

Sept. 21, 1948.

H. BAADE

2,449,634

AUTOMATIC WASHING MACHINE

Filed June 10, 1946

4 Sheets-Sheet 1

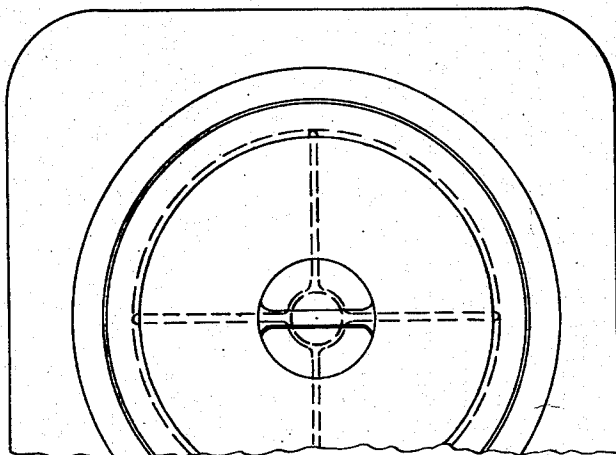


Fig. 2

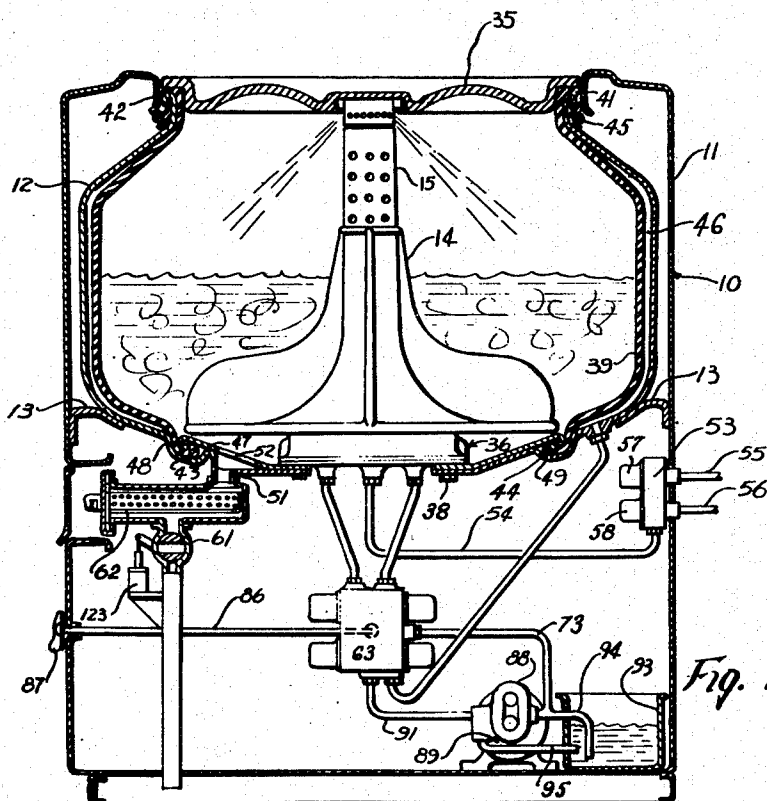


Fig. 1

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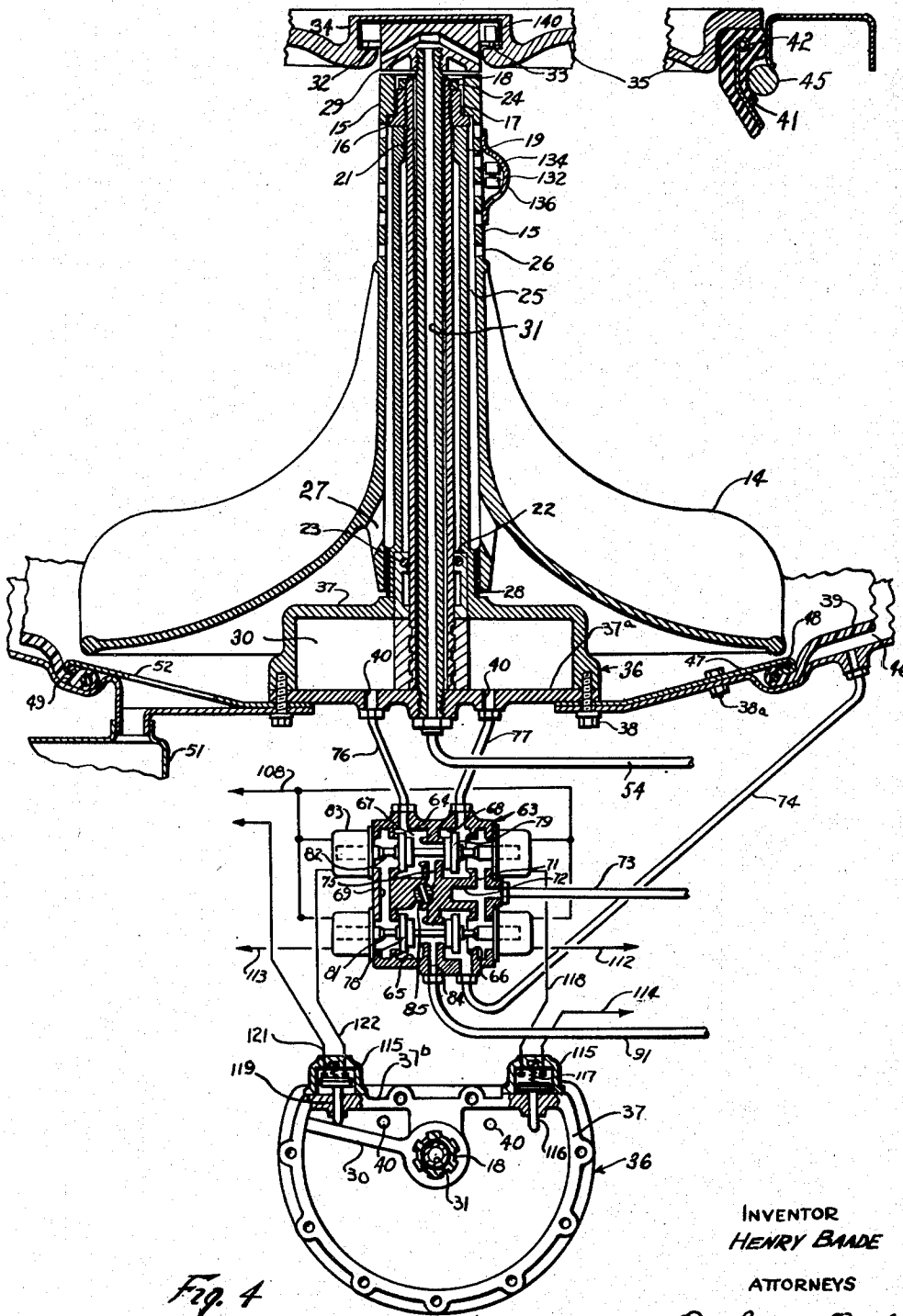
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4 Sheets-Sheet 3

