# United States Patent

[11] 3,595,438


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[54] **AUTOMATIC DETERGENT DISPENSER SYSTEM**
**14 Claims, 7 Drawing Figs.**


[52] U.S. Cl. ..... 222/67, 23/271
[51] Int. Cl. ..... B67d 5/08
[50] Field of Search ..... 222/145, 190, 54, 67; 23/267, 271



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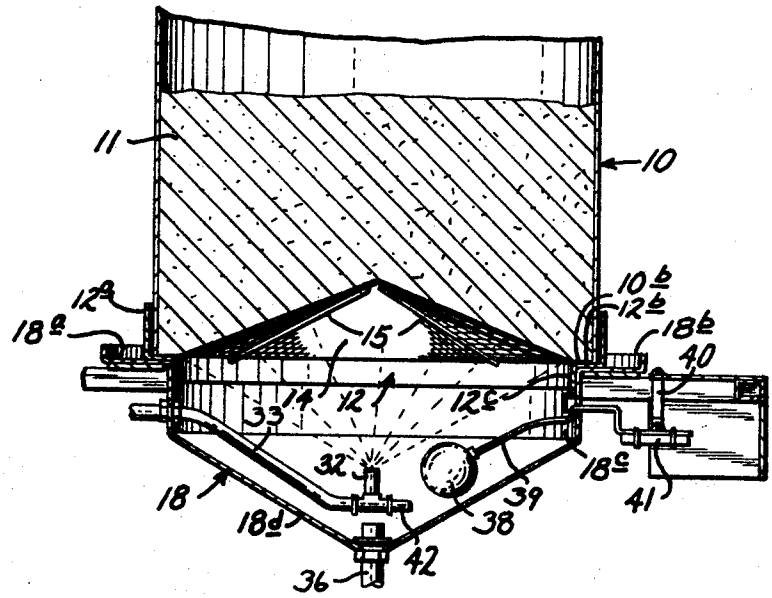
**ABSTRACT:** A system is shown for converting the powdered detergent in a large shipping container to a concentrated detergent solution and for keeping a predetermined amount of the solution available for use. A conical screen is mounted across and extends into an open end of the container. The detergent-filled container is inverted over an open receptacle with the screen holding the detergent in the container. A single water spray nozzle is mounted in the receptacle to spray water on the downwardly facing concave surface of the screen to dissolve a portion of the detergent carried thereby, which passes through the screen and collects in the receptacle.

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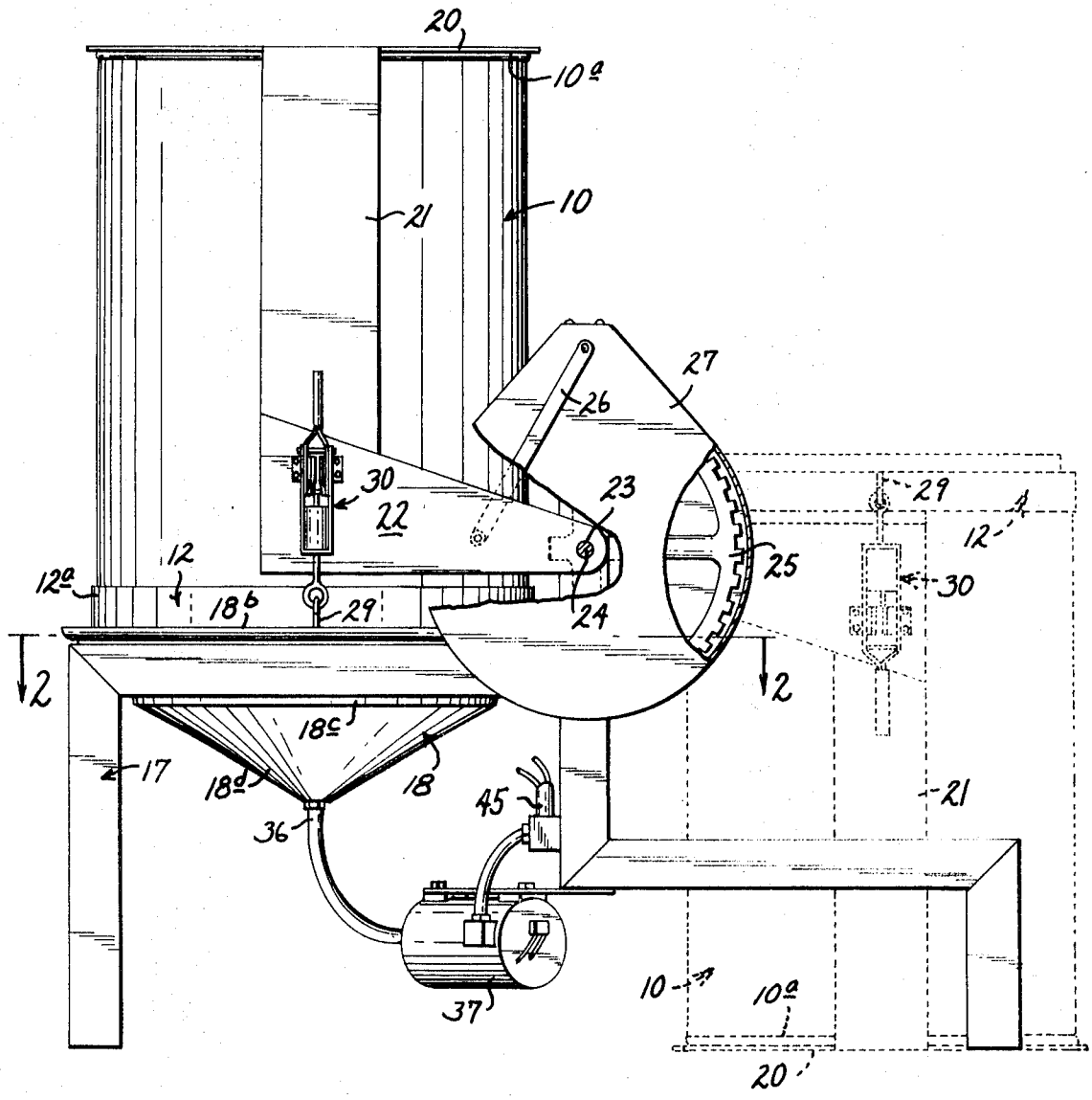


