

Aug. 31, 1943.

T. A. STONER

2,328,236

SUCTION CLEANER

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2.Sheets-Sheet 1

Fig. 1

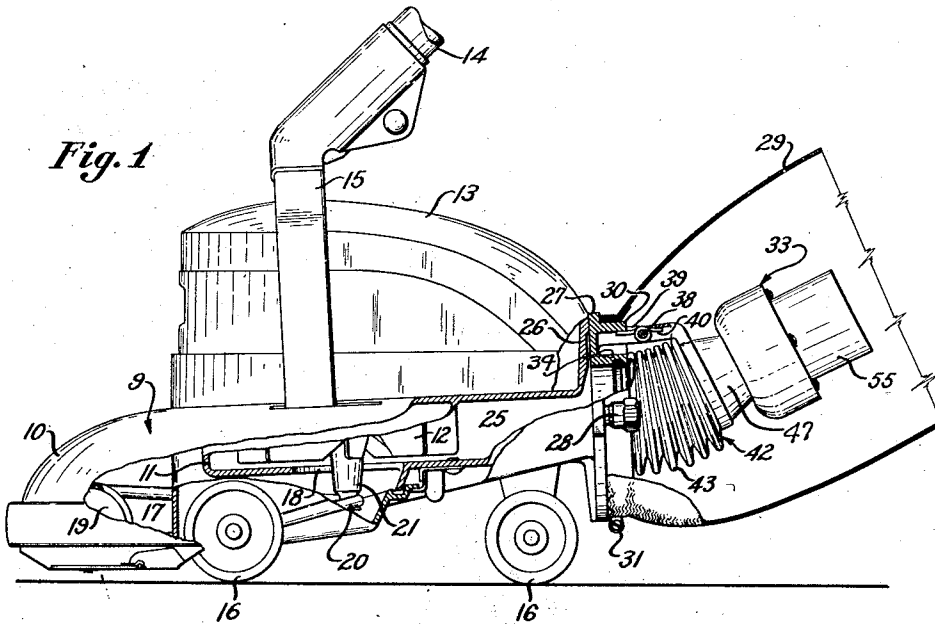
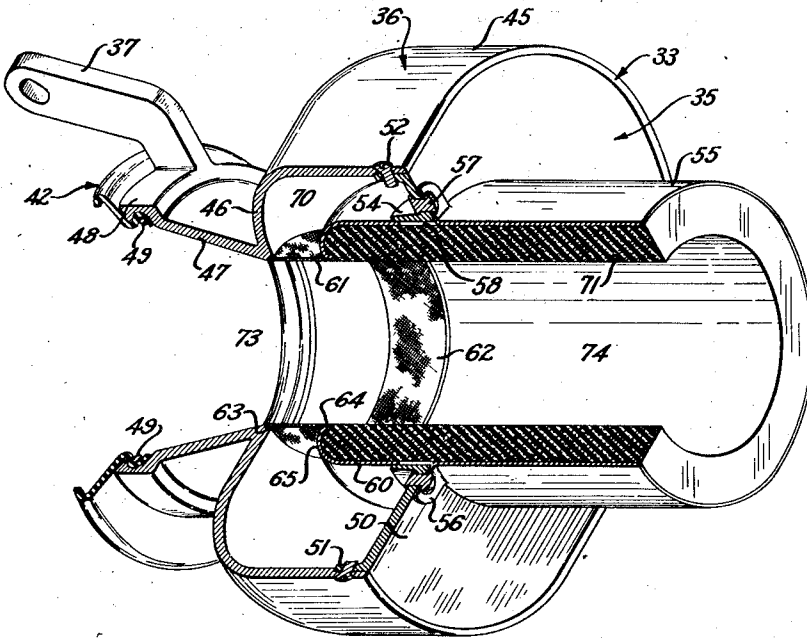


