March 25, 1947. N. B. WALES 2,417,998

AUTOMATIC HYDRAULIC CLOTHES WASHING MACHINE

Filed Dec. 28, 1944 4 Sheets-Sheet 1

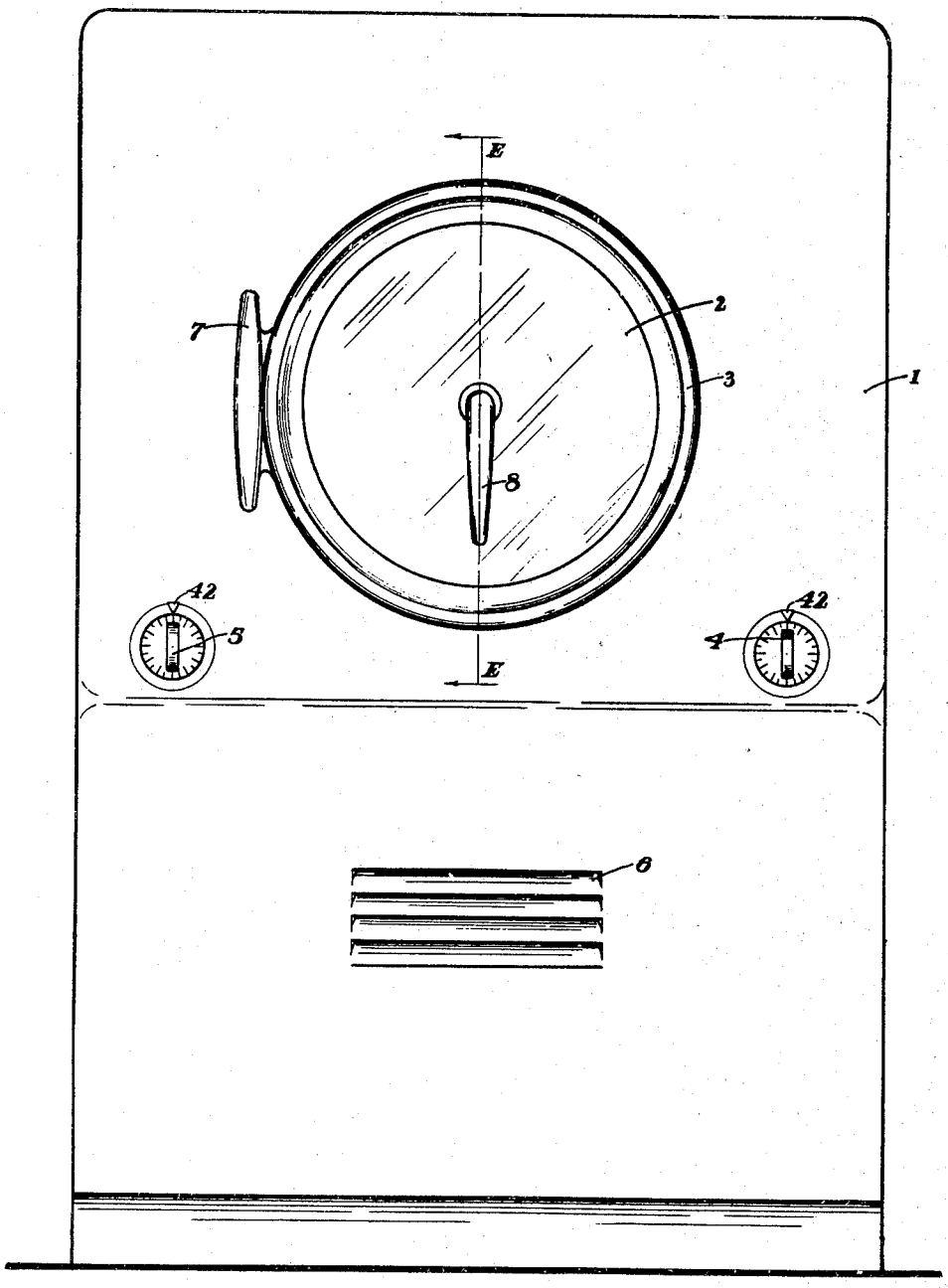


Fig. 1

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AUTOMATIC HYDRAULIC CLOTHES WASHING MACHINE

