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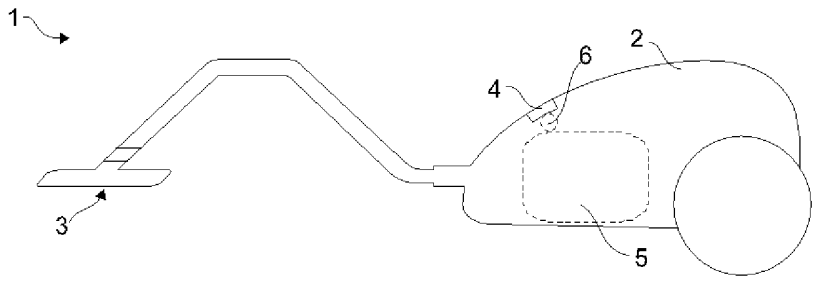
(54) Title: A VACUUM CLEANER



(57) Abstract: The present invention relates to a vacuum cleaner (1) comprising a dust indicator (6) the spring (9) stiffness of which can be adjusted.

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Description

A VACUUM CLEANER

[001] The present invention relates to a vacuum cleaner comprising an indicator that shows the level of fullness of the dust bag.

[002] In vacuum cleaners, the dust and dirt that is drawn through a suction inlet by creating a vacuum with the motor, is collected in a container or a bag. The filling up of this bag in time will result in a considerable reduction in the suction power of the vacuum cleaner and respectively more energy consumption.

[003] In the current state-of-the-art, various mechanical dust indicators showing the level of fullness of the bag have been designed to solve this problem.

[004] The mechanical dust indicators comprise a tube with one end opening into the vacuum chamber and the other to the atmosphere. The indicator functions on the principle of measuring the pressure difference between these two mediums. Usually a spring inside the tube and a piston connected to it is utilized for the process. When the said pressure difference is zero, the piston is pushed by the spring and rests on the end of the tube that opens to the atmosphere. When the motor operates creating a difference in pressure, the piston moves to a new point of equilibrium as it overcomes the pushing force of the spring by the resultant force acting on it. The position of the piston within the tube shows the fullness level of the dust bag. These types of indicators are described in European Patent no. EP0603590, British Patent no. GB470527, United States Patent no. US4060050 and International Patent Application no. WO9716110.

[005] The extent of piston movement in the mechanical indicators varies depending on the strength of the spring, the rate of compression, and the suction power of the motor. This necessitates the utilization of different springs in vacuum cleaners having different motor powers. Therefore indicators with different spring stiffnesses and compression rates are produced for different motor powers and the indicator that is suitable for the motor power is mounted on the vacuum cleaner during assembly. These phases render the production of vacuum cleaners difficult and increase costs.

[006] Furthermore, the indicator cannot measure the fullness level of the bag as required due to reasons like production tolerances etc. As a result, the user is misled, changing the bag when it is not yet full or not changing when full, operating the vacuum cleaner with low efficiency.

[007] In addition to all the above, in some vacuum cleaners, if the suction inlet is entirely clogged, the motor is burned by overheating. The indicator can also be utilized to create a bypass passage in order to prevent this. However, when the force exerted on the piston by the spring is not enough, this passage will open earlier than required

leading to a reduction in vacuum cleaner efficiency.

[008] A state-of-the-art embodiment is disclosed in the British Patent no. GB401195. This dust indicator comprises a spring, one end of which rests on a diaphragm which moves with pressure, and the other on a screwed element. Pointers connected to the diaphragm show the fullness of the bag.

[009] The aim of the present invention is to design a vacuum cleaner comprising a dust indicator that can be utilized with different motor powers.

[010] The vacuum cleaner designed to fulfill the objective of the present invention is shown in the annexed drawings, where:

[011] Figure 1 – is the schematic view of a vacuum cleaner.

[012] Figure 2 – is the schematic view of a dust indicator.

[013] Figure 3 - is the schematic view of an embodiment of a dust indicator wherein press-fitting method is utilized.

[014] Figure 4 - is the schematic view of an embodiment of a dust indicator having nails.

[015] Figure 5 - is the schematic view of another embodiment of a dust indicator having nails.

[016] Figure 6 - is the sectional perspective view of an embodiment of a dust indicator having grooves.

