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3,301,022

WASHING MACHINE HAVING A TREATING AGENT DISPENSING SYSTEM

Filed March 15, 1965

3 Sheets-Sheet 1

FIG. 1

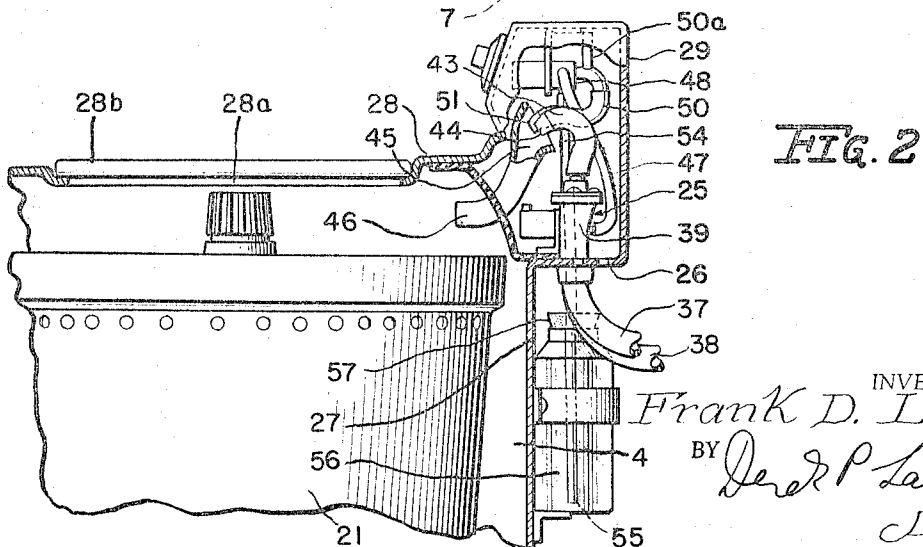
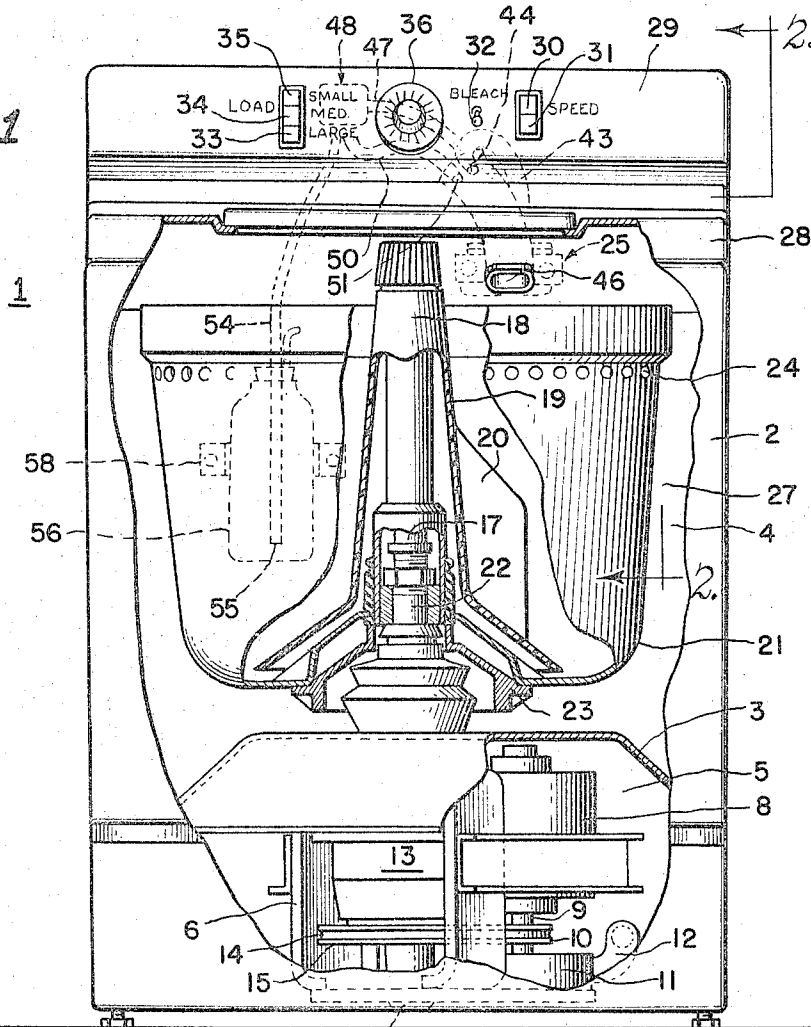


