

July 10, 1934.

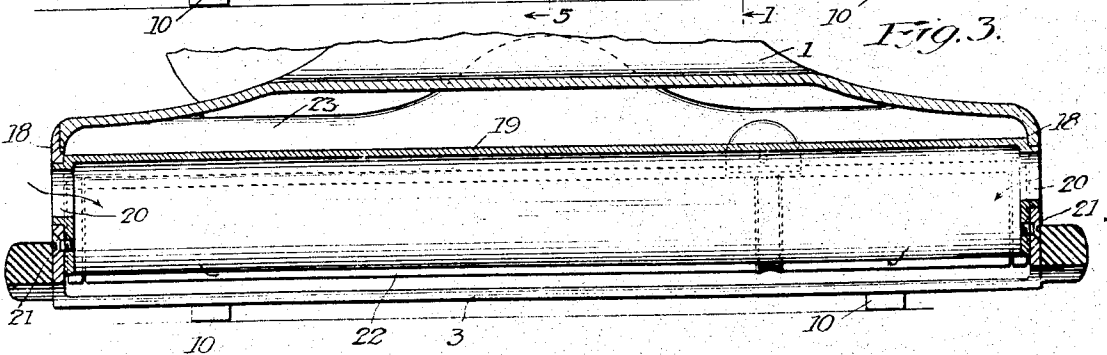
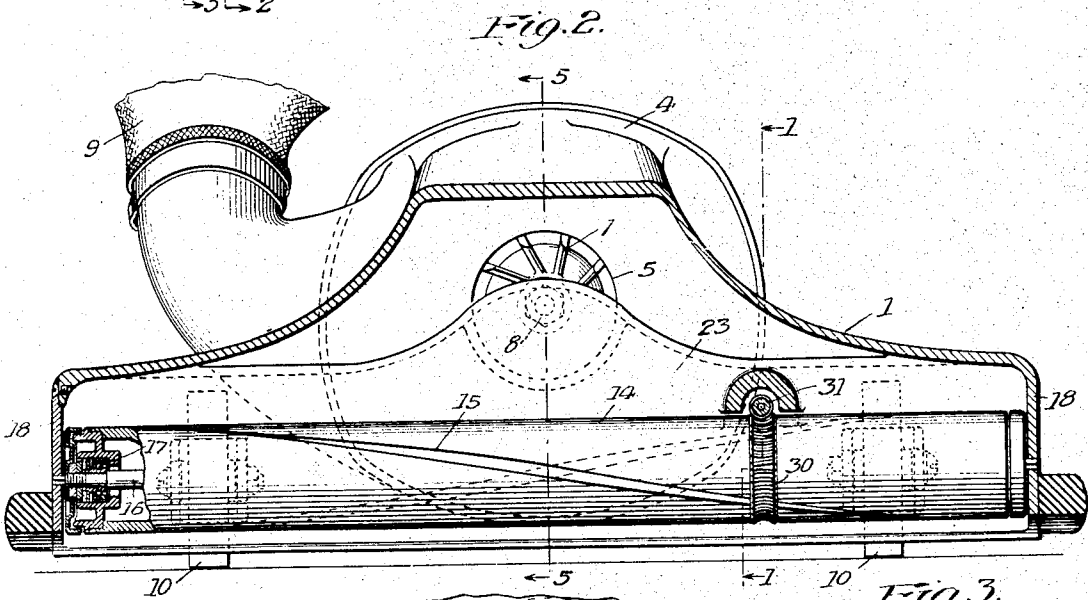
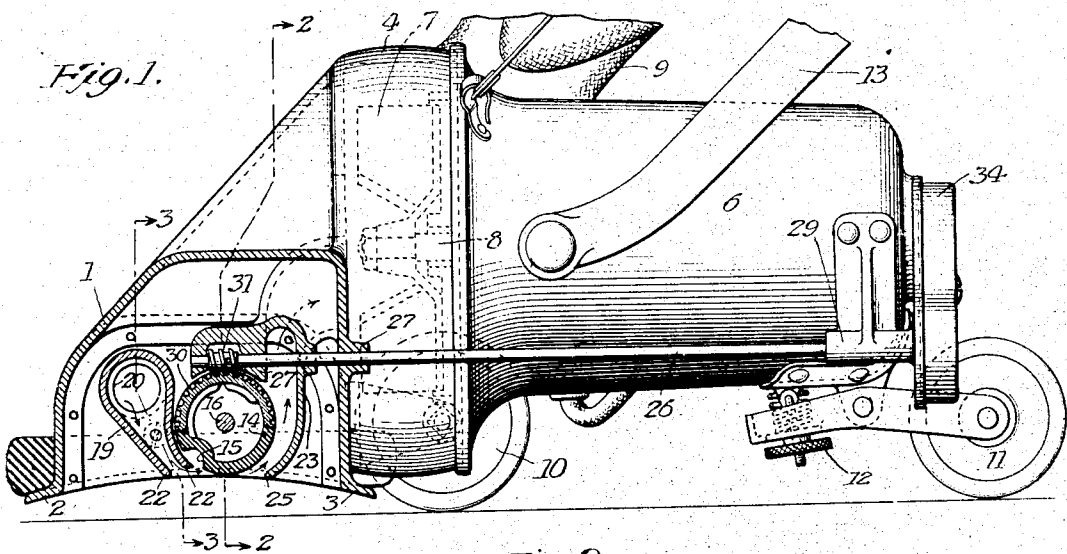
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1,965,614

