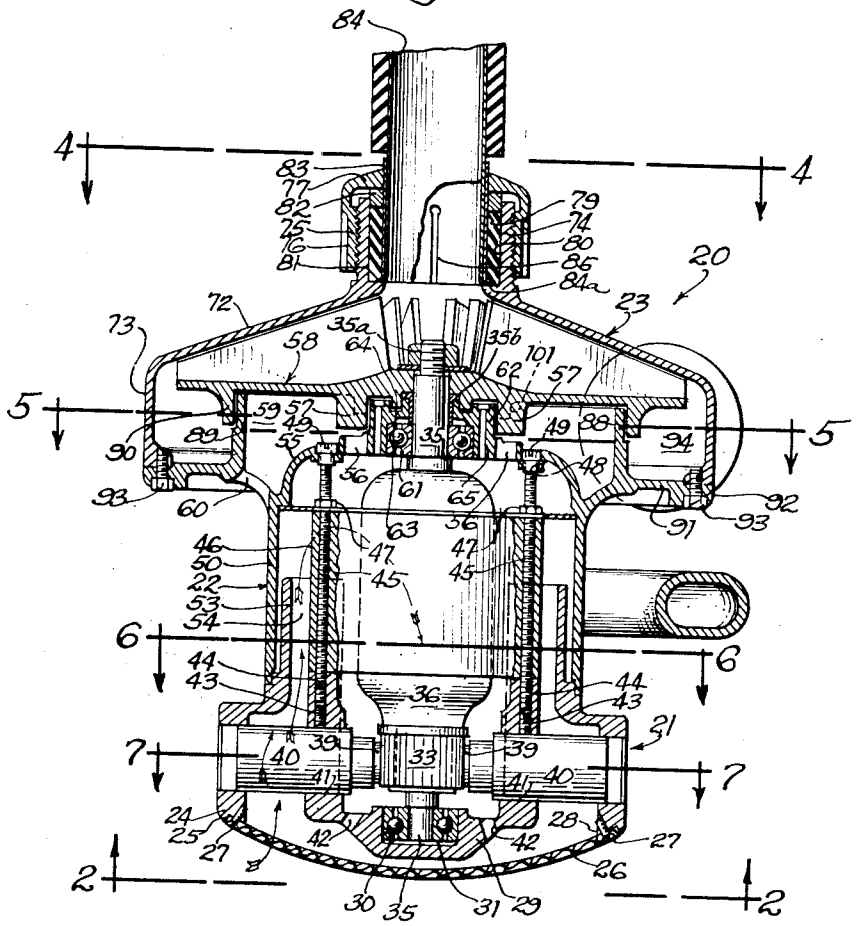
Nov. 2, 1954 C. W. LANTER 2,693,312

MOTOR-DRIVEN BLOWER AND VACUUM CLEANER

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4 Sheets-Sheet 1

Fig. 1



