

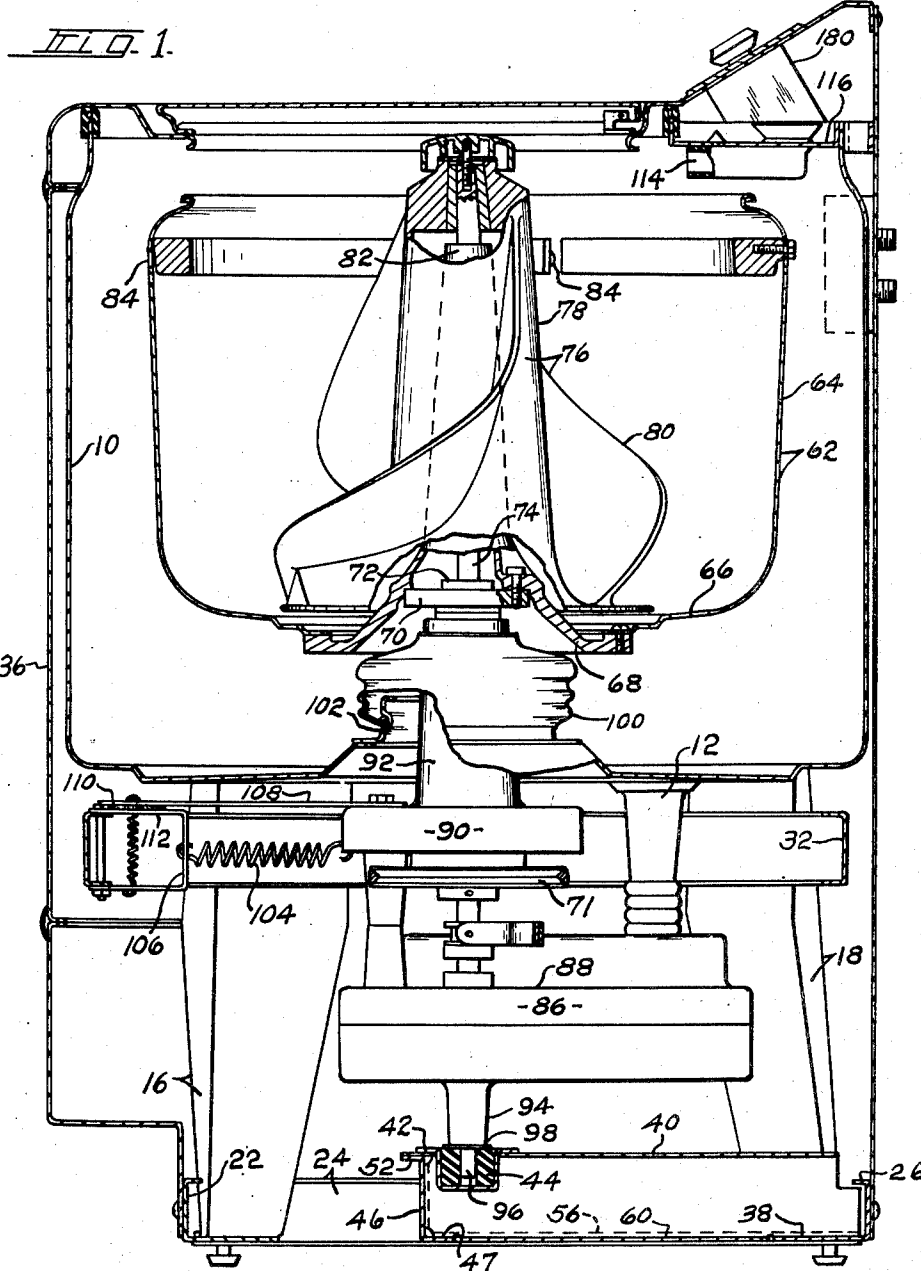
Nov. 19, 1957

H. K. LEACH
WASHING MACHINES

2,813,413

Filed June 2, 1953

3 Sheets-Sheet 1



INVENTOR
HUGH K. LEACH

BY *J. P. Keiper*

ATTORNEY

Nov. 19, 1957

H. K. LEACH
WASHING MACHINES

2,813,413

Filed June 2, 1953

3 Sheets-Sheet 2

FIG. 2.

