July 6, 1965 W. W. PITTENDREIGH ETAL 3,192,744

LAUNDRY APPARATUS

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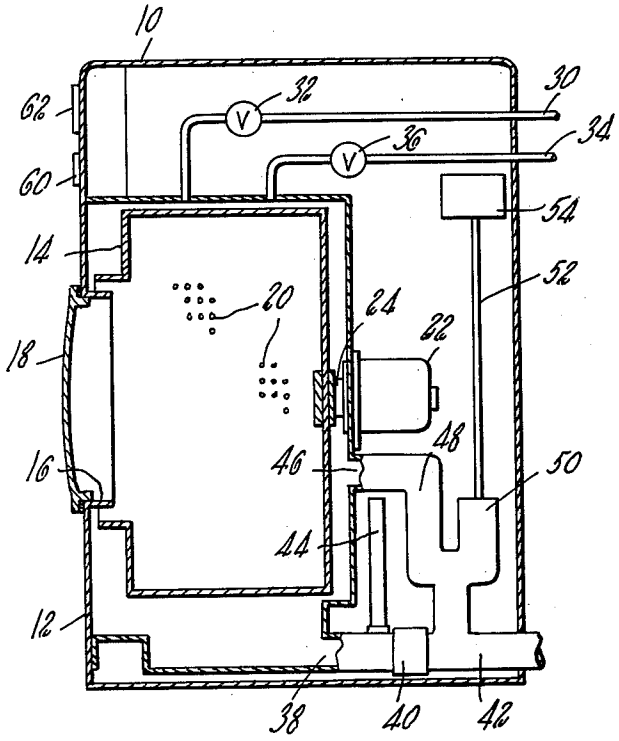


Fig. 1.

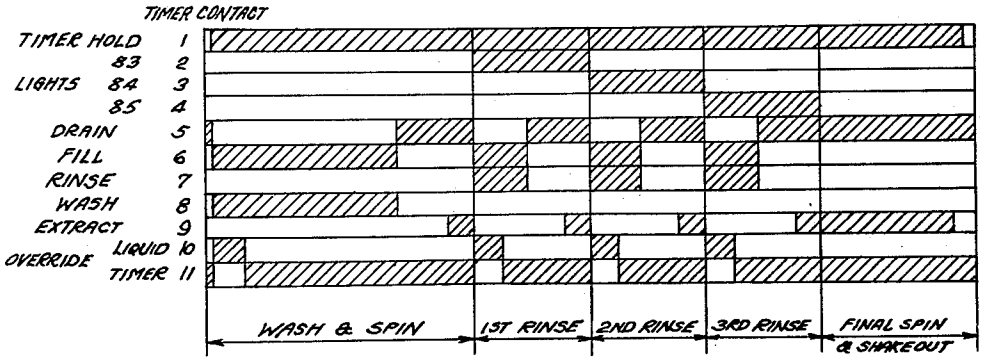


Fig. 3.