SUCTION CLEANER

Filed April 27, 1931

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

Fig. 4.

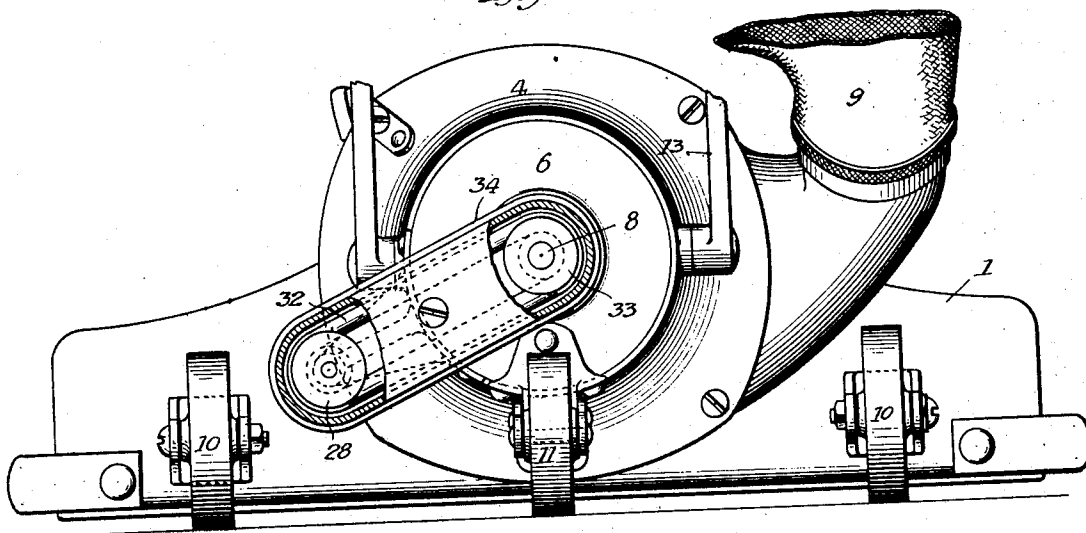


Fig. 5.

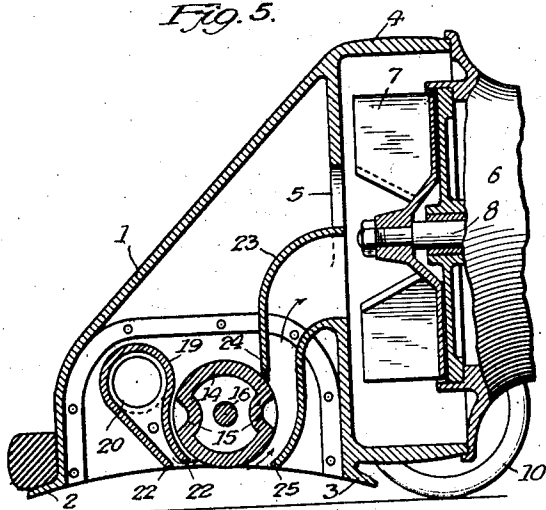
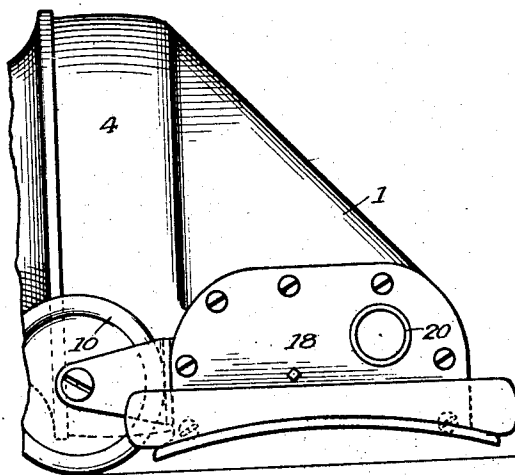


Fig. 6.



