

July 14, 1959

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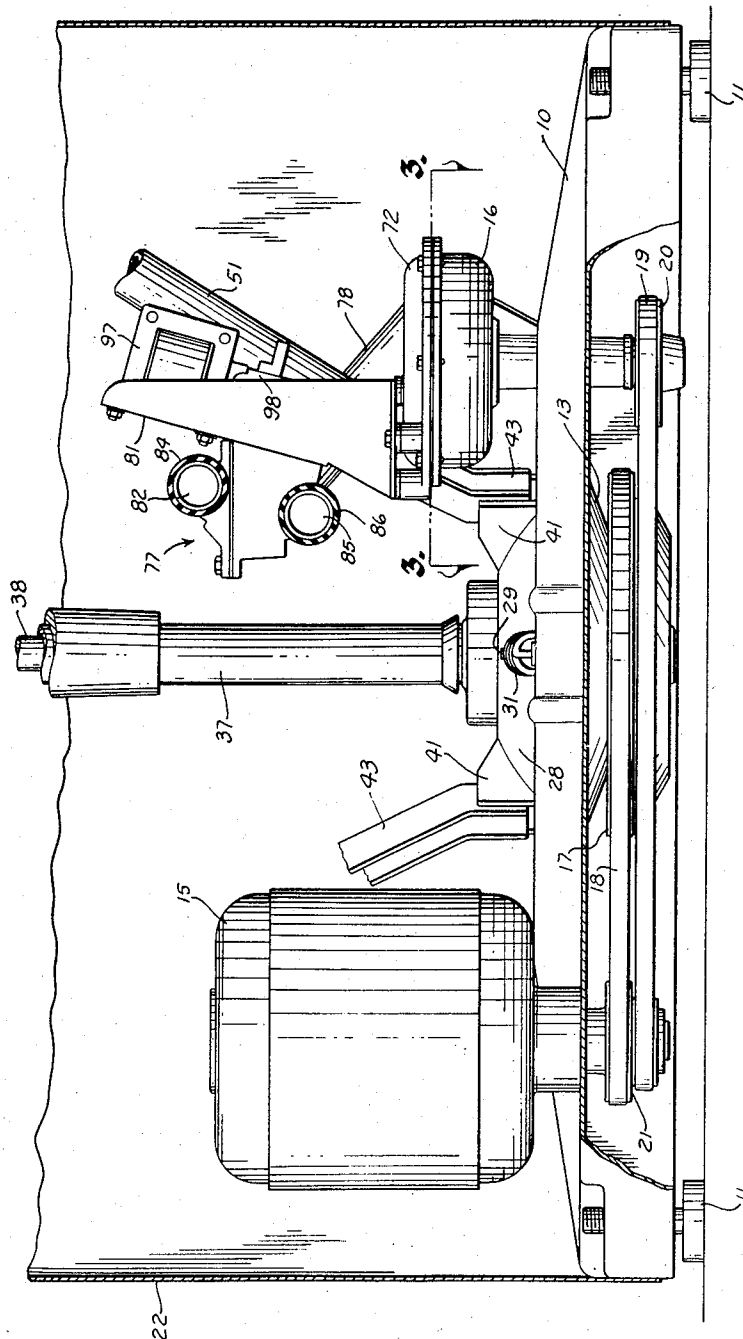
2,894,384

SUDS SAVING SYSTEM FOR WASHING MACHINE

Filed May 28, 1956

6 Sheets-Sheet 2

Fig. 2.



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Fig. 3.

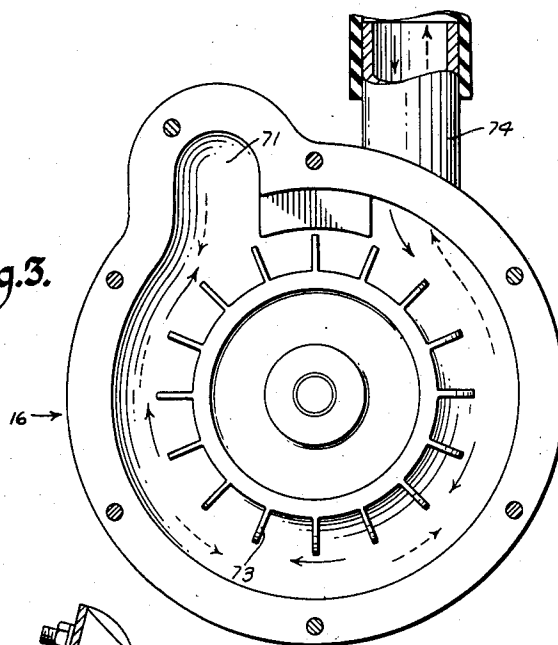
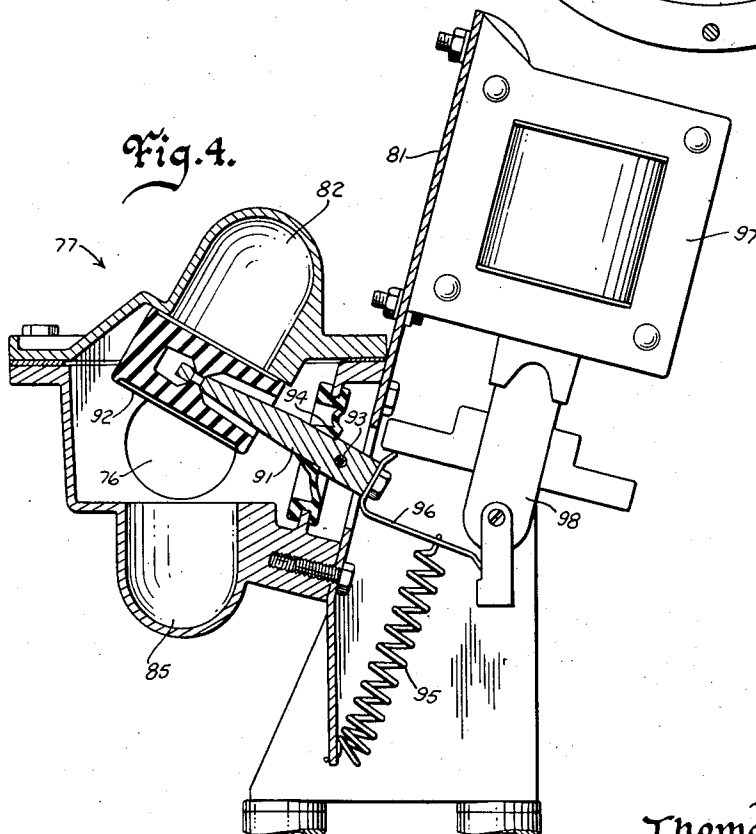


Fig. 4.



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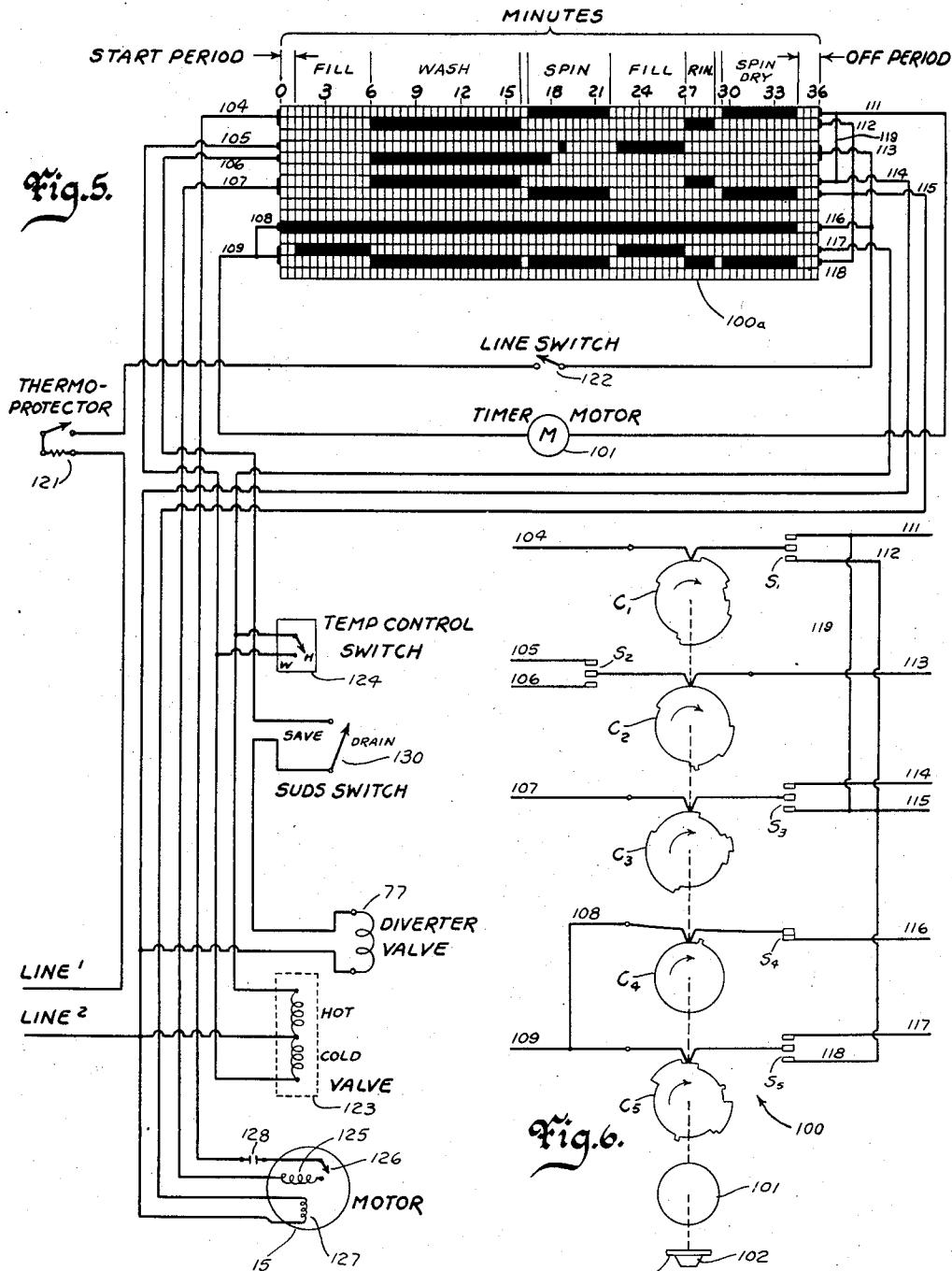
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SUDS SAVING SYSTEM FOR WASHING MACHINE