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LAUNDRY APPARATUS

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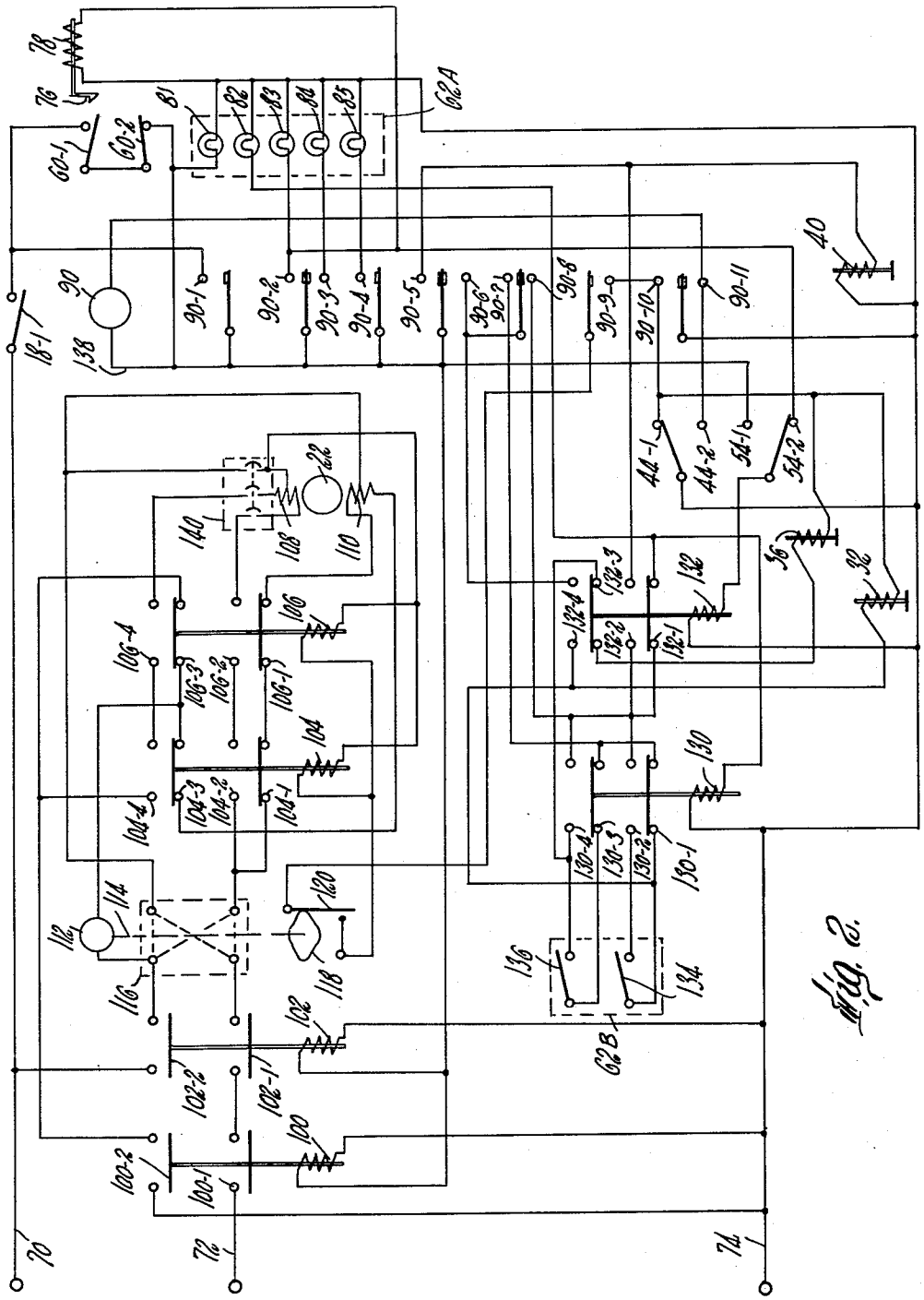


Fig. 2.

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LAUNDRY APPARATUS

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This invention relates to fabric treating apparatus and more particularly to clothes washing apparatus.

In the operation of clothes washing machines, there is often a tendency for the user of the machine to place an excessive amount of soap or detergent in the machine with the result that an abnormal amount of suds is produced. These suds may impair the efficiency of the washing operation and, unless promptly alleviated, frequently cause the washing solution to fill the entire washing chamber and overflow onto the floor and adjacent areas, creating dangerous and unsightly conditions. In addition, such an oversudsing condition tends to increase the friction between the tub chamber and the driven elements within the chamber and thus overload the drive elements.

This problem of excessive suds is particularly significant in washing machines designed for use in self-service laundries. In such establishments the machines may be in substantially continuous operation twenty-four hours a day, and as there are frequently no supervisory personnel present, the machine must function reliably irrespective of the treatment to which it is subjected by the customer. While in conventional machines designed for this purpose the customer has little or no control over the operating cycle of the machine (it being internally controlled), the customer can, and in practice frequently does, insert excess quantities of soap and/or other washing materials into the machine with the adverse results indicated above.

An overflow conduit provided in the washing chamber above the normal washing solution level is designed to allow excess washing solution, created by the introduction of too much soap into the washing chamber for example, to flow out of the apparatus. When such an overflow conduit is connected to an open drain system, such an arrangement adequately handles excess washing solution conditions. However, in most installations, the applicable plumbing codes require that such an overflow conduit be connected to a closed drain system, and the increased resistance of such a drain system to the flow of suds is such that the overflow outlet arrangement is inadequate to remove excess amounts of suds. Under these circumstances, when an oversudsing condition occurs the buildup of suds and washing solution creates a pressure within the washing chamber, which causes the washing solution to flow out into the surrounding areas, and also overloads the machine as indicated above.

