May 16, 1939. W. C. GROENIGER 2,158,362

DEFECATOR

Filed July 8, 1936 2 Sheets-Sheet 1

Fig. 1.

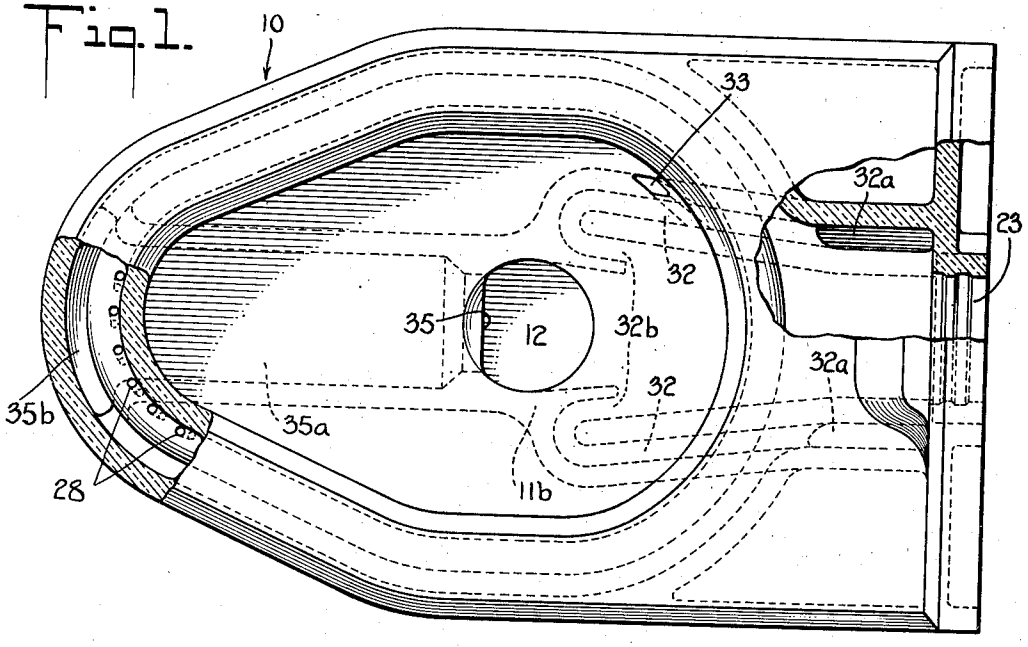

Fig. 2.