[017] Figure 7 - is the exploded perspective view of an embodiment of a dust indicator having grooves.

[018] Figure 8 - is the sectional perspective view of another embodiment of a dust indicator having grooves.

[019] Figure 9 – is the perspective view of a dust indicator having markings on the tube.

[020] Figure 10 - is the perspective view of a dust indicator having markings on the lid.

[021] Figure 11 - is the perspective view of a dust indicator having markings on the shaft.

[022] Elements shown in the figures are numbered as follows:

1. Vacuum cleaner
2. Body
3. Suction inlet
4. Window
5. Vacuum chamber
6. Dust indicator
7. Tube
8. Piston
9. Spring
10. Adjustment mechanism
11. Retainer
12. Lid

13. Shaft
14. Housing
15. Marking
16. Lock mechanism
17. Groove
18. Tongue
19. Nail
20. Washer
21. Slit
22. Rib
23. , 33. Opening
24. Stopper

[023] Vacuum cleaners (1) comprise a body (2) having a vacuum chamber (5) in which a motor to create the necessary vacuum for suction (not shown in the drawings) and a dust bag (not shown in the drawings) are situated, a suction inlet (3) opening to the surface to be cleaned and connected to the dust bag, and at least one dust indicator (6) to monitor the fullness level of the dust bag. When the motor is activated, the pressure (Pv) in the vacuum chamber (5) gets lower than the atmospheric pressure (Patm) so that the dust and particles are sucked to be collected in the dust bag in the vacuum chamber (5).

[024] The dust indicator (6) comprises a tube (7) with one end opening into the atmosphere and the other into the vacuum chamber (5), having one or more openings (23) at both ends, a piston (8) inside the tube (7) closer the side opening into the atmosphere, and at least one compressed spring (9) which pushes this piston (8) towards the end opening to the atmosphere.

[025] The vacuum cleaner (1) of the present invention comprises an adjustment mechanism (10) which enables the manufacturer to change the compression rate of the spring (9) in accordance with the motor power utilized.

[026] The adjustment mechanism (10) comprises a retainer (11) placed inside the tube (7) and connected to the spring (9) through its end on the side of the vacuum chamber (5), and that can be moved back and forth inside the tube (7), a lid (12) covering the base of the tube (7) at the side of the vacuum chamber (5), and having at least one opening (33) allowing the passage of air, a shaft (13) for transmitting movement to the retainer (11) from outside the tube, allowing the position of the retainer (11) and respectively the compression rate of the spring (9) to be changed, and a housing (14) which bears this shaft (13).

[027] The spring (9) rests on and/or is fixed to the retainer (11). The position of the retainer (11) inside the tube (7) determines the compression rate of the spring (9) and

respectively the force exerted on the piston (8). Furthermore, it prevents the unwanted movements of the spring (9) perpendicular to the axis (X) of the tube (7).

[028] The force required to change the position of the retainer (11) inside the tube (7) is transmitted to the retainer (11) via the shaft (13). Various implementations have been designed to this end:

[029] In one of these, the housing (14) is situated on the lid (12) and the shaft (13) is placed on the retainer (11) and the shaft (13) goes through this housing (14) extending to the outside of the tube (7). The shaft (13) is firmly attached to the housing (14), then is moved in the housing (14) by holding its end outside the tube (7), changing the posi tion of the retainer (11) (Figure 3). In this manner the compression rate of the spring (9) is adjusted according to the motor utilized in the vacuum cleaner (1). In this embodiment, the adjustment mechanism (10) comprises various lock mechanisms (16) to prevent the unwanted movements of the shaft (13) inside the housing (14) after the adjustments are made.

[030] In another embodiment of the present invention, the lock mechanism (16) comprises nails (19) around the shaft (13). The nails (19) go through the housing (14) by flexing and contracting, then expanding to lock the shaft (13) and the retainer (11) in their present position (Figure 4).

[031] In another embodiment of the present invention, the nails (19) are not flexible, and the lock mechanism (16) comprises one or more slits (21) on the shaft (13) to allow the shaft (13) to pass through the housing (14) (Figure 5).