Accordingly, it is an object of this invention to provide washing apparatus incorporating novel and improved means for alleviating oversudsing conditions in an apparatus which is particularly adapted for use in self-service laundry establishments.

Another object of the invention is to provide a novel and improved control circuitry for alleviating motor overload conditions due for example to an oversudsing condition.

A further object of the invention is to provide novel and improved control for a washing machine of the type used in self-service laundry establishments which will automatically alleviate overload or overflow problems and then continue the washing cycle.

A washing machine constructed in accordance with the invention includes a tub for containing a washing solution which has a main outlet coupled to a main conduit for connection to a drain system. A valve controls the flow of the washing solution from the tub through this main outlet-conduit system. The machine also includes an overflow outlet which is disposed at a level above the normal water level in the tub so that should an excess amount of water for example be placed in the tub, this condition may be alleviated through this overflow outlet. In the preferred embodiment an unvalved overflow conduit is connected between the overflow outlet and the main conduit so that flow between the overflow outlet and the drain system is not blocked by mechanical devices. A chamber is coupled to the overflow outlet-conduit which is closed at the upper end so as to trap air therein which is in direct communication with the overflow conduit.

Under most overflow conditions, including a moderate excess amount of suds, this overflow arrangement is sufficient to alleviate the condition and the machine operates through its normal cycle without interruption. However, suds often create a substantial resistance to flow even under the force of gravity and a back pressure may build up in the drain system and/or overflow conduit to impede the removal of excess suds from the tub. Unless this condition is alleviated, the suds may fill the entire tub and overflow through openings in the machine creating the above discussed oversudsing condition. In the machine of the invention the back pressure increase due to suds is applied to the closed chamber and pressure sensitive means, in the form of an electrical switch in the preferred embodiment, coupled to this chamber, senses this increase in pressure. When the pressure exceeds a predetermined value, which may be in the order of one to two inches of water, this switch is actuated to interrupt the washing cycle and operate the main valve to permit flow of the washing solution from the tub through the main outlet, thus immediately lowering the washing solution level within the tub. At the same time cool water is injected into the tub from a point directly above the washing solution so as to break up and quickly reduce excess suds which causes this sensed increase of pressure in the overflow conduit. The removal of the washing solution from the tub, coupled with the clearing of the main conduit and drain system of the flow impeding suds, relieves the back pressure in the overflow conduit and allows the pressure sensitive switch to reset, closing the valve and turning off the flow of cool water. The tub is then filled, if necessary, to the controlled level and the washing cycle resumes in an automatic manner.

Other objects, features and advantages of the invention will be seen as the following description of a preferred embodiment thereof progresses, in conjunction with the drawings, in which:

FIG. 1 is a diagrammatic view of a washing machine constructed in accordance with the invention;

FIG. 2 is a schematic diagram of the control circuitry employed in the washing machine apparatus of FIG. 1; and

FIG. 3 is a timing diagram indicating the cycle of operation of the washing machine as controlled by the circuitry of FIG. 2.

The washing machine shown in FIG. 1 includes a housing 10 in which is formed a tub structure 12. A fabric article receiving basket 14 is supported in the tub 12 for rotation about a horizontal axis. Access to the tub and basket is obtained through an access opening 16 in the housing which is closed by hinged, gasketed door 18. The basket 14 is generally an open ended drum in shape and the cylindrical side wall has a multiplicity of perforations generally indicated at 20. The basket is rotated by suitable drive means which is indicated as a motor 22

which drives shaft 24. Speed reducing mechanism or other types of drives may also be employed as desired.

At the upper end of the tub there is a cool water inlet line 30 controlled by solenoid operated valve 32 and a hot water inlet line 34 controlled by solenoid operated valve 36. The tub has a main outlet 38 at the bottom end and a solenoid operated drain valve 40 controls the flow of liquid from the tub outlet 38 to the closed drain system 42. A liquid level sensor 44, mounted in communication with outlet 38, senses the level of liquid within the tub. At an intermediate point in the wall of the tub there is an overflow orifice 46 which is connected through a substantially vertical unvalved conduit 48 to the drain system 42.

