Nov. 26, 1935. G. E. LOFGREN 2,022,250

VACUUM CLEANER

Filed Oct. 6, 1932 3 Sheets-Sheet 1

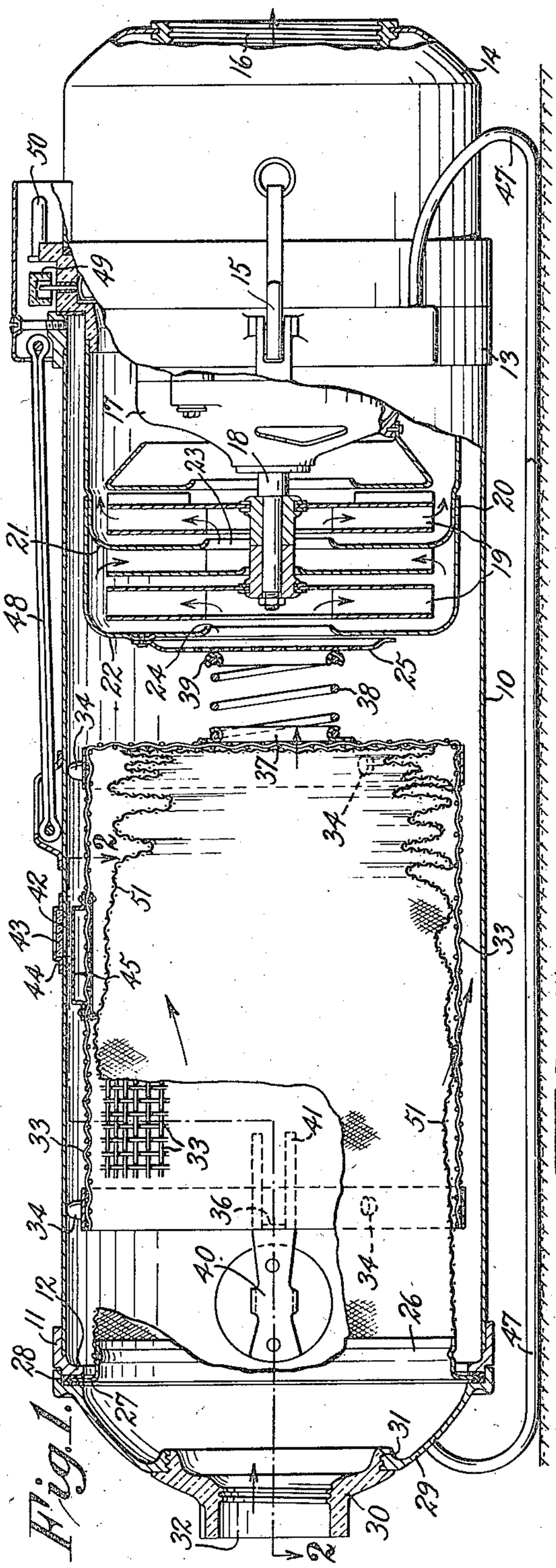


Fig. 1.

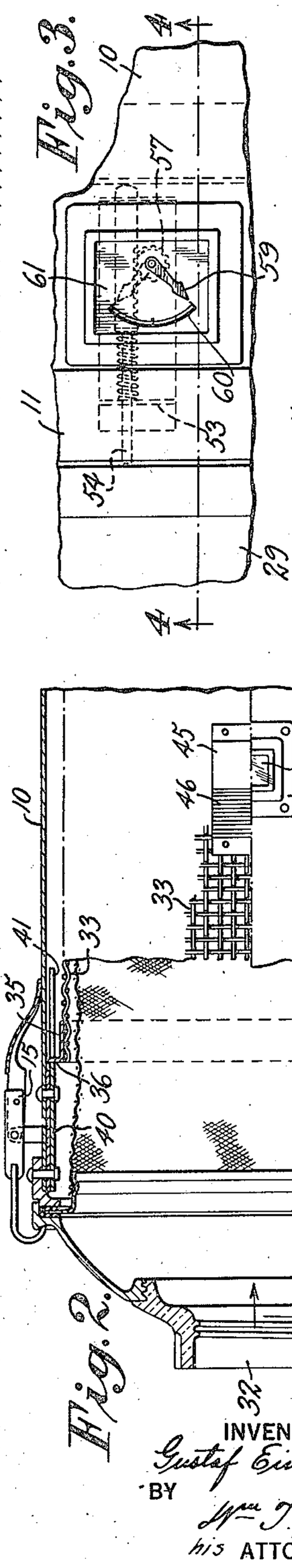


Fig. 3.

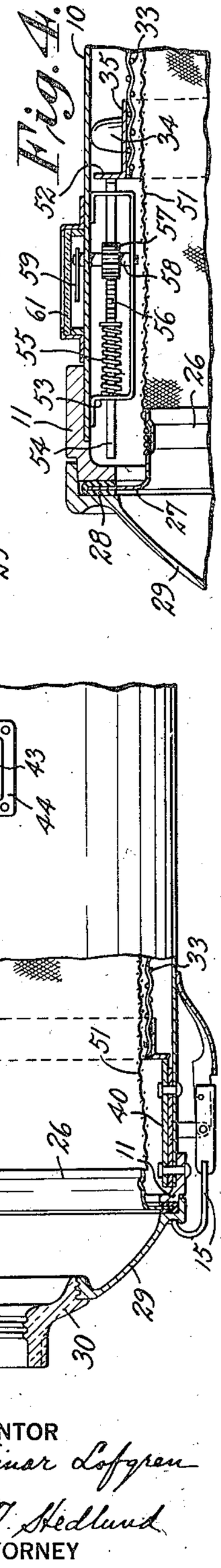


Fig. 4.

Fig. 2.

INVENTOR
Gustaf Einar Lofgren
BY
Wm. T. Hedlund
his ATTORNEY

Nov. 26, 1935. G. E. LOFGREN 2,022,250

VACUUM CLEANER

Filed Oct. 6, 1932 3 Sheets-Sheet 2

Fig. 5.

