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

(11) EP 1 297 772 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.04.2003 Bulletin 2003/14

(51) Int Cl.[7]: **A47L 5/22**, A47L 9/22

(21) Application number: **02013503.4**

(22) Date of filing: **17.06.2002**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **26.09.2001 KR 2001059485**
03.01.2002 KR 2002000250
03.01.2002 KR 2002000253

(71) Applicant: **LG ELECTRONICS INC.**
Seoul 150-010 (KR)

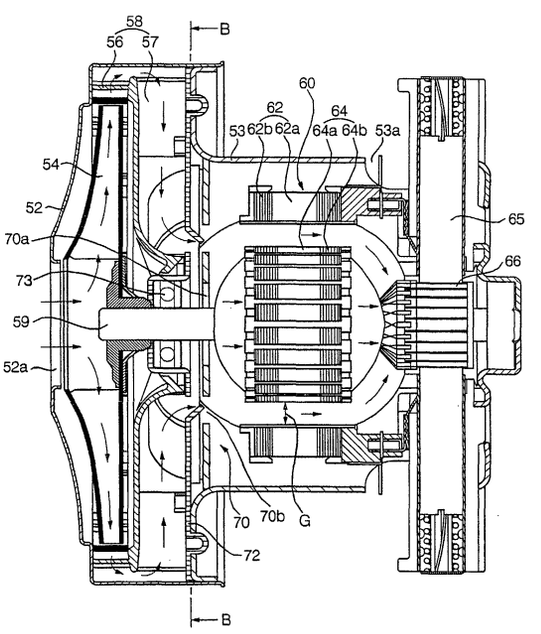
(72) Inventors:
- **Rew, Ho Seon**
  Seoul 121-140 (KR)
- **Lee, Young Woo**
  Kangnam-ku, Seoul 120-191 (KR)

(74) Representative:
TER MEER STEINMEISTER & PARTNER GbR
Patentanwälte,
Mauerkircherstrasse 45
81679 München (DE)

(54) Centrifugal blower for vacuum cleaner

(57) Disclosed is a centrifugal blower for a vacuum cleaner capable of achieving an improvement in motor cooling efficiency. The centrifugal blower includes air guides so that air sequentially passing through an impeller (54), diffuser vanes (56), and guide vanes (7) is guided in a concentrated fashion toward the rotor (64) of a motor (60). Accordingly, the rotor (64) generating a large amount of heat during operation of the motor (60) is effectively cooled, so that it is possible to achieve an improvement in the reliability of the motor while extending the life span of the motor, and reducing the insulation grade of the motor.

FIG. 6



EP 1 297 772 A2

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a centrifugal blower for a vacuum cleaner capable of achieving an improvement in motor cooling efficiency, and more particularly to a centrifugal blower for a vacuum cleaner in which air is blown toward a rotor generating a large amount of heat during operation of its motor, thereby being capable of achieving an improvement in motor cooling efficiency.

Description of the Related Art

[0002] As well known, a vacuum cleaner is a cleaning appliance adapted to generate a sucking force, thereby removing foreign matters such as dust. Such a vacuum cleaner is equipped with a dust collecting bag for filtering air sucked along a suction path, and a centrifugal blower adapted to generate a sucking force for sucking air.

[0003] Fig. 1 is a sectional view illustrating a conventional centrifugal blower for a vacuum cleaner. Fig. 2 is a perspective view illustrating a diffuser included in the conventional centrifugal blower. Fig. 3 is a cross-sectional view taken along the line A - A of Fig. 1.

[0004] As shown in Fig. 1, the conventional centrifugal blower for a vacuum cleaner includes an impeller 4 rotatably installed in an impeller housing 2 provided at a front end thereof with a suction port 2a, and a motor 10 installed in a motor housing 3, and adapted to rotate the impeller 4. The motor housing 3 is coupled at a front end thereof to a rear end of the impeller housing 2, and provided at side portions thereof with a plurality of discharge ports 3a.

[0005] A diffuser 8 is installed between the impeller 4 and the motor 10. As shown in Figs. 2 and 3, the diffuser 8 is provided at its front surface with diffuser vanes 6 for feeding air discharged from the outlet of the impeller 4 in a pressurized state. The diffuser 8 is also provided at its rear surface with guide vanes 7 for guiding the pressurized air fed by the diffuser vanes 6 to the motor 10.

[0006] Fig. 4 is a perspective view illustrating the motor of the conventional centrifugal blower used for vacuum cleaners. Fig. 5 is a plan view illustrating a bearing supporter mounted to the motor of the conventional centrifugal blower.

[0007] As shown in Fig. 4, the motor, which is denoted by the reference numeral 10, includes a stator 12 having a field core 12a fixedly mounted to an inner wall of the motor housing 3, and a field coil 12b wound around the field core 12a. The motor 10 also includes a rotor 14 having an armature core 14a mounted to a rotating shaft 9 connected to the impeller 4 while being inwardly spaced apart from the rotor 12, and an armature coil 14b wound around the armature core 14a. The motor 10 further includes a brush 15, and a commutator 16 which are arranged at the rear of the rotor 14, that is, connected to a rear end of the rotating shaft 9, in order to supply external electric power to the field coil 12b and the armature coil 14b. An air gap G with a desired dimension is defined between the stator 12 and the rotor 14.

