Jan. 8, 1935. H. E. HOOVER 1,987,296

SUCTION CLEANER

Filed June 25, 1932

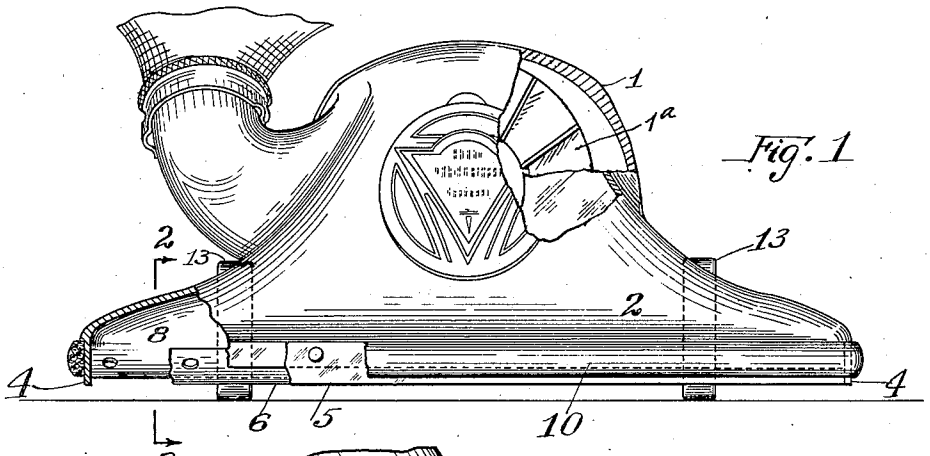


Fig. 1

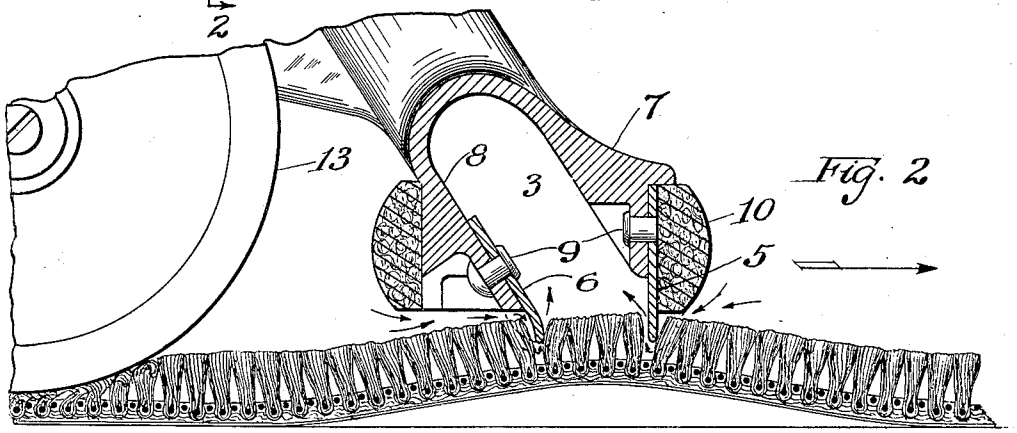


Fig. 2

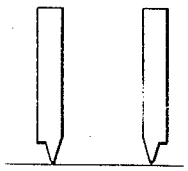


Fig. 3

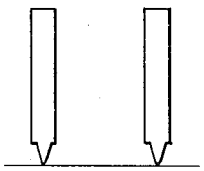


Fig. 4

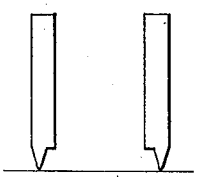


Fig. 5

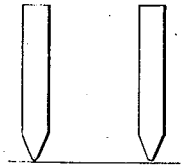


Fig. 6

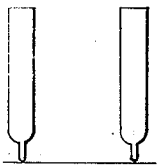


Fig. 7

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SUCTION CLEANER

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10 Claims. (Cl. 15—157)

The present invention relates to suction cleaners and more particularly to suction cleaner nozzles and the present application is a continuation in part of abandoned application Serial No. 341,933 filed February 23, 1929.

It has been the experience of manufacturers of suction cleaners that the ordinary straight-air machine, so called because the cleaning effect of the inrushing air into the nozzle is solely relied upon to do the cleaning, is unable to remove all the dirt embedded in the surface covering undergoing cleaning. In a suction cleaner constructed in accordance with the present invention cleaning efficiency heretofore impossible in straight-air machines is secured and results from the incorporation of new and novel improvements in the construction of the suction cleaner nozzle and more particularly the suction cleaner nozzle lip.

