Oct. 8, 1946. L. K. ACHESON 2,409,008

SUCTION CLEANER

Filed April 26, 1943 4 Sheets-Sheet 1

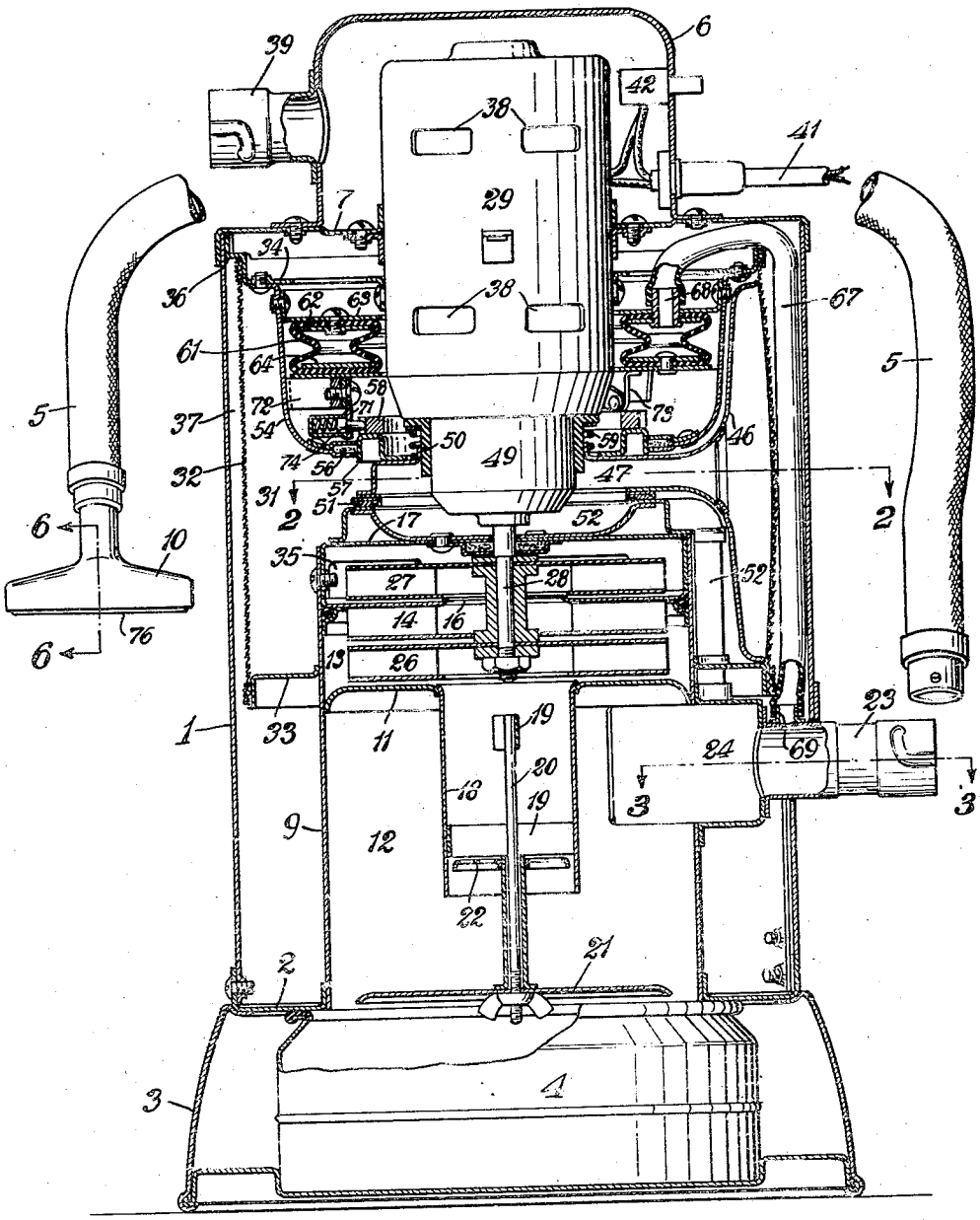


Fig. 1

INVENTOR.

Louis K. Acheson

BY

Harry S. Duvall

ATTORNEY

Oct. 8, 1946. L. K. ACHESON 2,409,008

SUCTION CLEANER

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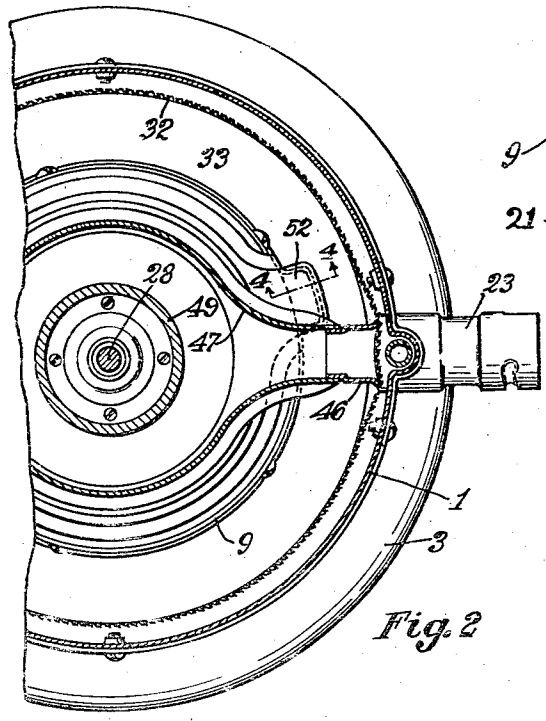