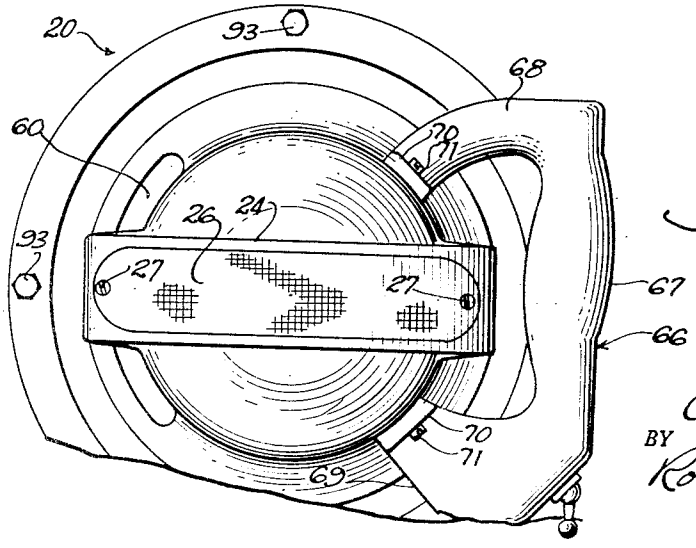


Fig. 2

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Fig. 3

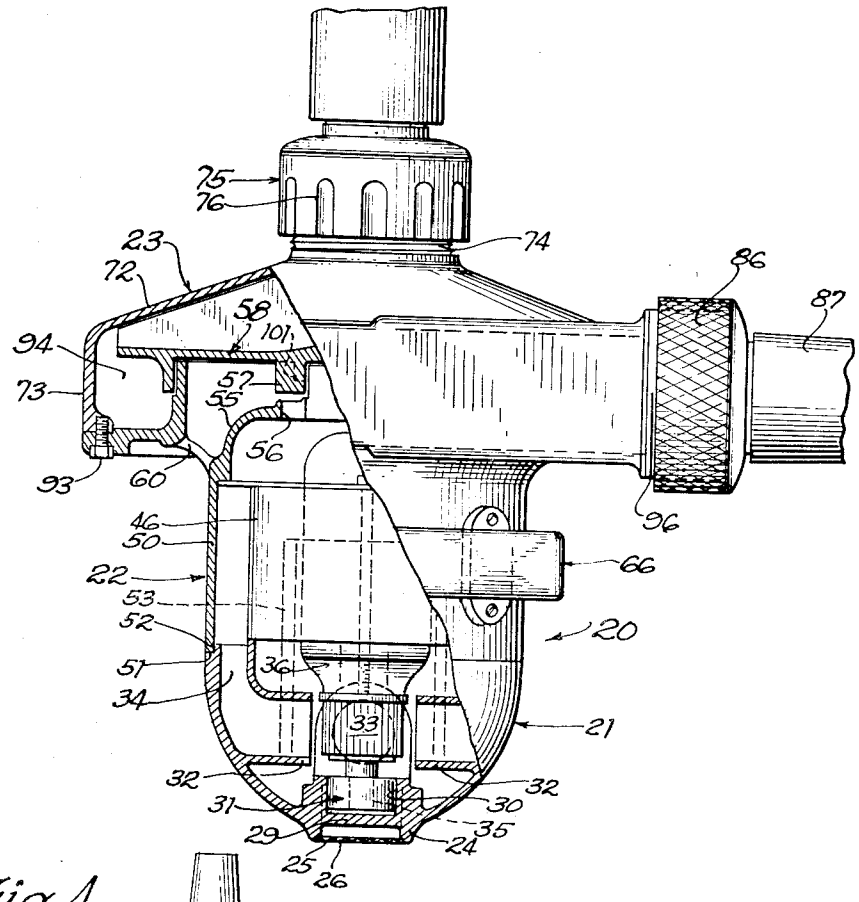
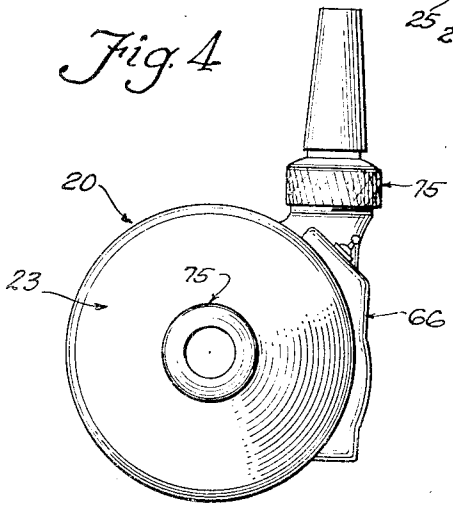


