

March 6, 1956

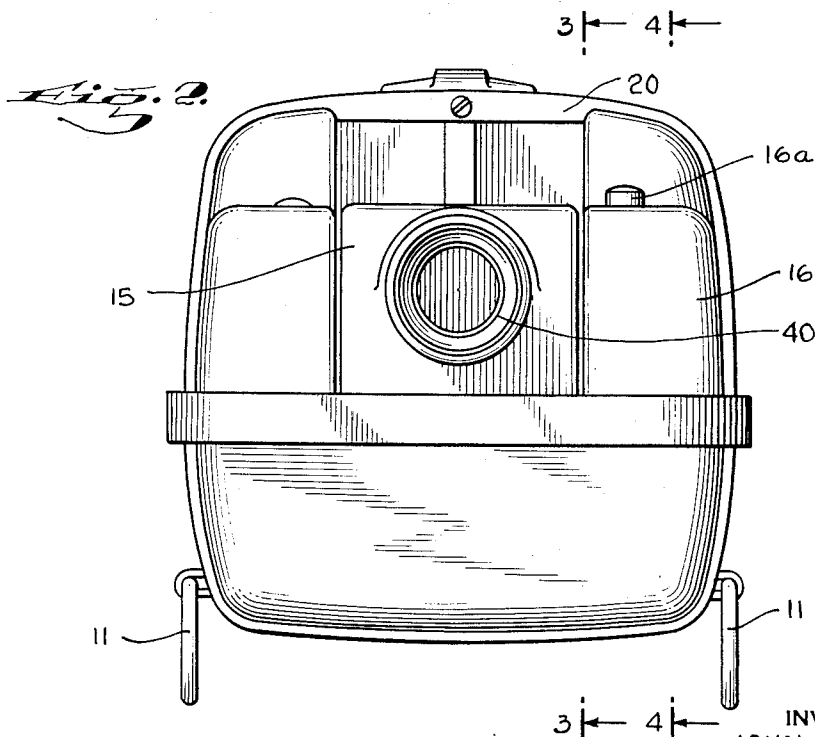
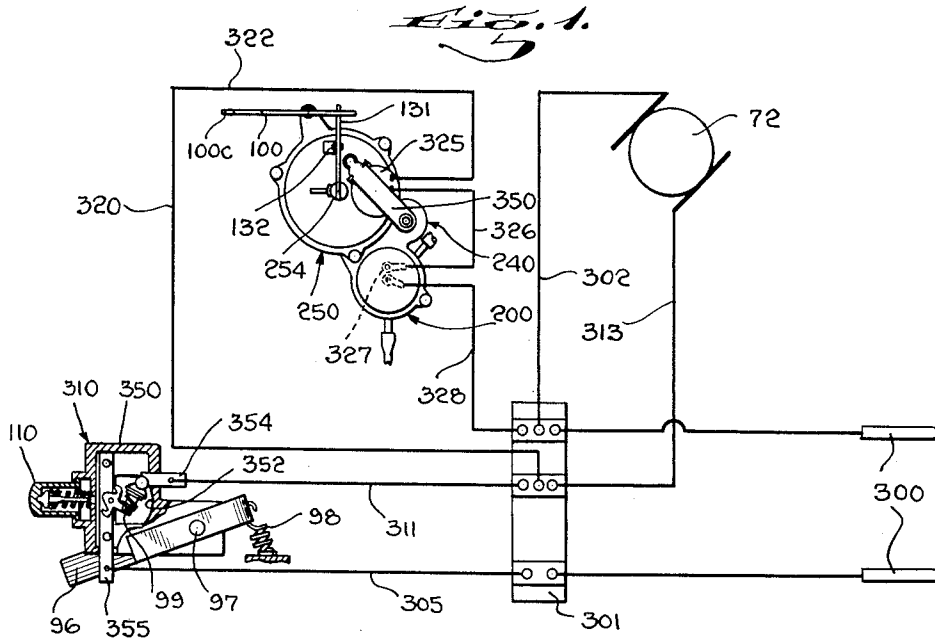
J. T. FERRARIS

