Sept. 25, 1956 O. L. ALLEN 2,764,256

CONTINUOUSLY ADJUSTABLE CONTROL DEVICE FOR AUTOMATIC VACUUM CLEANERS

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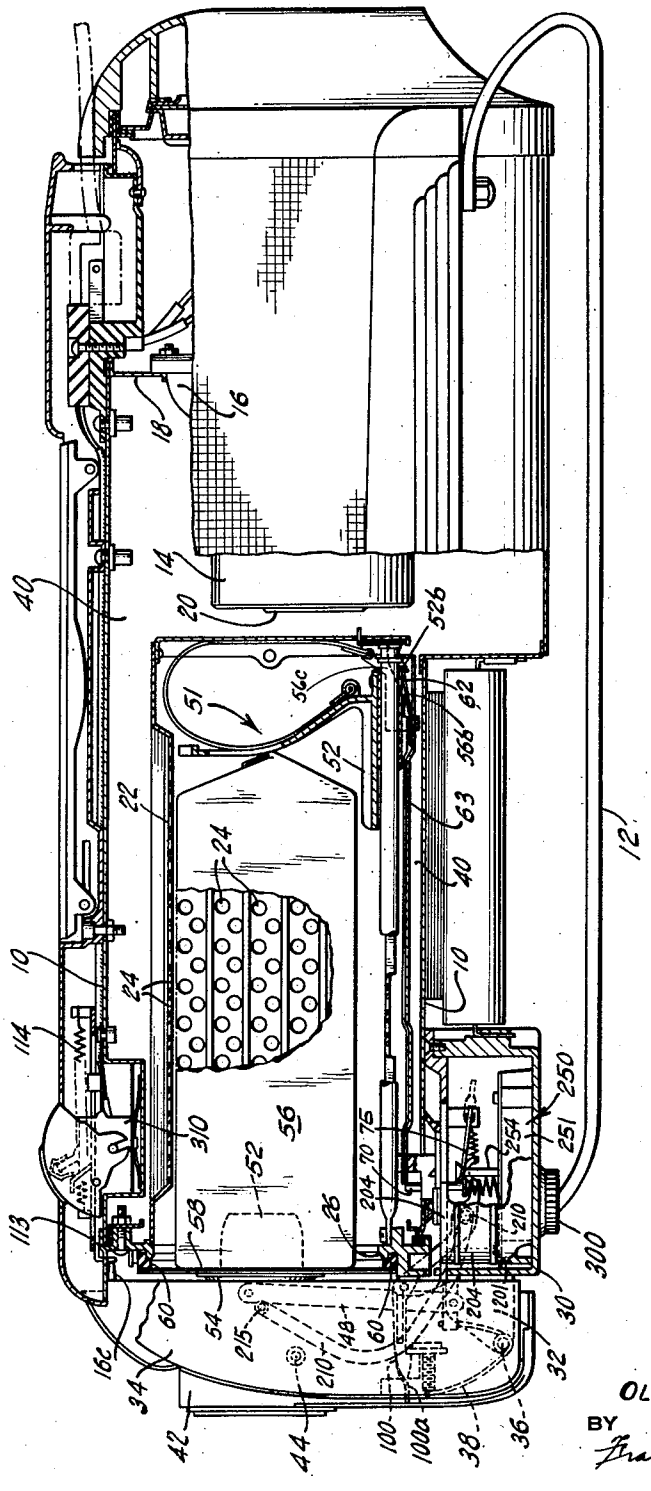
Fig. 1.