The unvalved overflow conduit 48 includes a closed chamber 50 connected to it, the upper end of which is connected, either directly or by means of a capillary tube 52, to a pressure-sensitive switch element 54. Disposed on the front of the housing 10 is a coin slot control mechanism generally indicated at 60 and an indicator panel 62 which includes control switches and indicator lights that will be discussed in greater detail in connection with FIG. 2.

The electrical control circuitry for this washing machine is shown in FIG. 2. Three-phase power is supplied to the apparatus over lines 70, 72 and 74. Connected in series with line 70 is a door switch 18–1 which is closed when the door 18 is closed. Also connected in series with the switch 18–1 are normally open contacts 60–1 of the coin mechanism which is secured by latch 76, and normally closed contacts 60–2. Latch 76 is released by solenoid 78. A series of lamps 81–85 on section 62A of the indicator panel provide an indication of the cycle of operation that the washing machine is in.

Included in the control circuitry is a timer motor 90 which operates eleven contact elements 90–1—90–11, the operative cycles of which are indicated in the timing diagram shown in FIG. 3.

Four relays 100, 102, 104, 106 control the application of three-phase power from lines 70, 72 and 74 to the high speed windings 108 and the low speed windings 110 of motor 22. The motor drive direction is regularly reversed by control motor 112, the output shaft 114 of which operates the circuit control generally indicated at 116 to periodically reverse the energization of low speed windings 119 of motor 22 and to rotate cam element 118 which actuates control switch 120.

Feed water control to the tub enclosure includes two solenoids 130, 132, each of which controls a set of four contacts; wash temperature control switch 134 and rinse temperature control switch 136, both of which are mounted on the control panel 62B; liquid level control switch contacts 44–1, 2; and suds level control contacts 54–1, 2.

In operation, when a user of the washing machine deposits a load of soiled articles in the basket 14 and closes the door 18, switch contacts 18–1 are closed. Upon deposit of the appropriate amount of money the coin mechanism 60 can be operated to close contacts 60–1 which are held in closed position by latch 76. (Contacts 60–2 are momentarily opened while the coin slide is pushed in and are reclosed when it moves out again.) This operation completes a circuit to energize the timer motor 90. With this operation, the machine on indicator light 81 is energized and power is supplied through bus 138 to energize solenoids 100 and 102 to close their respective contacts and apply power to the reversing motor 112 and to the low speed windings 110 of the basket motor 22. The basket then starts to rotate and its direction of revolution is periodically reversed at regular intervals of a few seconds to provide agitation of the fabrics within the basket under the control of switching circuit 116.

The timer motor is started as the override contact 90–11 completes a circuit to line 74. The contacts 90–11 are left in their closed position at the termination of the preceding cycle, as are contacts 90–5, FIG. 3. The latter momentarily energizes the drain solenoid 40. As the timer advances, normally open holding contacts 90–1 are closed completing the timer motor energizing circuit independently of the coin meter circuit; contacts 90–5 open and contacts 90–6 and 90–8 close completing a circuit to solenoid contacts 130–2, 130–4 and 132–1 of the wash-water control relay 130 and suds control relay 132 respectively; and the override element opens contacts 90–11 and closes contacts 90–10. The power applied through normally closed contacts 132–1 energizes the coil 130 of the wash-water control relay. The transfer of power signal through contacts 132–1 is also applied to the indicator light panel 62A to energize the lamp 82 indicating that the wash cycle is initiated. With the energization of the wash-water control solenoid 130, contacts 130–4 are closed and a circuit is completed through the normally closed contacts 132–3 to energize the hot water solenoid 36 to open the valve 36 in line 34 and allow hot water to flow into the tub chamber 12. This circuit bypasses the rinse water temperature select switch 136. If the wash-water temperature selection switch 134 is closed, power is also applied through contacts 130–2 and that switch to energize the cool water solenoid 32 and allow water to flow into the tub chamber from line 30. The circuits for both solenoids 32 and 36 are completed through the liquid level control switch contacts 44–1 and the control remains in the position shown in the diagram until a predetermined level of water in the tub chamber 12 is reached. As the override contacts 90–11 are opened, the timer motor 90 is de-energized. When the liquid level control is satisffied, contacts 44–2 are closed completing a circuit to line 74 to re-energize the timing motor 90. The timer 90 then advances and switches the override element, opening contacts 90–10 and closing contacts 90–11. This step de-energizes the water solenoids 32 and/or 36 while maintaining the timer motor 90 energized. This circuit arrangement permits the tub chamber to fill with water to a predetermined level as a function of the liquid level rather than of the timer control and thus enables the machine to operate independently of variable water pressures. The machine is now in its wash cycle and will normally continue through drain and extract subcycles to the end of the wash cycle.

