Nov. 23, 1937. D. G. SMELLIE 2,100,089

SUCTION CLEANER

Filed May 23, 1935 2 Sheets-Sheet 1

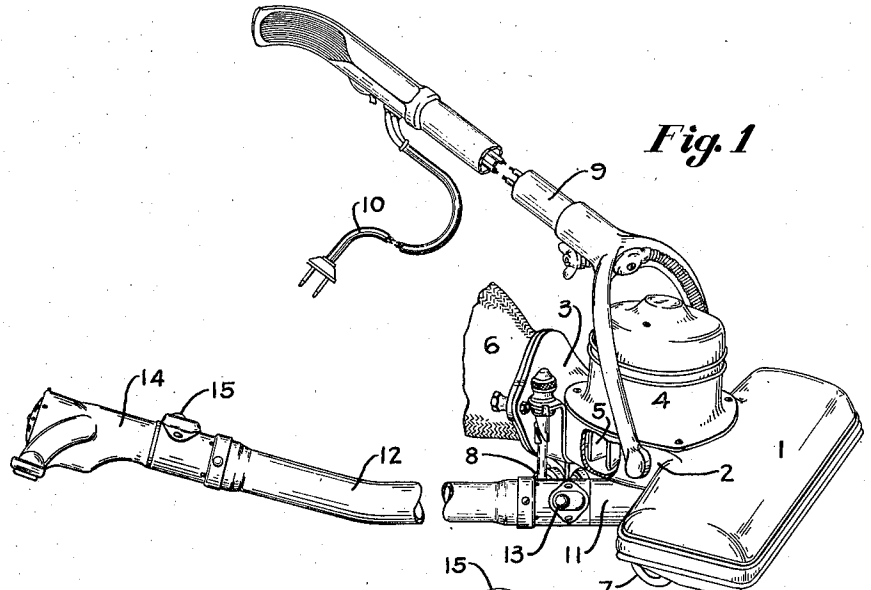

Fig. 1

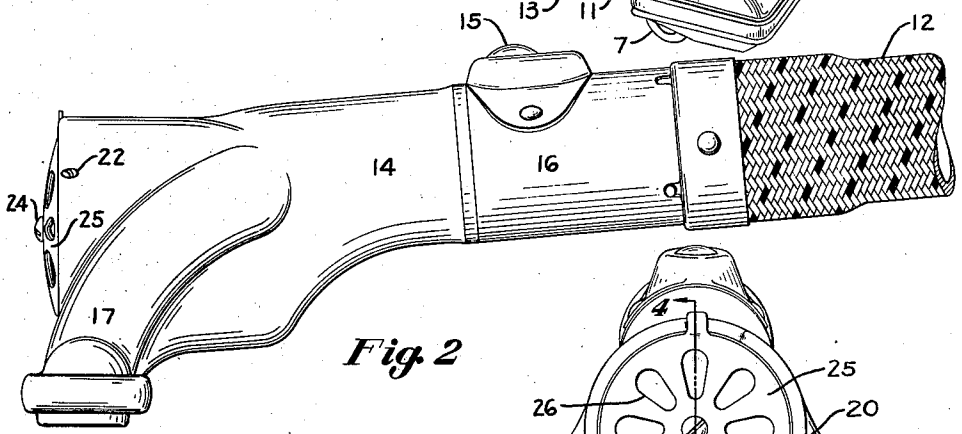

Fig. 2

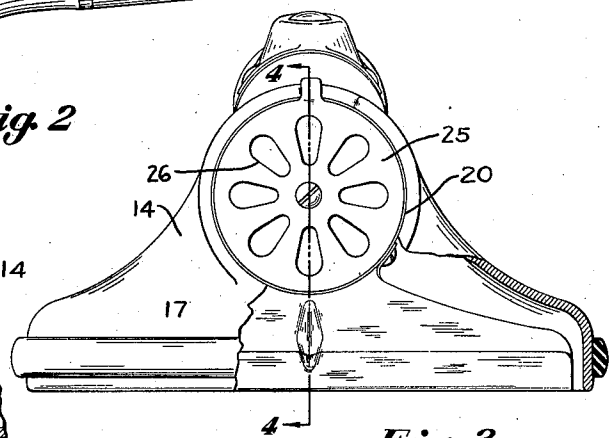

Fig. 3

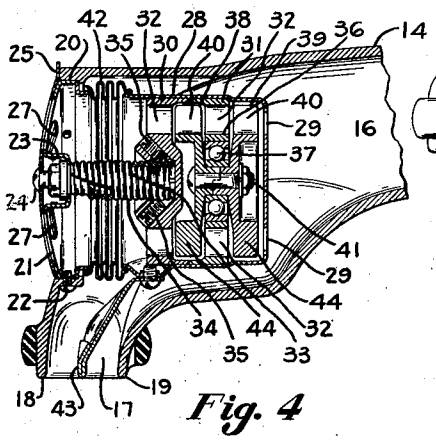

Fig. 4

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SUCTION CLEANER

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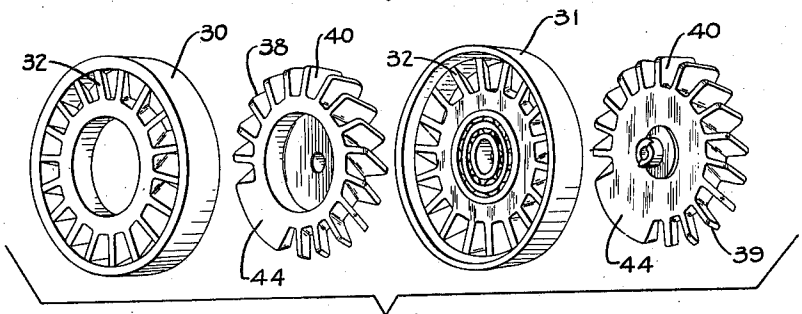

Fig. 5

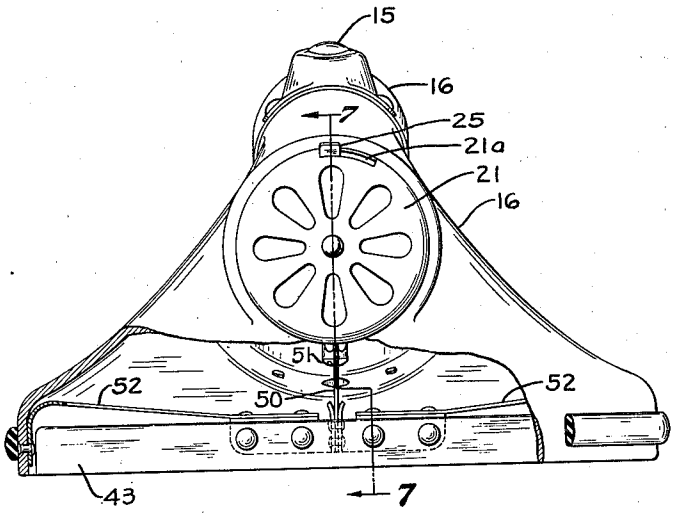

