DEVICE FOR SIGNALING NEED FOR CLEANING OR REPLACING SUCTION CLEANER DUST BAG

Filed July 14, 1965
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Filed July 14, 1965, Ser. No. 471,879
Claims priority, application Sweden, July 17, 1964, 8,753/64
6 Claims. (Cl. 116—70)

My invention relates to suction cleaners of the kind which employ a removable dust bag or dirt collector, and it is an object of the invention to provide an improved device for automatically signaling or indicating when such a dust bag should be removed to be cleaned or replaced by a new bag.

More particularly, it is an object of my invention to provide such a signaling or indicating device which functions responsive to the pressure differential at opposite sides of the dust bag and can be adjusted at will so that it will be rendered operable over a wide pressure differential range and may even be rendered inoperable when the need for doing so arises. When the quantity of dust and dirt collected in a dust bag becomes sufficiently great and the efficiency of the suction cleaner is reduced, the pressure differential at the opposing sides of the dust bag increases. In accordance with my invention, the signaling or indicating device may be provided with a manually operable control which is readily accessible at the exterior of the suction cleaner and can be adjusted to produce a signal or indication when the pressure differential at the opposing sides of the dust bag is extremely small or very great. The control also may be operatively connected with the device so that it will become ineffective to produce a signal or indication when the pressure differential at opposing sides of the dust bag increases due to dust and dirt collected in the dust bag.

Further objects and advantages of my invention will become apparent from the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention, reference may be had to the following description taken in connection with the accompanying drawing in which the single figure is a fragmentary elevational view of a suction cleaner, partly in section, embodying my invention.

Referring to the drawing, the suction cleaner which I have shown embodying my invention comprises a casing 10 having front and rear end covers 11 and 12, respectively, secured thereto in any suitable manner. The casing 10 includes an aperture end wall 14 which is fixed thereto in any suitable manner and with which the front end cover 11 coats when it is moved to its closed position illustrated in the drawing. A space 15 within the casing 10, which is located adjacent to the end wall 14, is adapted to receive a dust bag or dirt collecting member 16. The dust bag 16 comprises a filter 17, which may be formed of fabric or paper or other suitable material which is permeable to air, and a part 18 of annular form which is fixed to the bag at its open end. The part 18, which may be ring-shaped and serves as a reinforcement, is formed with an outwardly extending flange to which is fixed a gasket or sealing member 19 formed of an elastomeric material like rubber, for example.

The front end cover 11 is formed with a central opening 20 at which region a hollow tubular member 21 extends inward therefrom. A suction hose (not shown) is adapted to be removably connected to the tubular member 21 in any suitable manner. Dirt laden air is drawn through the suction hose into the interior of the casing 10 by a motor-fan unit (not shown) which may be located adjacent to the dirt collecting member 16.

The inside of the front end cover 11 is provided with wall members of annular form respectively defining a hollow passage 22 adjacent to the tubular member 21 and a cavity or recess 23 disposed adjacent to the passage 22. The front end cover 11 further includes a substantially flat apertured plate 24 which is detachably connected in any suitable manner (not shown) to the wall members therein. Although I do not wish to be limited thereto, the plate 24 may be formed with a central opening 24a in alignment with and abutting the inner open end of the tubular member 21 and include a ring-shaped outer peripheral section 246. The end wall 14 is formed with a lip or flange 25 which is of annular form and defines an access opening 26 into the space 15. The front end cover 11 functions to close the access opening 26 and also effectively hold the gasket 19 between the end wall 14 and the ring-shaped outer peripheral section 246 of the plate 24.

During operation of the suction cleaner, air is drawn to the interior of the casing 10 through the hollow tubular member 21 in the front end cover 11. Dirt entrained in the air during cleaning collects in the filter dust bag 16 and air free of such dirt passes through the dust bag and flows through the casing 10 and eventually may be discharged by the motor-fan unit through an end opening 48 in the rear end cover 12. Since dirt is trapped at the inner surface of the dust bag 16, there is a tendency for the dust collecting member 16 to become clogged during operation of the cleaner, the pressure differential at opposite sides of the dust bag 16 becoming increasingly greater responsive to dirt trapped at the inner side of the dust bag which is essentially prevented by the dirt laden air.

In accordance with my invention, in order to indicate when the dust collecting member 16 should be cleaned or replaced by a new dirt collecting member, I provide a device 27 which automatically is rendered operable responsive to a predetermined pressure differential at opposite sides of the dust bag 16 to produce a signal or other suitable indication. The device 27 is associated with the front end cover 11 and forms a unitary part thereof.