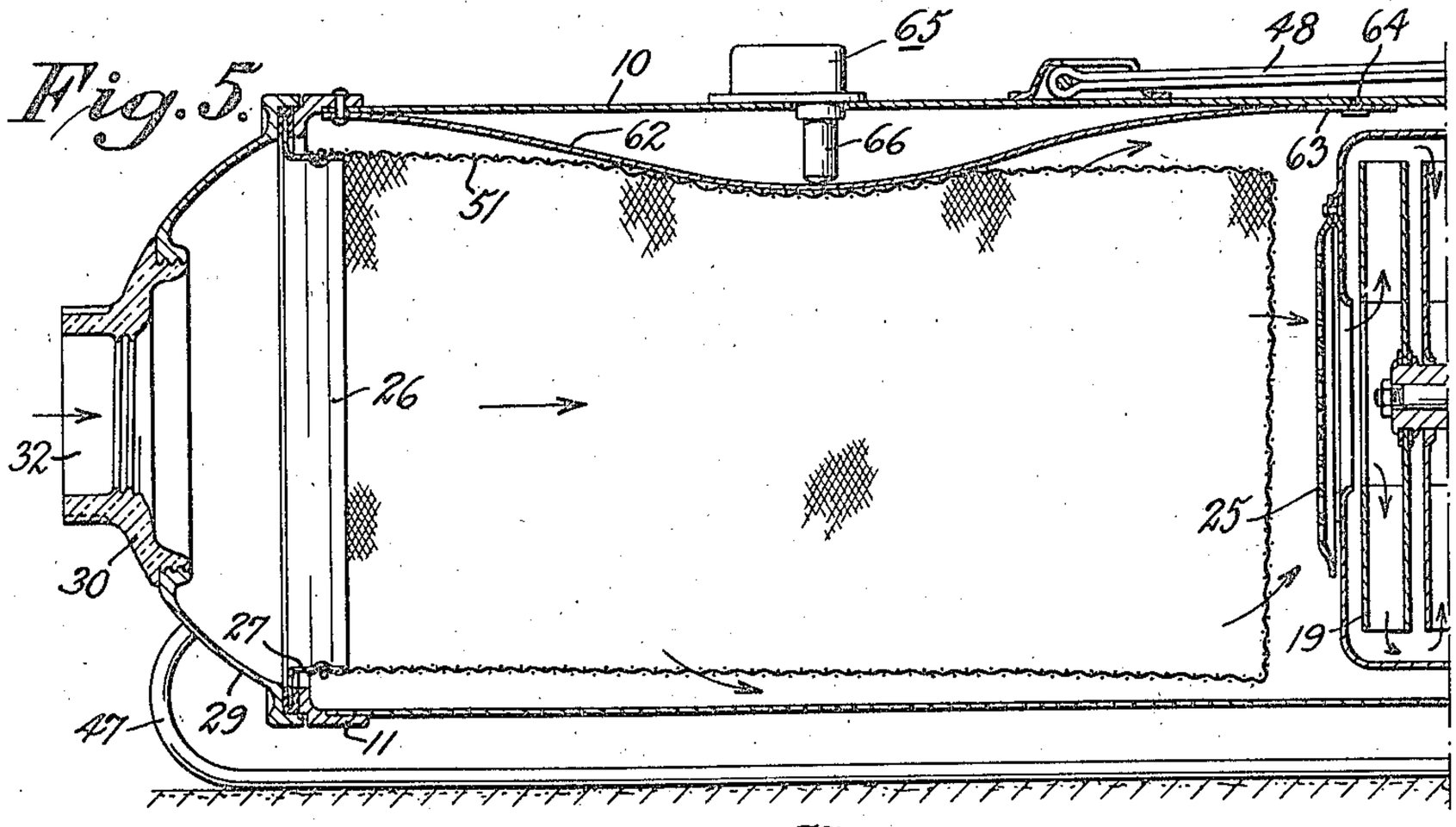


Fig. 6.

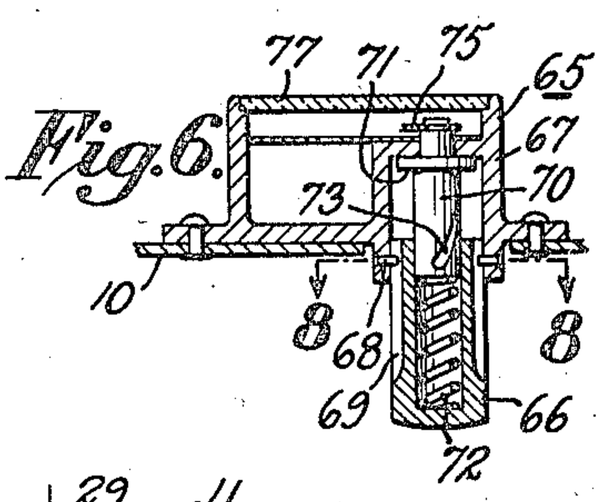


Fig. 7.

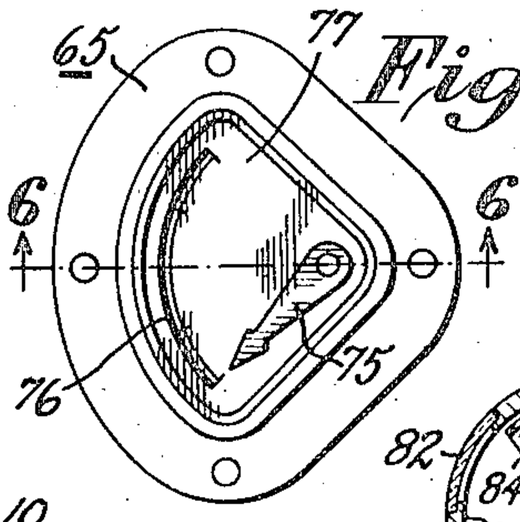
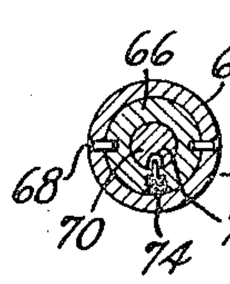


Fig. 8.



