Aug. 8, 1939. C. H. VIDAL 2,168,692

CLEANING APPARATUS

Filed Aug. 30, 1937 4 Sheets-Sheet 1

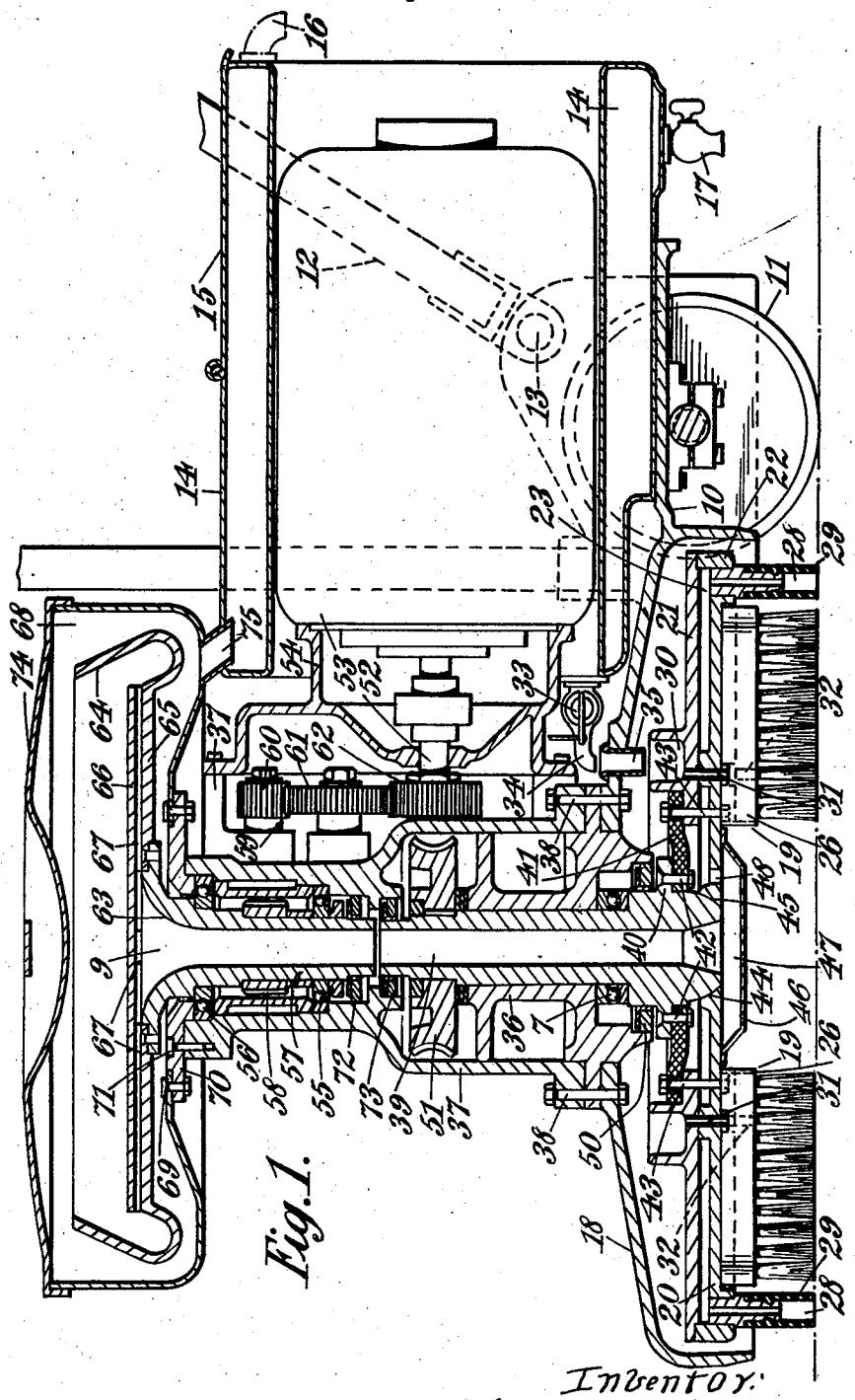

Fig. 1.

