

March 1, 1955

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2,703,097

WASHER CONTROL

Filed Oct. 7, 1949

5 Sheets-Sheet 1

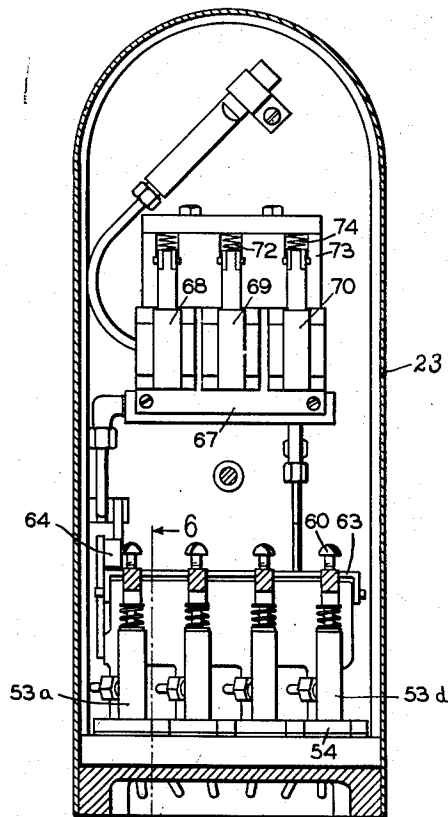


FIG-2

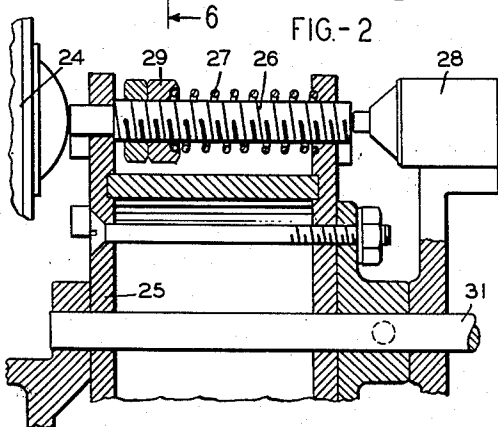


FIG-3

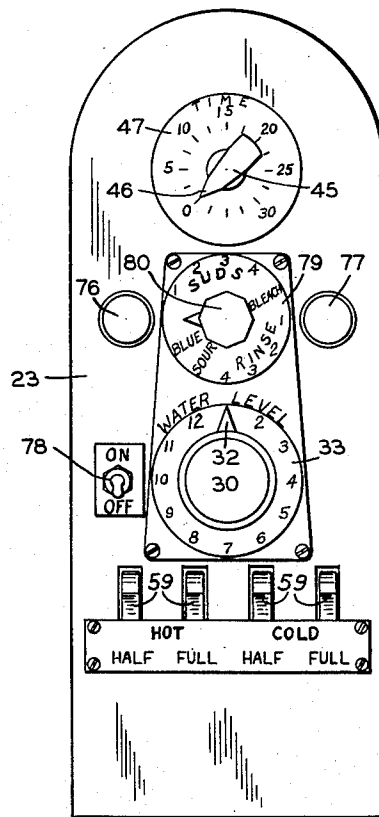


FIG-1

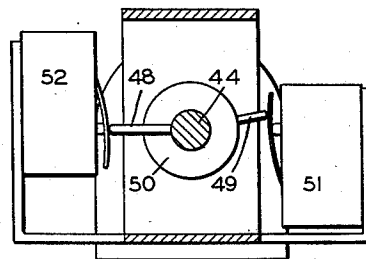


FIG-4

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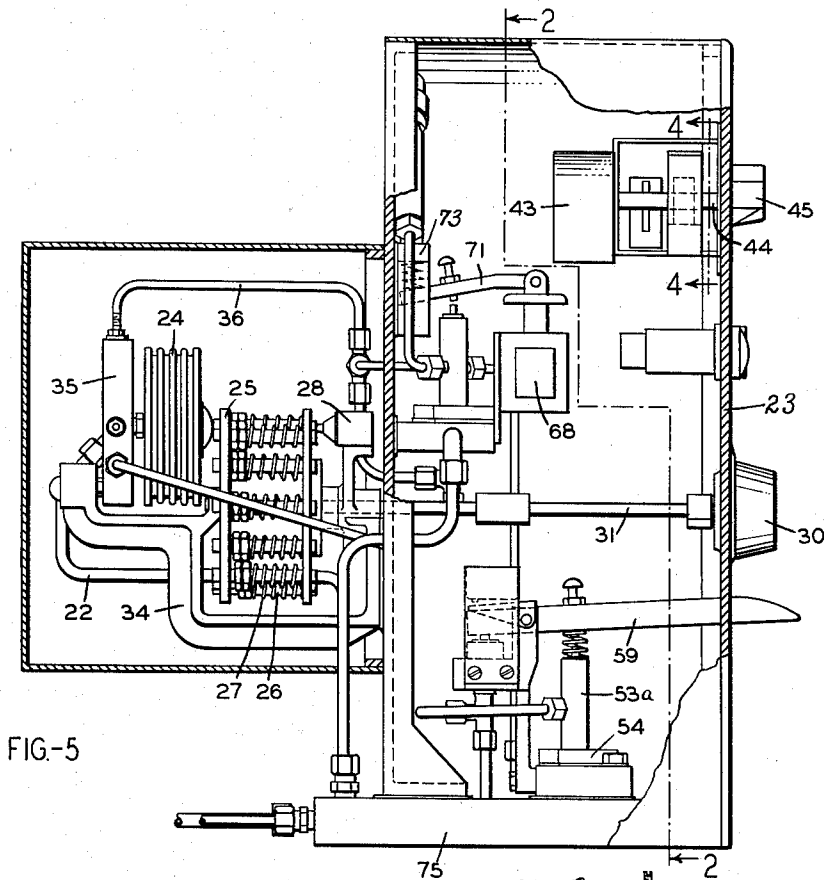


