



US 20060156508A1

(19) **United States**

(12) **Patent Application Publication**

Khalil

(10) **Pub. No.: US 2006/0156508 A1**

(43) **Pub. Date: Jul. 20, 2006**

(54) **VACUUM CLEANER WITH CYCLONIC SEPARATING DIRT CUP AND DIRT CUP DOOR**

Continuation-in-part of application No. 29/237,958, filed on Sep. 8, 2005.

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(21) Appl. No.: **11/249,282**

(22) Filed: **Oct. 13, 2005**

Related U.S. Application Data

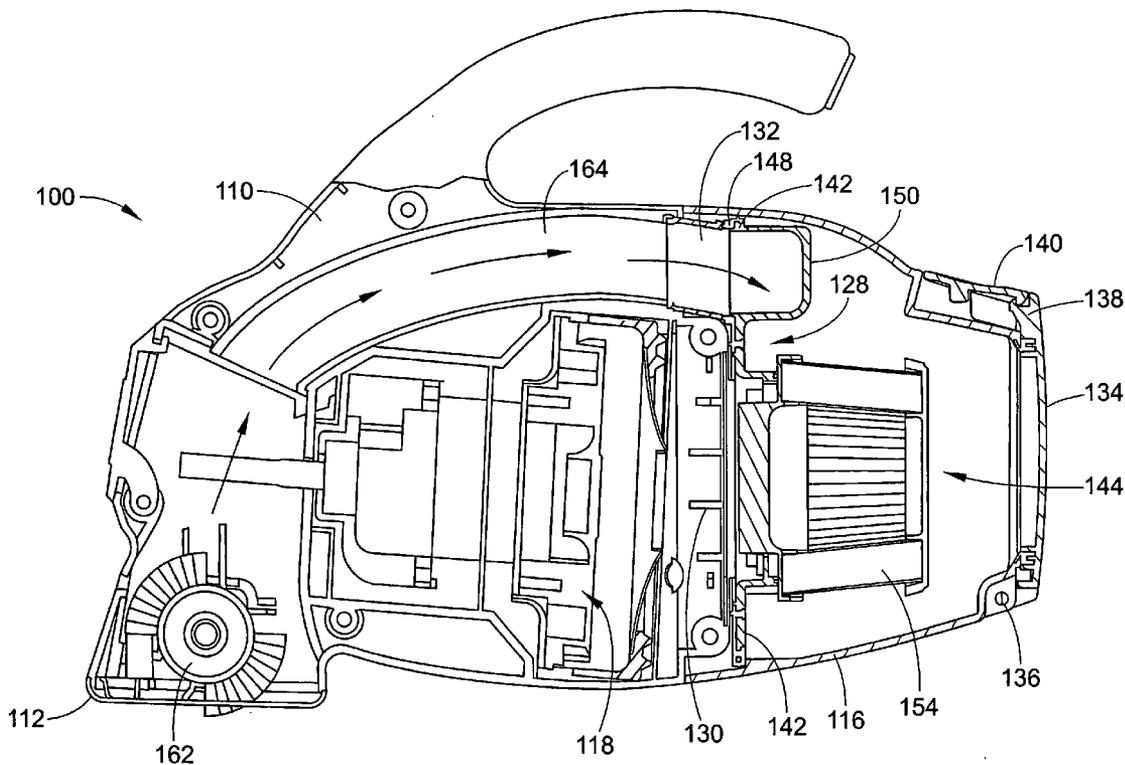
(63) Continuation-in-part of application No. 29/221,441, filed on Jan. 14, 2005, now Pat. No. D,521,137.
Continuation-in-part of application No. 29/221,442, filed on Jan. 14, 2005, now Pat. No. D,520,127.

Publication Classification

(51) **Int. Cl.**
A47L 5/24 (2006.01)
A47L 5/28 (2006.01)
(52) **U.S. Cl.** **15/353; 15/344**

(57) **ABSTRACT**

The present invention relates to a vacuum cleaner. In one embodiment, a hand-held vacuum cleaner includes a housing having a first end and a second end, a suction nozzle located at the first end of the housing, and a suction fan and motor assembly located in the housing. A brushroll may be disposed within the suction nozzle. The hand-held vacuum cleaner further includes a dirt cup including an inlet, an outlet, a cyclonic flow chamber, a filter assembly, and a dirt cup door. The dirt cup is rotatably detachable from the housing. At least one nub cooperates with the at least one slot in the dirt cup to rotatably secure the dirt cup to the second end of the housing. In addition, the filter assembly includes a twist on filter cartridge.



