Sept. 28, 1943. D. C. GERBER 2,330,701

SUCTION CLEANER

Filed Dec. 7, 1939 3 Sheets-Sheet 1

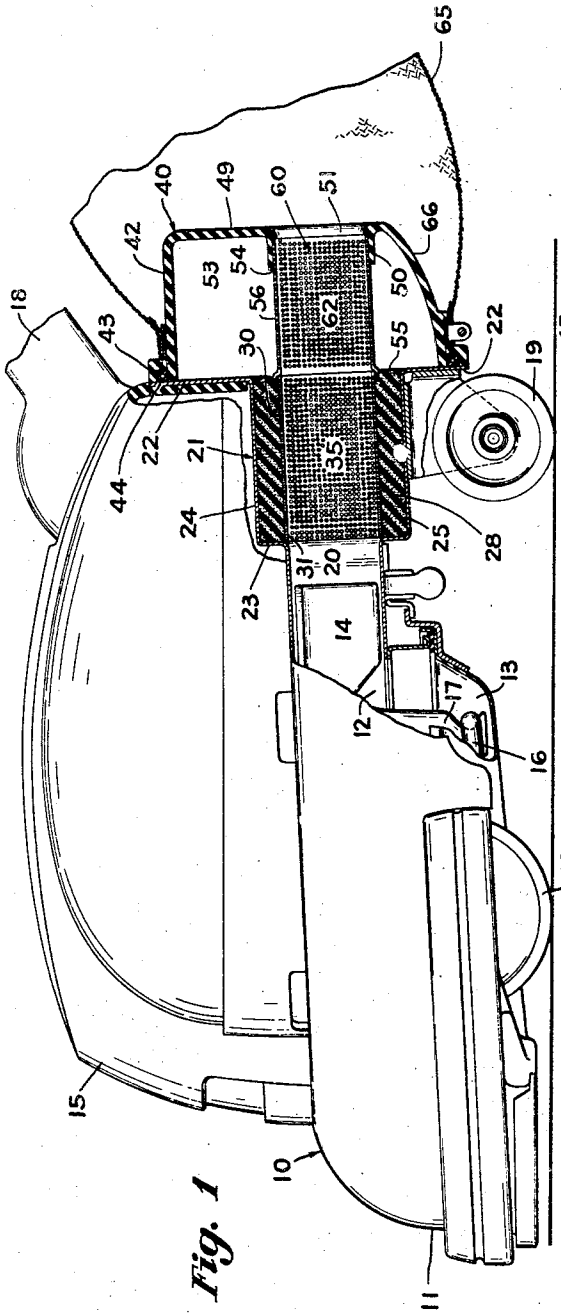


Fig. 1

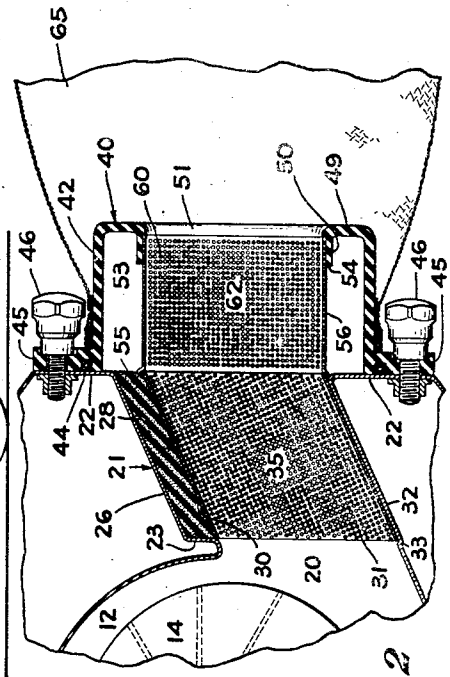


Fig. 2

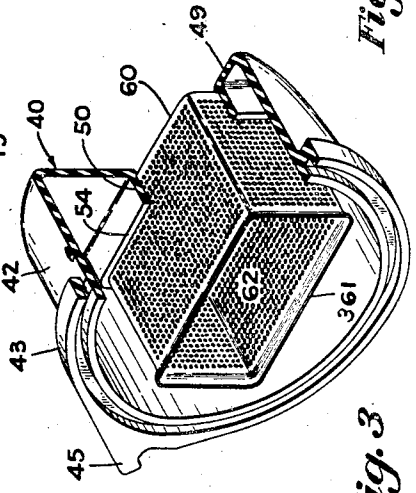


Fig. 3

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SUCTION CLEANER

