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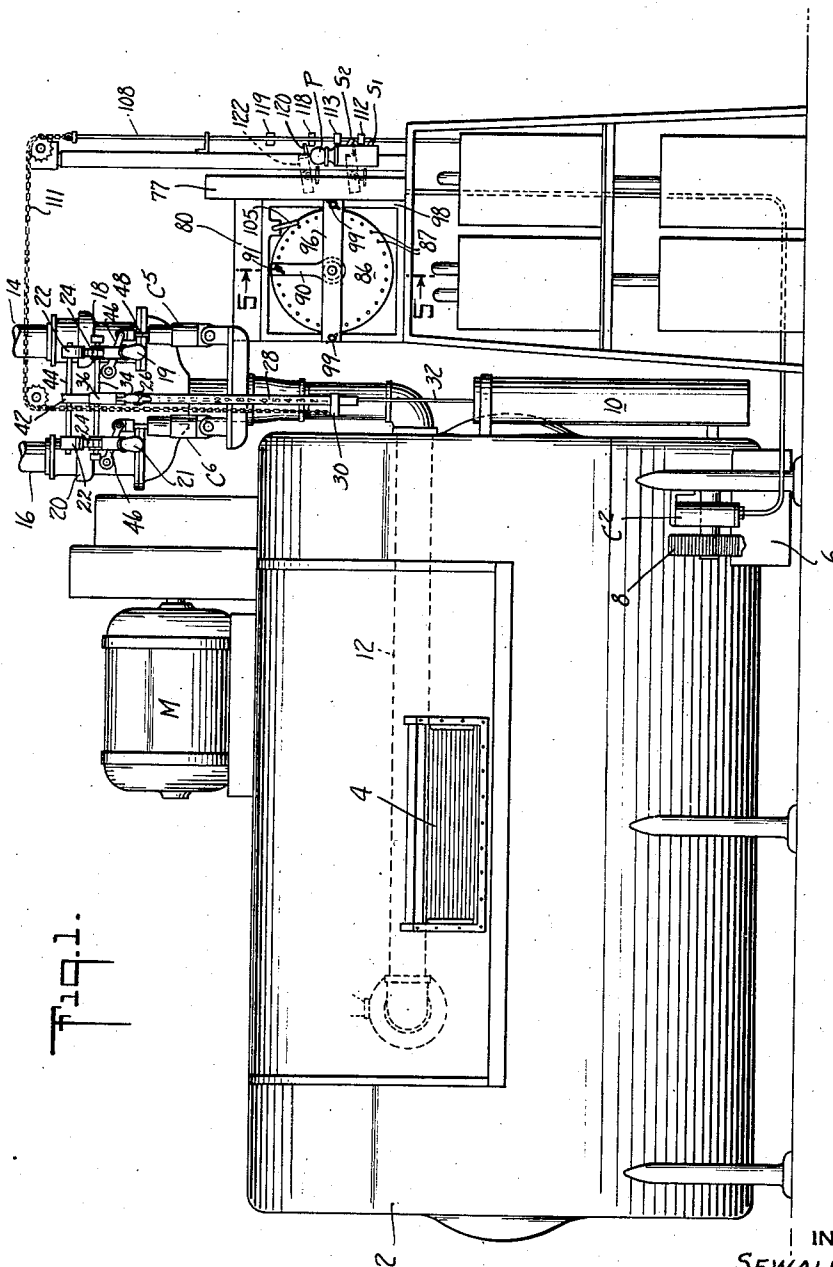
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2,355,162

