Oct. 22, 1935. A. GIAMBERTONI 2,018,207

VACUUM CLEANER

Filed Feb. 8, 1933 2 Sheets-Sheet 1

Fig. 1.

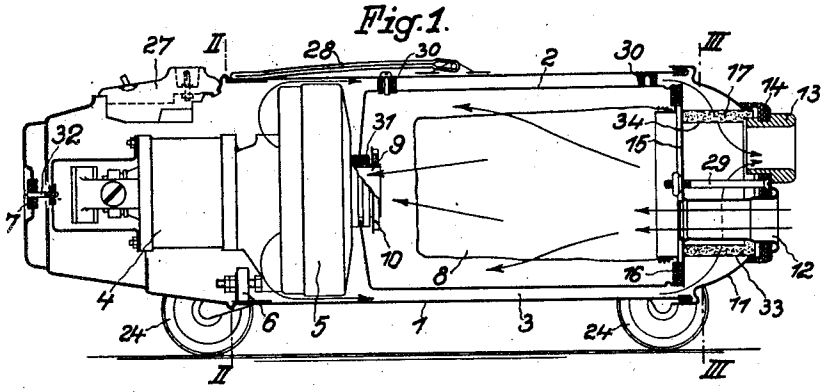


Fig. 2.

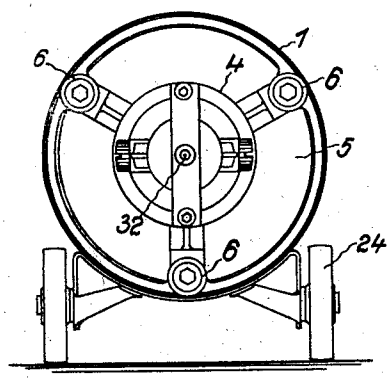


Fig. 3.

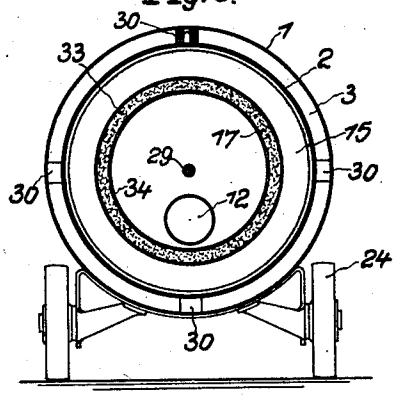


Fig. 4.

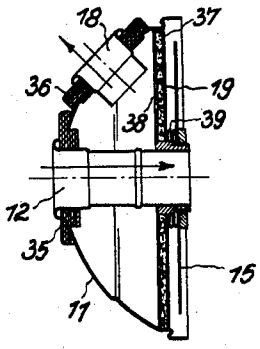
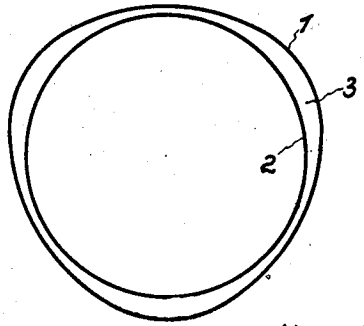


Fig. 5.



Andrea Giambertoni

By Watson, Coit, Morse & Grindle

Attorneys

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Fig. 6.

