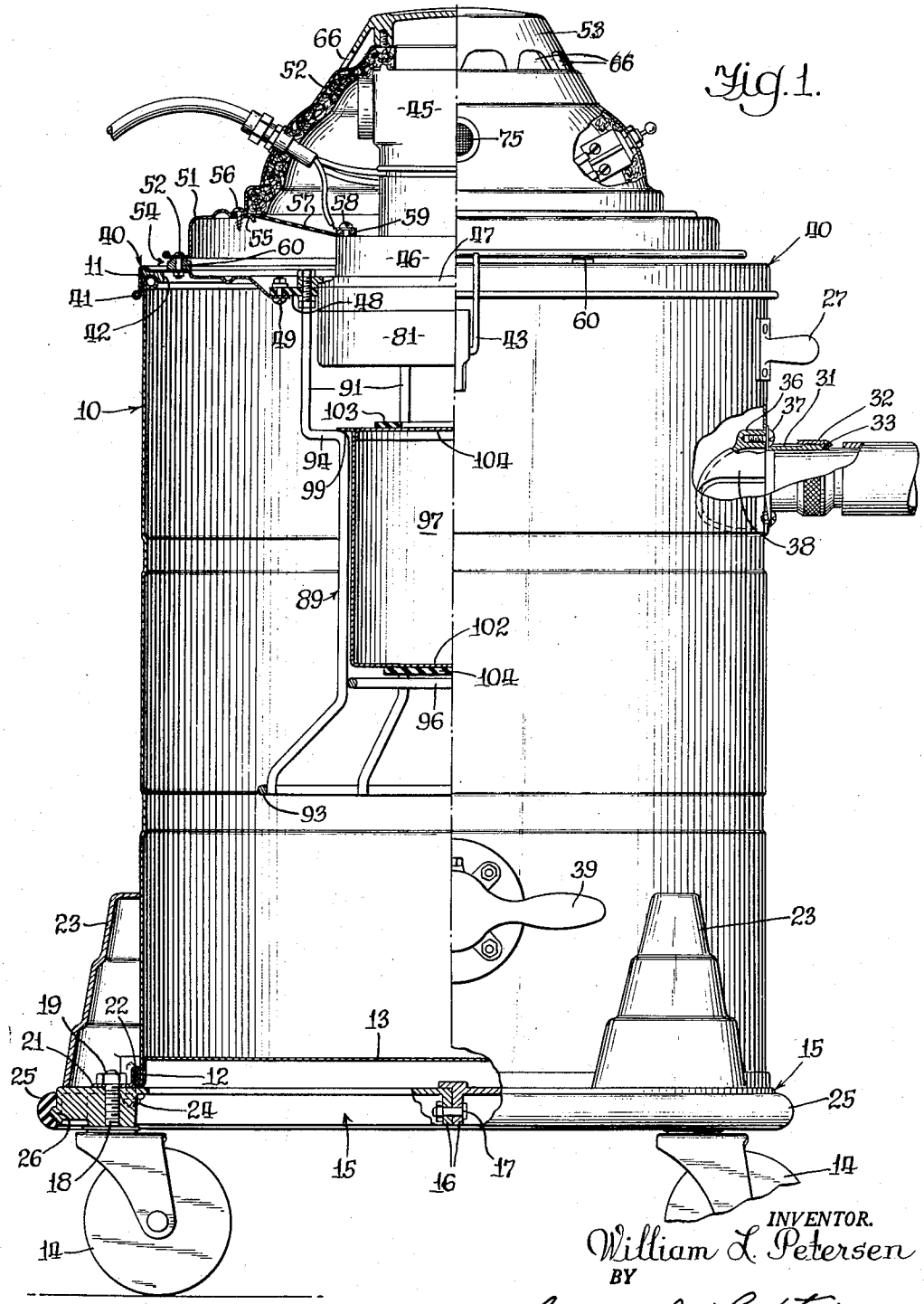
Jan. 19, 1954 W. L. PETERSEN 2,666,498

SUCTION CLEANER

Filed March 25, 1952 2 Sheets-Sheet 1

Fig. 1.



