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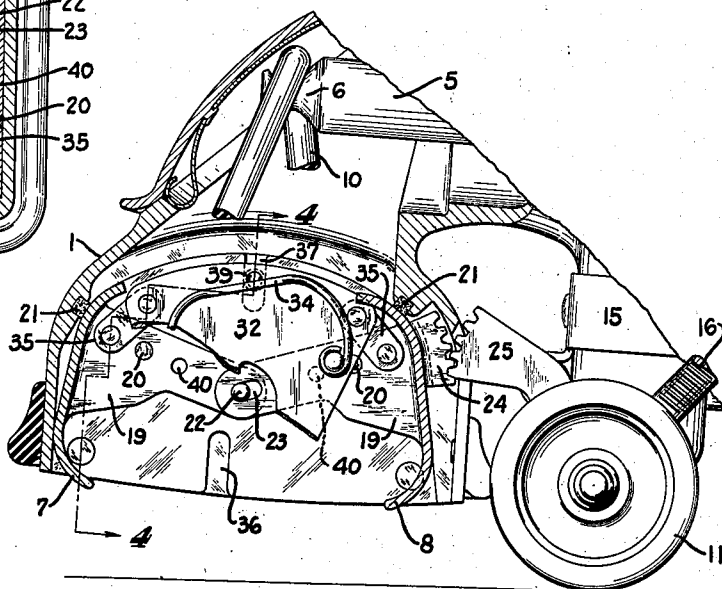
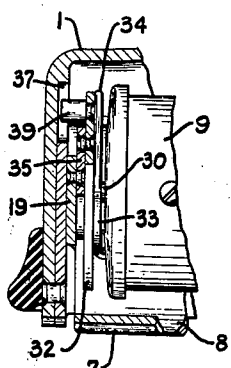
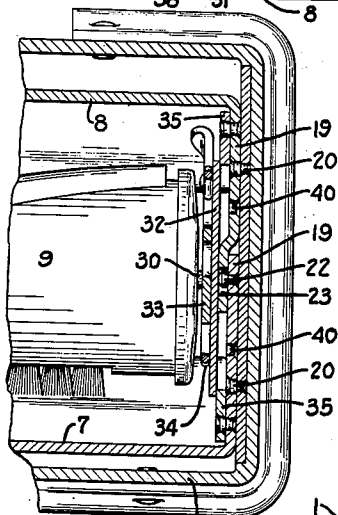
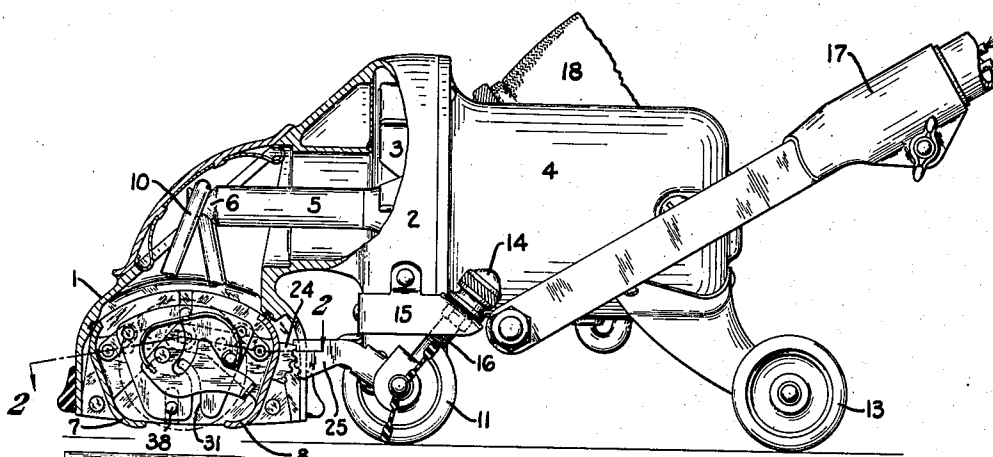
W. D. SELLERS

2,184,401

SUCTION CLEANER

Filed Feb. 13, 1936

3 Sheets-Sheet 1



INVENTOR

William D. Sellers

BY

Harry S. Bunker.

