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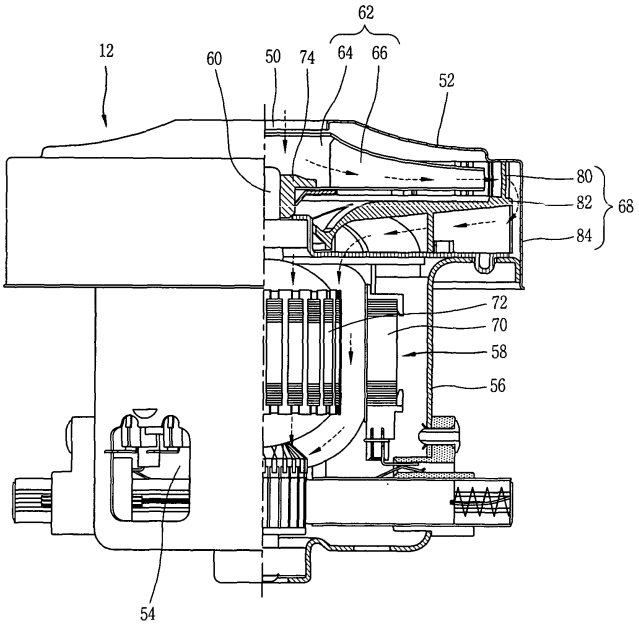
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(54) **Centrifugal fan and vacuum cleaner having the centrifugal fan**

(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 diffuser (80) disposed at an outer circumferential surface of the impeller and increasing a constant pressure of air sent from the impeller; a partition plate (82) installed inside an impeller casing (52); and 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. The diffuser is formed such that each blade (80a) is sloped downward from an inlet towards an outlet. Namely, two adjacent diffuser blades form an air flow path therebetween with each diffuser blade having are relatively greater width at an air inlet portion compared to the width at an air outlet portion. A pressure loss can be reduced and a suction force and efficiency of the fan can be enhanced.

FIG. 5



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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 reducing flow resistance of air forcibly sent from an impeller.

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, bent perpendicularly and is guided to pass through the motor by the rear vane 136 formed at the rear side of the partition plate 134. Air which has cooled the driving motor 110 while passing therethrough is discharged externally through the discharge hole 106 formed at the motor housing 108.

[0008] However, the conventional centrifugal fan constructed as described above has the following problems.

[0009] That is, since air which has passed through the diffuser 132 flows to be bent perpendicularly and then introduced into the rear vane 136 as indicated by the arrow 'R', the direction of the air flow is sharply changed, increasing a flow resistance, a pressure loss is generated to degrade a suction force and efficiency of the fan.

[0010] In addition, the air flow resistance generated as the air flow introduced into the rear vane 136 is sharply changed perpendicularly causes an impact with noise and a pressure loss.

[0011] Namely, the channel resistance generated in the diffuser 132 and the rear vane 136 causes degradation of efficiency by rapidly changing the speed energy of air to pressure energy, and increases a pressure loss of air.

SUMMARY OF THE INVENTION

[0012] Therefore, an object of the present invention is to provide a centrifugal fan capable of reducing a pressure loss and enhancing a suction force and efficiency by reducing air flow resistance by making air pass through a diffuser slopingly downward, and a vacuum cleaner having the centrifugal fan.

[0013] 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 diffuser disposed at an outer circumferential surface of the impeller and increasing a constant pressure of air sent from the impeller; a partition plate installed inside an impeller casing; and 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. The diffuser is formed such that each blade is sloped downward from an inlet towards an outlet. Namely, two adjacent diffuser blades form an air flow path therebetween with each diffuser blade having are relatively greater width at an air inlet portion compared to the width at an air outlet portion.

[0014] The partition plate has an outer edge portion, on which the diffuser is formed, that slopes downward from an inner portion toward an outer circumferential edge thereof.

[0015] The partition plate also has a lower surface that slopes downward from an outer circumferential edge toward an inner portion thereof.

[0016] 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 diffuser disposed at an outer circumferential surface of the impeller and increasing a constant pressure of air sent from the impeller; a partition plate fixed at an inner circumferential surface of an impeller casing; and 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, wherein the diffuser is formed to be sloped downward from the inlet to the outlet.

[0017] 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

[0018] 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.