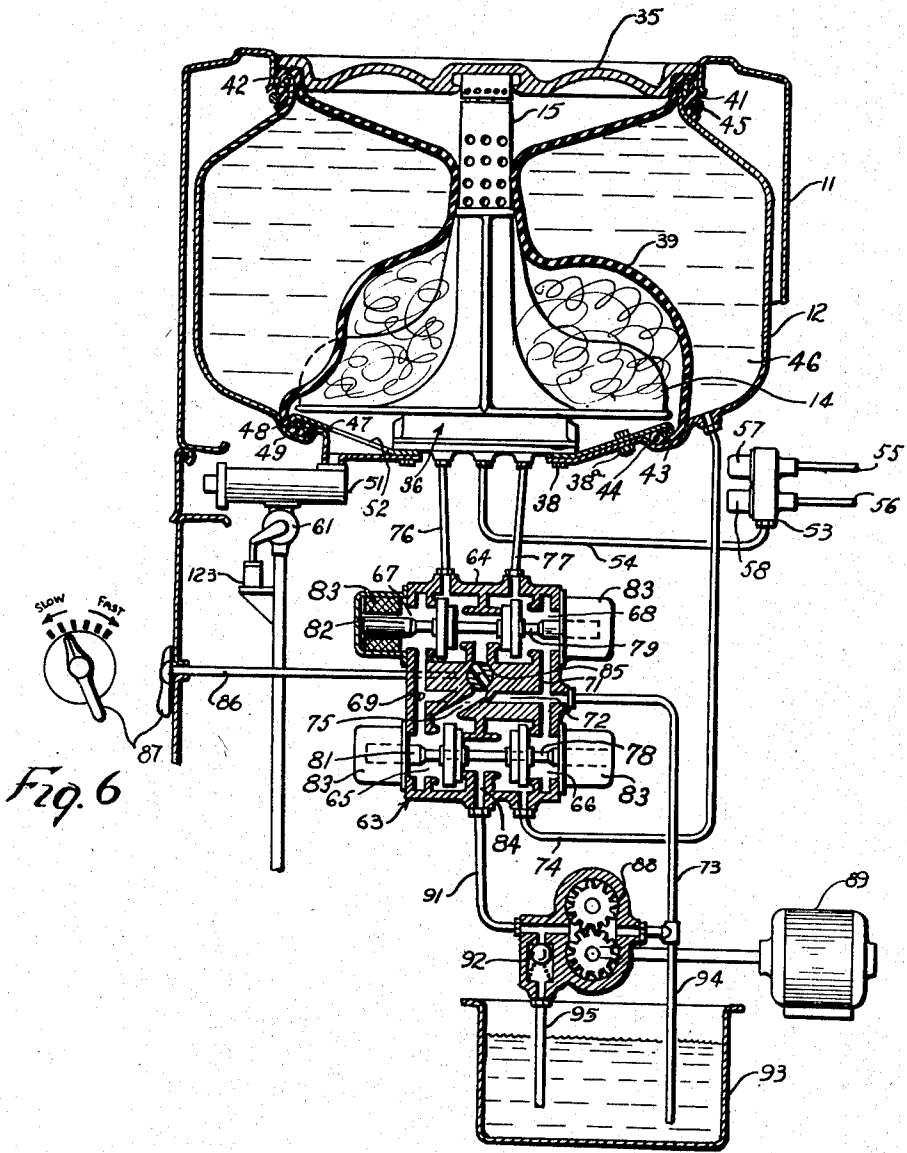


Fig. 3

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4 Sheets-Sheet 4

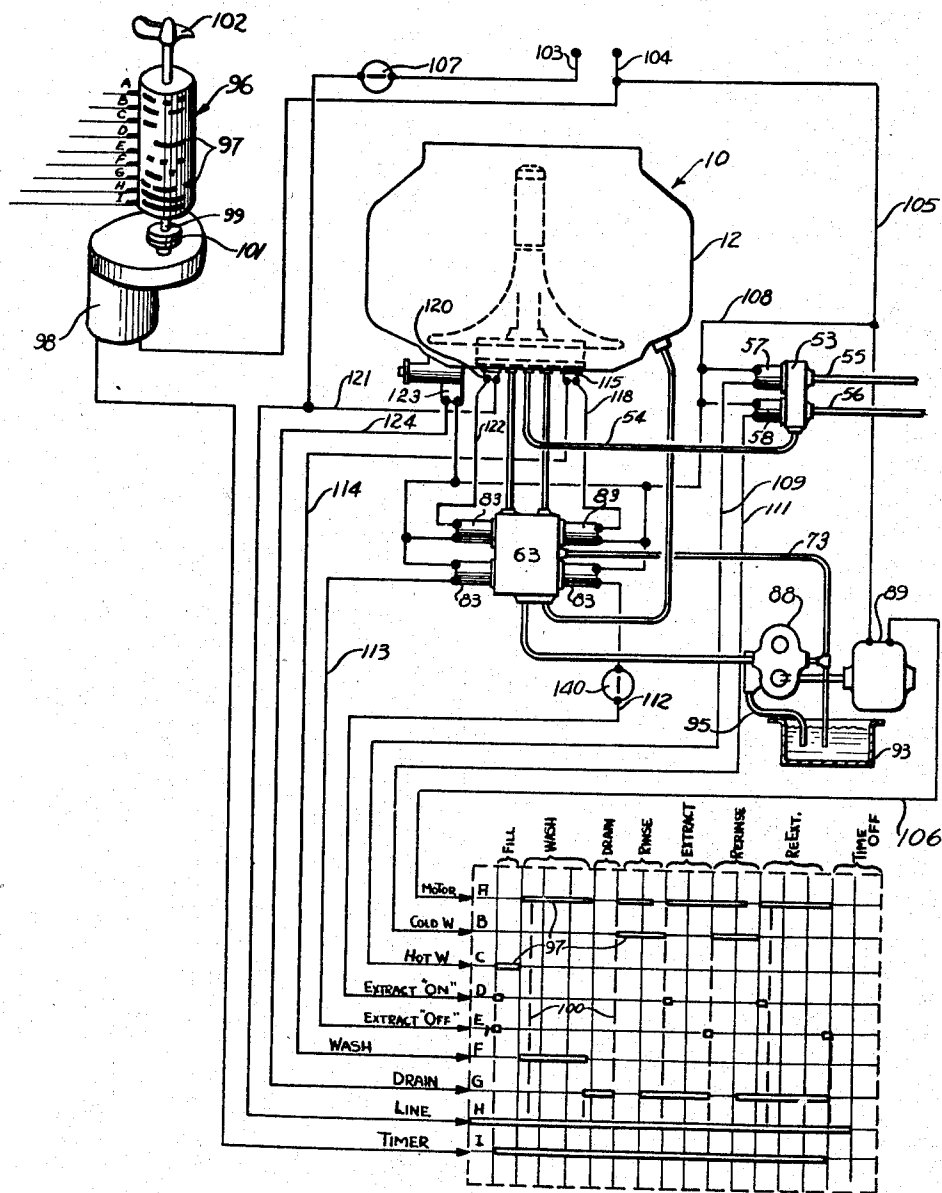


Fig. 5

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2,449,634

AUTOMATIC WASHING MACHINE

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Application June 10, 1946, Serial No. 675,540

11 Claims. (Cl. 68—12)

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This invention relates to washing machines, especially to a washer adapted to be automatically operated through a predetermined cycle.

Heretofore, various types of automatic washing machines have been provided and they have been received with varying degrees of approval by the trade. Many of such washers have been electrically operated and have used considerable electrical equipment of varying degrees of complexity. Such washers are quite expensive, may not have a satisfactory water extraction action, are too subject to mechanical failure, are difficult to repair, or may be objectionable for other reasons.

Some hydraulically operated washers also have been provided in the past and such washers have been subject to valve failure, low operational pressures, and fluid leakage, as well as other faults.

The general object of this invention is to avoid and overcome the foregoing and other disadvantages of and objections to known types of washing machines and to provide a well constructed, electrically controlled automatic washing machine which is operated by relatively uncomplicated valves and electrical apparatus.

Another object of the invention is to provide an electrically controlled, automatic, hydraulic washing machine.

Another object of the invention is to provide an automatic washing cycle which can be manually varied, when desired.

Another object of the invention is to utilize a closed flow fluid circuit in an automatic washer.

Another object is to use a fluid pressure source for both intermittent motor operation and fluid extraction action.