FIG. 1

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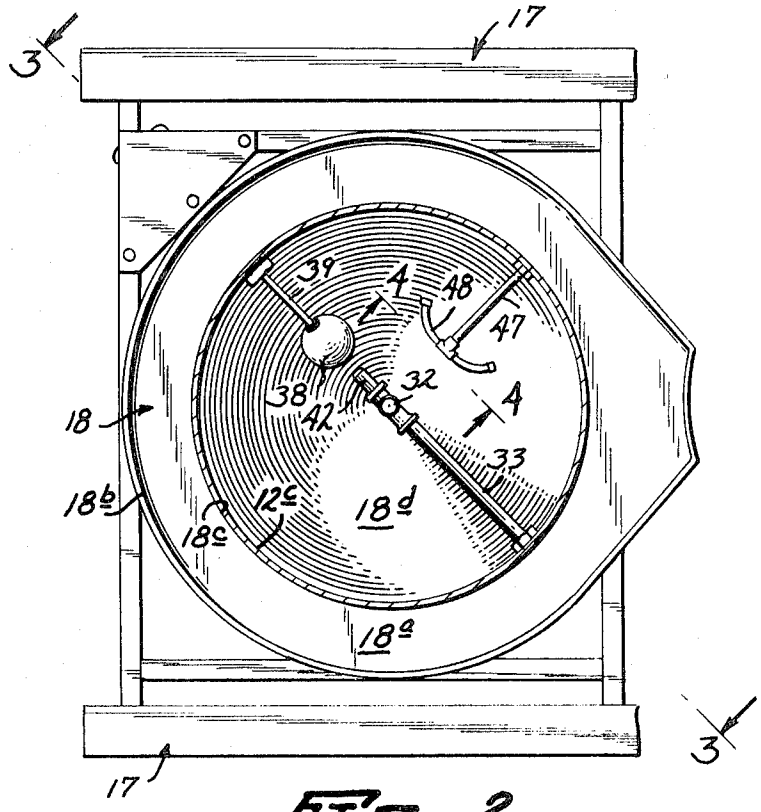


FIG. 2

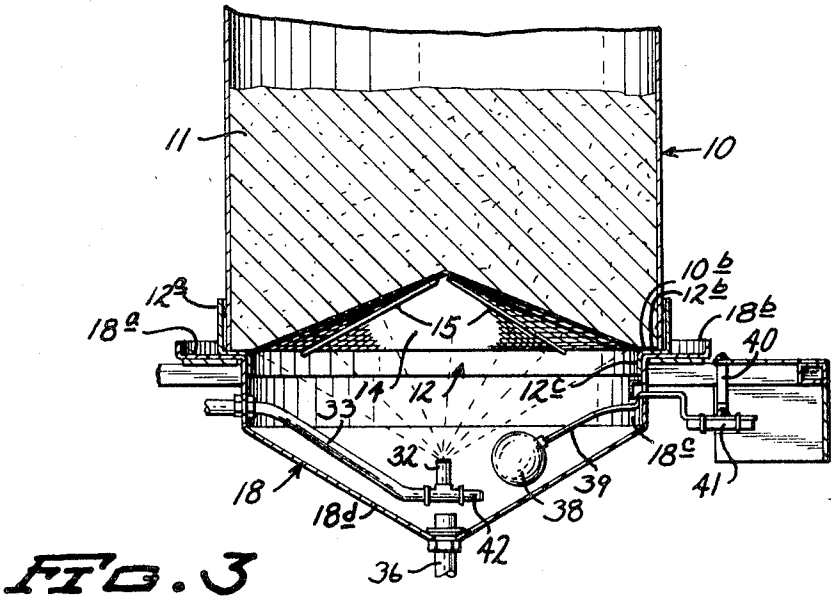


FIG. 3

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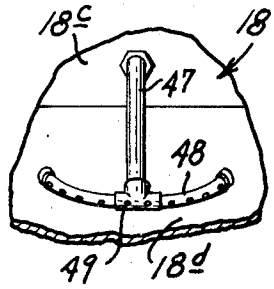



