Aug. 9, 1938. F. A. GROTHE 2,126,383

SUCTION CLEANER

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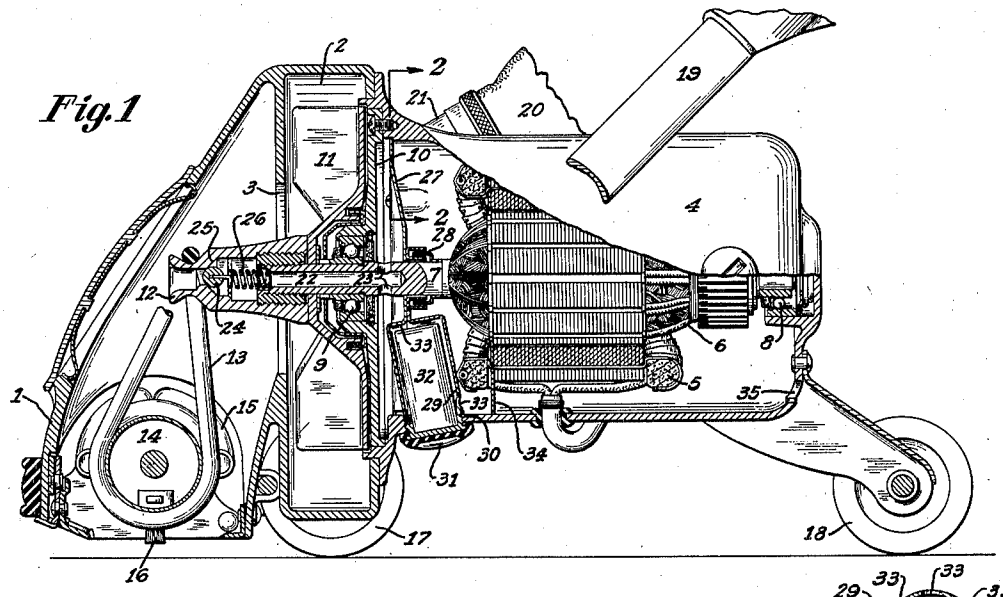
Fig. 1



