

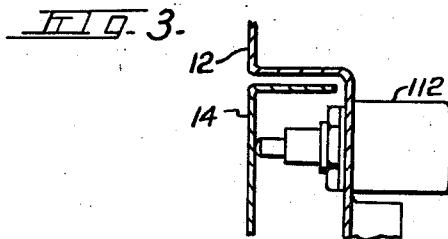
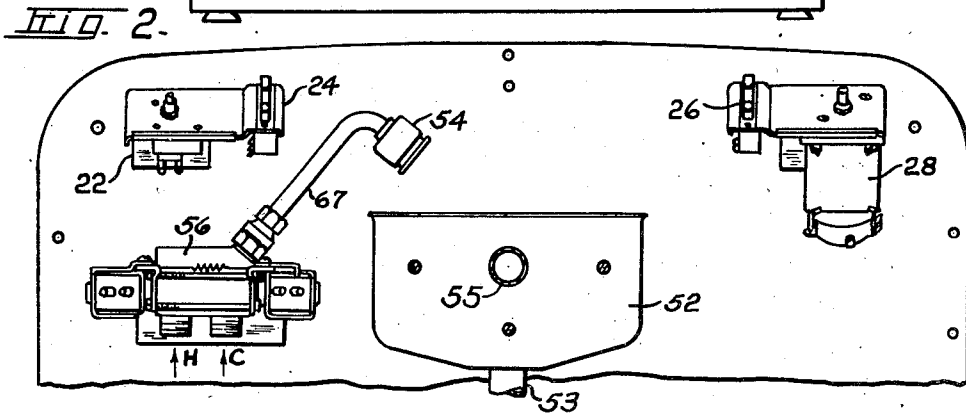
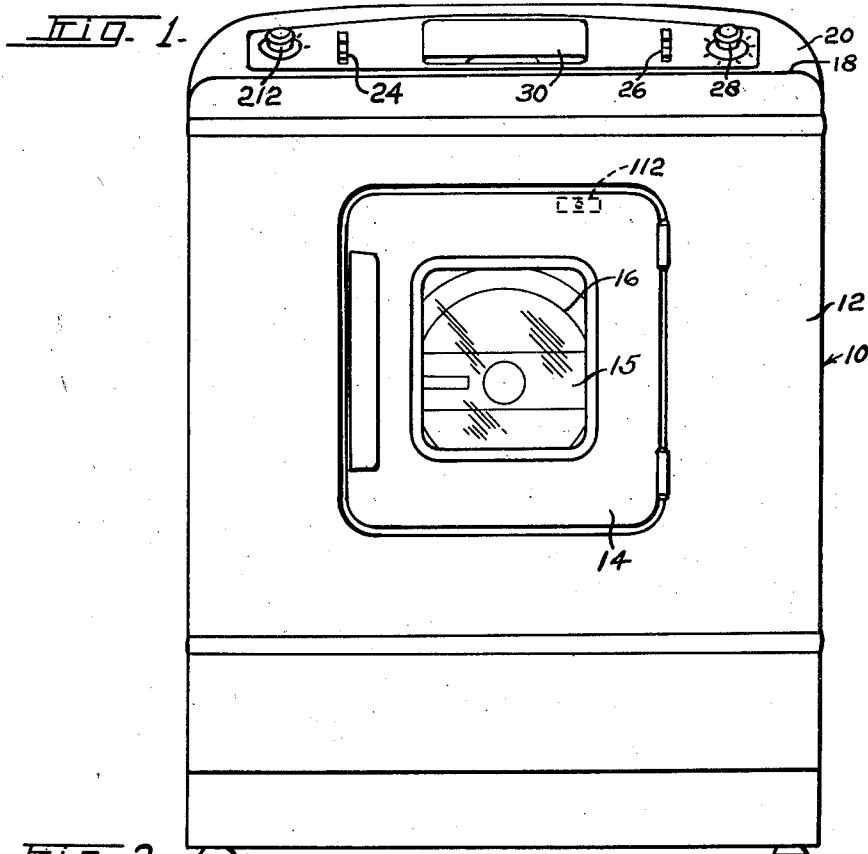
Oct. 30, 1956