[0019] 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 a sectional view of the guide vane of the centrifugal fan in accordance with the present invention;
Figure 8 is a side view of the guide vane of the centrifugal fan in accordance with the present invention;
Figure 9 is a top view of the guide vane of the centrifugal fan in accordance with the present invention; and
Figure 10 is a bottom view of the guide vane of the centrifugal fan in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] 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.

[0021] 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, and Figure 5 is a sectional view of a centrifugal fan in accordance with the present invention.

[0022] 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.

[0023] 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.

[0024] As shown in Figure 5, the centrifugal fan 12 includes an impeller casing 52 having 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.

[0025] 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.

[0026] 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.

[0027] Figure 6 is a perspective view of a guide vane of the centrifugal fan in accordance with the present invention, Figure 7 is a sectional view of the guide vane of the centrifugal fan in accordance with the present invention, Figure 8 is a side view of the guide vane of the centrifugal fan in accordance with the present invention, Figure 9 is a top view of the guide vane of the centrifugal fan in accordance with the present invention, and Figure 10 is a bottom view of the guide vane of the centrifugal fan in accordance with the present invention.

[0028] The guide vane 68 includes a diffuser 80 disposed at an outer circumferential surface of the blade 66 of the impeller 62 with a certain interval from an end of the blade 66, and increasing a constant pressure of air sent from the impeller 62; the partition plate 82 fixed at the impeller casing 52, and a rear vane 84 formed at a lower surface of the partition plate 82 and guiding air discharged from the diffuser 80 so as to pass through the driving motor 58.

[0029] The diffuser 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 outlet portion through which air is discharged to the rear vane 84 is larger than an area of an inlet portion to which air sent from the impeller 62 is introduced, whereby air can spread to increase its static pressure and reduce air flow rate.

[0030] The diffuser blades 80a of the diffuser 80 have a curved form in the same direction as a rotation direction of the impeller 62, and has a lower slope from an inlet to an outlet. Namely, the portion of the partition plate 82 on which the diffuser 80 is formed to be sloped downward from an outer circumferential edge toward an inner portion thereof. Accordingly, because the diffuser 80 is formed on the sloped surface 88 of the partition plate 82, the diffuser 80 slopes downward from the inlet to the outlet.

[0031] Since the diffuser blades 80a of the diffuser 80 are sloped from the inner portion to the outer circumferential edge, air passing through the passages 86 between the diffuser blades 80a is discharged to be sloped at a certain angle downward as indicated by an arrow 'P', whereby air flow resistance can be reduced.

[0032] The rear vane 84 includes a plurality of vane blades 86a formed in a spiral form in an outward direction at a lower surface of the partition plate 82 and guides air whose constant pressure has been increased while having passed through the diffuser 80 to the driving motor 58.

[0033] The rear vane 84 has a height which is increased from its edge to the center. Namely, the lower surface of the partition plate 82 has a slope surface 90 sloped at a certain angle from an outer side to the inner side, on which the rear vane 86 is formed, so that the height of the rear vane 86 is gradually increased from its edge to the center of the partition plate 82.

[0034] Since the height of the vane 86 is increased from its edge to the center, air discharged from the diffuser 80 flows slopingly at a certain angle toward the center of the lower surface of the partition plate 82 along the rear vane 86 as indicated by an arrow 'Q', and thus, air flow resistance can be reduced.

[0035] The centrifugal fan in accordance with the present invention operates as follows.

[0036] 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.

[0037] In this case, since the diffuser 80 is formed to be sloped downward from the inner portion toward the outer circumferential edge thereof, air which has passed through the passages 86 is discharged slopingly downward as indicated by the arrow 'P', and thus, its flow resistance can be reduced.

[0038] Having passed through the diffuser 80, air is guided by the rear vane 84 formed at the lower surface of the partition plate 82 and then introduced to the driving motor 58. In this case, since the rear vane 84 has the height increased from the edge to the inner portion, air flows slopingly at a certain angle from the edge to the center of the partition plate 82 as indicated by the arrow 'Q', so its flow resistance can be reduced.

[0039] In this manner, air guided by the rear vane 84 performs the cooling operation on the driving motor 58 while passing between the stator 70 and the rotor 72 of the driving motor 58 and then externally discharged through the discharge hole 54 formed at the motor housing 56.

[0040] As so far described, the centrifugal fan and the cleaner having the centrifugal fan have the following advantages.