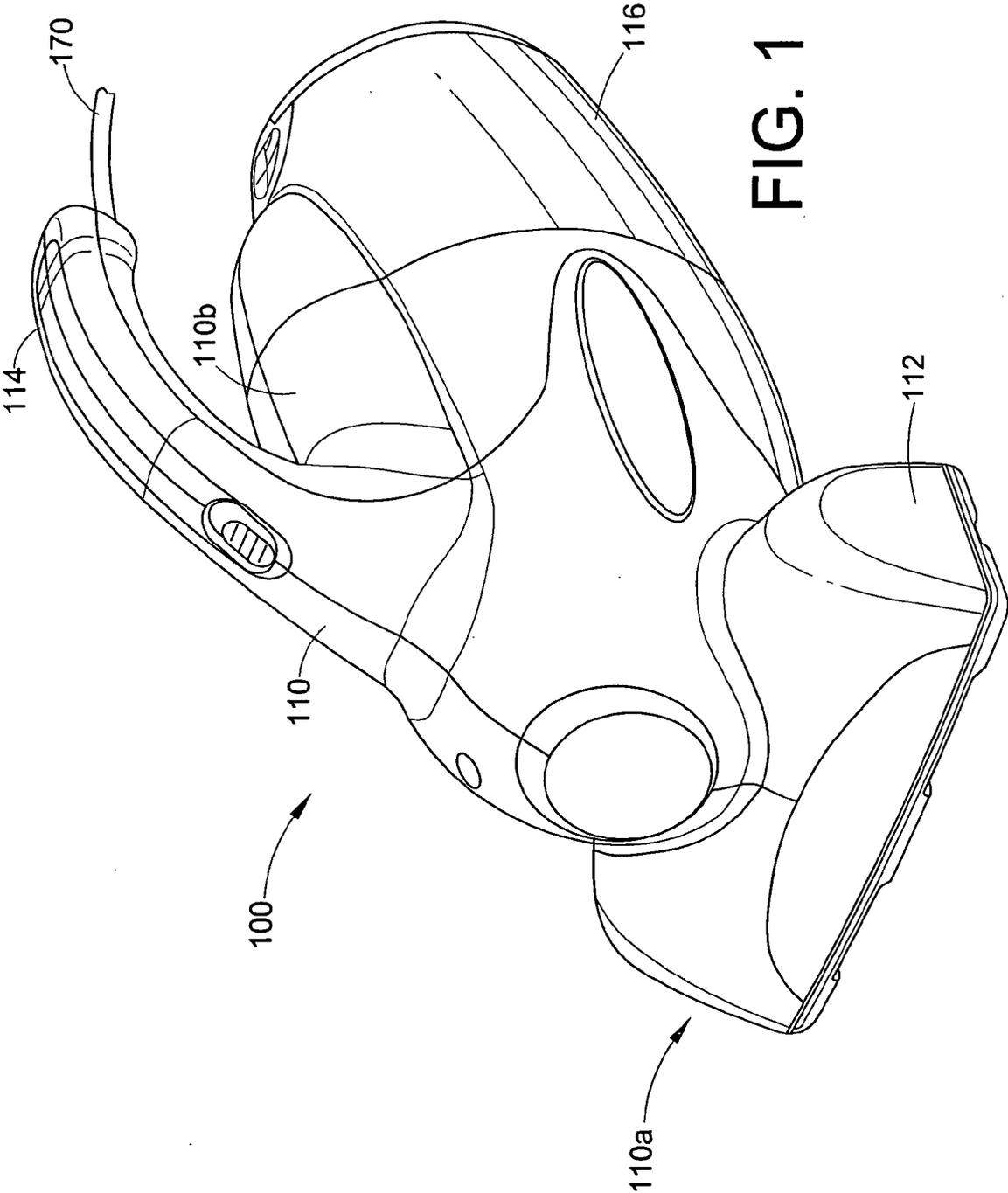


FIG. 1

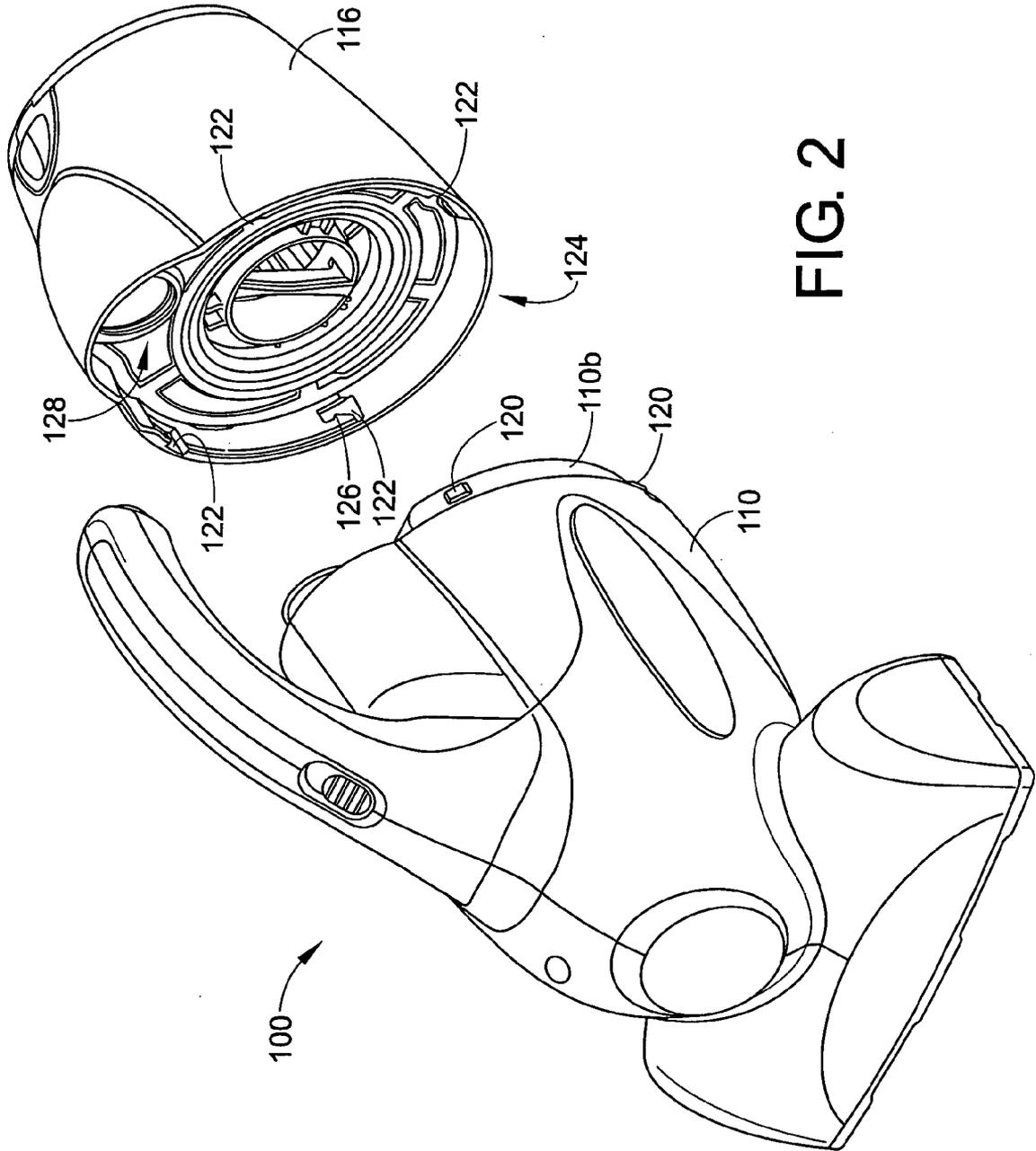


FIG. 2

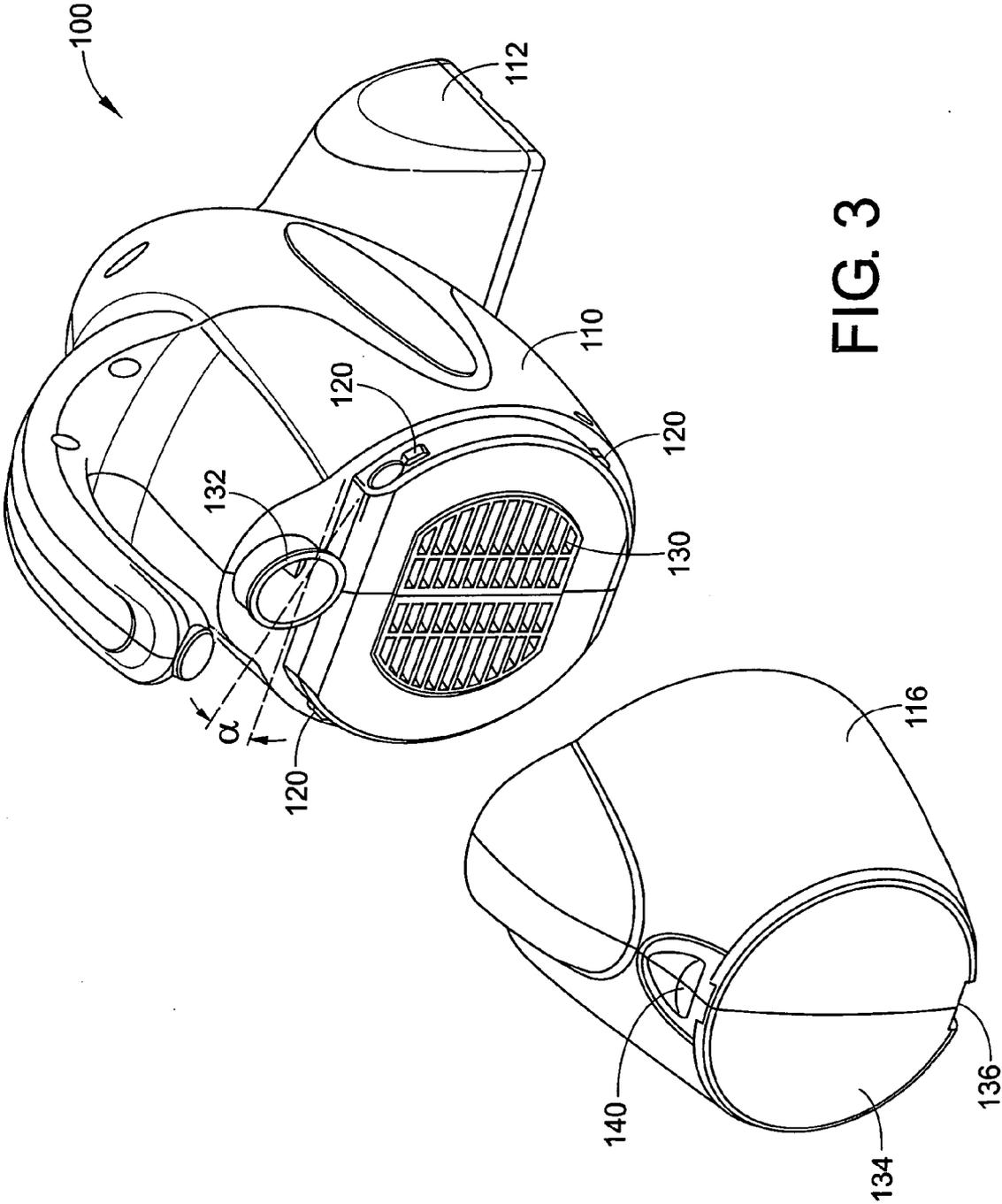


FIG. 3

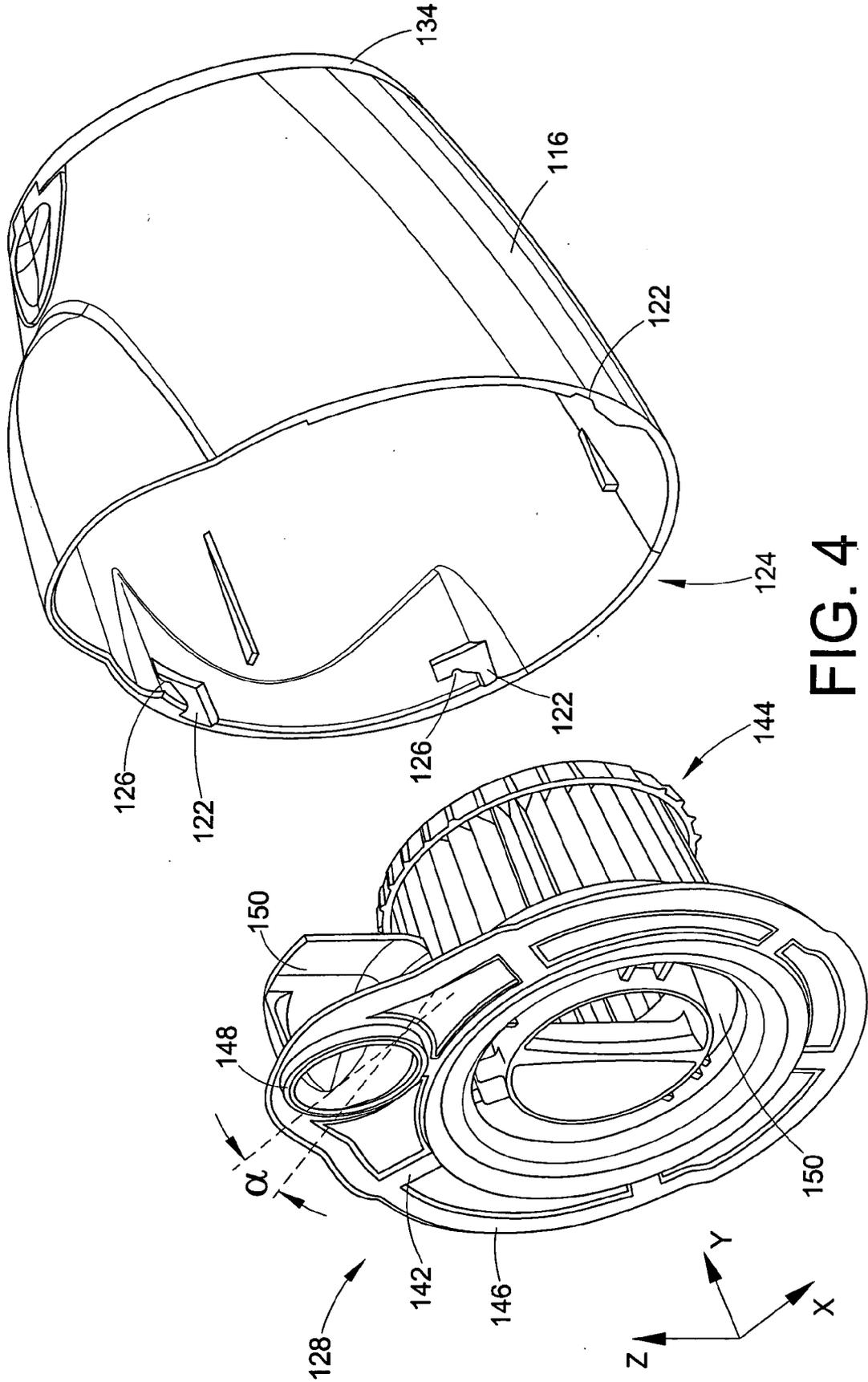


FIG. 4

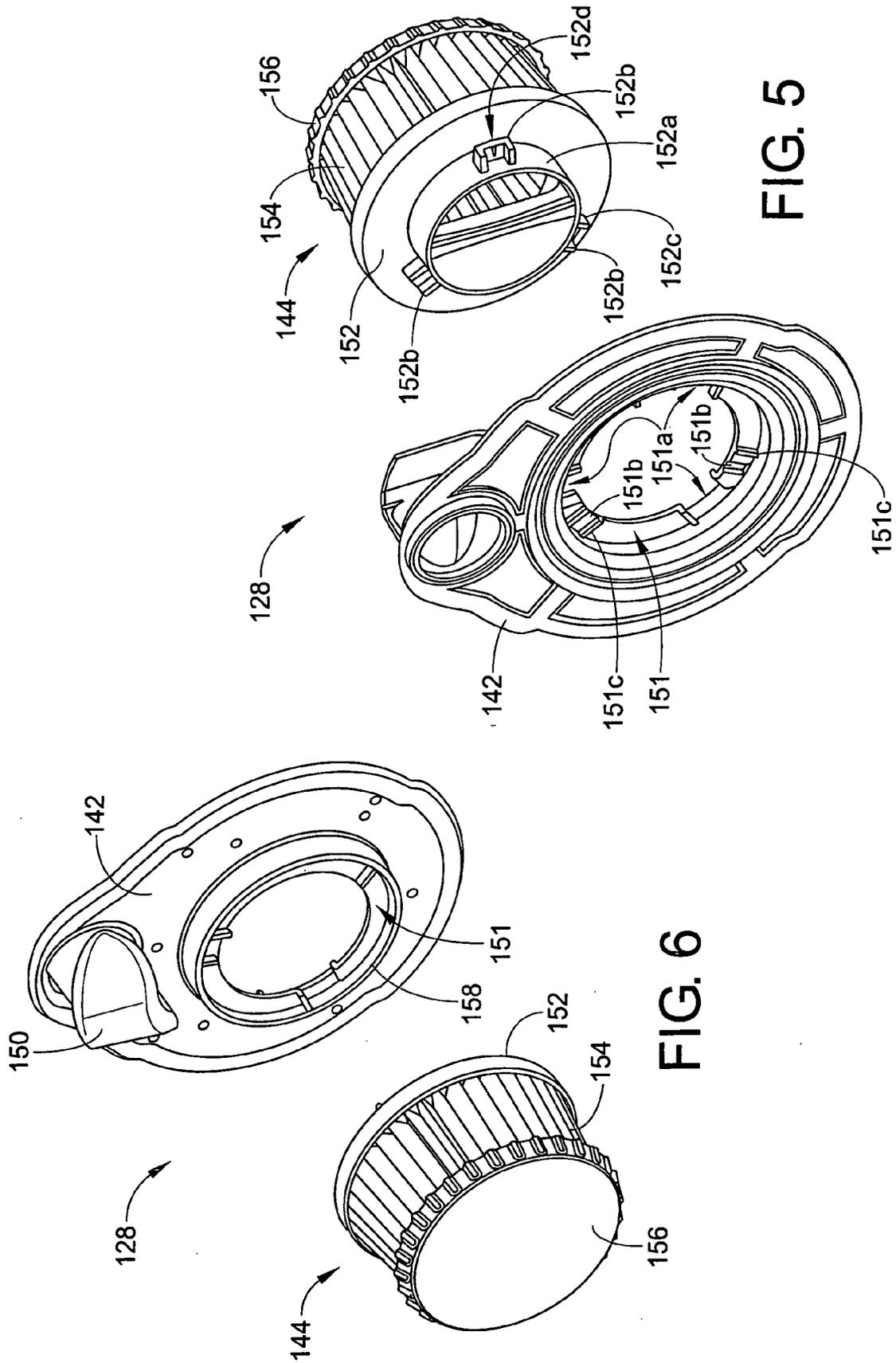


FIG. 5

FIG. 6

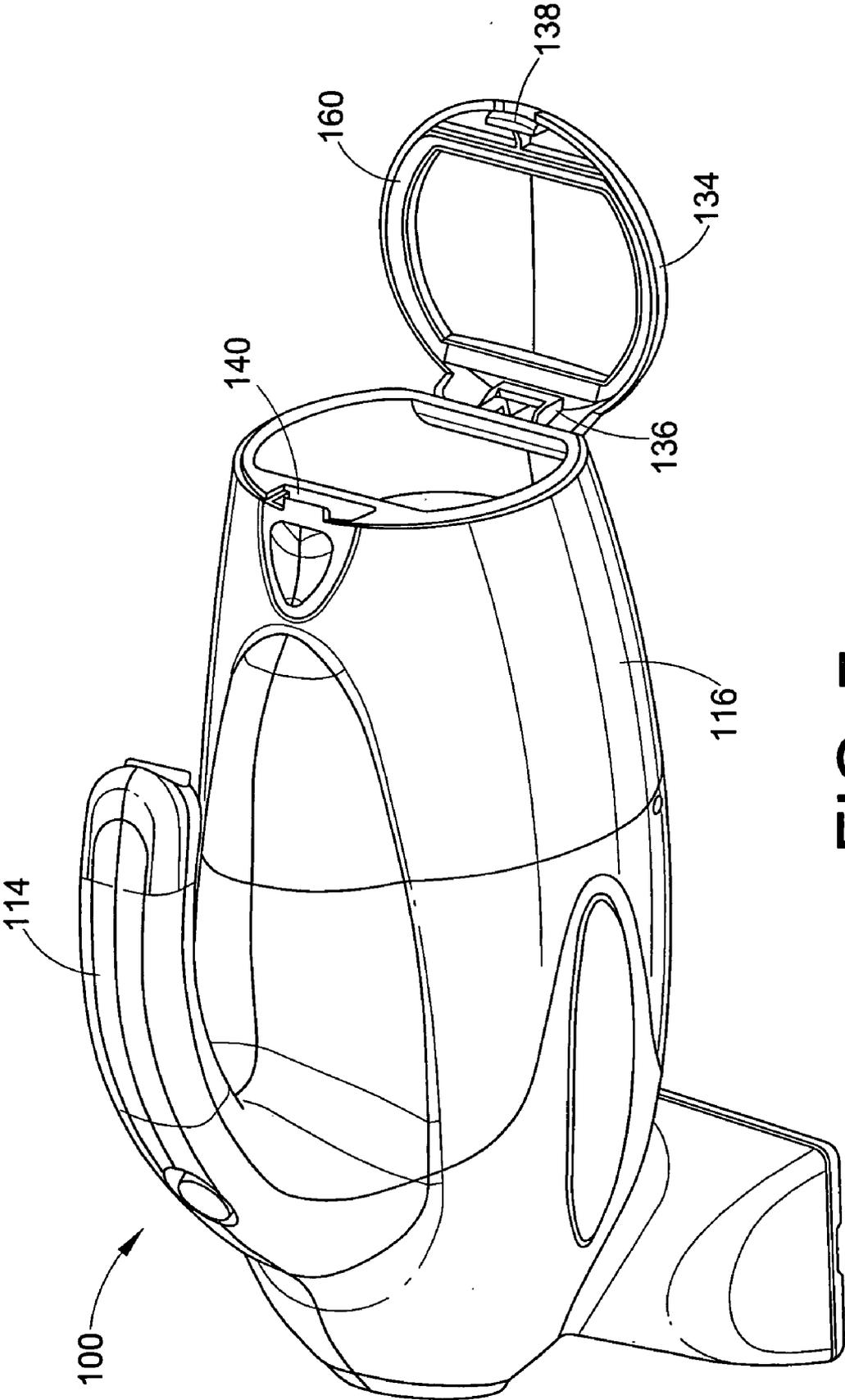


FIG. 7

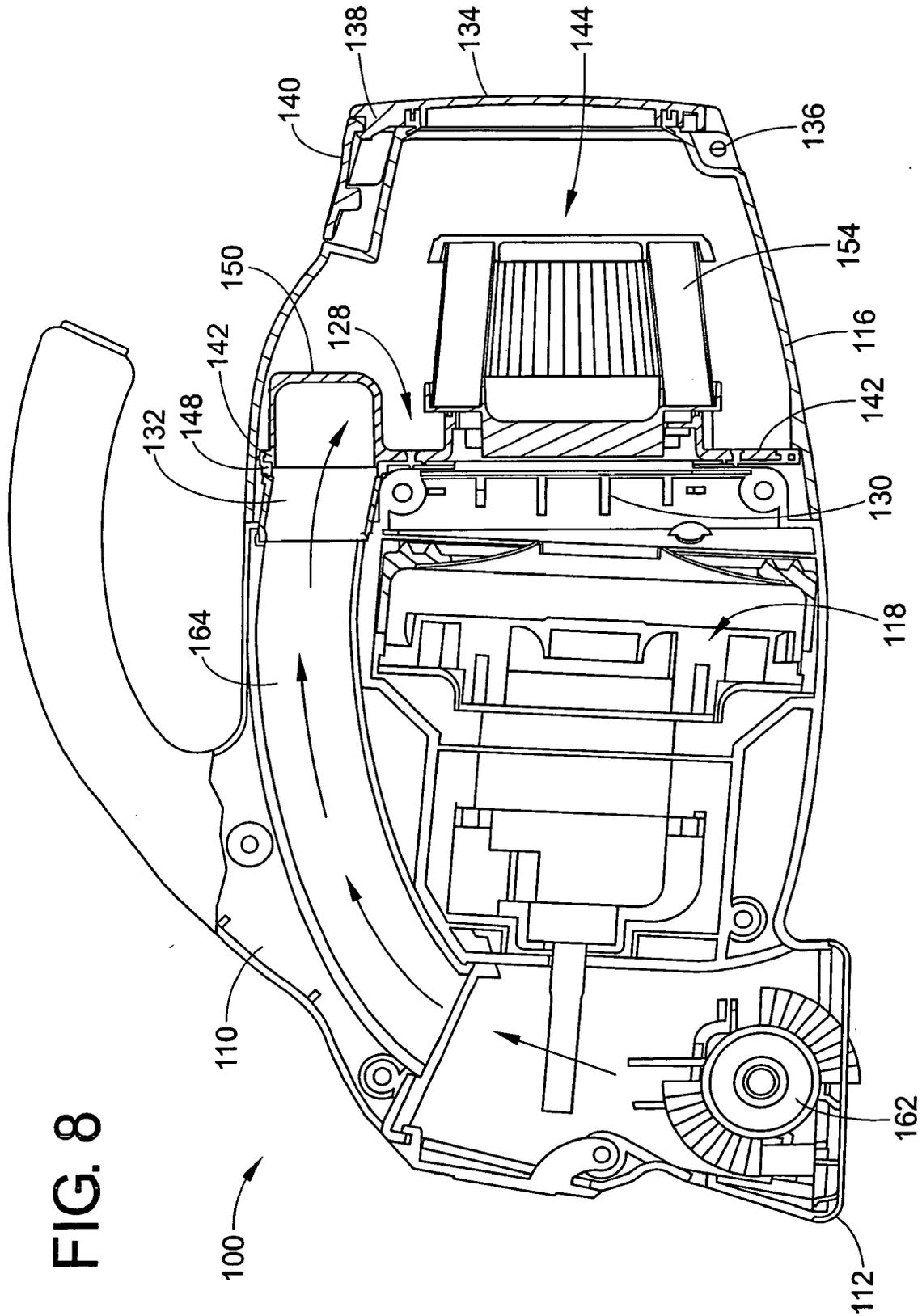


FIG. 8

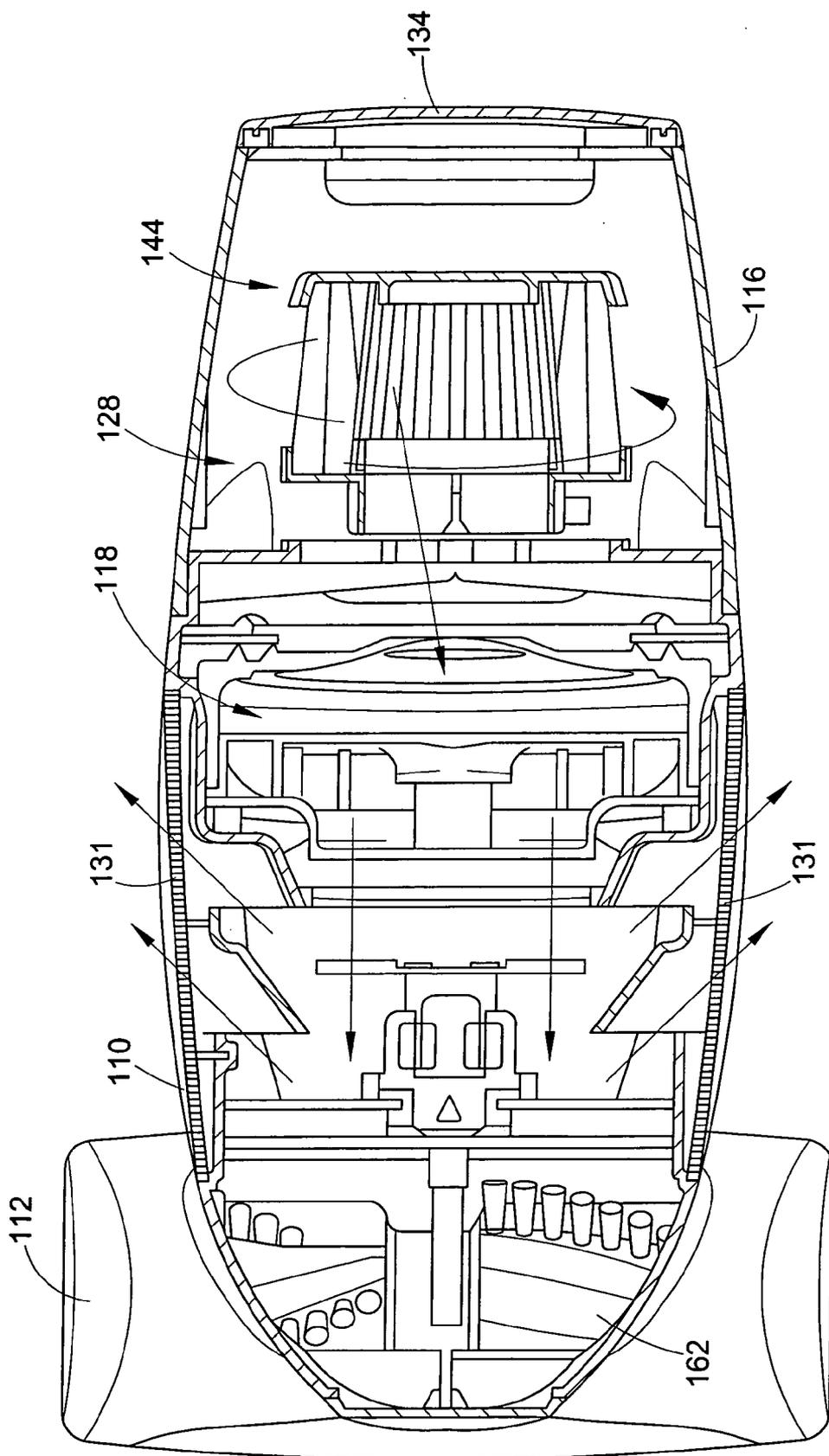


FIG. 9

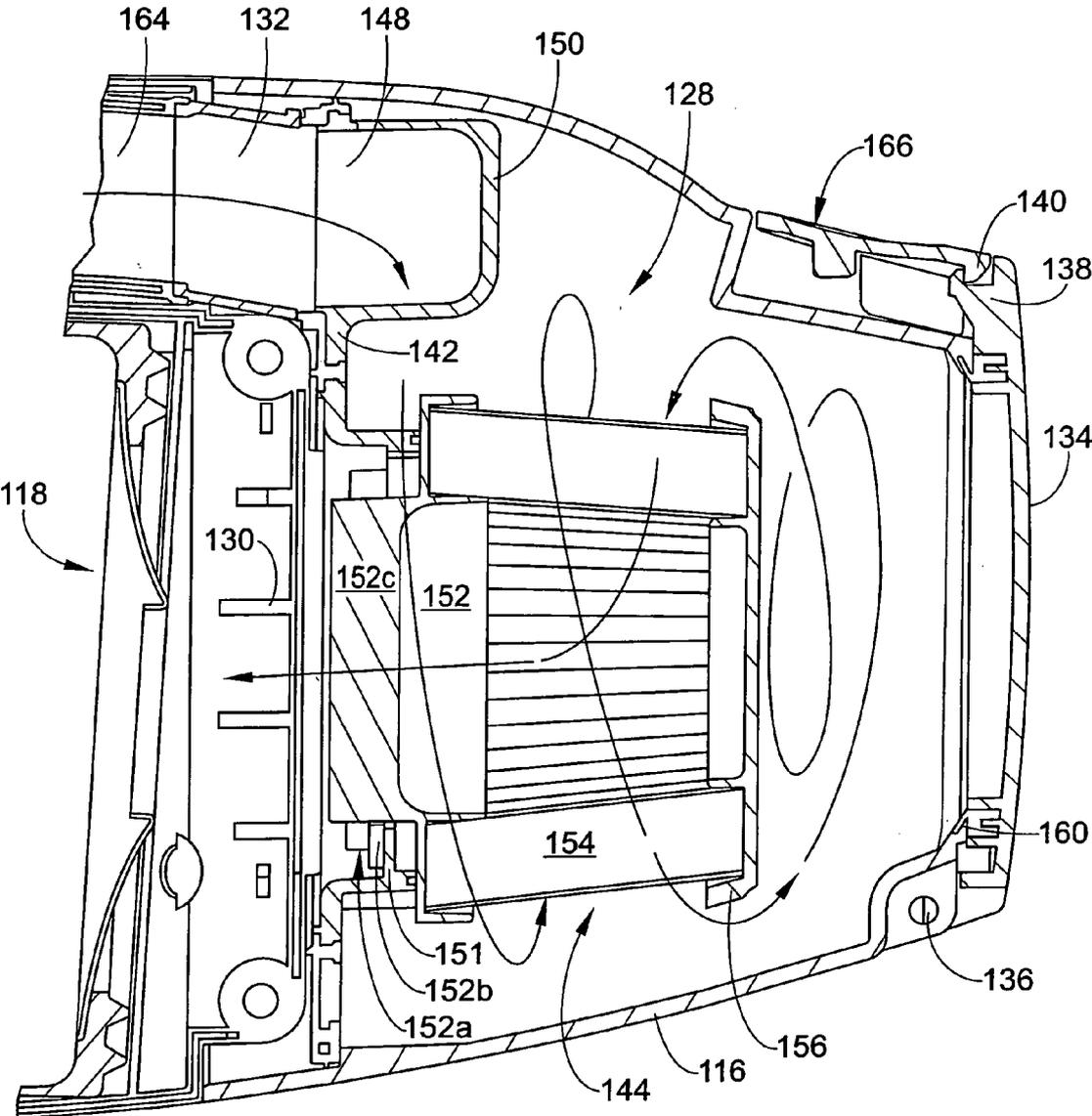


FIG. 10

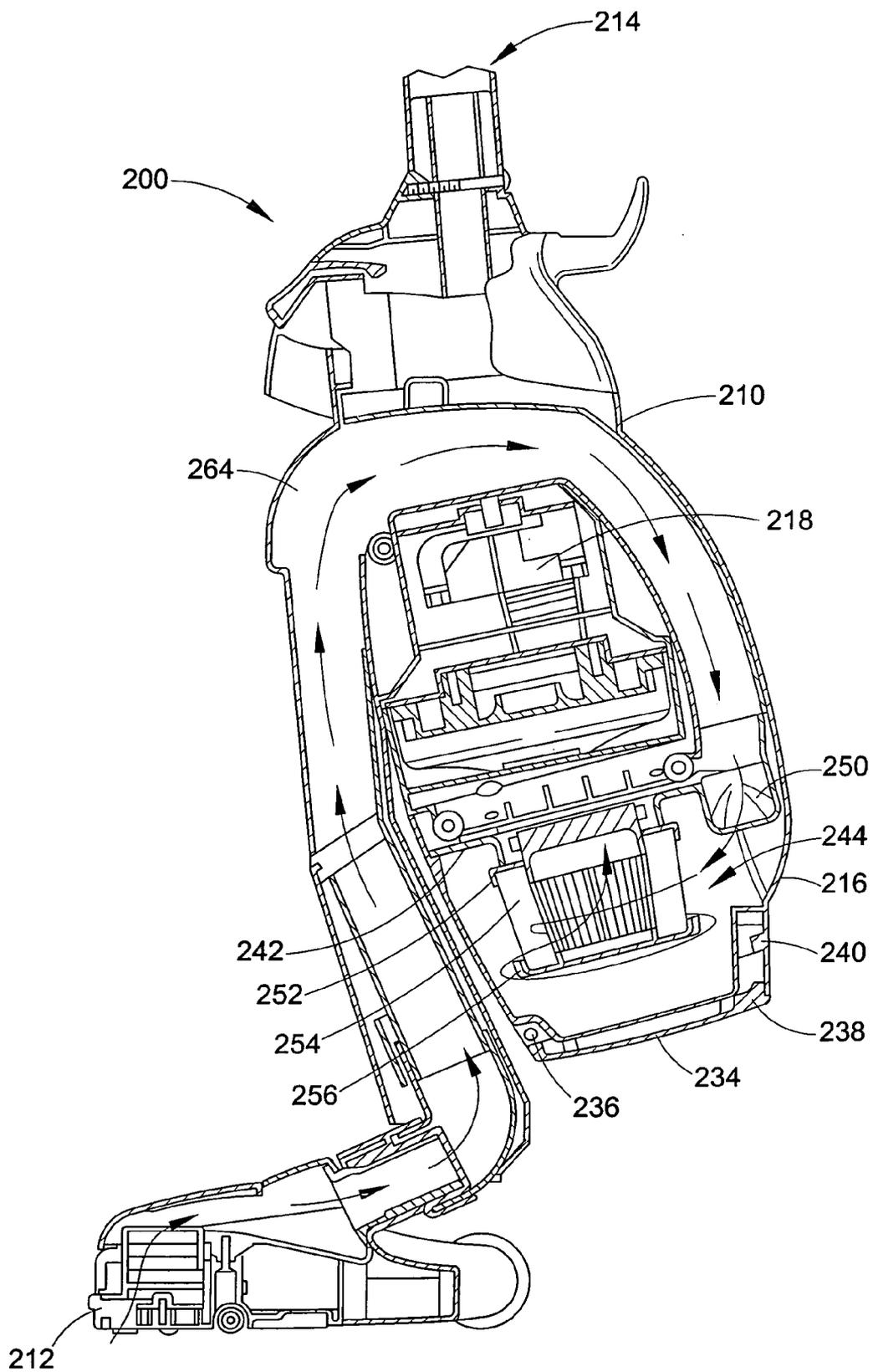
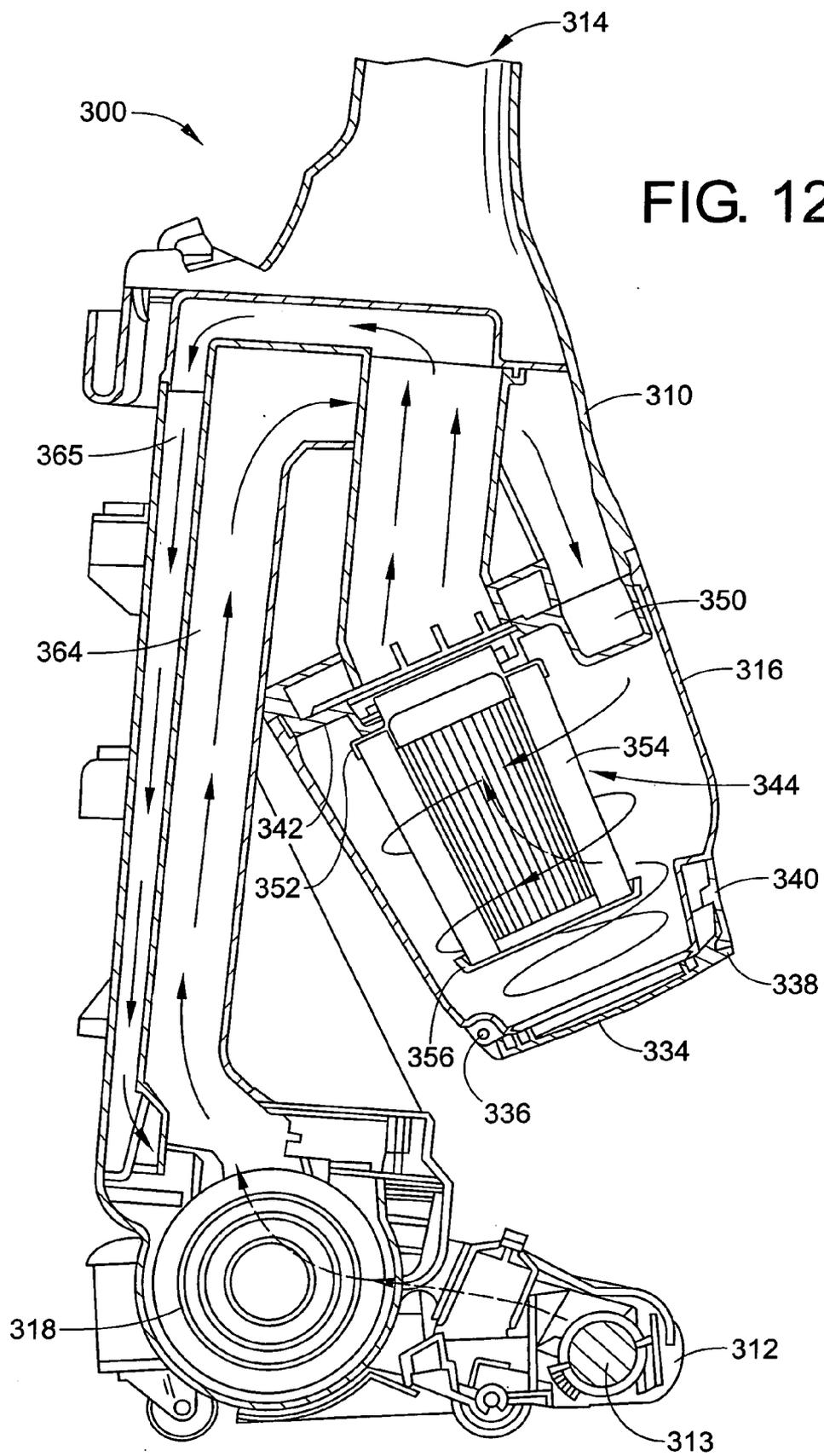


FIG. 11

FIG. 12



VACUUM CLEANER WITH CYCLONIC SEPARATING DIRT CUP AND DIRT CUP DOOR

[0001] This application is a continuation-in-part of application Ser. No. 29/221,441, filed on Jan. 14, 2005, and Ser. No. 29/221,442, filed on Jan. 14, 2005, and Ser. No. 29/237,958, filed on Sep. 8, 2005.

BACKGROUND

[0002] The present invention relates to the field of vacuum cleaners. It finds particular application in conjunction with vacuum cleaners which employ cyclonic separation.