INVENTOR.
William L. Petersen
BY
Clarence J. Loftus Atty

Jan. 19, 1954 W. L. PETERSEN 2,666,498

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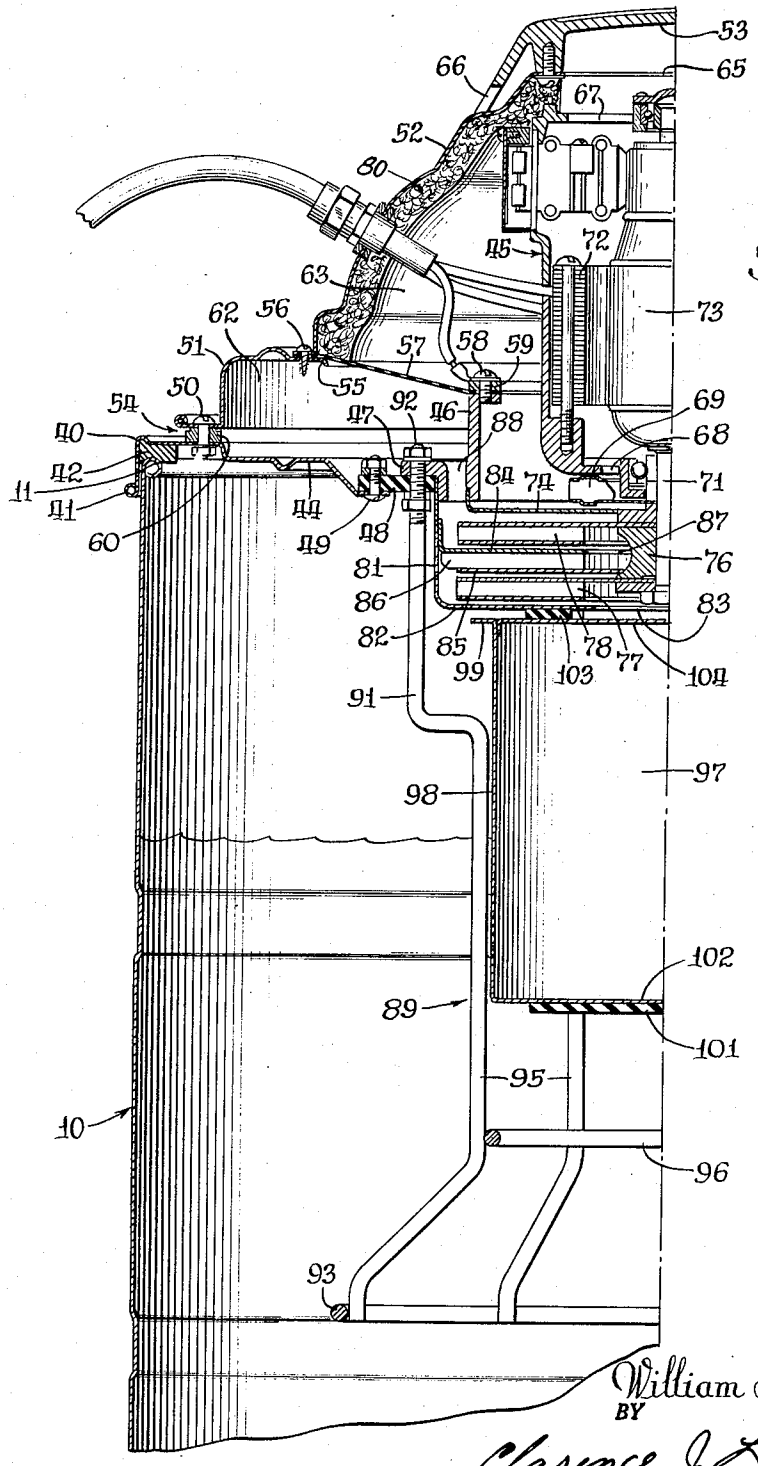


Fig. 2.

INVENTOR.
William L. Petersen
BY
Clarence J. Loftus
Atty

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SUCTION CLEANER

William L. Petersen, Muskegon, Mich., assignor to Clarke Sanding Machine Company, Muskegon, Mich., a corporation of Michigan

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2 Claims. (Cl. 183—37)

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This invention relates to suction cleaning equipment and has specific reference to suction cleaner of unique construction whereby it is ideally suited for use in picking up water, foam and suds incident to floor scrubbing or rug cleaning operations.

The general aim of the invention is to provide a water pick-up suction cleaner which is more efficient, more quiet, simpler, cheaper, and in general more desirable than cleaners of this type heretofore provided, but the accomplishment of this aim necessarily involves the simultaneous solution of various problems, and the accomplishment of a number of objects which are, in some cases, of such a nature as to conflict with each other.

