SILENCING VACUUM CLEANERS

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This invention relates to vacuum cleaners and has for its object the provision of a substantially "noiseless" cleaner or at least one which shall be operable with a minimum of noise. The essentials of a vacuum cleaner are a collecting nozzle, a pumping device, and a separator to free the dust from the air. The pumping device consists ordinarily of a centrifugal fan, direct-connected to the shaft of a high speed electric motor, and the rapid rotation of the same (ordinarily 8,000 to 12,000 R. P. M.) causes a piercing and intensely disagreeable whistling sound. This sound is also increased to a small degree by noises originating in the motor itself, but by far the greater part of the noise originates in some manner in or near the fan and is carried out in greatest part by the escaping air and it is the prime object of this invention to suppress that noise without at the same time impeding substantially the air flow.

Vacuum cleaners may be divided into two major types, namely, that type wherein the dust is removed from the air prior to its entrance into the pumping device, and that type wherein the dust and air are both passed through the fan and subsequently separated. My invention is equally applicable to both types of machines and consists essentially in passing the dust-free, but noise-laden air through a sound damping device or sound-filter so arranged as not materially to obstruct the air flow. It is also advantageous in a device of this character so to support the motor and fan (or fan casing) as to inhibit metallic conduction of the sound to the exterior of the casing.

In the drawings accompanying and forming a part of this application I have shown certain typical forms in which my inventive ideas are embodied, although it will be understood that these drawings are intended merely to illustrate the general principles of my invention and not to limit me in any respect to any details of shape, construction or arrangement. Fig. 1 is a central sectional view through one type of vacuum cleaner embodying my improvements; Fig. 2 is a view partly in elevation and partly in section showing my improvements as applied to a different type of cleaner; and Fig. 3 is a greatly magnified sectional view of a portion of the dust bag shown in Fig. 2.

The type of vacuum cleaner illustrated in Fig. 1 can be briefly defined as that wherein the dust bag is located in front of the fan, and is widely used in stationary cleaners and in the so-called "can-type" of portable cleaners. In the device chosen for illustrative purposes an outer casing is provided consisting of a substantially cylindrical shell 1 having an open end to which is detachably secured the closure 2 in which is attached the flexible hose 3 leading to a suitable suction tool or collecting nozzle not shown. Traversing the casing at a point removed from the closure 2 is a circular partition 4 having a central aperture through which the air is drawn; and while the margin of this partition may be attached to the outer casing in any suitable manner, I have here shown it as continued in the form of a cylindrical inner shelf 5 spaced from the casing 1 so as to make a double wall, suitable rings, washers, or the like bracing members, 6, 7, 8, of rubber or other sound-insulating substance, being interposed between the two. This inner shelf 5 is also shown as having an open end covered by the closure 2 and forms a receptacle for a dust bag 9 having a suitable brim 10 engaged by said closure and making a tight joint therewith. For illustrative purposes I have shown this closure as held in place by hooks 11 only one of which shows in illustration, although any suitable device or arrangement could be employed; and I have also shown a wire frame 12 as positioned in the bottom of the receptacle for holding the dust bag away from the air outlet.

Located upon the opposite side of the partition 4 from the dust bag is the pumping device for the air and the electric motor which drives it, and while a great many different detailed constructions can be employed within the scope of my invention, yet for certain practical reasons I have chosen and hereewith illustrate a specific type of device containing certain refinements which are highly desirable but not essential to the substantial enjoyment of my main invention. The end of the casing 1...
opposite the closure 2 is formed with a depressed neck portion 15 constituting a seat for a rubber ring 16 which constitutes the support for the cylindrical exterior 17 of one bearing of the electric motor 18. The partition 4 is likewise formed with a neck 20 forming a seat for the rubber ring 21 which in turn constitutes a support for the cylindrical inlet neck 22 of a fan chamber. This neck 22 merges with an outwardly flaring wall 23 which terminates in a rim 24 connected by arms 25 to the motor 18 so that the motor frame and fan chamber constitute one rigid assembly and are supported entirely by the rubber rings 16 and 21. The motor shaft 26 carries a fan comprising essentially a disk 27 having suitable blades 28 on its face, the edges of these blades swinging closely past the flaring wall 23 of the fan chamber, the air escaping through the adjacent arms 25 and leaving the casing through suitable apertures 30.

