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Halff et al.

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[54] APPARATUS FOR EMPTYING AND REFILLING LIQUID IN A RESERVOIR

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[52] **U.S. Cl.** **222/204,** 222/416, 4/47

[51] **Int. Cl.** **B67d 3/00**

[58] **Field of Search** 222/416, 204; 4/42, 44, 45, 4/46, 48, 47

[56] **References Cited**

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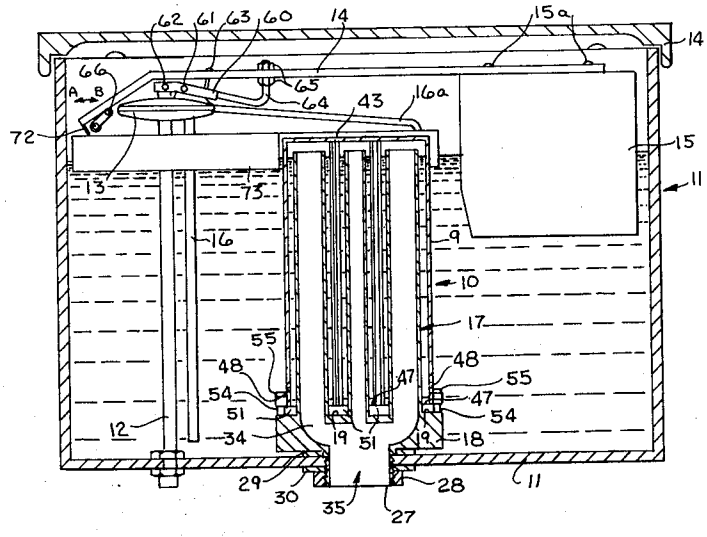
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Assistant Examiner—James M. Slattery
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[57] **ABSTRACT**

The apparatus has a tank for holding liquid and, a siphon discharge and a valve controlling the inflow of liquid by a float lever responsive to the level of the liquid. The siphon discharge has downflow discharge passages capped by a vertical casing with siphon upflow passages. The float lever is forced downwardly into the liquid by actuating the exterior level to start the siphon discharge and on refilling of the tank closes the inlet valve. Blocks of material are mounted at the upper level of the liquid to minimize the surface area of the liquid at the upper level.

