March 14, 1961 P. T. HAHN 2,974,346

NOZZLE AND FILTERING DEVICE FOR VACUUM CLEANERS

Original Filed Nov. 21, 1955 2 Sheets-Sheet 1

Fig. 1.

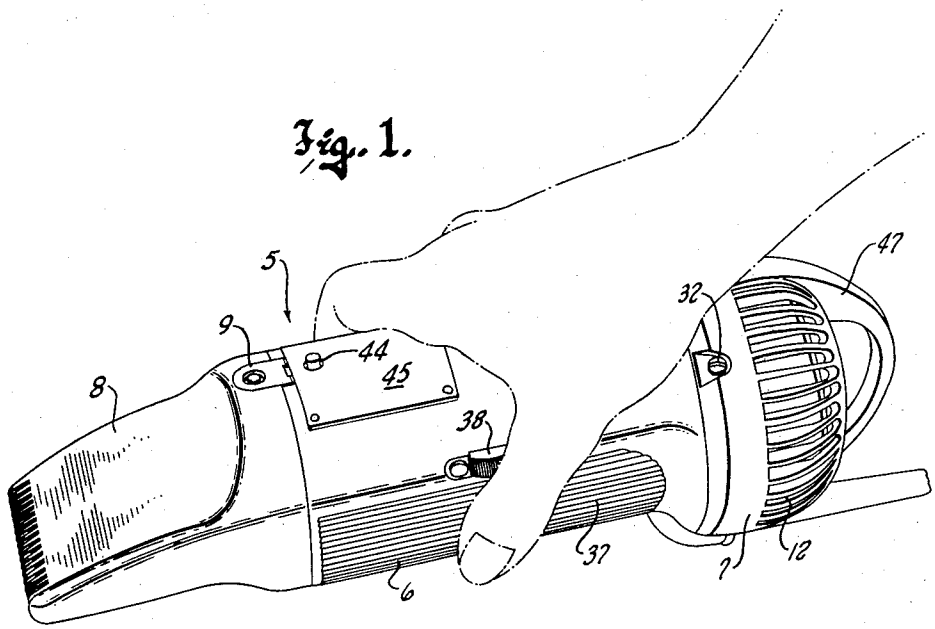
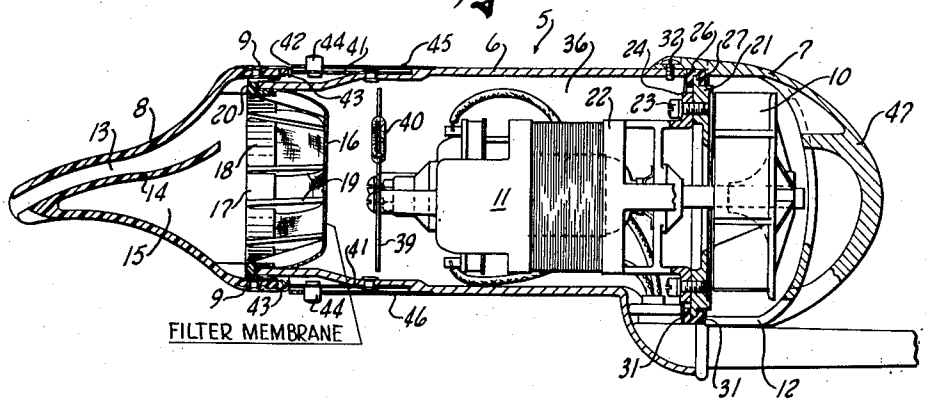


Fig. 2.



Inventor
Paul T. Hahn
By Drahuillon Jones
Attorney

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Fig. 3.