FIG-5

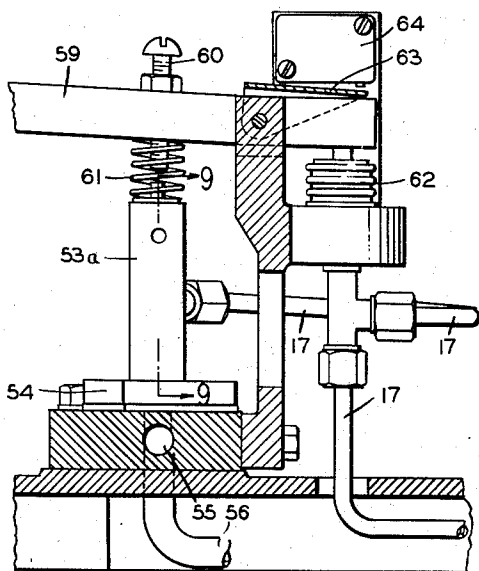


FIG-6

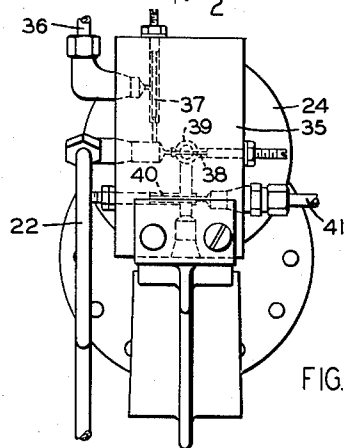


FIG-7

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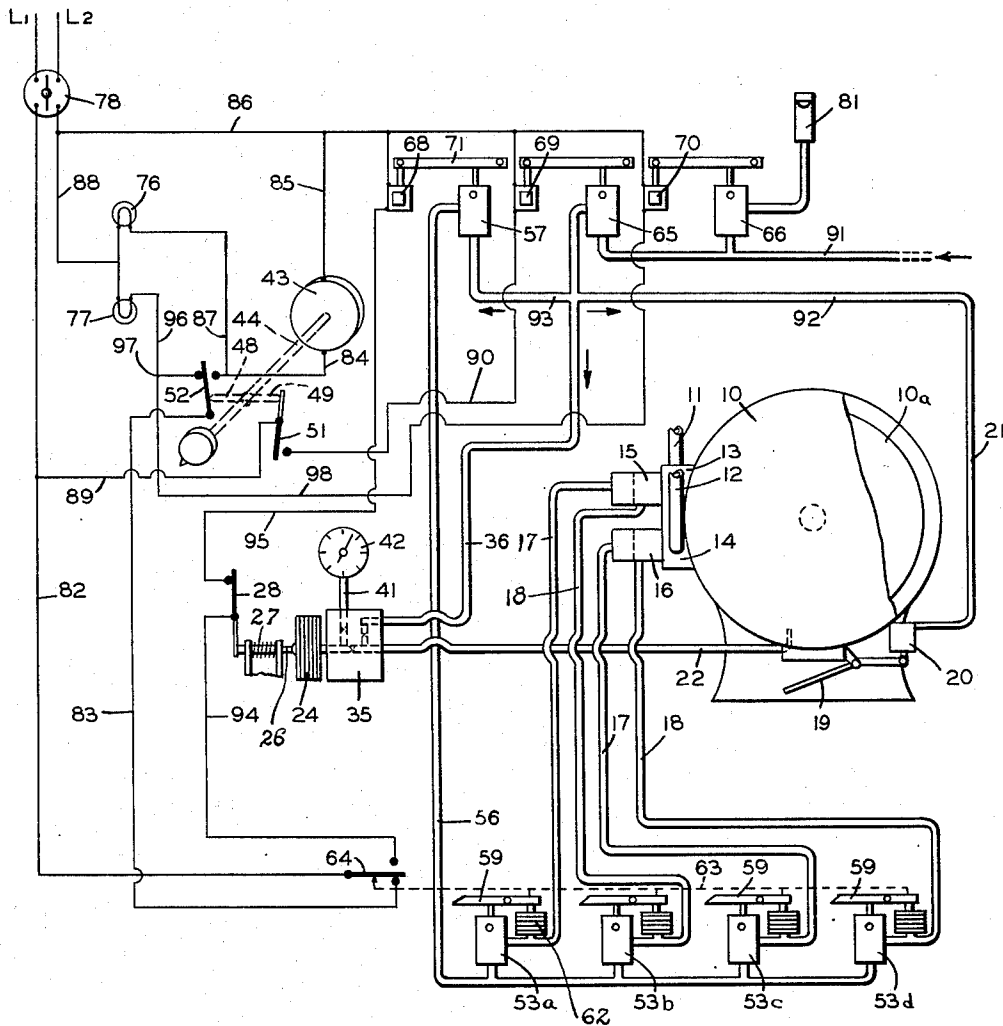
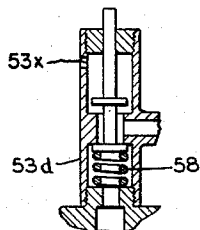
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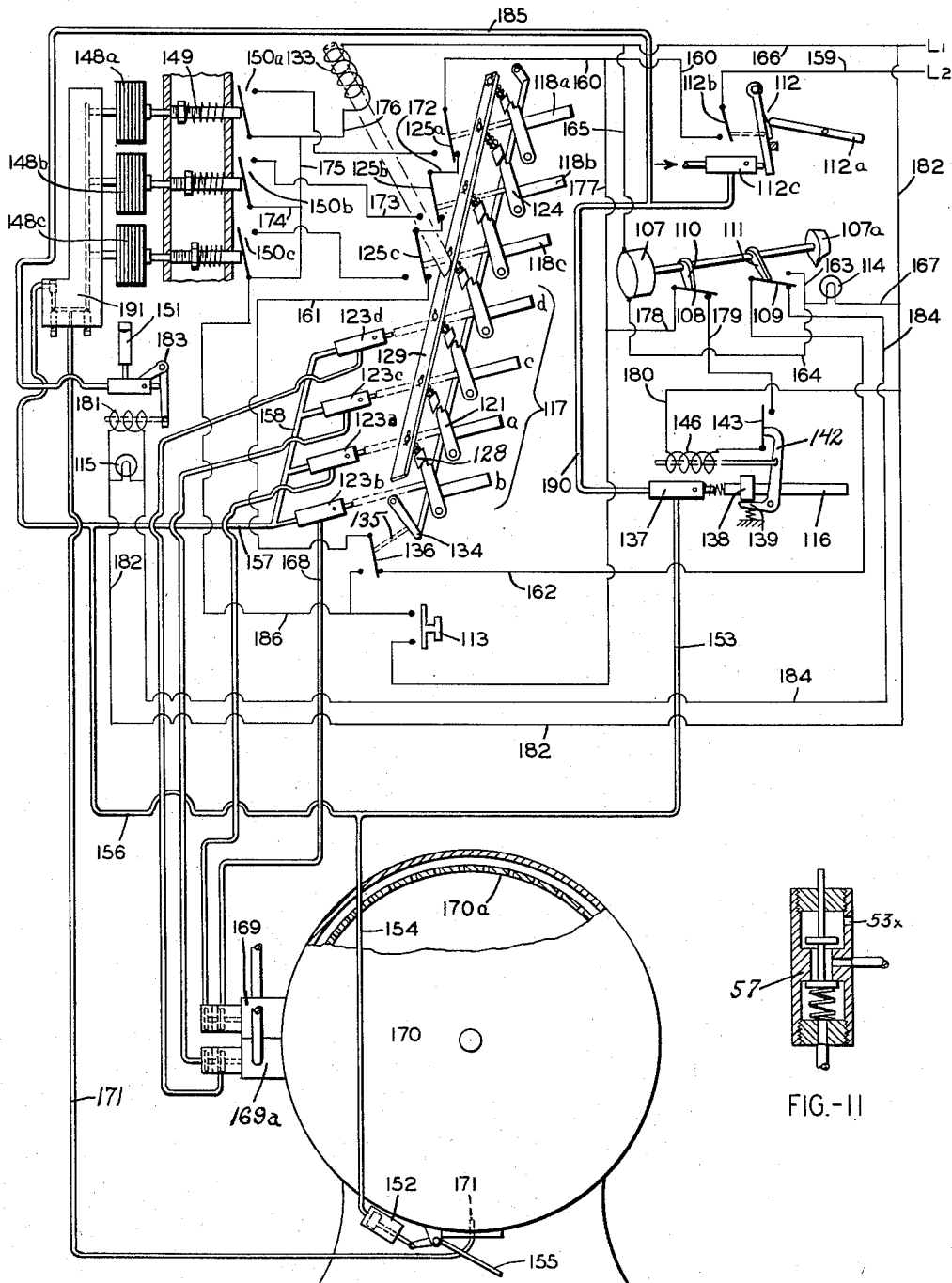