P. W. DOUGLAS  
WASHING MACHINES

2,768,518

Filed Sept. 5, 1952

3 Sheets-Sheet 1



INVENTOR  
PEYTON W. DOUGLAS  
BY *R. P. Keiper*  
ATTORNEY

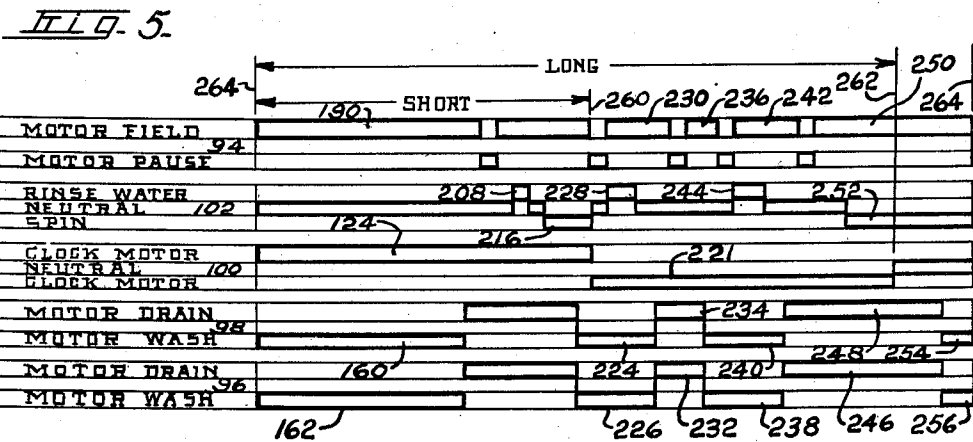
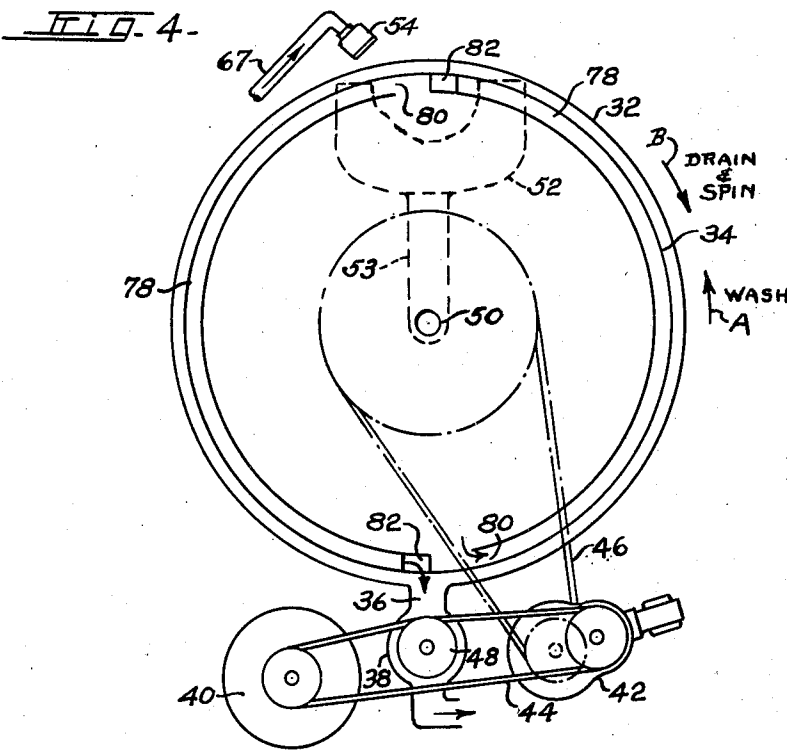
Oct. 30, 1956