It is, therefore, the primary object of the invention to provide a water pick-up suction cleaner wherein the conflicting mechanical requirements of a mechanism of this kind are reconciled, and a number of subsidiary objects are simultaneously accomplished. More specifically, it is an object of the present invention to provide a suction pick-up device so designed and constructed as to permit unusually free air flow through the internal mechanism, so that the greatest possible efficiency of suction is obtained.

Another object is to provide a suction pick-up wherein the air passages are so arranged as to move a large quantity of air through the machine at extremely high speeds, as required to attain the suction desired, yet to avoid, insofar as possible, the hissing, whistling "suction noises" such as characterize many of the machines of the prior art.

A further object is to provide a mechanism which is more simple and less expensive than devices heretofore employed for the purpose, and wherein the conventional array of small tubes, pipes, air ducts and baffle structures are completely eliminated, yet a more efficient and dependable action is obtained.

A subsidiary object in this line is to provide a mechanism wherein the major working parts are in all instances concentrically mounted, and whereby the machine is thus perfectly balanced and arranged to operate without undue noise or perceptible vibration.

A still further object is the provision of a water pick-up suction cleaner having a motor driven centrifugal suction fan wherein the motor is cooled by an air circulating system entirely separate from and independent of the suction system, so that there is no possibility whatsoever of drawing water, foam, or moisture-laden air into the motor itself.

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Last, but by no means least, it is a specific object of the present invention to provide an improved yet simplified automatic shut-off mechanism, whereby the suction of the machine will be automatically rendered inoperative whenever the machine container becomes filled with liquid, foam or suds. Another related object is to provide an automatic float controlled shut-off which is not only responsive to the level of liquid within the container, but is capable of actuation by foam or suds having a density far less than water yet wherein all structures of the machine are sturdy in their physical aspects, and stable and dependable in function, so that the shut-off mechanism of the machine is not subject to accidental closing, yet will unfailingly close when the requisite liquid or foam level has been reached. Other objects will appear in connection with the following description of preferred embodiment of the invention.

The foregoing objects are accomplished in the present invention by use of a suction mechanism including an upright cylindrical container disposing on a vertical axis with a cover and a main motor mounted in an inverted position on the cover, with the drive shaft of the motor extending downwardly into the container of the tank of the machine and carrying a centrifugal suction fan enclosed within a housing at the upper end of the tank. A relatively large open cage extends downwardly from the fan housing and is provided with slides in which an extremely large closed metal canister or shut-off float is mounted. The float has a diameter of about one-third of the height of the tank, and is centrally disposed immediately below the suction fan, with a large flat closure plate adapted to directly engage the fan housing and close the air inlet thereto whenever the level of liquid or foam in the tank rises to a predetermined point.

With this arrangement, it has been found feasible to entirely eliminate all of the baffles, small pipes, tubes, ducts, and similar structures which have been so characteristic of prior art machines, and at the same time to accomplish an unusual efficiency of suction, since the air enters the suction fan directly from the container through an annular air inlet passage extending through the entire periphery of the flat closure plate on the top of the shut-off float.

The air discharge passages from the suction fan are similarly designed to permit unrestricted flow of air, yet discharge air into the atmosphere relatively silently and without creating any unnecessary turbulence or direct air blasts into the vicinity of the machine. This, in the present

invention, is accomplished by discharging the air from the suction fan into an annular chamber around the fan housing from which it is permitted to flow into the atmosphere through air discharge outlet of a diameter almost equal to the outer diameter of the tank, so that a relatively large amount of air may be moved through the discharge outlet without developing air velocities high enough to cause perceptible noise or turbulence.

A preferred form of the invention is illustrated in the drawings of this specification, wherein:

Figure 1 is a side elevational view of a preferred form of the machine with the left half of the view shown in section to illustrate its internal construction; and

Figure 2 is a fragmental sectional view similar to Figure 1, showing the shut-off float in a closed position.

