March 11, 1958 L. K. ACHESON 2,825,925

SUCTION NOZZLE WITH SUCTION POWERED AGITATOR

Filed April 5, 1954 5 Sheets-Sheet 1

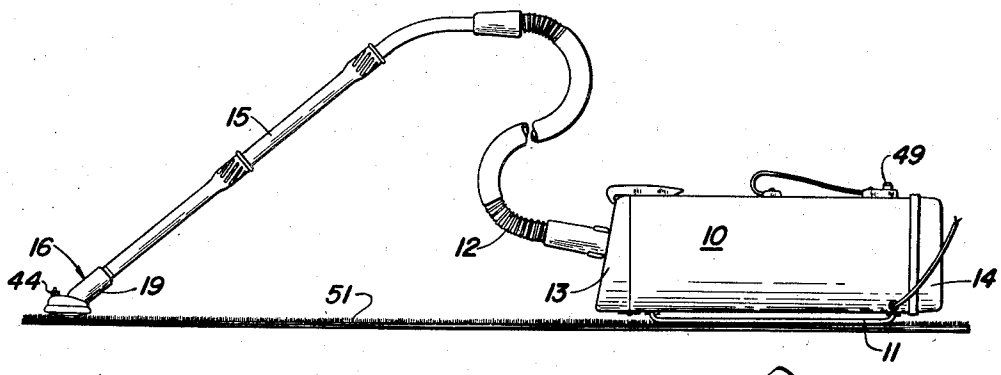

Fig. 1

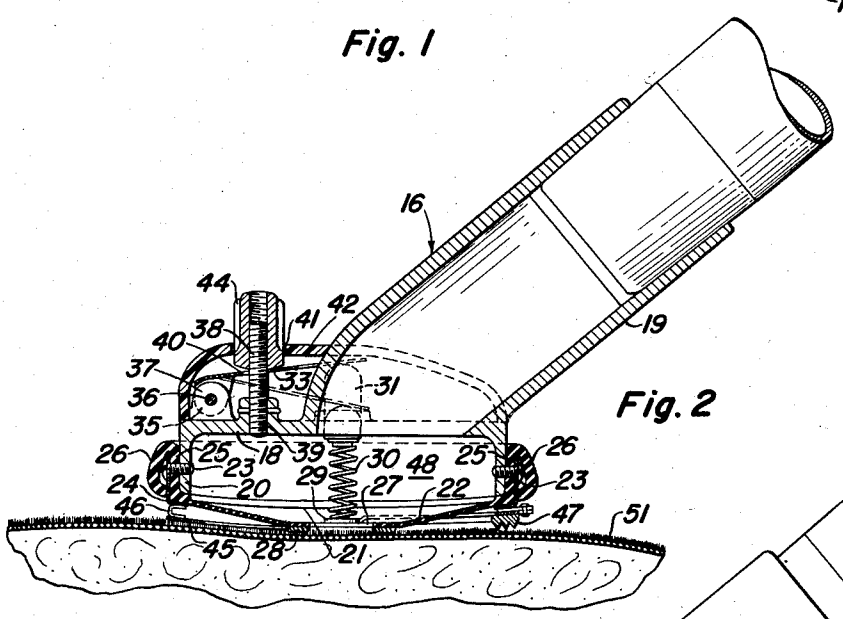

Fig. 2

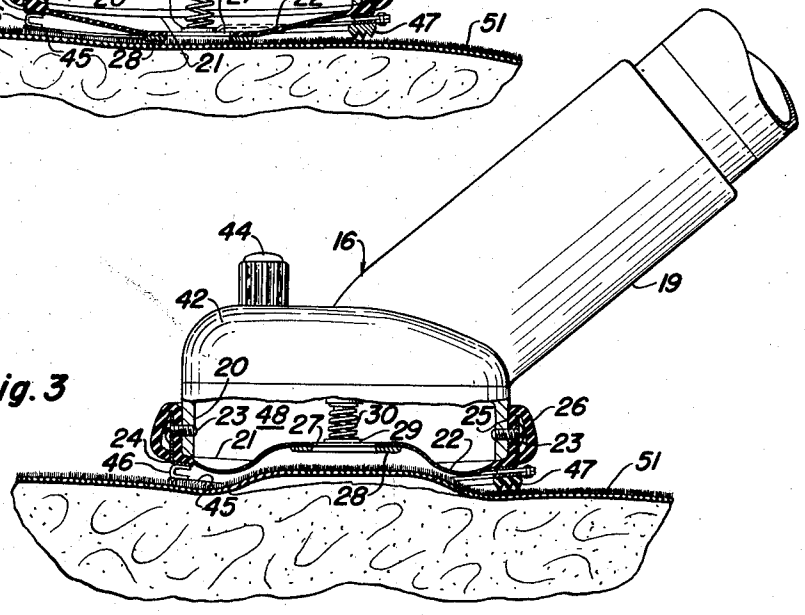

Fig. 3

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SUCTION NOZZLE WITH SUCTION POWERED AGITATOR

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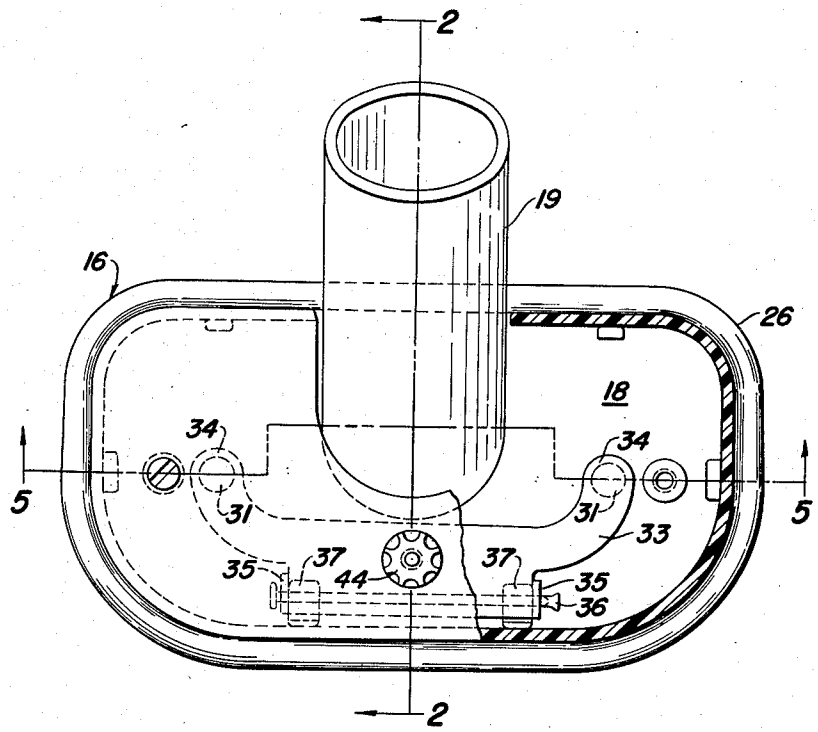