[0008] The motor 10 having the above mentioned configuration is driven by single-phase power. When current flows through the field coil 12b and armature coil 14b in accordance with serial connection of the field coil 12b, brush 15, commutator 16, and armature coil 14b to the single-phase power, magnetic flux is generated at the field coil 12b and armature coil 14b.

[0009] As a result, interacting electromagnetic forces are generated between the stator 12 and the rotor 14, so that a torque is generated. By the torque, the rotor 14 rotates, so that the rotating shaft 9 connected to the rotor 14 is rotated.

[0010] Air passing through the impeller 4 and diffuser 8 is collected by an air collecting plate 20 which, in turn, discharges the collected air in a concentrated fashion toward the air gap G defined between the stator 12 and the rotor 14 via cooling holes 20a and 20b formed at the air collecting plate 20, and toward the rotor 14, thereby cooling the motor 10. After cooling the motor 10, the air is outwardly discharged through the discharge ports 3a of the motor housing 3.

[0011] Although the air emerging from the impeller 4 and diffuser 8 is discharged in a concentrated fashion toward the air gap G defined between the stator 12 and the rotor 14 by the air collecting plate 20, the rotor 14 generating a relatively large amount of heat during operation of the motor 10 is insufficiently cooled because the armature coil 14b is shielded by a bearing supporter 22 arranged between the impeller housing 2 and the motor housing 3 to support a bearing 23 for rotatably supporting the rotating shaft 9 of the motor 10, as shown in Fig. 5.

[0012] Although the air emerging from the air collecting plate 20 is fed toward the rotor 14, it is forced to move toward the stator 12 without reaching the rotor 14 as the rotor 14 rotates at high speed. For this reason, it is difficult to cool the rotor 14 maintained at a relatively high temperature, as compared to the stator 12.

[0013] As a result, the armature coil 14b of the rotor 14 is excessively increased in temperature, so that the cooling characteristics of the armature coil 14b are degraded, thereby causing a degradation in the reliability of the motor 10. Furthermore, the life span of the motor 10 is reduced. In order to extend the life span of the motor 10, it is necessary to improve the insulation grade of the motor 10. For example, the material of the armature coil 14b should be replaced. Thus, there is a problem of inconvenience.

SUMMARY OF THE INVENTION

[0014] Therefore, the present invention has been

made in view of the above mentioned problems involved with the related art, and an object of the invention is to provide a centrifugal blower for a vacuum cleaner in which air passing through an impeller and a diffuser is blown toward the armature coil of a rotor having great influence on the reliability and life span of a motor including the rotor, thereby being capable of achieving an improvement in the reliability of the motor while extending the life span of the motor.

[0015] Another object of the invention is to provide a centrifugal blower for a vacuum cleaner in which air fed toward a motor included in the blower is allowed to mainly pass through the rotor even when the rotor of the motor rotates at high speed, thereby being capable of achieving an enhancement in motor cooling efficiency while reducing the insulation grade of the motor.

[0016] In accordance with the present invention, these objects are accomplished by providing a centrifugal blower for a vacuum cleaner comprising: a motor including a stator, and a rotor rotatably installed in the stator; an impeller connected with the rotor by a rotating shaft, and adapted to rotate in accordance with a drive force received from the motor via the rotating shaft, thereby sucking air; a diffuser installed between the motor and the impeller, the diffuser having guide vanes adapted to guide air discharged from the impeller toward the motor; and guide means for guiding the air emerging from the guide vanes toward the rotor of the motor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The above objects, and other features and advantages of the present invention will become more apparent after a reading of the following detailed description when taken in conjunction with the drawings, in which:

Fig. 1 is a sectional view illustrating a conventional centrifugal blower for a vacuum cleaner;
Fig. 2 is a perspective view illustrating a diffuser included in the conventional centrifugal blower;
Fig. 3 is a cross-sectional view taken along the line A - A of Fig. 1;
Fig. 4 is a perspective view illustrating a motor used in the conventional centrifugal blower;
Fig. 5 is a plan view illustrating a bearing supporter mounted to the motor of the conventional centrifugal blower;
Fig. 6 is a sectional view illustrating a centrifugal blower for a vacuum cleaner according to the present invention;
Fig. 7 is a perspective view illustrating a diffuser included in the centrifugal blower according to the present invention;
Fig. 8 is a cross-sectional view taken along the line B - B of Fig. 6;
Fig. 9 is a perspective view illustrating a motor included in the centrifugal blower according to the present invention;
Fig. 10 is a plan view illustrating a bearing supporter mounted to the motor of the centrifugal blower according to the present invention;
Fig. 11 is a sectional view illustrating the bearing supporter according to the present invention;
Fig. 12 is a plan view illustrating a bearing supporter plate according to an embodiment of the present invention; and
Fig. 13 is a plan view illustrating a bearing supporter plate according to another embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Now, preferred embodiments of the present invention will be described in detail, with reference to the annexed drawings.

[0019] Fig. 6 is a sectional view illustrating a centrifugal blower for a vacuum cleaner according to the present invention. Fig. 7 is a perspective view illustrating a diffuser included in the centrifugal blower according to the present invention. Fig. 8 is a cross-sectional view taken along the line B - B of Fig. 6. Fig. 9 is a perspective view illustrating a motor included in the centrifugal blower according to the present invention. Fig. 10 is a plan view illustrating a bearing supporter mounted to the motor of the centrifugal blower according to the present invention. Fig. 11 is a sectional view illustrating the bearing supporter according to the present invention.