2,737,262

AUTOMATIC VACUUM CLEANER SWITCH

Filed Dec. 9, 1952

4 Sheets-Sheet 1



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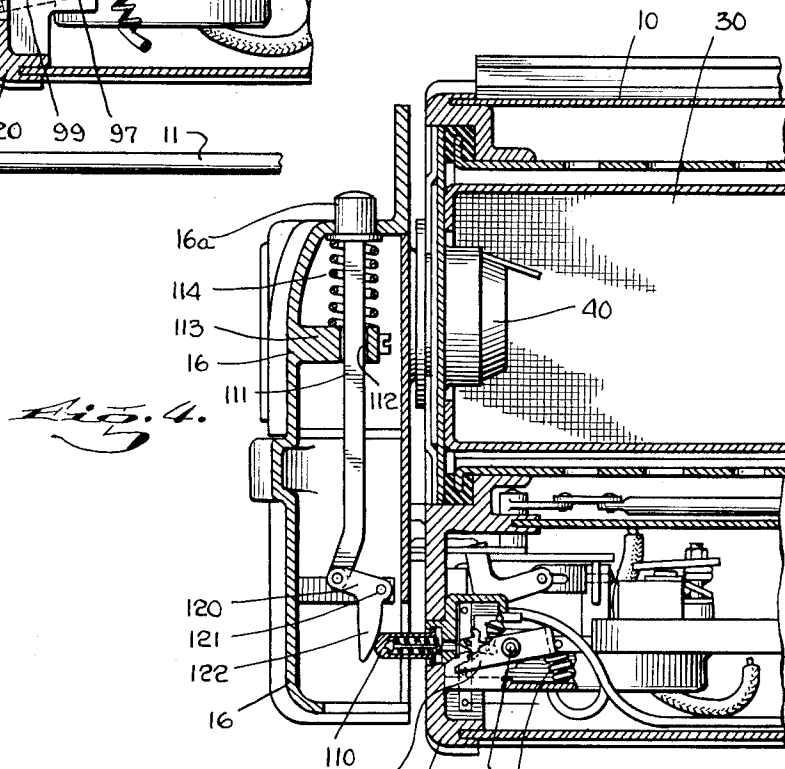
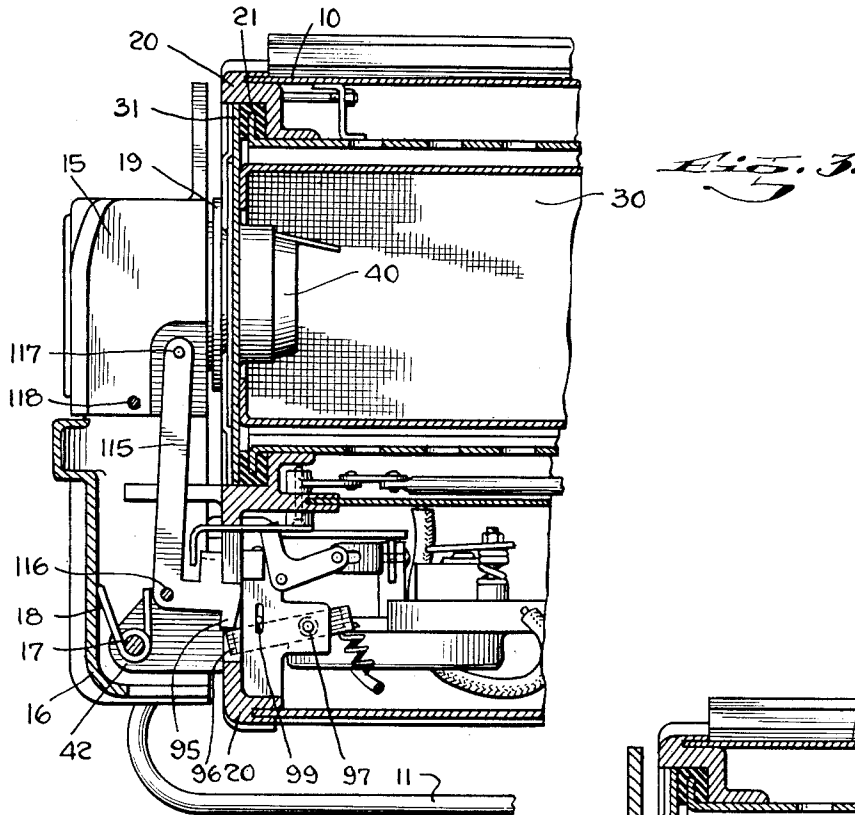
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AUTOMATIC VACUUM CLEANER SWITCH