Fig. 4

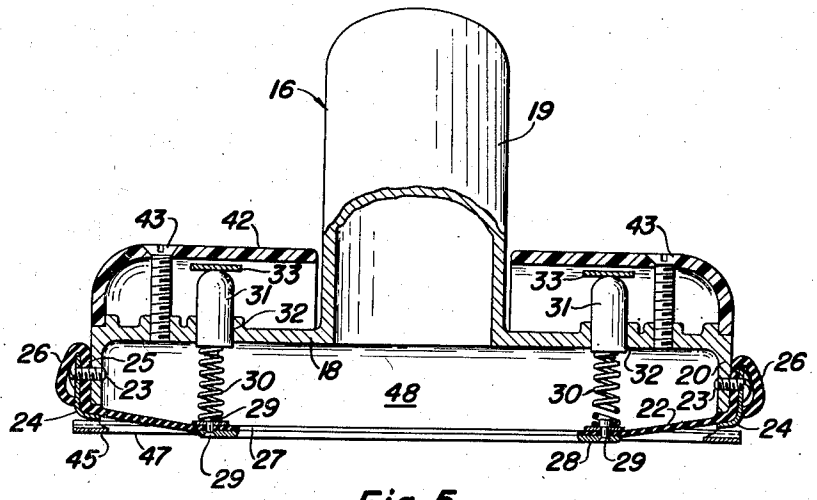

Fig. 5

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SUCTION NOZZLE WITH SUCTION POWERED AGITATOR

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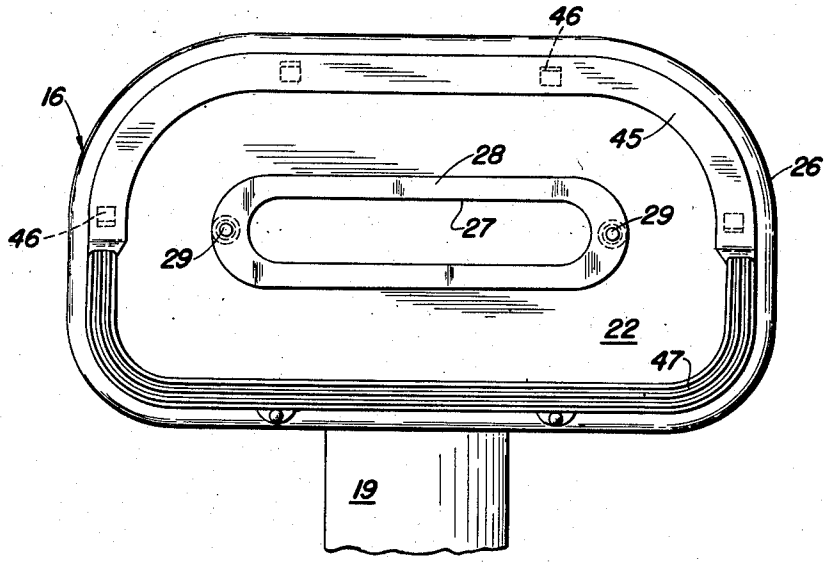