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3 Sheets-Sheet 3

Fig. 7.

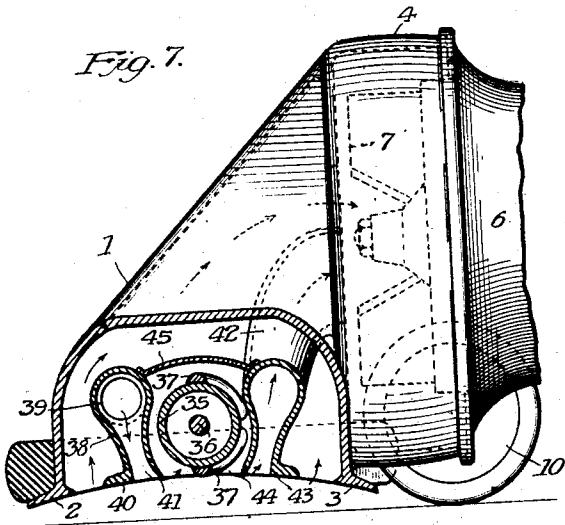


Fig. 8.

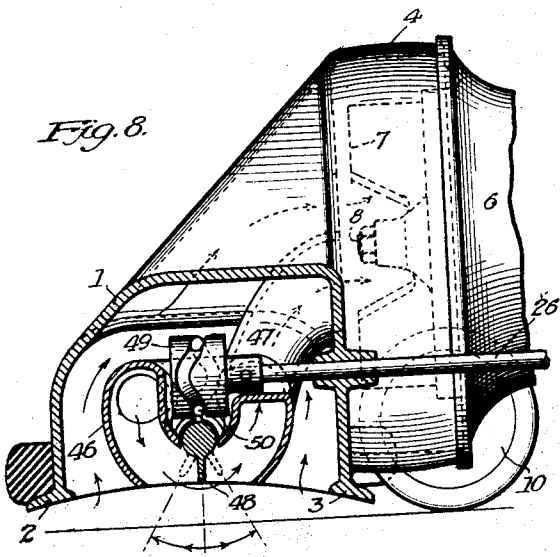


Fig. 9.

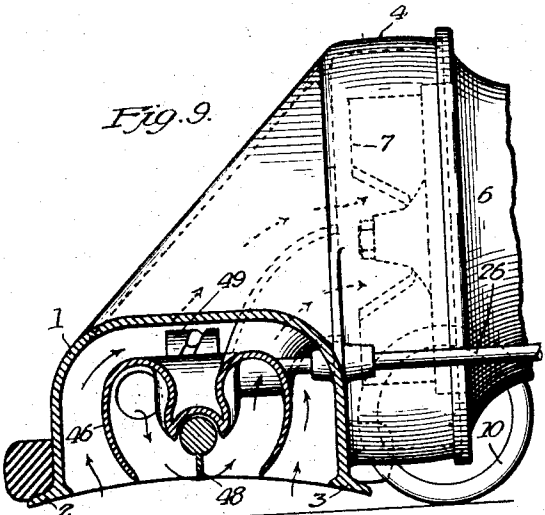
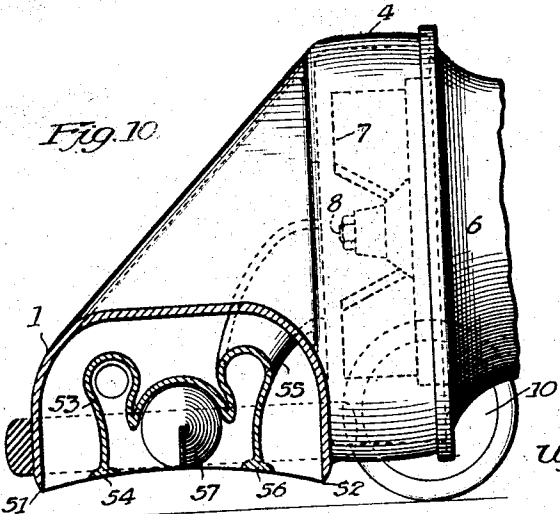


Fig. 10.