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4 Sheets-Sheet 2



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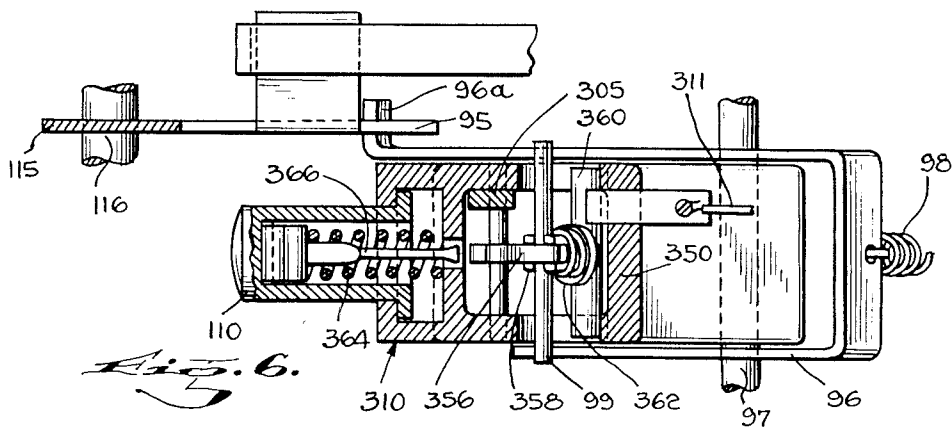
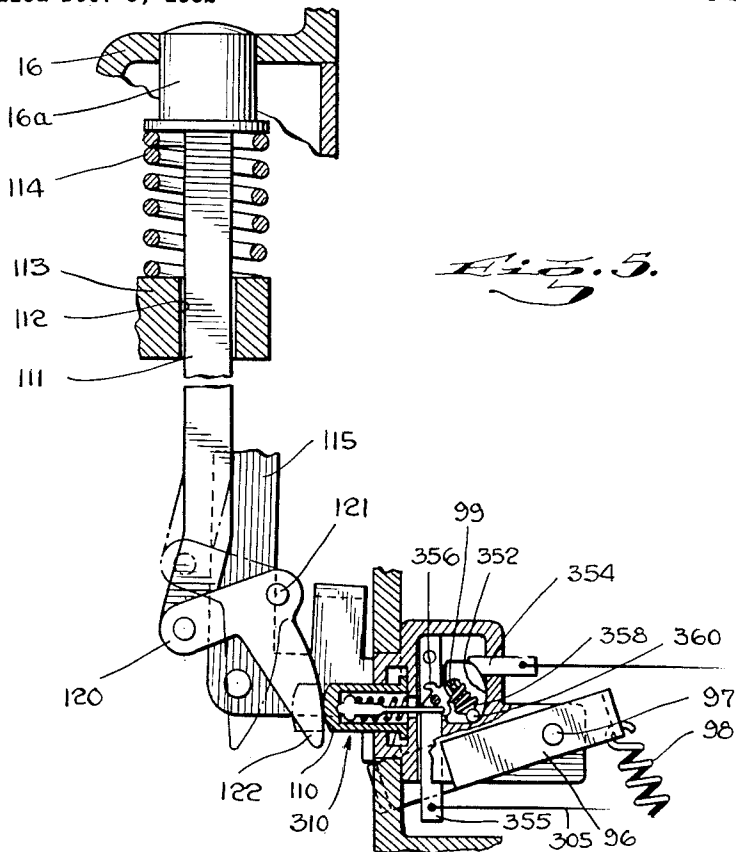
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AUTOMATIC VACUUM CLEANER SWITCH