P. W. DOUGLAS  
WASHING MACHINES

2,768,518

Filed Sept. 5, 1952

3 Sheets-Sheet 2



INVENTOR  
PEYTON W. DOUGLAS

BY *J. D. Keiser*

ATTORNEY

Oct. 30, 1956

P. W. DOUGLAS

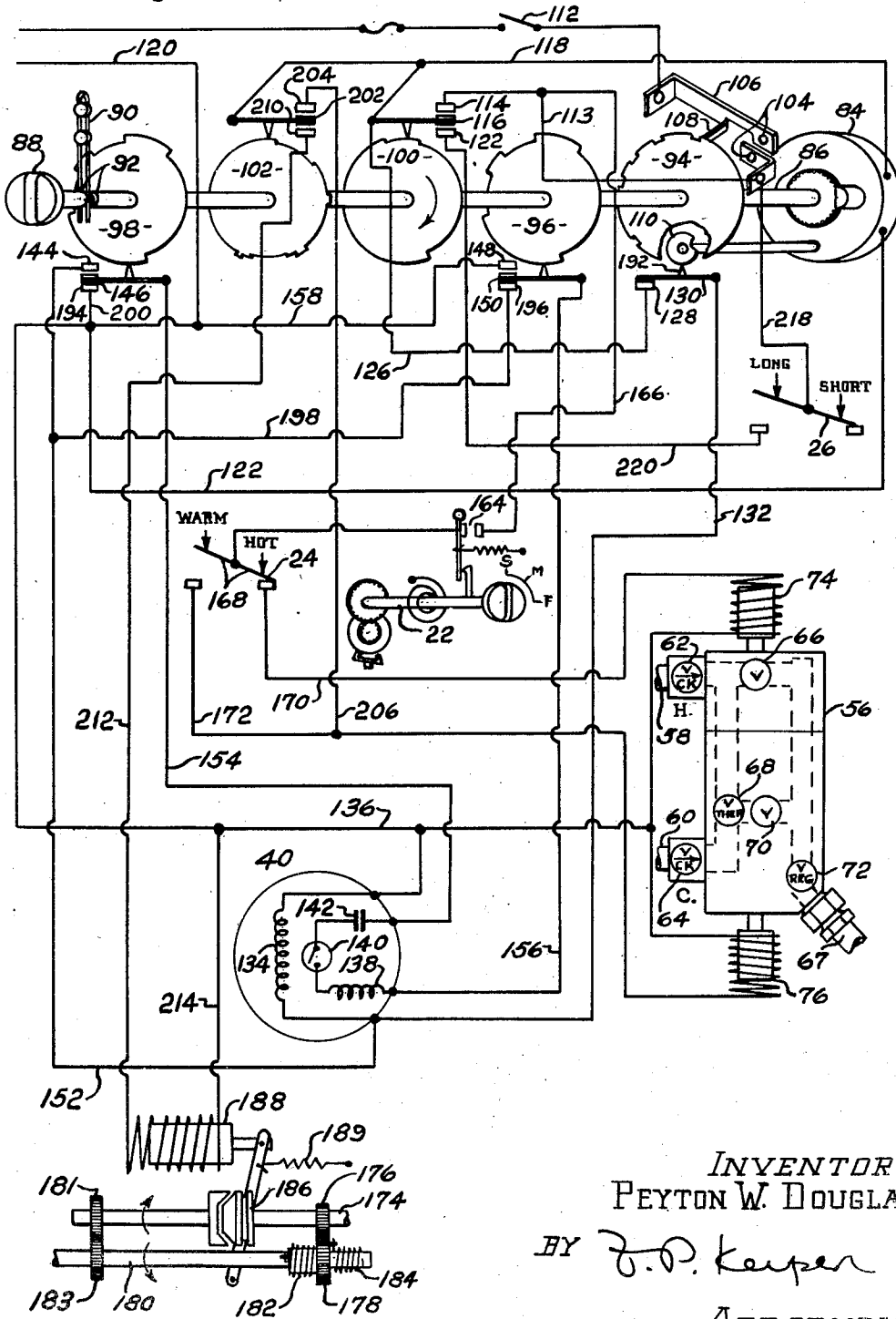
2,768,518

WASHING MACHINES

Filed Sept. 5, 1952

3 Sheets-Sheet 3

FIG. 6.



INVENTOR  
PEYTON W. DOUGLAS

BY *J. D. Keiper*

ATTORNEY

1

2,768,518

## WASHING MACHINES

Peyton W. Douglas, Syracuse, N. Y., assignor, by mesne assignments, to The Murray Corporation of America, Detroit, Mich., a corporation of Delaware

Application September 5, 1952, Serial No. 308,098

10 Claims. (Cl. 68—12)

This invention relates to washing machines, and more particularly to automatic controls therefor.

The present invention is an improvement upon and a continuation in part of the invention disclosed in a co-pending application Serial No. 143,019, filed February 8, 1950, in which there is disclosed a washing machine and automatic controls therefor, the washing machine utilizing an imperforate cylinder, so constructed as to retain or drain the water from the drum in accordance with rotation direction. The controls shown in the aforesaid application effect a cycle or sequence of operational stages, whereby water is introduced into the wash drum, washing is effected, the water drained from the tub by reverse rotation, rinse water introduced into the drum either for a tumbling rinse, after which it is drained from the tub, or a continuous rinse, or both, following which the laundry contained in the drum is subjected to centrifugal extraction. While provision is made in the disclosure of such application for shortening the over-all period by manually advancing the timer mechanism during any particular stage, the apparatus there shown proceeds through the sequence of operations; and no provision is made for alteration other than the change in the length of the stage of operation or the elimination of an intermediate operational stage by advancing the timer manually at the time such alteration is to be effected.

One of the features of the present invention is to provide for more than one sequence of operations in automatically washing and centrifugal extraction of the laundry, and to provide means whereby one sequence of operations or another may be selected at will by the operator at any time during or prior to the commencement of the entire washing cycle.

In automatic washers, it has generally been the practice to provide a cycle of operation which will not be extended over too long a period of time, and with this in view, the number of rinses provided for is generally reduced to a minimum necessary for a satisfactory operation, since if the washing machine is to handle a sequence of loads, the over-all time required would be great if each cycle of operation is made to include several rinsing operations as is normally considered desirable for producing a satisfactory washing operation. With the adoption of so-called no-rinse detergents requiring little or no rinsing for a satisfactory washing operation, the necessity for repeated rinsing stages following the washing stage and preceding the extraction stage, to a considerable extent disappears.

The invention is directed toward providing an automatic control which will function to operate the washing machine through a complete sequence of operations, including washing, several rinse stages, followed by centrifugal extraction, or a shortened sequence of operations including washing, draining and suds removal and centrifugal extraction. Where it is desirable to use the apparatus for successive loads, and with no-rinse detergents, a shortened cycle has considerable advantage in that several complete washing operations may be effected in the

2

time generally allowed for the washing operation including successive rinsing stages.

The above and other novel features of the invention will appear more fully hereinafter from the following detailed description when taken in conjunction with the accompanying drawings. It is expressly understood that the drawings are employed for purposes of illustration only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings, wherein like reference characters indicate like parts:

Figure 1 is a front elevation of the laundry apparatus, showing the controls therefor;

Figure 2 is a fragmentary front elevational view of the apparatus with the cabinet removed to illustrate the location of the manually actuated controls;

Figure 3 is an enlarged fragmentary section of the door switch taken substantially on the line 3—3 of Figure 1;

Figure 4 is a diagrammatic illustration of washing apparatus and driving mechanism therefor;

Figure 5 is a time chart diagram illustrative of the sequence of operations performed; and

Figure 6 is a control circuit.

Referring to the drawings, there is shown in Figure 1 a cabinet within which there is enclosed a substantially horizontal axis washing apparatus of the type disclosed in application Serial No. 143,019. Such apparatus is diagrammatically illustrated in Figure 4 for the purposes of this application. The washing apparatus includes a drum having a coaxial revolving door in its front wall, access to which is had through a stationary door in the front wall of the cabinet. More particularly, in Figure 1, there is shown the cabinet 10, the front wall 12 of which is provided with a door 14, such door having a window 15 through which will appear the circular revolving door 16 positioned on the front of the revolving wash drum therebehind. The cabinet is provided with a deck 18 having a sloping control panel 20 at the rear, upon which are mounted various controls including a water quantity control 22, a water temperature control 24, a long and short cycle control 26, and a timer and starting control 28. There is also arranged in the panel a hinged door 30 through which soap may be admitted for each cycle of operations.