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UNITED STATES PATENT OFFICE

1,965,614

SUCTION CLEANER

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Application April 27, 1931, Serial No. 533,109

17 Claims. (Cl. 15-14)

The present invention relates to suction cleaners in general and particularly to a new and novel suction cleaner construction which embodies a new cleaning principle. More specifically the invention comprises the provision of a suction cleaner in which means are provided: first, to lift the surface covering undergoing cleaning from the supporting surface; second, to agitate, vibrate and dislodge the embedded foreign matter in the surface covering; third, to direct a flow of cleaning or dirt-removing air past the exact point of surface-covering agitation for the purpose of removing and carrying away the dislodged foreign matter.

It is an object of the present invention to provide a new and improved suction cleaner. It is a further object to provide a new and improved suction cleaner embodying a novel principle of agitation and air-cleaning. A still further object is to provide means, in a suction cleaner, to lift the surface covering undergoing cleaning from the supporting surface, means to violently agitate the lifted surface covering, and still other means to direct cleaning air directly past the point at which the surface covering is being agitated. Still another object is the provision, in a suction cleaner, of a construction embodying a nozzle which is adapted to contact the surface covering and to contain air at pressure less than atmospheric, of a housing containing air at atmospheric pressure positioned within the nozzle which directs that air towards the surface covering, and of a secondary nozzle within the main nozzle containing air at a pressure lower than that in the first nozzle and which is adapted to draw air from said housing and under a surface covering agitator. Other and more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawings.

In the drawings, in which preferred embodiments of the present invention are disclosed:

Fig. 1 is a side view of a modern suction cleaner embodying the present invention showing a section thru the nozzle upon the line 1-1 of Fig. 2;

Fig. 2 is a section upon the line 2-2 of the cleaner shown in Fig. 1;

Fig. 3 is a section upon the lines 3-3 of Fig. 1;

Fig. 4 is a rear view of the cleaner shown in Fig. 1, showing the power-transmitting means;

Fig. 5 is a partial section upon the lines 5-5 of Fig. 2;

Fig. 6 is a partial side view showing the nozzle of the cleaner disclosed in Figures 1 to 5 inclusive;

Fig. 7 is a section thru the nozzle of a cleaner

embodying a modification of the present invention;

Fig. 8 is a transverse cross section thru the nozzle of a cleaner embodying a still further modification of the present invention;

Fig. 9 is a transverse section upon a different plane thru the nozzle of the modification shown in Fig. 8;

Fig. 10 is a cross section thru the nozzle of a cleaner embodying a still further modification of the present invention;

In the operation of a suction cleaner embodying positive agitation means, which are now conceded to be absolutely necessary for efficient surface-covering cleaning, it is necessary to provide means to lift the surface covering from the supporting surface in order that the agitating means may act thereon effectively and without injury. This lifting function is ordinarily performed by the cleaner nozzle, or more accurately, by the reduced pressure within the cleaner nozzle which is created by the suction-creating means of the cleaner. The agitator of the usual suction cleaner is positioned within the suction nozzle extending the length thereof parallel to the nozzle lips and is usually actuated by the cleaner motor. The cleaning air enters the nozzle under the lips thereof, which are positioned upon opposite sides of the agitator, and is drawn upwardly to the fan chamber. As the lips are spaced an appreciable distance from the point of surface-covering agitation, that is, the point or series of points at which the agitator contacts the surface covering in its operation, it is clear that, in the usual cleaner, the cleaning air does not pass directly by or over the point of agitation.

In the suction cleaner constructed in accordance with the present invention, however, the cleaning air passing thru the nozzle is directed to the exact point of surface covering agitation thereby effecting greater cleaning than is possible with the ordinary suction cleaner. The means by which this desirable, and theoretically correct result is obtained is hereinafter fully explained.

Referring now to the drawings, and Figures 1 to 6 in particular, the first preferred embodiment of the present invention is disclosed. The nozzle 1 of the machine is provided with spaced front and rear lips 2 and 3, respectively, which are relatively broad as compared to the usual nozzle lips, and preferably are curved to conform to the surface contour in the raised position. The fan chamber 4 is shown as formed integrally in the same casting with the nozzle 1

and is interiorly connected thereto thru an inlet or eye 5. The motor casing 6 is positioned adjacent to and immediately in the rear of the fan chamber and houses a suitable driving motor, which is not shown, for the suction-creating fan 7 which is rotatably mounted upon the extended motor shaft 8 within the chamber. As in the usual cleaner a dust bag 9 is provided which is adapted to receive the dirt-laden air exhausted from the fan chamber 4 in the operation of the machine. The forward end of the cleaner is movably supported by means of spaced wheels 10, 10, while the rear of the machine is carried by a castor 11 which is provided with height-adjusting means indicated generally by the reference character 12. A handle 13, of the usual pivoted type, is connected to the motor casing 6 and provides means by which the machine may be moved by the operator upon the supporting surface.