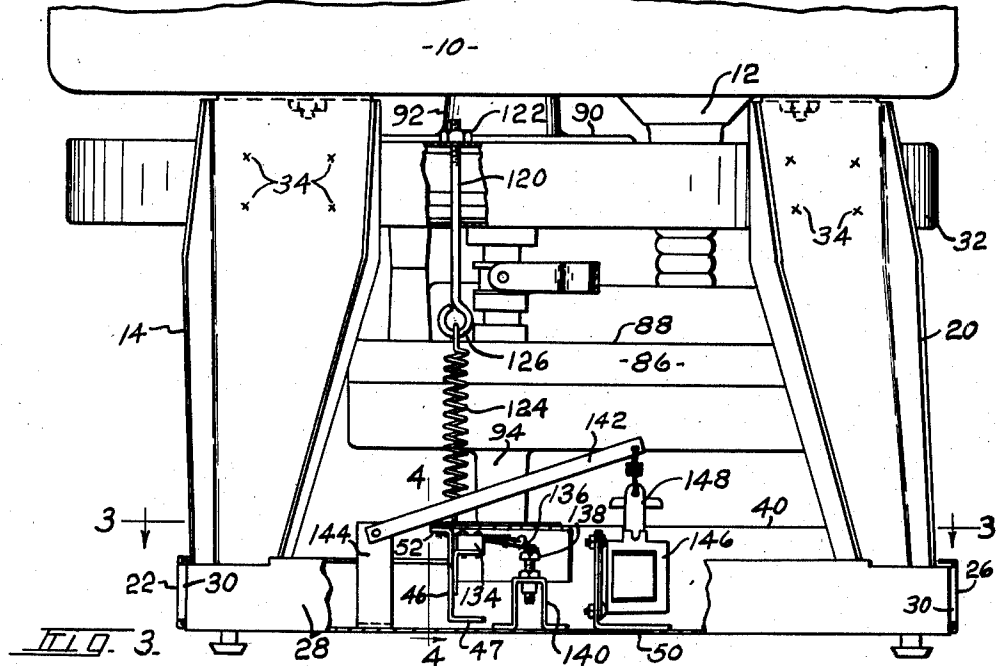
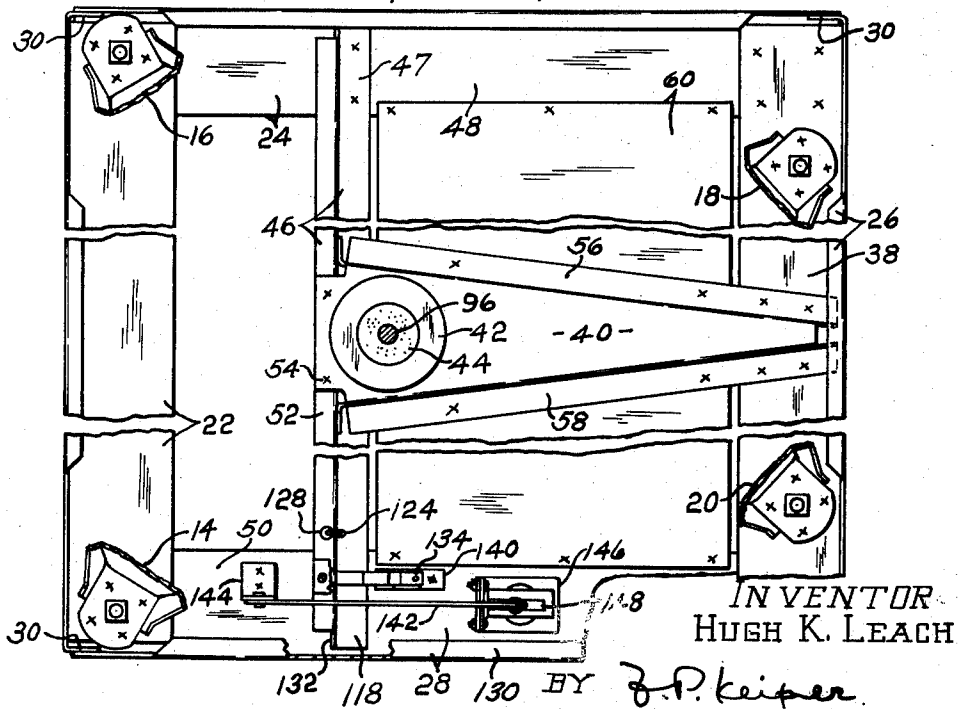


FIG. 3.