Fig. 4



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Fig. 5

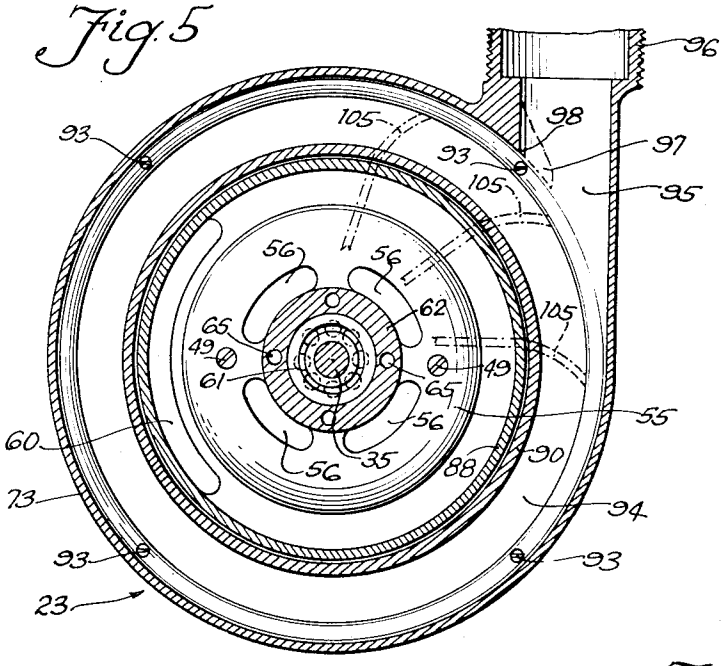


Fig. 6

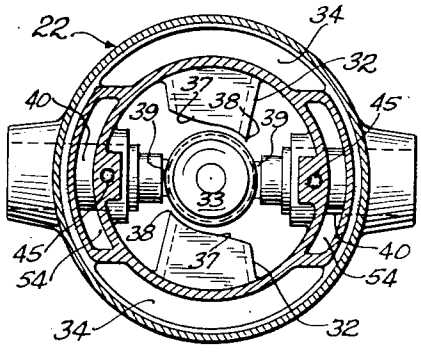
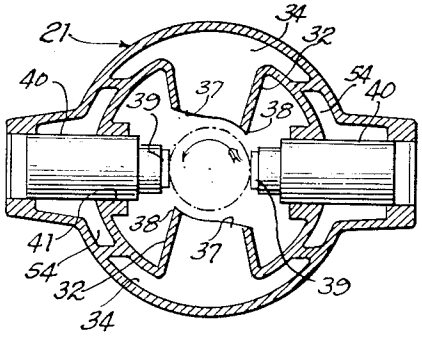


