Sept. 2, 1941. D. G. SMELLIE 2,254,666

SUCTION CLEANER

Filed May 2, 1938 3 Sheets-Sheet 1

Fig. 1

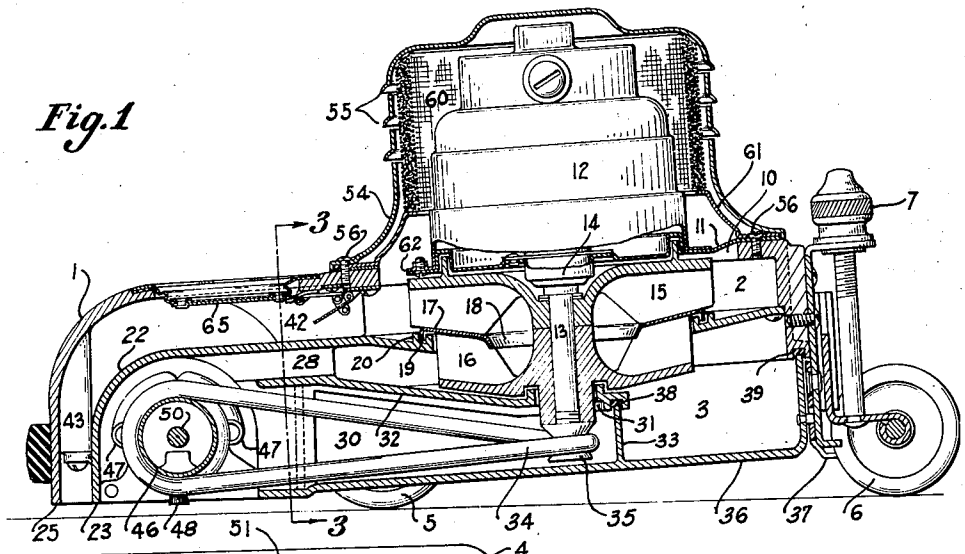
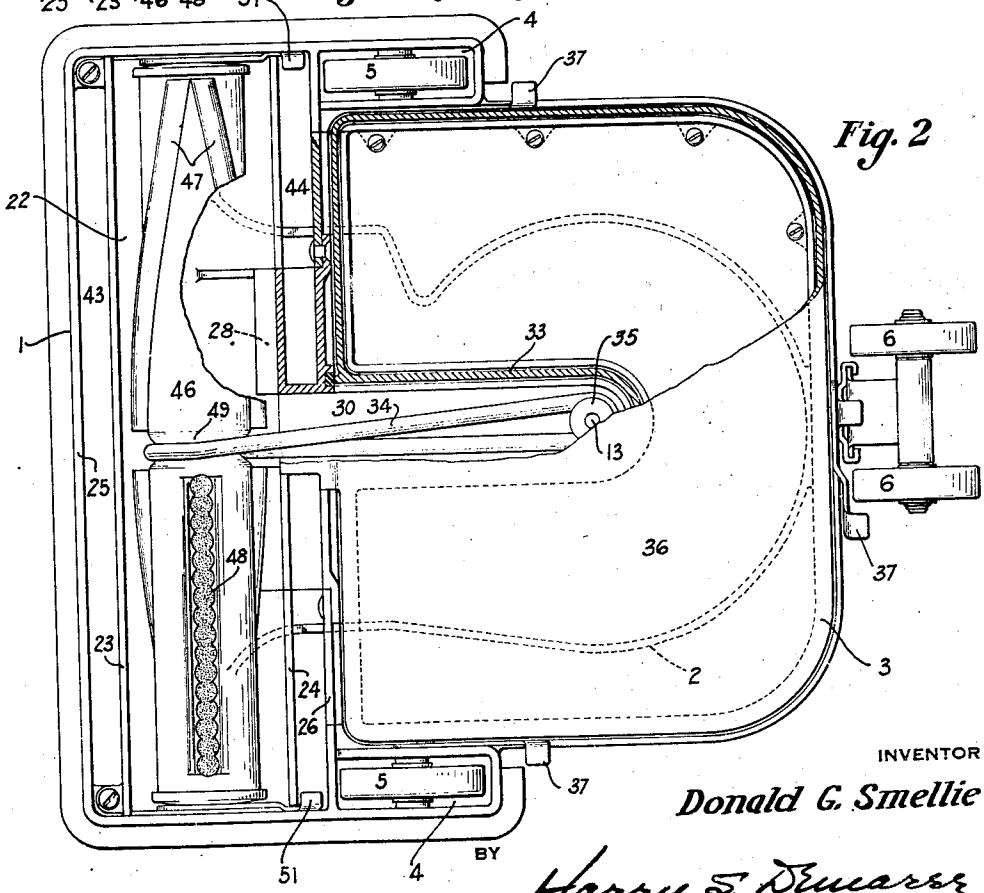