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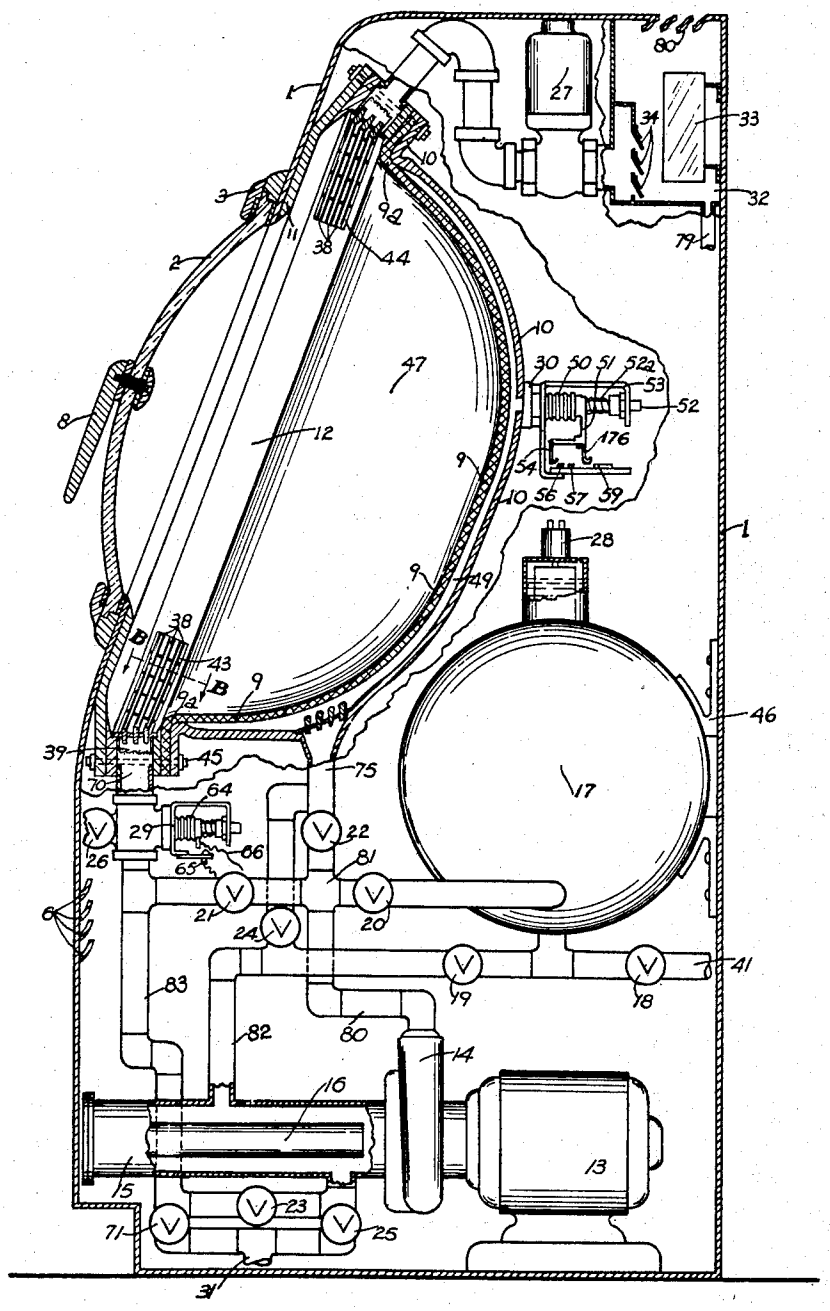


Fig. 2

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AUTOMATIC HYDRAULIC CLOTHES WASHING MACHINE

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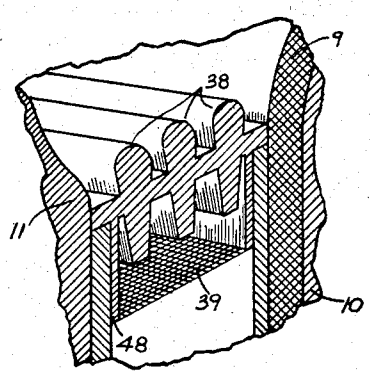


