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

(11) EP 1 618 821 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.01.2006 Bulletin 2006/04

(51) Int Cl.:
A47L 5/22 *(2006.01)*

(21) Application number: **05291532.9**

(22) Date of filing: **18.07.2005**

(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 LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **20.07.2004 KR 2004056491**

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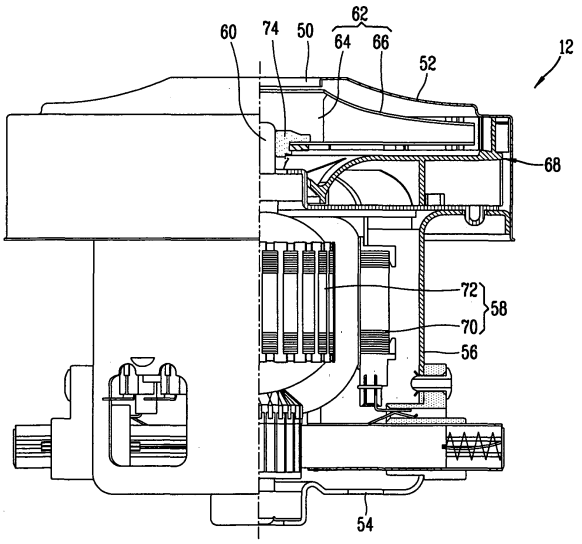
(54) Centrifugal fan and vacuum cleaner having the centrifugal fan

(57) A centrifugal fan (12) includes a driving motor (58) for generating a rotational force; an impeller (62) connected with the driving motor by a rotational shaft (60) and generating an air blowing force; a partition plate (82) installed inside an impeller casing (52); a diffuser (80) formed at an edge portion of an upper surface of the partition plate and increasing a pressure of air which has passed through the impeller; a rear vane (84) formed at a lower surface of the partition plate and guiding air discharged from the diffuser so as to pass through the driving motor; and an air guiding member (90) formed at certain intervals at an outer surface of the diffuser and guiding air which has passed through the diffuser toward the rear vane. Air which has passed through the diffuser is forcibly introduced to the lower side of the partition plate, so a flow loss caused as air is re-circulated to the upper side of the partition plate after passing through the diffuser can be reduced, and thus, a suction force and efficiency of the centrifugal fan can be enhanced.

FIG. 5



EP 1 618 821 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a centrifugal fan of a vacuum cleaner and, more particularly, to a centrifugal fan capable of enhancing a suction force and efficiency by forcibly introducing air discharged from a defuser toward a vane to reduce a flow loss of air, and a vacuum cleaner having the centrifugal fan.

2. Description of the Background Art

[0002] Figure 1 is a sectional view of a centrifugal fan in accordance with a conventional art.

[0003] The conventional centrifugal fan includes an impeller casing 104 having a suction opening 102 formed at its front side, a motor housing 108 connected with the impeller casing 104 and having a discharge hole 106 for discharging air, a driving motor 110 installed in the motor housing 108 and generating a rotational force, an impeller 116 rotatably disposed at the impeller casing 104 and connected with the driving motor 110 by a rotational shaft 112 to generate an air blowing force, and a guide vane 130 disposed at a rear side of the impeller 116, increasing a static pressure of air sent from the impeller 116 and guiding air sent from the impeller 116 toward the discharge hole 106 through the driving motor 110.

[0004] The impeller 116 includes a hub 118 fixed at the rotational shaft 112 by a holder 140 and a plurality of blades 120 connected at equal intervals in a circumferential direction at an outer circumferential surface of the hub 118 and sending air in a radial direction.

[0005] As shown in Figure 2, the guide vane 130 includes defusers 132 formed at an outer circumferential surface of the blade 120 of the impeller 116 with a certain interval from an end portion of the blade 120, a partition plate 134 fixed at an inner circumferential surface of the impeller casing 104 on which the diffusers 132 are formed, and a rear vane 136 formed at a lower surface of the partition plate 134 and guiding air discharged from the defusers 132 so as to pass through the driving motor 110.

[0006] The conventional centrifugal fan operates as follows.

[0007] When the rotational shaft 112 is rotated as the driving motor 110 is driven, the impeller 116 is rotated to suck air through the suction opening 102. The air sucked through the suction opening 102 is sent in the radial direction by the blades 120 of the impeller 116 to pass through the diffusers 132, a static pressure of the air being increased while passing through the diffusers 132, and then, flows downwardly through a space between an inner circumferential surface of the impeller casing and an outer circumferential surface of the partition plate. And then, the air is guided toward the center by the rear vane 136 so as to be guided to pass through the driving motor. While passing through the driving motor 110, the air cools the motor 110 and then externally discharged through the discharge hole 106 formed at the motor housing 108.

[0008] However, the conventional centrifugal fan has the following problems.

[0009] That is, since the pressure difference between the upper side and the lower side based on the partition plate 134, a portion of the air which has passed through the diffusers 132 is re-circulated at an upper side of the partition plate 134 owing to the centrifugal force of the impeller 116, rather than being sent to a lower side of the sectional plate 134, causing a flow loss of the air, which results in degradation of the suction force and efficiency of the fan.