It is the principal object of this invention to provide improvements in suction cleaners resulting in cleaning efficiencies greater than has heretofore been possible in a straight-air cleaner. A still further object is the provision of new and novel improvements in suction cleaner nozzles. A still further object is the provision of a new and novel nozzle lip. Other and more specific objects of the present invention will appear upon reading the following specification, reference being had to the drawing attached to which it relates.

Referring now to the drawing in which the same reference character indicates like parts throughout:

Figure 1 is a front view of a suction cleaner embodying the present invention.

Figure 2 is an enlarged cross section upon the line 2—2 of Figure 1 showing the device in full size and moving in the direction of the arrow.

Figure 3 is a diagrammatic showing of a modification of the penetrating lips shown in Figure 2.

Figure 4 is a diagrammatic showing of a further modification of the penetrating lips shown in Figure 2.

Figure 5 is a modified form of penetrating lips shown diagrammatically.

Figure 6 is still a further modified form of penetrating lips shown diagrammatically.

Figure 7 is a still further modification of the lips shown diagrammatically.

The present invention is shown embodied in a suction cleaner including a fan chamber, in which is positioned a suction-creating fan 1*a*. The cleaner nozzle 2 is formed at its lower end with the usual nozzle mouth 3, and which is of the usual type, being made of cast aluminum or some similar material suitable for the purpose, but inherently not adapted to contact a surface covering undergoing cleaning for reasons such as brittleness, hardness, porosity, inadequate strength for thin castings, tendency to discolor a contacting surface upon sliding thereover, etc. The mouth 3 is formed by the front and rear nozzle walls, 7 and 8 respectively, and by the side walls 4, 4 which extend below the front and rear walls. Permanently attached to the walls 7 and 8 by securing means such as rivets 9 are the nozzle lips 5 and 6 which function as extensions of said walls to form the opening of the nozzle mouth in the plane of the lower edges of walls 4, 4. The nozzle lips 5 and 6 are made of relatively thin rigid material of such thickness, one-tenth of an inch or less, that the lip may penetrate between adjacent rows of pile or adjacent tufts of pile of the surface undergoing cleaning. These surface-contacting lips are formed of a different material than that comprising the walls 7 and 8; of a material such as steel of glass-like hardness which will retain a smooth surface or edge under wear from contact with grit, sand and foreign material in a surface covering, and of a strength which permits it to have an extremely thin dimension as compared with the thickness necessarily present in the walls 7 and 8 to insure requisite strength. The bottom edges of lips 5 and 6 may be rounded so as to prevent injury, to the surface undergoing cleaning, through cutting.

Surrounding the nozzle mouth is the furniture guard indicated by the reference character 10 which serves to protect objects from coming in contact with the metal part of the nozzle itself and also to conceal the fastening means of the nozzle lips. Supporting wheels 13, of which one is shown in Figure 2, serve to support the nozzle 2 at the proper height above the normal place of the supporting surface and thereby the nozzle lips 5 and 6 in the proper working relation to the surface undergoing cleaning.

The present improvement in suction cleaners lies in the provision of the nozzle lips 5 and 6 which are known as pile penetrating. In the past the thickness of the nozzle lips at the line of contact with the surface undergoing cleaning has been considered immaterial in the sense that it was not recognized as a factor determining the cleaning efficiency of the cleaner. Accordingly cleaners have been equipped with relatively thick lips such as happened to be most convenient in the casting of the nozzle and as re-

quired for requisite strength and such as would be formed if walls 7 and 8 were continued unnarrowed to the plane of the opening of the nozzle mouth.

The operation of the machine equipped with broad nozzle lips is functionally different from that equipped with the present thin penetrating lips. With the machine equipped with broad lips as the machine passes over the surface covering to be cleaned said covering is lifted by suction up against the nozzle lips until the ends of the upstanding pile contact thereagainst. No deflection or bending of the pile takes place for the area of the pile covered by the lips includes a sufficiently large number of fibers that their combined strength and resistance to bending is greater than the compressing force of the lifting suction acting thereon. Because of the denseness of floor covering the major portion of the air passes, in gaining entrance to the nozzle, through the pile immediately below the lips and between said lips and the base of the floor covering. With wide nozzle lips merely sliding over the surface of the pile the deeply embedded caked and impacted dirt at the base of the pile is not loosened and the current of cleaning air rushing into the nozzle through said pile passes over said dirt and removes only the less firmly embedded particles nearer the surface of the covering. The cleaning efficiency of the straight-air machine which has the ordinary wide nozzle lips is, therefore, relatively low because of its failure to remove the deeply embedded and firmly lodged dirt particles.

