

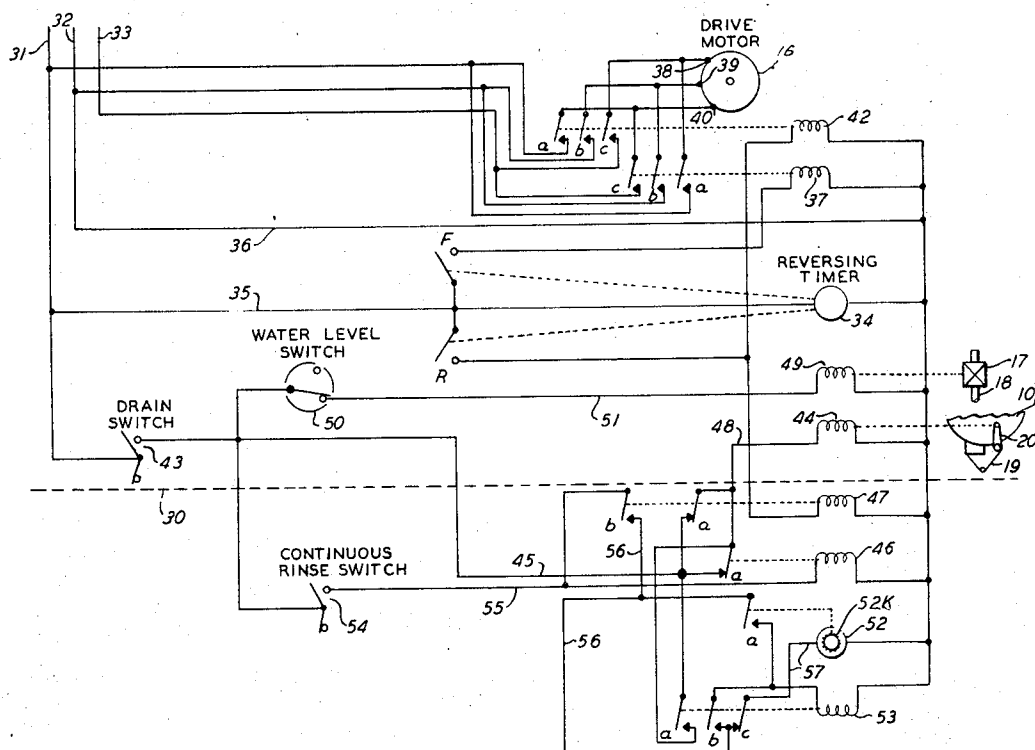
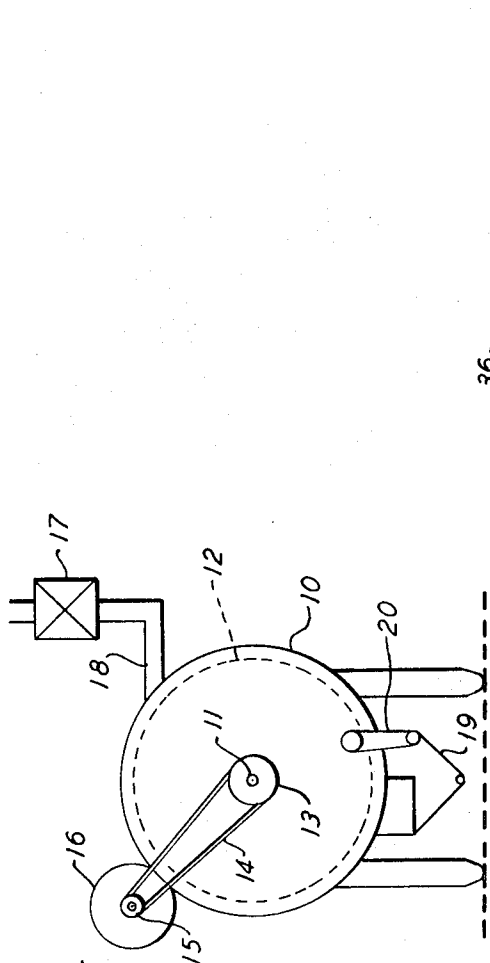