An agitator 14 of the positive agitation type, and which is provided with recessed beaters 15, 15 upon its surface, is positioned within the nozzle 1, being rotatably mounted upon a stationary shaft 16 by means of a bearing 17 at each of its ends. The stationary shaft is itself non-rotatably supported in the end walls 18, 18 of the nozzle, one of said walls being preferably removable to aid in the disassembly of the construction.

At one side of the agitator 14, extending parallel thereto and also supported by the end walls 18, 18 of the nozzle 1, is what is called an air tunnel or housing 19. At its ends the housing 19 is provided with openings or inlets 20, 20 which connect to the exterior atmosphere, or ambient, thru the end walls 18, 18 of the nozzle, said inlets or openings being of such size that the pressure within the air tunnel is at all times substantially the same as atmospheric. Except for the openings 20, 20 the air tunnel 19 is closed at its ends which lie against the end walls 18, 18 of the nozzle being suitably secured thereto as by screws 21, 21. The body of the air tunnel resembles an inverted U there being provided a narrow mouth defined by two parallel extending edges or lips 22, 22, the said mouth being immediately adjacent and extending parallel to the agitator 14. The side wall of the tunnel immediately adjacent the agitator 14 is curved to conform to the contour thereof and, because it is substantially in contact with the agitator surface, provides an effective seal against the leakage of air therebetween. The sealing relationship of the tunnel and the agitator surface is made possible thru the use of recessed beaters on the agitator.

Positioned immediately in the rear of the agitator and extending parallel thereto is what is preferably called a secondary nozzle, said nozzle being indicated by the reference character 23. In the embodiment shown the nozzle 23 is cast integrally with nozzle 1 though it is to be understood that the particular manner in which these parts are assembled is not of the essence of the invention. Nozzle 23 opens directly into the eye 5 of the fan chamber closing a portion thereof from the main nozzle 1, in fact, the opening of the eye 5 into the nozzle 23 is greater in area than its opening into the nozzle 1, thereby giving to nozzle 23 the greater part of the suction-creating power of the fan 7. The mouth of the nozzle 23 extends parallel to the line of contact which the agitator 14 makes with the surface covering undergoing cleaning and is defined by the edges 24 and 25. As shown in the present

embodiment, Figures 1 to 6 inclusive, the lip 24 of the secondary nozzle is not adapted to contact the surface covering undergoing cleaning but extends closely adjacent to the peripheral surface of the rotary agitator 14 in such a manner that but a slight amount of air will leak from the main nozzle 1 into the secondary nozzle 23 therebetween. The rear lip 25 of the secondary nozzle extends downwardly to a position adjacent the line of contact of the agitator with the surface covering and substantially into the plane of the mouth formed by the lips 22, 22 of the air tunnel 19 being adapted to contact the lifted surface covering in the operation of the machine.

The rotating force for the agitator 14 is received thru a longitudinally-extending shaft 26 which extends rearwardly from the nozzle, where it is rotatably supported by suitable bearings such as 27, 27, to the rear of the motor casing where it is carried by means of a bearing 29 and is provided with a suitable pulley 28. The agitator 14 is provided upon its surface, at the point at which the shaft 26 extends into the nozzle, with a suitable gear, indicated by the reference character 30. The shaft 26 is provided with a cooperating gear 31 immediately adjacent the agitator at this point and any rotation of the shaft necessarily results in the rotation of the agitator. The pulley 28 at the rear end of the shaft is connected, by means of a power-transmitting belt 32, to a cooperating pulley 33 carried by the extended end of the motor shaft 8. A suitable housing 34 is provided which encloses the pulleys 28 and 33 and the belt 32.