FIG. -10

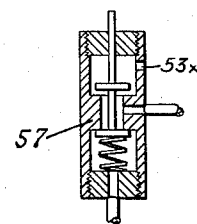


FIG. -11

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5 Sheets-Sheet 5

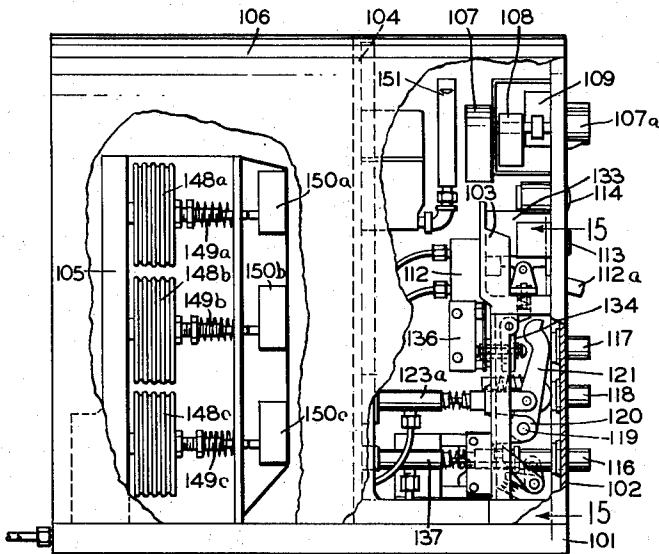


FIG-12

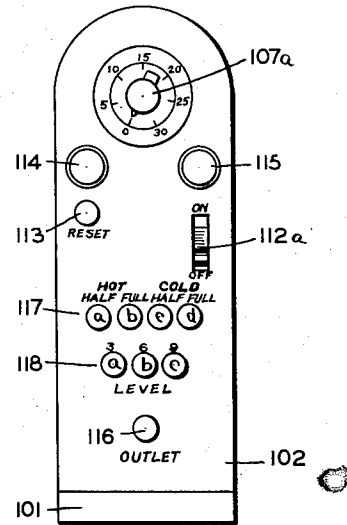


FIG-13

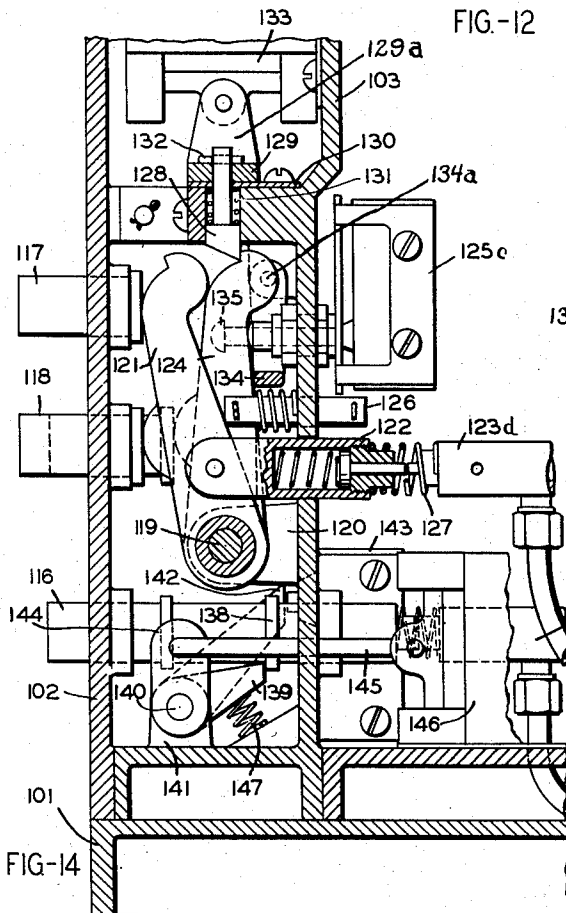


FIG-14

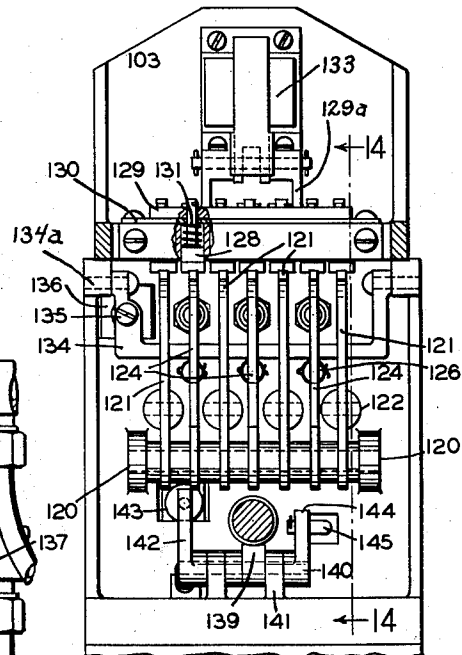


FIG-15

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2,703,097

WASHER CONTROL

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Application October 7, 1949, Serial No. 120,104

10 Claims. (Cl. 137—387)

This invention relates to a control system for washing or dry cleaning machines such as are used for cleaning textile fabrics or garments or other articles made therefrom.