FIG. 4

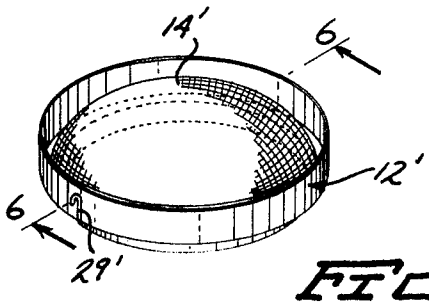
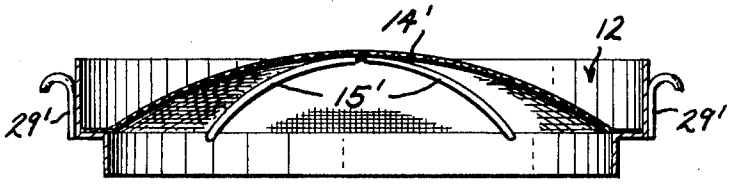



FIG. 5

FIG. 6



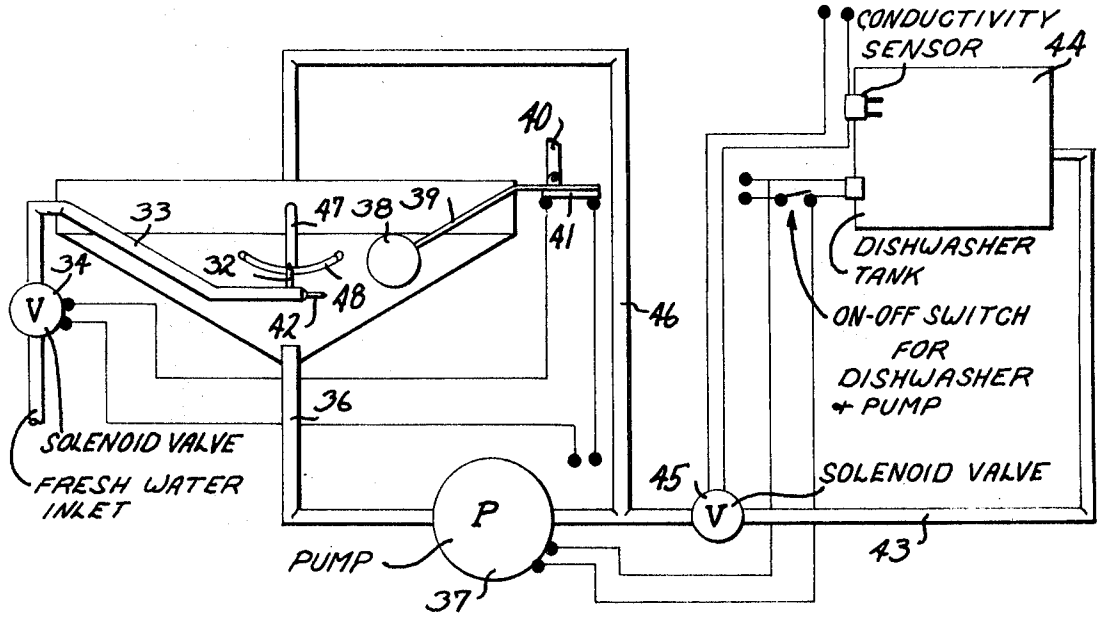




FIG. 7

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# AUTOMATIC DETERGENT DISPENSER SYSTEM

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to the field of detergent dispenser systems and more particularly relates to a system for automatically converting powdered detergent in a container to a concentrated detergent solution as necessary to maintain a predetermined volume of the solution available for use.

2. Description of the Prior Art

Large amounts of powdered detergent are used by commercial organizations such as carwashes, laundries and restaurants. The detergent is normally purchased in large cylindrical shipping containers that typically have a 30-gallon capacity.

In a commercial establishment such as a restaurant, the detergent is used in the automatic dishwashers. Each dishwasher has a wash tank that carries a large volume of detergent solution The dishwasher uses this detergent solution over and over again for a period of time, such as one day, until it is replaced by a new solution. During normal usage, however, some of the detergent solution is drained off along with food particles and grease removed by the dishwasher to keep the remaining solution as clean as possible. Water is then added to the wash tank to maintain the proper level. Of course, this reduces the concentration of the solution in the wash tank.

In order to keep the detergent solution in the wash tank at the proper concentration, detergent must be periodically added. The most simple prior art approach to increasing the concentration was to have an employee periodically add powdered detergent to the dishwasher wash tank. This was not a satisfactory approach. For one thing, it required more or less constant attention by an employee. Further, it was almost impossible for the employee to tell when to add detergent and how much to add. The result was that the detergent concentration in the wash tank fluctuated widely over a period of time.

The prior art approach to improving this situation was to provide a system that would automatically add concentrated detergent solution to the wash tank as its concentration dropped below a specified level. To accomplish this, suitable electrodes were placed in the wash tank to measure solution conductivity. Also, a source of concentrated detergent solution was provided. When the conductivity dropped below a certain level, a pump was energized to introduce clean concentrated detergent solution into the wash tank.

In our own prior design, a reservoir was provided having an open top. A 30-gallon shipping container having an open end was inverted over the receptacle with the openings aligned. A flat screen of sufficiently small mesh to prevent dry powder from sifting through was mounted between the container and the reservoir. A plurality of upwardly directed water spray nozzles were mounted within the reservoir at spaced-apart positions such that when energized, the resulting sprays would collectively wet the entire bottom surface of the flat screen positioned above them. A saturated detergent solution resulted, which fell through the screen into the reservoir. An electrical probe was used to turn off the water to the nozzles when the proper solution level was reached in the reservoir. This concentrated solution was then available for pumping to the wash tank when the concentrated therein fell below a predetermined figure. As the concentrated solution was pumped to the wash tank, the level in the reservoir fell below the probe, at which point the sprays were again turned on to provide more concentrated solution.