[032] In another embodiment, the lock mechanism (16) comprises grooves (17) in the housing (14) and tongues (18) on the shaft (13) matching these grooves (17). In this embodiment, the manufacturer can change the position of the retainer (11) by turning the shaft (13) or the lid (12) before assembling the dust indicator (6) inside the vacuum cleaner (1) (Figure 6 and Figure 7).

[033] In yet another embodiment of the present invention, the shaft (13) extends towards the retainer (11) from the side of the lid (12) facing inside the tube (7), and the housing (14) that bears this shaft (13) is situated in the middle of the retainer (11). The lock mechanism (16) comprises tongues (18) on the shaft (13) and grooves (17) inside the housing (14). The manufacturer can change the position of the retainer (11) inside the tube (7) by screwing the lid (12) (Figure 8).

[034] In the embodiments of the present invention comprising a lock mechanism (16) having grooves (17) and tongues (18) (Figure 6, Figure 7 and Figure 8), there is the risk of displacement of the retainer (11) in time due to the vibrations of the vacuum cleaner (1) body (2). The lock mechanism (16) comprises a washer (20) mounted on the shaft (13) to overcome this risk. This washer (20) can be situated inside or outside the tube (7).

[035] In the embodiments of the present invention where the shaft (13) is held and moved directly, with the lid (12) staying in a fixed position (Figure 3, Figure 4, Figure 5, Figure 6 and Figure 11), the lid (12) and the tube (7) can either be a single-piece or separate components.

[036] In one embodiment of the present invention, the adjustment mechanism (10) comprises markings (15) on the tube (7), the lid (12) or the shaft (13) indicating at which position the retainer (11) should be in respect to the power of the motor, in other words showing how much the spring (9) must be compressed (Figure 9, Figure 10 and Figure 1). These markings are placed with prior calculation of how much a spring (9) having a certain stiffness must be compressed for different motor powers. The manufacturer moves the retainer (11) until it comes to the appropriate position since he/she knows the power of the motor utilized in the vacuum cleaner (1).

[037] In the preferred embodiment of the present invention, the tube (7) comprises at least one stopper (24) at its end to avoid the components within to get out. The tube (7) can be produced in any form but is preferably cylindrical. The indicator (6) comprises a tube (7) made of a transparent material and a window (4) on the body (2) under which the tube (7) is positioned. Thus the movement of the piston (8) inside the tube (7) can be viewed from outside the body (2).

[038] In the preferred embodiment of the present invention, the piston (8) is formed of two or more parts, placed one after the other and fixed to each other (Figures 6, 7 and 8). These parts are painted in different colors, for example yellow and navy blue. Subsequently if the yellow piston is seen from the window (4) it indicates that the bag is not yet full, if the navy blue piston is seen, it indicates that the bag is full and has to be replaced.

[039] In the preferred embodiment, the piston (8) comprises ribs (22) on its exterior surface so that air can flow between itself and the tube (7). If the suction inlet (3) is clogged by large objects during cleaning, the piston (8) moves towards the middle of the tube (7) at the right time, allowing air to flow through the ribs (22) around it, providing the dust indicator (6) to act as a bypass passage, consequently preventing the burning of the motor.

[040] Indicators (6) comprising a spring (9) with appropriate stiffness are manufactured during production. During the assembly of the vacuum cleaner (1), the lid (12) in the adjustment mechanism (10) is turned or the shaft (13) is moved pushing the retainer (11) in the tube (7) forwards or backwards, thus the spring (9) is compressed more or is loosened for different motor powers. The manufacturer understands (15) which position of the retainer (11) corresponds to the desired motor power, from the markings. By way of the adjustment mechanism (10), the need for utilizing springs (9) of different stiffness scales is eliminated, facilitating the assembly and production of

vacuum cleaners (1). Furthermore the need for utilizing different dust indicators for different motors is not necessary, attaining advantages in terms of stocks and production line.

[041] Before the user activates the vacuum cleaner (1), the piston (8) rests at the end of the tube (7) that opens to the atmosphere from the inside . When the vacuum cleaner (1) is activated, the piston (8) moves towards the middle of the tube (7) if the resultant force created by the atmospheric pressure (Patm) and the pressure (Pv) of the vacuum chamber acting on its two opposite surfaces overcomes the force of the spring (9). When the piston (8) becomes visible through the window (4) on the body (2), the user knows that the bag is full. Since the compression rate of the spring (9) is correctly set by the adjustment mechanism (10) during production, the indicator (6) shows that the bag is full at the right time. Subsequently the user will not change the bag earlier or later than is necessary.