The object of the invention is to provide an improved washing machine control system which automatically or semi-automatically causes, permits or otherwise provides for or takes care of one or more of certain steps and conditions in the operation of such a machine, as follows:

1. Timing of the separate steps during the washing cycle, the control system being manually reset after each step.

2. Admission of water as detergent liquid to the washing chamber up to any one of a plurality of preselected levels.

3. Admission of the cleaning liquid at any one of several selected levels of temperature (within reasonable limits of variation in each level).

4. Holding up initiation of the timing of each step until the liquid level requisite to that step has been achieved.

5. Closure of the dump or drain valve as a condition precedent to the admission of liquid to the washing chamber.

6. Automatic opening of the dump valve a short time in advance of automatic notice to the operator of termination of a particular operation.

7. Reset of the water temperature controls for each step of the washing cycle.

Further objects of the invention in part are obvious and in part will appear more in detail in the description which follows.

In the drawings,

Fig. 1 is a front elevation of one form of control unit embodying the invention;

Fig. 2 is a sectional elevation on the line 2—2, Fig. 5;

Fig. 3 is an enlarged fragmentary sectional view, showing one of the water level control springs and its switch;

Fig. 4 is a fragmentary sectional view, on the line 4—4, Fig. 5, of the timer and its associated switches;

Fig. 5 is a side elevation, with the casing broken away to expose interior parts;

Fig. 6 is an enlarged fragmentary sectional view, on the line 6—6, Fig. 2, illustrating one of the water control valves and the interlock switch;

Fig. 7 is a fragmentary rear elevation from the left in Fig. 5, the casing being omitted;

Fig. 8 is a diagrammatic view, illustrating certain of the parts conventionally, and including a typical washer and the electrical, pneumatic and water flow connections therefor;

Fig. 9 is a detail section on the line 9—9, Fig. 6;

Fig. 10 is a diagrammatic view, illustrating another embodiment of the invention;

Fig. 11 is an enlarged detail sectional view of one of the air valves;

Fig. 12 is a side elevation, partly broken away, of the control unit;

Fig. 13 is a front elevation thereof;

Fig. 14 is an enlarged sectional view on the line 14—14, Fig. 15; and

Fig. 15 is a partial sectional elevation of the latching mechanism, the view being taken on the line 15—15, Fig. 12.

Referring to the drawings, the diagram, Fig. 8, illustrates conventionally one typical arrangement of washing machine and control system embodying the present in-

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vention. The washing machine shown conventionally, includes a chambered tub or casing 10 in which the work to be cleaned is agitated in any suitable manner in a bath of liquid for cleaning, rinsing, bleaching, dyeing or other purposes, such as by enclosing it in a rotatable perforate drum 10a actuated by conventional driving means (not shown). Liquid is supplied to the treating chamber in the usual manner, such as by one or more supply pipes 11, 12 (one for hot and the other for cold water, for example), controlled respectively by normally closed valve devices 13, 14. Each valve device may be opened by operation of a well known piston type servo-motor, 15 for the hot or 16 for the cold, to which air pressure is supplied by four pipes, two for each motor, marked 17, 18 respectively. In each case pressure supplied by pipe 17 opens the valve half way and by pipe 18 all the way, so that by selecting the proper combination of pipes the temperature of the liquid mixture and the rate of filling of the container may be determined by the operator, within suitable limits.

For example, in the form shown, where four air control valves are employed and each water valve (hot or cold) may be opened either half way or fully, it is possible by proper selection to supply either all cold water, all hot water, mixtures containing two thirds hot or two thirds cold, or mixtures containing equal amounts of hot and cold, with five consequent differing temperatures, each stable within reasonable limits. The operator therefore can select the desired temperature of the treating liquid for each washing step.

The container is also provided with a movable dump or drain valve 19 actuatable by pneumatic servo-motor 20 supplied by pipe 21, and with a water level determining bubble pipe 22, the end of which extends into the washing chamber and is open at a low level therein.

The control mechanism is neatly mounted in a suitable housing or casing 23 (Fig. 1) capable of attachment to the washing machine frame in any location convenient for the necessary operating connections thereto and for access by the operator for setting and operating purposes. It here includes four main sub-assemblies, each of unit form capable of individual manufacture and assembly, the four units being cooperatively related or joined by their assembly in the same housing. These four units are, respectively, the water level control unit, the timer unit, the water valve control unit, and the air valve control unit. They will be described separately in that order.

Water level control unit

The water level control unit may be any one of several different forms, several of which are shown, described and claimed in my copending application for Liquid Level Control filed August 5, 1949, Serial No. 108,697, now Patent No. 2,660,193 granted November 24, 1953, to which reference may be had, if desirable or necessary. The form shown in Figs. 3, 5 and 8 includes a single pressure operated prime mover in the form of an expandable bellows 24, a rotatable turret 25 carrying a series of motion transmitting rods 26, each biased by a spring 27 for longitudinal motion toward bellows 24 and away from a micro switch 28 actuated by motion of the rod by the bellows when the latter builds up sufficient force to overcome the bias of the spring. The springs on the several rods are individually adjustable, by nuts 29, to produce varying degrees of biasing opposition. Accordingly by rotating the turret to bring any particular rod and spring into aligning registration with the bellows and switch, any desired water level may be preselected, as will later appear.

Adjustment of the turret for this purpose is effected by turning a knob 30 on the end of turret supporting shaft 31, said knob carrying a pointer 32 traveling over a scale 33 to indicate to the operator the particular level selected.