Fig. 2

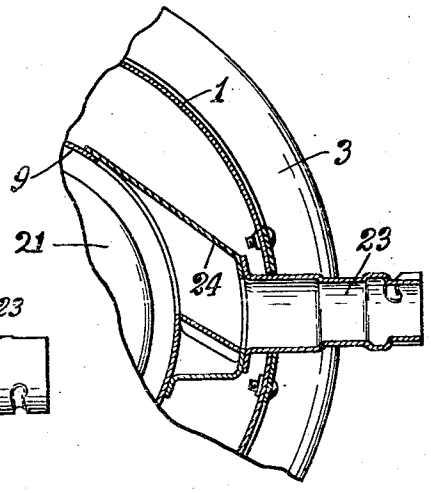


Fig. 3

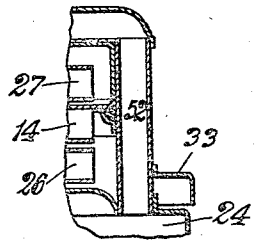


Fig. 4

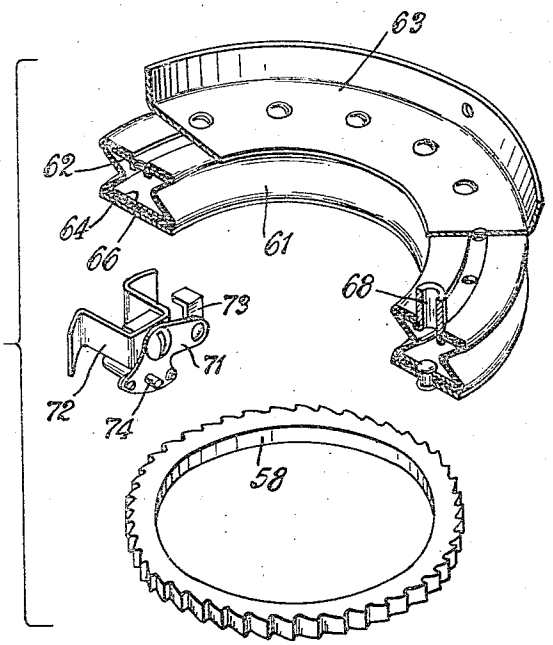


Fig. 5

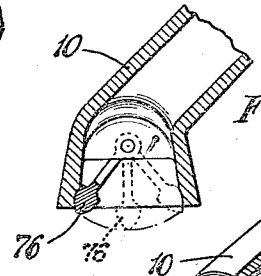


Fig. 6

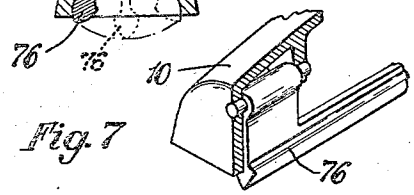


Fig. 7

INVENTOR.
Louis K. Acheson
BY
Harry S. Dimarse
ATTORNEY

Oct. 8, 1946. L. K. ACHESON 2,409,008

SUCTION CLEANER

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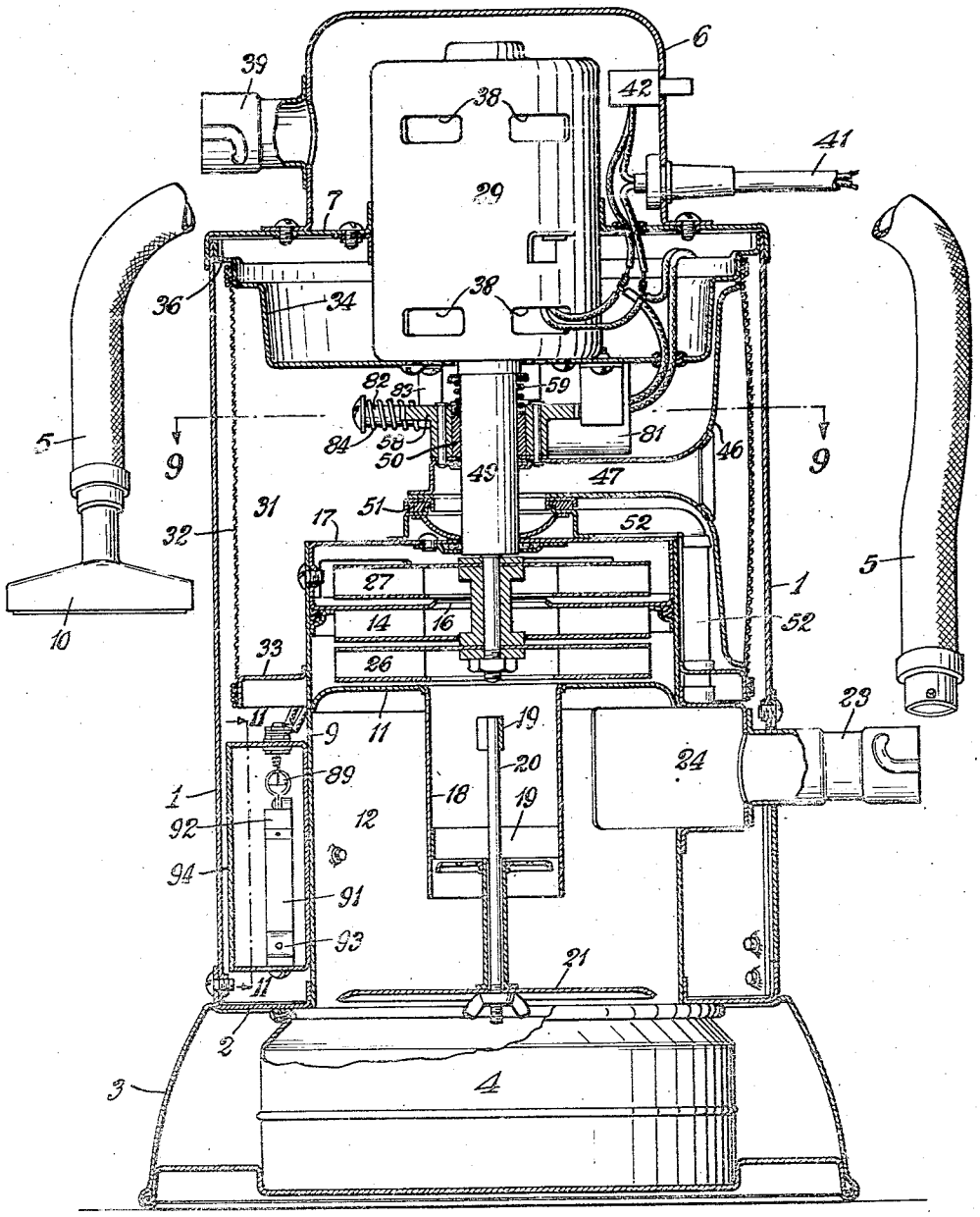