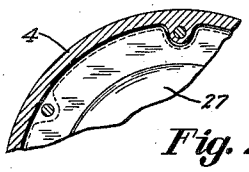


Fig. 2

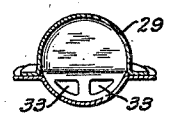


Fig. 4

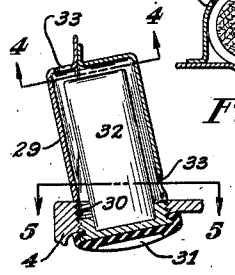


Fig. 3

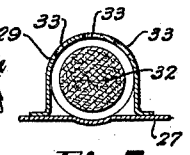


Fig. 5

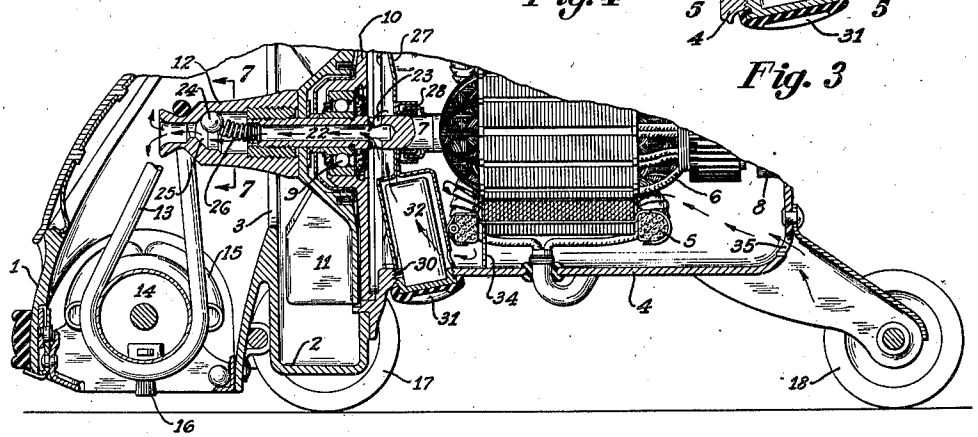


Fig. 6

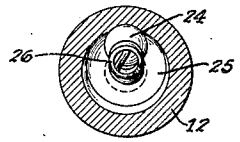


Fig. 7

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SUCTION CLEANER

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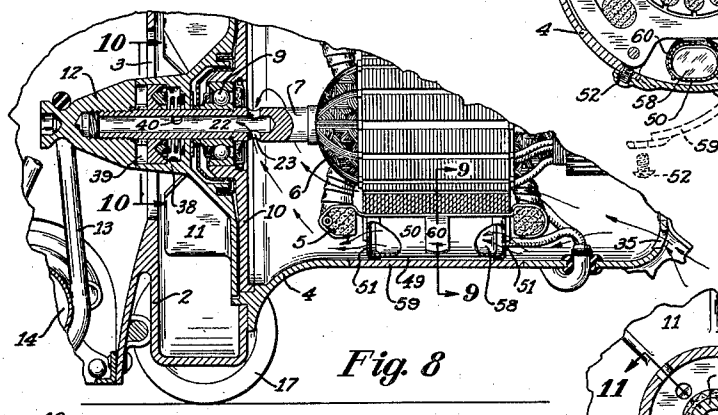

Fig. 8

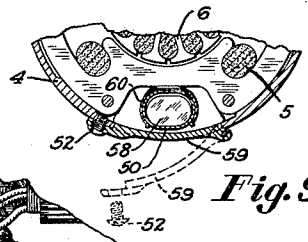

Fig. 9

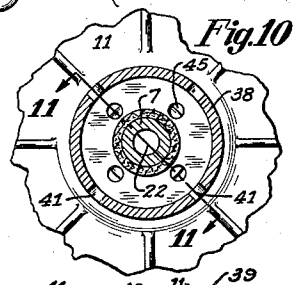

Fig. 10

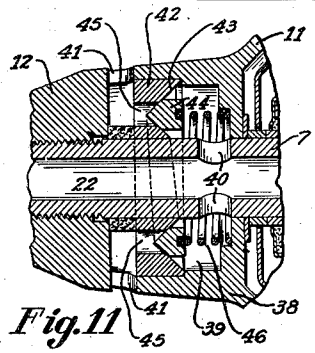

Fig. 11

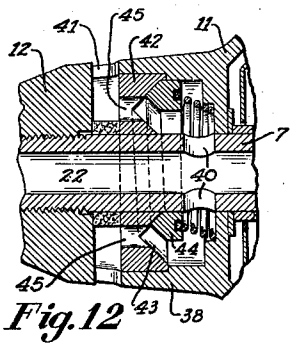

Fig. 12

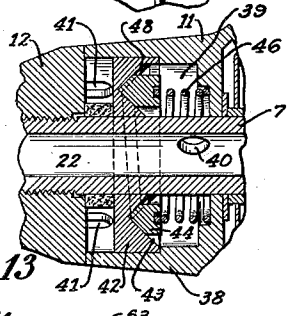

Fig. 13

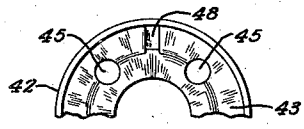

Fig. 14

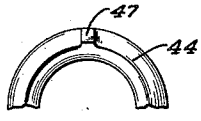

Fig. 15

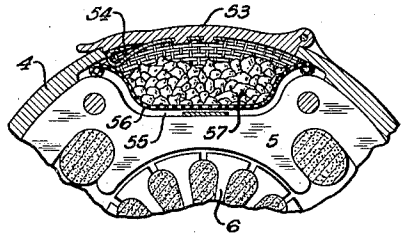

Fig. 17

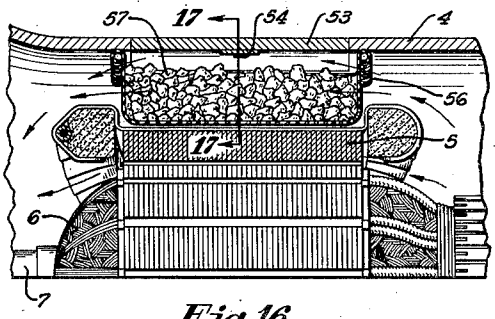

Fig. 16

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UNITED STATES PATENT OFFICE

2,126,383

SUCTION CLEANER

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Application June 8, 1934, Serial No. 729,549

16 Claims. (Cl. 21—127)

The present invention relates to suction cleaners in general and particularly to new and novel improvements in means to control the flow of air through the cleaner motor. More specifically the invention comprises a new and novel relationship of parts in a suction cleaner in which air is drawn through a motor to perform a cooling function and also through an air-conditioning unit, the air leaving the motor by way of the hollow motor shaft and passing into the fan chamber where it mixes with the main air stream carrying the foreign matter removed from the surface covering undergoing cleaning.