Fig. 7



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Fig. 8

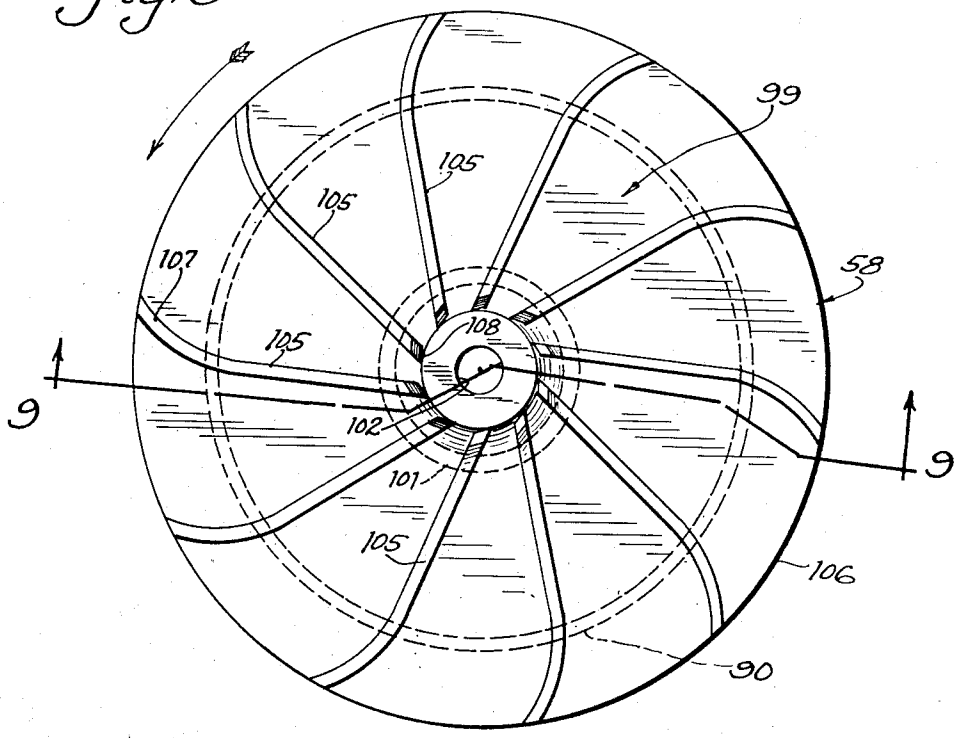


Fig. 9

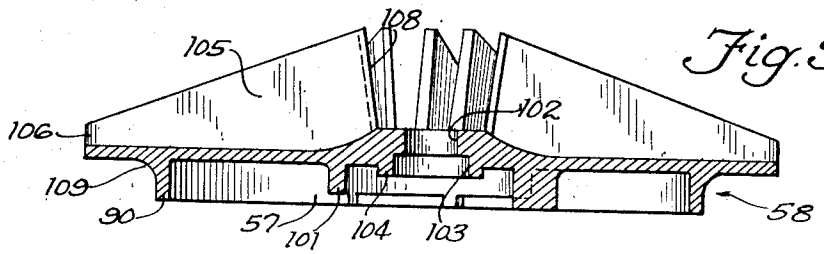
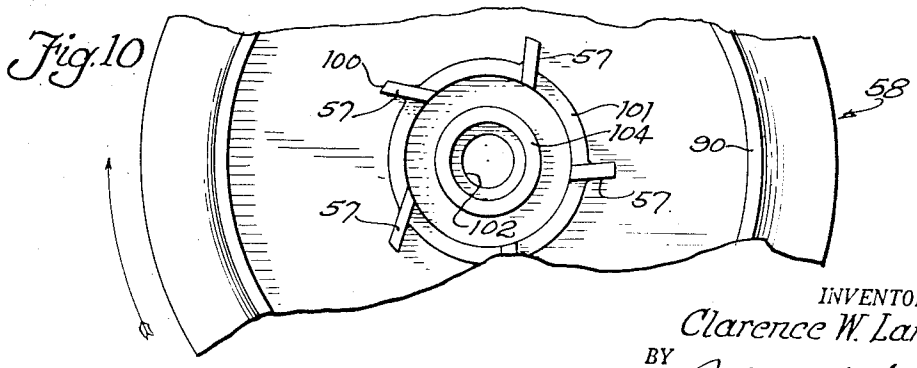


Fig. 10



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2,693,312

MOTOR-DRIVEN BLOWER AND VACUUM CLEANER

Clarence W. Lanter, Bartlett, Ill.

Application October 7, 1950, Serial No. 188,934

3 Claims. (Cl. 230—117)

The present invention relates to motor driven blowers and vacuum cleaners, and is particularly concerned with the provision of an improved structure which is more efficient, and in which the motor is maintained cooler than the devices of the prior art.

One of the objects of the invention is the provision of an improved motor driven fan structure in which the fan housing is provided with a toroidal air passage extending about the housing adjacent the blade ends, as distinguished from the prior art devices, which have a discharge orifice extending tangentially to the periphery of the fan, in which the conduit gradually increases in size and is provided with a definite cut-off point.

Another object is the provision of an improved motor fan structure having such a circular air passage about the blade ends for the purpose of causing the air in the fan housing to rotate at a high speed, developing a greater kinetic energy, a higher efficiency, and a higher static pressure than devices of the same size in the prior art.