Fig. 8

INVENTOR.
Louis K. Acheson
BY
Harry S. Dunerr
ATTORNEY

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SUCTION CLEANER

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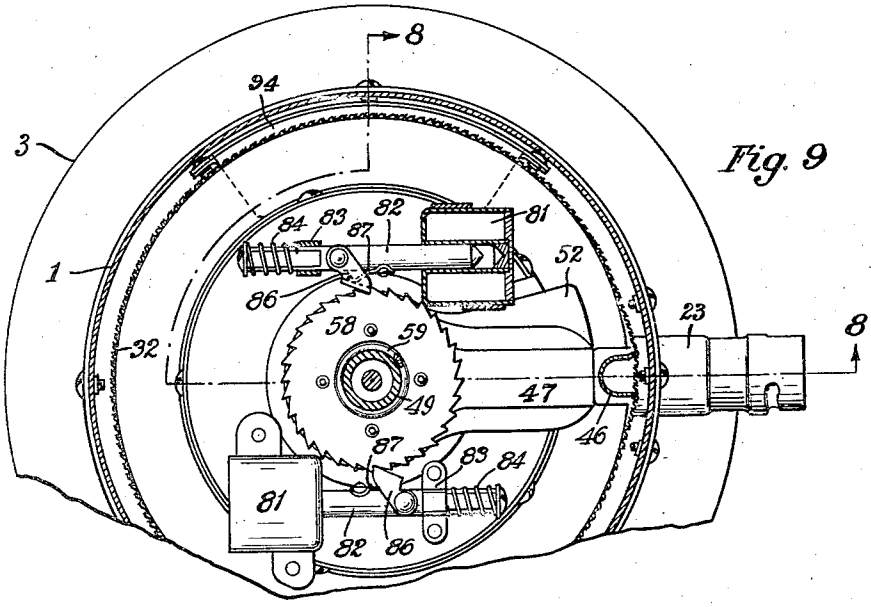


Fig. 9

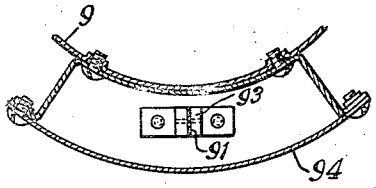


Fig. 10

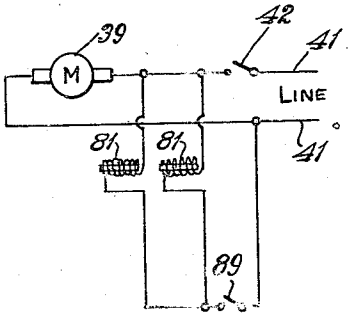


Fig. 12

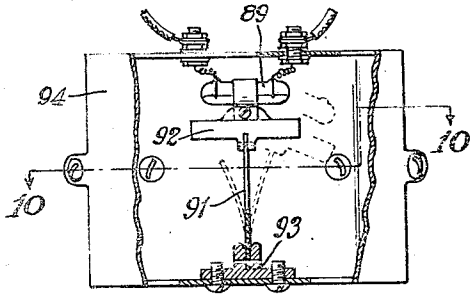


Fig. 11

INVENTOR.
Louis K. Acheson
BY
Harry S. Duncan
ATTORNEY.

Patented Oct. 8, 1946 2,409,008

UNITED STATES PATENT OFFICE

2,409,008

SUCTION CLEANER

Louis K. Acheson, North Canton, Ohio, assignor to The Hoover Company, North Canton, Ohio, a corporation of Ohio

Application April 26, 1943, Serial No. 484,511

15 Claims. (Cl. 15—16)

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This invention relates to suction cleaners in general and more particularly to a new and novel arrangement of parts in a suction cleaner. More specifically, the invention comprises improved actuating means in a suction cleaner of the type embodying an initial dirt separator, suction-creating means, a final dirt separator which receives air from the suction-creating means, and a cleaning nozzle for the final separator.

