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PNEUMATIC MECHANISM FOR RENDERING A VACUUM CLEANER INOPERATIVE IF NO BAG IS IN PLACE

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My invention relates to vacuum cleaners and more particularly to vacuum cleaners of the tank or canister type in which the dust bag is concealed from view within the casing of the cleaner.

With cleaners of this type it is necessary to periodically remove the dust bag in order to empty it or, if it is a disposable bag, to dispose of it with its contents. In either case it sometimes occurs that the operator forgets to replace the dust bag or to insert a new disposable bag, with the result that the dirt drawn into the cleaner during subsequent operation of the machine fouls the fan and motor and, if the machine is not provided with a filter, a large percentage of the dirt passes through the cleaner and is discharged into the air in the room.

If the cleaner is of a type using a disposable bag having a relatively stiff air impervious cardboard disc formed with a small inlet opening the removable cover of the cleaner may be so constructed that it does not seal the dust bag compartment, the aforementioned cardboard disc being relied upon for this purpose. Consequently, if no dust bag is in position within the cleaner, the dust bag compartment will not be sealed, but will be open to the atmosphere so that if the motor-fan unit is operated relatively clean air will be drawn directly into the dust bag compartment and little or no flow will take place through the hose, inasmuch as the latter path offers a greater resistance to flow. Hence, while the motor-fan unit may be operated, no dirt will be drawn into the cleaner. Such arrangements are shown in Patent No. 2,567,221, issued September 11, 1951, to G. E. Lofgren and Patent No. 2,641,330, issued June 19, 1953, to Lofgren and Rawski.

However, with an arrangement of this nature it is not possible to use a permanent cloth bag having a wide open mouth, as is preferable for easy emptying, as the dust bag compartment would not be sealed when such a bag is in place. Accordingly, it is an object of my invention to provide an arrangement whereby a cloth dust bag or a disposable dust bag may be employed, together with means for preventing operation of the vacuum cleaner in the event no bag is placed therein. More particularly, my invention includes pneumatically operated means for releasing the latch which normally secures the front cover in closed position, together with means responsive to the absence of a dust bag for connecting the pneumatic means to the fan so that, if a bag is not in position, as soon as the motor-fan unit is started the suction produced thereby is communicated to the pneumatic means so as to cause it to immediately open the latch. On the other hand it is desirable to have a dust separating member so as to automatically stop the operation of the cleaner when the bag requires emptying.

Further objects and advantages of my invention will be apparent from the following description considered in connection with the accompanying drawings which form a part of this specification and of which:

Fig. 1 is a view partially in cross-section of a vacuum cleaner including one embodiment of my invention and showing the cleaner with a disposable bag in place therein;

Fig. 2 is a cross-sectional view similar to Fig. 1, but on a larger scale and showing a cloth bag in the cleaner;

Fig. 3 is a cross-sectional view similar to Fig. 2, but showing the cleaner with no bag in position;

Fig. 4 is a cross-sectional view of another embodiment of my invention with a disposable bag in the cleaner;

Fig. 5 is a cross-sectional view similar to Fig. 4, but showing a cloth bag; and

Fig. 6 is a similar cross-sectional view, but showing no bag in the cleaner.

Referring more particularly to Figs. 1 through 3, reference character 10 designates generally the housing of a tank type vacuum cleaner, in one end of which is located a motor-fan unit 12 having an inlet 14. The space 16 within the housing 10 to the left of the motor-fan unit, as viewed in Fig. 1, is a dust bag compartment in which is disposed a bag supporting member 18 formed with a large number of perforations 20. The open end of member 18 is secured to a ring 22 fastened to the open end of casting 16.

A cover or closure member 24 is pivotally and removably secured to the ring 22 by means of a hinge 26. A latch member 30 is pivotally mounted at 32 in the cover diametrically opposite from the hinge 26 and is provided with a spring 34 urging it in a counter-clockwise direction, as viewed in Figs. 1 through 3. The upper part of ring 22 is provided with a pair of ears 36 extending forwardly therefrom and between which is disposed a keeper in the form of a bar or pin 38. As seen in Figs. 1 and 2, the latch 30 is in engagement with the pin 38 so as to hold the cover closed.