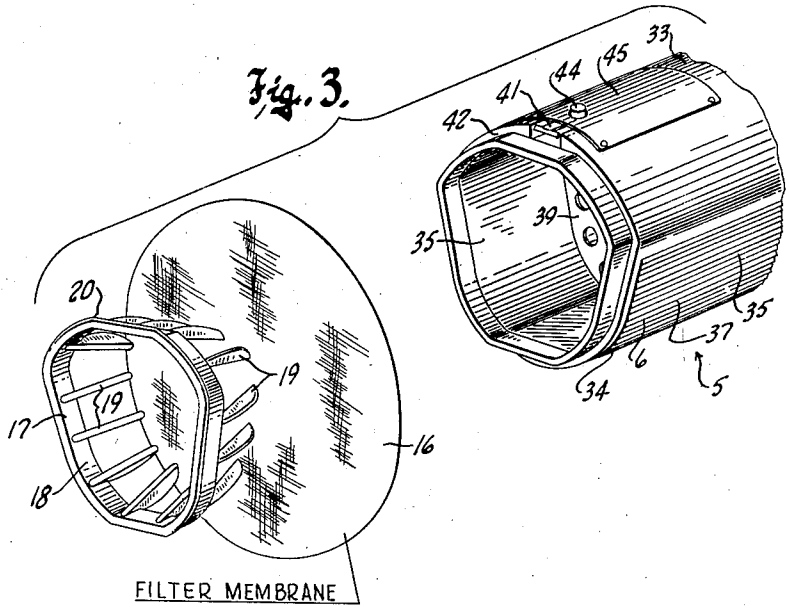
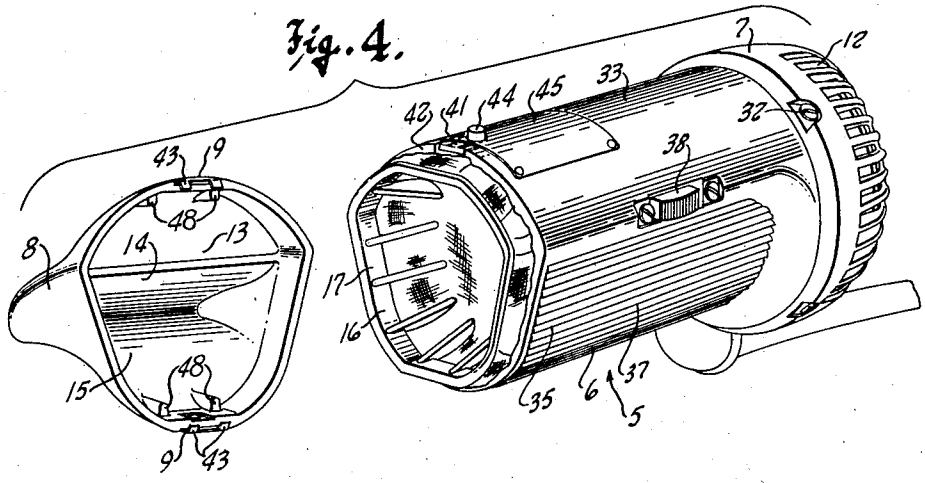


Fig. 4.



Inventor
Paul T. Hahn
By Ira Milton Jones
Attorney

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NOZZLE AND FILTERING DEVICE FOR VACUUM CLEANERS

Paul T. Hahn, Harrisburg, Pa., assignor to John Oster Manufacturing Co., Milwaukee, Wis., a corporation of Wisconsin

Original application Nov. 21, 1955, Ser. No. 547,970. Divided and this application Oct. 7, 1959, Ser. No. 844,934

1 Claim. (Cl. 15—344)

This invention relates to vacuum cleaners and refers more particularly to improvements in the suction nozzle and filter components of vacuum cleaners, particularly small portable hand-held electric vacuum cleaners of the type disclosed in my copending application, Serial No. 547,970, filed November 21, 1955, of which this application is a division.

In general, it is the primary objective of this invention to provide a small but efficient vacuum cleaner that can be easily operated while held in one hand, and is especially, though not exclusively, useful to barbers for removing hair clippings from the head, neck and clothing of their customers.

More particularly, it is the purpose of this invention to provide a hand-held vacuum cleaner of the character described featuring an improved arrangement of the components of the cleaner to assure the desired compactness thereof.

In a more specific sense, it is an object of this invention to provide a vacuum cleaner of the character described with an improved suction nozzle and filtering device that may be attached to the front of the cleaner housing and which enables the latter to be reduced to the small size necessary merely for enclosure of the fan of the cleaner and the electric motor by which the fan is driven.