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Fig. 2.

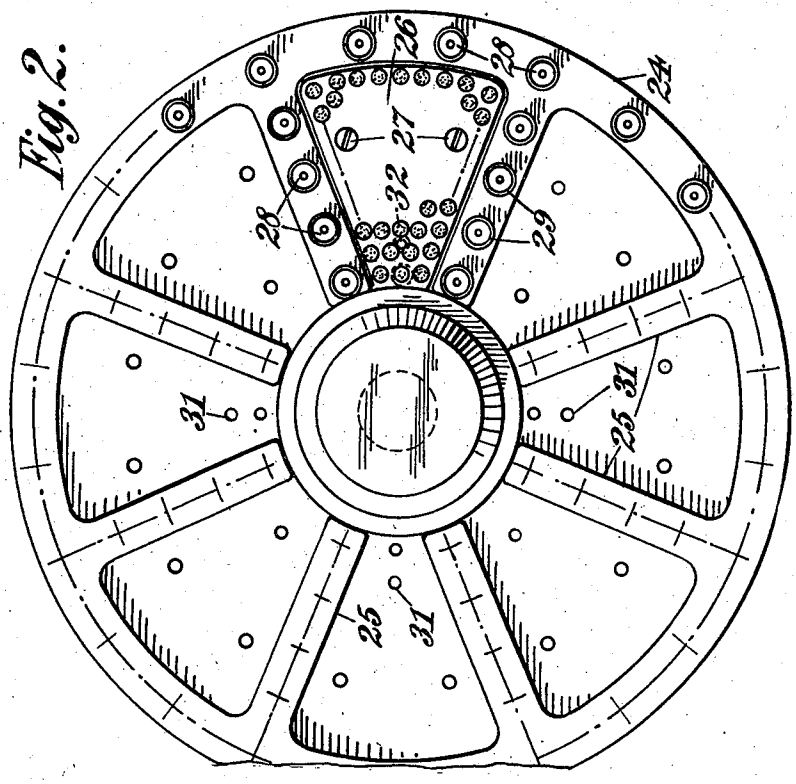

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Fig. 3.

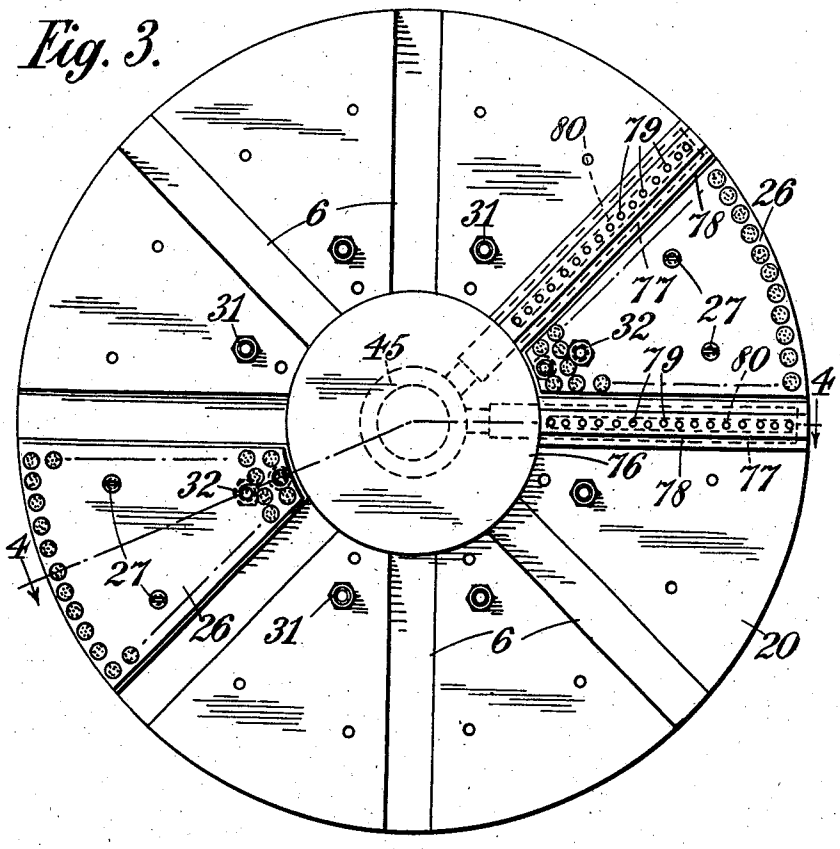


Fig. 4.