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 new and improved suction cleaner of the type embodying initial dirt separating means, air-moving means, final dirt-separating means, and means to clean the final dirt-separating means which are actuated in a new and novel manner. A still further object of the invention is to provide a suction cleaner having a plurality of dirt separators in combination with means to clean the final dirt separator upon each reoccurrence of a cleaner operational characteristic. A still further object of the invention is to provide a suction cleaner in which the final dirt separator is cleaned by a filter-cleaning nozzle which is actuated in cleaner operation by the reoccurrence of a characteristic of that operation, means being provided to provide such reoccurrence. A still further object of the invention is to provide a suction cleaner having an initial dirt separator, suction-creating means, and a final dirt separator in combination with air-pressure-driven means for cleaning the final filter. A still further object of the invention is to provide a suction cleaner having an initial dirt separator, suction-creating means, and a final dirt separator in combination with a filter-cleaning nozzle which is provided with a step-by-step movement. These and other more specific objects will appear upon reading the following specifications and claims and upon considering in connection therewith the attached drawings to which they relate.

Referring now to the drawings in which preferred embodiments of the invention are disclosed:

Figure 1 is a vertical section through a suction cleaner constructed in accordance with the present invention;

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

Figure 3 is a section upon the line 3—3 of Figure 1;

Figure 4 is a partial section through the cleaner upon the line 4—4 of Figure 2 and shows the air

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conduit connecting the filter-cleaning nozzle with the initial dirt separator;

Figure 5 is an exploded view of the air-actuated driving means for the filter-cleaning nozzle;

Figure 6 is a section upon the line 6—6 of Figure 1 and shows the main cleaning nozzle with seal-breaking means embodied therein;

Figure 7 is a view in perspective of the construction of Figure 6;

Figure 8 is a vertical section through a cleaner constructed in accordance with the second preferred embodiment of the invention;

Figure 9 is a transverse section upon the line 9—9 of Figure 8 and discloses the electrical actuating means for the filter-cleaning nozzle;

Figure 10 is a section upon the line 10—10 of Figure 11 and shows the mounting of the bob-weight-actuated switch;

Figure 11 is a view looking in the direction of the arrows upon the line 11—11 in Figure 8 and shows the bob-weight-actuated switch in side elevation; and

Figure 12 is a diagrammatic showing of the electrical connections of the cleaner constructed in accordance with the second embodiment of the invention.

Suction cleaners relying upon mechanical dirt separators, as for example separators relying upon centrifugal force to separate the dirt from the cleaning air, have been known in the suction cleaner art for a considerable period of time. The cleaner of this type which also embodies a second dirt separator intended to remove that small percentage of escaped foreign material which has passed through an initial separator is disclosed in the patent to Bible original number 2,247,472 reissued June 22, 1943, as Re. 22,336. The invention here disclosed is an improvement upon that type of machine and has the advantage of the provision of means which are automatically actuated upon the recurrence of an operational characteristic of the machine.

In the cleaner constructed in accordance with the present invention it is not necessary for the operator to elect to clean the final filter as in the Bible construction but instead this necessary step is accomplished automatically by the machine. In one embodiment of the invention the filter-cleaning nozzle is actuated by an air motor, while in another embodiment the actuation is accomplished by the use of electrical solenoids. In neither embodiment is it necessary for the operator to connect the filter-cleaning nozzle to the source of low pressure in the machine to effect

the movement of cleaning air through that nozzle.

Referring again to the drawings and to Figures 1 to 7 in particular the first preferred embodiment of the invention is illustrated. A cylindrical main casing 1 seats, at its centrally apertured and flanged bottom plate 2, upon a supporting base 3 which seats a removable dirt pan or container 4, the upper peripheral edges of which are in sealed contact with the bottom plate 2. The upper end of the cylindrical casing 1 is closed by a motor hood 6 which includes an inwardly flanged motor-supporting wall 7.

Positioned concentrically within the main casing 1 is a smaller cylindrical casing 9 which is carried by the inner flanged peripheral edge of the bottom plate 2 of the casing 1. A transverse closure wall 11 divides the cylindrical casing 9 into a lower whirl chamber 12 and upper fan chamber 13, the latter being itself divided into a lower stage and an upper stage by a centrally positioned deflector 14. Deflector 14 is formed with a multiplicity of fixed guide vanes which function to direct the air to the central inlet formed therein and which is indicated as 16. The top of the fan chamber 13 is closed by cover plate 17 of the cylindrical casing 9 while the bottom of the fan chamber is provided with a downwardly extending elongated inlet 18 which reaches downwardly beyond the mid-portion of the whirl chamber 12. Vertically spaced spiders 19 within inlet 18 support a downwardly extending rod 20 carrying a transverse pan-closing plate 21 at its lower end and a strainer 22 immediately below the lower spider 19. Plate 21 is spaced inwardly from the wall of casing 9 and provides a peripheral opening through which the foreign material can drop from the whirl chamber into the dirt pan 4 while the strainer 22 prevents the passage upwardly into the suction-creating fan chamber 13 of large size foreign objects.

The inlet of the cleaner comprises a port 23 which is adapted to receive and seat the cleaner end of a dusting tool hose 5 which at its outer end carries a suitable cleaning nozzle 10. Inlet 23 passes inwardly through the outer cylindrical casing 1 and connects directly to an inlet chamber 24 which opens tangentially into the whirl chamber 12. The construction is such that air entering through the inlet 23 and chamber 24 enters the whirl chamber tangentially resulting in a circular rotary movement of the air which tends to throw the foreign material outwardly and permits it to drop downwardly and into the dirt pan 4.