The foregoing, and other objects of the invention which will become apparent as the description proceeds, are achieved by the provision of a tub, an agitator member journaled in the tub for oscillatory movement, a hydraulic motor secured to the agitator for oscillating same, control means associated with the motor for regulating the movement thereof, a multi-section electrically operated control valve, a drain pipe, a solenoid controlled valve in the drain pipe, a timer switch connected to the control valve and adapted to position various sections thereof as desired at predetermined portions of an operative cycle to effect desired operation, automatic means for controlling the position of the timer switch, means connecting the control valve to the motor for operation thereof, means connecting the timer switch to the solenoid valve for actuating same to drain the tub at predetermined

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points in a cycle, a thermostat regulated mixing valve, water supply lines connected to the mixing valve, means connecting the mixing valve to the tub for filling same, means connecting the timer switch to the mixing valve for controlling same, a flexible diaphragm secured within the tub at the upper and lower extremities thereof to form an enclosure therewith, means connecting the control valve to the enclosure within the tub so that fluid can be inserted therein to expand the diaphragm so as to force it against material in the tub and expel fluid therefrom, and pressure booster means provided in a closed flow circuit including the last named means, the control valve and said hydraulic motor.

For a better understanding of the invention, attention is now directed to the accompanying drawings, wherein:

Fig. 1 is an elevation, partly in section, of an automatic washing machine embodying the principles of my invention, which elevation has the electric wiring omitted therefrom;

Fig. 2 is a fragmentary plan of the machine of Fig. 1;

Fig. 3 is an enlarged fragmentary elevation, partly in section, of the machine of Fig. 1 with the rubber sleeve in its fluid extracting position.

Fig. 4 is a sectional elevation, partly diagrammatic, of the agitator and its mounting and control apparatus;

Fig. 5 is a wiring diagram of the washing machine of my invention; and

Fig. 6 is a front elevation of the washing speed control of the invention.

Referring now more specifically to the drawings, there is shown an automatic washer indicated generally by the numeral 10, which washer includes a suitably constructed frame or casing 11 that mounts a wash tub 12 therein by brackets 13. Usually both the casing 11 and tub 12 are made from sheet metal which is formed to the desired shape and sections thereof are secured together by reinforcing members, welding, or other means. An agitator 14, having a tubular central portion 15, with a shoulder 16 formed at the upper end of its bore is supported in the tub 12 by a flanged drive collar 17 that engages with the shoulder 16. This drive collar 17, in turn, engages with the upper end of a tubular drive spindle 18 that is vertically positioned in the tub within a tubular support member 19 fixedly associated with the tub. The collar 17 may also be at least partially supported on the upper end of the support member 19 and it is connected to the agitator 14 for unitary arcuate

movement usually by forming the upper end of the collar 17 with a square or polygonal section which snugly fits in a complementary hole in the agitator portion 15.

Fig. 4 also shows that suitable bearings 21 and 22 are provided within the support 19 for the spindle 18 and a packing ring 23 may be carried by the bearing 22. A lock nut 24 is secured to the end of the spindle 18 to retain the drive collar 17 in position and a tubular chamber 25 is provided between the tubular portion 15 of the agitator 14 and the support member 19 so that any fluid trapped in the upper portion of the tub 12 can enter the chamber 25 through drain holes 26 in the tubular portion 15 of the agitator and flow into the bottom of the tub for draining through holes 27 provided in the lower end of the tubular portion 15. Suitable bearings 28 are provided in the lower section of the tubular portion 15 and on the support member 19 to position the lower end of the agitator.

In order to supply fluid to the tub, clean the inside of the tub 12 after a washing action and to obtain good rinsing action, a fluid inlet and spray head 29 is mounted in the tub at the upper portion thereof by an inlet tube 31 which is stationarily positioned within the drive spindle 18. As the invention contemplates setting up appreciable pressures within the tub 12 for extraction of liquid from articles within the tub, a feature of the invention resides in the provision of diametrically opposed bayonet lugs 32 on the spray head 29. These lugs 32 engage with a sectional bayonet lug seat 33 formed at the base of a boss 34 formed on a cover 35 for the tub to secure the cover assembly to the tub.

The spindle 18 may be driven in any desired manner but I prefer to use a hydraulic motor 36 for such purposes. The motor 36 is positioned on the inside of the bottom of the tub 12 and it includes a substantially annular housing 37 which has a flat end portion 37^a and that is removably secured to the tub by screws 38. The support member 19 may be formed integrally with the housing 37 as shown. The motor 36 has a radially extending vane 30 which divides the housing into two non-communicating chambers, and which is suitably secured to the spindle 18. Liquid inlet and outlet ports 40 are provided in opposed sections of the housing 37 adjacent the end section 37^a for introduction of liquid under pressure, and for drain of spent liquid from the housing so as to oscillate the vane 30.

As best seen in Figs. 1 and 3, the liquid extraction means provided in the invention comprises an expansible rubber sleeve or diaphragm 39 that is contoured so as to fit snugly within the tub 12 and covers the sides thereof. The sleeve 39 has a thickened, doubled back flange 41 formed on its upper edge for engagement with a bead 42 formed on the upper edge of the tub and a thickened bottom edge flange 43 which may carry a wire reinforcement 44 therein. The flange 41 extends downwardly of the upper edge of the tub and is suitably secured thereto, as by the metal clamping ring 45. The lower edge of the sleeve is secured to the tub to form a liquid tight expansible chamber 46 with the wall thereof by a dished anchor plate 47. The plate 47 is shown as having a beaded edge 48 that engages the flange 43 and secures it in an annular recess 49 formed in the lower portion of the tub. The screws 38, and 38^a secure the plate 47 in position. A suitable drain 51 is provided for the

tub 2 and the anchor plate 47 is apertured at 52 to pass liquid from the tub to the drain.