Fig. 6

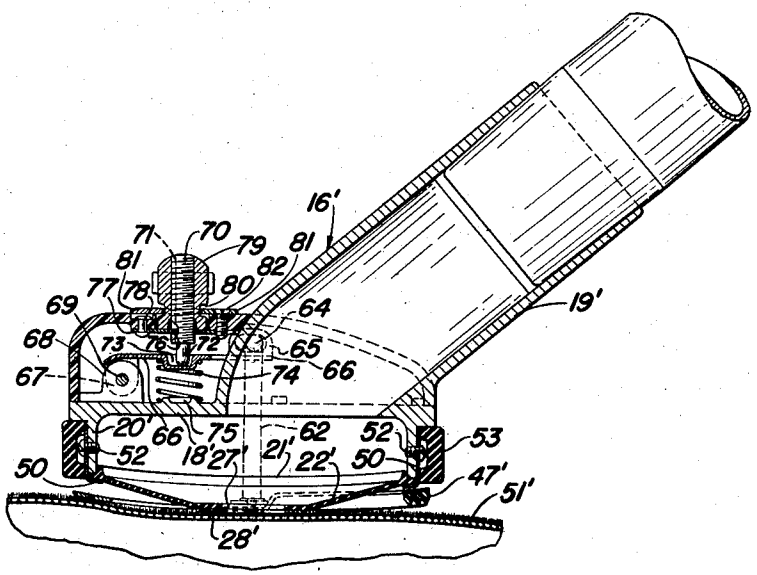

Fig. 7

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SUCTION NOZZLE WITH SUCTION POWERED AGITATOR

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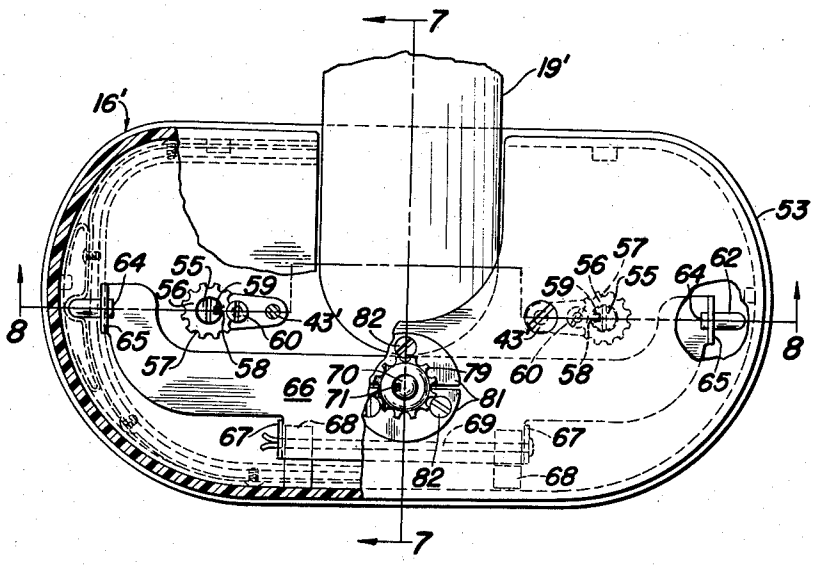

Fig. 9

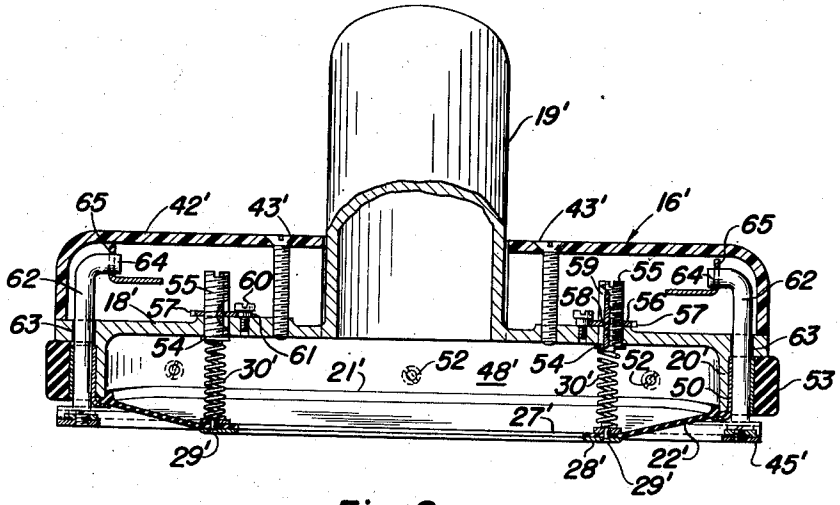

Fig. 8

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SUCTION NOZZLE WITH SUCTION POWERED AGITATOR

Filed April 5, 1954 5 Sheets-Sheet 5

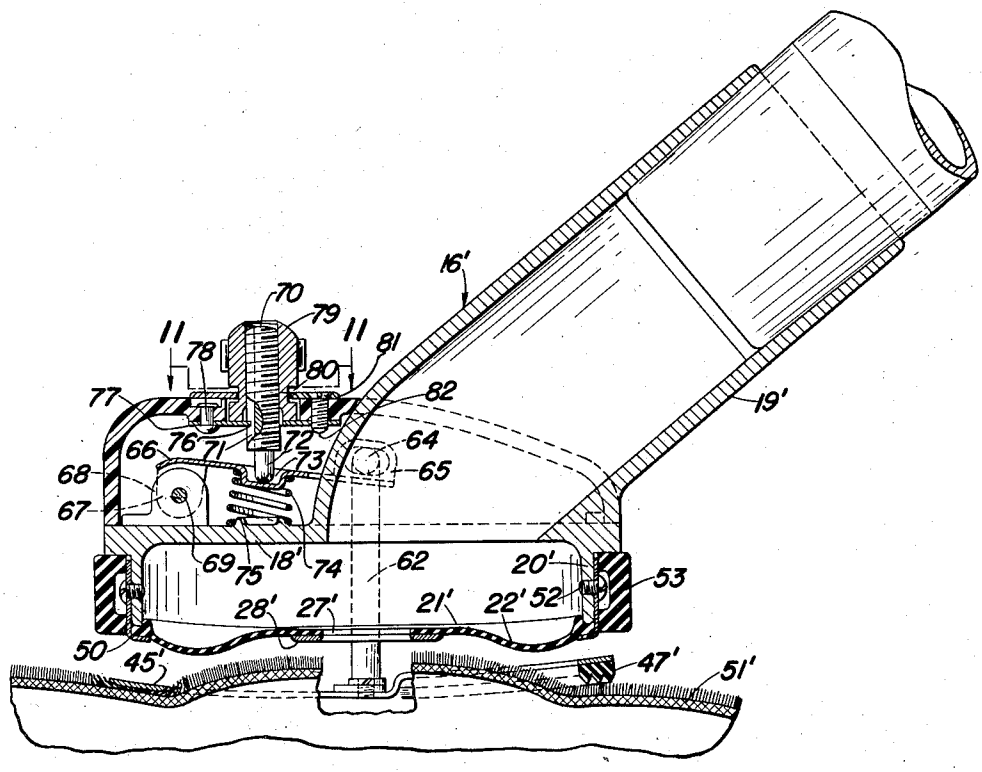

Fig. 10

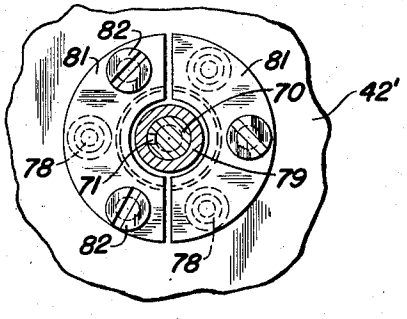

Fig. 11

United States Patent Office 2,825,925 Patented Mar. 11, 1958

2,825,925

SUCTION NOZZLE WITH SUCTION POWERED AGITATOR

Louis K. Acheson, North Canton, Ohio, assignor to The Hoover Company, North Canton, Ohio, a corporation of Ohio

Application April 5, 1954, Serial No. 420,825

12 Claims. (Cl. 15—354)

This invention relates to suction cleaners and more particularly to a unique suction nozzle for use therewith featuring a vibrating diaphragm structure which is highly effective in dislodging dirt and foreign matter from the fabric being cleaned.