INVENTOR
HUGH K. LEACH

BY *J. P. Keiper*
ATTORNEY

Nov. 19, 1957

H. K. LEACH
WASHING MACHINES

2,813,413

Filed June 2, 1953

3 Sheets-Sheet 3

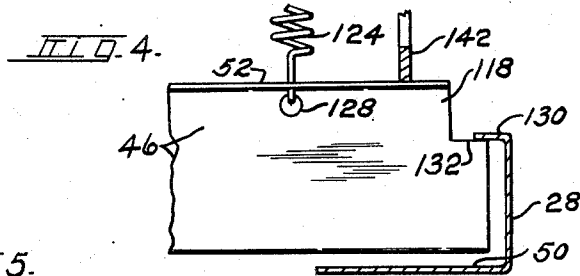
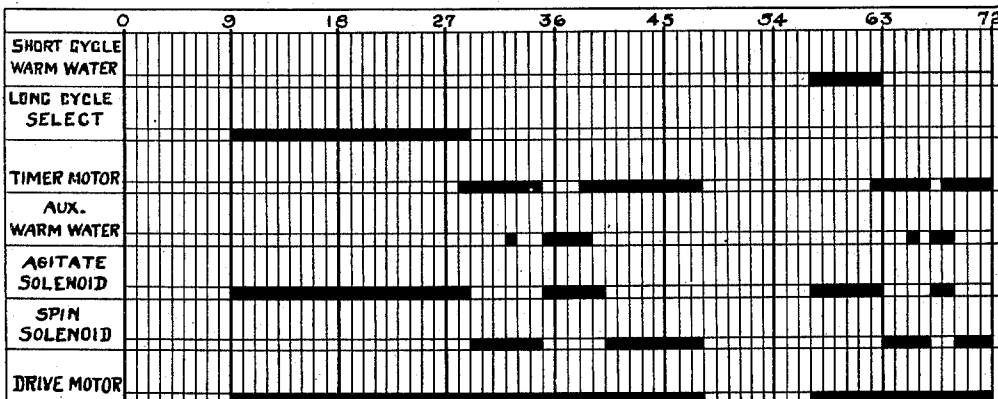
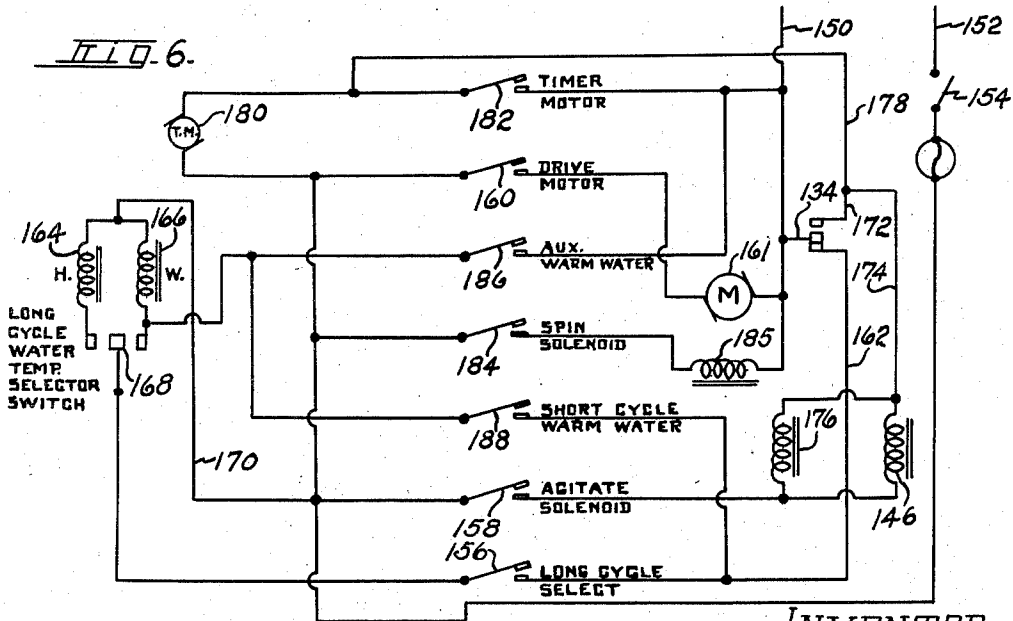


FIG. 5.



INVENTOR
HUGH K. LEACH

BY *R. P. Keiper*

ATTORNEY

1

2,813,413

WASHING MACHINES

Hugh K. Leach, Syracuse, N. Y., assignor, by mesne assignments, to The Murray Corporation of America, Detroit, Mich., a corporation of Delaware

Application June 2, 1953, Serial No. 359,100

8 Claims. (Cl. 68—12)

This invention relates to automatic washing machines, and more particularly to a machine having provision for controlling the water supply by weight.

In automatic washing machines, considerable difficulty is had in supplying to the wash tub prior to washing or during the rinsing period, a measured quantity of water. Various time flow devices operating on a constant flow principle have been employed, but the wide variation in domestic water supply pressure tends to render such devices highly inaccurate. Further, such devices generally establish a reduced rate of flow, rendering the filling period longer than necessary.