ATTORNEY

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W. D. SELLERS

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SUCTION CLEANER

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3 Sheets-Sheet 2

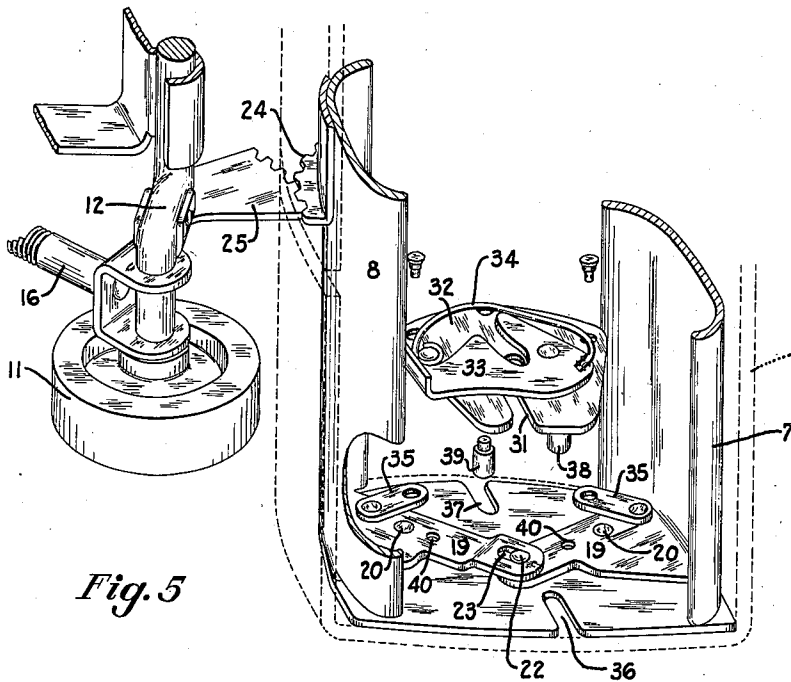


Fig. 5

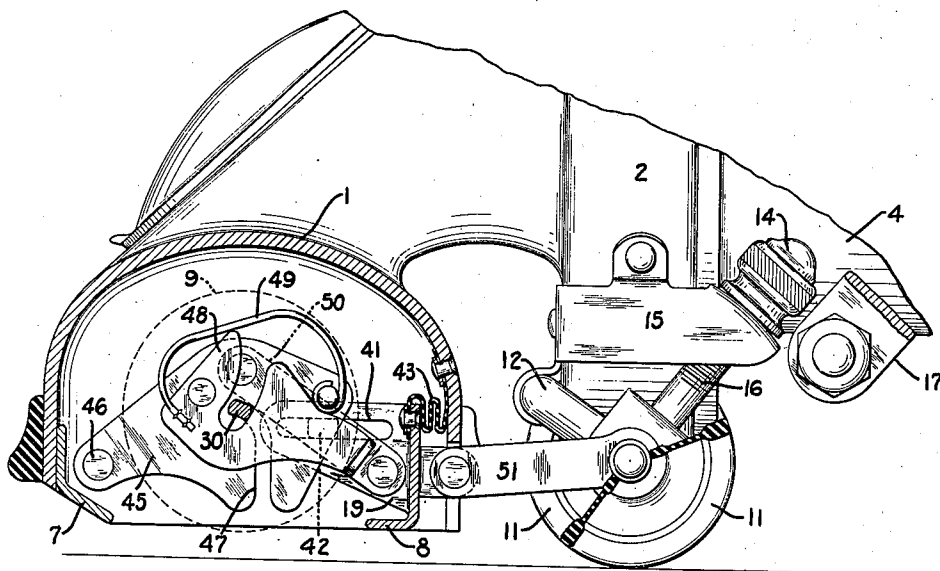


Fig. 6

INVENTOR

William D. Sellers

BY

Harry S. Demaree

ATTORNEY

Dec. 26, 1939.