Fig. 2



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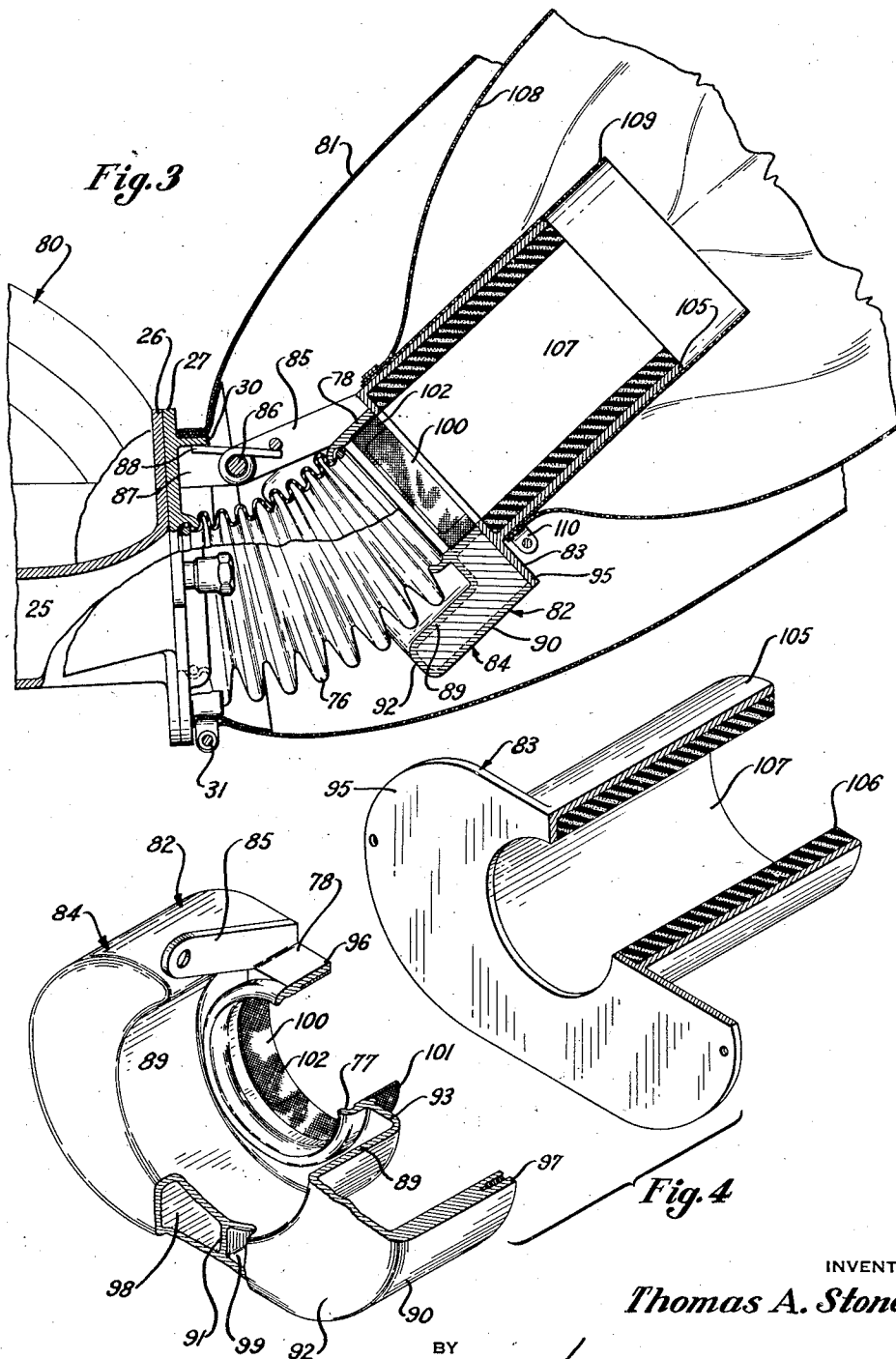
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

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SUCTION CLEANER

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4 Claims. (Cl. 183—51)

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

An object of the invention is to provide a new and improved muffler for suction cleaners. Another 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. A further object is to provide a muffler adapted to operate in the dirt-laden air stream of a suction cleaner. Another object is to provide a resonant muffler that is easily disassembled for removing foreign matter therefrom. Other objects and advantages of the invention will be apparent from the specification and drawings, wherein

Figure 1 is a side elevation with parts broken away to illustrate one embodiment of the resonant-absorption muffler attached to the exhaust passageway of a suction cleaner;

Figure 2 is a fragmentary perspective view partly in section of the resonant-absorption muffler removed from the cleaner;

Figure 3 is another embodiment of the invention showing the resonant muffler telescoped about a flexible bellows to reduce the over-all length of the muffler construction, and

Figure 4 is an enlarged fragmentary exploded perspective view of the muffler shown in Figure 3.