Fig. 2



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SUCTION CLEANER

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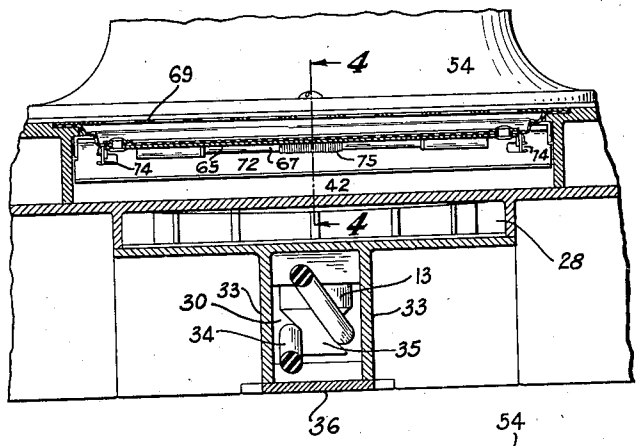
Fig. 3



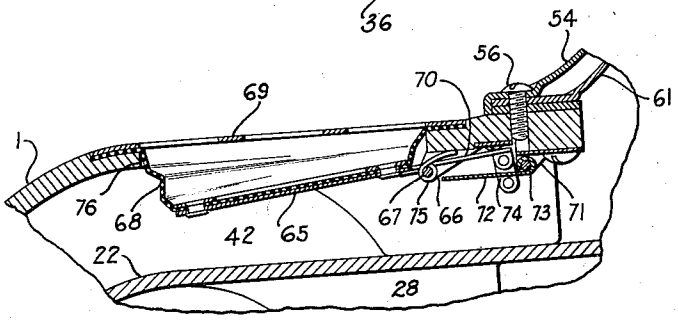


Fig. 4

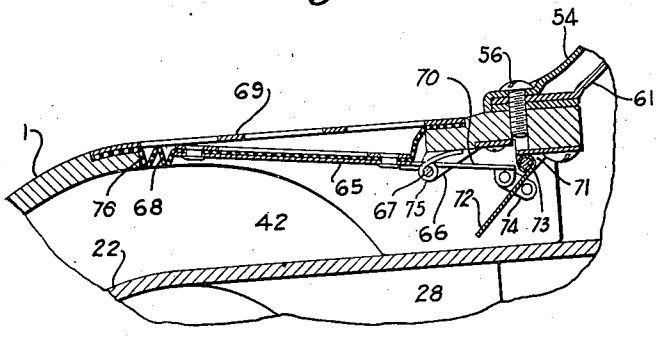


Fig. 5

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SUCTION CLEANER

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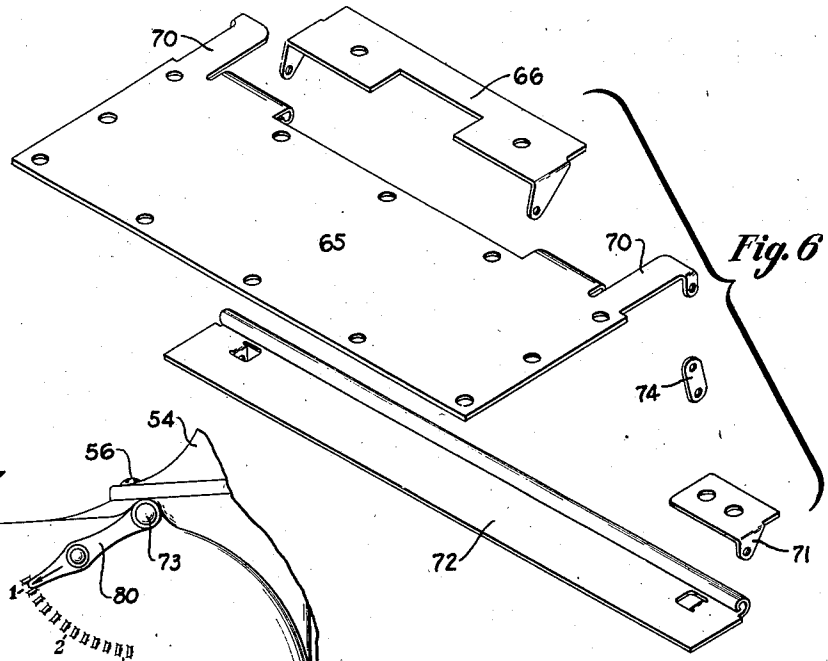