SUMMARY OF THE INVENTION

[0010] Therefore, an object of the present invention is to provide a centrifugal fan capable of enhancing a suction force and efficiency by reducing a flow loss of air by installing an air guiding member at a diffuser and inducing air discharged from the diffuser to a rear vane, and a vacuum cleaner having the centrifugal fan.

[0011] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein; there is provided a centrifugal fan including: a driving motor for generating a rotational force; an impeller connected with the driving motor by a rotational shaft and generating an air blowing force; a partition plate installed inside an impeller casing; a diffuser formed at an edge portion of an upper surface of the partition plate and increasing a pressure of air which has passed through the impeller; a rear vane formed at a lower surface of the partition plate and guiding air discharged from the diffuser so as to pass through the driving motor; and an air guiding member formed at certain intervals at an outer surface of the diffuser and guiding air which has passed through the diffuser toward the rear vane.

[0012] The air guiding member is formed as a plate in an air-foil shape and formed to be tilt downwardly at a side of the diffuser blade, of which one side is integrally formed with the side of the diffuser blades and the other side contacts with an inner circumferential surface of the impeller casing.

[0013] To achieve the object, there is also provided a vacuum cleaner including a cleaner body having a centrifugal fan for generating a suction force and a dust collection filter for collecting dust, and a suction nozzle for sucking dust, wherein the centrifugal fan includes: a driving motor for generating a rotational force; an impeller connected with the driving motor by a rotational shaft and generating an air blowing force; a partition plate installed inside an impeller casing; a diffuser formed at an edge portion of an upper surface of the partition plate and increasing a pressure of air which has passed through the

impeller; a rear vane formed at a lower surface of the partition plate and guiding air discharged from the diffuser so as to pass through the driving motor; and an air guiding member formed at certain intervals at an outer surface of the diffuser and guiding air which has passed through the diffuser toward the rear vane.

[0014] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[0016] In the drawings:

Figure 1 is a sectional view of a centrifugal fan in accordance with the conventional art;

Figure 2 is a perspective view of a guide vane of the centrifugal fan in accordance with the conventional art;

Figure 3 is a perspective view of a vacuum cleaner in accordance with the present invention;

Figure 4 is a sectional view of a main body of the vacuum cleaner in accordance with the present invention;

Figure 5 is a sectional view of a centrifugal fan in accordance with the present invention;

Figure 6 is a perspective view of a guide vane of the centrifugal fan in accordance with the present invention;

Figure 7 is an enlarged view of a portion 'A' of Figure 6; and

Figures 8 to 10 are graphs showing performance between the centrifugal fan in accordance with the present invention and that of the conventional art.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] A centrifugal fan and a cleaner having the centrifugal fan in accordance with a preferred embodiment of the present invention will now be described with reference to the accompanying drawings.

[0018] Figure 3 is a perspective view of a vacuum cleaner in accordance with the present invention, and Figure 4 is a sectional view of a main body of the vacuum cleaner in accordance with the present invention.

[0019] A cleaner in accordance with the present invention includes a cleaner body 14 having a dust collection filter 10 and a centrifugal fan 12, an extension pipe 18 connected with the cleaner body 14 by a suction hose 16, and a suction nozzle 20 mounted at an end portion of the extension pipe 18 and sucking dust and debris from the floor.

[0020] The cleaner body 14 includes a first chamber 24 having a connection part 22 formed at a front side thereof to which the suction hose 16 is connected and a dust collection filter 10 installed therein, and a second chamber 26 having the centrifugal fan 12 installed therein. A filter 28 is mounted at a suction side of the second chamber 26 and an exhaust hole 30 is formed to externally discharge air discharged from the centrifugal fan 12.

[0021] As shown in Figure 12, the centrifugal fan 12 includes an impeller casing 52having a suction opening 50 formed at its front side, a motor housing 56 mounted at a lower side of the impeller casing 52 and having a discharge hole 54 for discharging air, a driving motor 58 installed in the motor housing 56 and generating a rotational force, an impeller 62 rotatably disposed at the impeller casing 52 and connected with the driving motor by a rotational shaft 60 to generate an air blowing force, and a guide vane 68 rotatably disposed at a rear side of the impeller 62, increasing a static pressure of air sent from the impeller 62, and guiding air sent from the impeller 62 so as to pass through the driving motor 58 to the discharge hole 54.

[0022] The driving motor 58 includes a stator 70 fixed on an inner circumferential surface of the motor housing 56, to which power is applied, and a rotor 72 disposed at an inner circumferential surface of the stator 70, rotated by an electromagnetic force when power is applied to the stator 70. The rotational shaft 60 is fixed at the rotor 72.

[0023] The impeller 62 includes a hub 64 fixed at the rotational shaft 60 by a holder 74 and a plurality of blades 66 connected at an outer circumferential surface of the hub 64 at equal intervals and sending air in a radial direction.

[0024] Figure 6 is a perspective view of a guide vane of the centrifugal fan in accordance with the present invention, and Figure 7 is an enlarged view of a portion 'A' of Figure 6.