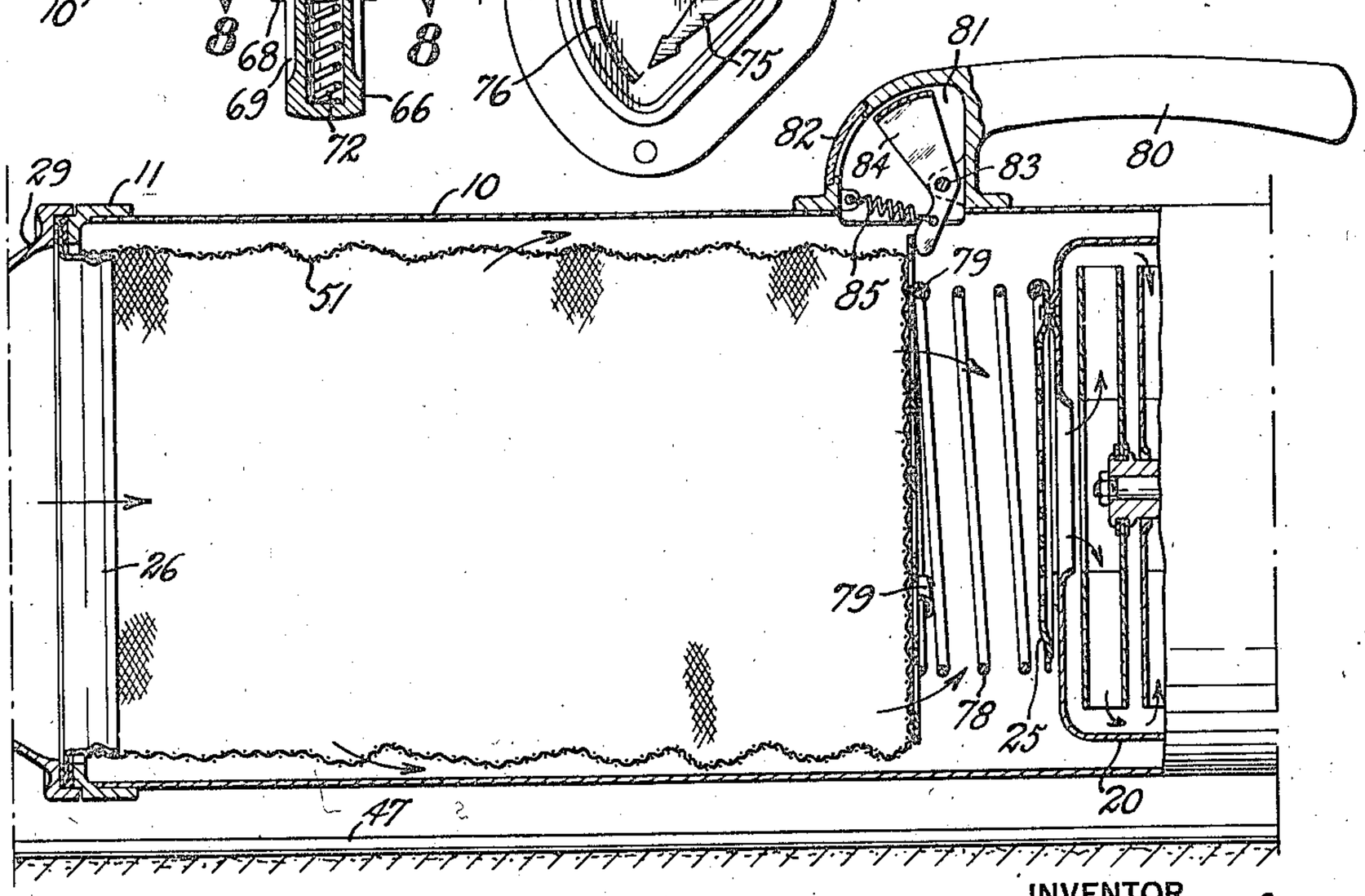


Fig. 9

INVENTOR
Gustaf Einar Lofgren
BY
Wm. T. Hedlund
his ATTORNEY

Nov. 26, 1935. G. E. LOFGREN 2,022,250

VACUUM CLEANER

Filed Oct. 6, 1932 3 Sheets-Sheet 3

Fig. 10.

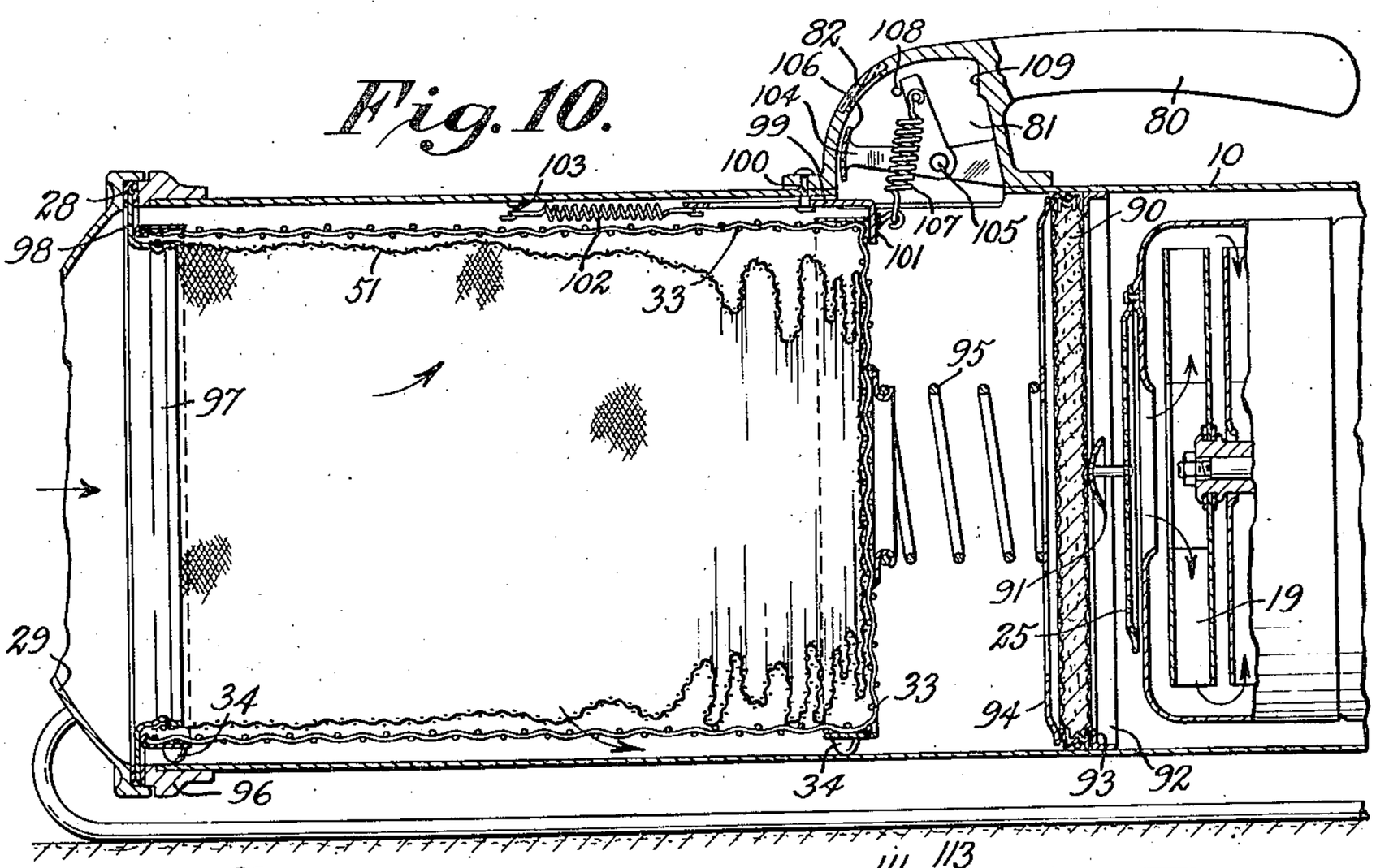


Fig. 11.

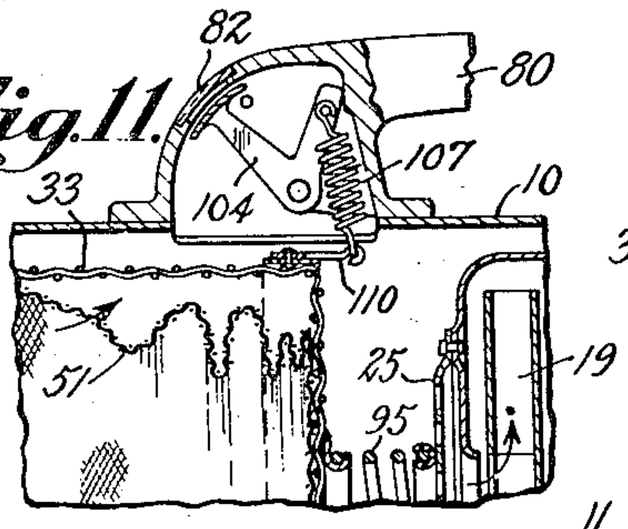


Fig. 12.

