

March 11, 1969

D. L. GRAVE
CLEANING DEVICE

3,431,582

Filed May 8, 1966

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FIG. 1

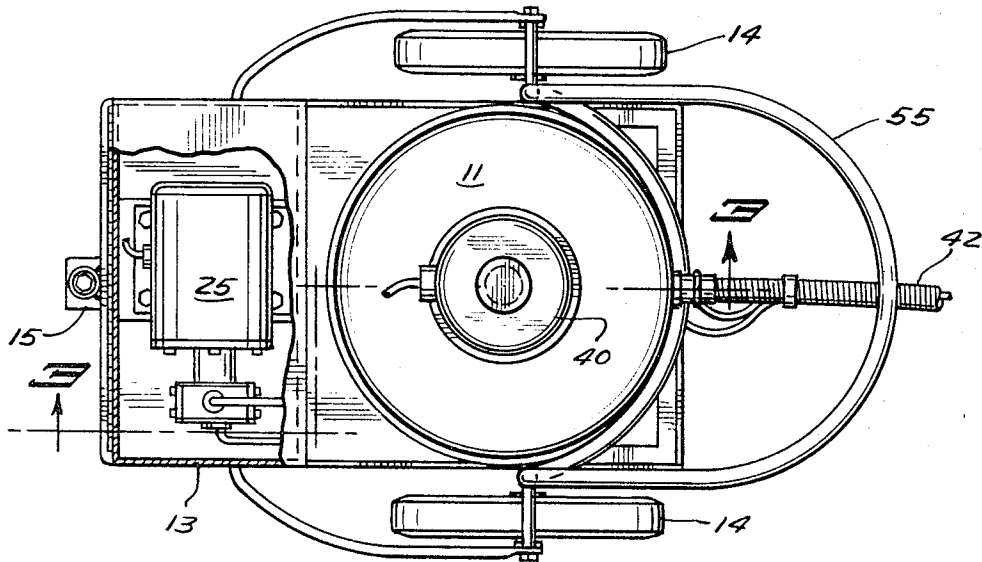
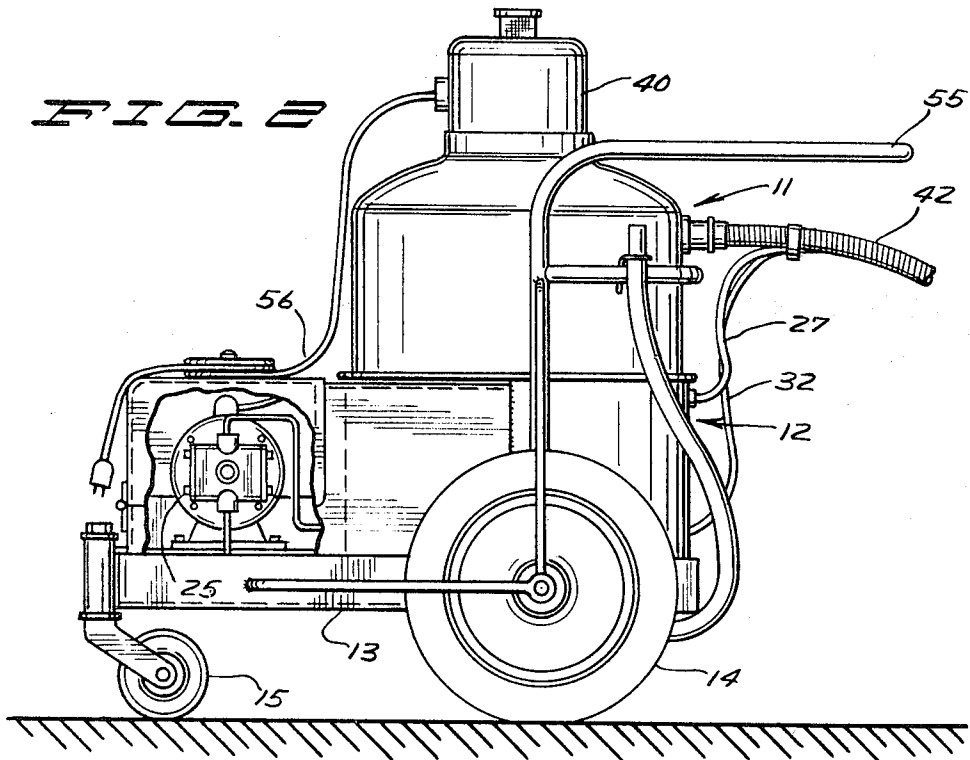