It is an object of the present invention to provide a new and improved suction cleaner. It is another object of the invention to provide a suction cleaner including improved means controlling the flow of air through the cleaner motor casing. A still further object is the provision, in a suction cleaner including a driving motor and a suction-creating fan, of automatically operated valve means which control the flow of air from the motor into the point of low pressure created by the rotating fan. A further object is the provision in a suction cleaner of a motor casing in which is positioned a rotating motor and an odorizing unit. A still further object is the provision in a suction cleaner of a motor and an air conditioning unit, means being provided to draw air through the motor and through the air-conditioning unit, there being automatic means to prevent the reversal of the direction of air flow thru the motor upon the rotating motor coming to a stop. These and other objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawings to which they relate.

In the drawings in which preferred embodiments of the present invention are disclosed:

Figure 1 is a vertical section thru a modern suction cleaner embodying the present invention;

Figure 2 is a partial section upon the line 2—2 of Figure 1;

Figure 3 is a cross section through the air-conditioning unit of Figure 1;

Figure 4 is a section upon the line 4—4 through the air-conditioning unit of Figure 3;

Figure 5 is a section upon the line 5—5 of Figure 3;

Figure 6 is a view similar to Figure 1 but with the air valve positioned as in the operating condition of the cleaner;

Figure 7 is a section thru the valve upon the line 7—7 of Figure 6;

Figure 8 is a section thru a cleaner embodying a second preferred embodiment of the invention;

Figure 9 is a section through the air-conditioning unit of Figure 8 upon the line 9—9;

Figure 10 is a section upon the line 10—10 of Figure 8;

Figure 11 is a section through the valve mechanism upon the line 11—11 of Figure 10;

Figure 12 is a section similar to Figure 11 but with the valve in the open or operating position;

Figure 13 is a view similar to Figure 11 but with the valve and motor shaft rotated through a slight angle;

Figure 14 is a partial side view of the valve seat;

Figure 15 is a partial side view of the valve element;

Figure 16 is a partial section through a suction cleaner motor and air-conditioning unit illustrating a third preferred type of air conditioning unit;

Figure 17 is a section upon the line 17—17 of Figure 16.

In the operation of a modern suction cleaner cleaning air is drawn through the cleaner nozzle, past a rotating agitating element positioned therein, and is exhausted by the rotating fan thru the exhaust outlet of the fan chamber into a filtering dust bag. The fan is ordinarily driven by a rotating electric motor and reduces the nozzle pressure.

The present day suction cleaner motor is a high speed unit and requires that cooling air pass thereover to prevent excessive temperature rise. For the purpose of obtaining a flow of cooling air the difference in pressure existing between atmosphere and the suction side of the fan may be utilized. This same flow of cooling air can also be utilized to create a pleasing dust-neutralizing odor in the air exhausted from the suction cleaner by passing it through an air-conditioning unit before it enters the main air stream in the fan chamber. In view of the fact, however, that upon the cessation of motor rotation the back pressure existing in the dust bag forces air back into the cleaner permitting dust to be deposited upon parts with which it comes into contact, it is necessary to provide automatic valve means to prevent the entrance of this air into the motor and the odorizing unit. In the suction cleaner constructed in accordance with the present invention this difficulty has been satisfactorily eliminated.

Referring again to the drawings, and to Figures 1 to 7 inclusive in particular, a modern suction cleaner constructed in accordance with the present invention is disclosed. The cleaner is seen to comprise a surface-contacting nozzle 1 which is interiorly connected to a fan chamber 2 by an inlet 3. A motor casing 4 abuts the fan chamber 2 and houses an electric motor including a stator 5 carried by the casing 4 and an armature 6 including a shaft 7. Shaft 7 is rotatably mounted at one end in a bearing 8 positioned in the end wall of the casing 4, and at the other end in a bearing 9 carried by the motor bottom plate 10 which is common to both the motor casing and the fan chamber. Within the fan chamber 2 the extended motor shaft 7 carries a fan 11, and at its end in the nozzle 1 a pulley 12. A belt 13 seats on pulley 12 and functions to drive a surface-contacting agitator 14, including rigid surface-contacting elements 15, 15 and flexible brushes 16. The cleaner is movably supported upon spaced front and rear supporting wheels 17 and 18 and a pivoted handle 19, which is connected to the body of the machine. The handle supports at its upper end, in a common but unshown manner, the dust bag 20 which is attached to the exhaust outlet 21 of the fan chamber 2.