Claims

[001] A vacuum cleaner (1) comprising a body (2) inside which at least one motor creating the necessary vacuum for suction and the dust bag are situated, a suction inlet (3) opening to the surface to be cleaned and connected to the dust bag, and at least one dust indicator (6) utilized for indicating the fullness level of the dust bag, having a tube (7) with one end opening into the vacuum chamber (5) and the other into the atmosphere, a piston (8) inside the tube (7) closer to the side opening to the atmosphere, and at least one compressed spring (9) which pushes this piston (8) towards the end opening to the atmosphere and **characterized by** an adjustment mechanism (10) which enables the compression rate of the spring (9) inside the dust indicator (6) to be changed according to the motor power utilized.

[002] A vacuum cleaner (1) as in Claim 1, characterized by an adjustment mechanism (10) comprising a retainer (11) situated inside the tube (7) and connected to the spring (9) through its end on the side of the vacuum chamber (5), that can be moved back and forth inside the tube (7), at least one lid (12) which covers the base of the tube (7) at the side of the vacuum chamber (5),and having at least one opening (23) allowing the passage of air, a shaft (13) transmitting movement to the retainer (11) from outside the tube, allowing to change the position of the retainer (11) and respectively the compression rate of the spring (9); and a housing (14) which bears this shaft (13).

[003] A vacuum cleaner (1) as in Claim 2, characterized by an adjustment mechanism (10) comprising a lock mechanism (16) preventing the unwanted movements of the shaft (13) inside the housing (14) after the adjustment is made.

[004] A vacuum cleaner (1) as in Claim 2 or 3, characterized by an adjustment mechanism (10) comprising a housing (14) situated on the lid (12) and a shaft (13) situated on the retainer (11), positioned firmly in this housing (14), going through the housing (14) extending to the outside of the tube (7) and moved by holding its end outside the tube (7) allowing to change the position of the retainer (11) by sliding back and forth inside the housing (14).

[005] A vacuum cleaner (1) as in Claim 4, characterized by an adjustment mechanism (10) comprising a lock mechanism (16) having nails (19) around the shaft (13) which pass through the housing (14) by flexing and contracting, and which lock the shaft (13) and the retainer (11) in their present position by expanding after it goes through the housing (14) .

[006] A vacuum cleaner (1) as in Claim 4, characterized by an adjustment mechanism (10) comprising a lock mechanism (16) having rigid nails (19) around the shaft

(13) and having slits (21) on the shaft (13) for these nails (19) to pass through the housing (14).

[007] A vacuum cleaner (1) as in Claim 4, characterized by an adjustment mechanism (10) comprising a lock mechanism (16) having grooves (17) in the housing (14) and tongues (18) on the shaft (13) matching these grooves, allowing to change the position of the retainer (11) by turning the lid (12) or the shaft (13).

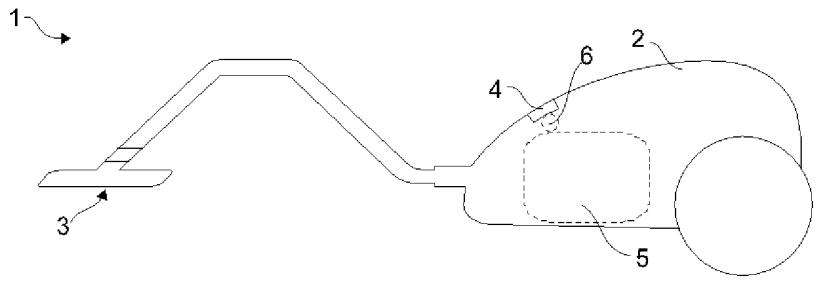
[008] A vacuum cleaner (1) as in Claim 3, characterized by an adjustment mechanism (10) comprising a lock mechanism (16) having a shaft (13) which extends towards the retainer (11) from the side of the lid (12) facing inside the tube (7), a housing (14) that bears this shaft (13) situated in the middle of the retainer (11), tongues (18) on the shaft (13) and grooves (17) inside the housing (14), and allowing to change the position of the retainer (11) inside the tube (7) by turning the lid (12).