As shown diagrammatically in Figure 4, the washing apparatus comprises a stationary tub or splash guard indicated at 32, and a revolving substantially imperforate drum contained therein indicated at 34. The tub 32 is continuously open to drain as at 36, such drain leading into a drain pump 38. The wash drum 34 is driven in one direction or the other by a reversible motor 40, such motor driving the drum 34 through a transmission 42. The transmission is driven by a belt drive 44 and the drum is driven from the transmission by a belt drive 46. The belt 44 also drives, through the pulley 48, the pump 38, which in practice will be effective in either direction of rotation. The transmission is adapted to drive the drum in one direction at a washing speed and in the other direction at a similar tumbling speed and also at a higher speed sufficient to effect centrifugal extraction. Water is admitted to the drum through a hollow shaft indicated at 50 entering the drum from the rear, such hollow shaft being fed by a hopper 52 and conduit 53, the hopper being located below the soap door 30 and thereby being adapted to receive soap injected through the door 30. Wash water is introduced into the hopper 52 from an anti-splash nozzle 54 leading from a control valve mechanism 56, such valve mechanism being adapted to supply water to the hopper at either one of two temperatures.

The water control valve mechanism may be constructed

in accordance with Patent No. 2,560,293, issued July 10, 1951, and comprises hot and cold inlets 58 and 60, respectively, such inlets having check valves 62 and 64 preventing back flow. The valve mechanism proper contains an electromagnetically controlled valve 66 leading from the hot water inlet 58 directly to the outlet 67 and the outlet nozzle 54. The valve mechanism also includes a thermostatic control mechanism 68 drawing water from both the hot and cold inlets and delivering tempered water to a second electromagnetic control valve 70 at a reduced controlled temperature. The outlet pipe 67 contains a constant flow valve 72 which may be of the type disclosed in British Patent 372,286 or U. S. Patent 2,389,134. The valve 66 is controlled by the solenoid 74 and the valve 70 is controlled by the solenoid 76. The hopper 52 has an overflow port 55 leading into the tub 32, through the back wall of the tub 32.

The wash drum is provided, as more in detail shown in the above referred-to application Serial No. 143,019, with one or more arcuate drain tubes 78 having an inlet 80 opening into the drum and an outlet 82 diametrically disposed therefrom opening into the tub. Through the use of such tubes, the tub is caused to retain wash water when rotated in the direction of arrow A, and is adapted to drain water from the tub when rotated in the direction of arrow B.

In Figure 2, the general arrangement of the control mechanism is shown with the deck 18 and panel 20 removed. The water quantity control 22 comprises an escapement mechanism which may be mechanically wound by the manual knob to different indicated degrees, and thereafter allowed to operate in the manner of a clockwork through the prescribed period selected, at the end of which time a water control circuit switch is opened, such switch being closed by the winding operation and remaining closed during the period of operation of the clockwork. The water temperature control switch 24 consists of a single pole double throw switch. The long and short cycle switch 26 consists of a single pole single throw switch.

The timer 28 comprises an electrically driven clock motor 84 adapted, through an intermittent motion, to drive a cam shaft 86 in a stepwise fashion, each movement being, for example, 8 degrees, and the intervals between movements being spaced by periods of, for example, 60 seconds. The cam shaft 86 is axially slidable through manual operation of the knob 88 between two positions, a resilient lock spring 90 being provided, adapted to engage in one or the other of the spaced grooves 92 in the cam shaft 86. The cam shaft carries a motor field control cam 94, motor starting winding reverse cams 96 and 98, a timer cam 100, and a rinse water and spin control cam 102. Axially shifting the cam shaft 86 opens and closes a pair of master control contacts 104, one of the contacts being mounted upon a resilient leaf spring 106 having a finger 108 adapted to engage the end face of the cam 94, so that upon movement of the shaft inwardly to the right hand position as shown in Figure 6, the contacts 104 are opened. Drive of the cam shaft 86 from the motor timer 84 is through an over-running clutch or friction device, whereby the cam shaft may be rotated manually at any time.

The clock motor 84 drives an additional or auxiliary cam 110 continuously at a rate of one revolution for each 60 seconds. Such cam is located with its periphery adjacent to and tangential to the periphery of the motor field cam 94, so as to cooperate therewith in actuating the cam follower 192 and reduce the interval during which the field of the motor is de-energized from the 60 second period between movements of the cam shaft to a lesser time interval, as determined by cam 110, approximately 15 seconds in a manner which will be referred to hereinafter. Such auxiliary cam is effective at each time the motor is stopped to affect such a shortening of the period.