FIG. 2

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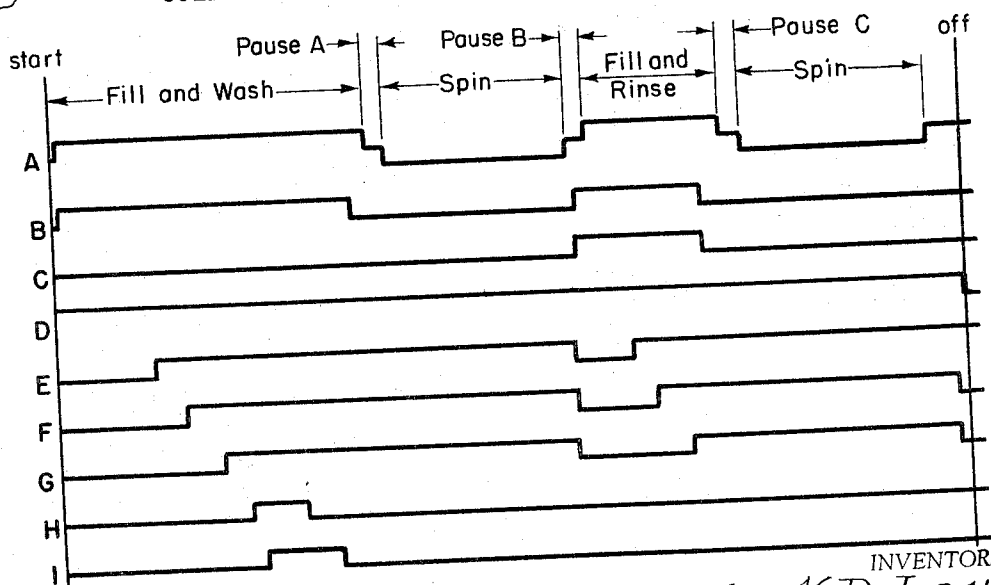
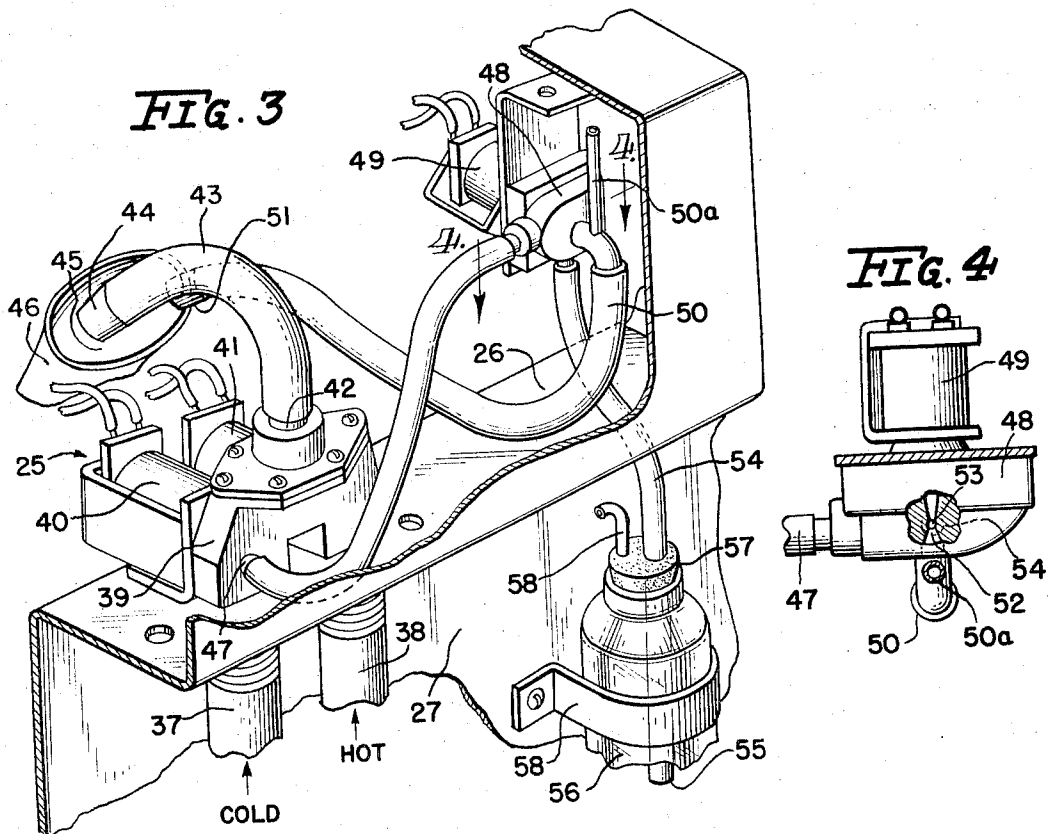


FIG. 6

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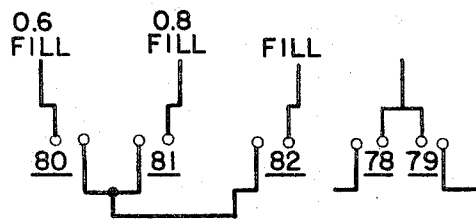
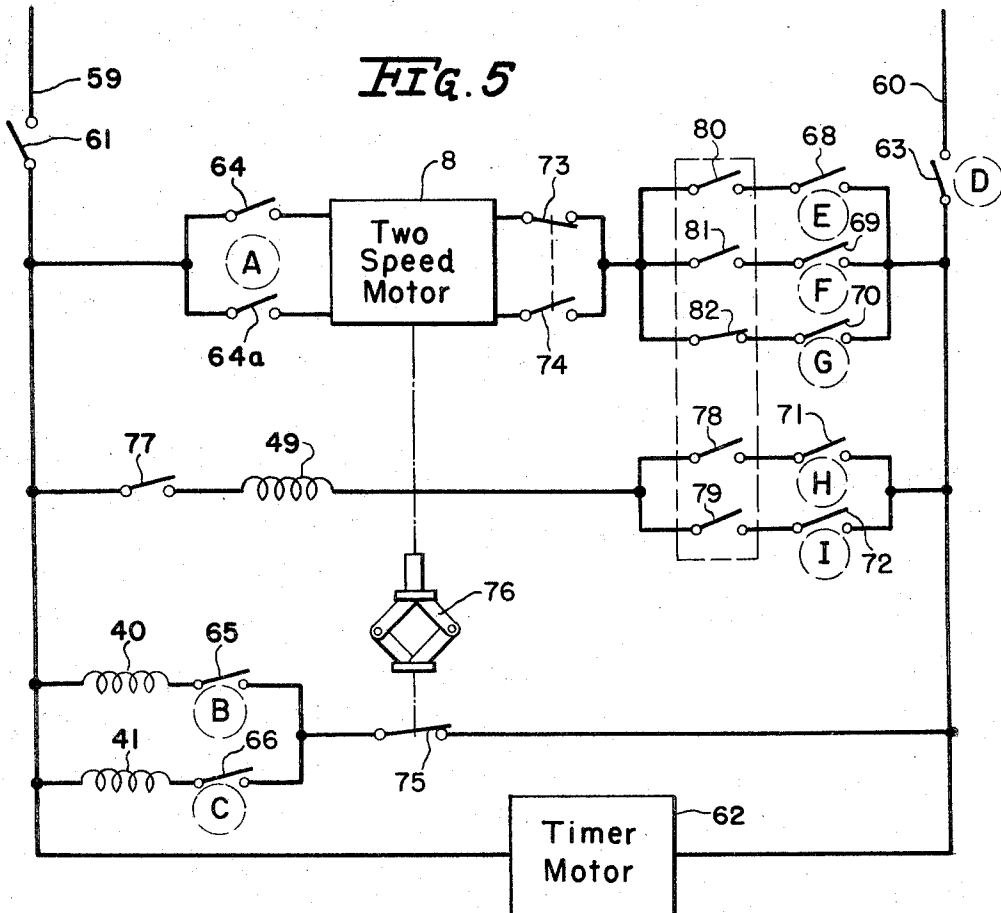