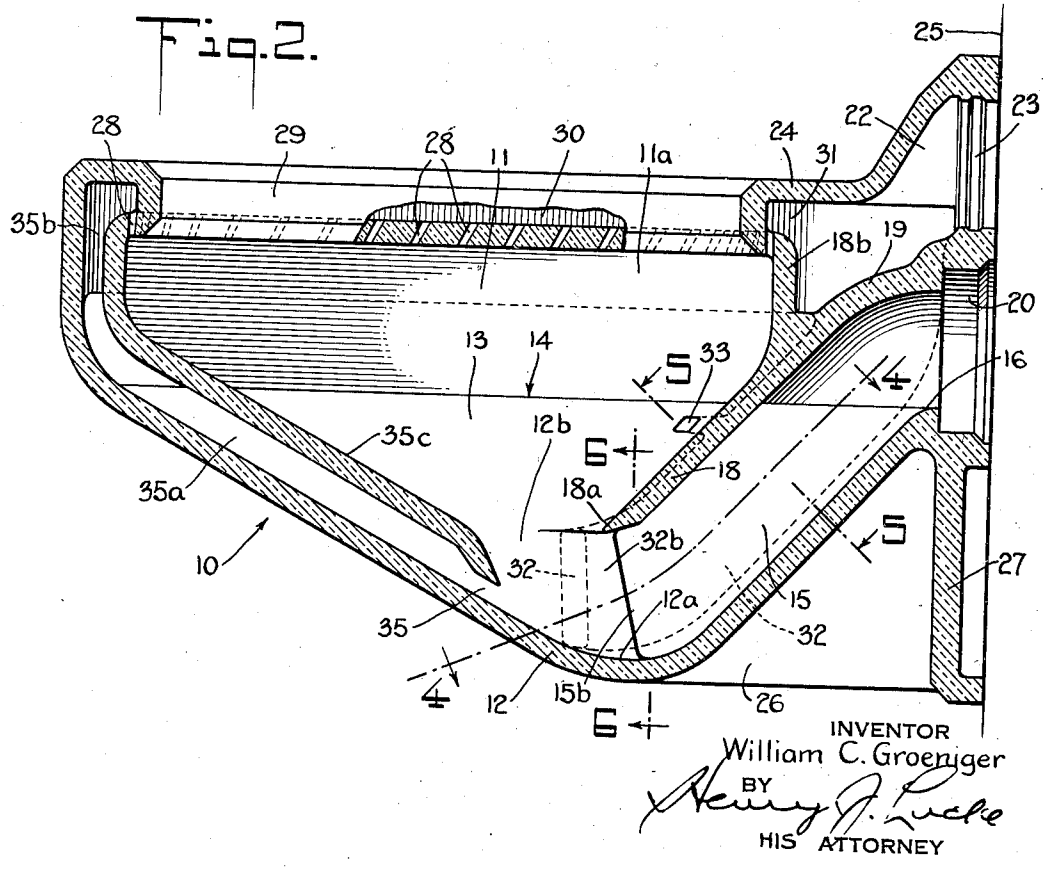

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Fig. 3.

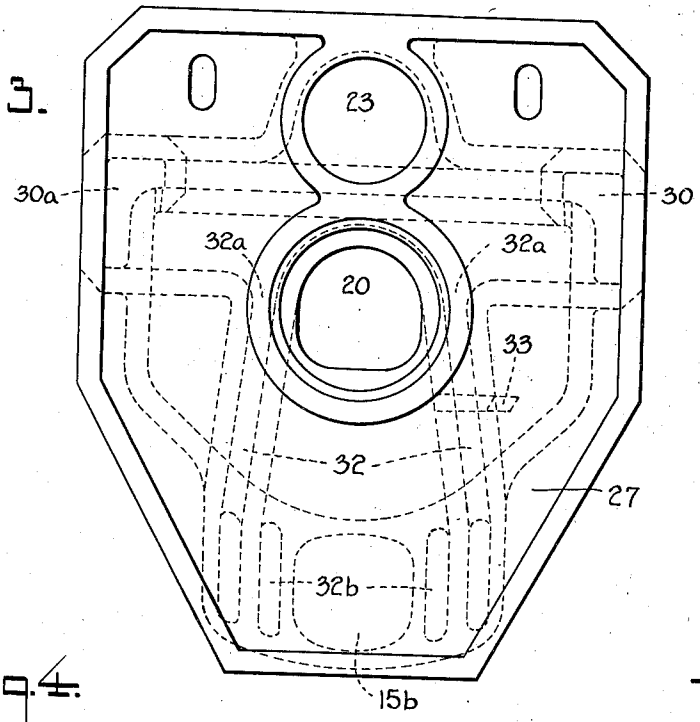


Fig. 4.

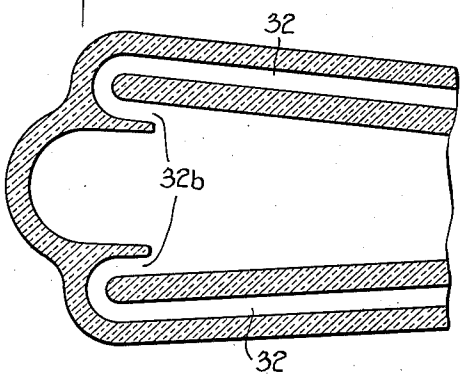


Fig. 5.

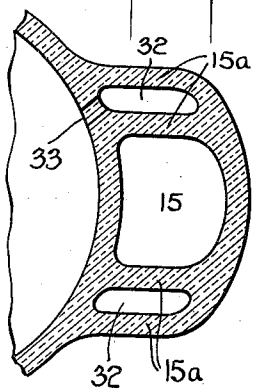
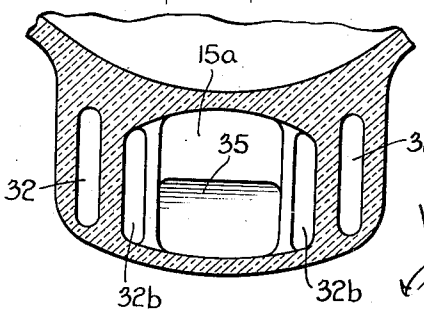


Fig. 6.