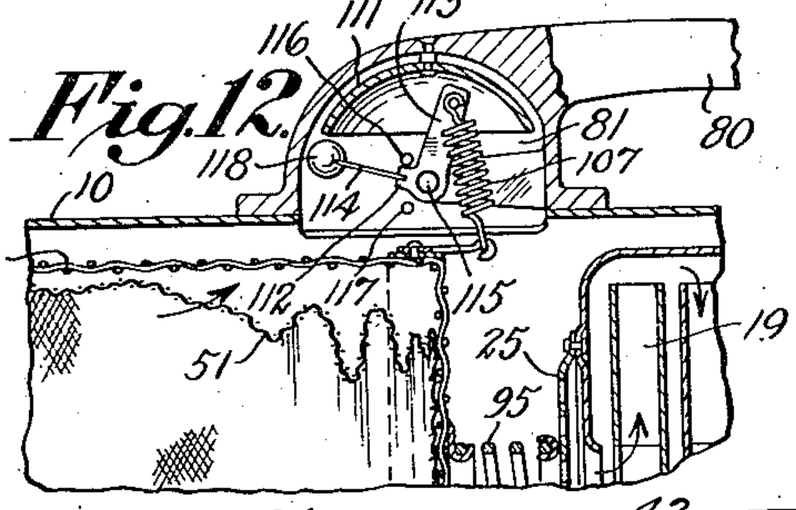
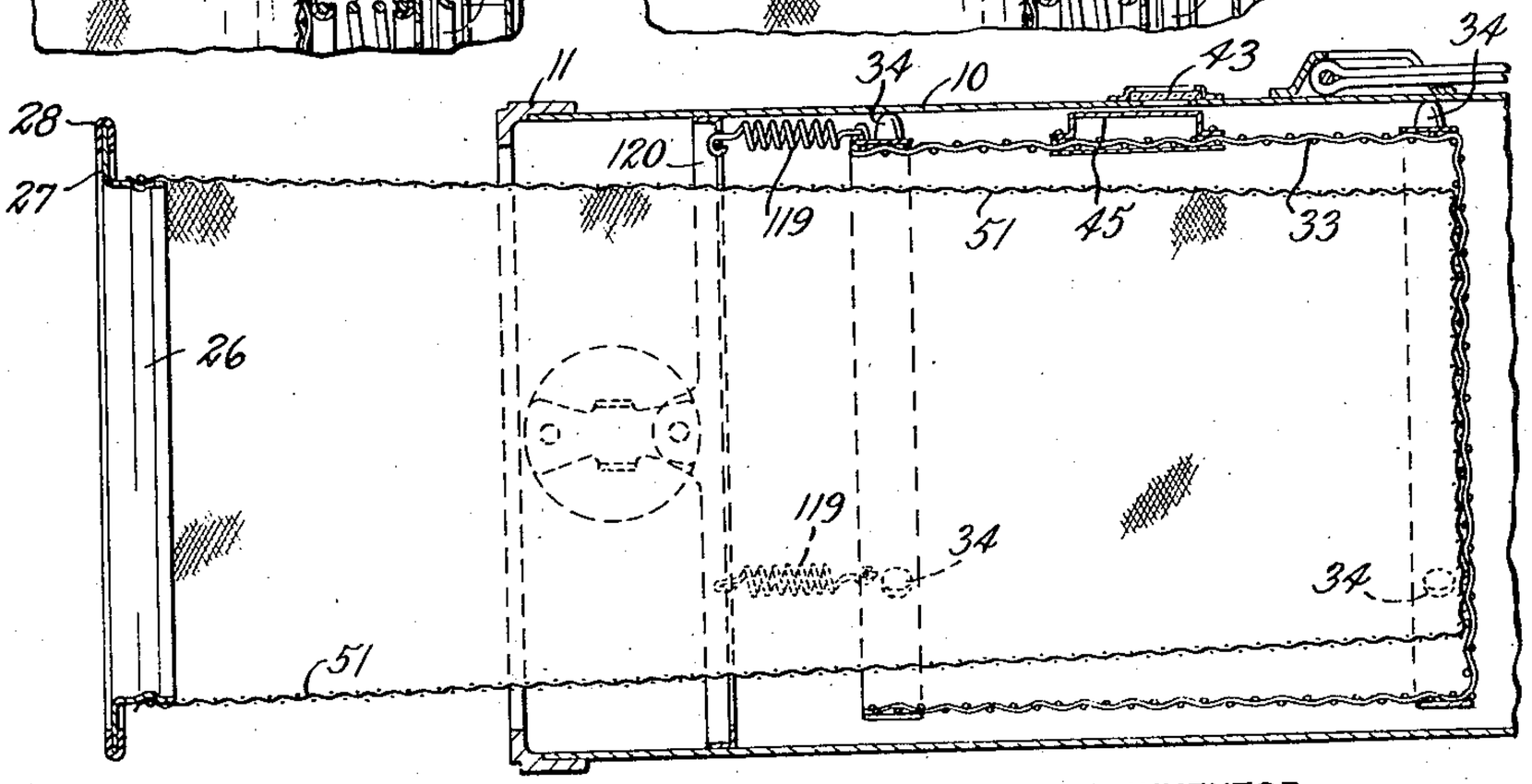


Fig. 13.



INVENTOR
Gustaf Einar Lofgren.
BY
Wm. T. Hedlund
his ATTORNEY

Patented Nov. 26, 1935 2,022,250

UNITED STATES PATENT OFFICE

2,022,250

VACUUM CLEANER

Gustaf Einar Lofgren, Rye, N. Y., assignor to Electrolux Corporation, Dover, Del., a corporation of Delaware

Application October 6, 1932, Serial No. 636,500

23 Claims. (Cl. 183—37)

My invention relates to vacuum cleaners and particularly to vacuum cleaners having an inclosed dust bag.

One of the objects of my invention is to provide means for indicating to the operator when sufficient dust has accumulated in the bag so that it is desirable to empty the bag.

A further object of my invention is to utilize the pressure difference on the two sides of a dust bag, that is the pressure drop through the dust bag due to clogging the pores by dust, to indicate the condition of the dust bag and to accomplish this by simple and reliable mechanism. In this connection, in the preferred embodiment of my invention, I combine features of extended surface for dust deposit with dust indication, a single member serving to permit a large dust bag and move the dust bag and through movement of the dust bag register its condition.

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

Fig. 1 is a side view, partially in cross-section, of a vacuum cleaner unit embodying my invention in a preferred form;

Fig. 2 is a view, partially in cross-section, taken on the line 2—2 of Fig. 1;

Fig. 3 is a top view of a modified indicating device which may be used in connection with the cleaner unit shown in Fig. 1;

Fig. 4 is a cross-sectional view, taken on the line 4—4 of Fig. 3;

Fig. 5 is a cross-sectional view of another form of my invention;

Fig. 6 is a cross-sectional view, taken on the line 6—6 of Fig. 7, of an indicating device shown in Fig. 5;

Fig. 7 is a top view of the device shown in Fig. 6;

Fig. 8 is a cross-sectional view taken on the line 8—8 of Fig. 6; and

Figs. 9 through 13 are cross-sectional views of five further embodiments of my invention.

