

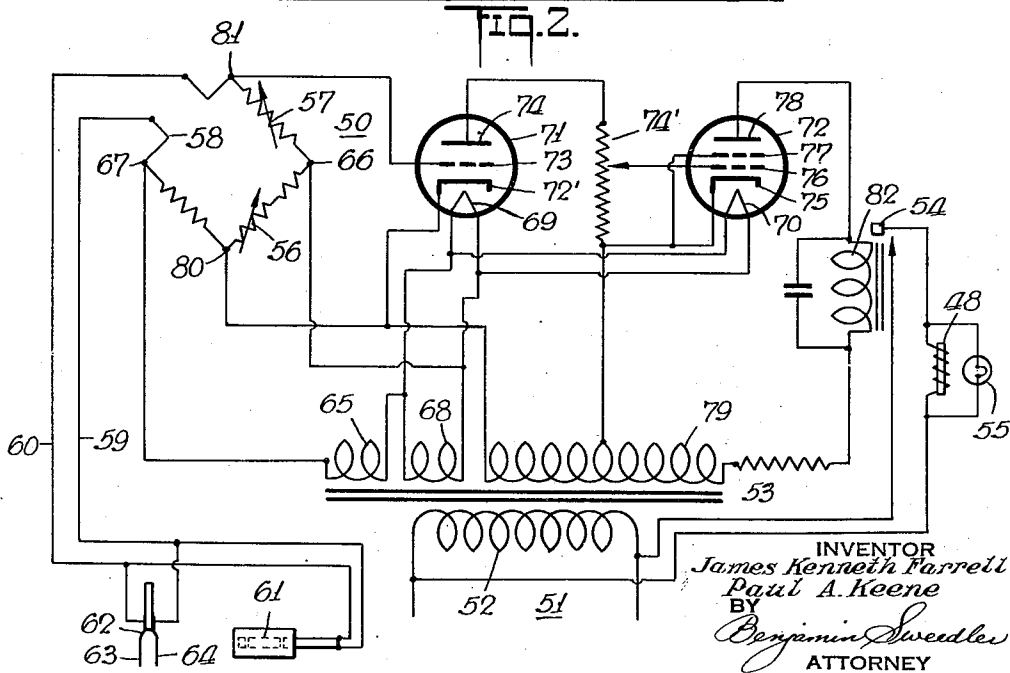
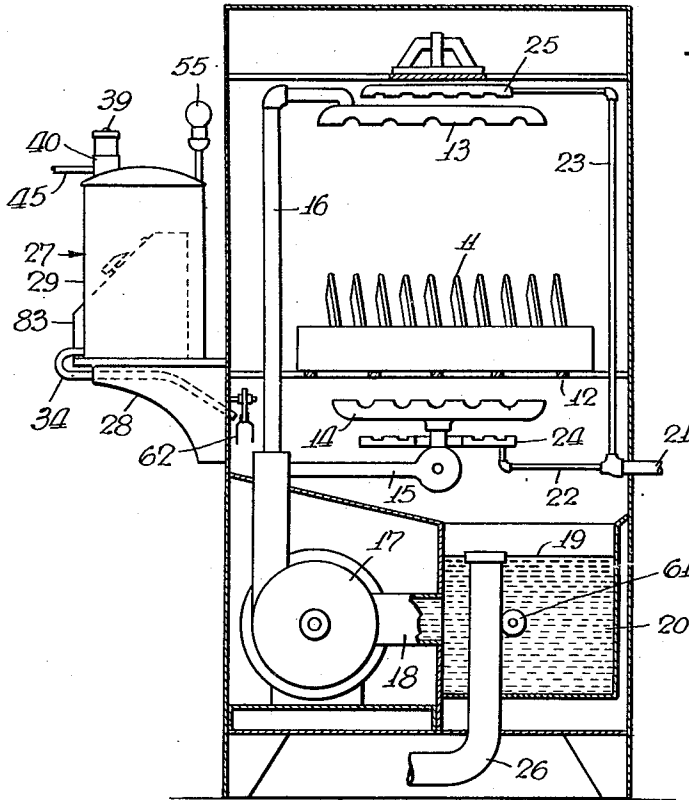
Nov. 27, 1951