CONTROL MECHANISM FOR COMMERCIAL LAUNDRY WASHING MACHINES

Filed Sept. 13, 1941

4 Sheets-Sheet 1



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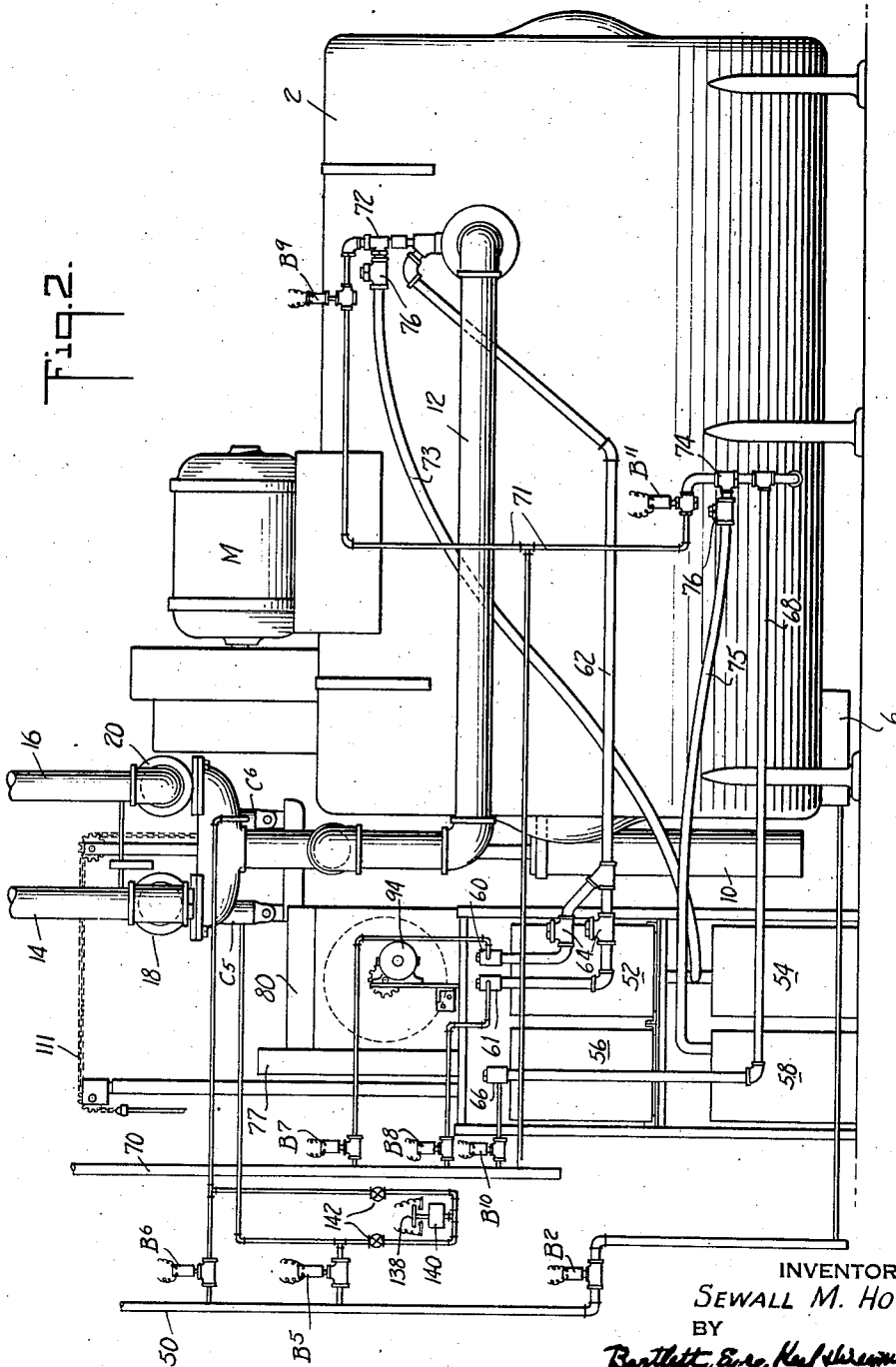
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Fig. 2.



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Fig. 3.

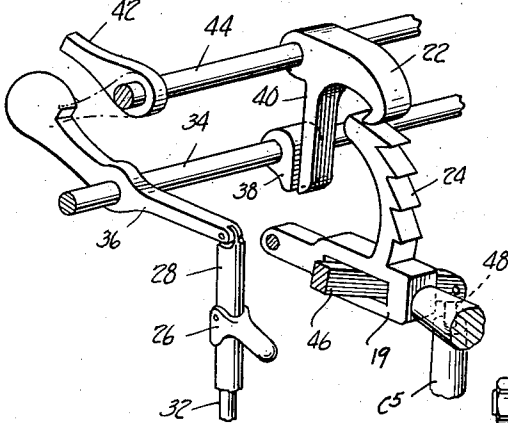


Fig. 5.

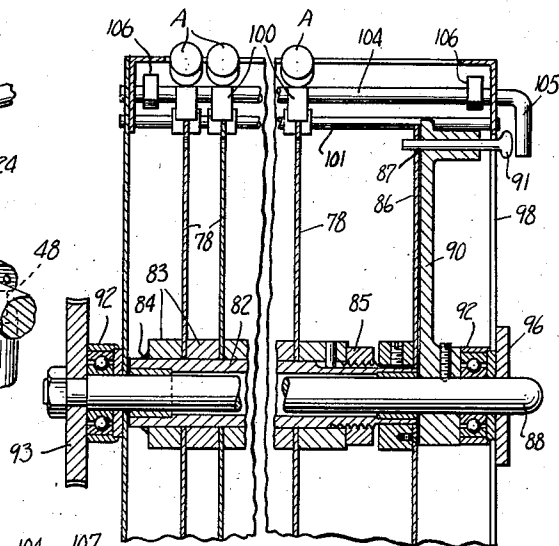


Fig. 4.