According to the present invention the motor shaft 7 is provided with a bore extending from within the motor casing 4 thru fan chamber 2 to its end. This bore is indicated by the reference character 22 and is connected and open to the interior of the motor casing by radially extending ports 23, 23. The pulley 12 is also provided with a longitudinally open ended passageway thereby directly connecting the internal bore 22 of the shaft to the low pressure existing in the nozzle 1.

In the inoperative relationship of the cleaner a ball valve 24 seats in a conical valve seat 25, being spring-pressed therein by a coil spring 26 which seats in the counterbored end of shaft 7, to close the passageway, as shown in Figure 1. In the rotation of the motor shaft, however, valve 24 is thrown by centrifugal force up the side of this conical seat to a position as shown in Figure 6 and the interior of the motor shaft is directly connected to low pressure in the nozzle 1. To insure that centrifugal force will act upon the ball to displace it as the shaft rotates at high speed the seat 25 is eccentrically positioned relative to the true axis of rotation of the shaft, as clearly illustrated in Figures 1 and 7.

Within the motor casing 4 and between the armature 6 and the bottom plate 10 is positioned a baffle plate 27 which is carried by the motor casing and which closely encloses the motor shaft 7, a labyrinth seal 28 being provided to prevent the passage of air between the shaft and the plate. A volatile element container 29 is formed at the bottom of baffle plate 27 immediately above a screw threaded opening 30 in the motor casing 4 which is closed normally by a cap 31. Within container 29, and supported by cap 31, is a body or cake 32 of a volatile redolent element. To permit the passage of air thru the container, openings 33, 33 are provided in the motor side and in the fan chamber side thereof. These openings form the sole passageway for air between the hollow motor shaft ports 23, 23, which are positioned between the baffle 27, and the bottom plate 10, and the cleaner motor including stator 5 and armature 6. All air so directed passes over the volatile element in container 29 to cause volatilization of that element. A second baffle plate indicated at 34, is provided on the inner side of the field stacks of stator 5 and substantially seals the stator to the motor casing 4 forcing all the air thru the motor to pass between the field and the armature. Motor casing 4 is provided with a bottom opening 35 at its rear wall to permit air to enter.

In this embodiment of the invention the air, which is drawn into the cleaner motor thru opening 35 in response to the low pressure made effective therein by the passageway through the motor shaft, passes first through the motor, then through the air-conditioning unit into the space between baffle 27 and bottom plate 10, and finally into the main air stream by way of the hollow shaft 7. As the air is somewhat warmed by its contact with the motor windings, and as the usual volatile element volatilizes at a greater rate with an increase in temperature, it is evident that the volume of air passing through the conditioning unit carries away more of the element than would a similar volume of air at atmospheric temperature.

In the operation of machine, as previously indicated, the valve 24 is in the open position where it is retained centrifugally and the air from the motor passes directly into the nozzle. When the current passing through the cleaner motor is cut off and the motor comes to rest the spring 26 urges valve 24 downwardly into its conical seat closing the port at the apex of the seat and rendering it impossible for air to pass either into or out from the motor casing by that passageway.

Referring now to Figures 8 to 15 inclusive, a second preferred embodiment of the invention is disclosed. In its general outline the cleaner is identical with that shown in the first embodiment. The differences which exist between it and the first embodiment lie in the valve mechanism and the relationship of the air-conditioning unit to the motor, as hereinafter fully set forth.

According to this second embodiment of the invention the motor shaft 7 is again provided with a bore 22 from a point within the motor casing 4 to the suction side of fan 11. Radial ports 23, 23 again connect this bore to the interior of the motor casing. The suction-creating fan 11, which is carried by the shaft 7, is formed with a hub 38 which extends into the inlet 3 and is counterbored to provide a chamber 39 surrounding the hollow shaft 7 and interiorly connected thereto by the ports 40 formed thereon. This chamber is closed at its forward end by the flat fan-contacting side of the pulley 12, but there are provided openings 41, 41 which connect the chamber 39 directly to the point of low pressure of the fan.