[0041] That is, for example, because the diffuser is formed to be sloped downward from the inlet to the outlet, air can be discharged slopingly in the downward direction, and also, because the rear vane is formed to have a slope, air can flow slopingly downward, the air flow resistance can be reduced and a pressure loss can be reduced, and accordingly, a suction force and efficiency of the fan can be enhanced.

[0042] 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 diffuser formed at an upper surface of a partition plate and increasing a constant pressure of air sent from the impeller; and
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, wherein the diffuser is formed to be sloped downward from an inlet towards an outlet.

2. The fan of claim 1, wherein the diffuser includes a plurality of diffuser blades arranged in a circumferential direction at an edge of the partition plate, and a passage allowing air to pass therethrough is provided between diffuser blades, the passage being formed sloped downward from an inlet toward an outlet.

3. The fan of claim 1, wherein the partition plate has an outer edge portion, on which the diffuser is formed, that slopes downward from an inner portion toward an outer circumferential edge thereof.

4. The fan of claim 1, wherein the rear vane has a height that is gradually increased from an edge portion to an inner portion thereof.

5. The fan of claim 1, wherein the partition plate has a lower surface that slopes downward form an outer circumferential edge toward an inner portion thereof.

6. 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 diffuser formed at an upper surface of a partition plate and increasing a constant pressure of air sent from the impeller; and
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,

wherein the diffuser is formed to be sloped downward from the inlet to the outlet.

7. The cleaner of claim 6, wherein the diffuser includes a plurality of diffuser blades arranged in a circumferential direction at an edge of the partition plate, and a passage allowing air to pass therethrough is provided between diffuser blades, the passage being formed sloped downward from an inlet toward an outlet.

8. The cleaner of claim 6, wherein the partition plate has an outer edge portion, on which the diffuser is formed, that slopes downward from an inner portion toward an outer circumferential edge thereof.

9. The cleaner of claim 6, wherein the rear vane has a height that is gradually increased from an edge portion to an inner portion thereof.

10. The cleaner of claim 6, wherein the partition plate has a lower surface that slopes downward form an outer circumferential edge toward an inner portion thereof.