FIG. 1



WATER LEVEL SWITCH

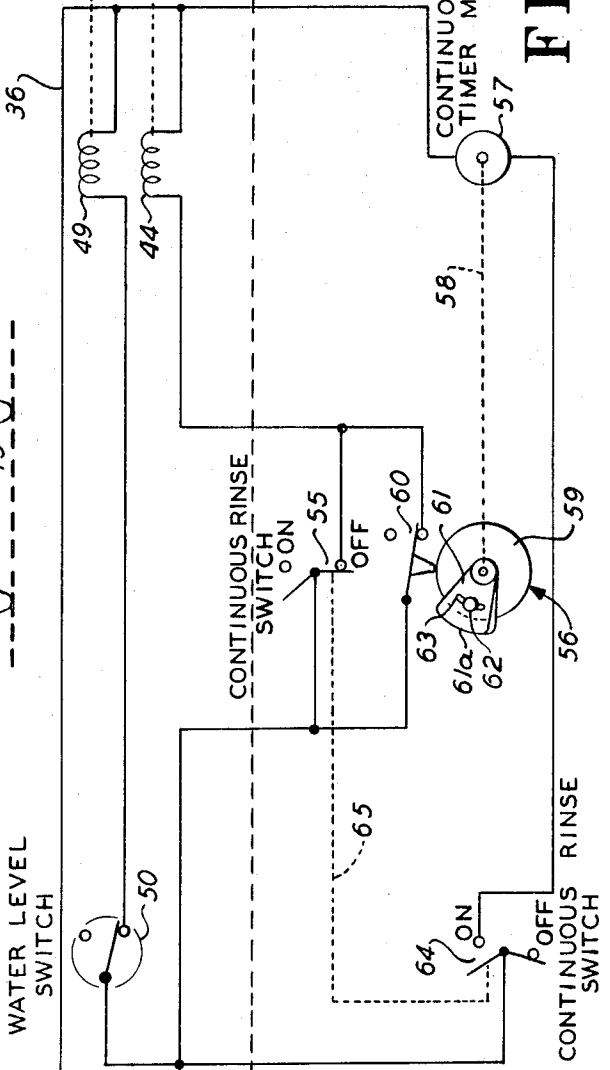
DRAIN SWITCH

CONTINUOUS RINSE SWITCH

CONTINUOUS RINSE SWITCH

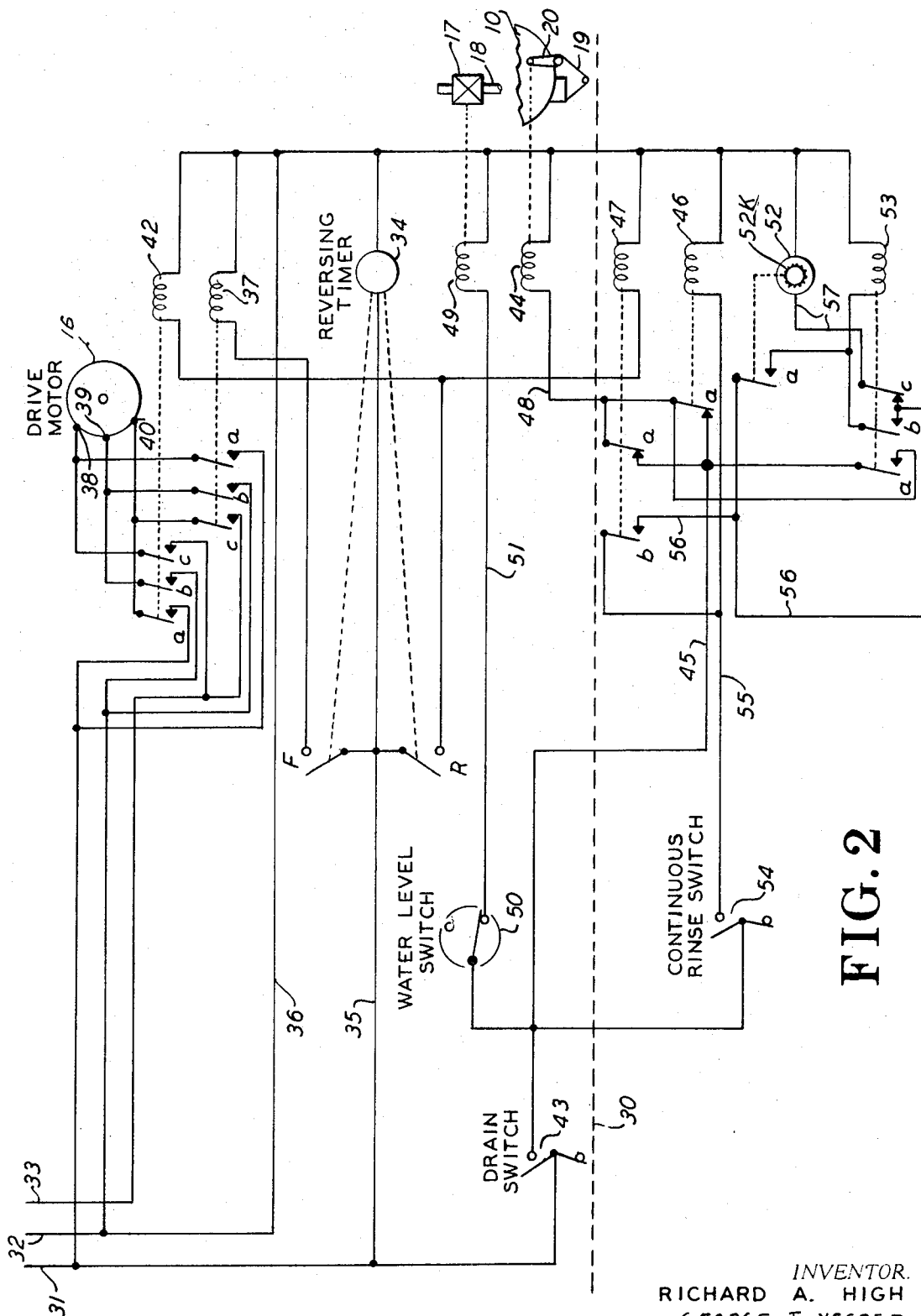
CONTINUOUS RINSE TIMER MOTOR

FIG. 4



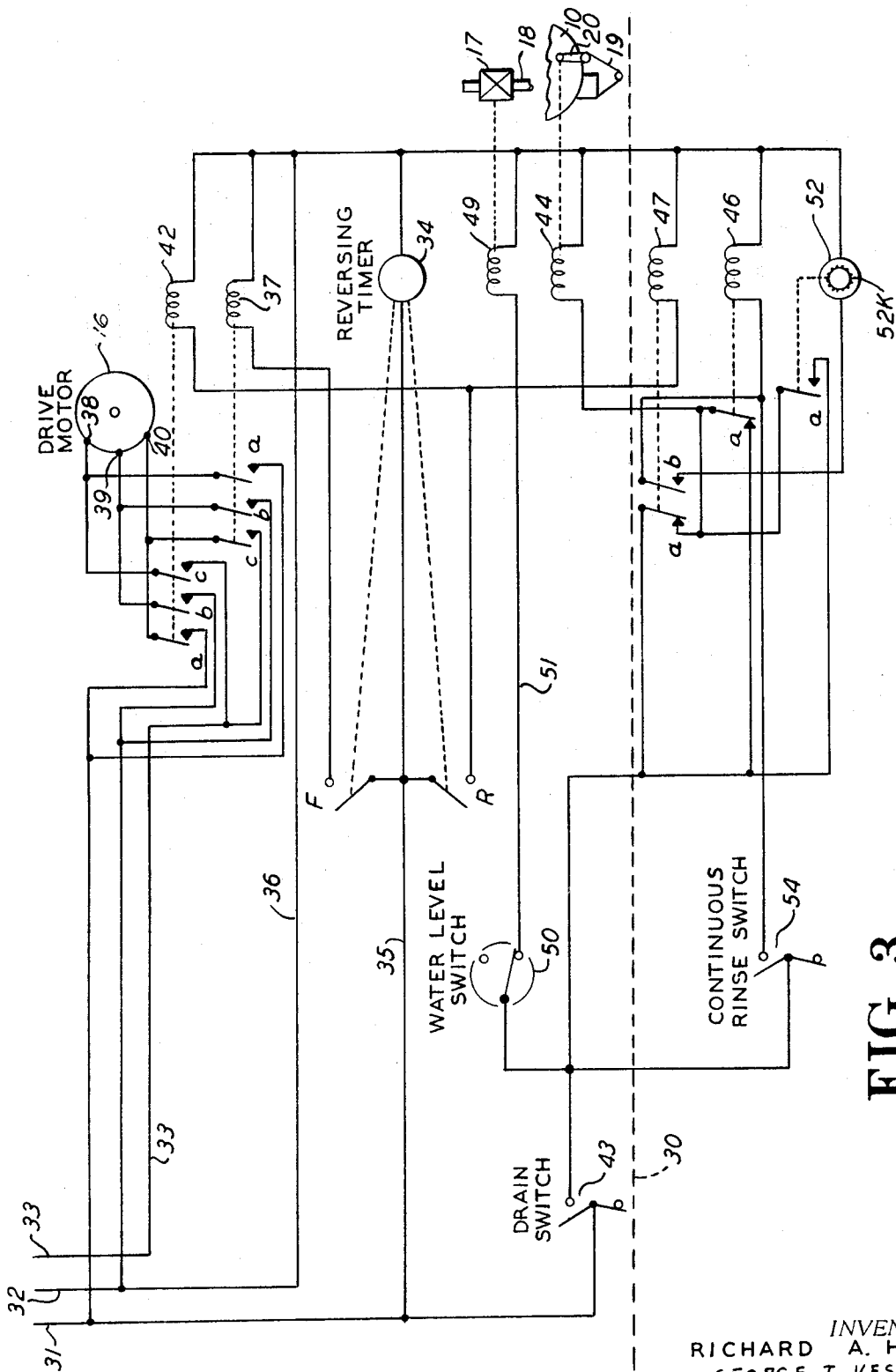
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CONTINUOUS RINSE AND COOL-DOWN CONTROL

In the washing of durable-press fabrics it is known that after the usual hot wash baths there should be a gradual, rather than abrupt, lowering of temperature in the rinse bath. While the disclosure is of simplified form, indicating one source of inlet water, it will be understood that there would conventionally be hot and cold water inlets, with provision for opening each or both, as desired. Accordingly, this rinse system can also be so used as to effect gradual cool-down where wanted, the machine being filled with hot rinse water and then put on continuous rinse with the increments cold (or mixed hot-cold).

An object of the invention is to provide a novel rinse and cool-down control which permits existing washers and washer-extractors of batch rinse type to be modified in a simple and economical manner to operate on a continuous rinse basis.

Another object is to provide such rinse and cool-down control which requires no structural changes but only modification of the electric control circuitry of existing machines.

Another object is to provide a simple and economical rinse and cool-down control which cools the load gradually from a high washing temperature to a suitably low rinsing temperature to protect durable press fabrics from under-going wrinkling.

Another object is to provide such simple and economical rinse and cool-down control which operates to save substantially in time required to carry out effective rinsing operations.

Another object is to provide a continuous rinse control in which the drain valve is opened by the reversing of the drive of the washer and is reclosed by a timer settable to control the flow rate of rinse.

Another object is to fulfill the aforesaid objectives by the addition of only switches, relays and a drain timer to the electric circuitry.

