

[54] WET/DRY SUCTION CLEANER

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[58] Field of Search 310/66, 67, 52, 58, 310/59, 62, 88; 15/352, 353, 257 A, 257 B, 15/412, 413

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[57]

ABSTRACT

A wet/dry suction cleaner having a dirt storage receptacle and a power suction module mounted thereon. The module includes a lower housing, a separator housing and a top cover. A by-pass motor-blower unit is mounted between the two housings and an air shut-off valve assembly depends downwardly from the lower housing into the receptacle. The separator housing includes downwardly depending annular walls which separate the blower working airflow from the motor cooling airflow and has an exhaust port which communicates with the blower airstream. Motor cooling air enters inlet slots in the separator housing and is baffled by a labyrinth of vertical walls formed by the top cover and separator housing. The air then flows between the top and the separator floor and enters the motor through an opening in the separator. The cooling air exits the motor to a cooling air exhaust chamber formed by the annular walls of the separator housing, exhausts therefrom between the cover and separator housings, and is baffled before exiting by a labyrinth similar to that at its entry.

3 Claims, 4 Drawing Figures

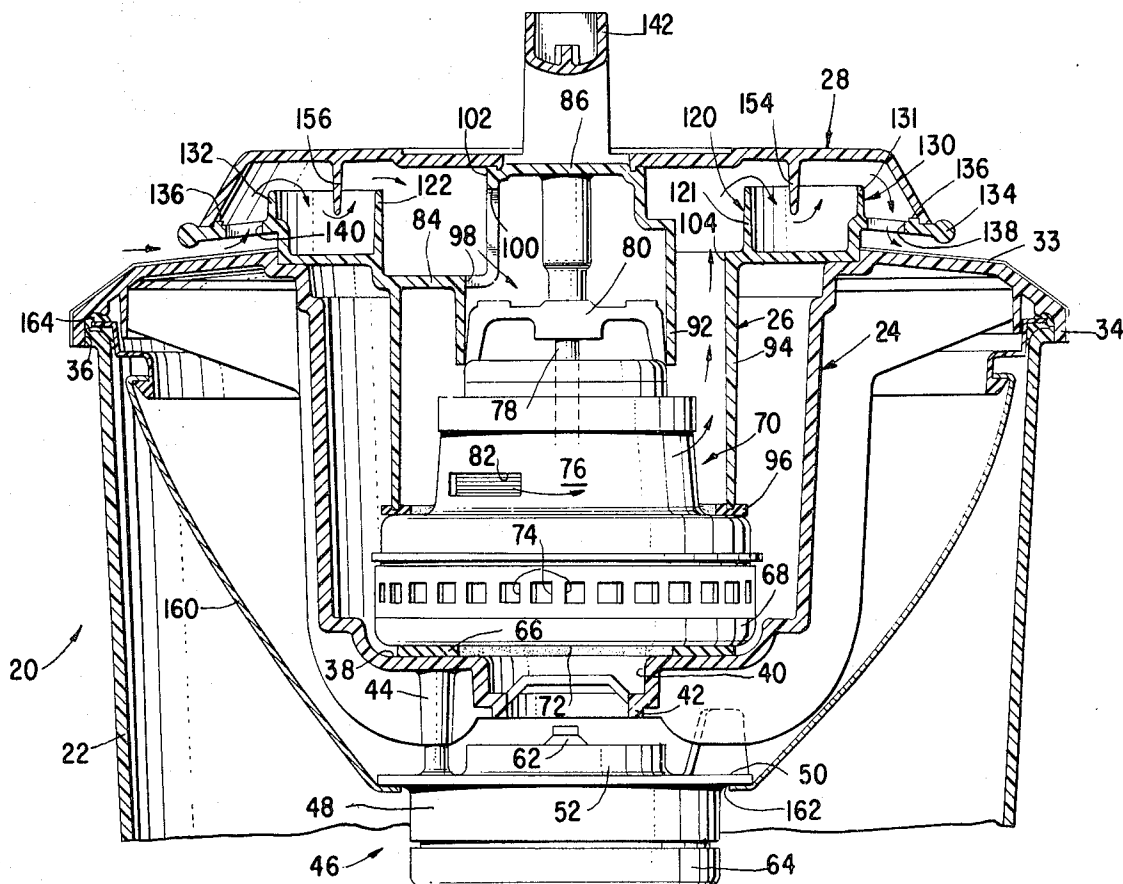


Fig. 1

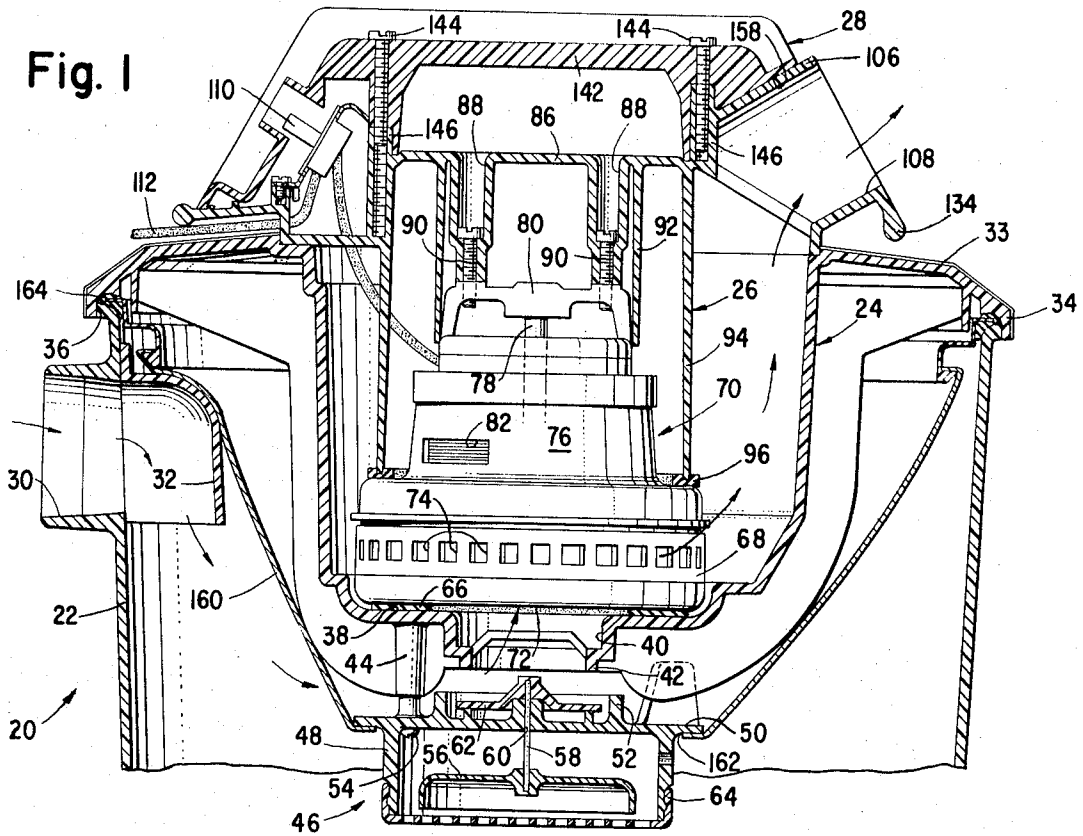


Fig. 2

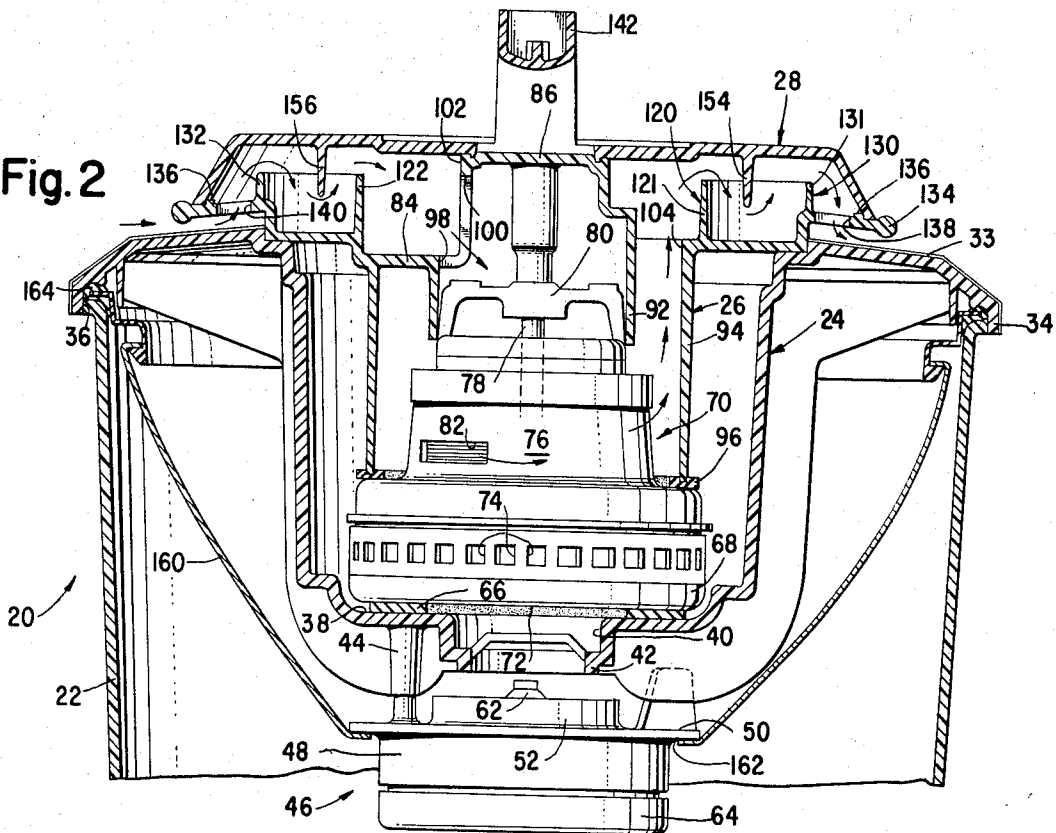


Fig. 3

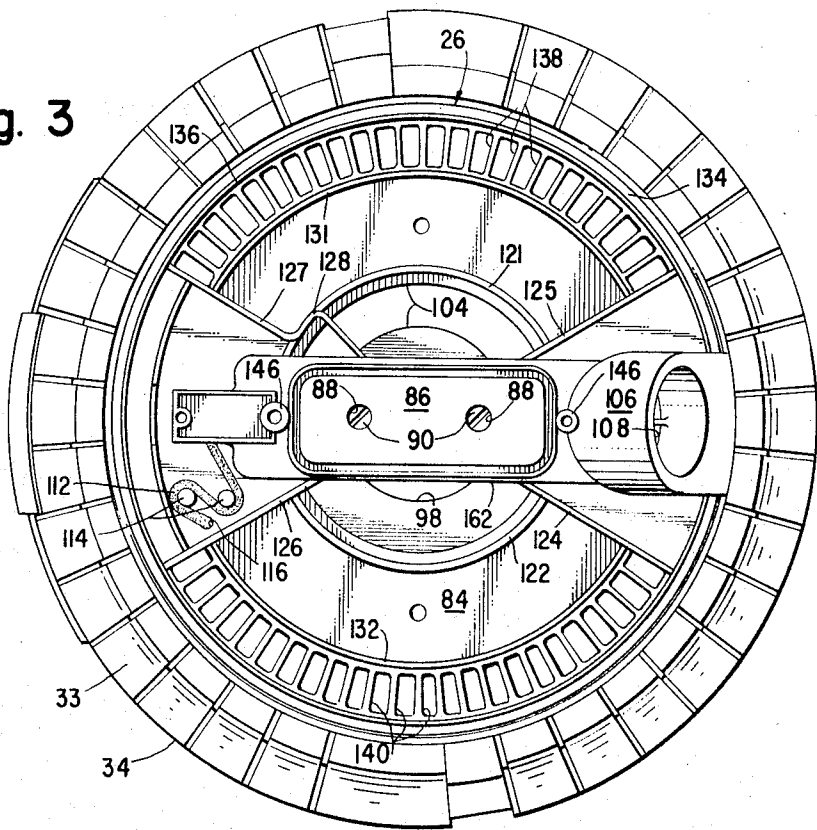
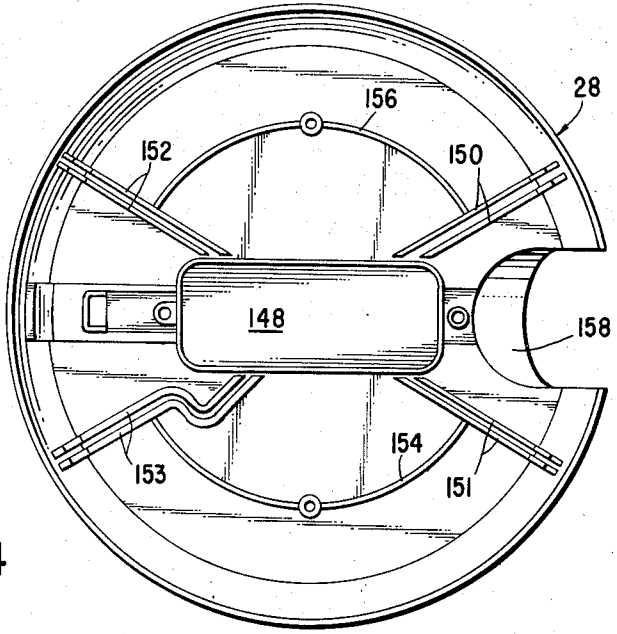