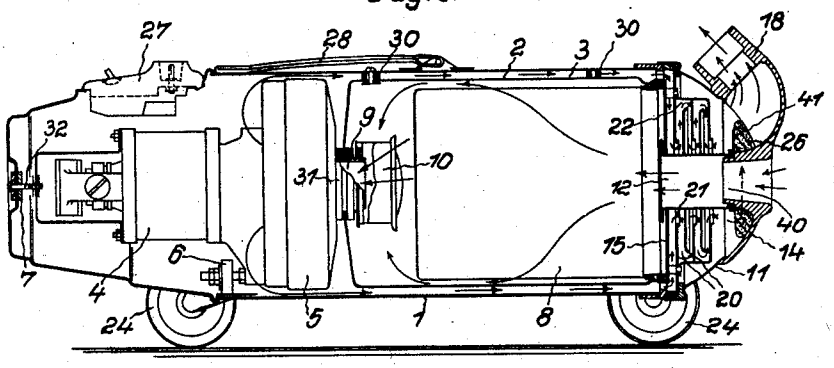
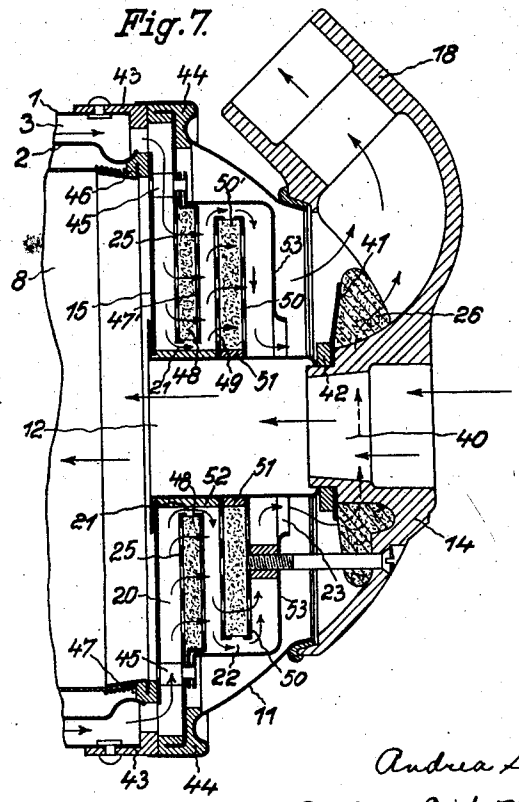


Fig. 7.



Andrea Giambertoni

By Watson, Coit, Morse & Grindle

Attorneys

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2,018,207

VACUUM CLEANER

Andrea Giambertoni, Milan, Italy

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In Germany February 12, 1932

12 Claims. (Cl. 183—37)

My invention relates to vacuum cleaners.

It is an object of my invention to reduce to a minimum the inevitable noise of such cleaners.

To this end, in a vacuum cleaner having a casing, a suction pump and a filter cowl in the casing, I so arrange the filter cowl that the cowl and the casing define a return-flow passage for the air from the suction pump.

The air in the passage has a sound-deadening effect which obviously is the more intense the longer the passage. The outlet end of the passage is therefore preferably positioned at that end of the casing which is remote from the pump.

Vacuum cleaners with casings having double walls throughout, or partly, are old but in such cleaners the air from the suction pump is discharged freely from the motor of the pump, or through staggered ports in the immediate vicinity of the motor. In both cases the noise of the motor is transmitted to the ambient air and mostly intensified by the noise of the flowing air.

By arranging the filter cowl in the casing of the cleaner as described, I obtain a long passage in which the air is backed up, i. e., its free return flow from the pump is throttled. The backing-up or throttling action should not be so intense as to exert an appreciable back pressure on the suction pump. On the contrary, the air should flow in the passage without substantial obstruction, and just be backed up or throttled enough for obtaining a sound-deadening air cushion.

A filter for the returning air is preferably provided at the outlet end of the passage, and sound-deadening means may be inserted between the filter plates.

In the accompanying drawings, vacuum cleaners embodying my invention and equipped with three distinct types of filters for the return flow from the pump, are illustrated by way of example.

In the drawings

Fig. 1 is an axial section, and

Figs. 2 and 3 are sections on the corresponding lines in Fig. 1, showing a cleaner with a cylindrical filter,

Fig. 4 is a detail showing a plate filter,

Fig. 5 is a cross section of a modified passage for the return flow,

Fig. 6 is an axial section, and

Fig. 7 is a detail, drawn to a larger scale, showing a cleaner with a plate filter which is subdivided into several units.

Referring now to the drawings, and first to Figs. 1 to 3, 1 is the outer, or principal, casing of the cleaner. The casing is mounted to run on four wheels 24 and equipped with a switch 27 and a handle 28 near its front end at the left.