Operation of the automatic control is initiated by manual axial movement of the cam shaft to the left position in order to close contacts 104. Assuming the door switch 112 to be closed by reason of the cabinet access door 14 being in a closed position, slight clockwise movement of the knob 88 will effect rotation of the cams and particularly cam 100, so as to close a circuit through the lead 118 to the clock motor, such clock motor being connected to the return wire 120 by a lead 122. The clock motor thus commences to drive the cams periodically through fixed angular increments and the cam 110 continuously. The cam will continue to maintain the contacts 114 and 116 closed for a period as indicated in the time chart of Figure 5 as at 124, such period being designated the short cycle. Should the switch 26 be actuated to the long cycle position, the clock will contrive to rotate for a period designated as the long cycle, a more complete description of which will appear hereinafter. Closure of the contacts 114 and 116 also completes a circuit through lead 126 to contact 128 and cam-actuated blade contact 130, actuated by the field cam 94, through a lead 132 to the field 134 of the motor 40, the other end of the field being connected to the return wire 120 through a lead 136.

The starting winding of the motor 138 which is connected in series with the usual motor drive shaft centrifugal cut-out switch 140 and a capacitor 142 is energized at this point through the contact 144 and cam blade contact 146 actuated by cam 98, and through the contact 148 and cam blade contact 150 actuated by the cam 96, to complete a circuit from motor field lead 132 through a connection 152 to the contact 144 and a lead 154 from the cam blade contact 146 to the capacitor 142, switch 140, and starting winding 138. The other side of the starting winding 138 is connected to the return 120 through a lead 156 extending to the cam blade contact 150, the latter closing a circuit to contact 148 connected to the return 120 through the lead 158.

The circuit to the starting winding remains closed so far as the cam-operated contacts 148 and 150 and 144 and 146 are concerned, for a period as indicated at 160 and 162 in the time chart, Figure 5. Since the centrifugal switch 140 opens as soon as the motor starts, the starting winding circuit is broken at all times during motor operation except briefly at starting, just before stopping, and while the motor is stopped, regardless of the cam-operated contacts 148 and 150 and 144 and 146.

When the cam shaft 86 is moved outwardly, or to the left in Figure 6, the operator will determine the quantity of water desired to be admitted to the tub by rotating the water quantity control 22 clockwise by the corresponding amount indicated, so that contacts 164 will be closed. With the door switch 112 closed and the cam shaft 86 moved to the left, contacts 104 are closed, and a circuit is established to the contacts of the water quantity timer 164 through the lead 166, such circuit extending to the temperature selector switch blade 168 of the hot and warm temperature control switch 24. Assuming hot water is desired for washing, the switch 24 will be in the position shown in Figure 6 to establish a circuit through a lead 170 to the solenoid 74 of the valve 66, such connection being completed to the return 120 through the previously referred-to lead 136. If it is desired to introduce warm water at this time, the switch 24 will be thrown to establish a connection through lead 172 with solenoid 76 of valve 70, such solenoid being likewise connected to the lead 136 and thence return 120. Thus, water may be admitted to the apparatus at any time after closure of the door 14, and movement of the cam shaft to the left to close contacts 104. Introduction of wash water may thus precede or accompany drum rotation, since tumbling of the clothes during water admission will effect no harm. While the escapement 22 returns to the diagrammatic end position shown in Figure 6, water will be admitted to the

machine at a constant rate for the period set, so that a specific quantity will be introduced. At the end of such period, the contacts 164 will be opened, causing either valve 66 or 70 to close and discontinue further water supply.

The motor will drive the drum 34 at a washing speed in the direction of arrow A in Figure 4 through the transmission 42. Such transmission corresponds in operation to that shown, for example, in Dyer Patent No. 2,606,452, issued August 12, 1952. Such transmission is diagrammatically shown in Figure 6, and comprises a shaft 174 driving a pinion 176 meshing with a reduction gear 178 adapted to drive the driven shaft 180 at slow speed for washing through an overrunning clutch such as 182. The transmission also has provision whereby upon reverse motor rotation of the motor, the driven shaft 180 may be driven at low speed in the opposite direction by the reduction gear 178, through a second overrunning clutch 184. The transmission further is provided with a clutch 186 magnetically operated into engagement by the solenoid 188, whereby the driven shaft 180 may be driven at high speed for centrifugal extraction in the last-named direction, through gears 181 and 183 of about equal diameter. The overrunning clutches 182 and 184 are so constructed as shown in the Dyer patent aforesaid, whereby the shaft 180 is free running with respect to the reduction gear 178, when the shaft 180 rotates at a higher speed than gear 178.

After a washing period, the cam 94, in combination with the cam wheel 110, opens the motor field circuit, the wash period being indicated in the diagram of Figure 5 as at 190. One of the notches in the cam 94 at this time is aligned with the follower 192 of the cam contact blade 130 and thereby adapted to allow the contact 128 and the blade contact 130 to open. The duration during which the contact and blade would be opened by cam 94 is determined by the dwell period between movements of the shaft 86, or 60 seconds. In order to shorten this period to one only sufficiently long to assure motor stoppage, the cam follower 192 also rides on the continuously rotating auxiliary cam wheel 110, such wheel having a sector removed therefrom of about 90° in length whereby the contact 128 and blade contact 130 are allowed to open for about 15 seconds. Prior to the opening of the contacts 128 and 130, cams 98 and 96 have acted to reverse the connections to the starting winding 138 by contacting the cam blade contact 146 with the contact 194, and the cam blade contact 150 with the contact 196, thus establishing through leads 198 and 200 a reverse connection to the starting winding 138. Such connection remains opened so long as the motor is running by reason of the rotation of the motor and the open circuit of the centrifugal starting switch 140. When the field circuit is opened to stop the motor, the starting switch closes as the motor ceases rotation, and the starting winding circuit remains open by reason of open contacts 128 and 130. Thus, when the cam 94 again closes a circuit through the contacts 128 and 130 to the motor field 134, the starting winding is thereupon reversely energized and the motor caused to rotate in a reverse direction or in the direction of arrow B. Such rotation causes the drum to be drained through the drain tubes 78 after a brief period.