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4 Sheets-Sheet 3



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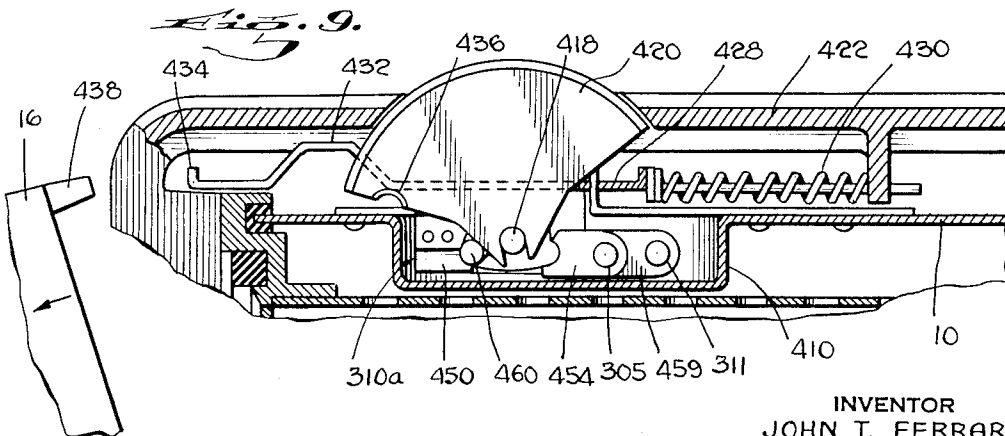
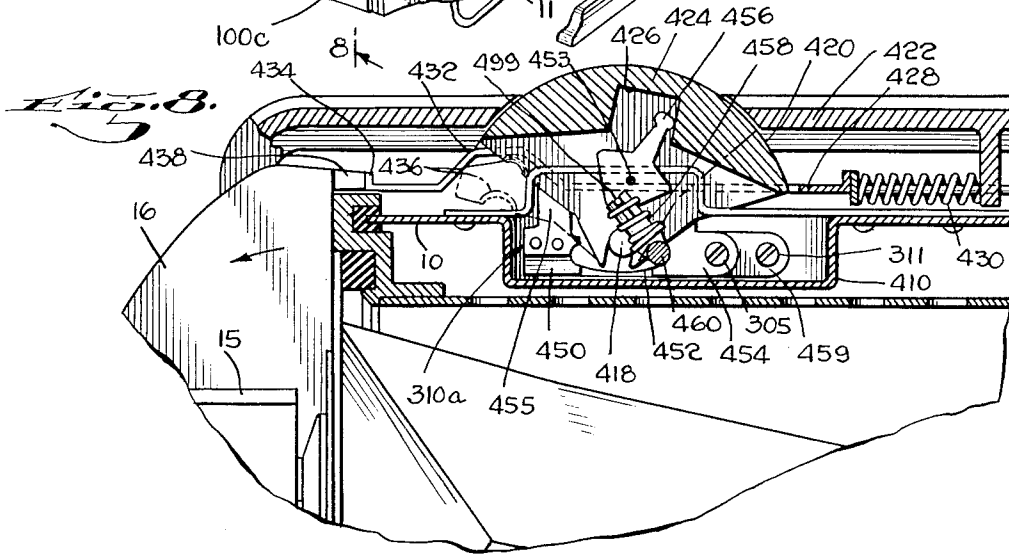
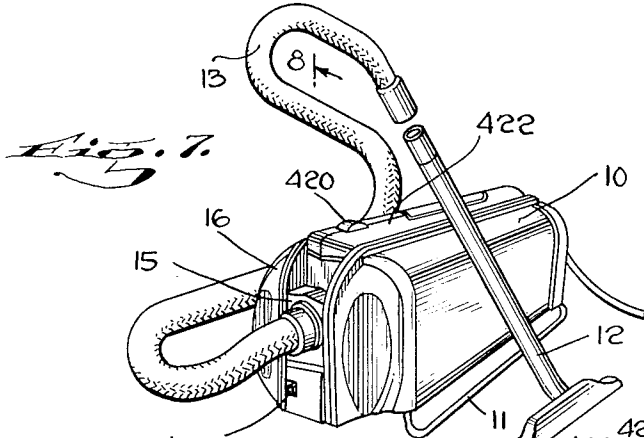
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AUTOMATIC VACUUM CLEANER SWITCH

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4 Sheets-Sheet 4



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2,737,262

AUTOMATIC VACUUM CLEANER SWITCH

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Application December 9, 1952, Serial No. 324,894

10 Claims. (Cl. 183—37)

This is a continuation in part of co-pending application Serial No. 140,394, filed January 25, 1950, jointly by Gustaf Einar Lofgren, Robert C. Lampe and myself, entitled "Vacuum Cleaners," Patent No. 2,641,330 issued June 9, 1953, and relates back thereto for all common subject matter.

This invention relates to a vacuum or suction type cleaner and more particularly, to a novel arrangement of parts effecting unusual simplicity and compactness with respect to switching mechanisms for energizing and deenergizing the cleaner.

It is a major object of this invention to provide new and improved means for automatically shutting off the motor fan unit of a vacuum cleaner preparatory to ejecting a dust filled disposable bag therefrom, utilizing a simple mechanical means to effect the necessary steps.

A still further object is to provide a switching device which can be operated manually to effect energization or deenergization of the motor fan unit when the vacuum cleaner is in operating condition, but which is automatically operated to and locked in deenergized position when the cleaner unit is opened either manually or in the course of its automatic operation.

Still other and further objects will be disclosed hereinbelow or will become evident to those skilled in the art upon reading the following description together with the appended drawings, wherein:

Figure 1 is a wiring diagram of a cleaner circuit wherein one embodiment of the particular switching device of this invention is incorporated;

Figure 2 is a front plan view of the cover of a vacuum cleaner embodying my invention in closed position;

Figure 3 is a vertical sectional view taken on the line 3—3 of Fig. 2 showing a parallel linkage connecting a hose coupling assembly to the cleaner, together with a lever arm portion of the linkage for actuating a spring biased switch arm;

Figure 4 is a sectional view taken on the line 4—4 of Fig. 2 showing the manually operable switch actuating button for energizing and deenergizing the motor fan unit;

Figure 5 is a partial view of the manually operable switch actuating button showing in full the actual position of the elements when the button is pressed down and showing partially, in broken lines, their position when released;

Figure 6 is a top plan view of the switch and operating mechanism therefor with portions of the switch broken away showing the association of parts for actuation of the switch elements;

Figure 7 is a perspective view of a complete cleaner as seen from the air intake end, wherein a modification of the switching device of this invention is embodied;

Figure 8 is a vertical sectional view showing the details of structure of the switch taken on the line 8—8 of Fig. 7; and

Figure 9 is a vertical sectional view similar to that of Fig. 8, but showing the position of the elements when the front cover is released.