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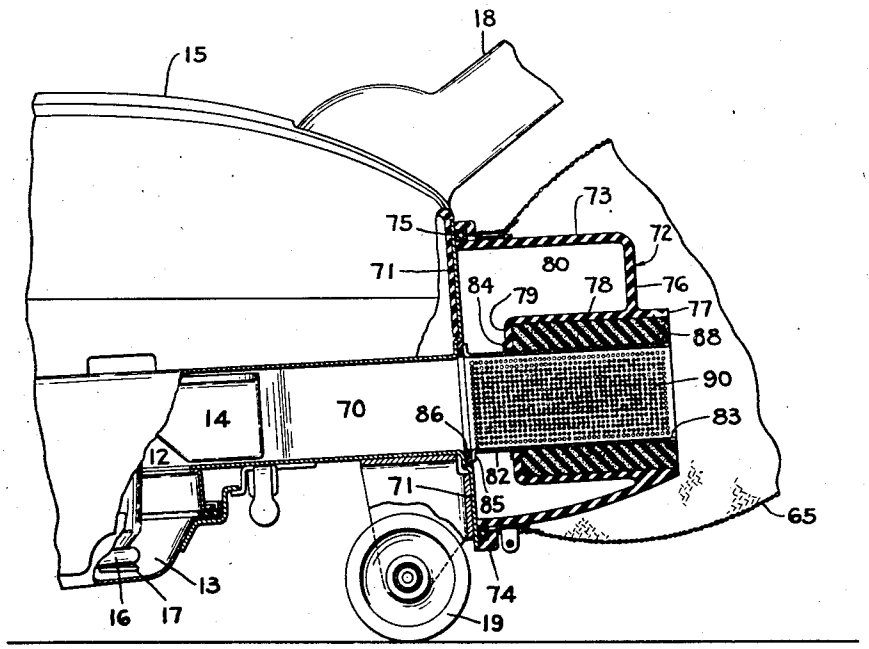


Fig. 4

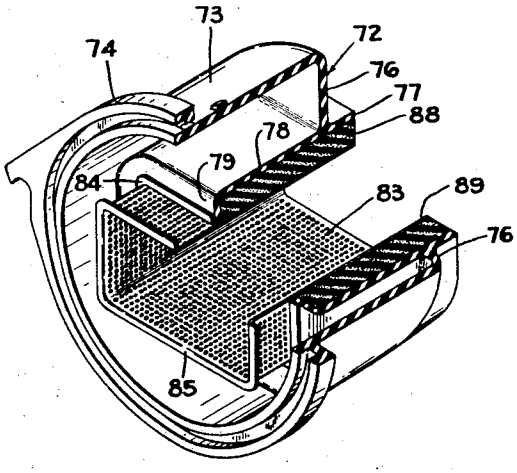


Fig. 5

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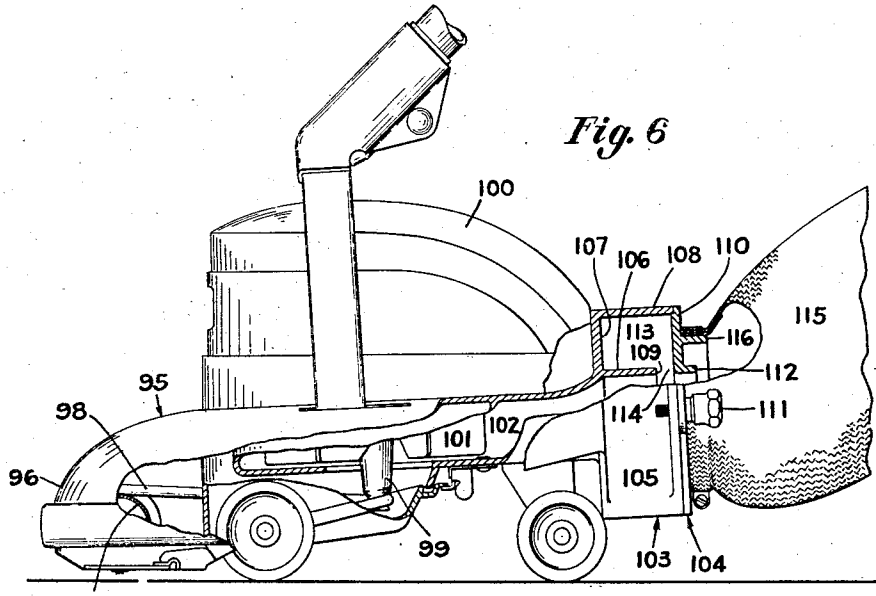
ATTORNEY

