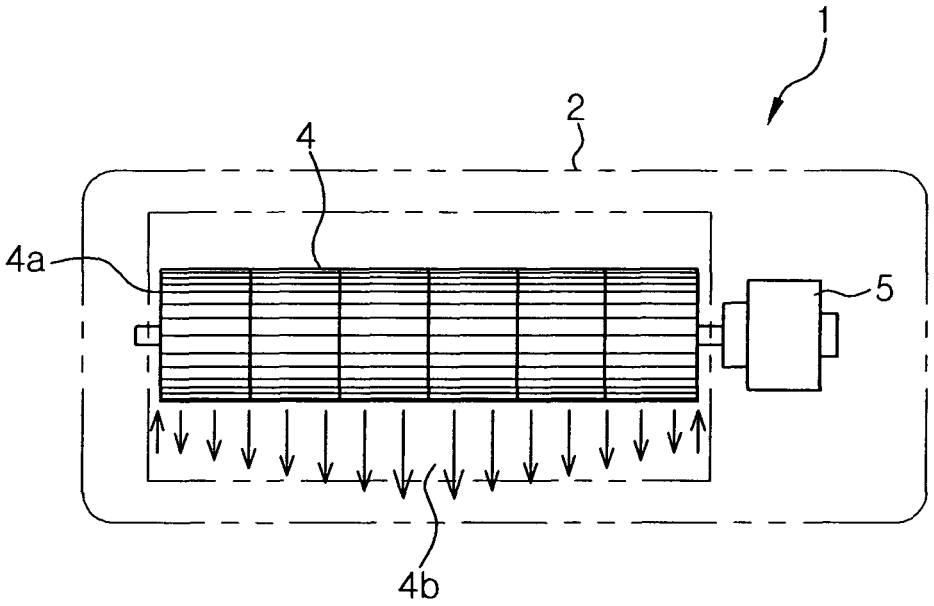


FIG. 2

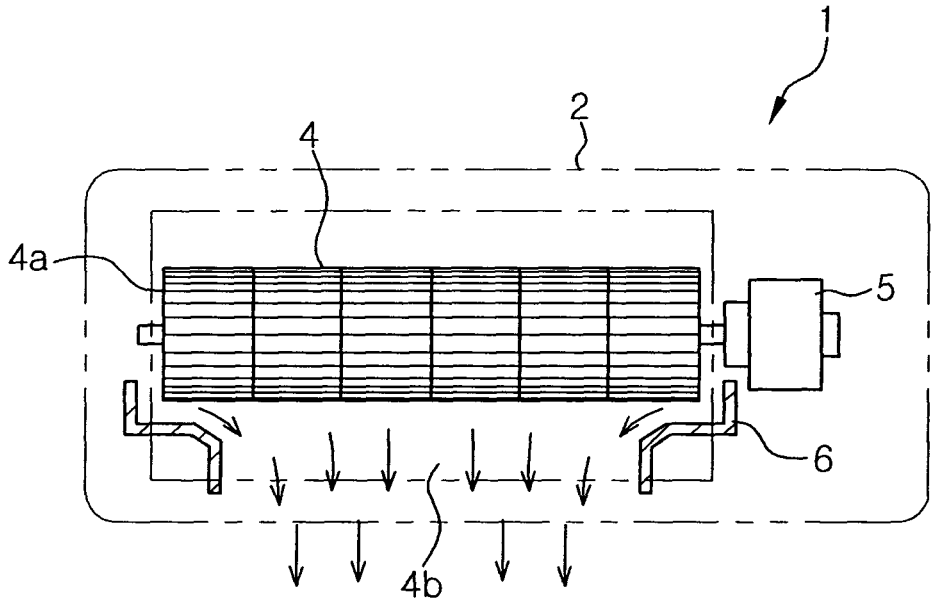


FIG. 3

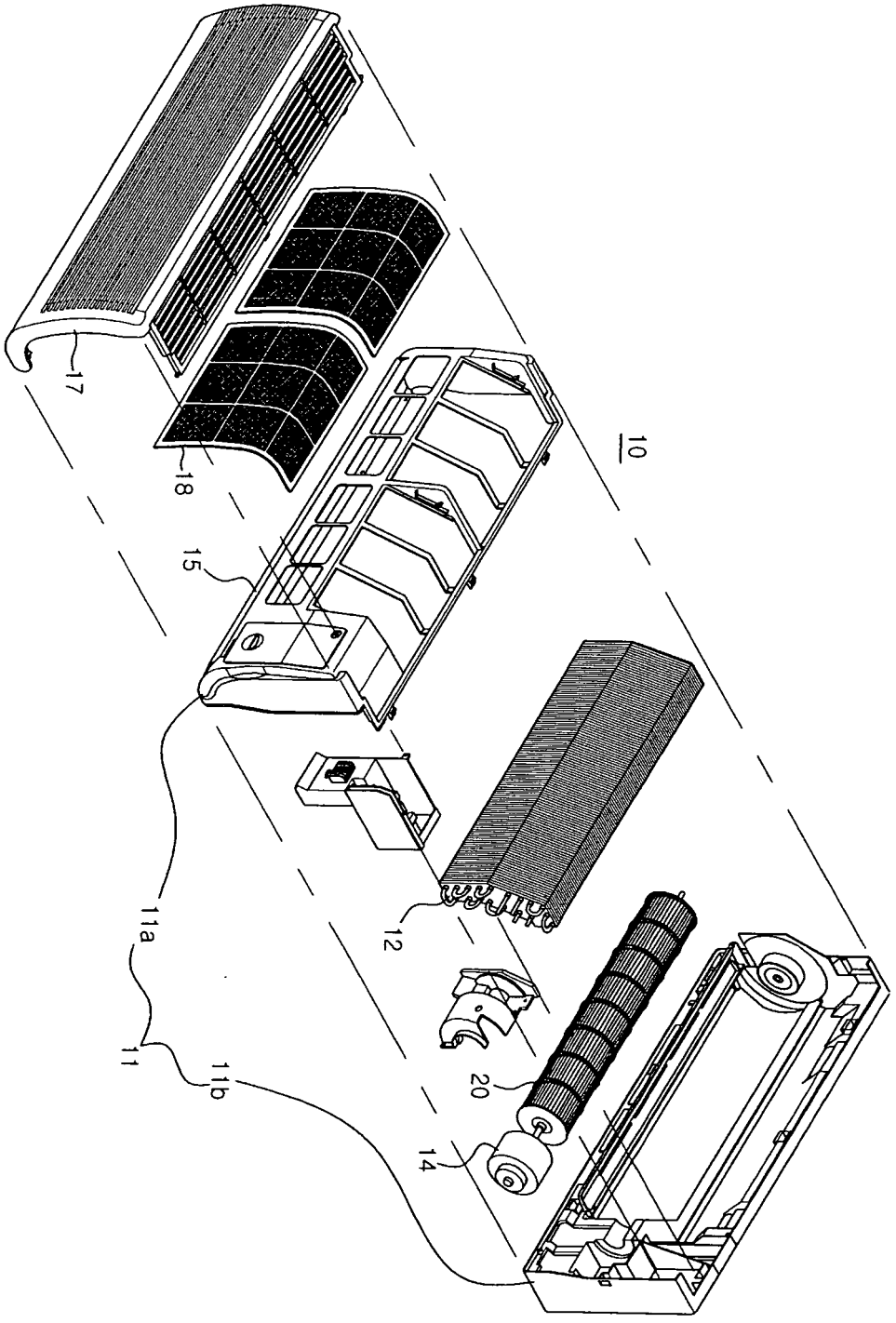