Fig. 3

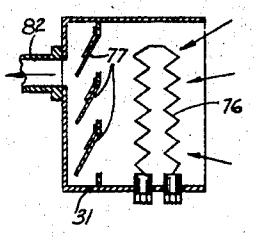


Fig. 4

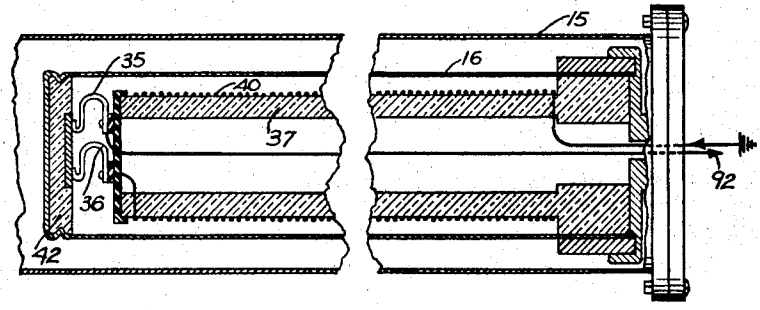


Fig. 5

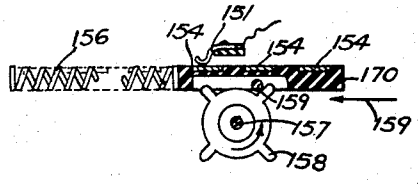


Fig. 6

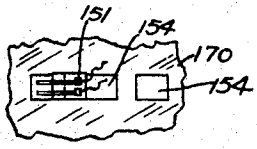


Fig. 7

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AUTOMATIC HYDRAULIC CLOTHES WASHING MACHINE

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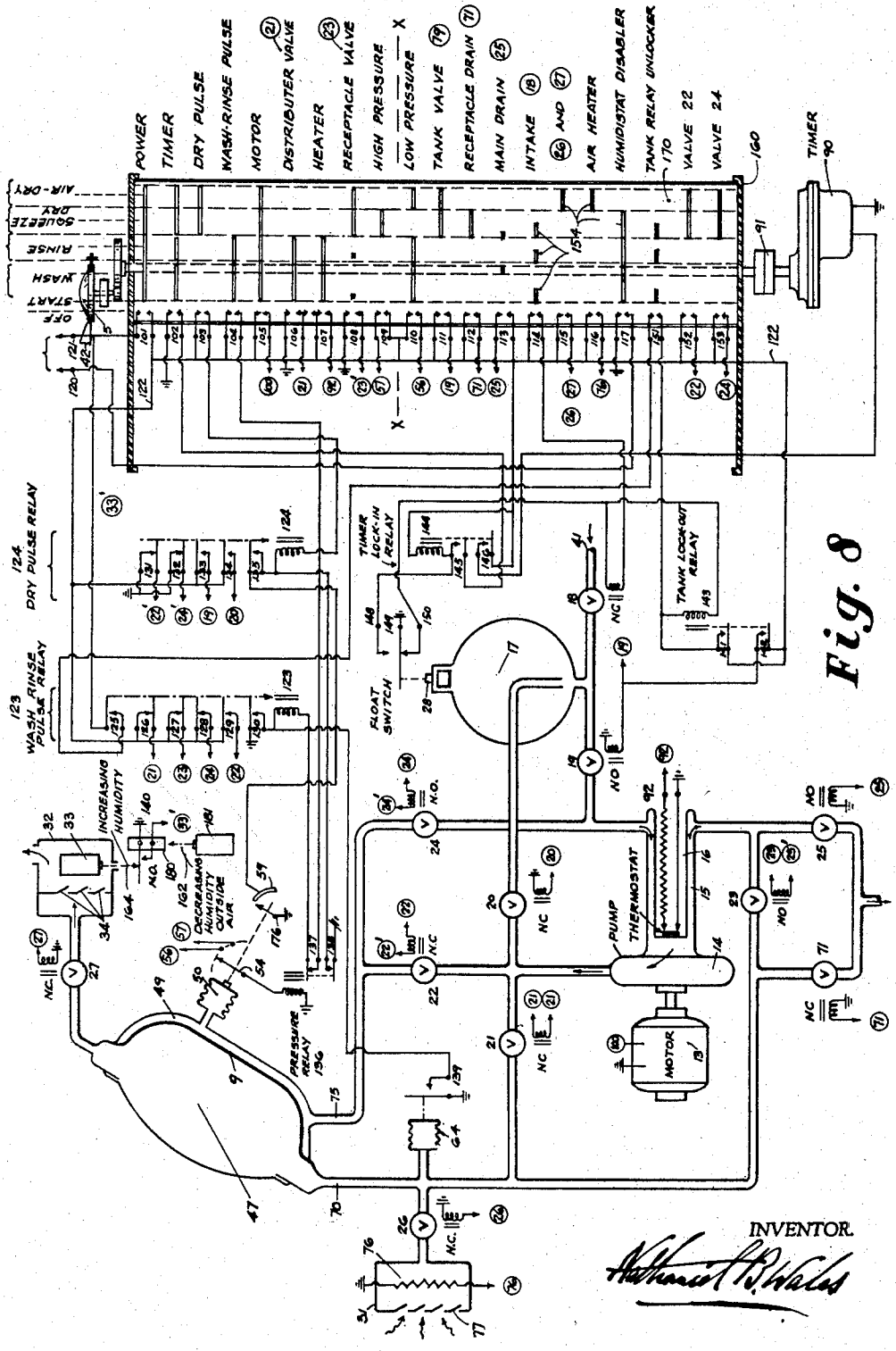


Fig. 8

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Patented Mar. 25, 1947 2,417,998

UNITED STATES PATENT OFFICE

2,417,998

AUTOMATIC HYDRAULIC CLOTHES WASHING MACHINE

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Application December 28, 1944, Serial No. 570,059

4 Claims. (Cl. 68—12)

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This invention relates to automatic washing machines, and more particularly is a further development and simplification of my co-pending patent application Number 556,131 filed September 28, 1944, in which a pulsating washing receptacle performs the washing function, the degree of pulsation being determined by the volume of the wash in the receptacle to attain a predetermined terminal pressure therein.

An object of this invention is to perform the functions of washing, rinsing, "squeeze-dry" and "iron-dry" by a single pulsating wall in the wash receptacle.

Another object is to minimize the amount of water that must be heated in the automatic cycle to attain the necessary washing and rinsing temperature.

A further object is to so position and shape the washing receptacle that the axis of pulsation energy will assist the force of gravity to drain and free the washed clothes of their water content.

Furthermore, combined with this desirable relationship between the pulsation axis and the gravity factor, these forces are further co-ordinated with the axis of the washing receptacle to enhance the continual shifting of the clothes mass therein during washing, rinsing and the drying phase of the automatic cycle. This desirable shifting is attained as follows:

As the pulsating wall exerts a slight downward component on one entire side of the washing receptacle, which side is approximately vertical and stationary, after each inwardly pulsing movement the clothes are piled up against this vertical wall and when the pulsing wall recedes the clothes fall down, due to the foundation of the pile, which is in part the pulsing wall, being withdrawn. This displacement of the clothes causes a gradual shifting of the entire mass as the above described pulsations continue.