It has long been known that effective suction cleaning of carpets, upholstery, fabrics and the like requires beating or sudden displacement of the material in order to dislodge embedded dirt. This is readily accomplished by the use of a rotary agitator in the mouth of the suction nozzle. However, such agitators require the presence of a power unit such as an electric motor at the nozzle which are costly, increase the nozzle weight and detract from its ease of maneuverability. Furthermore, electrical conductors to the motor are required and add to the cost, inconvenience of use, and constitute a hazard to the operator.

Other prior art constructions propose to employ variations in the flow of the suction air stream to vibrate a flexibly supported nozzle lip structure for the purpose of assisting in the dislodgment of dirt. Particular reference is had to the suction nozzles disclosed in United States Patents 2,031,957 and 2,070,834 granted to one Karlstrom. The present invention is related to the disclosures of these prior patents to the extent that this applicant also proposed to use the suction air stream as a source of power for driving the agitator but by the use of a greatly simplified structure operating in a distinctively different manner and according to different principles than those employed by Karlstrom.

My invention provides a suction cleaning tool possessed of extraordinary cleaning ability. In addition, my cleaning tool is possessed of the ability to be tuned or adjusted readily for operation on a wide variety of fabrics. My invention is embodied herein in two forms, one of which is somewhat more complex than the other. The simplest form of the invention is quite effective on most upholstery and drapery fabrics and on some forms of thin carpeting but it is not well adapted for modern carpeting in general; i. e., it is primarily for off-the-floor use. The more complex form of the invention is adaptable to an extremely wide variety of fabrics including deep pile carpet for which it may be adjusted as will be set forth hereinafter. Cleaning tools constructed according to my invention comprise a nozzle body having at the lower face thereof a flexible diaphragm which surrounds and supports a suction cleaning nozzle and fabric agitating means. Spring means are provided to project the nozzle and agitating means downwardly of the nozzle body to the extent permitted by the diaphragm. In the operation of my device the agitating elements impart a sharp blow to the fabric to beat the same for the purpose of loosening dirt therefrom and the nozzle seals or substantially seals against the fabric which causes pressure within the nozzle body to diminish to a minimum value creating a substantial pressure differential on opposite sides of the diaphragm which then almost instantaneously moves the diaphragm nozzle and agitating means upwardly until the

seal with the fabric is broken whereupon cleaning air rushes into the nozzle body carrying loosened dirt therewith and increases the pressure in the nozzle body so that the spring means immediately again projects the nozzle and agitating means to repeat the foregoing cycle. The series of events just described occur with great rapidity when my cleaning tool is adjusted properly to a particular fabric to be cleaned. In order to prevent the diaphragm, rim of the nozzle body, from sealing against the fabric to insure access of ambient air to the undersurface thereof, and to regulate the degree of penetration of the agitating elements to the fabric to be cleaned, my nozzle structure is provided with open skids or pontoons projecting below the nozzle body to engage the fabric to be cleaned. Sufficient adjustment of my device is provided for most ordinary upholstery and drapery fabrics and the like by the simple expedient of incorporating means in the nozzle body to adjust the stress on the spring means. The adjustment is simply accomplished by turning a suitable dial or knob while the device is operating until a high intensity vibration of the fabric is achieved. My invention also includes the provision of a slightly more complex construction capable of adjustment for use on the widest variety of fabrics including deep pile fabrics wherein the extension of the supporting skids or pontoons from the nozzle body is also made adjustable. The additional adjustment of the supporting skids or pontoons permit the operator to exercise complete control over the extent to which the agitating elements and suction nozzle penetrate the fabric and the extent to which they must rise from their most extended position in order to break the seal with the fabric.

Accordingly, it is a prime object of the invention to provide a unique suction nozzle construction having a positively driven fabric agitating means energized by suction.

Yet another object is provision of a suction nozzle having agitating elements powered by suction without reliance upon valves, reeds or other obstructions located in the path of dirty air flow.

A further object is the provision of a novel suction nozzle supported on a skid or pontoon and having an inlet formed in a flexible diaphragm arranged across the lower face of the nozzle and in a predetermined relation to the supporting surface of the skid or pontoon.

Still another object is the provision of a suction nozzle with suction powered agitator elements and manually operable means for adjusting the nozzle for most effective operation on fabrics of widely varying characteristics.

Another object is the provision of a suction nozzle with power driven agitating elements which is simple, rugged, light in weight and designed to operate effectively on a wide variety of fabrics.

Numerous other advantages and objects of the invention will become apparent from the following detailed specification of illustrative embodiments taken in connection with the accompanying drawings wherein:

Figure 1 is a view of a tank type suction cleaner coupled to the novel suction nozzle of the present invention shown supported in its normal operating position for cleaning carpets;

Figure 2 is a vertical sectional view through the nozzle taken along line 2—2 on Figure 4 and showing the relationship of parts when the flexible diaphragm is at the lower extremity of its operating cycle;

Figure 3 is a similar view of the nozzle with the diaphragm at the upper extremity of its operating cycle;

Figure 4 is a top plan view of the nozzle with parts broken away to show constructional details;

Figure 5 is a vertical sectional view along line 5—5 on Figure 4;

Figure 6 is a bottom plan view of the nozzle;

Figure 7 is a vertical sectional view of an alternate construction taken along line 7—7 on Figure 9 and showing the diaphragm at its lower extremity;

Figure 8 is a longitudinal sectional view taken along line 9—9 on Figure 8;

Figure 9 is a top plan view of the alternate nozzle with parts broken away to show constructional details;

Figure 10 is a view similar to Figure 7 but showing the diaphragm at the upper extremity of its operating cycle; and

Figure 11 is a fragmentary plan view along line 11—11 on Figure 10.

My unique suction cleaning nozzle is shown as connected to a conventional tank type suction cleaner 10 supported on a pair of skids 11. The usual flexible hose 12 is connected to the air inlet on end cap 13 for the cleaner casing. Any suitable type of motor driven suction unit is enclosed in the rear end of the cleaner casing and serves to draw clean air through the usual filter bag and discharges it through an outlet opening in end cap 14. The opposite end of suction hose 12 is connected to a sectional metal wand 15 having its lower end frictionally seated in the outlet end of coupling tube 19 cast integral with the top wall of the suction cleaning nozzle. The nozzle 16 is illustrated in Figure 1 as being applied to a carpet; however, as set forth above, the form of the invention shown in Figures 1 to 6 is primarily to be used for off-the-floor cleaning and the nozzle 16' of Figures 7 to 11 is the preferred form of the invention for cleaning deep pile fabrics such as most types of floor coverings.