FIG. 7

SMALL (35) X	○	○	X	○
MEDIUM (34) ○	X	○	○	X
LARGE (33) ○	○	X	X	X

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WASHING MACHINE HAVING A TREATING AGENT DISPENSING SYSTEM

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10 Claims. (Cl. 68—12)

This invention relates to washing machines, and more particularly to washing machines of the type incorporating a system for dispensing a predetermined amount of liquid treating agent.

There are many instances where it is advantageous, during the course of treatment of articles with an aqueous solution, to introduce a treating agent which will either modify or improve the treatment being provided. As a specific example, liquid bleach, generally of the chlorine type, is used on many types of clothing which are washed in automatic washing machines.

It is usually desirable that such treating agents be introduced in diluted condition since, in a concentrated form, they sometimes have harmful effects. This is quite true of the particular example given above: when concentrated chlorine bleach is poured onto clothes it not only bleaches them, but also has a substantial adverse effect on the strength of the fibers forming the clothes so that their useful life is substantially shortened.

It is also an important factor, with respect to treating agents, to introduce the correct amount of treating agent with respect to the total amount of water since the strength of the solution is obviously dependent on this relationship. Thus, in clothes washing machines which permit use of a smaller quantity of water for washing a small load of clothes, it is desirable to have a smaller quantity of a treating agent (such as bleach) introduced so that the proper strength of solution—to give bleaching with no substantial harm to the clothes—is achieved regardless of the size of the load being washed.

Another desirable feature for dispensing systems is the automatic measuring out of the treating agent by an effective and reliable mechanism. However, most washing machines, particularly the automatic clothes washing machines which are currently on the market and which have treating agent dispensers provided so that liquid bleach may be introduced into the machine for a washing operation, require the operator to measure out the correct amount of bleach each time.

It is, accordingly, an object of my invention to provide a washing machine where selectively variable quantities of treating agent may be introduced from a reservoir without requiring that the operator perform the measuring operation.

A more specific object of my invention is to effect this goal by causing the introduction of bleach to be effected on a timed basis controllable by the operator.

Yet another object of my invention is to provide a treating agent introducing system which operates in response to the force of water entering the machine, which force is a direct result of the fact that most municipal and other domestic water supplies maintain water under pressure for residential and industrial use.

In this connection, it will be understood that, because under certain adverse circumstances the pressure in a domestic water supply system can decrease so much that there may be a tendency to siphon backward, most plumbing codes require that there be an "air break" between the container of the domestic appliance and the source of supply. In this way, if there should be a failure in the domestic source of supply and the pressure should abruptly decrease, there is no chance that the contents of the machine—which in the case of a washing

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machine may well be vitiated water—will be sucked back into the supply system.

A further specific object of my invention is, accordingly, to introduce bleach, as a result of the energy of the water flowing under pressure upstream of the air break, by providing a reservoir of bleach with suitable means providing an aspirating effect on the bleach in the reservoir.

In one aspect, thereof, my invention contemplates the provision of a washing machine which, in the usual way, has water inlet means controlling passage of water to conventional container means for containing water and the articles to be washed. The inlet means is adapted to be connected to a source of water under pressure such as, for instance, the usual municipal water system; these systems generally have a gauge pressure of 20 p.s.i. or more. In accordance with a virtually universal requirement of plumbing codes, an air break is formed between the inlet means and the container means so that the contents of the container means cannot be siphoned back through the inlet means to the source of water under any circumstances.

Conduit means is arranged so as to have one end within a liquid treating agent reservoir in aspirating relation to liquid therewithin. The other end of the conduit is connected to the water inlet means above the reservoir so as to be subjected to the aspirating effect of flowing water upstream of the air break. Dispensing control means are arranged to prevent or permit aspiration of the treating agent by the flow of inlet water.

A control system is provided for controlling the amount of water to be passed by the inlet means to the container means. In this way, by controlling the length of time that the treating agent is subjected to the aspirating effect of the incoming water, the amount of treating agent is effectively controlled. In a preferred arrangement of my invention, the control system provides selectively for different amounts of water to be provided, and proportions the amount of treating agent provided by aspiration to the amount of water so that the proportion may remain essentially the same notwithstanding the fact that different total amounts of water are being provided for different operations.