[0025] The guide vane 68 includes a plate-type partition plate disposed at a lower side of the impeller 62, defusers 80 formed at equal intervals at an edge portion of an upper surface of the partition plate, arranged at a certain interval from an outer circumferential surface of the blades 66 of the impeller, and increasing a static pressure of air sent from the impeller 62, a rear vane 84 formed at a lower surface of the partition plate 82 and guiding air discharged from the diffusers 80 to pass through the driving motor 58, and air guiding members 90 formed on an outer surface of the diffusers 80 at equal intervals and forcibly introducing air which has passed the diffusers toward the rear vane 84 in order to reduce a flow loss.

[0026] The diffusers 80 includes a plurality of diffuser blades 80a disposed to overlap with a certain interval therebetween at the edge portion of the upper surface of the partition plate 82 in a circumferential direction, and a

passage 86 is formed between the diffuser blades 80a to allow air to pass therethrough. As for the passage 86, an area of an exit side through which air is discharged to the rear vane 84 is larger than an area of an entrance side at which air sent from the impeller 62 is introduced, whereby air can spread to increase its static pressure and reduce air flow rate.

[0027] The air guiding member 90 is formed at the side of each of the defuser blades 80a. The air guiding member 90 is formed as an air-foil type plate at an outer side of each diffuser blade 80a in a right angle direction. The air guiding member 90 is formed to be tilt downwardly at the exit side of the passage 86 of the diffuser 80. One side of the air guiding member 90 is integrally formed with the side of the diffuser blade 80a, and the other side thereof contacts with the inner circumferential surface of the impeller casing 52.

[0028] The rear vane 84 is formed in a spiral form in an outer direction at a lower surface of the partition plate 82 in order to guide air whose static pressure has been increased while passing through the diffuser 80 to the driving motor 58.

[0029] The operation of the centrifugal fan constructed as described above will be described as follows.

[0030] When power is applied to the driving motor, the rotor 72 is rotated according to interaction of the rotor 72 and the stator 70, and accordingly, the rotational shaft 60 connected with the rotor 72 is rotated to rotate the impeller 62. Then, air is sucked through the suction opening 50, and the sucked air is sent in a radial direction by the blades 66, passes through the passage 86 between diffuser blades 80a, during which its static pressure is increased.

[0031] Having passed through the diffuser 80, air is sent downwardly through a space between the partition plate 82 and the inner circumferential surface of the impeller casing 52, guided by the rear vane 84 formed at the lower surface of the partition plate 82, and then introduced to the driving motor 58.

[0032] Herein, since air is forcibly introduced to the lower side of the partition plate 82 by the air guiding member 90 formed at the side of the diffuser 80, air flow loss caused when air is re-circulated toward the upper side of the partition plate 82 after passing through the diffuser 80 can be reduced.

[0033] In this manner, air guided by the rear vane 84 performs a cooling operation on the driving motor 58 while passing between the stator 70 and the rotor 72 of the driving motor 58 and then is discharged externally through the discharge hole 54 formed at the motor housing 56.

[0034] Figures 8 to 10 are graphs showing performance between the centrifugal fan in accordance with the present invention and that of the conventional art.

[0035] As shown in Figure 8, the vacuum degree of the centrifugal fan in accordance with the present invention is higher than that of the related art centrifugal fan in the aspect of high air volume.

[0036] As shown in Figure 9, power of the centrifugal fan in accordance with the present invention is higher than that of the related art centrifugal fan in the aspect of high air volume.

[0037] As shown in Figure 10, efficiency of the centrifugal fan in accordance with the present invention is higher than that of the related art centrifugal fan in the aspect of high air volume.

[0038] As so far described, the centrifugal fan and a cleaner having the centrifugal fan in accordance with the present invention have the following advantages.

[0039] That is, since the air guiding member in the air-foil shape is formed at the outer side of the diffuser blade of the diffuser, air which has passed through the diffuser is forcibly introduced to the lower side of the partition plate. Accordingly, a flow loss caused as air is re-circulated to the upper side of the partition plate after passing through the diffuser can be reduced, and thus, a suction force and efficiency of the centrifugal fan can be enhanced.

[0040] As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.

Claims

1. A centrifugal fan comprising:

a driving motor for generating a rotational force;
an impeller connected with the driving motor by a rotational shaft and generating an air blowing force;
a partition plate installed inside an impeller casing;
a diffuser formed at an upper surface of the partition plate and increasing a pressure of air which has passed through the impeller;
a rear vane formed at a lower surface of the partition plate and guiding air discharged from the diffuser so as to pass through the driving motor; and
an air guiding member formed at an outer surface of the diffuser and guiding air which has passed through the diffuser toward the rear vane.

2. The fan of claim 1, wherein the air guiding member is formed as an air-foil shaped plate.

3. The fan of claim 1, wherein the air guiding member is formed to be tilt downwardly at the side of the diffuser blade.

4. The fan of claim 3, wherein one side of the air guiding member is integrally formed at the side of the diffuser blades and the other side contacts with an inner circumferential surface of the impeller casing.