Fig. 6

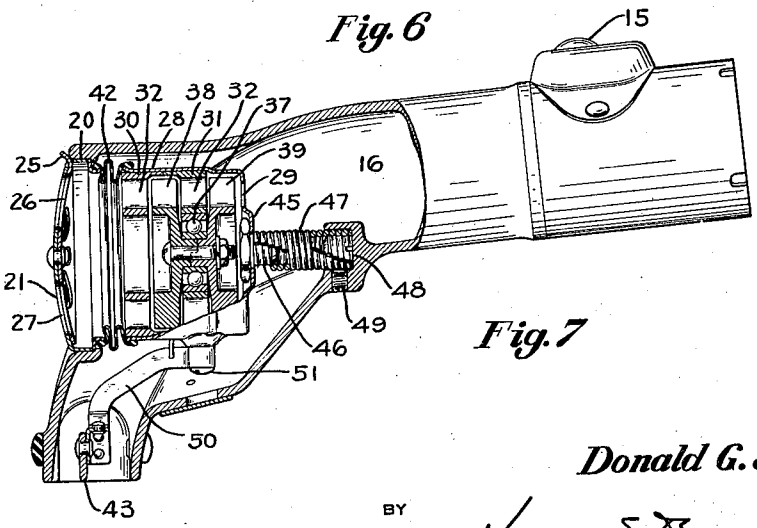

Fig. 7

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2,100,089

SUCTION CLEANER

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5 Claims. (Cl. 15—13)

The present invention relates to suction cleaners in general and particularly to new and novel improvements in suction cleaner agitating devices. More specifically the invention comprises an improved air-driven vibrator, and agitator positioned in the dusting tool nozzle of a suction cleaning unit.