The signaling device 27 comprises a member 28 which is formed of elastomeric material, such as rubber or soft plastic, for example, which includes an outer section 28a which serves as a diaphragm 28b which overlies the inner end of the passage 22, and an outer section 28b which overlies the open end of the cavity or recess 23 and may be referred to as a tab which projects radially outward from the diaphragm 28a. As shown in the drawing, the elastomeric member 28a is clamped against the inner end of the passage 22 and the open end of the cavity 23 by the plate 24.

A member 29 is disposed in the passage 22 and is axially movable therein toward and from the diaphragm 28a which functions as a valve member. The member 29 comprises a hollow sleeve 30 which is in threaded engagement with the wall of the passage 22, as indicated at 31, and is formed with an internal shoulder 32 intermediate its ends, the parts of the sleeve at the left and right of the shoulder 32 being of different diameters.

A flange 33 extends radially outward from the periphery of the sleeve 30 at the narrow diameter end thereof, such flange being radially spaced from the threaded section of the sleeve to form a recess 34 in which a sealing ring 35 is disposed to provide an air-tight seal between the wall of the passage 22 and the periphery of the sleeve 30. Further, a control knob 36 projects axially outward from the narrow diameter end of the sleeve 30 and may be provided with a suitable finger grip.
(not shown) to facilitate turning the member 29 so that the sleeve can be moved axially toward and from the diaphragm 28a.

A cup-shaped element 37 having a cavity 38 snugly fits within the larger diameter end of the sleeve 30. A metal reed 39 is held against the shoulder 41 by the open end of the cavity 38 of the cup-shaped element 37. A helical spring 40 disposed within the cavity 38 between the closed end of the cup-shaped element 37 and the reed 39 biases and urges the latter in a direction toward the control knob 36. The closed end of the cup-shaped element 37 is formed with a central opening 36 and a lip 42 which is disposed about the opening and serves as a seat for the diaphragm or movable valve member 28a.

The plate 24 is formed with an opening 43 in which a member 44 is axially movable, the member 44 being in threaded engagement with the wall of the opening 43 at 45. The member 44 essentially serves as a screw and may be formed with a slot 44' at its outer or right-hand end so that it is axially adjustable within the opening 43 toward and from the diaphragm 28a when the front end cover 11 is moved to an open position from its illustrated closed position. A smaller screw 46 is in threaded engagement at 47 within an opening in the member 44, the screw 46 being provided with a slot 46' at its outer or right-hand end so that it can be axially adjusted within the member 44 when the front cover 11 is moved to an open position from its illustrated closed position. The diaphragm 28a is biased against the seat 42 by a helical spring 49, one end of which bears against the diaphragm 28a and the opposite end of which bears against an external shoulder 50 at the outer periphery of the member 44.

The tubular member 21 is formed with a passage 51 so that a space 52 formed between the closed end of the cup-shaped member 37 and the diaphragm 28a, when the latter closes the passageway or opening 41, is substantially at the same pressure as the pressure within the dust bag 16. During operation of the suction cleaner when air is drawn into the inlet 20, the pressure in the space 52, at the left side of the diaphragm 28a, will be the same as the pressure existing within the dust bag 16 at the side thereof which is initially contacted by the air.

The outer tub 25b of the elastomeric member 28 is formed with a hollow sleeve 53 which extends through an opening in the plate 24 and communicates with an opening 54 in the end wall 14 when the front end cover 11 is in its closed position illustrated in the drawing. With this construction, a passageway is provided so that the space 55 at the right side of the diaphragm 28a, between the diaphragm and the plate 24, is substantially at the same pressure as the pressure in the space 15 at the outer surface of the dust bag 16. This passageway from the space 15 to the space 55 includes the hollow sleeve 53, cavity 55, an opening 56 in the tub 25b, and a radially extending groove 57 at the left side of the plate 24 which is directly opposite the opening 56 and at its inner end communicates with the space 55.

During operation of the suction cleaner, dust laden air is drawn into the casing 10 through the central opening 20 in the front end cover 11 and flows through the tube 21 into the dust bag 16. Dirt is trapped in the dust bag and air separated from such dirt passes into the space 15. When the dust bag 16 is clean, the pressure differential at opposite sides of the dust bag is relatively small. Under these conditions, the pressure in the space 55, aided by the biasing action of the spring 49, will be effective to maintain the diaphragm 28a in its illustrated closed position in contact with the seat 42 so that the fluid within the space 52 cannot pass into the passageway or opening 41. However, when the dust bag 16 becomes clogged due to dust and dirt collected therein, and the pressure differential at opposite sides of the dust bag 16 reaches a definite value, the pressure in the space 55 will be reduced sufficiently to allow the diaphragm 28a to move from the seat 42.