The same bracket 34 which supports the bellows, turret and switch 28 also supports a needle valve block 35 (Figs. 5 and 7). Air pressure supplied to the channels or passages in said block by pipe 36 flows by way of adjustable needle valve 37 to bubble pipe 22, before referred to, and also by way of needle valve 38 and pipe 39 to the bellows 24, and further, by way of needle valve 40

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and pipe 41 to a visual level indicating gauge 42. The needle valves enable the pressure to be reduced and controlled, eliminate surge fluctuations and secure accurate calibration of the gauge and dependable regulation and control of all operations.

Assuming that the drain valve 19 is closed, and that one or both of the liquid supply valves 13, 14 is open, and that a preselected motion transmitting rod 26 and spring 27 have been aligned with the bellows and switch 28, and that air pressure is effective, liquid will flow into the work container until it reaches a level where the back pressure produced or built up in bellows 24 is sufficient to overcome the bias of spring 27. Thereupon rod 26 is advanced and opens switch 28, the effect of which is to close the liquid supply valves 13, 14 and shut off further liquid supply to the container, as will appear more fully hereafter. Thus, preselection of the appropriate rod and spring predetermines the maximum level of liquid reached during the filling operation.

Timer unit

The timer unit (Figs. 5 and 8) is of simple form, but is positive in action and convenient to manipulate. It comprises a conventional geared-down electric clock motor 43 driving shaft 44 provided with an attached setting knob 45 having a pointer 46 traveling over a time indicating scale 47. Shaft 44 also carries two tripping arms or strikers 48, 49, Fig. 4, of which arm 49 is fixed in a rotatable adjustable collar 50 to allow variation in the time interval between actuation of its associated switch 51 and switch 52 actuated by arm 48. At the conclusion of the preselected time period the timer notifies the operator and, by causing opening of the drain valve, terminates the period of agitation of the work in the treating liquid or bath.

Water valve control unit

The water valve control unit (Figs. 6, 8, and 9) is made up of any suitable number, four being shown, of like combination inlet-exhaust air valves 53a, 53b, 53c, 53d, mounted in side by side relation on an air supply block 54, drilled to provide a manifold supply channel 55 communicating with all of said valves and connected to an air pressure supply pipe 56 in which is a normally closed control valve 57 (Fig. 8). Each valve 53a etc. is biased to exhaust through aperture 53X by its own spring 58 (Fig. 9), but may be moved to open or supply position by manually depressing one arm of a lever 59 carrying an adjustable abutment screw 60 opposite the end of the valve stem and normally held by spring 61 in the position shown in Fig. 6. The other arm of said lever lies above an expansible bellows or other servomotor 62 and below a pivoted elongated plate 63 which, as shown in Fig. 2, is operatively related to all four of the levers 59 to be actuated by any one thereof. One end of plate 63 lies below the operating button of a single pole double throw switch 64 normally biased to the position shown in Fig. 8.

Bellows 62 communicates with one of the pipes 17 or 18, each controlled by valve 53a or one of its counterparts, which pipes 17, 18 supply the pressure for actuating the servomotors 15, 16 controlling liquid supply to the container.

When pressure is supplied to pipe 56 by opening valve 57, air flows through all of the valves 53a, 53b, 53c, 53d which have been opened manually, and thence to both the bellows 62 and servomotor 15 or 16, as the case may be. Bellows 62 expands and serves to maintain its lever 59 in depressed or operating position. Thus those valves 53a etc. which are opened, as well as the liquid supply valves 13, 14 controlled thereby, remain open until the air pressure supply to pipe 56 is cut off and the control valves 53a return to exhaust position.

Air valve control unit

The air valve control unit includes three normally closed combination inlet and exhaust valves, all of the same well known form as the valve 53d shown in Fig. 9. These are respectively the valve 57 before referred to and valves 65, 66, Fig. 8. These are mounted, like valves 53a etc., on air supply block 67 (Fig. 2), and each is operated by its solenoid 68, 69 or 70 through an operating lever or arm 71. These arms are pivotally supported, at the back, in slots 72 in a bearing block 73, a spring 74 allowing full movement of the solenoid plunger.

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All air connections are grouped in the back end of a base block 75. On the front panel are mounted the described dials and knobs, and also green and red signal lights 76, 77, a main switch 78, and a dial 79 and pointer knob 80 which have no operative function, but are available for the convenience of the operator in keeping track of what is going on. 81 indicates an audible signal, such as a whistle, mounted in any convenient location.

The operation is as follows:

Referring to Fig. 8, which illustrates a washing machine equipped with the invention, the washer is assumed to be empty. The drain valve is open. The main switch 78 is open. Timer motor 43 is de-energized. Double throw switch 52 (on timer) is held against the left-hand contact. Switch 51 is held open. Switch 28 is in its normally closed position. Switch 64 is on its lower contact. Solenoids 68, 69, 70 are de-energized. All air and water valves are closed. Both signal lights and the whistle are off.

The operator first sets the timer for the first suds operation by turning knob 45 clockwise to the desired time indication. This allows switch 51 to close and switch 52 to move to its right hand contact. The main switch 78 is then closed, setting up circuits as follows:

From L1, switch 78, wire 82, switch 64 in lower position, wire 83, switch 52, wire 84, timer motor 43, wires 85, 86 and switch 78 to L2. At the same time a parallel circuit is closed from switch 52 by wire 87 and green light 76 and wire 88 to wire 86.

The operator next preselects or predetermines the desired water level by setting the knob 30 on dial 33 to the desired point, thus adjusting the turret 25 and selecting the proper rod 26 and spring 27. This step may be performed before the timer is set.

The appropriate lever or levers 59, to secure any desired temperature of mixture of hot and cold water, are next depressed.

Setting of the timer closes switch 51, thereby energizing solenoid 69 by a circuit from L1 through switch 78, line 82, line 89, switch 51, line 90, solenoid 69, wire 86 and switch 78 to L2. Energization of solenoid 69 opens valve 65, permitting air under pressure to flow from any suitable source, through supply pipe 91 and valve 65 to pipe 36, and thence to the needle valve block and to bubble pipe 22, and also by pipe 92 to drain valve actuating motor 20, and also by pipe 93 to valve 57 (now closed). Now, as one or more of the water control valves 53a-53d is set by the operator, to determine water temperature, the plate 63 is actuated and moves switch 64 from its lower to its upper position, Fig. 8. The effect is to close a circuit through solenoid 68, as follows:

From L1 by switch 78 and wire 82 to switch 64 (in its upper position), wire 94, switch 28, wire 95 and solenoid 68 to wire 86 and back to L2.