[0020] As shown in Fig. 6, the centrifugal blower for vacuum cleaners according to the present invention includes an impeller housing 52 centrally provided at a front wall thereof with a suction port 52a, an impeller 54 rotatably installed in the impeller housing 52, and adapted to suck air from the suction port 52a, a motor housing 53 connected at a front wall thereof to a rear wall of the impeller housing 52, and provided at side walls thereof with a plurality of discharge ports 53a, and a motor 60 installed in the motor housing 53, and adapted to rotate the impeller 54. The motor 60 includes a stator 62, and a rotor 64. The centrifugal blower also includes a diffuser 58 installed between the impeller 54 and the motor 60, and adapted to guide air discharged from the impeller 54 toward the motor 60 while increasing the pressure of the air, and a guide means for guiding the air emerging from the diffuser 58 toward the rotor 64 in a concentrated fashion.

[0021] As shown in Fig. 7, the diffuser 58 is provided at its front surface with diffuser vanes 56 for increasing the pressure of air emerging from the outlet of the impeller 54. The diffuser 58 is also provided at its rear surface with guide vanes 7 for guiding the pressurized air fed by the diffuser vanes 56 to the motor 60.

[0022] The motor 60 includes a stator 62 having a field core 62a fixedly mounted to an inner wall of the motor housing 53, and a field coil 62b wound around the field

core 62a. The motor 60 also includes a rotor 64 having an armature core 64a mounted to a rotating shaft 59 connected to the impeller 54, and an armature coil 64b wound around the armature core 64a. The motor 10 further includes a brush 65, and a commutator 66 which are arranged at the rear of the rotor 64, that is, connected to a rear end of the rotating shaft 59, in order to supply external electric power to the field coil 62b and the armature coil 64b. An air gap G is defined between the stator 62 and the rotor 64.

[0023] As shown in Figs. 8 and 9, a bearing supporter 72 is arranged between the impeller housing 52 and the motor housing 53 to support a bearing 73 for rotatably supporting the rotating shaft 59 of the motor 60. An air collecting plate 70 is also installed between the bearing supporter 72 and the motor housing 53. The air collecting plate 70 collects air fed toward the motor 60 after emerging from the impeller 54, and discharges the collected air toward the air gap G defined between the stator 62 and the rotor 64 in a concentrated fashion.

[0024] The air collecting plate 70 is provided at its central portion with a cooling hole 70a opened to the front surface of the rotor 64, and at its opposite lateral portions with cooling holes 70b opened to the air gap G.

[0025] As shown in Figs. 7 and 8, the guide means comprises holes 82 formed at the bearing support 72, and opened to the front surface of the rotor 64, air guides 57a adapted to guide air discharged from the guide vanes 57 to the holes 82, and guide portions 86 each formed at the bearing supporter 72 to have a structure bent toward an associated one of the holes 82 by a desired angle θ, and adapted to guide air emerging from the associated hole 82 to the rotor 64.

[0026] The guide means has two holes 82 respectively formed at opposite portions of the bearing support 72. The holes 82 may have diverse shapes, for example, a rectangular shape, or an arc shape with a desired width. Each of the air guides 57a is provided by extending the tip of a selected one of the guide vanes 57 toward the center of the diffuser 58 so as to guide air guided by the selected guide vane 57 to the holes 82.

[0027] That is, a plurality of guide vanes 57 are arranged at the rear surface of the diffuser 58 around the rotating shaft 59 while being uniformly spaced from one another in a circumferential direction, and having a structure curved in the clockwise direction. The air guides 57a are formed by extending, toward the holes 82, respective outlet ends of the guide vanes 57 positioned near those holes 82.

[0028] As shown in Fig. 10, each guide portion 86 is rearwardly inclined toward the rotor 64 while having an inclined angle θ of 0 to 70 ° with respect to the surface of the bearing supporter 72.

[0029] As shown in Fig. 9, the motor 60 includes two poles 62a' protruded from the inner surface of the field core 62a while facing each other. The field coils 62b are wound around the poles 62a', respectively. The motor 60 also includes air guide members 88 mounted to inner surface portions of the field core 62a not formed with the poles 62a'. Each of the air guide members 88 prevents air fed toward the rotor 64 from being moved toward the stator 12 without reaching the rotor as the rotor 14 rotates at high speed, so as to allow the air to be effectively guided to the rotor 64.

[0030] The air guide members 88 are arranged at the portions of the field core 62a not formed with the poles 62a' while facing each other. Each air guide member 88 has a convex central portion, and opposite ends fixedly mounted to the inner surface of the field core 62a.

[0031] Since each air guide member 88 is arranged between the stator 62 and rotor 64 generating interacting electromagnetic forces, it should be made of an insulating material.

[0032] By the poles 62a' and air guide members 88, the air fed toward the rotor 64 is reliably guided to pass through the rotor 64 even when the rotor 64 rotates at high speed. Thus, the rotor 64 is effectively cooled.

[0033] Fig. 12 is a plan view illustrating a bearing supporter plate according to an embodiment of the present invention. Fig. 13 is a plan view illustrating a bearing supporter plate according to another embodiment of the present invention.

