

Feb. 28, 1961

J. A. CASTRICONE

2,973,193

WASHING MACHINE

Filed April 18, 1958

3 Sheets-Sheet 1

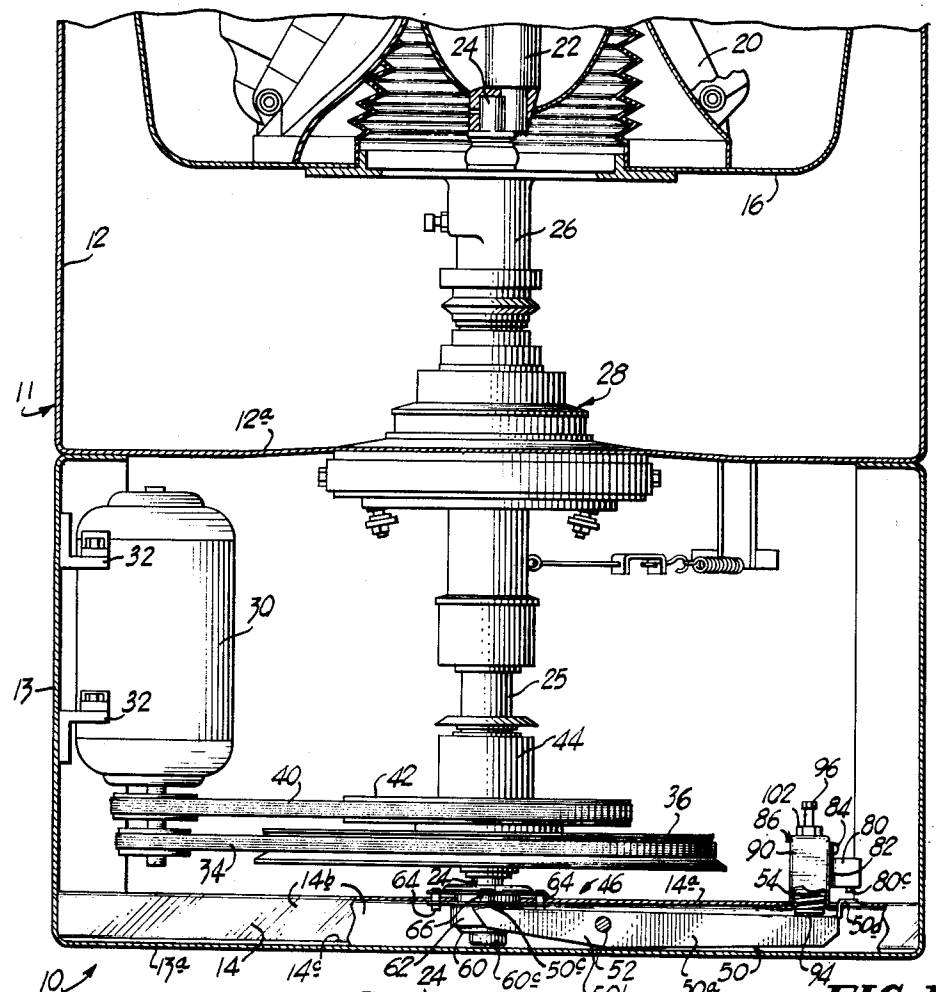


FIG. 1

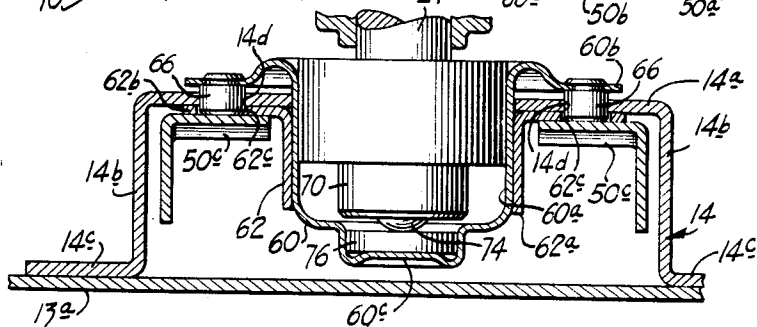


FIG. 3

INVENTOR

JOHN A. CASTRICONE

BY

Mason, Keldman, Rathburn and Wyss

ATTORNEYS

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J. A. CASTRICONE

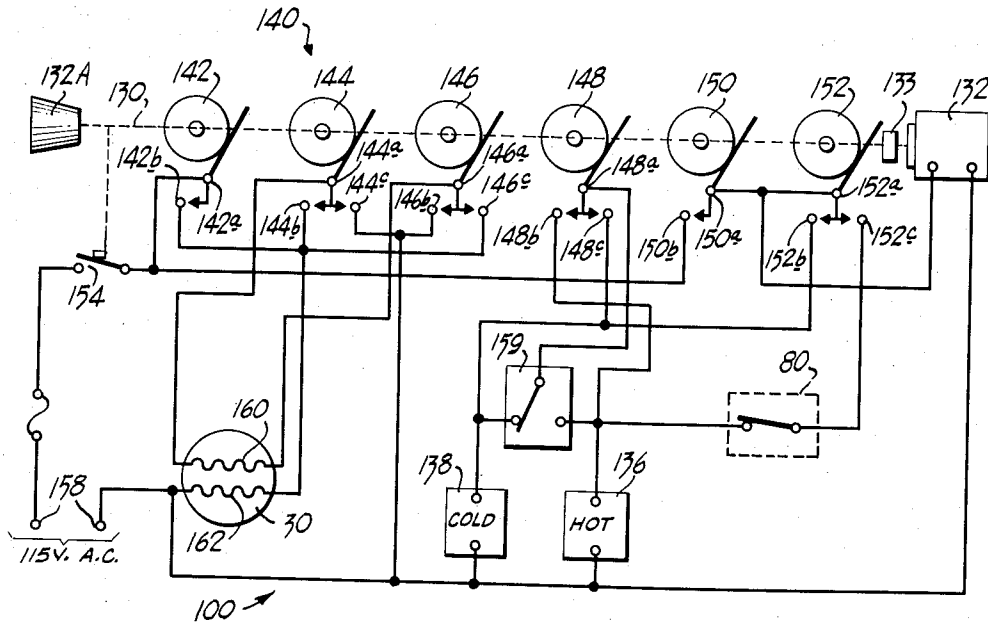
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FIG. 5



DESCRIPTION	CONTACTS	OPERATION	DURATION OF OPERATION							
			0	9	18	27	36	45	54	60
TIMER MOTOR CAM-150	150a 150b	TIMER								
INTERRUPTER MOTOR CAM-142	142a 142c	INTERRUPTER								
MOTOR CAM -144	144a 144b	WASH								
	144a 144c	SPIN								
MOTOR CAM -146	146a 146b	WASH								
	146a 146c	SPIN								
WATER CAM -152	152a 152c	HOT								
	152a 152b	COLD								
WATER CAM -148	148a 148b	WARM WATER (SELECTED IF DESIRED)								
	148a 148c									

45 SEC.

FIG. 6

INVENTOR

JOHN A. CASTRICONE

BY

Mason, Kolbmanian,
Rathburn and Wyss.

ATTORNEYS

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2,973,193

WASHING MACHINE

John A. Castricone, Peoria, Ill., assignor, by mesne assignments, to American Motors Corporation, Detroit, Mich., a corporation of Maryland

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1 Claim. (Cl. 265—49)

The present invention relates to washing machines and, more particularly, to a washing machine having new and improved means for controlling the supply of water to the machine, and is an improvement over the inventions disclosed and claimed in the copending applications of Henry W. Altorfer et al., Serial No. 585,375, filed May 14, 1956, and John A. Castricone, Serial No. 670,974, filed July 10, 1957, and constituting a continuation-in-part application of Serial No. 488,359, filed February 15, 1955, now abandoned.

It is a further object of the present invention to provide a washing machine having a new and improved weight responsive means for controlling the supply of water to the machine.

A further object of the present invention is to provide a new and improved weight responsive mechanism comprising a lever for resiliently supporting the tub, agitator and associated driving mechanism of a washing machine.

