

March 14, 1961

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2,974,516

TREATING AGENT DISPENSER SYSTEM FOR WASHING MACHINES

Filed July 27, 1959

4 Sheets-Sheet 1

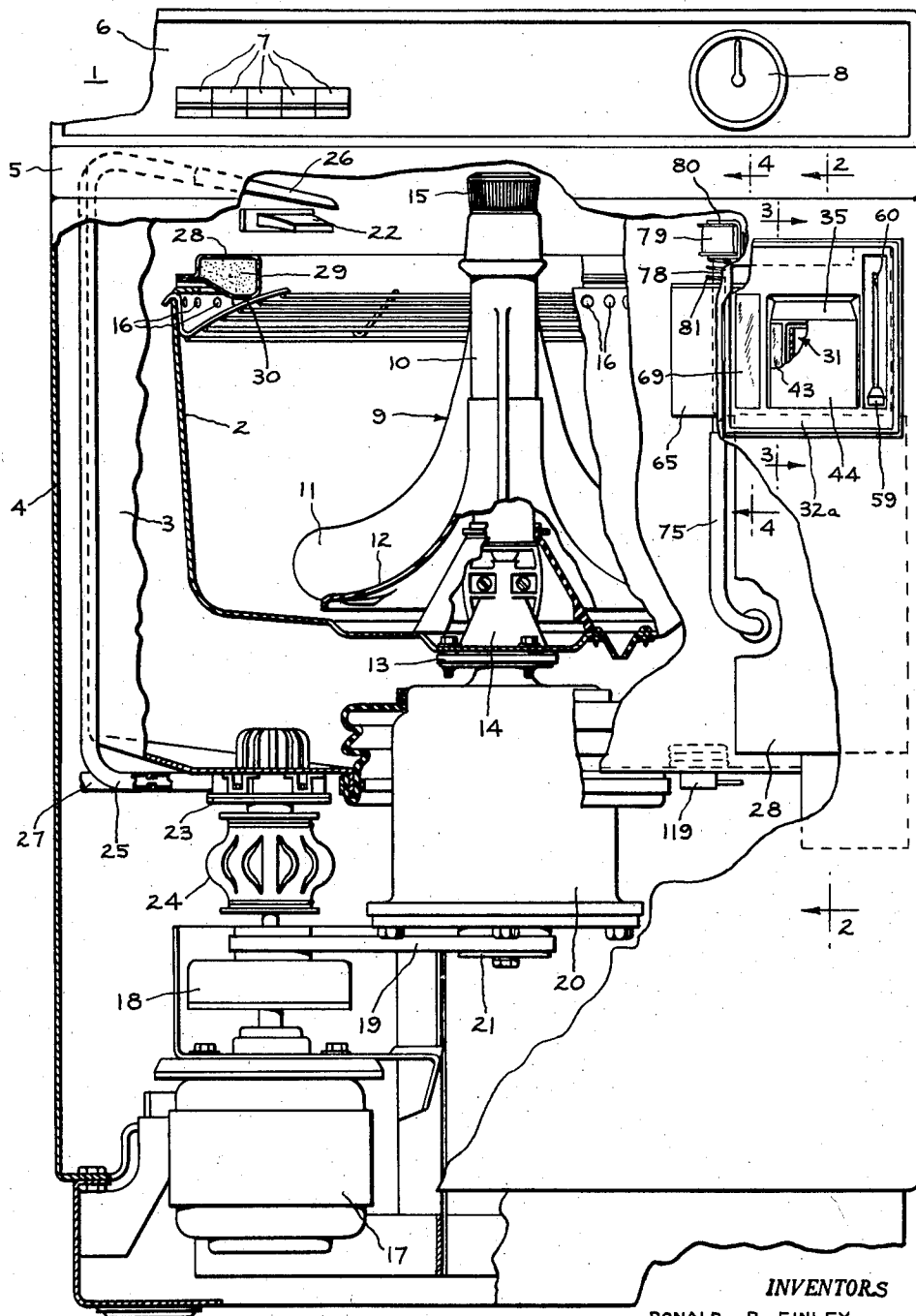


FIG. 1

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4 Sheets-Sheet 2

FIG. 2

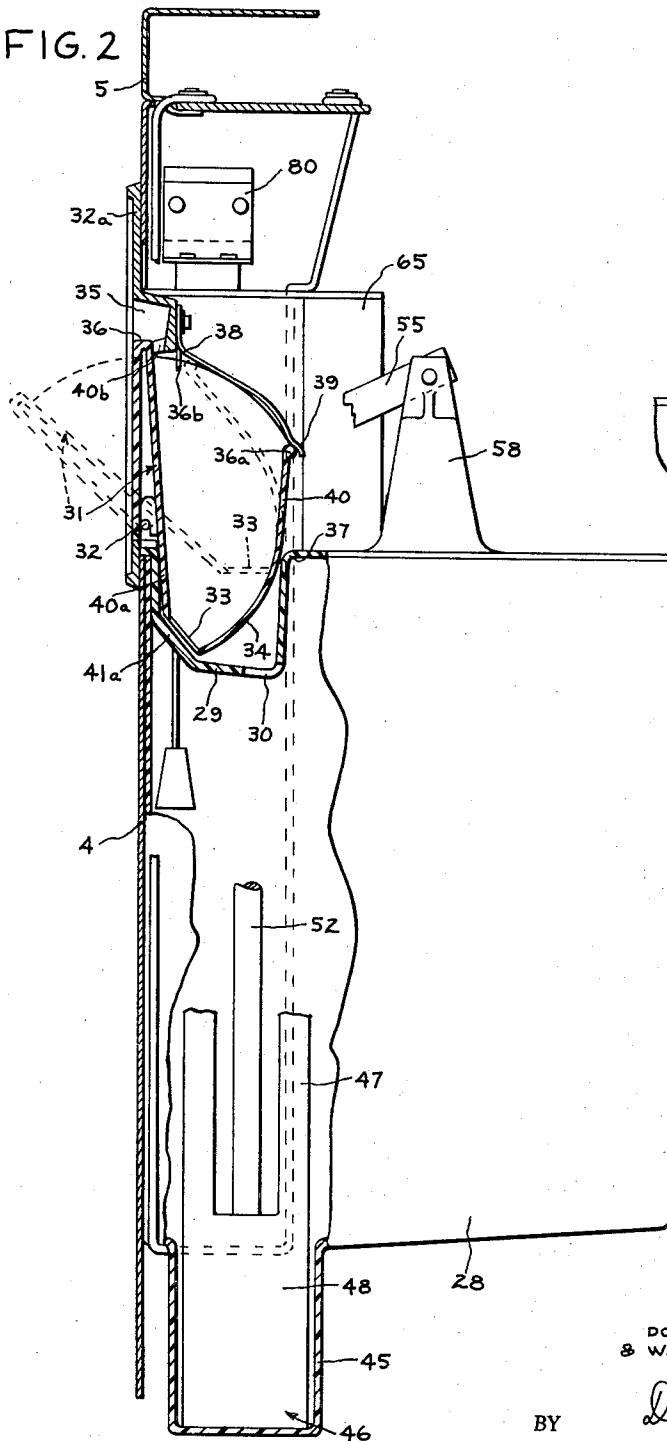


FIG. 3

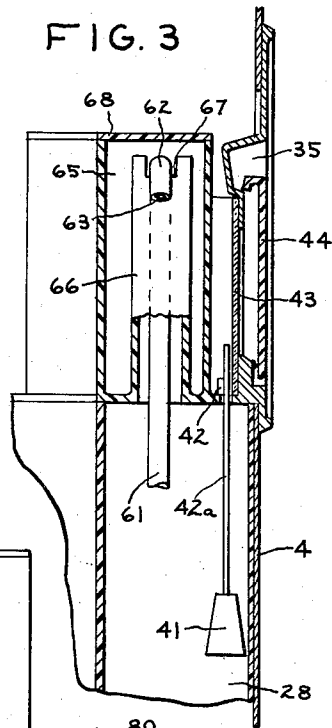
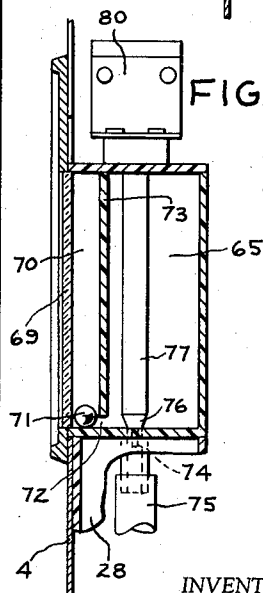


FIG. 4