The present invention is directed toward a water supply system wherein water is delivered to the tub and the supply thereof measured by the increased weight of the tub. Further the invention is directed to the utilization of the presence of a proper quantity of water to commence a predetermined manually variable washing cycle. Additionally, the invention has to do with a yielding mount for the wash tub wherein the yield reflects the water weight increase and actuates suitable mechanism for terminating water flow and commencing the washing cycle. Further, the invention is directed to a mechanism adapted to rigidify and render the yielding weighing device ineffective during stages of operation during the wash cycle when the tub is filled with water, such as the washing period and the submerged rinse period.

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 an elevational view with parts broken away and shown in section;

Figure 2 is a side elevation with parts of the frame broken away to illustrate the weight-responsive mechanism;

Figure 3 is a sectional view taken substantially on the line 3—3 of Figure 2;

Figure 4 is a fragmentary sectional view taken on the line 4—4 of Figure 2;

Figure 5 is a time diagram; and

Figure 6 is an electrical control circuit diagram.

Referring to Figures 1—3 of the drawings, there is illustrated a stationary tub 10 having a constantly open drain 12, such tub being supported upon four legs 14, 16, 18, and 20. The legs extend to a base frame formed of angle members 22, 24, 26, and 28, such members hav-

2

ing overlapped flanges at the corners and side flanges connected at the corners by integral overlapping tongues such as 30. The legs are of channel section with the webs thereof facing inwardly, and the entire frame structure is rigidified by a channel section annular ring 32 located beneath the tub, the web of which is secured to the webs of the respective legs, as by spot welding 34 as shown in Figure 2. The tub 10 and the rigid base structure referred to are enclosed in a suitable casing 36, the details of which form no part of the present invention.

Mounted on the flange 38 of the angle member 26 and secured thereto is a tapered flanged channel member 40 extending to the approximate center of the frame. Such channel member at a center point in respect to the tub 10 and channel ring 32 is provided with a socket 42 in which there is positioned a resilient rubber support sleeve 44, upon which the weight of the wash tub and mechanism is carried. The inner end of the tapered channel member 40 is supported upon a transversely extending Z-member 46, such member having its lower flange 47 secured to the flange 48 of the angle member 24 as by spot welding and being adapted at its other end to rest upon the flange 50 of the frame angle member 28. The upper flange 52 of the Z-member 46 is secured to the member 40 as at 54. The lower flanges 56 and 58 of the channel member 40 are welded to the flange 38 of the angle member 26 and to a plate member 60 extending from the flange 48 to the flange 50 of angle members 24 and 28. Such plate 60 has slight resiliency for reasons which will appear hereinafter.

The washing mechanism comprises a tub 62 having an upwardly and outwardly tapered wall 64. The annular bottom 66 of the tub is mounted upon a hub flange 68 which, in turn, is mounted upon a flange 70 secured to a hollow drive shaft 72 extending downwardly into the base structure and mechanism, terminating with a drive pulley 71. Extending through the hollow drive shaft is an agitator shaft 74 having affixed to its upper end an agitator 76, such agitator having a hollow cone 78 and a plurality of agitating blades 80. The hub flange 68 is provided with a sleeve 82 extending upwardly into the hollow cone 78 to a height above the normal water level within the tub, such water level being determined by a ring of overflow apertures 84 in the tapered wall 64.

Transmission mechanism 86, part of which is housed in casing 88, is rigidly secured to a flanged sleeve member 90, and forms a unit providing a support for the agitator and wash tub, the member 90 having an upstanding bearing sleeve 92 through which the shafts 72 and 74 extend, and in which they are journaled in a manner not shown herein. The casing member 88 is provided with a downwardly extending boss 94 located on the axis of the tub 62 and agitator 76, such boss having a reduced diameter centering pin 96 positioned in the resilient support block 44, the boss 94 having a shoulder 98 bearing against such resilient block. The sleeve 92 is provided with a corrugated annular boot 100 adapted to form a yielding connection between the upper end of the sleeve and an annular upstanding flange 102 secured to the bottom of the outer tub 10. A plurality of radially disposed tension springs such as 104 are provided to connect the flanged member 90 with U-members 106 mounted on the annular frame ring 32. Such springs are disposed angularly at uniformly spaced intervals around the housing 90 and within the ring 32, and serve to yieldingly hold the transmission and wash tub assembly erect. Friction damping devices comprising a leaf

3

spring 108 secured to the member 90 having friction padding 110 coating with the upper surface 112 of the U-member 106 provide damping against undue movement due to out-of-balance loads during acceleration of the tub 62.