Our prior system used a 12-jet manifold in combination with the flat screen. This combination proved to be unsatisfactory for commercial usage since it resulted in channeling of the detergent in the container, causing excess hydration and caking. The term "channeling" means the forming of multiple vertical channels in the powdered detergent above the screen. A desirable system would not form channels but would cause



even hydration of the product for only about one-half inch above the screen. When channeling occurs, a large surface area of the powdered detergent is exposed to the spray and thus becomes hydrated. During periods of nonusage, this hydrated detergent dries and can become caked. The caked product is not readily soluble. If the product in the container becomes channeled and caked, it is then difficult to dissolve sufficient detergent to provide the necessary concentration solution in the reservoir. Too much powdered detergent is also left in the container and wasted.

The channeling in the multiple jet-flat screen model was thought to be caused by uneven distribution of the spray through the screen. The water from the periphery of each spray tended to be deflected from the flat screen, while the interior perpendicularly directed sprays penetrated far through the screen. Channeling occurred at the points where the sprays impinged perpendicularly on the screen.

We are also aware of the similar system manufactured by W. R. Grace and Co. in which the detergent shipping container is provided with a relatively small opening at the center of one end. A screen is placed across this small opening and the container is inverted over a sump having a single nozzle that sprays water upwardly through the screen into the container to dissolve the powdered detergent. The solution concentrate strains back into the sump through the screen and is pumped into the dishwasher as needed. In the commercial form of this system, a 2-inch mesh screen is used, that fits on a standard drum opening. This system also suffers from the problems of channeling and caking, since the amount of hydration of the powdered detergent in the container is virtually uncontrolled.

## SUMMARY OF THE INVENTION

Our invention utilizes a container of powdered detergent having a substantially completely open end. A receptacle for detergent solution is provided, having an upwardly facing opening corresponding generally in size to the substantially completely open end of the container. A retainer ring is mounted on the open end of the container and a screen member is carried by the ring. In the preferred embodiment of our invention, the screen member is generally conical in shape and is convex with respect to the interior of the container. The screen member covers the entire open end of the container and is constructed from a mesh sized to prevent the powdered detergent from passing through it.

Frame means are provided to mount the container in an inverted position over the receptacle, with the retainer ring also cooperating with the receptacle to hold the container in the proper position. A single spray nozzle is mounted in the center of the receptacle to spray water on generally the entire downwardly facing concave surface of the screen member to dissolve a portion of the detergent being carried by the screen member. The detergent solution passes through the screen member and collects in the receptacle.

The present invention has proven to be much superior in operation to the prior art systems of which we are aware. The single nozzle provides a spray of water of sufficient size to cover the entire downwardly facing surface of the screen member. Since the screen member is generally cone shaped, each droplet of water in the spray impinges generally perpendicularly on the screen member. A more even distribution of spray results than with the multiple jet-flat screen system and the water pressure can be adjusted such that each portion of the spray impinges upon the screen member with the desired amount of force. As a result of this even distribution, virtually no channeling of the product occurs.

Surprisingly, with the inverted cone and single-jet system, only about the first half-inch of the exposed product is hydrated by the spray. The remainder of the product in the container remains very dry. As opposed to this, with the 12-jet manifold system, hydration into the drum was as much as 4 to 5 inches. With so much hydration, the caking was often great

enough to make it appear that the drum was empty since the water spray could not dissolve sufficient detergent within the time allowed by the system. In the present system, however, where only about the first half-inch of product above the screen member is hydrated by the spray, virtually no channeling and caking occurs. Even when the party used drum is allowed to sit over a weekend, the product adjacent the screen dries out sufficiently to permit normal operation of the system upon reactivation, i.e. almost no caking occurs. Thus, so long as detergent remains in the drum, it will be available for dissolving by the spray. We have observed in actual practice that the present invention will remove all but a very minor amount of the detergent from the container or drum.

Another reason for the reduction in channeling and caking is the lower water pressure we utilize. It was originally thought that the higher the pressure the better the dissolution of the powder in the drum. We have found, however, that the higher pressures merely cause channeling without at the same time improving dissolution of the powder. Certain other features of the present invention have also added to system performance. A float device is provided to maintain the proper level of concentrated solution in the receptacle. We have also provided means to reduce another problem found in the prior art system. In those systems, the detergent often precipitated out of solution and tended to clog the sump or receptacle. We have added two features to reduce this problem. First, we have added a second nozzle to direct a spray of water generally beneath the float device during operation of the previously mentioned water spray, to prevent any detergent precipitate from causing the float device to stick, and to dilute the solution to reduce precipitation. The second feature is a continuously operating pump that constantly takes solution from the receptacle and returns it through a suitable bypass conduit to induce a constant flow of solution through the receptacle. This constant flow of solution through the receptacle again aids in reducing the amount of detergent precipitating out of solution.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation of the detergent dispenser system of the present invention, portions thereof being broken away, with an alternate position of the detergent container being shown in dotted lines;

FIG. **2** is a horizontal sectional view taken along line **2–2** of FIG. **1**, portions thereof being broken away;

FIG. **3** is a vertical sectional view taken along line **3–3** of FIG. **2**, portions thereof being broken away;

FIG. **4** is a fragmentary plan view taken generally along the line **4–4** of FIG. **2**;

FIG. **5** is a view in perspective of the retainer ring and a generally hemispherical screen;

FIG. **6** is a sectional view taken along line **6–6** of FIG. **5**; and

FIG. **7** is a schematic view of the water and electrical systems.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, wherein like reference numerals will be used throughout the several views to identify like elements of the invention, there is disclosed a container or drum **10** carrying a quantity of powdered detergent **11**. Container **10** is a shipping container in the form of a right circular cylinder, and in the embodiment shown has a capacity of approximately 30 gallons. Container **10** has a closed end **10***a* and an open end **10***b*. As best shown in FIG. **3**, substantially the entire end **10***b* is open.