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Patented May 16, 1939 2,158,362

UNITED STATES PATENT OFFICE

2,158,362

DEFECATOR

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Application July 8, 1936, Serial No. 89,578

1 Claim. (Cl. 4—69)

The present invention relates to defecators.

In general, defecators of the instant type accomplish the removal of therein deposited wastes, by means of a flushing cycle comprising a plurality of actuating forces functioning conjointly in timed sequence of origin. The liquid contents, i. e., after-fill, of the well of the bowl of the defecator, together with the wastes deposited therein, are subjected to the action of the aforesaid forces combined in a manner affording positive, thorough flushing, silent compared to heretofore existing types.

A particular feature of my invention resides in the actuation of the contents of the bowl within its up-flow leg portion, i. e., up-flow discharge passage, and adjacent thereto by jet flow forces applied upwardly within the upflow leg portion and within the well of the bowl toward and upwardly of the up-flow leg portion, either simultaneously or initially in timed sequence and subsequently conjointly.

Vortical motion imparted to the after-fill at the beginning of the flushing cycle through the medium of a vortex-jet orifice located beneath the surface thereof, may be enhanced in its effectiveness by suitably directed rim jets operative from a rim channel encircling the upper portion of the bowl. Auxiliary jets, directed within and upwardly of the trapway of the bowl i. e. the up-flow of the discharge syphon, the syphon per se being formed by the stated up-flow leg coordinatingly connected with a down-flow leg represented by a suitable attached evacuator, initiate upward momentum of the after-fill in the up-flow leg. A main jet means located adjacent the lowest portion of the well of the bowl and directed preferably rectilinearly toward the up-flow leg, projects a momentum jet transverse of, and lowerly of the well of the bowl to create an undertow functioning conjointly with the vortical current in the well proper of the bowl and the upward current produced in the upflow leg by the auxiliary jets, to effect positive discharge of waste matter from the defecator.

In the bowl, the supply channel leading to the momentum jet opening, and the momentum jet opening per se, are preferably disposed in rectilinear axial alignment, longitudinally, with the lower opening of the up-flow leg and with the up-flow leg per se, the momentum jet opening and the lower opening of the up-flow leg being separated by the well of the bowl. The momentum jet supply channel advantageously slopes downwardly from the rim-channel at the front of the bowl, and the up-flow leg advantageously slopes upwardly at the rear of the bowl. That wall portion of the bowl which forms the bottom of the momentum jet supply channel is preferably rectilinear below the entrance portion of the channel with continuity of smooth surface and preferably continues in rectilinear formation with continuity of smooth surface beyond the momentum jet opening to a location within the well of the bowl, thus forming a portion of the bottom wall of the well and positioning the momentum jet opening on a rectilinear slope in direct line with the bottom of the well. The stated wall of the bowl, thereupon curves gradually forwardly, first downwardly to provide the remainder of the bottom wall of the well, and to form a slight depression adjacent the lower opening of the up-flow leg, and then upwardly, continuing in preferably rectilinear formation with continuity of smoothness to provide the bottom wall of the up-flow leg. The momentum jet opening is preferably flat having a width which approximates the width of the well of the bowl, and, also, the width of the lower opening of the up-flow leg. Thus, flushing liquid flowing into the momentum jet channel from the rim channel passes smoothly down to emerge from the momentum jet opening in a substantially horizontally flat smooth-flowing stream of a width approximating the width of the after-fill in the lower portion of the well of the bowl. Such flat, smooth-flowing stream hugs the bottom of the well of the bowl to form an under-tow.

The auxiliary jet openings are preferably disposed just within the lower opening of the up-flow leg at the opposite lateral walls thereof, being operative to direct flow of flushing liquid upwardly substantially parallel with the lateral walls of the up-flow leg. The auxiliary jet openings are advantageously vertically flat having a height approximately equal to the height of the stated lateral walls of the up-flow leg.

The vortex jet orifice is preferably placed below the normal level of the after-fill in the bowl and above the mouth of the well portion thereof. The interior surfaces of the walls of the bowl above the mouth of the well portion diverge outwardly from the well portion in substantially smooth rectilinear formation to locations above the normal level of the contents of the bowl, thus facilitating substantially undisturbed vortical motion of the contents of the bowl.

