

Jan. 1, 1952

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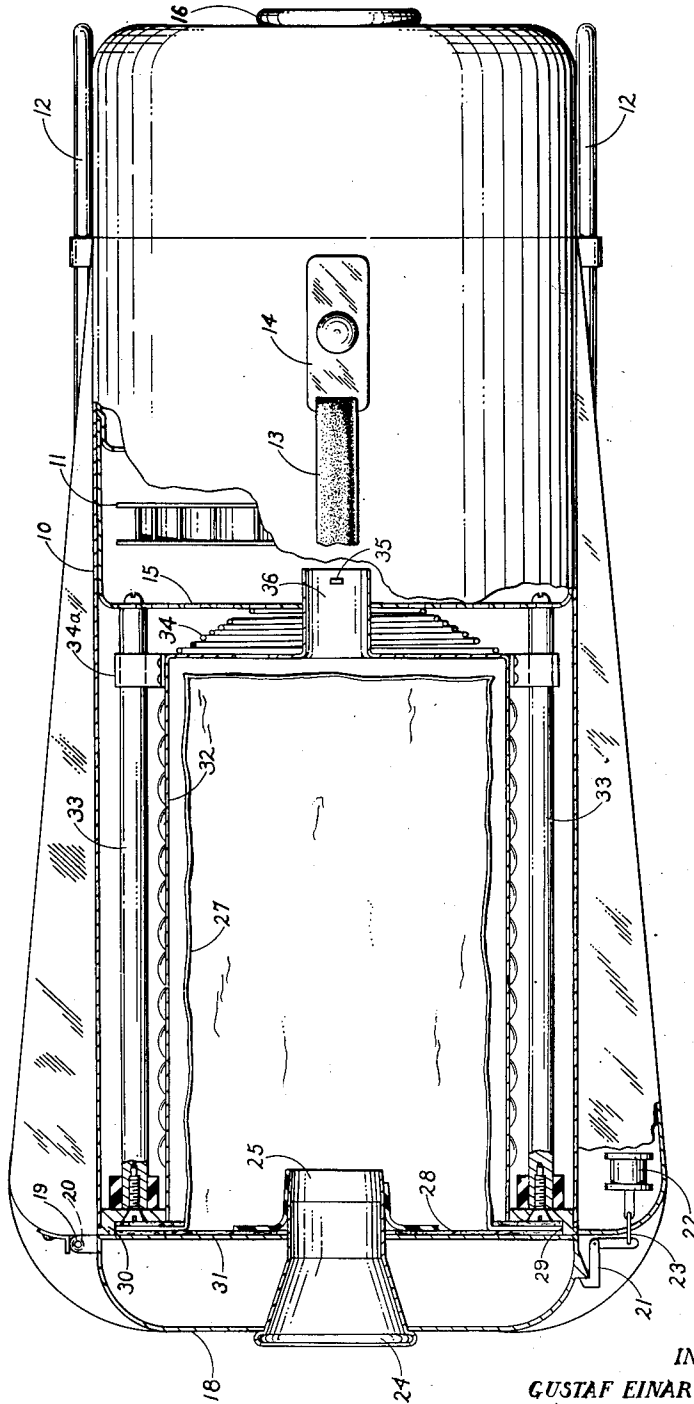
2,580,644