Fig. 1 shows a vacuum cleaner unit including an air-tight casing comprising a barrel 10, preferably cylindrical in form, and made of sheet metal or other suitable stiff impervious material. Secured to one end of barrel 10 is a ring 11 provided with an inwardly extending flange 12. Secured to the other end of the barrel is a ring 13. The outlet end of the barrel is closed by means of a cover member 14 which is secured to ring 13 by means of suitable snap fasteners 15, which may be similar in all respects to the snap fasteners shown in Fig. 2. Cover member 14 is provided with a threaded outlet opening 16.

A motor 17 is suitably supported adjacent to the outlet end of the casing and is provided with an armature shaft 18 upon which is mounted a centrifugal fan 19 comprising one or more rotors. A fan housing 20 is suitably supported by the motor 17 or the casing and surrounds the rotors of the centrifugal fan 19. The housing is provided with an intermediate wall 21 between the two rotors and a forward wall 22 in front of the first rotor. These walls are provided with central apertures 23 and 24, respectively, the latter opening being guarded by a perforated plate 25.

A ring 26 which forms part of a dust separator and which is provided with an outwardly extending flange 27 which carries a rubber packing member 28 is adapted to seat against flange 12 of ring 11. Ring 26 is held in place by means of an end member 29 forming part of the casing which seats against the packing 28 and is held in position by means of hook fasteners 15, as is shown in Fig. 2. A coupling member 30 is adapted to screw into a threaded inlet opening 31 formed in member 29. Coupling 30 is provided with a central aperture 32 which is adapted to receive the hose leading from a cleaning implement or the like. Coupling 30 is adapted to fit the threaded outlet opening 16 when it is desired to use the vacuum cleaner as a blower. A dust bag 51 of flexible material, which is pervious to air but prevents the passage therethrough of dust particles, is suitably secured to and supported by ring 26.

A cage 33 having open work wall structure, preferably made of heavy wire, suitably reenforced so as to be rigid, is slidably supported on rounded projections 34 within the smooth bore of barrel 10 between fan housing 20 and the inlet end of the casing. The cage has an open front end supported by a ring 35 having two outwardly extending projections 36 diametrically opposite each other. The rear end of the cage is closed by an open work wall to which is secured a member 37 which in turn is secured to one end of a coil spring 38. The other end of spring 38 is encased or supported in a member 39 of electrical insulating material such as rubber and is adapted to abut against perforated plate 25. Within the front end of barrel 10 there is secured on either side thereof, a stop 40 (Fig. 2) which engages the projections 36 on ring 35 and prevents the cage from being moved beyond this point by spring 38. One of the stops 40 is pro-

vided with a forked extension 41 between the prongs of which one of the projections 36 is adapted to slide. The cage is thus prevented from rotating within barrel 10.

An aperture 42 is formed in the upper side of barrel 10. Aperture 42 is made air-tight by means of a piece of glass or other transparent material 43 held in place by a flanged member 44. Located on the upper side of, and fixedly secured to, cage 33 and between the cage and barrel 10, so as to be visible through opening 42, is a plate constituting a signal 45. Plate 45 carries some designating symbol to indicate the position of cage 33 with respect to the casing. As shown in Fig. 2, the right hand portion of the plate may be of one color, such as white, while the left hand portion of the plate may be of a different color, such as red. The lines 46 indicate the color red. If desired, words may be printed or otherwise impressed on the plate to indicate the position of the cage.

The cleaner as a whole is supported on a pair of runners 47 secured at one end to ring 11 and at the other end to ring 13. These runners permit the cleaner to slide easily over a supporting surface. A handle 48 is provided for carrying the cleaner. An electric switch 49 controls the supply of current to the motor 17 while electric contacts 50 are adapted to engage a plug for supplying current to the motor.

What is shown on the drawing may be termed the cleaner unit. To the cleaner unit is attached the hose which conducts air to or away from the unit and by means of which the unit is drawn on the carpet or floor.

The operation is as follows:

Upon rotation of fan 19 by motor 17 a current of air is caused to flow through the air-tight casing from the inlet 31 thereof to the outlet 16. If a hose leading from a cleaning implement is connected to opening 32 in coupling 30, and the implement is passed over a surface to be cleaned, dust-laden air will be drawn into the interior of dust bag 51. Here the dust is deposited while the air passes through the pervious dust bag and through perforated plate 25 and opening 24 to the fan. The fan discharges the air through and around motor 17, thereby cooling the motor, and the air is finally discharged through outlet 16. The bar 51 offers a resistance to the flow of air therethrough. This resistance causes a higher pressure to exist within the bag than in the space within the casing outside of the bag but ahead of fan 19. The result is that there is a tendency for the bag to be inflated. This causes the closed end of the bag to press against the end of cage 33, which in turn tends to slide cage 33 toward the fan housing. Spring 38 is provided to resist this tendency up to a certain point. As dust continues to accumulate in the bag, the resistance to air flow therethrough is increased and hence the force exerted by the bag against the end of cage 33 is increased. When the value of this force (the differential of pressure inside and outside the bag) reaches a certain point, which corresponds to a quantity of dust in the bag such that the latter should be cleaned, the cage will have moved an appreciable distance to the right, as viewed in Figs. 1 and 2 against the increasing resistance of spring 38. Inasmuch as signal 45 is secured to the cage it likewise moves to the right and the red portion 46 becomes visible through opening 42. The operator then knows that the bag has accumulated sufficient dirt so that, for efficient operation of the machine, the bag should be emptied.

Inasmuch as an ordinary spring has a resistance which varies in direct proportion to the amount which the spring is compressed or expanded, it will be seen that the movement of the free end of the spring has a direct relation to the pressure drop through the dust bag. The signal may be considered as indicating the compression of the spring which is thus a measure of the extent of clogging of the dust bag.

In order to clean the bag it is only necessary to remove member 29 by unfastening catches 15 whereupon the bag may be lifted out of the cage and the casing.

In this embodiment the cage 33 and the resisting spring have a dual function in that as well as being a primary indicator member responsive to the pressure drop through the dust bag for indicating the extent of clogging of the dust bag, they also serve to permit a larger bag, and hence one having greater surface, than the length of the dust bag space provided by the cage and the casing and longer than would be the space provided for the dust bag if the cage were omitted. The bag thus can fold in the cage and for this purpose I preferably provide a tapered bag of a diameter everywhere less than the diameter of the cage. Also, movement of the cage tends to clear parts of the dust bag surface of dust. The cage and tapered extended dust bag are disclosed and claimed in a copending application Serial No. 636,499 filed by me concurrently herewith to which reference may be had for additional description.

In Figs. 3 and 4 I have illustrated a different form of dust indicator. Ring 35 of cage 33 is provided with an additional projection 52 at the top thereof, which may be similar to projections 36 described in connection with Figs. 1 and 2. A support 53 is secured within barrel 10 between the inlet end thereof and the end ring 35 of the cage and carries a rack 54, the right hand end of which (as shown) is forced against projection 52 by means of a spring 55. Rack 54 is provided with teeth 56 which engage a pinion 57 mounted on a shaft 58 which is journalled at its lower end in support 53. The other end of shaft 58 extends through an opening in barrel 10 and is provided with a pointer 59 constituting the signal. Pointer 59 moves over a scale 60 which is arranged beneath a window 61.