In the operation of the suction cleaner constructed in accordance with the aforescribed embodiment of the invention upon the starting of the cleaner motor by the operator as by closing a suitable circuit-controlling switch, the motor shaft 8 is rotated and a reduced pressure is created within the fan chamber 4 by the revolving fan 7 resulting in the drawing of air thru the inlet 5 and exhausting it into the dust bag 9. The removal of the air from the nozzle 1 results in a reduced pressure therein and the atmospheric pressure outside the nozzle forces the surface covering upwardly and against the nozzle lips 2 and 3 which, being relatively broad, effect a seal therewith permitting the vacuum of the nozzle to become even greater resulting in a more positive suspension of the surface covering. The rotation of the motor shaft 8 also results in the rotation of the power-transmitting shaft 26 which is connected thereto thru the driving belt 32 and the pulleys 33 and 28, as aforescribed. The rotation of the shaft 26 is transmitted thru the gears 30 and 31, to the agitator 14 resulting in the rotation of that member at high speed. The rotation of the agitator 14 violently vibrates and beats the surface covering, which is lifted into contact therewith by the reduced pressure in nozzle 1, as the edges of the recessed beaters 15, 15 contact therewith. The reduced pressure in the fan chamber 4 is also transmitted to the secondary nozzle 23, in fact the pressure therein is less than in the nozzle 1 for, as is clearly seen in Figure 2, a greater area of the inlet 5 of the fan chamber is open to the secondary nozzle 23 than is connected to the main nozzle 1. This is desirable as the only suction required for the nozzle 1 is that sufficient to lift the surface covering and hold it against the nozzle lips, while the suction within the nozzle 23 is that which is to move the cleaning air.

The ratio of the opening of the eye 5 to the main nozzle and to the secondary nozzle can be varied by the designer as required to obtain the greatest efficiency. The suction within the secondary nozzle 23 results in the drawing of air between the lower surface-contacting lip 25 and the rotary agitator body, the remainder of the mouth of the secondary nozzle being closed by the agitator. The most available source of air for the nozzle 23 is that found in the air tunnel 19 which, as afore-described, is positioned immediately adjacent the agitator 14 and upon the opposite side thereof from the secondary nozzle. Within the air tunnel 19 is air at substantially atmospheric pressure while within the nozzle 23 is the greatest vacuum present in the machine. As a result of this difference of pressure, air is drawn from the tunnel or housing 19 thru the mouth thereof, as defined by the lips 22, 22, past the line of contact of the agitator 14 and the surface covering and into the secondary nozzle 23 and so on into the fan chamber. The result of this construction is, therefore, that the cleaning air has come into contact with the surface covering at exactly the point at which the covering is agitated by the agitator. This relationship is, as before stated, extremely desirable as it results in maximum cleaning efficiency.

In Figure 7 a second embodiment of the present invention is disclosed. The main nozzle 1 with its broad sealing lips 2 and 3, the fan chamber 4 with its fan 7, the motor casing 6 and the front supporting wheels 10, are shown and are constructed precisely as in the first embodiment. In this modification, however, use has been made of a rotary agitator of the type in which the beating elements are positioned above the peripheral surface instead of below, as in the first embodiment. This change has made necessary certain structural modifications in the air tunnel and secondary nozzle which are hereinafter fully pointed out. According to this modification the agitator body, which is indicated by the reference character 35, is rotatably mounted upon the shaft 36 and is provided with positive beating elements 37, 37 which extend above the normal peripheral surface. The air tunnel 38 is provided at its end with an opening 39 to the exterior and, in the present instance, the lips of the air tunnel defining the tunnel mouth are positioned closely adjacent the line of contact which the rotary agitator makes with the surface covering undergoing cleaning and are of two different types. The outer lip, indicated by the reference character 40, is relatively broad and is adapted to contact the surface covering and limit the air flow from tunnel 38 into the main nozzle 1. The inner lip, indicated by the reference character 41, is exceedingly thin or narrow, being of a type known as pile-penetrating and not only offers but slight resistance to the passage of air between itself and the surface covering undergoing cleaning but in effect positively agitates and disturbs the pile of the surface covering as it is moved thereover. The secondary nozzle, which is indicated by the reference character 42, is also provided with an outer lip 43 of the broad sealing type which restricts and limits the flow of air into the secondary nozzle from the main nozzle 1. The inner lip 44 of the secondary nozzle is relatively thin and, as in the case of the lip 41, the air tunnel, offers but little resistance to the entrance of air and also functions as an agitator. In the present embodiment the presence of positive beating elements 37, 37 on the

rotor surface prevents the air tunnel and the secondary nozzle from closely enclosing the agitator to prevent the flow of air therearound. To overcome this difficulty a plate 45 is provided which extends between the air tunnel 28 and the secondary nozzle 42 and entirely seals the agitator from the enclosing nozzle 1 and prevents the flow of air from the tunnel to the main nozzle or from the main nozzle to the secondary nozzle past the agitator. The operation of the present embodiment is similar to that first described except that the agitation of the rotary agitator is supplemented by the pile-flexure agitation of the pile-penetrating lips of the tunnel and the secondary nozzle.