After a sufficient time has elapsed to drain the drum, rinse water is introduced by means of cam 102 closing a circuit between cam blade contact 202 and contact 204, the contact 204 being connected to the solenoid 76 of valve 70 through lead 206. Thus, tempered rinse water is introduced into the drum while rotating in the drain direction for a period as indicated on the chart of Figure 5 as at 208. After the rinse water is allowed to flow for a predetermined period as indicated, the contacts 202 and 204 are opened, and the valve 70

closed, and draining of the rinse water continues. After a brief period, cam 102 closes a circuit through blade contact 202 and contact 210, the latter being connected by a lead 212 to the transmission clutch actuating solenoid 188, such solenoid being connected to the return 120 through leads 214 and 136. The clutch 186 of the transmission is thus caused to engage, and the drum is accelerated to centrifuging speed in the direction of arrow B. Centrifuging continues for a period as indicated at 216 on the chart of Figure 5.

Assuming the long and short cycle switch 26 to be in the position shown in Figure 6, whereby a short wash cycle is called for, at the end of the spin period represented at 216 in the chart of Figure 5, the timer cam 100 will open the circuit between contacts 114 and 116 to stop the clock motor 84, and at the same time, open the circuit to the motor field and the starting winding. The shortened wash cycle including washing, rinsing and extracting, will be thus concluded.

In order to effect a further rinsing after the wash water and suds have been removed, it is desirable to introduce a quantity of rinse water into the drum and retain the same in the drum for a period of time while rotation is effected, and thereafter drain the rinse water from the drum. This is accomplished by reversing the drum rotation, so as to rotate in the wash direction or the direction indicated by the arrow A. Prior to the end of the period indicated by the bar 124 in the time chart Figure 5, the cams 96 and 98 effect reversal of the connections to the starting winding of the motor 40, as is indicated by the bars 224 and 226, so that upon the closing of the contacts 128 and 130, motor rotation is effected in a washing direction and the tub is rotated in the direction indicated by the arrow A. At the same time that rotation commences, cam 102 closes contacts 202 and 204 to energize the circuit through the lead 206 to the solenoid 76 operating the valve 70, whereby tempered water is introduced into the drum for a period as is indicated by the bar 228 on the time chart Figure 5. Tumbling of the laundry in the rinse water retained within the drum continues over a period of time as indicated by the bar 230 in the time chart Figure 5, at the end of which time contacts 130 and 128 are opened and the motor stopped.

Prior to the end of the rinse period referred to immediately preceding, the connections to the starting field are reversed by the cams 96 and 98, and such connections remain reversed for the periods indicated by the bars 232 and 234 in the time chart. Thus, when the cam 94 recloses contacts 130 and 128, as indicated by the bar 236, rotation of the motor takes place in the direction of arrow B, and draining of the rinse water is effected. Prior to the termination of such draining operation, the starting connections to the starting winding are again reversed by the cams 96 and 98, as is indicated by the bars 238 and 240, so that when the motor is stopped following the drain period and restarted, rotation is reversed for rotation in the wash direction as indicated by arrow A. Such rotation continues for a length of time as indicated by the bar 242. When such rotation commences, cam 102 again closes contacts 202 and 204 to complete a circuit through solenoid 76 to open the valve 70 to introduce tempered water into the drum. Such water is retained and the laundry tumbled therein for an agitated rinse, such rinse period continuing for a period after the valve 70 is closed. The period during which valve 70 is opened is indicated by the bar 244.

Prior to stoppage of the motor following the period indicated by the bar 242, cams 96 and 98 again reverse the field connection for a period or cam angle as indicated by the bars 246 and 248, so that when the motor again starts, rotation is effected in the drain and spin directions as indicated by arrow B. The motor con-

tinues to rotate in such direction for a period indicated by the bar 250, and draining of the tub is effected. Following a sufficient time for draining to take place, cam 102 closes contacts 202 and 210 to excite the clutch solenoid 188, whereupon the clutch 186 is engaged and the rotation speed of the drum increases to effect centrifugal extraction. The centrifugal extraction solenoid circuit remains closed for a period as indicated by the length of bar 252 and extraction continues up to the time at which the motor field circuit and the other circuits are broken by the opening of contacts 116 and 122 at the conclusion of the period indicated by the bar 221. When the cam shaft 86 is advanced manually from the point 262 to the point 264, the starting winding circuit connections are again reversed by the cams 96 and 98 so as to establish connections for rotation in the wash direction when the next wash load is to be undertaken. The cam angle over which the connections are thusly reversed is indicated by the bars 254 and 256 on the chart of Figure 5.