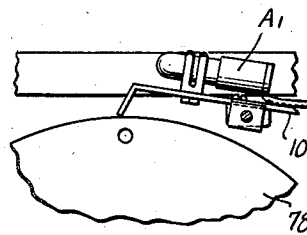
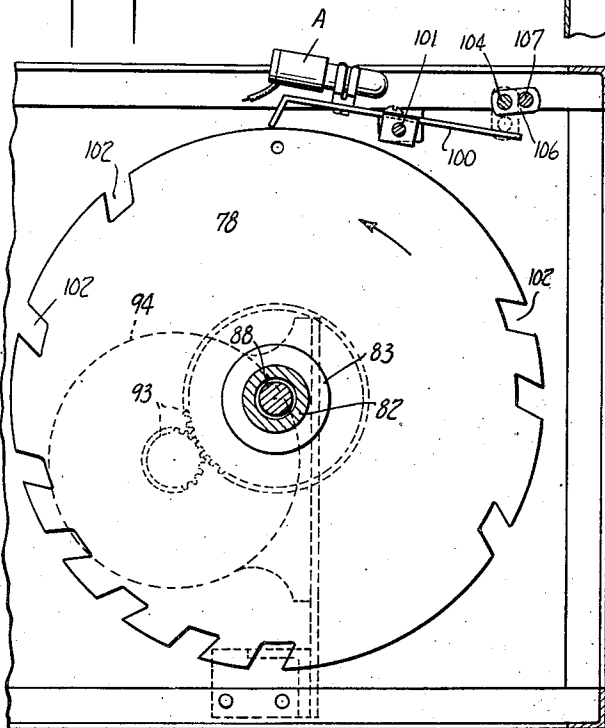


Fig. 4a.

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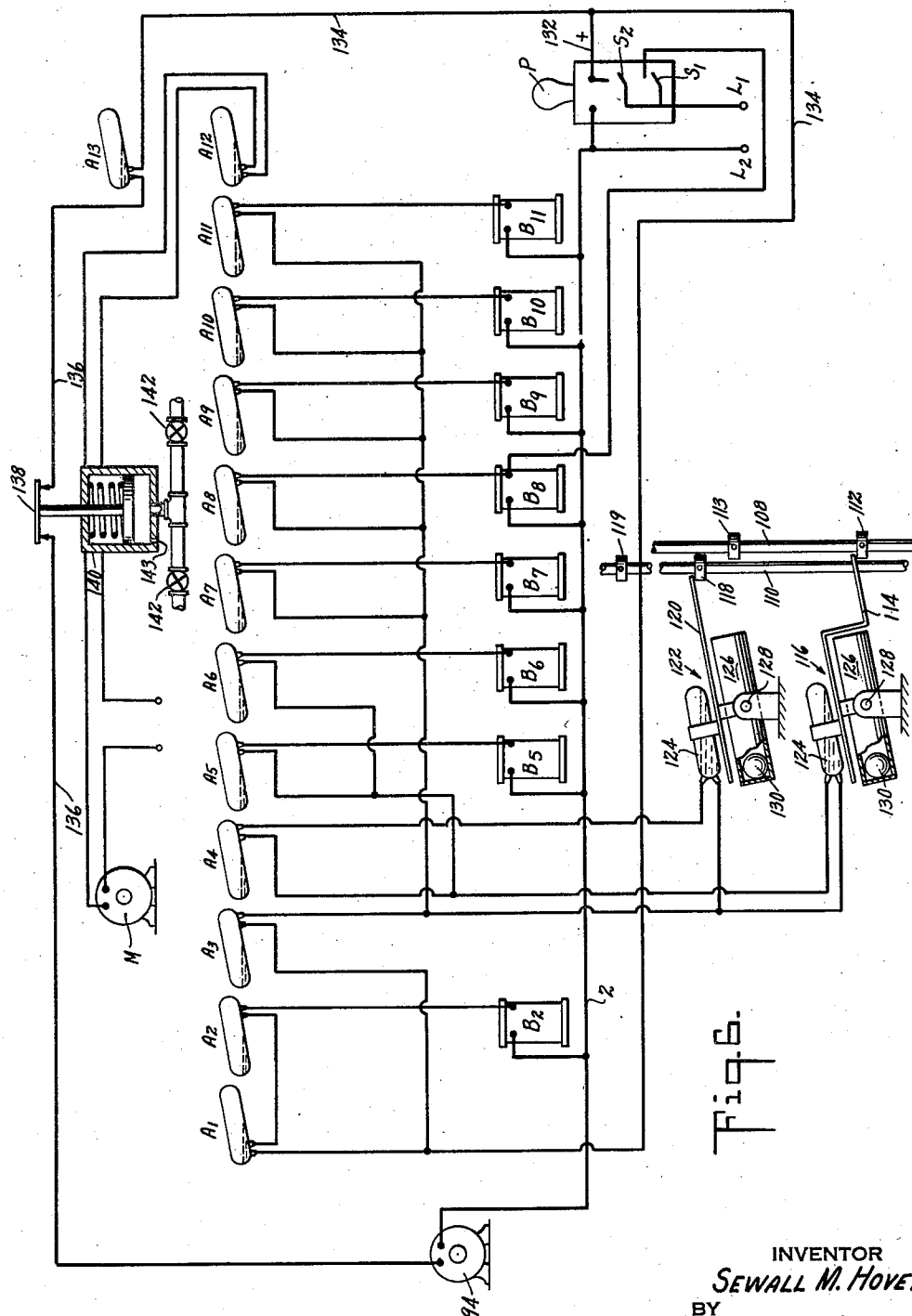