J. K. FARRELL ET AL
CONCENTRATION CONTROL SYSTEM

2,576,253

Filed March 11, 1946

2 SHEETS—SHEET 1



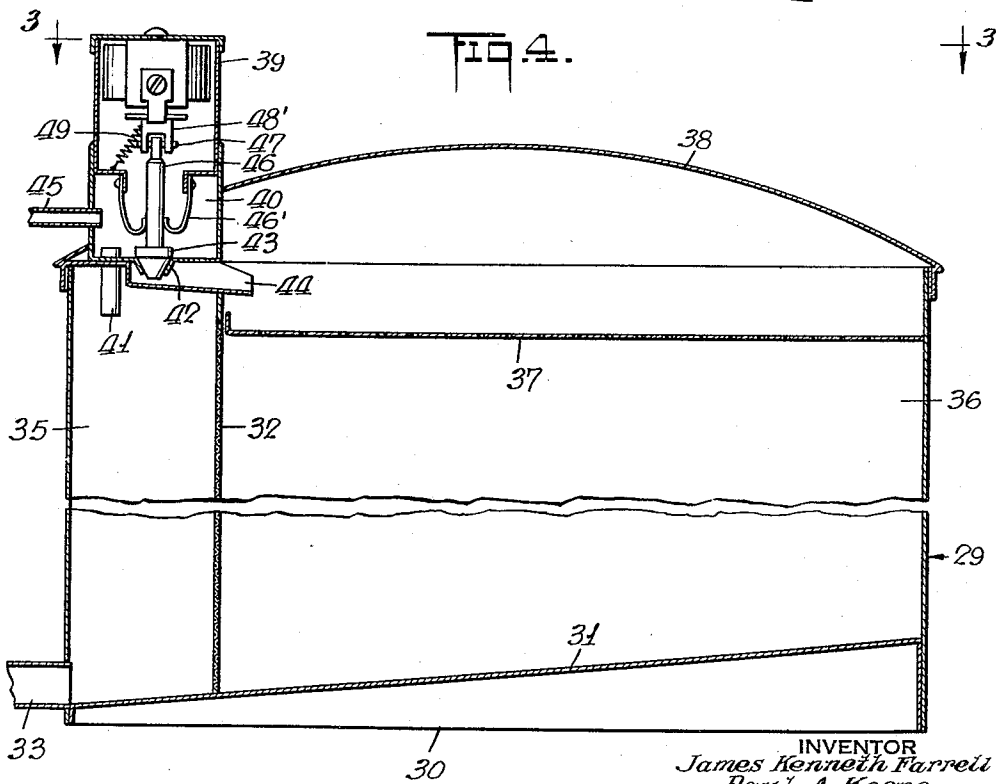
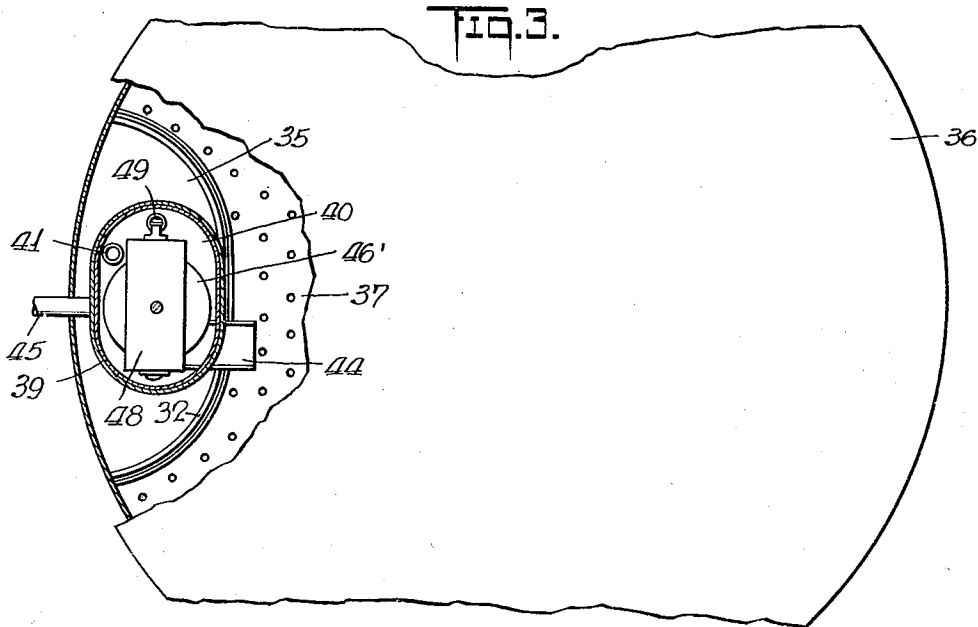
Nov. 27, 1951