The features of my 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 machine, more particularly a clothes washing machine in the present case, embodying my improved treating agent dispensing system, part of the machine being broken away and part being in cross section to illustrate details;

FIGURE 2 is a side elevational view along line 2—2 in FIGURE 1;

FIGURE 3 is an enlarged fragmentary view in perspective showing the upper back portion of the washing machine of FIGURE 1 and illustrating details of the improved dispensing system of my invention;

FIGURE 4 is a view along line 4—4 in FIGURE 3; FIGURE 5 is a simplified electrical circuit diagram showing a circuit suitable for use with the improved treating agent dispensing system of my invention;

FIGURE 6 is a schematic illustration of the developed surfaces of the cams shown in FIGURE 5, illustrating the sequence in which they control their associated switches; and

FIGURE 7 is a schematic illustration of the relationship of particular switches shown in FIGURE 5 which

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are closed by manual operation of members shown in FIGURE 1.

Referring now to FIGURE 1, there is shown, as an example of a washing machine in which my invention finds particularly appropriate use, a clothes washing machine 1. The machine is provided with an outer appearance casing 2, with a bottom bulkhead 3 being welded or otherwise secured within the casing to provide a water collection compartment 4 and a machinery compartment 5.

Disposed within compartment 5 is a frame 6 mounted for gyratory movement about a pivot 7 positioned at the base of the cabinet. Frame 6 carries a drive motor 8 having a downwardly disposed shaft 9 in driving relation to both a drive pulley 10 and the rotor of a drain pump 11. While the specific details of the pump, and its connection to compartment 4, are conventional, and will not be herein described, it will be understood that liquid from compartment 4 is brought down to pump 11 through a suitable conduit (not shown) and is then discharged by the pump to a drain conduit 12 adapted for discharge to a stationary tub or drain line.

A transmission assembly 13 is also mounted on frame 6. The transmission is operated by motor 8 and pulley 10 through a belt 14 which connects pulley 10 to a pulley 15 arranged in driving relationship to the transmission.

A shaft 17 extends upwardly from transmission 13; shaft 17 is secured at its upper end (not shown) to an agitator member 18 which may be of the conventional type having a center post 19 and washing vanes 20. As is conventional, transmission 13 is of the type which, when motor 8 operates in one direction, will cause oscillation of shaft 17. This in turn drives agitator 18 so that it oscillates in a horizontal plane and provides a washing action when there is liquid contained within a basket 21 provided for the purpose of receiving liquid and clothes to be washed therein.

When motor 8 rotates in the opposite direction it causes transmission 13 to rotate shaft 17 continuously in a single direction while, at the same time, like rotation of a sleeve 22, also connected to be operated by transmission 13, is provided. Sleeve 22 is secured to a fixture 23 on which basket 21 is mounted. Consequently, when shaft 17 and sleeve 22 rotate together continuously, the agitator 18 and basket 21 are rotated as a unit to effect centrifugal extraction of liquid from clothes contained in the basket. The liquid passes out through openings such as those shown at 24 which are provided for that purpose. A suitable clothes guard (not shown) may be provided to retain the clothes within the basket 21 while at the same time the liquid is allowed to escape.

Thus, rotation of motor 8 in one direction causes oscillating operation of agitator 18, while rotation of the motor in the other direction causes high speed rotation of the agitator 18 and basket 21 together. The first provides washing and rinsing operations, and the second causes liquid to be extracted from the clothes after such operations. A conventional clothes washing operation may, for instance, include first a washing operation, that is, operation of the agitator alone, then a spinning operation of the basket and agitator together, then at least one rinsing operation similar to the washing operation, followed by another spinning operation.

It will be understood that, during spinning operations, the centrifugal force causes the water to pass out through openings 24 into the compartment 4 so that it then is taken by pump 11 and passed out to the drain or stationary tub. Also, transmission mechanisms which operate in the manner described are well known in the art; for instance, reference is made to the mechanism described and claimed in application Serial Number 373,693, now abandoned, filed on June 9, 1964 by Billie D. Henderson, and assigned to the same assignee as this application.

A suitable water inlet assembly, generally indicated by the numeral 25 (FIGURES 2 and 3), is mounted at the

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back of machine 1. In order to accommodate assembly 25, the machine may be provided with a horizontal ledge 26 extending backwardly from the back wall 27 of compartment 4. Ledge 26 may be formed so as to support the top member 28 of the washing machine, which has an opening 28a formed therein. A lid 28b normally closes opening 28a; when access is desired to the interior of basket 21, the lid is then opened on its hinges (not shown) and then clothes may be inserted into or removed from basket 21.

Supported at the back and on top of member 28 is a control panel 29. While the control panel 29 may include any suitable set of controls, one desirable approach contemplates that it will include: speed selecting means with a high-speed button 30 and a low-speed button 31; a bleach selecting member 32 which in its up position provides for bleach and in its down position precludes the provision of bleach; a load selector for determining the amount of water to be provided in basket 21, with three buttons 33, 34 and 35 providing respectively enough water for large, medium and small loads of clothes; and a dial 36 which permits a cycle to be started and which shows the progress of a complete washing cycle. It will be understood that the manner in which the various controls on panel 29 achieve their functions will appear more fully and clearly from the description of the circuitry and the manner of operation of the components of the circuitry.

