

Aug. 7, 1951

W. F. OLIVER

2,563,738

WASHING MACHINE CONTROL SYSTEM

Filed Feb. 20, 1946

4 Sheets-Sheet 1

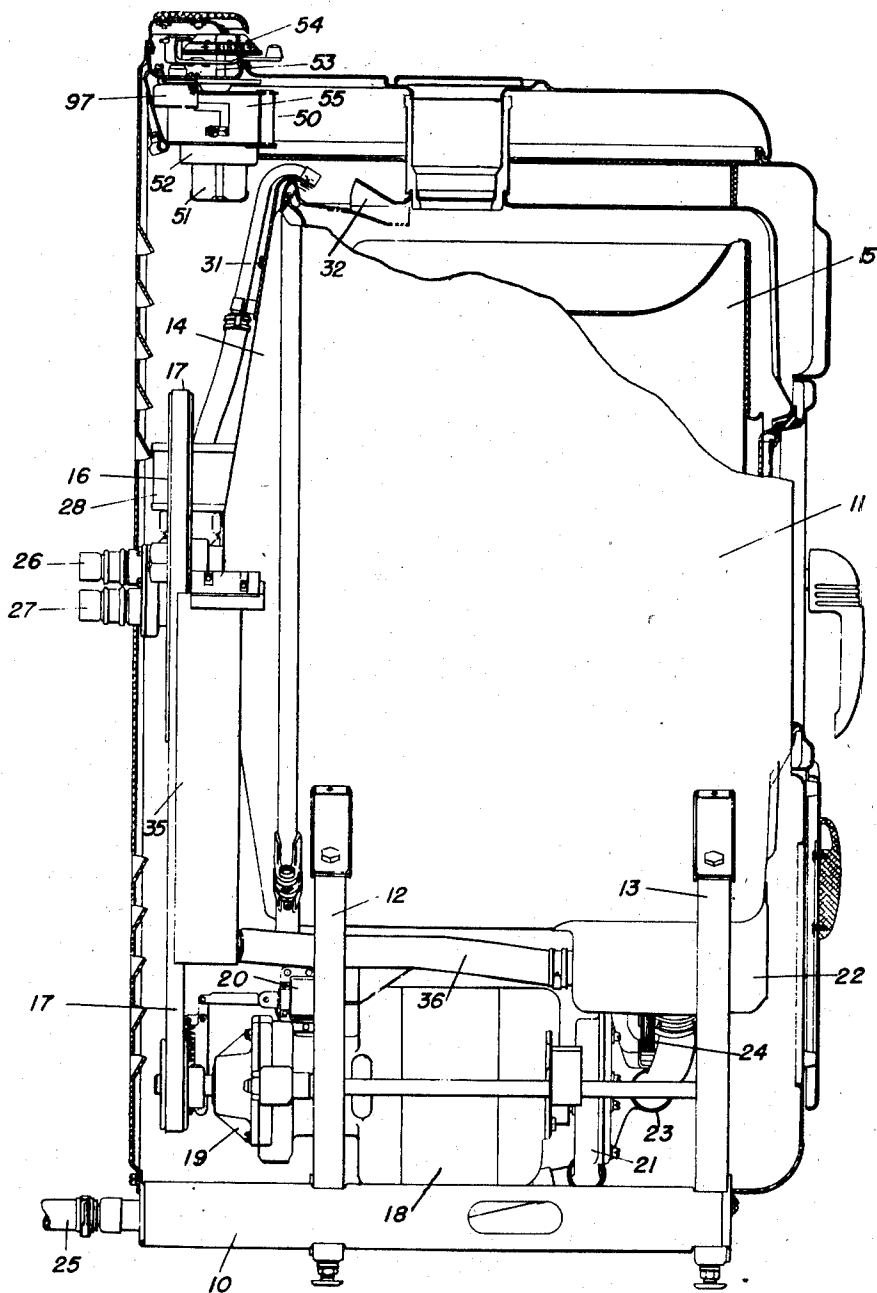


FIG. 1

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4 Sheets-Sheet 2

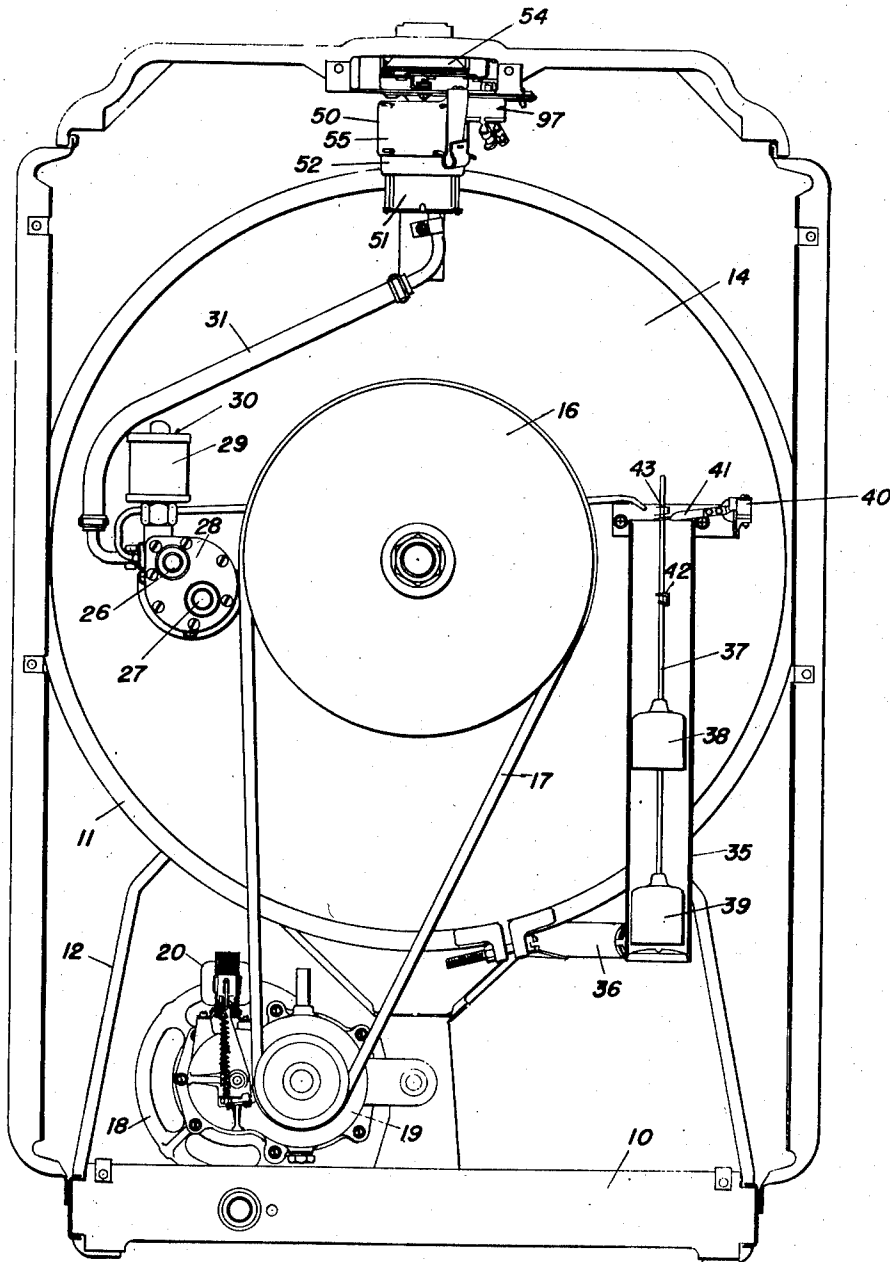


FIG. 2

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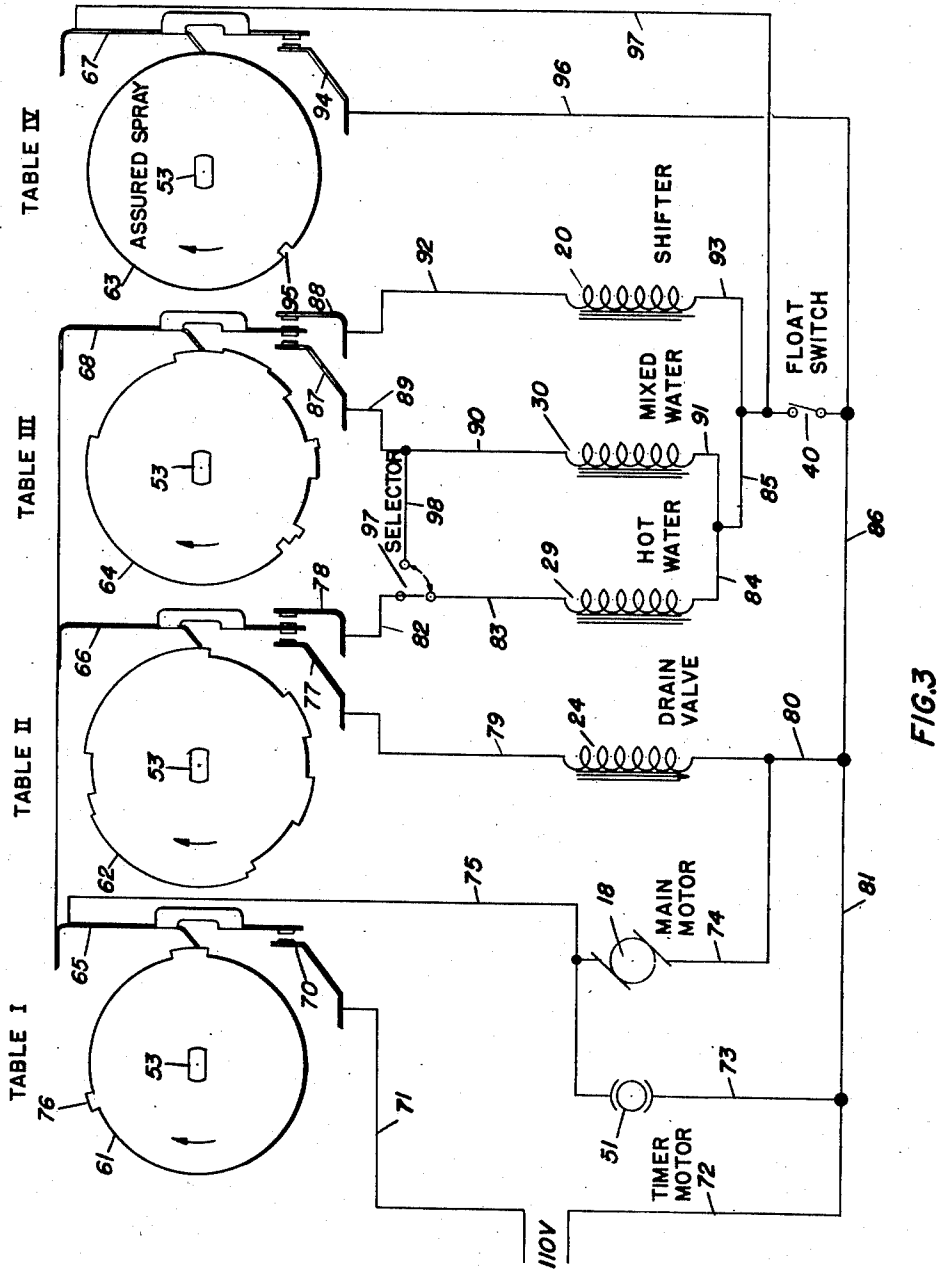
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WASHING MACHINE CONTROL SYSTEM

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4 Sheets-Sheet 3



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WASHING MACHINE CONTROL SYSTEM

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4 Sheets-Sheet 4

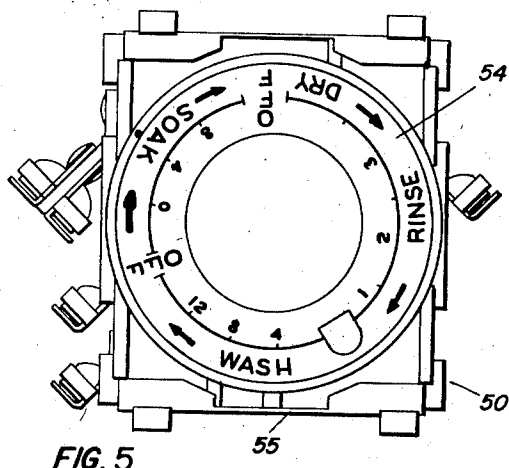


FIG. 5

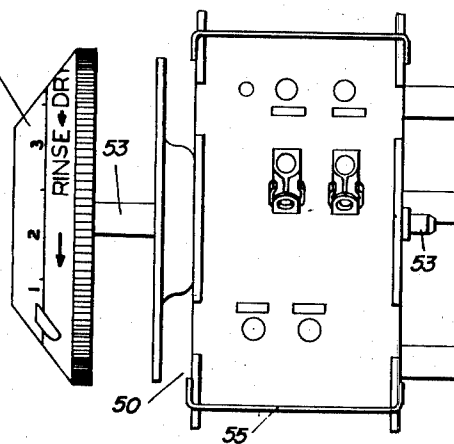


FIG. 6

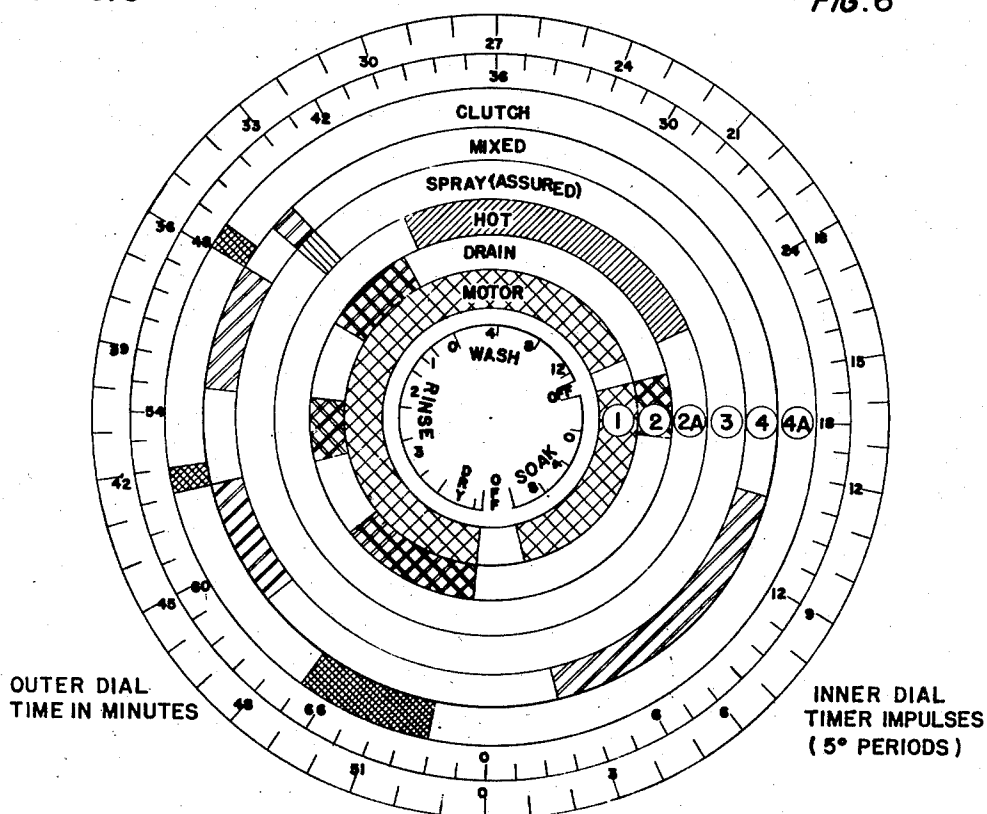


FIG. 4

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2,563,738

WASHING MACHINE CONTROL SYSTEM

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Application February 20, 1946, Serial No. 648,959

7 Claims. (Cl. 68—12)

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This invention relates to automatic washing machines, and more particularly to mechanism for automatic operation of such machines.

Washing machines having a series of controlled operations made possible by actuation in sequence of several actuating mechanisms carried on the machine to carry out a series or cycle of operations have been used for several years. The present invention is particularly applicable to the type of machine employing a rotating clothes cylinder mounted for rotation with a level of washing liquid accomplishing a washing action by tumbling of the clothes in the cylinder. The first operation of such a type of washer is a washing operation in which soap is used producing a suds necessary to a satisfactory washing action. However, when the washing step has been completed the next problem is to rinse the clothes in a satisfactory manner which means removing the suds and soap. It is therefore important that if an excessive amount of suds is formed in the washing operation this suds should be quickly reduced and a major amount of it flushed away into the drain as soon as possible. It is therefore quite essential that after the initial wash water has been drained away leaving a considerable amount of suds, that a "spray" rinse be employed, which means that the drain valve of the machine is left open and the water fed into the machine is allowed to drain as fast, or almost as fast, as it is put in; thus accomplishing a reduction in the amount of suds in a minimum of time. The provision of a deep rinse at this time would accomplish the desired result but in a longer time as the initial suds can obviously be carried away more quickly by a continuous flow of water which is also continuously drained.

The provision of a suitable sequence of washing and rinsing operations comprising a method which will effectively complete a satisfactory washing and rinsing of the clothes in the minimum of time is important and after careful tests the use of an initial spray rinse followed by a series of deep rinses with centrifugal extraction between these rinses has been found to accomplish exceptional results.

In the washing machine herein disclosed the sequence of operations, although set up on a cam controlled timer which closes necessary circuits, is for some of such operations also dependent on a closing of circuits by a float; that is the float must show the equivalent of an empty tub before the next operation will be allowed to start. The sequence of operations re-

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quires a spray rinse just after the washing operation when there is often a great amount of suds present but nevertheless it is important that the wash water and suds be drained from the tub. In some cases at the end of the washing operation there is sufficient amount of suds pressure to hold the float above the bottom position even after normal draining time has been provided and thereby prevent the float switch from closing the circuit which normally enables the operation of spray rinse to go forward and if no other means were provided such condition would cause the spray rinse to be skipped. The mechanism herein disclosed and claimed overcomes this difficulty however by employing a secondary cam controlled circuit which closes and therefore actuates the circuit controlling water entry for the short time necessary to supply water for the spray rinse to be completed. Such closing of the circuit during the time necessary to complete the spray rinse is independent of the position of the float and such an addition to the mechanism assures a result which is herein termed as "assured spray."

It is therefore a primary object of the present invention to provide an apparatus for washing and rinsing with an automatic machine which will assure a satisfactory washing and rinsing of the clothes automatically even with varying conditions of suds pressure and amount of suds.

It is a further object to provide a wash cycle and control therefor which will assure the operation of the automatic machine cycle in the desired sequence and include mechanism to assure carrying out of such cycle and will particularly assure suitable spray rinsing following the wash operation.

The above and other objects of the invention will appear more fully from the following more detailed description and by reference to the accompanying drawings forming a part thereof and wherein:

Figure 1 is a side view of an automatic washing machine, partly in section, of the type employing the mechanism herein disclosed.

Figure 2 is a rear view of the machine shown in Figure 1.

Figure 3 is a wiring diagram showing the control circuits and a diagram of the arrangement of the several timer cams to close the several circuits.

Figure 4 is a view of a time control chart showing a sequence of operations as determined by the timer.

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Figure 5 is a top view of the assembled timer and dial.

Figure 6 is a side view of the assembled timer and dial.

Referring to the drawings, the illustrated machine comprises a base 10 which supports a tub 11 through brackets 12 and 13. The tub 11 has a coneback portion 14 made up of two conically shaped sheet metal members placed base to base with their edges together at the periphery of the drum. These spaced cones provide supports for a bearing at the apex of each cone. Such spaced bearings provide a cantilever support for a clothes cylinder 15 which has a suitable shaft for such support, which shaft and clothes cylinder is rotated through a pulley 16 and belt 17 by a motor 18 through suitable speed transmission 19. This transmission provides a low rotation speed for washing and a higher speed for centrifugal extraction of water from the clothes by rotation of the cylinder 15. This transmission may be of the type shown in co-pending application Serial No. 585,947, now Patent 2,412,331, issued to M. H. Green December 10, 1946, and the two speeds of operation are made operable by actuation or non-actuation of an electric solenoid called a shifter solenoid 20. The transmission gearing with a 1750 R. P. M. motor in the machine illustrated will cause the drum 15 to be rotated at 59 R. P. M. at a speed for washing with the shifter solenoid not actuated. However, when the shifter solenoid 20 is actuated a different set of gears is put in operation to cause the motor to drive the cylinder 15 at a much higher speed, 350 R. P. M. in the machine disclosed, at which speed the centrifugal force acting on the liquid in the clothes carried in cylinder 15 will cause liquid to be thrown outward through perforated openings in the clothes cylinder 15.

On the opposite end of the motor 18 from the transmission a water pump 21 is provided which may be continuously rotated by the motor 18. The bottom of the tub has a sump 22 into which the water in the tub is drained and which connects with a drain valve 23 which drain valve 23 is in turn connected to the inlet of the water pump 21.

This drain valve 23 is normally held in a closed position which prevents outflow of water from the sump 22 and the tub 11. A drain solenoid 24 when actuated opens this drain valve 23 and allows water from the tub to flow into the pump 21. When such action occurs the pump 21 will pump the fluid from the tub out through the drain hose 25.

For the purpose of supplying water to the machine the hot water supply line is connected to a hot water inlet 26 and the cold water supply line is connected to a cold water inlet 27 of a thermostatically controlled mixing valve 28. This valve may be of any desired construction which will accomplish the function but for the purpose of illustration herein may be of the type described in U. S. Patents 2,269,259 and 2,310,975. The purpose of such mechanism is to mix hot and cold water at a temperature which will be substantially constant for use in the machine or to supply hot water directly from the hot water line into the machine. For the purpose of actuation of the mechanism of the control valve to accomplish the furnishing of these two temperatures of water a so-called hot water solenoid 29 is employed the actuation of which opens a valve to allow hot water from the hot water

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inlet 26 to be directly admitted into the machine while the actuation of another solenoid 30 which is termed a mixed water solenoid will cause mixed hot and cold water of a definite temperature to be admitted to the machine. This admittance of water to the machine is through a conduit 31 from the mixing valve 28 and may be so positioned as to send water into the top of the tub through the inlet 32.

For the purpose of indicating and controlling the height of water in the tub 11 a float chamber 35 is provided on the back of the machine as shown in Figure 2. The bottom of this float chamber is connected to the sump 22 of the machine through a hose connection 36 so that the level of the fluid in the float chamber will be indicative of the level of the fluid in the tub 11. A float rod 37 carrying a pair of floats 38 and 39 assures that the rod 37 will move up and down with the water level in the tub. Adjacent the float chamber 35 a float switch 40 is supported and provided with an actuating arm 41. This switch is so constructed that when the actuating arm 41 is in a downward position the switch 40 will be closed and when the actuating arm is in an upper position the switch will be open. The actuating arm is moved up and down by contact with stops 42 and 43 on the float rod 37. In other words, the switch will be closed by contact of stop 43 when the float is at the bottom of the float chamber when water is drained from the tub and the switch will be opened by contact of the stop 42 when the float is raised by water level to a pre-determined full position determined by the position of the stop 42 on the rod 37.

For the purpose of closing necessary electrical circuits to cause the several control mechanisms to be actuated in the desired sequence, an electric motor driven cam switch mechanism is employed. Such mechanism uses preferably a self starting synchronous electric motor such as is normally used in electric clocks. In the machine herein disclosed a motor 51 drives an escapement 52 which may be of the general type disclosed in Patent Number 2,227,133 and which will cause a cam carrying shaft 53 to be advanced in rotation, preferably in increments, with an impulse giving such movement each 45 seconds. As shown in Figures 5 and 6, the shaft 53 extends upwardly into a box 55 and mounted in spaced relation on this shaft are four cams 61, 62, 63 and 64 which rotate with the shaft 53. These four cams are shown in Figure 3. A dial 54 is mounted on shaft 53 above the box 55. This dial serves as an indicator and as a means to start the machine and to vary the setting as will later appear. Adjacent each of these four cams is a spring switch member shown in Figure 3 as number 65 for cam 61, 66 for cam 62, 67 for cam 63, and 68 for cam 64. Each of these switch members included in the box 55 has suitable connections to the outside of the box to provide for control of circuits, as shown in the wiring diagram Figure 3, on rotation of the shaft 53 as hereinafter described.

The shaft 53, and the cams 61, 62, 63, and 64 carried thereby as shown in Figure 3, rotate in a clockwise direction.

The cam 61 on clockwise rotation has its circumference so cut as shown so that for a rotation of $14\frac{1}{2}^\circ$ from the neutral point shown in Figure 3 the spring switch member 65 will be held away from contact with an electrical switch contact 70. However, after rotation of the cam

61 accomplished by manual rotation of dial 54, through the $14\frac{1}{2}^\circ$ above specified the change in radius of this section of the cam is such, as shown in Figure 3, that the spring switch member 65 will be allowed to swing into contact with the electrical switch contact 70 and close a circuit comprising conductors 71, 72, 73, 74, and 75 thereby to cause the synchronous motor 51 and the main electric drive motor 18 to be started by closing of the circuit to the 110 volt line current as shown on the diagram Figure 3. This contact continues closed as the clockwise rotation of the cam 61 continues until the spring switch member 65 contacts the projection 76 on the cam 61 which is located at 105 degrees from the zero starting point shown in Figure 3. When such projection contacts and moves the switch member the electric circuit to the motor is broken and remains broken during the rotation through $9\frac{1}{2}^\circ$ which corresponds with the width of the projection 76. The circuit is again closed when the switch member 65 drops off the projection 76, which movement is produced by manual movement of dial 54, and the circuit is closed for the remainder of the rotation of the cam up to the point of 355° where the cam again breaks the circuit. The above angular relations and the corresponding time relation is set forth in Table I.

Table I

Degrees of Rotation	Equivalent Time in Minutes ¹	Condition
0	0	Motor and timer motor off.
$14\frac{1}{2}$	$2\frac{1}{4}$	Motor and timer motor on.
105	$15\frac{3}{4}$	Motor and timer motor off.
$114\frac{1}{2}$	$17\frac{1}{4}$	Motor and timer motor on.
355	$53\frac{1}{4}$	Motor and timer motor off.

¹ When 5° equals 45 seconds.

Time given in Table I (as well as Tables II, III and IV) is equivalent time in minutes from a "zero" position assuming that 5 degrees of rotation equals 45 seconds in time which corresponds with the rate of rotation used. Equivalent time values therefore include dwell but are used to show relationship.

The cam 62 is likewise rotating with the cam 61 as it is carried by the same shaft 53. This cam, however, has provisions for control of two circuits and the spring switch member 66 is designed to close electrical contact 77 on a movement in a direction toward the cam and to close an electrical contact 78 on movement away from the cam. The radius of the cam at the neutral or zero point shown in Figure 3 is such that the spring switch member 66 is in a neutral position and does not therefore close either the contact 77 or 78. As shown on the wiring diagram Figure 3 the contact 77 controls the drain solenoid 24 through conductors 79, 80 and 81 and the contact 78 controls the hot water solenoid 29 through the conductors 82 and 83 this circuit being completely closed, however, only when the float switch 40 is closed by a down position of the float. The rotation of the cam 62 in a clockwise direction therefore produces the following actuations of the drain solenoid and the hot water solenoid because of its circumferential contour affording radii required to locate the spring switch member in the desired positions. The angular positions and the time provided by the rotation is set forth in Table II.

Table II

Degrees of Rotation	Equivalent Time in Minutes ¹	Condition
0	0	(Hot Water solenoid off. Drain solenoid off.)
$84\frac{1}{2}$	$12\frac{3}{4}$	(Hot water solenoid off. Drain solenoid on.)
105	$15\frac{3}{4}$	(Hot water solenoid off. Drain solenoid off.)
115	$17\frac{1}{4}$	(Hot water solenoid on. Drain solenoid off.)
$204\frac{1}{2}$	$30\frac{3}{4}$	(Hot water solenoid off. Drain solenoid off.)
$209\frac{1}{2}$	$31\frac{1}{2}$	(Hot water solenoid on. Drain solenoid on.)
240	36	(Hot water solenoid off. Drain solenoid off.)
$264\frac{1}{2}$	$39\frac{3}{4}$	(Hot water solenoid off. Drain solenoid on.)
285	$42\frac{3}{4}$	(Hot water solenoid on. Drain solenoid off.)
$309\frac{1}{2}$	$46\frac{1}{2}$	(Hot water solenoid off. Drain solenoid on.)
355	$53\frac{1}{4}$	(Hot water solenoid off. Drain solenoid off.)

¹ When 5° equals 45 seconds.

The cam 64 is likewise a cam which controls two circuits by selective closing of two contacts 87 and 88, the contact 87 controlling the mixed water solenoid 30 through the conductors 89, 90, 91, 85 and 86, this circuit also being dependent upon the closed position of the float switch 40. The contact 88 controls the shifter solenoid 20 through the conductors to the same circuit through the float switch 40. The actuation of the shifter solenoid 20, as previously stated, changes the transmission drive 19 to rotate the cylinder 15 at centrifuging speed instead of slower washing speed which is afforded when the motor 18 is operating and the shifter solenoid 20 is not actuated. Table III shows the degrees of rotation and the time of actuation of each of the units controlled by this cam 64.

Table III

Degrees of Rotation	Equivalent Time in Minutes ¹	Condition
0	0	(Mixed water off. Low speed clutch.)
$14\frac{1}{2}$	$2\frac{1}{4}$	(Mixed water on. Low speed clutch.)
75	$11\frac{1}{4}$	(Mixed water off. Low speed clutch.)
$224\frac{1}{2}$	$33\frac{3}{4}$	(Mixed water on. Low speed clutch.)
230	$34\frac{1}{2}$	(Mixed water off. Low speed clutch.)
235	$35\frac{3}{4}$	(Mixed water off. High speed clutch.)
$239\frac{1}{2}$	36	(Mixed water on. Low speed clutch.)
265	$39\frac{3}{4}$	(Mixed water off. Low speed clutch.)
280	42	(Mixed water off. High speed clutch.)
$284\frac{1}{2}$	$42\frac{3}{4}$	(Mixed water on. Low speed clutch.)
310	$46\frac{1}{2}$	(Mixed water off. Low speed clutch.)
325	$48\frac{3}{4}$	(Mixed water off. High speed clutch.)
$349\frac{1}{2}$	$52\frac{1}{2}$	(Mixed water off. Low speed clutch.)

¹ When 5° equals 45 seconds.

The cam 63 with its spring switch member 67 is designed to close the contact 94, this contact, however, being closed only for a period of time determined by the notch 95 cut in the circumference of the cam allowing the spring switch member 67 to close the contact 94 for $5\frac{1}{2}^\circ$ of rotation beginning $224\frac{1}{2}^\circ$ from the zero point shown in Figure 3. The effect of the closing of the contact 94 is to short circuit the float switch 40

through the conductors 96 and 97 for the short period of time the contact 94 is closed. The table showing times and angles is Table IV. This closing of the contact 94 coincides with the spray rinse provided on the cam 64.

Table IV

Degrees of Rotation	Equivalent Time in Minutes ¹	Condition
0	0	Timer switch. Short circuit open.
224 1/2	33 1/4	Timer switch. Short circuit closed.
230	34 1/2	Timer switch. Short circuit open.

¹ When 5° equals 45 seconds.

The rotation of the cams 61, 62, 63, and 64 as just described, by causing electrical contacts to be closed to actuate the several mechanisms previously mentioned and as shown in the wiring diagram Figure 3, will cause the actuation of several units in the relation shown by the chart Figure 4. The graduation on the inner dial represents impulses of the timer shaft 53, each impulse equaling 5° on the dial or 45 seconds in time. The graduation on the outer dial represents time in minutes. Each of the concentric portions marked represents the control unit indicated, the shaded portion in each concentric ring indicating the time that the particular unit is actuated by electrical impulse as controlled by the circuits in accordance with the previously described hook-up in the wiring diagram Figure 3.

From the above description and by reference to the chart the following time cycle is accomplished:

Table V

Condition:	Time
Dwell -----	
Fill and soak -----	10 1/2
Drain -----	3
Dwell -----	
Fill and wash -----	14 1/4
Drain -----	2 1/4
Spray rinse -----	3/4
Tumble -----	3/4
Spin -----	3/4
Fill and rinse -----	3 3/4
Drain -----	2 1/4
Spin -----	3/4
Fill and rinse -----	3 3/4
Drain -----	2 1/4
Spin -----	3 3/4
Tumble -----	3/4

Although the above table shows the time during which actuation of the various circuits to the units mentioned would be called for by the cams 61, 62, and 64, the full closing of such circuits, for some of the units, are also dependent upon the closing of the float switch 40 as previously stated. In the case of the mixed water solenoid, however, for the short time that the so-called spray rinse for 3/4 of a minute requiring mixed water and an open drain valve, the cam 63 closes the contact 94 to short circuit the float switch so that for this short period of time the circuit to the mixed water solenoid is closed. Therefore, even though an excessive amount of suds in the washing machine at this specific time may prevent the float from reaching the bottom of the float chamber 35 there will nevertheless be a closing of the circuit to the mixed water solenoid by contact 94 and contact 87 and therefore

a spray of mixed water into the washing machine tub is assured which will immediately dilute the suds in the tub and thereby assist in clearing the tub of such suds. It is important in this connection, that although this float switch control for the several units may be important for other portions of the cycle, still for this short interval of time the provision of a spray rinse is of primary importance and therefore the substitution of contact 94 for the float switch control is advisable.

When the spring switch member 66 is actuated by the cam 62 to close the electrical contact 78 the normal result is the actuation of the hot water solenoid 29 through the conductors 82 and 83. However, for the purpose of providing mixed water in place of hot water when desired a selector switch 97 is provided which makes possible a break in the connection between the conductors 82 and 83, and a connection of conductor 82 to a conductor which connects directly to the conductor 90 to thereby actuate the mixed water solenoid 30 in place of the hot water solenoid 29. This result is accomplished when switch 97 is moved to its opposite position as shown by the arrows in Figure 3.

In operation the clothes to be washed are placed in the machine through the door opening into the clothes cylinder 15 and the timer dial 54 is turned in a clockwise direction until the first part of the "soak" portion of the dial is opposite the zero position as shown on the diagram Figure 4. It is apparent from inspection of Figure 3, that the main driving motor 18 and the timer motor 51 will be started in operation by the closing of the contact 70 after such movement of dial 54. Therefore the timer will then be moving with intermittent impulses of rotative movement each 45 seconds to rotate the shaft 53 in a clockwise direction as viewed in Figure 3. The same rotation of the shaft 53 which starts the timer motor 51 and drive motor 18 also rotates the cam 64 in amount such that the contact 87 is closed and the mixed water solenoid 30 is actuated thus causing the mixing valve 28 to flow mixed water into the machine. The motor 18 and timer motor 51 continue to operate and the mixed water valve continues to feed water into the washing machine tub 11 until the float 38 carrying the stop 42 reaches an upper position such that it will contact the actuating arm 41 of the float switch 40. The float switch therefore is controlled by the height of water in the tub as shown by the water height in the float chamber 35 and when the stop 42 contacts the switch actuating arm 41 the switch is actuated to break the circuit, as shown in Figures 2 and 3, and therefore the mixed water solenoid is cut off and water no longer flows into the machine. However, the cam 64 continues to keep the contact 87 closed, generally for a longer period than is required to fill the machine with water but nevertheless the circuit is opened by switch 40. As the rotation of the timer dial continues, the cam 62 causes the spring switch member 66 to close the contact 77 and actuate the drain valve. Such actuation drains water from the tub and at the end of the time allowed for such drain the timer motor and the drive motor are both stopped and the machine is no longer in operation. The above described cycle of operations from the start to the time that both of the motors are stopped constitutes a so-called "soak" cycle for the machine and as soap is added manually soon after the water is introduced into the machine the result will be a saturation of the clothes with water

and soap and a drainage of the water will leave the clothes saturated with a soap solution. The machine may then be left with soap saturated clothes for the length of time desired and on subsequent rotation of the timer dial to the position to start the washing operation the drive motor 18 and the timer motor 51 will again be started and at this time the hot water solenoid 29 will be actuated to cause hot water to flow into the tub. This flow of hot water will continue until the float switch 40 is again actuated by raising of the water level and the lifting of the float so that the circuit to the hot water solenoid 29 is broken by breaking the float switch circuit. The washing action continues at the low speed rotation of the machine until the drain solenoid 24 is actuated by operation of cam 62 which causes the water to drain by opening the drain valve. After the drain valve has been open a sufficient amount of time to let the greater amount of the water drain from the machine the mixed water solenoid is actuated by operation of the cam 64 to close the contact 97. During the operation it must be remembered that the mixed water solenoid cannot operate unless the circuit is closed and if the float switch were allowed to close this circuit it would be necessary for the float to be near the bottom of the float chamber so that the stop 43 would contact the lever 41. However, in case there should be excessive suds in the machine it might happen that the float switch would not drop to the bottom of the float chamber 35 therefore unless this occurred the mixed water solenoid 30 could not be actuated. However, to assure that such actuation will occur at this time regardless of whether or not the float switch is closed an auxiliary circuit closing means is provided by a special cam 63. The sole purpose of this cam is to close a circuit made up of conductors 96 and 97 connected on opposite sides of the switch 40 which circuit will be closed by a contact 94, this contact being closed by a spring switch member 67 which drops into a notch 95 in the cam 63. When this occurs the effect is the same as though the float switch were closed and the mixed water will be allowed to flow into the machine for a spray rinse which has been termed an "assured spray rinse." Such flow of mixed water into the machine assures that the suds will be flushed from the machine and the clothes put in a condition to be more completely rinsed. The next operation is the changing of the gear ratio of the transmission by the actuation of the clutch therein to high speed for centrifugal drying, this actuation being accomplished by the actuation of the shifter solenoid 20, as previously stated, which is also controlled by the cam 64 and the contact 88. It is noted that this shifter solenoid can only be actuated when the float switch 40 has been closed by the dropping of the float to the bottom of the float chamber and therefore high speed spinning can not occur unless water has been drained from the machine. However, this draining of the water and definite closing of the circuit has been assured by clearing of suds by the spray rinse previously provided. After the short period of spin the mixed water solenoid is again actuated by the cam 64 and the drain valve is again closed at this point by the cam 62. The machine fills with fresh mixed water and the clothes are tumbled at the washing speed and are given a so-called "deep water rinse" which means that the clothes tumble with water in the tub as distinguished from a "spray rinse" when the drain valve is open. This deep rinse is terminated by the opening of the drain

valve by the cam 62 and the draining of the water from the tub by actuation of cam 64 followed by a spinning of the cylinder at higher speed to throw the water therefrom. A further rinse is provided by a second actuation of the mixed water solenoid through the cam 64 and a subsequent actuation of the drain valve followed by a longer spin for water extraction, at the end of which time the clothes are in condition to be removed from the tub. These last rinse operations as well as the entire cycle as described are shown on the cycle chart Figure 4.

Although the invention has been described by reference to a specific structure found practical in actual operation it is understood that modifications are intended within the scope of the following claims.

I claim:

1. In a washing machine having a washing liquid container, electrically operated mechanism controlling the flow of liquid into said washing liquid container, an electrical circuit operative to cause said mechanism to admit liquid into the container when said circuit is closed, an automatically operated sequential controller in said circuit for timing the cycles of wash, rinse and spin-dry, a switch in said circuit, operating mechanism for said switch providing actuation at timed intervals according to a predetermined cycle, liquid level responsive means indicative of the level of washing liquid in said container, a second switch also in said circuit actuated by said liquid level responsive means so connected that said switch remains open during draining of said container until the container has been drained to a predetermined minimum level at which time such switch is closed, and a third switch operable by said sequential controller to short circuit said liquid level controlled switch during said rinse cycle thereby to assure flow of liquid into said container regardless of the level of the liquid in said container.

2. In a washing machine comprising a washing liquid container, mechanism for automatically admitting washing liquid to said container, a mechanism responsive to the liquid level in said container, an electrical circuit operative to admit liquid to the container when said circuit is closed, an automatically operated sequential controller in said circuit for timing the cycles of wash, rinse and spin-dry, a switch in said circuit, mechanism for closing said switch at predetermined intervals in a cycle of operation, a second switch in said circuit operated by said water level responsive mechanism positioned to close at a predetermined low level of washing liquid and to open when a high level is reached, and separate mechanism operable by said sequential controller for short circuiting said second switch for a short interval in said rinse cycle.

3. In a washing machine having a drive motor, a water inlet, and a transmission providing a variation in speed to increase the speed of a rotatable member above a lower washing speed for centrifugal extraction, and electrical means for causing actuation of the aforesaid elements, comprising an automatically operable sequential controller for timing the cycles of wash, rinse and spin-dry, the combination therewith of a plurality of circuits one controlling actuation of each of the aforesaid elements, said sequential controller being adapted to close said circuits in a predetermined relation thereby providing a cycle of operation for said elements, a water level responsive mechanism, a switch in series with said water inlet circuit operable by said water level responsive

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mechanism requiring a low water level to assure actuation of said water inlet when said switch is closed, and a separate switch operable by said sequential controller to short circuit said water level responsive switch mechanism for an interval in the rinse cycle of operation to nullify the effect thereof for such interval.

4. In an automatic washing machine of the character described, having washing, rinsing, and extracting cycles, water admitting means comprising a solenoid operated valve the energization of which causes water to be admitted to said machine, water level responsive means, a circuit for energizing said water valve solenoid, a switch operable by said water level responsive means in the circuit of said water control solenoid, said switch being closed by position of said water level responsive means corresponding to a low water level and opened by said water level responsive means at a maximum predetermined water level, an automatically controlled sequence switch also in the circuit of said water valve solenoid and operable to admit water into said tub at desired times in the cycle of operation of said automatic washing machine, driving mechanism for said sequence switch, said water level control switch, however, limiting the energization of said water valve solenoid by said automatically controlled switch to the positions of said water level assumed when filling from empty to maximum water level position, and a short circuiting switch actuated by said sequence switch driving mechanism to short circuit said water level control switch at selected portions of the cycle whereby admittance of water is assured for said selected portions of the cycle, regardless of the position of said water level control.

5. In an automatic washing machine of the character described, an automatically operated sequence switch mechanism for timing the cycles of wash, rinse and spin-dry and for closing a plurality of circuits in timed relationship controlling the actuation of a plurality of electro-magnetically controlled elements including a water admission valve for operation in a predetermined cycle, a water level responsive mechanism for said washing machine, a switch operable to be closed by minimum water level as determined by said water level responsive mechanism and to be opened by a maximum water level also determined by said water level responsive mechanism in series with the circuit to said electro-magnetically controlled water admission valve, a separate short circuiting circuit for said water level responsive switch operable to short circuit said switch during said rinse cycle, said sequence switch mechanism being so constructed that said water admission valve can only be put in operation at minimum water level positions as determined by said water level responsive mech-

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anism at certain parts of the cycle and so arranged that said water admission valve is put in operation independently of said water level responsive switch during said rinse cycle.

6. In an automatic washing machine having a washing liquid container, an automatically operated sequential controller for timing the cycles of wash, rinse and spin-dry, a plurality of circuits controlling a plurality of elements including an electro-magnetically controlled water inlet valve in a predetermined cycle of operations, a water level actuated switch in the water inlet valve circuit being closed for water admission to said container at a minimum water level and adapted to limit actuation of said water inlet valve to the period between minimum water level and maximum water level, and means operable by said sequential controller to short circuit said switch during said rinse cycle.

7. In a washing machine having a drive motor, a water inlet, and a transmission providing a variation in speed to increase the speed of a rotatable member above a lower washing speed for centrifugal extraction, and electrical means for causing actuation of the aforesaid elements, the combination therewith of a plurality of circuits one controlling actuation of each of the aforesaid elements, an automatically operated sequential controller for timing the cycles of wash, rinse and spin-dry and for closing said circuits in a predetermined relation thereby providing a cycle of operation for said elements, which provides a washing action in the presence of washing liquid followed by a draining of said washing liquid with addition of water from said water inlet following a definite time interval after said washing action, and means to assure the admission of such water at such definite time comprising a water level responsive mechanism, a switch in series with said water inlet circuit operable by said water level responsive mechanism requiring a low water level to assure actuation of said water inlet, and a separate circuit operable by said sequential controller to short circuit said switch for an interval during the aforesaid rinse cycle of operation.

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