J. K. FARRELL ET AL
CONCENTRATION CONTROL SYSTEM

2,576,253

Filed March 11, 1946

2 SHEETS—SHEET 2



INVENTOR
James Kenneth Farrell
Paul A. Keene
BY
Benjamin Sweedler
ATTORNEY

UNITED STATES PATENT OFFICE

2,576,253

CONCENTRATION CONTROL SYSTEM

James K. Farrell and Paul A. Keene, Syracuse,
N. Y., assignors to Allied Chemical & Dye Cor-
poration, a corporation of New York

Application March 11, 1946, Serial No. 653,475

5 Claims. (Cl. 137-78)

1

This invention relates to a detergent dispenser, and more particularly to a detergent dispenser for washing machines such as dish or can washing machines.

One type of dispenser heretofore used for can and dish washing machines has required the compressing of the detergents into hard pellets or tablets which were placed in the dispenser, and water then dripped slowly thereover, the rate of water feed being adjusted to supply the normal demand for the detergent. Other types involved the formation of solutions of the detergent and the addition of such solution to the wash liquid by operation of a valve actuated by movement of the cans or trays of dishes, or the addition of such solution by allowing it to flow by gravity from a tank to the body of wash liquid. Still another type of dispenser involved the disposition of the solid detergent in a perforated container over which a stream of water continually flows, the drip from this container flowing into the body of wash solution. These dispensers have generally been unsuccessful for a number of reasons, among which may be mentioned:

(1) The rate at which detergent is consumed in the operation of the washing machines varies, widely in some cases, during the course of normal operation; hence, all dispensers which operate on a fixed rate of addition are unsatisfactory because they result in the concentration of the detergent in the wash solution varying widely. For best results the concentration of detergent in the wash solution should be maintained within fairly narrow limits; concentrations below the predetermined limit produce inefficient washing, and concentrations above this limit result in unnecessarily large losses of detergents;

(2) When solutions are added from a tank, the rate of addition constantly changes due to the change in head or level of solution in the tank; and

(3) Crystallization of detergent in the pipe lines through which the solutions flow, with consequent plugging thereof.

Among the objects of this invention is to provide a dispenser for dispensing detergent solution to a washer, which dispenser overcomes the objections hereinabove noted; is simple in construction and hence relatively inexpensive; involves few moving parts so that the maintenance cost is small; can readily be installed upon any can or dish washer by an ordinary mechanic, without special tools, in a very short time; is so designed that plugging of the discharge conduit

2

or pipe lines by crystallization of detergent cannot take place in operation; and is unusually efficient, particularly in that it maintains the concentration of the body of wash solution in the washer within fairly narrow limits. Other objects and advantages of this invention will be apparent from the following detailed description thereof.

In the preferred embodiment illustrated on the drawings, the invention is shown incorporated in a dish washing machine and the present description will be confined to the present illustrated embodiment of the invention. It will be understood, however, that the novel features and improvements are susceptible to other applications such, for example, as can washing machines or other machines in which it is desired to maintain within narrow limits the concentration of a solution which tends to foam in use. Hence, the scope of this invention is not confined to the embodiment herein described.