W. D. SELLERS

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SUCTION CLEANER

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3 Sheets-Sheet 3

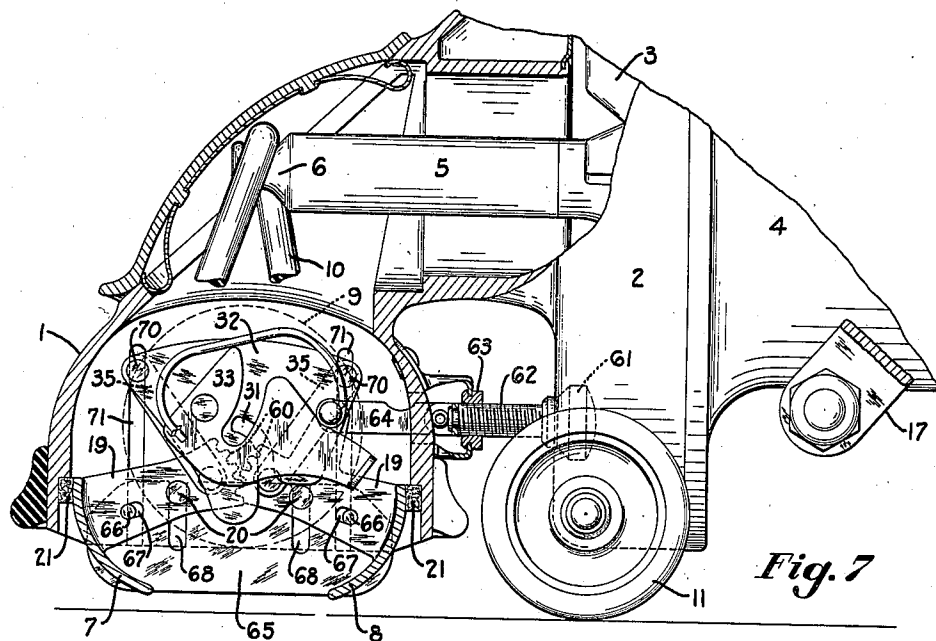


Fig. 7

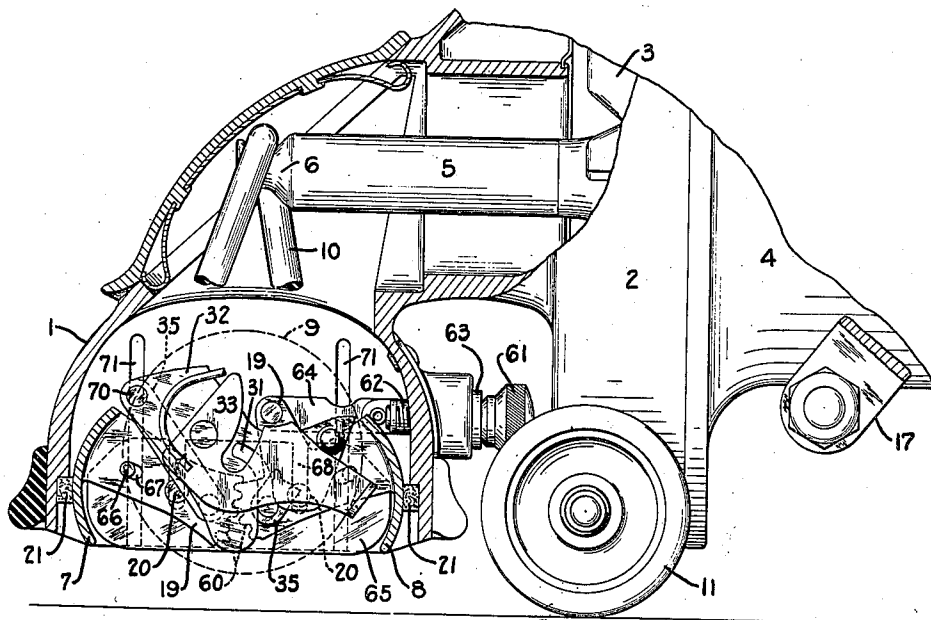


Fig. 8

INVENTOR

William D. Sellers

BY

Harry S. Bmarre

ATTORNEY

UNITED STATES PATENT OFFICE

2,184,401

SUCTION CLEANER

William Douglas Sellers, Glen Ellyn, Ill., assignor
to The Hoover Company, North Canton, Ohio,
a corporation of Ohio

Application February 13, 1936, Serial No. 63,762

18 Claims. (Cl. 15—6)

The present invention relates to suction cleaners in general and more particularly to new and novel improvements in the cleaner nozzle and its adjustment. More specifically the invention comprises a suction cleaner in which the nozzle width is varied as the nozzle is raised or lowered, the agitator in the nozzle changing its position relative to the supporting surface with the change in nozzle width.