Water is introduced into the tub 62 by a discharge orifice 114 mounted upon a deck member 116 secured to the rim of the tub 10. The apparatus thus far described, with the exception of the spiral-bladed agitator, constitutes a typical single tub vertical axis washer of the inverted pendulum type, having separate drive shafts for the tub and agitator, whereby the agitator may be oscillated for washing purposes and the tub spun for centrifugal extraction, the transmission providing suitable electromagnetically controlled clutch mechanism driven from a motor for providing either the agitator operation or the spinning operation, alternately and at will, as controlled by the automatic control mechanism. The drive mechanism in many respects resembles that shown in Castner Patent No. 2,623,359.

In order to predetermine the quantity of water to be introduced into the tub 62, which tub is imperforate below the overflow holes 84, the transverse member 46, previously set forth as affixed to the flange 48 of the channel 24 and resting on the flange 50 of angle member 28, is provided with adjustable coil spring tension means extending between the ring member 32 and the free end 118 of the Z-member 46. Such tension means comprises an eye bolt 120 extending through the flanges of the ring member 32 and tension coil spring 124 extending from the eye 126 to an aperture 128 in the end 118 of the Z-member 46. The eye bolt is adjustable by nut 122. The angle frame member 28 is provided with an inbent flange 130 adapted to engage an edge 132 on the end 118 of the Z-member 46, so that upward movement of the member 46 is limited to a small amount. The tension spring 124 is adapted to lift the Z-member to the position shown in Figure 4. However, the constant of the spring 124 and the tension applied thereto by the eye bolt adjustment is such as to permit the Z-member 46 to drop, so that its lower flange seats upon the flange 50 of the angle member 28 when the tub is filled with water to the desired level. In practice, the weight of such water may be about 90 pounds. Thus, the wash tub, agitator and drive mechanism has slightly lower position when full than when empty.

Movement of the Z-member 46 in response to the presence of the required quantity of water within the tub 62 is utilized to operate a single pole double throw switch 134 mounted upon the Z-member 46, such switch having an actuating arm 136 engaging an adjustable stop 138 mounted on a U-bracket 140 on the flange 50 of the angle member 28. The switch 134 is of the micro-switch over-center type, so that under all circumstances, a contact is made to one pole or the other thereof. It will thus be seen that the weight of the transmission, the tub, and its agitator and the wash water load bear on the Z-member 46 through the tapered channel member 40. Thus, accurate weighing mechanism, responsive to the quantity of water within the tub, actuates the switch mechanism for controlling the further supply of water and commencing the cycle of operation when the tube is filled to the predetermined level. Such predetermined level may be within an inch of the overflow parts 84 in the tub 62, so that considerable accuracy is desirable in order to avoid any possibility of the mechanism failing to operate before the level of the water reaches the overflow apertures 84, following which there would be no increase in weight to actuate the switch.

During washing, the agitator oscillates through an angle of approximately 180° about sixty times a minute. Such oscillations create turbulence in the water in the tub, so that some of the water within the tub may escape through the overflow apertures. Thus, during washing, the amount of water within the tub may appreciably decrease.

4

Such decrease in water might effect the operation of switch 134 and cause the introduction of additional water. Further, the nature of the agitator blades during agitation, whether spiral or otherwise, produces a lifting tendency during rotation with respect to the water within the tub, causing momentary increases and decreases in effective weight. Thus, there is an up and down thrust produced upon the mechanism which would tend to disturb the operation of the switch 134 during washing.

In order to prevent the effects of agitation or loss of water from actuating the switch 134, once the tube is properly filled, there is provided a hold-down mechanism for the end of the Z-member 46, such mechanism comprising a lever 142 fulcrumed on a bracket 144 secured to the angle member 28, and a solenoid 146 also mounted on the angle member 28, such solenoid having an armature 148 connected to the free end of the lever 142. The lever lies directly across the upper flange 52 of the Z-member 46, so that by energizing the solenoid during the washing period and such other periods as is desirable, the Z-member 46 may be retained in its downward position in tight engagement with the flange 50 of the angle member 28.

In Figures 5 and 6, there is disclosed a time and cam diagram, and control circuit adapted to utilize the water weight indication of the switch 134, as well as to provide suitable energization of the solenoid 146 at such times when weight indication is not required. Such circuit includes a 7-cam timer driven by a clock motor, the timer cams being moved through fixed angular increments at regular intervals. A timer of the general type described is shown in Patents Nos. 2,227,133 and 2,313,064, issued December 31, 1940, and March 9, 1943, respectively.

In the diagram of Figure 5, the vertical lines indicate the spaced instances at which the cam shaft and cams are substantially instantaneously advanced by the timer motor, and the spaces between adjacent vertical lines indicate the time interval or dwell between successive advances. The diagram is based on a cam shaft that moves 5° at a time, or 1/2 of a revolution. The time spacing between impulses, for discussion purposes, will be 30 seconds. Each of the horizontal pairs of lines represent a cam, and the heavy portions indicate the cam portions effective to close the circuit controlled by the particular cam. For example, the short cycle warm water cam closes its circuit for six intervals, or 3 minutes, commencing when the cam is advanced at time line 57, and ending at time line 63.