The automatic valve which controls the flow of air through the hollow motor shaft 7 in the present embodiment is positioned in chamber 39 and more specifically between the ports 40, 40 and 41, 41 which are longitudinally spaced relative to the motor shaft. In this embodiment the valve comprises a ring 42 which seats within the hub 38 and encloses the shaft 7. Ring 42 is provided on its fan side with a circular valve seat 43 which encircles the shaft 7 but is inclined at a slight angle to a plane perpenedicular to the shaft, as clearly illustrated in Figures 11, 12 and 13. The valve 44 comprises a ring conforming in shape to the seat 43 upon one side and has a flat surface perpendicular to the shaft 7 upon its other side. With valve 44 in the open position ports 40, 40 in shaft 7 are connected

with ports 41, 41 by openings 45, 45 in valve seat 43. Valve 44 is normally pressed into port-closing relationship by a spiral spring 46 which contacts the side wall of the chamber 39 at one of its ends and the flat face of the ring 44 at its other end.

To prevent relative rotation between valve ring 44 and valve seat 43 a key 47 is provided upon the valve which seats in a radial slot 48 in the seat. The cooperation of these two elements insure that the thick side of the valve ring 44, that is the side having the greater mass, will at all times seat within the deep side of the valve face 43.

In the inoperative relationship, as shown in Figure 11, the valve 44 is positioned in and is concentric with valve seat 43 and ports 45, 45 are closed. Upon the high speed rotation of the motor, however, valve 44 is thrown by centrifugal force up the side of the valve seat, to a position as shown in Figure 12, leaving the ports 45, 45 open and directly connecting ports 40, 40 to ports 41, 41. This movement of valve 44 takes place because one side of the ring is heavier than the other, thru being of greater mass as described.

The air which is drawn from the motor casing 4 and into the point of reduced pressure of the fan 11 in the present embodiment has first passed over the motor field and armature, some of the air passing through an air-conditioning unit 49 which is positioned adjacent the bottom of motor casing 4 and immediately below the field winding 5. The baffles 27 and 34 of the first embodiment are omitted so that all of the air thru the motor does not pass thru the odorizer unit. The unit 49 comprises a container 50 having ports 51, 51 at its ends and containing a cake of volatile material 53 over which the air must pass in traversing the container.

To permit replacement of the volatile element of the unit the motor casing 4 is provided with a pivoted bottom plate 59 immediately below the unit which is normally held in place by a removable screw 52. The replacement operation requires only removal of screw 52, the pivoting of plate or cover 59 downwardly to the dotted line position shown in Figure 9, and the removal of container 50 from the spring clip 60 which normally retains it in place.

Referring now to Figures 16 and 17 in particular a third preferred embodiment of the invention is disclosed in which a different type of odorizer or air-conditioning unit is disclosed. As in the two previous embodiments clean air is drawn through the motor and is accordingly available for motor-cooling purposes and for air-conditioning purposes. According to this embodiment a pivoted cover plate 53 is provided on the top of the motor casing 4 and includes a spring-latch 54 which normally underlies an adjacent side of the motor casing 4 to resistingly secure the plate in place. Within the casing 4, and in a cutout section 55 in the motor field 5, is positioned an odorizer compartment or container made of a fine mesh screen 56. In this compartment volatile crystals 57 are positioned and are adapted to be volatilized by the air passing through the motor and more specifically through the porous compartment 56. To replenish the supply of air-conditioning element it is necessary only to lift the cover 53 and to pour into the wire compartment 56 a fresh supply of crystals. The compartment 56 is practically enclosed on three sides by the field 5 and it is to be noted that with an increase in temperature of the field the rate of volatilization of the crystals will increase.

I claim:

1. In a suction cleaner, a driving motor, a suction-creating fan connected to said motor, a nozzle open to said fan and adapted to convey a main air stream thereto, an air-conditioning unit, and means to convey a secondary air stream from said motor and said air-conditioning unit to said fan.

2. The construction recited in the preceding claim in which the motor and the air-conditioning unit are arranged in series in said secondary air stream.

3. The construction recited in the second preceding claim in which the motor and the air-conditioning unit are arranged in parallel in said secondary air stream.

4. The construction recited in the third preceding claim in which means are provided to close automatically the passageway for said secondary air stream with the motor inoperative.