FIG. 1

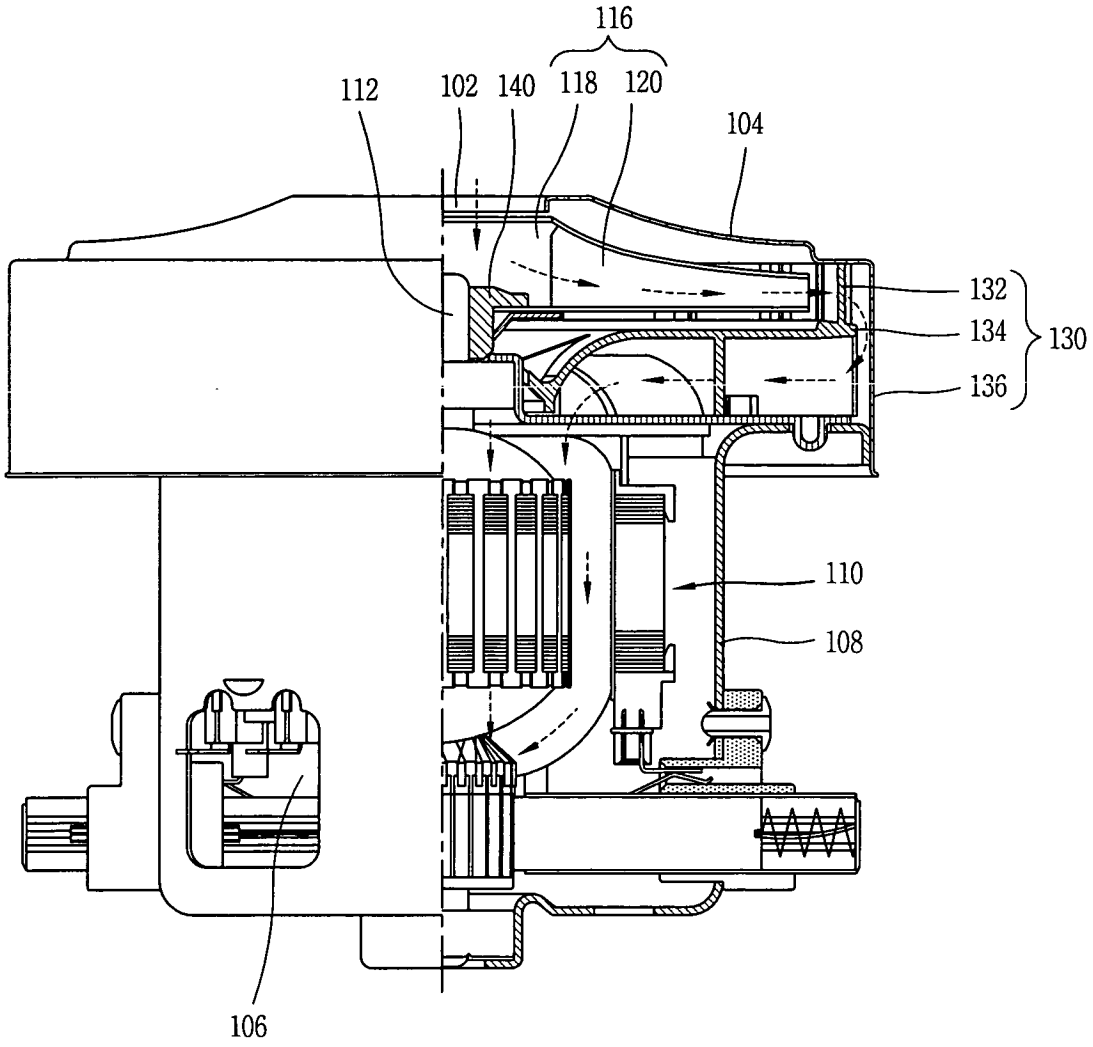

116
112
102
140
118
120
104
132
134
130
136
110
108
106

FIG. 2

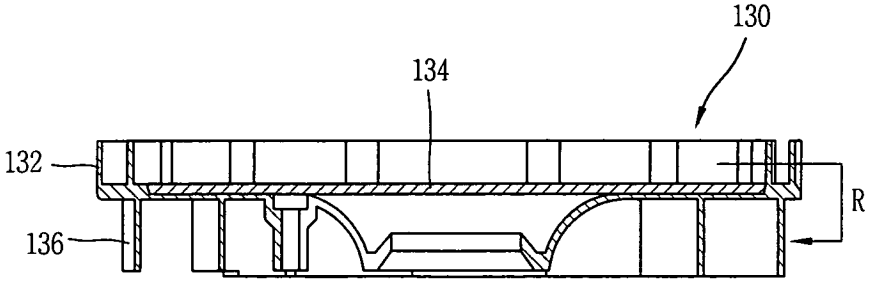