It is an object of the present invention to provide a new and improved suction cleaner. It is another object of the invention to provide a new and improved suction cleaner embodying a novel nozzle construction. A still further object is the provision of a suction cleaner in which the nozzle width is varied with adjustment in effective nozzle height. A still further object is the provision of a suction cleaner in which the agitator position is varied as the nozzle position relative to the surface covering is changed. A still further object is the provision of a suction cleaner in which the nozzle width is changed as the nozzle is raised or lowered relative to a surface covering undergoing cleaning, the cleaner agitator positioned within the nozzle changing its position relative to the plane of the nozzle lips in the same adjustment. 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 invention are disclosed:

Figure 1 is a side elevation of a modern suction cleaner embodying the present invention with certain parts broken away and shown in section;

Figure 2 is a section through the nozzle upon the line 2—2 of Figure 1;

Figure 3 is an enlargement of the nozzle section shown in Figure 1 with certain parts of the agitator-supporting means broken away to show the nozzle-adjusting features;

Figure 4 is a section through the nozzle upon the line 4—4 of Figure 3;

Figure 5 is an exploded view showing the adjusting mechanism for the nozzle lips and agitator;

Figure 6 is a partial section through a cleaner nozzle and illustrates a second preferred embodiment of the invention in which the agitator and the rear nozzle lip only are adjustable;

Figure 7 is a partial section through a cleaner, and particularly through the nozzle thereof, embodying a third preferred embodiment of the

invention in which nozzle lips and agitator position are varied without changing the height of the entire cleaner nozzle relative to the surface, the lips being shown in a lowered position;

Figure 8 is a section similar to Figure 7 but with the lips retracted to a high position.

Surface coverings cleaned by suction cleaners vary in thickness and in weight. In cleaning these coverings effectively it is desirable to change the height of the cleaner nozzle, and also its area. With thick deep carpets, the supporting means of the cleaner sink thereinto making it necessary for the nozzle of the ordinary cleaner to be raised. If the rug be not only thick but also heavy, it is difficult to lift by the suction in the nozzle, and it is desirable to have as large a nozzle area as possible. Given a definite suction within the nozzle, the greater the area of the nozzle in contact with a surface covering, the greater will be the lifting force. If the nozzle area be increased as by increasing the nozzle width, the surface covering will be bowed further into the nozzle, and with surface agitating means positioned therein, it will usually be desirable to raise the agitator relative to the plane of the nozzle lips in order to maintain the same force of contact of the agitator with the covering. If the cleaner is to be used upon a thin, light covering the supporting means or wheels will not sink thereinto appreciably and usually it will be necessary to lower the nozzle. With the light covering it will be desirable to have a relatively small nozzle area and accordingly a relatively narrow nozzle, in order that the covering cannot be lifted and bowed too far into the nozzle. It will normally be necessary to lower the agitator within the nozzle more closely to approach the plane of the surface covering in this last position. On certain types of coverings, however, it has been found desirable to reverse direction of movement of the agitator, so that the agitator is lowered as the nozzle width increases with increase in area, and accordingly raised as the nozzle width is decreased and the area thereof decreased.

Referring again to the drawings, and to Figures 1 to 5 in particular, the first preferred embodiment of the invention is illustrated. A suction cleaner is shown comprising a nozzle interiorly connected to a fan chamber 2 housing the suction-creating fan 3. A motor casing 4 is connected immediately adjacent the fan chamber 2 and houses an unshown driving motor, the shaft 5 of which extends through the fan chamber, where it carries the fan 3, and into the nozzle.

zle 1 where it is provided with a pulley 6 at its end.