Referring now in particular to FIGURES 2 and 3, it will be seen that appropriate connecting tubes 37 and 38 are provided in order to connect inlet valve 39 to sources of cold and hot water respectively. In this connection it will be understood that, in most homes, this is provided by a municipality so that water under pressure is available in conduits 37 and 38 at all times.

Valve 39 is of a conventional pilot-operated type having a first solenoid 40 which permits flow of cold water when it is energized and prevents flow of cold water when it is de-energized, and a solenoid 41 which permits flow of hot water from conduit 38 when it is energized, and prevents flow of hot water from conduit 38 when it is de-energized. The outlet for valve 39 is shown at 42. Outlet 42 leads through a conduit 43 to a nozzle 44 (FIGURE 2), which in turn feeds the water through an air gap, or break, 45 into a member 46 which guides the water through a protective shield member, provided to protect the control elements from the steam and vapor within compartment 4, so that it flows into basket 21. The provision of air gap 45 is, in accordance with the plumbing codes, such that it is above the maximum level that water can achieve within compartment 4 without overflowing onto the floor; thus, it is virtually impossible for water to be siphoned back from basket 21 or compartment 4 to the water inlet 42.

It will be understood then, that in accordance with the procedure common in clothes washing machines, energization of solenoid 41 alone will cause hot water to flow into basket 21, and energization of solenoid 40 alone will cause cold water to flow into the basket. Energization of both solenoids will cause the provision of both hot and cold water, and as a result warm water will flow into the basket 21.

The body of valve 39 provides a connection to a conduit 47 from conduit 37 which is entirely independent of the operation of the valve 39. In other words, water is led through conduit 37 to conduit 47, and the flow of the water in conduit 47 is then under the control of a valve 48, which may be of a similar type to valve 39, but which has only one solenoid 49 and which is mounted above valve 39 within panel 29. When solenoid 49 is energized, water may flow from valve 48 to a conduit 50, and at all other times flow of water through valve 48 is prevented. An important difference between the valves 39 and 48 is in the quantities of water which they pass. Valve 39 is constructed so as to pass a substantial

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quantity of water to fill basket 21; and this will generally, with pressures between 20 p.s.i. and 200 p.s.i., be on the order of 3¼ gallons a minute. Valve 48 on the other hand, when solenoid 49 is energized, is designed to pass a small amount of water, preferably on the order of a pint to a quart per minute.

Another difference between the valves is that valve 48 is provided at its outlet with a small upwardly extending air vent 50a. The relation of the size of passages 50 and 50a, plus the fact that conduit 50 extends downwardly and vent 50a extends upwardly, causes liquid passed by valve 48 to flow only through conduit 50. The liquid rises a little in vent 50a, but not enough to overflow. In the event of a sudden drop in pressure in the supply line, the vent 50a, by its position, prevents any mixture of water and treating agent to be drawn back into the supply line. Instead, the treating agent already aspirated will flow down conduit 50 by gravity. Thus, there can be no contamination of the water supply since not the slightest part of the treating agent can be drawn into it.

Returning again to FIGURE 2, it will be seen that the outlet conduit 50 from valve 48 extends down to a nozzle 51 which also feeds across the air gap 45 into member 46 so that the water from valve 48 is fed into basket 21. Referring now to FIGURE 4 in conjunction with FIGURE 3, it will be observed that valve 48 has a Venturi passage 52 formed in communication with outlet 50. A passage 53 communicates with the Venturi passage just upstream of the neck thereof. There is a vacuum created in passage 53 during flow of water through Venturi 52, as is well known, and consequently an aspirating effect is provided through passage 53 and its connecting conduit 54 at the other end 55 of the conduit 54.

End 55 of the conduit is located so as to be almost at the bottom of a container, or reservoir, 56 which is arranged to contain a substantial amount of a suitable treating agent. For the purposes of the present invention, it is contemplated that a liquid chlorine type bleach is representative of such treating agents, and it is in specific connection with the introduction of bleach for the purpose of improving a clothes washing operation that this invention is described. As shown, container 56 may be provided with a suitable stopper 57 if that is felt to be necessary in order to prevent foreign objects from entering the treating agent, or where the treating agent may deteriorate from excessive contact with the atmosphere as is true of chlorine bleach. Where stopper 57 is provided, a suitable tube 58 should be provided, passing through the stopper so as to provide a vent in container 56 and prevent a vacuum from being formed in container 57 as the liquid goes down.

In the embodiment shown, container 56 is secured to the back wall 27 of the cabinet below valve 48 by any suitable means such as a strap member 58. It will, however, be understood that the normal pressures and water velocities provided by the combination of municipal water systems and valve 48 give such a substantial aspirating effect that container 56 may be placed at the base of machine 1. Thus, while in the embodiment shown it is contemplated that the container will be an integral part of the structure, it is also readily feasible to provide the conduit 54 in such a way that it will reach down to an entirely separate container. In such a case, the treating agent may be kept in its original container and merely placed behind the washing machine, with the tube 54 extending down thereinto.

With the structure described, when solenoid 49 is energized the passage of water through Venturi 52 into outlet 50 will cause an aspirating effect through conduit 54, and as a result bleach will be drawn up through conduit 54, at a rate predetermined by the design of the structure, to mix with the outgoing water. While any suitable proportion of water to bleach may be pro-

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vided within normal limits, I contemplate a proportion of 2 or 3 to 1 in the instant case, where bleach is the agent to be injected, since this will provide a suitable solution of the bleach and will introduce a desired quantity without requiring that an excessive amount of water be mixed therewith.