In the accompanying drawings,

Fig. 1 is a diagrammatic vertical section, partly in elevation, illustrating a conventional type of dish washing machine with which the dispenser of this invention may be used, the dispenser being shown diagrammatically, and one possible location of the dispenser relative to the washer being depicted;

Fig. 2 is a wiring diagram showing a bridge-type of electrical control which may be used to control the operation of the dispenser embodying this invention;

Fig. 3 is a plan view partly broken away to show the interior structure of a dispenser embodying this invention; and

Fig. 4 is a vertical section partly in elevation, which section is broken away to enable showing the parts on a somewhat larger scale than would otherwise be possible, of a dispenser embodying this invention.

Referring to Fig. 1, the dish washing machine comprises a housing 10 in which racks of dishes 11 are placed on perforated supports 12. Top and bottom wash sprays 13, 14 are arranged to be supplied with wash solution under pressure through branch pipes 15, 16 from a motor driven pump 17, the suction intake 18 of which is in communication with a body of detergent solution 19 disposed in a tank 20 positioned near the bottom of the washing machine. Hot rinse water is supplied from a pipe 21 having branches 22, 23 extending to the top and bottom rinse sprays 24, 25. It will be understood that the washer shown in the drawing represents one

well-known type of washer and the present invention may be applied not only to this washer but to other types also.

Desirably the detergent solution may be a caustic soda, soda ash, modified soda or other alkaline solution, containing an organic detergent such, for example, as that sold under the trade-mark "Nacconol," (salts of alkyl benzene sulfonates, the alkyl group of which has an average carbon content of from 12 to 18 carbon atoms), or that sold under the trade-mark "Nytron," (organic nitrosation-sulfitation products disclosed in United States Patent No. 2,265,993 granted December 16, 1941) or other solutions, the conductivities of which vary with the concentrations of the solute, solutions with higher concentrations having higher conductivities.

In the operation of the dish washing machine, the dishes 11 are washed by operating pump 17 for a predetermined period of time, and then this pump is stopped and the dishes are rinsed by supplying relatively hot rinse water from the sprays 24, 25. Each rack of rinsed dishes, after rinsing, is removed and replaced by another rack of dishes to be washed, and the cycle of operation repeated. Rinse water from each cycle of operation dilutes the body of solution 19 and causes some of the latter to flow through the overflow pipe 26, the top of which is disposed at such elevation within tank 20 as to maintain the solution therein at the desired level. Thus the concentration of detergent in the body of solution 19 is progressively reduced by the reaction of the detergent with food and other material on the dishes, by the dilution of the solution with the rinse water and due to the overflow through pipe 26.

Dispenser 27 for supplying detergent solution to the washer may be mounted on a bracket support 28 fastened to the side of the washer. This dispenser 27 is desirably in the form of a cylindrical container 29, having a base 30. A plate 31 slopes downwardly from one side of the container, is disposed just above the base 30 and extends completely across the container 29. A discharge outlet 33 leads from the dispenser into a discharge conduit 34 which in turn leads into the washer. A concavo convex vertically extending member 32, the body portion thereof desirably being a 30-mesh screen, has its ends welded or otherwise fastened to the inner walls of container 29. Member 32 extends from near the top of container 29 to the plate 31. Thus there is produced a channel 35 substantially semi-circular in cross-section, extending vertically along an inner sidewall of container 29, and occupying a minor portion of the volume thereof, and a compartment 36 occupying a major portion of the volume of container 29, which compartment receives solid detergent to be dispensed. A perforated distributor plate 37 is disposed across the top of compartment 36. A removable cover 38 is provided for the container 29 completely enclosing the space above distributor plate 37, preventing steam and moisture from leaving the container when the cover 38 is in place.

A solenoid housing 39 is disposed above water reservoir 40 which extends through cover 38. Water reservoir 40 has in the base thereof an overflow pipe 41 through which the reservoir communicates with channel 35. The base of reservoir 40 is also provided with a valve opening or seat 42, flow through which is controlled by valve plug 43. Opening 42 communicates with

a spout 44, the discharge outlet of which is disposed above distributor plate 37. Water, preferably hot water at a temperature of 100° F., is supplied to reservoir 40 through water inlet line 45 which may be a branch line from the main rinse line 21. Valve plug 43 is fastened to one end of valve stem 46, the other end of which is secured by a valve hinge pin 47 to the armature 48'. Stem 46 passes through a flexible sleeve 46' which is fastened to the base wall of housing 39 and is secured to stem 46, thereby preventing moisture from entering the solenoid housing 39.