11 Claims, 8 Drawing Figures



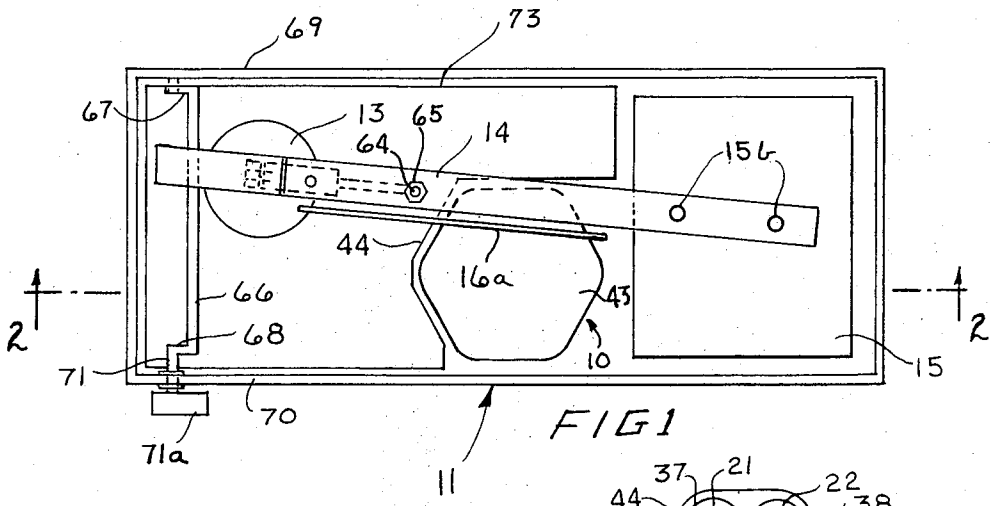


FIG 1

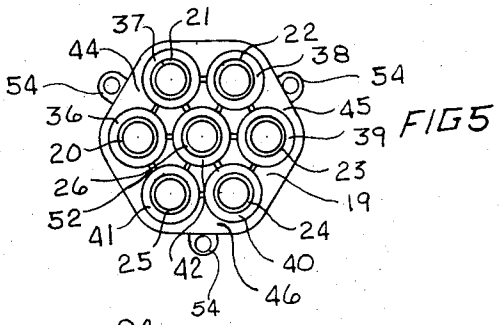


FIG 5

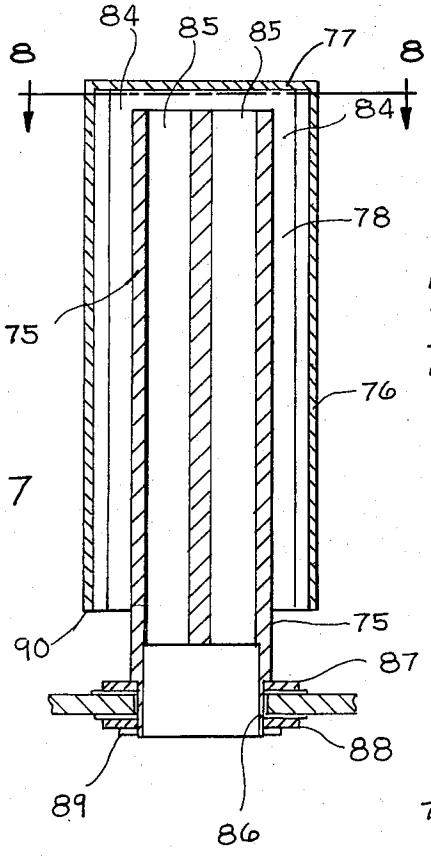


FIG 7

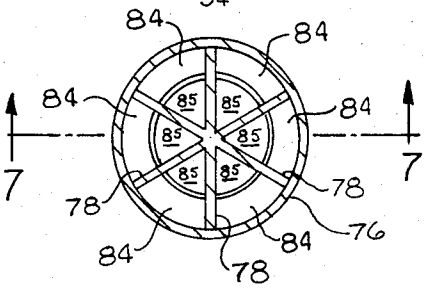


FIG 8

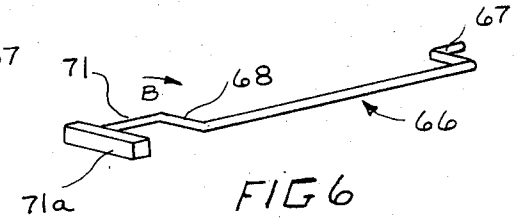


FIG 6

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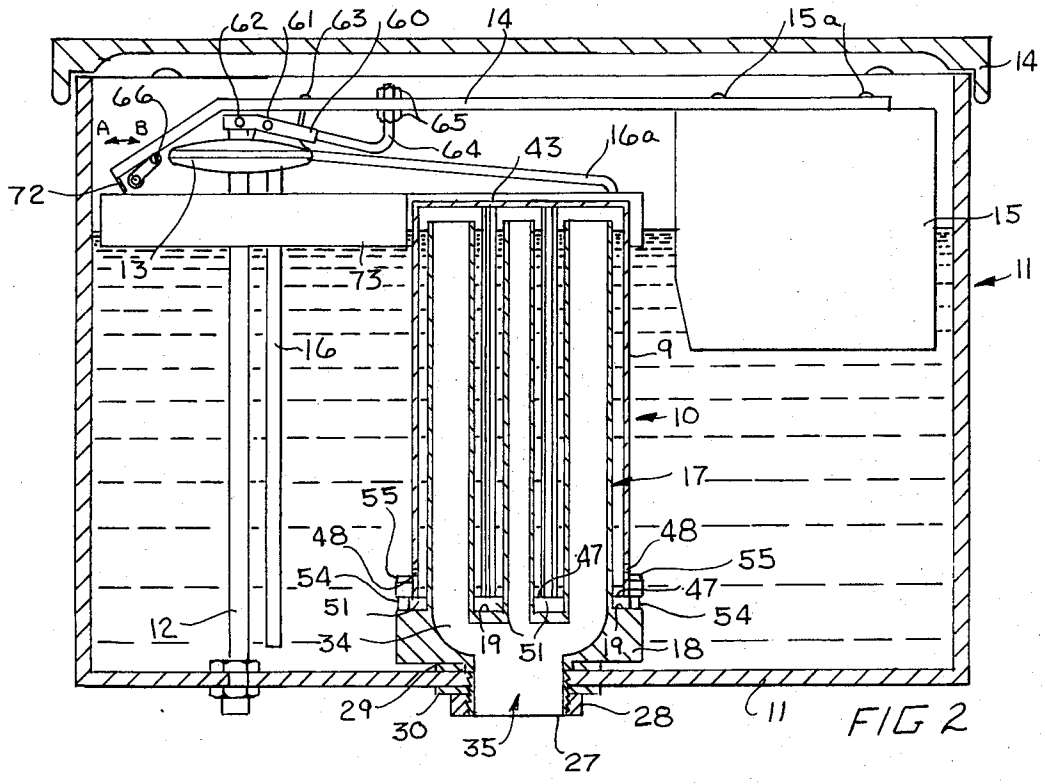