It is an object of the present invention to provide a new and improved suction cleaning unit. It is another object of the invention to provide a new and improved nozzle in a suction cleaning unit. Still another object is the provision of a new and improved dusting tool nozzle for a suction cleaning unit. A further object is the provision, in a suction cleaning unit, of a dusting tool nozzle connected to suction-creating means and provided with surface-agitating means which are positively actuated by an air driven unbalanced rotary air motor. Still another object is the provision, in a suction cleaner nozzle, of a surface agitating element which is connected to an unbalanced rotary air motor which is resiliently mounted relative to the nozzle. These and other more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawings to which they relate.

Referring now to the drawings in which preferred embodiments of the present invention are disclosed, and in which the same reference character refers to the same part throughout:

Figure 1 is a view in perspective of a modern suction cleaning unit including a suction cleaner proper to which is attached a dusting tool unit;

Figure 2 is an enlarged view of the dusting tool nozzle and the hose attached thereto;

Figure 3 is a front elevation of the dusting tool nozzle with certain portions of the front wall broken away showing the surface covering agitator positioned therein;

Figure 4 is a vertical longitudinal section upon the line 4—4 of Figure 3;

Figure 5 is an exploded view of the stators and rotors of the unbalanced air turbine, the outer stator being of the type used in the second embodiment of the invention;

Figure 6 is a front elevation of a second preferred embodiment of the dusting tool nozzle with certain portions of the front nozzle wall broken away;

Figure 7 is a section upon the line 7—7 of Figure 6.

Referring again to the drawings, and to Figure 1 in particular, a modern suction cleaner is shown provided with a dusting tool unit. The suction cleaner proper comprises a nozzle 1, a fan chamber 2, an exhaust outlet 3, and a motor casing 4. A suction-creating fan 5 is positioned within the fan chamber 2 and is driven by a suitable unshown motor positioned within the casing 4. At the exhaust outlet 3 a removable dust bag 6 is attached which functions to filter from the air exhausted thereinto the suspended foreign matter. The cleaner is movably supported by front and rear wheels 7 and 8, and a pivoted handle 9 provides means by which the machine can be propelled. The incoming power leads 10 enter the handle and pass downwardly therethrough into the motor casing and into contact with the unshown driving motor.

As illustrated in Figure 1 the machine is connected for off-the-floor cleaning. That is, a converter member 11 is connected to the fan chamber 2 so that air is drawn therefrom into the fan chamber instead of from the nozzle 1 into the fan chamber. To the converter member 11 is secured an elongated dusting tool hose 12, the cleaner end of which seats within the outer end of the converter and is removably secured thereto by a manually operable spring-pressed detent 13. At the outer end of the hose 12 a dusting tool nozzle 14 is positioned which encloses the end of the hose, being removably secured thereto by means of a second spring-pressed detent 15.

Referring now to Figures 2 to 4, inclusive, in particular, the specific construction of the dusting tool nozzle 14 is illustrated in its first embodiment. Dusting tool nozzle 14, in common with the usual dusting tool nozzle, comprises a conduit portion 16 which connects to the dusting tool hose 12, and a mouth portion 17 which is flared, or extended transversely of the conduit portion 16, and has its open end defined by spaced nozzle lips 18 and 19.

In the operation of the cleaner with the dusting tool unit cleaning air will be drawn through the dusting tool nozzle 14, entering through the nozzle portion 17 between the lips 18 and 19, and will travel through the conduit portion 16 into the hose 12 in which it will travel to the converter 11 and into the cleaner proper under the suction created by the fan 5. As distinguished from the usual dusting tool nozzle, however, nozzle 14 is formed with an auxiliary or secondary opening 20 which is normally closed by a convex plate 21 which is removably secured in place by circumferentially spaced screws 22, 22 etc. Plate 21 is provided with a central depressed seat portion 23 in which is seated a combination pin construction 24 the outer end of which extends slightly be-

yond the outer convex surface of plate 21 and functions to hold in place thereagainst a rotatable valve member 25 which is provided with a plurality of openings 26, 26 which are adapted to mate, in certain positions of the valve member, with openings 27, 27 in the closure plate 21.

Within the nozzle 14 and immediately in the rear of the opening 20 is positioned an unbalanced rotary air turbine unit. The outer casing of this unit is indicated at 28 and comprises a cylindrical member entirely open at its forward end, which faces the opening 20, and which is provided with a plurality of openings 29 near its periphery at its opposite end.