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6 Sheets-Sheet 4



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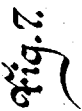
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SUDS SAVING SYSTEM FOR WASHING MACHINE

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6 Sheets-Sheet 5



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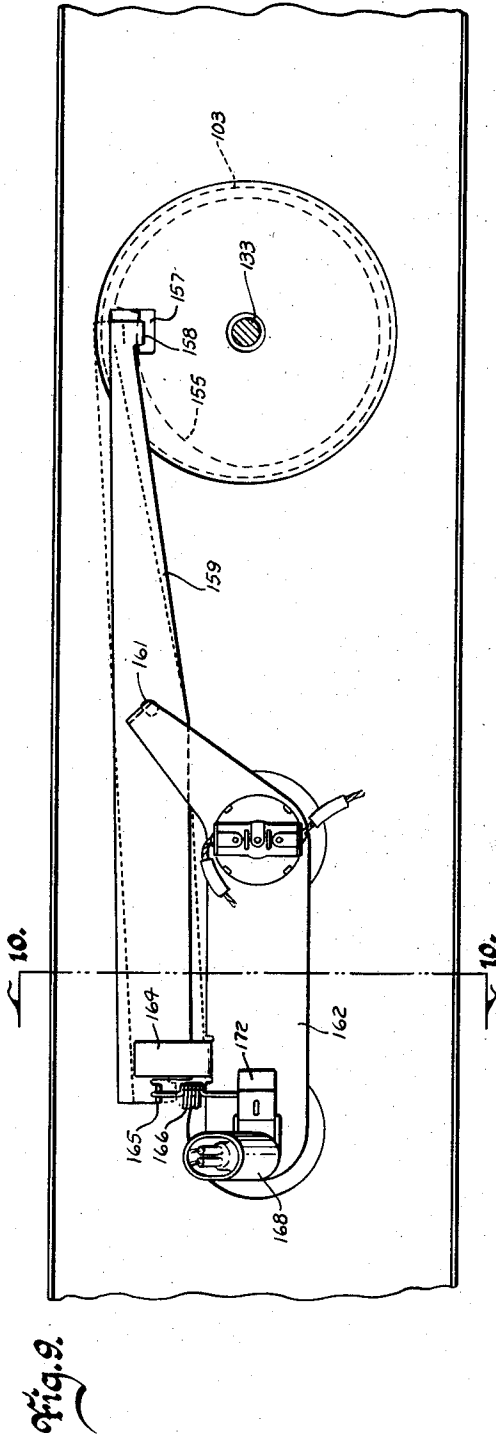
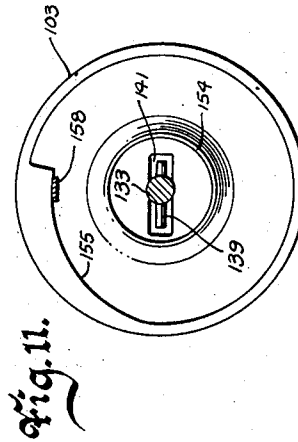
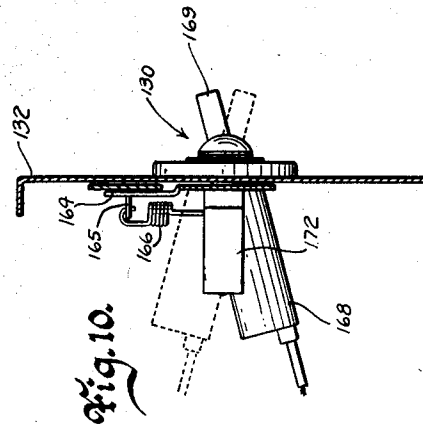
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SUDS SAVING SYSTEM FOR WASHING MACHINE

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6 Sheets-Sheet 6



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SUDS SAVING SYSTEM FOR WASHING MACHINE

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Application May 28, 1956, Serial No. 587,720

23 Claims. (Cl. 68—12)

This invention relates to a suds saving control system for automatic washing machines. It is based upon and is a continuation-in-part of my pending application Serial No. 555,321, filed December 27, 1955, and assigned to the assignee of the present invention.

That prior application disclosed a washing machine powered by a reversible motor which when energized in only direction effected a washing operation within its tub assembly and which when reversed effected a centrifugal extraction operation within the same tub assembly. During the washing operation of that machine, a water pump communicating with the tub assembly was driven by the reversible motor in one direction to pump washing fluid toward the tub assembly while during the centrifugal operation following the first washing period, the motor was reversed not only to effect the centrifugal process but also to pump sudsy washing fluids from the tub assembly to either an external drain or to a suds reservoir for reuse as determined by the option of the machine operator. The control system in that prior application permitted the suds pumped to the suds reservoir to be returned to the tub assembly for reuse during a subsequent washing operation in accordance with the desires of the operator.

Pumping of the washing fluid to and from the tub assembly was jointly controlled by a manually operated suds switch which conditioned the suds saving device for operation and by a presettable timer mechanism which governed the time and duration of energization of that suds saving device.

The machine illustrated in that prior application was of a time fill type which was initially filled by opening a timer operated fill valve for a maximum time of approximately six minutes. Partial filling of the tub assembly in that machine was accomplished by a proportional reduction in the time the fill valve was permitted to remain open.

During subsequent washing operations when washing suds retained in the suds reservoir were used again without the necessity of additional fresh water, it was necessary only that the suds save switch controlling the suds diverter valve be closed and that the timer knob of the timer controlling the entire cyclic operation be turned through the fill period and into the first agitation period. Thereafter the water would be automatically supplied to the tub assembly so that the clothes within the tub assembly would be automatically agitated and processed into a damp dry stage.

As it was necessary that the suds save switch controlling the energization of the diverter valve be placed in its closed position to divert the suds to the suds reservoir following the first wash or agitation period of each complete washing operation, the switch remained in that closed position following the completion of the washing operation unless it was manually opened after the termination of that period.

This positioning of the suds switch in the closed position eliminated one step for the operator desiring to use

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the suds from the external suds reservoir during the following complete washing operation making it necessary that the operator merely move the timer knob past the time fill period as indicated on the timer dial before the machine would automatically pump the salvaged suds back into the tub assembly at the beginning of that next following washing operation.

However, this feature was disadvantageous for the operator who, after saving the suds from the first washing operation, decided not to reuse the suds during the next following washing operation but forgot to open the suds switch at the beginning of that following washing operation and proceeded to preset the timer at the beginning of the time fill period. This naturally resulted in the tub's being filled first with fresh water during the fill period and then being filled to overflowing following that fill period by the addition of the sudsy washing fluid pumped back from the suds reservoir.

This invention relates to a timer operated self-cancelling device for that suds switch which is automatically opened at the end of each complete washing operation making it impossible for a forgetful machine operator to overflow the tub assembly in that manner.

The device through which this is accomplished includes an overcenter switch which may be thrown either into a suds save position to close the switch in order to pass sudsy fluid to or from the external suds reservoir or into a suds drain position to open the switch and pass suds from the machine tub assembly to an external drain. While this switch may be manually and independently actuated at the beginning of and during most of the operational cycle controlled by a sequential timer, its positioning during the latter part of the operational cycle is dependent upon the angular positioning of the timer shaft. In the embodiment of the invention disclosed hereinafter, the timer dial is provided with a cam surface controlling the positioning of a pivoted cam follower which in turn is connected through a resilient lost-motion connection to the overcenter switch.

During the latter part of the operational cycle, the rotation of the timer dial causes the cam follower to place tension in this resilient connection and move the suds switch into the open or suds drain position if that suds switch is not already in that position. While this makes it necessary for the machine operator to perform the positive act of closing that suds switch for each washing operation in order to divert sudsy fluid to the suds reservoir during the next operational cycle or to reuse the washing fluid from the reservoir, it is a more positive guarantee for preventing the over filling of the tub assembly due to the forgetfulness of the operator. In the accompanying drawings:

Figure 1 is a side elevational view, partially broken away, showing a washing machine embodying my invention;

Figure 2 is an enlarged view taken on line 2—2 of Figure 1;

Figure 3 is an enlarged view taken on line 3—3 of Figure 2 showing the inside features of the two-way centrifugal pump used in the suds saver system;

Figure 4 is an enlarged sectional view of the suds diverter valve incorporated in the suds saver system;

Figure 5 is an electrical wiring diagram of the control system controlling the operation of the washing machine illustrated in Figure 1;

Figure 6 is a simplified representation of a timer assembly controlling the programmed sequence illustrated in Figure 5;

Figure 7 is an enlarged fragmentary front plan view of the back panel of the washing machine illustrated in Figure 1;

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Figure 8 is a cross sectional view taken on line 8—8 of Figure 7;

Figure 9 is a fragmentary rear plan view of the back panel shown in Figure 7;

Figure 10 is a cross sectional view taken on line 10—10 of Figure 9 showing the suds save switch moved into its closed or save position; and

Figure 11 is a cross sectional view taken on line 11—11 of Figure 8.