Solenoid 68 opens air valve 57 admitting air pressure from pipe 93 to pipe 56, leading to and supplying all of the air valves 53a, 53b, 53c, 53d. Those of these valves which have been selected and thus are open, say full hot valve 53a and full cold valve 53c, are thereby maintained open by their respective bellows 62, and air goes to the motors 15, 16, for the air controlled water valves 13, 14 on the washer and opens said valves. Both hot and cold water flow to the washer at full force.

It should be noted that when the water control valves 53a, etc. were first operated, raising the switch 64 and putting level control switch 28 into series with solenoid 68, the opening of the lower contact of switch 64 disconnected line 83, thus putting timer motor 43 and green light 76 out of operation. In other words, actual initiation of the selected timing period is delayed or held back pending filling of the washer to the desired level.

As the water level rises in the washer, the air flowing through pipe 22 bubbles up freely, but against an increasing pressure or head of liquid, and the back pressure effective upon bellows 24 increases accordingly. Finally the back pressure reaches a value, dependent upon liquid level, high enough to preponderate over spring 27. Thereupon, rod 26 moves over and actuates and opens switch 28.

This opens the circuit to solenoid 68, cutting off the air supply at valve 57 to all valves 53a to 53d, which close. The corresponding water control valves 13, 14 close at the same time.

Release of levers 59 from the maintaining effect of

bellows 62 permits switch 64 to return to its lower position, thus restoring the circuits to timer motor 43 and green light 76. The timer motor now proceeds with its task, to wit, the reverse or counterclockwise rotation of shaft 44 back to its original zero position.

A short time before that position is reached, trip 49 opens switch 51, breaking the circuit to solenoid 69. This allows valve 65 to close, cutting off the flow of air to dump valve motor 20 and permitting quick discharge of all liquid from the work holding chamber, and thus terminating agitation of the work in the liquid or bath. The rotating drum, of course, may be stopped either automatically in any suitable manner, as by opening a motor switch controlled by solenoid 69, or by manually opening such a switch.

When the timer reaches zero position, the tripper 48 restores switch 52 to its left-hand position, Fig. 8, thus disconnecting the timer motor and green light, and closing a circuit to the red light 77, through wire 96, which is in shunt relationship with wire 87. At the same time a parallel circuit is closed from the point 97 by wire 98 through solenoid 70 and wire 86, and to L2 as before. This opens valve 66 supplying air to whistle 81. Thus the operator is notified, both visually and audibly of termination of this particular step (such as the first suds) in the washing cycle. These signals will persist until the operator opens the main switch 78, which de-energizes all circuits, with all parts restored to their original positions.

The control system is then reset by the operator for each one of all following steps in the cycle, as will be readily understood.

Figs. 10 to 15 inclusive illustrate another arrangement embodying the invention in which several bellows (three, for example) are employed instead of the single bellows of Fig. 5.

In this arrangement the sequence of control operations is as follows:

1. Actuate the main combination switch and valve.
2. Set the timer.
3. Set the level control.
4. Operate the drain valve control button.
5. Operate the water supply control valves.

Setting of the timer allows the drain valve to be held open, preventing accidental flooding. Operation of the drain valve button supplies air to the bellows and water supply control valves, thus preventing admission of water to the washer until the drain valve has been closed. Also, the arrangement requires presetting of the desired level of liquid before water may be admitted, again safeguarding against over flow.

The control illustrated in Figs. 10 to 15 includes a base 101 provided with front panel 102, subframe 103, frame 104, and frame 105 upon which is mounted the level control unit. All parts are enclosed in a suitable jacket or casing 106.

107 indicates a clock motor timer of the same type before described, equipped with a presetting knob 107a. Adjustment or operation thereof actuates two normally closed switches 108, 109 actuated respectively by fingers 110, 111.

Referring to Figs. 10 and 13, a main combination switch and air valve, marked generally 112, is actuated by lever 112a. It includes main switch 112b and valve 112c. Reset switch 113 permits the control to be cleared, if a wrong setting operation has been performed. This switch is in a circuit with coil 133 later referred to. Green indicator lamp 114 and red lamp 115 are also mounted upon the front panel. Push button 116 controls the drain valve. Four push buttons 117a, 117b, 117c and 117d control the admission of water. Three push buttons 118a, 118b and 118c control the preselected water level.

Referring to Figs. 12 and 14, push buttons 117a, 117b, 117c and 117d each engage one of a series of latch arms 121 all freely pivoted upon a pin or shaft 119 mounted in brackets 120 on frame 103.

Push buttons 118a, 118b and 118c engage similar arms 124 similarly pivoted.

The several arms 121 act through yieldable motion transmitting members 122 to operate four water control air valves 123a, 123b, 123c, 123d, the purpose, function and manner of operation of which is the same as the valves 53a, 53b, 53c and 53d before described, to control and cause operation of hot and cold water valves 169, 169a, Fig. 10, to preselect the desired temperature

of the water mixture to be admitted to the washer. Springs 127 bias levers 121 to retracted position.

The several arms 124 engage the actuators of associated switches 125a, 125b and 125c, and are biased to retracted position by spring studs 126.

In the frame 103, above arms 121, 124, are a series of spring latches 128 carried by an elongated bar 129 provided with arms 129a pivotally connecting it to the core of an electro magnet 133 energization of which raises the bar and the several latches against the biasing tension of springs 131. This motion is utilized to simultaneously release all arms 121, 124 which at the time are latched, as will later appear.

In the frame is pivotally mounted at 134a a rock bar 134. This extends along the row of arms 121, 124 so as to be actuatable by any one thereof. It carries an adjustable abutment screw 135 located in position to engage and operate switch 136, whenever any one of the arms 121, 124 is operated.

The drain valve control button 116 cooperates with and actuates an air valve 137 through a yieldable connection similar to that marked 122. This connection includes a collar 138 which coacts with a latch finger 139 mounted on shaft 140 which is provided with an arm 144 connected by link 145 to a solenoid 146. The same shaft 140 carries a finger 142 which cooperates with and actuates a switch 143. Movement of finger 142 in the direction away from solenoid 146 causes switch 143 to close. Compression spring 147 biases these parts to turn counterclockwise in Fig. 14.