Fig. 6

Fig. 7

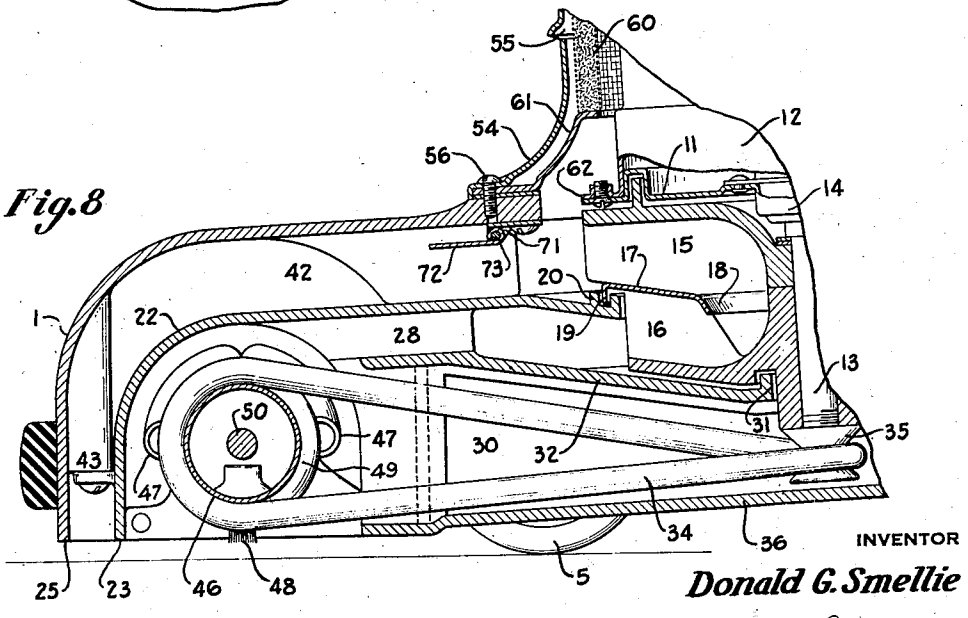

Fig. 8

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Patented Sept. 2, 1941 2,254,666

UNITED STATES PATENT OFFICE

2,254,666

SUCTION CLEANER

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Application May 2, 1938, Serial No. 205,486

17 Claims. (Cl. 15—14)

The present invention relates to suction cleaners in general and particularly to a new and improved closed circuit suction cleaner, that is, a suction cleaner in which the same cleaning air recirculates through the cleaner. More specifically, the invention comprises improvements to closed circuit cleaners which permit the cleaner to compensate for varying operating conditions to limit the escape of unfiltered air from the cleaner to the exterior atmosphere to a minimum.

In United States Letters Patent 1,999,667, granted April 30, 1935, the present inventor disclosed and claimed an improved suction cleaner of the present type. This invention comprises an improvement over the cleaner there disclosed through incorporating improvements which increase the operating efficiency thereof.

In all closed circuit cleaners there is a certain unavoidable leakage of the cleaning air from the cleaner circuit into the atmosphere. In the structure of Letters Patent 1,999,667 means were provided to permit of the escape of air displaced by the entrance of additional air into the cleaner circuit, the leakage air being filtered before escaping. According to the present invention, pressure-controlling means are provided within the cleaner for the purpose of eliminating the escape of circuit air from the cleaner to atmosphere at the cleaner nozzle, thereby forcing all displaced leakage air to pass through the filtered leak.

It is an object of the present invention to provide a new and improved suction cleaner. A further object of the invention is to provide a new and improved closed circuit suction cleaner. A still further object of the invention is to provide an improved closed circuit cleaner having a filtered leak. Still another object of the invention is to provide a closed circuit cleaner in which means control the air pressures in the circuit to prevent leakage of circuit air except through a filtered escape. A still further object is to provide a closed circuit cleaner having automatic means which control the leakage air from the cleaner. Another object is to provide in a suction cleaner a continuous flow of cleaning air having a filtered leak through which surplus air may escape to the exterior atmosphere, the pressure within the cleaner circuit being controlled as to prevent the leakage of air from the circuit to the atmosphere except through the filtered leaks. These and other more specific objects will appear upon reading the following specification 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 present invention are disclosed:

Figure 1 is a longitudinal vertical section through a suction cleaner embodying the present invention;

Figure 2 is a bottom view of the cleaner illustrated in Figure 1 with certain parts broken away and shown in section;

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

Figure 4 is a section upon the line 4—4 of Figure 3 illustrating the automatic pressure-controlling means and with the air valve in the open position;

Figure 5 is a view similar to Figure 4 but with the air valve in its closed position;

Figure 6 is an exploded view of the cooperating parts of the pressure bellows and the air valve;

Figure 7 is a partial side view of a suction cleaner embodying a second modification of the invention and illustrates a manual valve-positioning control member;

Figure 8 is a partial section through a cleaner constructed in accordance with the second embodiment of the invention with a manually controlled valve.