Referring now to the accompanying drawings there is shown a base member 10 mounted on adjustable feet 11 and provided with a supporting dome 12 rising out of a centrally located depression 13 in the base frame 10. Dome 12 serves as a mounting for a drive assembly 14 such as that disclosed in the John D. Goodlaxson application Serial No. 505,231, filed May 2, 1955, and assigned to the same assignee as that of the instant application.

Base frame member 10 also supports the upended reversible motor 15 and the two-way centrifugal water pump 16. Pulley 17, serving as the input member for drive assembly 14, is powered through belt 18 while belt 19 drives pulley 20 of water pump 16. Both belts 18 and 19 are driven in the same direction by the double pulley 21 carried on drive shaft of reversible motor 15 beneath base member 10.

Cabinet 22, attached to and enclosing base 10 together with the drive and tub assemblies supported thereby, is provided at its upper end with a depending annular flange 23 defining an access opening into the washing machine apparatus which is normally covered by the access door 24.

In Figure 1 it can be seen that dome 12 in base member 10 is provided with friction pads 26 on its periphery adjacent the aperture 27 in its uppermost portion. An umbrella-like member 28 rests on the friction pads 26 and is provided with three equally spaced ears 29 accommodating three centering springs 31 which are connected to base frame 10. This arrangement centers support member 28 on dome 12 and restrains it from rotation during the operation of drive assembly 14.

Threaded into the umbrella support member 28 is a member 34 of substantially frusto-conical configuration which serves as a housing for the drive assembly 14 of the previously identified Goodlaxson application, Serial No. 505,231. Housing member 34 cooperates with the umbrella support member 28 by gripping the outer race of a thrust bearing 35 which is provided with a tapered inner race.

Mating with and seated in this tapered inner race of bearing 35 is the spin tube or shaft 37 which journals a power shaft 38 also extending into the drive assembly 14. With this construction all weight placed on spin tube 37, housing member 34 and on umbrella member 28 may be used to an advantage to provide ample frictional forces between umbrella member 28 and the friction pads 26 for dampening nutational movements of the shafts 37 and 38 relative to dome 12 while permitting rotational movement of spin tube 37 in thrust bearing 35.

While the precise details of the Goodlaxson drive assembly forming the basis for the previously identified application Serial No. 505,231 are not essential to the construction of the instant invention, its operation can be briefly explained for environmental purposes. Upon energization of motor 15 in a direction to rotate the pulley 18 in a counterclockwise direction as viewed from the bottom of Figure 1, power shaft 38 is rotated in the same direction while spin shaft 37 is held against rotation by appropriate braking mechanism within housing 34. Upon the reversal of motor 15, spin shaft 37 is released for rotation to allow both shafts 37 and 38 to be spun in unison in a clockwise direction.

With the drive and support construction set forth above, it can be seen that shafts 37 and 38 may be selec-

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tively rotated as determined by the direction of rotation imparted to pulley 18 while permitting their nutation about a vertical axis at all times. In the embodiment set forth in the accompanying drawings, shafts 37 and 38 nutate on a point determined by the intersection of the vertical axis of rotation with a horizontal plane bisecting the groove of driven pulley 17.

With reference to the general details of the tub assembly, it will be noted that umbrella support member 28 is provided with recessed upstanding lugs 41 spaced equally from each other and alternately around member 28 with respect to ears 29. While not entirely obvious from Figure 1, it will be apparent from this description that there are three lugs 41 spaced 120° from each other each of which in turn is 60° removed from an adjacent ear 29 as more clearly shown in Figure 2.

Fastened within the recessed lugs 41 by connectors 42 are the three tub brace members 43 which are, in this embodiment, of channel-like cross section. Brace members 43 extend outwardly and upwardly from umbrella support member 28 to join the nonrotatable tub 44 through tub connectors 45 to form an inverted tripod support for tub 44. The tub 44 is provided with a bottom wall 47 in which is formed a C-shaped gutter 48 having its lowermost portion converging into the drain outlet 49 which in turn communicates with water pump 16 through the flexible drain hose 51.

The nonrotatable outer tub 44 is provided with a removable crown 52 which permits removal of the rotatable inner basket or tub 53 nested within outer tub 44. Inner tub 53 has a perforate bottom wall 54 and a perforate cylindrical side wall 55 which carries a concrete balancing ring 56 at its uppermost end. A conventional oscillating type agitator 57 is mounted within the spinner basket 53 to provide the proper agitation of fabrics placed within the tub assembly as formed.

In order to drive agitator 57 during the washing periods and to spin basket 53 during the fluid extraction periods the following connections are provided. Spin tube 37, which extends into the drive assembly 14, carries affixed to its upper end the lower gear case cover 58 which in turn is bolted to the upper gear case cover 59 carrying counterweight 61 which counter balances a conventional motion converting unit housed between covers 58 and 59 and which is driven by power shaft 38.

In this illustrated embodiment upper gear case cover 59 is provided with an upstanding tubular extension 62 which is coaxial with spin tube 38 and which projects through a water tight radial bearing (not shown) in a center of the bottom wall 47 of the outer tub 44. Tubular extension 62 also extends through the center of bottom wall 54 of the basket 53 to accommodate a fastening nut 63 threaded on its upper end and cooperating with a shouldered support portion (not shown) of extension 62 abutting the lower side of wall 47 in order to support and fasten basket 53 onto extension 62. In the preferred construction this shouldered flange on extension 62 is of the same taper as the central reentrant portion of basket 53 so that basket 53 is actually wedged onto its supporting flange by the tightening action of nut 63. It will be seen that with this construction basket 53 functionally becomes a unitary part of shaft 38 so that any movement imparted to power shaft 38 will also be imparted to basket 53.

Agitator 57 is constructed, in this embodiment, to oscillate in a conventional manner in response to the motions imparted to the splined agitator shaft 65 driven by the motion converting mechanism which is housed between covers 58 and 59 and which converts the rotary motion of the power shaft 38 into the desired oscillatory movements for agitator 57 to achieve a suitable washing action within the basket 53.

In accordance with the description to this point of the specification, it will be understood that upon rotation of pulley 17 by motor 15 in a counterclockwise direction as viewed from the bottom of Figure 1, spin shaft

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37 will be restrained from rotation while power shaft 38 will impart an oscillatory movement to agitator 57. This, of course, will thoroughly wash any soiled fabrics within basket 53 once tub 44 has been filled with the required amount of water and detergent. Upon reversal of motor 15, pulley 17 will drive both shafts 37 and 38 in a clockwise direction to spin tub 53 and agitator 57 in unison to effect an extraction of fluids from wet fabrics retained within basket 53. Unlike most domestic home laundry machines, fluids extracted through the perforate cylindrical side wall 55 of basket 53 will not be thrown upwardly out of tub 44 but will be pumped down drain hose 51 by pump 16 by the fluid distribution system to be described.

Now with respect to the details of the suds distribution system, it will be noted from Figure 1 that drain hose 51 is connected to water pump 16 through the upstanding passageway 71 formed in the cover plate 72 and in a slightly bulbous portion formed in the lower body member of water pump 16. Pump 16 is provided with an impeller 73 (Figure 3) and a second horizontal passageway 74 which communicates with ports 76 of the diverter valve 77 through the short length of hose 78.

Diverter valve 77 is carried on the bracket 81 mounted on the pump cover plate 72 and is provided with a two-piece housing. The upper housing piece defines a first effluent port 82 leading to the suds reservoir 83 through hose 84 while the lower housing piece defines a second effluent port 85 leading to an external drain (not shown) by way of hose 86.

Diverter valve 77 includes a lever 91 which carries a valve flapper 92 and which is pivoted to the valve housing by means of the pivot pin 93 connected to the lower housing piece. Lever 91 passes through a flexible sealing diaphragm 94 in the valve housing and has an exterior spring arm extension 96 connected through spring 95 to bracket 81 to bias the flapper element 92 into the position shown in Figure 4 to close port 82 and prevent its communication with port 76 while permitting communication between port 76 and port 85. Energization of solenoid 97 with the resultant movement of armature 98 linked to lever extension 96 moves lever 91 to its extreme opposite position against the bias of spring 95 to open port 82 and permit its communication with port 76 while closing port 85 to thereby prevent the latter port from communicating with port 76.

This brief description of the pump 16 and diverter valve 77 should indicate that when pump pulley 20 is rotated in a counterclockwise direction by motor 15 as viewed from the bottom of Figure 1, pump impeller 73, which is directly driven by pulley 20, will rotate in a clockwise direction as viewed in Figure 3 so as to tend to pump fluid in the direction of the solid arrows shown in Figures 1 and 3. Upon reversal of motor 15, impeller 73 will tend to pump fluid in the opposite direction as shown by the dotted arrows of Figures 1 and 3. It will be understood that in pumping fluid from tub 44 as shown in dotted arrows of Figure 1 the fluid passing into port 76 of diverter valve 77 may be diverted through port 82 to suds reservoir 83 by energization of solenoid 97 or may be discharged through port 85 to an external drain as shown by the dotted arrows in hoses 84 and 86, respectively. With solenoid 97 energized and the pump impeller 73 rotating in the direction of the solid arrows of Figure 3, it will be apparent that fluid within reservoir 83 will be pumped through valve 77 and pump 26 towards tub 44.