During the flushing cycle, the afore-described smooth-flowing under-tow functions conjointly with the undisturbed vortical currents, engendered in the after-fill by the vortex jet, and with the upward current in the up-flow leg, produced by the auxiliary jets, to accomplish a peculiarly effective flushing of wastes from the bowl with the expenditure of a minimum quantity of flushing liquid and with a minimum of sound.

The present application is related to the subject matter of my two U. S. Patents Nos. 2,066,881 and 2,066,882, entitled Defecator, issued January 5th, 1937.

In the drawings which illustrate only one embodiment of the present invention,

Fig. 1 is a top plan view of the defecator, hidden channels being revealed by dotted lines. Certain portions of the defecator are broken away to disclose internal structure.

Fig. 2 represents a vertical section taken centrally lengthwise through the embodiment of Fig. 1.

Fig. 3 is a rear elevation of the defecator, structure hidden in the background being revealed by dotted lines.

Fig. 4 is a fragmentary sectional view taken on the line 4—4, Fig. 2.

Fig. 5 is a fragmentary sectional view taken on the line 5—5, Fig. 2.

Fig. 6 is a fragmentary sectional view taken on the line 6—6, Fig. 2.

Referring to the drawings, at 10 is indicated a suitable type of defecator bowl applicable in carrying out my invention: however, my invention is not restricted to special contour of the walls of the bowl proper.

The bowl 10 is shown comprising generically an upper portion 11 and a lower or well portion 12. The normal level of the mass of water 13 or other matter-receiving and effluent fluid known as the after-fill, is indicated at 14.

Suitable flush means are incorporated in the bowl to afford the initial volume of water 13, or other effluent serving as the after-fill for receiving any solid and/or semisolid and/or fluid matter, and further to afford flushing of the after-fill and the therein deposited wastes from the defecator, and thereafter the further supply of after-fill to the defecator bowl. The means are embodied in component and appurtenant parts of the bowl to be wholly operative, at minimum pressure and with a minimum quantity of the effluent, conjointly with engendered currents of air.

Such flush means function in connection with a trap-way or up-flow leg, indicated at 15, and a dam or weir 16, effective to seal a portion of the mass of the effluent in the trapway 15, to insure silence during the flushing cycle.

Such up-flow leg 15 is afforded by the inwardly disposed ledge 18 extending downwardly toward the well portion 12 of the bowl, its terminal portion 18a being disposed in predetermined relation vertically and horizontally with respect to the central area of the well portion 12, as appears more fully hereinafter. The upper rearward portion of the up-leg 15 is defined by the septum 19 terminating in the wall formation of the discharge opening 20, for the reception and securement therein of a suitable evacuator (not shown), which forms the down-leg of the syphon. Any suitable type of connection between the receiving end of such evacuator and the wall formation of the discharge opening 20 of the up-flow leg 15, may be employed.

The stated ledge 18 extends upwardly as indicated at 18b to serve as a septum to define one side of the main water channel 22, the inflow port 23 of which may be adapted for connection with any suitable means for supply of water or other effluent, such as a gravity water tank or a nipple provided with a flush valve for supplying water from a domestic water line.

Such main water channel 22 is defined at its lower portion by the stated septum 19. The upper or top wall 24 of the main water channel may be afforded by a rearward horizontal ledge.

The bowl proper may be supported in the indicated substantially horizontal position in any suitable manner. Advantageously, the bowl is supported by attachment to a wall, indicated by the line 25, the material of the bowl proper being extended for such form of support, viz., by a rearward vertical web 26 extending to a vertical back plate 27, which back plate 27 is disposed substantially parallel to the face of the wall 25 and substantially normal to the web 26.

The upper bowl-portion 11 is preferably of general conical formation, as shown; however, broadly my invention is not limited to the illustrated form.

Preferably, the uppermost portion 11a, inclusive of the web 18b, is inwardly concave, receding from the vertical plane with respect to the effective area of discharge of the rim openings 28, provided for in the rim formation 29, the effectiveness of such relationship being set forth hereinafter. The rim formation 29 includes the rim channel 30 extending about the top of the bowl, and having an intake port 31 communicating with the main water channel 22. The rim openings 28, providing for a plurality of rim jets therefrom, are included in the flush means aforementioned.