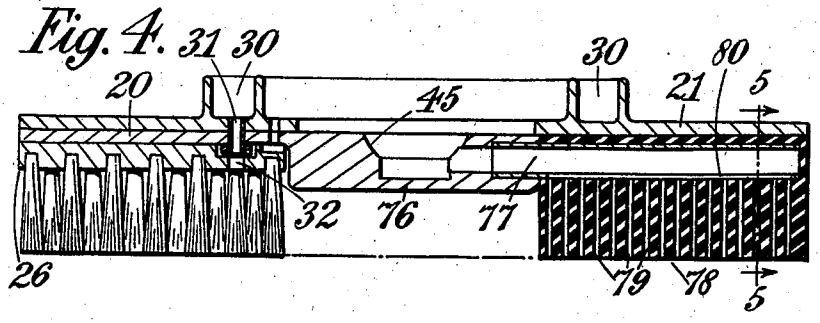
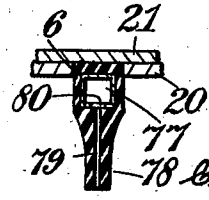


Fig. 5.



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CLEANING APPARATUS

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Fig. 6.

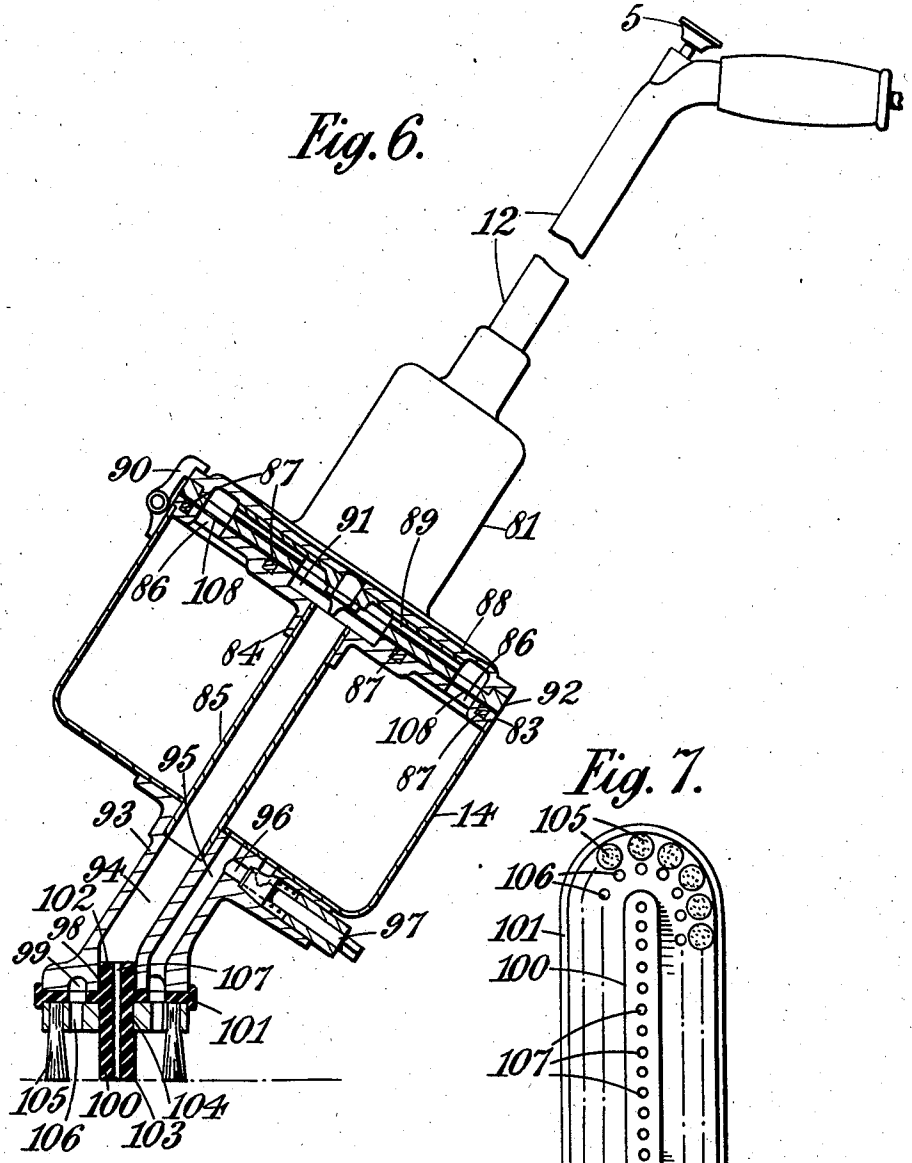

Fig. 7.

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UNITED STATES PATENT OFFICE

2,168,692

CLEANING APPARATUS

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7 Claims. (Cl. 15—4)

This invention is for improvements in or relating to surface cleaning apparatus.

According to this invention a surface cleaning apparatus comprises in combination a brush having a flat surface adapted to contact with the surface to be cleaned, a reservoir for cleaning liquid, a delivery conduit communicating with said reservoir and having its outlet end adapted to deliver cleaning liquid within the confines of the brush, an upwardly extending suction conduit secured at its lower end to the center of the brush, a plurality of branch suction conduits communicating with the lower end of said suction conduit and having openings close to said brush and to the said surface to be cleaned, a centrifugal pump having its rotor arranged above and co-axial with said suction conduit and having its inlet communicating with the upper end of the conduit and having its outlet communicating with said reservoir, and an electric motor adapted to drive said pump, all of which parts are mounted as a transportable unit.

In order that the cleaning operation may be more effective, a movable brush is arranged adjacent the delivery opening or openings so as to scrub the surface to be cleaned which brush is driven by a motor which preferably also actuates said pump. In such an arrangement, said delivery opening or openings may be arranged in said brush so as to feed the liquid on to the surface at the locality of contact with the brush. A disc-type brush may be provided which is mounted on a shaft to rotate about a vertical axis. Preferably, a universal joint may be provided between said brush and the driving shaft so that the brush may readily accommodate itself to inequalities of level in the surface being cleaned.