Mechanical transmission of vibrations from the fan and motor to the cleaner casing, are largely prevented by the rings 16 and 21, but the greater portion of the noise created by a vacuum cleaner is due to sound vibrations carried by the escaping air stream and in order to suppress this noise I interpose in the air stream a substance which shall absorb the sound waves without substantially impeding the air flow. This substance must be porous and may be of a type which tends to absorb air vibrations rather than to reflect or transmit the same; the substance may be of vegetable, animal or mineral origin. As examples of vegetable substances I will instance cotton, kapok, hemp, jute, and sisal fibers, or even the finely shredded wood product known as "excelsior", while certain grasses can also be employed; as examples of animal fibers I instance wool and slaughterhouse hair; as examples of mineral substances I instance fibrous asbestos, porous brick, etc.

One of the best ways of using the substance is to enclose the proper quantity thereof under suitable pressure between two layers of screen cloth 31 and 32, forming a sort of filtering cell traversing the entire area of the air stream and spaced both from the motor and from the casing 1. In the present embodiment I have shown this screening as soldered at one margin to a metal ring 35 carried by the rubber ring 16, the opposite margins of the screen cloth being soldered to a metal collar 36 which is detachably fastened to a supporting ring 37 which engages the rubber ring 21. The flexible electric cord 38 by which current is conveyed to the motor is brought in at any desired place.

It will be understood that this sound filter can be constructed as a part of the outer casing itself and many other changes made.

The most important feature of the foregoing device from the standpoint of the present invention is the employment of this sound filtering material somewhere in the air stream. The location of this filtering material around the motor and its mode of support by the rubber rings 16 and 21 and the supporting of the motor and fan casing by these rings, and the employment of a double walled vessel all exhibit additional sound insulating effect. I prefer to employ a filtering medium of rather coarse texture, which will not become matted or compacted together. For example I have used cotton waste with excellent success packed into the space provided therefor in such manner as to afford a reasonably uniform density. The sound filter can readily be removed if it becomes dirty and may also be impregnated with disinfecting substances to kill germs which may lodge therein, but in general if any dust is fine enough to pass through the bag, it will also pass freely through the sound-filter without contaminating or clogging the same.

In Figs. 2 and 3 I have shown my inventive idea as applied to a portable cleaner of the type having a casing comprising a fan chamber 40, nozzle 41 and motor housing 42 carried by suitable floor wheels 43 and moved about by a handle 44, the air displaced by the centrifugal fan 45 escaping by way of the outlet neck 46 to a dust bag 47 suitably supported from the handle 44 by a connection 48. This dust bag consists of a layer of finely porous flexible cloth 50 having a cleanout opening at one end closed by a suitable clamp 51 and having its opposite end connected tightly to the neck 46, an internal sleeve 52 being often employed to prevent the contents of the bag from falling back into the fan chamber. To the entire exterior of this bag I apply a thick layer 53 of one of the sound absorbing substances heretofore described, preferably covered by a layer 54 of some loosely woven cloth or fabric of much greater porosity than the bag 50. The substance 53 is also of a highly porous nature and is held in place by numerous ties 55 reinforced if desired by washers or pads 56. It will be understood that the dust filtering function is still served by the innermost layer 50 of the most finely porous cloth. The porosity of the substance 53 and the layer 54 is much higher so that any dust which may pass the cloth 50 may continue substantially unimpeded and thus avoid contamination of or entanglement in the sound filter. Preferably a slip or cover 57 of porous washable material such as dimity, lawn, percale, or calico is drawn over the bag exterior so that the same can always be kept clean and attractive.

It will be understood that in order to explain my invention I have been obliged to describe certain physical embodiments which necessarily contain many features which are not essential to the invention itself, and also
that some features of the invention can be used with more advantage than other features. Accordingly I do not limit myself to the conjoint use of all the features herein described nor to any details of design, arrangement, material, or structure except as specifically recited in the annexed claims which I desire may be construed each independently of limitations contained in other claims.

Having thus described my invention what I claim is:

1. The combination with the dust bag of a vacuum cleaner, of a sound filter consisting of a layer of interlaced fibers adapted to absorb sound vibrations from the cleansed air.

2. The combination with the dust bag of a vacuum cleaner, of a sound filter consisting of a layer of interlaced fibers secured to the outer face of the dust bag.

3. The combination with the dust bag of a vacuum cleaner, of a sound filter comprising an outer covering of more porous cloth and a filling between said bag and covering of many interlaced fibrous material.

4. The combination with the dust bag of a vacuum cleaner, of a sound filter comprising an outer covering of more porous cloth quilted thereto and a filling of many interlaced fibrous material between said bag and covering.

5. In a vacuum cleaner, a quilted dust bag having a wall comprising a filling material and a covering material, the filling of the quilted portion consisting of interlaced fibrous material having interstices larger than the pores in the covering material.

In testimony whereof I hereunto affix my signature.

STANLEY McClATCHIE.