130
134
132
136
R

FIG. 3

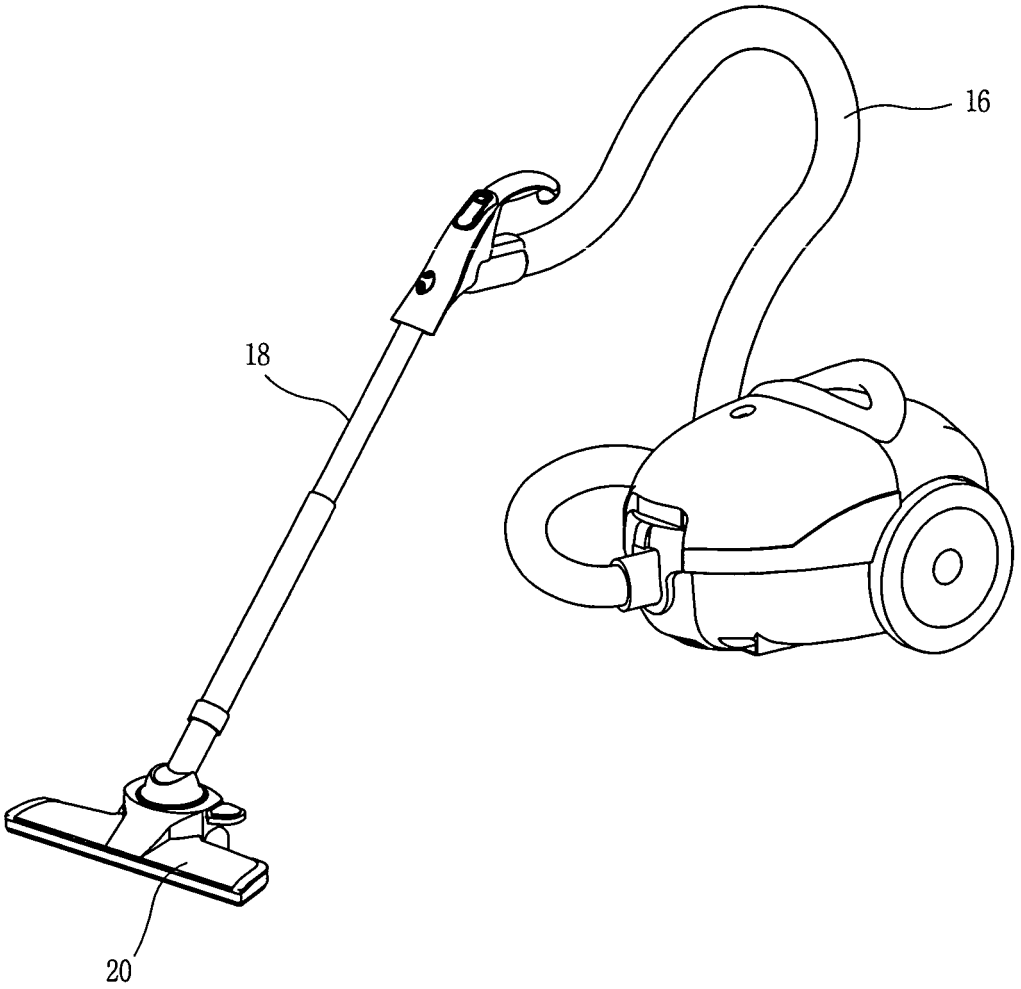


FIG. 4

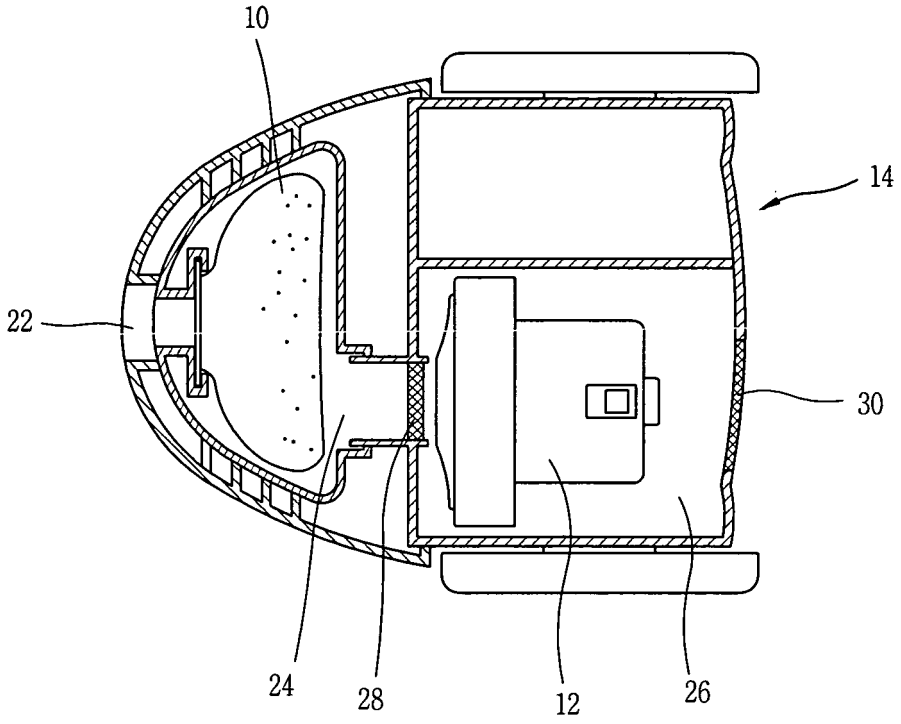