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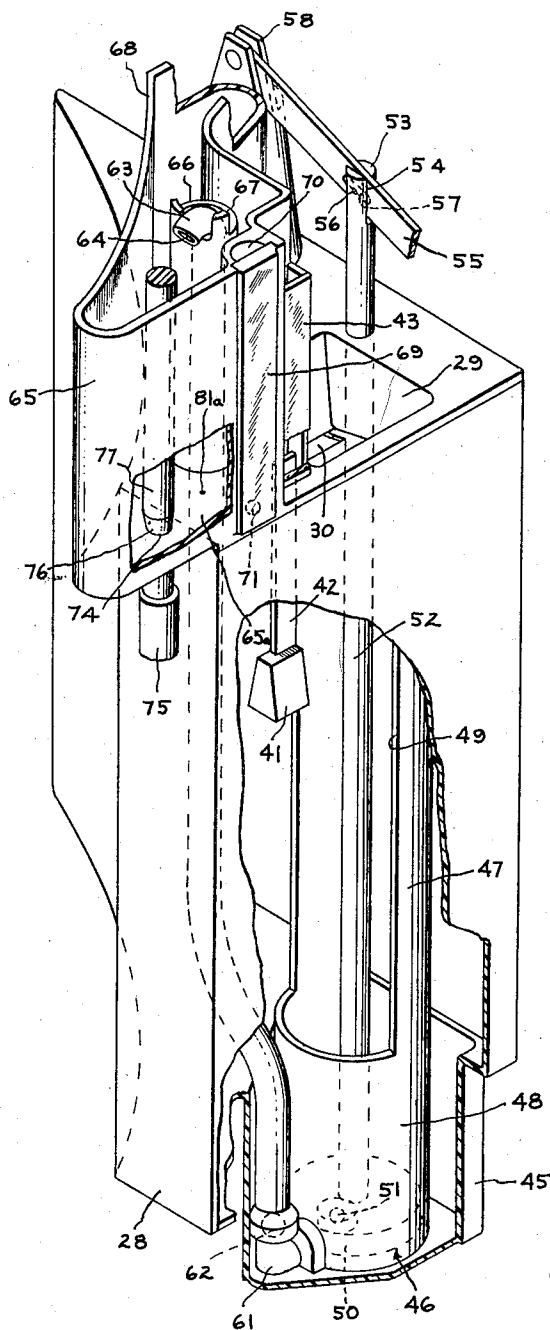
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TREATING AGENT DISPENSER SYSTEM FOR WASHING MACHINES

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4 Sheets-Sheet 3

FIG. 5



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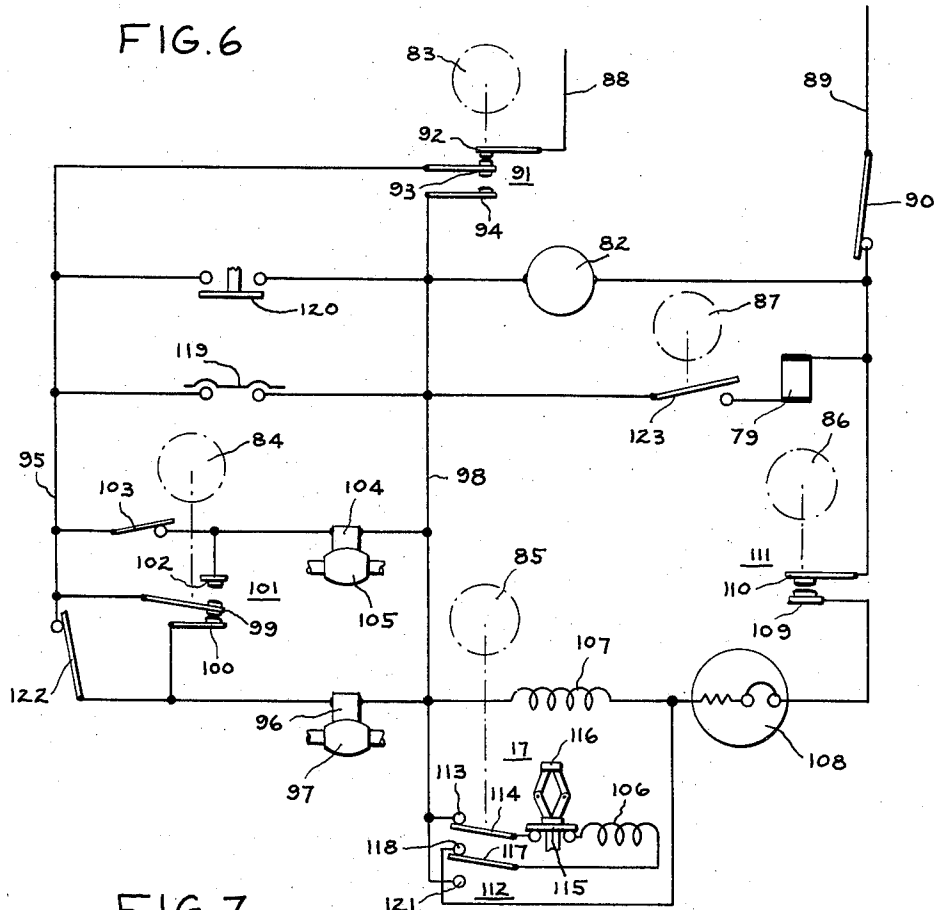
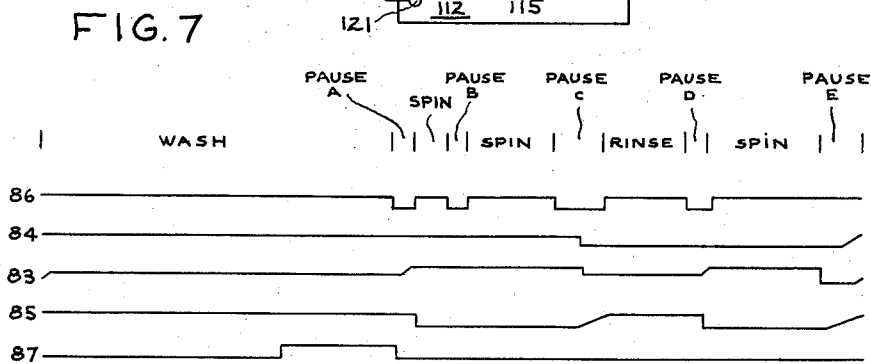
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TREATING AGENT DISPENSER SYSTEM FOR WASHING MACHINES

