

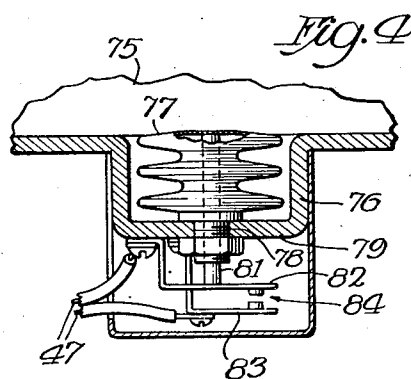
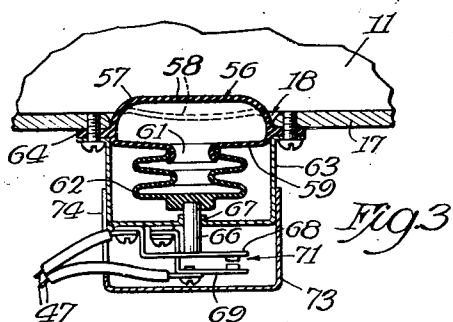
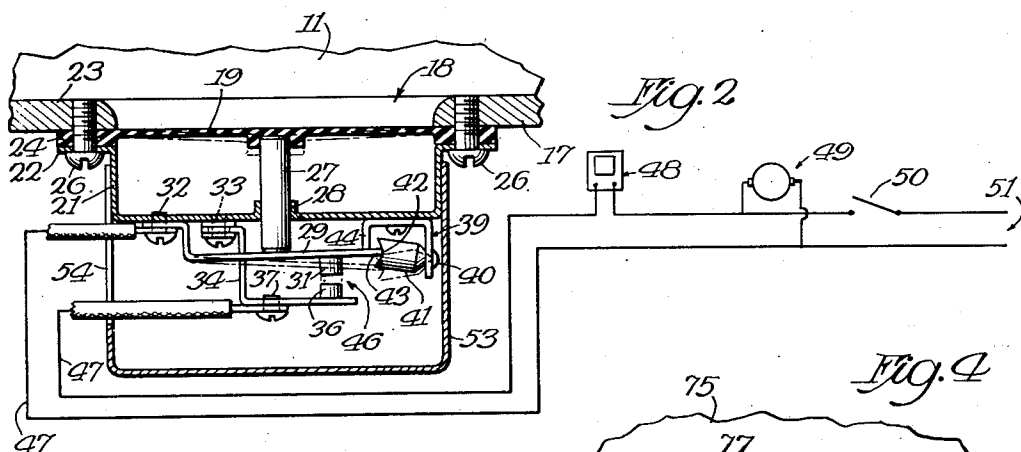
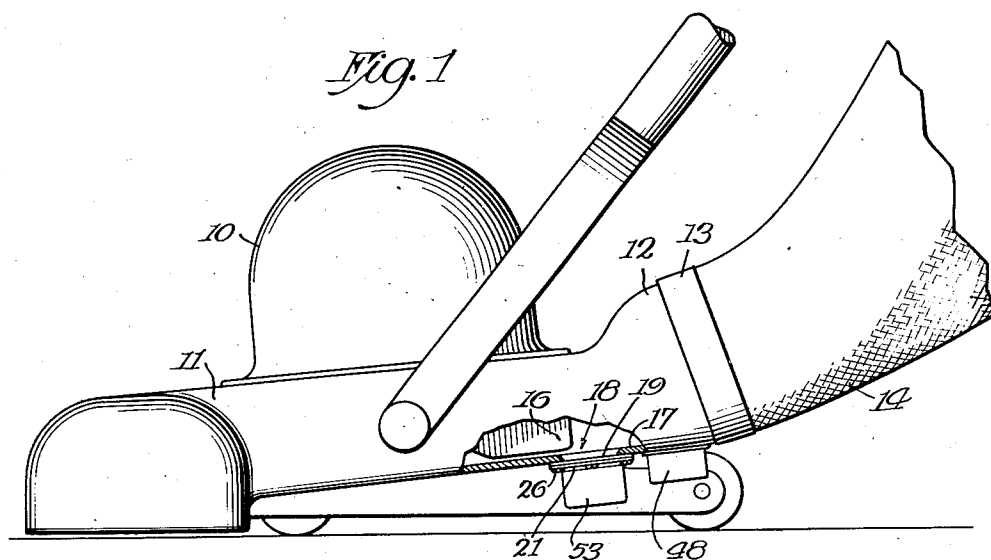
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PNEUMATIC DEVICE

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2,230,113

PNEUMATIC DEVICE

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1 Claim. (Cl. 200—83)

This invention relates to devices depending for their operation upon the movement of fluid. More particularly, the invention pertains to pneumatic devices such, for example, as vacuum cleaners.