Within the turbine casing are positioned spaced stators 30 and 31. Each stator comprises an outer circumferential rim which is diametrically spaced from an inner body portion by inclined guide vanes or blades 32 which are adapted to direct air passing through the stators. The central body portion of stator 30, in this embodiment, is solid and is provided with a seat 33. A substantial yet flexible coil wire spring 34 extends from the inner end of the pin construction 24, which is shaped to seat and hold a spring at its inner end as seen in Figure 4, into the seat 33 to be removably secured therein by the clamping screws 35, 35 which extend at an angle to the seat 33. The spring 34 is of sufficient strength to support the turbine construction opposite the opening 20, as illustrated in Figure 4. The second stator 31 is also provided with vanes 32 which are adapted to guide the air which passes therethrough. Its central body portion comprises a ring 36 which seats the outer race of a ball bearing 37.

Upon opposite sides of the stator 32 with their central portion seated within the ball bearing 37, are positioned unbalanced rotors 38 and 39 which are provided at their periphery adjacent the stator vanes 32, 32 etc. with vanes or blades 40, 40 etc. which slope in the opposite direction to the slope of the vanes of the stators. A sector 44 in each rotor, illustrated in Figures 4 and 5, provides an unbalanced mass which unbalances the entire rotor. The central portions of the two rotors are inter-fitting and are fixedly secured together and to the inner race of bearing 37 by an axially extending nut and bolt construction 41.

The forward open end of the air turbine body 28 is sealed to the nozzle opening 20 by a flexible air seal 42 so that the air which enters the nozzle through the opening 20 must traverse the air turbine and pass through the rear openings 29, 29 etc. to enter the nozzle proper.

On the under side of the body 28 of the air turbine is secured an elongated rigid beating element 43 which extends substantially the length of the nozzle mouth portion 17 between the lips 18 and 19. In this position it is adapted to contact and agitate any surface with which the nozzle comes into contact.

In the operation of this embodiment of the invention the creation of a reduced pressure within the fan chamber 2 by the rotation of the suction-creating fan 5 effects a reduction of pressure in the dusting tool unit. Air is drawn into the nozzle 16 entering through the primary opening or nozzle mouth 17 and also through the secondary or auxiliary opening 20. The air which enters through the nozzle mouth proper performs the usual cleaning function with the nozzle lips in contact with an object undergoing cleaning. The air which enters through the opening 20 first passes through ports 26 and 27 of the valve plate 25 and closure plate 21. It then passes through the flexible seal 42 and into the turbine casing 28. The guide vanes of stator 30 direct the air in such a manner that it impinges upon the sloping blades 40 of the rotor 38 to exert a rotational force upon that member. Upon leaving the rotor 40 the air is again redirected by the guide vanes 32 of stator 31 and is directed against the vanes of the rotor 39 to impart an additional rotational force to that member. The air then leaves the air turbine unit thru the casing openings 29, 29 and enters the conduit 16 of the nozzle, joining the main air stream from the nozzle.

The rotation of the turbine rotors 38 and 39 with their unbalanced sectors 44, 44 results in a vibration of the entire air turbine assembly. This vibration is permitted by the flexible spring mounting 34 of the unit which is designed to accommodate it. The flexible seal 42 which connects the unit to the auxiliary opening 20 also offers no appreciable opposition to the turbine vibration. The turbine movement is transmitted directly to the beater element 43, and this element, when in contact with a covering undergoing cleaning, vibrates that covering to dislodge therefrom all embedded foreign matter. Such dislodged matter is removed by the air stream thru the nozzle mouth in the usual manner.

Referring now to Figures 5, 6 and 7 in particular, a second preferred embodiment of this invention is disclosed. As illustrated in Figure 7 the vibrator is supported at its rear end instead of at its forward end as in the first embodiment. To accommodate this variation the turbine casing 28 is formed with a seat 45 in its rear face which accommodates an outwardly extending bolt member 46 exteriorly shaped to conform to the inner convolutions of a supporting coil spring 47. The opposite end of coil spring 47 extends into a seat 48 formed integrally in the underside of the nozzle 16 where it is fixedly held by a removable screw 49. The forward end of turbine casing 28 is sealed, as in the first embodiment, to the opening 20 of the nozzle by the flexible seal 42. Opening 20 is again closed, as in the first embodiment, by the closure plate 21 which, however, is without the recessed seat 23 of the first embodiment and carries upon its surface the relatively rotatable valve 25. In the present instance, however, valve 25 is positioned interiorly of plate 21 instead of exteriorly thereof, the valve plate extending at its upper end through a slot 21a in the plate in order that the operator may change its position to aline or move from alinement the openings in the valve and in the plate.