[0034] The embodiment of Fig. 12 is associated with a bearing supporter plate 90 in which the above described bearing supporter and air collecting plate are integral with each other. As shown in Fig. 12, the bearing supporter plate 90 is provided at its left and right portions with first holes 92 for discharging a part of air emerging from the guide vanes 57 toward the stator 62 of the motor 60, and at its upper and lower portions with second holes 94 for discharging the remaining part of the air emerging from the guide vanes 57 toward the rotor 64.

[0035] A pair of first holes 92 are symmetrically arranged around the rotating shaft 59. Similarly, a pair of second holes 94 are symmetrically arranged around the rotating shaft 59.

[0036] Each first hole 92 has an arc shape with a desired width, whereas each second hole 94 has a rectangular shape with a desired width. The first holes 92 are radially spaced from the center of the rotating shaft 59 by a distance longer than that of the second holes 94 from the center of the rotating shaft 59.

[0037] Now, the operation of the centrifugal blower having the above described configuration according to the present invention will be described.

[0038] When current from an external power supply is supplied to the motor 60 via the brush 65 and commutator 66, magnetic flux is generated at the field coil 62b and armature coil 64b. As a result, interacting electromagnetic forces are generated between the stator 62 and the rotor 64, so that a torque is generated. By the torque, the rotor 14 rotates, so that the rotating shaft 59 connected to the rotor 64 is rotated. Thus, the impeller 54 is rotated.

[0039] In accordance with the rotation of the impeller 54, air is introduced into the impeller housing 52, so that

it passes through the impeller 54. The air discharged from the impeller 54 then flows along the guide vanes 57 after flowing along the diffuser vanes 56.

[0040] A part of the air discharged from the guide vanes 57 is guided by the air guides 57a to enter the holes 82 formed at the bearing supporter 72, and then discharged toward the rotor 64 in a concentrated fashion along the guide portions 86 formed at the holes 82.

[0041] The remaining air part guided along the guide vanes 57 without being guided by the air guides 57a is collected by the air collecting plate 70 while being increased in pressure. Thus, the collected air is discharged at high speed toward the air gap G defined between the stator 62 and the rotor 64 via the cooling holes 70a and 70b formed at the air collecting plate 70, and toward the rotor 64.

[0042] Although the air discharged toward the rotor 64 tends to move radially outwardly due to a centrifugal force generated as the rotor 64 rotates at high speed, it is guided to pass through the rotor 64 without flowing toward the stator 62 by virtue of the poles 62a' and air guide members 88 arranged around the rotor 64. Thus, the rotor 64 is effectively cooled in a concentrated fashion.

[0043] Meanwhile, the air discharged toward the air gap G defined between the stator 62 and the rotor 64 cools both the stator 62 and the rotor 64, thereby preventing the motor 60 from overheating.

[0044] After cooling the motor 60, the air is outwardly discharged through the discharge ports 53a of the motor housing 53.

[0045] As apparent from the above description, the present invention provides a centrifugal blower for a vacuum cleaner in which air passing through an impeller and a diffuser is guided to holes and guide portions formed at a bearing supporter by air guides, so that it is discharged toward the armature coil of a rotor having great influence on the reliability and life span of a motor including the rotor, thereby being capable of achieving an improvement in the reliability of the motor while extending the life span of the motor.

[0046] In accordance with the present invention, air fed toward the motor is allowed to mainly pass through the rotor even when the rotor rotates at high speed. Accordingly, it is possible to achieve an enhancement in motor cooling efficiency while reducing the insulation grade of the motor.

[0047] Although the preferred embodiments of the invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

1. A centrifugal blower for a vacuum cleaner comprising:

a motor including a stator, and a rotor rotatably installed in the stator;
an impeller connected with the rotor by a rotating shaft, and adapted to rotate in accordance with a drive force received from the motor via the rotating shaft, thereby sucking air;
a diffuser installed between the motor and the impeller, the diffuser having guide vanes adapted to guide air discharged from the impeller toward the motor; and
guide means for guiding the air emerging from the guide vanes toward the rotor of the motor.

2. The centrifugal blower according to claim 1, wherein the guide means is provided at a bearing supporter installed between the diffuser and the motor, the bearing supporter having a central hole in which a bearing fitted around the rotating shaft is fitted.

3. The centrifugal blower according to claim 2, wherein the guide means comprises holes formed at the bearing supporter, and adapted to guide the air emerging from the guide vanes of the diffuser to be discharged toward the rotor.

4. The centrifugal blower according to claim 3, wherein each of the holes has a rectangular shape.

5. The centrifugal blower according to claim 3, wherein each of the holes has an arc shape with a desired width.

6. The centrifugal blower according to claim 3, wherein the number of the holes is two, and the holes are symmetrically arranged around a center of the bearing supporter.

7. The centrifugal blower according to claim 3, wherein the guide means further comprises guide portions each formed at the bearing supporter to have a structure bent toward an associated one of the holes by a desired angle, and adapted to guide air emerging from the associated hole to the rotor.

8. The centrifugal blower according to claim 7, wherein each of the guide portions is inclined toward the rotor while having an inclined angle of 0 to 70 ° with respect to a main surface of the bearing supporter.

9. The centrifugal blower according to claim 1, wherein the diffuser further has air guides adapted to guide air toward the guide means.

10. The centrifugal blower according to claim 9, wherein the air guides are formed by extending respective tips of selected ones of the guide vanes toward the

guide means, the selected guide vanes being at least a part of all the guide vanes.