The cam contours from line 9 to line 48 are adapted to provide a long wash cycle commencing as soon as the tub is properly filled with hot or warm water, as desired. Such cycle includes a maximum washing period of 10 minutes, a wash water extraction period of 3 minutes, with a half minute period of spray rinse, occurring during the extraction period, and immediately before the third minute thereof, a warm water refill period of indefinite duration commencing immediately after the timer advance at line 35, the timer motor being deenergized by such advance until reenergized by the filling of the tub to the level required to operate switch 134. At this time, the timer motor restarts, advancing the cams after 30 seconds, and after each 30 second interval thereafter, as before. When the water level required is reached, and the timer motor restarts, an agitated rinse of 2 1/2 minutes is effected. During the first two minutes of such rinse, water continues to flow into the tub, overflowing the same, to remove soapsuds, scum, etc. At the end of the agitated rinse, as indicated at line 40, extraction takes place for a period of 4 minutes, after which all cam switches are opened to end the cycle, when the position at line 48 is reached.

The long cycle uses up to 19 1/2 minutes of cam movement, or 195° of the cams. It is understood, however, that the actual wash time includes in addition two fill

periods. The same cams may be cut to provide a short cycle in the remaining 165° not used by the long cycle. Such short cycle, as shown, commences at cam advance line 57, and ends at 72, using 75° of the cam, or a cam operating time of 7½ minutes. The short cycle is essentially the same as the long cycle, except the initial fill uses warm water only and shortened periods are used. Again, it will be understood that the actual wash time is lengthened by the two fill periods.

It will be seen that the cam shaft will always stop at line 48, or 72 at the end of the long or short cycle. It will also stop during the rinse water fill period, at 35 and 67 during the long and short cycles, respectively.

To start the washing operation, the cam shaft is advanced manually from the termination line 48 or 72, of the previous wash conducted, to the position at 9, if a long cycle wash is desired, or to line 57 if a short cycle wash is desired. If a shortened wash period be desired, in either cycle, the cam shaft is manually advanced beyond the position at 9, for example, to 18, if the long cycle wash period is to be decreased 4½ minutes to a wash period of 5½ minutes, or, for example, to the position at line 57, if the short cycle wash period is to be shortened by one minute to a 2 minute wash period. Thus, any period less than the maximum of 10 minutes for the wash period of the long cycle or 3 minutes for the short cycle, can be initially selected, or in fact selected at any time during the initial fill period, or during the wash period.

Upon the manual advance of the timer cams to the position representing the wash period time desired, the timer motor is not energized, until the tub is filled with the correct weight of water as indicated by the switch 134. At this time, the agitator clutch solenoid is energized by cam switch 158, and the timer motor energized by the water weight switch 134. When the manual advance for starting is made, the motor starts, and idles until the agitator clutch solenoid is energized. Also, the cam switch 156 controlling the solenoid fill valves is closed. The hot or warm water switch may be in either position, or changed at will during the fill period to obtain an intermediate temperature between hot and warm.

Referring to the circuit of Figure 6, there is shown the corresponding cam switches whose operation is indicated in Figure 5. Such circuit discloses line wires 150 and 152, the latter having an over-all cut-out switch 154. When it is desired to commence the water fill and subsequent washing cycle, the cams are manually advanced to position 9, or any succeeding position short of position 28, depending upon the length of wash period desired. Should a 5½ minute wash period be desired, the timer cams would be advanced to the position indicated at line 18. The manual movement of the cams to the position shown closes switches 156, 158 and 160. It will be seen that closing of the switch 160 starts the drive motor 161 which runs continuously through the initial water fill period to the end of the complete wash cycle. With the tub 62 empty and the switch 134 in the empty position as shown, there is established a circuit from lead 150 through lead 162 to either one of the solenoid-operated hot or warm water valves 164 and 166, respectively, depending upon the position of the manual selector switch 168. Such solenoid water valves are provided with a common return lead 170 connecting with the line 152. Thus the tub 62 will commence to fill, and when the predetermined quantity of water has been introduced into the tub 62, the switch 134 will break the connection from the lead 150 to the lead 162, and establish a connection between lead 150 and lead 172, one branch 174 of which energizes an agitator clutch solenoid 176 and the hold-down solenoid 146. Such solenoids are connected through the cam switch 158 to the return lead 152. The other branch 178 establishes a circuit to the timer clock

motor 180, whereupon the cams are subsequently advanced periodically each 30 seconds through the fixed 5° increments previously referred to. The agitator solenoid 176, when energized, causes the motor to drive the agitator, oscillating the same for a wash period.