In the "iron-dry" phase the pulsing wall acts as a positive blower when associated with proper inlet and exhaust air valves and likewise keeps the mass of clothes shifting and thus presenting different surfaces to the blast of warm air, which circulates up through the moving mass of clothes from its entry in the bottom of the washing receptacle. This action dries the clothes in the receptacle so that they may be taken directly to

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the ironing board when the automatic cycle is completed in the washing machine.

As there is a difference in the rate of drying in woolens, rayons and cottons, due to the difference in the degree of moisture retention in the different fabrics, I preferably use a humidostat to dictate the termination of the "iron-dry" period. This adjustable humidostat is positioned in the exhaust air duct to measure the degree of humidity therein, as an index of the dryness of the clothes.

Further objects and details will be more specifically described and illustrated in the following specifications and drawings in which:

Figure 1 is a front view in elevation.

Figure 2 is an end elevation with the case removed and with a portion of the elevation cut through and shown in section along line E—E in Figure 1. For clarity of description of the water circuits all of the solenoid operated valves except one are shown symbolically.

Figure 3 is an enlarged view, in section, taken on line B—B in Figure 2, showing the grid and screen chamber covering the water flow duct leading from the washing receptacle.

Figure 4 is an elevation, in section, of the air heater and wafer flat air inlet valves which connect with valve 26 in Figure 2, and is seen in complete assembly in Figure 8.

Figure 5 is an enlarged view, shown partly in section, of the combined electric water heater and thermostatic controlling switch, which dictates the water temperature and also acts as a safety switch in case water is not normally in the heating circuit during the water heating periods.

Figure 6 is an end elevation, partly in section, taken on line X—X in Figure 8, showing the mechanical movement to actuate the linear cyclic switch block, and showing the spring employed to return block to "off" position.

Figure 7 is a fragmentary plan view of the switch block as shown in Figure 6.

Figure 8 is a schematic electromechanical diagram of the entire cyclic system, including details of the cyclic controller.

Referring more specifically to the drawings, similar numerals refer to similar parts throughout the several views:

In Figure 1, numeral 1 is the cabinet or case of the washing machine, 2 is the glass window in

door frame 3, which has a suitable hinge 7. A handle 8 is provided for the door. No locking mechanism to seal the door against the cabinet 1, see Figure 2, is specifically shown, but any conventional toggle movement actuated by handle 8 may be employed to form a pressure seal therebetween. The cycle control handle is shown by numeral 5 and water temperature control by numeral 4. One of the fixed indexes 42 shows the position for starting the washing cycle for control 5, and the other index, the base temperature for control 4.

Referring to Figure 2, numeral 9 is a flexible membrane hermetically secured at its periphery 9a to the metal wall 10, which forms a pressure chamber therebetween. An annular member 12, having a lower drain recess 43 and an upper outlet recess 44, and the element 11 are all secured together by suitable bolts or the like 45. Thus, the door 2, when closed, forms the washing receptacle 47 by its co-operation with elements 9, 10, 11 and 12. The outer shell 10 is secured to the cabinet 1 by suitable supports, not shown.

In the lower recess 43 in the washing receptacle 47, see Figure 3, is the grid element 38, which prevents the clothes, when under pressure, from being forced therein. The grid element 38 has depending walls 48, to which the screen 39 is suitably secured, so that the entire element can be lifted out and cleaned of lint or foreign particles. Likewise, in the upper recess 44 is a similar grid, which is locked in to the recess by any conventional means so that it can be readily removed.

An electric motor 13 is shown direct connected to a centrifugal water pump 14. An enlarged suction duct 15 is connected to the suction side of the pump 14, and an electric water heater 16 is located therein to heat the initially measured wash and rinse waters, as they circulate through duct 15 in their forced oscillation between receptacle 47 and chamber 49.

A water tank 17, secured to case 1 by brackets 46, is connected at its base by suitable piping with solenoid operated water inlet valve 18, which in turn, is connected to main water supply connection 41. A float controlled switch 28, at the top of tank 17, dictates the closing of valve 18, as will be fully described in Figure 8.

The pump 14 is connected to water discharge pipe 80 and connects to cross pipe fitting 81, which permits water from pump 14 to be directed to receptacle 47 through valve 21, or into chamber 49 through valve 22, or back into tank 17 through valve 20, which latter connection occurs during the squeeze-dry and air-dry periods, when water oscillates between chamber 49 and tank 17.

It is to be noted that all water circulation and control valves are shown symbolically except air outlet valve 27, which connects chamber 47 with the automatic wafer flap valves 34 in duct 32 and which co-operate with similar air inlet valves shown in Figure 4 by numeral 77.

The electric air heater 76 is shown in duct box 31. Pipe 82, see Figure 4, is connected to valve 26 in Figure 2, and as diaphragm 9 pulsates during the air-dry period, valves 31 and 34 produce an air flow in and out of receptacle 47, see Figure 8 showing this complete assembly.

A humidostat 33, located in exhaust air duct 32, is exposed to the circulation of the air expelled from receptacle 47 and reflects the percent of humidity of this air, as an index to the degree of dryness of the clothes in receptacle 47.