The aforesaid suction openings may be formed in a gallery-chamber formed in and rotatable with said brush, which gallery-chamber communicates with the inlet side of the pump. As already indicated, the suction openings may be arranged to encircle the delivery opening or openings and may be arranged around the contour of the brush.

In one arrangement the brush may comprise a number of sector-shaped bristle portions separated by a number of radially-extending suction pipes communicating with the inlet side of the pump with or without a number of circumferentially-disposed suction openings.

In any of the arrangements referred to above, the dirt-separator may comprise a centrifuge; preferably driven by the motor which operates the pump. The pump may be provided with a centrifugal rotor and the rotatable element of the centrifuge may be formed integral with or attached directly to said rotor. For example, the rotor may comprise a disc formed with the blades of the centrifugal pump, which blades are encircled by the bowl of the centrifuge.

In an arrangement in which a disc-type brush is employed, it and the pump rotor may be mounted, respectively, on two hollow shafts vertically disposed in axial alignment, driven at different speeds from the motor and housed in a fluid-tight casing. In such an arrangement, the upper end of the upper shaft communicates with a central low-pressure zone of the centrifugal pump and the lower end of the lower shaft communicates with the gallery-chamber in said brush.

The centrifugal pump and centrifuge may be housed in a closed casing into which the liquid separated by the centrifuge overflows. The bottom of the casing is arranged to communicate with the top of said reservoir. In order that the apparatus may operate as an ordinary vacuum cleaner, a cock is associated with the delivery conduit, whereby said outlet opening or openings may be cut off from communication with said fluid reservoir. Air will then be drawn over or through the surface to be cleaned by the suction openings.