11. The centrifugal blower according to claim 1, wherein a bearing supporter plate is installed between the diffuser and the motor, the bearing supporter having a central hole, in which a bearing fitted around the rotating shaft is fitted, and serving to collect air emerging from the guide vanes of the diffuser; and

the guide means comprises first holes formed at the bearing supporter plate while being symmetrically arranged around a center of the bearing supporter plate and opened to the rotor, and second holes formed at the bearing supporter plate while being symmetrically arranged around the center of the bearing supporter plate and opened to the stator.

12. The centrifugal blower according to claim 11, wherein the first holes have a rectangular shape.

13. The centrifugal blower according to claim 11, wherein the first holes have an arc shape with a desired width.

14. The centrifugal blower according to claim 1, wherein the motor is provided with air guide members for guiding air introduced between the stator and the rotor to pass through the rotor without flowing toward the stator.

15. The centrifugal blower according to claim 14, wherein each of the air guide members has a convex central portion, and opposite ends fixedly mounted to the stator.

16. The centrifugal blower according to claim 14, wherein each of the air guide members is made of an insulating material.

17. A centrifugal blower for a vacuum cleaner comprising a motor including a stator, and a rotor rotatably installed in the stator, an impeller connected with the rotor by a rotating shaft, and adapted to rotate in accordance with a drive force received from the motor via the rotating shaft, thereby sucking air, and a diffuser installed between the motor and the impeller, the diffuser having guide vanes adapted to guide air discharged from the impeller toward the motor, further comprising:

air guide members installed at the stator of the motor, and adapted to guide air introduced into the motor toward the rotor.

FIG. 1(Prior Art)

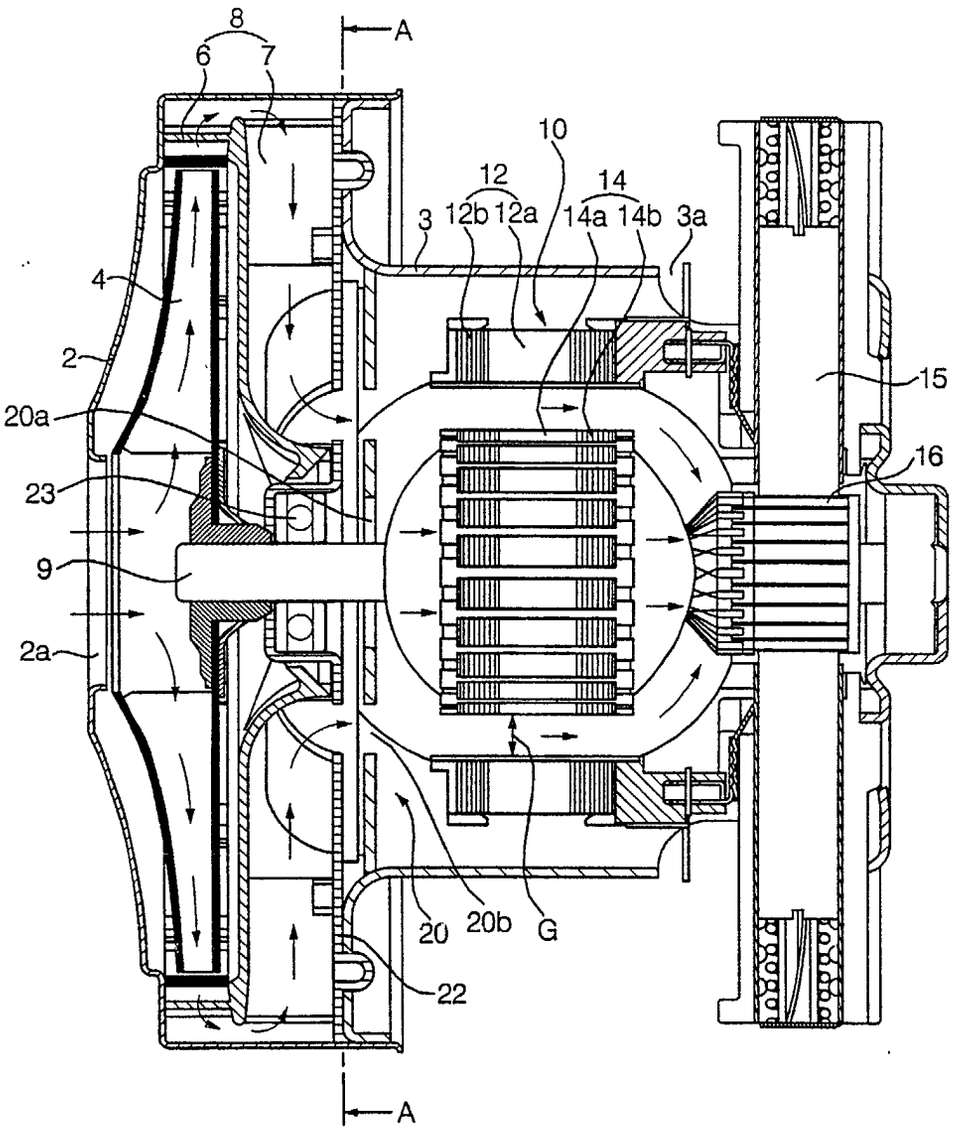


FIG. 2(Prior Art)