This nozzle, generally designated 16, is cast or molded from suitable material. It comprises an oblong casing having a top wall 18 and downwardly extending side walls 20 terminating in a wide area mouth 21. All except the central area of this mouth is closed by a thin, flexible walled diaphragm 22 made from rubber, plastic or the like. The upturned thickened rim 25 of the diaphragm fits closely against the exterior of side walls 20 and are firmly anchored and sealed thereto by screws 23 and metal strips or clips 24. The upper half 26 of thickened rim 25 is turned backwardly over the heads of screws 23 to conceal the latter and to provide a resilient bumper for the nozzle.

The nozzle inlet proper comprises a narrow opening 27 extending lengthwise of the nozzle centrally of diaphragm 22 as best shown in Figure 6. The lower edges of this inlet are preferably reinforced by a metal ring 28 secured to the diaphragm in any suitable manner as by rivets 29. The manner in which the metal strips or ring 28 serves as a beater for dislodging dirt will be explained in greater detail below. The beater 28 may have other forms such as pile penetrating lips or a rounded bead defining the air inlet or spaced therearound.

Referring to Figures 2, 4 and 5, it will be noted that a pair of light compression springs 30—30 have their lower ends anchored on the shouldered interior heads of rivets 29 at the opposite ends of inlet opening 27. The upper ends of the springs are similarly seated over the lower ends of a pair of pins 31, 31 reciprocally supported in openings 32 extending through top wall 18 of the nozzle body.

The manually operable control means for changing the position of pins 31 and the compressive forces applied to springs 30 is best shown in Figures 2 and 4. Thus, the control device is shown as comprising a forked lever 33 having the ends of its legs bearing upon the rounded upper ends of pins 31, 31. Tabs 35 struck downwardly from the bight portion of the lever are pivotally connected by a pivot pin 36 to a pair of bosses 37, 37 extending upwardly from the top wall of the nozzle body. A threaded stud 38 has its lower end enchored to the top wall of the nozzle, as indicated at 39 in Figure 2. Its upper end projects through an opening 40 in lever 33 and a second opening 41 of larger diameter in an appearance housing 42 overlying the top of the nozzle body and removably secured thereto by screws 43. A fluted control knob 44 extends freely through opening 41 and is screwed to the top end of the stud 38 with its base bearing against lever 33. It will be evident from the foregoing that by turning knob 44 upwardly or downwardly on stud 38, control lever 33 acts through pins 31, 31 to vary the compressive forces acting on springs 30, 30.

A supporting skid or pontoon is provided to support the nozzle. As here shown, the skid comprises a flat metal annulus 45 having the same general contour as the rim of the nozzle body, but other forms of skid may be used such as two or more independent pontoon elements at the opposite end areas of the nozzle body. The skid 45 is rigidly connected in slightly spaced relation below the rim of the nozzle by spaced U-shaped connector clips 46 to provide an air gap between the rim of the nozzle body and the upper face of the skid. As clearly shown in Figures 2 and 6, the rear half of skid 45 is offset upwardly from the forward half to provide room for litter pickup and pile agitating elements here shown as a ribbed strip 47 of resilient material like rubber or a plastic. The rear half of the skid is offset sufficiently for the lower half of the pile agitating strip to lie flush with and in the same plane as the front half of the skid.

OPERATION

The proper operating position for the nozzle on either a carpet or upholstery fabric is indicated in Figure 1 showing the nozzle resting on a piece of fabric 51. The lowermost operating position of the diaphragm is shown in Figure 2, while Figure 3 shows the diaphragm in its upper position with beater 28 surrounding inlet nozzle 27 out of sealing engagement with the fabric being cleaned.

The cleaner is energized by closing motor switch 49 on the cleaner casing. Since the beater surrounding nozzle 27 is held sealed against the carpet by springs 30, the suction produced in chamber 48 by the suction fan becomes effective to lift the diaphragm in opposition to springs 30, 30 as a consequence of the higher air pressure acting on the lower face of the diaphragm. The downwardly extending skid 45 prevents the diaphragm from sealing to the fabric at its outer edges and the air gap between the skid and rim of the nozzle body insures that the lower face of the diaphragm will be open to the atmosphere to maintain a pressure differential across the diaphragm. The diaphragm rises and leaves the fabric to break the seal between the fabric and beater 28 allowing atmospheric air to enter inlet 27 rapidly as it flows across the surface of the carpet nap carrying dirt, litter and foreign material with it. In consequence, the pressure within chamber 48 increases and this sharp shift in pressure together with the energy stored in springs 30 snaps the diaphragm downwardly to bring beater 28 into abrupt contact with the fabric to impart a vigorous beating action thereto to dislodge dirt which is immediately carried into the nozzle and suction line. The skid also holds the fabric at points spaced from the nozzle and limits upward flexing of the fabric to insure breaking of the seal. Thus the skid exerts a strong influence on the spring adjustment as the skid spacing from the body determines in part the forces opposing the spring.

The diaphragm cycles rapidly and with great force and vigor due to the alternately increasing and decreasing pressure differential acting on the opposing faces of the diaphragm. Atmospheric pressure is always present on the outer surface while the motor fan system strives to maintain a low, sub-atmospheric pressure on its interior surface.

The effectiveness of the bearing action is influenced strongly by the spacing of the supporting skids or pontoons below the rim of the nozzle body, by the stress in the springs and by the characteristics of the fabric being

treated such as its porosity, stiffness, depth of nap, thickness and the like. In this form of the invention the supporting skid or pontoon is spaced at an optimum value such that the desired beating action can be effected on most upholstery, drapery and some floor covering fabrics. The nozzle may then be tuned to the particular fabric by affecting a simple adjustment of the knob **44**. The adjustment of the nozzle beater structure is accomplished by placing the nozzle on the fabric to be cleaned with the motor fan unit in operation. The knob **44** is then turned until the intensity of the beating action reaches a maximum value which is readily apparent by the sound thereof.