Means may also be provided for heating the fluid in said circuit.

The following is a description of a number of embodiments of the invention, reference being made to the accompanying drawings, in which:—

Figure 1 is a sectional elevation of a cleaning device in which cleaning liquid flows from a reservoir under gravity through a rotating brush and is withdrawn from the surface being cleaned by suction openings by means of a pump which delivers the liquid back to the reservoir,

Figure 2 is an under-plan view of the brush, showing the disposition of the suction and delivery openings,

Figure 3 is a similar view to Figure 2, showing an alternative arrangement for the suction openings,

Figure 4 is a section on the line 4—4 of Figure 3,

Figure 5 is a section on the line 5—5 of Figure 4,

Figure 6 is a sectional elevation of a more simple form of construction embodying a fixed brush for traversing the surface to be cleaned but which operates upon the same general prin-

ciple as that of the construction of the previous figures, and

Figure 7 is an under-plan of the brush, showing the outlet openings and suction openings.

Referring to the construction shown in Figures 1 and 2, a supporting framework 10 is mounted on trolley-wheels 11 and may be propelled by a handle 12 pivoted to a part of the framework at 13. Mounted on the supporting framework is a reservoir 14 for cleaning liquid which is provided with a hinged filling lid 15 and an overflow pipe 16 at the upper part thereof and with a draw-off cock 17 at the bottom thereof. The supporting framework is provided with a dome-shaped casing part 18 within which is located a rotatable brush 19. The rotatable brush is secured to a back-plate formed in two parts 20 and 21. The part 20 is provided with an upwardly-extending peripheral flange 22 against which the back-plate 21 abuts so as to provide between the two plates a gallery-chamber 23. As will be seen from Figure 2, the underside of the plate 20 is provided with a circumferential rib 24 and a number of radially-extending ribs 25. A number of sector-shaped brushes 26 are secured to the plate 20 between the radial ribs 25 by suitable setscrews 27. Both the radial ribs and the circumferential ribs are provided with a number of downwardly-extending nozzles 28 which communicate with the gallery-chamber 23 and which are surrounded by hard rubber sleeves 29. The ends of the sleeves are arranged flush with the surface of the brushes. The openings at the ends of the hard rubber sleeves are referred to as suction openings since, as will be explained later, the sleeves and gallery-chamber communicate with the suction side of a centrifugal pump.

The upper back-plate 21 is provided on the upper side thereof with an annular trough 30, the bottom of which is provided with a number of discharge conduits 31 which extend in a fluid-tight manner through the gallery-chamber 23 and through the lower back-plate 20 so as to register with holes 32 formed in the backs of the brushes between the bristles.

The reservoir for cleaning fluid is provided at the lower part thereof with a delivery cock 33, the spout 34 of which is arranged over a funnel-member 35 which extends through the dome-shaped casing part 18 over the annular trough 30, whereby cleaning liquid may be arranged to flow through the brush on to the surface to be cleaned.

A bearing member 36 and an upright cylindrical casing 37 are clamped by bolts 38 to the top of the dome-shaped casing part 18. A hollow vertical shaft 39 is rotatably mounted in said bearing member. The lower end of the hollow shaft is provided with an outwardly-directed flange 40 to which is secured a flexible driving disc 41 by studs 42. The peripheral portion of the flexible driving disc is secured by bolts 43 to the upper back-plate 21. The lower extremity of the hollow shaft 39 is provided with a spherical surface 44 which engages a spherical socket 45 formed in the centre of the lower back-plate 20. A cap 46 is secured on the underside of the back-plate 20 opposite the end of the hollow shaft 39 to provide a space 47 which communicates through holes 48 with the gallery-chamber 23. A thrust race 7 is arranged between shoulders formed respectively on the hollow shaft 39 and on the bearing member 36. A sealing washer 50 is located in a housing formed in the bearing member 36 in contact with the hollow shaft 39. A worm-wheel 51 is fixed to the upper end of the hollow shaft 39 and is driven by a worm (not shown) secured to the shaft 52 of an electric motor 53. As will be seen from Figure 1, the motor is located in a cavity formed within the reservoir 14 and is carried by a bracket 54 attached to a part of the casing 37.