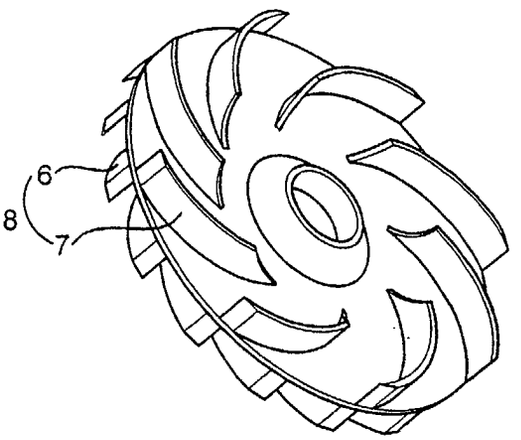


FIG. 3(Prior Art)

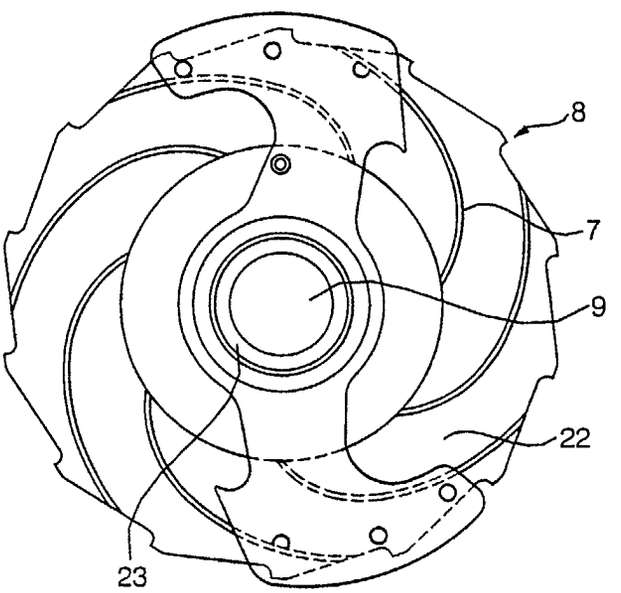


FIG. 4(Prior Art)

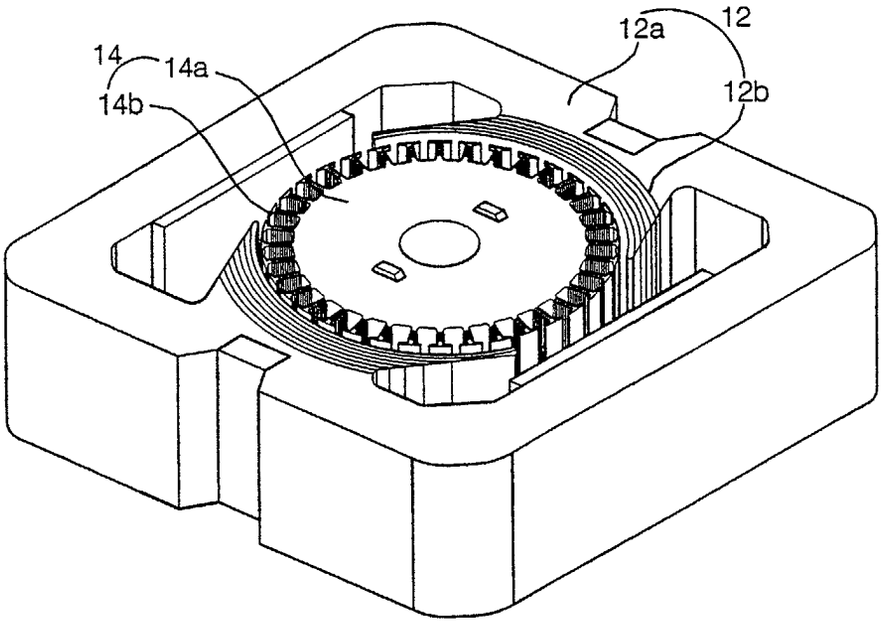


FIG. 5(Prior Art)