15 is a circular rear-end plate which is arranged in the casing 1 near its rear end at the right, 11 is a detachable cap on the rear end of the casing 1, 14 is a bracket of sound-deadening material which is preferably resilient, for closing the rear end of the cap 11, and 29 is a central stay which connects the bracket 14 to the rear-end plate 15. Mounted on the rear-end plate 15 are a filter cowl 2 and a filter 8 within the cowl. The filter cowl 2 defines an annular space 3 with the inner wall of the casing 1 which is the aforesaid return-flow passage. 16 is a sound-deadening resilient packing ring with which the open rear end of the cowl 2 is mounted on the rear-end plate 15. The cowl is supported by suitably distributed blocks 30 of sound-deadening material in the passage 3.

12 is an air inlet pipe which at its outer end is supported in the bracket 14 while its inner end opens into the filter 8 through the rear-end plate 15. 9 is a suction pipe which projects rearwardly into the filter cowl from the suction pump 5, and is equipped with sound-deadening washers 31 and a nut 10 for exerting pressure on the washers. 6 are sound-deadening buffers by which the casing of the pump 5 is supported in the principal casing 1. 4 is the motor casing which at its rear end is connected to the pump casing while its front end is supported by a stay 32 extending through the front-end wall of the principal casing 1, with sound-deadening washers 7.

The rear end of the return-flow passage opens into the cap 11 with an annular port. 33 and 34 are two co-axial cylinders which extend from the rear face of the rear-end plate 15 to the front face of the bracket 14, and are perforated, and 17 is a layer of foraminous, preferably sound-deadening material between the two cylinders. 13 is an outlet pipe which is connected to the space within the inner perforated cylinder 34.

It will appear that the principal casing 1 is closed throughout by the rear-end plate 15, the cap 11 and the bracket 14, and that sound-deadening means are arranged at many points. The inner wall of the principal casing 1, the outer wall of the cowl 2, and all other faces in contact with flowing air, are lined with sound-deadening layers (not shown) in the usual manner.

When the motor in the casing 4 is started, the impeller of the suction pump 5 is rotated and air is drawn into the pump through inlet pipe 12, filter 8 and suction pipe 9. Particles of dust and

other impurities in the air are retained by the filter 8 and the purified air, after having passed the pump 5, is reversed through 180 degs. and flows back to the rear end of the cleaner through the passage 3. It now traverses the filter 33, 17, 34 and is finally discharged through the outlet pipe 13. The flow of the air is indicated by the arrows in Fig. 1.

As the principal casing 1 is closed, amply equipped with sound-deadening means and, in addition, contains the sound-deadening air cushion in the passage 3, the operation of the cleaner is practically noiseless.

The section of the passage 3 is determined by the shape of the principal casing 1 and the cowl 2 and must be such as to be favorable for the flow of the returning air. The section of the passage 3 is not necessarily a circular annulus and an example for a different section of the passage is shown in Fig. 5 where the cowl 2 is circular in section while the principal casing 1 has three bulging or eccentric portions. Such modifications of the section are provided if a more favorable flow of the air is obtained thereby, and obviously the cowl 2, or both the casing and the cowl, might be of irregular section. Nor is it necessary that the section of the passage 3 should be uniform throughout but may be varied toward the outlet, or in the opposite direction, if found suitable.

Referring now to Fig. 4, this shows a central inlet pipe 12 in the cap 11 which performs the function of the central stay 29, Fig. 1. The bracket 14 is dispensed with and replaced by a washer or annulus of resilient and sound deadening material per pipe, 35 being the washer of the inlet, and 36 being that of the outlet pipe. The outlet pipe is here inclined upwards at about 45 degs. 37 is an inner, and 38 is an outer filtering plate of circular shape, and 19 is a filtering layer between the two plates which obviously must be perforated. The plain plate filter is placed on the central inlet pipe 12 with a hole in its boss and applied to the tapered inner wall of the cap 11 by a spring 39.