Within the suction-creating fan chamber 13 is positioned a two-stage fan comprising a lower rotary fan 26 and an upper fan 27, both carried by the downwardly depending shaft 28 of a motor 29 which is carried by the wall 7 and is positioned partially within the motor hood 6 and partially within the upper end of casing 1. The rotation of the motor shaft 28 causes the tandem fans 26 and 27 to draw cleaning air in through the inlet port 23 and to remove the cleaned air upwardly through the inlet 18 into the fan chamber from which it is exhausted through suitable ports 35 into a surrounding chamber which is indicated at 31 and which will be called the final filter chamber for a reason which will become apparent. Defining the side wall of the final filter chamber 31 and spaced inwardly from the enclosing main casing 1 is a cylindrical filter element 32 formed of suitable air-permeable dirt-impermeable material such as filter cloth. Filter

32 is supported at its lower end by a flanged collar 33 fixedly carried by the casing 9. At its upper end filter 32 is carried by a shouldered portion of a centrally apertured and flanged plate 34 which seats in sealing relationship upon the lower end of the casing of motor 29 and which is itself fixed in spaced relationship to the enclosing main casing 1 by means of spiders 36 which may be integrally formed. Collar 33 and upper plate 34 form end enclosures for the filter chamber 31 and air escaping therefrom must pass outwardly through the filter element 32 into that space between the filter and the main casing 1 which space is indicated by the reference character 37 and which will be referred to as the discharge chamber.

Discharge chamber 37 is closed at its upper end by the plate 7 and at its lower end by the bottom plate 2 of casing 1 and the only escape therefrom is afforded by the apertures 38 formed in the casing of motor 29 upon the opposite sides of the supporting wall 7 in the hood 6. Air entering the lower apertures 38 passes upwardly through the motor casing and escapes from the upper apertures and effects a cooling of the motor in doing so which is desirable. The motor hood 6 above the plate 7 is provided with an exhaust port 39 adapted to receive and seat a dusting tool unit when it is desired to use the cleaner as a blowing unit and serves at all times as the cleaner exhaust port. Incidentally, the driving motor 29 is provided with incoming power leads 41 which are connected to a suitable manually operable switch 42 to enable the operator to control the operation of the motor and so of the entire cleaner.

The machine which has hereinbefore been described comprises a completely operative cleaner but has the inherent defect that no means have been provided to clean the filter 32. To accomplish this desirable result there is provided, in accordance with applicant's invention, an elongated nozzle 46 the length of which is substantially equal to the height of the filter element and which is adapted to make sliding contact therewith. Nozzle 46 has a filter-contacting opening or mouth which contacts only a limited area of the filter element 32 in any one position and accordingly means are provided to move the nozzle relative to the filter. This is accomplished by supporting nozzle 46 by a rotatable conduit seat 47 which encloses a vertical sleeve 49 which houses a motor shaft 28. Conduit 47 is formed at its inner end with a downwardly facing circular seat which is rotatably supported upon a bearing 51 carried by the similarly shaped upwardly opening mouth of a stationary conduit 52. A second bearing 50 carried by conduit seat 47 mounts the latter rotatably upon the sleeve 49. Conduit 52, however, is fixedly mounted upon the fan chamber top plate 17 in fixed relationship and extends across the top thereof and down the side of the fan chamber and connects to the entrance of the inlet chamber 24 of the whirl chamber 12.

Filter-cleaning nozzle 46 is entirely unconnected to the driving-motor 29 and to provide actuating means therefor which will propel it around the inner surface of the filter 32 there is an air motor. This motor is located within a cup-shaped casing 54 secured to the underside of closure wall 34 of final filter chamber 31 and sealed by a seal 56 to the peripheral wall of a contoured plate 57 fixedly carried by the conduit seat 47 of the nozzle 46. A large ratchet gear

58 is fixedly secured to the top surface of the plate 57, the gear, the plate 57 and the conduit seat 47 with the nozzle 46 being rotatable as a unit on the bearings 50 and 51. To insure the seating of the conduit seat upon the bearing 51 there is provided a coil spring 59 which encircles the bearing 50 and exerts a force between the flanged end thereof and the surface of the conduit seat 47.

The air motor comprises an air-tight flexible bellows 61 which encircles the motor 29 at its lower end and within the cup-shaped casing 54. The walls of bellows 61 are formed of rubber or suitable air-tight air-impervious material which is sufficiently flexible as to be expansible under changes of pressure which are within the range of the pressures found in a suction cleaner. Bellows 61 is provided with a rigid top plate 62 fixedly secured to a closure plate 63 forming the top of the cup-shaped casing 54. A lower bellows plate 64 is also rigid and is fixedly attached to an exterior bottom plate 66. Bellows 61 is interiorly connected to the entrance to the inlet chamber 24 of whirl chamber 12 by means of an air conduit 67 which, as illustrated in Figure 1, may be made of rubber or other suitable material which connects to nipples 68 and 69 carried by the top plate 62 of the bellows and the inlet conduit 23, respectively.