FIG 2

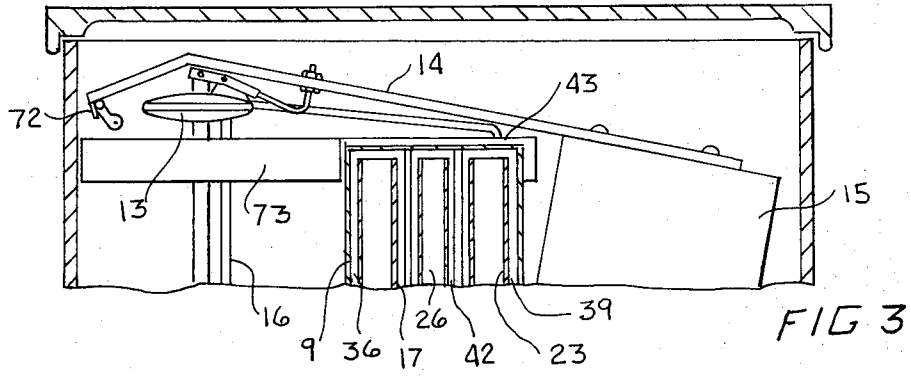


FIG 3

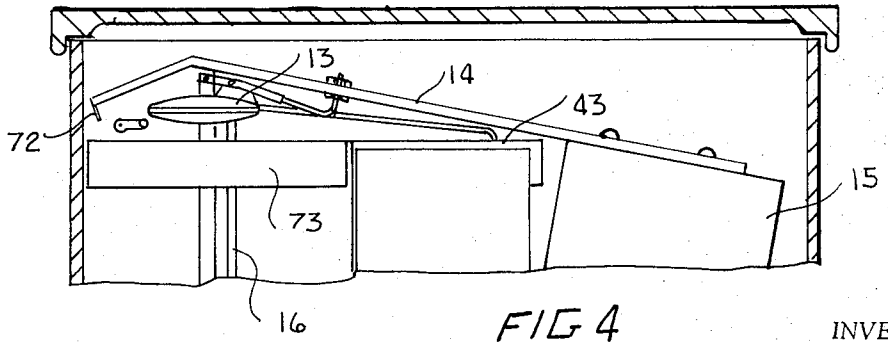


FIG 4

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APPARATUS FOR EMPTYING AND REFILLING LIQUID IN A RESERVOIR

BACKGROUND OF THE INVENTION

In the discharge of liquids from flush tanks different types of siphoning apparatuses have been devised to drain water from a tank. One of these initiates the siphoning action by raising the level of the water to above the passage between the downflow and upflow tubes of the siphon. The water level is raised by displacing the water by a member impervious to water. This type of siphoning apparatus requires a substantial raising of the level of the water and a large sizeof the inner member to provide an adequate flow of water.

OBJECTS AND SUMMARY OF THE INVENTION

An object of the invention is to provide means having a siphoning action with a high flow of water to the space required for the siphoning means.

Another object of the invention is to provide a siphoning means that requires a minimum raising of the water to initiate the siphoning action.

Another object of the invention is to provide an initiating means that is not substantially different from the present actuating mechanisms on conventional flush toilets.

Another object of this invention is to provide a tank siphon discharge that utilizes conventional liquid supply valves and is inexpensive to manufacture.

In summary the apparatus comprises a siphon discharge that has a plurality of upflow passages and a corresponding number of down flow passages fitting within the upflow passages with water impervious means the free surface of the water requiring only small rise in the water level to start the siphoning action.

Other and further objects and advantages will be apparent from the following description taken in connection with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of the drain control means with the cover removed from the reservoir tank.

FIG. 2 is a sectional view of the drain control means with the cover on the reservoir tank taken along lines 2—2 of FIG. 1.

FIG. 3 is a fragmentary sectional view along lines 2—2 of FIG. 1 illustrating the float and float arm in a discharge position with the offset trip arm in the held position.

