Jan. 7, 1936. A. A. FORSBERG 2,027,158

VACUUM CLEANER

Filed March 5, 1932 2 Sheets-Sheet 1

Fig. 1.

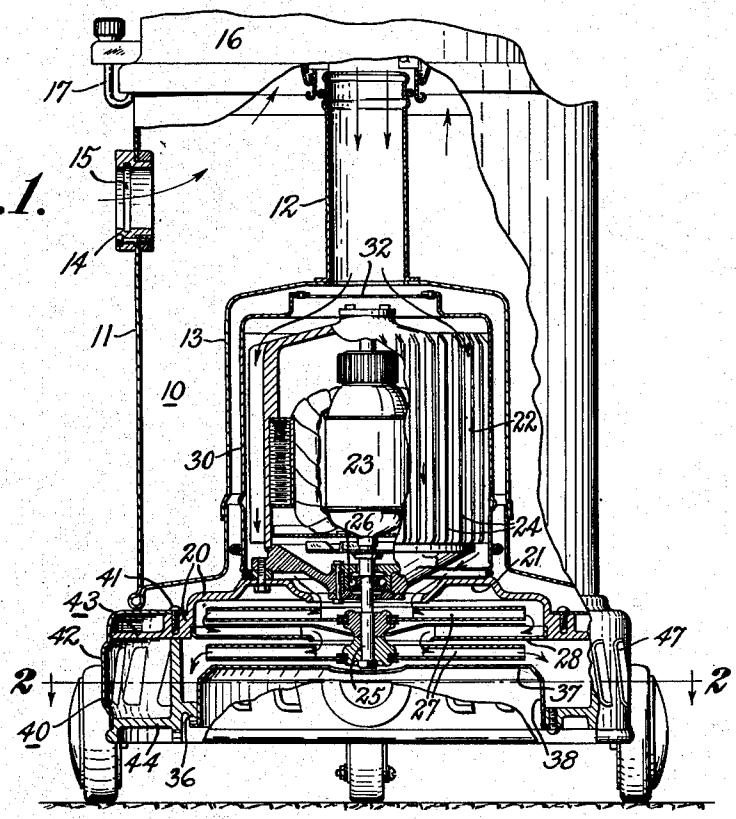
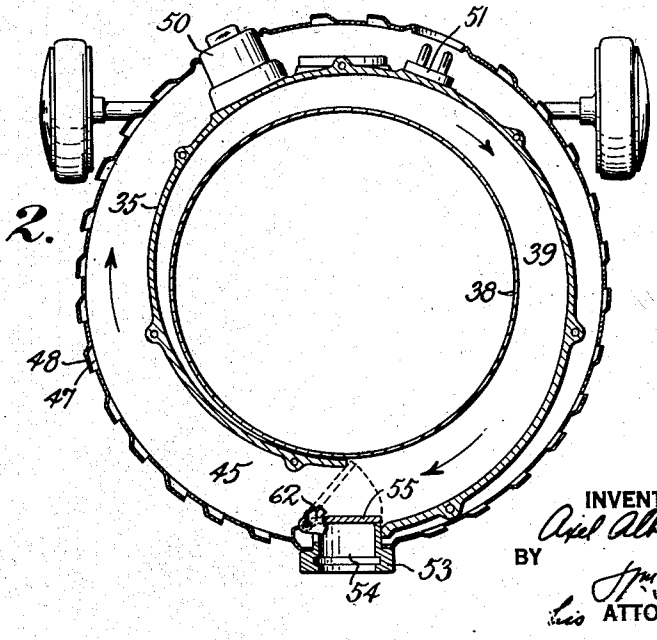


Fig. 2.



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Filed March 5, 1932 2 Sheets-Sheet 2

Fig. 3.