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2,974,516

TREATING AGENT DISPENSER SYSTEM FOR
WASHING MACHINES

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Filed July 27, 1959, Ser. No. 829,685

9 Claims. (Cl. 68—207)

This invention relates to automatic clothes washing machines, and more particularly to such machines where it is intended that a treating agent may be automatically introduced into the washing liquid at the proper time in the washing cycle.

Automatic clothes washing machines customarily proceed through a sequence of operations in order to wash, rinse and dry the clothes. The sequence ordinarily includes a washing operation, a rinsing operation in which the clothes are rinsed in clean water, and a final extraction operation in which the rinse water is removed from the clothes. Depending on the type of machine, the action within any given operation may be slightly different; for example, many machines include an initial extraction operation right after the washing operation in order to effect more complete removal of the washing liquid, and other machines include a spray rinse during the rinsing operation in addition to the customary submersion rinse. But the general sequence of washing and rinsing, with appropriate liquid extracting steps, is used in almost all automatic washing machines.

As automatic washing machines have become more perfected, they have automatically performed an increasing number of functions which previously had to be performed manually. For instance, one feature which may be provided is a suitable dispenser so that the operator may introduce a measured amount of detergent or soap prior to the start of the operation. In the same manner, appropriate water softeners and fabric softeners may be automatically added to the rinse water in some machines even though put in the machine prior to the start of the cycle.

In addition to detergents, soaps, and softening agents, it will readily occur that a suitable liquid bleach or bleaching agent is among the more important additives required by many operators for a large part of their washing operations. However, to date relatively few machines with liquid bleach dispensers have been provided commercially due to the difficulties created by the highly corrosive nature of most of the commercially available bleaches provided for clothes washing purposes. Also, another feature of most liquid bleaches is that, when introduced into the washing liquid at the beginning of a cycle (i.e., at about the same time as the detergent), the bleach has a tendency to counteract the beneficial whitening effect which is embodied in many modern detergents in the form of a fluorescent dye, and consequently the full whitening effect of the detergent is not achieved. In fact it has been determined that if the bleach is introduced toward the end of the washing operation rather than at the beginning thereof, the detergent by then has completed its whitening action on the clothes and the bleach is then free to treat the clothes without interfering with the brightening action of the detergent. The result of this approach has been shown in the laboratory to be visibly better than where

2

bleach and detergent are both introduced at the beginning of a cycle.

Because of this latter feature of bleach, the most desirable structure is one wherein the bleach, although introduced into the machine prior to the start of a washing cycle, is held in readiness throughout a substantial part of a washing operation in some container external to the basket in which the clothes are being washed. Also, because of the corrosive nature of the bleach, it is important that the receptacles and conduits through which the bleach is provided within the machine and in which it must remain until introduced into the clothes basket be so designed that any leakage of the bleach into the machine where it can corrode the metal parts is avoided.

Another aspect of liquid bleach well known to most owners of domestic automatic washing machines is the substantial price differential which exists between the purchase of bleach in quantities of a gallon and the purchase of bleach in smaller quantities such as a quart. In most cases, the price of a gallon is no more than that of three separate quarts. However, the difficulty of handling a gallon jug each time the operator wishes to introduce bleach into a machine has resulted in the purchase by many operators of quart containers of bleach rather than gallon containers despite the savings to be effected by purchasing the larger size. Accordingly, it becomes highly desirable that in any automatic bleach dispensing system the machine will not only be able to dispense the measured quantity into each washing load where bleach is desired, but that means also be provided in the machine to store a full gallon of bleach so that jugs or other heavy glass containers of bleach need not be handled by the operator each time a bleach washing operation is desired.

In order to permit filling of a clothes treating agent dispenser before the machine is set in operation and to provide for introduction of the agent automatically into the clothes basket at the appropriate time during the washing operation, there is proposed, in application Serial Number 829,684 filed concurrently herewith by Philip H. Houser and Winston L. Shelton and assigned to General Electric Company, owner of the present invention, an improved construction which effects the desired purposes. The improved construction set forth in the aforesaid Houser et al. application also permits the operator to avoid handling of the treating agent, such as bleach, altogether except for an occasional filling of the storage container which constitutes an integral part of the invention of the Houser et al. application. A further feature of that application is an inter-relationship of the different components of the system which precludes the possibility of damaging leaks occurring in the earlier made system.

Our invention constitutes an improvement on the invention claimed in the Houser et al. application, enhancing the certainty that no dispensing system leaks can occur which may be harmful to the operating components of the washing machine in which it is incorporated. In addition, our improvement takes into account the fact that exposure to the atmosphere decreases the effectiveness of certain treating agents, such as bleach, to an extent which increases as the time of storage increases, and provides a specific structure for minimizing the exposure of the bleach or other treating agent to the atmosphere. A further feature of our improved structure is the provision of suitable indicating means to show both when the storage container is approaching a full condition and to show the amount of liquid in the dispensing container which will be injected into the washing liquid, together with a suitable arrangement for preventing confusion

3

between the two indicators by concealing the storage container indicator except when the storage container is being filled.

Yet a further object of our invention is to provide an improved specific construction whereby the overflow arrangement disclosed in the Houser et al. application for preventing excessive filling of the dispensing container, and which returns excess treating agent from the dispensing container to the storage container, also constitutes a guiding passage for the conduit carrying liquid from the storage container to the dispensing container.

Another object of our invention is to incorporate the dispensing arrangement of the Houser et al. application in the washing machine in such a way that dilution of the treating agent prior to its contact with the clothes is insured.