The embodiment of the invention shown in Figures 1 and 2 comprises a suction cleaner having a casing 9 provided with a nozzle 10 communicating through a suction passageway 17 with an eye 18 of a fan chamber 11. Removably mounted on the casing 9 is a housing 13 which encloses an unshown motor for rotating a fan 12 and a pulley 21 which has driving connection with a belt 20 to operate a surface contacting member 19 rotatably mounted in the nozzle 10. A handle 14 is provided with a bail 15 pivotally mounted on the casing 9 which is supported on a pair of front and rear wheels 16.

Extending rearwardly from the fan chamber is an exhaust passage 25 terminating in an annular flange 26 to which a member 27 is removably attached by means of a pair of bolt and nut connections 28. The mouth of a porous dirt filter bag 29 is removably attached to an annular shoulder 30 on the member 27 by means of a clamping ring 31, and the upper end of the bag is suspended from the handle 14.

The muffler, indicated generally at 33, includes a metal casing composed of two sections 35 and

36, the latter having a pair of spaced arms 37 which are pivotally mounted by a pin 38 to a pair of spaced arms 39 extending rearwardly from the member 27. A torsion spring 40 is incorporated in the hinge and acts to support the weight of the muffler 33 to prevent the full weight of the latter from resting on the lower bag wall when the handle is moved to the conventional substantially vertical storage position. In order to connect the muffler to the exhaust passageway 25, a flexible bellows 42 is provided which permits the muffler to be inclined slightly in an upward direction following generally the inclination of the bag 29. Since the hinge connection is above the central longitudinal axis of the bellows 42, the lower corrugations 43 of the latter will expand and the upper corrugations contract when the handle and the muffler are moved upwardly, so as not to constrict the discharge passageway into the dirt bag 29.

The muffler casing section 36 comprises an annular outer wall 45, a radial end wall 46, and a reduced annular wall 47 which is frusto-conical in shape and flares outwardly toward the cleaner exhaust passageway 25. The conical wall 47 terminates in an annular ring 48 from which integrally extend the hinge arms 37, and is provided with an annular recess in which one end of the bellows 42 is removably attached by a spring ring 49, and the opposite end of the bellows is secured in a like manner to an annular shoulder 34 on the member 27. The cooperating muffler casing section 35 comprises a cylindrical shell 55 provided intermediate its ends with a radially extending flange 50 having a peripheral shoulder 51 for removable connection with the wall 45 by means of a plurality of screws 52. Punched out of the wall of the metal shell 55 are tabs 56 which are secured to the end wall 50 by means of rivets 57. The openings 58 resulting from forming the tabs 56 are closed by an annular flange 54 on the end wall 50. A portion 60 of the muffler casing section 35 extends inwardly into the enlarged portion of the casing section 36 and is spaced from the end wall 46 to provide an annular opening 61 which is covered by a perforated metal member 62. The perforated member 62 is seated in or rabbeted portions 63 and 64 respectively of the casing sections 35 and 36.

The re-entrant portion 60 of the shell 55, the walls 45 and 46, and the end wall 50 cooperate to form an annular resonant chamber 70 which is concentric with the muffler passageway 74, and the entrance 61 is of a predetermined area with respect to the volume of the resonant chamber 70 to attenuate the objectionable sound waves

emanating from the cleaner exhaust passageway 25.

The shell 55 is lined with suitable sound absorbing material 71, such as sponge rubber, or the like, and it extends from the entrance 61 of the resonant chamber 70 to the outer end of the shell 55, to form a sound absorbing muffler.