On activation, the solenoid armature 48' is raised, pulling the valve plug 43 from its seat against the action of a spring 49. Water already present in reservoir 40, along with fresh water from line 45, passes through opening 42 to the spout 44, and thence to distributor plate 37 where it passes over or through the detergent in the compartment 36. The resulting concentrated detergent solution flows through channel 35, discharge outlet 33 and conduit 34 into the washer, where it mixes with the body of wash solution 19. As the quantity of water required to dispense the required amount of detergent is small, of the order of 8 to 10 gallons per hour, the dilution of the wash solution 19 by the minor portion of this water flowing through overflow pipe 41 and channel 35 and not passing in contact with the solid detergent is negligible.

The controller for effecting operation of the dispenser, as shown in Fig. 2, involves a control circuit 50 and a main circuit 51. The latter is energized from an alternating current source which is connected to the input terminals of the primary 52 of a multi-coil transformer 53. Disposed in the main circuit 51 is the operating solenoid 48, a switch 54 which is normally open but which is adapted to be closed, as hereinafter described, by the control circuit to cause current to flow through the main circuit to energize solenoid 48, and a signal lamp 55 shunted across the solenoid 48 and showing when current is flowing in the main circuit, and the dispenser is, therefore, operative to dispense detergent solution to the washer.

The control circuit comprises variable resistors 56, 57 in a Wheatstone bridge arrangement to one arm 58 of which are connected conductors 59, 60 leading to a control electrode 61. This electrode may be of any well-known type for measuring conductivities of solutions, and desirably consists of a pair of closely spaced platinized rods in a common casing. It is disposed in the washer within the body of solution 19 as shown in Fig. 1. If it is desired to use a controller which operates to prevent flow of detergent to the washer when suds or foam rise to a predetermined point above the normal level of the body of wash solution, an auxiliary electrode 62 is disposed in parallel with the control electrode 61; a controller involving such auxiliary electrode is the subject of co-pending application Serial No. 653,675 filed the same date as this application by Paul A. Keene, one of the joint inventors of the present invention and which has matured into Patent 2,490,634, dated December 6, 1949. This auxiliary electrode, as disclosed in said copending application, may consist of two metallic plates 63, 64, say each approximately 2" long and 2½" wide, closely spaced, say one-half inch apart, so that the electrode has a lower resistance when foam fills the space between the plates than the resistance of electrode 61 when submerged in a solution of the

desired concentration. The presence of foam between plates 63, 64 in effect short circuits the control electrode 61, i. e. materially decreases the resistance in the arm 58 of the Wheatstone bridge. As shown in Fig. 1, electrode 62 is located at a point above the normal level of body of solution 19 where the foam will reach it quickly. Consequently, in operation the dispensing of detergent solution will be stopped when foam reaches the electrode 62, which will take place before enough detergent is added to cause the solution to overflow the machine. As soon as the foam dies down due, for example, to the presence of soil in the wash water, the electrode 62 is left free and clear, becoming an infinite resistance, and consequently exerting no further effect on the control electrode 61.

Secondary coils 65, 68 of transformer 53 are connected by conductors with points 66, 67 of the Wheatstone bridge. Secondary coil 68 supplies current to the filaments 69, 70 of electronic tubes 71, 72. Tube 71 desirably is of a conventional triode or pliotron, and tube 72 desirably is of a type to produce a higher emission of electrons, such as the well known Thyratron. Tube 71, as conventional, comprises a cathode 72', a grid 73 and an anode 74. The tube 72 comprises a cathode 75, a grid 76, a screen electrode 77 and an anode 78.