Fig. 4



WET/DRY SUCTION CLEANER

BACKGROUND OF THE INVENTION

This invention relates to utility suction cleaners for picking up liquid and other materials and more particularly to an improved casing construction of a power suction module for such cleaners which prevents liquid from entering the electrical system thereof. It is particularly well suited for a vertical axis utility type cleaner for use in and out of the home.

In order to prevent moisture from entering the motor section, cleaners of the type capable of vacuuming up both liquid and solid materials generally use by-pass motor-blowers in which the airstream for cooling the motor is maintained separately from the working air moving the dirt and/or liquid. Moreover, utility type suction cleaners which are used outside the home, e.g., on patios, driveways, walks etc. are known to be left outside inadvertently. A problem can therefore result if the weather changes over night and a rainstorm develops. This particularly can be a problem when the cleaner is of the wet/dry type using a by-pass motor-blower system, since the cooling air inlet and exhaust lead directly to and from the motor without first passing through the storage receptacle as would a purely dry suction cleaner having a motor-blower in which the cooling airstream is the working airstream that has passed through the blower. If the electrical system is not securely protected against the entry of moisture, an electrical path to ground and a breakdown in motor insulation could result. This situation could result in a hazardous shock to one later attempting to operate the cleaner. The trend toward double insulating to prevent hazardous shock has spurred at least one safety certifying organization to devise a series of stringent requirements for cleaners of this type. One test which the cleaner is required to pass is a high intensity rainstorm after which dielectric and current leakage test are conducted. In order for a cleaner to pass these tests it must be designed so that no water leaks into the electrical areas during both operation and nonuse conditions. One approach to such a design is disclosed in co-pending Patent Application No. 320,802 filed on even date herewith. The present invention is another, but simpler, construction for solving these problems.

SUMMARY OF THE INVENTION

It is therefore a primary object of the present invention to provide in a power suction module for a utility cleaner having a by-pass motor-blower, a casing construction which prevents the entry of liquids into the electrical system.

Another object of this invention is to provide in a power suction module for a utility vacuum cleaner having a by-pass motor-blower, a casing construction which prevents liquid from entering the electrical system through the motor cooling inlet and exhaust ports.

A further object of this invention is to provide in a utility power suction module for a vacuum cleaner having a by-pass motor-blower, a construction in which the working airflow and the motor cooling airflow are maintained separate.

A still further object of this invention is to provide a power suction module for a utility vacuum cleaner capable of wet and dry operation having a casing including a plurality of baffles which prevent any liquids from entering the cooling air inlet and exhaust.

The present invention achieves these objects by providing a power suction module for a utility cleaner in which the working airflow which enters into a dirt receiving receptacle and passes through the blower is maintained separate from the cooling airflow which separately enters the cleaner through slots formed in a separator housing and is deflected by a labyrinth of walls formed by the separator housing and a top cover. After the air cools the motor, it exhaust at the opposite side of the cleaner module through a labyrinth of walls and slots in the separator housing similar to that at which it entered.