Latch 30 has a button portion 49 which extends outwardly through an opening in the cover 24 so as to be accessible for manual operation. The latch 30 also has attached thereto an arm 42 which is engaged by a stem 44 connected to a diaphragm 46 which constituted one wall of a diaphragm chamber 48 formed in the cover. The interior of chamber 48 is connected by means of a conduit 50 with a space 52 within the housing of a differential pressure responsive device designated generally by reference character 54.

This device includes a pressure responsive diaphragm 56, the right-hand side of which, as viewed in Fig. 1, is subjected through a conduit 58 to the pressure existing within an inlet conduit 60 carried by the front cover. The other side of the diaphragm 56 is subject to the suction produced by the motor-fan unit and communicated through the dust bag compartment 16, a short conduit 62 carried by the ring 22 and a conduit 64 in the cover 24. The ends of conduits 62 and 64 are in sealing relationship with each other when the cover 24 is closed. The diaphragm 56 is biased to the right by means of a spring 66. A valve member 68 is slidably mounted in the device 54 and is attached to a valve stem 70 which is disposed so as to be contacted by the diaphragm 56 when the latter moves to the left. A spring 72 tends to seat the valve 68. As previously described, high suction from the fan will be communicated to the left side of the diaphragm 56 and, if the valve 68 is opened by movement of the diaphragm to the left, this suction will be communicated through the space 52 and the conduit 50 to the diaphragm chamber 48, thus moving the diaphragm 46 to the left so as to pivot the latch 30 in a clockwise direction to thereby disengage it from the
keeper 38. The latch 30, diaphragm chamber 48 and control devices 54 are enclosed within the cover 24 by a plate 73.

This vacuum cleaner is designed to employ either a disposable paper dust bag or a cloth bag which may be emptied and used repeatedly. In Fig. 1 there is shown a disposable bag designated generally by reference character 74. This bag includes a substantially rigid air impervious cardboard disc 76 to which is secured a bag portion 78 made of pervious paper so that the air may pass through while the dust is retained therein. The disc 76 is formed with a centrally located aperture through which extends the inlet conduit 60 when the cover is closed. Plate 73 of the cover preferably carries a gasket member 80 which surrounds the inlet conduit 60 and bears against the disc 76 so as to hold the outer perimeter or flange portion of the latter against a seat formed by a gasket 82 carried by the ring 72. A gasket 83 carried by plates 73 contacts the flange portion around its outer edge and aids in holding it against gasket 82.

In Fig. 2 there is shown a cloth bag 106 secured to a metal ring 108 having an outwardly extending flange portion 110, which is clamped between gaskets 82 and 83. The outer end of conduit 60 is formed as one part of a separable coupling so that a flexible hose carrying the other part of the coupling may be connected there-to. Operation of the motor-fan unit 12 serves to draw air in through the hose and conduit 60 to the interior of the dust bag, which separates from the air any dirt entrained therewith, the clean air passing through the pervious material of the bag.

Secured to the upper side of housing 10 is a bracket 84, which is disposed between the casing and a trim piece 85. This bracket is formed with a rear upwardly extending arm 90 having a slot formed therein. A rod 94 extends through the slot 90 and through an aligned opening formed in ring 22. A coil spring 96 is disposed around rod 94 and is confined between arm 90 and a collar or flange 98 formed on the rod. Consequently, this spring tends to move the rod 94 to the left, as viewed in Fig. 1. The right-hand end of the rod 94 is connected to the operating member 100 of an electric switch, the arrangement being such that when the rod is moved to the left under the influence of spring 96, the rod moves the member 100 to the off position. The left end of the rod which projects through the opening of the ring 22 is disposed so as to contact a projection 101 on the cover 24 when the latter is closed, the closing of the cover pushing the rod to the right so as to compress the spring 96. Hence, when the cover is released by the disengagement of latch 30 from the keeper 28, the rod 94 under the influence of spring 96 starts to pivot the cover to open position.