In order to operate the described apparatus in a predetermined sequence, the electrical control system of Figure 5 is utilized. That figure represents a wiring diagram interconnecting the various components controlled by a timer mechanism 100 mounted on cabinet 22 of Figure 1. Timer 100 is diagrammatically illustrated in Figure 6 as comprising a drive motor 101, a manually adjustable knob 102 for positioning the initial settings

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of the control cams C_1 , C_2 , C_3 , C_4 , and C_5 and a timer dial 103 to indicate the settings of these cams. The conventional overrunning clutch arrangement permitting manual adjustment of these cams relative to timer drive motor 101 is not shown. These cams actuate the respective switches S_1 , S_2 , S_3 , S_4 , and S_5 each of which, with the exception of switch S_4 is a single pole double throw switch having upper and lower contacts engageable by a spring contact arm biased towards the axis of rotation of the various cams. Switch S_4 is a single pole single throw switch having a lower contact engaged by a similarly biased contact arm.

Since the sequential operation of the control system is more easily comprehended by the substitution of an equivalent drum timer development 100_a as that indicated in the upper portion of Figure 5, the timer 100 of Figure 6 has been schematically illustrated as a 36 minute timer in Figure 5 in that manner. It will be noted that the left lead-in wires to the timer development 100_a correspond to the left lead-in wires to timer 100 in Figure 6 while the right lead-in wires to timer development 100_a correspond to those leading into the right side of timer 100. Timer 100 in Figure 6 is shown in the 0 minute setting corresponding to the same instant as that indicated at the extreme left side of timer development 100_a of Figure 5.

While timer 100 is rotated by timer motor 101 or the manually adjusted knob 102 in a clockwise direction to actuate switches S_1 , S_2 , S_3 , S_4 , and S_5 in response to the varying cam profiles shown in Figure 6, the electrical connections between the left and right lead-in wires to the equivalent timer development 100_a may be pictured as being produced by a sweeping movement of the left lead-in wires across development 100_a.

These contacts are therefore produced by assuming that the left lead-in wires move across the timer development 100_a making a connection with the respective right lead-in wire or wires horizontally opposite the left lead-in wire whenever the left lead-in wire contacts the darkened areas appearing on development 100_a.

For example, the upper lead-in wire 104, which makes no contact during the first six minutes of the timer operation as cam C_1 rotates clockwise, will make a complete circuit through the right lead-in wire 112 during the 6 to 16 minute interval while breaking for a half minute before completing a circuit through the right lead-in wire 111 during the 16.5 to 22 minute interval. Likewise, neither of left lead-in wires 105 or 106 makes contact with right lead-in wire 113 during the first six minutes of operation, but as cam C_2 rotates clockwise wire 106 will make contact with wire 113 during the 6 to 18 minute interval before breaking for a half minute after which wire 105 will make contact with wire 113 for the short 18.5 to 19 minute interval.

In energizing the timer circuits, a source potential of approximately 115 volts alternating current is supplied to lines L_1 and L_2 . Line L_1 connects to the thermoprotector 121 which automatically opens line L_1 upon the overloading of that particular line. Thermoprotector 121 is connected to line switch 122 carried in wire 113 which leads to the right side of the timer development 100_a.

Line L_2 energizes the conventional water mixing fill valve 123 provided with the hot and cold solenoids connected to wires 117 and 105 respectively.

While shown by a schematic representation in the wiring diagram of Figure 5, mixing valve 123 is of conventional construction and includes separate hot and cold water inlets each of which leads into a mixing chamber and each of which is respectively controlled by a solenoid operated valve energized by the hot and cold solenoids indicated in Figure 5. These hot and cold solenoids control the flow of the source fluids into the mixing chamber of valve 123 which communicates with a single effluent conduit provided with a flow control regulating the

discharge into tub 44 through appropriate hose connections. While eliminated in the sectional view of Figure 1 because of its normal location in the upper left rear corner of cabinet 22, mixing valve 123 in the preferred embodiment is provided with a single effluent port communicating with a mixing chamber and connected to a short length of flexible hose leading to a fill spout connected to and discharging through the top of crown 52. In this way the tub assembly is still free to move on the mounting dome 12 without restriction from the water inlet connections.

It will be apparent that the hot solenoid will be energized from line L₂, through the hot solenoid, right lead-in wire 117, timer development 100_a, line 109, line 108, back across timer development 100_a, line 116, line switch 122 controlled by the axial movement of the adjustable control knob 102, thermo-protector 121 and line L₁. Similarly, the cold solenoid is energized from line L₂, through the cold solenoid, through left lead-in wire 105, timer development 100_a, line 113, line switch 122, thermo-protector 121 and line L₁.

With these connections alone the hot and cold solenoids, each of which has separate actuating switches as schematically illustrated by development 100_a, will be energized according to that development chart sequence. For example, this will produce a hot water flow during the initial fill period during the 1 to 6 minute interval as well as producing a short cold rinse during the 18.5 to 19 minute interval of the first spin period. Since mixing valve 123 is timer operated and has a metered flow through its single effluent port, the simultaneous energization of the hot and cold solenoids will produce warm water at the same rate of flow as would be produced by the energization of one of these solenoids alone. An example of this metered flow of warm water occurs during the 22.5 to 27 minute interval constituting the second fill period.

However, since there are occasions when the use of hot water might be damaging to the fabrics to be cleaned, the temperature selector switch 124 connected across line 105 and 117 is provided. The closing of this switch, which is shown in the Hot position in Figure 5, moves the switch into the Warm position and places the hot and cold solenoids of valve 123 in parallel. This parallel connection causes the hot and cold solenoids to be energized together to produce a flow of warm water into tub 44 whenever the timer 100 normally energized either one or the other of these solenoids when switch 124 was in its open position.

Timer motor 101 which is energized from a 0 to 34.5 minute interval is energized through the following circuit. Line L₂ constitutes one side of the energizing line which connects to line 114 at the right side of development 100_a. Line 114 in turn joins the short lead 119 which connects to line 111 at the upper right side of the timer development 100_a. Line 111 leads through the timer motor 101 which is connected to line 109 at the left side of the timer development 100_a. Stub line 108, connected to line 109, leads into the timer development 100_a, across the longest darkened area of that timer development and connects to line 116 which leads to line L₁ through line switch 122 and thermo-protector 121.

Reversible motor 15 includes start winding 125, centrifugal switch 126, run winding 127 and capacitor 128 in series with start winding 125.

The power path to run winding 127 may be traced by starting from line L₂, then passing through run winding 127, up to right lead in wire 115, down to wire 118, left across timer development 100_a to conductor 109, then up the short jumper wire 108 and across timer development 100_a to conductor 116 which leads to line L₁ through line switch 122 and thermo-protector 121.

Since motor 15 rotates one direction during the agitation intervals of 6 to 16 minutes and 27 to 29 minutes and then reverses to rotate in the opposite direction

during the centrifuging operations occurring during intervals of 16.5 to 22 minutes and 29.5 to 34.5 minutes, the connections to start winding 125 must be reversed with respect to the run winding 127 to achieve this reversal of rotation.

During the agitation periods, start winding 125 is energized through line L₂, up to right lead-in wire 114, left across timer development 100_a to conductor 107 leading to the lower side of start winding 125, through start winding 125, through centrifugal switch 126, capacitor 128, line 104, then right across timer development 100_a to conductor 112, down to conductor 118, left across timer development 100_a to conductor 109, up wire 108, back across timer development 100_a to wire 116 which passes through line switch 122 and thermo-protector switch 121 to line L₁. Energization of start winding 125 through this circuit, which lasts only for a short interval before centrifugal switch 126 opens the start circuit, causes motor 15 to rotate in a counterclockwise direction as viewed from the bottom of Figure 1.

During the spin periods when motor 15 rotates in a clockwise direction as viewed from the bottom of Figure 1, power is supplied to start winding 125 through line L₂, conductor 114, up line 119 to conductor 111, across timer development 100_a to wire 104 which leads back to capacitor 128, through centrifugal switch 126, to the top of start winding 125, through start winding 125, up to conductor 107, then right across timer development 100_a to conductor 115 which leads back down to conductor 118, then left across timer development 100_a to wire 109, up to jumper wire 108, right across timer development 100_a to wire 116 then to line switch 122, thermo-protector switch 121 and back to line L₁. While these circuits do appear to be rather circuitous, it will be apparent from this description that the current flow through start winding 125 will be in opposite directions during the agitate and spin periods.

Diverter valve 77, which has its lower end connected to line L₂, is energized through the suds switch 130 which in turn leads to the conductor 106. Switch 130 is shown in this illustrative embodiment as being of the mercury type but need not be limited to that particular type as will be apparent from the remainder of the specification. Power flows through wire 106 across timer development 100_a to wire 113 which leads to line L₁ through line switch 22 and thermo-protector 121.

It will be apparent that until valve 77 is energized through the series switches 130 and the switch (S₂) represented between conductor 106 and conductor 113, tub 44 will always communicate with the exterior drain through the deenergized diverter valve 77 due to the bias of spring 95. Assuming line switch 122 and thermo-protector switch 121 closed, two conditions must be satisfied before the diverter valve 77 can be energized to permit communication between tub 44 and reservoir 83 through diverter valve 77. First, the suds switch 130 must be closed to condition or prepare the diverter valve circuit for programmed energization by timer 100, and secondly, the timer 100 must establish contact between conductors 106 and 113. Timer 100, of course, establishes the contact between the conductors 106 and 113 during the 6 to 18 minute time interval as apparent from timer development 100_a in Figure 5. It should be apparent then that this particular time interval represents the only period that there may be fluid flow between reservoir 83 and tub 44 in this particular embodiment. The two-way centrifugal pump 16 controls the direction of water flow during that time interval.