Immediately before the end of the wash period, the timer motor cam switch 182 is closed, providing a direct connection to the timer motor 180 from the lead 150, so that the timer motor will continue operation in advancing the cam regardless of the position of the switch 134. When the wash period is ended, the agitator solenoid 176 and the hold-down solenoid 146 are deenergized by the opening of the cam switch 158. At the same time, the spin clutch solenoid cam switch 184 is closed, energizing spin clutch solenoid 185, thereby causing the motor to accelerate the tub for centrifugal extraction. As the tub accelerates, the wash water within the tub is thrown out through the discharge apertures 84 and the wash water eliminated from the tub. After a period of time, while the tub is spinning, an auxiliary warm water cam switch 186 is closed, causing warm water to be introduced into the tub during the spinning operation. Such water introduced into the tub rinses the soapsuds from the laundry contained in the tub, and is discharged centrifugally through the discharge apertures 84. When the extraction period is finished, the spin solenoid is deenergized by the opening of the cam switch 184 and at the same time the cam switch 182 to the timer motor is opened. At this time, there is no water within the tub 62 except that entrained in the damp clothes contained therein, so that the weight switch 134 has assumed the empty position as shown. Thus, the timer motor is temporarily stopped until such time as the tub is again filled and the weight switch indicates that fact. Thereupon, the switch 134 recloses a circuit to the timer motor through the lead 178. The cams will thus be advanced 30 seconds thereafter, and will periodically advance as a result of the reenergization of the timer motor, as before. Cam switch 186 is closed at the same time that the timer motor is stopped to fill the tub. When the water weight switch closes, the cam switch 186 remains closed for two minutes to admit further water over and beyond the quantity normally introduced as measured by the water weight switches for the initial wash, and water continues to flow into the tub for a period as indicated. At the same time, the agitator cam switch is closed, reenergizing the agitator clutch solenoid 176 and the hold-down solenoid 146. Agitation of the rinse water introduced into the tub continues as shown for a half minute beyond the time when the water flow is terminated by the opening of the auxiliary warm water cam switch 186. Prior to the opening of the auxiliary warm water cam switch 186, the timer motor cam switch 182 is closed, so that thereafter, the timer motor will continue to function to periodically advance the cam shaft by direct connection through the cam switch 182, rather than the weight switch 134. At the close of the agitation rinse period, the agitator solenoid cam contact 158 is opened, and the spin solenoid cam switch 184 closed. Thus, at this time, acceleration of the tub is effected, and the rinse water is centrifugally extracted, and the tub allowed to spin for a period of four minutes to damp dry the clothes. At the end of the 4 minute period at position 48, as indicated in Figure 5, the timer motor, the agitator, spin solenoid and drive motor cam-operated switches 182, 184, and 160, respectively, are opened, and the tub allowed to decelerate. The wash cycle at this point has been completed, and the timer motor deenergized so that the switch cams do not further advance until advanced manually.

The short cycle operates in the same manner as the long cycle, with the exception that warm water is initially introduced into the tub instead of providing a choice of hot or warm water. This is effected by the closing of the cam switch 188, which will be seen to be in circuit with the warm water solenoid 166 and the lead 162 extending

to the water fill switch. Such circuit is energized during the fill period and is deenergized when the correct weight of water in the tub is established.

It will thus be seen that an operator may select either a long wash cycle for ordinary wash or a short cycle for washing fragile garments, and that the length of the actual wash period in either cycle may be shortened by half minute increments as desired. It will also appear that the length of the wash period may be varied at any time prior to the end thereof, either in the long cycle operation or the short cycle operation.

It will further appear that the method of using the water weight to determine the quantity of water makes it possible to be certain to an exact amount, regardless of waterpressure, and the circuit provides that once the quantity of water desired has been obtained, no further water may be added, except, for example, as in the rinse fill where the cam provides for an additional flow of 2 minutes in the long cycle and one minute in the short cycle. Such time is adequate under almost any variation of water pressure to cause overflow, and thus remove soapsuds and scum floating on the surface. Further, during the operation of the agitator, the frame member 46 is held down solid upon the angle member 28, so that no relative motion may take place, thus protecting against unnecessary otherwise possible actuation of the water weight switch 134. Such switch, being sensitive to a specific weight, would during this period be likely to be operated by any loss of water, or as a result of the agitator movement, or both, and the hold-down feature effectively prevents such a contingency. When the tub is empty, the support member 46 is in its upper position, and thus the switch 134 is spared from any possible flutter, the support member 46 either at all times being in the up position, or held down rigidly in the full tub position.