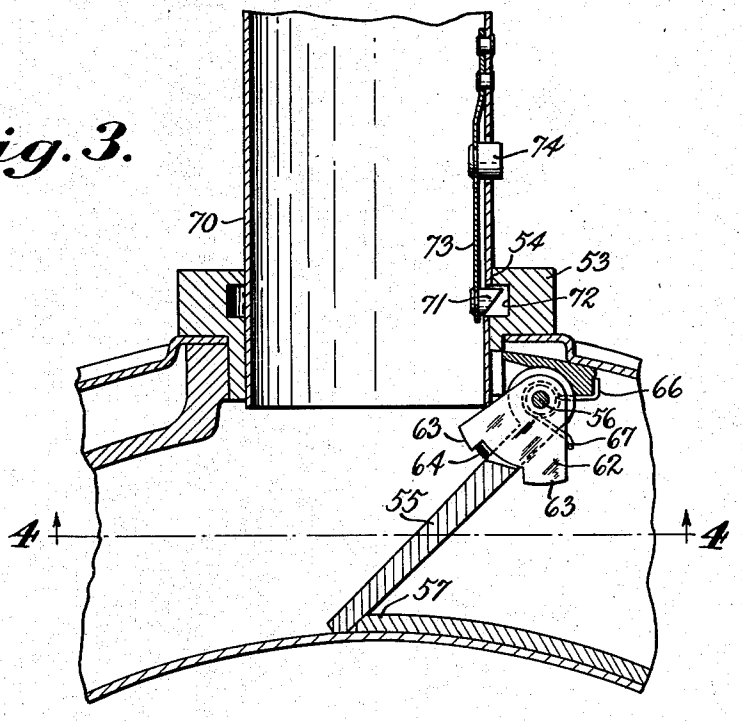
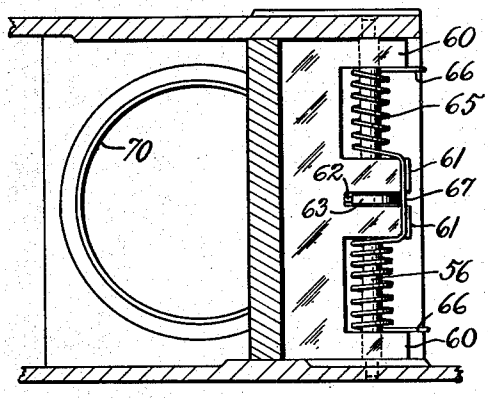


Fig. 4.



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UNITED STATES PATENT OFFICE

2,027,158

VACUUM CLEANER

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Application March 5, 1932, Serial No. 596,909
In Germany March 7, 1931

13 Claims. (Cl. 230—127)

This invention relates to vacuum cleaners and more particularly to air discharge means therefor providing for discharge of air in a diffused condition. More specifically, the invention provides an air channel extending in the general direction of air flow induced by the impeller or fan and having a constantly decreasing cross-sectional area in the direction of the air flow. A plurality of louvers are associated with this channel to permit the escape of air from the various parts thereof to the surrounding atmosphere. Means is also provided involving novel valve mechanism for interrupting the air flow through the air channel and supplying the air to a blower opening or air pressure hose connection. Various other features of the invention will be apparent from the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is an elevational view of a vacuum cleaner, essentially in central cross-section, constructed in accordance with the present invention and showing the operating mechanism;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1 showing the air channels;

Fig. 3 is an enlarged sectional view showing the details of construction of valve mechanism associated with the blower opening; and

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3 showing further details of this valve.

Referring to the drawings more in detail, the invention is shown as applied to a vacuum cleaner comprising a dust collector 10 having an outer wall 11 and an inner wall formed with a cylindrical section 12 forming an air duct and an enlarged section 13 which is adapted to pass over the motor assembly to be described. Wall 11 carries a coupling member 14 which forms the air inlet port of the machine and is provided with means such as annular groove 15 by which an air suction hose may be coupled thereto. A cover 16 carrying a dust separating member, not shown, is supported on the outer wall 11 and is secured thereto as by clamps 17.

The main support for the operating parts of the machine comprises a frame or casting 20 which is provided with an in-turned flange 21 on which a motor housing 22 is supported. Said housing encloses motor 23 and is provided with a plurality of heat radiating fins 24 which are preferably integrally formed therewith. Said motor is provided with a shaft 25 which is supported in a suitable bearing 26 carried in said housing 22. Said shaft carries a pair of impellers or fans 27 which are of well known construction and are adapted to receive air centrally thereof and discharge air peripherally. A stationary baffle or guide member 28, secured to frame 20, is located between impellers 27 to suitably control the direction of air flow.

A shield 30 having a screen 32, is mounted between motor housing 22 and enlarged section 13 of the dust collector and is spaced from said motor housing to provide an air channel. Said shield may be supported from flange 21 in any suitable manner and is adapted to remain in position and to enclose and protect the motor assembly when the dust collector 10 is removed.

A spiral wall 35 is secured to frame 20 or is integrally formed therewith and is provided with an in-turned flange 36 which supports a cup-shaped member 37. Said member 37 is provided with a down-turned flange 38 engaging flange 36 and forming in connection with spiral wall 35 a spiral air channel 39 of constantly increasing cross-sectional area. A hood 40 is also secured to frame 20, as by screws 41, and is provided with a down-turned flange or wall 42 forming a portion of the outer wall of the vacuum cleaner and engaging flanges or walls 43 and 44 formed on frame 20 and spiral wall 35 respectively and forming in connection with said wall 35 an outer spiral air channel 45 of constantly decreasing cross-sectional area. Said flange 42 may be provided with a plurality of louvers 47 formed, for example, by pressing or stamping louver vanes 48 therefrom. Said louvers are preferably inclined to the vertical so as to discharge air currents in an upwardly inclined direction and to thereby prevent said currents from picking up dust from the floor or surface on which the machine is supported.