So that the temperature of liquid supplied to the tub 12 can be controlled, it usually is desirable to provide a conventional thermostat controlled mixing valve 53 that connects to the inlet tube 31 by a conduit 54. Suitable hot and cold liquid supply lines 55 and 56 connect to the valve 53 and solenoids 57 and 58, respectively, are associated with the valve 53 for controlling the individual opening and closing of the lines 55 and 56 so that all hot, or all cold liquid, as well as mixtures thereof, may be supplied to the washer 10. An automatic control for the solenoids 57 and 58 will be described hereinafter.

The draining of liquid from the tub 12 by the drain 51 is controlled by an electrically operated valve 61 which has a solenoid 123 associated with it for positioning same. A lint screen 62 is removably secured in the drain 51.

A multi-chambered control valve 63 is provided for the hydraulic motor 36 and for the liquid extraction action, which valve comprises a substantially rectangular valve body 64 having two pairs of axially opposed chambers 65, 66, 67 and 68 formed therein. Each chamber of both pairs of chambers has openings in its inner and outer ends aligned with similar openings in its companion chamber and with the inner surface of both ends of the chambers forming valve seats. The valve body has connecting conduits 69 and 71 formed therein extending between the outer ends of chambers 65 and 67, and 66 and 68, respectively. The conduits 69 and 71 are connected by a transversely extending conduit 72 that connects to a drain line 73 for removal of liquid from the valve. The chamber 66 is connected to the extractor chamber 46 by a line 73 and its associated chamber 65 connects to a feed conduit 75 for the other pair of chambers, which chambers 67 and 68 are connected to the hydraulic motor by lines 76 and 77 and form a closed circuit therewith which returns fluid to the valve, as explained more fully hereinafter.

A liquid inlet opening 84 for the valve 63 is connected to the valve between the pair of chambers 65 and 66 for liquid supply and flow of liquid through the valve is controlled by tandem valves 78 and 79 individually mounted in each of the pairs of chambers for axial movement therein to seal opposite ends of the chambers at the extremities of movement of the tandem valves. It is to be noted that the unequal areas of the high and low pressure sides of the tandem valves are important for the reasons that the unequal areas insure positive seating of the valves in either direction of movement, and yet permit ready movement of the valves due to the almost counter-balanced pressure on the valves. Moreover, the valve closing movement is with a snap type of action. The tandem valves have shafts 81 and 82 respectively extending therebeyond from both ends thereof and solenoid coils 83 are positioned around the valve shaft ends for controlling the positions of the tandem valves 78 and 79. The coils 83 are automatically energized as explained hereinafter. It will be seen that liquid flow through the valve 63 may go to either of the two loads, namely the agitator motor or the expansion chamber controlled thereby, but that the tandem valve 78 prevents simultaneous flow to the loads when it is positioned at either extremity of its movement. An adjustable rotary valve 85 may be provided in the feed conduit 75 to control the rate of liquid flow to the chambers 67 and

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68 and thence to the motor 36. In this way the agitating speed of the motor 36 can be controlled to provide the best operating speed for any given type of clothes to be washed. A control shaft 86 is suitably secured to the valve 85 and extends to a point outside the casing 11 where a readily available control handle 87 is provided. An indicator scale marked in terms of speed or type of clothes to be washed, or both, is formed on the casing 11 adjacent the handle 87 to indicate the control action and position of the valve 85.

As it usually is desirable to use the liquid in the washer 10 under greater pressures than those normally available in households, a self priming pressure pump 88 of conventional design is provided. The pump 88 is driven by a suitable electric motor 89 and it connects to the inlet 84 of the valve 63 by line 91. Fig. 3 shows that a safety valve such as the poppet valve 92 is provided in the pump 88 on its pressure side. To reduce the cost of operation, a closed liquid flow circuit is provided in the washer 10, which circuit includes a storage tank 93 that connects to the inlet of the pump 88 by a line 94 which also connects to the drain line 73 of the valve 63. The valve 92 likewise may connect to the tank 93 by a line 95. Instead of the pump 88, the line 91 may be directly connected to the household water supply, and with a pressure booster being used of the type described and claimed in my copending application, Serial No. 661,963, filed April 13, 1946, and entitled "Automatic washing machine."

Control and operation

In order to operate the washer 10 automatically through a predetermined cycle of desired washing action, an electric timer rotor switch 96 is provided and it carries a plurality of contacts 97 on its outer surface, which surface is made of any suitable insulating material. Any desired means, such as an electric motor 98 may connect to a support shaft 99 for the switch 96 through gears (not shown) and an overrunning clutch 101 which is adapted to permit manual movement of the switch 96 by a control handle 102 secured thereto. The handle 102 is positioned outside of the top or side of the casing 11, for example, in association with the handle 87. A plurality of stationary contacts A, B, C, D, E, F, G, H, and I are positioned so as to bear on the rotor switch 96 and close circuits through the contacts 97 to perform the various operations indicated as contacts 97 are brought into proper position with relation to the stationary contacts. Fig. 5 best shows that connector strips 100 connect each of the contacts 97 to the line contact which is associated with the stationary control H.