The casing 37 extends above the top of the hollow shaft 39 and carries two ball-bearings 55 and 56 in which is mounted a second hollow shaft 57. The two hollow shafts are arranged in axial alignment. Secured to the centre part of the hollow shaft 57 is a worm-wheel 58 which is driven by a worm (not shown) formed on a cross-shaft 59 to which is secured a pinion 60. The pinion 60 is driven through an intermediate gear 61 from a gear-wheel 62 secured to the motor-shaft 52. The hollow shaft 57 is provided at its upper end with an outwardly-directed flange 63 to which is secured the bowl 64 of a centrifuge. The upper end of the hollow shaft 57 is outwardly-flared so as to provide an inlet chamber 9 at the centre of the blades 67 of the centrifugal pump. The bowl is provided with a flat bottom plate 65 over which is secured a plate 66 having formed on its under surface the said centrifugal pump-blades 67. It will be noted that the bowl of the centrifuge extends downwardly and outwardly from the tips of the blades and the outer wall thereof extends upwardly and inwardly. The centrifuge is surrounded by a casing 68 which is secured by studs 69 to a flange 70 which, in its turn, is secured by setscrews 71 to the top of the casing 37. A suitable sealing ring 72 is arranged to surround the lower end of the hollow shaft 57 within the casing 37. Another sealing ring 73 is arranged to surround the upper end of the hollow shaft 39. The casing 68 is closed by a suitable cover 74. The lower part of the casing 68 communicates through a short discharge conduit 75 with the upper part of the reservoir 14. The gearing between the motor and the lower shaft 39 is such as to rotate the brush about 150 revolutions per minute, whereas the gearing between the motor and the pump and centrifuge is such as to rotate those parts about 6,000 revolutions per minute. The vanes on the centrifugal pump are designed to provide a lift of about 2 feet of water. A suitable switch control (not shown) for the motor may be provided on the propelling handle 12, which switch may, if desired, be interconnected with the delivery cock 33.

The operation of the device is as follows. After the reservoir has been filled with cleaning liquid, the motor-switch and delivery cock 33 are turned on, whereupon the washing liquid will be fed to the rotating annular trough 30 and find its way through the brush on to the surface to be cleaned. The liquid, after being thoroughly brushed on to the surface, will find its way through one or other of the outlet openings in the hard rubber tubes 29 and thence through the nozzles 28, the gallery-chamber 23, through the openings 48, up through the hollow shafts 39 and 57 to the inlet chamber 67 of the centrifugal pump. The dirty liquid will leave the tips of the blades and the heavier dirt particles will be thrown out by centrifugal force into the lower part of the centrifuge bowl, while the clean liquid will pass over the outer wall of the bowl into the bottom of the casing 68 and thence to the short discharge conduit 75 and back again into the reservoir 15.

Figures 3, 4 and 5 show an alternative way of

arranging the suction openings. The lower back-plate 20, instead of being spaced away from the upper back-plate 21 by a peripheral flange, is secured flat against it and is provided with a downwardly-extending hollow boss 76. A number of square-section tubular arms 77 are secured in suitably-shaped holes in the side wall of said hollow boss and are arranged to extend radially outwards. The lower back-plate 20 is provided with radial slots 6 opposite to each radial tube 77. Encircling each radial tube 77 is a flexible rubber block 78, a cross-section through which is shown in Figure 5. A number of downwardly-extending passages 79 are formed in each block, which passages are arranged to register at their upper ends with a slot 80 formed in the under wall of the tubular arm.