FIG. 4

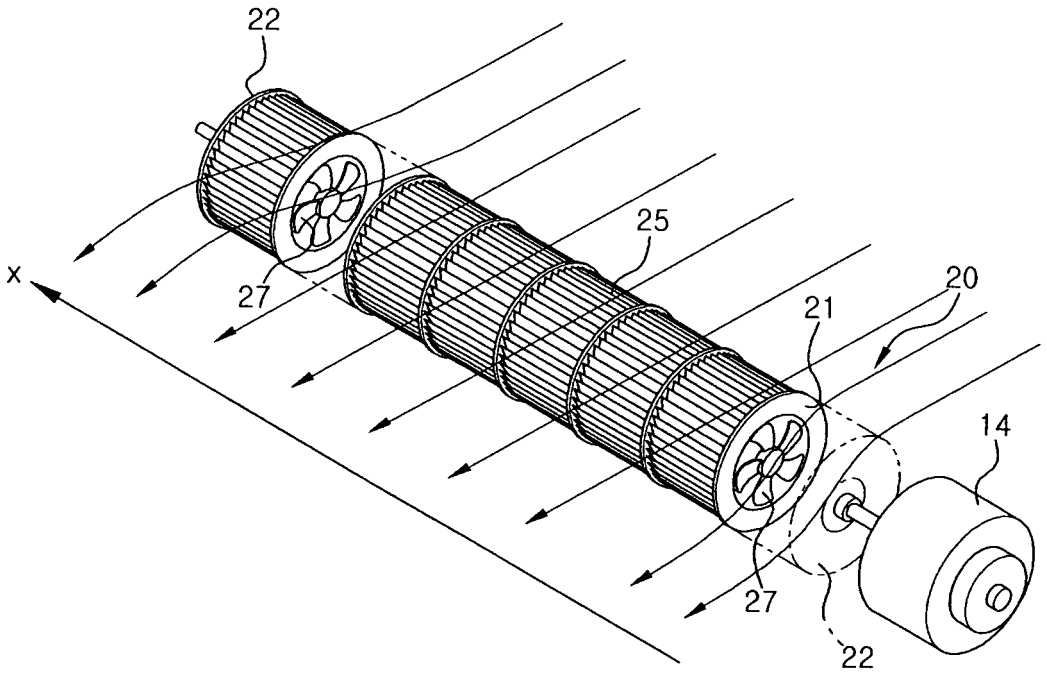


FIG. 5

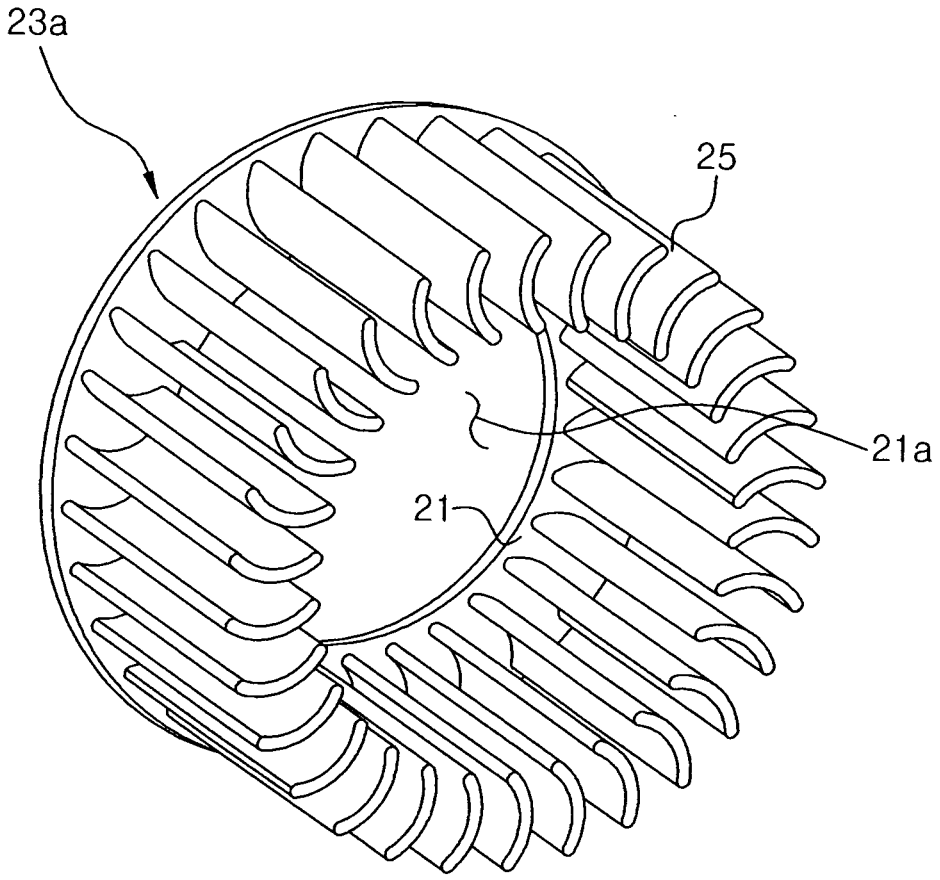


FIG. 6