SUCTION CLEANER

Filed Nov. 15, 1946

5 Sheets-Sheet 1

Fig. 1



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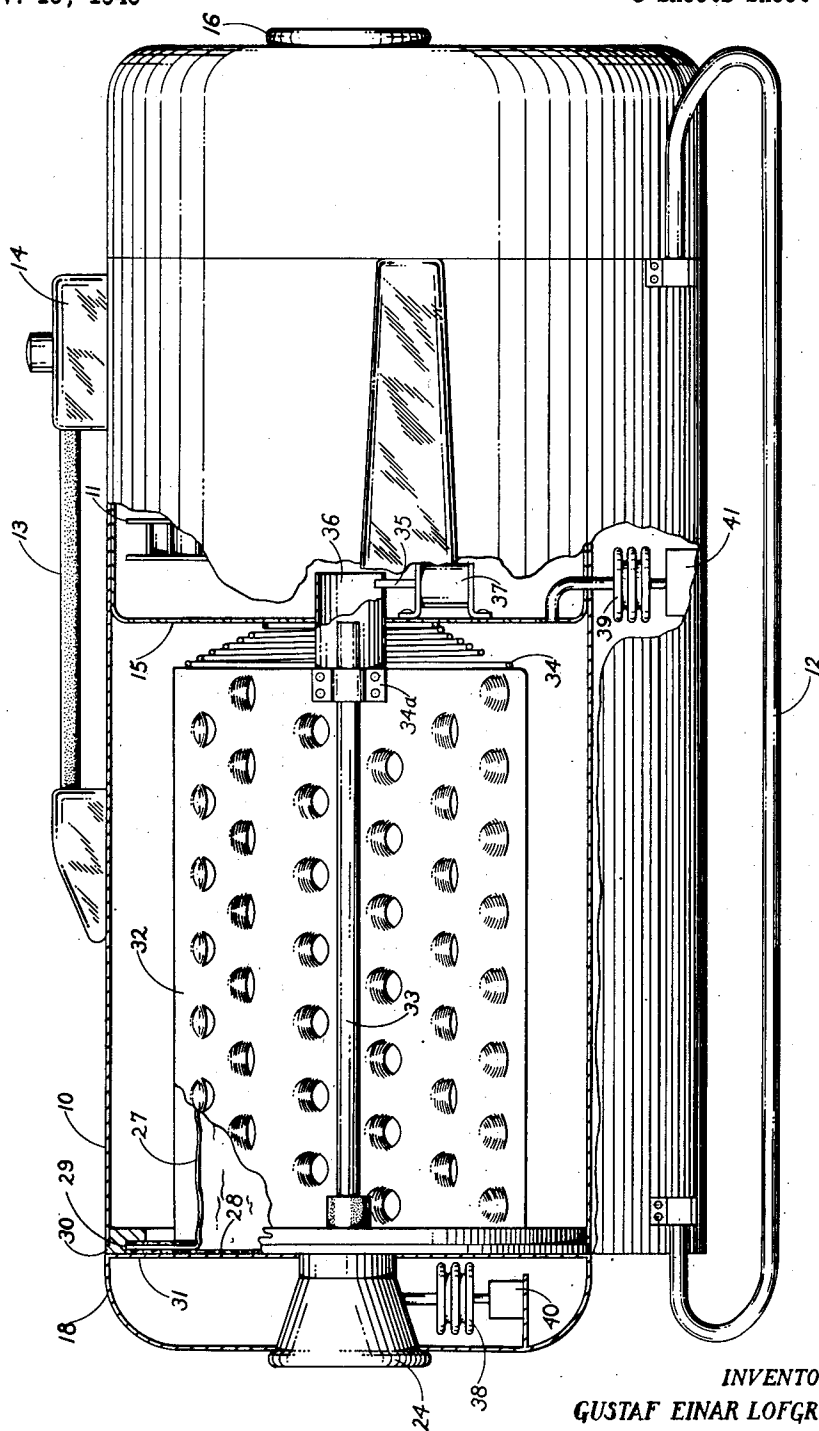
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Fig. 2