BRIEF DESCRIPTION OF THE DRAWINGS

The particular features and advantages of the invention as well as other objects will become apparent from the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a vertical cross-sectional view of a vacuum cleaner embodying the novel features of the present invention, the dirt receptacle being broken away for convenience,

FIG. 2 is a vertical cross-sectional view taken through the vacuum cleaner of FIG. 1 but in a plane normal thereto;

FIG. 3 is a top plane view of the vacuum cleaner of FIG. 1, with the top cover removed; and

FIG. 4 is a bottom plan view of the top cover.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the accompanying drawings wherein like reference numerals denote similar parts throughout the various views, there is disclosed a utility vacuum cleaner similar to that disclosed in the aforesaid co-pending U.S. Pat. Application No. 320,802, but incorporating the new and improved power suction module construction of the present invention. The cleaner generally designated 20 comprises an open top substantially cylindrical dirt receptacle 22 and a power suction module comprising a lower housing 24, a separator housing 26 and a top or cover 28, which hereinafter will be described in detail. Each of these assemblies preferably is comprised of synthetic plastic and is manufactured by molding. Formed adjacent to the open end of the dirt receptacle 22 is an air suction inlet conduit 30 opening into the receptacle and adapted to couple a conventional vacuum cleaner flexible hose (not shown) in the usual manner. Preferably, a styrene baffle 32 may be mounted behind the inlet aperture defined by the conduit 30. The baffle should be shaped to direct the inlet air and liquid downwardly and circumferentially toward the lower inside walls of the receptacle.

The lower housing 24 is substantially cup shaped having a peripheral flange 33 including a peripheral rim 34 substantially corresponding in shape to the periphery of the top of the dirt receptacle, and includes at its underside an annular groove 36 for receiving the top peripheral portion of the dirt receptacle. In this manner the lower housing is supported on the dirt receptacle with the cup shaped portion of the housing nested therein, and the housing is detachably secured to the receptacle in the same manner as described in co-pending U.S. Pat. Application No. 133,655, filed Apr. 13, 1971, now U.S. Pat. No. 3,732,667. At the bottom of the housing 24 there is formed a substantially flat circular seating

portion 38 having an aperture 40 formed centrally therein with a downwardly extending neck 42 communicating with the interior of the dirt receptacle. A number of threaded bosses 44 (only two of which are shown) are molded on the bottom of the housing radially outwardly from the aperture 40 for supporting a valve housing assembly generally designated as 46.

The valve housing assembly 46 comprises a substantially cylindrical valve housing 48 extending downwardly from a flanged disc portion 50. A short upstanding cylindrical wall 52 extends upwardly from the disc surface 50 of the housing assembly. Mounting screws 54 pass into the bottom of the disc 50 and are threadedly received into the bosses 44 to secure the assembly 46 to the housing 24. An inverted cup shaped plastic float valve 56 having a short metal rod 58 centrally secured to the upper surface thereof, is positioned within the housing 48. The rod extends through a substantially central opening 60 in the surface of the disc 50 and is secured at its upper end to a valve member 62 adapted to close off the airflow to the aperture 40. The float 56 is made of a light weight polyethylene material and is capable of floating not only on liquids but also on foam. When the level of liquid and/or foam in the receptacle 22 reaches a predetermined level, the float 56 moves upwardly until the valve 62 seats against the bottom of the neck 42 to shut off the airflow to the aperture 40. A grid type guard 64 is fitted around the bottom of the housing 48 to protect the float 56 against the entry of large dirt particles and to protect the float against contact with a paper filter (not shown) used during dry operation of the cleaner.

Mounted on an annular seal 66 positioned in the seat 38 is the blower 68 of a by-pass type motor-blower unit generally indicated as 70. A by-pass motor-blower is one in which a separate airstream from the working airstream is utilized to cool the motor. The blower has a centrally disposed inlet 72 positioned in communication with the aperture 40, and includes a plurality of exhaust openings 74 tangentially disposed about the cylindrical housing thereof. Mounted vertically above the blower 68 is the motor portion 76 of the motor-blower unit. A motor-blower shaft 78 is journaled at its upper end in a yoke member 80 and at its lower end in the blower wheel (not shown) of the blower unit. The motor armature (not shown) is secured to the shaft 78 and provides the power to drive the blower. Two cooling air exhaust apertures 82 may be formed in the lower portions of the motor casing. The upper portion of the motor just beneath the yoke 80 is opened for receiving the cooling air and preferably has a small cooling fan secured to the shaft 78 just below the yoke for providing positive cooling to the motor core and armature.