A smaller and more simple construction is shown in Figures 6 and 7, which dispenses with the use of a rotating brush and with the centrifuge. The shaft of the propelling handle 12, the motor-casing 81 and the reservoir 14 for cleaning liquid are arranged co-axially, one above the other, the reservoir is cylindrical in shape and has secured in the mouth thereof a plate 83 having a central boss 84 into which a suction conduit 85 extends. The plate is provided with a number of delivery apertures 86 and inset into the outer face thereof are a number of sealing rings 87. The lower part of the motor casing is provided with an outwardly-directed flange 88, the under-side of which is recessed to receive the rotor 89 of a centrifugal pump driven by said motor. Disposed between the plate 83 and the recessed flange is a second apertured plate 92 which parts are clamped together by a number of clamps 90. A filter disc 108 may be disposed between the two apertured plates 83 and 92. The plate 83 and the rotor are so shaped as to provide at their centre an inlet chamber 91 which communicates with the suction conduit 85. An annular gap is left between the tips of the blades of the rotor and the outer wall of the aforesaid recessed flange, which annular gap communicates with the delivery apertures 86.

Secured to the underside of the reservoir is an operating nozzle 93 having a passage 94 formed therein with which the suction conduit 85 registers and a delivery conduit 95 communicating at its upper end through a right-angled passage 96 with the bottom of the reservoir. Said passage 96 is controlled by an adjusting valve 97.

As will be seen from Figure 7, the lower end of the nozzle 93 is elongated in shape. It is provided with a centrally-extending slot 98 which communicates with the passage 94. The nozzle is also provided on its under face with a surrounding channel 99 which communicates with the passage 95. A flexible rubber block 100 is provided with a flanged portion 101 arranged to rest against the underside of the nozzle 93 and with an upwardly-extending portion 102 which projects into the aforesaid slot 98. A downwardly-extending portion 103 is arranged to pass through a hole in the back 104 of a brush. The back of the brush conforms to the shape of the nozzle part and is provided with a peripheral row of bristles 105. A number of small passages 106 in the back of the brush communicate with the channel 99 and a number of small passages 107 in the flexible rubber block communicate with the passage 94. The weight of the apparatus is supported on the surface solely by the brush.

The operation of the device is as follows. After the reservoir has been filled, the motor is started, for example, by means of a switch control 5 which may extend down through the centre of the propelling handle 12. The valve 97 is adjusted so as to provide the required rate of flow of cleaning liquid through the brush. The cleaning liquid descends through the passage 95 and through the channel 99 and passage 106 to the space within the bristles 105. The brush is traversed backwards and forwards over the floor, brushing the liquid well into the surface. A suction is created by the motor in the suction conduit 85 and the passages 107. Thus the liquid, after performing the cleaning operation, is sucked up through those passages into the centre of the pump rotor. It passes out through the tips of the blades and is directed through the apertures 86 and filter 108 back again into the reservoir.

I claim:

1. A cleaning apparatus comprising a pump having a disc-type rotor adapted to rotate about an upright axis, a centrifuge operatively associated with the outlet of the pump, a reservoir for cleaning liquid in communication with the outlet of the centrifuge, a delivery conduit operatively associated with said reservoir, a disc-type brush mounted to rotate about a vertical axis in alignment with the axis of said rotor, means for directing said liquid from said delivery conduit within the confines of said brush on to the surface to be cleaned, a plurality of suction openings in said brush disposed close to said surface to be cleaned, which brush is mounted on a hollow driving shaft and is provided with passages between said suction openings and the interior of said shaft and which pump rotor is also mounted on a hollow shaft communicating at one end with the inlet of the rotor and at the other end with the brush shaft so as to provide a return conduit for the liquid withdrawn from said surface.

2. A surface cleaning apparatus comprising, in combination, a brush having a flat surface adapted to contact with the surface to be cleaned, a reservoir for cleaning liquid, a delivery conduit communicating with said reservoir and having its outlet end adapted to deliver cleaning liquid within the confines of the brush, an upwardly-extending suction conduit secured at its lower end to the center of the brush, a plurality of branch suction conduits communicating with the lower end of said suction conduit and having openings disposed close to said brush and to the surface to be cleaned, a centrifugal pump having its rotor arranged above and co-axial with said suction conduit and having its inlet communicating with the upper end of the conduit and having its outlet communicating with said reservoir and an electric motor adapted to drive said pump, all of which parts are mounted as a transportable unit.