A circular retainer ring **12** is mounted on the circular open end **10***b* of the container **10**. Ring **12** includes a cylindrical large-diameter portion **12***a* that fits snugly over the open end **10***b*, an inwardly extending peripheral support flange **12***b*, and a smaller diameter cylindrical portion **12***c*. As best shown in FIG. **3**, cylindrical portions **12***a* and **12***c* are concentrically mounted on flange **12***b*. Assuming that flange **12***b* lies in a horizontal plane, cylindrical portion **12***a* is welded to the outer edge thereof and extends upwardly therefrom, while smaller diameter cylindrical portion **12***c* is welded to the inner edge thereof and extends downwardly therefrom. The inside diameter of cylindrical portion **12***a* is slightly larger than the outside diameter of container **10** so that it fits snugly thereover with the surface of flange **12***b* in contact with the edge of open end **10***b*.

A screen member **14** is carried within retainer ring **12**. In the preferred embodiment, the screen member or screen **14** is generally cone shaped, and the circular edge thereof is welded to the interior of retainer ring **12**. A plurality of steel support rods **15** are positioned against the concave surface of screen **14** to provide support for the screen. Since screen **14** is generally conical, the plurality of support rods **15** are also positioned in a generally conical arrangement with their inner ends welded together at the tip of the cone and their outer ends welded to the inner periphery of retainer ring **12**. As best shown in FIG. **3**, conical screen **14** is convex with respect to the interior of container **10** and in conjunction with the support rods **15** prevents powdered detergent **11** from escaping from the inverted drum **10**.

The detergent dispenser system of the present invention is supported by a metal frame **17** as shown on the drawings. Mounted within and carried by the frame **17** is a detergent sump or receptacle **18**. Receptacle **18** constitutes a reservoir for concentrated detergent solution. Receptacle **18** includes a horizontally extending peripheral flange portion **18***a* that rests on the horizontally extending portions of the frame **17** to support receptacle **18**, as shown in the drawings. The outer edge of flange portion **18***a* is curled upwardly to form a lip **18***b*. Lip **18***b* is designed to prevent excess solution from dripping on the floor. As shown in FIG. **2**, the flange portion **18***a* is of generally uniform width except for one side where the width is increased. The purpose of this extra width portion will be described later in the specification. Extending downwardly from the inner edge of the flange portion **18***a* is a cylindrical portion **18***c*. Extending downwardly from the bottom edge of cylindrical portion **18***c* is a conical portion **18***d*. In the preferred embodiment of our invention, the entire receptacle **18** is molded as a single unit from a suitable plastic. This aids in reducing corrosion of the unit. However, the receptacle **18** could be made from metal as well. Also mounted on frame **17** is a pivotable cradle assembly that includes a circular drum support plate **20**, a pair of arms **21** attached at one end thereto and which extend along opposite sides of container **10**, and a pair of rocker arms **22** that are connected at one end to the free end of an associated arm **21** and have openings **23** formed at their opposite ends through which a horizontally extending shaft **24** extends. Shaft **24** is rotatably mounted at its opposite ends within frame **17**. The pair of rocker arms **22** are both welded to shaft **24**. As best shown in FIG. **1**, the rocker arm **22** on one side of the container **10** is welded to vertically extending arm **21** at its free end and is perpendicular with respect thereto. Although the drawings do not show them, it should be understood that the other arm **21** and rocker arm **22** are located on the other side of drum **10** as viewed in FIG. **1**. When shaft **24** is rotated, the entire cradle assembly rotates therewith from a loading position as shown in dotted lines in FIG. **1** to a fully inverted position as shown in full lines in FIG. **1**. To provide for manual rotation of shaft **24**, a large gear **25** is mounted on shaft **24**. A manually operated crank **26** is provided that when rotated causes the rotation of a smaller gear (not shown) that meshes with gear **25** to in turn cause its rotation. Because of the favorable gear ratio, crank **26** can be operated quite easily by one person to continuously rotate shaft **24**. Gear **25** and the smaller drive gear are covered by a suitable housing **27**.

A container **10** full of powdered detergent **11** is placed on the assembly as follows. The cradle assembly is cranked to the dotted line loading position shown in FIG. **1**. The drum **10** is slid over the support plate **20** with its open end **10***b* facing upwardly. In this position, the pair of support arms **21** will extend

upwardly along opposite sides of container 10. Retainer ring 12 is placed over the open end 10*b* so that the surface of flange 12*b* rests on the edge of the container. Welded to the opposite sides of retainer ring 12 are a pair of hooks 29 that cooperate with a pair of turnbuckle assemblies that are secured to the rocker arms 22. When the handle of each turnbuckle assembly 30 is released, the associated loop can be placed over hook 29. When the handle of the turnbuckle assembly 30 is closed, retainer ring 12 is drawn down tightly against the edge of container 10 so that container 10 becomes tightly locked between ring 12 and support plate 20. Again, only one of the turnbuckle assemblies 20 and hooks 29 is shown, it being understood identical members are located on the other side as viewed from FIG. 1.