[0003] Vacuum cleaners have become extremely popular for cleaning a variety of surfaces in homes, offices, cars or the like. One well known type of vacuum cleaner is a portable hand-held unit. Such units are utilized typically for small clean-up jobs or for cleaning in hard-to-reach places. These portable vacuum cleaner units are relatively light-weight and have a handle in order to enable a user to readily employ them in places where canister, upright, or shop-type vacuum cleaners cannot be used or are inconvenient to use.

[0004] However, the above mentioned hand-held vacuum cleaners suffer a number of disadvantages. One disadvantage is that the filter elements are often small and tend to clog with debris relatively quickly. This disadvantage arises as a result of the compact nature of these hand-held vacuum cleaners. As the filter collects debris the air flow through the hand-held vacuum cleaner is reduced. Thus, the overall vacuum and pickup efficiency of the cleaner is reduced as well.

[0005] Another disadvantage with prior hand-held vacuum cleaners is that they do not provide a convenient method of emptying the dirt which accumulates in the dirt cup of the cleaner. These units require the operator to shut-off the device and physically remove the dirt cup in order to empty the collected debris.

[0006] Accordingly, it is desirable to develop a new and improved vacuum cleaner which would overcome the foregoing deficiencies and others while meeting the above stated needs and providing better and more advantageous results.

SUMMARY OF THE INVENTION

[0007] According to one aspect of the present invention, a hand-held vacuum cleaner includes a housing having a first end and a second end, a suction nozzle located adjacent the first end of the housing, a suction fan and motor assembly located in the housing, and a dirt cup detachably mounted adjacent the second end of the housing. The dirt cup includes an inlet in fluid communication with the suction nozzle, an outlet in fluid communication with the suction fan and motor assembly, and a dirt cup door located on one end of the dirt cup.

[0008] According to another aspect of the present invention, a vacuum cleaner includes a housing having at least one nub disposed about an outer circumference of the housing, a suction nozzle located adjacent a first end of the housing, a suction fan and motor assembly located in the housing, and a dirt cup including a first end and a second end. The dirt cup includes an inlet in fluid communication with the suction nozzle and an outlet in fluid communication with the suction fan and motor assembly. The dirt cup further includes at least

one slot disposed about an inner circumference of the first end of the dirt cup, wherein the at least one nub of the housing cooperates with the at least one slot to rotatably secure the dirt cup to the housing. The vacuum cleaner further includes a filter assembly mounted to at least one of the dirt cup and the housing.