However, should an oversudsing condition exist in the tub chamber, due for example to the deposit of an excess amount of soap or detergent in the tub chamber, the excess suds will tend to flow into the overflow conduit 48 (FIG. 1). Should the resistance of the drain system 42 impede this flow, the suds will flow into the closed chamber 50. As indicated above, an oversudsing condition of this nature may cause the suds to discharge through openings in the tub chamber and housing and spill onto the floor. In addition, the excess suds fill the gap between the basket and the tub chamber walls and create a drag which increases the load on the motor 22. The suds pressure within the tub chamber is communicated to the closed chamber 50 and the pressure sensitive switch 54 connected thereto. With an increase in pressure in the order of one to two inches of water, switch 54 is actuated and opens contacts 54–2 and closes contacts 54–1 to energize solenoid 132 which closes contacts 132–2 and 132–4. The closing of contacts 132–2 energizes the drain solenoid 40 and opens the drain valve 40 to allow the washing liquid to the flow out of the tub chamber 12 and affords immediate relief of the oversudsing condition.

At the same time, the closing of contacts 44–1 and 132–4 completes a circuit from bus 138 and timer contacts 90–6 to energize the solenoid 32 and inject cool water from line 30 into the tub and basket, thereby collapsing the suds with cool water and diluting the washing solution to further reduce the suds. As soon as the pressure communicated to closed chamber 50 is reduced, the pressure sensor 54 is released so that contacts 54–1 re-

open, deenergizing the suds control relay solenoid 132 and thus closing the drain valve 46 and turning off the cool water spray.

Upon satisfaction of the suds pressure sensor 54, the wash cycle light 82 is re-energized. If the liquid level in the tub 12 has fallen sufficiently so that contacts 44–1 remain closed, the tub is then refilled as controlled by the position of switch 134 until the liquid level sensor 44 is satisfied. The machine then resumes its normal wash cycle. (The extinguishing of lamp 82 in an oversudsing condition provides an indication of the existence of this abnormal condition.)

Towards the end of the wash cycle timer contacts 90–6 and 90–8 open, and contacts 90–5 close supplying power from the bus 138 directly to the drain solenoid 40 to open the drain valve and empty the tub chamber. The opening of contacts 90–6 de-energizes solenoid 130 so that the water control solenoids 32 and 36 will not be energized in response to a request from the liquid level sensor 44. The wash cycle lamp 82 is also extinguished.

As the water level falls, the contacts 44–1 close and just before the end of the wash cycle, timer contacts 90–9 close and complete a circuit from line 74 through the contacts 44–1 and contacts 90–9 to the motor control contacts 120. The cam 118 is synchronized with the operation of the reversing control circuit 116, and permits contacts 120 to close only after a particular direction of rotation of the drive motor 22 has been established. When those contacts close, solenoids 104 and 106 are energized and transfer power from the low speed windings 110 to the high speed windings 108 without any change in phase. Thus, the drive motor 22 is switched from low speed to high speed (extract) without reversal of direction of rotation so that the extract speed starting load imposed on the motor 22 is minimized.

Should the drive motor 22 become overloaded during the extract cycle due to an oversudsing condition or otherwise, the thermal overload circuit breaker 140 will interrupt the power to the extract windings 108 and also break the circuit to the relay coils 104 and 106 so that those relays are de-energized allowing the drive motor to drop back to wash cycle speed rather than to stop entirely. The extract operation continues at wash cycle rotation speed until the thermal overload circuit breaker resets or the timer contacts 90–9 open. (Also, when the solenoids 104 and 106 are energized the circuit to reversing motor 112 is opened so that there is no reversal of the direction of rotation of the basket while it is being driven at extract speed.)