The subject-matter of this application embraces those features described in the above-identified application relating to a manually operable switching means for energizing and deenergizing the cleaner in combination with a front cover which, upon release, causes the switching means to deenergize the cleaner and renders the switching means inoperative to energize the cleaner as long as the cover is released.

Although it is a preferred feature of this invention that it be embodied in a vacuum cleaner together with automatic devices which are responsive to predetermined changes in the operational characteristics of the cleaner to open the cover, it is equally feasible to utilize this particular cover actuated switching device in a simple manually opened and closed type of cleaner cover.

Referring now more particularly to the drawings, the vacuum cleaner includes a housing 10 provided with a cover 16, Fig. 2, and is supported on a pair of runners 11. An air inlet nozzle and wand 12 is connected by a suitable flexible hose 13 to a movable hose coupling assembly 15, including an inlet conduit 40, mounted on cover 16. Cover 16, Fig. 3, is hinged at 17 to a projection 42 extending forwardly from a front body ring 20 which is secured to the front open end of housing 10. The cover is biased to open position by a spring 18 and effects an air tight seal with casing 10 when in closed position by means of a rubber sealing ring member 19 around conduit 40 which pierces cardboard disc 31 of dust bag 30 against a sealing ring 21 positioned in front body ring 20. Dust bag 30 intercepts and retains dust and other solids present in the air stream admitted through inlet conduit 40, clean air passing through the porous walls of the bag. Switch button 16a, Figs. 2 and 4, on cover 16 provides the manual on-and-off control for the motor 72 of the cleaner unit.

The parallel linkage between the hose coupling assembly 15 and the body ring 20 is most clearly shown in Fig. 3, where bell crank 115, fulcrumed at 116 to projection 42 and at 117 to hose coupling assembly 15, forms one link of the complete parallel linkage while cover 16, fulcrumed at 17 to the projection 42 and at 113 to hose coupling assembly 15 forms the other link.

The electrical circuit of the cleaner is shown in Fig. 1, wherein leads 300 convey current from the house lines to terminal strips 301 located within the cleaner housing and from which a conductor 302 goes directly to one side of motor 72. The other side of motor 72 is connected through a circuit including conductor 303, on-and-off switch 310, and conductors 311 and 313. The circuit for energizing the electrical part of the automatic controls comprises conductor 320, electromagnet 325 of electro-magnetically controlled air valve 240, line 326, pneumatically operated switch 327 of the pressure differential pneumatic control unit 200 and conductor 328 to the house circuit.

Unit 200 includes a diaphragm subjected on one side to the air pressure existing within the dust bag 30 and on the other side to the pressure outside the bag but within the casing 10, which latter is the full suction produced by the fan. With a clean bag, which offers but little resistance to flow of air therethrough, the difference between these two pressures is a minimum. However, as dirt accumulates within the bag, it increases the pressure drop therethrough, thus increasing the pressure difference acting on the diaphragm which distends the latter. When the diaphragm is thus moved a predetermined amount, it closes the contacts of a switch 327 to energize solenoid 325. The resulting movement of the solenoid armature 350 opens a valve 240 which communicates full fan suction to one side of a power diaphragm mounted within a control unit 250, thus causing sudden movement of the diaphragm and a stem 254 connected thereto. A lever 131

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pivotally mounted at 132 transmits this movement to a latch bar 100, movement of which releases cover 16, which thereupon pivots to open position under the influence of spring 18.

As shown in Figs. 1, 3, 4, 5 and 6, switch 310 is a toggle type snap switch. As is usual in this type, the switch includes a frame 350 of insulating material, an inner surface of which forms an arcuate track 352 at one end of which is located a contact member 354. Conductor 311 is connected to this contact, while conductor 305 is connected to a metal bar 355 secured to the frame. Pivotally mounted on bar 355 is a switch throw arm 356, one end of which carries a pin 99 of sufficient length to extend outwardly beyond frame 350 on either side, as is shown in Fig. 6. Pin 99 engages within the forked end of a member 358 which carries a roller 360 arranged to travel on track 352. A coil spring 362 is compressed between a shoulder on member 358 and the pin 99 and tends to retain the roller in either the "on" position shown in Fig. 1, or in the "off" position shown in Fig. 5, but never in an intermediate position.