Referring now to Figs. 6 and 7, the general arrangement of the cleaner is similar to that described with reference to Figs. 1 to 4 but here the filter illustrated in Fig. 4 is more elaborate. The bracket 14 is modified as required with respect to the central arrangement of the inlet pipe 12. It has an inwardly projecting hollow boss 40 to which the rear end of the inlet pipe 12 is beaded. Mounted on the boss at the rear of the beaded portion of pipe 12 is an annular body 26 of sound-deadening material, such as rubber sponge. 41 is a plate supporting the body 26, and 42 is a washer of sound-deadening material between the plate and the rear end of pipe 12. The outlet pipe 18 is made integral with the bracket 14.

The cap 11 is placed on a flange 43, Fig. 7, which is riveted to the principal casing 1. 44 is a washer of sound-deadening material which is inserted in the outer rim of the cap 11 and bears against a flat face on the end of the flange 43. 25 is the first filter plate whose rim is beaded over at 90 degs. and inserted in the washer 44. 45 are stays by which the rear-end plate 15 is connected to the first filter plate 25. 46 is a ring of sound-deadening material on the rear-end plate 15 and 47 is a tapered ring which is inserted in the ring 46 and serves as a support for the filter 8.

47' is the second filter plate which is connected to the stays 45 and spaced from the first plate 25. 48 is a layer of sound-deadening and foraminous material, for instance, rubber sponge, between the two plates. These two plates make up one of the filter units. The other unit is built up from the third and fourth plates 49 and 50, with a layer 50' between them. This unit is held on the pipe 12 by a sleeve 51. The four plates are perforated and the perforations in one unit are staggered with respect to those in the other unit. 53 is a hood which surrounds the two filter units and is also secured to the stays 45. The returning air from passage 3 flows along the plate 25 in a passage 20 between the plates 15 and 25, partly through the material 48 between the plates 25 and 47', and partly around the inner edge of the first unit at 21. Similarly, the air between the first and second unit flows partly through the unit, and partly around its outer edge at 22. Finally, the air leaves the hood through a central opening 23 surrounding the pipe 12. The passage 21, 22, 23 has a gradually increasing cross section whose widest portion is at 23.

It is understood that the horizontal vacuum cleaner has only been shown by way of example and that my invention may be adapted to other types of vacuum cleaners, such as pot cleaners, vertical cleaners, etc., without departing from the gist thereof.

I claim:

1. In a vacuum cleaner, a casing, a suction pump and a filter cowl in said casing, said cowl and said casing defining a return-flow passage for the air from said pump, a cap at the rear end of said casing to which said passage is connected, an outlet pipe on said cap, and a partition of foraminous and sound-deadening material interposed between said passage and said pipe.

2. In a vacuum cleaner, a casing, a suction pump and a filter cowl in said casing, said cowl and said casing defining a return-flow passage for the air from said pump, a cap at the rear end of said casing to which said passage is connected, an outlet pipe on said cap, and an annular partition of foraminous and sound-deadening material interposed between said passage and said pipe.

3. In a vacuum cleaner, a casing, a suction pump and a filter cowl in said casing, said cowl and said casing defining a return-flow passage for the air from said pump, a cap at the rear end of said casing to which said passage is connected, an outlet pipe on said cap, and a flat partition of foraminous and sound-deadening material interposed between said passage and said pipe.

4. In a vacuum cleaner, a casing, a suction pump and a filter cowl in said casing, said cowl and said casing defining a return-flow passage for the air from said pump, a cap at the rear end of said casing to which said passage is connected, an outlet pipe on said cap, and a filter interposed between said passage and said pipe and having filtering units with perforated plates, the perforations in each unit being staggered with respect to those in the other unit, and a passage defined by said units, whose free cross sectional area increases from the end of said return-flow passage toward said outlet pipe.

5. In a vacuum cleaner, a casing, a suction pump and a filter cowl in said casing, said cowl and said casing defining a return-flow passage for the air from said pump, a cap at the rear end of said casing, to which said passage is connected, an outlet pipe on said cap, and a filter interposed between said passage and said pipe and having filtering units with perforated plates, the per-

forations in each unit being staggered with respect to those in the other unit, layers of sound-deadening material inserted between the plates of said units, and a passage defined by said units, whose free cross-sectional area increases from the end of said return-flow passage toward said outlet pipe.