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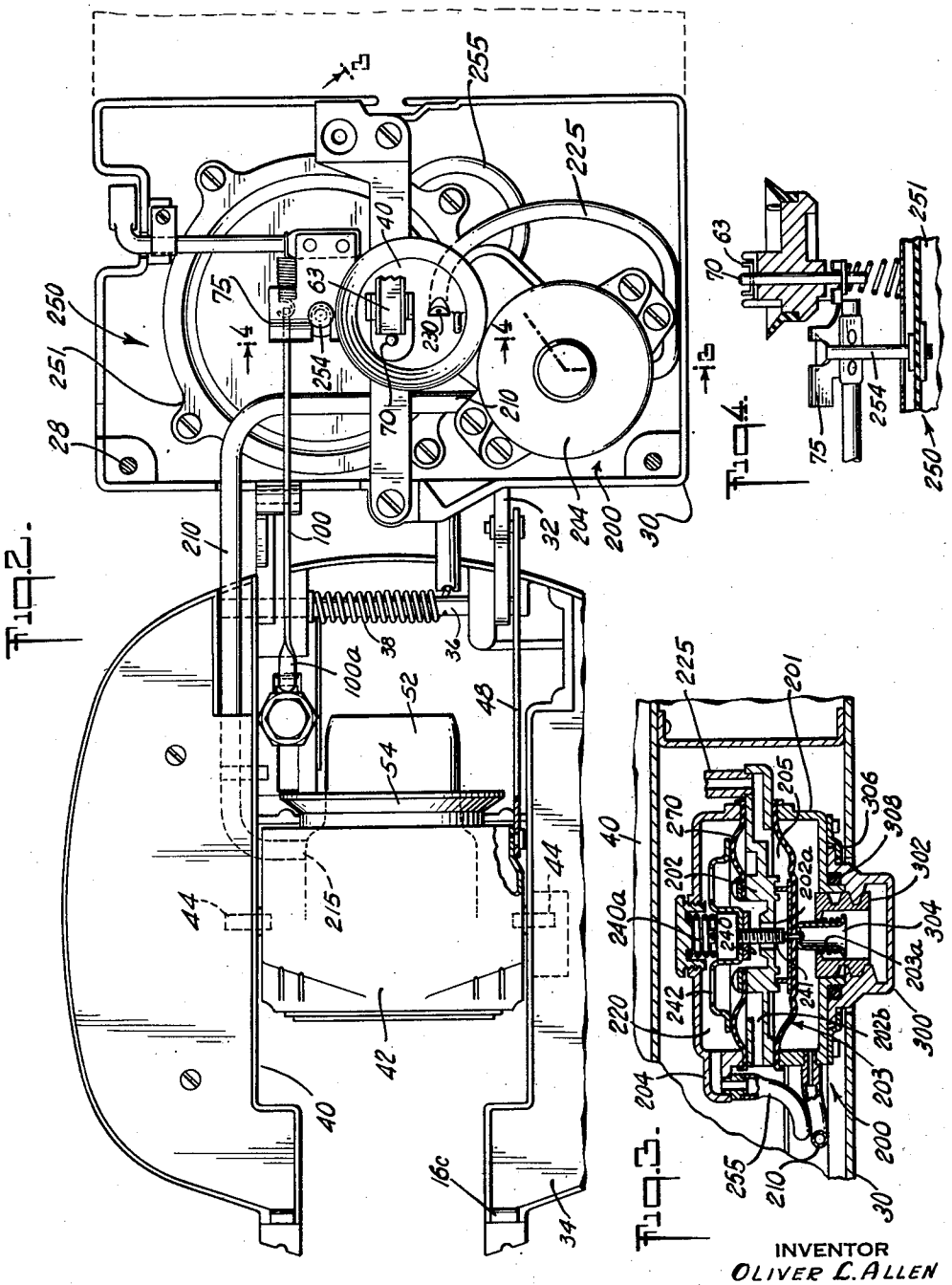

Fig. 2.

Fig. 4.

Fig. 3.

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CONTINUOUSLY ADJUSTABLE CONTROL DEVICE FOR AUTOMATIC VACUUM CLEANERS

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Application May 11, 1954, Serial No. 428,969

6 Claims. (Cl. 183—37)

This invention relates to vacuum cleaners and more particularly to such cleaners as have automatic means for controlling certain desirable functional operations of the cleaner in accordance with predeterminable variations in air pressure resulting from dust and dirt collected therein during use.

It is a major object of this invention to provide an adjustable control device which enables an operator of the vacuum cleaner to set in advance, as on a dial, the differential pressure variations at which automatic responses take place within the cleaner. Among such responses may be the actuation of a valve for controlling the admission of vacuum or pressure to a power diaphragm. This power diaphragm may in turn be used to deerengize the vacuum cleaner motor fan unit, open the front cover, eject the dust container or merely cause the operation of a visible or audible signal.

It is a further and important object hereof to provide a simple control device, accessible from the exterior of the cleaner body and enabling the operator to adjust the point at which the pressure differential within the cleaner opens the valve at any one of a number of predeterminable values suitable for fine dust, coarse dust, fluffy materials, etc. This is effected by providing a screw threaded member which may be raised or lowered at will to cooperate with a tension or pressure spring so as to result in a faster or slower diaphragm operation.