[009] A vacuum cleaner (1) as in Claim 7 or 8, characterized by a lock mechanism (16) comprising a washer (20) mounted on the shaft (13).

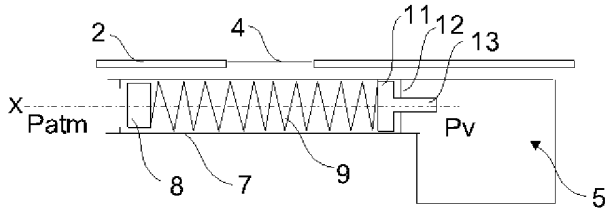
[010] A vacuum cleaner (1) as in any one of the Claims 2 through 6, characterized by a lid (12) being in one piece with the tube (7).

[011] A vacuum cleaner (1) as in any one of the Claims 2 through 10, characterized by an adjustment mechanism (10) comprising markings (15) on the tube (7), the lid (12) or the shaft (13) indicating at which position the retainer (11) should be in respect to the power of the motor, and how much the spring (9) must be compressed.

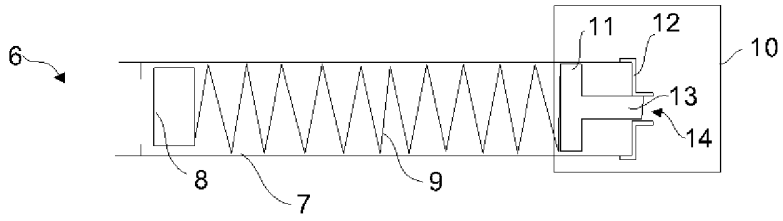
[Fig. 001]



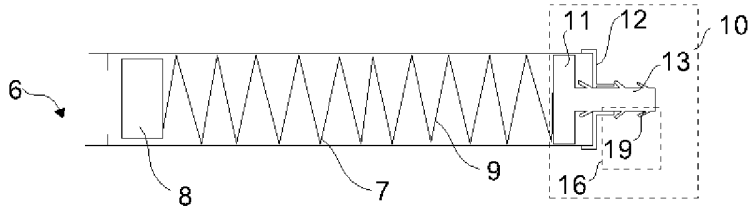
[Fig. 002]



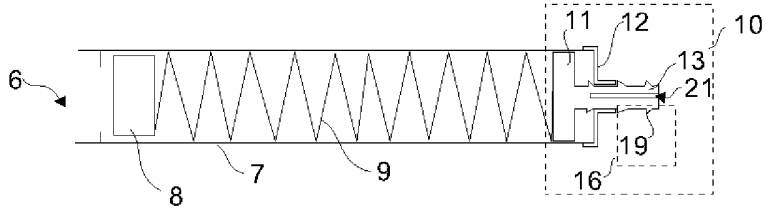
[Fig. 003]



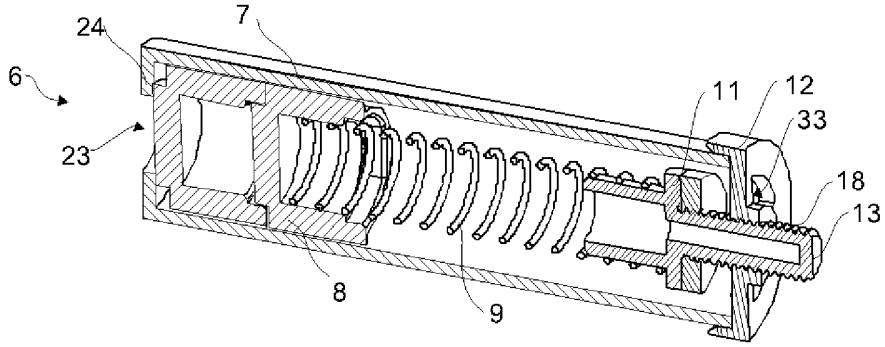
[Fig. 004]