In the machine illustrated, the working parts of the mechanism are mounted upon and within an upright tank or container 10 which is preferably of sheet metal construction and, as shown, is in the form of a cylinder disposed on a vertical axis. Conveniently, the upper edge of the tank may terminate in a rolled or beaded rim 11, and the lower edge may be rolled into an interlocking seam 12 whereby the vertical walls of the tank are joined with a horizontal sheet metal tank bottom 13. In the commercial embodiment of the invention it has been found desirable to mount the machine on a relatively heavy and rigid undercarriage having a plurality of casters 14, and to this end there have been provided four identical supporting brackets 15 which are provided with flanges 16 bolted to each other by machine screws 17 so that the four brackets form the undercarriage or supporting frame for the tank 10. The casters 14 may then be mounted directly onto the individual brackets 15 by passing their screw threaded shanks 18 through apertures provided therefor, and securing them by nuts 19. The nuts 19 also hold the tank 10 on the undercarriage. To accomplish this, sheet metal clips 21 are secured on the shanks 18 by the nuts 19, and these clips are provided with flanges 22 which partially surround and engage the beaded edge 12 of the lower rim of the tank. Thus the tank may rest directly on the upper surfaces of the four brackets 15, and be firmly secured thereto without the need of any drilling, welding, cutting or other machine operations. It should also be noted that the sheet metal of the tank itself need not have any fastening holes nor other special structures, and that the metal of which it is formed can be painted, plated, galvanized, or otherwise finished over the entire surface, inside and out.

As shown, the undercarriage brackets 15 of the machine are each provided with an ornamental hollow cap 23 to cover the fastening clips 21 and nuts 19. These caps or covers are secured to the brackets 15 by screws 24 extending upwardly therethrough. The undercarriage of the machine is completed by a marginal rubber bumper 25 which is preferably formed as an endless member having a groove on the underside thereof, so that it may be stretched around the assembled brackets 15, and will be held in engagement thereon by projections 26 formed on the brackets. Thus the bumper 25 provides a marginal cushion around the bottom of the tank and the outer edge of the undercarriage. The machine is also preferably provided with one or more handles 27 to facilitate moving the machine about the floor or emptying the tank.

The tank 10 includes an inlet fitting 31 with a threaded coupling nut 32 and locking ring 33 by which the machine may be coupled to the tubular fitting 34 of a suction hose 35. It is contemplated that the machine may be used with any desired type of water pickup tool attached to the remote end of this hose. The inlet fitting 31 is secured to the vertical wall of the tank 10 in the upper portion thereof, and, as shown, is provided with an inside member 36 into which a plurality of fastening screws 37 are threaded. The inside member includes a deflector 38 arranged to deflect the flow of incoming air or water in a downward and generally circumferential direction on the inner surface of the tank.

A drain valve 39 is also provided. This valve is preferably located at or near the bottom of the tank to facilitate emptying the liquid therefrom.

The operating mechanism of the machine is mounted on the tank cover 40. The cover 40 is preferably provided with an edge flange 41 surrounding the top rim 11 of the tank 10, and the cover is sealed thereon by a gasket 42. One or more quick acting trunk latches 43 are mounted on the side walls of the tank to hold the cover firmly in position. The cover 40 has a top surface 44 with a large aperture at its center, and the motor 45 and its fan housing are mounted within this aperture. As shown, the motor 45 and the fan housing have a common supporting frame 46 provided with an outstanding flange 47 bolted to a heavy rubber mounting ring 48. The rubber ring 48 is in turn secured to the inner edge of the top portion 44 of the machine cover by a plurality of mounting screws 49. The frame 46 is of generally cylindrical form, surrounding the lower end of the motor 45 and secured thereto or integral therewith.

The motor is surrounded by a housing comprising a ring member 51, a shell 52 and a cap 53. The ring 51 is secured to cover top portion 44 of the cover 40 by a plurality of machine screws 50, each of which is provided with a rubber spacer 60 to permit unrestricted air flow in the annular space 54 between the cover and the ring. The ring 51 also serves as a mounting for the shell 52, which is secured to the inwardly extending flange 55 of the ring 51 by any convenient means, as by the screws 56 illustrated. A flexible rubber sheet 57 has its outer marginal edge secured between the flange 55 and the lower flange of the motor shell 52. This rubber sheet extends inwardly to the upper rim of the frame 46, when it is secured by screws 58 and a clamping ring 59. Thus, the rubber sheet 57 functions as a gasket and sound deadening member between the ring 51 and the shell 52, and also serves as a partition between an exhaust air compartment 62 and a compartment 63 surrounding the motor.

The upper end of the shell 52 has an air inlet aperture 65 covered by the cap 53, and the cap is notched at 66 to provide inlets through which air may be drawn from the atmosphere and down through the top of the shell to the open end frame 67 of the motor. The lower end of the motor frame is open at 68 and a cooling fan 69 is mounted on the armature shaft 71. Thus, air for cooling the motor is drawn directly from the atmosphere into the motor housing and passes downward between field laminations 72 and the armature 73, after which it is discharged through the central apertures 68 and cooling fan 69.