With the machine in operation and a reduced pressure existing within the intake port 23 and intake chamber 24 that pressure is also present within the bellows 24 by virtue of the conduit connection 67 and the bellows is contracted, being moved to a collapsed condition from the expanded or lower position illustrated in Figure 1. Sufficient reduction of pressure is present within the bellows 61 to collapse it whenever the cleaning nozzle 10 is sealed against a surface undergoing cleaning, but upon the breaking of that seal the inrush of air raises the pressure and the bellows expands, the weight of the lower plates 64 and 66 being sufficient to accomplish this expansion although additional resilient expanding means can be provided if necessary. The expanding movement of the bellows 61 is transmitted to the nozzle-connected ratchet ring 58 by means of a bell crank lever 71 which is centrally pivoted upon a bracket 72 supported by the interior surface of the cup-shaped casing 54 immediately under the bellows 61. One end of bell crank lever 71 is connected to the bottom plate 66 of the bellows 61 through its pivotal connection with a depending arm 73 fixedly connected to plate 66. Clearly the vertical displacement of the bellows bottom plate 66 of the bellows 61 results in the pivotal movement of the lever 71. Transmission of this movement to the ratchet gear 58 is by means of a spring-pressed pin or detent 74 which is carried by the lever 71 at a distance from its pivotal axis at a position as to engage the teeth of the ratchet ring 58 which teeth are so contoured as to engage pin 74 in the pivotal movement of lever 71 in one direction only, that direction being counter clockwise as viewed in Figure 5, and to cam the pin outwardly without engagement in the pivotal movement of the lever in the opposite direction. The relationship is such that as the lever 71 is moved in a counter-clockwise direction as viewed in Figure 5, which occurs upon the collapse of the bellows under a reduced pressure, the ratchet gear 58 is rotated together with the nozzle 46. Upon the expansion of the bellows, which as stated occurs upon an increase in the internal pressure therein as above explained, the downward movement of the bottom plate of the bellows causes the lever 71 to move in a clockwise direction and the pin 74 to return to its original position without movement of the ratchet ring 58 and into position to engage a new tooth of that ring upon the subsequent and next collapse of the bellows. A plurality of bell crank levers 71 are indicated in Figure 1 and a sufficient number is provided to insure a positive action, the exact number used not being of the essence.

To insure that the air pressure within the bellows 61 will vary with regularity during cleaner operation means are provided to insure the variation of that pressure within the inlet 23 and inlet chamber 24. These means comprise a rock plate 76 which is pivotally mounted within the mouth of the cleaner nozzle 10 being adapted to pivot from side to side of the mouth as illustrated in Figures 6 and 7. Upon the forward movement of the nozzle over a surface being cleaned the rock plate will be pivoted to the rearmost dotted line position illustrated in Figure 6 and will remain there during the entire forward stroke. Upon the reversal of the direction of the nozzle movement the frictional contact of the rock plate with the surface will cause the plate to move from the right hand position illustrated in Figure 6, through the central dotted line position, to the full line position shown in the same figure. As illustrated in Figure 6 when in the vertical position the rock plate extends considerably below the plane of the nozzle mouth and, being in contact itself with the supporting surface covering undergoing cleaning, would in this position raise the nozzle mouth from its sealing contact with the surface covering. This breaking of the nozzle seal permits an inrush of air into the cleaner which effects an increase in the pressure present at the inlet 23 and inlet chamber 24 and directly produces an increase in pressure in the bellows 61 and causes its expansion. This nozzle-lifting action of the rocker plate 76 occurs only upon reversal in direction of nozzle travel which occurs at each end of each operational stroke. During nozzle movement and excepting the period of direction reversal at the end of each stroke plate 76 lies against one wall of nozzle 10, as illustrated in full lines in Figure 6, and its lower edge forms a continuation of the adjacent nozzle lip projecting therebelow only sufficiently to insure that upon the reversal of direction of movement the frictional resistance against the supporting surface will be sufficient to effect the pivotal action described.

In the operation of this embodiment of the invention cleaning air with foreign material is drawn into the cleaner through the nozzle 10, through conduit 5, and into the whirl chamber 12 where by centrifugal action substantially all the foreign material is removed from the air and drops into the dirt container 4 positioned below the whirl chamber. The cleaned air enters the fan chamber 13 through the depending inlet 18 and is exhausted from the fan chamber by the fans 26 and 27 into the final filter chamber 31. From the latter chamber the air passes through the filter 32 into the surrounding discharge chamber 37 from which it escapes into the ambient atmosphere via the apertures 38 in motor casing 29 and exhaust port 39 in motor hood 6. As stated, practically all of the foreign material is removed in the whirl chamber 12, but a very small percentage of fine dust does escape therefrom and is collected upon the final filter 32. This collected material is removed by the filter-

cleaning nozzle 46 which is actuated, as described, by the reciprocation of the air bellows 61 which effects the step-by-step rotation of the ratchet ring 58 rigidly connected to the nozzle. At all times during cleaning operation air is drawn through the filter-cleaning nozzle 46 and the contacted surface of the filter 32, the direction of air movement through the filter surface into the nozzle 46 being in the opposite direction to the normal direction of the flow therethrough. The air leaves the nozzle 46 and passes through conduits 47 and 52 to join the main air stream of the cleaner at the inlet chamber 24 where it enters the whirl chamber. Step-by-step movement of the filter-cleaning nozzle 46 is effected, as previously described, by the fluctuations in the air pressure at the inlet chamber 24 resulting from the breaking of the covering seal of the main cleaning nozzle 10 by the rocker plate 76 upon the reversal of movement of the nozzle. Each time the nozzle direction of movement is reversed the rocker plate lifts the nozzle, breaks the nozzle seal, whereupon the air pressure in the nozzle and bellows increases and the bellows drops to the position shown in Figure 1. Upon the seal being reestablished immediately following the reversal of direction of movement, the bellows is contracted, the ratchet ring is advanced a single step, and the nozzle is moved to a new position. The final filter 32 is regularly cleaned by nozzle 46 and the back pressure in the cleaner never increases beyond a reasonable limit as a result of the accumulation of foreign material.

Turning now to the second embodiment of the invention illustrated in Figures 8 to 12, inclusive, it is seen that the cleaner generally is very similar to that described in connection with the first embodiment. Accordingly, similar reference characters are applied to similar parts and only those features of the cleaner will be described which differ from the first embodiment in a material respect. The principal difference between the second embodiment and the first lies in the actuating means for the filter-cleaning nozzle 46, the air-operated motor of the first embodiment being replaced by electrical solenoids which are controlled by a bob-weight-actuated switch.