FIG. 4 is a fragmentary sectional view along lines 2—2 of FIG. 1 illustrating the float and float arm in the extreme discharge position with the offset trip arm in the released position.

FIG. 5 is a bottom view of the discharge siphon.

FIG. 6 is a perspective view of the actuating rod.

FIG. 7 is a top end sectional view of another form of the siphon discharge taken along lines 7—7 of FIG. 8.

FIG. 8 is a longitudinal sectional view of the siphon means taken along lines 8—8 of FIG. 7.

DETAILED DESCRIPTION

In referring to FIGS. 1–4, the apparatus generally comprises a siphon discharge 10 mounted in the bottom of the tank 11, a liquid inlet pipe 12, a valve 13, and a lever 14 with a float 15 controlling the valve 13. The liquid supplied to the tank enters through the vertical pipe 12, the control valve 13 and the downflow pipe 16 discharging the liquid to the tank adjacent the bottom. The lever 14 controls the discharge of liquid and opens the valve when in the positions shown in FIGS. 3 and 4. The valve is closed when the lever is in the position shown in FIG. 2.

The siphon discharge 10 has an inner siphon member 17 with a lower base member 18 and vertically extending downward flow tubes 20–26 (FIG. 5) extending upwardly from the base 18. A threaded fitting 27 extends downwardly

from the base 18 and through the bottom for securing the siphon discharge 10 in place by means of a cooperating nut 28. Washers 29 and 30 on opposite sides of the bottom prevent leakage of liquid from the tank. The base 18 has a circular shape with six of the tubes 20–25 circumferentially on 60° centers and with a seventh tube 26 extending from the center of the base. The tubes are cylindrical in cross section with the center tube 26 being smaller in diameter than the outer peripheral tubes to compensate for the lesser flow of water due to the internal position of the tube 26. The downward flow tubes drain into a common space 34 and then into the discharge or drain 35 in the threaded fitting 27.

The outer siphon member 9 has seven bores 36–42 (FIG. 5) corresponding in arrangement to the tubes 20–26, respectively. The member may be formed as a single piece with the bores formed therein and has a top wall 43 closing the upper ends of the bores. The bores 36–41 are at the corners of the hexagonal configuration and the bore 42 is at the center. On alternate side walls 44, 45, 46 bosses 54 may be provided extending below the lower edge 47 to rest on the top surface 19 of the base 18 to space the lower ends of the bores from the base and provide a space 51 for liquid to flow into the bores 36–42. Bolts 55 fit through the bosses and thread in the base 18 to fasten the member 19 to the base. Slots 52 (FIG. 5) in the bottom of the siphon member 19 interconnect adjacent bores for an even distribution of water between the bores. The slots 52 also even the stopping of the siphon of all of the downflow tubes. The holes 48 (FIG. 2) prevent the continuance of the siphoning by one or two downflow tubes. The holes 48 are positioned high enough that on the return of liquid to the main body from the bores 36–42 caused by stopping the siphon, the holes 48 would still be above the liquid level to prevent reestablishment of the siphoning action and thereby maintain the interruption of the siphoning action. The holes are too small or constrictive to allow enough or sufficient air to enter into the bores to stop a siphoning when it is operating.

On occurrence of a siphoning action the liquid flows from the tank past the edge 47 through the ring-shaped openings and up the cylindrical passages formed by the bores and tubes to the spaces at the top of the respective bores between the tubes and top wall and then down the tube for discharge through the drain passage 35. This siphoning action continues until the water level drops below the lower edge 47 of the siphon member permitting air to enter.

The upper level of the liquid is controlled by the valve 13 and the lever 14 with the float 15. The lever may be a flat rectangular-shaped strip of metal and is pivotally mounted on the control valve 13 by the valve operating lever 60 with a pivotally attaching means 61 connecting the lever to the casing of the valve and attached to the attaching means of the valve at 62. The lever 14 is attached to the valve-operating lever 60 by the screw 63 and generally L-shaped bolt 64. The nuts 65 fasten the bolt to the lever 14 and set the angle of the lever 60 to the lever 14. This determines the angle the lever 14 closes valve 13.

The float 15 is fastened at one end of the lever 14 by the screws 15*a*. At the other end on the opposite side of the pivot 61 from the float 15 the lever 14 is bent downwardly and has a downwardly projecting pin or stop 72 on the extreme end of the level 14. The float lifts the lever to force the bent end downwardly and to close the valve.