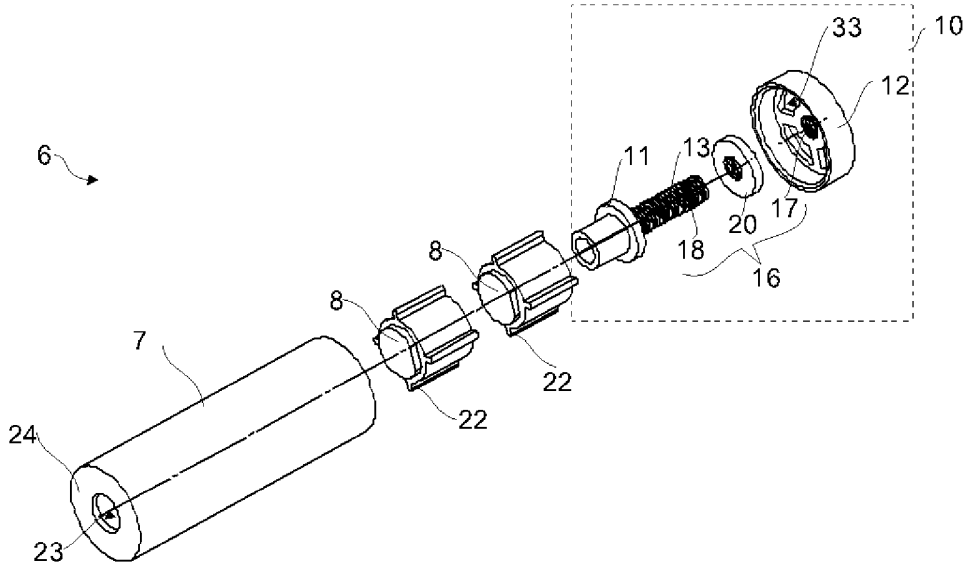
[Fig. 005]



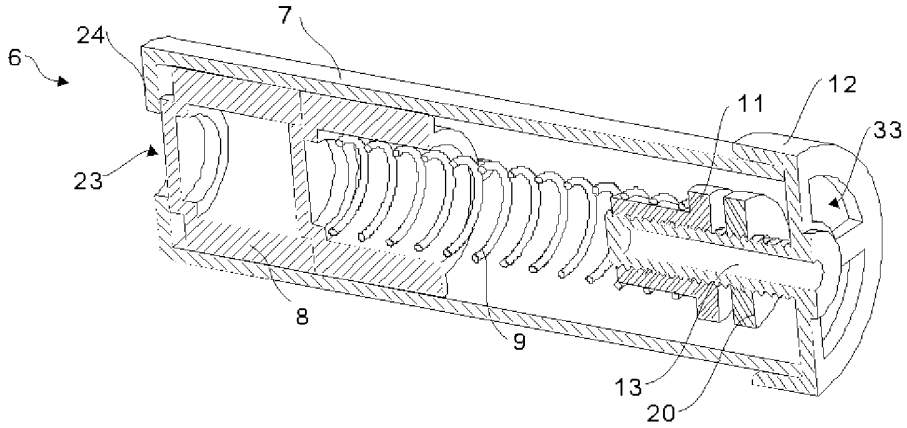
[Fig. 006]



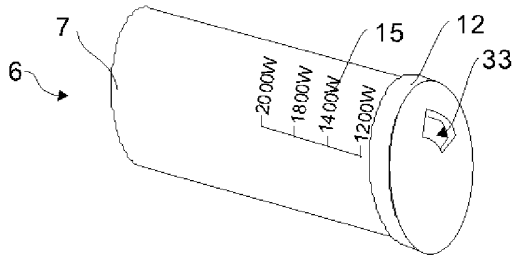
[Fig. 007]



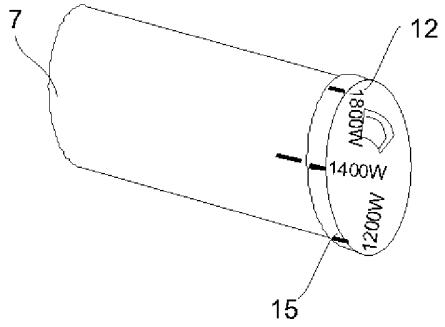
[Fig. 008]



[Fig. 009]



[Fig. 010]



[Fig. 011]