An essential feature of each rim opening 28, in its preferred formation, is its discharge outwardly against the interior faces of the walls of the bowl, whereby any matter possibly deposited thereon, particularly the back wall 18b of the upper wall portion 11a of the bowl, is subjected to a quasi-chiselling action by the jets of water discharged through the rim openings. Such preferred form of rim jet discharge may be employed for the forwardly disposed rim openings 28, and/or at the sides of the bowl.

The rim openings, particularly those of the sets disposed about the sides of the bowl, further, are directed to cooperate with a vortex-jet, also included in the aforementioned flush means and later described, to enhance the vortical movement of the flowable mass 13, initiated by the stated vortex-jet.

To initiate movement of the flowable mass 13 upwardly and outwardly of the up-flow leg, and as a part of the aforementioned flush means, two oppositely disposed channels 32, respectively, having intakes 32a communicating with the main water channel 22, and out-flow ports 32b, the latter each communicating with, and being adapted to direct a jet i. e. an auxiliary jet upwardly of the upflow trap leg 15, are provided. Advantageously, such channels 32 are formed in the septum 19 and side walls of the up-flow leg 15, thus locating the out-flow ports 32b, and therewith the dynamically sustained auxiliary jets upwardly directed relative to the flowable mass 13, which lies dormant within the up-flow leg 15. The outflow ports, i. e., auxiliary jet openings 32b, are advantageously disposed at opposite lateral walls 15a, 15a of the up-flow leg 15, and are each of substantially flat formation, as illustrated, having a height approximately equal to the height of its respective lateral wall of the up-flow leg, whereby the auxiliary jets of flushing liquid which issue therefrom will flow substantially parallel with the respective lateral walls.

Such channels 32 serve also for the flow of the effluent to and through the vortex-jet 33, which may terminate in a nozzle formation, the same being directed, as appears in Figs. 1 and 2, to maintain a vortical movement of the mass of the effluent 13 within the bowl, say, in a counter-clockwise direction. The vortex jet 33 is advantageously disposed between the normal level of

the after-fill and the mouth of the well of the bowl.

Preferably, as shown in the drawings, each outflow port 32b extends at opposing side walls 15a, 15a, see Fig. 5, of the upflow leg 15 and opens out over an elongated area, its mean direction of opening being substantially in alignment with the mean upward direction of the upflow leg 15.

A further structural feature of my present invention is the provision of a main jet opening 35 directed substantially centrally of the mean axis of the up-flow leg 15 and preferably in rectilinear alignment therewith. Preferably, the volume of the jet discharged through the main jet opening 35 is relatively large, to thus impart sufficient momentum to the jet to insure the desired result of evacuation of the contents of the bowl upwardly through the up-flow leg 15 and thence through the discharge opening 20 into the down siphon leg or other suitable passageway to the soil pipe or equivalent.

Preferably, such main jet and its required flushing medium is supplied by the provision of the channel 35a extending internally of the bowl material and communicating at its entrance 35b with the rim channel 30. Thus, the flushing fluid is supplied from the main water channel 22 through the two halves of the rim channel 30 jointly, to the entrance 35b of the main jet channel 35a.

Such main jet channel 35a, see Figs. 1 and 2, is formed, as by proper coring, within the material of the bowl, the exposed face of the upper wall 35c of the channel forming a part of the lowerly disposed generally conical portion 11b of the interior of the bowl proper. The pitch of the forward portion, including the exposed face of the wall 35c is less than the pitch of the rearward wall portion 18, and the whole of the generally conical lower portion 11b is interrupted solely by the opening 12b of the well. The inner surfaces of the walls making up the generally conical configuration of the bowl diverge outwardly from the mouth of the well in substantially smooth rectilinear formation to locations above the normal level of the contents of the bowl.

A primary functional feature of the discharge projected through the main jet 35 resides in the propulsion of the body 13 of the effluent and its contents in substantially rectilinear direction and substantially uniformly distributed relative to the entrance 15b of the up-flow leg 15, as will appear more fully hereinafter.