[0009] According to yet another aspect of the present invention, a vacuum cleaner includes a housing having a first end and a second end, a suction nozzle located adjacent the first end of the housing, a suction fan and motor assembly located in the housing, a dirt cup rotatably mounted to the housing, and a filter support including a segmented flange. The segmented flange includes at least one notch and at least one detent adjacent to the at least one notch. The filter support plate is disposed upstream from said suction fan and motor assembly. The vacuum cleaner further includes a filter which includes at least one tab disposed on the filter. The at least one tab includes a ridge. The at least one tab and the ridge cooperate with the at least one notch and the at least one detent to rotatably mount the filter to the filter support.

[0010] Other benefits and advantages of the invention will become apparent to those of average skill in the art upon a reading of the following detailed specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The invention may take form in certain structures and components, several embodiments of which will be described in detail in this specification and illustrated in the accompanying drawings. In the drawings:

[0012] **FIG. 1** is an assembled front perspective view of a first embodiment of a vacuum cleaner according to the present invention illustrating a hand-held cyclonic vacuum cleaner.

[0013] **FIG. 2** is an enlarged exploded front perspective view of the hand-held cyclonic vacuum cleaner of **FIG. 1**, showing a dirt cup being detached from a housing of the hand-held vacuum cleaner.

[0014] **FIG. 3** is an enlarged exploded rear perspective view of the hand-held cyclonic vacuum cleaner of **FIG. 1**, the detached dirt cup, is shown as including a dirt cup door.

[0015] **FIG. 4** is an enlarged exploded front perspective view of the dirt cup of the hand-held cyclonic vacuum cleaner of **FIG. 1**, showing a filter assembly removed from the dirt cup.

[0016] **FIG. 5** is an exploded perspective view from the front of the filter assembly of **FIG. 4** showing a filter cartridge removed from a filter support plate.

[0017] **FIG. 6** is an exploded perspective view from the rear of the filter assembly of **FIG. 4** showing the filter cartridge removed from the filter support plate.

[0018] **FIG. 7** is a side perspective view of the hand-held cyclonic vacuum cleaner of **FIG. 1** illustrating the dirt cup door of the dirt cup in an open position.

[0019] **FIG. 8** is an enlarged longitudinal vertical cross sectional view of the hand-held cyclonic vacuum cleaner of **FIG. 1**, illustrating the air flow path.

[0020] **FIG. 9** is an enlarged horizontal cross section as viewed from the top of the hand-held cyclonic vacuum cleaner of **FIG. 1**, illustrating the air flow path.

[0021] FIG. 10 is a greatly enlarged view of the dirt cup and the filter assembly of the hand-held cyclonic vacuum cleaner shown in FIG. 8.

[0022] FIG. 11 is a vertical cross section of a second embodiment of a vacuum cleaner according to the present invention illustrating a stick type vacuum cleaner.

[0023] FIG. 12 is a vertical cross section of a third embodiment of a vacuum cleaner according to the present invention illustrating an upright vacuum cleaner.

DETAILED DESCRIPTION

[0024] With reference to FIG. 1, a first embodiment of a hand-held vacuum cleaner 100 is shown. The hand-held vacuum cleaner 100 generally includes a housing 110, a suction nozzle 112, a handle 114, a dirt cup 116 and a suction fan and motor assembly 118 (FIG. 8). As shown in FIG. 1, the housing 110 can be formed of two bilaterally symmetrical pieces, a left half portion and a right half portion. Of course, other housing constructions are also contemplated. As can be seen in FIG. 9, the suction fan and motor assembly 118 is disposed internally to the housing 110. The suction nozzle 112 can be disposed adjacent a first end 110a of the housing 110, whereas the dirt cup 116 can be disposed adjacent a second end 110b of the housing 110.

[0025] Now with reference to FIG. 2, a perspective view of the first embodiment 100 of the hand-held vacuum cleaner is shown with the dirt cup 116 removed from the housing 110. A plurality of nubs 120 are disposed along the second end 110b of the housing 110. More particularly, the nubs are located circumferentially around a periphery of the housing 110. The nubs 120 cooperate with a plurality of slots 122 defined in the dirt cup 116. As shown in both FIGS. 2 and 4, the slots 122 are disposed along an inner circumference of an opening 124 of the dirt cup 116. The shape of each slot 122 may resemble an 'L'. In the first embodiment, a first portion of the slot 122 is formed perpendicular to the opening 124, whereas a second portion of the slot 122 continues at about a 90° angle to the first portion and parallel to the opening 124. The second portion of the slot 122 includes a raised ridge 126 which functions as a frictional lock for the nub 120. As shown in FIG. 2, the dirt cup 116 can be secured to the housing 110 by first aligning the nubs 120 with the first portion of the slots 122 and advancing the dirt cup 116 towards the second end 110b of the housing 110 until the opening 124 abuts the housing 110. Once the nubs 120 have seated fully into the first portion of the slots 122, the dirt cup 116 is rotated in a counterclockwise fashion (as viewed from the front of the hand-held vacuum cleaner 100). The dirt cup 116 is rotated until each of the nubs 120 snap past its respective raised ridge 126. Also visible in FIG. 2, is a filter assembly 128 that is disposed internally to the dirt cup 116. The filter assembly 128 slides into the dirt cup 116 and is held in place by a frictional fit between the filter assembly 128 and an inner wall surface of the dirt cup 116.

[0026] With reference now to FIG. 3, a perspective view of the first embodiment of the hand-held cyclonic vacuum cleaner 100 is shown (as in FIG. 2) but now from a rear view. As in FIG. 2, the dirt cup 116 is shown to be removed from the housing 110. More clearly visible in FIG. 3 are the nubs 120. In addition, a suction fan inlet 130 is shown. As best shown in FIG. 9, a pair of suction fan exhaust ports 131 can be defined in the housing 110. A dirty air outlet 132 is

located at an upper portion of the second end 110b of the housing 110. Generally speaking, the suction fan and motor assembly 118 draws air through the suction fan inlet 130 which in turn, draws air through the filter assembly 128 and through the dirty air outlet 132. The dirty air outlet 132 is in fluid communication with the suction nozzle 112.

[0027] With reference now to FIG. 7, a dirt cup door 134 is located at a rear portion of the dirt cup 116. The dirt cup door 134 is attached to the dirt cup 116 via a hinge 136. Located at an upper portion of the dirt cup door 134 is a catch 138. The catch 138 is engaged by a latch 140 which firmly secures the dirt cup door 134 against the dirt cup 116. The latch 140, the catch 138, and the hinge 136 are further depicted in FIG. 10. By depressing the latch 140, the catch 138 on the dirt cup door 134 is released and the dirt cup door 134 will pivot downward about the hinge 136. A spring, not illustrated, can be employed for this purpose. In this manner, the dirt cup door 134 provides a convenient method of emptying the dirt cup 116 without requiring the removal of the dirt cup 116 from the housing 110.

[0028] Now with reference to FIG. 4, the filter assembly 128 disposed in the dirt cup 116 of the first embodiment of the hand-held cyclonic vacuum cleaner 100 is shown. The filter assembly 128 generally includes a filter support plate 142 and a filter cartridge 144. The filter support plate 142 includes an outer sealing gasket 146, that is attached to the outer circumference of the filter support plate 142, a dirty air inlet 148, a cyclonic air flow deflector 150, and a segmented flange 151.

[0029] When the filter assembly 128 is inserted into the dirt cup 116, the volumetric space between the filter support plate 142 and the dirt cup door 134 defines a cyclonic flow chamber. It should be noted that the dirty air outlet 132 (FIG. 3) and the dirty air inlet 148 (FIG. 4) are rotated slightly about a Z-axis by an angular displacement α . This slight angular displacement permits the dirt cup 116 to rotate with respect to the housing 110 without interference during attachment of the dirt cup 116. As the dirt cup is attached, the dirty air inlet 148 rotates into alignment with the dirty air outlet 132 such that the one contacts the other and a seal is formed when the dirt cup 116 is fully attached. In addition, a dirty air outlet sealing gasket is disposed about the circumference of the dirty air outlet 132 (FIG. 3) and is pinched between the interface of the dirty air outlet 132 and the dirty air inlet 148 when the dirt cup 116 is mounted to the housing 110.

[0030] As illustrated in FIGS. 4-6, the filter cartridge 144 is secured to the filter support plate 142 via a frictional twist-on assembly. With particular reference to FIG. 5, the filter assembly 128 is shown in an exploded perspective view. The segmented flange 151 of the filter support plate 142 and the filter cartridge 144 are plainly visible. The segmented flange 151 can include a notch 151a, a detent 151b, and one or more stops 151c. The filter cartridge 144 includes a filter base 152, a filter medium 154 and a filter end cap 156. The filter base 152 includes a collar 152a, a plurality of tabs 152b, and a handle 152c. The plurality of tabs 152b, include a raised ridge 152d. The collar 152a and the tabs 152b are oriented such that they are received by the segmented flange 151 of the filter support plate 142. Specifically, each tab 152b slides past its respective notch 151a in the segmented flange 151. Then, the filter cartridge 144 is

rotated counterclockwise (as viewed from the front) causing the ridge 152d to slide over the segmented flange 151 and into the detent 151b. Furthermore, as the filter cartridge 144 is rotated, each of the tabs 152b will eventually come to rest against a respective one of the plurality of stops 151c. As the tabs 152b are rotated into position, the segmented flange 151 deflects slightly such that a small amount of pressure is generated between the segmented flange 151 and the tabs 152b. Eventually, each tab 152b snaps into place when each ridge 152d is aligned with its respective detent 151b. This pressure, in combination with the seating of the ridge 152d into the detent 151b, holds the filter cartridge 144 firmly in place with the filter support plate 142.

[0031] The handle 152c may be used to grip the filter cartridge 144 so as to facilitate the installation and removal of the filter cartridge 144 without damaging the filter medium 154. The filter medium 154 may be formed from a pleated filter material such as paper or a filter mesh material using fiberglass, nylon, plastic, or other various synthetic or organic materials. Assembly of the filter cartridge 144 may be accomplished by adhering, molding, or crimping the filter cap 156 to a first end of the filter medium 154 and by similarly attaching the base 152 to a second end of the filter medium 154.