A rod 66 (FIGS. 1 and 6) extends across the width of the tank and has legs 67, 68 pivotally mounted in opposite walls 69, 70, respectively, of the tank. A shaft 71 attached to leg 68 rotatably extends through the wall 70 and has a handle or actuating means 71*a* with its weight off center from the shaft and rod to rotate the rod 66 clockwise away from the bent portion of the lever 14. The rod is underneath the lever and on rotation of the rod about the pivots in direction A the rod presses against the lever and tilts the lever to force the float into the liquid. This raises the level of the liquid in the tank and in the siphon discharge. The water flows over the upper edges of the tubes and fills the spaces thereabove to commence the discharge of liquid from the tank.

The off-center weight of handle biases the rod to rotate in direction B (FIG. 1) out of engagement with the lever **14**. However, the rod **66** is rotated past the axis of the pivots and is held in the past center position by the buoyance of the float in the liquid. This buoyance applies an opposite force to the off-center weight of the handle. When the liquid drains to a level at which the float is not sufficiently submerged to create this counter force the rod will drop or return to the non-actuating position. The center of weight of the lever **14** and float **15** is on the float side of the pivot **61** so that the float and lever remain in the valve open position. The liquid empties from the tank until the siphon stops. On tilting of the lever liquid flows from the inlet pipe to the downflow pipe **16** and the upper supply pipe **16***a*.

With the siphoning action stopped, the liquid ceases to discharge and the liquid level starts to rise. The liquid flows into the discharge member as previously described. The float is raised closing the valve before the level of the liquid reaches the tops of the tubes **20–26**.

In order to raise the liquid in the discharge siphon the liquid level throughout the tank must be raised. The volume of liquid forced upwardly by the downward displacement should be at a minimum. The float is of the configuration of the tank and fills the space formed by the tank walls and discharge siphon. A substantial portion of the remainder of the space is filled by the block **73** of liquid impervious rigid material. The configuration is best illustrated in FIG. **1**. The liquid level raises in the small spaces around the float and block with a minimum of liquid.

The downflow tubes **20–26** form an inner tubular-like means with downflow passages and said outer siphoning member **19** with the bores **36–42** forms an outer tubular-like means with upflow passage means. The liquid transfer means formed between the top edges of the downflow passage means and the outer upflow passage means transfers a long flow of liquid on a small liquid level rise.

In FIGS. **7** and **8** another embodiment of the discharge siphon is illustrated and comprises an inner tubular member **75** and an outer tubular member **76**. The outer tubular member has a top wall **77** spaced from the upper end of the inner tubular member for passage of liquid. Three diametrically extending walls **78** extend across the members at 60° angles to one another to form six outer passages **84** and six inner passages **85**. The cross-sectional areas of the passages **84** and **85** should be equal or substantially equal. The walls extend to the top wall so that each set of passages **84**, **85** are isolated from the other sets. The inner tubular member has a threaded end **86** extending through the bottom wall. Washers **87**, **88** and nut **89** fasten the discharge siphon to the bottom wall and seal against leakage. The bottom edge **90** of the outer member is spaced from the bottom to permit easy flow of liquid into the passages **84**.

In operation the float **15** and lever **14** rise with the liquid level until the liquid level is just below the top of the downflow tubes **20–26**. The valve **13** is set to close at this level resetting the mechanism for the succeeding operation. This is initiated by turning the handle **71***a* to rotate the rod **66** in direction A until the pin **72** is engaged. The handle **71***a* is released and is held in the actuated position by the stop **72** and lever **14**. When the float is no longer buoyant, the pressure of the arm on the rod **66** is released and it rotates back to the actuating position. The valve remains open and liquid flows into the tank through the pipes and when the liquid level drops below the lower edge **47** the siphoning action ceases and the tank fills. The float **15** becomes buoyant and when the desired level is reached just below the tops of the downflow tubes **20–26** the lever shuts the valve off. The apparatus is ready for another emptying operation.

Various modifications and changes may be made in the foregoing embodiments without departing from the invention as set forth in the appended claims.

We claim:

1. Apparatus for discharging liquid from a reservoir comprising liquid discharge means having a plurality of downflow tubes extending vertically and having separate intake means at the upper end and having common discharge means at the lower end, a member having a plurality of passages and extending vertically and fitting over said downflow tubes, said passages having closed upper ends above said reservoir, said downflow tubes and said passages have substantially equal cross sectional areas, buoyant, liquid impervious means for raising the level of liquid to start a siphoning action to discharge liquid from the reservoir, actuating means for forcing said buoyant means into the liquid to raise the liquid level, and discharge means stopping the discharge on the liquid level dropping below the lower open ends of said passages.