In operation, with the thermo-protector switch 121 and line switch 122 closed subsequent to the insertion of fabrics and detergent to basket 53, timer motor 101 is energized by the rotation of control knob 102 past the 0 timer setting to energize timer motor 101 in order for timer motor 101 to rotate cams C₁, C₂, C₃, C₄, and C₅ and actuate switches S₁, S₂, S₃, S₄, and S₅ in the se-

quence indicated by the timer development 100_a of Figure 5.

Assuming that the timer control knob 102 has been turned just sufficiently past the zero setting to actuate timer motor 101, that motor will be actuated for approximately one minute before the mixing valve 123 is energized during the 1 to 6 minute interval to fill tub 44 with either hot or warm water depending upon whether or not the temperature selector switch 124 is open or closed. As previously stated, tub 44 is meter filled from mixing valve 123 and receives the same flow of water regardless of whether or not one or both of the solenoids of valve 123 is energized during this fill period. Partial filling of tub 44 is achieved by decreasing the amount of time that mixing valve 123 is energized. This in turn is dependent upon the original preset position of cam C₅ with respect to the zero minute mark.

At the beginning of the 6 to 16 minute interval, start winding 125 is energized through timer lead-in wires 104 and 112, 107 and 114, 108 and 116, and 109 and 118 through the circuit path previously set forth in this specification. Run winding 127 is energized through the lead-in wires 108 and 116 and through wires 109 and 118 also as previously set forth. This causes the double pulley 21 of motor 15 to rotate in a counterclockwise direction as viewed from bottom of Figure 1 to cause an oscillation of agitator 57 to produce the required agitation of the fabrics within basket 53 during the wash or first agitation period.

This rotation of double pulley 21 also causes pump pulley 20 to rotate in the same direction and drive impeller 73 which is carried on the same shaft as pulley 20. This causes pump 26 to tend to pump toward tub 44 in the direction of the solid arrows appearing in drain hose 51 of Figure 1. However, since valve 77 is deenergized preventing any communication between tub 44 and reservoir 83, assuming, of course, that suds switch 130 is open, and since no fluid is pumped back through drain hose 86, this pumping action merely acts as a valve and prevents water from gravitating down drain hose 51 regardless of the position of drain hose 86 during this period.

At the end of the 6 to 16 minute interval ending the first agitation period, motor 15 is deenergized for a half minute allowing it to come to a full stop before being reversed to commence the first spin period occurring during the 16.5 to 22 minute interval. While the run winding 127 of motor 15 is energized through the same circuit as during the first agitation period, the start winding 125 is energized through the lead-in wires 104 and 111, 107 and 115, 108 and 116, and 109 and 118 as set forth in another part of this specification. The reversal of double drive pulley 21 reverse the rotation of the drive assembly input pulley 17 to cause shafts 37 and 38 to rotate in unison in a clockwise direction as viewed from the bottom of Figure 1 to spin basket 53 and agitator 57 in unison within tub 44 to accomplish the desired fluid extraction through the cylindrical side wall of basket 53.

This reversal of rotation of pulley 21 also reverses pump pulley 20 and allows pump impeller 73 to pump the washing fluid from tub 44 and, since valve 77 is deenergized due to suds switch 130 being in its open position, to drain hose 86 to an external drain.

It will be apparent from timer development 100_a of Figure 5 that a spray rinse will take place during the 18.5 to 19 minute interval. If the water temperature switch 124 is open (in the Hot position), only the cold solenoid of valve 123 will be energized and will produce a cold spray during that interval while if switch 124 is closed placing the solenoids of valve 123 in parallel, both will be energized and the rinse will be of warm water. At the conclusion of the 16.5 to 22 minute interval, motor 15 will be deenergized terminating the driving power to pulleys 17 and 20.

With the energization of one or both of the solenoids of mixing valve 123, depending upon the positioning of switch 124, water will again be supplied to tub 44 on a time fill basis during the second fill period which lasts from the 22.5 to 27 minute interval. Since, in this particular embodiment, motor 15 is deenergized during this second fill period and since no valve has been provided in hose 51, the gravitational flow of fluid from tub 44 is prevented by merely elevating drain hose 86 above the level of the fluid retained in tub 44.

Following the conclusion of this second fill period, motor 15 is again energized for two minutes in a counterclockwise direction to oscillate agitator 57 in the fresh water to free the fabrics within the basket of their retained suds. This constitutes the deep rinse period which is concluded at the end of minute 29.

After another half minute has elapsed, motor 15 is energized in a clockwise direction in the final spin dry period to spin basket 53 free of this rinse water to place the fabrics retained in basket 53 in a damp dry condition. With this reversal of direction of motor 15, pump 16 also reverses and pumps the rinse fluid through the deenergized valve 77 and drain hose 86. All circuits are deenergized terminating the complete washing cycle following minute 34.5 as apparent from timer development 100_a in Figure 5.

Now, assuming that switch 130 is closed by moving it into the Save position, the operation of the washing machine during the 0 to 6 minute interval will be identical to that previously described when switch 130 was in the Drain or open position. With the beginning of the wash period at minute 6, valve 77 is energized through lead-in wires 106 and 113 to establish communication between reservoir 83 and tub 44 by way of the hoses 84 and 51. However, since pump 16 tends to pump toward tub 44 during this wash period lasting from the 6 to 16 minute interval, no fluid will flow from tub 44 to suds reservoir 83 during this period.

However, when motor 15 is deenergized following that agitation period and is reversed at the beginning of the first spin period, pump 16 does pump the suds contained in tub 44 to the suds reservoir 83 by way of port 82 of the energized diverter valve 77. This fluid transfer from tub 44 to reservoir 83 takes slightly over a minute at the maximum and accounts for the reason that diverter valve 77 is deenergized at the beginning of the 18 minute interval and allows diverter valve 77 to establish communication between tub 44 and reservoir 83 for only a minute and one half while pump 16 is pumping toward reservoir 83. With the deenergization of diverter valve 77, the slight amount of residual fluids extracted from the fabrics during the remaining part of the first spin period will pass to the drain through hose 86. From that point on of the cycle, the operation of the machine utilizing this suds system is identical to that previously explained with the suds switch 130 being in its Drain or open position.

In order for the salvaged suds retained in the suds reservoir 83 to be used again suds switch 130 must be positioned in its closed or Save position. Timer knob 102 must then be rotated past the 0 to 6 minute interval and allowed to start operation at the 6 minute mark constituting the beginning of the wash period. This, of course, omits the time fill period and immediately starts motor 15 rotating in a counterclockwise direction to oscillate agitator 57 and causes pump 16 to pump toward tub 44. While there is a momentary agitation without washing fluid within the tub 44, pump 16 immediately pumps suds from reservoir 83 to tub 44 and fills it with the suds from the reservoir 83 so that there is agitation in the sudsy fluid for approximately 14 minutes before motor 14 is deenergized.

If suds switch 130 is permitted to remain in its closed position, it will be apparent that the same suds will again be returned to the suds reservoir 83 during the

16.5 to 18 minute interval of the following first spin period in the same manner as when the suds were originally saved by diversion to reservoir 83.

However, if after the minute or so taken at the beginning of the agitation period for the return of the suds from reservoir 83 to tub 44, the operator wishes to divert the unused suds to the external drain at the beginning of the following first spin period, switch 130 may be thrown into its Drain of open position to de-energize diverter valve 77 during the remainder of the agitation period since pump 16 pumps toward tub 44 during the remaining part of that wash period.

It will be noted in Figures 7 to 11 that the manually operable switch 130 is mechanically connected to timer 100 to form a self-cancelling device for switch 130. The purpose of this interconnection is to prevent switch 130 from remaining in its closed position following a complete cycle of washing operation in which reservoir 83 was filled with salvaged suds because if switch 130 were to remain in its closed or Save position and timer 100 then preset for the next cycle of operations at the beginning of the first fill period rather than at the beginning of the agitation period by an operator forgetting the previous saving of the suds, tub 44 would be filled first by fresh water during the first fill period and then filled to overflowing during the following wash period by the suds pumped back into tub 44 from reservoir 83 at the beginning of the latter period. This suds switch cancellation device makes the positive closing of switch 130 mandatory for each washing operation thereby reminding the operator that switch 130 should be closed and timer 100 preset at the beginning of the first fill period only if suds have not been previously diverted to suds reservoir 83 during a prior washing operation. For those times of operation in which suds have been saved once and wish to save again, it is necessary only that the timer 100 be preset to the beginning of the wash period and switch 130 be placed in its closed or Save position.

While timers of varying basic construction may be used to produce this self-cancelling feature, timer 100, mounted on cabinet back panel 132, achieves a desirable result in that timer dial 103 is constantly urged against back panel 132 to assume a constant lateral position relative to that back panel regardless of the axial positioning of knob 102. This timer construction forms the subject matter of the pending application of Gerald W. Jones, Serial No. 568,495, filed February 29, 1956, and assigned to the assignee of the present invention.

This timer construction may be understood by noting that timer knob 102 is revolvably mounted on timer shaft 133 but restrained from axial movement relative to that shaft by the shaft shoulder 134 and by the slotted retaining washer 135 centered on shaft 133 by means of a knob cap 137 whose outer periphery is securely fitted into a cylindrical recess at the outer end of timer control knob 102.

Timer control knob 102 is also counterbored to receive the hub portion 138 of the timer dial 103 which is axially slideable on but not revoluble relative to timer shaft 133. Although timer dial 103 may be keyed or splined to timer shaft 133 by equivalent connections to permit axial movement between these parts while restraining relative rotation therebetween, this function is achieved in this particular timer construction by means of a pin and slot connection.