3. A surface cleaning apparatus comprising, in combination, a rotatable brush having a flat surface adapted to contact with the surface to be cleaned, a reservoir for cleaning liquid, a delivery conduit communicating with said reservoir and having its outlet end adapted to deliver cleaning liquid within the confines of the brush, a rotatably mounted upwardly-extending suction conduit secured at its lower end to the center of the brush, a plurality of branch conduits communicating with the lower end of said suction conduit and having openings disposed close to said brush and to the surface to be cleaned, a centrifugal pump having its rotor arranged above and co-axial with said suction conduit and having its inlet communicating with the upper

end of the conduit and having its outlet communicating with said reservoir and an electric motor adapted to drive both said brush and said rotatably mounted suction conduit, all of which parts are mounted as a transportable unit.

4. A surface cleaning apparatus comprising, in combination, a brush having a flat surface adapted to contact with the surface to be cleaned, a reservoir for cleaning liquid, mounted above said brush, a delivery conduit communicating with said reservoir and having its outlet end adapted to deliver cleaning liquid within the confines of said brush, an upwardly-extending suction conduit secured at its lower end to the center of the brush, a plurality of branch suction conduits communicating with the lower end of said suction conduit and having openings disposed close to said brush and to the surface to be cleaned, a centrifugal pump arranged above said reservoir, having its rotor arranged above and co-axial with said suction conduit and having its inlet communicating with the upper end of the conduit and having its outlet communicating with said reservoir and an electric motor adapted to drive said pump, all of which parts are mounted as a transportable unit.

5. A surface cleaning apparatus comprising, in combination, a brush having a flat surface adapted to contact with the surface to be cleaned, a reservoir for cleaning liquid, a delivery conduit communicating with said reservoir and having its outlet end adapted to deliver cleaning liquid within the confines of the brush, an upwardly-extending suction conduit secured at its lower end to the center of the brush, a plurality of branch suction conduits communicating with the lower end of said suction conduit and having openings disposed close to said brush and to the surface to be cleaned, a centrifugal pump having its rotor arranged above and co-axial with said suction conduit and having its inlet communicating with the upper end of the conduit, a dirt separator arranged between the outlet of the pump and said reservoir and an electric motor adapted to drive said pump, all of which parts are mounted as a transportable unit.

6. A surface cleaning apparatus comprising, in combination, a rotatable brush having a flat surface adapted to contact with the surface to be cleaned, a reservoir for cleaning liquid, a delivery conduit communicating with said reservoir and having its outlet end adapted to deliver cleaning liquid within the confines of the brush, a rotatably mounted upwardly-extending suction conduit secured at its lower end to the center of the brush, a plurality of branch suction conduits communicating with the lower end of said suction conduit and having openings disposed close to said brush and to the surface to be cleaned, a centrifugal pump having its rotor arranged above and co-axial with said suction conduit and having its inlet end communicating with the upper end of the conduit, a centrifuge associated with the outlet of said pump and adapted to deliver the separated liquid to said reservoir, an electric motor, transmission mechanisms between said motor, and rotatably mounted brush and suction conduit, and between said motor and pump and centrifuge, which transmission mechanisms are so arranged that the centrifuge and motor are driven at a greater speed than the brush and conduit.

7. A surface cleaning apparatus comprising, in combination, a rotatable disc-brush having a suction chamber at the center thereof and having a flat surface adapted to contact with the surface to be cleaned, a reservoir for cleaning liquid, a delivery conduit communicating with said reservoir and having its outlet end adapted to deliver cleaning liquid within the confines of the brush, a rotatably mounted upwardly extending suction conduit, a universal joint adapted hermetically to connect the lower end of the suction conduit to the suction chamber at the center of the disc brush, a plurality of branch suction conduits communicating with the suction chamber, and having openings disposed close to said brush and to the surface to be cleaned, a centrifugal pump having its rotor arranged above and co-axial with said suction conduit and having its inlet communicating with the upper end of the conduit and having its outlet communicating with said reservoir and an electric motor adapted to drive both said brush and said rotatably mounted suction conduit, all of which parts are mounted as a transportable unit.

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