Referring again to the drawings, a closed circuit suction cleaner is illustrated which comprises a main casing including a nozzle casing 1, a fan chamber 2, and a dirt receptacle 3. Wheel pockets 4, 4 within the main casing house the front supporting wheels 5, 5 there being rear supporting wheels 6, 6 at the rear of the casing which are provided with manually operable height adjusting means 7, adapted to raise and lower the nozzle relative to the surface covering undergoing cleaning.

The main casing of the cleaner is formed rearwardly of the nozzle as a fan chamber 2 and dirt container 3, the former having a top opening 10 closed by a plate 11 functioning as a common wall for the fan chamber 2 and for the motor casing 12. The motor shaft 13 extends downwardly from the casing 12 and is rotatably mounted in a suitable bearing 14 carried by plate 11. The motor shaft within the fan chamber 2 carries the suction-creating fan 15 and immediately therebelow within the container 3 and separated therefrom only by a frusto-conical plate 17, a separator 16. Plate 17 which separates the fan 15 from the separator 16, is provided with a central opening 18 and with a

downwardly extended peripheral flange 19. The flange 19 extends into and cooperates with a circular groove 20 in the surrounding edge of the fan chamber 2 to provide a labyrinth seal which effectively prevents the passage of air from the fan chamber 2 to the dirt chamber 3, or vice versa, at the periphery of the fan. The opening 18 functions as the eye for the fan chamber 2.

Positioned within the nozzle casing 1 is the suction nozzle 22 formed with surface-contacting front and rear lips 23 and 24, respectively, which define the nozzle mouth and which are positioned between and spaced from the front and rear nozzle lips 25 and 26 of the nozzle casing. Nozzle 22 is interiorly connected to the fan chamber 2 by the passageway 28 and the container 3, the latter being open to the suction-creating fan 15 through the separator 16 and fan eye 18. A belt channel 30 opens to and extends rearwardly from the nozzle 22 to a point in the container 3 immediately below the motor shaft 13 and is entirely closed to the container except for an opening 31 in its top wall 32, which opening is substantially closed by the motor shaft 13 extending therethrough. The channel serves as a belt passageway for the power-transmitting belt 34, the latter extending from a pulley 35 on the lower end of the motor shaft 13 forwardly into the nozzle proper 22 to which the belt passageway is opened. The side walls 33, 33 of the belt channel 30 within the container are carried by the bottom plate 36 which is itself detachably secured to the main casing of the cleaner by suitable manually operable securing latches 37, 37, 37 of any common type positioned around its exterior. Air seals 38 and 39 lie between the channel walls 33 and the side walls of the container 3 to prevent air leakage, in the case of the channel 30 between the channel and the container 3, and in the case of the side walls of the container, between the container and the exterior atmosphere.

Positioned in front of and in the rear of suction nozzle 22 are pressure nozzles 43 and 44, respectively. The pressure nozzles are interconnected above the suction nozzle 22 and are both open to the exhaust passageway 42 leading from the fan chamber 2, and from which they receive exhausted air under pressure. The pressure-contacting mouth of nozzle 43 is defined by the lips 25 and 23, and that of nozzle 44 by the lips 24 and 26.

Positioned within the suction nozzle 22 and adapted to contact the surface covering undergoing cleaning between the lips 23 and 24 is a rotatable agitator 46 including rigid beater elements 47, 47 and flexible brush elements 48. A pulley surface 49 is formed upon the agitator opposite the belt channel 30 and the power-transmitting belt 34 encircles this pulley in order that it may drive the agitator upon the rotation of the motor shaft 13. The agitator itself is of a common and well known design including a stationary supporting shaft 50 which is suitably mounted within the end walls of the nozzle casing where it is retained by manually operable latches 51, 51 in a common and well known manner forming no part of the present invention.