When the pressure in the space 55 decreases to such an extent that the pressure in the space 52 will be effective to open passageway 41 against the biasing action of the spring 49, air drawn into casing 10 through the inlet opening 20 can flow at a relatively high velocity from the tube 21, passage 51, space 52, passageway or opening 41, cavity 38 and axially extending passage 58 in the control knob 36 to the atmosphere. The air flowing through the cavity 38 of the cup-shaped element 37 and the dust bag 16 will cause the latter to vibrate rapidly and produce an audible sound. When such audible sound is produced, any one in the vicinity of the suction cleaner will become aware of the fact that the dust collecting member 29 should be withdrawn from the casing 10 for cleaning the latter or a fresh filter bag should be provided in the event that paper dust bags of the throw-away type are employed.

In view of the foregoing, it will now be understood that the diaphragm or valve member 28a is biased and urged against the seat 42 by the helical spring 49 which is disposed between the diaphragm 28a and the screw member 44 which can be axially moved within the opening 43 in the plate 24 to adjust the initial tension of the spring 49. The smaller screw 46 axially movable within the larger screw member 44 functions to limit the distance the member 29 can be moved toward the right in the drawing by the control knob 36. Hence, the smaller screw 46 serves as a stop to limit axial movement of the member 29 toward the right in the drawing.

The smaller screw 46 can be adjusted to such a position that the control knob 36 can be moved between first and second positions to regulate the pressure differential at the opposite sides of the diaphragm 28a at which the diaphragm will move toward and from the seat 42 and allow air to flow through the passageway or opening 41 to render the metal reed 39 operable to produce an audible sound. In the first position, which can be referred to as a zero or starting position, the diaphragm 28a can be rendered operable to move toward the right from its seat 42 and open the passageway 41 responsive to a slight pressure differential between the opposing sides of the dust bag 16. As the control knob 36 is rotated and moved from its first or starting position toward its second or final position and the member 29 is moved by increments toward the right in the drawing, the diaphragm 28a is rendered operable to move from the seat 42 and open the passageway 41 responsive to an increasingly greater pressure differential between the opposing sides of the dust bag 16. As pointed out above, the larger screw 44 can be moved axially in the opening 43 of the plate 24 to initially adjust the tension of the spring 49 and the pressure differential range in which the control device 27 will function responsive to movement of the control knob 36 between its first or initial position and its second or final position referred to above.

Further, the smaller screw 46, which functions as a stop to limit axial movement of the member 29, can be so positioned axially with respect to the member 29 that, when the control knob 36 has been moved to its second or final position or slightly past it, the diaphragm 28a will be locked and clamped between the seat 42 and the inner or left-hand end of the smaller screw 46. Under these operating conditions, the control device 27 will be rendered inoperable and the metal reed 39 responsive to an effective to produce an audible response irrespective of the pressure differential produced between the opposing sides of the dust bag 16.

The screws 44 and 46 permit certain preliminary adjustments to be made when the suction cleaner is being fabricated to suit the initial position of the seat 42, so that the different components of the control device 27. In this way, all suction cleaners embodying the control device 27 will function more or less in substantially the same way in the field to indicate to a user under substantially the same
operating conditions that the dust bag is clogged and reducing the efficiency of the suction cleaner and the dust bag shall be cleaned or replaced by a new dust bag.

Although I have shown and described a single embodiment of my invention, I do not wish to be limited to the particular arrangement set forth. For example, the signal or indication effected by the control device of the invention may be employed not only to produce an audible sound but may also be employed to actuate a switch in an electrical circuit to produce a visual signal or to disconnect the suction cleaner motor from the source of electrical supply to indicate the need for cleaning or replacing a dust bag. Therefore, I intend in the following claims to cover all modifications which do not depart from the spirit and scope of my invention.

I claim:

1. In a suction cleaner of the class described having a casing provided with an inlet and outlet for air adapted to flow therethrough and a dust bag therein for removing dirt from the air, the pressure differential at opposite sides of said dust bag becoming increasingly greater responsive to dirt trapped at the side thereof initially contacted by the air, the combination of a device for indicating the need for cleaning or replacing the dust bag due to dirt trapped therein, said device producing such indication with the aid of air and including a member which has a passageway therein and defines a dust bag element being accessible at the exterior of the end cover at the vicinity of the opening and having a passageway there through which is in communication with the passageway in said member.