A pressure actuated switch 30, in open communication with the space 49 formed between the flexible diaphragm 9 and the shell 10 operates as follows:

A metallic bellows 50, closed at its outer end and open to space 49 is secured to insulation cap 51, to which is attached the guiding shaft 52, which passes through arm 53. A spring 52a resists to a predetermined degree the extension of bellows 50. On the insulated cap 51 is one of the switch terminals 54, and on insulation arm 55 are three switch terminals, 56, 57 and 59. When a relatively low water pressure is generated in space 49, the bellows 50 extends, carrying switch terminal 54 into yielding contact with terminal 56, which pressure condition occurs during the peaks of the pulsing of diaphragm 9 during the washing and rinsing phases, and as will be explained in detail later, determines the amplitude of the pulsing diaphragm 9 by reversing the water flow from pump 14 into space 49 and changing this flow from the pump 14 into washing receptacle 47, draining in the interim space 49.

During the squeeze-dry phase of the automatic cycle, which requires a higher pressure on the clothes, the bellows 50 distends to a greater extent under this greater pressure and as contact 56 has been disabled, switch terminal 54 contacts with terminal 57 thus terminating the greater amplitude under the greater pressure of the pulsing membrane 9.

Pressure control switch 29 is identical with pressure control switch 30 previously described, except that it only has a single pair of contacts 65 and 66, which on coming into contact, reverses the flow of water out of receptacle 47 by opening or closing the proper solenoid actuated valves, as will be specifically described later, so that the water in receptacle 47 is forced into space 49 by pump 14.

Having described the main elements in the automatic washer, I will briefly state, in proper sequence, the hydraulic actions successively operating diaphragm 9, before describing the automatic electric control circuits as are shown in Figure 8.

Soiled clothes, with a proper soap charge, having been placed in receptacle 47 through door 8, cyclic controller 5 in Figure 1 is manually turned to "start" position. By the proper electric circuits, valve 18 is opened and tank 17 fills with water from water supply connection 41, until float operated switch 28 shuts its off. The motor 13 being started and valve 19 being open, water flows into the suction duct 15 of pump 14 through pipe 82. The water heater is now turned on and pump 14 discharges this water through pipe 80, into cross fitting 81, and through valve 21, up pipe connection 70 into the lower annular recess 43, filling receptacle 47 with its load of soiled clothes.

When the water has attained a predetermined pressure, which thereby indexes the volume of wash water to be oscillated in and out of washing receptacle 47, pressure control switch 29, through contacts 65 and 66 terminate the inflow of water into receptacle 47, by opening valves 22 and 23 and closing valve 21; valves 20 and 24 having previously been closed, the wash water is drawn from receptacle 47 through pipe 83 into the suction side of pump 14, and discharged through pipe 80, valve 22 and pipe connection 75, into chamber 49 formed by diaphragm 9 and shell 10.

This water flow continues until pressure actuated switch 30 causes its cessation at a predetermined pressure as dictated by spring 52a. At

this moment diaphragm 9 under the pressure of the water forced into space 49 by pump 14 has been forced into chamber 47, so that the soiled clothes drained of the water which previously encompassed them are subjected to a predetermined squeeze pressure by the flexible diaphragm 9.

The water flow is now reversed by the electric circuits initiated by the contacting of terminals 54 and 56, opening valves 21 and 24 and closing valves 22 and 23. The wash water now flows into receptacle 47 draining space 49 and the diaphragm 9 recedes to the position as is shown in Figure 2.

When the water pressure again rises in receptacle 47, the pressure actuated switch 29 again shifts the electric circuits, opening and closing the valves, and the oscillation of the wash water continues, thus causing the pulsing of diaphragm 9 and producing a sequential saturation and squeeze on the clothes. This action also produces a shifting of the clothes mass in receptacle 47, due to its slightly inclined axis, since as the clothes are pressed against the element 11 and door 3, the water inherent in the clothes is partially pressed out by the flexible diaphragm 9, which forced them into this position, and as the diaphragm 9 pulses in the opposite direction the clothes fall away from element 11 and door 3. This gravity displacement produces the above referred to shifting of the clothes.

When the timer 90, as will be subsequently described, dictates the termination of the washing period, valves 23, 24 and 25 open and the dirty wash water enters the drain connection 31.

The rinsing period is identical to the above described operation of the washing period. The clothes being subjected to the same pulsating squeeze action.

Water temperature, as dictated by water temperature thermostat switches 35 and 36, see Figure 5, is actuated as follows:

Due to the differential existing between the thermal coefficient of expansion of spindle 37, on which is wound the resistance wire, which is made of any conventional insulating material to withstand high temperature, and the metallic sleeve 16, forming the shell of the heater, switch contacts 35 and 37 are made to "make" and "break" at the predetermined temperature of the water enveloping the shell 16. As this construction is a well known art further explanation is unnecessary.

It should be noted, however, that, due to the initially measured volume of water, which fills receptacle 47, together with the clothes therein, which will vary from time to time as the washer is operated, a minimum of electric energy is required to bring the wash and rinse water to the desired temperature. Furthermore, I may employ a multiple of thermostatic switch contacts operative at different desired temperatures, but for clarity I have shown the wiring diagram, as in Figure 8, with only one temperature point.