It will thus be seen that a short washing cycle is provided for in which washing occurs for a period of time, followed by a continuous rinsing operation and a centrifugal extraction operation, and that a long cycle may be had wherein two additional submerged rinse periods are provided for, followed by centrifugal extraction. Either the long cycle or the short cycle may be chosen when the wash is commenced by suitable actuation of the switch 26. If the short cycle has been chosen and it is desired to change to a long cycle, such change may be effected at any time even after the conclusion of the short cycle, or vice versa. It will be apparent, however, in the latter instance, that closing the switch 26 for the long cycle after the short cycle is completed will effect restarting of the apparatus regardless of how long since the short cycle has been completed. Thus, it is possible for the operator to inspect the laundry contained within the drum, and if it then appears desirable for additional rinsing to be effected, it is merely necessary to close the access door and the inspection door, and actuate the switch 26 to the long cycle period.

When the short washing cycle terminates, the cams have been advanced, as indicated in the time chart of Figure 5, to the point indicated at 260, when contacts 130 and 128 are opened as well as the contacts 114 and 116. When the long washing cycle terminates, the cams have advanced, as indicated in the time chart to the point indicated at 262. In either case, the clock motor 84, stops, and the further advance of the cam shaft stops. When a new cycle of operation is to be started, the cam shaft 86 is advanced manually from the point 260 or 262 to the point 264, which recommences the sequence of operations, either short or long cycle, dependent on the position of switch 26. Such manual advance may be made with or without shifting the cam shaft axially to open contacts 104, but if the apparatus is not to be used immediately, shifting of the shaft to the right to open contacts 104 is desirable in order to leave all the circuits open. If the contacts 104 are not opened, advancing the cam shaft should be restricted to a position between the point indicated at 262, and the restart position 264, to avoid commencement of a new cycle of operations. In any event, it is desirable, if the apparatus is not to be used immediately, to move the shaft 86 to open contacts 104 when the apparatus is unloaded, whether or not the shaft be advanced to the region between point 262 and 264.

While the solenoid for actuating the transmission clutch 186 is shown as adapted, when energized to engage the clutch for the periods indicated at 216 and 252 against the bias of spring 189, the transmission could be constructed like that shown in application Serial No. 271,474, filed February 14, 1952, wherein the solenoid is energized for low speed forward and reverse, and de-energized for high speed centrifuging. Where such an

arrangement is used, an additional cam and contacts similar to 202 and 210 can be employed, the cam, however, functioning to hold the contacts closed except for the periods indicated at 216 and 252, when the circuit would be open, or a manually closed circuit relay when de-energized may be employed, the relay coil being connected to leads 212 and 214, in place of the clutch operating solenoid 188, and the relay contacts being connected in series with the clutch actuating solenoid 188 in a circuit powered by a connection to lead 218 and return lead 120.

While a single embodiment of the invention has been illustrated and described, it is to be understood that the invention is not limited thereto. As various changes in the construction and arrangement may be made without departing from the spirit of the invention, as will be apparent to those skilled in the art, reference will be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. In an automatic washing machine, a laundry wash container; means associated with said container for effecting washing, rinsing and water extraction upon laundry placed within said container; cyclic means for sequentially controlling said associated means to perform in sequence within said container upon laundry contained therein, a washing operation, a rinsing operation, a water extraction operation, a subsequent rinsing operation, and a subsequent water extraction operation, said cyclic means including means for terminating the sequential control of said cyclic means upon completion of the first-named extraction operation; and manual means for neutralizing said terminating means to effect said subsequent rinsing and extraction operations.

2. In an automatic washing machine, a laundry wash container; means associated with said container for effecting washing, rinsing and centrifugal extraction upon laundry placed within said container; cyclic means for sequentially controlling said associated means to perform in sequence within said container upon laundry contained therein, a washing operation, a rinsing operation, a centrifugal extraction operation, a subsequent rinsing operation, and a subsequent centrifugal extraction operation, said cyclic means including means for terminating the sequential control of said cyclic means upon completion of the first-named extraction operation; and manual means for neutralizing said terminating means to effect said subsequent rinsing and extraction operations.

3. In an automatic washing machine, a laundry wash container mounted for rotation on an axis out of the vertical; means associated with said container for effecting washing including means for rotating said drum in one direction, rinsing and centrifugal extraction including means for rotating said drum in the reverse direction, upon laundry placed within said container; cyclic means for sequentially controlling said associated means to perform in sequence within said container upon laundry contained therein, a washing operation while rotating in one direction, a rinsing operation, a centrifugal extraction operation while rotating in the reverse direction, a rinsing operation, and a centrifugal extraction operation while rotating in said reverse direction; and manual means associated with said cyclic means and operable in conjunction therewith for controlling said cyclic means to terminate operation of said cyclic means upon completion of the first-named centrifugal extraction operation.

4. In an automatic washing machine, a laundry wash container mounted for rotation on an axis out of the vertical; means associated with said container for effecting washing, including means for rotating said drum in one direction, rinsing and centrifugal extraction, including means for rotating said drum in the reverse direction, upon laundry placed within said container; said container comprising a drum having arcuate drain tubes for draining said drum when rotating in the reverse direction;

cyclic means for sequentially controlling said associated means to perform in sequence within said container upon laundry contained therein, a washing operation while rotating in one direction, a rinsing operation, a centrifugal extraction operation while rotating in the reverse direction, a rinsing operation, and a centrifugal extraction operation while rotating in said reverse direction; and manual means for controlling said cyclic means to terminate operation of said cyclic means upon completion of the first-named centrifugal extraction operation.