Preferably, as appears in the drawings, the well formation 12 at the bottom of the bowl proper has its lowermost portion 12a disposed rearwardly of the center of the well opening 12b and in the direction toward the up-flow leg 15. By such provision of means, solid and semi-solid matter received within the after-fill constituting the mass 13 of the effluent during the period of quiescence of the effluent 13 subside toward the depressed portion 12a of the well, thus being located under optimum conditions for direct entry within the entrance opening 15a and to a definite extent within the passageway of the up-flow leg 15 in advance of the discharge of the main discharge jet through the jet opening 35.

The well portion 12 preferably has its entry opening 12b of an effective cross-sectional area—measured by a horizontal plane passing through the tip 18a of the wall 18—less than the cross-sectional area of the mouth and/or posterior portions of the up-flow leg 15, to thereby serve as restriction means for preventing objects from entering the trapway which would not pass through the up-flow leg 15 and/or the evacuator connected to the discharge opening 20 of the up-flow leg 15 and forming therewith the siphonic passageway for the discharge of the contents of the bowl during the period of flushing.

Preferably, the up-flow leg is oval in cross-section and rises at its bottom face from the entrance opening 15a to the dam or weir 16 without change in size and without change of its angle of inclination, thus reducing to a minimum friction in the movement of the effluent and its contents during the stage of flushing.

Pursuant to preferred forms of my invention, the vortex movement engendered by the discharge through the vortex jet 33 is carried out without substantial rise of the level 14 of the mass 13 of the effluent and contained matter. The preferred forms of my invention embody the vortex discharge jet disposed a substantial depth below the level 14 of the mass 13 of the effluent, such arrangement effecting two essential functions, namely to impart positive vortical movement to the mass 13 and to effect the discharge through the vortex jet 33 without noise. If desired, the jet opening may be directed downwardly relative to the level 14.

The rim channel 30, communicates directly with the main water channel 22 and discharges into the auxiliary jet channel 32 and into the main jet channel 35a, the rim channel 30, serving also to supply effluent to the respective jet openings 28. For the purpose of providing a relatively large mass of the effluent and maximum effective momentum of the effluent through the auxiliary jets 32b and through the main jet 35, including the reduction of friction to a minimum, and the substantial elimination of noise, the rim channel 30, is formed of relatively great depth, as is apparent from Fig. 3, and also from Fig. 2, and has its upper interior 30a, large relative to its lower interior 30b, the communication with the respective rim openings 28 being had by communication of their respective entrances with the relatively large upper interior 30a.

By such provision of means, upon initiation of the flushing operation, the effluent passes rapidly and in relatively large volume firstly through the lower interior portion 30b, displacing the air therein upwardly into the relatively large upper interior 30a gradually, causing the displaced air to pass through the respective rim openings, whereby the displacement of the air is effected, and the supply of the effluent to the rim openings takes place subsequent to the stage of effective operation of the auxiliary jet and the main discharge jet.

The operation of my invention will be largely understood from the foregoing. Suffice it to add that upon flushing the defecator the effluent flowing into the main water channel 22 passes directly downwardly into the channels 32 leading firstly to the vortex jet 33, and thereafter to the auxiliary jets 32b. At this stage the vortical movement of the mass 13 of the effluent and contained matter has been set in operation accompanied by a lowering of the central portion of the mass 13, and an upward momentum has been imparted to the liquid contents of the upflow leg 15. Upon further filling of the main water channel 22, the effluent passes into the respective rim channels 30, continuing downwardly through the main jet channel 35a, and thus through the main jet opening 35 to effect, by an

undertow action, the positive flow of the effluent and contained matter upwardly through the up-flow discharge passage 15, over the dam 16, and thus into the soil pipe or equivalent discharge means. Such lowering of the central portion of the mass, enhanced by the general conical contour of upwardly increasing radius of the inner face of the bowl, brings about an increase of the atmospheric pressure upon the mass, which increased pressure is effective downwardly upon the mass, and accordingly is effectual in propelling the mass upwardly of the upflow discharge leg 15.

The above kinetic forces, imparted in timed sequence of origin by the flushing effluent to the mass 13, is further accelerated by the forces engendered by the currents of air arising from the setting of the mass 13 into vortical movement and the stated up-flow movement of the mass through the up-flow leg 15.

Subsequent to the setting in operation of the stated vortical movement by the vortex jet 33 and the stated positive discharge through the up-flow leg 15 by the auxiliary jets 32b and the main jet 35, the further rise of the water in the main channel 22 supplies effluent to the respective rim openings, which as hereinabove referred to, combine with the vortex-jet 33 to maintain the mass within the bowl in vortical movement, as well as to scour the sides of the bowl.