In this embodiment the main nozzle, dusting tool hose, inlet, whirl chamber, suction-creating fan unit, and final filter unit together with the driving motor and the exhaust passageways can be considered to be identical for all practical purposes with the first described embodiment of the invention. The cup-shaped casing 54 of the first embodiment which housed the air-operated motor has been eliminated and the closure plate 34 comprises the only closure for the top of the filter chamber 31 and extends entirely across to the motor casing 29 to which it is fixedly connected. The filter-cleaning nozzle 46 is again rotatably mounted upon the conduit seat 47 which in turn is carried by the lower bearing 51 on the lower conduit 52. The upper bearing 50 of member 47 is located within the ratchet ring or gear 58 carried directly by the top surface of the conduit seat 47, the coil spring 59 acting between the bearing 50 and a shoulder upon the sleeve 49 to force conduit 47 against bearing 51.

The actuation of the ratchet gear 58 in this embodiment of the invention for the purpose of actuating the filter-cleaning nozzle 46 is accomplished by the following mechanism. A pair of electrical solenoids 81 have their stators fixedly carried on the underside of the top wall 34 of the final filter chamber 31. The armature 82 of each solenoid extends tangentially of the ratchet gear 58 being slidably mounted within the solenoid and supported by spaced bearing seats 83 also secured to the underside of the closure plate 34. A coil spring 84 is interposed between the headed end of each armature element 82 and the bearing seat 83 and at all times exerts a force upon the armature 82 which tends to move it outwardly from its stator.

Each solenoid armature 82 carries a pivoted detent 86 which is urged by a leaf spring 87, also carried by armature 82, into contact with the adjacent teeth of the ratchet gear 58. The teeth of ratchet gear 58 are so shaped and the relationship and position of the detent 86 is such that upon the inward movement of the armatures 82 at the solenoid the gear 58 is rotated whereas upon the outward movement of the armatures under the actuation of the coil spring 84 the detent slides past the gear teeth without causing movement of the gear.

Reference to Figure 12, comprising a diagrammatic showing of the electrical circuit of the cleaner, illustrates that the solenoids 81 are connected across the incoming power leads 41 and are controlled by a single switch 89. This switch is bob-weight actuated and is clearly illustrated in Figures 8, 10, and 11 and is seen to comprise the usual mercury switch mounted upon a vertical spring element 91 together with a bob weight 92. Spring 91 is mounted for flexing in a base 93 and the entire unit is housed within a housing 94 positioned exteriorly of whirl chamber 12 and within the main casing 1. The construction is such that as the machine is moved from place to place in the cleaning operation, the bob-weight 92 will accomplish the tilting of the mercury switch 89 in the usual and well known manner thereby establishing electrical circuit through the solenoids. Each time the electrical circuit is established each solenoid is energized and its armature 82 is drawn into and toward the stator thereupon moving the ratchet gear 58 in a clockwise direction as viewed in Figure 9. This gear being fixedly connected to the filter-cleaning nozzle 46 directly results in the step-by-step actuation of that element relative to the final filter 32. The operation of this embodiment of the invention in its general outline is similar to that first described, the difference lying in the actuation of the filter-cleaning nozzle which is by means of the electrical solenoids controlled by the bob-weight-actuated switch as previously described.

I claim:

1. A suction cleaner having an inlet port for dirt-laden air, a main cleaning nozzle connected thereto and adapted to vary the air flow through and the air pressures in the cleaner by its contact with a surface being cleaned, a preliminary separator connected to said inlet port, suction-creating means connected to said preliminary separator to draw air therethrough, a final dirt separator connected to said suction-creating means to receive air exhausted therefrom, a driving motor for said suction-creating means, movable dirt-removing means to remove foreign material from said final separator, air-conducting means to connect said dirt-removing means to said preliminary separator, a pressure-variation-actuated air motor to drive said dirt-removing means, and air-conducting means to connect said air motor to a point of air pressure variation in said cleaner.

2. A suction cleaner having an inlet port for dirt-laden air, a main cleaning nozzle connected thereto and adapted to vary the air flow through and the air pressures in the cleaner by its contact with a surface being cleaned, a preliminary separator connected to said inlet portion, suction-creating means connected to said preliminary separator to draw air therethrough, a final dirt separator connected to said suction-creating means to receive air exhausted therefrom, a driving motor for said suction-creating means, movable dirt-removing means to remove foreign material from said final separator, air-conducting means to connect said dirt-removing means to said preliminary separator, a pressure-responsive element connected to said dirt-removing means to exert a moving force thereon, and air-conducting means connecting said element to a point of air pressure variation in said cleaner.

3. A suction cleaner having an inlet port for dirt-laden air, a preliminary separator connected to said inlet port, suction-creating means connected to said preliminary separator to draw air therethrough, a final dirt separator connected to said suction-creating means to receive air exhausted therefrom, a driving motor for said suction-creating means, movable dirt-removing means to remove foreign material from said final separator, air-conducting means to connect said dirt-removing means to said preliminary separator, an air-pressure-variation-actuated air motor directly connected to said dirt-removing means to drive same and interiorly connected to a point of air flow in the cleaner, and means to provide fluctuation in the air pressure in said cleaner to drive said air motor.

4. A suction cleaner having an inlet port for dirt-laden air, a main cleaning nozzle connected thereto, a preliminary separator connected to said inlet port, suction-creating means connected to said preliminary separator to draw air therethrough, a final dirt separator connected to said suction-creating means to receive air exhausted therefrom, a driving motor for said suction-creating means, movable dirt-removing means to remove foreign material from said final separator, air-conducting means to connect said dirt-removing means to said preliminary separator, an air motor directly connected to said dirt-removing means to actuate same, air-conducting means connecting said air motor to said inlet, and means in said nozzle to vary the pressure at said inlet with each reversal in the direction of travel of said nozzle.