The separator housing 26 comprises a floor or plate surface 84 including an upstanding substantially narrow rectangular bridging or spanning portion 86 substantially centrally located above the plate surface and extending lengthwise a distance substantially equal to the diameter of the blower. The top surface of the bridging portion 86 may include preferably two holes 88 for receiving a respective screw 90 which is threadedly received in the yoke of the motor-blower unit to secure the housing thereto. Extending downwardly from the floor or plate 84 of the housing 26 is an inner substantially cylindrical annular wall 92 and an outer substantially cylindrical longer annular wall 94. The outer wall 94 engages a seal 96 which abuts the upper

surface of the blower housing, while the inner wall 92 engages the upper portion of the motor housing just below the yoke. The cup shaped housing 24 and the downwardly extending annular wall 94 define therebetween a blower exhaust chamber communicating with the blower ports 74, while the walls 92 and 94 of the housing 26 define therebetween a motor cooling air exhaust chamber for receiving cooling air exhausted through the openings 82. Formed in the separator floor or plate 84 on the left side of the motor as illustrated in FIG. 2, is a small substantially arcuate sector shaped opening 98 which merges with an opening 100 formed in the upstanding wall 102 of the spanning portion 86. The aperture defined by openings 98 and 100 is the cooling air inlet and communicates with the upper end of the motor. Communicating with the motor cooling air exhaust chamber is a larger substantially arcuate sector shaped opening 104 formed in the separator housing floor or plate 84 on the left side of the motor as illustrated in FIG. 2. As best illustrated in FIGS. 1 and 3, the floor 84 of the separator housing 26 adjacent the right side of the spanning member 86, is flared upwardly at an acute angle into an annular wall 106 defining an aperture 108. The aperture forms an exhaust port in the separator and communicates with the blower exhaust chamber formed between the wall 94 and the interior of the lower housing 24. Mounted on the floor 84 on the left side of the bridging member 86 and to the bridging member as illustrated in FIGS. 1 and 3 is a conventional toggle actuated switch 110 to which the electrical wiring 112 from the motor leads. The wiring may be wrapped about a pair of posts 114 and extends out the module through a hole 116 in the separator floor 84.

On the upper surface of the floor 84 and spaced radially slightly outwardly from the wall 94 is an upstanding annular wall 120 (FIG. 2). This wall, as best illustrated in FIG. 3, is divided into two arc shaped upstanding walls 121 and 122 by four walls 124, 125, 126 and 127 extending radially from the bridging member toward the periphery of the separator housing. A second upstanding annular wall 130 (FIG. 2) spaced radially outwardly from the wall 120 on the upper surface of the plate 84 is also divided into two arc shaped upstanding walls 131 and 132 by the radial walls 124, 125, 126 and 127. The peripheral rim portion of the separator housing 26 includes a peripheral bead 134. The peripheral portion between the bead 134 and the wall 130 is spaced above the upper surface of the flange 33 of housing 24. A short annular rib 136 radially spaced inwardly from the bead 134 extends upwardly from the top surface of the housing 26 except in the vicinity of the exhaust port annular wall 106. Between the wall 131 and the rib 136 in the sector determined by the walls 125 and 127 is a plurality of horizontally disposed slots 138 which form cooling air exhaust apertures, while similar slots 140 between wall 132 and the rib 136 in the sector determined by the walls 124 and 126 form the cooling air inlet apertures. Since the housing 26 in the preferred embodiment is circular, it should be clear that the walls 124 and 126 thus form a sector of a circle within which is located the cooling air intake path, while the walls 125 and 127 form a sector within which is located the cooling air exhaust path. Except for a small jog 128 in wall 127, in the preferred embodiment each sector is substantially 120°.

The cover 28 is substantially an inverted pan shaped member preferably having a circular periphery which engages the separator housing between the bead 134 and the rib 136. Centrally spanning the upper surface is a handle 142 through which a pair of screws 144 extend and are threadedly received in bosses 146 on the member 86 to secure the top to the separator. The underside of the top includes an annular rectangular recess 148 which receives the rectangular bridging portion 86 of the separator housing while four pair of spaced radial ribs 150, 151, 152 and 153 respectively receive the walls 124, 125, 126 and 127. Depending downwardly from the top, radially between the walls 121 and 131, is an arc shaped wall 154 extending angularly between the ribs 151 and 153 while a similar wall 156 depends downwardly between the walls 122 and 132 and angularly extends between ribs 150 and 152. Each of the walls 154 and 156 extends vertically below the respective walls 121, 131 and 122, 132, but does not contact the floor 86. Similarly, the walls 121, 131, 122 and 132 do not contact the top. The upper surface of the top in the vicinity of the exhaust port wall 106, is tapered outwardly as at 158 to receive the upper surface of the wall 106 in complementary fashion.