It is an object of my invention to provide a device employing fluid with an alarm adapted to be actuated by the fluid as long as the fluid is at an abnormal pressure.

It is another object of my invention to provide means for signaling the operator when the dust bag of a vacuum cleaner is clogged.

It is a further object to provide a vacuum cleaner with an automatic signal adapted substantially continuously to apprise the operator that the dust bag should be emptied.

Another object is to provide a signal of this character depending for its operation upon the air pressure beyond the suction motor.

Further objects and advantages of the invention will appear as the description proceeds.

Three embodiments of my invention are illustrated on the accompanying drawing in which:

Fig. 1 is a fragmentary elevation of a vacuum cleaner embodying the invention, a portion being cut away to show one form of the invention.

Fig. 2 is an enlarged fragmentary sectional view of the form of the invention appearing in Fig. 1.

Figs. 3 and 4 are views similar to Fig. 2 but of two additional forms of the invention.

Referring now more particularly to the drawing, a device employing fluid, such as a vacuum cleaner of any suitable design, may be employed, that shown fragmentarily in Fig. 1 being merely illustrative. The cleaner has a suction motor casing 10 supported by a fan casing 11 which opens rearwardly at 12 into the mouth 13 of a dust bag 14, the portion of the casing between the fan and the bag constituting in effect a wind tunnel.

The device embodying the invention, whichever form it may take, may be made compact and to occupy a small space, and may be attached in any of a variety of places to vacuum cleaners of conventional design with little change if any, and without reorganization of the operative design. So that it may offer no obstruction and be substantially concealed, the device is preferably mounted on the elevated bottom wall of the suction fan casing 11.

In accordance with the form of the invention appearing in Figs. 1 and 2, the casing wall 17 has an opening 18 covered by a diaphragm 19

of rubber, metal or other suitable material. A cup 21 has a flange 22 between which and the margin 23 of the casing opening 18 is disposed the diaphragm flange 24, all fastened together airtight by any suitable means, such as screws 26.

Depending from the diaphragm is a switch actuating plunger 27 which passes through an opening 28 in the bottom of the cup 21 and engages a movable spring switch arm 29 having a switch contact 31 and cantilever-mounted at the binding post 32 on the bottom of the cup. Insulated from and supported by the cup at 33 is a relatively stationary switch contact arm 34 having a switch contact 36 in juxtaposition to the contact 31 and also having a binding post 37.

Also mounted on the bottom of the cup is a bracket 39 having a depression 40 forming a pivot bearing for a snap switch or toggle piece 41. This piece has at its other end a recess 42 in which is received in knife-edge bearing relationship the free end 43 of the switch arm or blade 29. The spring 29 and piece 41 form a toggle-like mechanism which is limited in its switch-opening movement by the bracket abutment 44 and requires pressure resisted by the spring in order to move from the position shown in full lines, when the switch 46 is open, to the closed position of the switch, shown in dotted lines.

From the binding posts 32 and 37 extend wires 47, one of which is connected to any suitable signal means such as an electric bell or buzzer 48. The buzzer is in series with the switch 46, and the fan motor 49 is connected in parallel therewith as shown. A hand switch 50 which may be of any suitable type controlled by the operator is connected in the circuit which may be plugged into the line 51.

Now it will be observed that when the switch 50 is closed the motor will commence turning and the vacuum cleaner will be in operation. The parallel circuit permits the motor to be operated irrespective of the condition of the switch 46. As the dust bag 14 fills up, the back pressure of the air therein increases due to the increased obstruction to escape of air from the bag, and the efficiency of the suction fan accordingly decreases. This pressure is exerted upon the diaphragm 19, and when it reaches a predetermined degree which indicates the bag is substantially full of dust, the diaphragm, whose flexure is resisted by the spring 29 as well as its own inherent resilience, is depressed to such an extent as to close the switch 46. This closes the part of the circuit containing the buz-

zer 48, which then apprises the operator that the bag is substantially full. The mechanism may of course be built to operate the buzzer for any condition of the bag, whether full, nearly full or otherwise. For example, this may be done by replacing the spring 29 by one which is more or less stiff, or on which the contact 31 is longer or shorter, or locating the contact 36 farther from or closer to the contact 31. The diaphragm 19 could be replaced by one more or less stiff, or the plunger 27 could be of less or greater length.