The parts heretofore described comprise a closed circuit suction cleaner in which the rotation of the suction-creating fan functions to draw cleaning air through the suction nozzle 22, through the passageway 28 and into the dirt container 3. Before the dirt-carrying air can enter the fan chamber 2, however, it must pass through the rotating separator 16 which rotates with the fan and which functions to separate the suspended dirt from the carrying air and to permit the latter to pass therethrough while throwing the former to the sides of the container 3. The air filtered of practically all of its dirt, passes through the eye or opening 18 and into the fan chamber 2 under the suction exerted by the fan 15 and is exhausted from that chamber through the passageway 42 into the pressure nozzles 43 and 44 at the sides of the suction nozzle. Normally, the pressure existing within the pressure nozzles 43 and 44 would be above atmospheric, just as the pressure within the suction nozzle 22 would be below atmospheric. Also, in the usual closed circuit cleaner the larger part of the air exhausted from the pressure nozzles would reenter the suction nozzle 22 but an appreciable part thereof would leak into the surrounding atmosphere by escaping under the outer nozzle lips 25 and 26. According to the present invention, however, means are embodied which substantially eliminate this leakage of air.

The means which make possible this improved operation in the present invention comprise a filtered leak through which a part of the air within the circuit of the cleaner can escape to the atmosphere, first being filtered to remove all foreign material; in combination with means which control the pressure within the pressure nozzles 43 and 44 so that the pressure therein is slightly below atmospheric, thereby preventing the flow of air therefrom into the atmosphere.

Referring now to Figure 1 in particular, it is seen that a motor hood or housing 54 having formed upon its sides louvers 55 encloses the motor casing 12 in spaced relationship and is itself removably secured upon the top wall of the main casing of the cleaner by screws 56, 56. A cylindrical filter member 60, formed of any suitable filtering material common to the suction cleaner field, is positioned within the housing 54 in spaced relationship to the motor casing 12, being supported with its upper end in contact with the top of the housing 54 by means of a centrally apertured filter seat ring 61. Filter 60 forms an encircling air passageway completely enclosing the motor casing 12 and which is open to the fan chamber 2 through the ring 61 and the ports 62 formed in the plate 11 common to the fan chamber 2 and to the motor casing 12. The top of housing 54 which makes line contact with the filter prevents the flow of air from the upper end thereof and restricts the air flow to a path through the filter and out through the louvers 55. The entire passageway through the hood 54 which connects the passageway 42 to the atmosphere, together with the filter 60, is referred to as the leak or filtered leak.

The controlling means by which the pressure of the pressure nozzles 43 and 44 is regulated comprises a pressure-responsive diaphragm or bellows in the top wall of the main casing of the cleaner which has its interior side exposed to the air passageway 42. This bellows comprises a movable rigid side wall or plate 65 pivoted to the top wall of the passageway 42 by means of a pin 67 carried by a rigid hanger 66. Flexible side walls 68 connect the margins of plate 65 to the margins of an adjacent opening 76 in the top wall of the cleaner casing. Through this opening the top of plate 65 is exposed to atmospheric pressure while the opposite side thereof is exposed to the pressure existing within the passageway 42. A fixed perforated plate 69 secures the edges of the flexible element 68 to the casing

wall and also prevents the entrance of foreign objects into the bellows. Rearwardly of the bellows, and also in the passageway 42, is pivotally mounted a valve element 72 upon supports 71 by means of a pivot pin 73. Link elements 74, 74 are pivotally connected between the valve 72 and the side arms 70, 70 of the plate 65 rearwardly of its pivotal axis 67.

Valve 72 is adapted to assume an upper position, as illustrated in Figure 4, in which it offers substantially no resistance to the flow of air through the passageway 42, and to assume a lower position, as illustrated in Figure 5, in which it substantially reduces the flow of air through the passageway. The valve is moved between these positions by the action of the bellows. The bellows, comprising the pivoted plate 65 and the flexible side walls 68, collapses or expands depending upon the relative pressures existing within the passageway 42 and atmosphere, there being provided a coil spring 75 at the pivotal axis 67 of the bellows which at all times exerts a lifting force upon the plate 65 tending to pivot it in a clockwise direction as viewed in Figures 4 and 5, and which accordingly opposes the force of atmospheric pressure acting upon the exterior face of plate 65. It is clear that when the air pressure within the passageway 42 exerted upon the plate 65, plus the spring pressure exerted thereon by the spring 75, exceeds the atmospheric pressure exerted upon the opposite side of the plate 65, that the bellows will be collapsed pivoting the plate 65 upwardly. That is, the plate 65 will be moved upwardly about its axis 67 from the position shown in Figure 4 to that shown in Figure 5, and will move with it the valve 72 from its open position shown in Figure 4 to its closed position illustrated in Figure 5. Correspondingly, when the atmospheric pressure acting on the bellows exceeds the opposing force the bellows will move from its closed to its open position, moving the valve with it. The movement of the bellows and valve, in either case, continues until the valve has so varied the flow of air through the passageway as to establish an equal pressure acting upon the opposite faces of bellows plate 65. The air pressure within the passageway acting on the bellows will, however, always be less than atmospheric by an amount which is determined by the force exerted by the coil spring 75.