Turning now to the squeeze-dry period of the automatic cycle. Under dictation of timer 90, tank 17 is again refilled, valves 19, 22 and 71 are opened and valves 21, 22, 23, 24 and 25 are closed. Water enters the suction side of pump 14 through pipe 82 and is forced into space 49 through pipe 75. As there is no water in receptacle 47 except that inherent in the rinsed clothes, and as drain valve 71 is open, as diaphragm 9 is forced inward by the water from pump 14 it compresses the clothes in receptacle 47 and the water squeezed therefrom falls into drain 31.

By the cyclic switch block contacts, which will be fully described in Figure 8, contact 56 is disabled and the bellows 50 expands, under the water pressure generated in space 49, to such an extent against spring 52a that terminal 54 contacts terminal 57, thus squeezing the clothes under the predetermined squeeze-dry pressure. It is to be noted that, irrespective of the volume of the clothes the terminal pulse pressure exerted by the diaphragm is constant.

When terminal 54 contacts terminal 57 the electric control circuit opens valves 20 and 24 and closes valve 22 and the water is drained from chamber 49 into tank 17. This reversal of flow continues until, by virtue of chamber 49 being in open communication with the suction side of the pump 14, atmospheric pressure is attained therein and switch terminal 54 contacts terminal 59 and the electric control circuit reverses the flow of water, so that it is drawn from tank 17 and again forced into chamber 49.

This squeeze-dry pulsation of diaphragm 9 continues until timer 90 changes the cyclic phase to the air-dry period, at which time, switch terminal 56 is made effective, so that the pulsing peak pressure of diaphragm 9 is now the same as during the washing and rinsing periods. At the same time solenoid operated valves 26 and 27 are opened, causing the pulsing of diaphragm 9 to draw in air, see Figure 4, through duct 31, in which is located air heater 76, and by the suction formed as diaphragm 9 pulses to its position as is shown in Figure 2, the flap valves 77 open and heated air rushes up through recess 43, and through the clothes in receptacle 47, and as diaphragm 9 reverses its movement the air in receptacle 9 is forced out through the open valve 27, through the flap valves 34 in duct 32, and past humidostat 33, out through louvres 80.

The heated air forced past the clothes in receptacle 47 absorbs the moisture therefrom, thereby increasing its humidity percentage, and as the electrical control circuit does not connect in the humidostat control until a few minutes after the air-dry action starts, the humidostat is cut-in while it registers a high degree of saturation of the air forced out of receptacle 9. The humidostat permits the air dry operation to continue until a predetermined lower degree of humidity of the expelled air reflects the dryness of the clothes, at which time the humidostat opens the operating circuit of the machine. It should be noted that during the air-dry period the pulsation of the diaphragm 9 combined with the inclination of the axis of the receptacle 47 continues to shift the clothes mass presenting changing surfaces to the air blast.

Referring to Figure 6 and Figure 7, which shows the operative details of the commutator block 170, which is also seen in outline in the schematic electro-mechanical diagram in Figure 8, those specific structures will not be fully described in detail inasmuch as they form no part of the present invention, as they are described in my co-pending patent application Serial number 559,553, filed on October 20, 1944. However, it may be noted that the commutator block 170, see Figure 6 is moved in the direction of arrow 159, and against the resistance of spring 156, thereby allowing the switch terminals, 151 for instance, to progressively move over the metal inserts 154

giving the required commutation in predetermined intervals of time in the operative cycle.

The timer 90, or the manual control 5, operating through the shaft 157 move commutator block 170 by virtue of spokes on element 150, secured to shaft 157, contacting with pin 159 secured to block 170. The spoke in question on element 158 under-rides pin 159 after a predetermined movement of block 170, and the spring 156 restores block 170 to its initial or "off" position. Block 170 is supported in guides 160.

Turning now to Figure 8 the operation of the electric circuits during the cycle is as follows: When manual cyclic switch 5 is turned to "start" position it closes power contact 101, timer contacts 102, and valve contacts 114 controlling intake valve 18, and contacts 111 controlling tank valve 19, thereby initiating the filling of tank 17. However, the timer 90 is inoperative, since it receives power from normally open contacts 146 of timer lock-in relay 144. Relay 144 is inoperative until it receives current through the closing of leaf 149 to contact 148, which takes place on the operation of float switch 28 when the tank has been filled.

At this point, relay 144 closes switch 146, thereby energizing timer 90, and in addition relay 144 closes the lock-in contacts 145, thereby locking itself and timer 90 into an energized condition, regardless of the subsequent opening of contacts 148 and 149, until at such a time as the movement of the cyclic commutator block 170 opens timer contacts 102, thereby unlocking relay 144 and stopping timer 90. When timer 90 has been first initiated by the action of float switch 28, as above described, commutator block 170 moves from the "start" position into the wash phase. The contacts of commutator block 170 are so arranged that the following operations ensue:

In the description of these operations it is presumed that the previous condition of the points of the contacts 101—153 remain unchanged until a specific change is mentioned.