Fig. 6.

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CONTROL MECHANISM FOR COMMERCIAL
LAUNDRY WASHING MACHINES

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Application September 13, 1941, Serial No. 410,682

5 Claims. (Cl. 68—12)

My present invention relates to the automatic control of commercial laundry machinery and comprises mechanism for this purpose that may be readily installed and easily operated and that is adapted for use in the practice of any desired formula.

A feature of the invention is the ease with which the new control means may be applied to existing commercial washing machines without reconstruction or rebuilding of the machinery.

Another feature of the invention is the use therein of standard parts, such as air cylinders, solenoid valves, steam injectors and the like, thereby reducing the cost of manufacture and facilitating the installation of the control system.

A further feature of the invention is novel water level control means which permits the automatic control of the water to different levels depending upon the particular step of the formula being practiced.

Other features of the invention, including the ease of change over from automatic to manual control will become apparent as the description proceeds.

Of the accompanying drawings,

Fig. 1 is a front view of a laundry machine and of my control system therefor, showing the location of the controller and the control of the water and dump valves;

Fig. 2 is a rear view of the machine of Fig. 1, showing the control means and connections for the supplies, such as soap, bluing, etc.;

Fig. 3 is an enlarged detail view illustrating the control of the water valves and the latch for changing from manual to automatic control;

Fig. 4 is an enlarged sectional view, partly diagrammatic, through the control mechanism, showing one controller disk and the cooperating normally open mercury switch operated thereby;

Fig. 4a is a fragmentary view similar to Fig. 4 but illustrating a normally closed mercury switch;

Fig. 5 is a sectional view, taken at right angles to Fig. 4 and on the line 5—5 of Fig. 1 and showing the mounting and assembly of the control disks; and

Fig. 6 is a diagrammatic view showing the electrical controlling circuit and the water level responsive and controlling means.

In the drawings my new control system is shown as applied to a conventional laundry machine comprising the tub 2, having the usual door 4 for admission of the clothes, the dump valve 6 and operating foot pedal 8 therefor, water level tank 10 and drive motor M. Water is supplied to the tub 2 through conduit 12 to which

are connected the branch pipes 14 and 16. Pipe 14 connects with the hot water supply and is provided with the usual water valve 18 having the handle 19 for manual operation thereof and pipe 16 connects with the cold water supply and has the usual water valve 20 therein having the handle 21 for manual operation thereof.

Valves 18 and 20 are any standard type manifold valves which, during manual operation of the tube 2 are automatically closed when the water level in the tub reaches a predetermined level. As shown in Figs. 1 and 3, the valves 18 and 20 have been shown as of the type wherein pawls 22 engaging ratchets 24 on the operating handles hold the valves in open position until the water level in the tub reaches a level corresponding to the setting of a gauge rod stop 26 on the usual gauge rod 28. At this level, engagement of the gauge rod collar 30, operated by the gauge stem 32, with the gauge rod stop 26 lifts the gauge rod 28 and thereby rotates a shaft 34 through a counterweighted lever 36 linked to the gauge rod 28. Cams 38 on shaft 34, operating through triggers 40 rotate the pawls 22 to inoperative position upon rotation of shaft 34 and thus permit the valves 18 and 20 to close by gravity.