Power is supplied to the washer by leads 103 and 104 which connect to a suitable power source and with the lead 103 connecting to the stationary contact H for continuous supply of one side of a power source to all of the contacts 97 on the rotor switch 96. The other lead 104 connects through the motor 98 to the contact I and through leads 105 and 106 to the motor 89 and to the contact A. Thus the pressure pump 88 operates whenever any contacts 97 engage the stationary contact A, which is during the agitation and extraction periods as well as the greater portion of the rinsing actions. A control switch 107 is provided in the lead 103 by which the washer 10 may be started and stopped at any desired time, usually between cycles of operation. Lead 105 has a lead 108 connecting it to one side of each of the controls for the mixing valve 53,

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the control valve 63, and the drain valve 61. Then leads 109 and 111 connect the opposite sides of the solenoids 57 and 58 of the mixing valve to the stationary contacts B and C, respectively, of the rotor switch 96 for operation of the hot and cold liquid inlets at the proper points in an operational cycle, usually hot liquid for the washing step and cold for the rinsing actions. By use of the thermostat control valve 53 both the hot and the cold inlets may be opened simultaneously, as during the initial filling of the tub, but this possibility is not used in the connection shown in Fig. 5.

Leads 112 and 113 connect the solenoid coils 83 of the valve chambers 66 and 65, respectively, to the stationary contacts D and E, respectively so that when the contact 97 on the switch adapted to engage with the stationary contact D strikes it, the coil 83 associated with valve chamber 66 is energized and this pulls the tandem valve 78 to its innermost position with relation to such chamber. Such position of the valve 78 permits flow of liquid from the valve 63 only to the expandible chamber 46. When liquid under pressure is conducted, as just described to the expandible chamber 46 it will be understood that the rubber sleeve or diaphragm 39 is pressed inwardly to squeeze the water from the clothes in the washer, the squeezed out water flowing out holes 26 or out under the agitator 14 to the drain 51. The tandem valve 78 is snapped to its other position when the stationary contact E meets its cooperative contact 97 on continued switch rotation so that liquid then will be available for flow through the conduit 75 to the valve chambers 67 and 68, and to the motor 36 to effect oscillation of the agitator and the washing of the clothes.

Hydraulic motor operation is controlled by stationary contact F which is connected by lead 114 to a switch 115 having a movable, but insulated, contact member 116 that is positioned for axial movement in the end section 37^a of the motor housing. The vane 30 of the motor is adapted to move the insulated contact member 116 outwardly of the housing against the resistance of a spring 117 to close a circuit between the lead 114 and a second lead 118 which connects to the solenoid coil 83 associated with the chamber 68 and close a circuit therethrough. Such coil 83 then pulls the tandem valve 79 into it and opens a flow circuit to the housing 37 intermediate the vane 30 and the portion of the motor chamber adjacent the switch 115. Flow of liquid to the motor continues in such manner until the vane 30 strikes an insulated contact 119, similar to the contact 116 of a switch 120 and forces it to connect against the ends of leads 121 and 122. Lead 121 connects to the lead 103 while lead 122 connects to one side of the coil 83 associated with the chamber 67, the other side of such coil being connected to lead 104 through leads 108 and 105 so that power is continuously available at the switch 120. The closing of contact 116 energizes the solenoid coil of the chamber 67 to draw the tandem valve 79 therein and reverse the flow of liquid under pressure supplied to the chambers 67 and 68 by the conduit 75. This then drives the vane back towards the switch 115 and the oscillatory cycle is repeated. Liquid in the housing 37 at the end of each power stroke drains therefrom through the valve chamber 67 or 68 connected thereto and then back through the outer end of the associated chamber to the drain 73 which returns the liquid to the pump 88 or the storage tank 93.

The drain control contact G connects to a solenoid 123 associated with the drain valve 61 by lead 124 to open the drain at the periods indicated in Fig. 5 since the other side of the solenoid 123 is connected to a live or hot branch of the lead 108 which is connected with the other side of the power source.

In order that the rotor switch is only driven through one cycle and then automatically stopped, the line contact and the timer contact which engage the stationary contacts H and I, respectively, do not extend completely around the switch. Thus the switch must be manually turned to starting position to operate the washer 10 through its predetermined cycle.

It may be advisable to include a float valve or other means for operating a suitable water level limiting device to shut off the cold or hot water inlet valves after the tub is filled to a desired level. For example, a float 132 and an electric switch 134 operated by the float can be housed in a half round blister cover 136 secured to the tubular portion of the agitator 14 just above the lowest drain holes 26 to achieve this purpose. The switch will also act as a safety means to prevent overflowing during the rinsing cycle should this be done with the lid off. The switch 134 may be connected in various ways, but one of the simplest is to merely connect it so that it will operate solenoid 123 to open drain valve 61 until the water level drops below the float 134, or until the control 96 takes over its normal function to open drain valve 61.

Another structural feature to be noted is that the cover or lid 35 makes a liquid and air tight seal with the top of the tub, and it is therefore necessary to provide a small air vent in the top of the cover to allow the escape of air during the filling of the tub with water, and to admit air during the draining of the tub.