Referring to the schematic diagram, Fig. 10, it will be observed that the bellows arrangement is similar to that of the single bellows type, Fig. 8, so far as the needle valves are concerned. Hence these require no description. The three bellows shown, marked 148a, 148b, 148c, work through spring pressed studs 149 to operate normally open switches 150a, 150b, 150c.

The operation is as follows:

Let us assume that the operator desires to set the control for operation of the washer at intermediate liquid level.

He first actuates the main combination controller 112, simultaneously opening air valve 112c and closing normally open switch 112b.

Closing of switch 112b energizes a circuit from L1 by wire 182, through red lamp 115 and coil 181 in parallel, wire 184, switch 109, wire 162, switch 136, wire 161, switches 125c, 125b, 125a, wire 160, switch 112b and wire 159 to L2. The effect is to light the red lamp and actuate valve 183 for whistle 151, which receives its air supply through pipe 185 from main supply valve 112c. Therefore, to shut off the whistle, by opening switch 109, the operator immediately sets or advances the timer 107 to a selected position, according to the desired time interval of treatment.

When the timer was set, switches 108 and 109 moved to their second positions, with switch 108 open. Operation of switch 109 started the timer motor, and turned on the green light by a circuit as follows:

From L2, by wire 159, switch 112b, wire 160, switches 125a, 125b and 125c, wire 161, switch 136, wire 162, switch 109, wires 163, 164, timer motor 107, and wires 165 and 166 to L1. Also, the parallel light circuit was energized from switch 109 by wire 163, lamp 114, and wires 167 and 182 to L1.

Opening of main air valve 112c also admits air pressure by way of pipe 190, down to normally closed valve 137.

Next the operator predetermines the desired liquid level, here the intermediate level, by depressing, in this instance, push button 118b.

Switch 125b is thereby moved to its second position and its latch arm 124 is latched and maintains the switch in such position. This stops the timer motor as will be explained later.

The dump or drain valve button 116 is now depressed, opening air valve 137, thus admitting air through pipes 153, 154 to servomotor 152 which closes and maintains closed the dump or drain valve 155. Air is also admitted by way of pipes 153, 156, 157 and 158 to the inlets of the water control valves 123a, 123b, 123c, 123d and to the bubble tube needle valve block 191.

Then the operator predetermines the water temperature by depressing the appropriate push buttons 117a, 117b, 117c, 117d, as for instance button 117b, full hot, alone.

Its latch bar 121 is accordingly latched and its valve is maintained open.

With water control valve 123b operated, air is admitted by way of pipe 168 to hot water valve 169 on washer 170, thus admitting water to the latter, and to the rotatable container 170a therein.

As the level rises in the washer, the air stream rising from the bubble tube 171 encounters increasing resistance thus increasing pressure in all three of the bellows 148. As indicated in Fig. 10, the springs on the several studs 149 are adjusted to different tensions, representing different liquid levels.

The first switch to be operated will be 150a, but nothing happens because this switch is in a dead circuit. The pressure continues to rise until bellows 148b closes switch 150b. A circuit is thus completed from L2, wire 159, switch 112b, wire 160, switch 125a, wire 172, switch 125b, wire 173, switch 150b, wires 174, 175, 176 to solenoid 133, thence by wire 166 to L1.

Actuation of solenoid 133 raises the latch bar 129, releasing all the latch arms. Water control valve 123b closes and switch 125b moves back to the right-hand contact.

Admission of water to the washer is thus cut off and a series circuit is again established through the right-hand contacts of the three switches 125.

When switch 125b was first operated, this series circuit was broken thereby cutting off current to the timer motor and the green light. These now resume operation and continue until the timer reaches zero. Shortly before this, the switch 108 is operated by finger 110 closing a circuit from L2, wire 159, switch 112b, wires 160, 177, 178, switch 108, wire 179, closed switch 143, solenoid 146, and wires 180 and 182 to L1.

This energizes solenoid 146, momentarily pulling finger 139 down out of engagement with collar 138, and push button 116 returns to its retracted position, thereby closing air valve 137 and cutting off air to dump valve cylinder 152 to open the drain valve 155.

About a minute later, timer finger 111 actuates switch 109 to its lower position closing a circuit to solenoid 181 which controls operation of air valve 183, thus blowing signal whistle 151.

This circuit is from L2, wire 159, switch 112b, wire 160, switches 125a, 125b, 125c, wire 161, switch 136, wire 162, switch 109, wire 184, solenoid 181, wire 182, to L1.

Red light 115 is in parallel with solenoid 181.

To shut off the whistle, the operator opens switch 112b.

The foregoing has described the normal operation when the correct sequence is followed. What it amounts to is that actuation of the main switch-valve 112 supplies air to the whistle valve 183 and to the closed air valve 137 controlled by the dump valve button 116. Then, after the timer is set (stopping whistle), button 116 can be operated or a level may first be set. Operation of the outlet control valve 137 supplies air to the washer dump valve cylinder and also to the bellows unit and to the water control valves 123a, 123b, 123c, 123d. A level is set, the mechanical latching unit thereby holding actuated one of the double throw switches 125a, 125b, 125c, to set up a possible circuit through the corresponding bellows-operated normally open switch 150a, 150b or 150c. A water control valve or valves 123 is then similarly operated and is latched by the same latching unit. When the switch 150a, 150b, or 150c is closed by its bellows, a circuit is completed through its associated switch 125a, 125b or 125c to solenoid 133 which trips the latching mechanism to release any of the level switches and water control valves which have been set, thus shutting off the water supply to the washer, and at the same time re-establishing the circuit to the timer motor and green light. Finally the timer nears zero and operates a switch 108, unlatching the dump valve control by means of solenoid 146. Shortly after this, another switch 109 is actuated by the timer, cutting off current to its motor and to the green light and supplying current to the solenoid operated signal whistle and to the red light. These are cut off by the operator's throwing the main switch-valve 112. Incidentally, the reason for the independent air line 185 to the signal whistle is to allow operation of this signal after the dump valve has been released.