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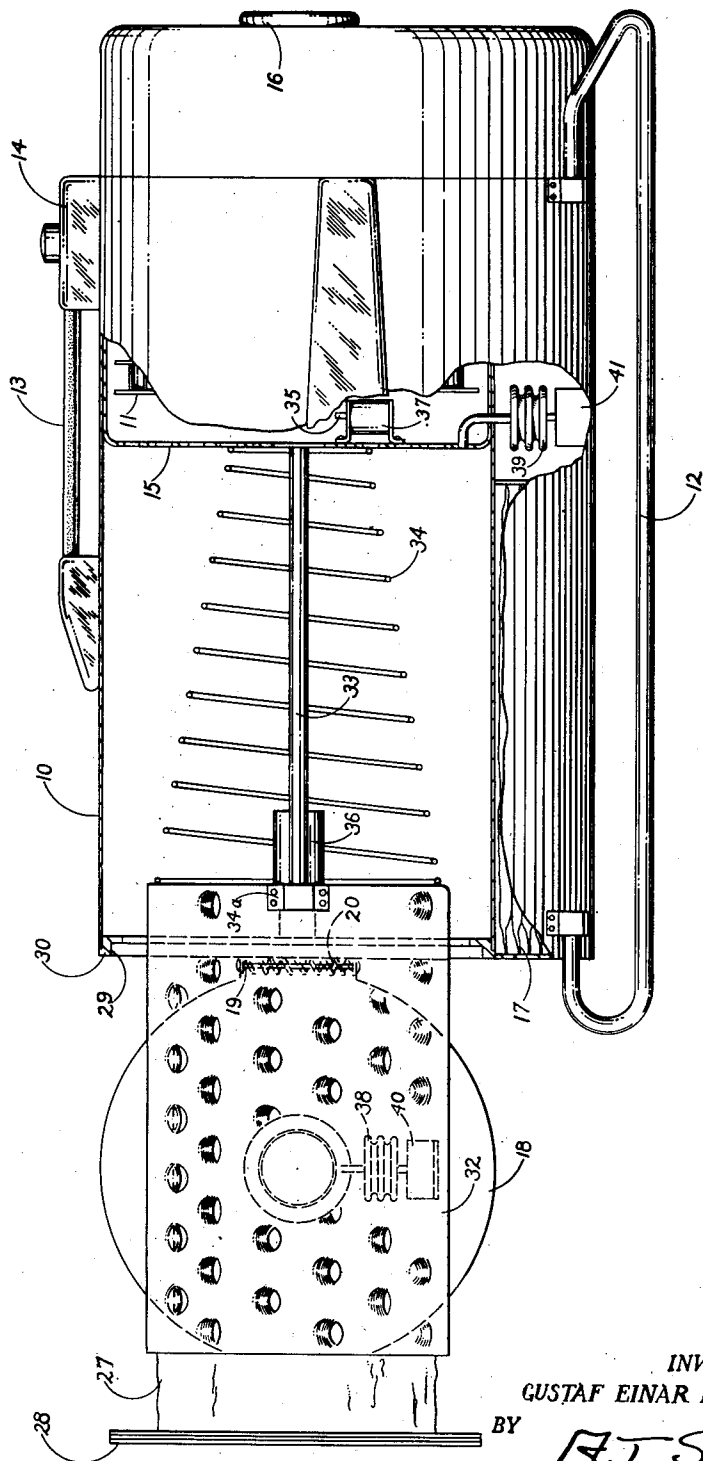
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Fig. 3



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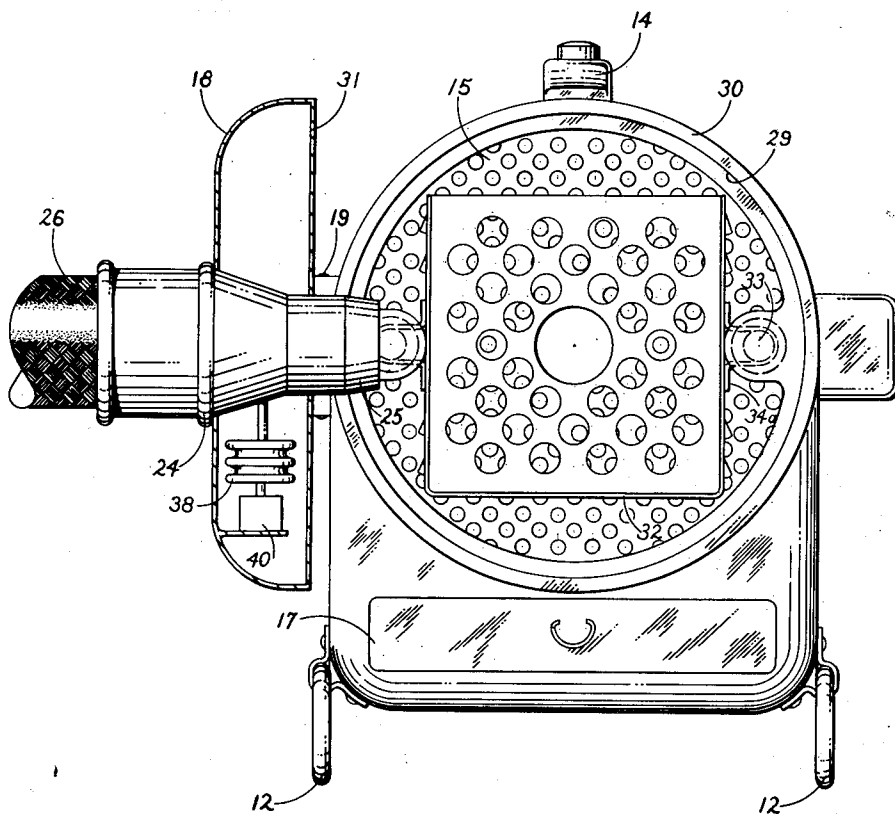
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SUCTION CLEANER