Also, a safety switch 140 is mounted on the spray head 29 which is adapted to be operated by one of the bayonet lugs 32 when the cover 35 is locked in place over the tub. The switch 140 is in series with the electric circuit operating the extraction or pressure squeeze valve. Thus, overinflation and damage to the diaphragm 39 is avoided inasmuch as the extraction cycle will not proceed unless the cover 35 is locked tightly on the tub.

From the foregoing description it is seen that an economical, automatic hydraulic washer is provided and that uncomplicated, positive acting controls are provided. The washer is adapted for a long operative life with a minimum of upkeep.

What is claimed is:

1. An automatic washer comprising a tub having a cover secured thereto, an agitator member journaled in said tub for oscillatory movement, a hydraulic motor secured to said agitator for oscillating same, an electrically operated control valve having two tandem valves received in two pairs of opposed valve chambers formed therein, a drain pipe, a solenoid operated valve in said drain pipe, a timer switch for controlling the operation of the automatic washer, means connecting said timer switch to said control valve and adapted to position the tandem valves thereof as desired at predetermined portions of an operative cycle to effect desired operation, automatic means controlled by said timer switch for rotating same through a cycle, means connecting said control valve to said motor for flow of liquid thereto for operation thereof and for receiving spent liquid from said motor, means connecting

said timer switch to said solenoid valve for actuating same to drain said tub at predetermined points in a cycle, liquid supply means, means connecting said liquid supply means to said tub for filling same and being operated by said timer switch, a flexible diaphragm secured within said tub at the upper and lower extremities thereof to form an enclosure therewith, means connecting said control valve to the enclosure within said tub so that liquid can be inserted therein to expand said diaphragm so as to force it against material in said tub and expel liquid therefrom, and pressure booster means connected to said control valve for receiving liquid therefrom and supplying liquid under pressure thereto, said control valve and said hydraulic motor and the enclosure formed by said flexible diaphragm forming with their connecting means a closed liquid flow circuit.

2. An automatic washer comprising a tub having a cover secured thereto, an agitator member journaled in said tub for oscillatory movement, a hydraulic motor secured to said agitator for oscillating same, an electrically operated control valve having two tandem valves received in two pairs of opposed valve chambers formed therein, drain means for said tub, a timer switch for controlling the operation of the automatic washer, means connecting said timer switch to said control valve and adapted to position the tandem valves thereof as desired at predetermined portions of an operative cycle to effect desired operation, automatic means controlled by said timer switch for rotating same through a cycle, means connecting said control valve to said motor for flow of liquid thereto for operation thereof and for receiving spent liquid from said motor, means connecting said timer switch to said drain means for actuating same to drain said tub at predetermined points in a cycle, liquid supply means, means connecting said liquid supply means to said tub for filling same and being operated by said timer switch, a flexible diaphragm secured within said tub at the upper and lower extremities thereof to form an enclosure therewith, means connecting said control valve to the enclosure within said tub so that liquid can be inserted therein to expand said diaphragm so as to force it against material in said tub and expel liquid therefrom, and pressure booster means connected to said control valve for receiving liquid therefrom and supplying liquid under pressure thereto.

3. An automatic washer comprising a tub, an agitator member journaled in said tub for oscillatory movement, a hydraulic motor secured to said agitator for oscillating same, control means associated with said motor for regulating the movement thereof, a multi-section electrically operated control valve, a drain pipe, a solenoid controlled valve in said drain pipe, a timer switch connected to said control valve and adapted to position various sections thereof as desired at predetermined portions of an operative cycle to effect desired operation, automatic means for controlling the position of said timer switch, means connecting said control valve to said motor for operation thereof, means connecting said timer switch to said solenoid valve for actuating same to drain said tub at predetermined points in a cycle, a thermostat regulated mixing valve, water supply lines connected to said mixing valve, means connecting said mixing valve to said tub for filling same, means connecting said timer switch to said mixing valve for controlling same,

a flexible diaphragm secured within said tub at the upper and lower extremities thereof to form an enclosure therewith, means connecting said control valve to the enclosure within said tub so that fluid can be inserted therein to expand said diaphragm so as to force it against material in said tub and expel fluid therefrom, and pressure booster means provided in a closed flow circuit including said last named means, said control valve and said hydraulic motor.

4. An automatic washer comprising a tub, an agitator member journaled in said tub for oscillatory movement, a hydraulic motor secured to said agitator for oscillating same, a multisection electrically operated control valve, a drain pipe, an electrically controlled valve in said drain pipe, a timer switch connected to said control valve and adapted to position various sections thereof as desired at predetermined portions of an operative cycle to effect desired operation, automatic means for controlling the position of said timer switch, means connecting said control valve to said motor for operation thereof, means connecting said timer switch to said drain valve for actuating same to drain said tub at predetermined points in a cycle, fluid supply means, means connecting said fluid supply means to said tub and operated by said timer switch for filling said tub, a flexible diaphragm secured within said tub at the upper and lower extremities thereof to form an enclosure therewith, means connecting said control valve to the enclosure within said tub so that fluid can be inserted therein to expand said diaphragm so as to force it against material in said tub and expel fluid therefrom, and pressure booster means provided in said last named means.