In this connection, it is a further object of this invention to provide a vacuum cleaner with a suction nozzle and a filtering device in the rear or discharge end portion of the nozzle, and wherein partition means in the nozzle defines a dirt receiving and collecting pocket ahead of the filtering device, into which dirt removed from the air passing through the nozzle may accumulate.

Still another object of the invention resides in the provision of a vacuum cleaner of the character described wherein the partition in the suction nozzle extends forwardly to the mouth of the nozzle and rearwardly to a zone near the filter device in the discharge end of the nozzle to enable nearly the entire nozzle to be immersed in a sterilizing solution without danger of entry of the solution into the dirt collecting pocket of the nozzle.

A further object of this invention is to provide a small, hand-held vacuum cleaner of the character described, wherein the filtering device includes a mounting member that fits within the rear of the suction nozzle and is held in place in the cleaner by attachment of the nozzle to the front of the cleaner housing, and wherein the filtering device is removable from the rear of the nozzle upon detachment of the nozzle to facilitate replacement of the filter and emptying of dirt from the dirt collecting pocket of the nozzle.

The filtering device of this invention also constitutes an improvement over its predecessors in that it enables and provides for the use of flexible filtering material in sheet form, which nevertheless may be releasably held in the form of a cup, while in use, by novel grid means which constitutes part of this invention. This grid means makes it possible to provide a filtering surface having an area far greater than that of the cross section of the

suction duct in which the filter is mounted, thus increasing the overall filtration capacity without requiring any increase in the size of the passage.

This is particularly important in hand-held vacuum cleaners where the housing, which in this case provides the walls of the suction passage, must be kept relatively small in diameter to enable it to be comfortably held in the hand of a user.

It is therefore another object of this invention to provide a filtering device for use in the suction duct of a vacuum cleaner, which filtering device includes means for forming and releasably holding normally flat sheet filtering material in the shape of a cup of a size to fit within a suction duct of limited size and to provide a filtering surface therein having an area far greater than the cross-sectional area of the duct.

More specifically it is an object of this invention to provide a filter device for vacuum cleaners comprising an easily disposable paper filter membrane and a retainer for readily removably securing the same in position in the cleaner at the joint between the suction producing means therein and the cleaner nozzle, while at the same time imparting to the filter membrane the shape of a cup so as to provide increased filtering area.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claim, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claim.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a perspective view of a hand-held vacuum cleaner utilizing the suction nozzle and filtering device of this invention, illustrating the manner in which such a cleaner is held during use;

Figure 2 is a longitudinal sectional view through the cleaner illustrating the suction nozzle and filtering device of this invention in place thereon;

Figure 3 is an exploded perspective view illustrating the components of the filter device of this invention and their relationship to the front end portion of the body section of the cleaner; and

Figure 4 is a perspective view of the cleaner with its suction nozzle separated from the rest of the unit.

Referring now particularly to the accompanying drawings, in which like numerals indicate like parts, the numeral **5** designates the generally tubular housing of a hand-held vacuum cleaner of the type disclosed and claimed in my copending application, Serial No. 547,970, filed November 21, 1956. Generally, the cleaner includes the aforementioned housing **5** which comprises a body section **6** and a rear end section **7** removably secured together. At the front end of the housing is a substantially short suction nozzle **8** having a transversely flattened and narrow front end portion opening into an enlarged substantially tubular rear or discharge end portion which is readily detachably secured to the front of the body section by releasable latches **9**. The adjoining substantially tubular portions of the suction nozzle and the housing, of course, provide part of the suction duct of the cleaner.

A suction fan **10** and its drive motor **11** are mounted within the housing, and as best seen in Figure 2, the fan is of the centrifugal type and discharges through ports **12** in the rear section of the housing.

The air entering the fan, is, of course, drawn into the

mouth of the suction nozzle 8 where it flows through a channel 13 defined by a transverse partition wall 14 which divides the nozzle interior into the air channel 13 along the upper part of the nozzle and a dirt collecting pocket 15 below the air channel. From the channel 13 the incoming current of air passes through a filter 16 forming part of the filtering device of this invention, where its entrained dirt and hair clippings are caught in the manner brought out hereinbelow. The filtered air then enters the body 6 of the housing to flow longitudinally therethrough and over the drive motor 11 before reaching the fan inlet.