5. In an automatic washing machine, a laundry wash container; means associated with said container for effecting washing, rinsing and centrifugal extraction upon laundry placed within said container; cyclic means including an electric timer motor and a plurality of cams actuated thereby for sequentially controlling said associated means to perform in sequence within said container upon laundry contained therein, a washing operation, a rinsing operation, a centrifugal extraction operation, a rinsing operation, and a centrifugal extraction operation; manual means for controlling said cyclic means to terminate operation of said cyclic means upon completion of the first-named centrifugal extraction, said manual means including one of said cams and a circuit including contacts opened and closed thereby at the completion of the first-named centrifugal extraction operation; and a manually controlled circuit adapted to bridge said contacts.

6. A washing machine comprising, in combination, a wash container mounted for rotation, drive means for rotating said container in forward and reverse directions including a reversible motor, having a starting winding and normal running winding, said starting winding having a motor-driven centrifugal switch interposed therein for closing a circuit therethrough when said motor stops, said container having means to retain wash fluid therein when rotated in a forward direction and to discharge wash fluid therefrom when rotated in a reverse direction, cyclic timing means including a plurality of sequentially operated switches, one of said switches being connected to said normal winding, and others connected to said starting winding in forward and reverse relation, said means being adapted to establish a circuit through said centrifugal switch to said starting winding when the motor stops for rotation in a forward direction or for rotation in a reverse direction, and to complete a circuit shortly thereafter to said running winding and starting winding to establish rotation of the motor and container in the corresponding direction.

7. A washing machine comprising, in combination, a wash container mounted for rotation, drive means for rotating said container in forward and reverse directions including a reversible motor, having a starting winding and normal running winding, said starting winding having a motor-driven centrifugal switch interposed therein for closing a circuit therethrough when said motor stops, said container having means to retain wash fluid therein when rotated in a forward direction and to discharge wash fluid therefrom when rotated in a reverse direction, means for increasing the speed of rotation in the reverse direction, for centrifugal extracting, cyclic timing means including a plurality of sequentially operated switches, one of said switches being connected to said normal winding, and others connected to said starting winding in forward and reverse relation, said means being adapted to establish a circuit through said centrifugal switch to said starting winding when the motor stops for rotation in a forward direction and subsequently for rotation in a reverse direction, and including means to subsequently complete a circuit to said running winding and starting winding to establish rotation of the motor and container in the forward direction and subsequently in the reverse direction.

8. A washing machine comprising, in combination, a

wash container mounted for rotation, drive means for rotating said container in forward and reverse directions including a reversible motor, having a starting winding and normal running winding, said container having means to retain wash fluid therein when rotated in a forward direction and to discharge wash fluid therefrom when rotated in a reverse direction, means for increasing the speed of rotation in the reverse direction for centrifugal extracting, cyclic timing means including a plurality of sequentially operated switches, one of said switches being connected to said normal winding, and others connected to said starting winding in forward and reverse relation, said means being adapted to establish a circuit to said starting winding for rotation in a forward direction and subsequently for rotation in a reverse direction, and including means to simultaneously complete a circuit to said running winding and starting winding to subsequently establish rotation of the motor and container in the forward direction and subsequently in the reverse direction, and means operated by said timing means for subsequently actuating said speed increasing means.

9. In an automatic washing machine, a laundry wash container mounted for rotation on an axis out of the vertical; means associated with said container for effecting washing including means for rotating said drum in one direction, rinsing and centrifugal extraction, including means for rotating said drum in the reverse direction, upon laundry placed within said container; cyclic means for sequentially controlling said associated means to perform in sequence within said container upon laundry contained therein, a washing operation while rotating in one direction, a rinsing operation, a centrifugal extraction operation while rotating in the reverse direction, a rinsing operation, and a centrifugal extraction operation while rotating in said reverse direction, said cyclic means including means for terminating the sequential control of said cyclic means upon completion of the first-named extraction operation; and manual means for neutralizing said terminating means to effect said last-named rinsing and extraction operations.

10. In an automatic washing machine, a laundry wash container mounted for rotation on an axis out of the vertical; means associated with said container for effecting washing, including means for rotating said drum in one direction, rinsing and centrifugal extraction including means for rotating said drum in the reverse direction, upon laundry placed within said container; said container comprising a drum having arcuate drain tubes for draining said drum when rotating in the reverse direction; cyclic means for sequentially controlling said associated means to perform in sequence within said container upon laundry contained therein, a washing operation while rotating in one direction, a rinsing operation, a centrifugal extraction operation while rotating in the reverse direction, a rinsing operation, and a centrifugal extraction operation while rotating in said reverse direction, said cyclic means including means for terminating the sequential control of said cyclic means upon completion of the first-named extraction operation; and manual means for neutralizing said terminating means to effect said last-named rinsing and extraction operations.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |                           |               |
|-----------|---------------------------|---------------|
| 2,302,836 | Breckenridge et al. ----- | Nov. 24, 1942 |
| 2,311,545 | Hurley et al. -----       | Feb. 16, 1943 |
| 2,376,901 | Clark -----               | May 29, 1945  |
| 2,381,894 | Ferris -----              | Aug. 14, 1945 |
| 2,391,634 | Lewis et al. -----        | Dec. 25, 1945 |
| 2,441,926 | Zahn et al. -----         | May 18, 1946  |
| 2,561,186 | Dunham -----              | July 17, 1951 |