The above and other objects are achieved in accordance with the present invention by providing a weight responsive mechanism adapted resiliently to support the tub, agitator and driving means of a washing machine and a control circuit operable in conjunction with the weight responsive means to control the supply of water to the machine and its sequential operation. Briefly, the weight responsive device includes a lever mechanism housed within and pivotally supported intermediate its ends upon a channel structure which may form a portion of the frame of the washing machine. One end of the lever is biased by adjustable spring means while the other end of the lever engages a cup-like structure which supports the tub, agitator, and associated driving means, thereby to provide vertical movement between the frame and the tub, agitator, and driving means. The tub is lowered under the weight of the clothing and water admitted to the tub and, when this weight reaches a predetermined value, the lever operates a limit switch which terminates the admission of water into the tub.

The control includes an on-off switch serially connected between a power source and a plurality of cam switches operated respectively by cams mounted on a shaft, the shaft being rotatable either by a timer motor or manually by an operator. Once the timer motor is moved to its "on" position, the timer cams are operated under the control of the timer motor to cause the cam switches respectively to energize and deenergize the timer motor; cold and hot water inlet solenoid valves which, in cooperation with a water temperature switch, control the temperature of water admitted to the tub during washing and rinsing periods; and the windings of a single phase motor operable selectively to actuate the agitator and to rotate the tub. The weight responsive device is serially connected with one of the timer switches to deenergize the water inlet solenoid valves when the weight of the clothing load and water in the tub reaches a predetermined value, whereby a simultaneous filling

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and washing cycle is terminated. Thereafter, the weight responsive device is rendered ineffective by the operation of the one timer cam so that the subsequent operation of the washing machine is exclusively under the control of the timer motor and independent of the weight responsive device. The control operates consecutively to provide an initial filling cycle in which a limited quantity of water is admitted to the tub for a predetermined short time interval, a shampoo cycle during which clothing is agitated in the limited amount of water, a filling and washing period in which the supply of water is terminated by the operation of the water weight responsive device, a spinning period, a rinsing period, and a final spinning period.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings, in which:

Fig. 1 is a fragmentary elevational view, shown partially in section, of a washing machine embodying the present invention;

Fig. 2 is an enlarged view of a portion of Fig. 1 better illustrating the details of the weight responsive mechanism;

Fig. 3 is a fragmentary vertical sectional view taken along line 3—3 of Fig. 2;

Fig. 4 is a fragmentary horizontal sectional view taken along line 4—4 of Fig. 2;

Fig. 5 is a partially schematic and diagrammatic drawing of the control circuit embodied in the washing machine of Fig. 1; and

Fig. 6 is a chart showing the sequence of operations provided by the control circuit of Fig. 5.

Referring now to the drawings, the washing machine is indicated as a whole by the reference character 10 and comprises a housing or cabinet 11. It includes an upper portion 12 having a bottom 12a, which constitutes a stationary tub, and a lower compartment 13 in which is mounted driving and control apparatus and having a bottom 13a traversed by a frame element 14 taking the form of a cross-channel having a top 14a and downwardly extending vertical side walls 14b terminating in horizontal flanges 14c which may be secured to the bottom 13a.

The major portion of the washing machine may take the form shown in my copending applications Serial Nos. 488,359, filed February 15, 1955, and 670,974, filed July 10, 1957. In brief, it includes a rotatable tub 16 disposed within a stationary tub 12 and within which is mounted an agitator 20 driven in an orbital path as by a crank pin 22 eccentrically connected to a rotatable drive shaft 24 disposed within an outer tubular tub driving shaft 25 connected to the tub by bracket 26. The driving shaft structures extend from compartment 13 into the tub 12 through suitable sealing and guiding structure 28 at the tub bottom 12a and permitting gyration of the tub-agitator assembly.

The agitator 20 alone is driven during washing and both the agitator and tub during spinning or extraction. The drive is effected by a reversible motor 30 suitably supported by brackets 32. The shaft 24 is directly driven by the motor through belt 34 and a pulley 36 connected to shaft 24 as by pin 38 (see Fig. 2) so that shaft 24 is driven no matter in which direction the motor rotates. The outer shaft 25 is driven through belt 40 and pulley 42 and a one-way clutch 44 so that the shaft 25 rotates only when the motor rotates in one direction. For additional details of the supporting details, recourse may be had to the above referred to applications.