FIG. 5

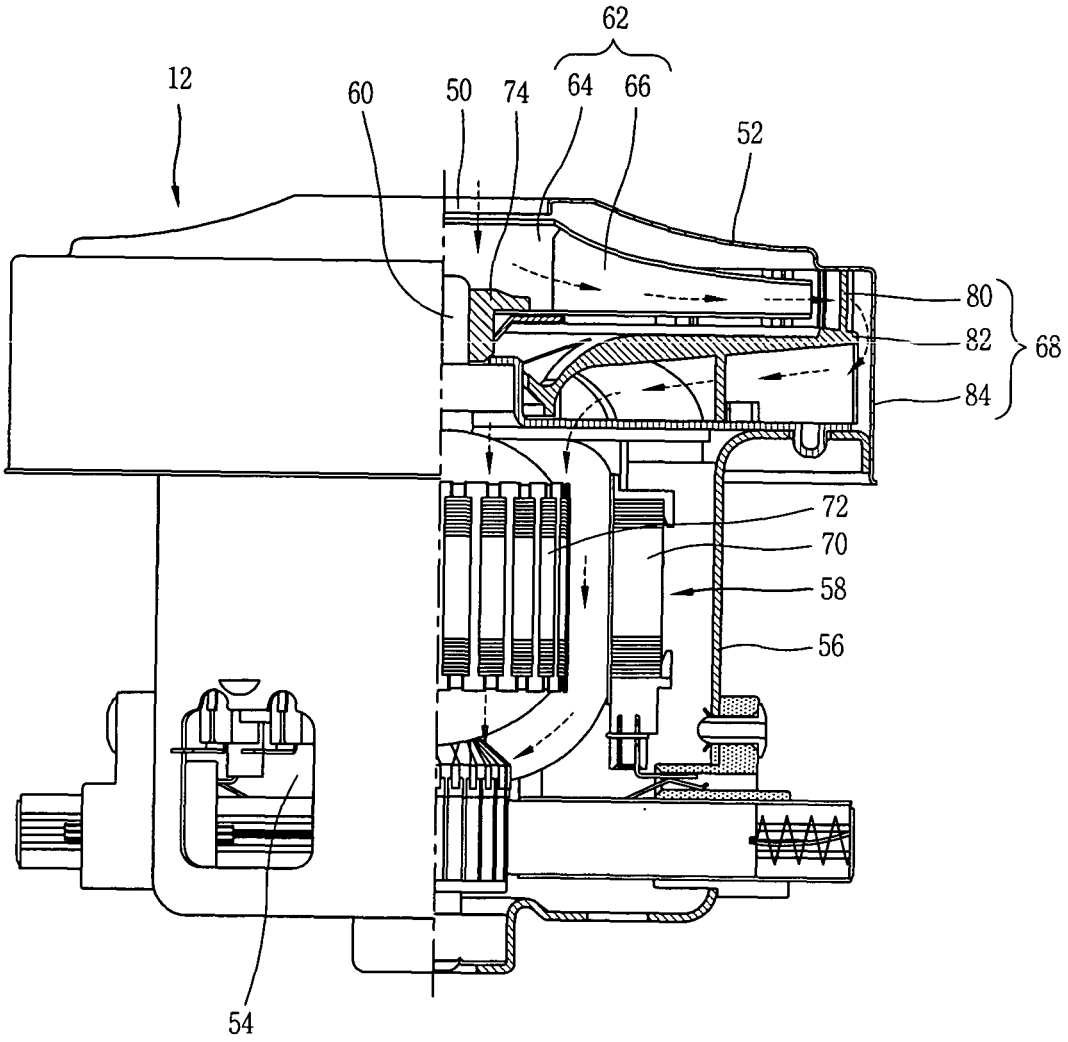


FIG. 6

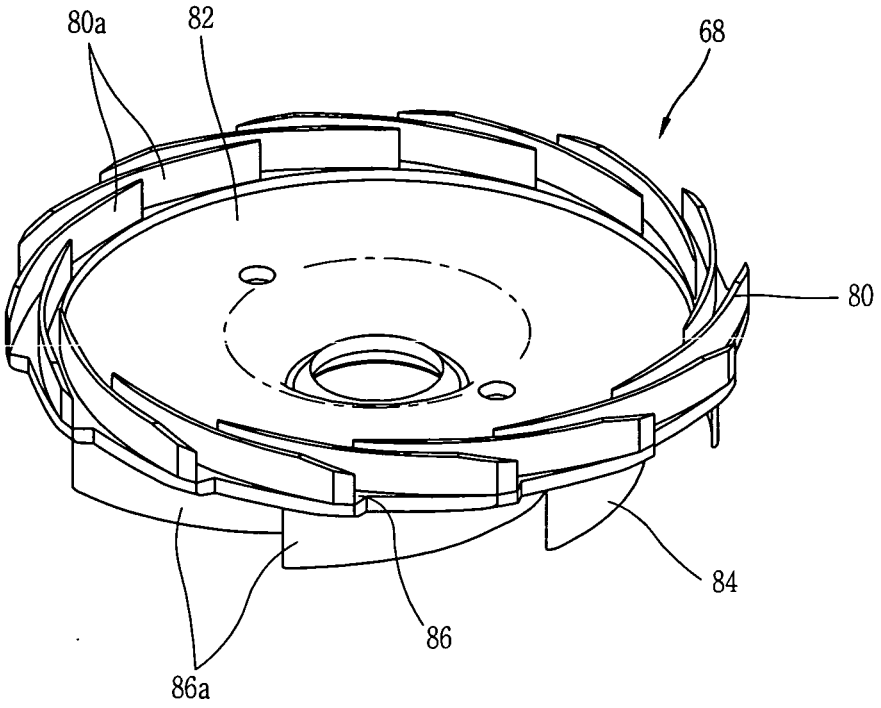


FIG. 7