Reciprocally mounted in the frame 350 is an actuating button 110. The frame is secured in an opening in the front body ring 20 and the button 110 projects forwardly from the ring. The button is hollow and a coil spring 364 urges it outwardly. An arm 366 is pivotally mounted within the button 110 and its inner free end is positioned so that, upon depression of the button, this end enters one or the other of two notches formed in arm 356. Thus, for example, with the switch in the "on" position shown in Fig. 1, depression of the button 110 causes arm 366 to enter the lower notch in arm 356 and to pivot the latter in a counter-clockwise direction. This straightens out the toggle consisting of the arm 356 and member 358 until it passes dead center, whereupon the spring 362 rapidly moves the toggle to the "off" position shown in Fig. 5.

Inasmuch as button 110 extends into a hollow portion of cover 16 when the latter is closed, the button is not accessible for direct manual operation. In order to operate this button manually for starting and stopping the cleaner motor, a bell crank lever 120 is pivotally mounted at 121 within the cover. An arm 122 of the lever bears against button 110 when the cover is closed so that counter-clockwise rotation of the lever 120 depresses the button 110. The other arm of the lever is pivotally connected to a rod 111 slidably mounted in a bore 112 formed in a portion 113 of cover 16. The upper end of rod 111 carries a button 16a which extends through an aperture in the upper part of the cover, where it is accessible for convenient operation by one's foot. A spring 114 is compressed between the portion 113 and the button 16a and tends to maintain the rod 111 and bell crank lever 120 in the position shown in Fig. 4. When the cover 16 is closed, depression of button 16a results in depression of button 110 of switch 310, but when the cover is pivoted about hinge 17 to open position, arm 122 of the bell crank lever is swung away from button 110, and consequently with the cover in open position the button 16a is inoperative to actuate the switch.

Pivotally mounted on the switch frame 350 at 97 is a U-shaped member 96. A spring 98 tends to turn member 96 in a clockwise direction. One leg of member 96 is formed with a projection 96a which is contacted by the end of arm 95 of bell crank lever 115 when the cover 16 is closed so as to retain the member 96 in the position shown in Fig. 3. However, when the cover is opened the bell crank lever 115 pivots counter-clockwise about pivot 116, thus moving arm 95 away from projection 96a on member 96. Spring 98 is then able to pivot member 96 clockwise, as viewed in Figs. 1, 3, 4 and 5, the legs of member 96 striking the opposite projecting ends of pin 99 and, if the switch is in the "on" position, moving the pin upwardly so as to first straighten out the toggle, whereupon spring 362 throws the switch to the "off" posi-

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tion. Member 96 continues to bear against pin 99 as long as the cover is open, thus locking the switch in "off" position.

When the cover 16 is again closed, arm 95 contacts projection 96a so as to pivot member 96 against the force of spring 98 in a counter-clockwise direction and away from pin 99. This does not throw the switch to closed position, but unlocks it so that it may be actuated manually by button 16a.

Thus, opening of cover 16, whether as the result of automatic or manual operation, opens switch 310 and stops motor 72 and also deenergizes the automatic control circuit. As above stated, the switch is locked in open position as long as the cover remains open, and is unlocked by closure of the cover so that it may thereafter be manipulated at will by the depression of button 16a to start and stop the motor.

A second embodiment of my invention is illustrated in Figs. 7, 8 and 9. The electric switch 310a shown herein corresponds to switch 310 in the first described embodiment and may be connected into the wiring diagram of Fig. 1 in the same manner as switch 310.

Switch 310a is of the snap action toggle type and includes a frame 450 which is suitably mounted within a pocket 410 formed in the top of housing 10 near the front end thereof. Pivotally mounted on bar 455 of the frame 450 at 453 is a switch throw arm 456, one end of which carries a pin 499 to actuate the forked end of member 458 carrying a roller contact 460 in the same manner as described in connection with the switch 310 of the first embodiment. This roller travels on an arcuate track 452 formed in switch frame 450. At the right-hand end of the track as viewed in Fig. 8 there is disposed a pair of spaced contacts 454 and 459, so arranged as to be bridged by the roller 460 when the switch is in the "on" position.

Pivotally mounted at 418 is a switch actuating member 420. This member has an arcuate upper surface which extends through an opening formed in a trim member 422 secured to the upper side of housing 10. Fixed within the member 420 and forming a part thereof is a block of preferably insulated material 424 which is formed with a recess 426 into which extends the upper end of switch arm 456.