One of the features of the present invention has to do

with the supporting means whereby the supply of water to the rotatable tub 16 is determined by the weight of clothes and water in it. This supporting means, indicated as a whole by reference character 46, includes a pivotally movable lever 50 located within the confines of channel 14 and pivotally mounted intermediate its ends about a pivot pin 52 supported transversely of channel 14 in the side walls 14b as best shown in Fig. 4. One end 50a of lever 50 is resiliently loaded by spring 54 and the tub assembly is supported by the other end 50b by novel structure now to be described.

The tub assembly supporting structure includes a cup-like bearing housing 60 mounted for vertical movement in a guide 62 having a tubular depending portion 62a closely surrounding the vertical portion 60a of the housing 60 and having an annular flange 62b fixedly secured as by welding to the underside of top 14a of channel 14. The bearing housing has an annular flange 60b disposed above the top of channel 14 and a pair of diametrically oppositely located pins 64 are suitably secured to it.

The vertical movements of the tub assembly are transmitted to the lever 50 through the thrust and guide pins 66, the lower ends of which project through aligned openings 14d and 62c in the channel 14 and guide 62 and are seated upon the rounded top portions 59c of lever 50.

The bottom end 24a of shaft 24 is journaled in a sleeve bearing 70 resiliently supported within cup 60 as by a rubber sleeve 72. The downward thrust of the tub assembly is transmitted to the bottom 60c of the bearing cup through a ball bearing 74 and a disc 76 mounted in the bottom of the cup. The ball bearing fits into a tapered opening 24b at the bottom of the shaft.

The lever 50 is biased by spring 54 in a clockwise direction about the pivot pin 52 and when the tub is unloaded, the tub is in an upper position determined by engagement of the lever portions 50c against the flange 62b of the guide 62, as shown in Figs. 1, 2 and 3. When the tub is loaded, the lever moves in counterclockwise direction, compressing spring 54, and when a predetermined load is reached and a predetermined movement occurs, a snap acting limit switch 80 is actuated as by a projection 50d at the right end of lever 50, as shown in Figs. 1 and 2. The switch has an actuating projection 80c engageable by projection 50d and the switch is mounted for vertical adjustment as by a supporting plate 82 adapted to be held in desired vertical position by screws 84 as upon the spring housing 86.

The spring housing 86 is an inverted cup-like structure 90 having a peripheral flange secured as to the underside of the top 14a of channel 14. The spring 54 is located between upper and lower compression plugs 92 and 94, the latter of which bears against the end 50a of lever 50. The upper plug 94 bears against a spring adjusting screw 96 passing through a Tinnerman nut 98 and spacer 99 and held in adjusted position by a lock nut 102.

It will be thus appreciated that the lever 50 is disposed within the frame channel 14 and is protected from damage caused by moisture, accidental blows or impacts. Moreover, it will be understood that when the tub is in its empty and elevated position, the tub assembly, including shafts 24 and 25, and the supporting means, including cup 60, lever 50 and spring 92, are in the positions indicated in Fig. 2. Specifically, the lip 60b of the cup 60 is slightly spaced from the web 14a of the channel 14 and the left end 50b of the lever 50 is in its uppermost position. In addition, the right end of the lever 50 is in its lowermost position and the spring 54 is in its maximum extended position. However, when clothing is placed in the tub and water is admitted, the tub 16 and associated structure are gradually lowered to rotate the lever 50. When the weight of clothes and water reaches a predetermined value and the lever rotated in a counterclockwise direction, the lip 60b is lowered to a position immediately adjacent to the web 14a of the channel 14 and the right

end of the lever 50 is elevated so as to operate the micro-switch 80 and thereby terminate the supply of water. This lip limits excessive downward movement of the assembly which might possibly occur in some instances.

In order to control the sequential operation of the washing machine 10, the control circuit 100 is employed. Briefly, the control includes a timer motor shaft 130 which is adapted to be continuously and automatically driven by a timer motor 132, or it may be manually turned by knob 132A. A clutch 133 located between the timer motor 132 and shaft 130 is employed to permit manual rotation of the timer shaft 130. The control specifically renders operative and inoperative the timer motor 132 itself, a reversible single phase A.C. motor 30, a hot water solenoid valve 136 and a cold water solenoid valve 138, the microswitch 80 of the weight responsive control being included in the control circuit 100 for controlling the hot and cold water solenoid valves 136 and 138.