After the container 10 is secured between ring 12 and support plate 20 as shown in the dotted line position of FIG. 1, crank 26 is turned to cause rotation of shaft 24. The entire cradle assembly rotates with shaft 24 in a counterclockwise direction as viewed in FIG. 1 until it reaches the container-inverted position shown in full lines in FIG. 1. In this position, the open end 10*b* of container 10 faces downwardly directly in line with the upwardly facing open end of receptacle 18. In this position, as best shown in FIG. 3, the bottom surface of flange 12*b* rests on the upwardly facing surface of flange portion 18*a*. The small-diameter cylindrical portion 12*c* of retainer ring 12 fits downwardly into the open receptacle 18 with the outer surface thereof engaging the inner surface of cylindrical portion 18*c*. Retainer ring 12 not only cooperates with container 10 and receptacle 18 to hold the container in the proper inverted position, but also acts to prevent water or detergent solution from splashing out of the receptacle between the receptacle and the container. In this container-inverted position, screen 14 and rods 15 support the entire weight of the powdered detergent 11 carried by the container. The mesh of screen 14 is sized so that the powdered detergent cannot sift through it. Thus, for different types of detergent, different screen mesh sizes may be utilized if necessary or desirable. We have found that with most detergents, a 20-mesh screen can be used. In some cases, we have also used a 30-mesh screen. Actual testing may be necessary to determine the correct screen mesh size for any particular detergent that is being used. When the container is empty, the crank 26 is rotated in the opposite direction to return the empty container to the dotted line position of FIG. 1, where it can be replaced by a full container. The purpose of the wide portion of flange portion 18*a* is to catch any water or detergent solution that escapes from the container as it is rotated from the inverted position to the dotted line position of FIG. 1. It is noted that the crank assembly is provided with a suitable brake (not shown) so that the operator need not worry about losing control of the container. The operator can let go of the handle at any time and the brake will engage to prevent further rotation of the shaft and cradle assembly.

A single, vertically extending, water-spray-forming nozzle 32 is mounted in the center of receptacle 18 so as to spray water on generally the entire downwardly facing concave surface of screen 14. In the preferred embodiment, the centerline of nozzle 32 lies along a vertical line that extends through the tip of conical screen 14 and the top of conical portion 18*d*. Nozzle 32 is selected and positioned such that the entire undersurface of screen 14 will be wetted by the water spray, as indicated in FIG. 3. Nozzle 32 is supported within receptacle 18 by means of a curved conduit or pipe 33 that extends through an opening in cylindrical portion 18*c* to a source of water under pressure. As shown in in FIG. 7, a solenoid valve 34 is mounted in conduit 33 to control the flow of water therethrough. A drain pipe or conduit 36 is mounted in an opening and formed at the lowermost point of conical portion 18*d*. One end of pipe 36 extends a short distance up into receptacle 18 so that a small amount of fluid will always remain in the receptacle to provide a place for solids to accumulate. The other end of conduit 36 connects to the intake port of a centrifugal-type pump 37. Also extending into receptacle 18 is a float device which includes a ball member 38 adapted to float on the surface of a solution in receptacle 18 and a support arm 39. Support arm 39 extends through an opening formed in cylindrical portion 18*c*. One end of support arm 39 is connected to ball member 38 within receptacle 18, and the other end is pivotally supported on the bottom end of a tubular support member 40 attached to frame 17. Secured to the end of support arm 39 adjacent support member 40 is a mercury switch 41. Mercury switch 41 closes as ball member 38 drops, and opens again as ball member 38 arises to a predetermined level. A second nozzle 42 is connected to the end of conduit 33 within receptacle 18 so as to direct a spray of water at the receptacle wall generally beneath ball float member 38 when valve 34 is opened. This prevents detergent precipitate from forming adjacent the ball and also acts to dilute the solution in the receptacle to reduce precipitation of detergent out of solution.

Referring to FIG. 7, there is disclosed a discharge pipe 43 that extends from pump 37 to a dishwasher tank 44. Mounted in pipe 43 is a solenoid valve 45. A bypass conduit 46 is also provided having one end extending into receptacle 18 and the other end connected to conduit 43 between pump 37 and valve 45. Connected to the end of bypass conduit 46 within receptacle 18 is a pipe 47 having a plugged-T pipe 48 connected to the end thereof. A plurality of water-spray-forming openings 49 are formed in pipe 48 as shown in FIG. 4.

The operation of the system is as follows. Pump 37 is energized whenever the dishwasher is energized since it is connected in series with the on-off switch for the dishwasher. Therefore, for all practical purposes, pump 37 operates continuously. As mentioned in the introduction to the specification, the dishwasher tank is provided with a conductivity sensor that indicates when more detergent is needed. As shown in FIG. 7, when more detergent is needed in the wash tank, the conductivity sensor energizes valve 45 to provide a flow of concentrated detergent solution from pump 37 through pipe 43 to the wash tank. When the conductivity sensor is satisfied, it closes valve 45. Since pump 37 runs continuously, solution is continually pumped through bypass conduit 46 and through openings 49 into receptacle 18. As shown in FIG. 2, pipe 48 extends generally along one side of receptacle 18, and is positioned beneath the normal solution level, to induce a constant flow of solution along the bottom of the receptacle in a direction away from pipe 48. This constant agitation or recirculation of the concentrated detergent solution acts to prevent the buildup of detergent precipitate in the receptacle. Since the openings 49 are formed all along the curved pipe 48, the water sprays emerging from these openings tend to sweep the entire bottom surface of receptacle 18. It is noted that since pump 37 is a centrifugal-type pump, the closing of valve 45 does not damage the pump.