These and other objects and features of the invention will be apparent from the following description and appended claims.

In the description of my invention reference is had to the accompanying drawings, of which:

FIG. 1 is a schematic end view of a washing machine to which our invention pertains;

FIG. 2 is a schematic circuit diagram of a washer circuit with a continuous rinse and cool-down control according to one embodiment of our invention;

FIG. 3 is a schematic diagram of another washer circuit according to a second embodiment of our invention; and

FIG. 4 is a schematic diagram of a simplified washer circuit according to a third embodiment of the invention.

The washing machine to which my invention pertains may be of a standard character comprising an outer cylindrical case 10 having a rotating shaft 11 at its axis carrying an inner rotatable perforated drum 12. The shaft has a pulley 13 at one end coupled by a belt 14 to the drive pulley 15 of a reversible motor 16. Water is supplied to the machine via an inlet valve 17 and pipes 18 connecting to the top of the drum and water is drained from the bottom of the drum via a valve 19 controlled by a drain actuator 20.

The standard portion of the circuit shown in FIG. 2 appears above the dotted line 30. The operation of this standard portion of the machine is as follows: When three phase power is supplied to the three input lines 31, 32 and 33 a timer motor 34 is operated from the lines 31 and 32 via lead lines 35 and 36 to alternately close the F (forward) and R (Reverse) contacts. Closure of the F contacts supplies power to a forward relay 37 from lead wires 35 and 36. Operation of this relay closes its normally open switch contacts *a*, *b* and *c* to complete a three-way line connection from the input lines 31, 32 and 33 to the input terminals 38, 39 and 40 of the drive motor 16. The motor thus turns in its forward direction. When the timer motor 34 shifts to its R position, the relay 37 is dropped to open the connection of the power lines 31, 32 and 33 to the drive motor and a reverse relay 42 is energized from the lead lines 35 and 36. Operation of the reverse relay closes its contacts *a*, *b* and *c* to connect the input line 31 to the motor terminal 40, the input line 32 straight through to the center motor terminal 39 and the input line 33 to the motor terminal 38 whereby to cause the motor to turn in a reverse direction.

Further, the standard portion of the machine includes a drain switch 43 which when closed operates a drain solenoid 44 from power line 31, switch 43, line 45, contact *a* of relay 46, lead wire 48, solenoid valve 44 and lead line 36 to input line 32. The solenoid 44 closes the drain valve 19 when the solenoid is energized. Simultaneously, a supply solenoid 49 is energized via the drain switch 43, water level control switch 50, lead line 51, supply solenoid 49 and lead line 36. Energization of the supply solenoid 49 opens the input valve 17 to cause water to flow into the drum until the water level reaches a preset height to open the water level switch 50 and cut off the supply solenoid 49.

The continuous rinse and cool-down operation is accomplished by adding the relay 46 already mentioned, the relay 47, a timer relay 52 and a relay 53 as well as a continuous rinse switch 54. When the rinse switch 54 is in open position, it opens a circuit of the relay 46 causing its *a* contacts to be closed. This completes the circuit 45-48 from the drain switch 43 to the drain solenoid 44 whereby to cause the drain valve 19 to be closed when the drain switch 43 is closed.

If while the drain switch 43 is closed the continuous rinse switch 54 is closed, the relay 46 is operated to open its *a* contacts in the circuit of the drain solenoid 44. This places the drain solenoid under the control of the normally closed *a* contacts of the relay 47 and the normally open *a* contacts of the relay 53.

If the machine is rotating in the forward direction the reverse switch R is open and the relay 47 is deenergized causing its *a* contacts to be closed. The drain solenoid is then normally energized, to hold the drain valve closed, via the drain switch 43 and the *a* contacts of the relay 47.