5. A vacuum cleaner comprising:

a cleaner body having a centrifugal fan for generating a suction force and a dust collection filter for collecting dust; and
a suction nozzle for sucking dust,
wherein the centrifugal fan comprises:

a driving motor for generating a rotational force;
an impeller connected with the driving motor by a rotational shaft and generating an air blowing force;
a partition plate installed inside an impeller casing;
a diffuser formed at an upper surface of the partition plate and increasing a pressure of air which has passed through the impeller;
a rear vane formed at a lower surface of the partition plate and guiding air discharged from the diffuser so as to pass through the driving motor; and
an air guiding member formed at an outer surface of the diffuser and guiding air which has passed through the diffuser toward the rear vane.

6. The cleaner of claim 5, wherein the air guiding member is formed as an air-foil shaped plate.

7. The cleaner of claim 5, wherein the air guiding member is formed to be tilt downwardly at the side of the diffuser blade.

8. The cleaner of claim 7, wherein one side of the air guiding member is integrally formed at the side of the diffuser blades and the other side contacts with an inner circumferential surface of the impeller casing.

FIG. 1

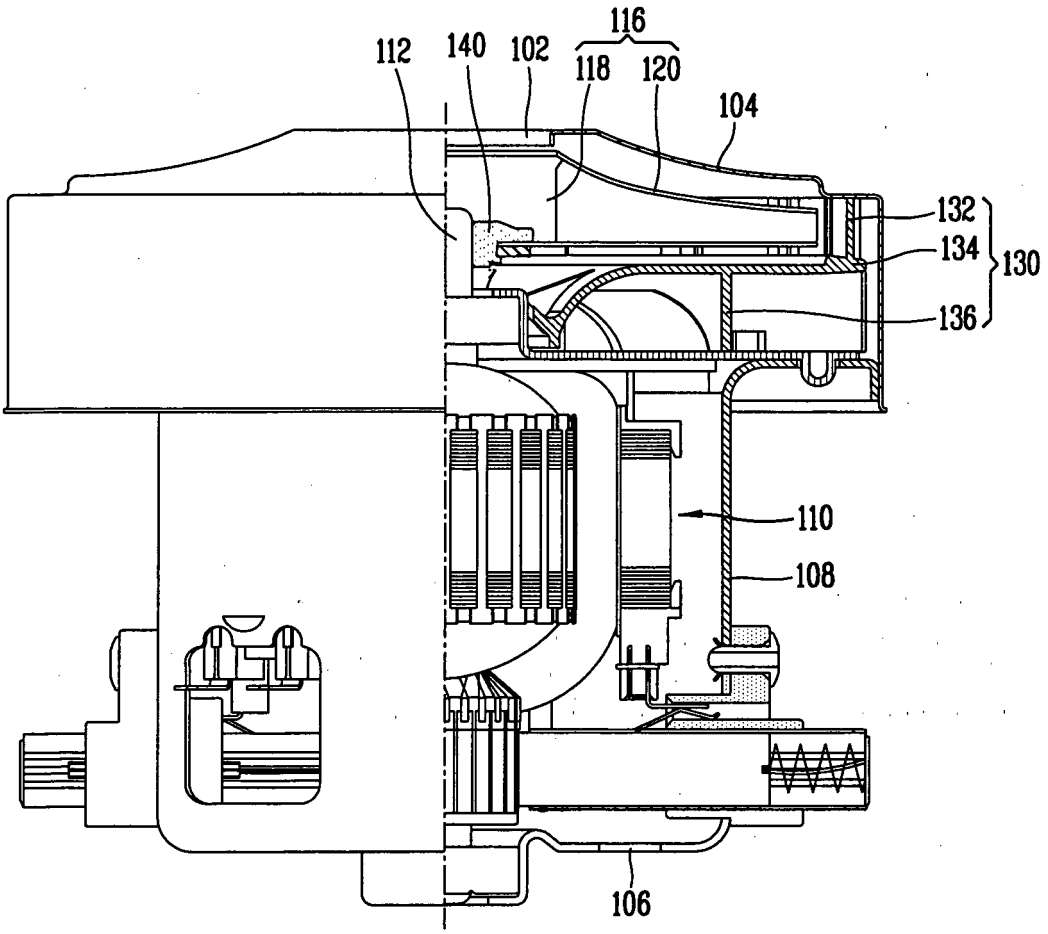


FIG. 2

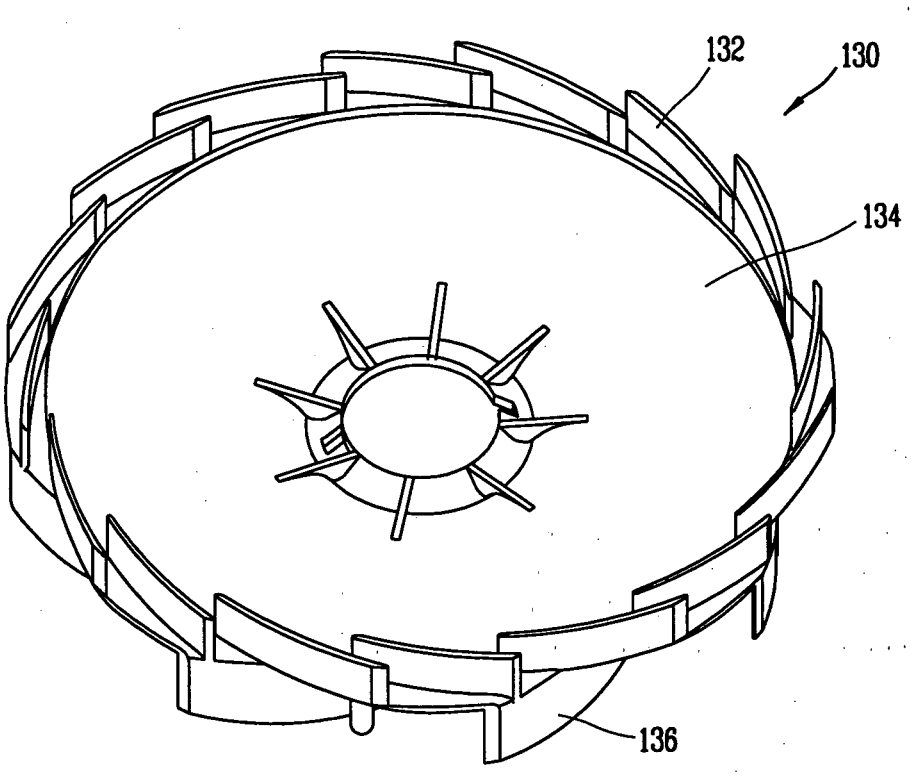


FIG. 3

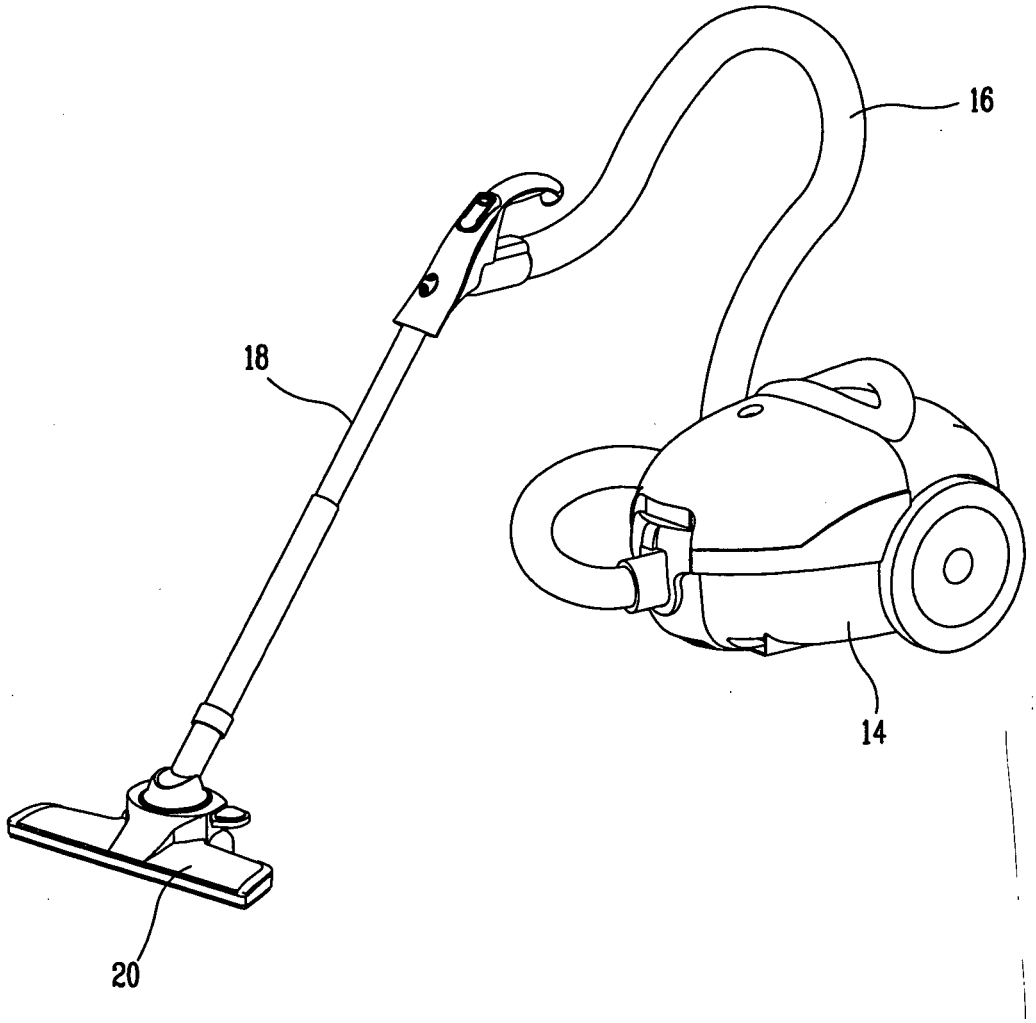


FIG. 4

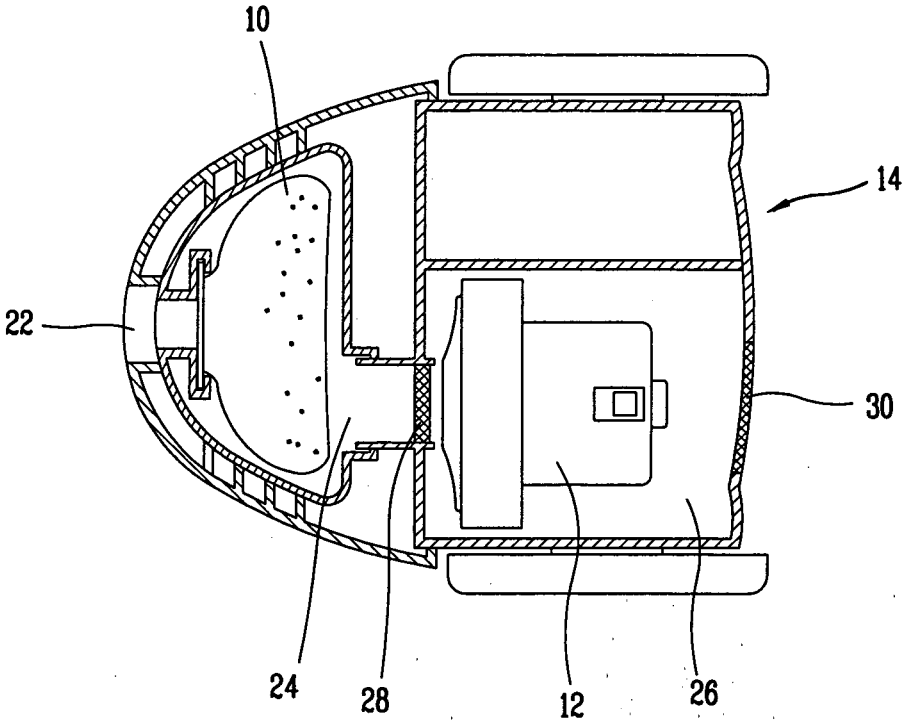


FIG. 5

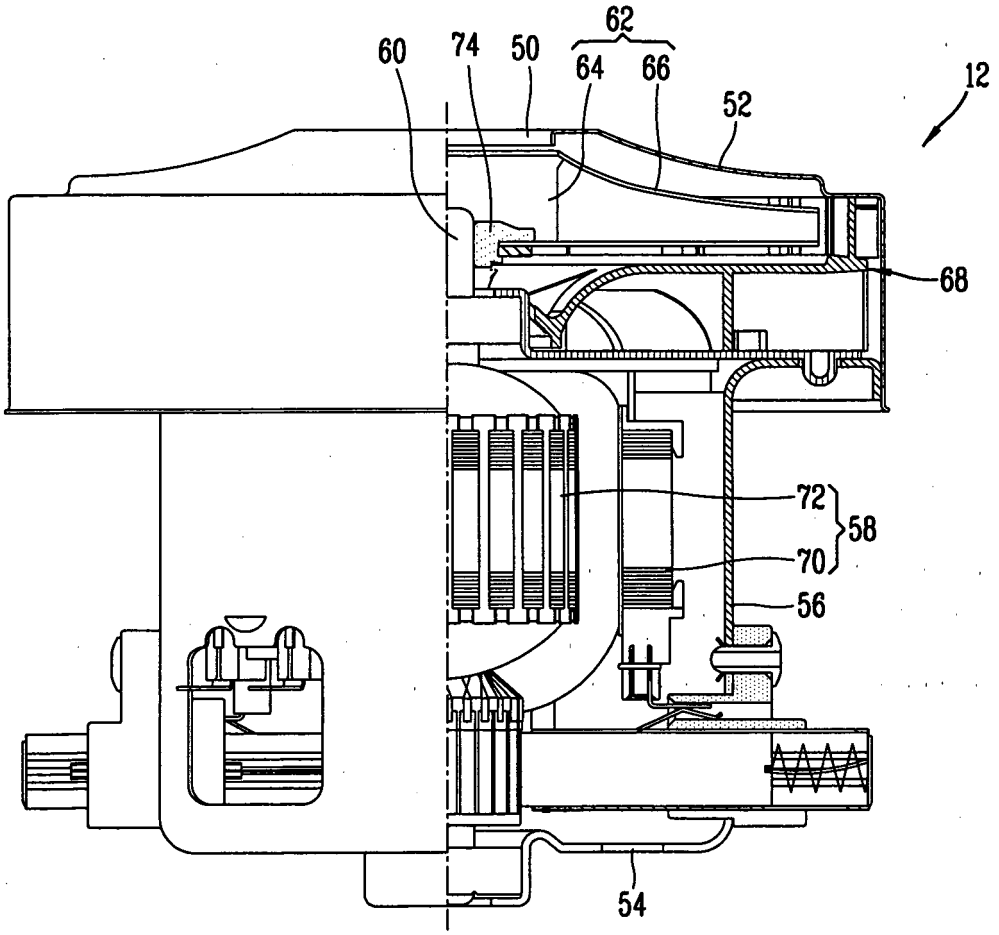


FIG. 6