The nozzle 1 is provided with movable lips 7 and 8 which are adapted to be adjusted relative to the cleaner in a manner which will hereinafter be fully described. A rotary agitator 9, including rigid beating elements and flexible brush elements, is rotatably mounted in the nozzle in a manner to be hereinafter fully set forth, and is adapted to contact a surface covering undergoing cleaning between the nozzle lips 7 and 8. In operation the agitator is rotated by a power-transmitting belt 10 which connects to the pulley 6.

The cleaner is movably supported upon spaced front wheels, indicated by 11, which are pivotally mounted upon a crankshaft 12, and by a rear wheel 13. The front wheels are adapted to be raised and lowered to effect an adjustment in the nozzle height. To make this adjustment possible a manually rotatable nut 14, carried by a fixed bracket 15, encloses in screw-threaded relationship the end of a shaft 16 which is connected at its opposite end to an offset arm of the crank shaft 12 upon which the wheels are mounted. A pivoted handle 17 is provided by which the machine can be propelled over a supporting surface by the operator. As in the usual suction cleaner, a dust bag 18 is suitably connected to the fan chamber 2 to receive therefrom the dirt-laden air bearing foreign matter removed from a surface covering undergoing cleaning.

In this embodiment of the invention, the raising or lowering of the front supporting wheels results in the raising or lowering of the nozzle 1 and its surface-contacting nozzle lips 7 and 8. The nozzle lips are not only raised with the nozzle but simultaneously are moved apart to increase nozzle width and nozzle area. Synchronously with this adjustment, the agitator 9 in the nozzle is raised. This is accomplished by means now to be described.

The front and rear nozzle lips 7 and 8, respectively, comprise surface-contacting portions at their lower ends, and wall portions extending therefrom upwardly into the nozzle. From each end of these wall portions adjacent the end walls of the nozzle there extends a supporting arm 19 which is pivoted to the end wall upon a pivot pin 20. The lips 7 and 8 are adapted to pivot about the supporting pins at their ends as pivots, but are at all times sealed to the side walls of the nozzle by air-seals 21, 21 which are carried by the nozzle and which make sliding contact with the curved upper wall portions of the lips. At each end of the nozzle the inner ends of the supporting lever arms 19, 19 of the two lips are connected by a pin-and-slot arrangement 22, 23 to insure synchronous movement and adjustment.

The pivotal movement of the lips is accomplished by means of a toothed rack 24 carried on the back of rear lip 8 which is contacted by a toothed arcuate sector 25 carried by the wheel shaft 12. As the crank shaft 12 is rotated to raise or lower the front wheels, the arcuate sector 25 meshes with the rack 24 to force it upwardly or downwardly and to pivot the rear lip 8 about its supporting pins 20, 20 at its opposite ends. Any movement of rear lip 8 is transmitted to the front lip 7 by the pin and slot arrangement 22, 23. As the front wheels are lowered to raise the nozzle, the arcuate sector 25 rotates in a clockwise direction, as viewed in Figure 1, resulting in the upward movement of the toothed rack 24 and the pivotal movement of rear lip 8 in a counterclockwise direction about

its supporting pivots. Front lip 7 receives a similar pivotal movement, but in a clockwise direction about its supporting pivots, resulting in an increase in the nozzle width by the movement of the lips from each other. Lips 7 and 8 are mounted upon lever arms of the same length and the relationship is such that the distances they move are equal but opposite.

The agitator 9 within the nozzle has also been adjusted relative to the plane of the surface covering upon the adjustment of the lips. The agitator comprises a stationary supporting shaft 30 which is seated and locked at each end in the upper offset end of a downwardly opening slot 31 formed in the agitator-supporting plate 32. Latch 33, which is manually operable and which locks shaft 30 in its seat, is pivotally mounted upon plate 32 and is adapted to be retained in either the agitator-locking or open position by means of a curved spring 34, an "over-center" relationship existing. The agitator-supporting plate 32 at each end of the nozzle is connected to and supported by the arms 19, 19 of the front and rear supporting lips by means of levers 35, 35 pivoted at both ends. As the nozzle lips 7 and 8 move apart, their upper ends move upwardly as do the adjacent ends of the levers 19, 19 to which the arms 35, 35 connect. This movement results in the forcing of the agitator-supporting plates 32, 32 upwardly and accordingly the agitator carried thereby is raised. To eliminate movement of the agitator and the supporting plates from side to side in the nozzle, each nozzle end wall is provided with spaced vertical slots 36 and 37 within which pins 38 and 39 fixed rigidly on plates 32, 32 are adapted to slide. The slots 36 and 37 are parallel and aligned and the sliding of the pins 38 and 39 therein does no more than definitely fix the path of movement of the agitator-supporting plate.