FIG. 2



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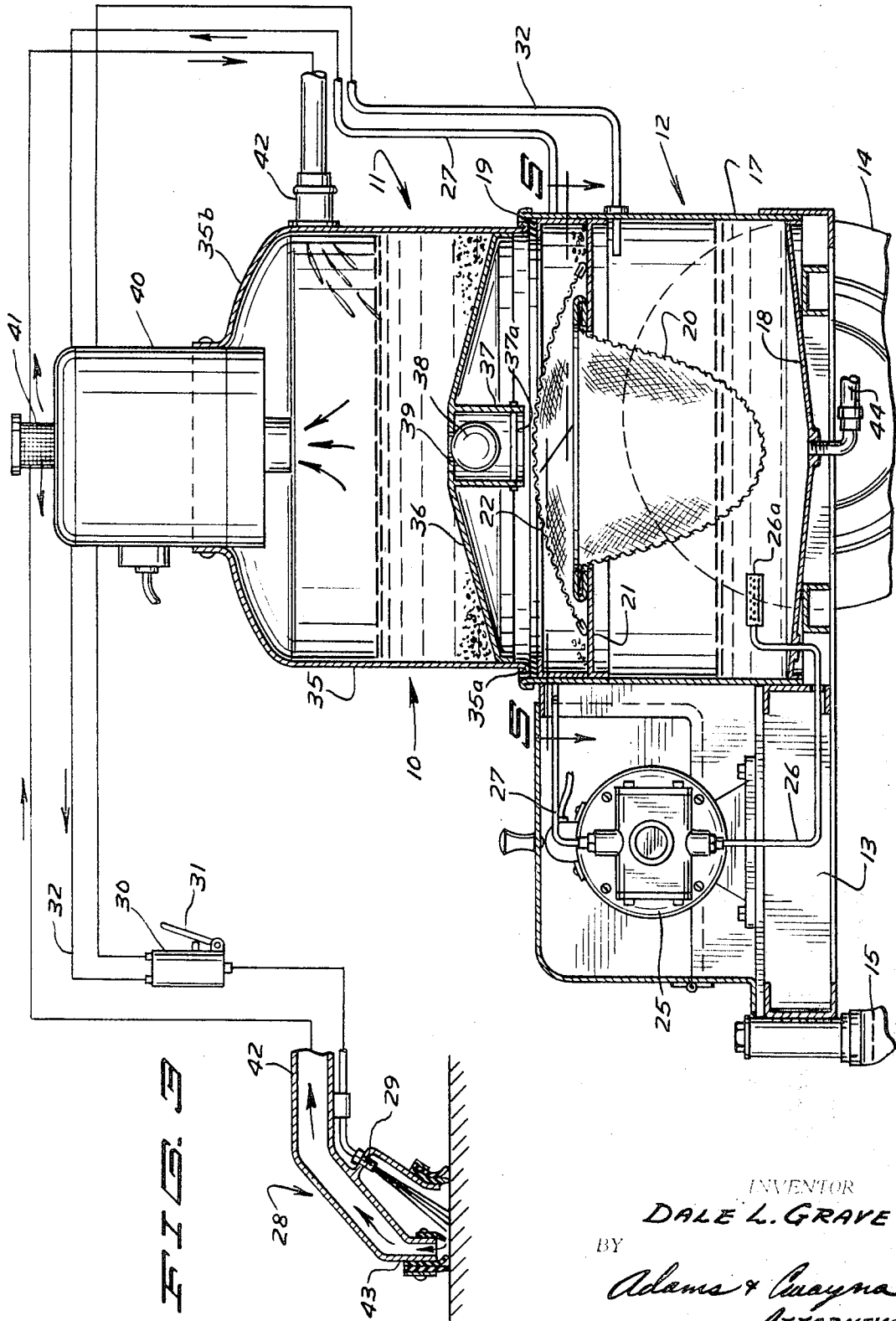