If the nozzle is moved forwardly and backwardly over the surface of the fabric to be cleaned the litter pickup strip **47** on the rear half of the skid rubs across the surface of the fabric and effectively dislodges litter and flicks the same upwardly into the air stream flowing to the nozzle inlet **27**.

Second embodiment

An alternative construction is illustrated in Figures 7 to 11 wherein the same or similar parts are designated by the same reference characters distinguished by a prime. As the drawings make clear, the second form is generally similar to the first nozzle and incorporates substantially all of its features and additionally provides a manual adjustment for varying the elevation of the nozzle supporting skid relative to the body of the nozzle and to the beater element carried by the pressure responsive diaphragm. Experience has disclosed that it is desirable to provide a manual adjustment for the skid as well as for the springs mounted between the nozzle body and inlet to render the nozzle effective on all types of fabric. The adjustment for the skid is highly effective in adjusting the nozzle for optimum operation on fabrics of varying porosity, thickness and other characteristics. Furthermore, the incorporation of adjustments for both the skid and the pressure on the diaphragm is particularly desirable since it will be quite apparent that a change in spring pressure should accompany any wide change in the elevation of the skid. However, for general household use, experience indicates that it is not necessary to change the spring pressure if it is adjusted initially at a median value for the maximum range in skid height required to handle the fabrics in a particular house. This makes it possible for an expert to adjust the spring pressure at this median value for a particular house at the time the nozzle is purchased and to then instruct the housewife in adjusting the single control for the skid support.

The nozzle construction will now be described with particular reference to Figures 7 and 8. Note that the peripheral rim **53** of flexible diaphragm **22'** is molded to interfit with the lower edge of the nozzle chamber wall **20'** to which it is held assembled by means of an L-shaped metal retainer clip **50** secured to the nozzle by screws **52**. The soft rubber rim **53** provides a furniture guard similar to the downturned rim **26** in the first described embodiment. Diaphragm **22'** is otherwise identical with the diaphragm described above and has the same type narrow air inlet opening **27'**. Secured to the lower rim of opening **27'** by rivets **29'** is a rigid flat beater ring **28'**. These rivets have an upstanding stud on the interior of the nozzle about which the lower ends of spring **30'** seat.

The manual adjustment for compression springs **30'** will be best understood by reference to Figures 8 and 9 from which it will be noted that the upper end of the springs rests against a washer **54** seated on the lower end of an adjustment screw **55**. The latter extends through threaded openings in the top wall **18'** of the nozzle body as well as through a thin washer **56** having semicircular notches **57** spaced along its peripheral edge. Washer **56** fits loosely over screw **55** and has an inwardly-extending tang **58** movable along a slot or keyway **59** cut lengthwise of the screw. Because of the interlocking relationship of tang **58** and slot **59**, it will be clear that washer **56** rotates with the screw as it is screwed up or down in the nozzle wall to change the compression on springs **30'**. Normally, however, the adjusting screw **55** is locked in the desired adjusted position by means of the shouldered locking screw **60** having a shoulder **61** seated in a selected one of notches **57** in washer **56**. So long as locking screw **60** is seated in one of these notches, it will be clear that it is impossible to adjust screws **55**.

If the operator wishes to change the adjustment of screw **55**, she first turns locking screws **60** upwardly until shoulders **61** are out of locking engagement with notches **57**. Screws **55** can then be rotated up or down as desired. Once the desired setting is obtained, screws **60** are tightened with shoulder **61** seating in the particular notch **57** thereadjacent. The locking screw is then firmly tightened and appearance cap **42'** and the assembly screws **43'** therefor are resassembled to the nozzle body.

The vertically adjustable skid **45'** is generally similar to that described in connection with Figures 1 to 6 except that the end strips underlying the ends of the nozzle are preferably curved upwardly slightly with the result that the nozzle is somewhat easier to manipulate. This arrangement also provides a convenient means for permitting the pile agitating strips or litter pickers **47'** to be brought in contact with the carpet nap or elevated slightly thereabove as preferred by the user. Another advantage of the curved configuration of the skid member is that the operator need not hold the wand at any precise angle to avoid having the leading edge of the skid dig into the carpet nap as it is propelled thereover.

As best shown in Figure 8, the skid has a pair of L-shaped connecting rods **62** secured to the mid-portions of its opposite ends. These connecting rods extend upwardly through openings **63** at the opposite ends of the nozzle body into the chamber enclosed by the appearance cap or housing **42'**. The shorter legs **64** of the connecting rods face one another and extend through bearing openings in the upturned ends of **65** of a U-shaped actuating lever **66**. Lever **66** is generally similar to lever 33 described above in connection with the first embodiment. Thus, the bight portion of the lever is provided with a pair of downwardly turned tabs **67** and these are journaled by pivot pin **69** to bosses **68** projecting upwardly from wall **18'** of the nozzle body.

The control means for adjusting the position of the skid through rods **62** and lever **66** is best shown in Figure 7. It comprises a threaded post **70** having a slot **71** extending lengthwise thereof. The rounded lower end **72** of post **70** bears against a depression **73** in lever **66**. Depression **73** forms a keeper for the upper end of a light compression spring **74** while the lower end of the spring is seated about a circular flange **75** carried by the upper wall **18'** of the nozzle body. Hence, it will be clear that this spring **74** urges lever **66** upwardly against end **72** of post **70**.

Post **70** is prevented from rotating by a tang **76** carried by a disk **77** secured to housing **42'**, as by rivets **78**. A knurled control knob **79** is threaded to the portion of post **70** projecting above housing **42'**. An annular slot **80** formed in the base portion of knob **79** provides a seat for a pair of semi-circular keeper rings secured to cap **42'** as by screws **82**. Annular channel **80** is so positioned relative to the lower end of knob **79** as to receive the inner edge of keeper rings **81** while permitting the lower end of the control knob to rest against disk **77**. As a result, knob **79** is held against vertical movement but is free to rotate about the threaded post and to elevate or lower the same depending upon the direction in which the knob is rotated.