5. A suction cleaner having an inlet port for dirt-laden air, a main cleaning nozzle connected thereto, a preliminary separator connected to said inlet port, suction-creating means connected to said preliminary separator to draw air therethrough, a final dirt separator connected to said suction-creating means to receive air exhausted therefrom, a driving motor for said suction-creating means, movable dirt-removing means to remove foreign material from said final separator, air-conducting means to connect said dirt-removing means to said preliminary separator, step-by-step means actuated by variations in air pressure in said cleaner to move said dirt-removing means, and means including said nozzle to effect variations in the air pressure of said cleaner.

6. A suction cleaner having an inlet port for dirt-laden air, a main cleaning nozzle connected thereto, a preliminary separator connected to said inlet port, suction-creating means connected to said preliminary separator to draw air therethrough, a final dirt separator connected to said suction-creating means to receive air exhausted therefrom, a driving motor for said suction-creating means, movable dirt-removing means to remove foreign material from said final separator, air-conducting means to connect said dirt-removing means to said preliminary separator, means actuated by variations in air pressure in said cleaner to move said dirt-removing means, and means to cause variations in said air pressure comprising means to lift said nozzle upon reversal in the direction of nozzle travel.

7. In a suction cleaner, a surface cleaning nozzle, suction-creating means to draw cleaning air through said nozzle, a dirt separator to remove dirt from air passing through said nozzle, dirt-removing means to remove dirt from said separator, and step-by-step means to effect the step-by-step movement of said dirt-removing means under predetermined air pressure conditions in said surface-cleaning nozzle, and manually operable means including said nozzle to produce said conditions in said surface-cleaning nozzle.

8. In a suction cleaner, a body movable along a supporting surface, a part movably supported on said body and movable by the operator as an incident to the physical displacement of said body relative to the supporting surface, a dirt separator, means to move dirt-laden air through said separator, dirt-removing means to remove dirt from said separator, means to effect intermittent relative movement between said dirt-removing means and said separator to perform the cleaning operation, and means controlling the actuation of said last-mentioned means and including means positioned by the movement of said movable part upon said operator movement of said body along the supporting surface.

9. In a suction cleaner, a movable surface-contacting nozzle, a dirt separator, means to move dirt-laden air through said separator, dirt-removing means to remove dirt from said separator, air-pressure-variation-operated means to effect relative movement between said dirt-removing means and said separator to perform the cleaning operation, and nozzle-lifting means positioned by the operator movement of said movable nozzle to lift said nozzle from a surface covering to vary the air pressure at said air-pressure-variation-operated means.

10. In a suction cleaner, a main casing, a dirt separator therein, means to move dirt-laden air through said separator, dirt-removing means to remove dirt from said separator, means to effect relative movement between said dirt-removing means and said separator to perform the cleaning operation, and means controlling the actuation of said last-mentioned means and including means positioned by the operator movement of said main casing.

11. In a suction cleaner, a body movable along a supporting surface, a part movably supported on said body and movable by the operator as an incident to the physical displacement of said body relative to the supporting surface, a dirt separator, suction-creating means to move dirt-laden air through said separator, a nozzle connected to said suction-creating means to remove dirt from said separator, a ratchet gear connected to said nozzle and movable therewith, a reciprocatory motor to actuate said gear with a step-by-step movement, and means controlled by the movement of said movable part upon said operator

movement of said body along the supporting surface to energize said motor.

12. In a suction cleaner, a movable cleaning nozzle, a dirt collector, suction-creating means to move dirt-laden air through said nozzle and collector, a second nozzle connected to said suction-creating means to remove dirt from said collector, a ratchet gear connected to said second nozzle and movable therewith, an expansible-contractible air bellows, means connecting said bellows to said ratchet to effect the movement thereof upon the movement of said bellows, air-conducting means connecting said bellows to a point in the air stream moved by said suction-creating means, and means in said cleaning nozzle to effect variations in pressure in said air stream to energize said bellows.

13. In a suction cleaner, a movable cleaning nozzle, a dirt collector, suction-creating means to move dirt-laden air through said nozzle and collector, a second nozzle connected to said suction-creating means to remove dirt from said collector, a ratchet connected to said second nozzle and movable therewith, an expansible-contractible air bellows, means connecting said bellows to said ratchet to effect the movement thereof upon the movement of said bellows, air-conducting means connecting said bellows to a point of suction between said suction-creating means and

said nozzle, and a pivoted rocker element in said nozzle in contact with a surface undergoing cleaning adapted to lift said nozzle upon a reversal in the direction of movement thereof to admit air into said nozzle to decrease said suction and to vary the pressure in said bellows.

14. In a suction cleaner, a movable cleaning nozzle, a dirt collector, suction-creating means to move dirt-laden air through said nozzle and collector, a second nozzle connected to said suction-creating means to remove dirt from said collector, a ratchet connected to said second nozzle and movable therewith, an electric solenoid to actuate said ratchet, and means adjustable by an operator in the movement of said cleaner to control the flow of electric current to said solenoid.

15. In a suction cleaner, a body, a movable cleaning nozzle, a dirt collector, suction-creating means to move dirt-laden air through said nozzle and collector, a second nozzle connected to said suction-creating means to remove dirt from said collector, a ratchet connected to said second nozzle and movable therewith, an electric solenoid to actuate said ratchet with a step-by-step movement, and a bob weight actuated switch carried by said body and movable to closed position to energize said solenoid upon the movement of said body.

LOUIS K. ACHESON.