In Figures 8 and 9 a still further modified embodiment of the present invention is disclosed in which the air tunnel is indicated by the reference character 46 and the secondary nozzle by the reference character 47. In the place of the rotary agitator, which has characterized the previous modifications, an oscillating or reciprocating scratching agitator 48 has been provided. The actuation of the oscillating agitator is accomplished by means of a cam 49 carried at the forward end of the power transmitting shaft 26 which is driven as in the first modification. The agitating member 48 is provided with an up-standing finger 50 which seats at its upper end within the cam-way and upon the rotation of the shaft 26 functions to move the agitating member between the two positions of maximum displacement indicated by the dotted lines. As in the previous modifications the flow of cleaning air is from the air tunnel into the secondary nozzle and will be, as is clearly seen from the drawings, directly past the surface covering at the point of agitation.

Referring now to Figure 10 in particular, a still further modified embodiment of the present invention is disclosed in which the sealing lips on the main nozzle of the previous embodiments have been eliminated and in their place pile-penetrating lips 51 and 52 have been provided. Within the nozzle the air tunnel, indicated by the reference character 53, is itself provided with a relatively broad sealing lip 54. The secondary nozzle is indicated by the reference character 55 and is provided with a broad lip 56. Between the two is positioned a rotary agitator of the screw type which is indicated by the reference character 57 and which is adapted to be rotated in the manner shown in Figure 1 but which, instead of beating the surface covering functions merely to deflect and bend the pile thereof.

I claim:

1. In a suction cleaner, a nozzle having surface-contacting lips, an agitator in said nozzle, a hollow member in said nozzle interiorly connected with the atmosphere and having an opening to direct cleaning air adjacent said agitator, a second hollow member having an opening adjacent the opposite side of said agitator to admit dirt-laden air, and suction-creating means connected individually to said nozzle and to said second hollow member.

2. In a suction cleaner, a nozzle having surface-contacting lips, means supporting the nozzle with said lips above the surface covering undergoing cleaning, an agitator in said nozzle, a hollow member open to the atmosphere and having an opening within said nozzle adjacent the agitator adapted to convey and direct air at atmospheric pressure, a second hollow member having an opening adjacent the opposite side of

said agitator adapted to convey air therefrom, and suction-creating means connected individually to said nozzle and to said second hollow member.