Yet a further object of the invention is to provide a structure which precludes the storing of the treating agent in the dispensing container over a prolonged period in the event that the treating agent has been pumped into the dispensing container from the storage container but the operator for some reason has decided not to perform a washing operation right away.

In one aspect thereof, our improvement, provided in conjunction with the basic structure as set forth in the Houser et al. application, includes a clothes washing machine with the usual receptacle intended to receive the washing liquid. In the machine, there is provided a storage container for a liquid clothes treating agent, such as bleach, and a dispensing container for the agent which is positioned higher than the storage container. Pumping means are positioned within the storage container, with a conduit which connects the outlet of the pumping means to the dispensing container. A second conduit connects the dispensing container to the liquid receptacle and is controlled by appropriate means, such as a valve, to prevent flow of the agent from the dispensing container to the receptacle until the appropriate time.

As a first improved feature, we provide a common partition member which forms at least part of the bottom of the dispensing container and at least part of the top of the storage container, with the first conduit means extending through this partition member and thus being entirely disposed within the dispensing and storage containers.

As a second feature of our invention, we provide a passage extending through the common partition member and having its upper end communicating with the dispensing container substantially above the bottom of the dispensing container, so that when the liquid level in the dispensing container reaches the upper end of the passage any further liquid pumped from the storage container up to the dispensing container will flow back down through the passage. In addition, we preferably arrange this passage so that the first conduit means extends through the passage; this permits the single major opening through the partition to be used both for the passage and the conduit member.

As yet another feature of our invention we provide the structure of the Houser et al. application incorporated in a washing machine which includes both a basket member for receiving clothes to be washed, an outer liquid receptacle surrounding the basket member and receiving the overflow therefrom, and means for recirculating liquid from the liquid receptacle back into the basket. In accordance with our invention, the treating agent when released from the dispensing container flows into the liquid receptacle so that it mixes with the washing liquid therein prior to contact with the clothes and is then recirculated in a diluted condition into the basket member wherein the clothes are contained.

Yet another feature of our invention is the provision of two separate indicating means, one connected to the dispensing container and always visible from the exterior of the cabinet to indicate the quantity of liquid in the

4

dispensing container, and a second indicating means connected with the storage container and visible from the exterior of the cabinet only when the structure arranged to provide for filling of the storage container is in fill position.

In accordance with yet another feature of our invention, the partition member mentioned above has a small opening therein whereby liquid contained in the dispensing container drains slowly back into the storage container. The draining of the treating agent is so slow that if a washing operation is provided relatively soon after the pumping of the agent into the dispensing container, substantially all the treating agent will pass into the washing machine. However, if a more substantial length of time elapses, all the agent drains back into the storage container.

A further feature of our invention is the provision of fill means for the storage container which automatically provides a barrier between the fill opening of the storage container and atmosphere at all times except when the fill means is in the fill position.

The features of our invention which are believed to be novel are set forth with particularity in the appended claims. The invention itself, however, both as to organization and as to method of operation, together with further objects and advantages thereof, may best be understood by reference to the following detailed description taken in conjunction with the accompanying drawings.

In the drawings,

Figure 1 is a front elevational view of a clothes washing machine including our new and improved bleach dispenser, the view being partially broken away and partially in section in order to illustrate details;

Figure 2 is an enlarged sectional view along line 2—2 in Figure 1;

Figure 3 is a sectional view along line 3—3 in Figure 1;

Figure 4 is a sectional view along line 4—4 in Figure 1;

Figure 5 is an enlarged view in perspective of the improved bleach storage and dispenser system of our invention, partly in section and partly broken away in order to illustrate details;

Figure 6 is a schematic diagram of an electrical control circuit suitable for use in the machine of Figure 1 and including suitable control means for the improved bleach dispenser of the invention, arranged in accordance with the invention; and

Figure 7 is a cam chart showing in extended form the surfaces of the various timer driven cams included in the control system of Figure 6, thereby to illustrate the sequence of operation of the switches controlled by the cams.

Referring now to Figure 1 of the drawings, I have shown therein an agitator-type washing machine 1 having a clothes basket 2 disposed within an outer imperforate tub or casing 3. Tub 3 is mounted within an appearance cabinet 4 which includes an appropriate cover (not shown) in its top surface 5 for providing access to the clothes basket. Secured to the top surface 5 is a control panel or backplasher 6 which includes appropriate manually operated levers or keys 7 for selecting a particular desired sequence of washing operations, and an indicator dial 8 for showing which stage of the sequence is in process at any given instant. At the center of basket 2 there is provided a vertical axis agitator 9 which includes a center post 10 and a plurality of radially extending vanes 11. The agitator is further provided with an outwardly and downwardly flared skirt 12 to which the vanes are joined at their lower ends.

Both the clothes basket 2 and the agitator 9 are rotatably mounted. The basket is mounted on a flange 13 of a rotatable hub 14, and the agitator is mounted on a shaft (not shown) which extends upwardly through hub 14 and center post 10. The agitator is secured to the shaft by any suitable means such as, for instance, a decorative nut

member 15. During the cycle of operation of the machine 1, the agitator is first oscillated back and forth within the basket 2 to wash the clothes therein. Then, after a predetermined period of this washing action, the basket 2 is rotated at high speed to extract centrifugally the washing liquid and discharge it into the outer tub 3 through appropriate small openings 16 provided adjacent the top of basket 2. In the usual construction the openings 16 extend in a horizontal line around the basket adjacent the top thereof. Following this extraction operation, a supply of clean liquid is introduced into the wash basket for rinsing the clothes as the agitator is again oscillated. Finally, the basket is once more rotated at high speed to extract the rinse water and discharge it into the outer tub.

The basket 2 and agitator 9 may be driven by any suitable means, as the drive means forms no part of the present invention. However, by way of example I have shown them as driven from a reversible motor 17 which drives the basket and agitator through a drive including a clutch 18 mounted on the motor shaft. Clutch 18 allows the motor to start without load and then picks up the load as it comes up to speed. A suitable belt 19 transmits power to transmission assembly 20 through pulley 21; thus, depending upon the direction of motor rotation, pulley 21 of transmission 20 is driven in opposite directions.

The transmission 20 is so arranged that it supports and drives both the agitator drive shaft and the basket mounting hub 14. When motor 17 is rotated in one direction the transmission causes the agitator 9 to oscillate within the basket 2. Conversely, when the motor 17 is driven in the opposite direction, the transmission drives the wash basket 2 and the agitator 9 together at high speed for centrifugal extraction. While the drive means forms no part of the present invention, reference is made to Patent 2,844,225 issued on July 22, 1958, to James R. Hubbard et al. and owned by the General Electric Company, assignee of the present invention. The patent discloses in detail the structural characteristics of a transmission assembly suitable for use in the illustrated machine.