In operation, when the cage 33 moves to the right, due to increase of pressure drop through the bag, in turn due to an accumulation of dust in the dust bag, as was described in connection with Figs. 1 and 2, spring 55 causes rack 54 to follow the cage. This movement of the rack rotates pinion 57 and with it shaft 58 and pointer 59. When the pointer has moved in a clockwise direction (as shown) to the position shown in dash and dot lines in Fig. 3, it indicates to the operator that the dust bag should be cleaned.

In Figs. 5 to 8, I have illustrated still another form of my invention wherein I utilize the tendency of an inflated bag to take a cylindrical or expanded form to operate the indicating device. This embodiment differs from that shown in Figs. 1 and 2 in that the cage is omitted. The dust bag 51 is secured to ring 26 which in turn is secured to the inlet end of barrel 10 in the same manner as previously described. Secured to the inlet end of barrel 10 at the top thereof is one end of a leaf spring 62. The other end of the spring is provided with a slot 63 through which

extends a headed pin 64 for guiding and supporting that end of the spring. The spring is formed so as to be normally bowed to such an extent that it extends into the space which would normally be occupied by the dust bag 51 when the latter is inflated. Indicating mechanism designated generally by reference character 65, is secured to barrel 10 and is provided with a slidable hollow pin 66 (see particularly Fig. 6) the lower end of which bears against the bowed portion of spring 62. Pin 66 slides within housing 67 of the indicating mechanism, but is prevented from rotating by means of pins 68 which engage grooves 69 in pin 66. A pin 70 rotatably journalled in housing 67, but restrained from longitudinal movement by a collar 71, extends within the hollow center of pin 66. A spring 72 is provided for forcing pin 66 downwardly against leaf spring 62. Pin 70 is provided with a helical groove 73 which engages a pin 74 (Fig. 8) carried by hollow pin 66. Thus, when pin 66 is moved upwardly, pin 74 working in groove 73 causes pin 70 to rotate in a clockwise direction, as viewed from the top in Fig. 7. The upper end of pin 70 is provided with a pointer constituting a signal 75 which moves over a scale 76 which is visible through a window 77 of the indicator.

The operation of the device shown in Figs. 5 to 8, is as follows:

When the pressure difference between the space inside the bag and the space immediately outside thereof within the casing increases, due to the accumulation of dirt in the bag, as has been previously explained, the bag exerts a greater force in attempting to become fully inflated and to take a cylindrical form or other form of maximum volume depending on the shape of the bag. The tension of the bowed portion of spring 62 tends to prevent the top of the bag from becoming cylindrical. As the pressure difference increases, the force exerted by the bag against the spring overcomes the tension of spring 62 and causes it to become straightened. This causes the central portion of the spring to be raised whereupon the right hand end of the spring moves to the right, as viewed in Fig. 5. When the central portion of the spring moves upwardly, it moves pin 66 upwardly which, in the manner previously described, causes pointer or signal 75 to move in a clockwise direction. When the signal has moved to the end of the scale in this direction it indicates to the operator that the bag requires cleaning. The bag may be removed and cleaned in the same manner as described in connection with the previous modification.

In Fig. 9 I have shown a still further embodiment of my invention. A spring 78 is secured to plate 25 which is carried by fan housing 20. The other end of spring 78 is secured to a perforated plate 79. When spring 78 is expanded the distance between plate 79 and ring 26 is less than the length of dust bag 51, wherefore the dust bag cannot be fully inflated with the plate in this position. As dust accumulates in the bag and the pressure drop therethrough increases, in other words when the pressure within the bag with respect to that immediately outside thereof increases, the closed end of the bag presses against plate 79 and moves it towards the fan housing by compressing spring 78.

A handle 80 is secured to the top of barrel 10 and is provided with a hollow portion 81 which is in communication with the interior of barrel 10. The hollow portion is provided with an air-tight window 82. Pivotally mounted at 83 within the handle is a signal 84. The upper end of signal 84 is adapted to move in front of window 82, while the other end bears against the rear of plate 79. A spring 85 is arranged to hold the lower end of member 84 against plate 79.

When plate 79 is moved towards the fan housing, due to an accumulation of dirt in the bag, member 84 is caused to pivot in a counter-clockwise direction, as viewed in Fig. 9, and the upper end thereof becomes visible through window 82. This indicates to the operator that so much dirt has accumulated within the dust bag 51 that the latter requires cleaning in order that the device may operate efficiently.

It will be obvious that instead of using different colors on the indicating dial or face, a legend may be used such as —"Remove Dirt"—.

In the cleaner shown in Fig. 10, a filter 90 is provided between the fan and the inlet end of the casing. Perforated plate 25 carries an abutment member 91 which supports the central portion of the filter. A ring 92 having an inturned flange 93 is secured to barrel 10 in the plane of abutment 91. A perforated plate or frame 94 is arranged to be pressed against the forward side of filter 90 and to hold the filter in place between it and abutment 91 and flange 93. The filter may comprise a circular frame carrying a layer of cloth on either side thereof between which may be located filter material. It will be seen that plate 94 is normally a stationary member.

A cage 33 is slidably positioned within barrel 10 and slides on rounded projections 34. A spring 95 is suitably secured to the closed end of cage 33 and is adapted to abut against plate or frame 94. The inlet end of barrel 10 is provided with a ring 96, which is similar to ring 11 shown in Fig. 1 but differs therefrom in that the inwardly extending flange has an inner diameter equal to the inner diameter of barrel 10. This provides an opening of barrel 10 which is as large as the internal diameter of any part of the barrel and hence cage 33 may be removed from this end of the barrel.

Dust bag 51 is supported at its open end by a ring 97, which is similar to ring 26 shown in Fig. 1, but has a larger outwardly extending flange 98. This flange is provided with a packing 28 which is clamped between ring 96 and end member 29. The open end of cage 33 abuts against flange 98 and is thus prevented from further movement towards the left as viewed in Fig. 10 when the dust bag is clamped in position. When the end of the cage is in contact with flange 98 spring 95 is slightly compressed.

A member 99 is slidably supported within barrel 10 by means of a headed pin 100 extending through a slot formed in the member. One end of member 99 is bent at right angles to form a projection 101 which is held against the closed end of cage 33 by means of a spring 102 secured to the other end of member 99 and anchored to a projection 103 on the inside of the barrel. Thus, when cage 33 moves to the right, as viewed in Fig. 10, it moves member 99 along with it, and when the cage moves to the left spring 102 causes member 99 to follow the cage.

Secured to barrel 10 is a handle 80 having a hollow end portion 81 provided with an air-tight window 82. Pivotally mounted within hollow portion 81 is a signal 104 comprising a bell-crank lever pivoted at 105. One end of the lever is provided with a plate 106 which, in one of its two positions, is visible through window 82. The other end of the lever is secured to a spring 107,

the other end of which is secured to member 99. The pivot point 105 is so situated with respect to the path of travel of member 99 that the spring 107 is caused to pass through dead center when the member 99 moves from one end of its path of travel to the other. This causes the signal 104 to have "snap-action". The movement of the signal is limited in one direction by a stop 108 and in the other direction by striking the interior of the handle at 109.