Various operating devices such as electric switch 50 and connector 51 may be mounted on wall 35. The outer end of spiral wall 35 supports a coupling member 53 having a channel 54 which forms the blower opening of the machine. Said spiral wall 35 also supports a valve flap 55 adjacent said member 53. Said valve flap is adapted in one position to seat against member 53 and close the blower opening as illustrated in Fig. 2 and in another position to bear against the inner end 57 of wall 35 as illustrated in Fig. 3, and thereby close the entrance to air channel 45. Flap 55 is provided with a plurality of tongues 60 and 61 which pivotally engage pin 56 which is mounted in wall 35. Tongues 61 are spaced to receive a yoke 62 which is also pivoted on rod 56 and is provided with ears 63 which ex-

tend on opposite sides of flap 55. A spring 64 may be inserted between one of said ears 63 and flap 55 to normally maintain said yoke in the position illustrated in Fig. 3 and to provide a limited amount of lost motion between said yoke and said valve flap. A spring 65 is seated about pin 56 between tongues 60 and 61 and at its ends 66 engages a stationary member such as a portion of wall 35. The spring is bent at its center to provide a U-shaped section 67 which engages yoke 62 and normally holds flap 55 in position to close blower opening 54.

The valve flap is adapted to be operated by the end of hose coupling or hose end 70 which engages yoke 62 and causes pivotal movement thereof about pin 56 whereby the valve flap is brought into the position illustrated in Fig. 3 and closes air channel 45. The lost motion between yoke 62 and flap 55 permits said flap to be normally held in engagement with end 57 of wall 35, regardless of slight variations in size of the hose coupling 70. Hose coupling 70 is secured in member 53 by detent 71 which is adapted to enter annular groove 72 in said member 53 and is carried by spring 73. Pressure button 74 permits spring 73 to be depressed for releasing detent 71 from said member 53. The annular recess 72, however, permits rotation of hose coupling 70 in said member 53.

In the operation of the above described device, air is received through inlet opening 15 into dust collector 10 and is passed upwardly through the dust separating apparatus, not shown, thence downwardly through tubular section 12 and over motor housing 22. Thereafter, the air is discharged by the action of fans 27 into spiral chamber 39 and is caused to pass along this chamber and thereafter to enter chamber 45 from which it is discharged through louvers 47. It will be noted that the cross-sectional area of chamber 39 increases in the direction of air movement and as the quantity of air which is supplied thereto by fan 27 increases. It will also be noted that the cross-sectional area of channel 45 continually decreases in the direction of air flow as the quantity of air (per unit length) is reduced by discharge thereof through louvers 47. The arrangement is preferably such that a substantially constant pressure is maintained throughout the length of channel 45 so that a uniform rate of discharge is obtained from the various louvers. If desired, the diffusion may be made more complete by inserting a diffusion medium such as cloth within flange 42 and across said louvers.

It is also to be noted that the large total discharge opening obtained by the use of a plurality of louvers which are spaced about the entire periphery of the machine prevents appreciable air currents from being set up and insures the maximum diffusion of the discharged air. This action is assisted by the fact that the louvers open in a direction opposite to that of the air flow so that the velocity of discharge is maintained at a minimum.

Normally valve flap 55 closes blower opening 54. When, however, it is desired to use the blower opening, the valve is automatically moved to the position shown in Fig. 3, by the insertion of the air hose and thereafter the passage to channel 45 and to the various louvers is cut off and all of the air is caused to pass through the blower opening.

The location of the valve flap at this point is particularly advantageous because the maximum air pressure obtains and because of the mechanical rigidity of the ends of wall 35 by which the valve flap is carried.

In the above description, certain specific terms have been used for purposes of illustration. It is to be understood, however, that they are to be given as broad an interpretation as the state of the art will permit and that a preferred form of the invention has been set forth by way of illustration only. The scope of the invention is only to be limited in accordance with the following claims considered with reference to the state of the prior art.

What is claimed is:

1. In a vacuum cleaner, an air impeller, air conveying means connected to receive air from said impeller associated therewith comprising a casing having a curved air channel of constantly decreasing cross-sectional area, said casing having air discharge louver openings progressively disposed along the path of air flow and arranged so that the direction of air flow therethrough is suddenly reversed from the direction of air flow in said channel.