2. Apparatus for discharging liquid from a reservoir comprising liquid discharge means having a plurality of downflow tubes extending vertically and having separate intake means at the upper end and having common discharge means at the lower end, a member having a plurality of passages and extending vertically and fitting over said downflow tubes, said passages having closed upper ends above said downflow tubes and lower ends open for passage of liquid from said reservoir, and first buoyant liquid impervious means for raising the level of liquid to start a siphoning action to discharge liquid from the reservoir actuating means for forcing said buoyant means into the liquid to raise the liquid level, and second liquid impervious means at a level above and below said intake means and extending at said level to restrict in cooperation with said buoyant liquid impervious means the free liquid surface at said level for minimizing the amount of liquid required to be displaced by said buoyant means to raise the liquid level above said intake means, and said discharge means stopping the discharge on the liquid level dropping below the lower open ends of said passages.

3. Apparatus for discharging liquid from a reservoir as set forth in claim **2** wherein there is an upflow passage for each downflow tube.

4. Apparatus for discharging liquid from a reservoir as set forth in claim **3** wherein said upflow passage member has liquid passing means interconnectiong adjacent passages.

5. Apparatus for discharging liquid from a reservoir as set forth in claim **3** wherein said member has a bottom forming lower open ends with said passages, said lower open ends and said surface have notches interconnecting adjacent passages for distribution of liquid between the passages.

6. Apparatus for discharging liquid from a reservoir comprising liquid discharge means having a vertical inner tubular member forming an inner space and with a top edge means and having a vertical outer tubular member around said inner tubular member and forming an outer annular space therewith, radially extending partition means separating said inner space into vertical downflow passages and said outer annular space into upflow passages, a wall closing the upper end of said outer tubular member and spaced from said inner tubular member to form openings with said top edge means from said upflow passages to said respective down flow passages, buoyant liquid impervious means for raising the level of liquid on further immersion to start a siphoning action to discharge liquid from the reservoir, a second impervious means at a level above and below said top edge means and extending at said level to restrict in cooperation with said buoyant liquid impervious means the free liquid surface at said level for minimizing the amount of liquid required to be displaced by said liquid impervious means to raise the liquid level above said top edge means and said outer tubular member having inlet means at the bottom thereof passing the liquid to said upflow passages and disrupting the siphoning action on the liquid level dropping below said inlet means.

7. Apparatus for discharging liquid from a reservoir as set forth in claim **6** wherein said partition means separates said spaces into an equal number of upflow passages and downflow tubes.

8. Apparatus for discharging liquid from a reservoir as set forth in claim **7** wherein upflow passages and downflow tubes have substantially equal cross-sections.

9. Apparatus for discharging liquid from a reservoir comprising liquid discharge means having a plurality of downflow tubes extending vertically and having separate intake means at the upper end and having common discharge means at the lower end, a member having a plurality of upflow passages and extending vertically and fitting over said downflow tubes, said passages having closed upper ends above said downflow tubes and lower ends open for passage of liquid from said reservoir, said upflow passage member having liquid passing means interconnecting adjacent passages, means for raising the level of liquid to start a siphoning action to discharge liquid from the reservoir, and discharge means stopping the discharge on the liquid level dropping below the lower open ends of said upflow passages.

10. Apparatus for discharging liquid from a reservoir as set forth in claim 9 wherein said member has a bottom forming lower open ends with said passages, said lower open ends and said surface has notches interconnecting adjacent passages for distribution of liquid between the passages.

11. Apparatus for discharging liquid from a reservoir comprising liquid discharge means having downflow tubular means extending vertically and having an intake means at the upper end and having discharge means at the lower end, a member extending vertically and fitting over said downflow tubular means, said member being closed the upper end above said downflow tubular means and open at the lower end for passage of liquid from said reservoir into said member and to the upper end of said downflow tubular means, and buoyant liquid impervious means for raising the level of liquid to start a siphoning action to discharge liquid from the reservoir actuating means for forcing said buoyant means into the liquid to raise the liquid level, and water impervious means at a level above and below said intake means and extending at said level to restrict in cooperation with said buoyant liquid impervious means the free liquid surface at said level for minimizing the amount of liquid required to be displaced by said buoyant means to raise the liquid level above said intake means, and said discharge means stopping the discharge on the liquid level dropping below the lower open end of said member.

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