When the R switch of the motor timer 34 is closed to reverse the drive motor the relay 47 is energized to open its *a* contacts and drop the drain solenoid 44, thus causing the drain valve 19 to open. At the same time the normally open *b* contacts of the relay 47 are closed to energize the timer relay 52 via the rinse switch 54, lead line 55, *b* contacts of relay 47, lead line 56, *c* contacts of relay 53, lead line 57, timer relay 52 and lead line 36 to input line 32. When the timer relay 52 times out its closes its *a* contacts to energize the relay 53. An adjustable knob 52K permits the timer setting to be varied. When the normally open *b* contacts of the relay 53 are closed, they operate as hold contacts to keep the relay 53 operated. As the normally open *a* contacts of the relay 52 are closed the circuit to the drain solenoid 44 is restored to cause the drain valve to be closed. When the normally closed contact C of the relay 53 is opened it deenergizes the timer 52, which then resets to its starting point. This allows the timer contact *a* to open, but, as noted above, the relay 53 is now kept operated through its holding contact. When the timer 34 shifts next from reverse to forward position, the relay 47 is deenergized to open its *b* contacts and to drop the relay 53.

The overall result of the above-described sequence of operations is that the drain valve 19 is closed when the machine is operated in the forward direction and is opened the instant the machine is operated in the reverse direction. However, the period that the drain valve is held open is determined by the timer 52. By providing a manually adjustable timer the amount of water drained from the machine during each cycle of the timer motor 34 is determined by the timer setting. As water is drained from a present level the water level switch closes to energize the inlet solenoid 49 and start the inflow of water until the water level is restored and the level switch 50 is again opened.

The embodiment of FIG. 3 differs from that of FIG. 2 in that the *a* contacts of the timer 52 are connected directly in the drain circuit and the relay 53 is not required. If both the drain switch 43 and the continuous rinse switch 54 are now closed, the relay 46 is energized opening the *a* contacts in the circuit of the drain solenoid 44. The drain valve 44 is then under the control of the normally closed *a* contacts of relay 47 and normally open *a* contacts of the timer 52 connected in parallel. When the machine is driven in reverse the relay 47 is energized. The resultant opening of the *a* contacts of the relay 47

open the circuit to the drain solenoid, causing the drain valve 19 to open and causing the drain valve to be placed under the control of the normally open *a* contacts of the timer relay 52. Also, when the relay 47 is energized its *b* contacts are closed to start the timer relay 52 running. When the timer relay times out, its *a* contacts are closed to energize the drain solenoid and close the drain valve 19.

When the timer motor 34 next shifts to forward position the relay 47 and timer relay 52 are both deenergized to maintain the drain valve closed. When the drive is reversed another cycle is started causing the drain valve to be again opened for an interval dependent upon the setting of the timer relay 52.

In the embodiment of the invention shown in FIG. 4 the portion of the circuit above the dotted line 30 again represents a standard washer circuit. When power is supplied to the input lines 31 and 36 and the drain switch 43 is closed the drain solenoid 44 is normally energized to close the drain valve 19, as will appear. At the same time the inlet solenoid is energized via the water level switch 50 to open the inlet valve 17. The inflow of water will continue until the level is reached where the water level switch 50 is opened.

A continuous rinse operation is made feasible according to the invention by adding a continuous-rinse switch 55 and a timer 56. The timer includes a motor 57 having a coupling 58 (diagrammatically indicated) to a cam 59. The cam operates a switch 60 biased into closed position as shown. The cam has two overlapping sectors pivoted at the axis of the cam which provides the cam with a raised portion 61a. These sector portions can be shifted apart or towards each other about the axis of the cam to vary the length of the raised portion and are secured in their adjusted positions by a locking screw 62 passing through an arcuate slot 63 in the sectors.

In the standard operation above-described the continuous-rinse switch 55 is in its "off" position completing a circuit from the drain switch 43 to the drain solenoid 44. In this "off" position of the continuous-rinse switch 55 a secondary switch 64, coupled as indicated at 65 to the continuous-rinse switch 55, is in open position to disconnect the continuous-rinse timer motor 57 from the power supply. The timer motor 57 is thus at standstill during standard operation.