First.—Contacts 108 controlling receptacle drain valve 23 closes, thereby energizing normally open valve 23 into its closed position. Similarly contacts 113, controlling main valve 25 are closed, thereby energizing normally open valve 25 into its closed position. Finally and simultaneously, with the two above contact closures, contacts 114, controlling water main intake valve 18, are opened from their previously closed condition in the start position of commutator block 170. Subsequently, valve 21 is energized by the closure of contacts 106, and simultaneously therewith, contacts 111 are opened, thereby opening valve 19. This allows the water in tank 17 to flow into the suction side of pump 14.

The next step effected by motion of commutator block 170 simultaneously closes contacts 104, 105, 107 and 110, thereby energizing respectively the wash-rinse pulse relay 123, the motor, via connection 100, the water heater connection 92 and the low pressure selector contact 56. In addition, at this time contacts 106 and 108 of commutator block 170 are closed. This initiates the washing cycle described as follows:

At this point, the tank 17 is full and the valves in the system are in the following position. Valves 19, 21 and 24 are open and valves 18, 20, 22, 23, 25, 26, 27 and 71 are closed.

The un-energized position of the contacts associated with relay 123 is such that, in view of the circuit conditions previously specified, valves 21 and 23 are energized, consequently, on the starting of motor 13, water pressure is delivered through valve 21 into the receptacle 47. This first "metering" filling of the tank continues until the volume of receptacles 47, less the arbitrary volume of the soiled clothes therein, is occupied by the incoming water, and until a predetermined value of pressure in the bellows of switch control 29 closes contact 139, thereby energizing pulse relay 123 which then locks itself closed by virtue of locking contacts 130.

This action de-energizes valves 21 and 23 by opening of contacts 126 and 127 respectively, and energizes valves 24 and 22, by the closing of contacts 128 and 129. In addition, the energization of relay 123 closes contacts 125, thus energizing tank lock-out relay 143. This action locks 143 in the energized position through contacts 141, regardless of the subsequent pulsation of 123, and until unlocking is effected at the end of the washing period, by contacts 151. Simultaneously 143 energizes valve 19, through the closure of contacts 142, thereby closing valve 19, and isolating from the tank 17 the metered amount of water, necessary for the washing pulsation, withdrawn therefrom.

This initial locking-in of pulse relay 123, by the closing of valve 21 and 24, the opening of valves 22 and 23, causes the pump to withdraw the needed amount of wash water from receptacle 47 and to pump it into the membrane space 49. This transfer continues, until the pressure in space 49, as reflected by bellows 50 is adequate to close the contact points 54—56, thereby energizing pressure relay 136 and unlocking relay 123 by the opening of contacts 137, thus de-energizing valves 22 and 24 and re-energizing valves 21 and 23. The pump now withdraws water from space 49 and returns it to the washing receptacle 47, thereby completing the first cycle of the washing pulsation.

This washing pulsation continues for a predetermined time until commutator block 170 opens contacts 104, 105, 106, 107 and 108 thereby de-energizing relay 123 with the consequent discontinuation of the pulse cycle and allowing the dirty wash water to drain off through valve 25. This draining condition continues for a predetermined period of time, dictated by timer 90 and is adequate to allow the system to completely drain. Thereupon the commutator block 170 returns the contacts 105—153 to the configuration corresponding to the "start" position, as above described, with the exception that the timer contacts 102 are open, thereby unlocking relay 144 and stopping timer 90, until upon refilling of tank 17, which re-initiates the locking of relay 144, and the re-energization of timer 90. This return to the "start" configuration thus repeats all of the functions described above for the washing period, and consequently comprises the rinsing period.

At the end of the rinsing period, block 170 again opens timer contacts, after having set up the contact configuration corresponding to the "start" position, and in addition, closes contacts 112, opening valve 71, thus allowing any water in receptacle 47 to drain.

This action refills tank 17, as previously described, for the "start" position of wash and rinse periods. On refilling tank 17, float switch 28 relocks timer relay 144 and re-energizes timer 90. The subsequent motion of block 170 thereupon re-energizes valve 23 and 25 by the closure of contact points 108 and 113, and thereafter,

closes contacts 152 and 153, thereby returning control of valves 22 and 24 to the dry pulse relay 124 through contacts 131 and 132 respectively.

At this point, contacts 103, 105 and 109 are also closed, thereby making available current for the operation of pulse relay 124. In the un-energized position of relay 124, in addition to the valves determined by block 170, valves 22 and 24 are energized through contacts 131 and 132, whereas valves 19 and 20 are un-energized, due to the open condition of contacts 133 and 134. The consequent position of the valves causes pump 14 to draw water from tank 17 and to deliver it under pressure to chamber 49. This action continues until the squeezing pressure by membrane 9 on the clothes, as reflected by bellows 50, causes contacts 54—57 to close at the predetermined squeezing pressure. By the closing of these contacts 54—57, relay 136 is energized, thereby locking into energization the relay 124 via contacts 138 and 135. However, the switch-arm 176, which is mechanically linked to switch-arm 54 and bellows 50, is in a closed position with contact segment 59 for this high pressure condition.