In order to introduce washing and rinsing liquid into basket 2, a suitable conduit 22 is provided having an outlet opening over the basket so that water introduced into the conduit 22 flows into the basket. The water is supplied in the usual manner well known in the art, and the specific mechanical construction of the water supply will not be further described herein.

In addition to operating transmission 20 as described, motor 17 drives a pump 23 through a flexible coupling 24 which connects the motor shaft and the pump shaft. During washing and rinsing operations, pump 23 discharges into a conduit 25 which leads to a nozzle 26 positioned above basket 2 so that liquid overflowing through openings 16 may be recirculated through a suitable filter (not shown) in order to clean and filter the liquid during the operation. The system constantly circulates the washing liquid from tub 3 through conduit 25 and nozzle 26 back into basket 2 where it overflows through openings 16 into tub 3 to repeat the cycle. At the end of the washing and rinsing portions of the cycle, and in response to a reverse direction of rotation of motor 17, pump 23 discharges into a drain conduit 27 which is adapted for discharge to a stationary tub or drain line so that the pump is effective to drain tub 3. While any suitable pump may be used for draining purposes, I prefer to use the one just now described; it is described in full detail and claimed in Patent 2,883,843, issued April 28, 1959, to John Bochan and assigned to General Electric Company, owner of the present invention.

In order to help balance the basket 2 during its high speed rotation for centrifugal liquid extraction purposes, a balance ring 28, either solid or, as shown, filled with particulate material 29, is secured to the top of basket 2.

Cooperating with this balance ring and secured within several of the openings 16 of the basket 2 is a clothes retainer member 30 whose construction is more fully described in application Serial No. 790,536, filed February 2, 1959, by Philip H. Houser and Harlan F. Besse, now Patent No. 2,943,740, and assigned to General Electric Company, assignee of the present invention.

As described above it is desirable to provide a suitable means for storing and for automatically dispensing bleach at appropriate times during a cycle when bleach is desired in order to improve the appearance of the clothes being washed. In order to achieve this result we provide the following structure as illustrated in Figures 1, 2, 3, 4 and 5. Secured within cabinet 4, between the inner wall surface of the side wall of the cabinet and the outer surface of tub 3, is a storage container 28 which is made of a material suitably resistant to the corrosive action of most liquid bleaches, such as for instance, polyvinyl chloride, or acrylonitrile methylstyrene, and having a large capacity so that a large portion or all of a gallon jug (as generally provided in retail sales quantities) may be stored within container 28.

Referring now particularly to Figures 2 and 5, it will be observed that container 28 is formed with a recessed portion 29 in the top thereof, an opening 30 into the container being provided at the base of the recess. The top of container 28 may, of course, be formed as a separate part and then secured to the other parts for convenience of manufacture. The fill member 31 is pivotally mounted on pins 32 which are secured to a plate 32a, in turn fastened to the front of cabinet 4. The fill member 31 is generally cup shaped, with an opening 33 at the bottom portion 34 thereof which, in the position shown in Figure 2, fits within the recess 29 of container 28. Recess 35 is provided in plate 32a directly above the top 36 of fill member 31 so that the operator may readily pull member 31 at top 36 thereof so as to cause the fill member to pivot about pins 32 to the position shown in phantom. The pivoting movement of fill member 31 is limited because, as the member pivots, the upper back edge 36a thereof comes into engagement with a depending stop member 36b secured to the cabinet.

It will readily be observed that the fill member opening 33 is directly above recess opening 30 when the fill member is in its outwardly pivoted position. Thus, it is a simple matter to pivot the fill member to the position shown in phantom in Figure 2, and pour in a substantial amount of liquid bleach which then passes through openings 30 and 33 into the storage container 28. Fill member 31 is preferably lightly biased to a closed position by means of a leaf spring member 38 which has a portion 39 engaging the back wall 40 of the fill member so as to cause it to tend to pivot in a clockwise direction back to the position shown in solid outline where it is retained by engagement of the top 36 of front wall 40a with a stationary stop member 40b.

It will further be observed that when the fill member 31 is in the position shown in solid outline, that is, in closed non-operative position, opening 33 thereof faces against section 41a of recess 29. Since the back of the fill member 31 is substantially abutting portion 37 of the recess and since the front of the fill member abuts the front of the cabinet 4, there is no path for air to pass in through opening 30 to the storage container 28 when fill member 31 is in its closed position. This is of high importance inasmuch as, when air is allowed free access to certain treating agents such as liquid bleach, it progressively decreases the strength thereof. By means of the arrangement shown the storage container is fully closed by movement of the fill member to closed position and is opened, with openings 30 and 33 aligned, when the fill member is pivoted to its open position.

Referring particularly to Figures 3 and 5, there is provided within the container 28 a float member 41 which is shown in its lowest position as determined by stop

member 42 secured on extending portion 42a. Portion 42a is readily visible through a window 43 when float 41 is moved upwardly by the presence of liquid bleach in receptacle 28. The window 43 is normally covered by an extension of the front surface 44 of fill member 31 (see also Figure 1), but when the fill member is pivoted to its open position the window is clearly visible and the operator can see when the storage container is approaching its filled condition.

At the bottom of container 28 (Figures 2 and 5) there is provided a portion 45 which constitutes the deepest part of the container. Within portion 45 there is secured a pump assembly, generally indicated at 46, which includes a housing member 47 formed with a very substantial opening 49 so that the interior of the pump housing, except for cylinder 48, is in complete communication with the remainder of the interior of storage container 28. A piston member 50 is mounted to be reciprocable within the cylinder portion 48 of the pump housing 47, and is provided with a ball valve 51 which is designed in the conventional fashion so as to open in response to an excess of pressure above the valve over the pressure below the valve, and to close when the pressure below the valve exceeds the pressure above the valve. Piston member 50 is secured in turn to a rod 52 which extends upwardly through the top of the container 28. The top end 53 of rod 52 is provided with a slot 54 in which a lever member 55 is pivotably secured to the rod 52 by means of a pin 56 secured on the rod and which passes through a slot 57 formed in the lever. One end of lever member 55 is pivotably secured in a mount 58. The other end of lever member 55 is formed as a handle 59 (Figure 1) extending through a slot 60 formed in the front of cabinet 4 next to the fill member 31.

Communicating with the bottom of cylinder portion 48 is a conduit 61 in which a second ball valve member 62 is provided. Ball valve 62 is appropriately formed so that under the influence of pressure from the underside of the ball the valve opens whereas pressure from the upper side of the ball causes the valve to close. It will readily be seen that when handle 59 is raised to raise the lever 55, the upward motion of rod 52 and piston 50 in cylinder 48 will cause valve 51 to open and valve 62 to close. As a result the liquid within storage receptacle 28 will pass through valve 51 into the space under the piston within the cylinder. When the piston 50 is moved down in cylinder 48 by a downward movement of handle 59, the resulting pressure underneath the piston in the cylinder causes valve 51 to close and valve 62 to open so that the liquid is then forced through valve 62 and up to the top 63 of conduit 61 which terminates in a downwardly facing opening 64.