When the solenoid valve 45 is energized and detergent solution is pumped into tank 44, the level of solution drops within receptacle 18. As the solution level drops, ball member 38 also drops causing mercury switch 41 to close. When it closes, valve 34 is energized to provide a flow of water under pressure to nozzles 32 and 42. As previously mentioned, this flow of water through nozzle 42 acts to keep the area around the ball member clean and also dilutes the solution in the receptacle. The water emerging from nozzle 32 sprays upwardly and impinges upon the downwardly facing concave surface of screen 14, as shown schematically in FIG. 3. This water spray passes through screen 14 and hydrates the powdered detergent carried thereby. The water pressure is adjusted such that only a small amount of detergent above screen 14 is hydrated. This detergent passes into solution and drops through screen 14 and collects in receptacle 18. When ball member 38 rises to the proper level, valve 34 is again deenergized and closed to stop the flow of water to nozzles 32 and 42.

This system is designed to be used with a source of either hot or cold water, with the water supply pressure being approximately 30 to 40 p.s.i. Generally speaking, the water pressure should be as low as possible consistent with obtaining a

spray that covers the entire under surface of the screen and that hydrates the powder to a depth of approximately one-half inch above the screen, without channeling.

As previously mentioned, the best results are obtained if the water spray impinges upon the surface perpendicular to the surface. In the preferred embodiment we have heretofore described, a conical screen has been utilized since it comes reasonably close to attaining this objective and since it is easier and less expensive to fabricate. However, it would be preferable to use a hemispherical screen since if the tip of the nozzle were at the center of the sphere, all of the droplets would impinge on the surface of the screen at right angles thereto, Therefore, in FIGS. **5** and **6**, we show an alternate embodiment in which retainer ring **12** carries a screen **14'** and a plurality of support rods **15'** that all lie along the surface of a portion of an imaginary sphere, forming a spherical segment. The structure shown in FIGS. **5** and **6** could be substituted for that shown in the other drawings without departing from the invention. Generally speaking, the screen could be convex with respect to the interior of the container and concave with respect to the water spray so that the droplets impinge upon the screen surface as closely as possible to a right angle. Obviously, this objective will not be realized with anything less than a spherical-segment-type screen, but any type of concave screen will more closely approach the objective than will a flat screen.

We have shown out invention as being used in combination with a 30 gallon shipping container and means for handling the container. However, our invention has also been used in combination with smaller containers and in apparatus wherein the container and receptacle are welded or otherwise connected together as a single unit. It may also be used in combination with larger shipping containers, as for example, 55-gallon drums. In all situations, however, a single water spray nozzle is used in combination with a screen that is concave with respect to the water spray nozzle. Our invention is set forth in the appended claims.

What I claim is:

1. Apparatus for preparing and collecting a concentrated detergent solution, comprising:
   a. a container for containing a powdered detergent, said container having a substantially open end;
   b. a receptacle for detergent solution, said receptacle having an upwardly facing open end;
   c. means including a retainer ring cooperating with said container and with said receptacle for mounting said container in an inverted position over said receptacle;
   d. a screen member carried by said retainer ring and covering said open end of said container, said screen member being convex with respect to the interior of said container and being constructed from a mesh extending continuously over the entirety of said open end and which is sized to prevent said powdered detergent from passing therethrough; and
   e. a single, vertically extending, water-spray-forming nozzle mounted in said receptacle generally below the center of said screen member so as to spray water on substantially the entire downwardly facing concave surface of said screen member to dissolve a portion of the powdered detergent being carried thereby, said detergent solution passing through said screen member and collecting in said receptacle.

2. The apparatus of claim **1** wherein said screen member is generally cone shaped.

3. The apparatus of claim **1** wherein said screen member is formed generally as a spherical segment.

4. Apparatus for withdrawing, as a concentrated detergent solution, the detergent from a substantially completely open end of a container of powdered detergent, comprising:
   a. a receptacle for detergent solution having an upwardly facing opening corresponding generally in size to the substantially completely open end of the container;
   b. a screen mounted over said receptacle opening, said screen being concave with respect to said open receptacle and extending continuously over said open end;
   c. means for mounting the container in an inverted position over said screen and receptacle, said screen being sized to prevent the powdered detergent from passing therethrough; and
   d. a single nozzle mounted in said receptacle to spray water upwardly onto generally the entire downwardly facing concave surface of said screen to dissolve an adjacent portion of the powdered detergent being carried thereby, said detergent solution passing through said screen and collecting in said receptacle.

5. The apparatus of claim **4** wherein said screen is generally conical in shape.

6. The apparatus of claim **4** wherein said screen is shaped generally as a spherical segment.

7. The apparatus of claim **4** wherein said receptacle and the container both have a circular opening, said means for mounting the container includes a cylindrical retainer ring having a support flange intermediate the ends thereof, said screen is mounted within said ring, one end of said ring extends downwardly into said opening in said receptacle with said flange resting on said receptacle, and wherein the open end of the container extends into the other end of said ring over said screen.