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Fig. 4



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SUCTION CLEANER

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Fig. 5

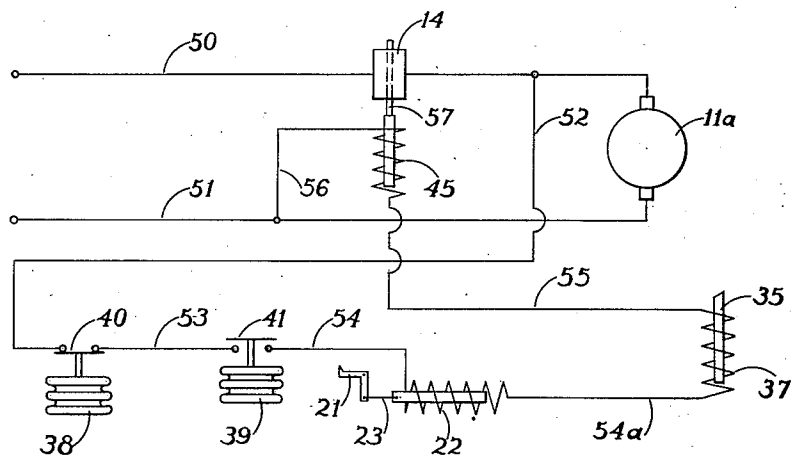
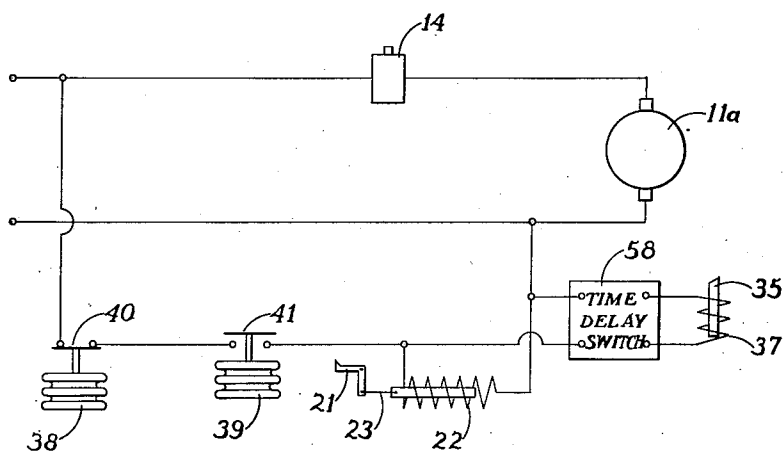


Fig. 6



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SUCTION CLEANER

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10 Claims. (Cl. 183—37)

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This invention relates to suction cleaners and is particularly concerned with means for disposing of dust, dirt, and like foreign matter which has been accumulated during cleaning operations. The present invention is also concerned with automatic control means responsive to certain operating characteristics of the device.

While certain aspects of the present inventive concept may be broadly applicable to a wide variety of types of vacuum cleaners, the invention is more particularly concerned with tank type cleaners in which a relatively stationary casing, housing a motor-fan unit and a removable dust collecting bag, is provided with an intake opening to which a suction hose is applied. Such devices are provided with suitable cleaning tools which may be selectively attached to the end of the hose and from which tools dust is drawn through the tube and deposited in the bag, the clean air being exhausted through the opposite end of the casing.