In order to initiate an operation of the washing machine 10, the knob 132A is rotated to its start position (not shown), thereby moving the timer cams, referred to collectively as 140 and shown only diagrammatically in Fig. 5. The individual cams are an interrupter main motor cam 142, a main motor cam 144, a second main motor cam 146, a water cam 148, a timer motor cam 150, and a second water cam 152. The knob 132A is moved axially to effect axial movement of the shaft 130 whereby an on-off switch 154 is closed and the timer cams 140 are moved into driving engagement with the timer motor shaft 130. Slight rotation of the shaft energizes the motor 132 and thereafter the cams 140 are rotated under the control of the motor throughout the cyclic operation of the machine.

The chart in Fig. 6 illustrates the operative positions of the timer cams 140 and the duration of time during which each cam operates its associated switch contacts, it being understood that each of the vertical lines 141 on the chart represents a six degree index position of each cam or a forty-five second time interval.

At the beginning of the operation of the washing machine the timer motor cam 150 is operative to complete a timer motor circuit from an A.C. source 158 through the timer controlled on-off switch 154 closed incident to axial movement of the knob 132A, a contact 150b, a cam contact 150a, a timer motor 132 and back to the source 158. As shown in Fig. 6, the contacts 150a and 150b remain closed under the control of the cam 150 throughout the entire operation of the mechanism and, hence, maintain the timer motor circuit closed and the timer motor 132 energized throughout the operation of the washing machine. As indicated above, the energization of the timer motor causes the timer shaft 130 to be rotated and the timer cams 140 to be operated.

After a forty-five second time interval, as indicated by the first index position, the water cams 148 and 152 are operated to provide an initial fill period of predetermined time as determined by the cams and in which a limited amount of water is supplied to the tub 16 for the shampoo wash period. Specifically, a water solenoid circuit is completed from an A.C. source 158 through the switch 154, the contact 150b, the cam contact 150a, a cam contact 152a, a contact 152c, the microswitch 80 of the water weight responsive device 46, a hot water solenoid valve 136 and back to the A.C. source 158. The water cam 148 is also operative so that another water solenoid circuit in parallel with the branch of the circuit through the hot water solenoid valve 136 is provided, i.e., from the microswitch 80 of the weight responsive device 46 through a contact 148b, a cam contact 148a to a water temperature switch 159. Depending upon the position of the water temperature switch 159, either hot or warm water is supplied to the tub 16 during the timer controlled initial filling period. For example, if the switch 159 is in its left position, as viewed in Fig. 5, then the immediately above-described circuit is completed through

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the water temperature switch to a cold water solenoid valve 138 and back to the source 158. Since both the hot and cold water solenoids 136 and 138 are energized, both hot and cold water are admitted to the tub with the result that warm water is supplied. However, in the event that the switch 159 is disposed in its right position, the circuit to the cold water solenoid valve 138 is opened and only the hot water solenoid valve 136 is energized to provide hot water during the filling cycle.

At the end of the sixth index position the contacts 152a—152c, 143a—148b, associated with the water cams 148 and 152, are rendered inoperative under the control of the timer motor 132, whereby the water solenoid circuits are opened, the water solenoid valve or valves are deenergized, and the initial filling cycle is terminated by operation of the timer. However, prior to termination of the initial filling cycle at the end of the fifth index position, the contacts 144a—144b, 146a—146b controlled by the motor cams 144 and 146, are closed to condition the main motor 30 for operation. But since contacts 142a and 142b of the interrupter motor cam 142 are opened, the motor 30 remains deenergized. Specifically, a motor circuit is provided from the source 158, through the switch 154, the cam contact 142a, the contact 142b (the cam contact 142a and contact 142b being opened under the control of the interrupter cam 142), the contact 144b, the cam contact 144a, through the phase winding 160 of the motor 30, the cam contact 146a, the contact 146b, and then to the source 158. Moreover, another motor circuit is conditioned to operate from the contact 142b through the main winding 162 of the motor 30 and back to the source 158.