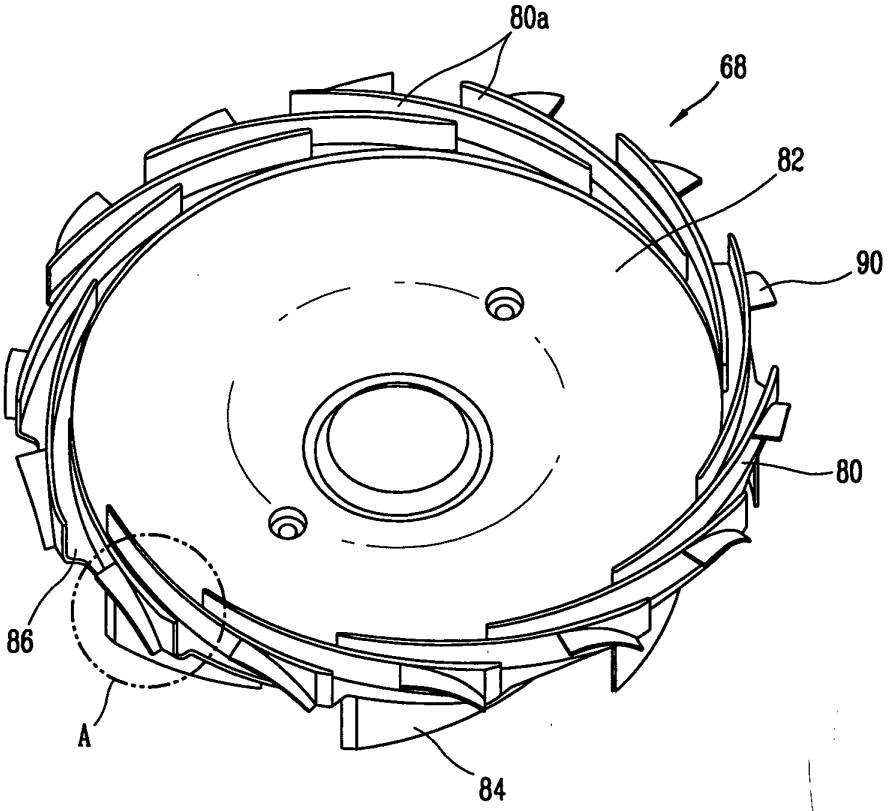


FIG. 7

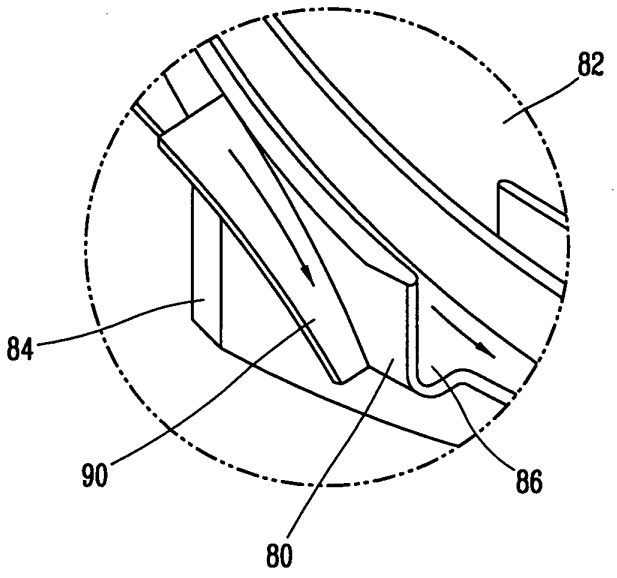


FIG. 8

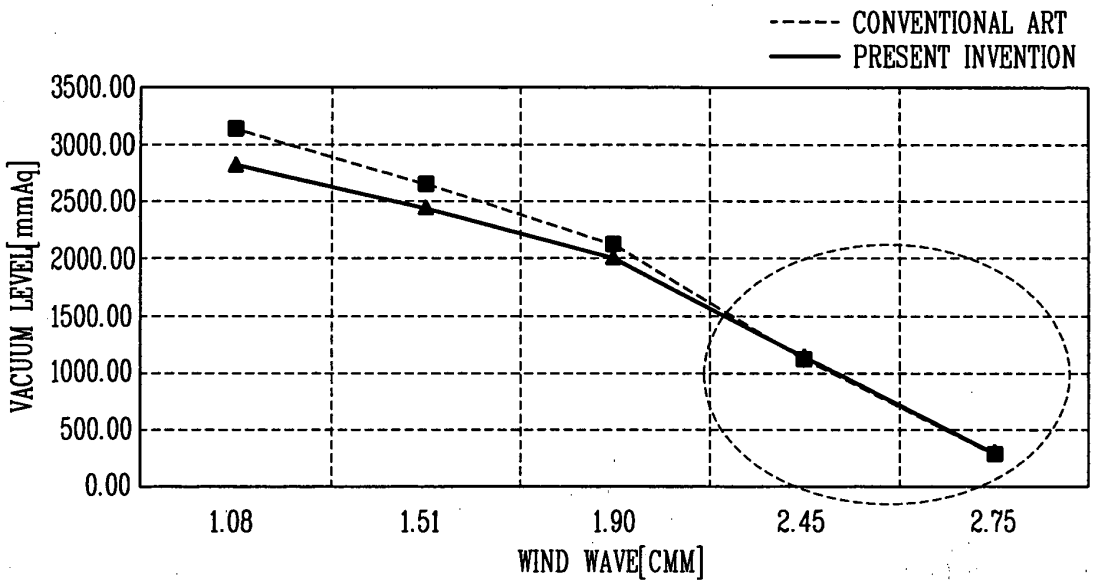

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FIG. 9

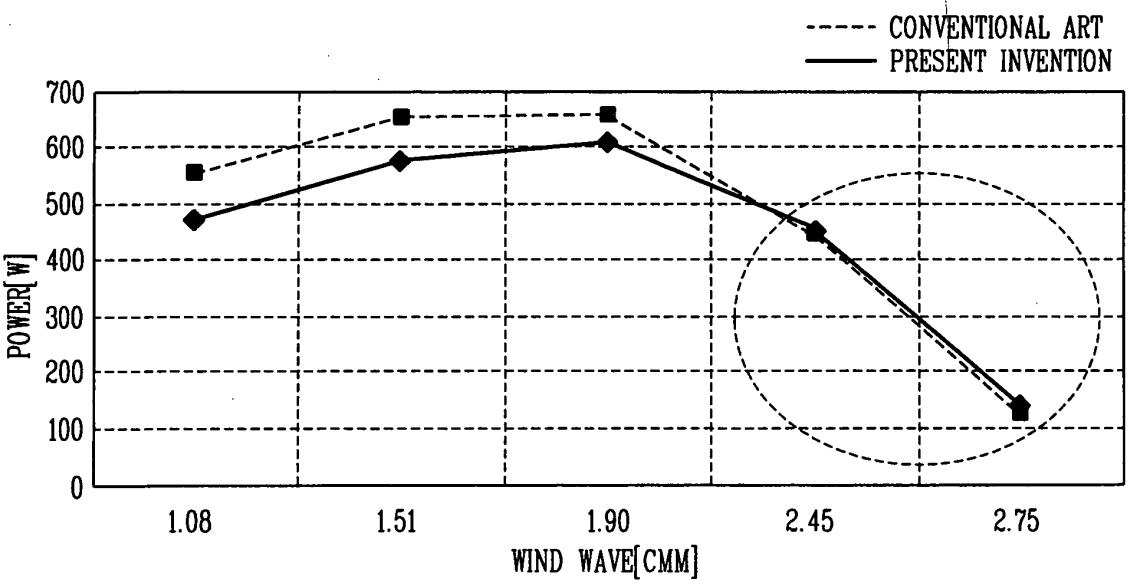
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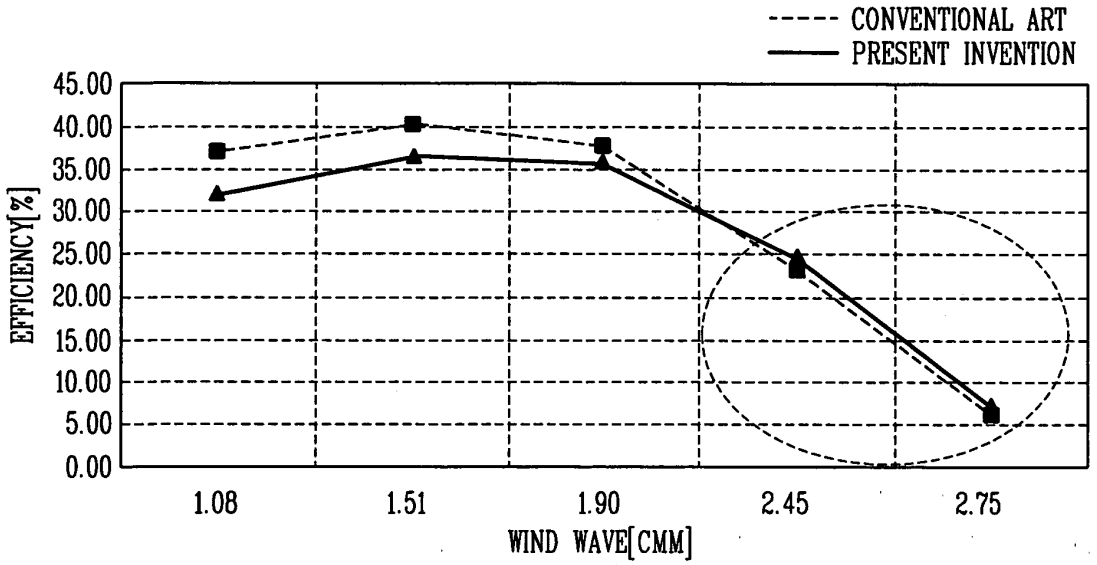
FIG. 10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