Shaft 133 is pierced by a fixed cross pin 139 one end of which projects farther from shaft 133 than the other. Timer dial 103 in turn is provided with a mating slot 141 to accommodate this cross pin 139 in one position only. In this way the pin and slot connection between timer dial 103 and shaft 133 not only permits axial movement between these members but also indexes the timer dial nomenclature generally indicated at 142 with respect to the control cams C_1 , C_2 , C_3 , C_4 and C_5 so that the nomen-

clature 142 appearing opposite the cabinet panel reference arrow 143 will always correctly designate the function being performed by the apparatus controlled by timer 100.

Since the timer control knob 102 is revolvably mounted on the timer shaft 133, any rotational movement imparted to timer control knob 102 must be transmitted through timer dial 103 and the pin and slot connection on that shaft before any rotational movement will be imparted to the control cams C_1 , C_2 , C_3 , C_4 and C_5 . To accomplish this function timer dial 103 is provided with a ring of clutch teeth 145 which may engage with similar mating teeth 146 formed on the rear end of the control knob 102.

While the configuration of the clutch teeth 145 and 146 may take several different forms a saw tooth configuration (not shown in detail in Figure 8) is preferred for two reasons.

First, this construction permits rotary motion to be imparted to the timer dial 103 through the timer control knob 102 in a clockwise direction but allows the teeth to ratchet with respect to each other whenever timer knob 102 is turned in a counterclockwise direction. Secondly, whereas clutch teeth of square tooth design would tend to abut each other rather than engaging each other properly upon axial movement of control knob 102, a saw tooth construction will prevent any abutting of the clutch teeth and will provide a more positive engagement of these teeth whenever knob 102 is shifted axially toward timer dial 103.

Axial positioning of timer shaft 133 in the timer illustrated in this invention is limited to two stabilized axial settings as diagrammatically illustrated in Figure 8. Figure 8, which shows clutch teeth 145 and 146 in their engaged position, indicates one of these settings. In this position the rear face of cam C_5 opens line switch 122 to deenergize the entire electrical circuit to prevent actuation of the various circuit components whenever control knob 102 is manually rotated to preset the desired indicia 142 on timer dial 103 opposite the cabinet panel reference arrow 143. Timer shaft 133 is stabilized in this position by the spring detent member 148 which seats in notch 151 formed on shaft 133.

To close line switch 122 and energize the timer motor 101, timer control knob 102 is pulled away from panel 132. In this shifting movement of shaft 133 spring detent member 148 is cammed out of notch 151 before snapping back into the second notch 152 on shaft 133 as the latter shaft moves into its second position. This movement of shaft 133 not only closes line switch 122 but separates clutch teeth 145 and 146 which are maintained in their separated positions by the coil spring 156 encompassing timer dial hub 138 and having its opposite ends bearing against the timer dial 103 and the base of a cylindrical recess 153 formed in control knob 102.

Spring 156, which separates knob 102 from dial 103 during the energization of the machine, also constantly urges timer dial 103 against the back panel 132 regardless of the positioning of timer shaft 133. Spring 156 is not, however, strong enough to separate clutch teeth 145 and 146 when knob 102 is positioned as in Figure 8.

It will be noted that timer dial 103 is molded with a slightly protruding nose ring 154 to provide a line contact rather than an area contact between dial 103 and the back panel member 132 to reduce the frictional drag between these members as timer dial 103 is rotated relative to panel 132.

As indicated by the dotted directional arrow in Figure 7, timer dial 103 rotates in a clockwise direction as timer shaft 133 is rotated by timer motor 101. It will be apparent from indicia 142 and the explanation of the circuitry of Figure 5 that after timer dial 103 is manually rotated past reference arrow 143 to start the operation of the machine, it automatically progresses past reference arrow 143 into the first fill period, the wash period, the spin period, the second fill period, the final rinse period

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and finally into the spin dry period before the washing machine is terminated in its off position.

The rear side of timer dial 103 is provided with an internal cam surface 155 which, as apparent from a comparison of Figures 9 and 11 with Figure 7, moves gradually radially toward the rotational axis of timer dial 103 during the final rinse and the spin dry periods of the washing cycle before it drops sharply back into its greatest radius at the beginning of the fill period of the next cycle.

In Figure 9 it will be seen that panel 132 is provided with a small rectangular aperture 157 to accommodate the cam follower tang 158 projecting from one end of cam follower lever 159 and protruding through the cabinet panel 132 to engage the cam surface 155. The fact that timer dial 103 does not shift axially makes it unnecessary for the tang 158 to project very far past aperture 157 or for cam surface 155 to be of a width great enough to accommodate any shifting movement of an equivalent dial of another timer embodiment in which the dial itself is shiftable.

Support for the lever follower 159 is provided by a fulcrum tab 161 projecting from a stationary support member 162 clamped to panel 132 by the connectors fastening switches 124 and 130 to panel 132. Support member 162 also serves to keep cam follower 159 against panel 132 and is provided with an additional guide projection 164 for this purpose.

Cam follower 159 is provided at its opposite end with a small tab 165 anchoring the coil spring 166 connected to the switch holder 168 for the switch 130 which in this illustrative example is a mercury switch. Switch holder 168 is hollow to accommodate the glass envelope of switch 130 and is rigidly connected in turn to the manually operable switch actuator 169 so that any movement imparted to actuator 169 is directly transmitted to holder 168 and its restrained mercury switch.

Therefore, whenever the actuator 169 is raised into the full line position of Figure 10 to lower the switch contacts at the base of the glass envelope, the globule of mercury within that glass envelope will bridge the switch contacts and complete an electrical circuit through the solenoid of diverter valve 77 provided that the timer cams are properly positioned. This closing of switch 130 conditions or prepares the diverter valve circuit for energization at the proper times by timer 100.

While switch actuator 169 is pivoted on panel 132 for arcuate movement in the horizontal plane perpendicular to that panel, it is maintained in either the full line Save position of Figure 10 or the dotted line Drain position in that same figure by means of the overcenter leaf spring 171 flexed between switch holder 168 and a stationary arm member 172 fastened to and extending from panel 132.

This overcenter spring structure allows the switch 130 to be manually actuated by a snap action into or out of either of the Save or Drain positions to close or open the suds save circuit for diverter valve 77 at any time prior to the final rinse or damp dry periods due to the lost motion connection existing between spring 166 and spring tab 165.

However, as timer dial 103 rotates clockwise in Figure 7 (counterclockwise in Figures 9 and 11), cam follower tang 158 is moved closer to the rotational axis of dial 103 by the cam surface 155 to raise the spring anchor tab 165 on the opposite end of cam follower lever 159 as shown in the full line portion of Figure 9. This takes the lost motion out of the connection between tab 165 and spring 166 and tensions the latter spring. This in turn causes spring 166 to pull up on switch holder 168 against the action of leaf spring 171 which snaps switch 130 into its dotted line open position of Figure 10 if the latter switch had been closed at any time during the washing operation. If switch 130 had remained open prior to this time, the spring 166 merely resiliently opposes any movement of holder 168 into the full line position of

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Figure 10 during the latter periods of the washing operation. This resilient connection therefore serves as a means for preventing breakage of the connections to switch actuator 169 due to any forced operation of switch 130 during the latter part of the washing operation as might occur with a rigid linkage between tab 165 and switch holder 168.

It should be apparent from this description that through the use of this switch cancellation device dependent upon the rotational positioning of timer dial 103, tub 44 cannot be filled to overflowing by the addition of fresh water and suds from reservoir 83 unless switch 130 is positively closed at the beginning of the cycle and timer 100 intentionally preset to the beginning of the first fill period. This cancellation device therefore not only prevents such accidental overfilling of the tub 44 but also serves as a reminder to the operator of the machine to set the machine controls in accordance with the existing water level within reservoir 83 and the functions desired to be performed during the next washing operation.

While I have described and shown in detail the preferred embodiment of my invention, it should be understood that the invention is not limited thereto but may comprehend other constructions and arrangements of parts, details and features without departing from the spirit of this invention. Such other constructions would include the positioning of suds reservoir 83 inside as well as outside cabinet 22 as shown in Figure 1.

I claim:

1. A washing machine adapted to cooperate with a fluid storage reservoir and including a tub for receiving fluid from said reservoir, said washing machine including means for performing a series of programmed operations including an agitation operation within said tub, conduit means connected to said tub and adapted to extend into said fluid reservoir for communication therewith, reversible pump means in said conduit for selectively pumping fluid from said fluid reservoir to said tub and for pumping fluid from said tub to said reservoir, control means including a circuit controlling fluid flow through said conduit means, timer means controlling the operation of said machine including said pump means and said control means during said series of operations, a manually operable switch in said circuit movable into a closed position to condition said circuit for energization by said timer means to permit fluid flow through said conduit means, said timer means energizing said circuit and operating said pump means in one direction prior to the completion of said agitation operation to pump fluid from said reservoir to said tub and energizing said circuit and operating said pump means in a reverse direction after the completion of said agitation operation to pump fluid from said tub to said reservoir, and means controlled by said timer means for opening said manually operable switch to terminate further fluid flow through said conduit means after said fluid has been pumped from said tub to said reservoir.

2. A washing machine adapted to cooperate with a fluid storage reservoir and including a tub for receiving fluid from said reservoir, said washing machine including means for performing a series of programmed operations including an agitation operation within said tub, conduit means connected to said tub and adapted to extend into said fluid reservoir for communication therewith, reversible pump means in said conduit means for selectively pumping fluid from said fluid reservoir to said tub and for pumping fluid from said tub to said reservoir, control means including a circuit controlling fluid flow through said conduit means, timer means controlling the operation of said machine including said pump means and said control means during said series of operations, a manually operable switch in said circuit movable into a closed position to condition said circuit for energization by said timer means to permit fluid flow through said conduit means, said timer means energizing said circuit

and operating said pump means in one direction prior to the completion of said agitation operation to pump fluid from said reservoir to said tub and energizing said circuit and operating said pump means in a reverse direction after the completion of said agitation operation to pump fluid from said tub to said reservoir, and linkage means including a cam and follower mechanism controlled by said timer means for opening said manually operable switch to terminate further fluid flow through said conduit means after said fluid has been pumped from said tub to said reservoir.