Opening 64 of conduit 61 is located at the upper part of a dispensing container 65 which is located above the storage container 28 and may preferably, as shown, be formed of the same material. In fact, as shown, a portion 65a of the base of container 65 also forms the top of container 28, i.e., the containers have a common partition member. Conduit 61 extends upwardly through a passageway 66 which has a top portion 67 over which the end 63 of conduit 61 extends; thus, the liquid pumped by manipulation of lever 59 passes through conduit 61 into the dispensing container 65. The top 68 of the dispensing container is at a higher level than the top 67 of the passageway 66 so that the volume within the dispensing container 65 up to the level of the top 67 of passageway 66 is in the maximum amount of bleach that can be introduced into the dispensing container. Preferably, the area of passage 66 is substantially larger than the area of conduit 61 so that regardless of the rate of manual pumping, the overflow liquid will always return to the storage container as fast as it is being pumped up. If the handle 59 should be manipulated so many times that an excessive quantity of bleach is pumped into the dis-

persing container 65, it will merely start to flow back over the edge 67 down through passage 66 and back into the storage container 28. Thus, the positioning of the dispensing container above the storage container and the particular relationship shown permits the use of the passage 66 to prevent any excessive amount of bleach being introduced to the wash load regardless of excessive manipulation of handle 59.

In connection with the amount of bleach pumped into the dispensing container 65, a visual indication is provided to the operator by the provision of a strip 69 of transparent material which, as shown in Figure 4, is positioned in front of a narrow cylindrical chamber 70 in which a small float member 71 is positioned. Chamber 70 communicates with the remainder of the dispensing container 65 by means of an opening 72 provided at the bottom of wall 73 which separates chamber 70 from container 65. Opening 72 is too small for float 71 to escape through it, so that the float 71 is always positioned directly behind the transparent member 69 so as to be fully visible to the operator. It will readily be seen that when liquid is introduced into container 65 it will rise in chamber 70 at the same time thereby causing the float 71 to move upwardly behind the transparent strip which may be appropriately calibrated to show the operator what amount of bleach (in quarters of a cup, for instance) is to be delivered to the wash. Purely as an example, in the case of liquid bleach, the container 65 may be arranged to contain a maximum of 1¼ cups of bleach, with all bleach over that amount returning through passage 66 into storage container 28.

The dispensing container 65 has an opening 74 in the bottom thereof communicating with the top end of a conduit 75. Conduit 75 extends down, and at its other end 76 extends inwardly through the wall of tub 3 so as to provide a substantially tangential flow of liquid from the conduit into the tub. Flow of liquid from the dispensing container through conduit 75 is controlled by a closure member 76 formed at the end of a rod 77 whose upper end is secured to a movable armature 78 of a solenoid 79 secured by a bracket 80 to the top of container 65. The solenoid is of the standard type which, when energized, pulls its armature member upwardly against the action of a spring 81. When the armature is pulled upwardly it takes with it the rod member 77 thereby removing the end 76 thereof from opening 74 and permitting the liquid in the dispensing container 65 to drain down through conduit 75 into tub 3. When the solenoid 79 is de-energized spring 81 then returns the rod 77 into the position where end 76 thereof closes the opening 74 of the dispensing container 65.

A further structural feature of the invention is the provision of a very small opening 81a extending through the bottom wall 65a of the dispensing container 65 to the storage container 28. While opening 81a permits a flow of bleach back from the dispensing container to the storage container, the leakage flow is too restricted to be of consequence if a washing operation is started shortly after the bleach has been measured into the dispensing container. However, should the operator for any reason not wish to provide a washing operation subsequent to measuring out a quantity of bleach into the dispensing container, the bleach will within a period of about four hours return entirely to the storage container so that when the operator is prepared to provide a washing operation the quantity desired for the particular washing operation may again be measured into the dispensing container.

Referring now to Figures 6 and 7, there is shown a preferred electric control system for the machine 1 in which suitable control means for solenoid 79 of the improved bleach agent dispenser of our invention are provided. It will be understood that present-day washers often include various controls (such as dial light, water saver, etc.) which do not relate in any way to the present in-

vention, and that, to some extent, these have been omitted for the sake of simplicity and ease of understanding. In order to control the sequence of operations of washing machine 1 the circuit includes a timer motor 82 which drives a plurality of cams 83, 84, 85, 86 and 87. These cams during their rotation by the timer motor actuate various switches in the conventional manner to cause the machine to pass through the above mentioned cycle of operations, first washing the clothes, next extracting wash water from them, then rinsing the clothes in clean water, and finally extracting the rinse water from the clothes.

The electrical circuit as a whole is energized from a two wire power supply 88, 89 and the manner in which the various electrical components of the machine are connected to the power supply during the machine operation will now be explained. To initiate a washing cycle, switch 90 is closed. This may be effected in the usual manner, for instance, by depression of one of the levers 7 (Figure 1). Cam 83 controls a switch 91 with three contacts 92, 93, and 94. The cam 83 may either cause contact 92 to engage the contact 93, or may cause all three contacts to be moved into engagement with each other. At the initial part of a cycle, as shown in Figure 7, cam 83 is in its intermediate position, that is, the position where contacts 92 and 93 are in engagement. A circuit is thus completed from conductor 88 through switch 91 and a conductor 95 to the control solenoid 96 of a hot water valve 97, and then to a conductor 98. This is effected through the contacts 99 and 100 of a switch 101 controlled by cam 84 which closes contacts 99 and 100 for a washing operation and, as shown in Figure 7, moves contact 99 into engagement with a third contact 102 during a rinsing operation. If it is desired to supply warm water to basket 2 rather than hot water, a switch 103 is also closed. This closes a circuit energizing the control solenoid 104 of a cold water valve 105 in parallel with hot water solenoid 96 so that both hot and cold water may be supplied through conduit 22 to basket 2. The position of switch 103 is determined by the particular selection of one of the keys 7 on the control panel.

From conductor 98 the valve energizing circuit continues through timer motor 82 and switch 90 back to line 89. From conductor 98, a circuit also extends through a path in parallel with the timer motor, which path includes both the start winding 106 and the main winding 107 of drive motor 17. More specifically, the circuit extends from main winding 107 through a protective device 108 and a pair of contacts 109 and 110 of a switch 111 controlled by cam 86. As shown in Figure 7, contacts 109 and 110 are caused to engage each other by cam 86 when the timer is in the wash portion of the cycle. The start winding 106 is connected in the circuit in parallel with main winding 107 by means of a double pole, double throw motor reversing switch 112 controlled by cam 85. From conductor 98, the circuit extends to start winding 106 through contact 113 and switch arm 114 of switch 112, and through the contact 115 of a motor operated centrifugal device 116 which closes contact 115 when the motor is at rest or rotating below a predetermined speed. The start winding circuit is completed on its other side through switch arm 117 and contact 118 of switch 112.