Still other and further objects and additional advantages of this invention will become evident to those skilled in the art upon consideration of the following description together with the accompanying drawings wherein:

Figure 1 is a side view, partly in section and with portions broken away to show details of construction of a vacuum cleaner embodying this invention;

Figure 2 is a top plan view, somewhat enlarged, of the control unit and front cover in open position for use with the vacuum cleaner of Fig. 1;

Figure 3 is a cross-section, somewhat enlarged, taken on the line 3—3 of Fig. 2; and

Figure 4 is a cross-section taken on the line 4—4 of Fig. 2 showing a detail of the power diaphragm linkage.

Referring now in more detail to the drawings, elongated body or cleaner housing **10**, is appropriately supported on a pair of runners **12**. A motor fan unit comprising a fan **14** and an electric motor **16** is mounted by airtight partition or bulkhead **18** within the posterior portion of body **10**. Fan inlet **20** draws air by suction through the space within body **10** which contains inner body or dust bag receiving compartment **22** perforated with apertures **24** for free passage of suction air current therethrough. Inner body **22** is secured at one end to front body ring **26** which in turn is secured within the open anterior end of outer body **10**.

Suspended from the lower part of ring **26** and attached thereto by suitable fastening means such as bolts **28**, Fig. 2, is control chamber **30**. Front cover **34** is hinged by pin **36** to a pair of projections **32** extending from the front

wall of **30** and is biased to open position by spring **38**. A hose coupling assembly **42** is pivotally mounted by pins **44** in the opening **40**, Fig. 2, formed in the cover. Link **48** pivotally connected to the hose coupling assembly at one end and to a projection **32** at the other end forms a parallel motion linkage which causes the hose coupling assembly **42** to move parallel to itself throughout the opening and closing of the cover **34**.

Hose coupling assembly **42** effects an airtight seal with front body ring **26** by means of the stiff cardboard disc **58** of dust bag or dust separating member **56** with the aid of flexible gasket **54** bearing against the disc and holding the edges thereof against sealing ring gasket **60** carried by front body ring **26**. Tubular member **52** of hose coupling assembly **42** extends through a centrally disposed opening in disc **58** when the cover is in the closed position shown in Fig. 1, in order to introduce the air and entrained dust directly into the interior of dust bag **56**.

The electrical and pneumatic control units are operatively interrelated. The pneumatically operated power diaphragm device **250** consists of a large upwardly spring biased diaphragm which is operatively connected to the high suction side of the vacuum cleaner chamber **40** by conduit **255**, the top chamber **220**, Fig. 3, perforations in the supporting ring **242** of valve **240**, center opening **202***a* in casing **202**, upper chamber **205** of a pressure differential measuring device and conduit **225** to the opening **230**, Fig. 2, in the inner sealed chamber **40**.

The pneumatic system includes a pressure differential measuring device (lower half of **200** below casing **202**) which initiates the lifting of valve **240** and combined therewith is an auxiliary valve lifting membrane **270** (upper half of **200** above casing **202**) which completes the opening of valve **240** and holds it open until power diaphragm **250** completes its work. The lower half of unit **200** comprises a pressure differential measuring control device, Fig. 3, having a lower casing **201** and an upper casing **202**, separated by a diaphragm **203**. The space in the lower casing below diaphragm **203** is connected by communicating conduit **210**, Figs. 2 and 3, to opening **215** on the dirty or dust collecting side of the dust bag, while the space in the upper casing above the diaphragm is connected by communicating conduit **225** to opening **230**, on the clean side of the dust bag. Diaphragm **203** is urged downwardly by a coil spring **203***a* which is compressed between the flared end of a spring holder **304** depending from the center of the diaphragm and an annular shoulder formed in a threaded sleeve **302**.