When the continuous rinse switch 55 is moved to "on" position while the drain switch 43 is closed, the drain solenoid 44 is placed wholly under the control of the rinse timer switch 60. Further, when the continuous-rinse switch 55 is in "on" position the secondary switch 64 is closed to start the timer motor 57 running. The timer cam 59 is therefore rotated continuously to open the timer cam switch 60 during a portion of each revolution of the cam 59. When the timer cam switch 60 is opened the drain solenoid 44 is deenergized to open the drain valve 19. By adjusting the cam sectors 61 the time that the switch 60 is open during each revolution of the cam 59 is varied. For example, if the timer cam makes one revolution every 30 seconds and the cam sectors are set for 6 seconds, the drain valves 19 will be open for 6 seconds during each 30 second period. The amount of water that is drained from the washing machine during each revolution of the cam switch 59 is therefore determined by the setting of the cam sector 61.

As the water is drained from the machine the water level switch 50 closes to energize the inlet valve solenoid 49 whereby to open the inlet valve 17. The water which is drained from the machine is therefore replenished until the water level rises to the preset level at which the water level switch 50 is opened.

The embodiments of our invention herein particularly shown and described are intended to be illustrative and not necessarily limitative of our invention since the same are sub-

ject to changes and modifications without departure from the scope of our invention, which we endeavor to express accordingly to the following claims.

We claim:

1. In a laundry machine with continuous rinse control: the combination of a tub, a rotatable work-treating drum in said tub, a drive motor for rotating said drum, supply and drain valves for said tub, respective actuating means for said valves, a level control settable to operate when the liquid reaches a present level, and a continuous rinse control means including a rinse control movable between "on" and "off" positions, a drive reversing timer for periodically changing the direction of said drive motor, means rendered operative when said rinse control is in "on" position to open said drain valve when the direction of said drive motor is changed, means responsive to said level control for opening said supply valve to replenish the liquid in said tub when the liquid falls below said preset level, and a drain timer for closing said drain valve a predetermined interval after each opening thereof.
2. The laundry machine as set forth in claim 1 including means to open said drain valve each time said drive motor is reversed from its forward direction.
3. The laundry machine set forth in claim 2 including adjustable means for changing the setting of said timer and means rendered operative by said drive reversing timer when said motor is started in the other of its two directions for closing said drain valve in the event the same has not already been closed by said timer.
4. The laundry machine set forth in claim 2 including a solenoid energizable to close said drain valve, an on-off drain switch in the circuit of said drain solenoid, a second switch in said solenoid circuit standing normally closed, and means for opening said second switch responsive to said drive reversing timer moving to a reverse position causing the drive motor to start in said other of its two directions.
5. The laundry machine set forth in claim 4 including a third normally closed switch in parallel with said second switch, and means operative to open said third switch when said rinse control is moved to "on" position.
6. The laundry machine set forth in claim 5 including a fourth normally open switch in parallel with both said second and third switches, a manually settable drain control timer, means to start said drain control timer responsive to said drive reversing timer moving to start said drive in said one of its two directions, and means operated by said drain control timer for closing said fourth switch a preset interval after said drain control timer is started.
7. The laundry machine set forth in claim 6 including means for cutting off the current supply to said drain control timer responsive to said drive reversing timer shifting to start said drive in said other of its two directions.
8. A laundry machine comprising a cylindrical tub, a rotatable perforated drum in said tub journaled at the axis thereof, a reversible drive motor for rotating said drum, supply and drain valves connected to said tub, respective actuating solenoids for said valves, a water level control settable to operate when the water reaches a predetermined level, a drive reversing timer for periodically shifting said drive motor between forward and reverse directions, means responsive to said reversing timer moving to reverse position for opening said drain valve, a drain control timer started by said reversing timer when the same is moved to reverse position for causing said drain valve to be closed a predetermined interval after it is opened, and means responsive to said reversing timer moving to forward position for cutting off the current supply to said drain control timer.

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