Coincident with the opening of the contacts 152a—152c, 148a—148b controlled by the water cams 148 and 152, the cam contact 142a and the contact 142b of the interrupter motor cam 142 are closed thereby energizing the phase windings 160 and 162 of the motor 30 and causing the motor to rotate in a first predetermined direction. The drive shaft of the motor 30 is rotated so as to operate the pulleys 36 and 42 but only the rotatable shaft 24 is rotated to effect operation of the agitator 20 since the unidirectional clutch 44 does not effect engagement between the pulley 42 and the outer shaft 25 when the motor shaft rotates in the first direction. During two index positions, as shown in Fig. 6, the agitator 20 is operated to provide a shampoo action during which the clothes are vigorously washed in only the limited amount of water admitted to the tub during the initial timer controlled filling cycle.

At the termination of the shampoo washing period or at the end of the eighth index position, the contacts 152a—152c, 148a—148b controlled by the water cams 148 and 152 are again closed in the manner described above so that water is again admitted to the tub but now the contacts controlled by the interrupter and motor cams are closed with the result that water is supplied to the tub and the clothing within the tub is agitated at the same time. As indicated above, the continued admission of water to the tub 24 continually increases the weight of the rotating tub and assembly and, accordingly, the weight applied to the left end of the lever 50 moves the right end of the lever 50 upwardly until the microswitch 80 is operated. Depending upon the water pressure and whether or not one or both of the hot and cold solenoid valves 136 and 138 are operated, the microswitch 80 is operated some time prior to the end of the fifteenth index position, for example, at the end of the twelfth index position. Incident to operation of the microswitch 80, its normally closed switching mechanism is opened and the water circuits are opened to deenergize the hot and cold inlet solenoid valves 136 and 138 thereby to terminate the supply of water. The washing continues since the contacts associated with the interrupter and motor cams remain closed.

In the event that the weight responsive device 46 is for

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any reason inoperative, then the simultaneous washing and filling cycle is automatically terminated under the control of the timer motor 132. In any event, the washing period is terminated at the end of the twenty-second index position by the opening of the contacts 142a—142b, 144a—144b, and 146a—146b under the control of the interrupter motor cam 142 and the motor cams 144 and 146, with the result that the motor 30 is deenergized to stop operation of the agitator 20.

The weight responsive device 46 is rendered ineffective after the filling of the tub for the washing operation even though the microswitch 80 may be closed by the upward movement of tub 16 and associated structure during subsequent operations. The subsequent rinsing operation is thus not terminated by the weight responsive device 46 but is terminated under the control of the timer motor 132.

Between the twenty-second and twenty-third index positions, the main motor is deenergized, preparatory to reversal for a spin operation. At the termination of the twenty-third index position, the contacts 142a—142b, 144a—144c, 146a—146c controlled by the interrupter motor cam 142, the motor cam 144 and motor cam 146, respectively, are closed to energize the motor windings 160 and 162 and effect operation of the motor 30. However, the direction of current flow through the phase winding 160 is reversed and to that end, a reversing motor circuit is provided from the source 158 through the switch 154, the arm contact 142a, the contact 142b, the contact 146c, the arm contact 146a through the phase winding 160, the arm contact 144a, the contact 144c and back to the source 158. The main motor winding 162 is energized as described above. Inasmuch as the direction of current through the phase winding 160 is the reverse of the direction of current flow through the winding 160 during the prior washing cycle, the direction of rotation of the motor 30 and its drive shaft is likewise reversed. The reverse rotation of the shaft causes operation of both the pulleys 36 and 42 and the shaft 24 and agitator are operated as described above. However, now the unidirectional clutch 44 effects driving engagement between the pulley 42 and shaft 25, so that the tub 16 is rotated by the motor 30 to effect a high speed spinning operation during which the clothes in the tub 16 are centrifuged preparatory to rinsing. The spinning cycle is terminated under the control of the timer motor 132 at the end of the twenty-sixth index position whereupon the contacts 142a—142b controlled by the interrupter cam 142 are opened thereby to open the motor circuits and deenergize the motor 30. The rotatable tub 16 and associated structure, however, continue to free-spin by virtue of the inertia of the tub 16 and associated structure.