3. A washing machine adapted to cooperate with a fluid storage reservoir and including a tub for receiving fluid from said reservoir, said washing machine including means for performing a series of programmed operations including an agitation operation within said tub, conduit means connected to said tub and adapted to extend into said fluid reservoir for communication therewith, reversible pump means in said conduit means for selectively pumping fluid from said fluid reservoir to said tub and for pumping fluid from said tub to said reservoir, control means including a circuit controlling fluid flow through said conduit means, timer means controlling the operation of said machine including said pump means and said control means during said series of operations, a manually operable switch in said circuit movable into a closed position to condition said circuit for energization by said timer means to permit fluid flow through said conduit means, said timer means energizing said circuit and operating said pump means in one direction prior to the completion of said agitation operation to pump fluid from said reservoir to said tub and energizing said circuit and operating said pump means in a reverse direction after the completion of said agitation operation to pump fluid from said tub to said reservoir, a lever having means on one end thereof for moving said switch into its open position, and a cam driven by said timer means engaging an opposite end of said lever for opening said switch to terminate further fluid flow through said conduit means after said fluid has been pumped from said tub to said reservoir.

4. A washing machine adapted to cooperate with a fluid storage reservoir and including a tub for receiving fluid from said reservoir, said washing machine including means for performing a series of programmed operations including an agitation operation within said tub, conduit means connected to said tub and adapted to extend into said fluid reservoir for communication therewith, reversible pump means in said conduit means for selectively pumping fluid from said fluid reservoir to said tub and for pumping fluid from said tub to said reservoir, control means including a circuit controlling fluid flow through said conduit means, timer means controlling the operation of said machine including said pump means and said control means during said series of operations, a manually operable switch in said circuit movable into a closed position to condition said circuit for energization by said timer means to permit fluid flow through said conduit means, said timer means energizing said circuit and operating said pump means in one direction prior to the completion of said agitation operation to pump fluid from said reservoir to said tub and energizing said circuit and operating said pump means in a reverse direction after the completion of said agitation operation to pump fluid from said tub to said reservoir, a panel member, a lever positioned on one side of said panel member and having means on one end thereof for moving said switch from a closed to an open position, cam means positioned on the opposite side of said panel member and engaging an opposite end of said lever, said timer means driving said cam means to open said switch and terminate fluid flow through said conduit means after said fluid has been pumped from said tub to said reservoir.

5. A washing machine adapted to cooperate with a

fluid storage reservoir and including a tub for receiving fluid from said reservoir, said washing machine including means for performing a series of programmed operations including an agitation operation within said tub, conduit means connected to said tub and adapted to extend into said fluid reservoir for communication therewith, reversible pump means in said conduit means for selectively pumping fluid from said fluid reservoir to said tub and for pumping fluid from said tub to said reservoir, control means including a circuit controlling fluid flow through said conduit means, timer means controlling the operation of said machine including said pump means and said control means during said series of operations, a manually operable switch in said circuit movable into a closed position to condition said circuit for energization by said timer means to permit fluid flow through said conduit means, said timer means energizing said circuit and operating said pump means in one direction prior to the completion of said agitation operation to pump fluid from said reservoir to said tub and energizing said circuit and operating said pump means in a reverse direction after the completion of said agitation operation to pump fluid from said tub to said reservoir, a panel member, a lever positioned on one side of said panel member and having one end thereof resiliently connected to said manually operable switch through a lost-motion connection for moving said switch from a closed to an open position, said timer means driving a cam positioned on the opposite side of said panel member and engaging an opposite end of said lever to open said switch and terminate further fluid flow through said conduit means after said fluid has been pumped from said tub to said reservoir.

6. A washing machine adapted to cooperate with a fluid storage reservoir and including a tub for receiving fluid from said reservoir, said washing machine including means for performing a series of programmed operations including an agitation operation within said tub, conduit means connected to said tub and adapted to extend into said fluid reservoir for communication therewith, reversible pump means in said conduit means for selectively pumping fluid from said fluid reservoir to said tub and for pumping fluid from said tub to said reservoir, control means including a circuit controlling fluid flow through said conduit means, timer means controlling the operation of said machine including said pump means and said control means during said series of operations, a manually operable switch in said circuit movable into a closed position to condition said circuit for energization by said timer means to permit fluid flow through said conduit means, said timer means energizing said circuit and operating said pump means in one direction prior to the completion of said agitation operation to pump fluid from said reservoir to said tub and energizing said circuit and operating said pump means in a reverse direction after the completion of said agitation operation to pump fluid from said tub to said reservoir, a panel member provided with an aperture therein, a lever positioned on one side of said panel member and having means on one end thereof for opening said switch to deenergize said circuit, said lever having a tang projecting through said aperture in said panel, a cam positioned on the opposite side of said panel member and engaging said tang, said timer means driving said cam to open said switch to terminate further fluid flow through said conduit means after said fluid has been pumped from said tub to said reservoir.

7. A washing machine adapted to cooperate with a fluid storage reservoir and including a tub for receiving fluid from said reservoir, said washing machine including means for performing a series of programmed operations including an agitation operation within said tub, conduit means connected to said tub and adapted to extend into said fluid reservoir for communication therewith, reversible pump means in said conduit means for selectively pumping fluid from said fluid reservoir to said tub and for pumping fluid from said tub to said reservoir, control

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means including a circuit controlling fluid flow through said conduit means, timer means controlling the operation of said machine including said pump means and said control means during said series of operations, a manually operable snap action switch in said circuit movable into a closed position to condition said circuit for energization by said timer means to permit fluid flow through said conduit means, said timer means energizing said circuit and operating said pump means in one direction prior to the completion of said agitation operation to pump fluid from said reservoir to said tub and energizing said circuit and operating said pump means in a reverse direction after the completion of said agitation operation to pump fluid from said tub to said reservoir, a panel member provided with an aperture therein, a lever positioned on one side of said panel member, said lever having means on one end thereof for moving said switch into its open position to deenergize said circuit, said lever having a second end provided with a tang protruding through said aperture in said panel member, an indicia disc driven by said timer means and positioned on the opposite side of said panel member, said disc having an internal cam engaging said tang for opening said switch to terminate further fluid flow through said conduit means after said fluid has been pumped from said tub to said reservoir.

8. In a washing machine adapted to receive fluid and articles to be washed therein, mechanism for pumping said fluid from said machine to a storage reservoir, control means including an electrical circuit controlling communication between said machine and said reservoir, means for returning said fluid to said machine from said reservoir, timer means sequentially controlling the operation of said mechanism and said control means, a manually operable switch in said circuit, said switch being movable into a closed position to condition said circuit for programmed energization by said timer means and being movable into an open position to deenergize said circuit and terminate the communication between said machine and said reservoir, and means controlled by said timer means for opening said switch subsequent to a period of operation of said control means.

9. In a washing machine adapted to receive fluid and having at least one agitation cycle, mechanism for pumping fluid from said machine subsequent to said agitation cycle, control means including an electrical circuit controlling communication between said machine and a storage reservoir for receiving said fluid from said machine for reuse therein, means for returning said fluid to said machine from said reservoir, timer means controlling the operation of said mechanism and said control means, a manually operable switch in said circuit, said switch being movable into a closed position to condition said circuit for energization by said timer means and being movable into an open position to deenergize said circuit to terminate communication between said machine and said reservoir, and means controlled by said timer means for automatically opening said switch subsequent to a period of operation of said mechanism and said control means after said agitation cycle.

10. In a washing machine adapted to receive fluid and operating through a series of operations including an agitation operation, mechanism for pumping fluid from said machine subsequent to said agitation operation, control means including an electrical circuit controlling communication between said machine and a storage reservoir for receiving said fluid from said machine for reuse therein, means for returning said fluid to said machine from said reservoir, timer means controlling the operation of said mechanism and said control means, a manually operable switch in said circuit, said switch being movable into a closed position to condition said circuit for energization by said timer means and being movable into an open position to deenergize said circuit and terminate communication between said machine and said reservoir, and cam

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operated means controlled by said timer means for automatically opening said switch subsequent to the energization of said circuit after said agitation operation.

11. In a washing machine adapted to receive fluid and operating through an agitation cycle for cleansing articles placed within said fluid, a fluid storage control system for said machine comprising, mechanism for pumping fluid from said machine subsequent to said agitation cycle, control means including an electrical circuit controlling communication between said machine and a storage reservoir for receiving said fluid from said machine for reuse therein, means for returning said fluid to said machine from said reservoir, timer means controlling the operation of said mechanism and said control means, a manually operable switch in said circuit, said switch being movable into a closed position to condition said circuit for energization by said timer means and being movable into an open position to deenergize said circuit and terminate communication between said machine and said reservoir, a lever actuator for said switch, said timer means further including a cam engaging said lever actuator for automatically opening said switch subsequent to a period of operation of said control means after said agitation cycle.

12. In a washing machine adapted to receive fluid and having an agitation cycle for cleansing articles placed within said fluid, a fluid storage control system comprising, mechanism for pumping said fluid from said machine subsequent to said agitation cycle, control means including an electrical circuit controlling communication between said machine and a fluid storage reservoir for receiving said fluid from said machine for reuse therein, means for returning said fluid to said machine from said reservoir, timer means controlling the operation of said mechanism and said control means, a manually operable switch in said circuit, said switch being movable into a closed position to condition said circuit for energization by said timer means and being movable into an open position to deenergize said circuit and terminate communication between said machine and said reservoir, a panel member on said machine, a lever actuator for said switch on one side of said panel, means on said lever actuator projecting through said panel member to an opposite side of said panel member, a cam member controlled by said timer means and located on said opposite side of said panel member, said cam member engaging said last named means to automatically open said switch subsequent to a period of operation of said control means after said agitation cycle.