In operation, motor cooling air enters between the peripheral bead 134 and the top of the flange 33 of the lower housing 24 in the inlet sector and passes in through the inlet slots 140 in the separator. The cooling air must then pass over the annular wall 132, under the wall 156 and up on the wall 122 before it can enter the cooling air inlet openings 98 and 100 leading to the motor. Motor cooling air is exhausted from the openings 82, pass into the exhaust chamber between walls 92 and 94 and upwardly through the opening 104. It must then pass over wall 121, under wall 154 and over wall 131 before exiting from the slots 138 on the side of the cleaner opposite to where it entered. The path of motor cooling airflow is clearly illustrated in FIG. 2. It is obvious, therefore, that the walls 122, 132 & 156 and walls 121, 131 & 154 comprise a respective labyrinth of inlet and exhaust baffles for diverting the respective intake and exhaust cooling airstreams, and for preventing water, even during a driving rainstorm from entering the motor and electrical areas.

The working airstream as illustrated in FIG. 1 enters the inlet 30 and may pass through a filter 160 prior to entering the aperture 40 and the blower inlet 72. The filter 160 is described in detail in co-pending Patent Application No. 320,801 filed on even date herewith but for present purposes can be described as being of a substantially cup-like shape comprising a fabric material, and as having an opening 162 in the lower peripheral portion thereof through which the valve housing 48 protrudes. The upper peripheral portion of the filter 160 includes a resilient gasket 164 to seal the dirt receptacle from the housing 24. Any liquid entering with the dirt through the inlet port 30 drops to the bottom of the receptacle and as the liquid and/or foam level in the receptacle raises to the point where the float 56 is lifted to close the opening 40 by means of the valve 62, the airflow entering the cleaner through the openings 30 is effectively closed off to protect the blower and motor unit from damage by the liquid and/or foam.

Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to a preferred embodiment of the invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

Having thus set forth the nature of the invention, what is claimed herein is:

1. A power suction module adapted for use with an open top storage receptacle having an air inlet for drawing wet and dry dirt laden air therethrough, said module comprising a substantially cup shaped lower housing having an air inlet supporting a by-pass motor-blower unit with the blower intake in flow communication with said inlet, the motor of said unit positioned above the blower and being cooled by an airstream separate from the blower working airstream, a separator housing having inner and outer downwardly extending annular walls positioned on the motor-blower unit, the outer wall forming with the lower housing a blower working airstream exhaust chamber for receiving working air exhausted from the blower, means defining an exhaust port in said separator housing communicating with said blower exhaust chamber, the inner and outer walls forming therebetween a motor cooling air exhaust chamber for receiving cooling air which has passed through the motor, means defining a cooling air inlet aperture in said inner wall, means defining a cooling air exhaust aperture communicating with said cooling air exhaust chamber, said separator housing including inlet baffles and exhaust baffles, each of said baffles comprising at least an inner and outer upstanding wall and a peripheral rim spaced above the lower housing, means defining cooling air inlet and cooling air exhaust slots intermediate a respective outer upstanding annular wall and peripheral rim, a cover positioned on said separator housing including a peripheral rim engaging said separator housing outwardly of each of said inlet and exhaust slots and being spaced from said separator housing to define a cooling air inlet path from said cooling air inlet slots to said motor cooling air inlet aperture, and a cooling air exhaust path from said cooling air exhaust aperture to said exhaust slots, and a downwardly extending annular wall formed on said cover intermediate the upstanding annular walls of each said baffle, each last named wall terminating below the elevation of the tops of respective upstanding annular walls.

2. A power suction module as recited in claim 1 wherein said cooling air inlet and exhaust slots are disposed in a substantially horizontal plane.

3. A power suction module as recited in claim 1 wherein the upstanding walls of said inlet baffles, said inlet slots and said cooling air inlet aperture are substantially within the sector of a circle on one side of said separator housing, and the upstanding walls of said exhaust baffles, said exhaust slots and said cooling air exhaust aperture are substantially within the sector of a circle on the opposite side of said separator housing.

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