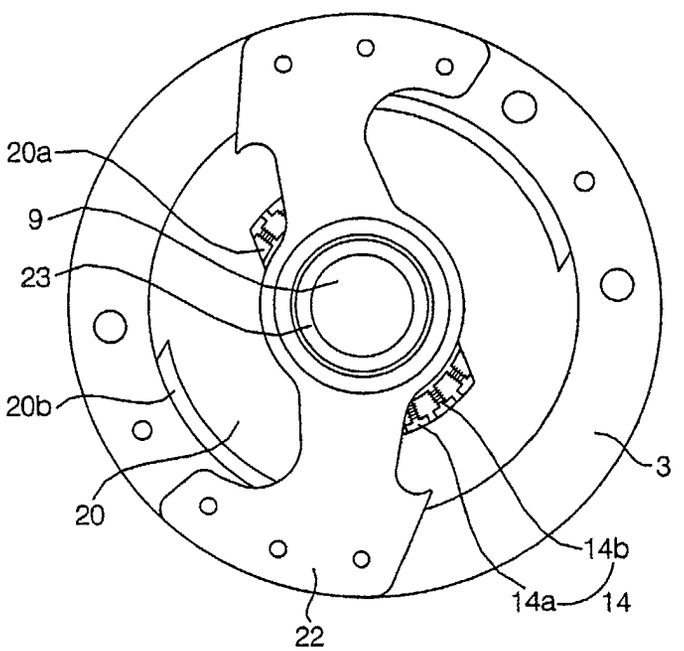


FIG. 6

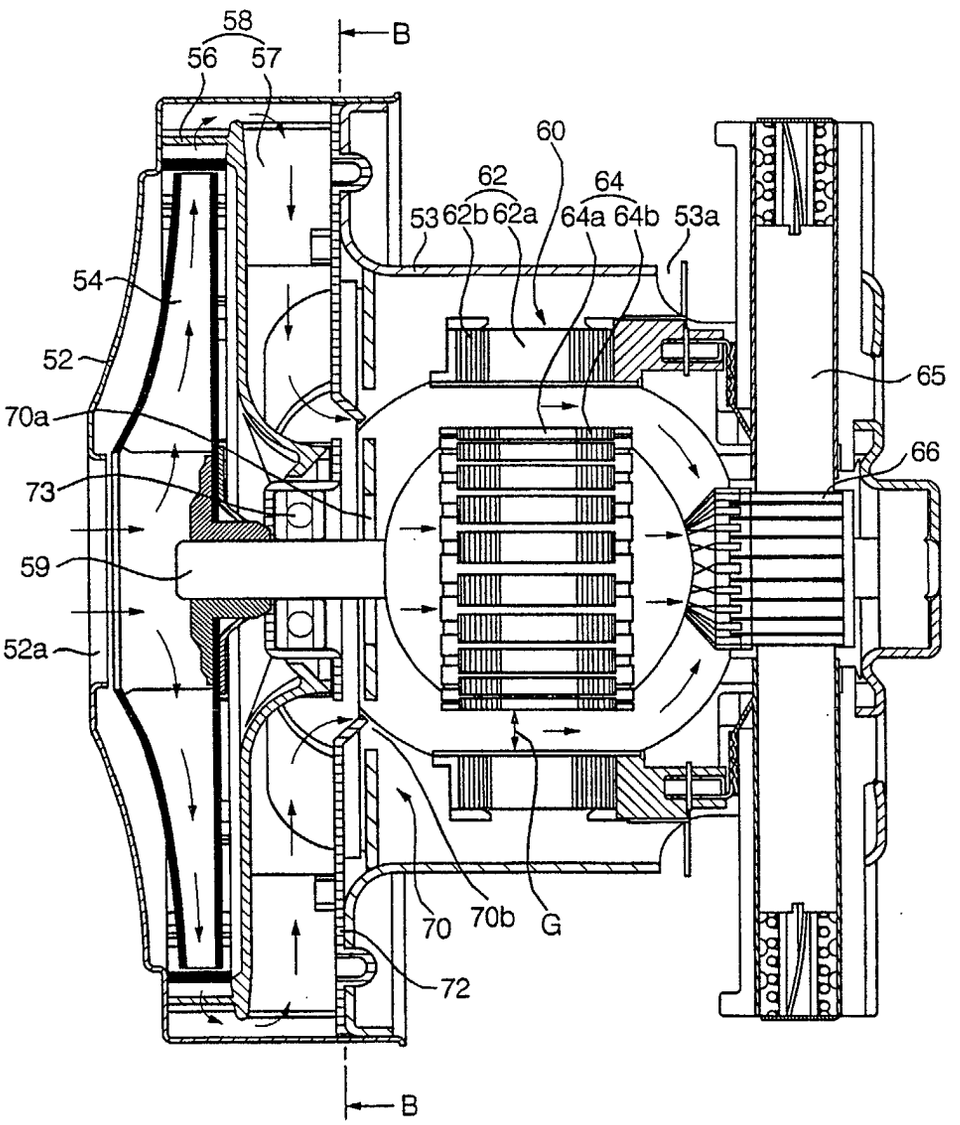

58
56
57
B
60
62
64
53
62b
62a
64a
64b
53a
54
52
65
70a
66
73
59
52a
70
70b
G
72
B