5. In a suction cleaner, a nozzle, a fan chamber open thereto, and a motor casing adjacent said chamber and communicating with atmosphere, a motor in said casing having a hollow shaft extended into said fan chamber, a fan on said shaft in said fan chamber, said shaft being interiorly connected to said motor casing and to a point of low pressure created by said fan, an air-conditioning unit in said casing, said motor and said unit arranged in said casing so that air drawn through said hollow shaft by said fan first passes therethrough.

6. The construction recited in the preceding claim in which a centrifugally operated valve is positioned in said shaft to open and close said motor and said unit from said fan, said valve moving to the open position in the operation of the motor.

7. In a suction cleaner, a nozzle, a fan chamber open thereto, and a motor casing adjacent said chamber communicating with atmosphere, a motor in said casing having a hollow shaft extended into said fan chamber, a fan on said shaft in said fan chamber, said shaft being interiorly connected to said motor casing and to a point of low pressure created by said fan, an air-conditioning unit in said casing, said motor and said unit being arranged in series in said casing so that air drawn through said hollow shaft by said fan first passes through said motor and then through said unit.

8. In a suction cleaner, a nozzle, a fan chamber open thereto, and a motor casing adjacent said chamber communicating with atmosphere, a motor in said casing having a hollow shaft extended into said fan chamber, a fan on said shaft in said fan chamber, said shaft being interiorly connected to said motor casing and to a point of low pressure created by said fan, an air-conditioning unit in said casing, said motor and said unit being arranged in parallel in said casing so that air drawn through said hollow shaft by said fan passes partly through said motor and partly through said unit.

9. In a suction cleaner, suction-creating means, a motor to drive said means, an odorizer unit connected to said means so that volatizing air is drawn therethrough, and a valve operated by said motor controlling the flow of air through said unit.

10. In a suction cleaner, suction-creating means, a motor to drive said means, an odorizer unit connected to said means so that volatiliz-

ing air is drawn therethrough, and a valve mounted on a rotatable part of said motor controlling the flow of air through said unit.

11. In a suction cleaner, an odorizer unit including a passageway through which air can pass, a valve controlling the flow of air through said passageway, said valve including a rotatable element movable under centrifugal force, and means to rotate said rotatable element in the operation of the cleaner to move it to one of its positions.

12. In a suction cleaner, a driving motor, a suction-creating fan connected to said motor, a nozzle open to said fan adapted to convey a main air stream thereto, an air-conditioning unit, and means to convey a secondary air stream from said motor and said air-conditioning unit to said fan, and centrifugally operative valve means controlling the flow of said secondary air stream.

13. In a suction cleaner, the combination of a casing, suction producing means including a fan mounted in a fan chamber forming a portion of said casing, a motor having a shaft extending axially of said fan chamber and carrying said fan, said shaft having an open ended axial passage with its outlet on the suction side of said fan chamber, means for supplying air impregnated with a conditioning substance to the inlet of said passage, and a valve member normally closing said passage and operative by centrifugal force to open when said motor is in operation.

14. In a suction cleaner, the combination of a casing, suction producing means including a fan mounted in a fan chamber forming a portion of said casing, a motor having a shaft extending axially of said fan chamber and carrying said fan, said shaft having an axial passage with openings at its ends, the outlet opening being on the suction side of said fan chamber and inlet opening being exposed at a point of higher pressure, a receptacle containing an air treating substance and provided with an opening to permit the passage of atmospheric air through said receptacle and into said inlet, and a valve member in said passage and operating by centrifugal force to open the same when said motor is in operation.

15. In a suction cleaner, the combination of a casing, suction producing means including a fan mounted in a fan chamber forming a portion of said casing, a motor having a shaft extending axially of said fan chamber and carrying said fan, said shaft having an open ended axial passage with its outlet on the suction side of said fan chamber, a receptacle containing an air treating substance and open to permit the passage of atmospheric air into said receptacle and thence to the inlet of said axial passage, said passageway having a valve seat intermediate its ends, and a spring-pressed valve member normally engaging said seat to close said passage and adapted to be unseated by centrifugal force to open said passage when said motor is in operation.

16. In a suction cleaner, the combination of suction producing means, a motor, and an air conditioning unit adapted to give off a volatile material at a greater rate as its temperature is increased, said air conditioning unit being positioned in sufficiently close proximity to said motor to absorb heat directly therefrom, and means for conducting air in a path to pick up the volatile material from said air conditioning unit and to conduct it to said suction producing means.

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