When the fan 19 is rotated, it causes the passage of air through the casing and through the dust bag 51 in the direction of the arrows. As the dust bag accumulates dirt, the resistance to flow of air therethrough increases and the cage 33 is moved against the resistance of spring 95, as described in connection with the device shown in, for instance, Fig. 1. This movement of the cage causes member 99 to move to the right, as seen in Fig. 10. This movement of member 99 does not cause movement of signal 104 until the end of spring 107 which is attached to member 99 has passed a line drawn from the other end of the spring through the pivot point 105. When member 99 has been moved by the cage sufficiently to carry the end of spring 107 past this line, the spring snaps the signal 104 quickly in a clockwise direction, as viewed in Fig. 10, so that the disc 106, which may be colored in any distinctive manner or may bear any desired legend, appears underneath window 82 and indicates to the operator that the bag should be cleaned.

In order to clean the bag it is only necessary to unfasten end member 29 and the bag may be removed from the cage 33. If it is desired to clean or replace filter 90, this may be done by removing cage 33 after the bag has been removed. Inasmuch as spring 95 is secured to the cage, it will be removed with the cage. The plate 94 may then be tilted so as to avoid striking projection 101 and withdrawn from the barrel 10 and filter 90 may be removed in the same manner. If desired, filter 90 may be fastened to plate 94 so that the two members may be removed as a unit.

The device shown in Fig. 11 is similar to that shown in Fig. 10, with the exception that spring 107 is secured directly to cage 33 by means of a hooked member 110. In this modification no filter is employed between the fan and the dust bag and hence it is not necessary for the operator to remove the cage. The cage may be put in place during the course of manufacture of the cleaner and hence the spring 107 may be connected directly to it.

The operation of this modification is the same as that shown in Fig. 10, and hence a description thereof need not be repeated. In Fig. 11 the signal 104 is shown in the position in which it is visible through window 82, thereby indicating that the dust bag should be cleaned.

In the embodiment shown in Fig. 12, an audible signal is employed instead of a visual one. A bell 111 is suitably secured within the hollow end portion 81 of handle 80. A bell-crank lever 112 comprising a rigid arm 113 and a flexible arm 114 is pivoted at 115 and is arranged to move between stops 116 and 117. The end of flexible arm 114 carries a bell striker 118. A spring 107 is connected to cage 33 in the same manner as described in connection with Fig. 11. In operation, when the cage 33 has moved a sufficient distance to the right, as viewed in Fig. 12, due to increase in force exerted by the dust bag, the lower end of spring 107 passes dead center and causes the bell-crank lever 112 to be snapped in a clockwise direction. This causes striker 118 to strike the edge of bell 111, and the resulting sound warns the operator that the bag requires cleaning. It will be noted that, in the position shown in Fig. 12, striker 118 is not in contact with bell 111, but very close to it. The flexible nature of arm 114 allows striker 118 to strike the bell when the bell-crank lever is snapped but then removes the striker from contact with the bell. This is desirable, as continued contact with the bell would deaden the sound.

In the modification shown in Fig. 13, movement of the cage 33 towards the right, as viewed in this figure, is resisted by a plurality of springs 119 which are secured at one end to the open end of cage 33 and are anchored at the other end to a ring 120 secured within barrel 10. Thus, when the bag 51 exerts force against the cage 33 it moves the cage by expanding springs 119. In this modification the cage is shown with a signal 45 similar to that shown in Fig. 1.

In Fig. 13, the bag 51 is shown in its fully extended state in order to clearly show the length of the bag as compared with the length of the space between the ring 11 and the closed end of cage 33 into which the bag is forced when the cleaner is assembled. In going into this smaller space, the bag is folded in some such manner as that indicated in the other figures. Fig. 13 likewise clearly shows the taper of the dust bag. While this taper is not necessary, it is preferable in order to provide increased space towards the closed end of the cage to accommodate the folds and wrinkles of the bag. It is preferable that these folds and wrinkles take place at this end so that they will not interfere with the entrance of dirt at the open mouth of the bag. Even though the wrinkles and folds are near the mouth of the bag when the latter is first placed in position, they will be worked towards the closed end due to the flow of air through the bag and the movement of cage 33.

It will be appreciated that, in the above described embodiments of my invention employing a spring or springs and a plate or cage arranged to be moved by the bag as the latter is being inflated, the spring or springs and the plate or cage may be considered as comprising a yieldable member.

It will be appreciated that my invention can be embodied in a great variety of forms.

What I claim is:

1. In a vacuum cleaner, a casing, a movable signal, resilient mechanism constructed and arranged to move said signal in one direction, a distensible member pressing against said mechanism to move it in opposite direction, and air-flow means to produce a pressure differential on opposite sides of said distensible member in accordance with dust accumulation.

2. In a vacuum cleaner, a casing, a movable signal, resilient mechanism including a spring constructed and arranged to move said signal in one direction on spring expansion, a distensible member pressing against said mechanism to move it in opposite direction, air-flow means to produce a pressure differential on opposite sides of said distensible member, and means to secure the edge of the distensible member with respect to the casing.

3. The combination with vacuum cleaner apparatus including an air-tight casing, a fibrous dust separating member in said casing, and means to produce flow of air through said dust separating member, of an indicator including a

visible signal and means contacting said dust separating member to automatically move said visible signal in response to the pressure difference on opposite sides of said dust separating member.

4. In a vacuum cleaner including a casing, a distensible fibrous dust separating member in said casing and means for producing suction on said dust separating member, a spring arranged to resist distension of the dust separating member, and a signal movable in response to distortion of said spring.

5. A vacuum cleaner including an air-tight casing having an air inlet and an air outlet, means to produce flow of air therethrough, a dust bag in said casing, and resilient mechanism to removably retain said dust bag in folded condition in said casing while permitting movement thereof due to variation of pressure drop through the dust bag, and means to indicate the position of said mechanism.

6. A vacuum cleaner including an air-tight casing having an air inlet and an air outlet, means to produce flow of air therethrough, a dust bag in said casing, and means to removably retain said dust bag in said casing in folded condition while permitting movement thereof due to variation of pressure drop through the dust bag, and means to indicate movement of the retaining means.

7. In a vacuum cleaner, an air-tight casing provided with an inlet opening and an outlet opening, means for causing flow of air therethrough, a cage having openwork wall structure movably mounted in said casing in the path of air flow therethrough, a dust bag adapted to be disposed in and held by said casing and to rest in said cage in folded condition, and means to indicate the position of said cage in said casing.

8. In a vacuum cleaner, an air-tight casing provided with an inlet opening and an outlet opening, means for causing flow of air therethrough, a cage having openwork wall structure movably mounted in said casing in the path of air flow therethrough, a dust bag adapted to be disposed in and held by said casing and to rest in said cage in folded condition, a spring arranged to exert force against said cage in opposition to the direction of flow of air in said casing, and means to indicate movement of said cage.