The mounting for the fan and its drive motor within the housing comprises a centrally apertured disc 21 to one side of which the stator frame 22 of the motor is secured by screws 23 passed through a plurality of circumferentially spaced legs 24 on the stator frame and threaded into the disc 21. This secures the motor to the disc with the motor shaft protruding through the aperture in the disc to the other side thereof where the fan is fixed to the shaft. The aperture in the disc thus defines the inlet of the fan, and unrestricted access thereto from inside the housing body 6 is afforded by large spaces between the legs 24.

An elastic collar 26 of rubber or other similar material tightly embraces a peripheral flange 27 on the disc, and this elastic collar is clamped between the rear end of the housing body section 6 and a shoulder collectively formed by the adjacent extremities of lands between the discharge ports 12 in the rear housing section 7. Metal washers 31 are preferably interposed between the opposite faces of the elastic collar and the housing parts or shoulders between which it is clamped; and to secure these parts together the rear housing section 7 telescopes over the adjacent rear end of the body 6 and is secured thereto by fastening screws 32.

By mounting the fan and drive motor in this manner, the body 6 of the housing is permitted to be of smaller cross section than the rear housing section 7, and this has the advantage of enabling the body 6, which serves as the handle for the device, to have a cross sectional size and shape least fatiguing to be held in one hand. Such a shape by experience has been found to be a substantially triangular formation which is characterized by diametrically opposite large and small curved portions 33 and 34, respectively, connected or joined by relatively flat upwardly divergent side portions 35. Both curved portions 33 and 34 are concentric to the axis of the motor and the fan but the larger curved portion 33, which may be considered the top of the handle, has a larger radius than the curved portion 34. As a result, a relatively large space 36 is provided across the top of the motor so that the flow of air through the motor housing is greatest across the top of the motor where it is more effective to dissipate the heat developed by the motor.

The exteriors of the relatively flat sides 35 and also of the smaller curved portion 34 are longitudinally fluted to define downwardly facing mildly sharp edged ridges 37 to give the handle an easily gripped non-slip surface.

A perforated guard plate 39 secured to the front end of the motor stator and equipped with a plurality of resilient bumpers 40, which occupy the corners defined by the junction of the large radius curved portion 33 with the relatively flat sides 35 of the housing wall, provide means to assure installation of the motor in a predetermined angular position in the housing. By so doing, the leads by which the motor is connected to the terminals of an on-off switch having its actuator 38 located on the left side of the housing, where it may be easily manipulated by the thumb of the right hand, will also be properly positioned.

The filtering device of this invention is mounted partly in the front of the body section 6 of the housing, and partly in the rear of the suction nozzle 8. Hence, it may be said to be located in the suction duct of the cleaner. It includes a disposable filter membrane 16 provided by a disc of flexible filter paper, and a grid 17 around which the disc is folded to shape the same into a shallow cup or basket. A substantial part of the well of the filter cup extends into the rear of the suction nozzle 8, and is received between the open front end of the body 6 and the grid.

The grid 17, which is an important part of the filter device and is best seen in Figure 3, has a ring-like filter retaining portion or rim 18 of a size and shape to fit somewhat snugly into the front end of the body section 6 of the housing, and an outwardly directed flange or bead 20 on its front, which fits snugly within the rear or discharge end of the nozzle 8, ahead of the front of the body. Projecting axially rearwardly from the ring-like portion 18, the grid has a number of circumferentially spaced fingers 19 which protrude into the front of the duct defined by the body section 6 and hold the central portion of the filter disc 16 displaced a distance rearwardly from the front of the body section. The outer portions of the filter disc are folded forwardly around the fingers 19 and are confined between them and the surrounding wall portions of the body section 6 so that the filter membrane is held in the desired cup-like shape during use of the cleaner. In this manner a large filter area is obtained without necessitating enlarging the cross section of the housing.

The grid 17 is preferably a plastic molding and the flange 20 at its front also provides a shoulder which seats upon the front edge of the housing to clamp the peripheral portion of the filter cup therebetween.