Secondary coil 79 of the transformer 53 is in circuit with points 80, 81 of the Wheatstone bridge. Located in this circuit is the grid circuit of the tube 71 as shown in Fig. 2. The output anode circuit of the tube 71 includes a resistance 74' across which the input circuit of the tube 72 is shunted. In the output anode circuit of tube 72 is disposed relay 82 for operating switch 54 in the main circuit 51. Resistance 74' is such that when the current flowing through the output anode circuit of tube 71 reaches a certain value, the potential drop across the resistance 74' causes the tube 72 to pass sufficient current through its anode circuit to operate the relay 82, to close switch 54.

The control circuit hereinabove described, except for the electrodes 61, 62 and the lead wires connected thereto, and the parts of the main circuit except for the solenoid 48 and signal lamp 55, are all preferably disposed in a control box 83 which may be positioned on support 28 next to dispenser 27. The control is, therefore, readily applicable to existing washers not equipped with controls, particularly in cases where it is desired to supply such washers with dispensers of the type herein described. When modifying a washer to embody this invention, it is only necessary to install the dispenser and control box on the side of the washer, connect the discharge of the dispenser with the washer, and place the electrodes 61, 64 within the washer in the relative positions shown.

In operation, resistance 57 is set at a point previously determined by calibration, which point is dependent upon the desired concentration of the detergent used. Resistance 56 is likewise set at a point previously determined by calibration, which point is dependent upon the temperature of the body of wash solution 19. Since the grid 73 and plate 74 of tube 71 are approximately 180° out of phase, an increase in the resistance of the solution, due to a decrease in concentration, causes a gradual increase in the instantaneous voltages between the grid 73 and cathode 72 which in turn causes a decrease in the current flow through the resistor 74'. The con-

trol voltage developed across resistor 74', applied across the control grid 76 and cathode 75 of tube 72, is sufficient to prevent tube 72 from firing before the concentration of the solution starts to decrease. When the decrease in voltage drop across resistor 74', resulting from the increase in resistance across the electrode 61, reaches a critical value, depending upon the tube employed, the control grid 76 loses control and the tube 72 fires which causes current to flow through the relay 82 which effects closing of the switch 54 causing current to flow through the solenoid 48. The armature 48' of the solenoid 48 is thus raised against the action of spring 49, to move plug 43 from its seat 42. Water in reservoir 40 along with that supplied thereto through line 45 flows through opening 42 and spout 44, to the distributor plate 37, and flows in contact with the detergent, the resultant solution passing through passageway 35 into and through passageway 34, into the washer where it collects in tank 20.

As the concentration of the solution in tank 20 increases, the resistance across the electrode 61 decreases, and a gradual decrease in the instantaneous voltages between the grid 73 and cathode 72' of tube 71 occurs, which causes an increase in the current flowing through resistor 74'. The resultant increase in voltage appearing across the control grid 76 and cathode 75 of tube 72 finally reaches a point where the control grid 76 resumes control and extinguishes the tube, stopping the current flow through the relay 82, deenergizing it, and opening the switch 54, whereupon, under the influence of spring 49, valve stem 46 returns valve plug 43 to its seat 42. Water thereafter supplied through line 45 flows from reservoir 40 through overflow pipe 41 into and through passage 35 and not to the body of detergent maintained in compartment 36 of the dispenser 27.

If the controller has an auxiliary electrode as disclosed in said co-pending application of Paul A. Keene, which type of controller should be used when using detergents which tend to foam, when the foam rises to a point such that it enters between the plates 63, 64 of the auxiliary electrode 62, the resistance in the arm 58 of the Wheatstone bridge is thereby reduced so that, as hereinabove described, valve plug 43 is seated in seat 42 and the water flows through channel 35 and not through the body of detergent. Hence, as long as foam is present at a level such that it contacts the auxiliary electrode 62, no detergent is fed to the washer. When the foam dies down, the auxiliary electrode 62 is left free and clear, exerting no further effect on the control electrode 61 and permitting this electrode to maintain the concentration of the detergent in the washer within the desired narrow limits.