FIG. 2

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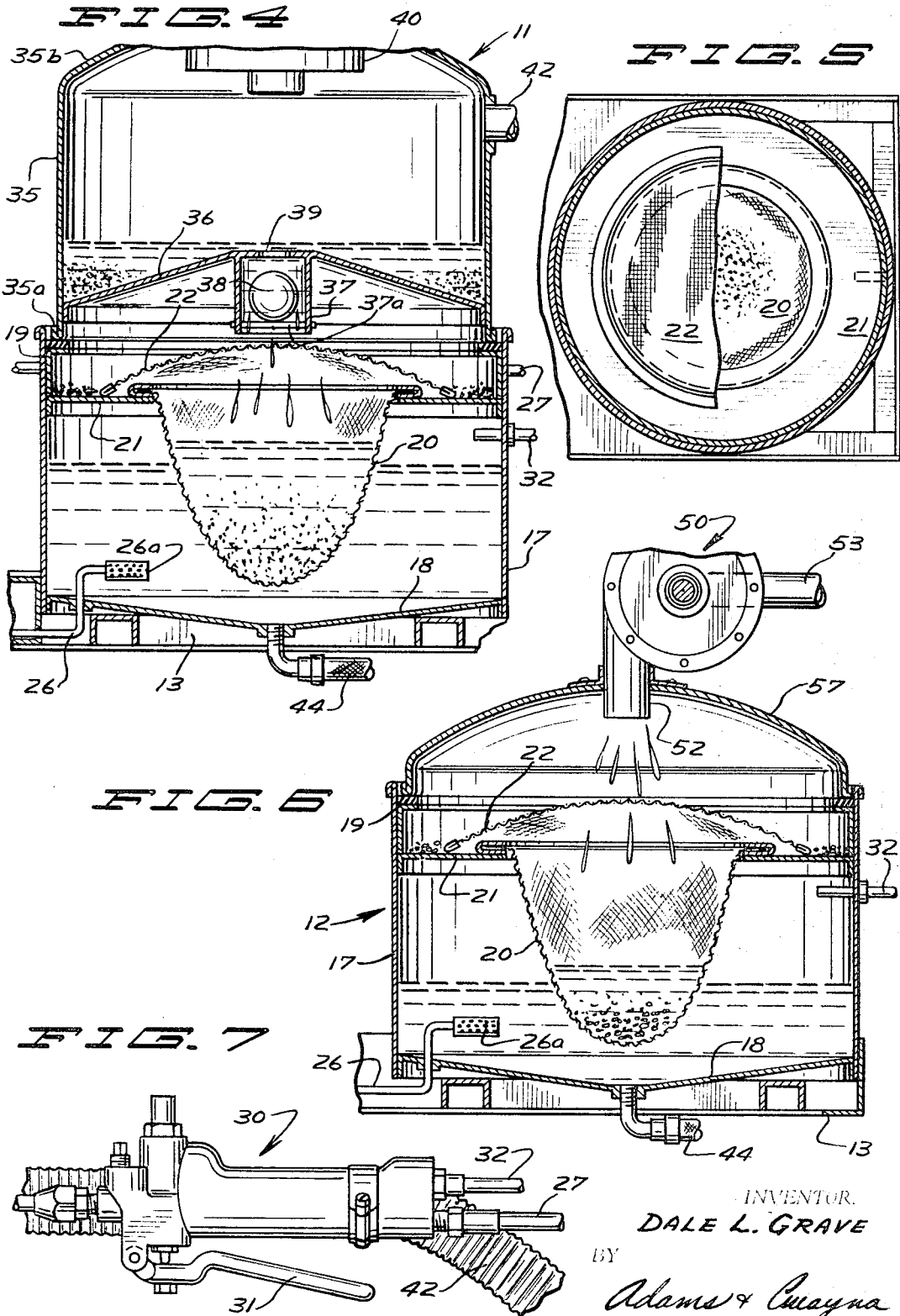
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CLEANING DEVICE

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2 Claims

Int. Cl. A471 5/32, 7/00, 9/20

ABSTRACT OF THE DISCLOSURE

This invention relates to cleaning equipment and particularly to a cleaning device utilizing both high pressure water as the cleaning element and a vacuum pick up for picking up the water sprayed onto the surface to be cleaned and the accompanying dirt. The unit includes a reservoir system for providing clean useable water and a vacuum return system which includes a used water reservoir for storing the water picked up by the vacuum, separating the majority of dirt therefrom with means for controlling the return of the water from the vacuum delivery reservoir to the water reservoir. The means for returning the water from the vacuum delivery portion to the water reservoir portion includes a free floating valve member.

In the past various cleaning devices particularly devoted to commercial cleaning fields have been provided which include fluid distribution means and a vacuum means for picking up fluid and loosened material from surfaces after the surface has been scrubbed by brushes or other material loosening devices. The device provided herein includes means for high pressure fluid distribution and a vacuum pickup device closely associated therewith for receiving the fluid delivered to the surface to be cleaned therein and returning the same to the unit for recirculation of the fluid.