FIG. 7

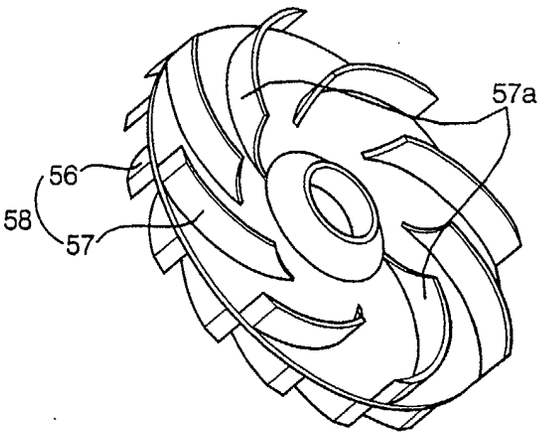


FIG. 8

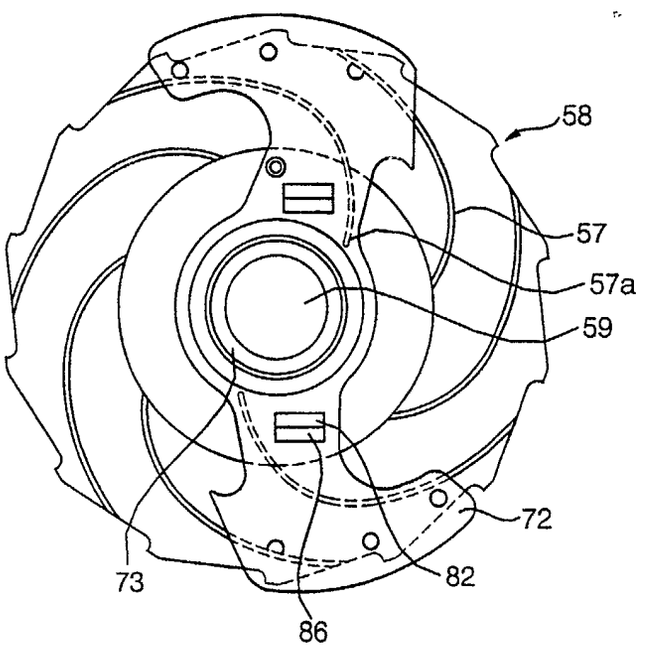


FIG. 9

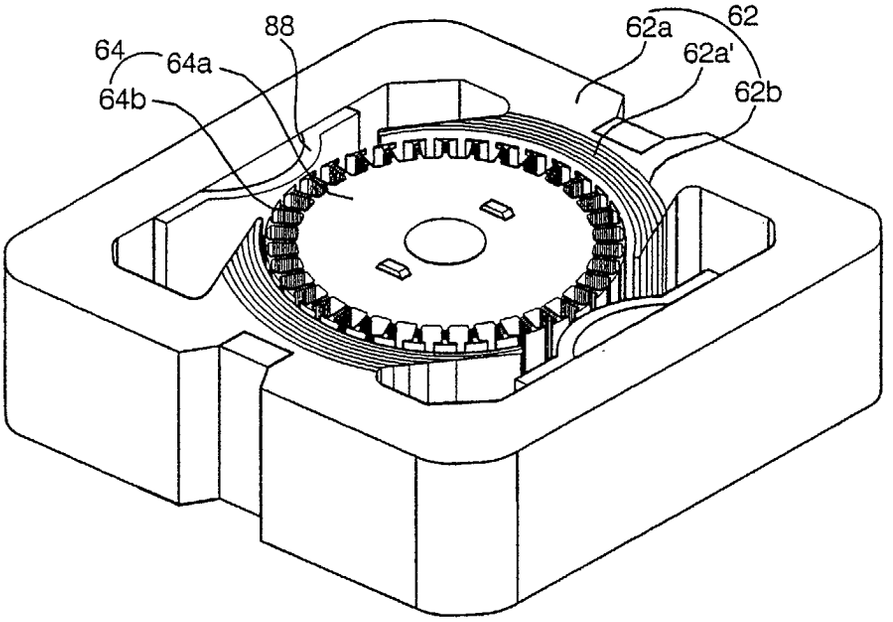


FIG. 10

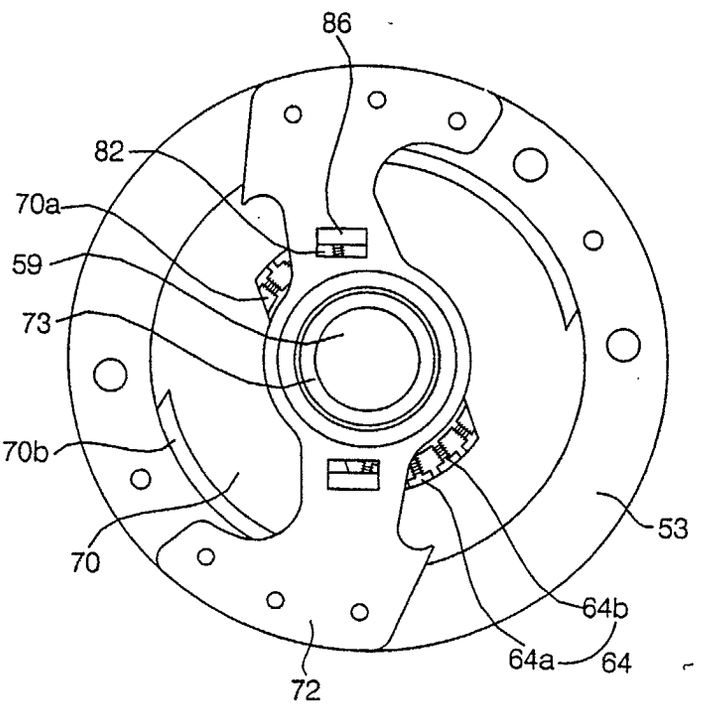


FIG. 11

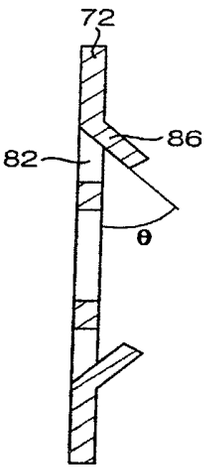


FIG. 12

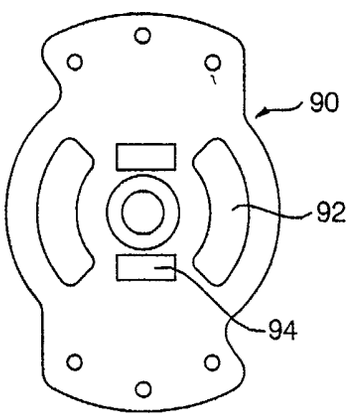


FIG. 13