13. In a washing machine adapted to contain fluid and having mechanism for pumping said fluid to and from said machine respectively out of and into a storage reservoir, means including an electrical circuit controlling fluid flow out of and into said reservoir, timer means, a manually operable switch movable from a first position into a second position to condition said circuit for energization by said timer means, said timer means controlling the energization of said circuit and the operation of said mechanism, and means actuated by said timer means for shifting said switch from said second position into said first position to deenergize said circuit.

14. In a washing machine adapted to contain fluid and cooperate with a fluid storage reservoir during a cycle of programmed operations of said machine, mechanism for pumping fluid to and from said machine respectively out of and into said reservoir, means including an electrical control circuit controlling fluid flow out of and into said reservoir, timer means controlling the programmed energization of said circuit, a manually operable switch in said circuit movable from a first to a second position, and means actuated by said timer means for shifting said switch from said second position into said first position during said cycle to terminate control of said circuit by said timer means for the remainder of said cycle.

15. In a washing machine adapted to contain fluid and

operable through a cycle of programmed operations, mechanism for pumping fluid from said machine to a storage reservoir, means including an electrical circuit controlling fluid flow between said machine and said reservoir, timer means controlling the energization of said circuit, a manually operable switch in said circuit movable from an open to a closed position to condition said circuit for energization by said timer means, said mechanism pumping said fluid to said reservoir only during energization of said circuit, and means actuated by said timer means after transfer of said fluid from said machine to said reservoir for opening said switch to terminate control of said circuit by said timer means during the remainder of said cycle.

16. A washing machine adapted to cooperate with a fluid storage reservoir and including a tub for receiving fluid from said reservoir, said washing machine including means for performing a series of programmed operations including an agitation operation within said tub, conduit means connected to said tub and adapted to extend into said fluid reservoir for communication therewith, reversible pump means in said conduit means for selectively pumping fluid from said fluid reservoir to said tub and for pumping fluid from said tub to said reservoir, control means including a circuit controlling fluid flow through said conduit means, timer means controlling the operation of said machine including said pump means and said control means during said series of operations, a manually operable switch in said circuit movable into a closed position to condition said circuit for energization by said timer means to permit fluid flow through said conduit means, said timer means energizing said circuit and operating said pump means in one direction prior to the completion of the agitation operation to pump fluid from said reservoir to said tub and energizing said circuit and operating said pump means in a reverse direction after the completion of said agitation operation to pump fluid from said tub to said reservoir, a panel member, a movable member positioned on one side of panel member and including means for moving said switch from a closed to an open position, cam means positioned on the opposite side of said panel member and engaging said movable member, said cam means being driven by said timer means so as to automatically open said switch and thereby preclude further fluid flow through said conduit means after said fluid has been pumped from said tub to said reservoir.

17. A washing machine adapted to cooperate with a fluid storage reservoir and including a tub for receiving fluid from said reservoir, said washing machine including means for performing a series of programmed operations including an agitation operation within said tub, conduit means connected to said tub and adapted to extend into said fluid reservoir for communication therewith, reversible pump means in said conduit means for selectively pumping fluid from said fluid reservoir to said tub and for pumping fluid from said tub to said reservoir, control means including a circuit controlling fluid flow through said conduit means, timer means controlling the operation of said machine including said pump means and said control means during said series of operations, a manually operable switch in said circuit movable into a closed position to condition said circuit for energization by said timer means to prevent fluid flow through said conduit means, said timer means energizing said circuit and operating said pump means in one direction prior to the completion of said agitation operation to pump fluid from said reservoir to said tub and energizing said circuit and operating said pump means in a reverse direction after the completion of said agitation operation to pump fluid from said tub to said reservoir, a panel member provided with an aperture therein, a movable member positioned on one side of said panel member and including means for moving said switch to a closed from an open position, said movable member including an exten-

sion protruding through said aperture, cam means positioned on the opposite side of said panel member and engaging said extension, said cam means being driven by said timer means so as to automatically open said switch and thereby preclude further fluid flow through said conduit means after said fluid has been pumped from said tub to said reservoir.

18. A washing machine adapted to cooperate with a fluid storage reservoir and including a tub for receiving fluid from said reservoir, said washing machine including means for performing a series of programmed operations including an agitation operation within said tub, conduit means connected to said tub and adapted to extend into said fluid reservoir for communication therewith, reversible pump means in said conduit means for selectively pumping fluid from said fluid reservoir to said tub and for pumping fluid from said tub to said reservoir, control means including a circuit controlling fluid flow through said conduit means, timer means controlling the operation of said machine including said pump means and said control means during said series of operations, a manually operable switch in said circuit movable into a closed position to condition said circuit for energization by said timer means to permit fluid flow through said conduit means, said timer means energizing said circuit and operating said pump means in one direction prior to the completion of said agitation operation to pump fluid from said reservoir to said tub and energizing said circuit and operating said pump means in a reverse direction after the completion of said agitation operation to pump fluid from said tub to said reservoir, a panel member provided with an aperture therein, a movable member positioned on one side of said panel member, said movable member including means for moving said switch into its open position to deenergize said circuit, said movable member further including an extension protruding through said aperture in said panel member, an indicia disc driven by said timer means and positioned on the opposite side of said panel member, said disc having an internal cam engaging said extension for automatically opening said switch to preclude further fluid flow through said conduit means after said fluid has been pumped from said tub to said reservoir.

19. In a washing machine operable through a series of washing operations including an agitation operation and adapted to cooperate with a fluid reservoir for the storage of fluids used in said washing machine during said agitation operation, a tub, a conduit connected to said tub and communicating with said reservoir, reversible pump means in said conduit for automatically pumping fluid from said tub toward said reservoir subsequent to said agitation operation and for pumping said fluid from said reservoir toward said tub during the next successive series of washing operations, valve means in said conduit controlling fluid flow therethrough, means including an electric circuit controlling said valve means, a sequential controller controlling the operation of said machine including said pump means and said circuit, a manually operable switch in said circuit movable into a closed position to condition said circuit for energization by said sequential controller to open said valve means and movable into an open position to close said valve means, and means controlled by said sequential controller for automatically opening said switch prior to the conclusion of each series of washing operations to preclude an automatic return of said fluid to said tub by said reversible pump means during the next succeeding series of washing operations.

20. In a washing machine operable through a series of washing operations including an agitation operation and adapted to cooperate with a fluid reservoir for the storage of fluids used in said washing machine during said agitation operation, a tub, a conduit connected to said tub and communicating with said reservoir, reversible pump means in said conduit for automatically pumping

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fluid from said tub toward said reservoir subsequent to said agitation operation and for pumping said fluid from said reservoir toward said tub during the next successive series of washing operations, valve means in said conduit controlling fluid flow therethrough, means including an electric circuit controlling said valve means, a sequential controller controlling the operation of said machine including said pump means and said circuit, a manually operable switch in said circuit movable into a closed position to condition said circuit for energization by said sequential controller to open said valve means and movable into an open position to close said valve means, and means including a cam controlled by said sequential controller for automatically opening said switch prior to the conclusion of each series of washing operations to preclude the automatic return of said fluid to said tub by said reversible pump means during the next succeeding series of washing operations.

21. Suds saving apparatus for a washing machine comprising a fluid container for said washing machine, a suds reservoir, conduit means interconnecting said container and said suds reservoir, a valve in said conduit means controlling communication therethrough, a circuit including means controlling the operation of said valve, reversible pump means in said conduit means for pumping fluid from said container to said reservoir and for pumping said fluid from said reservoir back to said container, timer means controlling the energization of said circuit and the operation of said pump means throughout a series of programmed washing operations, a manually operable suds switch in said circuit movable into a closed position to condition said circuit for energization by said timer means, and means controlled by said timer means for automatically opening said suds switch subsequent to the pumping of said fluid from said container to said reservoir by said pump means.

22. Suds saving apparatus for a washing machine comprising, a fluid container for said machine, a suds reservoir, conduit means interconnecting said container and

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said suds reservoir, a valve in said conduit means controlling communication therethrough, a circuit including means controlling the operation of said valve, reversible pump means in said conduit means for pumping washing fluid from said container to said reservoir and for pumping said fluid from said reservoir back to said tub, timer means controlling the energization of said circuit and the operation of said pump means throughout a programmed washing operation, a manually operable suds switch in said circuit movable into a closed position to condition said circuit for energization by said timer means and means controlled by said timer means including a cam and follower mechanism for automatically opening said suds switch subsequent to the pumping of said fluid from said container to said reservoir by said pump means.

23. Suds saving apparatus for a washing machine comprising, a fluid container for said washing machine, a suds reservoir for receiving and storing fluid received from said fluid container, conduit means interconnecting said container and said reservoir, a valve in said conduit means controlling communication therethrough, a circuit including means controlling the operation of said valve, reversible pump means in said conduit means for pumping washing fluid from said container to said reservoir and for pumping said fluid from said reservoir back to said container, timer means controlling the energization of said circuit and the operation of said pump means throughout a series of programmed washing operations, a manually operable suds switch in said circuit movable into a closed position to condition said circuit for energization by said timer means, a cam follower providing an actuator mechanism for said suds switch, and means including an indicia disc provided with a cam engaging said cam follower and controlled by said timer means for automatically opening said suds switch subsequent to the pumping of said fluid from said container to said reservoir by said pump means.

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