Sept. 28, 1943. D. C. GERBER 2,330,701

SUCTION CLEANER

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Fig. 6



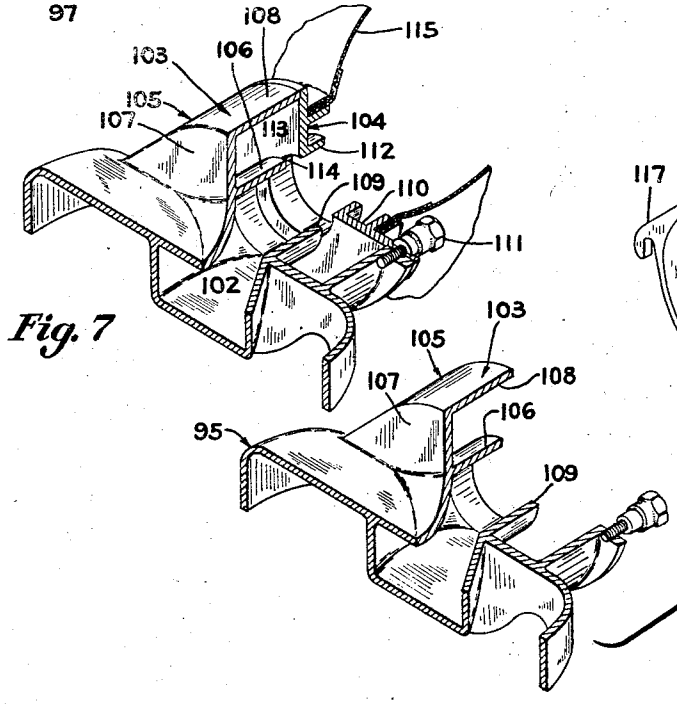


Fig. 7

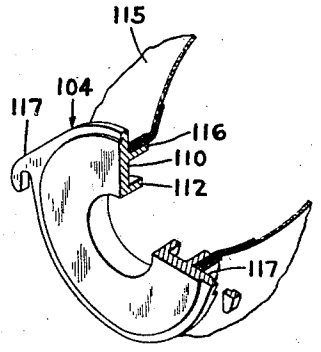


Fig. 8

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UNITED STATES PATENT OFFICE

2,330,701

SUCTION CLEANER

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Application December 7, 1939, Serial No. 307,969

9 Claims. (Cl. 15—16)

This invention relates to improvements in suction cleaners and more particularly, to an improved form of muffler to reduce the operating noise of the cleaner.

An object of the invention is to provide a new and improved suction cleaner. Another object is to provide a new and improved muffler for suction cleaners. A further object is to provide a combination resonant-absorption muffler for suction cleaners, wherein the resonant portion of the muffler attenuates certain undesirable sound waves, and the absorption portion reduces noise throughout the audible range. Another object is to provide a combination resonant-absorption muffler constructed as a unit for attachment to the cleaner. A further object is to provide a resonant muffler wherein the cleaner casing forms part of the muffler construction. Still another object of the invention is to provide a resonant-absorption muffler adapted to operate in dirt-laden air streams. Other objects and advantages of the invention will be apparent from the specification and drawings, wherein:

Figure 1 is a side elevational view of the suction cleaner with parts broken away to illustrate one embodiment of the resonant-absorption muffler;

Figure 2 is a horizontal sectional view of the resonant-absorption muffler shown in Figure 1;

Figure 3 is a perspective view of the resonant portion of the muffler detached from the cleaner casing;

Figure 4 is a sectional view of another embodiment of the invention, wherein the absorption muffling portion is carried by the resonant muffling portion;

Figure 5 is a perspective view of the muffler construction shown in Figure 4.

Figure 6 is a side elevational view, partly sectional, of a further embodiment of the invention;

Figure 7 is a fragmentary perspective view of the resonant muffler shown in Figure 6, and

Figure 8 is a fragmentary exploded perspective view of the disassembled resonant muffler.