In a machine constructed in accordance with the present invention the nozzle lips are so constructed that the dirt in the surface covering, formerly considered too firmly lodged to be removed by the straight-air machine, is removed with ease. In place of the broad lips aforedescribed are substituted thin lips, known as pile penetrating or pile deflecting lips, whose thickness is such that they may penetrate between adjacent rows or adjacent tufts of the pile of the surface covering, or stated somewhat differently, whose width is equal to or less than the width of the warp or weft threads separating adjacent pile tufts.

In the operation of the cleaner embodying lips constructed in accordance with the present invention, as the covering is lifted up against the nozzle mouth the lips being supported above the normal plane of the covering by the wheels 13, 13, the lips do not rest on the top of the surface covering but penetrate therein because of their thinness. Figure 2 of the drawing clearly illustrates the penetration of the lips into the pile of the surface covering undergoing cleaning. As the machine is moved over the surface the lips flex and bend the individual tufts about their anchor points in the base of the covering and the dirt surrounding and adhering to and between said tufts at their base is broken, cracked and loosened. As the lip slides over one tuft that tuft is released and springs back into normal position and the lip comes into contact with the adjacent tuft where the function is repeated, the operation necessarily extending the entire length of the lip at one time.

The nozzle lip constructed in accordance with the present invention and incorporated in the structure of a straight-air cleaner in which the surface covering is drawn up against the nozzle mouth further functions to vibrate the covering during the cleaning operation when the individual rows of pile are well defined and the cleaner is moving in a direction substantially perpendicular to the length of said rows. As the cleaner moves over the surface the covering is alternately lifted and depressed under the individual lips as said lips enter the space between the rows of pile and then slide thereover. This alternate rising and lowering serves to vibrate and shake the covering and results in the further loosening of the embedded dirt.

As is clearly seen from Figure 2 the pile penetrating lips serve to part the individual tufts in the operation of the machine and so present to the inrushing air under the nozzle lips into the nozzle an unobstructed and open pathway to the base of said tufts thereby making possible the removal of dirt at that point.

From the foregoing it is seen that nozzle lips constructed in accordance with the present invention do not slide over the top of the surface covering but instead penetrate therein thereby deflecting and vibrating the pile as well as vibrating the entire surface thereby loosening the deeply embedded dirt and at the same time making possible the removal of this dirt through providing an open pathway thereto for the inrushing air.

Referring now to Figure 3 a modified form of the present invention is there disclosed. In the embodiment there shown the penetrating part of the lips is shown as an angular projection extending below the body of the lip proper, said projection being on the inside of said lips. In the operation of a machine embodying these lips, as the covering is drawn up against the nozzle the penetrating part of the lips only is projected into the pile thereof, the flat surface or shoulder of the lip at the top of said projection riding on the surface of the pile as in the ordinary suction cleaner lip and functioning to limit the penetration. A lip constructed in accordance with this embodiment functions exactly in the same manner as that disclosed for the preferred embodiment shown in Figure 2.

Figures 4 and 5 disclose embodiments similar to that shown in Figure 3 differing therefrom only in the number and the position of surface-contacting shoulders at the top of the penetrating part of the lip.

Figure 6 discloses an embodiment in which the main or upper part of the lip is made of a relatively great width of the magnitude of the ordinary nozzle lip but having its lower end tapered to the desired width for penetration.

Figure 7 discloses a still further modification in which the penetrating part of the lip is shown projecting from the rounded end of the main body of said lip and functioning in the same manner as those heretofore described.

I claim:—

1. A suction cleaner nozzle comprising walls which form a conduit and a suction mouth in combination with a member formed of rigid material of greater hardness than the material forming said walls and of substantially less thickness than the walls of said nozzle, said member being secured to a wall of said nozzle at said mouth and extending beyond said wall and presenting an edge adapted to contact a surface covering undergoing cleaning to function as a lip for said nozzle, said nozzle mouth being shaped so that cleaning air must pass under said lip in entering said nozzle.