OPERATION

The operation of the second embodiment is basically identical with that described above in connection with the first embodiment. However, the provision for the

adjustment of the skid affords the operator a greater choice and latitude in adjusting the nozzle for the most effective operation on a wider range of fabrics and floor coverings. The proper relative position of the nozzle parts for use on surface coverings having relatively short pile is shown in Figures 7 and 8. Note Figure 8 in particular and the fact that the lowermost position of the diaphragm and of the beater ring 28' is somewhat below the lower surface of skid 45'. This relative position of the beater and skid members permits the nozzle to be supported on the skid as the diaphragm moves upwardly in response to the lowering of the pressure within the chamber 48' of the nozzle body. If the carpet or fabric being cleaned is flexible, the diaphragm will be drawn upwardly by the suction effect until it reaches a level generally opposite the lower rim edge of wall 20'. As the diaphragm moves upwardly above this level the seal will be broken between beater 28' and the fabric and air will flow freely through opening 27' into chamber 48' and the suction line. The pressure within the nozzle body rises abruptly and sufficiently for the energy stored in compressed springs 30' to snap the diaphragm back against the carpet causing beater 28' to strike the covering sharply. This up and down cycling movement of the diaphragm occurs very rapidly and produces thorough and continuous beating of the carpet as the nozzle is propelled forwardly and backwardly thereover. Also the nap flicker element provided by the resilient strip 47' on the rear half of skid 45' agitates the carpet pile to dislodge litter as described above in connection with the first embodiment.

If the nozzle is moved onto fabric of greater pile depth and greater porosity as depicted in Figure 10, it may be desirable to adjust the skid member to a different postion relative to the nozzle body and, in particular, to beater element 28'. The proper adjusted position is best determined by placing the nozzle on the covering to be cleaned with the front and rear edges of the skid resting on the covering. The suction motor is then energized and the operator turns the skid control knob 79 up or down until the most vigorous beating and cleaning action is achieved. The correct position is readily determined by the rhythmic sound of the beater against the carpet and by the rapidity with which the beater functions. The sound of a proper operating nozzle is so characteristic that it is soon impressed upon the mind of the user making it a very simple matter for her to find the proper adjustment.

Occasionally, it is desirable to readjust springs 30'. Caps 42' is first removed after which locking screws 60 are loosened sufficiently to permit screws 55 to be adjusted. Only a very small change should be made in the position of these screws after which knobs 79 should be adjusted while the cleaner is operating and the nozzle is supported on a covering to be obtained, the operator may again adjust screws 55 through a small increment followed by readjustments of knob 79 both above and below the previous setting. When the most effective settings are located, the operator replaces screws 60 to lock screws 55 in their adjusted positions and reassembles cap 42' to the nozzle body. It will, of course, be borne in mind that screws 55 rarely need readjustment and when properly set, enable the operator to compensate for widely varying cleaning conditions merely by adjusting skid control knob 79.

From the foregoing description of two illustrative embodiments of the invention, it will be appreciated that the present invention provides a suction cleaning nozzle of unusual construction and operating on new and unique principles. The extremely simple and rugged suction nozzle is so constructed and arranged that the suction pressure produced by a suction fan cooperates with the atmospheric pressure and with a simple spring biased pressure responsive diaphragm to make and break a seal with the carpet and, in so doing, to beat the same vigorously. It will be readily apparent that the nozzle can be made in various forms, shapes and sizes other than those illustrated and described. Furthermore, it will be equally apparent that various types of skids or supporting pontoons may be employed along with numerous types of adjustments for the spring pressure on the beater elements as well as for changing the position of the supporting skids relative to the beater elements and the nozzle body. It will be further understood that the spring adjustment in the second embodiment may make use of a common control similar to that described for the first embodiment.

While I have shown and described but two embodiments of my invention, it is to be understood that these embodiments are to be taken as illustrative only and not in a limiting sense. I do not wish to be limited to the particular structure shown and described but to include all equivalent variations except as limited by the scope of the claims.

I claim:

1. A suction nozzle of the type having an air flow operated agitating device mounted across its mouth, said nozzle comprising a main body having a downwardly opening mouth and an upwardly directed outlet adapted to be connected to a suction source, a flexible diaphragm mounted horizontally crosswise of said mouth and having a centrally disposed air inlet opening adapted to lie flush against a surface being cleaned when the diaphragm lies in its lowermost position, said diaphragm being movable upwardly with said inlet lying in a plane spaced above the surface being cleaned, spring means biasing said diaphragm to said lowermost position, supporting skids carried by said body for supporting the weight of said nozzle when said diaphragm is oscillating between said upper and lower positions and having a supporting surface intermediate the upper and lower positions of said oscillating diaphragm inlet, said skids having portions spaced from the lower edge of the main body to admit atmospheric air above the supporting surfaces thereof to the underside of the diaphragm, said diaphragm being responsive to a low pressure condition within said nozzle due to the sealing of the air inlet thereof to move upwardly in opposition to said spring means until said inlet becomes unsealed and allows a free flow of air therethrough whereupon said spring means is operative to snap the diaphragm back into sealing contact with the surface being cleaned.

2. A suction nozzle for use on a suction cleaner, said nozzle having an elongated hollow main body provided with an upwardly extending air outlet coupling and a downwardly opening mouth, a flexible diaphragm mounted crosswise of said body and closing said mouth except for a narrow air inlet opening centrally thereof, spring means biasing said inlet to a depressed position below the plane of said nozzle mouth, supporting means projecting downwardly from said mouth and lying in a plane slightly above said diaphragm inlet when the same is held depressed by said spring means, said supporting means being operable to support the weight of said nozzle when said diaphragm is pulled upwardly to a position out of contact with a surface covering, means for freely admitting atmospheric air to the underside of the diaphragm when the supporting means engage a surface to be cleaned, said diaphragm having agitating means carried by the lower surface thereof and operable when said nozzle is connected to a source of suction to move upwardly in opposition to said spring means until the inlet thereof is out of sealing contact with the surface covering and to thereafter move downwardly with a snap action to dislodge dirt from the surface covering and again seal the diaphragm against the covering before repeating the same cycle of operation.