When the timer motor 82 and the start and main windings 106 and 107 of drive motor 17 are connected in parallel, a much lower impedance is presented in the circuit by the motors than is presented by the valve solenoid 98 (and, if switch 103 is closed as illustrated, valve solenoid 104). As a result, the greatest portion of the supply voltage is taken up across whichever of solenoids 96 and 104 are in circuit, and relatively little is across the motors. This causes solenoids 96 and 104 to be energized sufficiently to open the water valves to admit

hot and cold water to the machine through conduit 22, with the timer and drive motors remaining inactive.

With this arrangement, water is introduced through conduit 22 into the basket 2 to fill it until such time as the water reaches the level of the overflow apertures 16 provided at the upper edge of the basket side wall (Figure 1). When the water reaches this level, it then overflows through the apertures into the tub forming a pool of water in the bottom of the tub until a water level responsive switch 119 is closed. Switch 119 is connected directly between conductors 95 and 98 so that it is closed it shorts them together and removes substantially all power from across the solenoids 96 and 104. This then connects the timer motor 82 and the drive motor 17 directly between conductors 88 and 89 and both motors then start in operation. As motor 17 comes up to speed, centrifugal mechanism 116 opens contact 115 so as to remove the start winding 106 from the circuit. At the same time, the centrifugal mechanism 116 closes a contact 120 between conductors 95 and 98 so that the timer and drive motors continue to be energized even if the level of water in the tub 3 should decrease below that necessary to keep switch 119 closed. With switch 112 in the position shown in Figures 6 and 7, the polarity of the start winding of motor 17 is such that the motor rotates in the direction to cause operation of the agitator 9 and recirculation of water through nozzle 26.

The resulting washing operation continues until cam 86 opens contacts 109 and 110 of switch 111 to remove power from drive motor 17 and thereby halt operation of agitator 9. This point in the cycle is represented by pause A in Figure 7 showing the change in the contour of cam 86 to permit opening of contacts 109 and 110. Power is not removed from the timer motor 82 at this time since a circuit is still completed to it from conductor 95 through solenoids 96 and 104. The impedance of the timer motor 82 is much greater than that of the valve solenoids so that it takes up most of the supply of voltage and continues in operation, with so little voltage across the solenoids that they are ineffective to operate their respective valves.

As the timer continues to run, cam 85, during pause A (Figure 7) reverses the switch arms 114 and 117 from their illustrated position so that switch arm 114 engages contact 118 and switch arm 117 engages another contact 121. This reverses the polarity of the start winding 106. Timer 82 continues to run and during pause A causes cam 83 to close all three contacts 92, 93 and 94 of switch 91. Finally, during pause A cam 86 is caused to reclose the contacts 109 and 110 of switch 111. This energizes the windings 106 and 107 of motor 17, and, because the start winding has a polarity reversed from that of the washing operation, the motor begins to rotate in the reverse direction from that in which it rotated during wash. As explained, this has the effect of driving wash basket 2 at high speed for extracting wash water from the clothes.

At the same time, pump 23 is being operated by motor 17 in the appropriate direction to cause a discharge of washing liquid into drain conduit 27. The extraction period continues until cam 86 again causes contacts 109 and 110 to be opened to remove power from drive motor 17 for pause B of Figure 7. The removal of power from drive motor 17 allows basket 2 to coast toward a stop. This interruption of a spin period has been found effective in avoiding suds locking of the basket, and during this pause the positions of the other cam operated switches are not changed, and the timer motor continues to run.

At the end of pause B cam 86 again closes switch 111 to energize motor 17 for the second half of the spin operation which follows the wash. This action continues until pause C is reached, at which time the switch 111 is again opened by cam 86. During pause C cam 83 moves back to the same position it had for wash, that is, with

11

contacts 92 and 93 engaged. Cam 84 moves contact 99 out of engagement with contact 100 and into engagement with contact 102. Also, during this pause cam 85 returns switch arms 114 and 117 to the first position as shown in Figure 1. The timer motor then continues to run until the end of pause C is reached, at which time cam 86 recloses switch 111. This connects the main and start windings of the drive motor in parallel with timer motor 82, so that a relatively low impedance is presented between conductors 98 and 89. Since the timer motor and the drive motor are both in series with the valve solenoids 96 and 104, the timer motor stops running, the drive motor does not start, and solenoid 104 opens valve 105 to cause cold water to be introduced to the machine. If warm water is desired rather than cold water, switch 122 is closed by the operator. The position of switch 122 may be predetermined by the selection of a particular one of keys 7, with each key providing a different combination of positions of switches 103 and 122. As shown in Figure 1, it is assumed that switch 122 is closed, so that both hot and cold water is introduced to the basket for rinsing.

As before, the machine continues to fill until sufficient water overflows into tub 3 to close the water level switch 119. When this occurs, the solenoids are again shorted out, and the timer motor 82 and the main motor 17 start to operate to cause operation of the agitator 9 and recirculating action of the pump 23. This continues until the fourth pause D is reached at which time switch 111 again opens, switch 112 reverses the positions of switch arms 114 and 117, and cam 83 causes all three contacts 92, 93 and 94 of switch 91 to be closed together. As a result, when cam 86 recloses switch 111 at the end of pause D another spin operation takes place to get rid of the rinse water, with the water so removed from the basket being pumped out of the tub by the rotation of pump 23.

At the end of this spin operation the continued operation of timer motor 82 causes cam 83 to separate all three contacts 92, 93 and 94 to terminate all operations of the machine. The clean clothes may then be removed from the machine.

In this control circuit as described, our improved bleach agent dispenser is incorporated by providing the solenoid 79 in parallel with timer motor 82 and drive motor 17. In series with the solenoid 79 we provide a switch 123 controlled by cam 87. By so arranging the solenoid 79 in the circuit, in series with the solenoids 96 and 104 and in parallel with the timer and drive motors, it will readily be seen that the solenoid 79 is operable only at the same time that the timer motor 82 is operable, that is, alternatively with solenoids 104 and 96.

As can be seen by reference to Figure 7, cam 87 closes switch 123 at a predetermined time during the washing step, at a point relatively near the end thereof so that an appreciable amount of washing is performed prior to energization of the solenoid 79. As described above, the energization of solenoid 79 lifts valve member 76 out of opening 74 so that whatever amount of liquid is in the dispensing container 65 is then free to pass through conduit 75 into tub 3 and then be recirculated in a dilute state through conduit 25 into basket 2. It will be seen that in this manner the introduction of the bleach is effected substantially after the start of the washing operation so that if a detergent with a fluorescent dye should be used, the agent in the detergent will have time to be deposited on the clothes being washed rather than react adversely with the bleach so that the detergent does not perform its function with full effectiveness.