As provided herein by applicant the device incorporates a means for delivering a high pressure quantity of fluid to a surface to be cleaned and a recirculation system for this fluid by providing a vacuum pickup device closely associated with a delivery head portion of the unit. In comparison to now available units the high pressure fluid delivery serves as the cleaning and scrubbing element and eliminates the normal brush or other scrubbing devices. Rather the high pressure fluid serves to peel and actually chisel the dirt and similar debris from the floor without any auxiliary scrubbing devices.

The device provided by applicant includes a unique vacuum pickup unit wherein recirculation of the fluid utilized in the unit is achieved through a device which incorporates a means for transferring water or cleansing fluid from a first section of the cleansing unit to a pumping section of the cleansing unit with only a minimal time delay therein to complete the transfer of fluid from one section of the unit to the other. In completing this transfer of fluid the fluid passes through a plurality of filter units arranged in entrapping relation to particles contained within the fluid such that the recirculated fluid will be in a proper reuseable condition.

As well known in the art a vacuum water separation is usually accomplished only through a very complicated valving or porting mechanism and the device included herein by applicant includes a simple means for providing fluid and air separation under vacuum and substantially instantaneous fluid recirculation and filtering after such separation occurs.

It is therefore an object of applicant's invention to provide a cleansing device which is designed to deliver a high pressure water or fluid cleansing agent and to recover this agent through the use of a vacuum system.

It is a further object of applicant's device to provide a cleansing device providing a vacuum pickup system for a cleansing fluid and to provide means for recirculating and separating the fluid recovered thereby.

It is a further object of applicant's invention to provide a cleansing device incorporating a source of high pressure fluid which fluid is retrieved through a vacuum pickup device and which provides immediate separation for the fluid utilized in the device to permit a constant flow of high pressure fluid and thus provide a constant operation unit.

It is a further object of applicant's invention to provide a cleansing device incorporating a recirculating high pressure fluid system which permits selection of either a vacuum head, a fluid delivery system or a combined vacuum fluid delivery system which will eliminate the usual scrubbing brushes usually provided with such units.

It is a further object of applicant's invention to provide a completely portable cleansing device for cleaning surfaces having a high pressure dirt and debris loosening section actuated through the delivery of high pressure fluid to the surface and a vacuum head pickup in close relation thereto for recovering the fluid delivered thereto and the dirt loosened thereby.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a top plan view of a cleaning unit embodying the concepts of applicant's invention with certain portions thereof broken for purposes of illustration;

FIG. 2 is a side elevation of the unit illustrated in FIG. 1 with portions thereof broken away for purposes of illustration;

FIG. 3 is a vertical section taken substantially along line 3—3 of FIG. 1;

FIG. 4 is a view similar to that illustrated in FIG. 3 showing operative portions of the unit in a second position;

FIG. 5 is a horizontal section taken substantially along line 5—5 of FIG. 3;

FIG. 6 is a vertical section taken through a modified version of the unit; and

FIG. 7 is a view of a typical control valve for the unit.

In accordance with the accompanying drawings the cleaning unit generally designated 10 in a preferred form includes an upper vacuum and collecting tank 11 and a lower fluid reservoir tank 12 mounted on a frame 13 which frame member is mounted on a plurality of wheel members 14—15 to aid in transporting the unit 10.

Lower reservoir tank 12 includes a generally cylindrical upstanding side member 17, a downwardly arranged tapered bottom portion 18 and an upper, open center support member 19 on the upper end thereof for supporting the vacuum or collecting tank 11 thereon. A first strainer member 20 is provided in bag like form in a first support flange 21 arranged intermediate the ends of cylindrical side portion 17 and in the form shown the strainer 20 provides a substantially flexible unit for entrapping particles of dirt as they are carried therethrough by fluid passing downwardly therethrough. A second substantially less flexible filter member 22 is provided in overlying upwardly convex relation to the first strainer member 20 and again is supported on the inwardly arranged flange 21 on the side 17 of the tank 12.

A high pressure pump mechanism 25 is mounted on frame 13 and draws water or other fluid solutions through conduit 26 from the reservoir tank 12. A filter mechanism 26a may be provided on the receiving end of conduit 26 as a further filter device. An outlet conduit 27 receives the

fluid from high pressure pump 25 and delivers the same to a cleansing head mechanism 28.