Furthermore, segment 159 is so formed that the circuit 176—59 remains closed until pressure in chamber 49 drops to atmospheric, at which point it opens. Consequently, relay 124, having locked-in, energizes valves 19 and 20 and de-energizes valves 23 and 24, and thereafter continues in this condition until the transfer of water from chamber 49 back into tank 17, consequent to this valve configuration, reduces the pressure in chamber 49 to atmospheric, thereby unlocking relay 124, due to the opening or circuit 176—59, and the cycle repeats itself.

This squeeze dry cycle continues for a period determined by the movement of block 170, at the termination of which, valve 71 is de-energized and valves 26 and 27 via contacts 115 are energized. Also, at this point contact block 170 opens contacts 109 and closes contacts 110. In addition, contacts 116 are closed, thus starting the air heater 76. As a result of this circuit condition, the pulsation of water between chamber 49 and tank 17 continues, but at the lower predetermined pressure which is identical to the washing and rinsing pressure phases. This results in the drying of the clothes by circulation of the heated air, as previously described.

At the beginning of the air-dry period, contacts 117, which have been continuously closed, in the previous portion of the cycle remain closed for a short period during the start of the air-dry period, allowing contacts 140 of humidostat 33 to close. At the termination of this short period contacts 117 open, thus transferring control of the common power line via lead 33' to the humidostat. This air-dry pulsation continues until the compensated humidostat 33, the action of which will be fully explained below, opens contacts 140, thereby removing power from the entire system and terminating the squeeze-dry phase of the automatic cycle.

The operation of the compensated humidostat system, see Figure 8, is as follows: If the humidity of the air drawn through heater 76 is low, then after heating, the humidity of this air entering chamber 47 will be further reduced, and the drying ability of this air will be maximum. Consequently the compensating humidostat 181 is arranged to take advantage of the relatively low eventual humidity, to which the air passing by the wet clothes in chamber 47 will lower the exhaust air passing over humidostat 33 by reducing the absolute value of humidity, at which contacts 140 will be broken, thereby terminating the cycle.

On the other hand, if the "outside" humidity is relatively high, even with heating, by its passage by heater 76, the eventual absolute humidity of the air exhausted from chamber 47 will be high and under these conditions a relatively lower degree of drying can be accomplished by the system. Consequently the action of compensating humidostat 181 is such as to raise the acceptable value of humidity at which the system shuts itself off.

The mechanism shown to accomplish the above operation comprises an insulated slideable support block 180, carrying the switch contacts 140. This increased humidity, above referred to, of the air passing over humidostat 33 causes the control rod 161 to push contacts 140 into a closed position. On the otherhand, compensating humidostat 181 is mechanically linked to the slideable switch block 180 by member 162, thus moving the same under this high humidity condition and changing the absolute value of humidity at which contacts 140 are opened, as above described.

What I desire to claim by United States Letters Patent is encompassed in the following claims:

1. An automatic washing machine, adapted to wash and rinse clothes, comprising a diaphragm hermetically dividing an operative receptacle and adapted to pulse therein under the hydraulic pressure of a cleaning fluid, motor actuated pumping means for said fluid, a conduit connecting each division of said operative receptacle with said pumping means, and automatic valve control means to cause said working fluid to be oscillated from one division of said receptacle to the other in order to pulse said diaphragm during the washing and rinsing periods.

2. An automatic washing machine, adapted to wash and rinse clothes, comprising a diaphragm hermetically dividing an operative receptacle and adapted to pulse therein under the hydraulic pressure of a cleaning fluid, motor actuated pumping means for said fluid, a conduit connecting each division of said operative receptacle with said pumping means, and valve control means, actuated by a predetermined pressure in each of said divisions, to cause said cleaning fluid to be oscillated from one division of said receptacle to the other in order to pulse said diaphragm during the washing and rinsing periods.

3. An automatic washing machine, adapted to wash and rinse clothes, comprising a diaphragm hermetically dividing an operative receptacle, the diaphragm adapted to pulse therein under the hydraulic pressure of a cleaning fluid, during the automatic sequence of the machine, motor actuated pumping means for said fluid, a conduit connecting each division of said operative receptacle with said pumping means, and automatic valve control means to oscillate the flow of said fluid through said conduits into their respective division of the operative receptacle in order to pulse said diaphragm and thereby said clothes, and wash and rinse fluid heating means inserted in one of said conduits to heat said cleaning fluid during said oscillation.

4. An automatic washing machine, adapted to wash and rinse clothes, comprising a diaphragm hermetically dividing an operative receptacle, said clothes being confined to one of said divisions of said receptacle, access means to said division, motor operated pumping means, an automatic valve system for the initial filling with cleaning water

for both washing and rinsing in their proper sequence, of that division of said receptacle containing said clothes, a conduit connecting each division of said receptacle with said pumping means, and a valve control associated with the discharge and suction of said pumping means to oscillate the flow of said cleaning water during the respective sequences, through said conduits into the respective divisions of the receptacle in order to pulse said diaphragm, and thereby wash and rinse said clothes, said valve control associated with said pumping means initiated in its movement by a predetermined pressure as generated in each of said divisions of said receptacle by said oscillation of the water.

NATHANIEL B. WALES.

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Number	Name	Date
1,531,922	Graham	Mar. 31, 1925
2,178,385	Alward	Oct. 31, 1939
1,447,017	Fleming	Feb. 27, 1923
1,567,710	Carroll	Dec. 29, 1925