In applying the new control system to the above described standard type of water valves, a latch 42, pivotally mounted on a shaft 44, is provided for engagement with the weighted end of lever 36, to hold the same in rotated position with pawls 22 out of engagement with ratchets 24, thus permitting closing of the valves independently of the position of the gauge stem.

Each handle 19 and 21 is slotted to receive an arm 46 which is pivoted at one end and linked at its other end to the piston rod 48 of an air pressure operated cylinder.

The pressure cylinder connected with the hot water valve 18 is identified in Figs. 1 and 2 by C₁ and that connected with the cold water valve 20 by C₂. Cylinders C₁ and C₂ may be of any standard type, as for example, one in which a piston is raised by air pressure and lowered when the supply of air is cut off, a suitable vent permitting a spring to return the piston to lowered position. Air from the compressed air pipe 50 to cylinders C₁ and C₂ together with air from pipe 50 to a similar cylinder C₃ for operating the dump valve 6 is controlled by solenoid valves B₁, B₂ and B₃ respectively (see Fig. 2), the electrical circuits for which are controlled by the operation of a program controller shown in Figs. 4 and 5 and hereinafter to be described.

The program controller controls in addition to the water, the supply of other materials such as soap, blue, sour and bleach to the tub. The connections for the delivery of these materials will now be described in connection with Fig. 2. Four tanks 52, 54, 56 and 58 for the soap, bleach, blue and sour solutions respectively are carried by a framework adjacent one end of the tub 2 and carry predetermined amounts of these materials. The tanks are removable for cleaning. Soap tank 52 is of steel and tanks 54, 56 and 58 are of hard rubber to prevent corrosion. Soap tank 52 has two steam syphons 60 and 61, the suction lines being of different length and corresponding to the second and third additions of soap in the washing formula hereinafter discussed. The syphons 60 and 61 convey the soap solutions through an iron pipe 62 to the water main 12 near the tub; suitable check valves 64 being provided to prevent solution and water from flowing back into the tanks. Steam syphon 66 conveys the blue solution from tank 56 through a copper tube 68. The syphons 60, 61, and 66 are all near the top of the tanks 52 and 56 to permit any solution to drain back in the tank and thus avoid solidification in the syphon. Steam from steam pipe 70 is admitted to the syphons 60, 61 and 66 by solenoid valves B₇, B₈ and B₁₀ respectively under control of the program controller.

Steam syphon 72 for the bleach and steam syphon 74 for the sour are located near the entrance to the tub, so that corrosion is reduced to a minimum by the flushing action of the water. The suction lines 73 and 75 for the bleach and sour, respectively, are of acid-resisting hose and check valves 76 therein adjacent the syphons prevent back flow to the tanks. Steam from pipe 70 is admitted to the syphons 72 and 74 by solenoid valves B₉ and B₁₁, respectively, in branch steam pipes 71 under control of the program controller.

Solenoid valves B₂, B₃, B₄, B₇, B₈ and B₁₀ are ordinarily housed within the casing 77 above the various tanks, but for convenience of illustration and in order to show the connections for steam and compressed air, these valves in Fig. 2 have been diagrammatically illustrated as located outside of the casing. The same is true of a pressure cylinder 140 which operates to open the circuit of the program motor when either water valve is opened, as hereinafter described in connection with Fig. 6.

The program controller is mounted on the framework carrying the various tanks and comprises a plurality of notched disks 78 of which one is shown in Fig. 4. The disks 78 cooperate with mercury switches which are mounted above the disk assembly and housed within a casing 80 (Fig. 1), each disk 78 having one switch associated therewith. In Figs. 4 and 5 the mercury switches are indicated by the letter A, whereas in the circuit diagram, Fig. 6, the switches are diagrammatically indicated and identified separately by A₁ to A₁₃ inclusive. As shown in Figs. 4 and 5 the various disks 78 are mounted on a hollow shaft 82 and are spaced apart thereon by collars 83. The disks 78 and collars 83 are clamped together on the shaft in any suitable manner so as to rotate as a unit. As shown in Fig. 5 one end collar 83 is welded to the shaft at 84, and the other end of the shaft is threaded and a clamping nut 85 screwed thereon. An index disk 86, containing a plurality of index holes 87, is mounted on one end of the hollow shaft. A solid shaft 88 passing through the hollow shaft

82 has an index arm 90 fixedly mounted thereon. A pin 91 carried by the arm 90 couples the arm to the index disk 86 by passage, with one of the holes 87 of the disk, thus driving the disk assembly from shaft 88. Shaft 88, which is journaled in suitable bearings 92 is driven through suitable gear reduction 93 from the program motor 94. The front bearing 92 is mounted in a bracket 96 secured to the housing 98 of the disk assembly by thumb screws 99. Thus by removal of bracket 96 and of index arm 90, the disk assembly can be readily removed from the housing 98 (or rotated independently of the motor).