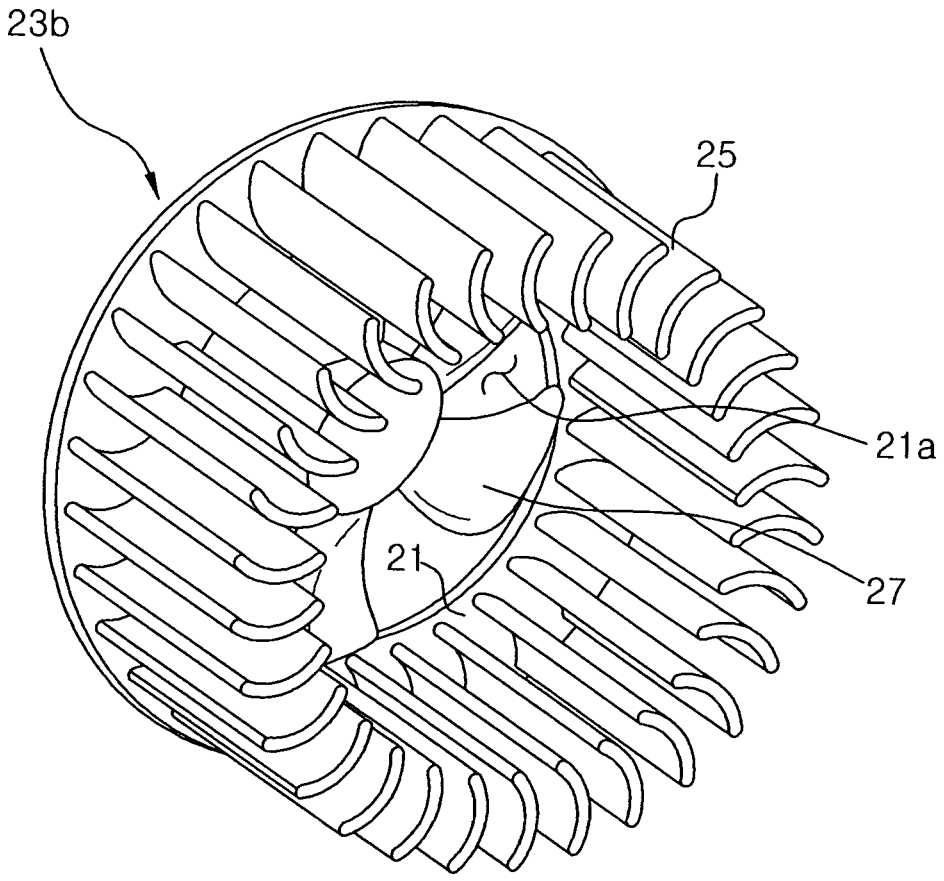
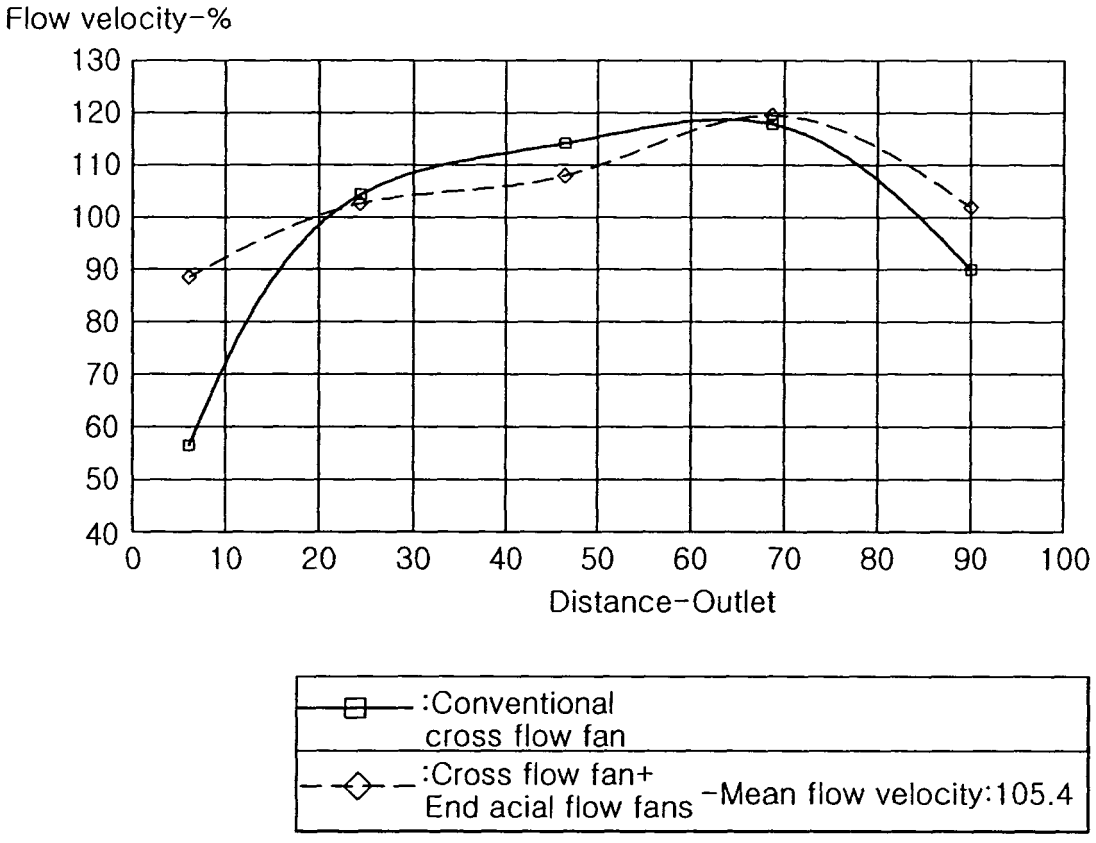


FIG. 7


Flow velocity-%
130
120
110
100
90
80
70
60
50
40
0
10
20
30
40
50
60
70
80
90
100
Distance-Outlet
:Conventional cross flow fan
:Cross flow fan+ End acial flow fans
-Mean flow velocity:105.4