9. In a vacuum cleaner, a casing having an inlet for dust-laden air and an outlet for air from which dust has been removed, means to cause flow of air through said casing, a dust bag of flexible air-pervious material in said casing so positioned therein that the air which enters as dust-laden air passes therethrough, said dust bag being mounted in the casing so as to be distensible due to the flow of air, means to resist distention of the dust bag, the last mentioned means being movable in variable degree depending on the pressure drop through the dust bag, and means to indicate degree of movement of the resisting means.

10. In a vacuum cleaner, a casing having an inlet for dust-laden air and an outlet for air from which dust has been removed, means to cause flow of air through said casing, a dust bag of flexible air-pervious material in said casing having one end thereof fixed against movement and so positioned within the casing that all the air which enters as dust-laden air passes therethrough, said dust bag being distensible due to the flow of air, a movable member in said casing against which the dust bag is pressed due to pressure drop therethrough and which resists distension of the dust bag, resilient means for yieldably pressing said member against the dust bag, whereby on increase in pressure drop said member is moved in one direction and on decrease in pressure drop the resilient means moves said member in the opposite direction, and means to indicate movement of said movable member.

11. In a vacuum cleaner having an air-tight casing, a dust bag in said casing and means for causing flow of air through said casing, apparatus for indicating the condition of said bag comprising a member disposed in contact with the end of said bag, a spring arranged to press said member against said bag and to be compressed when the bag is being inflated due to the passage of air through the casing, and a signal operable by movement of said member.

12. A vacuum cleaner comprising an air-tight casing, a handle having a hollow portion secured to said casing, a distensible fibrous dust separating member in said casing, means for causing flow of air through said casing, yieldably movable mechanism arranged to press against said dust separating member and to be moved as the dust separating member is distended due to the passage of air through the casing, a window formed in the hollow portion of said handle, and a signal pivoted with respect to said casing within said hollow portion, one end of said signal having engagement with said mechanism so as to be moved thereby and the other end being arranged so as to be visible through said window.

13. A vacuum cleaner comprising an air-tight casing, a handle having a hollow portion secured to said casing, a distensible fibrous dust separating member in said casing, means for causing flow of air through said casing, yieldably movable mechanism arranged to press against said dust separating member and to be moved as the dust separating member is distended due to the passage of air through the casing, a window formed in the hollow portion of said handle, a signal pivoted with respect to said casing within said hollow portion, one end of said signal being arranged so as to be visible through said window, and a spring secured to said signal and to said mechanism, the pivot point being so located with respect to the path of travel of said mechanism that said spring passes through dead center when said mechanism moves from one end of its path of travel to the other.

14. In a vacuum cleaner having an air-tight casing, a dust bag in said casing, and means for causing flow of air through said casing, apparatus for indicating the condition of said bag comprising a yieldable member between the side of said bag and said casing arranged to press against said bag and to be moved as the bag is inflated due to the passage of air through the casing, and a signal operable by movement of said yieldable member.

15. In a vacuum cleaner having an air-tight casing, a dust bag in said casing and means for creating a suction in said casing, apparatus for indicating the condition of said dust bag comprising a cage having openwork wall structure disposed around and in contact with said bag, a yieldable member arranged to press said cage against said bag and to be compressed as the bag is inflated due to suction, and a signal operable by movement of said yieldable member.

16. In a vacuum cleaner, an air-tight casing having an inlet opening and an outlet opening, means for producing flow of air through said casing, a dust bag of air-pervious flexible material

within said casing having one end open and the other end closed, means for securing the open end of said bag to said casing, a yieldable member within said casing arranged to press against said bag when the latter is being inflated due to air flow therethrough, and a signal operable by movement of said member.

17. In a vacuum cleaner, an air-tight casing having an inlet opening and an outlet opening, means for producing flow of air through said casing, a dust bag of air-pervious flexible material within said casing having one end open and the other end closed, means for securing the open end of said bag to said casing, a yieldable member within said casing, the length of said bag being greater than the distance between the place where the bag is secured to the casing and said member, and a signal operable by movement of said member.

18. In a vacuum cleaner, an air-tight casing having an inlet opening and an outlet opening, means for producing flow of air through said casing, a dust bag of air-pervious flexible material within said casing between said means and said inlet, one end of said bag being open and the other end being closed, means for securing the open end of said bag to said casing adjacent to said inlet, movable mechanism including a spring between said bag and the first mentioned means, the closed end of said bag being adapted to press against said movable mechanism when the bag is being inflated due to air flow therethrough, and a visible signal operable by movement of said movable mechanism.

19. In a vacuum cleaner, an air-tight casing having an inlet opening and an outlet opening, a fan in said casing, a housing around said fan, means for driving said fan, a dust bag of air-pervious flexible material within said casing between said fan and said inlet, one end of said bag being open and the other end being closed, means for securing the open end of said bag to said casing adjacent to said inlet, a spring secured to the front of said fan housing, a member attached to said spring, the closed end of said bag being adapted to press against said member when the bag is being inflated due to air flow therethrough, and a signal operable by movement of said member.

20. In a vacuum cleaner, an air-tight casing having an inlet opening and an outlet opening, a fan in said casing, a housing around said fan, means for driving said fan, a dust bag of air-pervious flexible material within said casing between said fan and said inlet, one end of said bag being open and the other end being closed, means for securing the open end of said bag to said casing adjacent to said inlet, resilient mechanism secured to the front of said fan housing, the length of said bag being greater than the distance between the place where the bag is secured to the casing and said resilient mechanism, and a signal operable by movement of said mechanism.

21. In a vacuum cleaner, an air-tight casing having an inlet opening and an outlet opening, a fan in said casing, a housing around said fan, means for driving said fan, a dust bag of air-pervious flexible material within said casing between said fan and said inlet, one end of said bag being open and the other end being closed, means for securing the open end of said bag to said casing adjacent to said inlet, resilient mechanism secured to the front of said fan housing, the closed end of said bag being adapted to press against said member when the bag is being inflated due to air flow therethrough, and a signal operable by movement of said member.

22. In a vacuum cleaner, an air-tight casing having an inlet opening and an outlet opening, means for producing flow of air through said casing, a cage having openwork wall structure movably mounted in said casing between said means and said inlet opening, a dust bag of air-pervious flexible material having one end open and the other end closed, means for securing the open end of said bag to said casing adjacent to said inlet opening, the other end of said bag being adapted to be placed within said cage, the length of said bag being sufficiently greater than the length of said cage so that the end of said bag presses against the end of the cage when the bag is being inflated due to air flow therethrough, resilient means for resisting movement of said cage, and indicating means operable by movement of said cage.

23. In a vacuum cleaner having an air-tight casing, a distensible fibrous dust separating member in said casing, and means for causing flow of air through said casing, apparatus for indicating the condition of said separating member comprising a yieldably movable mechanism arranged to press against said dust separating member and to be moved as the dust separating member is distended due to the passage of air through the casing, a bell carried by said casing, and a striker for said bell operable by movement of said mechanism.

GUSTAF EINAR LOFGREN.