2. Apparatus as set forth in claim 1 which includes structure to establish a path of flow of air through the casing from the side of said dust bag initially contacted by air to the passageway of said member, and said means responsive to the pressure differential at opposite sides of said dust bag to move said valve means from said seat for effecting flow of air through said passageway to render said device operable to produce said indication functioning to divert air flowing in the casing through said path of flow to said passageway to render said device operable to produce said indication and thence flow from said device to the atmosphere through the passageway in said control element.

3. In a suction cleaner of the class described having a casing provided with an inlet and outlet for air adapted to flow therethrough and a dust bag therein for removing dirt from the air, the pressure differential at opposite sides of said dust bag becoming increasingly greater responsive to dirt trapped at the side thereof initially contacted by the air, the combination of a device for indicating the need for cleaning or replacing the dust bag due to dirt trapped therein, said device producing such indication with the aid of air and including a member which has a passageway therein and defines a valve seat, valve means movable toward and from said seat for controlling flow of air for operating said device, means responsive to a pressure differential at opposite sides of said dust bag to move said valve means from said seat for effecting flow of air through said passageway to render said device operable to produce said indication, said member being movable toward and from said valve means, means for imparting movement to said member toward and from said valve means to regulate the pressure differential at opposite sides of said dust bag at which said device is rendered operable to produce said indication.

4. In a suction cleaner of the class described having a casing provided with an inlet and outlet for air adapted to flow therethrough and a dust bag therein for removing dirt from the air, the pressure differential at opposite sides of said dust bag becoming increasingly greater responsive to dirt trapped at the side thereof initially contacted by the air, the combination of a device for indicating the need for cleaning or replacing the dust bag due to dirt trapped therein, said device producing such indication with the aid of air and including a member which has a passageway therein and defines a valve seat, valve means movable toward and from said seat for controlling flow of air for operating said device, means responsive to a pressure differential at opposite sides of said dust bag to move said valve means from said seat for effecting flow of air through said passageway to render said device operable to produce said indication, said member being movable toward and from said valve means, means for imparting movement to said member toward and from said valve means to regulate the pressure differential at opposite sides of said dust bag at which said device is rendered operable to produce said indication, resilient means for biasing said valve means toward said seat, and means operable to act against said resilient means and movable toward and from the latter to adjust the magnitude of the biasing action of said resilient means.

5. In a suction cleaner of the class described having a casing provided with an inlet and outlet for air adapted to flow therethrough and a dust bag therein for removing dirt from the air, the pressure differential at opposite sides of said dust bag becoming increasingly greater responsive to dirt trapped at the side thereof initially contacted by the air, the combination of a device for indicating the need for cleaning or replacing the dust bag due to dirt trapped therein, said device producing such indication with the aid of air and including a member which has a passageway therein and defines a valve seat, valve means movable toward and from said seat for controlling flow of air for operating said device, means responsive to a pressure differential at opposite sides of said dust bag to move said valve means from said seat for effecting flow of air through said passageway to render said device operable to produce said indication, said member being movable toward and from said valve means, means for imparting movement to said member toward and from said valve means to regulate the pressure differential at opposite sides of said dust bag at which said device is rendered operable to produce said indication, resilient means for biasing said valve means toward said seat, a part, said part being movable toward and from said seat and operable to act against said resilient means and impart movement to said valve means toward said seat, and said part and said means for imparting movement to said member toward and from said valve means being operable to hold said valve means against said seat and render said device inoperable irrespective of the pressure differential at opposite sides of said dust bag.

6. In a suction cleaner of the class described having a
casing provided with an inlet and outlet for air adapted to flow therethrough and a dust bag therein for removing dirt from the air, the pressure differential at opposite sides of said dust bag becoming increasing greater responsive to dirt trapped at the side thereof initially contacted by the air, the combination of a device for indicating the need for cleaning or replacing the dust bag due to dirt trapped therein, said device producing such indication with the aid of air and including a member which has a passageway therein and defines a valve seat, valve means movable toward and from said seat for controlling flow of air for operating said device, means responsive to a pressure differential at opposite sides of said dust bag to move said valve means from said seat for effecting flow of air through said passageway to render said device operable to produce said indication, said member being movable toward and from said valve means, means for imparting movement to said member toward and from said valve means to regulate the pressure differential at opposite sides of said dust bag at which said device is rendered operable to produce said indication, spring means for biasing said valve means toward said seat, a first movable element, means including said first movable element to regulate the tension of said spring means and control the magnitude of the biasing action of said spring means, and said last-mentioned means including a second element which is carried by said first element and movable on the latter toward and from said valve means, and said second element and said means for imparting movement to said member toward and from said valve means being movable and operable to hold said valve means against said seat and render said device inoperable to produce said indication irrespective of the pressure differential at opposite sides of said dust bag.

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