In this first-described embodiment of the invention, the lowering of the front supporting wheels by the manual adjustment means results in the raising of the nozzle and the separation of the nozzle lips increasing nozzle width and nozzle area. The agitator within the nozzle is raised as the nozzle lips separate. In the event that conditions make it desirable that the agitator should be lowered as the lips separate, a condition which can arise in certain circumstances, each lever 19 is provided with an opening 40 which is adapted to receive and seat the connecting pin at the lower ends of the arm 35. The opening 40 is upon the opposite side of the pivot point 20 of the lever arms 19 from the connecting points of the arm 35, as illustrated. This change in the connection points of the arms 35, 35 results in the agitator-supporting plates 32, 32 reversing their direction of movement upon the separation or approach of the lips 7 and 8 from that previously described.

Referring now to Figure 6 in particular, a second preferred embodiment of the invention is disclosed. In this embodiment, the front lip 7 of the cleaner is fixed and is not movable relative to the nozzle. The rear lip 8 is provided at each end with a supporting arm 19 formed with a horizontal slot 41 which encloses a rectangular shoulder or block 42 on the end wall of the nozzle. By this slot-and-block relationship the lip 8 is slidably supported for horizontal movement. A seal of the accordion type, indicated at 43, connects the top of the lip 8 to the adjacent side wall of the nozzle and prevents air leakage therebetween.

The agitator-supporting plate in this embodiment, there being one at each end of the nozzle, is indicated by the reference character 45, and is pivoted to the nozzle end wall upon a pivot pin 46. As in the previous embodiment a downwardly opening slot, indicated at 47, seats the agitator shaft in its upper offset end, a latch plate 48 locking the shaft in place under the urging of a spring 49. The agitator may be removed from the supporting plates by pivoting the latching members 48, 48 so that the slots in the latter coincide with the open end of slots 47. This is a common and well known arrangement. A lever 50 is pivoted at each end of the nozzle, between the adjacent side arms 19 of the lip 8 and the agitator-supporting plate 45. The presence of this arm, connecting the movable lip to the supporting plate, causes the latter to be raised or lowered with the inward or outward movement of the lip, respectively. Adjustment of the lip is accomplished by an arm 51 which connects the offset end of the shaft 12 to the rear of the lip 8, being pivotally connected at each of its ends.

In this second embodiment of the invention as the front supporting wheels are lowered to raise the nozzle, the arm 51 moves forwardly and causes the rear lip 8 to move horizontally into the nozzle, decreasing the effective nozzle width as determined by the distance between the front lip 7 and itself. As the lip 8 moves inwardly, it causes the arm 50 to force the agitator-supporting plate 45 to pivot upwardly about its supporting pin 46. This relationship is the same at both ends of the nozzle. As the plates 45, 45 move upwardly, they carry with them the agitator-supporting shaft thereby raising the agitator as the nozzle width and nozzle area are decreased.

Referring now to Figures 7 and 8 in particular, a third preferred embodiment of the invention is disclosed. Here the front supporting wheels of the machine are not adjustable relative to the cleaner to vary the height of the entire cleaner nozzle relative to the supporting surface. The supporting crank-shaft for the wheels shown in the previous embodiment has been eliminated, and instead each front supporting wheel 11 is connected directly to the cleaner body and particularly to the fan chamber 2. The front and rear nozzle lips 7 and 8 are again pivotally connected to the end walls of the nozzle by their supporting arms 19, 19, as in the first described embodiment, and sealed to the nozzle walls by the seals 21, 21. The ends of the adjacent arms 19, 19 are, in this embodiment, formed as two toothed sectors, 60, 60, the sectors carried by the front lip meshing with the sectors carried by the rear lip, thereby insuring synchronous adjustment. The pivot points 20, 20 are so positioned relatively to the surface-contacting portions of the lips that as the lips move thereabout, they not only move toward and from each other, but also move upwardly or downwardly relative to the supporting surface, thereby eliminating the necessity for the upward or downward movement of the entire nozzle. This adjustment of the lips is accomplished by means of a manually operable knurled nut 61, fixedly carried by the end of a threaded shaft 62 which is adapted to advance or retract in its threaded seat 63 in the rear wall of the nozzle. The inner end of threaded shaft 62 is connected to a plunger arm 64 which is pivotally connected to the supporting arm 19 of the rear lip 8. The forward movement of the plunger arm 64 causes the lip 8