Now, in the event that the operator tries to operate

the control in an incorrect sequence, he is defeated by several interlocks or trips. In the first place, should he attempt to turn on the water without closing the drain valve, he cannot succeed because drain or dump control air valve 137 supplies the operating air to the water control valves. Also, if he tries to operate the dump control without setting the timer, the dump valve could not be held operated, because timer switch 108, being closed, would set up a possible circuit to trip solenoid 146 on the dump valve unit, so that when button 116 is operated the latch arm 139 engages behind latch collar 138. But movement of arm 142 to cause engagement of latch arm 139 would allow normally closed switch 143 to close, establishing a circuit to trip solenoid 146 as follows: L2, wire 159, switch 112b, wires 160, 177, 178, switch 108, wire 179, switch 143, solenoid 146, wires 180 and 182 to L1. As soon as this solenoid is energized it rotates the latch arm 139 out of engagement with collar 138 so that the button 116 cannot be maintained operated. This immediately breaks the circuit to solenoid 146 at switch 143 and it remains thus, the latch arm 139 resting against the bottom edge of collar 138.

Another safeguard prevents turning on the water without first setting or predetermining some level. This depends upon the relation between the three switches 125a, 125b, 125c and switch 136. Notice that, unoperated, the switches 125a, 125b, 125c form a series through the right-hand contacts, the circuit running from L2, wire 159, switch 112b, wire 160, these three switches 125a, 125b, 125c, and then wire 161 to switch 136 in its right-hand, retracted position, wire 162 to middle contact of double-throw timer switch 109 and thence to either the timer motor or the signal whistle solenoid and to L1. However, when any of the level or water buttons are actuated, switch 136 is moved to its left-hand contact. Now if a level is first set, the series through the right-hand contacts of switches 125a, 125b and 125c is broken and switch 136 is dead. But if a water valve button 117 is operated first, the series through switch 125 is unbroken, and current goes through the left-hand contact of switch 136 to main trip solenoid 133 by way of wires 186, 175, 176 preventing the latching of the water control valve. A push button switch 113 is connected to this trip solenoid 133 to allow operator release of any undesired setting of the buttons. The circuit runs from L2, wire 159, switch 112b, wires 160, 177, switch 113, wires 186, 175, 176, solenoid 133 and wire 166 to L1.

In all forms, the control system described is relatively simple, easy to install, operate and maintain, and yet is rugged, positive in action and dependable and accurate in its determinations. It avoids guesswork and relieves the operator of considerable duty and time which well may be devoted to other service.

What I claim is:

1. A work treating machine, comprising a container for the work provided with a drain valve and with valve controlled supply conduits for hot and cold liquids, manually operated means for causing opening operation of said supply conduits to supply to said container a preselected mixture of hot and cold liquid at a preselected temperature, automatic means for maintaining said conduits open, timing means for opening said drain valve after the lapse of a predetermined period, and means dependent upon presetting of said timer for preventing said manually operated means from becoming effective unless the timer has been preset.

2. A work treating machine, comprising a container for the work provided with a drain valve and with valve controlled supply conduits for hot and cold liquids, manually operated means for causing opening operation of said supply conduits to supply to said container a preselected mixture of hot and cold liquid at a preselected temperature, automatic means for maintaining said conduits open, timing means for opening said drain valve after the lapse of a predetermined period, and means dependent upon presetting of said timer for preventing said manually operated means from becoming effective unless the timer has been preset and for delaying operation of said timer until after the liquid supplied to said container has reached a preselected level.

3. A work treating machine, comprising a container for the work provided with a drain valve and with valve controlled supply conduits for hot and cold liquids, manually operated means for causing opening operation of

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said supply conduits to supply to said container a preselected mixture of hot and cold liquid at a preselected temperature, automatic means for maintaining said conduits open, timing means for opening said drain valve after the lapse of a predetermined period, means for preventing said manually operated means from becoming effective unless the timer has been preset and for delaying operation of said timer until after the liquid supplied to said container has reached a preselected level, and means capable of adjustment by the operator for preselecting varying levels of liquid.

4. A work treating machine, comprising a container for work provided with a drain valve, means for supplying liquid thereto, timing means capable of being preset by the operator and adapted to open the drain valve at the conclusion of a treating period, operator operated means for initiating operation of the liquid supply means, and means operative when the head of liquid in said container reaches a predetermined level for stopping liquid supply, and means controlled by setting of said timing means for rendering the operator operated means effective.

5. A work treating machine, comprising a container for work provided with a drain valve, means for supplying liquid thereto, timing means capable of being preset by the operator, operator operated means for initiating operation of the liquid supply means, means operative when the head of liquid in said container reaches a predetermined level for stopping liquid supply, means controlled by setting of said timing means for rendering the operator operated means effective, and means controlled by said timer for causing the drain valve to open at the conclusion of the treating period.

6. A work treating machine, comprising a container for the work provided with a drain valve and with variably adjustable valve controlled supply means for treating liquid capable of being set by the operator to supply a mixture of hot and cold liquids at any desired temperature, and means for preventing setting of said valve controlled supply means unless the drain valve is closed.

7. A work treating machine, comprising a container for the work provided with a drain valve and with variably adjustable valve controlled supply means for treating liquid capable of being set by the operator to supply any one of several different mixtures of hot and cold liquids, level control means capable of being preset by the operator for closing the liquid supply valve when the liquid supply reaches a level predetermined by the operator, and means for preventing latching of the valve controlled supply means in open position unless the supply means and level control means have both been set.

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8. A work treating machine, comprising a container for the work provided with a drain valve and with variably adjustable valve controlled supply means for treating liquid capable of being set by the operator to supply any one of several different mixtures of hot and cold liquids, level control means capable of being preset by the operator for closing the liquid supply valve when the liquid supply reaches a level predetermined by the operator, and means for preventing latching of the valve controlled supply means in open position unless the drain valve is closed and the supply means has been set.

9. A work treating machine, comprising a container for the work provided with a drain valve and with variably adjustable valve controlled supply means for treating liquid capable of being set by the operator to supply any one of several different mixtures of hot and cold liquids, level control means capable of being preset by the operator for closing the liquid supply valve when the liquid supply reaches a level predetermined by the operator, and means for preventing latching of the valve controlled supply means in open position unless the drain valve is closed and the supply means and level control means have both been set.

10. A work treating machine comprising a container for the work provided with a drain valve and with a valve-controlled supply conduit for treating liquid whereby to supply and remove treating liquid to and from the work container, timing means for predetermining the time of work immersion in the liquid, means for closing the liquid supply valve when the liquid supply reaches a level predetermined by the operator, means for delaying operation of the timing means pending rise of liquid to the predetermined level, and means for preventing opening of said control valve means for said supply means unless the drain valve is closed.

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