The operator, having been warned by the buzzer, will open the switch 50 and thereby stop both the motor and the buzzer, and the resultant reduction in air pressure will enable the spring 29 to reopen the switch 46, the parts then being arranged as shown in full lines in Fig. 2. When the bag has been emptied and reattached, the motor may again be turned on by the operator merely by closing the switch 50.

The buzzer switch mechanism is disposed substantially entirely outside the cup 21 where it is readily accessible for easy repair and replacement. The mechanism is extremely simple and involves few parts which are easy to produce, assemble and disassemble. The diaphragm 19 serves as a gasket protecting the switch mechanism from dust from the cleaner. The mechanism is further protected from injury and dust and the like by a guard or case 53 which may be readily slipped on and off the cup 21 and held by friction as shown, or by a bayonet connection or in any other suitable way. The case has a slot 54 to clear the wires 47 so that the case may be applied and removed without disturbing the wires or other parts.

In the form of the invention appearing in Fig. 3, a bellows type diaphragm 56 is employed. This diaphragm may be formed of a hollow rubber or other flexible element 57 having an inner part 58 projecting through the casing opening 18 and an outer part 59 having an opening 61 where communication is established between the element 57 and a bellows member 62 attached thereto. A cup 63 housing the member 62 has a flange between which and the casing wall 17 the flange 64 of the element 57 is secured in sealing position. Depending from the member 62 is a plunger 66 passing through an opening 67 in the cup 63.

When the bag is substantially full of dust, the increased air pressure will depress the inner part 58 of the element 57 as shown by the dotted line and increase the pressure in the diaphragm 56, expanding the bellows member 62 and the plunger 66, and the spring switch arm 68 toward the relatively stationary switch arm 69, carried by and insulated from the cup 63, closing the buzzer switch 71. This switch mechanism bears the same relation electrically to the buzzer, motor and hand switch as the first described buzzer switch mechanism. When the pressure upon the part 58 is relieved, it will be returned to its full line position by the resilience of the bellows element 62 and the spring 68 as they reassume their initial conditions. If desired, toggle means such as that shown in Fig. 2 could be employed in connection with the arm 68.

A protective case 73 like that shown at 53 in

Fig. 2 and slotted at 74 is removably mounted on the cup 63.

In the forms described it will be noted that the entire structure may be applied to and removed from the outside of the casing, and that to equip any manufactured fan casing with either form merely requires the formation of the opening 18.

In the form of the invention appearing in Fig. 4, the fan casing 75 as original equipment may be formed with a well 76 housing a spring bellows 77 whose hollow outer end may be threaded as at 78 or otherwise suitably secured to the base 79 of the well. Secured to the inner end of the bellows is a plunger 81 which passes through the connection 78 and engages a spring switch arm 82 carried by the base. When the excessive dust in the bag causes the increased air pressure to contract the bellows 77, the plunger 81 depresses the spring 82 which engages the relatively stationary switch arm 83, carried by and insulated from the well base 79, closing the buzzer switch 84. When the air pressure in the casing 75 is lower, the bellows 77 and arm 82 will spring to the positions shown.

A protective case 85 slotted at 86 for the wires 47 is frictionally or otherwise attached to the well 76.

The buzzer switch shown in Fig. 4 may replace that of Fig. 2 in the circuit shown. In Fig. 4, as in the other forms, the switch mechanism is readily accessible from the outside of the casing.

Although I have shown the invention as applied to a vacuum cleaner, I have done so for purposes of illustration only, since my invention may be of value in any installation where excessive, insufficient or other fluid pressure may be utilized to actuate an alarm. While I have shown an audible alarm, obviously a visual or other sensible signal could be employed instead of or with an audible signal.

I am aware that reversals of parts may be resorted to, and that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted hereon otherwise than as necessitated by the prior art.

I claim:

A fluid responsive switch comprising a fluid responsive diaphragm, an actuating element engaged with said diaphragm, a cup supporting said diaphragm and providing a guide for said element, a cup-like dust cap telescopically and removably mounted about said cup and forming a housing therewith, and a pair of electric switch contacts mounted in said housing, one of said contacts being movable into engagement with the other by said element when said diaphragm responds to the fluid, and wires connected to said contacts, said cap having a slot in its cup-engaging wall, said slot extending from and transverse to the rim of said cap to accommodate said wires so that the latter will not interfere with said cap as said cap is assembled with said cup, said wires passing transversely through said slot.

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