The cleansing head mechanism 28 is provided with a high pressure nozzle system 29 for delivering fluid to the surface to be cleaned such that the fluid is delivered with a velocity and pressure to substantially remove material on the upper surface thereof. With this particular high pressure method utilized it is not necessary that a scrubbing brush or the like be provided with the unit as the high pressure fluid is sufficient to break up a layer of dirt or similar material on the surface such that the same can easily be removed therefrom.

In order to permit the unit to be selectively operated a valve mechanism 30 is provided with control means 31 thereon for selecting either a passage directing fluid to the nozzles 29 or selecting a bypass conduit 32 to return the undelivered fluid back into the reservoir tank 12. This of course is necessary to provide a complete circulatory system for water that has not been used and prevent the pressure pump from working against a dead end circuit.

Collector tank 11 in the form shown consists of a generally cylindrical closed unit having an upstanding side 35 cover plate 35b and an upwardly sloping bottom closure plate 36 arranged therewithin. The bottom most edge 35a of side 35 is of slightly smaller diameter than the fluid reservoir diameter such that this end 35a may rest upon and abut with the uppermost flange 19 of the reservoir 12. Bottom plate member 36 in the form shown is provided with a downwardly extending valve capturing cage 37 with a valve element such as a light weight spherical ball member 38 arranged therein. An aperture 39 is provided in central alignment with the cage 37 such that the ball valve member 38 is free to be pulled upwardly into sealing engagement with aperture 39 or is free to fall downwardly within cage 37 and be carried on lower cage element 37a while permitting fluid to flow therepast into water reservoir tank 12. The purpose of the tapered bottom 36 of tank 11 is to provide a further particle entrapping arrangement about the lowermost edge thereof.

In the form shown a high vacuum pump 40 is sealingly mounted in the uppermost surface 35b of the tank 11 and is arranged to draw air from tank 11 and exhaust the same through an outlet to atmosphere 41 exteriorly of tank 11. These vacuum pumps as known are of extremely high capacity and must be capable of drawing a sufficiently large vacuum to effectively lift articles and material from the surface to be cleaned. A vacuum inlet 42 is provided on tank 11 at the uppermost end thereof such that upon actuation of vacuum pump 40 air will normally be drawn from the tank 11 closing valve 38 and drawing air inwardly through conduit 42 which conduit extends to the high pressure cleaning head 28 and has its inlet 43 in close relation to the area at which the spray from high pressure nozzle 29 is directed.

In operation of this particular form of the invention two specific instances of operation are illustrated in FIGS. 3 and 4. FIG. 3 illustrates the unit in operative condition during which time the cleaning function is accomplished, and FIG. 4 illustrates an inoperative condition at which time cleansing solution is being drained from the upper vacuum collecting tank 11 into the lower reservoir tank 12. At the onset of operation all of the cleansing solution is arranged within tank 12 with the ball valve member 38 being in the position illustrated in FIG. 4 supported solely by the lower capturing cage elements 37a. Upon actuation and energization of vacuum pump 40 a sufficient vacuum is provided to lift the ball member 38 upwardly into sealing position with passage 39 in bottom plate 36 of tank 11 whereby the vacuum will now draw air in through conduit 42 from the high pressure cleaning head 28. It is now possible to actuate the pump member 25 and upon such actuation fluid will be delivered from tank reservoir 12 through the pump 25 and into the high pressure spray nozzle 29 where it will be discharged at the

surface to be cleaned. With the high pressure utilized dirt and other foreign material will be substantially separated from the surface to be cleaned and the close association of the high vacuum inlet 43 will draw not only the dirt but also all of the cleansing solution upwardly therein to return the same to collector tank 11. The vacuum generated by the vacuum pump 40 is sufficient to hold the ball member 38 in proper sealing relation against the aperture 39 such that fluid is collected in tank 11 and will not be returned to the reservoir 12 until the entire amount of fluid has been drained from reservoir 12. This sealing even under what appears to be a positive water head is due solely to the amount of vacuum developed by the pump 40. With the types of vacuum pumps utilized it has been found to be impossible to hold fluid in a container, apply a vacuum thereto and continue to pump the water therefrom while the vacuum is in operation. The vacuum pump will not permit the water to be drawn from the tank but rather will hold the same within the tank.

With the selector valve 30 utilized it is possible to provide either a vacuuming operation, a fluid wetting operation or to combine a cleansing and vacuuming operation. By actuation of selector valve 30 fluid may be directed into the bypass conduit 32 to be returned into the reservoir tank 12.