Referring now to FIGURE 5, a simplified electrical circuit for providing operation of my improved system will be described. It will be understood in connection with the circuit shown that many features which do not relate to the invention, such as, for instance, fluorescent lights, water temperature selecting means, and various safety inter-locks, have been omitted to simplify and clarify the description of the subject with regard to my invention. The circuit is intended to be connected across a pair of lines 59 and 60 which are, in the usual way, energized across a source of 120-volt, 60-cycle, alternating current power. The connection of the different components of the machine across the source is controlled by a switch 61 which may normally be actuated by axial movement of member 36 (FIGURE 1). When member 36 is pushed in and rotated, switch 61 is opened; then, when the member 36 is pulled axially outward, switch 61 is closed so as to connect the components of machine 1 across the source of power.

Closure of switch 61 permits energization of a timer motor schematically shown by numeral 62, provided a switch 63 is closed. In this connection it will be understood that a group of cams A, B, C, D, E, F, G, H, and I, are all controlled by both the timer motor 62 and by the manually operable member 36. In other words, in the conventional way, the cams may be preset to a position corresponding to the start of a washing operation by the manual operation of member 36. At this point cam D causes switch 63 to be closed. Then, when the timer motor is energized by closure of switch 61, it will rotate the cams to effect a complete cycle of operations as will be described. In this connection, referring for an instant to FIGURE 6, it will be seen that there is shown the effect of cams A through I and their associated switches at any time during the cycle, from beginning to end. In particular connection with cam D, it will be seen that the cam is closed at the beginning of the cycle, that it does not open until the end of the cycle, and that it is open at all times when the machine is in its off position.

As already mentioned, cam D controls the operation of switch 63. The other cams A through C and E through I control the operation of a group of switches 64 through 66 and 68 through 72. Cam A is shown as controlling two switches 64 and 64a. By conventional motor circuitry (not shown), switches 64 and 64a when opened and closed alternatively by cam A provide one direction of motor rotation or the other. In this connection, it is to be assumed that closure of switch 64 provides the wash direction of operation of motor 8, and closure of switch 64a provides the spin direction of rotation. This is shown in FIGURE 6, where the line showing the configuration of cam A in its uppermost position denotes closure of switch 64, in its lowermost position denotes closure of switch 64a, and in its intermediate position denotes that both switches are open.

As previously mentioned, it is common to provide a motor 8 which is capable of producing two different speeds, and in this connection switches 73 and 74 are arranged so that depression of button 30 closes switch 73 and opens switch 74, while depression of button 31 closes switch 74 and opens switch 73. It will be assumed that switch 73 provides a high speed operation, and that switch 74 provides a low speed operation. Thus, either direction of rotation with either speed may be obtained.

Solenoids 40 and 41 are in series respectively with switches 65 and 66. Thus, the solenoids are under the control of these switches respectively, provided that a

switch 75 which is in series with both of them, is also closed. Switch 75 is controlled by motor 8 through a centrifugal mechanism schematically shown at 76 so that when the motor is operating switch 75 is open, and when the motor is stopped, switch 75 is closed. Thus, regardless of the position of switches 65 and 66, any time that operation of motor 8 is started the flow of water through valve 39 will be stopped as a result of the opening of switch 75.

For purposes of illustration, in FIGURE 6, cam B is shown as causing closure of switch 65 during the fill and wash period, and during the fill and rinse period, while cam C causes switch 66 to be closed only during the fill and rinse period. This provides a hot wash and a warm rinse. It will, however, readily be seen that various manually operable switches may be added to this arrangement so as to provide for different combinations of water temperature for different washing operations, if that is desired.

Solenoid 49 of valve 48 is in series with a switch 77 which is controlled by the manual member 32 on the control panel so that when member 32 is in its up position switch 77 is closed, and when member 32 is in its down position switch 77 is open. Switches 71 and 72, controlled by cams H and I respectively, are respectively in series with a pair of switches 78 and 79, with the entire arrangement being in series with the solenoid 49 and switch 77. Thus, when switch 77 is open solenoid 49 cannot be energized, but when switch 77 is closed, the energization of the solenoid is then dependent upon the relationship of switches 71, 72, 78 and 79.

The switches 68, 69 and 70 are all in parallel with each other, and in series with the motor and its associated switches so that closure of any one of these three switches permits completion of the motor circuit. Switches 68, 69 and 70 respectively have switches 80, 81 and 82 in series with them.

Valve 39 and valve 48 are of the conventional type which provide for a substantially constant flow regardless of substantial pressure variations; consequently the filling of basket 21 may be effected by valve 39 on a timed basis. The timing of switches 68, 69 and 70 is such that they close the motor circuit after, respectively, six-tenths fill, eight-tenths fill and complete fill have been provided within basket 21 by valve 39. Of course, as soon as the motor starts, the switch 75 opens and stops further admission of water. Thus, depending upon which one of the switches 80, 81 and 82 has been closed, a six-tenths fill, an eight-tenths fill, or a complete fill may be provided for small, medium and large loads.

It will be noted, from the chart of FIGURE 7, that when button 35 has been depressed to close switch 80 and select a small load fill, switch 78 is also closed by the operation of the button. Similarly, when button 34 is depressed switch 81 is closed together with switch 79. When button 33 is depressed, switch 82 is closed, together with both of switches 78 and 79.

It will be seen from FIGURE 6 that when switch 78 has been closed, closure of switch 71 will cause energization of solenoid 49 for a predetermined period. When switch 79 makes switch 72 the effective one, the closing of that switch will cause energization of the solenoid 49 for a second longer period, slightly offset from the first period. Thus, the closure of both switches 78 and 79 gives energization of solenoid 49 for a third period which is longer than the others.