[0032] Now with reference to FIG. 6, a rear exploded perspective view of the filter assembly 128 is shown. Here, the rear portions of the filter support plate 142 and the filter cartridge 144 are clearly visible. With respect to the filter support plate 142, the cyclonic air flow deflector 150 is shown as is an inner sealing gasket 158. With respect to the filter cartridge 144, the end cap 156 and the filter medium 154 are clearly visible, whereas the base 152 is partially eclipsed. As the filter cartridge 144 is mated with the filter support plate 142, the inner sealing gasket 158 is compressed between the filter support plate 142 and the base 152 of the filter cartridge 144 providing an airtight seal for reducing the possibility of unfiltered airflow across the filter assembly 128.

[0033] Now with reference to FIG. 7, a side perspective view of the first embodiment of the hand-held cyclonic vacuum cleaner 100 is shown. FIG. 7 clearly illustrates the operation of the dirt cup door 134. Here, the dirt cup door 134 is shown in an open position. With the dirt cup door 134 in the open position, the catch 138 and the hinge 136, as well as the latch 140, are clearly visible. In addition, a sealing gasket 160 is located about the outer perimeter of the dirt cup door 134. As described previously, when the latch 140 is depressed, the catch 138 is released and a spring biasing element that may be located within the hinge 136 urges the dirt cup door 134 open. At this stage, the user of the hand-held vacuum cleaner 100 may hold the cleaner by its handle 114 in a vertical orientation, such that any debris within the dirt cup 116 will simply drop out. Once the debris has been emptied, the user may close the dirt cup door 134 by lifting it and pressing it up against the latch 140.

[0034] Now with reference to FIG. 8, a vertical cross section of the hand-held vacuum cleaner 100 is shown. The section fan and motor assembly 118, the filter assembly 128, the filter cartridge 144, and a brushroll 162 are shown. The brushroll 162 may be disposed internally to the housing 110 and adjacent to the suction nozzle 112. When the suction fan and motor assembly 118 is operating, air begins to enter

through the suction nozzle 112, past the rotating brushroll 162, through a fluid channel 164 and out the dirty air outlet 132. As shown in FIG. 8, the dirty air outlet 132 abuts the dirty air inlet 148 of the filter support plate 142 when the dirt cup 116 is attached to the housing 110. As airflow exits the dirty air outlet 132 it enters the dirty air inlet 148 and impinges against the cyclonic air flow deflector 150. The air flow then continues in a tangential direction with respect to the filter cartridge 144 and spirals towards the rear portion of the dirt cup 116. Heavier than air particles are separated from the airflow due to the centrifugal forces generated by the cyclonic flow of the air. These particles accumulate in or near the bottom and rear portions of the dirt cup 116. As the airflow slows it moves towards the center of the cyclonic airflow chamber and is drawn through the filter medium 154 toward the suction fan inlet 130. Lastly, the airflow exits the dirt cup 116 via the collar 152a (FIG. 5) and enters the suction fan and motor assembly 118. As the air flow passes through the suction fan and motor assembly 118, the air cools the motor and exits the vacuum cleaner through the exhaust ports 131 in the housing 110.

[0035] With reference now to FIG. 9, a horizontal cross section of the hand-held vacuum cleaner 100 is shown. Clearly visible in FIG. 9 are the suction nozzle 112, the brushroll 162, the housing 110, the suction fan and motor assembly 118, the dirt cup 116, the dirt cup door 134 and the filter assembly 128. Also, a portion of the air flow path is shown within the cyclonic separating chamber of the dirt cup 116 (as indicated by the solid arrows showing circular movement about the filter cartridge 144). Dotted arrows indicate air flow from the filter cartridge 144 into the suction fan and motor assembly 118 and out through the exhaust ports 131 on the sides of the housing 110.

[0036] Now with reference to FIG. 10, an enlarged vertical cross section of the dirt cup 116 and the filter assembly 128 is shown. The filter cartridge 144 including the base 152, the filter medium 154 and the filter cap 156 are shown. The handle portion 152c of the base 152 of the filter cartridge 144 is also shown. As described previously, the filter cartridge 144 is rotatably engaged with the filter support plate 142 via the segmented flange 151. The tabs 152b of the collar 152a engage and generate a pressure fit between the base 152 and the segmented flange 151.

[0037] With continued reference to FIG. 10, the air flow moves from the fluid channel 164 through the dirty air outlet 132 past the dirty air inlet 148 as indicated by reference indicia A. The air flow is then redirected by the cyclonic air flow deflector 150 to produce a cyclonic air flow B. The air flow C then spirals about the filter cartridge 144 by which dense heavier than air debris is deposited in the dirt cup 116. The airflow D then proceeds through the filter medium 154, through the collar 152a, past the suction fan inlet 130, and into the suction fan and motor assembly 118. Also illustrated in FIG. 10 is an enlarged cross section of the latch 140, the catch 138, the hinge 136 and the dirt cup door sealing gasket 160. The latch 140 includes a button surface 166 which the user may depress to open the dirt cup door 134. Depressing the latch 140 causes an end of the latch to pivot upward. As the latch end pivots upward the catch 138 disengages permitting the dirt cup door 134 to pivot about the hinge 136 into the open position.

[0038] During operation of the hand-held vacuum cleaner 100, dirty air is drawn into the dirt cup wherein the dirty air

undergoes a cyclonic dirt separation as described previously. As more and more debris collects in the dirt cup, the air flow through the vacuum cleaner **100** is reduced. This results in a lower amount of suction being produced at the suction nozzle. In order to restore the air flow to its original level, the user of the hand-held vacuum cleaner **100** will need to empty the dirt cup. Emptying the dirt cup may be accomplished in a number of ways. One way of emptying the dirt cup is by simply removing the dirt cup from the housing. This is accomplished by rotating the dirt cup in a clockwise direction (as viewed from the front of the hand-held vacuum cleaner **100**) and pulling outward until the nubs **120** disengage the slots **122** (FIGS. 3, 4). Once the dirt cup is removed, the filter assembly may be removed by gently pulling on the handle portion **152c** of the filter cartridge. With the filter assembly removed, the dirt cup may be emptied by tilting the dirt cup opening towards and into an appropriate trash receptacle. At this point, the user may also elect to replace the filter cartridge with a new clean cartridge, or simply clean the filter material of the cartridge.

[0039] Another technique for emptying the dirt cup involves using the dirt cup door. In this case, the dirt cup need not be removed from the housing. Nor does this require the filter assembly to be removed from the dirt cup. In fact, the hand-held vacuum cleaner **100** need only be tilted in a vertical orientation with the dirt cup door pointing in a downward direction while the user depresses the latch. Depressing the latch releases the catch and allows the dirt cup door to swing open. Agitating or lightly tapping the dirt cup will aid in dislodging dirt and debris within the dirt cup, allowing such dirt and debris to drop through the dirt cup door opening and into an appropriate trash receptacle. As before, the user may elect to clean or change out the filter cartridge after removing the dirt cup. In fact, it should be appreciated, that the filter cartridge could be removed from the dirt cup (without first removing the dirt cup from the housing) by reaching through the dirt cup door opening and disengaging the filter cartridge from the filter support plate. However, as illustrated, the present filter cartridge is too large to pass entirely through the dirt cup door opening. Nevertheless, it can be contemplated that either the present filter cartridge can be reduced in size to accommodate the dirt cup door opening or the dirt cup door opening could be enlarged to accommodate the filter cartridge.

[0040] Also, to facilitate the removal of the filter cartridge from the filter support plate, it should be appreciated that the handle on the filter cartridge could be differently shaped and located elsewhere on the filter cartridge. For example, the filter cartridge could utilize a filter frame that would rigidly secure the filter base **152** to the end cap **156** (FIG. 5), thus, allowing the end cap to be used as a handle surface. Similarly, the handle portion could be formed on the outer circumference of the base. In addition, the filter support plate could be fastened or integrally formed to the housing, rather than being secured internally to the dirt cup via a frictional fit.

[0041] It should be noted that multiple gaskets located in the handheld vacuum cleaner **100** cooperate to prevent unfiltered dirty air flow from entering the suction fan and motor assembly and to also prevent ambient air from entering into the dirt cup from the edges of the dirt cup door during operation. The dirty air outlet gasket, the filter support plate gasket, and the filter cartridge base gasket

prevents unfiltered dirty air within the dirt cup **116** from directly entering the suction fan and motor assembly **118**. A leak of this nature, over-time, could cause extensive dirt accumulation within the suction fan and motor assembly. This accumulation could result in overheating of the motor or premature wear-out of journal and or roller bearings. The dirt cup door gasket, located about the perimeter of the dirt cup door, prevents ambient air from entering the dirt cup during operation of the hand-held vacuum cleaner **100** and prevents fine debris from escaping when the cleaner is not operating. An air leak of this nature would have no detrimental impact on the suction fan and motor assembly, however, it would reduce the overall suction capability of the hand-held vacuum cleaner **100**. The dirt cup door gasket is compressed due to the pressure generated between the catch and the latch, thus, providing an air tight seal about the dirt cup door opening. Because of the pressure generated between the catch and the latch, the dirt cup door is prevented from accidentally opening on its own during use. Additional latch pressure may be generated by placing a compression spring beneath the button surface of the latch to generate greater downward force at the tip of the latch.

[0042] The hand-held vacuum cleaner **100** may be powered by a variety of sources. One source could be a 110-120 volts AC house supply (as is standard in the U.S.A.) or 220-240 volts AC (as prevalent in Europe) provided via a power line **170**, shown in FIG. 1. Alternately, the hand-held vacuum cleaner **100** could be configured to operate on a DC power supply by having an appropriate DC motor. A DC power supply could include a 12 volt supply as provided, for example, by a rechargeable or removable battery pack or even by a cigarette lighter or a power outlet in an automobile or other vehicle. Doing so would have the advantage of making the hand-held vacuum cleaner **100** even more portable. Lastly, it should be noted that the hand-held vacuum cleaner **100** need not contain the brushroll as described previously. As an alternative to having the brushroll, the suction nozzle may be flat, smooth, or only contain static bristles located along an opening of the suction nozzle to help agitate and deflect debris into the suction nozzle.