It will be noted the dispenser of this invention uses solid detergent in compartment 36, as obtained from the package or barrel, thus avoiding the necessity of preparing solutions or special physical forms of detergents such as pellets or tablets required in the operation of some dispensers. It will be further noted the dispenser is simple in design and can easily be fabricated; hence, it is of relatively low cost. The only mechanical movements involved in the dispenser are the movement of the valve plug 43 from a position where the water is discharged so that it flows in contact with the solid detergent in compartment 36 to a position where the water flows directly to and through channel 35; hence

the maintenance cost of the dispenser is very small. Since the supply of detergent is controlled by small changes in the concentration of the body of wash solution, the concentration is maintained within narrow limits, determined to be most effective for producing efficient washing. This results in a substantial saving of detergent since feeding thereof does not take place unless there is a demand for the detergent. In other words, if the demand for the detergent falls off, the controller operates to interrupt detergent feed; if, on the other hand, the demand for the detergent increases, then the controller operates to increase the time interval during which detergent is fed to the washer, to maintain the desired concentration.

Due to the flow of water, preferably at a temperature of about 100° F. or higher through the discharge conduit 34 when there is no demand for detergent, crystallization of detergent within the discharge conduit is avoided since this water washes out any residual detergent solution in the discharge conduit 34 leading to the washer, thus preventing this line from becoming plugged by crystallization.

In the operation of the dispenser, it has been found, the water fed to the distributor plate 37 seldom penetrates the body of solid detergent therebelow to a depth exceeding $\frac{1}{2}$ " to $\frac{3}{4}$ ". Accordingly, recrystallization of detergent within the body of solid detergent in the dispenser is limited to this depth of the body of solid detergent. Since the recrystallized detergent is in all cases more difficultly soluble than the original solid detergent, it will be appreciated it is highly advantageous to limit the formation of recrystallized detergent to such small depth; if the recrystallized detergent were to extend all of the way to the base of the dispenser, this would materially reduce the efficiency of the operation of the dispenser.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a washer, receiving means for a body of detergent solution, a dispenser for supplying detergent solution to said receiving means to maintain the concentration of the body of detergent solution therein within narrow limits, said dispenser comprising in combination, a container for solid detergent, a passageway communicating with said receiving means, a sidewall of said container having a portion thereof provided with a screen to place said container in communication with said passageway, a water reservoir having an overflow pipe leading into said passageway and a valve controlled outlet in communication with said container, a water pipe having its discharge outlet disposed to supply water to said water reservoir, means for operating said valve to cause water supplied to said reservoir to flow therefrom through said container in contact with the solid detergent, the resultant solution flowing through said screen into said passageway and thence into said receiving means, means for closing said valve so that the water flows from said reservoir through said overflow pipe directly to said passageway and flows there-through into said receiving means; and a con-

troller responsive to changes in the concentration of said body of solution to effect the operation of said valve to cause the water to flow in contact with said solid detergent and the resultant solution to flow into said receiving means when the concentration of said body of solution falls below a predetermined value, and to cause said water to flow through said overflow pipe, into and through said passageway, and thence into said receiving means when the concentration of said body of solution is restored to said predetermined value.

2. A dispenser for detergent to maintain the concentration of a body of detergent solution within narrow limits, comprising, in combination, receiving means for said body of detergent solution, a container for solid detergent, a passageway communicating with said receiving means, a side wall of said container having a portion thereof provided with a screen to place said container in communication with said passageway, means for supplying water to said container whereby the water dissolves a portion of said solid detergent and the resultant solution flows through said screen into said passageway and thence into said receiving means for said body of detergent solution, means for diverting said water supply so that the water is fed directly to said passageway and flows therethrough into said receiving means, the rate of supply of water to said passageway being such that the volume of water passed directly into said passageway and thence into said receiving means has no appreciable effect on the concentration of said body of detergent solution in said receiving means, and a controller responsive to changes in the concentration of said body of detergent solution to affect the operation of said water supply to cause water to flow in contact with said solid detergent when the concentration of said body of detergent solution falls below a predetermined value and to cause the water to flow directly to and through said passageway into said receiving means for said body of detergent solution when the concentration of said body of detergent solution is restored to said predetermined value.