The embodiment of the invention disclosed in Figures 1 to 3 comprises a suction cleaner having a casing 10 provided with a nozzle 11 communicating with a fan chamber 12 through a suction passageway 13. Disposed in the fan chamber 12 is a fan 14 driven by an unshown motor enclosed in a housing 15 removably supported on the casing 10. An unshown carpet contacting member is rotatably mounted in the nozzle 11 and is driven by a belt 16 extending through the suction passageway 13 and having driving connection with a pulley 17 rigidly mounted on the motor armature shaft. A handle 18 is pivotally mounted on the cleaner casing for moving the cleaner on its wheels 19 over the surface to be cleaned.

Extending rearwardly from the fan chamber 12 and slightly oblique to the longitudinal center line of the cleaner body is a rectangular exhaust passageway 20 having increased vertical and transverse areas as indicated at 21, terminating in an exhaust flange 22. The increased section 21 of the exhaust passageway is formed by a shoulder 23, top wall 24, bottom wall 25 and one side wall 26.

Secured to the three expanded walls of the exhaust passageway is an absorption muffler comprising sound-absorbing material 28 such as sponge rubber, the walls 24, 25 and 26 forming the outer imperforate wall of the absorption muffler. The interior surface 30 of the sound absorbing material 28 is provided with a perforated sheet metal liner 31 as a protection to the soft sound-absorbing material 28 against the severe abrasive effects of the dirt particles and other objects discharged from the fan chamber. The sound absorbing material 28 is omitted from the muffler casing side wall 32 because of the likelihood of pins and other pointed objects being driven into the surface with such force as to penetrate the perforations and become firmly imbedded in the sound-absorbing material. The side wall 32 is recessed at 33 to accommodate the thickness of the perforated metal liner 31 so that the latter defines a rectangular exhaust passageway 35 flush with the fan chamber exhaust passageway 20.

A resonant muffler, indicated generally at 40 includes a casing formed from a plastic material, such as Bakelite, although metal can also be employed, and is provided with an outer wall 42 terminating at one end in an annular flange 43 provided with a sealing ring 44, and a pair of diametrically opposed hooks 45 received by the bolt and nut connections 46 for removably securing the muffler casing against the cleaner casing exhaust flange 22. The opposite end of the muffler casing wall 42 terminates in a radial wall 49 provided with a re-entrant portion 50 defining a rectangular discharge opening 51. The exhaust flange 22 and the extreme end 55 of the sound-absorbing material 28 cooperate with the muffler casing to define a resonant chamber 53 of a predetermined volume. The end 54 of the re-entrant portion 50 is spaced from the end 55 of the sound-absorbing material 28 to define an annular opening 56 of a predetermined area with

respect to the volume of the resonant chamber 53 to attenuate the objectionable sound waves emanating from the cleaner exhaust passageway 20.

Carried by the re-entrant portion 50 is a perforated metal member 60 provided with a flared end 61 to receive the end of the perforated member 31 to form a passageway 62 which is a continuation of the absorption muffler exhaust passageway 35. The entrance 56 to the resonant chamber 53 is covered by the perforated member 60.

The lower end of a dust-filtering bag 65 is removably attached to the muffler wall 42 adjacent the ring 43, and its upper end is attached to the handle 18 in the conventional manner. In order to accommodate the bend in the lower end of the bag when the handle 18 is in vertical or storage position, the bottom wall of the muffler is curved upwardly as indicated at 66.

Another embodiment of the invention is disclosed in Figures 4 and 5 and comprises a suction cleaner similar in all respects to that previously described with the exception of the cleaner exhaust passageway 70 which terminates in an exhaust flange 71. Detachably secured to the exhaust flange 71, by means of unshown bolt and nut connections, is a muffler casing 72 on which is removably mounted the lower end of the dust filtering bag 65.

The muffler casing 72 is formed of plastic material such as Bakelite, altho metal can also be employed, and comprises an annular wall 73 terminating at one end in a flange 74 provided with a sealing member 75 to form an air tight seal with the exhaust flange 71. The opposite end of the muffler casing wall 73 terminates in an inwardly extending radial wall 76 having a projecting portion 77 and a re-entrant rectangular portion 78 terminating in an inwardly extending annular flange 79. The muffler casing wall 73, radial wall 76, re-entrant portion 78 and its flange 79 cooperate with the cleaner casing exhaust flange 71 to define a resonant muffling chamber 80 of predetermined volume.