[0043] Now with reference to FIG. 11, a side cross sectional view of a second embodiment of a vacuum cleaner having a cyclonic twist off dirt cup is shown. More particularly, the second embodiment depicts a stick type vacuum cleaner **200**. Generally, the stick vacuum cleaner **200** includes a housing **210**, a nozzle portion **212**, a handle located at an upper portion **214**, a dirt cup **216** and a suction motor and fan assembly **218**. Normally, stick vacuums do not employ a brushroll. Thus, one is not shown in FIG. 11. As described with reference to the first embodiment of the vacuum cleaner **100**, the second embodiment of the vacuum cleaner **200** also includes a dirt cup door **234** having a hinge **236**, a catch **238** and a latch **240**. Disposed internally to the dirt cup **216** is a filter support plate **242**, a filter cartridge **244** and a cyclonic air flow deflector **250**. The cyclonic air flow deflector **250** may be formed integrally with the filter support plate **242**. The filter cartridge **244** further includes a base **252**, a filter medium **254** and an end cap **256**. As before, the filter base **252** includes a plurality of tabs which engage a plurality of notches in a segmented flange of the filter support plate **242**. In addition, the dirt cup **216** of the second embodiment can employ the same twist on assembly as does the first embodiment. The dirt cup **216** may be attached to the housing **210** through the use of a plurality of nubs

disposed along an outer circumference of the housing 210, as well as a plurality of slots disposed along an inner circumference of the dirt cup 216. The plurality of slots in the dirt cup 216 engage the plurality of nubs along the outer circumference of the housing 210.

[0044] In much the same way (as described previously with respect to the first embodiment 100), the user of the second embodiment may use a dirt cup door 234 to empty debris that is collected in the dirt cup 216 during vacuuming. As before, the dirt cup 216 may be emptied a number of ways. The user may elect to twist off the entire dirt cup 216, remove the filter support plate 242 along with the filter cartridge 244 and empty out the contents of the dirt cup 216. Alternatively, the user may elect to leave the dirt cup 216 attached and use the dirt cup door 234 to empty the dirt cup 216. The debris may be emptied through the dirt cup door 234 by depressing the latch 240 and allowing the dirt cup door 234 to rotate about the hinge 236. In this case, the user may conveniently empty the dirt cup by simply lifting the stick type vacuum cleaner 200 over a trash receptacle while depressing the latch 240. In all other aspects, the operation of the dirt cup 216 and the dirt cup door 234 are the same as in the first embodiment 100.

[0045] Now with reference to FIG. 12, a side cross sectional view of a third embodiment of a vacuum cleaner having a cyclonic twist off dirt cup is shown. In particular, the third embodiment depicts an upright type vacuum cleaner 300. As in the earlier two embodiments, the upright vacuum cleaner 300 also includes a housing 310, a suction head portion 312, a handle that may be located at an upper portion 314 of the housing 310, a dirt cup 316 and a suction motor and fan assembly 318. In contrast to the stick type vacuum cleaner 200 of the second embodiment, in the third embodiment, the suction motor and fan assembly 318 is disposed in the suction head portion 312, rather than in the housing portion 310. Similar to the first and second embodiments, the dirt cup 316 of the third embodiment includes a dirt cup door 334, a hinge 336, a catch 338 and a latch 340. However, a filter support plate 342 may be rigidly secured or made of one-piece with the housing 310 and may only be partially disposed internally to the dirt cup 316. As with the first and second embodiments, a filter cartridge 344, is at least partially disposed internally to the dirt cup 316 and may be secured via a twist-on assembly to the filter support plate 342. In addition, the third embodiment 300 includes a cyclonic air flow deflector 350 that can be integrally formed with the filter support plate 342.

[0046] Once again, the method of operation and attachment of the dirt cup 316 and the filter cartridge 344 are the same in the third embodiment as they were in the first and second embodiments. One noteworthy difference is the dirt cup 316 and the filter cartridge 344 have an overall longer length than the dirt cup 216 and filter cartridge 244 of the second embodiment. The longer or larger dirt cup 316 and larger filter cartridge 344 provide for greater volume of debris accumulation than do the first or second embodiments. This provides the added advantage of reducing the frequency of emptying the dirt cup 316. Furthermore, a larger cartridge 344 provides a lower loss of air flow through the upright vacuum cleaner 300 as dirt and debris begin to accumulate in the dirt cup 316.

[0047] Another difference involves the pathways of the clean air and dirty air through the upright vacuum cleaner

300. The dirty air flow pathway begins at an opening in the suction head 312 moving past a rotating brushroll 313 and flows through the suction head through a dirty air fluid channel 364 in the housing 310. Then the airflow begins to move downward towards the dirt cup 316 and impinges against the cyclonic air flow deflector 350 which induces the cyclonic airflow separation within the dirt cup 316. As the air flow slows, it enters through the sides of the filter cartridge 344 initially traveling upward into the clean air fluid channel in the housing 310, then downwards through the suction fan and motor assembly 318 eventually exiting the upright vacuum cleaner 300.

[0048] It should also be noted that the dirt cup 316 need not be removed in order to be emptied. The user may simply and conveniently locate a trash receptacle beneath the dirt cup 316 directly below the dirt cup door 334 and depress the latch 340 in order to empty any dirt and debris directly into the trash receptacle. The unique structural orientation of the dirt cup 316 with respect to the upright vacuum cleaner 300 permits this method of convenient emptying of the dirt cup 316. In all other aspects, the operation of the dirt cup 316 and the dirt cup door 334 are the same as in the first embodiment.

[0049] Modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the embodiments described herein be construed as including all such modifications and alterations, insofar as they come within the scope of the appended claims or the equivalents thereof.

1. A hand-held vacuum cleaner comprising:

a housing having a first end and a second end;

a suction nozzle located adjacent the first end of the housing;

a suction fan and motor assembly located in the housing;

a dirt cup detachably mounted adjacent the second end of the housing;

wherein, the dirt cup includes an inlet in fluid communication with the suction nozzle, an outlet in fluid communication with the suction fan and motor assembly, and a dirt cup door located on one end of the dirt cup.

2. The hand-held vacuum cleaner of claim 1 wherein at least a portion of the dirt cup defines a cyclonic flow chamber.

3. The hand-held vacuum cleaner of claim 1 wherein the dirt cup includes a latch for releasably engaging the dirt cup door.

4. The hand-held vacuum cleaner of claim 3 wherein the dirt cup door includes a catch for releasably engaging the latch.

5. The hand-held vacuum cleaner of claim 1 wherein the dirt cup includes a hinge for the dirt cup door.

6. The hand-held vacuum cleaner of claim 1 further comprising a filter assembly releasably mounted to the dirt cup, wherein the filter assembly is disposed upstream of the suction fan and motor assembly.

7. The hand-held vacuum cleaner of claim 6 wherein the filter assembly includes a filter cartridge and a filter support plate.

8. The hand-held vacuum cleaner of claim 7 wherein the filter support plate includes a cyclonic airflow deflector inlet,

a centrally located clean air outlet, and a sealing gasket disposed about an outer circumference of the filter support plate.

9. The hand-held vacuum cleaner of claim 1 further comprising a brushroll mounted to the housing wherein the brushroll is rotatably driven by the fan and motor assembly.

10. The hand-held vacuum cleaner of claim 1 wherein the dirt cup door includes a sealing gasket.

11. A vacuum cleaner comprising:

a housing including at least one nub disposed about an outer circumference of the housing;

a suction nozzle located adjacent a first end of the housing;

a suction fan and motor assembly located in the housing; and

a dirt cup including a first end and a second end, the dirt cup having an inlet in fluid communication with the suction nozzle and an outlet in fluid communication with the suction fan and motor assembly, and at least one slot disposed about an inner circumference of the first end of the dirt cup, wherein the at least one nub of the housing cooperates with the at least one slot to rotatably secure the dirt cup to the housing; and

a filter assembly mounted to at least one of the dirt cup and the housing.

12. The hand-held vacuum cleaner of claim 11 further comprising a brushroll which is rotatably driven by the fan and motor assembly.

13. The hand-held vacuum cleaner of claim 11 wherein the filter assembly includes a filter cartridge and a filter support plate.

14. The hand-held vacuum cleaner of claim 13 wherein a cyclonic flow chamber is defined within the dirt cup between the filter support plate and the second end of the dirt cup.

15. The hand-held vacuum cleaner of claim 13 wherein the filter support plate includes a cyclonic airflow deflector, a centrally located outlet, and a sealing gasket about an outer circumference of the filter support plate.

16. The hand-held vacuum cleaner of claim 13 wherein the filter assembly is disposed upstream of the suction fan.

17. The hand-held vacuum cleaner of claim 13 wherein the filter assembly is frictionally engaged along an inner wall surface of the dirt cup.

18. The hand-held vacuum cleaner of claim 13 wherein the filter cartridge includes a filter base, a filter end cap, and a filter medium disposed between the filter base and the filter end cap.

19. The hand-held vacuum cleaner of claim 18 wherein the filter base includes at least one tab that is snappingly engageable with at least one detent of the filter support plate.

20. The hand-held vacuum cleaner of claim 18 wherein the filter base includes a handle portion.

21. A vacuum cleaner comprising:

a housing having a first end and a second end;

a suction nozzle located adjacent the first end of the housing;

a suction fan and motor assembly located in the housing;

a dirt cup rotatably mounted to the housing;

a filter support including a segmented flange, the segmented flange having at least one notch and at least one detent adjacent to the at least one notch, the filter support plate being disposed upstream from said suction fan and motor assembly; and

a filter including at least one tab disposed on the filter, the at least one tab having a ridge, the at least one tab and the ridge cooperating with the at least one notch and the at least one detent to rotatably mount the filter to the filter support.

22. The hand-held vacuum cleaner of claim 21 wherein the segmented flange includes at least one stop adjacent to the at least one detent, the at least one stop precluding the at least one tab from rotating past the at least one detent.

23. The hand-held vacuum cleaner of claim 21 wherein the filter further comprises a handle portion.

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