Connected to diaphragm chamber 48 is a conduit 102 which leads to a resilient funnel shaped member 104 carried by the plate 73. This funnel shaped member is so positioned that if a disposable dust bag is in position within the cleaner the cardboard disc 76 thereof serves to close the end of the member as is shown in Fig. 1. Likewise, if the cloth bag 106 is in the cleaner, as shown in Fig. 2, the metal flange 110 of ring 108 serves to block the end of member 104. However, if there is no dust separating member in the cleaner, the end of member 104 is open and is in communication with the dust bag compartment 16, as is shown in Fig. 3. Filter disc 76 hence acts in conjunction with member 104 as a simple valve for controlling flow through conduit 102 from chamber 48 to the dust bag compartment 16.

Thus, if no bag is in the cleaner, the front cover 24 may be closed and the latch will engage the keeper 38 so as to secure the cover in closed position. However, as soon as the motor-fan unit is started, the suction produced thereby is communicated through the dust bag compartment to the member 104 and thence through conduit 102 to diaphragm chamber 48. This causes the diaphragm 46 to be moved to the left, as viewed in the figures, thus pivoting latch 30 so as to disengage it from the keeper. The rod 94, under the influence of spring 96 moves to the left, opening cover 24 and stopping the motor by opening switch 100. Hence, although the cover may be closed with no bag in the cleaner, operation of the motor-fan unit immediately releases the front cover latch, thus permitting the cover to open and the motor to be shut off and hence prevents continued operation of the cleaner. On the other hand, if either a disposable dust bag or a cloth bag is in the cleaner, the end of member 104 is sealed by the cardboard disc 76 or the metal flange 110, respectively, and consequently the suction resulting from operation of the motor-fan unit is not communicated through the conduit 102 to the diaphragm chamber, and hence the latch is not released.

Continued operation of the cleaner with a dust bag in position results in accumulation of dirt within the bag which increases the pressure drop there through. This causes a pressure differential to act on the diaphragm 46, the greater suction being applied to the left-hand side of the diaphragm through the conduits 62 and 64, while the lesser suction is applied to the other side through the conduit 60. This causes the diaphragm 46 to move to the left against the force of spring 66 and when a predetermined pressure drop has occurred this movement of the diaphragm will be sufficient to unseal the valve 68, thus communicating high suction through the conduit 59 to the diaphragm chamber 48, which causes the diaphragm to move to the left to thereby release the latch 30, whereupon the cover is opened and movement of the rod 94 under the influence of spring 96 serves to move the switch 100 of the off position.

If automatic stopping of the cleaner upon the attainment of a predetermined pressure drop through the bag is desired, the air or dust pressure responsive device 54 may be omitted and the diaphragm 46 used only to unlatch the cover when no bag is in the cleaner.

In the embodiment illustrated in Figs. 4, 5 and 6 the chamber to the right of the diaphragm 56 in the differential pressure responsive device 54 is provided with a port 112 communicating with the space within the cover 24 and hence with atmospheric pressure. A valve 114 is provided for closing this port and a spring 116 serves to urge this valve towards open position and in contact with the inner side of plate 73. Pivoted mounted on the outer side of plate 73 is a lever 118 having an intermediate projection 115 in contact with a valve 114 which extends through an opening in plate 73. The lever is so positioned that if there is a paper bag in the cleaner, as shown in Fig. 4, when the cover 24 is closed the disc 76 of the bag strikes the free end of the lever and pivots it in a clockwise direction so as to close the valve 114. Likewise, if a cloth bag 106 is in the machine, as illustrated in Fig. 5, the free end of the lever 118 strikes the flange 110 of the dust bag ring 108 when the cover is closed, thus forcing the valve 114 to closed position. However, if no bag is in the cleaner, as shown in Fig. 6, the lever 118 strikes nothing and the spring 116 holds the valve 114 in open position, thus connecting the space to the right of the diaphragm 56 directly with the atmosphere.