The mercury switches controlled by the disks 78 are mounted on fingers 100 which are pivotally mounted on a rod 101 carried by the housing. The fingers 100 ride on the periphery of the disks 78 and drop by gravity into notches 102 therein. Switches A₂ to A₁₁, inclusive (Fig. 6), are normally opened and closed when the associated finger 100 drops into a notch 102. Such switches are exemplified by switch A of Fig. 4. Switches A₁, A₁₂ and A₁₃ are normally closed and opened when the associated finger 100 drops into a notch 102. These normally closed switches are exemplified by switch A₁ shown in Fig. 4a.

In order that the disk assembly may be turned in the reverse direction for initiation of a program, or may be removed from the housing, means are provided for holding all of the fingers 100 out of the notches 102. These means comprise a rod 104 which is mounted for rotation in the housing and operated by a handle 105, and a second rod 107 linked by yokes 106 to the rod 104. When rod 104 is rotated by the handle 105, rod 107 is moved into the dotted line position of Fig. 4 to engage the ends of all of fingers 100 and thus prevents the other ends of the fingers from entering the notches in disks 78.

Disks 78 of the disk assembly are notched in accordance with the particular formula to be employed. One disk 78 controls the opening of the dump valve 6, another the closing thereof, a third provides a delay to insure complete closure of the dump valve, others control the opening of the hot and cold water valves, the closure thereof in response to the water level, and the supply of materials to the tub. As any disk 78 may be readily removed and another substituted therefor, it will be apparent that the mechanism lends itself to any particular formula.

In the particular embodiment of the invention illustrated provision is made for controlling the water to two different levels according to the particular step of the formula being practiced. This is ordinarily sufficient but obviously additional levels could be obtained if desired. The water level responsive means comprise a pair of rods 108 and 110 (Figs. 1 and 6) which are supported from a chain 111 which passes over suitable pulleys and is connected to the gauge collar 30. Thus as the water level increases the rods 108 and 110 descend. Rod 108 carries two stops or collars 112 and 113 which are adjustable on the rod and which during travel of rod 108 engage a finger 114 on a tiltable switch device 116. Rod 110 likewise carries two adjustable stops or collars 118 and 119 which engage a finger 120 on a tiltable switch device 122. These switch devices 116 and 122 are similar and control low and high water levels respectively. Each comprises a mercury switch 124 and a hollow cylinder 126 pivoted together with the associated finger 114 or 120 on a shaft 128. A steel ball 130 in each cylinder 126 insures that the switch device will stay in the

position to which tilted by the stops on the water level rods. In the positions shown in Fig. 6 both mercury switches 124 are closed. Thus, when the tub 2 is substantially empty, rods 108 and 110 are in their uppermost position, at which time collar 112 on rod 108 engages finger 114 to close switch device 116 and collar 118 engages finger 120 to close switch device 122. As the tub 2 fills, these switches remain closed until collar 112 engages finger 114 to open switch 116 at one water level. At the higher level for which collar 119 is adjusted, that collar engages finger 120 and opens switch 122; these switches then remaining open until the tub is emptied.

The circuits of the program motor 94 and of the solenoid valves B₂, B₅, B₆ to B₁₁ and the control thereof by the mercury switches A₁ to A₁₃ and by the water level switch devices 116 and 122 will be apparent from Fig. 6 to which reference should now be had. The power lines for the control motor and for the various solenoid valves are indicated by L₁, L₂. Line L₁ is connected to the movable arms of two switches S₁ and S₂. The other side of switch S₂ is connected through a lamp P with line L₂, hence that light is always on when switch S₂ is closed. Switch S₂ is for automatic operation and switch S₁ for initial manual operation as hereinafter indicated. The fixed terminal of switch S₂ is connected to a conductor 132 which in turn connects through conductor 134, normally closed mercury switch A₁₃ and conductor 136 with one side of the program motor 94. Line L₂ is connected with the other side of the program motor 94. A switch 138 controlled by the pressure cylinder 140 is inserted in line 136 to open the circuit of motor 94 whenever air is delivered to cylinder 140. Cylinder 140, as shown in Fig. 2, is connected so as to be supplied with air under pressure whenever air is delivered to either of cylinders B₅ and B₆ controlling the hot and cold water valves respectively. Check valves 142 in the air lines leading to cylinder 140 prevent back flow of air and a vent 143 in the cylinder insures closing of switch 138 when the air is cut off by solenoid valves B₅ or B₆. This switch arrangement insures stopping of the program motor during filling of the tub and thus insures that formula periods will be based on full tub conditions.