To clean the various filters 20 and 22 and other portions of the unit it is only necessary to lift the vacuum chamber 11 from the supporting ledge 19 which completely exposes the two filter members 20 and 22. A drain 44 may be provided on the bottom most surface 18 of the reservoir tank 12 to permit complete draining thereof.

When all of the water or cleansing solution has been drained from the reservoir 12 the vacuum pump 40 is deenergized and the ball valve member 38 will return to the position illustrated in FIG. 4, at which time the cleansing fluid is free to drain downwardly from vacuum tank 11 into the water reservoir 12 passing through the dual filter system as it travels downwardly into tank 12. With this particular situation it should be obvious that certain delays are required in operation of the unit as this is not a complete cycling system. Rather fluid must be returned to the reservoir 12 before a new cleansing operation may be continued.

A modified form of the invention is illustrated in FIG. 6 wherein a pump known as a centrifugal or vane pump 50 is substituted for the high vacuum pump 40. In this form the collector tank 11 is eliminated and replaced by a simple bonnet pump supporting member 51 which again is supported by the upper flange member 19 of reservoir 12. With this particular form the fluid is directed through the high pressure nozzles 29 loosening the dirt from a surface and is drawn upwardly from the surface and discharged directly downwardly by pump 50 through an outlet 52 extending through the bonnet closure portion 51. The inlet for pump 50 is designated 53 and would communicate with a vacuum conduit portion 42 similar to that illustrated in the first preferred form.

It is well known that a vane pump or centrifugal pump does not ordinarily develop a substantial suction to lift fluids but by providing a multiple vane pump situation and running this pump at sufficiently high speeds a certain vacuum is developed within the unit such that a sufficient amount of air will be drawn upwardly through conduit 53 which air will carry all of the fluid cleansing solution.

Reservoir system 12 in this form is identical to that illustrated in the first preferred form and includes the first bag type filter 20 and the second less flexible straining member 22 arranged in receiving relation to the outlet 52 of the pump 50.

This modified version of the unit permits complete continued operation in that it is not necessary to recycle the system to provide a continuous flow of fluid to the

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reservoir 12. Rather the fluid is continually picked up and returned directly to the reservoir 12.

It should be obvious that with either of the units the high pressure supply combination with the vacuum unit is a definite and unique improvement over present day cleaners which require the utilization of scrubbing features such as brushes and the like to effectively remove soil or similar material from the surface to be cleaned. This high pressure system not only effectively chisels the soil from the floor but provides a prying force and positive collecting force such that only a simple one pass operation to properly clean a surface is required.

As illustrated in FIGS. 1 and 2 a commercial installation of the unit would of necessity require certain handle features 55 and the like to facilitate moving the unit over the cleaning surface. Accordingly when the unit is moved over such surfaces the power to both the pump 25 and the vacuum system utilized will require a power carrying conduit such as illustrated at 56 for proper electrical energization thereof.

It should be obvious that applicant has provided a new and unique surface cleaning apparatus which utilizes not only a high pressure force for delivering a cleaning solution to a surface to be cleaned but also incorporates a high pressure vacuum system for returning the used fluid cleaning solution and the removed dirt to a collecting compartment.

It will, of course, be understood that various changes may be made in the form, details, arrangements and proportion of parts without departing from the scope of my invention, which generally stated consists in the matter set forth in the appended claims.

I claim:

1. A cleaning unit including:

- (a) a fluid reservoir;
- (b) a cleaning head adapted for movement over a surface to be cleaned;
- (c) a high pressure pump receiving fluid from said reservoir and delivering the same to said cleaning head;
- (d) a collector tank arranged in generally overlying relation to said reservoir;

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(e) passage means permitting fluid flow from said collector tank to said reservoir;

(f) a source of low pressure communicating with said cleaning head collecting fluid and material from the surface to be cleaned and communicating with said collector tank for the delivery of fluid and material thereto;

(g) a pressure responsive valving member arranged to control flow through said passage;

(h) said source of low pressure communicating with said tank and said valving member closing said valve member upon actuation of said source of low pressure normally preventing flow therethrough when said low pressure is operative; and

(i) said passage means including:

- (1) a seat formed in said passage means;
- (2) valve retaining means adjacent said seat; and
- (3) said valving member including a free floating valve element of a weight to permit the same to be responsive to low pressure delivered to the collector tank for urging the same into sealing position.

2. The structure set forth in claim 1 and said collector tank having a bottom with portions thereof lying below the entrance to said passage means whereby a portion of said tank will function as a first settling collector for material carried by the fluid.

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U.S. Cl. X.R.

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