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 a clothes washer, a tub for holding the clothes, a concentric oscillatory washing member within the tub, means for spinning the tub, mechanism including means to energize said mechanism for alternately oscillating the washing member and for spinning the tub, a timer arranged to control said mechanism energizing means, means for supplying the tub with water, resilient supporting means connected with the tub acting to give the tub a lower position when full than empty, mechanism between the tub and the timer acting to start the timer when the tub reaches its lowest position, including a switch closed by movement of said tub to the lower position, and means independent of the position of said supporting means for maintaining said switch closed during energization of said mechanism for oscillation of the washing member.

2. In a clothes washer, a tub for holding the clothes, means whereby the washing function may be performed, a timer for controlling a cycle of washing operations, a valve for supplying water to the tub, yielding supporting means acting to give the tub a lower position when full than when empty, mechanism comprising an electric circuit located between the tub and the timer acting to start the timer when the tub reaches its lowest position and closes the circuit, means responsive to closure of said circuit and independent of the position of said supporting means for positively holding said circuit closed independent of said mechanism during a part of said washing cycle of timer controlled duration, and means between the water valve and the timer operating to shut off the water when the timer has passed through a lesser

part of the said washing cycle part of timer controlled duration.

3. In a washing machine, a frame, a wash tube adapted to hold a quantity of wash liquid, means for mounting said tub on said frame, including a member movable relative to said frame in response to tub weight and liquid contained therein, means for filling said tub with liquid, including a valve, means responsive to movement of said member upon the filling of said tub with a predetermined weight of liquid to close said valve, means responsive to valve closing movement of said member independent of the movement of said mounting means member to lock said member against subsequent movement relative to said frame and timer means acting in response to valve closing movement of said member and operatively associated with said locking means to unlock said member after a predetermined time.

4. In a washing machine, a frame, a tub, means for mounting said tub upon said frame, including a member movable with respect to the frame in response to the weight of the tub and contents therein, means for agitating laundry within the tube, a timer for energizing said agitating means for a period of time, means for supplying water to said tub, including a valve, means for closing said valve in response to movement of said member upon filling said tub with a predetermined quantity of water and for energizing said timer to energize said agitating means, and means responsive to operation of the valve closing means and independent of the movement of said mounting means member for locking said member against movement relative to said frame for the duration of said agitating period.

5. In a washing machine, a frame, a tub, means for mounting said tub upon said frame, including a member movable with respect to the frame in response to the weight of the tub and contents therein, means for agitating laundry within the tub, means for supplying water to said tub, including a valve, means for closing said valve in response to movement of said member upon the filling of said tub with a predetermined quantity of water, means responsive to operation of the valve closing means and independent of the movement of said mounting means member for locking said member against movement relative to said frame, and means acting simultaneously with said locking means for activating said agitating means for a predetermined agitated wash period, and effective to release said locking means at the end of said wash period.

6. In a washing machine, a frame, a tub, means for mounting said tub upon said frame, including a member movable with respect to the frame in response to the weight of the tub, means for agitating laundry within the tub, means for supplying water to said tub, including a valve, means for closing said valve in response to movement of said member, a cam timer, means responsive to operation of the valve closing means and independent of the moving of said mounting means member for locking said member against movement relative to said frame, activating said agitator means and starting said timer, and means actuated by said timer for subsequently deactivating said agitator means and simultaneously releasing said locking means.

7. In washing machine control apparatus, in combination, a wash tub having agitating means and extraction means, a timer motor including cam switches actuated thereby, one of said cam switches being adapted to energize said timer for predetermined periods, and other cam switches for energizing said agitating means for establishing a wash period and for energizing said extraction means during a following extraction period, means responsive to the filling of said tub for setting said timer motor in operation and initiating said wash period, means responsive to said first-named cam switch for maintaining timer motor operation immediately prior to and during said extraction period, and means for locking

said responsive means in wash period initiating position for the duration of said wash period only.

8. In a clothes washing machine, a tub for holding clothes, means for introducing water into said tub, means for agitating the clothes within the tub for a predetermined period of time, means responsive to the weight of the tub including a predetermined water content and wash load for terminating the operation of the water filling means and for initiating and continuing the operation of the agitating means, and means for locking said weight responsive means against movement for the duration of the agitating period, whereby said agitating

means may continue uninterrupted operation for the duration of said period, irrespective of changes in the weight of said tub during said period.

References Cited in the file of this patent

UNITED STATES PATENTS

2,155,868	Pauly et al. -----	Apr. 25, 1930
2,254,269	Clark et al. -----	Sept. 2, 1941
2,300,421	Henderson -----	Nov. 3, 1942
2,302,836	Breckenridge et al. -----	Nov. 24, 1942
2,381,894	Ferris -----	Aug. 14, 1945