Within the air turbine casing 28 are positioned the stators 30 and 31 with their guide vanes 32, 32. In the present embodiment the stator 30 is without the central spring-seating construction which characterized it in the first embodiment, the spring being seated, as previously described, in the rear face of the turbine casing. Stator 31 again seats the bearing 37 which rotatably supports the unbalanced rotors 38 and 39 which, as in the first embodiment, are interconnected and rotate together.

According to the second embodiment of the invention the agitator 43, an elongated thin rigid beater element, is connected to the turbine casing 28 by a flexible flat spring 50 lying in a vertical plane. The turbine end of the spring is secured by a vertical screw 51. Agitator 43 is additionally supported by L-shaped leaf springs 52, 52 which connect to the central part of the agitator and at their opposite ends to the side walls of nozzle 14. Springs 52, 52 oppose and eliminate any tend-

ency of the agitator **43** to move transversely of the nozzle but freely permit of its vertical movement.

In the operation of this last embodiment of the invention the rotation of the turbine rotors, as in the first embodiment, causes every point therein to move in a continuous path in a substantially vertical plane. This movement is imparted to the turbine end of power-transmitting spring **50**. As agitator-supporting springs **52**, **52** prevent transverse agitator movement the horizontal components of turbine movement are absorbed in the flexible spring **50**. Spring **50** is relatively rigid in a vertical direction, however, and the vertical components of turbine movement are transmitted directly to the agitator which accordingly vibrates only in a vertical direction.

In both embodiments of the invention if the operator desires to use air exclusively to perform the cleaning the agitator can be rendered inoperative by manually rotating the plate valve **25** to a position such that the openings in the valve and in the closure plate **21** are out of alinement. No air is drawn through the air turbine into the nozzle, and the agitator is unactuated.

I claim:

1. In a cleaner nozzle having a mouth, a second inlet into said nozzle, an unbalanced air turbine connected in series with said inlet and exhausting at a point spaced from said mouth, said turbine including an open-ended casing, means sealing said casing to said inlet, stationary guide vanes for air passing thru said turbine, rotors having blades to be contacted and rotated by the air directed thereagainst by said stationary guide vanes and an unbalanced mass to cause vibration upon rotation, means movably supporting said turbine in said nozzle and an agitator element connected to said turbine and extended into said nozzle mouth.

2. In a cleaner nozzle having a mouth, a second inlet into said nozzle, an unbalanced air turbine connected in series with said inlet, and exhausting at a point spaced from said mouth, said turbine including an open-ended casing, means sealing said casing to said inlet, stationary guide vanes for air passing thru said turbine, rotors having blades to be contacted and rotated by the air directed thereagainst by said stationary guide vanes and an unbalanced mass to cause vibration upon rotation, a resilient spring mounting said turbine in said nozzle, and an agitator element connected to said turbine and extended into said nozzle mouth.

3. In a cleaner nozzle having a mouth, a second inlet into said nozzle, an unbalanced air turbine connected in series with said inlet, and exhausting at a point spaced from said mouth, said turbine including an open-ended casing, means sealing said casing to said inlet, stationary guide vanes for air passing thru said turbine, rotors having blades to be contacted and rotated by the air directed thereagainst by said stationary guide vanes and an unbalanced mass to cause vibration upon rotation, a spiral coil spring extended parallel to the axis of turbine rotation mounting said turbine in said nozzle for vibration, and an agitator element connected to said turbine and extended into said nozzle mouth.

4. In a cleaner nozzle, an air turbine exposed to atmospheric pressure on one of its sides and nozzle pressure upon its opposite side, said turbine including an unbalanced rotor adapted to be rotated by air passing therethru, means movably mounting said turbine relative to said nozzle, an agitator mounted on said nozzle for linear movement, and movement-transmitting-and-eliminating means connecting said turbine to said agitator.

5. The construction recited by the preceding claim characterized in that said last-mentioned means comprises a spring member relatively rigid in the direction of agitator movement and relatively flexible in a direction at right angles thereto.

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