The lower end of the frame 46 is closed by the

flat plate 74, so that the air discharged from the motor cooling fan 69 passes upwardly through the frame 46 to the compartment 63, and thence through screened apertures 75 to the atmosphere. A layer of fiber glass 80 on the inside of the shell 52 serves to deaden motor and suction noises.

The motor shaft 71 also carries a hub 76 on which rotary fan blade assemblies 77 and 78 of the main suction fan are mounted. These blades are surrounded by an exterior fan housing 81 having a lower bottom plate 82 in which an air inlet aperture 83 is provided. The housing 81 also includes an intermediate wall or partition positioned between the rotors 77 and 78 and having an upper plate 84 and lower plate 85, with radial fins 86 between the plates.

From the foregoing it will be seen that the rotors 77 and 78 comprise a two stage suction fan. The fan serves to exhaust air from the interior of the tank 10 by drawing it in through the aperture 83, from which it passes outwardly in a radial direction through the rotor 77. The air is then caused to flow inwardly between the upper and lower walls 84 and 85 of the partition, and to pass through the aperture 87 to center of the rotor 78.

The air leaving the second state rotor 78 flows through the passages 88 to the compartment 62. It is then discharged from the machine through the thin, narrow, annular discharge passage 54, provided between the top 44 of the cover and the lower edge of the ring member 51.

The flange 47 of the frame 46 on which the motor 45 is mounted also serves as the mounting for a central cage structure generally designated as 89. The cage consists of a plurality of individual wires or rods 91 each having their upper ends bolted to the flange 47 by threaded nuts 92. The lower extremities of each of the rods 91 are joined by a circular ring or rim 93, and the individual rods 91 may be offset inwardly at 94 to provide a plurality of parallel vertical slide portions 95 joined at their lower ends by a ring 96.

This cage comprises a slide mounting and guide for the float of a shutoff valve mechanism.

The float controlled shutoff valve employs a relatively large, centrally disposed float 97, preferably in the form of a hollow canister having vertical side walls 98 in sliding engagement with the vertical portions 95 of the cage 89, and an outwardly extending flange 99 at the top of the canister arranged to engage and rest on the offset portions 94 of the rods, so that the downward motion of the float is limited. Thus the float will normally be held in spaced relationship below the fan housing 81 as illustrated in Figure 1. The canister is closed at the top by a large, flat closure plate 104 and, as shown, is also closed at the bottom by the plate 102 to which a circular rubber sheet 101 is attached.

A rubber ring or sealing gasket 103 is secured to the top closure plate 104 and cemented thereto, so that when the float is lifted to the position of Figure 2, the gasket 103 will come into flat surface engagement with the lower plate 82 of the fan housing 81, and the closure plate 104 will close the air inlet to the fan.

In the operation of the machine, the fan within the housing 81 will exhaust air from the inside of the tank, and air flowing inwardly through the suction hose 35 will bring about the suction required for the vacuum cleaning operation.

The air entering the tank 10 will pass upwardly and be drawn radially inwardly into the annular gap between the top closure plate 99 of the shut-off float 97 and the bottom face plate 82 of the fan housing 81, so that air will enter the inlet aperture 83 of the fan housing from all sides thereof and will thus reach the center of the first stage centrifugal fan rotor 77. As hereinbefore mentioned, the air discharged from this rotor will flow radially inwardly between the partition plates 84 and 85 to the aperture 87 leading to the second stage rotor 78, and will then be forced radially outwardly and will flow upwardly through ports 88 in the motor casting into the annular exhaust air chamber 62 between the top plate 44 of the cover and the rubber diaphragm 57. From this chamber the air will be dislodged radially in all directions through the narrow annular air discharge opening 54 between the lower rim of the ring 51 and the top of the cover, so that a large quantity of air may be discharged silently and without setting up direct air blasts or turbulence in the atmosphere surrounding the machine. This is of considerable advantage in several respects, since the absence of direct air blasts about the machine not only reduces noise and overcomes the annoyances caused by direct air blasts, but also largely eliminates the tendency of prior machines to blow loose dust into the air.

It is also to be noted that the apparatus of the present invention does not depend upon the air used for suction purposes to cool the motor. Motor cooling air is drawn inwardly through the notches 66 in the top cap 53, and is thence drawn downwardly through openings 65 and 67, and through the motor 45 and ports 68 by the motor cooling fan 69. The air discharged from the motor cooling fan flows into the compartment 63 between the motor housing and the shell 52, and is discharged through the screened vents 75 (Figure 1).