3. A dispenser for detergent to maintain the concentration of a body of detergent solution within narrow limits, comprising, in combination, receiving means for said body of detergent solution, a container having a compartment for solid detergent, a passageway contiguous to said compartment and separated from said compartment by a perforated wall thereby placing said compartment in communication with said passageway through said perforations, a discharge conduit leading from said passageway to said receiving means for said body of detergent solution, means for supplying a stream of liquid to the body of solid detergent in said compartment, the liquid flowing in contact with said solid detergent and the resultant solution flowing into and through said passageway and said discharge conduit and thence into said receiving means for said body of detergent solution, means for diverting the flow of said stream of liquid to cause said liquid to flow through said passageway without flowing in contact with said solid detergent in said compartment, the liquid flowing from said passageway through said discharge conduit into said receiving means for said body of detergent solution and thus flushing out and removing from said passageway and said discharge conduit any solid detergent deposited therein, and a con-

troller responsive to changes in the concentration of said body of detergent solution to affect the operation of said liquid supply to cause the liquid to flow in contact with said solid detergent when the concentration of said body of detergent solution falls below a predetermined value and to cause the liquid to flow directly to and through said passageway and discharge conduit into said receiving means for said body of detergent solution when the concentration of said body of detergent solution is restored to said predetermined value.

4. A dispenser for detergent, comprising, in combination, a cylindrical container, an arcuate perforated wall disposed in said container to separate the container into a compartment and a contiguous passageway, said compartment occupying a major portion of the volume of said container and adapted to receive solid detergent, receiving means for a body of detergent solution, a discharge conduit leading from said passageway to said receiving means, means positioned above said passageway for supplying water to the top surface of the body of solid detergent, said water flowing in contact with said solid detergent and the resultant solution flowing into and through said passageway and discharge conduit into said receiving means for said body of detergent solution, means for diverting the water flow to cause it to flow through said passageway and said discharge conduit into said receiving means without flowing in contact with the solid detergent in said compartment, whereby said water flushes out and removes from said passageway and said discharge conduit any solid detergent deposited therein, and a controller responsive to changes in the concentration of said body of detergent solution to affect operation of said water supply to cause the water to flow in contact with said solid detergent when the concentration of said body of detergent solution falls below a predetermined value and to cause the water to flow directly to and through said passageway and said discharge conduit into said receiving means for said body of detergent solution when the concentration of said body of detergent solution is restored to said predetermined value.

5. A dispenser for detergent to maintain the concentration of a body of detergent solution within narrow limits, comprising, in combination, receiving means for said body of detergent solution, means for supplying water to said dispenser, a container for solid detergent, a passageway communicating with said receiving means, a side wall of said container having a portion thereof

provided with a screen to place said container in communication with said passageway, water conduit means for passage of water from said water supply means directly to said passageway and to said container for solid detergent, said water conduit means which supplies water directly to said passageway supplying said water in amount such that the volume of water delivered to said receiving means has no appreciable effect on the concentration of said body of detergent solution in said receiving means, means for controlling passage of water through said water conduit means, whereby water supplied to said container for detergent dissolves a portion of said solid detergent and the resultant solution flows through said screen into said passageway and thence into said receiving means for said body of detergent solution and water supplied from said water supply means directly to said passageway flows therethrough and into said receiving means, and a controller responsive to changes in the concentration of said body of detergent solution and effecting the operation of said means for controlling the passage of water through that portion of said water conduit means supplying water to said container for detergent to cause water to flow in contact with said detergent when the concentration of said body of detergent solution falls below a predetermined value and to discontinue this flow of water in contact with the solid detergent so the water from said water supply flows directly to and through said passageway and into said receiving means for said body of detergent solution when the concentration of said body of detergent solution is restored to said predetermined value.

JAMES K. FARRELL.
PAUL A. KEENE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,799,051	Le Baron	Mar. 31, 1931
1,928,128	Guth	Sept. 26, 1933
1,945,351	Grafton	Jan. 30, 1934
1,951,426	Littler	Mar. 20, 1934
1,991,388	Healy	Feb. 19, 1935
1,995,318	Merrill	Mar. 26, 1935
2,278,769	Chayie	Apr. 7, 1942
2,370,609	Wilson et al.	Feb. 27, 1945
2,377,363	Noble	June 5, 1945
2,392,026	Cram	Jan. 1, 1946