Another object of the invention is the provision of an improved mode of attachment for a hose or nozzle, including a split sleeve and a deformable rubber ring, which may so clamp the hose or nozzle that it is provided with a rotating airtight connection or with a fixed connection.

Another object is the provision of an improved motor driven fan in which the air is utilized to cool the commutator and is directed at the brush holders, the field, the rotor, the commutator bearing, and the fan bearing.

Another object is the provision of an improved structure by means of which the existing pressure or vacuum at the fan bearing is relieved to keep the air from sucking in dirt or blowing the oil out of this bearing.

Another object is the provision of an improved air nozzle structure adjacent the commutator, by means of which the nozzles strip the air off the commutator and aid in sucking the air into engagement with the commutator.

Another object is the provision of an improved motor blower housing structure in which the same studs hold the brush holder, secure the baffle, the housing, and the field, and in which the parts are more easily assembled than any of the devices of the prior art.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the four sheets of drawings,

Fig. 1 is an axial sectional view taken through a motor blower embodying my invention;

Fig. 2 is a fragmentary end elevational view taken on the plane of the line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is a side elevational view in partial section;

Fig. 4 is an end elevational view taken from the end opposite to Fig. 2, on the plane of the line 4—4 of Fig. 1, looking in the direction of the arrows;

Fig. 5 is a sectional view taken on the plane of the line 5—5 of Fig. 1, looking in the direction of the arrows;

Fig. 6 is a sectional view taken on the plane of the line 6—6 of Fig. 1, looking in the direction of the arrows;

Fig. 7 is a sectional view taken on the plane of the line 7—7 of Fig. 1, looking in the direction of the arrows;

Fig. 8 is an end plan view of the fan rotor;

Fig. 9 is a transverse sectional view taken on the plane of the line 9—9 of Fig. 8;

Fig. 10 is a fragmentary bottom plan view of the fan rotor.

Referring to Figs. 1 to 4, **20** indicates in its entirety the combined motor blower and vacuum cleaner, which is enclosed in a housing having three main parts, the commutator housing **21**, the motor housing **22**, and the fan housing **23**.

The commutator housing member **21** may consist of a cast metal member which is partially spherical and is provided with a transverse convex rectangular frame **24** extending diametrically across the end and provided with a rabbeted recess **25** for receiving a screen **26**, which may be secured at its ends by a pair of screw bolts **27** threaded into the body.

The rabbeted recess **25** surrounds an elongated oval aperture **28** (Fig. 1), which is traversed at a point by an integral portion **29** formed with a cylindrical socket **30** for receiving a ball bearing assembly **31**. This ball bearing assembly may include the usual pair of ball races and a multiplicity of balls.

The commutator housing **21** is hollow and is formed on its inside with a pair of diametrically opposite integral tubular members **32**, which extend to a point adjacent the commutator **33** and conduct the air from that point adjacent the commutator outwardly through a longitudinally extending conduit **34**.

The motor shaft **35** is mounted to be rotatably supported by the ball bearing assembly **31** and also supports the motor rotor **36**. The commutator housing has the ends of the tubular members **32** preferably beveled, as shown at **37** (Fig. 6), leaving a sharp cutoff edge **38** adjacent the commutator **33** to increase the suction effect, which brings air close to the commutator.

The motion of the commutator in the direction shown in Fig. 6 against the pointed edge 38 tends to carry air with it, which is stripped off the commutator by the sharp edge **38**, enhancing the travel of air against the commutator.

The commutator is engaged by the usual brushes **39** (Fig. 7) spring pressed and slidably mounted in the brush holders **40** and urged toward the commutator. The brush holders are at substantially right angles to the commutator ventilation tubes **32**; and the brush holders **40** are mounted in bores **41**.