8. The apparatus of claim **4** in combination with means for removing concentrated detergent solution from said receptacle and means for maintaining the level of concentrated detergent solution in said receptacle within a predetermined range by periodically energizing said nozzle to spray water onto said screen.

9. Apparatus for preparing and collecting a concentrated detergent solution, comprising:
   a. a container for containing a powdered detergent, said container having a substantially completely open end;
   b. a receptacle for detergent solution, said receptacle having an upwardly facing open end;
   c. means for securing said container to said receptacle with said open ends aligned;
   d. a screen member mounted between said receptacle and said container covering said open end of each, said screen member being convex with respect to the interior of said container and being constructed from a mesh extending continuously over the entirety of said open ends and which is sized to prevent said powdered detergent from passing therethrough; and
   e. a single water-spray-forming nozzle mounted in the center of said receptacle to spray water on generally the entire downwardly facing concave surface of said screen member to dissolve a portion of the powdered detergent being carried thereby, said detergent solution passing through said screen member and collecting in said receptacle.

10. Apparatus for preparing a concentrated detergent solution comprising:
   a. a container adapted to carry a powdered detergent, said container having a downwardly facing, substantially completely open end;
   b. a screen member mounted in said container between said open end and the detergent-carrying portion thereof, said screen member being concave with respect to said open end and being constructed from a mesh extending continuously over said open end and which is sized to prevent the powdered detergent from passing therethrough;
   c. a receptacle positioned below said open end; and
   d. a single water-spray-forming nozzle mounted in said receptacle to spray water on generally the entire downwardly facing concave surface of said screen member to dissolve a portion of the powdered detergent through said screen member into said receptacle.

11. Apparatus for withdrawing, as a concentrated detergent solution, the detergent from a substantially completely open end of a container of powdered detergent, comprising:

a. a receptacle for detergent solution having an upwardly facing opening corresponding generally in size to the substantially completely open end of the container;

b. a screen mounted over said receptacle opening, said screen being concave with respect to said open receptacle;

c. means for mounting the container in an inverted position over said screen and receptacle, said screen being sized to prevent the powdered detergent from passing therethrough;

d. a single nozzle mounted in said receptacle to spray water upwardly onto generally the entire downwardly facing concave surface of said screen to dissolve an adjacent portion of the powdered detergent being carried thereby, said detergent solution passing through said screen and collecting in said receptacle;

e. means in liquid communication with said receptacle for removing concentrated detergent solution therefrom; and

f. means for maintaining the level of concentrated detergent solution in said receptacle within a predetermined range including a source of water under pressure, a first conduit connecting said source to said nozzle, a valve in said first conduit, a float device mounted in said receptacle so as to detect changes in solution level, and means responsive to said float device to open and close said valve in response to changes in solution level thereby intermittently spraying water onto said screen.

12. The apparatus of claim 11 wherein a second nozzle is connected to said first conduit and is positioned within said receptacle so as to direct a spray of water at a wall of said receptacle generally beneath said float device when said valve is open.

13. Apparatus for withdrawing, as a concentrated detergent solution, the detergent form a substantially completely open end of a container of powdered detergent, comprising:

a. a receptacle for detergent solution having an upwardly facing opening corresponding generally in size to the substantially completely open end of the container;

b. a screen mounted over said receptacle opening, said screen being concave with respect to said open receptacle;

c. means for mounting the container in an inverted position over said screen and receptacle, said screen being sized to prevent the powdered detergent from passing therethrough;

d. a single nozzle mounted in said receptacle to spray water upwardly onto generally the entire downwardly facing concave surface of said screen to dissolve an adjacent portion of the powdered detergent being carried thereby, said detergent solution passing through said screen and collecting in said receptacle; and

e. means for removing concentrated detergent solution from said receptacle including a continuously operating pump having an intake port and a discharge port, a first conduit having one end extending into said receptacle and another end connected to said intake port, a second conduit connected to said discharge port and having a control valve therein, and a bypass conduit having one end extending into said receptacle and the other end connected to said second conduit between said discharge port and said control valve to provide essentially constant circulation of said solution in said receptacle.

14. The apparatus of claim 13 wherein a pipe having a plurality of water-spray-forming openings is connected to said one end of said bypass conduit, said pipe extending along one side of said receptacle within said solution to induce a constant flow of solution along the bottom of said receptacle in a direction away from said pipe.

# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,595,438 Dated July 27, 1971

Inventor(s) Leo R. Daley et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 21, before "The dishwasher" insert a period; line 64, "concentrated" should read -- concentration --. Column 2, line 8, "concentration" should read -- concentrated --. Column 3, line 6 "party" should read -- partly --; line 25, "system" should read -- systems --. Column 4, line 64, "operated" should read -- operable --. Column 5, line 19, "container-in-" should read -- container in- --; line 26, "small-diameter" should read -- small diameter --; line 33, "container-inverted" should read -- container inverted --; line 61, "top" should read -- tip --; line 67, cancel "in", second occurrence. Column 6, line 10, "arises" should read -- rises --; line 47, "buildup" should read -- build-up --. Column 7, line 14, "thereto," should read -- thereto. --; line 20, "could" should read -- should --; line 28, "out" should read -- our --.

Signed and sealed this 23rd day of May 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

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