In order to prevent the creation of back pressure by reason of any restrictive effect on the muffler, the bellows 42 is of relatively large diameter throughout its length, and the muffler 33 is provided with the conical passageway 73 which discharges into the muffler exhaust passageway 74 adjacent the entrance 61 of the resonant chamber 70.

In operation, assume the motor is rotating the fan 12 and the surface agitating member 19, and the cleaner is being moved over the surface being cleaned. Operation of the cleaner produces sound waves over the entire audible range, and some of these sound waves are of such frequency as to be sensitive to the operator. In order to eliminate, for example, the fan noise, which is in a relatively limited range of frequency, the resonant chamber 70 is constructed to a predetermined volume and the entrance 61 to a predetermined area. Upon discharge of the dirt-laden air into the muffler passageway 74, the sound waves pass through the screened opening 61 into the concentric annular resonant chamber 70, and are attenuated in the closed resonant chamber to reduce the undesirable fan noise. The member 62 removes the foreign matter from the dirt-laden air without affecting the efficiency of the resonant muffler. The energy of the sound waves passing through the muffler passageway 74 are also reduced by the absorption effect of the sound-absorbing material 71 and its metallic shell 55. Finally, the sound waves that escape into the filter bag 29 have been attenuated and absorbed to such a degree that the resulting noise is negligible.

Another embodiment of the invention is shown in Figures 3 and 4 and comprises a suction cleaner 80 similar to that described in the foregoing embodiment and is provided with the exhaust passageway 25 and the flange 26 to which is removably mounted the member 27 having an annular flange 30 on which a dust-filtering bag 81 is detachably connected by the clamp 31.

A muffler, indicated generally at 82, includes a casing formed of two sections 83 and 84, the latter being provided with a pair of spaced arms 85 which are pivotally mounted by a pin 86 to a pair of arms 87 extending rearwardly from the bag supporting member 27. A torsion spring 88 about the pivot pin 86 acts to support the weight of the muffler 82 to prevent the full weight of the latter from resting on the lower wall of the bag 81 when the handle is moved to the conventional substantially vertical storage position. In order to connect the muffler to the exhaust passageway 25, a flexible bellows 76 is supported at its lower end in the member 27 and its upper end is removably supported in an annular groove 77 on a collar 78 forming part of the muffler casing section 84.

As shown in Figure 4, the muffler casing section 84 is of substantially U-shape and has an inner wall 89 and a spaced outer wall 90, the two walls being separated by a partition 91 and joined at one end by an end wall 92. The inner wall 89 is provided with a flange 93 which terminates in the collar 78. The muffler casing section 83 is provided with a wall 95 of substantial elliptic

contour and which abuts the extreme edges 96 and 97 of the collar 78 and the outer wall 90 respectively, and is removably secured thereto by suitable bolts threaded into the outer muffler wall 90. The end wall 95 cooperates with the collar 78, casing walls 93, 89, 92 and 90 and the partition 91 to define a pair of resonant chambers 98 and 99. Entrances 100 and 101 to the resonant chambers 98 and 99 respectively, are provided by recessing the collar 78 from its outer edge 96, the end wall 95 cooperating to define one edge of these entrances. The entrances are covered by perforated metal members 102 which are seated in the collar 78 and abut against the end wall 95. The entrances 100 and 101 are of predetermined area with respect to the volumes of their respective resonant chambers, whereby each resonant chamber will attenuate a selected range of sound waves to thereby muffle the cleaner noise.

The resonant chambers 98 and 99 are L-shaped and telescope the flexible bellows 76 whereby the over-all length of the resonant muffler and bellows is reduced so as not to extend a great distance into the filter bag 81, and since the resonant muffler telescopes the bellows 76 in spaced relation, the latter flexes within the confines of the muffler when the handle and filter bag are raised and lowered with respect to the cleaner casing.

Extending outwardly from the end wall 95 of the muffler casing section 83 is a tubular shell 105 which is lined with a suitable sound-absorbing material 106, such as sponge rubber, and defines a discharge passageway 107 which communicates with the cleaner exhaust passageway 25.