The flange 79 of the re-entrant portion 78 is spaced a predetermined distance from the exhaust flange 71 to define an entrance 82 to the resonant chamber 80 and is of a certain area with respect to the volume of the latter in order to attenuate particular sound waves. A rectangular elongated perforated metal liner 83 covers the entrance 82 to the resonant chamber 80, and is held in position by being provided with a shoulder 84 which bears against the flange 79, and a shoulder 85 which bears against a sealing ring 86 in a recess surrounding the outlet of the exhaust passageway 70.

Mounted in the recessed area defined by the re-entrant portion 78 and the projecting portion 77 of the resonant muffler is a sound-absorbing muffler comprising sound-absorbing material 88, such as sponge rubber. The walls 77, 78 and 79 of the resonant muffler form the outer imperforate wall of the sound-absorbing material 88, and the interior surface 89 of the latter is lined by the perforated metal member 83 which extends to the extreme outer end of the sound-absorbing material. The metal screen 83 defines a muffler exhaust passageway 90 which is in alignment with the exhaust passageway 70 to discharge the dirt-laden air into the bag 65.

In the operation of the foregoing embodiments of the invention, assume the fans are removing dirt from the surface being cleaned. The objectionable sound waves emanating from the cleaner exhaust passageways enter the resonant chambers and are attenuated therein because the entrances thereto are of a predetermined area with respect to the volume of the resonant chamber. The perforated metal members at the entrances to the resonant chambers remove foreign matter from the dirt-laden air entering the resonant chambers. The energy of the sound waves are reduced by the absorption effect of the sound-absorbing materials and their surrounding casings. Finally, the sound waves that escape into the filter bag are attenuated and absorbed to such a degree that the resulting noise is negligible.

Any foreign material that collects in the resonant chambers is easily removed by disconnecting the resonant muffler casings from the cleaner casings, to thereby uncover an opening through which the dirt may be removed without disturbing the other portions of the muffler constructions.

Figures 6 through 8 illustrate a further embodiment of the invention and comprises a suction cleaner having a casing 95 provided with a nozzle 96 rotatably supporting a surface contacting member 97 driven by a belt 98 connected to a motor pulley 99 supported on an unshown motor mounted on the casing 95. The motor is enclosed in a housing 100 and drives a fan 101 which discharges the dirt-laden air through an exhaust passageway 102.

A resonant muffler casing 103 is composed of two casing sections 104 and 105, the latter being formed integrally with the cleaner casing 95 and comprising a conduit 106 forming an extension of the exhaust passageway 102, an end wall 107 extending about the muffler conduit 106 and an outer annular wall 108 spaced radially from the conduit 106 and projecting outwardly beyond the extreme end of 109 of the latter. The muffler casing section 104 comprises a wall 110 removably secured to the wall 108 by means of a pair of bolts 111, and is provided with an annular projection 112 which forms a continuation of the suction cleaner exhaust passageway 102. The cleaner casing walls 106, 107 and 108 cooperate with the removable end wall 110 to define a resonant chamber 113 concentric with the exhaust passageway 102, and the end wall 110 is spaced from the extreme end 109 of the muffler conduit 106 to form an annular entrance 114 to the resonant chamber 113. The entrance 114 is of predetermined area with respect to the volume of the resonant chamber 113 to attenuate sound waves over a certain range of frequencies. A dust filtering bag 115 has its lower end removably secured to an annular shoulder 116 on the muffler casing wall 110 whereby the latter acts as a bag support.

In operation, assume the cleaner is removing dirt from the surface being cleaned. The dirt-laden air is discharged through the exhaust passageway 102, and the sound waves pass through the annular entrance 114 into the resonant chamber 113. Due to the relative area of the entrance 114 with respect to the volume of the resonant chamber 113, the sound waves are attenuated in the latter to reduce the noise created by the suction cleaner and thereafter the dirt-laden air is discharged into the dust bag 115 and filtered prior to escape into the atmosphere.

When it is desired to clean the bag 115, the bolts 111 are loosened and the muffler casing end wall 110 is removed and placed on a refuse receiving paper, the operator then steps on the

flat portions 117 of the muffler wall 110 and shakes the upper end of the bag to loosen the dirt.

I claim:

1. In a suction cleaner, a casing therefor, a fan chamber in said casing, an exhaust passageway in said casing leading from said fan chamber, sound-absorbing material in said exhaust passageway in said casing for absorbing the energy of the sound waves passing through said exhaust passageway, and muffler casing means cooperating with said cleaner casing to define a resonant chamber, means in said muffler casing means communicating with said exhaust passageway, said resonant chamber attenuating the sound waves emanating from said fan chamber.