One of the outstanding problems presented by such cleaners is the removal and disposition of the dirt collected. Cleaners of this type now on the market provide for the removal of the front cover whereupon an open mouthed dust collecting bag is removed and the dust shaken from the bag which is thereafter returned for further cleaning operations. In addition to the obvious objection to such procedure because of the required cover manipulation and exposure of the collected dirt, it is frequently impossible for the operator to determine when the bag should be emptied. The collection of dirt by the bag causes the pores and interstices of the fabric to become clogged, thus reducing the flow of air therethrough and consequently reducing the efficiency and effectiveness of the cleaner. However, such reduction in efficiency may not be apparent to the operator and thus, since the emptying of the bag is the least pleasant of the cleaning operations, it is frequently postponed beyond the time when efficiency would best be served by emptying.

It is one of the primary objects of the present invention to provide a new and improved means for disposing of the accumulated dirt of a vacuum cleaner.

It is a further object of the invention to provide in a suction cleaner means responsive to accumulation of dust therein for actuating a dirt disposal means.

More specifically, it is an object of the present invention to provide for the opening of the cover

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and for the discharge of the dust receptacle from the casing.

Other objects and features of the present invention will be apparent from the consideration of the following specification when taken in conjunction with the accompanying drawings in which:

Fig. 1 is a top plan view partly in section of one embodiment of the present invention;

Fig. 2 is a side elevation partly broken away showing the tray in retracted position;

Fig. 3 is a view similar to Fig. 2 showing the tray extended;

Fig. 4 is a front elevation of the device with the cover open;

Fig. 5 is a wiring diagram showing a suitable control circuit for the vacuum cleaner illustrated in the preceding figures, and;

Fig. 6 is a wiring diagram showing a somewhat modified control circuit.

In general terms, the structure of the present embodiment of the invention may be defined as including a substantially cylindrical normally horizontal body within which is mounted a motor-fan unit for causing a flow of air from the front to the rear therethrough. As distinct from cleaners of this general type which are presently in use and in which the dust bag is inserted directly in the body, the body of the present device is provided with a sliding tray or drawer which receives the dust bag and which when the bag is to be disposed of, slides forwardly to extend beyond the body to present the bag for disposal or if the tray moves rapidly, the bag will be thrown clear of the tray when it reaches the end of its motion.

Another important feature of the invention is the provision of means for inaugurating the cycle of operations in response to changes in the cleaning characteristics of the device and more particularly in automatic response to the accumulation of dirt in the bag by which the porosity of the bag is diminished and the suction through the hose reduced.

Referring specifically to the drawings which depict one preferred embodiment of the inventive concept, the numeral 10 designates the cleaner body which houses the motor-fan unit indicated by the numeral 11, the housing being preferably supported in slightly spaced relation to the floor by sleighs 12 and being provided with a carrying handle 13 and a manually operable control switch 14. Forwardly of the motor-fan unit 11 there is mounted a bulkhead 15 through which air is drawn by the motor-fan unit to be ex-

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hausted through a suitable outlet port 16. Since in the preferred embodiment of the invention the use of disposable paper dust receptacles is contemplated, storage space therefor is provided in the base of the housing 10 as indicated at 17. The front of the housing 10 is provided with a cover 18 which is pivoted to the housing by a vertical pintle 19. A spring 20 associated with the pintle 19 biases the cover 18 towards the open position shown in Figs. 3 and 4, while the pivoted latch 21 normally retains the cover in closed position. A solenoid 22 engages the latch by means of link 23 so that upon energization thereof, the latch will be pivotally moved to release the cover permitting it to be opened by the spring 20. The cover 19 is provided with a centrally located hose receiving fixture 24 and air inlet tube 25. It will be understood that during cleaning operation a suction hose as indicated at 26 in Fig. 4 is attached to the fixture 24 and suitable cleaning tools are applied to the end of the hose. Thus, with the motor-fan unit in operation, air is drawn inwardly through the cleaning tools and hose and is exhausted through the port 16.