In effect, the relationship of the two periods and their overlap is such that when both switches 78 and 79 are closed a full load of treating agent will be aspirated by passage of water through valve 48. When switch 79 is the only one closed about eight-tenths as much will pass through, and when switch 78 is the only one closed, about six-tenths as much will pass through. Thus, the amount of treating agent to be aspirated by operation of valve

48 is readily made proportional to the amount of water to be provided for the washing operation.

Referring now particularly to FIGURES 1, 5, 6 and 7, a complete operation will be described, using the assumption that a large load is to be washed, and it is intended that bleach be provided. With this assumption, the desired speed button is pushed, the bleach member 32 is placed in its up position, and button 33 is pushed to select the fill for large load and the large amount of bleach. Member 36 is rotated to the start position, and is then pushed in so as to close switch 61. Since, in the start position, switch 63 is closed, the timer motor will start to operate.

After a brief period of this operation, cams A and B will close their associated switches, with cam A closing switch 64 so as to prepare the motor for operation in the wash direction. It will be understood, however, that operation is not started at this time, in view of the fact that completion of a circuit through one of switches 68, 69 and 70 still remains to be effected. The closure of switch 65 causes solenoid 40 to be energized so that hot water enters basket 21. This continues for a period determined by cam G acting on switch 70. Toward the end of this period, and during it, switches 68 and 69 are closed by cams E and F consecutively, but since switches 80 and 81 are open, there is no effect. However, when switch 70 is closed by cam G, an energizing circuit for the motor is started through it because switch 82 has been closed by member 33.

The motor causes operation of agitator 18 to start the washing function. The operation of the motor also causes centrifugal mechanism 76 to open switch 75 so that, despite the fact that switch 65 continues to be closed, the solenoid 40 is deenergized, and no further water enters the basket.

Before the end of the wash function, cam H will close switch 71. Since both switches 78 and 79 are closed by operation of button 33, this will energize solenoid 49 and water will then pass through valve 48. The passage of this water will cause aspiration of treating agent from reservoir 56 so that a mixture of water and treating agent passes into the basket. Essentially a 2 to 1 ratio can be achieved, it has been determined by experimentation, so that only a pint of water is necessary to effect the introduction of a cup of bleach.

If switch 79 were open, the introduction of treating agent would cease when cam H opens switch 71. However, with switch 79 closed, the energizing circuit for solenoid 49 will continue to exist through switches 79 and 72, at the time that cam H opens, until cam I opens. When cam I opens its associated switch 72, solenoid 49 will be de-energized, with between a pint and a quart of water having been introduced together with a full cup of treating agent. This is generally considered to be the most desirable amount in connection with a full load of clothes to be washed in basket 21.

It will readily be observed that if a medium load had been selected only cam I would have operated, and would have provided a proportionately smaller amount of bleach, and that if a small load had been selected, cam H would have been the only one effective to cause energization of solenoid 49, and would have caused a small amount of bleach to be provided. Thus, selection of a particular amount of water based on the size of the clothes load, also automatically, according to this preferred embodiment, provides a proportional inflow of bleach.

It will, however, be recognized that it is within the broad scope of my invention to cause the operation of switches 78 and 79 to be independent of switches 80, 81 and 82 so that the amount of bleach may be independently varied rather than selected at the same time as the size of the load. Also, of course, it will be understood that in the broadest embodiment other means of varying the length of time of energization of solenoid 49 may be

provided rather than the particular four-switch, two-cam arrangement shown.

Continuing briefly with the description of the operation of the machine, the washing operation continues until cam A opens its associated switches to cause deenergiza- 5
tion of motor 8. At this time the valve solenoids are also de-energized through cams B and C, so that the stopping of the motor does not cause water to be introduced. At the end of this pause (Pause A in FIGURE 6) the motor is reconnected for operation in the opposite direction. 10
This provides a spin, as previously mentioned, for a desired period of time. At the end of the spin cam A again opens its associated switches, and as before, operation of the motor terminates. During this second pause (Pause B) the cams E, F and G open their associated switches, 15
and cams B and C close their associated switches.

The closure of cams B and C causes a mixture of hot and cold water—that is, warm water—to start to enter basket 21. The closure of switch 54 by cam A at the end of the pause does not affect the entry of the water: no circuit is completed for the motor because cams E, F and G have opened their associated switches. Then, as during wash, cam G will cause the motor to start because switch 82 has been closed, thereby shutting off the water and providing an agitated rinse for the desired period of time 25
until cam A again opens switch 64. Then, after a pause (Pause C) to permit the motor to come to a stop, cam A re-closes switch 64a to provide a final spin. At the end of the final spin cam D opens the switch 63 to terminate the cycle of operation. 30

It will be seen that with the structure and the electrical control system provided, two highly important objectives have been achieved. First, with regard to the physical construction, the energy of the inlet water has been utilized upstream of the air gap to introduce treating agent without any possibility that the treating agent in the reservoir may be drawn back into the supply system. While the particular embodiment I have shown contemplates the provision of an agent which should be brought in subsequent to the initial filling, the invention in its broader aspect also applies to the introduction of an agent with the initial filling. For instance, there are liquid detergents which could be used, and which could be aspirated directly by the main inlet valve 39. In such a case, a closure member to block conduit 47 during rinse is all that would be required. Such an arrangement would give the substantial advantage that, during wash, the introduction of different amounts of water would automatically cause the introduction of differing amounts of detergent in the correct proportions. 40