The operation of this embodiment of the invention is as follows: Upon the suction cleaner being placed in operation, the rotation of the suction-creating fan 15 causes air to be drawn into the suction nozzle 22 under the cleaning lips 23 and 24. From the nozzle the air passes through the passageway 28 into the dirt container 3. As stated, the air is separated from the suspended foreign matter in passing into the fan chamber 2 by the separator 16 through which the air must pass before passing through the eye 18 of the fan chamber. The air within the fan chamber 2 is free from all but a very minute percentage of the foreign material which it carries in the dirt chamber 3. From the fan chamber the air is exhausted through the passageway 42 into the pressure nozzles 43 and 44 from which it escapes under the common lips 23 and 24 into the suction nozzle 22. Thereafter it repeats the circuit.

If the pressure which exists within the pressure nozzles 43 and 44 is greater than atmospheric the air therein will pass not only under the common lips 23 and 24 into the suction nozzle 22, but also under the outer lips 25 and 26 into the surrounding atmosphere. This is undesirable for the small percentage of dirt in the escaping air is noticeable to the user. To prevent such escape the pressure of the air within the pressure nozzles 43 and 44 is maintained at slightly below atmospheric pressure. To do this, the valve 72 in the air passageway 42 is automatically positioned as to maintain the flow of air through the passageway in such volume that the pressure within the passageway, and therefore within the nozzles which are directly connected thereto, will be that which is desired. It is the collapsible bellows which accomplishes this automatic regulation.

Let it be assumed that the pressure within the air passageway 42 approaches atmospheric. Immediately the movable side 65 of the bellows pivots upwardly toward the position shown in Figure 5, the passageway pressure being complemented by the force exerted by the pivoting spring 75 so that together the two forces overcome the force of atmospheric pressure acting upon the opposite side of the plate 65. This upward movement of the plate 65, acting through the links 74, 74, causes the valve 72 to be pivoted toward its passageway-closing position. This movement of the valve results directly in the throttling of the air entering the passageway 42 from the fan chamber 2. As the volume of air entering the passageway is reduced, the pressure therein also is reduced and the valve movement continues only until the pressures on plate 65 balance and the movable side 65 tends to move in the opposite direction. In Figure 4 the valve 72 is illustrated in a completely open position and performs no throttling effects. In actual operation, valve 72 varies between its limits, as illustrated in Figures 4 and 5, and tends to maintain a position at which the pressure of the air within passageway 42 acting upon the plate 65, plus the pressure exerted by the pivoting spring 75, exactly equals atmospheric pressure which opposes those forces and which acts upon the opposite side of that plate.

When the valve 72 is in its open position and exerts no throttling effect, substantially all of the air handled by the fan 15 passes into the discharge pressure nozzles 43 and 44 and again enters the suction nozzle 22. As the valve 72 assumes positions at which throttling effects are obtained, however, a greater percentage of the air escapes from the fan chamber by the filtered leak comprised in the passageway around the motor casing 12 which exhausts through the filter 60 and the louvers 55 etc. of the motor housing. With the air passageway 42 substantially closed by the valve 72, as illustrated in Figure 5, a very large percentage of the air handled by the fan 15 would escape by the filtered leak, but this relationship seldom if ever occurs in the actual operation of the cleaner. In normal operation, the quantity of air handled by the filtered leak varies with the position of the valve 72, its function being always to filter air which is displaced from the cleaner by the leakage into the machine of additional air at the nozzle thereof.

Referring now to Figures 7 and 8 in particular, a second preferred embodiment of the invention is disclosed. In this embodiment the automatic bellows control of the first modification has been eliminated and instead the valve 72 is controlled by a manually operating lever 80 on the side of the cleaner casing and which connects to the pivotal pin 73 of the valve. The handle or lever

80 is adapted to be moved by the operator through a range which is indicated by the position numbers appearing upon the side of the casing. The valve in this embodiment functions exactly as in the first embodiment and the filtered leak also functions in the same manner. Here, however, the operator must judge for himself when it is necessary to reduce the pressure in the pressure nozzles in order to prevent the escape of air into the room. When it is noticed that a slight odor is present, he merely adjusts the lever 80 to close the passageway 42 which results in the desired condition being attained.