The transversely extending portion **29** of the housing member **21** has a plurality of air nozzle bores **42** for carrying air from the screen **26** toward the commutator, the air being directed against the commutator with a nozzle action. The air which comes in the screen **26** also circulates around the bearing supporting member **29** to keep it cool and around the brush holders **40** to cool them and the brushes.

The brushes are secured in place by a short threaded stud bolt **43** without a head, but having a screwdriver slot and mounted in the threaded bore **44**. The same threaded bore is adapted to receive another stud bolt **45**, which passes through the motor field **46** and is provided with a nut **47** for securing the field in place.

The same stud bolt passes through a bore **48** in the motor housing **22** and is provided with a countersunk nut **49** for securing the motor housing to the field and commutator housing.

The motor housing member **22** includes a substantially cylindrical portion **50**, the end **51** of which is mounted in a rabbeted recess **52** formed in the commutator housing member.

The commutator housing member is provided with a pair of inwardly extending cylindrical skirts **53** (Fig. 1) which define conduits **54** for conducting the air from the brush holders longitudinally at the outside of the field.

At its fan end the cylindrical portion **50** of the motor housing **22** has an inwardly curved end portion **55**, which is visible in Fig. 5, and which is provided with a plurality of arcuate slots **56** for the air to pass outwardly of the motor housing into engagement with the impeller members **57** carried by the fan **58**.

The impeller members **57** are on the rear side of the fan **58** and serve to drive the air peripherally in the chamber **59**, from which the air is exhausted through an arcuate slot **60** preferably located only on one side of the motor housing.

The motor shaft **35** has its fan end rotatably mounted in a ball bearing **61**, which is carried by a bearing sup-

porting member 62 in a suitable socket. The bearing supporting member 62 is formed with an annular groove 63 facing the fan; and the fan has an annular rib 64 in said groove, tending to prevent air leakage at this point.

A pair of through conduits 65 are preferably provided in the bearing supporting member 62 leading to its socket for the purpose of relieving any pressure which might force the oil out of the bearing, or for relieving any vacuum at this point, which might tend to suck in dirt.

The motor housing is preferably provided with a handle 66 of the spade type, having a grip 67 and a pair of end frame members 68, 69. The end frame members have attaching flanges 70, which are secured by screw bolts 71 to the housing.

The motor shaft 35 carries fan 58 clamped by nut 35*a*; the fan engages sleeve 35*b*, which engages bearing 61, which engages an annular shoulder.

The course of the air through the motor and about the commutator is as follows: Air is impelled out of the slot 60 by the short impellers 57 on the fan rotor 58. This causes a suction through the holes 56; and the course of the air through the motor housing and commutator housing is as follows:

The air passes in at the screen 26 and passes about the brush holders 40 through the conduit 54 outside the field 46. After passing over the skirt 53, it returns about the brushes 39 and is sucked toward the commutator by the tubes 32, through which the air passes and is again delivered to the other end of the motor around the rotor and in the air gap.

Some of the air passes in from the screen 26 directly through the nozzle apertures 42, which direct the air against the commutator; and this air is also picked up by the tubes 32.

At the fan end of the motor rotor the air passes out of the apertures 56, previously mentioned. The fan housing member 23 comprises a substantially circular cast metal member, which is formed with a frusto-conical wall 72 joined to a cylindrical wall 73.

The frusto-conical wall 72 terminates at its apex in a tubular externally threaded member 74, the threads of which are to be engaged by a cap 75. The cap 75 has a knurled outer surface 76 and is provided with an end wall 77 extending inwardly over the tube 74 and provided with a cylindrical bore 80.

A resilient rubber sleeve 79 is located in the bore 80 of tube 74 and has its end engaging an integral annular shoulder 81. A metal slide ring 82 engages the end of the rubber sleeve 79 and slides freely against the under side of the cap 75.

Sleeve 84 is received and cemented inside a hose or nozzle and has an annular flange 84*a* at its inner end, energizing split sleeve 83.