Normally closed mercury switch A₁ is the dump valve closing switch and normally open mercury switch A₂ is the dump valve opening switch. These switches as shown are connected in series with solenoid valve B₂ across the lines L₁ and 134. Mercury switch A₃ is a delay switch to insure complete closure of the dump valve before delivery of water or supplies to the tub. For this purpose it is connected in series with each of the other controls as follows: It is connected in series with the hot water control mercury switch A₅ and solenoid valve B₅ through low water level switch 116. It is also connected to A₆ and B₆ through high water level 124 and mercury switch A₄. Thus if the formula calls for the higher level, switch A₄ will be closed by the finger thereof dropping into a notch on the control disk 78 thereof and switch 116 will be by-passed so that the water valve is held open until the level is reached for which collar 119 on rod 110 has been set. Delay switch A₃ is similarly connected through the water level controls with cold water control mercury switch A₆ and solenoid valve B₆. It is connected directly in series, independently of the water level controls, with each of the supply control solenoids B₇, B₈, B₉, B₁₀ and B₁₁ and the

associated mercury switches A₇, A₈, etc., therefor. Switch A₁₂ is connected in the circuit of the main drive motor M of the laundry machine and operates to open the circuit thereof upon completion of the formula. Switch A₁₃ similarly opens the circuit of the program motor 94.

Due to the variation in quantity and condition of clothes to be washed in any one load it is desirable to be able to manually regulate the quantity of soap, the water level and the temperature of the first suds. For this purpose the switch S₁ which directly connects soap solenoid valve B₃ across the power lines is provided. With this arrangement after the clothes are inspected and put into the tub 2 through door 4, and the main motor is started, the hot and cold water valves are manually operated by handles 19 and 21 while latch 42 is moved to the inoperative position of Fig. 3. Switch S₁ is manually closed and opened when the desired quantity of soap has been supplied. When the water level corresponding to the setting of the gauge stop 26 has been reached, the water valves close in the usual manner.

After this initial semi-manual operation is finished, latch 42 is moved to the dotted line position of Fig. 3, and switch S₂ is closed to energize the program motor 94 and start the rotation of the control disks 78. Light P lights to indicate automatic operation in force.

With the automatic operation, when the first suds is completed, valve A₂ closes, due to the falling of the finger thereof into a notch on the controlling disk 78, and thereby closes the circuit of solenoid B₂. Air is then admitted to dump valve cylinder C₂ to open the dump valve 6. Thereafter normally closed switch A₁ opens, opening the circuit of solenoid B₂ and closing the dump valve. Fingers on switches A₅, A₆ and A₇ then drop into notches on their respective control disks and circuits for solenoids B₅, B₆ and B₇ are then closed as soon as delay switch A₃ closes; the circuit for B₅ and B₆ being closed through level switch 116. Water and soap are now admitted to the tub and the program motor 94 is stopped due to the opening of switch 138 by air pressure delivered to cylinder 140. The water valves thus remain open until switch 116 opens, or, if the formula calls for the higher level and consequently switch A₄ has closed, until switch 122 opens. Upon opening of the circuit of solenoids B₅ and B₆ by the water level control, the circuit for motor 94 is again closed and rotation of the disks continued. After the desired interval of time, say seven minutes, valves A₂ and A₁ again operate to open and close the dump valve, the third suds is admitted by closing of switches A₅, A₆ and A₇; the motor 94 again shutting off during filling of the tub. The operation then continues in accordance with the formula, the blue, sour, bleach, hot and cold rinses, all being introduced in response to the opening and closing of the mercury switches A under the control of the disks 78. At the completion of the formula switches A₁₂ and A₁₃ open, opening the circuits of the main and control motors respectively.

The rate of rotation of the disk assembly is such that the formula is completed in less than one complete revolution. When the motor stops with the completion of the formula, lever 105 on the front of the disk assembly is turned to hold the mercury switch fingers out of the disk notches, and the disk assembly is then returned to initial position ready for the next run.

By providing the face of the index disk 86 with

suitable indicia, the stage of the formula may be readily noted at any time, or the formula may be started at any desired step thereof.

When it is desired to change from automatic to manual control it is only necessary to release the pawls 22 by means of latch 42 and to stop the control motor 94 by means of switch S₂.