The specific form of float and shut-off mechanism used in the present device has considerable advantage over forms utilized heretofore, in that it accomplishes far more dependable operation than other known shut-off devices yet does so by the use of a comparatively simplified structure. It appears that one of the important practical features of the present structure arises from the complete absence of any pipes, ducts, tubes or similar structures in the air passages, and it is believed that the elimination of such parts permits a considerable greater degree of efficiency and a consequent increase in suction over other machines, and that the elimination of such tubes and pipes brings about a further advantage in providing more dependable and trouble-free operation, particularly as to the float and shut-off operation. With the present arrangement the float may be about one-third of the entire diameter of the machine container (or even larger if desired) and may be about one-third or more of the height thereof, without imposing any limitations on the functioning of the machine, and it has been found that a float of such large dimensions is more stable and dependable in operation than any devices heretofore employed in the art, and that it is less subject to sticking, jamming or to influence by unexpected splashes, surges or eddying movements of the water and foam within the tank.

It has also been found that the central disposition of the float on the axis of the fan and on the central axis of the container gives it additional stability of operation and avoids false responses as a result of splashing, turbulence or surging of the water within the container. It is

also believed that the relatively large annular air inlet between the top of the float closure plate and the fan housing permits the largest possible air inflow without substantial resistance to air movement, and thus accomplishes a further increase in efficiency.

In short, the invention provides for elimination of many unnecessary pipes, ports and similar structures, and accomplishes a simplification of mechanical structure together with an increased dependability and versatility of operation.

Having thus described my invention, what I claim as new and desire to protect by United States Letters Patent is:

1. In a suction cleaner having a vertically disposed cylindrical container, a removable cover and suction assembly comprising a main cover plate of annular conformation; an electric motor having a frame centrally disposed with respect to said cover plate, with a peripheral flange at the lower end of said motor resiliently mounted on the cover plate by a circular rubber ring secured between the flange of the motor frame and the inner edge of the cover plate; an annular cover ring concentric with and fixedly secured in spaced relation above said cover plate and defining an exhaust air chamber with an annular outlet between said cover plate and ring, with a yieldable resilient diaphragm extending between an inner marginal edge of said cover ring and the aforesaid motor frame; a hollow shell secured to the cover ring and enclosing the aforementioned electric motor and with a motor cooling fan positioned within said motor frame and adapted to circulate air through said motor and shell; said motor including an armature shaft extending downwardly and projecting from said motor frame, with a rotatable suction fan carried on the projecting end of said armature shaft and disposed below the motor frame and substantially below said cover plate; a circular suction fan housing surrounding said suction fan and detachably secured to the lower end of the motor frame, with exhaust ports leading from said suction fan to the exhaust air chamber between the cover plate and cover ring and thence through the annular air outlet therebetween, and with a central air inlet on the bottom of the suction fan housing and a shut-off float comprising a relatively large hollow metallic container having a closure plate substantially the diameter of the suction fan at its upper end adapted to engage the bottom of said suction fan housing and close the air inlet to said fan.

2. In a suction cleaner having a vertically disposed cylindrical container, a removable cover and suction assembly comprising a main cover plate of annular conformation; an electric motor having a frame centrally disposed with respect to said cover plate, with a peripheral flange at the lower end of said motor resiliently mounted on the cover plate by a circular rubber ring secured between the flange of the motor frame and the inner edge of the cover plate; an annular cover ring concentric with and fixedly secured in spaced relation above said cover plate and defining an exhaust air chamber with an annular outlet between said cover plate and ring, with a yieldable resilient diaphragm extending between an inner marginal edge of said cover ring and the aforesaid motor frame; said motor including an armature shaft extending downwardly and projecting from said motor frame, with a rotatable suction fan carried on the projecting end of said armature shaft and disposed below the motor frame and substantially below said cover plate; a circular suction fan housing surrounding said suction fan and detachably secured to the lower end of the motor frame, with exhaust ports leading from said suction fan to the exhaust air chamber between the cover plate and cover ring and thence through the annular air outlet therebetween, and with a central air inlet on the bottom of the suction fan housing and a shut-off float comprising a relatively large hollow metallic container having a closure plate substantially the diameter of the suction fan at its upper end adapted to engage the bottom of said suction fan housing and close the air inlet to said fan.

WILLIAM L. PETERSEN.

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