Toward the stage of shutting off of the supply of the effluent to the main water channel 22, the completion of the discharge of the bowl will have taken place, following which air enters through the entrance of the up-flow leg 15, thus causing a breaking of the siphonic action and part return of the effluent in the up-flow leg, which, with the remainder of the supplied effluent flowing through the rim openings referred to above, and through the channels 32 and out of the vortex jet 33, provides for the after-fill of the effluent 13, preparatory for the next operation of the defecator.

The rim openings 28 are preferably of the general shape of an inverted L, extending at an angle, say 30°, to the vertical, inclined in correspondence to the direction of the vortical movement effected by the rim openings in combination with the vortex jet 33. The most preferred form of the discharge opening outlet of each rim opening is outwardly tapered, i. e. extending laterally of the axis of the opening to thereby more effectively chisel matter deposited upon the sides of the bowl. The most preferred form of the inlet of each rim opening 28 is inwardly tapering, thereby facilitating the entry of the air displaced upon flow of the effluent through the lowerly portion of the rim channel 30 in transit to the main jet channel 35a which function is enhanced by the outwardly divergent formation of the discharge opening of each rim opening.

Stated more succinctly, the principle of operation of embodiments of applicant's present invention, is believed to be aptly termed a "push-pull" principle. Thus, in the specific embodiments illustrated in the drawings, the supply of effluent through the jet opening 35 operates as a "push" jet and the supply of effluent through the jet or jets 32b operates as the "pull" jet.

The bowl and the stated component parts may be of vitreous material suitably molded and otherwise treated, or of cast metal or other proper material, enamelled or otherwise appropriately surfaced and/or suitably treated. The defecator illustrated in the drawings, and to scaled dimensions, has been designed for manufacture of porcelain, suitable provision being made for the proper coring of the channel parts, allowance of shrinkage of the material ensuing during the baking stage, etc. The stated preferred form of the rim openings is conveniently had by drilling through the uppermost wall of the rim 29 during an intermediate baking stage, the thus formed drill openings in the upper wall of the rim 29 being later plugged with the porcelain-forming material in the final status of the bowl.

A most preferred form of the bowl, based upon my observations of tests carried out with full size commercial embodiments and under regulation commercial conditions, is that shown in scale in the drawings; I have particular reference to the formation of the walls of the bowl proper, and note that the side walls of the uppermost part of the bowl indicated by 11b, have faces of general conical contour of gradually decreasing radius converging to and terminating at the well hole, the pitch of the respective decreasing radii of the conical portion toward the front of the bowl being less than corresponding radii at the rear of the bowl.

Further, the front of the well hole, indicated at 12c, slopes toward the bottom of the well hole in the direction toward the inlet 15b of the up-flow leg 15, and the back of the well hole, indicated at 12d, recedes toward the inlet 15b of the up-flow leg 15.

Whereas I have described my invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the spirit of the invention.

I claim:

A defecator comprising in combination, a bowl provided with a well adapted to confine an after-fill, and further provided with an up-flow discharge passage, said upflow discharge passage communicating at its lowest point with the bottom of the well of the bowl, jet openings directed upwardly within the said up-flow discharge passage at opposite lateral walls thereof, said jet openings being of substantially flat formation and having lengths approximately equal to the heights of the lateral walls of the said up-flow discharge passage and being operative to discharge flushing liquid in streams substantially parallel with the said lateral walls of the up-flow discharge passage, a substantially flat jet opening disposed oppositely from and in substantially rectilinear axial alignment with said up-flow discharge passage and communicating at its lowest point with the bottom of the well of the bowl, said jet opening having a width approximately equal to the width of the well of the bowl and being operative to discharge flushing liquid in a substantially horizontally flat stream across the said bottom of the well of the bowl toward and up the said up-flow discharge passage thereof, a vortex jet opening disposed within the bowl below the normal level of the after-fill and above the mouth of the well of the bowl, the inner surfaces of the walls of the bowl above the mouth of the well diverging outwardly in substantially smooth rectilinear formation to locations above the normal level of the contents of the bowl, and means for supplying flushing liquid concurrently to all of said jet openings.

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