It will thus be seen that in addition to the advantages obtained from the invention of the aforesaid Houser et al. application, the dispenser arrangement is substantially leak proof, that the suitable indication of both the amount of agent in the storage container and in the dispensing container is provided with means to prevent confusion between the two, that there is no access for air to contact

12

the agent in the storage except when it is being filled, and that dilution of the agent before it contacts the clothes is also insured.

These features are integral parts of our invention, the general structure providing the storage container below the dispenser container and the overflow return from the dispensing container to the storage container being the joint invention covered in the claims of the aforesaid Houser et al. application.

While in accordance with the patent statutes we have shown what at present is considered to be the preferred embodiment of our invention it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and we therefore aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In a clothes washing machine, washing means for providing wash, rinse and extraction steps including a basket member for receiving clothes to be washed, an outer liquid receptacle surrounding said basket member and receiving the overflow therefrom, recirculation means for recirculating liquid from said liquid receptacle into said basket, a storage container for a liquid clothes treating agent, a dispensing container for the agent positioned higher than said storage container, a common partition forming at least part of the bottom of said dispensing container and at least part of the top of said storage container, said partition having a small opening formed therein thereby to permit treating agent to drain from said dispensing container slowly back into said storage container, pumping means in said storage container, first conduit means connecting the outlet of said pumping means to said dispensing container, fill means communicating with said storage container and movable to first and second positions, said fill means providing open communication to atmosphere for said storage container when in said first position and constituting a closure between said storage container and atmosphere in said second position, first indicating means showing the amount of agent contained in said dispensing container, second indicating means adjacent said fill means showing the amount of agent contained in said storage container, said fill means concealing said second indicating means when in said second position and revealing said second indicating means when in said first position, said first conduit means extending through said partition member and being entirely disposed within said dispensing and storage containers, a passage formed through said partition and having an open upper end disposed within said dispensing container at a substantial height above the bottom thereof, second conduit means extending down from said dispensing container to said liquid receptacle, means controlling flow through said second conduit means from said dispensing container to said liquid receptacle, electric means controlling said flow control means and causing flow when energized, and timer means for causing said washing means to proceed through a sequence including a wash step followed by rinsing and liquid extraction steps, said timer means also causing energization of said electric means at a predetermined time during said wash step.

2. In a clothes washing machine, a washing liquid receptacle, a storage container for a liquid clothes treating agent, a dispensing container for the agent positioned higher than said storage container, a common partition member forming at least part of the bottom of said dispensing container and part of the top of said storage container, pumping means in said storage container, first conduit means connecting the outlet of said pumping means to said dispensing container, said first conduit means extending through said partition member and being entirely disposed within said dispensing and storage

containers, second conduit means connecting said dispensing container to said liquid receptacle, and means controlling flow through said second conduit means from said dispensing container to said liquid receptacle, said flow control means upon operation causing said dispensing container to be substantially emptied.

3. In a clothes washing machine, a washing liquid receptacle, a storage container for a liquid clothes treating agent, a dispensing container for the agent positioned higher than said storage container, a common partition member forming at least part of the bottom of said dispensing container and forming at least part of the top of said storage container, means forming a passage extending through said common partition, said passage having its upper end communicating with said dispensing container substantially above the bottom of said dispensing container thereby to limit the amount of liquid that can be passed from said storage container up to said dispensing container, pumping means in said storage container, first conduit means connected to the outlet of said pumping means and extending up through said passage into said dispensing container, second conduit means extending down from said dispensing container to said liquid receptacle, a normally closed valve positioned in said second conduit means for preventing flow from said dispensing container to said liquid receptacle, and means for opening said valve to cause said dispensing container to be substantially emptied.

4. In a clothes washing machine, a cabinet, washing means positioned within said cabinet including a washing liquid receptacle, a storage container for a liquid clothes treating agent positioned within said cabinet, said storage container having an opening formed therein, fill means secured to said cabinet, said fill means being arranged to be manually movable to first and second positions and having an opening formed therein, said fill means opening and said storage container opening being in communication with each other to connect the interior of said storage container to atmosphere in said first position of said fill means, said fill means opening and said storage container opening being offset from each other and said fill means forming a closure for said storage container opening when said fill means is in said second position, a dispensing container for the agent positioned within said cabinet higher than said storage container, pumping means communicating with said storage container, manually operable means for operating said pumping means extending outside said cabinet, first conduit means connecting the outlet of said pumping means to said dispensing container, second conduit means connecting said dispensing container to said liquid receptacle and connected to the interior of said dispensing container adjacent the bottom thereof, normally closed valve means controlling flow through said second conduit means from said dispensing container to said liquid receptacle, and means for opening said valve means to cause said dispensing container to be substantially emptied.

5. The apparatus defined in claim 4 including first and second indicating means, said first indicating means being connected with said dispensing container and being secured to have a portion visible externally of said cabinet at all times, said second indicating means being connected with said storage container and being positioned adjacent

said fill means, said fill means including a portion positioned to conceal said second indicating means when said fill means is in said second position thereof and to reveal said second indicating means from the exterior of said cabinet when said fill means is in said first position thereof.

6. The apparatus defined in claim 4 including means pivotably mounting said fill means to said cabinet, said fill means being pivotable between said first and second positions, said storage container having a recess formed in the top thereof and having its fill opening formed in said recess, said fill means opening abutting the surface of said recess when said fill means is in its first position, said fill means opening being directly above said storage container opening and in said recess when said fill means is pivoted to its second position.

7. In a clothes washing machine, a basket member for receiving clothes to be washed, an outer liquid receptacle surrounding said basket member and receiving the overflow therefrom, recirculation means for recirculating liquid from said liquid receptacle back into said basket, a storage container for a liquid clothes treating agent, a dispensing container for the agent positioned higher than said storage container and above the highest liquid level reached in said liquid receptacle, pumping means in said storage container, first conduit means connecting the outlet of said pumping means to said dispensing container, second conduit means extending down from said dispensing container to said liquid receptacle, and normally-closed valve means in said second conduit means controlling the flow therethrough from said dispensing container to said liquid receptacle.

8. The apparatus defined in claim 2 wherein said partition member has a small opening formed therein connecting said dispensing container to said storage container for permitting liquid in said dispensing container to drain slowly back into said storage container.

9. In a clothes washing machine, a basket member for receiving clothes to be washed, an outer liquid receptacle surrounding said basket member, means providing for passage of liquid from said basket member to said liquid receptacle, a recirculation system for recirculating liquid from said liquid receptacle back into the top of said basket member, a storage container for a liquid clothes treating agent, a dispensing container for the agent positioned higher than said storage container, pumping means in said storage container, first conduit means connecting the outlet of said pumping means to said dispensing container, second conduit means extending down from said dispensing container adjacent the bottom thereof and communicating with said recirculation system so that liquid passing down through said second conduit means is carried by said recirculation system into said basket, and normally closed valve means positioned to control the flow through said second conduit means from said dispensing container.

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