I claim:

1. In a suction cleaner, a surface-contacting suction nozzle, a surface-contacting exhaust nozzle adjacent said suction nozzle so arranged that all air from said exhaust nozzle passes into said suction nozzle, means to draw air from said suction nozzle and to force air to said exhaust nozzle, and a pressure controlled valve to limit the pressure in said exhaust nozzle to less than atmospheric to prevent air from passing therefrom into the atmosphere.

2. In a closed circuit suction cleaner, pressure and suction nozzles having adjacent surface-contacting mouths in order that the air from the pressure nozzle mouth will pass to the suction nozzle mouth, air-conducting means to move air from said suction nozzle to said pressure nozzle and including suction-creating means, an escape leak open to the pressure side of said means to permit circuit air to pass into atmosphere, and means to limit the air pressure in said pressure nozzle to less than atmospheric.

3. In a closed circuit suction cleaner, pressure and suction nozzles having adjacent mouths in order that air may pass from the pressure nozzle mouth to the suction nozzle mouth, air-conducting means to move air from said suction nozzle to said pressure nozzle and including suction-creating means, a filtered leak open to said air-conducting means through which circuit air may escape to atmosphere, and pressure-responsive means to limit the air pressure in said pressure nozzle.

4. In a closed circuit suction cleaner, pressure and suction nozzles having adjacent surface-contacting mouths in order that air may directly pass from the pressure nozzle mouth to the suction nozzle mouth, air-conducting means to move air from said suction nozzle to said pressure nozzle and including suction-creating means, a filtered leak open to said air-conducting means between said suction-creating means and said pressure nozzle, and valve means to control the flow of air to said pressure nozzle and to said leak.

5. In a closed circuit suction cleaner, pressure and suction nozzles having adjacent mouths in order that air may pass from the pressure nozzle mouth to the suction nozzle mouth, air-conducting means to move air from said suction nozzle to said pressure nozzle and including suction-creating means, a filtered leak open to said air-conducting means between said suction-creating means and said pressure nozzle, a pressure-responsive device exposed to nozzle pressure, and valve means operatively connected to said device to control the flow of air to said leak and to said pressure nozzle.

6. In a closed circuit suction cleaner, pressure and suction nozzles having adjacent surface-contacting mouths in order that air may pass from the pressure nozzle mouth to the suction nozzle mouth without passing through the atmosphere, means to convey air from said suction nozzle, remove foreign material therefrom, and return it under an increased pressure to said pressure nozzle, means by which air can escape to atmosphere before entering said pressure nozzle, and means to divide the air between said escape means and said pressure nozzle to limit the pressure in the latter to less than atmospheric pressure.

7. In a closed circuit suction cleaner, pressure and suction nozzles having adjacent mouths in order that air may pass from the pressure nozzle mouth to the suction nozzle mouth, means to convey air from said suction nozzle, remove foreign material therefrom, and return it under an increased pressure to said pressure nozzle, means by which air can escape to atmosphere before entering said pressure nozzle, and means to divide the air between said escape means and said pressure nozzle to limit the pressure in the latter to less than atmospheric pressure, said last-mentioned means comprising an air-responsive bellows exposed upon one side at atmospheric pressure and upon the other side to the pressure of the pressure nozzle and valve means between said pressure nozzle and said escape means operatively connected to said bellows.

8. In a closed circuit suction cleaner, pressure and suction nozzles having adjacent mouths in order that air may pass from the pressure nozzle mouth to the suction nozzle mouth, means to convey air from said suction nozzle, remove foreign material therefrom, and return it under an increased pressure to said pressure nozzle, means by which air can escape to atmosphere before entering said pressure nozzle, and means to divide the air between said escape means and said pressure nozzle to limit the pressure in the latter to less than atmospheric pressure, said last-mentioned means comprising a valve controlling the flow of air into said pressure nozzle, and manually operable means to position said valve.

9. In combination in a bagless suction cleaner, a nozzle, suction-creating means to draw cleaning air through said nozzle, mechanical means to remove the suspended foreign matter from the cleaning air moved by said suction-creating means, a dirt receiver to receive foreign matter removed by said separator, means to guide the air exhausted by said suction-creating means to the inlet of said nozzle, means for the escape of excess air from said cleaner to the exterior atmosphere including a passage open to the exhaust of said suction-creating means and an air-permeable filter in said passage through which the air escaping through said passage must pass, and means to limit the pressure of the air exhausted to the inlet of said nozzle to less than atmospheric pressure.