2. In a vacuum cleaner, an air impeller, a circular casing wall and a spiral wall spaced therefrom to form an air channel of constantly decreasing cross-sectional area having air receiving communication with said impeller, said casing wall having air discharge louver openings disposed along the path of air flow whereby said air is discharged around substantially the entire periphery of said casing, said air discharge louver openings being arranged so that the direction of air flow therethrough is suddenly reversed from the direction of air flow in said channel.

3. In a vacuum cleaner, an air impeller, a circular outer casing wall, an inner circular wall concentric therewith, a spiral wall between said outer and inner walls and dividing the space therebetween into two connected spiral air channels, one channel being connected to receive air from said impeller and having an increasing cross-sectional area and the other channel receiving air from the last-mentioned channel and having a decreasing cross-sectional area in the direction of air flow therethrough and being provided with air discharge openings.

4. In a vacuum cleaner, an air impeller, a circular outer casing wall, an inner circular wall concentric therewith, a spiral wall between said outer and inner walls and dividing the space therebetween into two connected spiral air channels, one channel being connected to receive air from said impeller and having an increasing cross-sectional area and the other channel receiving air from the last-mentioned channel and having a decreasing cross-sectional area in the direction of air flow therethrough and air discharge means disposed along said casing in the path of air flow and adapted to discharge air peripherally thereof.

5. In a vacuum cleaner, an air impeller, a casing member surrounding said impeller and spaced therefrom and a spiral wall located within said casing member and extending between said casing member and a point adjacent said impeller, said wall forming with said casing member an air discharge channel of constantly decreasing cross-sectional area, and air discharge means associated with said casing member and disposed along the path of air flow in said channel whereby air is progressively discharged as it advances therethrough.

6. In a vacuum cleaner, an air impeller, a pair

of concentric circular walls associated with said impeller and a spiral wall mounted therebetween and dividing the space between said walls into a pair of air channels, one channel being connected to receive air from said impeller and having a constantly increasing cross-sectional area and the other channel receiving air from the last-mentioned channel and having a constantly decreasing cross-sectional area and provided with air discharge openings.

7. In a vacuum cleaner, an air impeller, and air discharge means comprising a pair of concentric circular walls, a spiral wall located between said circular walls and forming therewith a pair of air discharge channels, said channels being serially arranged with respect to the direction of air flow whereby the air flows first through a channel of constantly increasing cross-sectional area and then through a channel of constantly decreasing cross-sectional area, said last mentioned channel having means for progressively discharging air as it advances therethrough.

8. In a vacuum cleaner, means for producing an air current and discharge means for said air current comprising outer and inner concentric circular members and a spiral member located therebetween and forming therewith inner and outer air channels, said outer member having a blower opening formed therein and a valve member adapted to alternately close said blower opening and said outer air channel.

9. In a vacuum cleaner, a circular outer wall having a plurality of air discharge louvers and having a blower opening, a spiral member mounted within said wall and forming in connection therewith an air channel, and a valve carried by said spiral member and adapted to alternately close said blower opening and said channel.

10. In a vacuum cleaner, a circular casing member having a plurality of discharge louvers therein, a spiral wall mounted within said casing and forming in connection therewith an air channel, and a valve flap pivotally secured to one portion of said spiral wall and adapted to engage another portion thereof for closing said air channel.

11. In a vacuum cleaner, a circular outer casing member having a plurality of air discharge louvers therein, a spiral wall located internally of said casing member and forming an air channel, said casing member having a blower opening formed therein, a valve flap carried by the outer end of said spiral wall and adapted normally to close said blower opening and means for removing said valve flap from said blower opening and causing said valve flap to contact with the inner end of said spiral member thereby to close said air channel.

12. In a vacuum cleaner, a circular outer casing member having a plurality of air discharge louvers therein, a spiral wall located internally of said casing and forming an air channel, said casing member having a blower opening formed therein, a valve flap pivotally mounted on the outer end of said spiral member and adapted to normally close said blower opening, a yoke associated with said flap and resiliently secured thereto, said yoke extending within said blower opening and adapted to be engaged by a hose coupling and to be operated thereby to rotate said valve against the inner end of said spiral member.

13. A vacuum cleaner comprising means to produce flow of air, a diffuser channel of gradually increasing cross-section connected to receive air from said means, an outflow passage forming a continuation of said channel and having gradually decreasing cross-section and having a plurality of openings communicating with the atmosphere, an air discharge member at the junction of said channel and said passage and adapted to receive an air hose, and means normally closing said air discharge member and adapted on insertion of the air hose to open the air discharge member and close the outflow passage.

AXEL ALBERT FORSBERG.