to pivot upwardly, and from the forward lip 7, while the rearward movement of plunger 64 causes the lip to move downwardly, and toward the front lip 7; a synchronous movement is transmitted to the front lip 7 by the toothed sector construction described.

In the present embodiment, the lips 7 and 8 move from an upper position in which the surface-contacting portions are approximately in line with the end walls of the nozzle, as illustrated in Figure 8, to a lower position in which they extend considerably therebelow, as illustrated in Figure 7. To prevent an inrush of air at the ends of the nozzle, between the lips and below the normal nozzle end wall, it is necessary to provide, in the present embodiment, movable nozzle end walls which will move downwardly with the lips. These movable end plates or walls are indicated by the reference character 65 and are carried by the arms 19, 19 of the front and rear lips, by a pin and slot arrangement 66, 67 in each instance. The slots 67 are slightly greater in length than the diameter of the pins 66 to prevent any binding as the lips move about their pivotal axes. Slots 68, 68 are provided in the end walls 65 to accommodate the pivotal pins 20, 20 of the arms 19, 19 which extend through the plane of these end walls to the nozzle end.

As in the previous embodiments, means are provided in this third embodiment to adjust the agitator height relative to the plane of the nozzle lips upon the adjustment thereof. The agitator-supporting plate 32 of the first embodiment is again provided with the agitator-shaft receiving slot 31 and the pivoted latch 33. As in the first embodiment arms 35, 35 extend from the lip arms 19, 19 to the plate. In this instance the arms 35 are connected between the pivotal axes 20, 20 of the arms 19, 19, as suggested as a modification in the first embodiment, causing the agitator to be lowered as the nozzle lips 7 and 8 move from each other to increase the nozzle width. This is the reverse of the relationship illustrated in the first embodiment. To prevent sideward displacement of the agitator-supporting plate 32 at the end of the nozzle, the pins 70, 70, by which the arms 35, 35 are connected to the plate 32, are extended through the latter into vertical slots 71, 71 formed in the end wall of the nozzle. The slots guide the pins and cause the agitator plates, and so the agitator, to move in a vertical path at all times.

I claim:

1. In a suction cleaner, a body including a nozzle, a movable lip on said nozzle defining one side of a nozzle mouth, an agitator adjustably mounted in said nozzle, means to move said lip to widen or to narrow said nozzle mouth, and means to adjust the position of said agitator in said nozzle, said means being responsive to the adjustment of said first-mentioned means.

2. In a suction cleaner, a body including a nozzle, a movable lip on said nozzle defining one side of a nozzle mouth, surface agitating means adjustably mounted in said nozzle, means to raise and lower said body relative to a supporting surface, and means responsive to the adjustment of said last-mentioned means to alter the position of said lip to widen or narrow said mouth and to raise or lower said agitator in said nozzle.

3. In a suction cleaner, a body including a nozzle, movable lips determining the width of the nozzle mouth, an agitator mounted for vertical adjustment in said nozzle, means to move said lips to widen or narrow said nozzle, and

means responsive to the adjustment of said last-mentioned means to adjust the height of said agitator in said nozzle.

4. In a suction cleaner, a body including a nozzle, movable lips determining the width of the nozzle mouth, an agitator mounted for vertical adjustment in said nozzle, means to move said body to adjust the height of said nozzle above a supporting surface, and means responsive to the adjustment of said last-mentioned means to move said lips to widen or narrow said nozzle mouth and to raise or lower said agitator.