10. A closed circuit bagless suction cleaner including a nozzle, a fan, a mechanical separator, and means to convey air in said cleaner from said nozzle, through said fan and separator, and back to said nozzle, characterized by the fact that there is provided a leak passageway open to said means between the pressure side of said fan and said nozzle and to the exterior atmosphere to permit the escape of air, a filter in said passageway to remove foreign matter from the escaping air, and automatic pressure-responsive means to restrict the pressure of the air returned to said nozzle to less than atmospheric pressure.

11. A closed circuit bagless suction cleaner including a nozzle, a suction-creating fan, a dirt separator and means to convey air in said cleaner from said nozzle, through said fan and separator and back to said nozzle, characterized by the fact that there is provided a leak passageway open to said means and to the exterior atmosphere to permit the escape of air, a removable stationary filter in said passageway to remove foreign matter from the escaping air, said passageway including manually removable means securing said filter in place, and also there is provided a pressure-controller to control the pressure of the air conveyed into said nozzle from said fan.

12. In a suction cleaner, a nozzle including spaced surface-contacting lips, a mechanical dirt separator, a suction-creating fan, a driving motor operatively connected to said separator and fan, means to convey air from said nozzle to said separator and fan and back to said nozzle including a surface-contacting open-ended passageway adjacent a lip of said nozzle and subject to the suction thereof, and means to convey to the exterior of the cleaner any excess of air caused by leakage of atmospheric air into said nozzle, said means including a perforated casing around said driving motor interiorly connected to said first-mentioned means, and a filter between the perforations in said casing and said first-mentioned means, and a valve controlling the pressure in said open-ended passageway to limit the pressure therein to less than atmospheric pressure.

13. In a suction cleaner, a nozzle including spaced surface-contacting lips, a mechanical dirt separator, a suction-creating fan, a driving motor operatively connected to said separator and fan and including an enclosing casing, means to convey air from said nozzle to said separator and fan and back to said nozzle including an open-ended passageway adjacent a lip of said nozzle, and means to convey to the exterior of the cleaner any excess of air caused by leakage of atmospheric air into said nozzle, said means including a removable casing surrounding and spaced from said motor casing and having an opening therein, said first-mentioned means provided with an opening into the space between said casings, a filter in said removable casing through which air must pass in leaving said casing, a pressure-responsive bellows operated by pressure in said open-ended passageway, and an air-flow-controlling valve operated by said bellows and controlling the pressure in said passageway.

14. In a closed circuit bagless suction cleaner, a nozzle, suction-creating means, a mechanical dirt separator, means to convey air from the nozzle to said suction-creating means and separator and back to said nozzle, and a leak of relatively small capacity as compared with the air handled by said suction-creating means in the return circuit of said air-conveying means, a filter in said leak through which escaping air must pass, said leak functioning to permit the escape of excess air drawn into said nozzle, and valve means to control the volume of air escaping through said leak.

15. In a suction cleaner, a surface-contacting suction nozzle, a surface-contacting exhaust nozzle adjacent said suction nozzle so arranged that all air from said exhaust nozzle passes into said suction nozzle, means to draw air from said suction nozzle and to force air to said exhaust nozzle, means to control the flow of air to said exhaust nozzle, and pressure-controlled means to control said last mentioned means to maintain at all times the pressure in said exhaust nozzle at a pressure not exceeding atmospheric.

16. In a suction cleaner, a suction nozzle, a pressure nozzle adjacent said suction nozzle and so arranged that all air from said exhaust nozzle passes into said suction nozzle, means movably supporting said nozzles for movement over a surface covering and thereabove, and suction-creating means connected to said suction nozzle adapted to create a sufficient suction therein to lift into contact with said nozzle a surface covering undergoing cleaning, means to remove foreign material from air drawn into said suction nozzle, air-conducting means connecting said exhaust nozzle to the high pressure side of said suction-creating means, a filtered leak connected to said air-conducting means, and an air-flow-controlling valve in said air-conducting means controlling the division of air flow between said exhaust nozzle and said filtered leak.

17. In a suction cleaner, a suction nozzle, a pressure nozzle adjacent said suction nozzle and so arranged that all air from said exhaust nozzle passes into said suction nozzle, means movably supporting said nozzles for movement over a surface covering and thereabove, and suction-creating means connected to said suction nozzle adapted to create a sufficient suction therein to lift into contact with said nozzle a surface covering undergoing cleaning, means to remove foreign material from air drawn into said suction nozzle, air-conducting means connecting said exhaust nozzle to the high pressure side of said suction-creating means, a filtered leak connected to said air-conducting means, an air-flow-controlling valve in said air-conducting means controlling the division of air flow between said exhaust nozzle and said filtered leak, and pressure operated means controlling the setting of said valve.

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