5. An automatic washer comprising a tub, an agitator member journaled in said tub for oscillatory movement, a hydraulic motor secured to said agitator for oscillating same, drain means for said tub, a multi-section electrically operated control valve, a timer switch connected to said control valve and adapted to position various sections thereof as desired at predetermined portions of an operative cycle to effect desired operation, automatic means for controlling the position of said timer switch, means connecting said control valve to said motor for flow of liquid thereto for operation thereof, said last named means and control valve being adapted to transmit liquid under pressure to said motor for operation thereof and to drain liquid from said motor after the pressure on such liquid is spent, means connecting said timer switch to said drain means for actuating same to drain said tub at predetermined points in a cycle, liquid supply means, means connecting said liquid supply means to said tube for filling same and being operated by said timer switch, means in said tub for extracting liquid from material in said tub, means connecting said last named means to said timer switch for control of operation thereby, and means for supplying liquid under pressure to said control valve.

6. An automatic washer comprising a tub, an agitator member positioned in said tub for movement therein, a hydraulic motor secured to said agitator for driving same, a multi-section electrically operated control valve, electrically controlled drain means for said tub, a driven timer switch connected to said control valve and adapted to position various sections thereof as desired at predetermined portions of an operative cycle to effect desired operation, means con-

necting said control valve to said motor for flow of fluid under pressure thereto for operation thereof and for receiving spent fluid from said motor, means connecting said timer switch to said drain means for actuating same to drain said tub at predetermined points in a cycle, fluid supply means, means connecting said fluid supply means to said tub for filling same and having flow therethrough controlled by said timer switch, and means for supplying fluid under pressure to said control valve.

7. A washer as in claim 6 wherein a flexible diaphragm is secured within said tub at the upper and lower extremities thereof to form an enclosure therewith; means are provided to connect said control valve to the enclosure within said tub so that fluid can be inserted therein to expand said diaphragm so as to force it against material in said tub and expel fluid therefrom; and pressure booster means are provided in said fluid pressure supply means; said control valve, motor, pressure booster, and enclosure formed by said flexible diaphragm being connected to form a closed flow fluid circuit.

8. In an automatic washer; the combination of a tub having an agitator journaled therein; means secured within said tub for forming an expansible chamber therein; a hydraulic motor for reciprocating said agitator; a multi-section valve comprising a valve body having a plurality of inlet and outlet openings and two pair of opposed valve chambers, and two tandem valve means one of which is positioned in each of said pairs of valve chambers to control flow of fluid therethrough, said tandem valve means being positioned in said valve body for reciprocal movement; a plurality of solenoid controls associated with said valve means to move same individually from one extremity to the other extremity of their movement; a hydraulic pressure booster pump; means connecting said pressure pump to said valve; means for connecting one pair of chambers of said valve to opposite portions of said motor; means for connecting one of the remaining pair of chambers of said valve to said tub to the expansible chamber therein; means for filling and for draining said tub; and automatic control means connected to said valve and to said pump and to said filling and draining means to operate same in predetermined sequence and at predetermined intervals so as to effect a washing cycle in said tub.

9. In an automatic washer; the combination of a tub having an agitator journaled therein; means secured in said tub for forming an expansible chamber therein; a hydraulic motor for reciprocating said agitator; a multi-section valve comprising a valve body having a plurality of inlet and outlet openings and two pair of opposed valve chambers, and two tandem valve means one of which is positioned in each of said pairs of valve chambers to control flow of fluid therethrough, said tandem valve means being positioned in said valve body for reciprocal movement; a plurality of electrical controls associated with said valve means to move same individually from one extremity to the other extremity of their movement; a hydraulic pressure pump; means connecting said pressure pump to said valve; means for connecting one pair of chambers of said valve to opposite portions of said motor; and means for connecting one of the remaining pair of chambers of said valve to said tub to the expansible chamber therein; said valve, pressure

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pump, motor and expansible chamber being connected to form a closed flow fluid circuit.

10. An automatic washer comprising a tub, an agitator member positioned in said tub for movement therein, a hydraulic motor secured to said agitator for driving same, a multi-section control valve, drain means for said tub, a driven timer connected to said control valve and adapted to position various sections thereof as desired at predetermined portions of an operative cycle to effect desired operation, means connecting said control valve to said motor for flow of fluid under pressure thereto for operation thereof and for receiving spent fluid from said motor, means connecting said timer to said drain means for actuating same to drain said tub at predetermined points in a cycle, fluid supply means, means connecting said fluid supply means to said tub for filling same and having flow therethrough controlled by said timer, and means for supplying fluid under pressure to said control valve.

11. An automatic washer comprising a tub, an agitator member positioned in said tub for movement therein, a hydraulic motor secured to said agitator for driving same, a multi-section control valve, drain means for said tub, a driven timer connected to said control valve and adapted to position various sections thereof as desired at predetermined portions of an operative cycle to effect desired operation, means connecting said

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control valve to said motor for flow of fluid under pressure thereto for operation thereof and for receiving spent fluid from said motor, means connecting said timer to said drain means for actuating same to drain said tub at predetermined points in a cycle, fluid supply means, means connecting said fluid supply means to said tub for filling same, and means for supplying fluid under pressure to said control valve.

HENRY BAADE,

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