Disposed within the filter bag 81 is a dust-filtering bag 108 composed of paper, or the like, and has a re-entrant portion 109 that snugly fits the shell 105 and projects beyond the upper end thereof to form a deflector to prevent dirt from dropping back into the muffler passageway 107. A clamp 110 removably secures the paper bag 108 to the shell 105. The outer bag 81 is provided with an unshown opening for removing the paper bag 108 and to disconnect the latter from the muffler.

In operation, assume the cleaner 80 is removing dirt from the surface being cleaned. The sound waves in the dirt-laden air stream being discharged from the exhaust passageway 25 pass through the screened openings 100 and 101 into the resonant chambers 98 and 99. The entrances 100 and 101 being of predetermined areas with respect to the volumes of the resonant chambers 98 and 99 respectively, attenuate the sound waves to reduce the noise produced by the suction cleaner. Each resonant chamber 98 and 99 may be of different volume for attenuating sound waves within certain bands of frequencies. The members 102 remove the foreign material from the dirt-laden air without affecting the efficiency of the resonant chambers.

The energy of the sound waves passing through the muffler exhaust passageway 107 are reduced by the absorption effect of the sound-absorbing material 106 and its metallic shell 105, to thereby reduce the energy of the sound waves over the entire audible range.

When it is desired to clean the muffler, the casing end wall 92 is removed from the wall 90 to expose the resonant chambers 98 and 99 whereby the foreign material may easily be removed.

From the foregoing it will be perceived that I have provided a combination resonant-absorp-

tion muffler which functions to attenuate sound waves in relatively certain frequencies and also reduces the energy of the sound waves over the entire audible range, and that the resonant chambers are adapted to attenuate sound waves in dirt-laden air.

I claim:

1. A sound-reducing resonant muffler adapted to be mounted on a cleaner body in communication with the suction system of a suction cleaner and comprising, a muffler casing and perforated conduit cooperating to define a resonant chamber of a volume calculated to reduce sound vibrations in the moving air stream in a suction cleaner, said resonant chamber extending longitudinally and laterally beyond said conduit, and means connecting said conduit to said cleaner body and to the suction system, said resonant chamber telescoping said connecting means, extending therealong and slightly therebeyond laterally to provide protecting means for said connecting means.

2. In a suction cleaner, a cleaner body having an exhaust passageway for dirt-laden air, a bag for receiving the dirt-laden air, a sound-reducing muffler attached to said cleaner body and having a resonant chamber and sound-absorbing material, a conduit in said muffler communicating with said sound-absorbing material and having perforations leading to said resonant chamber, said conduit communicating with said exhaust passageway and said bag, said bag being attached to and supported by said muffler, said resonant chamber attenuating the sound waves in said dirt-laden air as the latter passes said perforations in said conduit, and said sound-absorbing material absorbing the energy of the sound waves in said dirt-laden air prior to discharge into said bag.

3. In a suction cleaner, a cleaner body having an exhaust passageway for dirt-laden air, a bag attached to one end of said cleaner body for filtering the dirt-laden air, a sound-reducing muffler attached to said one end of said cleaner body and having a resonant chamber and a conduit having a portion thereof provided with perforations leading to said resonant chamber, sound-absorbing material lining another portion of said conduit, said conduit communicating with said exhaust passageway and said bag, said muffler being completely disposed within said bag in spaced relationship to the walls thereof and being of such length as not to interfere with the filtering operation of said bag, said resonant chamber attenuating the sound waves in said dirt-laden air as the latter passes said perforations in said conduit, and said sound-absorbing material absorbing the energy of the sound waves in said dirt-laden air prior to discharge into said bag.

4. In a suction cleaner, a cleaner body having an exhaust passageway for dirt-laden air, a bag attached to one end of said cleaner body for filtering the dirt-laden air, a muffler casing and perforated conduit cooperating to define a resonant chamber of a volume calculated to reduce sound vibrations in the dirt-laden air, said resonant chamber extending longitudinally and laterally beyond said conduit, means connecting said conduit to said cleaner body and said exhaust passageway, said muffler casing being disposed completely in said bag, said resonant chamber telescoping said connecting means to reduce the lateral extension of said resonant chamber in said bag and to provide protecting means for said connecting means.

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