The other main aspect of my invention lies in the provision of a circuit arrangement which permits varying quantities of agent to be added in the broadest aspect thereof, and in a more specific and narrow aspect provides for tying the amount of treating agent brought in to the amount of water brought into the basket so that the proper proportional relationship of the two is maintained.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my 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 it is therefore aimed in the appended claims to cover all such equivalent variations as fall within the true spirit and scope of my invention. 60

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

1. A washing machine comprising:

- (a) container means for water and articles to be washed; 70
- (b) water inlet means arranged to control passage of water to said container means and adapted to be connected to a source of water under pressure, said inlet means including first and second valve means; 75

(c) means forming of air break between said first and second valve means and said container means;

(d) a reservoir for liquid treating agent;

(e) conduit means having one end within said reservoir in aspirating relation to liquid therewithin and having its other end connected to said first valve means above said reservoir so as to be subjected to the aspirating effect of flowing water upstream of said air break;

(f) said second valve means passing a substantially larger amount of water when opened than said first valve means; and

(g) a control system for controlling the periods during which said first valve means is open and during which said second valve means is open.

2. A washing machine comprising:

(a) container means for water and articles to be washed;

(b) water inlet means arranged to control passage of water to said container means and adapted to be connected to a source of water under pressure, said inlet means including first and second valve means;

(c) means forming an air break between said inlet means and said container means;

(d) conduit means having one end connected to said first valve means so as to be subjected to the aspirating effect of flowing water upstream of said air break and extending downwardly to its other end so that its other end may be positioned within a reservoir of treating agent in aspirating relation to the agent therewithin;

(e) said second valve means passing a substantially larger amount of water when opened than said first valve means; and

(f) a control system for controlling the periods during which said first valve means is opened and during which said second valve means is opened.

3. The apparatus defined in claim 2 wherein said control system is arranged to cause the length of time of aspiration to increase proportionately with the amount of water provided to said container means.

4. The apparatus defined in claim 2 wherein said air break is formed at least in part by a vent passage extending upwardly from said inlet means downstream of said other end of said conduit means, and wherein an outlet conduit has one end connected to said inlet means and extends downwardly toward said container means, said vent passage and said outlet conduit being formed in relation to each other so that liquid flows from said inlet means only through said outlet conduit and not through said vent passage. 45

5. The apparatus defined in claim 1 wherein said air break for said first valve means is formed at least in part by a vent passage extending upwardly from said first valve means downstream of said other end of said conduit means, and wherein an outlet conduit has one end connected to said inlet means and extends downwardly toward said container means, said vent passage and said outlet conduit being formed in relation to each other so that liquid flows from said first valve means only through said outlet conduit and not through said vent passage. 50

6. A washing machine comprising:

(a) container means for water and articles to be washed;

(b) water inlet means arranged to control passage of water to said container means and adapted to be connected to a source of water under pressure, said inlet means including first and second valve means;

(c) means forming an air break between said inlet means and said container means;

(d) a reservoir for liquid treating agent;

(e) conduit means having one end within said reservoir in aspirating relation to liquid therewithin, and having its other end connected to said first valve means above said reservoir so as to be subjected to 75

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the aspirating effect of water flowing upstream of said air break;

- (f) first control means for controlling the length of time said first valve means is open;
- (g) second control means for controlling the amount of water passed by said second valve means; 5
- (h) said first control means including a pair of energizing circuits for causing operation of said first valve means, means for causing one of said energizing circuits to be completed for a first predetermined period of time and the other of said energizing circuits to be completed for a second longer predetermined period of time offset from said first period of time, and means for selecting either or both of said energizing circuits. 10 15

7. The apparatus defined in claim 6 wherein said first control means and said control means are provided with a single manual control so as to cause the length of time of operation of said second valve means to increase with the length of time of energization of said first valve means. 20

8. A washing machine comprising:

- (a) container means for water and articles to be washed;
- (b) water inlet means arranged to control passage of water to said container means and adapted to be connected to a source of water under pressure including first valve means and second valve means; 25
- (c) means forming an air break between the outlets of said valve means and said container means; 30
- (d) a reservoir for liquid treating agent;
- (e) conduit means having one end within said reservoir in aspirating relation to liquid therewithin and having its other end connected to said first valve means above said reservoir so as to be subjected to the aspirating effect of water flowing therethrough; 35
- (f) first control means for providing a selectively variable predetermined amount of water from said first valve means; and
- (g) second control means for providing a second larger amount of water from said second valve means than any provided from said first valve means. 40

9. A washing machine comprising:

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- (a) container means for water and articles to be washed;
- (b) water inlet means arranged to control passage of water to said container means and adapted to be connected to a source of water under pressure;
- (c) a reservoir for liquid treating agent;
- (d) means for causing liquid treating agent to pass from said reservoir into said container means at a predetermined rate;
- (e) a control system for controlling the length of time that treating agent is caused to pass from said reservoir to said container means; and
- (f) manual means for selectively and variably manually pre-setting the length of time that said control system causes passage of liquid from said reservoir, said manual means also preselecting the amount of water that is passed from said water inlet means into said container means so that a substantially predetermined ratio of treating agent to water in said container is attained.

10. The apparatus defined in claim 9 wherein said control system includes first and second energizing circuits for causing passage of treating agent from said reservoir into said container means, means for causing said first energizing circuit to be completed for a first predetermined length of time and said second energizing circuit to be completed for a second longer predetermined length of time offset from said first length of time, said manual means providing for selection of said first energizing circuit, said second energizing circuit, or both energizing circuits, thereby to provide for three different amounts of treating agent to be passed from said reservoir into said container means.

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