The upper half of unit **200** comprises an auxiliary valve lifting device having a lower casing **202** and an upper casing **204**, separated by a diaphragm **270** having a fixed periphery and a fixed perforated center portion through which valve **240** moves. Valve **240** is biased normally to closed position by a spring **240***a*. Valve stem **241** is of fixed height and its opening is initiated by diaphragm **203**. When valve **240** is opened it communicates high suction to the interior of pneumatically operating power diaphragm or triggering device **250**, comprising a lower casing **251**, Fig. 2, sealed by a diaphragm biased to distended or upward position by a spring and capable of actuating tripping mechanism through link member **254**, Figs. 2 and 4 With this device, membrane **270** (open on its lower surface to the atmosphere through opening **202***b* and subject upon the opening of valve **240** to high suction on its upper surface) assures the completion of the operating cycle including the release of both pin **70** and the latch **100** by maintaining valve **240** in wide open position through a lifting action exerted on the outer edges of valve supporting ring **242** by the upwardly distended diaphragm **270** (see Fig. 3).

With the opening of front end assembly **34**, the discharge of the bag and the slowing down of the motor fan

unit, atmospheric pressure is reestablished on both sides of each of diaphragms 203 and 270 which are returned to their original positions under the biasing action of springs 203*a* and 240*a*, respectively.

The electrical system for energizing the motor fan unit and the electrical controls are of the conventional form and hence need not be specifically described.

In detail and particularly with respect to the operation of the pneumatic and electrical controls and referring especially to Figs. 2 and 3, where details of structure are illustrated, the force exerted on the pressure differential diaphragm 203 progressively increases with continued dust collection, until it attains sufficient value to displace the diaphragm upwardly against the resistance of spring 203*a* until stem 241 is lifted to slightly open valve 240, whereupon high suction is applied to the upper surface of diaphragm 270 and permits atmospheric pressure to fully open valve 240 and to hold it open. This allows high suction to operate pneumatically functioning device 250 which in turn through link 254 and latch pin release arm 75, etc., selectively positions pin 70 so that pin 70 is prevented from relatching by being overridden by the under side of superpositioned latch bar 63. The actual release and ejection of the dust bag 56 is subsequently effected by the more substantial movement or more complete opening of cover 34 the lug 16*c* of which finally releases switch deenergizing mechanism 113. The decelerating motor fan unit causes a drop in the suction air current. This frees latch bar 63 for further forward travel, causes latch spring 62 to ride down the inclined edge 56*b* of cam bracket 56*c* to release lug 52*b* holding ejection plate 52.

Thus, substantially simultaneously with the withdrawal of pin 70, release arm 75, Fig. 2, trips cover releasing latch 100 which holds cover assembly 34 closed against spring tension. The release of cover 34 first breaks a circuit at the contact points of switch 310, Fig. 1, by a lug 16*c* releasing sliding mechanism 113 which latter is biased by spring 114 to throw switch 310 to off position, thereby deenergizing the motor fan unit. Thereafter, the front cover continues its opening movement, moving substantially 90°, while the suction air current drops sufficiently to release the bag ejector mechanism 51 through a previously traced series of steps, allowing the bag ejector plate 52, Fig. 1, to push the bag forward and throw the bag and its contained dirt out of the cleaner casing.

In accordance with the improved control device of this invention, means is provided for adjusting the pressure on spring 203*a* with the aid of an internally threaded knob 300 cooperating with the externally threaded sleeve 302 having a hollow center bore in which is compressed the spring 203*a*. The other end of spring 203*a* presses against the flared end of cup shaped spring holder 304 which in turn is affixed to the bottom of control diaphragm 203.

Thus, the rotation of knob 300, which is held in place on lower casting 201 by retaining plate 306 and appropriate fastening screws and is sealed thereagainst by sealing ring 308, causes sleeve 302 to either increase or decrease the compression of spring 203*a*. By this adjustment the differential pressure at which diaphragm 203 contacts and actuates valve stem 241 can be adjusted from the exterior of casing 30. Increasing the compression of spring 203*a* results in increasing the differential pressure necessary to be established by dust collection within the cleaner bag in order to enable diaphragm 203 to contact valve stem 241 and open valve 240. This causes actuation of the power diaphragm 250 and results in any one of a number of subsequent steps, such as opening the cover, sounding of an audible or visual signal, ejection of the dust bag, etc.

Thus, with this type of structure, an operator is readily able to vary the spring load to any desirable limit and thus predetermine the point at which valve 240 opens and automatic operation takes effect, since knob 300 is shown extending through an opening in casing 30, Fig. 1, and hence is readily accessible to the operator for adjustment.

The various details forming the elements of the ejector system, the latching system, etc., among other structural elements not being a part of this particular invention may be readily understood by those skilled in the related art by referring to various other applications and Letters Patent among which may specifically be cited U. S. Patent No. 2,642,151 to L. P. Borkoski, et al.