5. In a suction cleaner, a body including a nozzle, a pivoted lip defining one side of the mouth of said nozzle, an agitator mounted in said nozzle for adjustment, nozzle-supporting wheels, means to adjust said wheels to vary the height of said nozzle above a supporting surface, and means operated by said last-mentioned means to pivot said lip to change the width of said nozzle and to raise or lower said agitator in said nozzle.

6. In a suction cleaner, a nozzle, spaced lips on said nozzle defining the sides of the mouth thereof, means mounting said lips for movement toward and from each other at their surface-contacting portions, means interconnecting said lips for synchronous adjustment, means to adjust said lips, a surface covering agitator in said nozzle adapted to contact a covering between said lips, and means supporting said agitator for vertical adjustment connected to and operable upon the adjustment of said lips.

7. In a suction cleaner, a nozzle, spaced lips on said nozzle defining the sides of the mouth thereof, means mounting said lips for movement toward and from each other at their surface-contacting portions, means at the ends of said nozzle interconnecting said lips for synchronous adjustment, an agitator in said nozzle adapted to contact a surface covering between said lips, means at the ends of said nozzle supporting said agitator for vertical adjustment, means connecting said agitator-supporting means to said lips, and manually operable means to effect adjustment of said lips and said agitator.

8. In a suction cleaner, a nozzle, a nozzle lip sealed to said nozzle and movable relative thereto to vary the nozzle mouth area, a rotary agitator in said nozzle mounted for vertical adjustment, means interconnecting said lip and said rotary agitator to effect a change in agitator height upon movement of said lip, and manually operable means to adjust the position of said lip.

9. The construction defined by claim 8 characterized in that said agitator is raised as said lip is moved to increase the area of said nozzle.

10. The construction recited by claim 8 characterized in that said agitator is lowered as said lip is moved to increase the area of said nozzle.

11. In a suction cleaner, a body including a nozzle, a lip determining one side of the nozzle mouth and slidably mounted on said nozzle, an agitator mounted in said nozzle for adjustment, means to move said lip to widen or narrow said

nozzle, and means responsive to the adjustment of said last-mentioned means to change the position of said agitator in said nozzle.

12. The construction recited in claim 11 characterized in that said agitator is raised as said lip is moved to narrow said nozzle.

13. In a suction cleaner, a nozzle, a surface-contacting lip defining a side of the mouth of said nozzle, means mounting said lip for movement to vary the area of the nozzle mouth and for effective vertical movement to vary the height of said lip above a supporting surface, and manually operable means to adjust said last-mentioned means.

14. In a suction cleaner, a body including a nozzle, a movable lip on said nozzle defining one side of a nozzle mouth, an agitator mounted in said nozzle for movement toward and from a surface covering undergoing cleaning, manually operable means, and means actuated by said manually operable means to move said lip to vary the nozzle size and to raise and lower said agitator.

15. In a suction cleaner, a nozzle, spaced lips mounted for synchronous movement toward and from each other defining the sides of the nozzle mouth, a surface covering agitator in said nozzle mounted for movement toward and from a surface covering undergoing cleaning, and means operated by a single manually operable means to adjust said lips and to raise and lower said agitator.

16. In a suction cleaner, a body including a variable area nozzle having surface-contacting portions adapted to be raised and lowered relatively to a surface covering undergoing cleaning, an adjustable agitator adapted to contact a surface covering undergoing cleaning within the area thereof contacted by said nozzle, and dependent means to vary the area and height of said nozzle and to adjust said agitator.

17. In a suction cleaner, a nozzle including a plurality of surface-contacting elements movable toward and from one another to vary the area of a contacted surface covering undergoing cleaning therebetween, a surface-contacting agitator positioned in said nozzle arranged to contact the surface covering undergoing cleaning in all adjustments of said elements, and cooperating means to raise and lower said agitator in a predetermined manner upon the adjustment of said elements, and means to adjust said elements toward and from each other.

18. In a suction cleaner, a nozzle including a plurality of surface-contacting portions movable relative to the remainder of the nozzle and to the plane of a surface covering undergoing cleaning, a surface-contacting agitator adjustably positioned between said portions, means to drive said agitator, and interconnected means to adjust said portions relative to the nozzle and to adjust said agitator relative to said nozzle and to said portions in a predetermined manner.