3. In a suction cleaner, a nozzle having surface-contacting lips, an agitator in said nozzle adapted to contact a surface covering undergoing cleaning, a hollow member interiorly connected with the atmosphere and having an opening extending along said agitator between said nozzle lips, a second hollow member upon the opposite side of said agitator from said first-mentioned hollow member and having an opening extending along said agitator between said lips, and means to draw air from said nozzle and from said first-mentioned hollow member into said second mentioned hollow member.
4. In a suction cleaner, a nozzle having surface-contacting lips, an agitator in said nozzle, a housing interiorly connected to the external atmosphere positioned in said nozzle between said lips and having an opening extending at the side of said agitator, and means to draw air from said nozzle and from said housing and under said agitator.
5. In a suction cleaner, agitating means, means to direct a flow of air to said agitator, means to draw air from said second means under said agitator, and means to lift the surface covering undergoing cleaning against said agitator.
6. In a suction cleaner, agitating means, a housing open to the atmosphere and having a mouth adjacent said agitating means, a nozzle upon the opposite side of said agitator and having a mouth adjacent thereto, means to draw air from said nozzle, and means to lift the surface covering undergoing cleaning against said agitator and across the mouths of said housing and said nozzle.
7. In a suction cleaner, a main nozzle, a motor, suction-creating means operatively connected to said motor, a rotary agitator in said main nozzle operatively connected to said motor, an air tunnel having an open mouth positioned adjacent said agitator, said tunnel being interiorly connected to the atmosphere, a secondary nozzle upon the opposite side of said agitator and having a mouth adjacent thereto, said main and said secondary nozzles being connected to said suction-creating means.
8. In a suction cleaner, a main nozzle, broad sealing lips defining the mouth of said nozzle, a motor, suction-creating means operatively connected to said motor and to said nozzle, an agitator in said main nozzle operatively connected to said motor, an air tunnel having a surface-contacting mouth and interiorly connected to the atmosphere positioned adjacent said agitator, a relatively broad lip defining one side of said tunnel mouth to restrict the flow of cleaning air thereunder, and a relatively thin lip defining the opposite side of said mouth to flex the pile of the surface covering undergoing cleaning and to offer less resistance to the flow of air thereunder than said broad lip.
9. In a suction cleaner, a main nozzle, surface-contacting lips defining the mouth of said nozzle, a motor, suction-creating means connected to said motor, an agitator in said main nozzle connected to said motor, a secondary nozzle having a mouth closely adjacent said agitator, and suction-creating means connected to said main nozzle and to said secondary nozzles effecting a greater suction in the latter adjacent said agitator than in the main nozzle.
10. In a suction cleaner, a main nozzle, broad sealing lips defining the mouth of said nozzle, a motor, suction-creating means connected to said motor, an agitator in said main nozzle connected to said motor, a secondary nozzle having a mouth adjacent said agitator, a broad sealing lip defining one side of said mouth, and suction-creating means connected to said main nozzle and to said secondary nozzles effecting a greater suction in the latter adjacent said agitator than in the main nozzle.
11. In a suction cleaner, a main nozzle, a motor, suction-creating means operatively connected to said motor, an agitator in said nozzle, means connected to said motor to impart an alternate rotary motion to said agitator, an air tunnel interiorly connected to the atmosphere and having an opening adjacent said agitator in said nozzle, a secondary nozzle having an opening adjacent the opposite side of said agitator, said main and said secondary nozzles being interiorly connected to said suction-creating means.
12. In a suction cleaner, a main nozzle including surface-contacting lips defining a mouth, an agitator in said nozzle adapted to contact a surface covering undergoing cleaning, an air tunnel interiorly connected to the atmosphere and having a mouth extended substantially into the plane of the nozzle mouth and adjacent and at the side of said agitator, and suction-creating means connected to said nozzle for the purpose of drawing cleaning air thereinto and through said air tunnel.
13. In a suction cleaner, a main nozzle, broad sealing lips on said nozzle defining a mouth, a surface covering agitator in said nozzle, an air tunnel in said nozzle interiorly connected to the atmosphere and including a surface-contacting mouth positioned closely adjacent and at the side of said agitator, and suction-creating means connected to said nozzle.
14. In a suction cleaner, a main nozzle, surface-contacting lips on said nozzle defining a nozzle mouth, a rotary agitator in said nozzle, an air tunnel connected to an air source having a higher-than-nozzle pressure positioned in said nozzle having a mouth extended parallel to and closely adjacent said agitator, a broad sealing lip defining a side of the tunnel mouth spaced from said agitator, a secondary nozzle having a mouth extended parallel to and closely adjacent the opposite side of said agitator from said tunnel, a broad sealing lip defining the side of said secondary nozzle mouth spaced from said agitator, and suction-creating means connected to said nozzles.
15. In a suction cleaner, a nozzle, surface-contacting lips on said nozzle defining a mouth, means supporting said nozzle with said lips above the normal plane of the surface covering undergoing cleaning, an elongated rotary agitator in said nozzle extended substantially into the plane of the nozzle lips, an air tunnel connected to atmosphere positioned in said nozzle, a broad sealing lip on said tunnel extended parallel to said agitator and defining one side of the tunnel mouth, a pile-penetrating lip on said tunnel extended parallel to said agitator and defining the side of said tunnel mouth adjacent to said agitator, a secondary nozzle in said nozzle, a pile-penetrating lip defining the side of said secondary nozzle adjacent said agitator and extended parallel thereto, a broad sealing lip extended parallel to said agitator defining the opposite side of said secondary nozzle mouth, and suction-creating means connected to said nozzles.

16. In a suction cleaner, a nozzle having a relatively wide mouth, surface-contacting lips defining the sides of said nozzle mouth, an air tunnel having a relatively narrow mouth positioned in said nozzle, a surface-contacting lip defining a side of said tunnel mouth, a secondary nozzle positioned in said main nozzle having a relatively narrow mouth, a surface-contacting lip defining a side of said secondary nozzle mouth, and suction-creating means connected to said nozzles and adapted to produce a higher suction in said secondary nozzle than in said main nozzle, said tunnel and said secondary nozzle being so arranged that air passing from the former to the

latter passes over the surface covering undergoing cleaning.

17. In a suction cleaner, a nozzle having lips defining a mouth, suction-creating means, said nozzle being connected to said means, means to convey a stream of cleaning air into said nozzle between said lips and against a surface covering undergoing cleaning, and means within said nozzle to remove the air exhausted from said last mentioned means from said nozzle, said last mentioned means being connected to said suction-producing means.

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