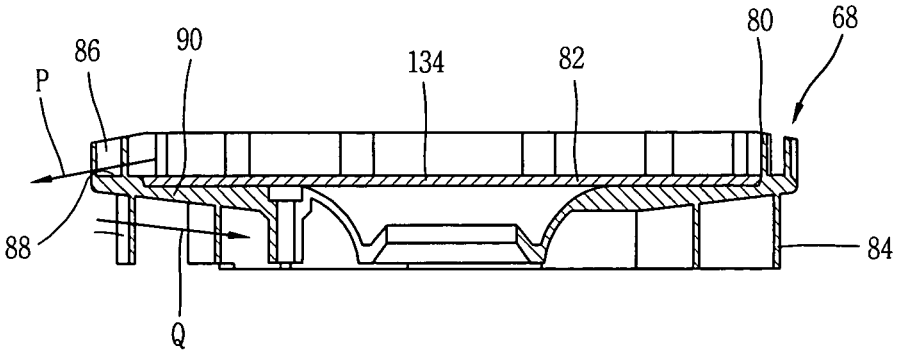


FIG. 8

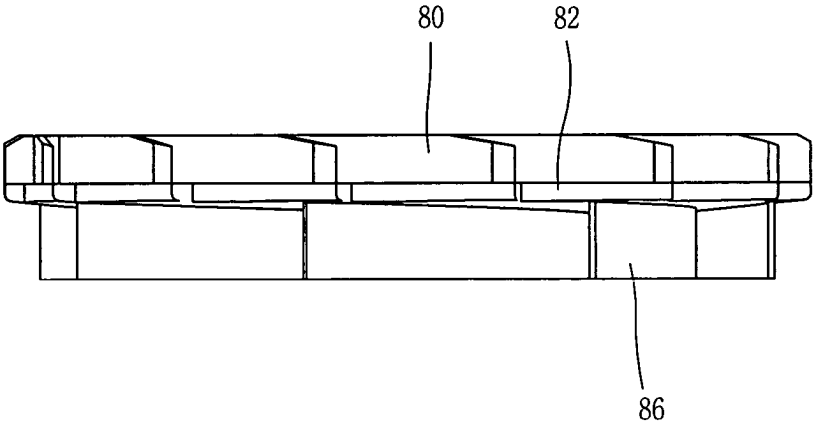


FIG. 9

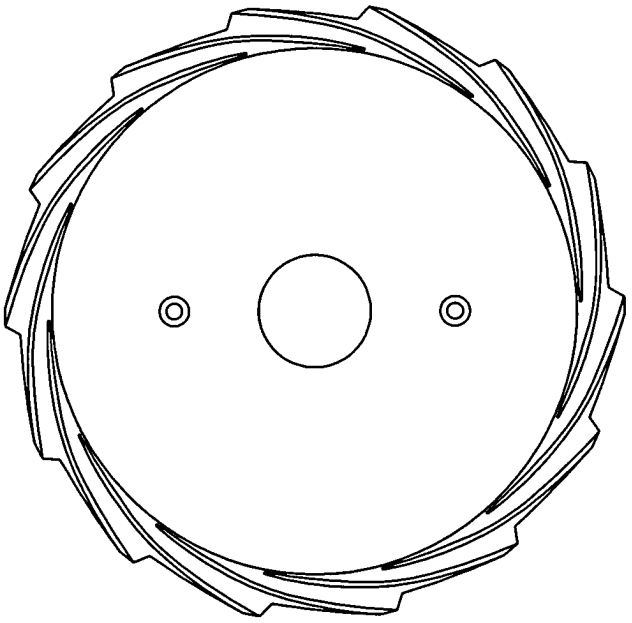


FIG. 10