The new control system has now been described in connection with the preferred embodiment thereof. As heretofore indicated such preferred embodiment includes means for semi-manual control of the first suds. Obviously, however, if the flexibility of control so provided is not desired, the apparatus could be arranged for complete automatic control of the whole formula. If but one water level is desired throughout the program, the by-pass circuit about switch 116, comprising switches 122 and A₄, could be omitted, together with rod 110 and the parts carried thereby. On the other hand, if more than two different levels, say three, are desired during a program it is only necessary to provide a second and similar by-pass about switch 116, together with a third water level responsive rod controlling the switch therein corresponding to switch 122.

The delay switch A₃ is provided because different dump valves have different closing times and hence this switch provides a simple means for adjusting time intervals to different valves. It could, however, be omitted and the settings of the other disks correspondingly adjusted to insure the opening of the water valves and steam syphons only after closure of the dump valve.

As all of the controlled elements, such as pistons C₂, C₅, C₆, syphons 60, 61, 66, 72 and 74, as well as the controlling solenoid valves B₂, B₃ to B₁₁, inclusive, may be standard commercial elements, the apparatus may be readily and simply installed. By attaching the water level control means directly through the chain 112 to the standard gauge rod collar, the automatic control of the water level may be added directly to the usual control without interference therewith or change thereof.

The construction of the disk assembly with the readily removable separate notched disks permits a quick change of set-up for different formulas either in whole or in part or the omission or addition of steps thereto. By providing the pressure valve 140 for opening the control circuit during filling of the tub, assurance is had that variation in water pressure in the mains will not affect formula periods and that timing of formula periods will be based on full tub conditions.

The following is claimed:

1. The combination with a laundry machine having hot and cold water valves of an electrically driven program device, an electrical circuit therefor, a switch in said circuit, a plurality of switches controlled by said program device, fluid operated means for operating said hot water valve, fluid operated means for operating said cold water valve, electrically operated valves controlling the supply of fluid to said fluid operated means, a pressure responsive device controlled by the flow of fluid to each of said fluid operated means for opening said first mentioned switch upon supply of fluid to either of said means, and electrical circuits for said electrically operated valves including the switches controlled by the program device.

2. The combination with a laundry machine having hot and cold water valves, a dump valve and means for delivering various supplies to the machine, of an electrically driven program device, 75

a plurality of switches controlled thereby, fluid operated means for operating said water and dump valves and said delivery means, electrically operated valves controlling said fluid operated means, and electrical circuits for said electrically operated valves, said circuits including said switches whereby operation of said program device, through said switches, electrically operated valves and fluid operated means, controls said water and dump valves and the supply of materials to the laundry machine, said program device comprising a plurality of vertically disposed disks each having notches in the periphery thereof spaced in accordance with the formula to be followed, and all driven so as to rotate about a common horizontal axis, said switches comprising tiltable devices mounted above said disks and provided with fingers engaging the peripheries of the disks so as to be tilted when the fingers enter said notches and manual means for simultaneously disengaging said tiltable devices from said disks to permit counterrotation of said disks to program initiation position.

3. The combination with a laundry machine having hot and cold water valves of an electrically driven program device, fluid operated means for opening each of said valves, a solenoid valve controlling the supply of fluid to one of said means, a second solenoid valve controlling the supply of fluid to the other of said means, means responsive to the level of the water in the laundry machine, circuits for said solenoid valves, switches in said circuits controlled by said program device, and a switch in said circuits controlled by said water level responsive means, a circuit bypassing said last mentioned switch, a second means responsive to the level of the water in the laundry machine, a switch in said bypassing circuit controlled by said second water level responsive means, and a second switch in said bypassing circuit controlled by said program device.

4. The combination with a washing machine having hot and cold water inlet valves, of a control mechanism comprising a rotating program device, means controlled by the rotation thereof for opening and closing said valves, manual means for opening said valves, holding means for maintaining said valves open, a water level responsive device for tripping said holding means at a predetermined water level, a manually operable latch for rendering said holding means inoperative during control of said inlet valves by said program device, a steam syphon for supplying soap to the machine, an electrically operated valve controlling delivery of steam to said syphon, a circuit for said electrically operated valve controlled by said program device, a second circuit for said electrically operated valve, and manually operated means for closing said second circuit, whereby with said latch released the delivery of the first suds to the machine may be manually controlled.

5. The combination according to claim 4 including a pair of water level responsive means, one of said means operating to prevent opening of said water valves by said means controlled by the program device when the water in the machine reaches a predetermined level, and the other of said means operating at predetermined positions of said program device to render said first mentioned water responsive means inoperative.

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