Slidably mounted between housing 10 and the trim 422 is a member 428 which is urged to the left, as viewed in Fig. 8, by means of a coil spring 430. Member 428 includes two parallel arms which extend on either side of member 420. In Figs. 8 and 9 only the arm which extends behind the member 420 is shown, inasmuch as the other arm is located in front of the section, 8—8, Fig. 7, on which these figures are taken. Each of these arms includes an upwardly offset portion 432 and each member terminates in a forward end 434. Member 420 is provided with a laterally extending projection 436 on either side thereof, and each of these projections extends into a space underneath the offset portion 432 of arms of member 428.

Cover 16 is formed with a pair of projections 438 so positioned on the cover as to strike the ends 434 of member 428 when the cover is in closed position, and to hold the member 428 against the force of spring 430 in the position shown in Fig. 8.

In Fig. 8 the parts are shown in full lines in the position which they occupy when the switch is closed. In order to open the switch the operator may pivot the member 420 in a counter-clockwise direction, either by hand or by foot. This pivots the switch arm 456 in the same direction and consequently, as explained in connection with the first embodiment, the roller 460 is caused to travel to the other end of the track 452, thus opening the circuit between the contacts 454 and 459. During this motion of the member 420 the projections 436 move away from the offset portions 432 of member 428, to the position shown in broken lines in Fig. 8. The switch may be closed manually when the cover is closed by

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pivoting the member 420 in clockwise direction from its broken line to its full line position, the projections 436 moving freely in the spaces underneath the offset portions 432 during such manual manipulation of the switch.

However, when the front cover 16 is opened, projections 438 are then withdrawn from contact with the ends 434, whereupon the spring 430 moves the member 428 to the left to the position shown in Fig. 9. Since the switch is normally closed when the front end cover is automatically opened, release of the members 428 by projections 438 causes the offset portions 432 to engage projections 436 and thus pivot the member 420 in a counter-clockwise direction so as to automatically open the switch. The movement of the member 428 to the left is not only sufficient to open the switch, but it also causes straight portions of the member 428 to overlie the projections 436, as is shown in Fig. 9, to thereby lock the switch in the "off" position, thus making it impossible for the switch to be closed manually while the front cover is opened.

When the cover is closed the projections 438 contact the ends 434 of member 428, thus moving this member to the right against the action of spring 430 until it occupies the position shown in Fig. 8. This movement of the member 428 does not actuate the switch, but merely releases the projections 436 so that the switch may thereafter be operated manually in the manner above described.

It will thus be seen that in accordance with my invention, a single switch serves to accomplish both manual and automatic control of the motor and further that when the switch is automatically operated by opening of the cover, it is rendered incapable of manual operation until the cover again has been closed.

While I have shown and described two more or less specific embodiments of my invention, it is to be understood that this has been done for purposes of illustration only and that the scope of my invention is not to be limited thereby, but is to be determined solely from the appended claims.

I claim:

1. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, releasable means for holding said cover in closed position, a dust bag insertable in said casing through said opening, a motor fan unit for producing a flow of air through said dust bag, an inlet conduit for introducing air into said dust bag, means responsive to a drop in pressure through said dust bag for operating said releasable means for said cover, manually operable switching means for energizing and deenergizing said cleaner, and means actuated by the opening of said cover for causing said manual switching means to deenergize said motor fan unit.

2. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, releasable means for holding said cover in closed position, a dust bag insertable in said casing through said opening, a motor fan unit for producing a flow of air through said dust bag, an inlet conduit for introducing air into said dust bag, means responsive to a drop in pressure through said dust bag for operating said releasable means for said cover, manually operable switching means for energizing and deenergizing said cleaner, resiliently operable means normally ineffective for actuating said switching means, and means operatively connecting said cover and said resiliently operable means whereby opening of the cover causes the resiliently operable means to actuate said switching means to deenergize said motor fan unit.

3. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, releasable means for holding said cover in closed position, a dust bag insertable in said casing through said opening, a motor fan unit for producing a flow of air through said dust bag, an inlet conduit for introducing air

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into said dust bag, means responsive to a drop in pressure through said dust bag for operating said releasable means for said cover, manually operable switching means for energizing and deenergizing said cleaner, resiliently operable means normally ineffective for actuating said switching means, and means operatively connecting said cover and said resiliently operable means whereby opening of the cover causes the resiliently operable means to actuate said switching means to deenergize said motor fan unit and to restrain said switching means from manual operation.

4. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, means for biasing said cover to open position, releasable means for holding said cover in closed position, a dust bag insertable in said casing through said opening, a motor fan unit for producing a flow of air through said dust bag, an inlet conduit for introducing air into said dust bag, means responsive to a drop in pressure through said dust bag for operating said releasable means for said cover, manually operating switching means for energizing and deenergizing said cleaner, a resiliently mounted slidably operable member normally ineffective for actuating said switching means, an arm on said slidably operable member, an offset portion on said arm, a projecting member on said switching means operably actuatable by said offset portion, means operatively connecting said cover and said slidably operable member whereby opening of the cover causes the slidably operable member to actuate said switching means to deenergize said motor fan unit.

5. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, means for biasing said cover to open position, releasable means for holding said cover in closed position, a dust bag insertable in said casing through said opening, a motor fan unit for producing a flow of air through said dust bag, an inlet conduit for introducing air into said dust bag, means responsive to a drop in pressure through said dust bag for operating said releasable means for said cover, manually operable switching means for energizing and deenergizing said cleaner, a resiliently mounted slidably operable member normally ineffective for actuating said switching means, an arm on said slidably operable member, an offset portion on said arm, a projecting member on said switching means operably actuatable by said offset portion, means operatively connecting said cover and said slidably operable member whereby opening of the cover causes the slidably operable member to actuate said switching means to deenergize said motor fan unit and to restrain said switching means from operation.

6. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, means for biasing said cover to open position, releasable means for holding said cover in closed position, a dust bag insertable in said casing through said opening, a motor fan unit for producing a flow of air through said dust bag, an inlet conduit for introducing air into said dust bag, means responsive to a drop in pressure through said dust bag for operating said releasable means for said cover, manually operable switching means for energizing and deenergizing said cleaner, a resiliently mounted slidably operable member normally ineffective for actuating said switching means, a pair of arms on said slidably operable member, an offset portion on each of said arms, projecting members on said switching means operably actuatable by said offset portions, means operatively connecting said cover and said slidably operable member whereby opening of the cover causes the slidably operable member to actuate said switching means to deenergize said motor fan unit.

7. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, means for biasing said cover to open position, releasable means for holding said cover in closed position, a dust

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bag insertable in said casing through said opening, a motor fan unit for producing a flow of air through said dust bag, an inlet conduit for introducing air into said dust bag, means responsive to a drop in pressure through said dust bag for operating said releasable means for said cover, manually operable switching means for energizing and deenergizing said cleaner, a second releasable means for actuating said manually operable switching means to its deenergizing position, and latching means settable to restraining or releasing position with respect to said second releasable means, and means responsive substantially simultaneously with the opening of said cover for setting said latching means to releasing position with respect to said second releasable means whereupon said second releasable means causes said manual switching means to deenergize said motor fan unit, and restrains said switching means from manual operation.

8. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, means for biasing said cover to open position, releasable means for holding said cover in closed position, a dust bag insertable in said casing through said opening, a motor fan unit for producing a flow of air through said dust bag, an inlet conduit for introducing air into said dust bag, means responsive to a drop in pressure through said dust bag for operating said releasable means for said cover, manually operable switching means for energizing and deenergizing said cleaner, resiliently operable means comprising a pair of parallel arms normally ineffective for actuating said switching means, an offset portion on each of said pair of arms, a projection on each side of said manually operable switching means extending into and actuatable by said offset portions and means operatively connecting said cover and said resiliently operable means whereby opening of the cover causes the resiliently operable means to actuate said switching means to deenergize said motor fan unit.

9. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, means for biasing said cover to open position, releasable means for holding said cover in closed position, a dust bag insertable in said casing through said opening,

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a motor fan unit for producing a flow of air through said dust bag, an inlet conduit for introducing air into said dust bag, means responsive to a drop in pressure through said dust bag for operating said releasable means for said cover, manually operable switching means for energizing and deenergizing said cleaner, resiliently operable means comprising a pair of parallel arms normally ineffective for actuating said switching means, an offset portion on each of said pair of arms, a projection on each side of said manually operable switching means extending into and actuatable by said offset portions and means operatively connecting said cover and said resiliently operable means whereby opening of the cover causes the resiliently operable means to actuate said switching means to deenergize said motor fan unit and a flat portion on each of said pair of arms to restrain said projections by overlying said projections and restraining said switching means from manual operation.

10. In a vacuum cleaner, the combination comprising a casing having an opening, a movable cover for said opening, releasable means for holding said cover in closed position, a dust bag insertable in said casing through said opening, a motor fan unit for producing a flow of air through said dust bag, an inlet conduit for introducing air into said dust bag, means responsive to a drop in pressure through said dust bag for operating said releasable means for said cover, manually operable switching means for energizing and deenergizing said cleaner, and means actuated by the opening of said cover for causing said manual switching means to deenergize said motor fan unit and to restrain said switching means against manual operation, while said cover remains open.

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