For separating dust and dirt from the air passing through the cleaner and collecting the same within the cleaner, there is provided a dust receptacle preferably formed of inexpensive porous material, such as paper and comprising a flexible paper body 27 closed at its forward end by a relatively stiff centrally apertured disc 28, the arrangement being such that with the cover closed the inlet tube 25 extends through the central aperture of the disc 28 to deliver the dust-laden air into the body of the dust bag or receptacle. In that form of construction herein shown, it will be noted that the rim of the disc 28 extends beyond the body 27 and the disc edge is seated within a rabbet 29 of an annular supporting rim 30 of the body 10. Such engagement of the disc edge seals the body to prevent air leakage and insures inward air flow through the tube 25 only. An inner cover plate 31 assists in securing the disc when the cover is closed.

The tray or drawer is generally indicated by the numeral 32, the drawer being shown as substantially U-shaped in cross-section and having an open top and forward end so as to accommodate placement and removal of the dust receptacle. The drawer is mounted for guided sliding movement on a pair of longitudinally extending guide bars 33 secured between bulkhead 15 and rim 30, apertured ears 34a secured to the tray being arranged to fit over the bars 33 to support and guide the tray.

In the present arrangement it will be seen that with the tray 32 extended as indicated in Fig. 3, the receptacle may be readily inserted and since the front disc 28 of the receptacle extends laterally beyond the front edges of the tray or drawer 32, pressure applied to the disc will push the tray back into retracted position, as in Figs. 1 and 2 within the body 10 without requiring insertion of the hand or any contact with the tray or other mechanism of the device. Such inward pressure and movement will also act to seat and seal the disc edge within the rabbet 29 of the annular body end 30, thus preventing leakage of air into the casing around the edge of the cover.

The tray 32 is propelled forwardly after the cover is opened by a coil spring 34 which, during the cleaning operation is in the retracted position shown in Figs. 1 and 2, the tray and spring

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being retained in retracted position by a latch member 35. The latch 35 engages an aperture in a rearwardly extending tube 36 mounted centrally of the rear end of the tray. The latch 35 is preferably actuated by a solenoid 37 which is a companion solenoid to the solenoid 22 which releases the front cover. Since a certain element of time is consumed in the movement of the cover from fully closed to fully opened position, it is preferable that the tray move forwardly only after such interval time has passed.

By selecting the strength of the spring 34 such that it will not overcome the suction applied to the receptacle disc 28 when seated in the ring 30, it will be seen that opening of the cover 18 and release of latch 35 will not permit the spring to move the tray while the motor is in operation. In such an arrangement the latches 21 and 35 may be simultaneously released by energization of solenoids 22 and 37. With such an arrangement it is contemplated that means be provided for deenergizing the motor simultaneously with the energization of the solenoids, thus while the cover is opening, the gradual diminishment of suction as the motor slows down, will gradually release the pressure on the disc and receptacle, permitting the spring to gradually move the tray outward.

A suitable circuit for this purpose is shown in Fig. 5, wherein reference characters 50 and 51 designate electric current leads for the motor 11a of the motor-fan unit. The manually operable switch 14 is connected in the lead 50 for starting and stopping the motor. A conductor 52 is connected between lead 50 and one terminal of a microswitch 40 operated by a bellows 38, the interior of which communicates with air inlet tube 25 and hence with the space within dust receptacle 27. The other terminal of switch 40 is connected through a conductor 53 with one terminal of a microswitch 41 operated by a bellows 39, the interior of which communicates with the space between the outside of dust receptacle 27 and the fan 11. Connected in series between the other terminal of switch 41 and motor lead 51, by means of conductors 54, 54a, 55 and 56, are the solenoids 22 and 37 for actuating latches 21 and 35, respectively, and a solenoid 45 the armature 57 of which is arranged to actuate switch 14. The bellows 38 and 39 and the switches 40 and 41 are so constructed that when the fan is not in operation, and hence no suction is applied to either bellows, switch 40 is closed and switch 41 is open, as shown in Fig. 5.

In order to start the motor-fan unit, the switch 14 is closed by manually depressing the usual button thereon, so as to complete the circuit to the motor. Operation of the fan creates suction within the casing 10 which produces flow of air through the tube 25 to the interior of receptacle 27, and through the porous walls of the receptacle to the fan, from where it is discharged through outlet 16. This suction tends to collapse both of the bellows, and if receptacle 27 is clean and hence offers a minimum resistance to the flow of air, the suction applied to bellows 38 is sufficient to maintain switch 40 open, while the suction applied to bellows 39 may or may not be sufficient to close switch 41. However, inasmuch as switches 40 and 41 are in series, both must be closed at the same time in order to energize the solenoids.