Under the latter condition, as the motor-fan unit is started, air is communicated through the conduits 62 and 64 to the left-hand side of the diaphragm 56. While full fan suction also exists in the inlet 60 to which is connected the conduit 58, nevertheless this has little or no effect on the right-hand side of the diaphragm 56, due to the fact that the chamber on this side of the diaphragm is open to the atmosphere and consequently atmospheric pressure is applied to this side of the diaphragm. Hence, the diaphragm is immediately moved to the left against the force of spring 66, thus opening valve 68 which permits the full fan suction to be con-
communicated therethrough and through conduit 50 to diaphragm chamber 48. This causes the diaphragm 46 to be moved to the left to thereby release the latch 30 from engagement with the keeper 38, whereupon the rod 94 under the influence of screw 96 starts to open the cover 24 and at the same time shifts the switch 100 to the off position.

On the other hand, if either a cloth bag or a disposable bag is in position in the cleaner, the valve 114 is held in closed position, as previously described, and if the bag is clean substantially the same pressure will exist on both sides of the diaphragm 56 and hence the valve 68 will remain closed until, such time as the accumulation of dirt in the dust bag has increased the pressure drop therethrough to such a value that the resulting pressure differential acting on the diaphragm 56 is sufficient to cause it to open the valve 68, whereupon the cover is unlatched and the motor stopped, indicating that the bag should be emptied or, if it is a disposable one, replaced with a clean one.

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

Certain subject matter disclosed but not claimed herein constitutes the claimed subject matter of my copending divisional application Serial No. 803,755, filed April 2, 1959.

What I claim is:

1. In a vacuum cleaner, a casing forming a filter compartment having an opening, a filter member introduceble into said compartment through said opening, said filter member including an air-impervious portion, means for producing flow of air through said filter compartment, a closure for said opening, latch means for releasably securing said closure in closed position, pneumatically operated means for releasing said latch means, a conduit extending from said pneumatically operated means to said compartment for connecting the former with said means for producing flow of air independently of said pressure responsive means, the end of said conduit being disposed so as to be closed by said impervious portion when said filter is in said compartment.

2. In a vacuum cleaner, a casing forming a filter compartment having an opening, a filter member introduceble into said compartment through said opening, said filter including an air impervious portion, means for producing flow of air through said compartment, a closure for said opening, latch means for releasably securing said closure in closed position, pneumatically operated means for releasing said latch means, pressure responsive means operating upon a predetermined pressure drop through said filter member for connecting said pneumatically operated means with said means for producing flow of air, and a conduit extending from said pneumatically operated means to said compartment for connecting the former with said means for producing flow of air independently of said pressure responsive means, the end of said conduit being disposed so as to be closed by said impervious portion when said filter is in said compartment.

3. In a vacuum cleaner, a casing forming a filter compartment having an opening, a filter member introduceble into said compartment through said opening, said filter member including an air-impervious supporting portion, means for producing flow of air through said filter compartment, a closure for said opening, latch means for releasably securing said closure in closed position, pneumatically operated means for releasing said latch means, control means responsive to a predetermined pressure drop through said filter member for connecting said means for producing flow of air to said pneumatically operated means, and a conduit for connecting said means for producing flow of air to said pneumatically operated means independently of said control means, the end of said conduit being disposed so as to be closed by said impervious portion when said filter member is in said compartment.

4. In a vacuum cleaner, a casing forming a dust bag compartment having an opening, means forming a seat around said opening, a dust bag introducible into said compartment through said opening and having an air-impervious supporting portion receivable on said seat, means for producing flow of air through said filter compartment, a cover for said opening hinged to said casing and pivotable to a closed position clamping said supporting portion against said seat, latch means for releasably securing said closure in closed position, pneumatically operated means mounted on said cover for releasing said latch means, and a conduit carried by said cover and connected to said pneumatically operated means, said conduit having an open end so disposed that, when said cover is in closed position, said open end is closed by contact with said impervious portion when said dust bag is in said compartment and communicates with said compartment and thereby connects said pneumatically operated means with said means for producing flow of air when said bag is absent.

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