It is to be understood that the embodiment herein specifically described is merely illustrative and not limitative of this invention, the scope of which is to be determined solely by the appended claims.

What is claimed is:

1. In combination with a vacuum cleaner having a dust separating member and means for producing flow of air therethrough, a pneumatically actuated element for controlling the operation of said cleaner, a differential pressure diaphragm movable in response to variations in pressure drop of air passing through said dust separating member, valve means operable by a predetermined movement of said diaphragm for controlling flow of air between said pneumatically actuated element and said means for producing flow, a spring for resisting movement of said diaphragm in the direction causing operation of said valve, and manually operable means for varying the tension of said spring.

2. In combination with a vacuum cleaner having a casing, a dust separating member and means for producing flow of air therethrough disposed in said casing, a pneumatically actuated element for controlling the operation of said cleaner, a housing, a differential pressure diaphragm dividing said housing into a high suction chamber and a low suction chamber, means for connecting said high suction chamber to a point in said casing between said dust separating member and the flow producing means, means for connecting said low suction chamber to a point in said casing ahead of said dust separating member, valve means operable by a predetermined movement of said diaphragm for controlling flow of air between said pneumatically actuated element and said flow producing means, a spring disposed in said low suction chamber for resisting movement of said diaphragm in the direction causing operation of said valve, and manually operable means for varying the tension of said spring.

3. In combination with a vacuum cleaner having a casing enclosing dust separating means and suction producing means for causing flow of air therethrough, a pneumatically actuated element for controlling the operation of said cleaner, a housing, a diaphragm dividing said housing into a low suction chamber and a high suction chamber, conduit means for connecting said high suction chamber to a point in said casing between said dust separating means and said suction producing means, conduit means for connecting said low suction chamber with a point in said casing ahead of said dust separating means, a spring retainer secured to said diaphragm and extending into said low suction chamber, an abutment disposed in said low suction chamber, a spring compressed between said retainer and said abutment, and means operable from the exterior of said low suction chamber for changing the position of said abutment to alter the compression of said spring.

4. In combination with a vacuum cleaner having a casing, a dust separating member and means for producing flow of air therethrough disposed in said casing, a pneumatically actuated element for controlling the operation of said cleaner, a housing disposed underneath said casing, a differential pressure diaphragm dividing said housing into an upper high suction chamber and a lower low suction chamber, means for connecting said high suction chamber to a point in said casing between said dust sepa-

rating member and the flow producing means, means for connecting said low suction chamber to a point in said casing ahead of said dust separating member, valve means operable by a predetermined movement of said diaphragm for controlling flow of air between said pneumatically actuated element and said flow producing means, a spring disposed in said low suction chamber for resisting movement of said diaphragm in the direction causing operation of said valve, and manually operable means extending through the bottom wall of said housing from within said lower chamber for varying the tension of said spring.

5. In combination with a vacuum cleaner having a casing enclosing a dust separating member and means for producing flow of air therethrough disposed in said casing, a pneumatically actuated element for controlling the operation of said cleaner, a differential pressure diaphragm movable in response to variations in pressure drop of air passing through said dust separating member, valve means operable by a predetermined movement of said diaphragm for controlling flow of air between said pneumatically actuated element and said means for producing flow, a spring for resisting movement of said diaphragm in the direction causing operation of said valve, manually operable means for varying the tension of said spring, and an auxiliary assist diaphragm associated with said valve means and effective upon the opening of said valve to hold said valve in its open position.

6. In combination with a vacuum cleaner having a

casing, a dust separating member and means for producing flow of air therethrough disposed in said casing, a pneumatically actuated element for controlling the operation of said cleaner, a housing, a differential pressure diaphragm dividing said housing into a high suction chamber and a low suction chamber, means for connecting said high suction chamber to a point in said casing between said dust separating member and the flow producing means, means for connecting said low suction chamber to a point in said casing ahead of said dust separating member, valve means operable by a predetermined movement of said diaphragm for controlling flow of air between said pneumatically actuated element and said flow producing means, a spring disposed in said low suction chamber for resisting movement of said diaphragm in the direction causing operation of said valve, manually operable means for varying the tension of said spring, and an auxiliary assist diaphragm associated with said valve means and effective upon the opening of said valve to hold said valve in its open position.

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