3. A suction nozzle comprising a hollow nozzle body having an air outlet adapted to be connected to a source of suction and a wide area downwardly-facing open bot-

tom closed by a flexible diaphragm sealed to the nozzle body at its edges, said diaphragm having an opening therein defining a suction air inlet nozzle, fabric agitating means carried by said diaphragm, spring means on the nozzle body biasing the diaphragm downwardly of the nozzle body to maintain the diaphragm taut, a supporting skid carried by the nozzle body and projecting therebelow to an extent such that the air inlet portion of the diaphragm will engage and seal with a fabric to be cleaned when the diaphragm is taut and the supporting skid is in engagement with such fabric, at least a portion of said skid being positioned in spaced relation to the nozzle body to form an air flow passageway over the top surface of the skid to the underside of the diaphragm, the upper surface of the diaphragm being subjected to the suction pressure within the nozzle body whereby the low pressure produced in the nozzle body when the portion of the diaphragm surrounding the air inlet nozzle seals to a fabric to be cleaned lifts the diaphragm against the bias of the spring means until the seal is broken and the springs then drive the nozzle air inlet and agitating means against the fabric.

4. Apparatus according to claim 3 including means for adjusting the spring means to vary the force required to raise the diaphragm to break the seal.

5. Apparatus according to claim 3 including means to vary the spacing of the skid relative to the nozzle body to vary the extent to which the diaphragm rises to break the seal.

6. In a nozzle structure for use with suction cleaning apparatus, a hollow nozzle body having an open face covered by a flexible diaphragm having an air inlet nozzle opening therein, fabric beating means carried by the diaphragm, the nozzle air inlet and beating means being spaced inwardly of the outer periphery of the diaphragm, spring means biasing the air inlet and beating means outwardly of the nozzle body to the extent permitted by the diaphragm, means for holding fabric being cleaned away from at least a portion of the peripheral portion of the diaphragm when the diaphragm is projected outwardly to the maximum extent and the air inlet portion thereof is sealed against a fabric to be cleaned, and means forming an atmospheric air inlet to the underside of the diaphragm above the fabric.

7. Apparatus according to claim 6 including means for varying the position of the fabric holding means relative to the nozzle body to vary the extension of the air inlet nozzle required to effect a seal with a fabric being cleaned.

8. A suction nozzle of the type having a pressure operated surface covering agitating device powered by the suction air stream, said nozzle comprising a hollow nozzle body having an air outlet adapted to be connected to a source of suction, and a wide downwardly opening inlet mouth, said nozzle body also having supporting means provided with a surface contacting portion positioned below the inlet mouth and air inlet means for admitting air to the underside of the nozzle body below the inlet mouth and above the surface contacting portion of the supporting means, a flexible diaphragm secured to the nozzle body across the inlet mouth above the level at which air is admitted by the air inlet means and having an air inlet opening, surface covering agitating means carried on the lower side of the diaphragm, spring means on the nozzle body biasing the air inlet portion of the diaphragm outwardly of the nozzle body and normally projecting the air inlet portion of the diaphragm to a position in which the air inlet will engage and seal against a surface covering to be cleaned when such surface covering is engaged by the surface contacting portion of the supporting means, whereby the nozzle body is supported by the supporting means when the diaphragm is pulled upwardly in response to a reduction in pressure within the hollow body and the diaphragm moves up and down cyclically in response to the changing air pressure within said nozzle body due to the seating of said air inlet against the surface covering being cleaned when the diaphragm is in its lower position and the unsealing thereof as the diaphragm is pulled upwardly out of contact with the surface covering.

9. A suction cleaning nozzle of the type having beating means driven by the stream of suction air flowing therethrough, comprising a hollow nozzle body having downwardly projecting surface engaging supporting means and air inlet means to admit atmospheric air to the underside of the hollow body above the surface contacting portions of the supporting means, said nozzle body having a downwardly facing large area inlet mouth positioned above the surface contacting portions of the supporting means, a flexible diaphragm secured to the nozzle body across said inlet mouth above the level at which air is admitted to the underside of the nozzle body whereby the lower downwardly facing surface of the diaphragm is exposed to atmospheric pressure, said diaphragm being formed with an air inlet opening and including stiff beater means near the edges of the air inlet opening on the lower surface of the diaphragm, spring means on the nozzle body biasing the portion of said diaphragm including the air inlet opening therein downwardly to a position in which the diaphragm will engage a surface covering and seal the diaphragm air inlet opening against such surface covering when the supporting means engages such surface covering whereby the suction pressure acting within the nozzle is effective to pull said diaphragm upwardly in opposition to said spring means to break the seal between said inlet and the surface covering whereupon the pressure within said nozzle rises suddenly and cooperates with said spring means in snapping the diaphragm and the stiff beater means into re-engagement with the surface covering to dislodge dirt and to initiate a new cycle of operation automatically.

10. A suction cleaning nozzle as defined in claim 9 including means for adjusting the force exerted by said spring means on said diaphragm to vary the cycling frequency of said diaphragm and to render the diaphragm responsive to suction air sources of different magnitudes.

11. A suction cleaning nozzle as defined in claim 10 wherein said supporting means includes means for adjusting the vertical position thereof with respect to the nozzle body and with respect to said diaphragm when the latter is in its lowest position thereof whereby said nozzle can be adjusted for optimum effectiveness on different surface coverings.

12. A suction cleaning nozzle as defined in claim 9 wherein said supporting means is adjustable through a limited path toward and away from the mouth of said nozzle body, and manually operable means for adjusting said supporting means within said limited path so that said supporting means can be adjusted to provide the desired degree of beating action from said diaphragm and the beating means carried thereby.

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U. S. DEPARTMENT OF COMMERCE

PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,825,925 March 11, 1958

Louis K. Acheson

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 40, for "proposed" read -- proposes --; column 6, line 39, after "ends" strike out "of"; column 7, line 50, for "Caps" read -- Cap --; line 57, for "readjustments" read -- readjustment --; column 10, line 4, for "cyclically" read -- cyclicly --.

Signed and sealed this 20th day of May 1958.

(SEAL)
Attest:
KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents