Sept. 30, 1952 A. R. CONSTANTINE 2,612,034

AUTOMATIC WASHING MACHINE WITH DETERGENT INJECTOR

Filed June 9, 1948 6 Sheets-Sheet 1

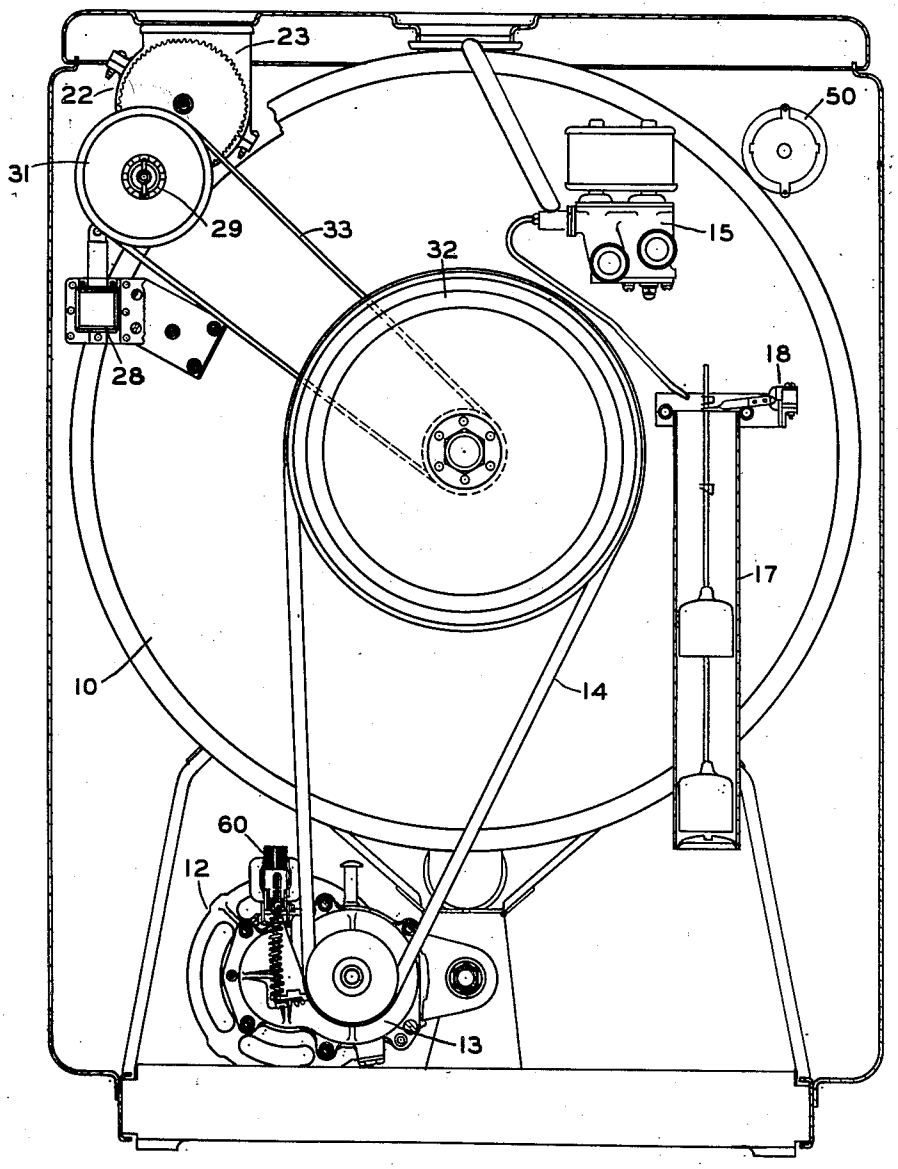


Fig. 1.

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Filed June 9, 1948 6 Sheets-Sheet 2

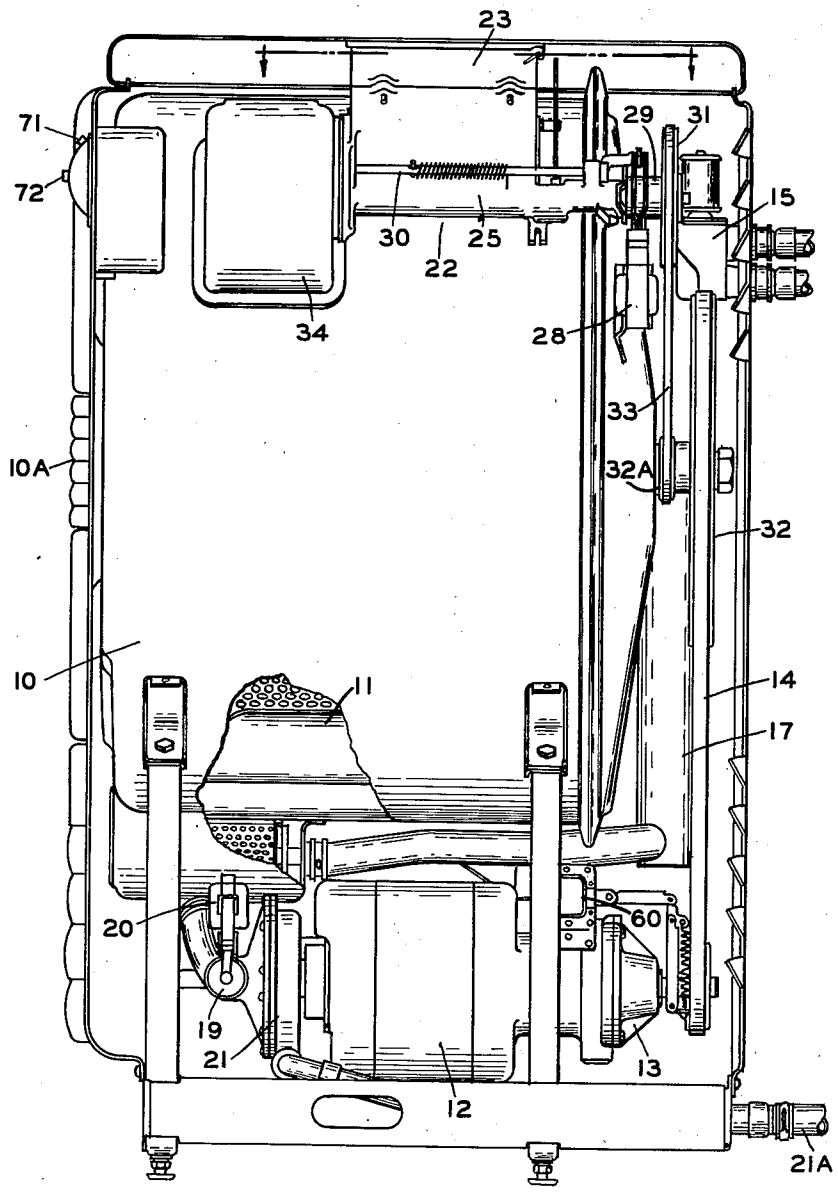


Fig. 2.

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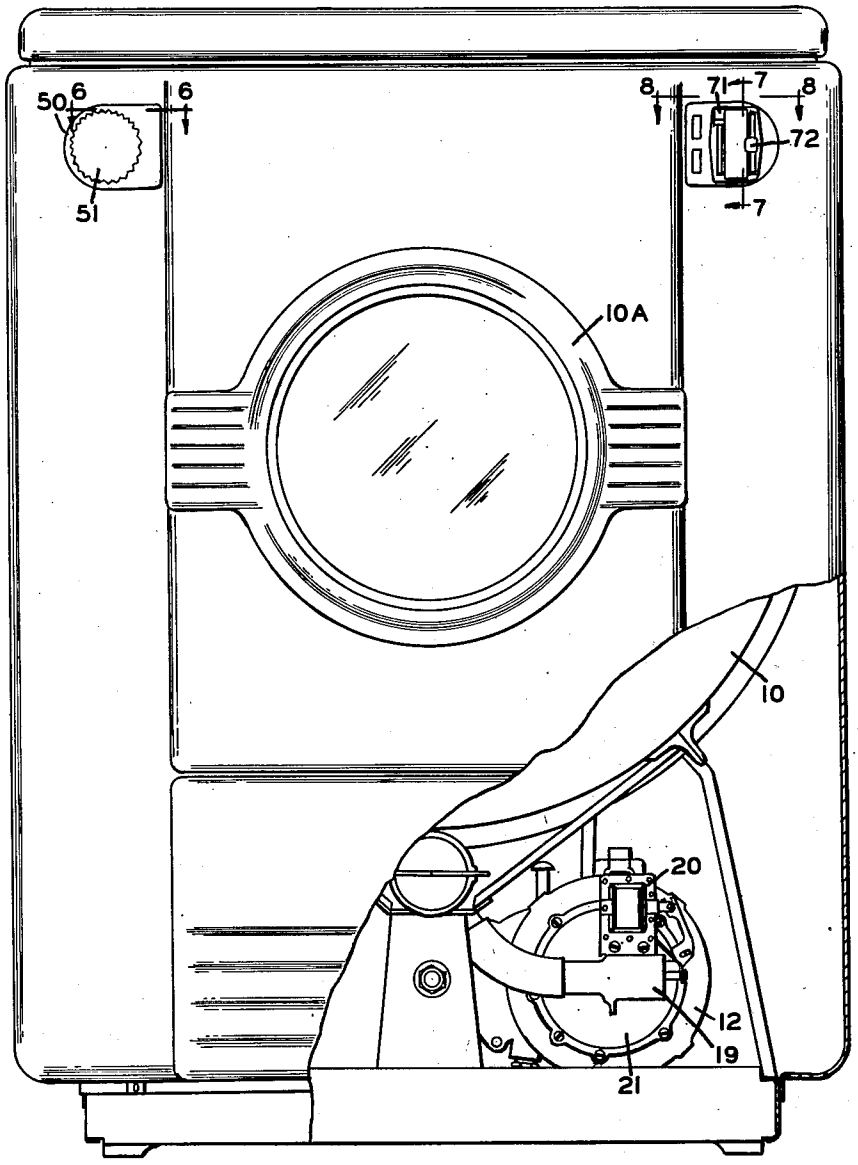


Fig. 3.

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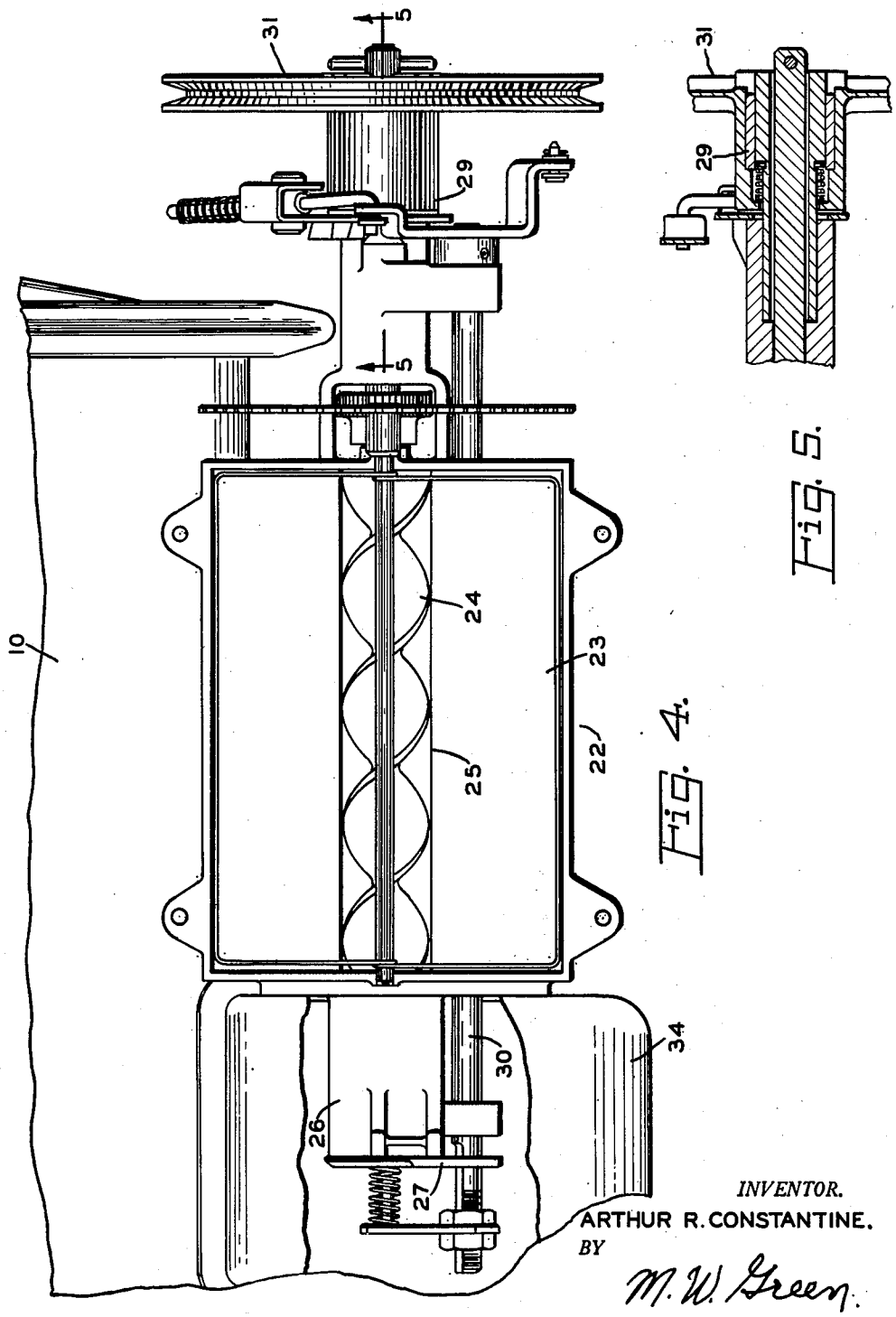


Fig. 4.

Fig. 5.

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AUTOMATIC WASHING MACHINE WITH DETERGENT INJECTOR

Filed June 9, 1948 6 Sheets-Sheet 5

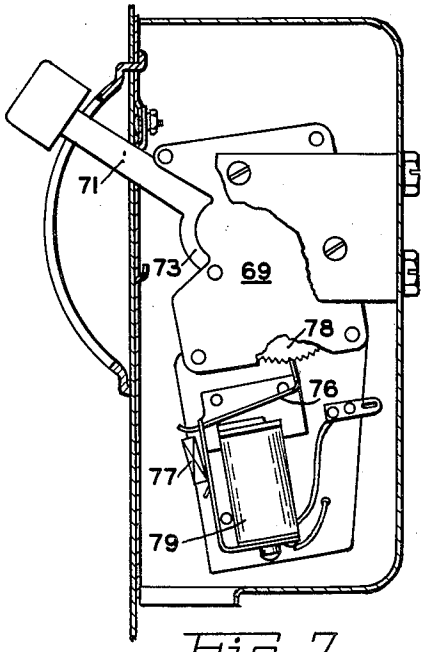


Fig. 7.

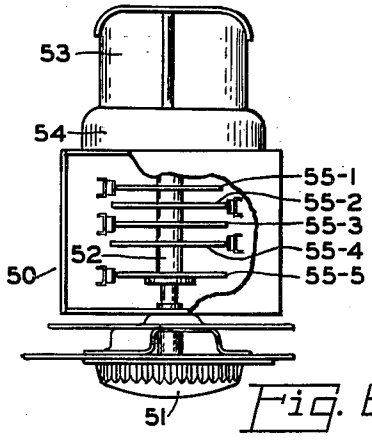


Fig. 6.

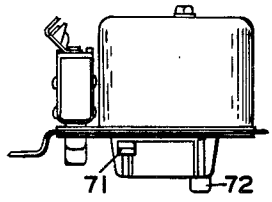


Fig. 8.

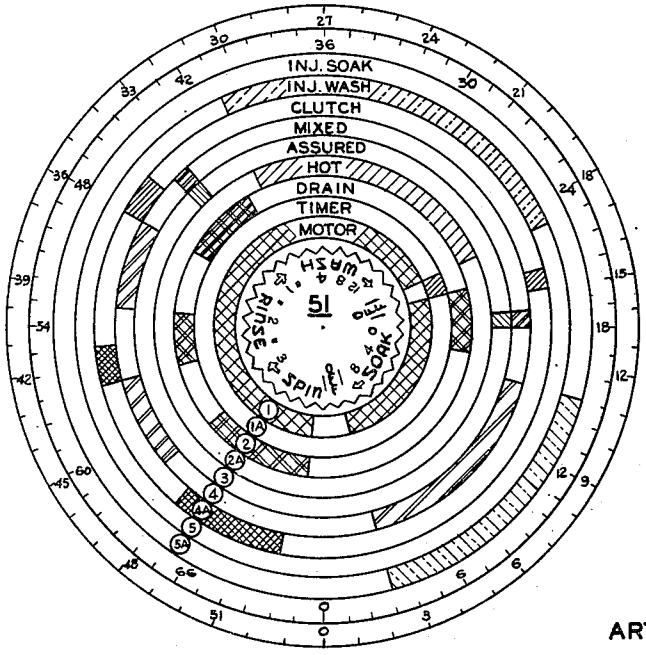


Fig. 9.

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AUTOMATIC WASHING MACHINE WITH DETERGENT INJECTOR

Filed June 9, 1948 6 Sheets-Sheet 6

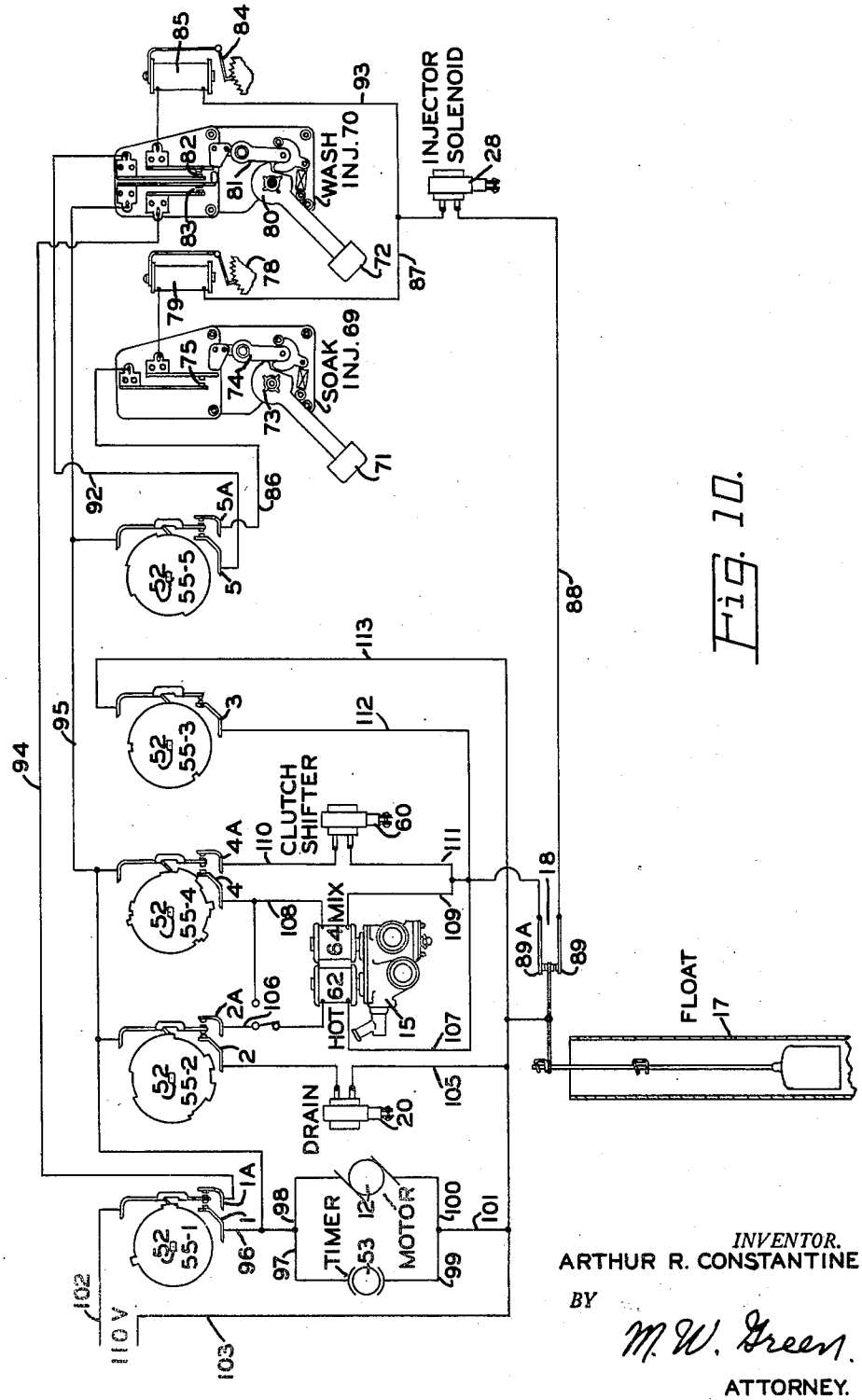


Fig. 10.

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Patented Sept. 30, 1952

2,612,034

UNITED STATES PATENT OFFICE

2,612,034

AUTOMATIC WASHING MACHINE WITH DETERGENT INJECTOR

Arthur R. Constantine, South Bend, Ind., assignor, by mesne assignments, to Avco Manufacturing Corporation, New York, N. Y., a corporation of Delaware

Application June 9, 1948, Serial No. 31,893

7 Claims. (Cl. 68—12)

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This invention relates to automatic washing machines and particularly to machines of the type including means for automatically injecting detergent material into a clothes washing machine during a cycle of automatic operation.

Automatic washing machines employing automatic operation have been in common use for some years. These machines have provided automatic cycle of operation but assumed manual addition of soap powder or other detergent material, it being generally recommended that this material be added just after the machine had filled with water to the desired level. The amount of soap powder to be added at this time varied with the hardness of the water, the size of the clothes load as well as the degree of soil in the clothes and the amount of soap was generally determined by visual observation of suds level and the manual addition of soap in increments small enough to keep this level within proper specified limits.

With the development of so called non-sudsing synthetic detergents it is possible to specify a more definite quantity of detergent material which gives satisfactory results independently of reasonable variation in water hardness and degree of soil. One type of machine in prior use provides for a preliminary washing operation called a soak cycle which requires manual addition of detergent material and necessitates that the machine be attended after this preliminary cycle and manually started in operation after said soak cycle to start a second washing operation. The stopping of the machine at the end of the soak cycle in these previously used machines and manual starting thereof was necessary in order that detergent material could be added.

It is therefore a primary object of the present invention to provide an automatic washing machine with an automatic detergent injection device automatically operable at a certain time in the cycle of operation.

It is another object to provide mechanism for automatic injection of detergent material at a predetermined time in the cycle of an automatic washer in amount preselected by a manual setting of a control member which setting can be made at any desired time and can be generally made prior to the starting of the automatic cycle.

It is another object to provide means for automatically injecting detergent material into the machine at desired times in the cycle in both the prewash or soak and the principal washing portion of the cycle and thereby to eliminate the

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necessity for stopping the machine at the end of the soak cycle.

It is a further object to provide interdependent relationship between mechanism calling for automatic detergent injection in the principal washing cycle and the main cycle control mechanism, whereby continuous operation between soak cycle and principal washing cycle will be accomplished whenever and only whenever, automatic injection is called for in said principal cycle.

It is a further object to provide means for automatic detergent injection to be automatically operated at a predetermined time in the cycle of operation and at a predetermined liquid level in the washing container.

It is a further object to provide an automatic washing machine with automatic injection mechanism and with a manual preselection control, the magnitude or degree of movement of which will preselect the amount of detergent to be injected into the washing container.

The above and other objects of the invention will appear more fully in the following detailed description and in the accompanying drawings forming a part hereof and wherein:

Figure 1 is a rear view of an automatic washing machine of the type herein disclosed showing the drive mechanism water level inlet and control, as well as a mechanism for detergent injection.

Figure 2 is a side view of the machine shown in Figure 1 with a cabinet panel removed and partly in section.

Figure 3 is a front view partly in section of the machine shown in Figure 1 and includes a showing of certain of the control mechanisms.

Figure 4 is a top view of the detergent injection mechanism.

Figure 5 is a sectional view of the clutch mechanism of detergent injector shown in Figure 4.

Figure 6 is a top view partly in section of the timer or so called sequential control mechanism.

Figure 7 is a sectional view showing the preselection and timer control for the detergent injector.

Figure 8 is the top view of the mechanism shown in Figure 7.

Figure 9 is a cycle chart showing the cycle of operation of the machine.

Figure 10 is a wiring diagram showing the electrical connections and the relationship of the several units.

Referring to the drawings, there is shown an automatic washing machine of the type employ-

ing a control mechanism for sequential operation of several related mechanisms in a cycle. The machine employs a tub 10 forming a container for laundry and washing liquid in which a perforated clothes tumbling cylinder 11 is mounted for rotation within the tub 10, the cylinder being driven by a motor 12 through a transmission 13 and belt 14. Clothes to be washed are placed in and removed from the tub and cylinder through a door 10A in the front of the machine Figure 3. Inlet of water into the tub 10 from normal household supply lines is accomplished by a solenoid operated thermostatic controlled mixing valve mechanism 15 which on electrical actuation causes flow of water into the top of the tub through inlet conduit 16. A float assembly 17 actuating a float switch 18 provides for closure of an electrical circuit at a predetermined level of liquid in the tub 10 as will be described in more detail hereinafter.

The removal of water from the tub 10 is provided for by a drain valve 19 actuated by drain solenoid 20, which on actuation allows flow of water into the housing of a continuously rotating drain pump 21 thereby to drain liquid from the tub 10 through the drain outlet 21A.

A mechanism for injecting detergent material into the tub 10 is shown as a detergent injector assembly 22. This detergent injector assembly 22 is described in more complete detail as to mechanical features in copending application Serial No. 14,492, filed March 12, 1948. However, the principal features of this mechanism comprises a hopper 23 for detergent material which is located above a feed screw 24 rotatably mounted in a feed screw housing 25 at the bottom of the hopper 23 and which housing extends toward an outlet 26 closed by a sliding blade cover 27. The actuation of a solenoid 28 causes opening of the blade closure 27 by rotation of a shaft 30 and also causes rotation of the feed screw 24 by actuation of a clutch 29. The clutch 29 connects the continuously rotating drive wheel 31 to rotate feed screw 24. Drive wheel 31 is driven from a main pulley 32 through a belt 33 thus the actuation of the solenoid 28 causes continuous injection of the detergent material from the end 26 of the injector mechanism which projects into a housing 34 forming a part of the tub 10. The injection of detergent material is continuous during the time of actuation of the solenoid 28, thereby providing a mechanism, the duration of actuation of which will determine the amount of detergent material injected into the tub 10.

The controls and the several units of the automatic washer are required to be co-related in order to accomplish the desired cycle of automatic washing, the cycle including the automatic injection of powdered detergent at the portions of the cycle where such injection is carried.

On the wiring diagram Figure 10 and on the general views of the machine Figures 1 to 10 inclusive there are shown the several co-related mechanisms which are sequentially controlled electrically operated actuating units, the arrangement being described in some detail as follows:

For the purpose of closing electrical circuits to various units in a predetermined time cycle of operation, a sequential controller or so called timer assembly 50, having an indicating dial 51, a cam shaft 52, a motor 53 of the synchronous clock type, and an escapement mechanism 54, are all housed in the assembly 50. The motor 53 on closing of the electrical circuit that starts rotation to actuate an escapement 54 and which in turn rotates the cam shaft 52 in intermittent steps of rotation in a single direction, these rotative impulses being timed by the escapement mechanism 54 to occur at forty-five second intervals. Each impulse moves the cam shaft 52, 5 degrees. The cam shaft 52 carries a plurality of cams 55—1, 55—2, 55—3, 55—4, 55—5. These cams are shown on Figure 6 and are attached to the shaft 52 and are also shown on the diagram Figure 10. Referring to the cycle chart Figure 9 and the wiring diagram Figure 10, it appears on reference to Figure 9 that clockwise rotation of the dial 51 will successively close switches connecting electrical circuits as shown by inspection of the several circular arcs surrounding the dial 51 in Figure 9 and also on reference to Figure 10 it is apparent upon inspection that the cam 55—1 controls a switch contact 1 and a switch contact 1A while cam 55—2 controls a switch contact 2 and a switch contact 2A. The cam 55—3 controls only one switch contact 3. Cam 55—4 controls switch contacts 4 and 4A while the cam 55—5 controls switch contacts 5 and 5A.

The cycle chart Figure 9 shows by shaded portions various arcuate positions in a counterclockwise relation consecutively during which the respectively numbered switch contacts are closed. These switch contacts are shown on Figure 10 and are 1, 1A, 2A, 3, 4, 4A, 5, 5A considering the cycle chart of Figure 9 the marked numbers on the outer circumference indicate the time in minutes, while the marked divisions of the circle next to the outer circumference indicate the impulses of movement corresponding to 45 second intervals, which impulses are provided for by the escapement mechanism 54 previously mentioned and each impulse represents a movement of 5 degrees of rotation.

The mechanisms which are set in operation by the closing of the several switch contacts above enumerated are shown on the wiring diagram Figure 10 and are correspondingly numbered on the several views of the machine where the location of each of the several units is indicated for the purpose of identification. Of these units on Figure 10 the timer motor 53 has been previously mentioned. Also the main driving electric motor 12 of the washing machine is shown on the wiring diagram figure and is also shown on the general views of the machine Figures 1, 2 and 3. The motor 12 shown on the machine is a one-quarter horse power motor which drives the rotating cylinder of the machine at two speeds of rotation, a low speed for washing and a higher speed for centrifugal extraction, the transmission 13 provides these two speeds with uniform rotating speed of the motor and is shown generally in Figure 1. The construction of transmission 13 is a two speed gear box of the general type shown in U. S. Patent No. 2,412,331. This transmission 13 drives the main drive pulley 32 on the washing machine through a belt 14. For the purpose of changing the speed of rotation of tumbling cylinder 11 from normally low speed washing to high speed extraction, an electrical solenoid 60 is provided which, when actuated, causes the higher speed of rotation to be put in operation. This solenoid 60 is known as the shifter solenoid 60 and is shown in the diagram Figure 10 as well as Figure 1. The mechanism is such that on actuation of the shifter solenoid 60 the speed of rotation of the washing cylinder is changed from

low to high speed, the low or washing speed of rotation being in effect when the solenoid is not actuated.

For the purpose of providing a flow of water into the machine at desired times and at a controlled temperature, a thermostatically controlled mixing valve 15 is provided. The details of this mixing valve are not important herein, but it is sufficient to state that the actuation of solenoid 62 will provide a flow of hot water from a hot water supply line through the inlet tube 16 into the washing machine, while actuation of a solenoid 64 will open valves necessary to mix hot and cold water to provide luke warm water at controlled temperature of approximately 100° into the washing machine through the inlet tube 16. These two solenoids, the hot water solenoid 62 and the luke warm or mixed water solenoid 64, are shown in the diagram Figure 10 and on Figure 1.

When it is desired to drain water from the machine such operation is accomplished by opening drain valve 19 and the opening of this drain valve 19 allows water to flow by gravity into a pump housing 21 which pump housing has a continuously rotating pumping member rotated by the motor 12. Thus when water is allowed to flow into the pump housing 21 the water will be pumped out of the machine through a suitable outlet hose 21A. Actuation of the drain valve 19 to open such valve to allow flow into pump housing 21, is accomplished by actuation of an electrical solenoid called the drain solenoid 20 shown on Figures 2 and 3 and also shown on the wiring diagram Figure 10. It is evident from the above description that actuation of the drain solenoid 20 by closing the electrical circuit thereto will cause the water to be drain from the tub 10 and from the washing machine.

In the general description of the detergent injector mechanism 22 it was explained that the actuation of the injector solenoid 28 by closing the electrical circuit thereto would cause the injecting mechanism to feed powdered detergent into the tub 10 of the washing machine. For the purpose of closing the circuit to the solenoid 28 at the desired time and holding it closed for the desired length of time two separate spring wound timers operating with other controls are provided, a so called soak cycle injection timer 69 and a wash cycle injection timer 70. The control levers 71 and 72 for these two timers are positioned on the front panel of the machine as shown in Figures 2, 3, 7, 8, and 10, the timer 69 being provided with a winding and setting lever 71 and the timer 70 being provided with a winding and setting lever 72. Considering the soak injection timer 69, its winding and setting lever 71 has a cam portion 73 which, on rotation, moves a pivoted lever 74 to close a pair of switch contacts 75. The pivoted lever 74 is normally urged in a direction to cause release of the contact 75 as shown in Figure 10. It was previously mentioned that the movement of the lever 71 caused a winding of the spring of the timer mechanism and as shown in Figure 7 a detent 76 urged by a spring 77 (Figures 7 and 10) contacts a gear 78 on the spring actuated timer mechanism so that the detent 76 normally holds the spring wound mechanism in an inoperative position even though the arm 71 is moved downwardly to wind the mechanism and to preselect a definite travel of the arm back to a position which would again release the switch contact 75. For the purpose of releasing the detent 76 an electrical magnet coil 79 is provided. This electrical coil 79 being shown in Figure 7 and diagrammatically in Figure 10. It is evident therefore from the above description that the time that the arm 71 travels before releasing the contacts 75 will depend upon the degree of arcuate movement of arm 71. The arm 71 manually is moved a desired amount to preselect a desired time for return but will start only on the actuation of the electrical magnet 79 to release the detent 76 thereby to cause the timer to start in operation. The contact 75 will therefore remain closed until the lever 71 returns to its normal position. The wash cycle injection timer 70 is similar to timer 69 and has a winding and setting lever 72 and like the soak injection timer the end of the lever 72 is provided with a cam portion 80 which, on arcuate movement of lever 72 pushes pivoted lever 81 to close two pairs of switch contacts 82 and 83. There is also a detent 84 which normally holds the timer 70 from operation and is set in motion by actuation of a magnet coil 85 which pulls the detent 84 away from the gear, which is a portion of the spring wound timer 70 thereby releasing the timer to allow return movement of lever 72.

On manual movement of the winding and setting levers 71 or 72 in a clockwise direction as shown in Figure 10 or in a downward direction, as shown in Figures 3 and 7 the switch contact 75 will be closed on the timer 69, on movement of lever 71 and the switch contacts 82 and 83 will be closed on the timer 70, on movement of lever 72. Furthermore, the arcuate distance of movement of levers 71 and 72 will determine the time that is required for the levers 71 or 72 to return to the position shown in Figure 10 and at such time the switch contacts 75 or 82 and 83 will be again opened. The start of this period of time selected by the movement of the levers is determined by the closing of two other switches in series in each circuit to actuate the magnet coils 79 or 85 to allow the preselected period of time to begin. Current actuating the solenoid 79 starts the soak timer in operation and is provided by the closing of the circuit controlled by contacts 5A through connector 86. Referring to Figure 13 as well as Figure 14, it will be apparent that the cam 55—5 is so formed as to close the contact 5A at the beginning of the so called soak period, with that contact closed and with the soap injection timer 69 actuated by manual setting movement of the lever 71, the contact 75 is also closed so that the circuit will be closed in connector 87 to one side of the injector solenoid actuator 28. However, the opposite connection 88 to the injector solenoid 28 is connected through a float switch contact 89 in float switch 18 and current will not flow to the solenoid 28 until upward movement of a float 17 closes contact 89 of the float switch when the water level in the tub reaches a predetermined maximum. It is apparent therefore that although the cam 55—5 closes the circuit through the timer 69 at the beginning of the soak cycle, as shown on Figure 10, that the timer 69 although previously set to close switch 75, will not be released and begin to pay out its time until the float 17 closes the contact 89. That is, although the two contacts 5A and 75 may be closed and ready to start injection of detergent into the machine, the start of such injection cannot take place until the tub is filled with water to the desired level and the third contact 89 is closed.

The contact 5 controlled by cam 55—5 is in series with injection timer 70 for the wash cycle

and as shown in Figure 9 this injection is later in time than the soak cycle injection. A connection 92 extends from the contact 5 to the contact 82 of the timer 70 and connector 93 leads to the solenoid 28. As previously mentioned in connection with the timer 69 the opposite connection to the solenoid 28 comes through the connector 88 and before the circuit can be completed the contact 89 and the float switch 18 must be closed by a maximum water level in the tub which is controlled by the float 17.

Considering the diagram Figure 9 the so called soak cycle extends from approximately 2¼ minutes on the chart to about 15¾ minutes at which time, unless special provision is made, both the timer motor 53 and the main drive motor will stop, in fact the entire machine will stop its operation. This stopping of the machine is necessary at the end of the soak cycle if no one is present to manually insert soap or other detergent material into the machine or if no automatic injection of detergent is to be available. However, in the case of the use of timer 70 to control injection of detergent into the tub during the wash cycle such automatic injection is available and then there is no necessity to stop the operation of the machine. Therefore, in order to assure that the mechanism will continue in operation without stopping, when and if, the lever 72 of the wash injection timer 70 is moved into position to inject detergent the previously mentioned contacts 83 are provided which are closed on the movement of the lever 72 and these contacts are connected in series with the contacts 1A through connector 94. The opposite side of the contact 83 is connected to the timer motor and the main motor circuits through connector 95. It is therefore the purpose of the contact 83 and the contact 1A on cam 55 to close the circuit during the normal stop period between soak and wash cycles when and if automatic soap injection in the wash cycle is called for by preselection of powdered detergent injection movement of the lever 72.

Considering further details of Figure 10 and the functions performed as shown in Figure 9 it may be stated that connectors 96, 97, 98, 99, 100, 101, control flow of current through contact 1 controlled by cam 55—1 connectors 102 and 103 feeding current from 110 volt line as shown. Closing of contact 1 starts the timer action 53 and the main driving motor 12. Connectors for contact 2 adjacent cam 55—2 are shown on Figure 10 as connectors 104, 105, feeding current to the drain valve solenoid 21.

The connectors for hot water solenoid 62 from the contacts 2A are 106, 107 as shown.

Connectors for contact 4 to the mix solenoid 64 are 108 and 109 as shown while connectors for contact 4A are 110 and 111 to feed current to the transmission change speed shifter solenoid 60. The contact 3 attached to cam 55—3 is provided with connectors 112 and 113 for the purpose of shorting out the float switch contacts 89A at the desired time to provide an assured spray rinse of limited amount as shown on Figure 9 without reference as to whether or not the tub is filled with water.

In operation, clothes to be washed are put in the machine through the door 10A in the front of the cabinet and the machine started in operation by rotation by the timer dial 51 in clockwise direction, which causes contact to be made by contacts 1 controlled by timer cam 55—1, the timer motor 53 and the main driving motor 12 thus being started in operation because of closing of electrical circuits thereto. (See Figure 10.) The rotation of the timer dial 51 and shaft 52 carrying the cams 55—1, 55—2, 55—3, 55—4, and 55—5, will continue as long as the timer motor 53 is in operation. Referring to the cycle diagram Figure 9 and the wiring diagram Figure 10 the same initial rotative movement of dial 51 which causes starting of the timer motor 53 and the main drive motor 12 also causes contacts 4 to close which closes circuit to the mix water solenoid 64 resulting in mixing valve 15 feeding water into the tub 10. This feeding of water will continue until the contacts 89A of the float switch 18 are broken by the raising of the float 17 to its uppermost position. This raising of the float 17 to the maximum predetermined water level in the tub will also cause the contacts 89 in the float switch assembly 18 to open and if the lever 71 for preselecting automatic detergent injection into the tub has been manually set to a definite position the float switch contacts 89 will cause actuation of the detergent injector solenoid 28. Contact 5A on the injector control cam 55—5 and the contact 75 of the soak injector timer 69 have previously been closed and therefore the contacts 89 are the last to be closed of the three sets of contacts in series with the injector solenoid 28. Therefore, the circuit is completed and the injector timer 69 is released by actuation of the magnet coil 79 in the same circuit, and the solenoid 28 is actuated causing detergent injector feed screw 24 to begin rotation, feeding detergent into the tub 10 at housing 34 from the outer end 26 of the injector mechanism. This injection of detergent material continues until the timer lever 71 returns to its normal position and releases the contacts 75 which breaks the circuit to the injector solenoid 28 and the injector therefore stops. The amount of detergent injected in the soak cycle is determined by the magnitude of movement of the lever 71, graduations being placed adjacent the lever for visual observation at the time of setting. The soak cycle then continues in accordance with the cycle diagram, Figure 9 until the end of the soak cycle as shown on the diagram. The tumbling rotation of cylinder 11 for washing continues and at the twelve minute mark (see Figure 9) the drain valve 19 is opened and a one minute spin at higher rotation to remove water starts at the fifteen minute mark on the diagram. If the wash injector timer preselection control lever 72 has not been set to call for automatic detergent injection in the main wash cycle, the machine will then stop at the end of the spin because of the breaking of the circuit at contact 1 by the projection on the cam 55—1 as this is the end of the soak cycle. However, if the preselection lever 72 calling for automatic detergent injection in the wash cycle has been manually set, the contact 83 will have been closed and the projection on cam 55—1 will have also closed the contacts 1A in the same circuit and therefore the timer motor and main drive motor will continue without interruption through the normal stop interval between the pre-wash soak cycle and the main washing cycle (see Figure 10). The same movement of the pre-selecting lever 72 will have also closed the contacts 82 on the main injector timer 70 and as the timer cams continue rotation, hot water will be injected into the machine by the closing of contacts 2A closing the circuit to the hot water solenoid 62 of the mixing valve 15 and as soon as the float 17 raises to a position which will close the contacts 89, the injector

mechanism will be started by actuation of the solenoid 28. This closing of contacts 89 is a final closing of the third switch in the series circuit, the other two switches in series with contacts 89, being contact 5 controlled by cam 55—5 and the contact 82 in the wash injector timer 70. Thus on the closing of the contacts 89 at the pre-determined water level the magnet coil 85 will release the timer 70 and actuate injector solenoid 28 of the injector mechanism as previously described and injection of detergent material will continue for a period of time previously determined by the magnitude of movement of the lever 72 of the wash injection timer 70. After a period of time when the lever 72 has reached its cut-off position shown in Figure 10 both the contacts 82 and 83 will be released and because of the release of the contact 82 and interruption of current to solenoid 28 the detergent injector will stop. However, release of contact 83 will have no result at this time inasmuch as the continued operation of the timer motor 53 and the main drive motor 12 are now assured by the fact that the contacts 1 are now closed by the action of the cam 55—1. The automatic injection of detergent having been accomplished in the main wash cycle the sequential cycle of operation continues in accordance with the cycle chart, Figure 9, the several mechanisms being actuated in a manner which can be readily followed by reference to Figures 9 and 10.

The machine can be operated at will to inject detergent automatically in the pre-wash cycle and to stop at the end of the pre-wash cycle by failure to set the wash injector lever 72, as the closure of the contacts 83 accomplished by movement of lever 72 is controlling over the carry through from the soak cycle to the main wash cycle. Likewise it is possible to omit entirely the pre-wash or soak cycle by failure to move the setting lever 71 to inject soap in that cycle and in such case the dial 51 can be set to start with the main washing cycle with automatic detergent injection assured by merely setting the lever 72 for pre-selecting the amount of detergent to be injected when the water level reaches the predetermined maximum. Automatic injection is therefore possible in either or both the soak cycle and the main washing cycle and there will be a carry through without stopping between the cycles whenever the lever 72 is set to call for detergent injection in the wash cycle.

Although the invention has been described by reference to a specific construction found practical in actual operation it is not intended to limit the invention by such disclosure as modifications are intended within the scope of the following claims.

I claim:

1. In an automatic washing machine, a liquid container, an element responsive to a predetermined maximum liquid level in said container, a detergent injector mechanism having a control element therefor, a sequential controller providing mechanism for an automatic sequential cycle of operation for soaking and washing and including provision for actuation of said control element during said soaking and washing cycles, means providing actuation of said control element by said sequential controller for a period of time in said cycle so arranged that said control element allows actuation of said detergent injector mechanism, a manually actuable timer means for preselecting the length of subsequent operation of said injector mechanism, connections between (1) said control element (2) said timer (3) said liquid level responsive element providing for actuation of said injector mechanism for said preselected period of time when all three of the aforesaid elements are actuated.

2. In an automatic washing machine, a container for laundry and washing liquid, a detergent injector mechanism operable to inject detergent material into said container in amount proportional to time said injector is in operation, electrically operated mechanism connected to start said detergent injector in operation on actuation and to stop said injector when not actuated, a water level responsive switch arranged to close at a predetermined maximum liquid level in said container, an injector control switch connected in series with said water level responsive switch and said electrically operated mechanism, an interval timer arranged to disconnect said injector control switch, a manually operable timer control member arranged to close said injector control switch and to preselect time interval of said timer and therefore the time interval of closing of said switch, electrically operated release mechanism connected to be operable in series with said water level responsive switch and said control switch and positioned to start said interval timer in operation whereby said detergent injector mechanism starts operation to inject material in amount proportional to its time in operation when water level in said container reaches the aforesaid predetermined maximum and continues in operation for time preselected by said manually operable control member.

3. In an automatic washing machine having a sequential controller providing mechanism for closing a plurality of electrical circuits in sequence to provide a cycle of operations for washing including filling and draining of liquid and soak and wash cycles, a detergent injector mechanism operable to inject detergent material into said container in amount proportional to time said injector is in operation, electrically operated mechanism connected to start said detergent injector in operation on actuation and to stop said injector when not actuated, an injector control switch, an interval timer arranged to disconnect said injector control switch, a manually operable timer control member arranged to close said injector control switch and to preselect time interval of said timer and therefore the time interval of closing of said switch, a second injector control switch in series with said first mentioned injector control switch and actuated by said sequential controller to close at a predetermined position in said cycle, electrically operated release mechanism connected to be operable in series with said first and second injector control switches and positioned to start said interval timer in operation when all said series connected switches are closed, said release mechanism being actuated only when the said liquid reaches a predetermined level whereby said detergent injector mechanism starts operation to inject material in amount proportional to its preselected time in operation at positions in said soak and wash cycles determined by said controller operated injector control switch and continues in operation for time preselected by said manually operable control member.

4. In an automatic washing machine, having a sequential controller providing mechanism for closing a plurality of electrical circuits in sequence to provide a cycle of operations for wash-

ing including filling and draining of washing liquid and soak and wash cycles, a container for laundry and washing liquid, a detergent injector mechanism operable to inject detergent material into said container in amount proportional to time said injector is in operation, electrically operated mechanism connected to start said detergent injector in operation on actuation and to stop said injector when not actuated, a water level responsive switch arranged to close at a predetermined maximum liquid level in said container, an injector control switch connected in series with said water level responsive switch and said electrically operated mechanism, an interval timer arranged to disconnect said injector control switch, a manually operable timer control member arranged to close said injector control switch and to preselect time interval of said timer and therefore the time interval of closing of said switch, a second injector control switch in series with said first mentioned injector control switch and said liquid level responsive switch and actuated by said sequential controller to close at a predetermined position in said cycle, electrically operated release mechanism connected to be operable in series with said first and second injector control switches and said water level responsive switch and positioned to start said interval timer in operation when said series connected switches are closed whereby said detergent injector mechanism starts operation to inject material in amount proportional to its preselected time in operation at positions in both said soak and wash cycles, determined by said controller operated switches and when said water level reaches a said predetermined maximum and continues in operation for time preselected by said manually operable control member.

5. In an automatic washing machine having a tub for wash fluids and of the type employing a sequential control mechanism for automatic operation through a preliminary soak cycle of washing operations with elements in said control mechanism normally causing said machine to stop after said preliminary soak cycle and with manual control mechanism to start said sequential control mechanism for a second and principal cycle of washing operations, the combination therewith of a detergent material injector, actuating mechanism for said injector, a manually operable control member conditioning said injector actuating mechanism to cause injection of detergent material during said preliminary soak cycle of washing operations, a second manually operable control member conditioning said injector actuating mechanism to inject detergent material during said principal cycle, said injector actuating mechanisms being actuated only when said fluids reach a predetermined level, and an element actuated on movement of said second manually operable control member connected to cause said sequential control mechanism to continue automatic operation without stop between said soak cycle and said principal washing cycle.

6. In an automatic washing machine having a tub for wash fluid, a sequential controller providing mechanism for actuating a plurality of elements in sequence for a preliminary soak cycle and a principal washing cycle, drive mechanism for said sequential controller, connections actuated by said controller to stop said drive mechanism at the end of said soak cycle, mechanism for injecting detergent material during said soak and principal washing cycles, a manually actuable control member for conditioning said detergent injecting mechanism for operation, said detergent injecting mechanism being actuated only at predetermined fluid levels, additional controls actuated on movement of said manually actuable control member for causing said drive mechanism to continue operation without stop through both said preliminary soak cycle and said principal washing cycle.

7. In an automatic washing machine having a tub for wash liquid and being of the type employing a sequential control mechanism for automatic operation through a preliminary soak cycle of washing operations, with elements in said control mechanism normally causing said machine to stop after said preliminary soak cycle and with manual control mechanism to start sequential control mechanism for a second and principal cycle of washing operations, the combination therewith of a detergent material injector, actuating mechanism for said injector, a manual operable control member conditioning said injector actuating mechanism to inject detergent material during said preliminary soak cycle of washing operations, a second manually operable control member conditioning said injector actuating mechanism to inject detergent material during said principal cycle, said injector actuating mechanism being activated only at predetermined liquid levels, and an element actuated on movement of said second manually operable control member connected to cause said sequential control mechanism to continue automatic operation without stop between said soak cycle and said principal washing cycle.

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