2. In a suction cleaner, spaced walls forming a suction nozzle mouth, a rigid member secured

to one of said walls positioned as to present its edge to a covering being cleaned and forming a nozzle lip, said lip including a surface-contacting portion having a thickness of one-tenth inch or less, said nozzle mouth being so shaped and restricted that cleaning air must pass under said lip.

3. In a suction cleaner, walls forming a suction mouth, a rigid surface-contacting lip including a thin portion carried by one of said walls and adapted to penetrate between adjacent tufts of pile of a surface covering undergoing cleaning, and means to limit the penetration of said lip into said covering, said nozzle mouth being so shaped and restricted that cleaning air must pass under said lip in entering said nozzle.

4. In a suction cleaner nozzle, a rigid surface-contacting lip comprising a thin portion adapted to penetrate between adjacent tufts of pile of a surface covering undergoing cleaning and a shoulder defining the end of said thin portion and adapted to contact said covering to limit the penetration of said thin portion therein.

5. In a suction cleaner nozzle, a rigid surface-contacting lip comprising a thin portion adapted to penetrate between adjacent tufts of pile of a surface covering undergoing cleaning and means defining the end of said thin portion and adapted to contact said covering to limit the penetration of said thin portion therein, said means including shoulders extending along the sides of said thin portion and adapted to contact the surface covering.

6. In a suction cleaner of the type adapted to lift the surface covering undergoing cleaning from the supporting surface and into contact with the nozzle lips, a nozzle having a mouth, a surface-contacting lip defining a side of the said mouth, the thickness of the lip at its surface-contacting portion being such that the lip may extend into the covering and between the adjacent tufts of pile thereof and between the fibers of a single tuft of pile, said nozzle mouth being so formed that cleaning air must pass under said lip.

7. In a suction cleaner, a suction-creating means, a nozzle interiorly connected to said means and including a suction mouth, a thin penetrating lip defining one side of said mouth and presenting a surface-contacting edge, and means supporting said nozzle and said lip above the normal position of a surface covering, the surface-contacting lip being made of relatively hard rigid material as compared to the material of said nozzle and of substantially less thickness than the walls of said nozzle whereby the thin surface-contacting edge of said lip can extend directly into the body of a surface covering undergoing cleaning and can withstand abrasion, said nozzle mouth being so formed that cleaning air must pass under said lip in entering said nozzle.

8. In a cleaner for surface coverings, a main casing, a suction nozzle communicating therewith having an inlet opening at its lower end, supporting means for the casing and nozzle, whereby the lower end of the nozzle is maintained at a distance above the surface and substantially parallel therewith, a thin penetrating lip secured to the nozzle and projecting downwardly therefrom adjacent the inlet opening therein, suction means mounted in the casing for drawing a current of air under said lip and through the nozzle and into the main casing and discharging it therefrom, and for progressively drawing the surface covering upwardly into contact with the nozzle and thereby causing the thin lip to penetrate between tufts of the pile of the covering while it is in contact with the lip as the cleaner is moved over the surface covering, said suction means, nozzle and lip being designed to thoroughly and progressively vibrate and cleanse the covering as it is drawn upwardly.

9. In a cleaner for surface coverings, a main casing provided with suction-producing means, a suction nozzle communicating therewith and having an inlet at its lower end whereby to draw a current of air through the nozzle into the main casing and discharging it therefrom, means for supporting and maintaining the lower end of the nozzle above the surface covering, and a rigid penetrating lip, relatively hard as compared to the material of the nozzle, secured to the side wall of the nozzle and of a thickness materially less than that of the side wall, said lip being adapted to penetrate and vibrate the pile of the surface covering as it is progressively drawn upwardly while the cleaner is moved thereover for dislodging the embedded dirt and foreign particles whereby said suction means is assisted in the withdrawal and removal of such dirt and foreign particles, said suction means, nozzle and lip being so designed that cleaning air is drawn under said lip and so arranged as to thoroughly and progressively vibrate and cleanse the surface covering.

10. In a suction cleaner adapted to lift the surface covering undergoing cleaning, a nozzle having a mouth against which the covering is lifted, and a lip defining a side of said mouth under which cleaning air is drawn and projecting below the nozzle, said lip being of a thickness materially less than the side walls of the nozzle whereby the lip is adapted to penetrate between tufts of pile of the covering to dislodge dirt and other foreign particles, without substantial vertical compression of said pile, said lip being adapted to progressively agitate the pile and covering as the cleaner is moved over the covering, suction means for progressively drawing the surface covering upwardly and means for limiting the upward movement of the covering as the cleaner is operated.

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