As the accumulating dirt within the receptacle 27 increases the resistance to air flow there-through, the suction on bellows 39 increases still

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further, while the suction on bellows 38 decreases. When the increasing resistance to flow has sufficiently decreased the air flow so that the receptacle should be removed and replaced by a clean one, the suction applied to bellows 39 will have increased to a value assuring the closure of switch 41, while the decrease of suction on bellows 38 will have been sufficient to have closed switch 40.

The closing of both of these switches completes the circuit through solenoids 22, 37 and 45. The consequent energization of solenoid 22 releases latch 21 and front cover 18 is swung to the open position, shown in Figs. 3 and 4, by the spring 20. Energization of solenoid 45 causes its armature 57 to depress the button of switch 14 so as to open the motor circuit and consequently the fan starts to slow down. Energization of solenoid 37 retracts latch 35, thus freeing tray 32 for movement by spring 34. As previously stated, the suction still produced by the fan prevents the spring 34 from immediately moving the tray 32 out of the housing 10, but sufficient movement of the tray and tube 36 takes place so that, when solenoid 37 is deenergized by the opening of switch 14, latch 35 will not re-enter the aperture in the tube. Consequently, as the suction drops as the fan slows down, spring 34 moves the tray 32 and the receptacle 27 out of the housing.

Should a more accelerated action be desired, the strength of spring 34 may be so selected that upon release of the cover the tray will slide forwardly under the pressure of the spring regardless of the fact that the motor is still applying suction. In such instance, it will be desirable to provide means for delaying the release of the latch 35 until the cover is fully open and this may be accomplished by a simple delay action switch for the solenoid 37 so that a suitable timed sequence between the operation of solenoids 22 and 37 will be provided for. In such case the motor may be deenergized with the operation of either solenoid or by manual actuation.

Fig. 6 illustrates a suitable arrangement for delaying the release latch 35. As was the case in Fig. 5, solenoid 22 is energized directly by the closing of the circuit through switches 40 and 41, but any suitable time delay switch 58 is interposed in the circuit to solenoid 37. Consequently, latch 35 is not retracted, so as to prevent spring 34 to move the tray outwardly, until cover 18 has been fully opened.

From the foregoing, it will be seen that the present device provides a novel, simple and efficient apparatus by which the dust receptacle is automatically carried forwardly from the body of the cleaner and presented for disposal in response to a decrease in cleaning efficiency due to the accumulation of dust in the bag.

It will be understood, of course, that the invention is not limited to the specific structural details herein set forth and that numerous changes, modifications and full use of equivalents may be resorted to without departure from the spirit or scope of the invention as outlined in the appended claims.

What I claim is:

1. In a vacuum cleaner, a casing having an opening, suction means for producing sub-atmospheric pressure in said casing to induce flow of air therethrough, a dust separating member positioned within said casing and removable through said opening, supporting structure for said dust separating member slidably mounted in said casing and movable outwardly for moving said dust separating member outwardly through

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said opening, means for moving said structure outwardly, and control means for actuating said means for moving said structure actuable in response to an increase in pressure within said dust separating member and to a concurrent decrease in pressure between said dust separating member and said suction means.

2. In a vacuum cleaner, a housing having an inlet opening, suction means for producing flow of air into said housing through said inlet, a dust separating member in said housing in the path of air flow between said inlet and said means, a closure on said housing providing access to said dust separating member, supporting structure for said dust separating member slidably mounted within said housing, means for moving said supporting structure outwardly, and means responsive to an increase in pressure within said dust separating member and to a concurrent decrease in pressure between said dust separating member and said suction means for opening said closure and actuating said means for moving said supporting structure.

3. In a vacuum cleaner, a housing having an inlet opening, suction means for producing flow of air into said housing through said inlet, a dust separating member in said housing in the path of air flow between said inlet and said means, an access opening in said housing, a closure for said opening providing access to said dust separating member, supporting structure for said dust separating member movably mounted within said housing, means for moving said supporting structure outwardly with respect to said access opening, and means responsive to an increase in pressure within said dust separating member and to a concurrent decrease in pressure between said dust separating member and said suction means for opening said closure and actuating said means for moving said supporting structure.

4. In a vacuum cleaner, a housing having an inlet opening, suction means for producing flow of air into said housing through said inlet, a dust separating member in said housing in the path of air flow between said inlet and said means, an access opening in said housing, a closure for said opening providing access to said dust separating member, latch means maintaining said closure in closed position, supporting structure for said dust separating member movably mounted within said housing, means for moving said supporting structure outwardly through said access opening, and means responsive to an increase in pressure within said dust separating member and to a concurrent decrease in pressure between said dust separating member and said suction means for releasing said latch and actuating said means for moving said supporting structure.

5. In a vacuum cleaner, an elongated housing having an inlet opening, suction means for producing flow of air into said housing through said inlet, a dust separating member in said housing in the path of air flow between said inlet and said means, a closure on one end of said housing providing access to said dust separating member, supporting structure for said dust separating member mounted for longitudinal movement within said housing, means for moving said supporting structure outwardly, and means responsive to an increase in pressure within said dust separating member and to a concurrent decrease in pressure between said dust separating member and said suction means for opening said closure

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and actuating said means for moving said supporting structure.

6. In a vacuum cleaner, an elongated cylindrical housing having one open end, an inlet opening adjacent said one open end, suction means for producing flow of air into said housing through said inlet, a dust separating member in said housing in the path of air flow between said inlet and said means, a closure for said open end providing access to said dust separating member, latch means maintaining said closure in closed position, supporting structure for said dust separating member mounted for longitudinal movement within said housing, resilient means for urging said supporting structure outwardly with respect to said housing, latch means for retaining said supporting structure within said housing, and means responsive to an increase in pressure within said dust separating member and to a concurrent decrease in pressure between said dust separating member and said suction means for releasing both of said latch means.

7. In a vacuum cleaner, a housing having an inlet opening, suction means for producing flow of air into said housing through said inlet, a dust separating member in said housing in the path of air flow between said inlet and said means, a closure on said housing providing access to said dust separating member, latch means maintaining said closure in closed position, supporting structure for said dust separating member movably mounted within said housing, resilient means for urging said supporting structure outwardly with respect to said housing, latch means for retaining said supporting structure within said housing, and means responsive to an increase in pressure within said dust separating member and to a concurrent decrease in pressure between said dust separating member and said suction means for releasing both of said latch means.

8. In a vacuum cleaner, an elongated housing having an inlet opening, suction means for producing flow of air into said housing through said inlet, a dust separating member in said housing in the path of air flow between said inlet and said means, an access opening in said housing, a closure for said opening providing access to said dust separating member, latch means maintaining said closure in closed position, supporting structure for said dust separating member mounted for longitudinal movement within said housing, means for moving said supporting structure outwardly with respect to said access open-

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ing, and means responsive to an increase in pressure within said dust separating member and to a concurrent decrease in pressure between said dust separating member and said suction means for releasing said latch means and actuating said means for moving said supporting structure.

9. In a vacuum cleaner, a casing having an opening, suction means for producing sub-atmospheric pressure in said casing to induce flow of air therethrough, a dust separating member positioned within said casing and removable through said opening, structure slidably mounted in said casing and movable outwardly through said opening for moving said dust separating member outwardly therethrough, spring means for moving said structure outwardly, said spring means being stressable by inward movement of said structure, and control means actuatable in response to an increase in pressure within said dust separating member and to a concurrent decrease in pressure between said dust separating member and said suction means for releasing the stressed spring means to thereby move said structure.

10. In a vacuum cleaner, a casing having an opening, suction means for producing flow of air through said casing, a closure member for said opening, a tray slidably mounted within said casing and movable inwardly and outwardly through said opening, a spring for moving said tray outwardly, said spring being stressable by inward movement of said tray, a dust separating member supported and carried by said tray, means for opening said closure member, and control means actuatable in response to an increase in pressure within said dust separating member and to a concurrent decrease in pressure between said dust separating member and said suction means for actuating said means for opening said closure member and for releasing said spring to thereby move said tray and dust separating member outwardly through said opening.

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