2. In a suction cleaner, a casing therefor, a fan chamber in said casing, an exhaust passageway in said casing leading from said fan chamber, an exhaust flange at the end of said passageway in said casing, sound-absorbing material in said exhaust passageway, and a muffler casing connected to said exhaust flange, means in said muffler casing communicating with said passageway, said muffler casing, exhaust flange and sound absorbing material cooperating to define a resonant chamber for attenuating sound waves emanating from said fan chamber.

3. In a suction cleaner, a cleaner body having an exhaust passageway for discharging air, and a casing removably mounted on said body and cooperating with the exterior of a wall of said body to form a space therebetween, said casing having a re-entrant wall section within said space, sound absorbing means lining said re-entrant wall section and forming a continuation of said exhaust passageway exteriorly of said body, and means defining an opening connecting said space with said exhaust passageway and said space being otherwise closed, said opening and space being dimensioned with respect to each other and to form a resonant chamber for attenuating the sound waves in the air flowing through said exhaust passageway.

4. In a suction cleaner, a cleaner body having an exhaust passageway terminating in a flange, a casing exteriorly of said body and cooperating with said flange to form a space therebetween and an axial extension of the exhaust passageway, and means defining an opening connecting said space with said exhaust passageway and said space being otherwise closed, said opening and space being dimensioned with respect to each other to form a resonant chamber for attenuating the sound waves in the air flowing through said exhaust passageway.

5. In a suction cleaner, a cleaner body having an exhaust passageway for discharging air, a casing exteriorly of said body and cooperating with a wall of said body to form a space therebetween and an axial extension of said exhaust passageway, means defining an opening connecting said space with said exhaust passageway and said space being otherwise closed, said opening and space forming a resonant chamber to attenuate the sound waves flowing through said exhaust passageway, and sound-absorbing material forming a wall for said exhaust passageway for absorbing the energy of the sound waves passing through said exhaust passageway.

6. In a suction cleaner, a cleaner body having an exhaust passageway for discharging dirt-laden air, a casing removably mounted on said body and cooperating with the exterior wall of said body to form a space therebetween, said casing having a wall section forming a continuation of said exhaust passageway exteriorly of said body, means defining an opening connecting said space with said exhaust passageway and said space being otherwise closed to form a muffler for the dirt-laden air passing through said exhaust passageway, and a dirt bag mounted on said casing for receiving the dirt-laden air expelled therefrom, said bag and casing being removable as a unit from said body.

7. In a suction cleaner, a cleaner body having an exhaust passageway for discharging dirt-laden air, a casing removably mounted on said body and cooperating with the exterior wall of said body to form a space therebetween, said casing having a wall section forming a continuation of said exhaust passageway exteriorly of said body, means defining an opening connecting said space with said exhaust passageway and said space being otherwise closed to form a muffler for the dirt-laden air passing through said exhaust passageway, and a dirt bag having its lower end attached to said casing and enclosing the latter and its upper end movable to position said bag in substantially a vertical position, said casing having its lower exterior surface contoured to accommodate the bend in the lower wall of said bag when the latter is in said substantially vertical position.

8. In a suction cleaner, a cleaner body having an exhaust passageway for discharging dirt-laden air, a muffler casing removably mounted on said body to form an axial extension of said exhaust passageway exteriorly of said cleaner body, said muffler casing cooperating with said cleaner body to form an open space adjacent said exhaust passageway, means defining an opening connecting said space with said exhaust passageway and said space being otherwise closed, said opening and space being dimensioned with respect to each other for attenuating the sound waves in the dirt-laden air in said exhaust passageway passing said opening, and a dirt-filtering bag for receiving the dirt-laden air after the sound waves have been attenuated.

9. In a suction cleaner, a cleaner body having a nozzle, suction creating means, and an exhaust passageway connected directly to said suction creating means, said suction creating means drawing through said nozzle air laden with dirt and surface litter removed from the surface being cleaned and expelling said air directly into and through said exhaust passageway, a bag for receiving the dirt-laden air from said exhaust passageway, a casing cooperating with said cleaner body to form a resonant muffler chamber, means defining an opening connecting said resonant chamber with said exhaust passageway for passage of the sound waves in said dirt-laden air into said resonant chamber to attenuate said sound waves as the air, dirt and surface litter pass said opening to said resonant chamber and prior to discharge of said air, dirt and surface litter into said dirt-receiving bag.

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