A split sheet metal sleeve 83 is located about metal sleeve 84 and provided with a multiplicity of inwardly extending slots 85. When the cap 75 is threaded on the tube 74, end wall 77 engages slide ring 82 and compresses the rubber sleeve 79, which is of substantially constant volume, although it is resilient.

Rubber sleeve 79 must expand in some direction; and being confined at its end by shoulder 81 and at its outside by walls of bore 80, it expands inwardly, compressing the split sleeve 83, which engages the metal sleeve 84.

If a moderate clamping action is impressed upon the compressible rubber sleeve 79, the metal sleeve 84 is retained in place, but its rotation is permitted. If a heavier clamping action is brought to bear by means of the cap 75, then the metal hose sleeve 84 is fixedly held. While this hose connection is shown in detail at the inlet or central orifice of the pump, the same structure may be used at the outlet end, where a similar cap 86 is used to secure hose 87.

The motor housing is provided with an axially extending cylindrical wall 88 (Fig. 1), which extends into close proximity with the fan blade 58. This cylindrical wall 88 has an accurately machined annular recess 89 for the downwardly extending flange 90 on the fan blade, adjacent which the fan blade operates with a very close clearance.

The motor housing 22 also has an outwardly extending radial flange for engagement with the fan housing 23. Flange 91 has a circular periphery 92 which is flush with the cylindrical wall 73 of the fan housing, to which it is secured by a plurality of through screw bolts 93. The flanges or walls 88, 91 and 73 define a toroidal or annular conduit extending about this end of the motor

housing, this conduit being completed by the rear side of the fan body 58.

As distinguished from the devices of the prior art, in which the discharge outlet becomes gradually larger and extends off tangentially, the annular air chamber 94 (Fig. 1) has a tangentially extending discharge tube 95, which may be of substantially the same cross sectional area as the annular conduit 94. This discharge conduit ends in an externally threaded tubular member 96 for engagement with the cap 86.

In some embodiments of the invention the discharge conduit may have a backwardly extending cut-off flange 97 for directing air into the outlet; but in other embodiments of the invention this cut-off flange may be eliminated, the outlet conduit 35 terminating at a relatively sharp point 98.

The fan blade or rotor is shown in detail in Figs. 8 to 10. It consists of a cast metal member having a flat circular plate 99, which has a plurality of radial impellers 57 on its rear side and a cylindrical flange 90 on its rear side. The impellers 57 are preferably beveled, as indicated at 100; and they are integrally joined to the annular flange 101.

The fan blade has a central hole 102 (Fig. 9) for receiving the motor shaft 35 and has a counterbore 103 surrounded by the depending flange 104. The working face of the fan blade 58 has a plurality of integral tapered impeller blades 105, which extend from the inside of the discharge opening in the tube 74 to the outer edge 106 of the fan.

The purpose of tapering the blades outwardly and also tapering the housing oppositely is so that as the blades inevitably spread from each other, because of their radial direction, the thickness of the housing may be made less so that the cross sectional area of the air between the blades may be constant.

This eliminates the tendency of the air to expand as it passes outwardly of the blades, and permits the blades to act upon air of constant volume, which it can impel with a greater force than the expanding air, if the blades were of the same depth from inside to outside.

At their outer edges the impeller blades 105 are curved at 107 in a backward direction to reduce whistling and other noise, and thereby increase efficiency. The blades preferably do not extend radially, but are substantially tangential to the outlet aperture, and are beveled at 108 on their inner edges, which edges diverge toward the outlet tube 74.

The body is preferably provided with a curved surface at 109 on the outside of the flange 90 and below the body of the blade 58, these surfaces aiding in defining the annular air chamber 94.

The operation of this part of my blower is as follows: As the fan blade rotates, it throws the air outwardly, due to centrifugal action; but as the housing diminishes in thickness and the blades diminish in their width toward the outer edge, the air is kept from expanding and is kept at constant volume so that the blades can act on the air with greater force.