Simultaneously with the opening of the contacts 142a—142b controlled by the interrupter cam 142, the contacts 152a—152b, 148a—148c controlled by the water cams 148 and 152 are closed thereby to supply to the tub 16, while the tub is still spinning, either warm or cold water depending upon the position of the water temperature switch 159. For example, if the water temperature switch 159 is disposed in its left position, which provides for warm water during the washing cycle, then a water circuit is provided from the source 158 through the switch 154, the contacts 150b—150a, the contacts 152a—152b (1) through the cold water solenoid valve 138 to the source 158 or (2) through the contacts 148c—148a, the water temperature switch 159, the cold water solenoid 138 and back to the source 158. In this case, only the cold water solenoid valve is energized and, thus, only cold water is supplied during rinsing. However, in the event that water temperature switch 159 is located in its right position, which provides for hot water during the washing cycle, then a water circuit is completed from the source 158, through the contacts 150b—150a, the contacts 152a—152b through (1) the cold water solenoid

valve 138 to the source 158 and also (2) through the contacts 148c—148a, the water temperature switch 159, the hot water solenoid valve 136 and back to the source 158. Hence, the water selector switch 159 and associated water cams and contacts provide for either warm washing water and cold rinsing water or hot washing water and warm rinsing water. It will be appreciated that any combination of hot, warm and cold water may be supplied during the washing and rinsing cycles, depending upon the configuration of the water cams 148 and 152 and whether or not a two or three position water temperature switch 159 is used.

As indicated in Fig. 6, at the end of the twenty-ninth index position, the contacts 142a—142b controlled by the interrupter motor cam 142 are closed thereby to complete the motor circuit partially completed by closure of the contacts 144a—144b, 146a—146b controlled by the motor cams 144 and 146 at the end of the twenty-eighth index position, whereby the motor 30 is energized to rotate in the first predetermined direction to provide for operation of the agitator as described above. By this arrangement, a simultaneous filling and rinsing cycle is effected with operation of the agitator. This cycle is terminated at the end of the thirty-second index position by the opening of the contacts 142b—142a controlled by the interrupter motor cam 142.

Since the contacts 152a—152b and 148a—148c remain closed, water is supplied to the tub to provide an overflow rinse.

The supply of rinse water is terminated by opening of the contacts 152a—152b and 148a—148c by the cams 148 and 152 at the end of the thirty-fifth index position. Since the contacts 144a—144b and 146a—146b remained closed, the closure of the contacts 142a—142b interrupted by the cam 142 at the end of the thirty-fifth index position effect the reenergization of the motor 30 to provide a splash rinse in which water is splashed from the tub by operation of the agitator. This final rinsing operation is terminated by the simultaneous opening of the contacts 142a—142b, 144a—144b, and 146a—146b under the control of the timer motor 132 at the end of the thirty-eighth position. During the thirty-ninth index position the main motor is stopped preparatory to reversal for the final spinning operation. At the termination of the thirty-ninth index position, the contacts 144a—144c and 146a—146c controlled by the motor cams 144 and 146 are closed so that the motor 30 is operated to effect a spinning operation. The spinning period is of extended duration in order effectively to damp dry the clothes and is terminated under the control of the timer motor 132.

It will be appreciated that there has been provided a new and improved control circuit which effects a shampoo wash operation after a limited amount of water has been supplied to the tub as determined by time controlled

means and thereafter provides for a simultaneous washing and filling period, which filling period is terminated under the control of the weight responsive device. In the event of inoperation of the weight responsive device, the admission of water to the tub is terminated under the control of the timer motor.

While there has been described an embodiment of the present invention, it will be readily understood that numerous changes and modifications may be made which will readily occur to those skilled in the art. It is aimed in the appended claim to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is as follows:

In a washing machine, the combination including a rotatable tub assembly, an inverted U-shaped channel disposed below said assembly and having an opening in its top side and a weight responsive mechanism for supporting said assembly, said mechanism including cup-like means vertically movable within said opening and upon which said assembly is mounted, lever means mounted upon the sidewalls of and beneath the top side of said channel, said cup-like means having a peripheral horizontal flange disposed above the top of the channel and engageable therewith to limit possible excessive downward movement thereof and said channel having a pair of diametrically oppositely located apertures in its top spaced from said opening, a pair of guide and thrust pins secured to said flange and extending through said apertures into engagement with said lever means for actuating the latter, the top of said channel having another pair of diametrically oppositely located openings located between said first mentioned pair of openings and said flange having a pair of guide pins secured to it and passing through said other pair of openings, and resilient means disposed between said channel and another portion of said lever means for resiliently loading said lever and tub assembly.

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