6. An electric vacuum cleaner comprising a partly double-walled casing, a pump- and motor unit, a dust filter arranged in front of said unit, a filter cowl in said casing which cowl surrounds said filter, and a throttling, long passage defined by said cowl and said casing, for supplying air to a cap having an inlet and an outlet pipe.

7. An electric vacuum cleaner comprising a partly double-walled casing, a pump- and motor unit, a dust filter arranged in front of said unit, a filter cowl in said casing which cowl surrounds said filter, a throttling, long passage defined by said cowl and said casing, a detachable cap having an inlet and an outlet pipe which cap is connected to said passage, is seated on the outer casing and tightly closes the cowl, interengaging filter plates with staggered perforations in said cap, and an air-discharge passage defined by said plates, with its free cross-sectional area widened toward said outlet pipe.

8. In a vacuum cleaner designed to operate with a minimum of noise, in combination, a casing which is double walled throughout the greater portion of its length, a motor within said casing at one end thereof, a blower adapted to be driven by said motor and also disposed adjacent said end of the casing, a dirt bag carried by the double walled portion of said casing interiorly thereof and arranged in advance of said blower, an inlet and an outlet opening at the end of said casing remote from said blower, said casing defining an elongated annular uninterrupted outlet chamber between the double walls thereof which communicates with the exhaust side of said blower and with said outlet opening.

9. In a vacuum cleaner designed to operate with a minimum of noise, in combination, a casing which is double walled throughout the greater portion of its length, a motor within said casing at one end thereof, a blower adapted to be driven by said motor and also disposed adjacent said end of the casing, a dirt bag carried by the double walled portion of said casing interiorly thereof and arranged in advance of said blower, an inlet and an outlet opening at the end of said casing remote from said blower, said casing defining an elongated annular uninterrupted outlet chamber between the double walls thereof which communicates with the exhaust side of said blower and with said outlet opening, and means for throttling the flow of air in said chamber.

10. In a vacuum cleaner designed to operate with a minimum of noise, in combination, a casing which is double walled throughout the greater portion of its length, a motor within said casing at one end thereof, a blower adapted to be driven by said motor and also disposed adjacent said end of the casing, a dirt bag carried by the double walled portion of said casing interiorly thereof and arranged in advance of said blower, an inlet and an outlet opening at the end of said casing remote from said blower, said casing defining an elongated annular uninterrupted outlet chamber between the double walls thereof which communicates with the exhaust side of said blower and with said outlet opening, and a labyrinth packing assembly adjacent said outlet opening for throttling the flow of air in said chamber.

11. In a vacuum cleaner designed to operate with a minimum of noise, in combination, a casing which is double walled throughout the greater portion of its length, a motor within said casing at one end thereof, a blower adapted to be driven by said motor and also disposed adjacent said end of the casing, a dirt bag carried by the double walled portion of said casing interiorly thereof and arranged in advance of said blower, an inlet and an outlet opening at the end of said casing remote from said blower, said casing defining an elongated annular uninterrupted outlet chamber between the double walls thereof which communicate with the exhaust side of said blower and with said outlet opening, and an outlet passageway between said chamber and said outlet opening, said outlet passageway being constricted near its inlet end whereby the flow of air in said chamber is throttled, the effective cross sectional area of said passageway increasing toward the discharge end thereof.

12. In a vacuum cleaner designed to operate with a minimum of noise, in combination, a casing which is double walled throughout the greater portion of its length, a motor within said casing at one end thereof, a blower adapted to be driven by said motor and also disposed adjacent said end of the casing, a dirt bag carried by the double walled portion of said casing interiorly thereof and arranged in advance of said blower, an inlet and an outlet opening at the end of said casing remote from said blower, a cap for said double walled casing at the end remote from said motor, inlet and outlet conduits passing through said cap, sound deadening means between said cap and said conduits, said casing defining an elongated annular uninterrupted outlet chamber between the double walls thereof which communicates with the exhaust side of said blower and with said outlet conduit.

ANDREA GIAMBERTONI.