The air passes off the outer edge of the blade 58 into the annular chamber 94, where it rotates in a circle through the conduit 94 and acquires considerable kinetic energy, as well as pressure energy. This increases the efficiency of the blower, which has a higher static pressure for the same size blower and motor than the devices of the prior art.

When the discharge orifice is closed, the air in the conduit 94 may continue to rotate at a high speed, as this conduit is continuous, and is not interrupted or diminished in size or reduced to zero at a cut-off point.

The present arrangements provide a better cooling for the commutator bearing, the fan bearing, the commutator, the brush holders, the brushes, the field, and the rotor. Constant lubrication is assured by relieving pressure or vacuum at the fan bearing; and the present device is also provided with a very economical mode of attachment of a hose or nozzle, which may be secured for rotation, or which may be fixedly secured by merely making a slight adjustment of the cap.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a motor driven blower, the combination of an electric motor having a housing and a drive shaft, a fan carried by said drive shaft, and a fan housing surrounding the fan, said fan housing being of substantially circular shape and provided adjacent its periphery with a continuous circular conduit of uniform cross-sectional area, within which the air may rotate at high speed as it comes off said fan, the said conduit having a substantially tangentially extending discharge orifice, but continuing past the discharge orifice, said fan comprising a circular body provided on one side with a plurality of outwardly extending blades, and the blades tapering in width from their innermost ends to a minimum size at their outermost ends, to maintain the volume of air acted on by the blades at substantially constant size as it passes outward, and the fan housing having a complementary frusto-conical form adjacent the edges of said blades, the said blades being located with their inner ends adjacent a central inlet orifice in the housing, and the said blades being provided with backwardly curved outer ends of minimum width to reduce noise and increase efficiency of the blower.

2. In a motor driven blower, the combination of an electric motor having a housing and a drive shaft, a fan carried by said drive shaft, and a fan housing surrounding the fan, said fan housing being of substantially circular shape and provided adjacent its periphery with a continuous circular conduit of uniform cross-sectional area, within which the air may rotate at high speed as it comes off said fan, the said conduit having a substantially tangentially extending discharge orifice, but continuing past the discharge orifice, said fan comprising a circular body provided on one side with a plurality of outwardly extending blades, and the blades tapering in width from their innermost ends to a minimum size at their outermost ends, to maintain the volume of air acted on by the blades at substantially constant size as it passes outward, and the fan housing having a complementary frusto-conical form adjacent the edges of said blades, the said blades terminating at their inner ends adjacent a centrally located inlet orifice in the fan housing, and being backwardly beveled and provided with a sharp forward leading edge at their inner ends, to aid in scooping the air into the spaces between the blades.

3. A motor driven blower and vacuum cleaner comprising, an electric motor having a shaft and a housing,

the housing being provided with an axial cylindrical projecting wall at one end, said end also having a radially projecting annular flange, located rearwardly of said projecting wall, the wall and flange forming two sides of a toroidal conduit of uniform cross section, and a fan housing member having an outer cylindrical wall engaging said radial flange and secured thereto, defining the outer wall of said toroidal conduit, said fan housing member having its cylindrical wall extending axially beyond said projecting wall to provide space beyond said projecting end for a fan rotor, a fan rotor carried by said shaft and comprising a circular body overlapping the end of said projecting wall and forming the fourth side of said toroidal conduit but having its periphery spaced from said fan housing cylindrical wall, and a cylindrical discharge conduit carried by said fan housing member and extending tangentially from said toroidal conduit, said fan housing member having a frusto-conical end wall extending from its cylindrical wall and communicating with a central tubular inlet conduit, and a multiplicity of blades on said rotor extending outwardly from the center and tapered outwardly in conformity with said frusto-conical wall to a close clearance, said blades ending at said periphery, spaced from said fan housing cylindrical wall, said blades beginning at a circular area inside said inlet and extending tangentially to a circle smaller than said area.

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