Changing or replacement of the filter requires detachment of the suction nozzle from the front of the body section of the housing, and to permit this to be quickly done, each latch 9 is of the spring type and consists simply of a spring blade 41 fixed at one end to the fore part of the body portion 6 of the housing and projecting forwardly to have its free end terminate adjacent to a shoulder 42 encircling the housing slightly rearwardly of the extreme front edge thereof. The free end of the spring blade has its side portions cut away to provide rearwardly facing edges over which hooks 43 projecting rearwardly from the adjacent rear edge of the nozzle engage.

Disengagement of the latches to permit detachment of the nozzle is accomplished by depression of the spring blades through the medium of buttons 44. In one case, the button 44 projects through an opening in the name-plate 45 of the cleaner and in the other case it projects through an opening in a narrow cover plate 46 secured to the housing.

On the inside of the suction nozzle just forwardly of its rearmost edge are four abutments 48 the rear ends of which lie in a common plane so disposed with respect to the extreme rear edge of the nozzle that when the nozzle is in position on the housing these rear ends of the abutments bear against the flange 20 on the front of the filter-shaping grid to hold the same in place.

As noted hereinbefore, the suction nozzle has a transverse partition wall 14 dividing it into an air passage 13 along the top of the nozzle, and a dirt collecting pocket 15, beneath the air passage or channel and communicating with the interior of the nozzle only at the rear portion thereof, along a transverse zone adjacent to the front of the filtering device. This partition wall is imperforate as is also its junction with the opposite sides of the nozzle. Accordingly, the nozzle may be immersed in a bath of antiseptic solution to cleanse and sterilize the mouth thereof without entailing wetting of the interior of the dirt collecting pocket, but of course it should be understood that in doing so the nozzle must not be immersed into the solution to a depth at which the rear edge of the partition wall 14 lies below

the surface of the bath, and that during the immersion the nozzle would be disposed substantially vertically.

Although the purpose of the dirt collecting pocket may be apparent, it might be noted that its location assures that hair clippings and dirt drawn through the air passage 13 and against the filter membrane will drop by gravity and be retained in the pocket, not to fall back through the mouth of the nozzle if the motor is stopped while the device is held with its nozzle pointing downward. Also, a substantial quantity of dirt or hair clippings may accumulate in the pocket, without interfering with free flow of air through the filter membrane, and the latter as a result, is substantially self cleaning.

When not in use, the vacuum cleaner may be hung from any suitable support by means of a bail 47 formed integrally with the rear section 7 of the housing.

From the foregoing description taken in connection with the accompanying drawings, it will be apparent to those skilled in this art that this invention provides a suction nozzle and filter means for vacuum cleaners and the like which is not only economical in use but also effectively utilizes normally flat filter material in such a way that maximum filtration is achieved within a space of limited cross section; and that the provision of a dirt receiving pocket in the nozzle, immediately ahead of the filtering device at the rear of the nozzle, renders the filter membrane usable for long periods of time before it must be replaced.

What is claimed as my invention is:

In a hand held vacuum cleaner: an elongated, hollow housing providing a handle for the cleaner of a size to be easily held in one hand, said housing being open at its front; means in the housing, spaced behind its front end, for drawing air into the front of the housing; a disposable filter comprising a normally flat sheet of filtering material extending across the front of the housing and having its marginal edge portion overlying the exterior surface of the housing, at the front thereof, all around the

housing; a grid in front of the filter having a rim portion which telescopes only a short distance into the front end of the housing to confine a portion of the filter against the inner surface of the housing wall at the front thereof, said grid also having on its rim portion a circumferential rearwardly facing abutment which opposes the front edge of the housing and confines another portion of the filter thereagainst, said grid also having circumferentially spaced elongated fingers projecting inwardly and rearwardly from its rim portion into the front of the housing, said fingers being substantially thin and having convex outer edges facing but receding rearwardly from the surrounding housing wall to hold the filter shaped into a shallow forwardly opening bag having a flat bottom substantially smaller in area than the interior of the housing and an outwardly and forwardly curving side wall embracing said fingers; a suction nozzle telescoped over the front end portion of the housing to cooperate therewith in confining the marginal edge portion of the filter, said nozzle having circumferentially spaced rearwardly facing abutment means in its interior which engage the front edge of the rim portion of the grid and cooperate with the front edge of the housing in confining the grid against axial displacement; and means readily removably securing the nozzle to the housing.

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