At the end of the wash cycle the timer contacts 90–9 open, de-energizing solenoids 104 and 106 allowing the motor to return to low speed operation. The drain control contacts 90–5 also open and contacts 90–6 and 90–7 close to apply power to the wash-water control relay contacts 130–1 and 130–3. The cool water solenoid 32 is energized directly through contacts 130–1. Also, timer contacts 90–10 close, paralleling the liquid level contacts 44–1 and de-energizing the timer motor 90, and timer contacts 90–2 close energizing the first rinse cycle light 83 and providing a circuit through the suds control pressure switch contacts 54–2 to energize the suds control solenoid 132. With this energization, the circuit to the hot water solenoid 36 through the contacts 132–3 is opened so that only cool water is injected during the first rinse. Also, the coin control latch solenoid 78 is energized releasing the latch 76 to open the contacts 60–1 so that the timer energizing circuit is maintained by timer contacts 90–1 alone.

Thus in the first rinse cycle only cool water is provided to further depress any possible sudsing. When the liquid level sensor 44 is satisfied, contacts 44–2 close, and timer motor 90 is restarted. Shortly thereafter contacts 90–10 open and the contacts 90–11 are closed, de-energizing the solenoid 32 and terminating the flow of water into the tub chamber 12. At an intermediate point in the rinse cycle contacts 90–6 and 90–7 open and contacts 90–5 close to open the drain valve 40. Shortly thereafter contacts 90–9 close and connect the drive motor 22 for high speed rotation in the extract operation.

At the end of the rinse cycle, the timer opens contacts 90–2, 90–5, 90–9 and 90–11 and closes contacts 90–3, 90–6, 90–7 and 90–10 to initiate the second rinse cycle. This cycle is the same as the first rinse cycle with the exception that the suds control solenoid 132 is not energized so that hot water solenoid 36 may be energized, depending on the setting of control switch 136. At the end of the cycle, contacts 90–3, 90–5 90–9 and 90–11 are opened and contacts 90–4, 90–6, 90–7 and 90–10 are closed. The third rinse cycle progresses the same as the second rinse cycle. At the end of the cycle, however, contacts 90–5, 90–9 and 90–11 remain closed for the final spin and shake-out cycle. This cycle is terminated, first by the extract contacts 90–9 opening and then the timer hold contacts 90–1 opening, de-energizing the timer motor and terminating the washing operation. Contacts 90–5 and 90–11 remain closed, however, in anticipation of the next washing operation. Thus at the start of the next wash the drain valve solenoid 40 will be opened momentarily and the timing motor circuit will be established through contacts 90–11.

Opening the load door 18 at any time during the washing cycle opens the door switch 18–1 and de-energizes the entire control circuit, causing all machine functions to cease. However, as soon as the door 18 is closed again the washing cycle will be resumed at the same point and proceed to conclusion in the above-described manner.

Thus it will be seen that the invention provides an improved washing machine control in which overload or overflow problems, due to an excess amount of soap for example, are controlled automatically to alleviate quickly the abnormal condition without terminating the washing cycle or requiring any reset of the control circuitry. While a preferred embodiment of the invention has been shown and described, various modifications thereof will be apparent to those skilled in the art, and therefore it is not intended that the invention be limited to the disclosed embodiment or to details thereof and departures may be made therefrom within the spirit and scope of the invention as defined in the claims.

We claim:

1. In apparatus for washing fabrics or the like, the combination of a tub for containing a washing solution of water and a sudsing detergent,

timer means for normally cycling the apparatus through wash and rinse cycles in an automatic and continuous manner,

means responsive to said timer means for introducing hot and cool water into said tub,

means in said tub responsive to said timer means for agitating the fabrics in said washing solution in a washing operation,

a main outlet at the bottom of said tub,

a main conduit for connecting said main outlet to a drain system,

a valve responsive to said timer means to control the flow of washing solution from said tub through said main outlet and main conduit to the drain system,

an overflow outlet disposed in said tub above the normal water level therein,

an overflow conduit connected to said overflow outlet for discharging excess washing solution from said tub into the drain system,

pressure sensitive means coupled to said overflow conduit including a chamber closed at its upper end, and

a pressure sensitive switch connected to said chamber at said upper end and operable in response to an increase in pressure of said closed chamber,

means responsive to the operation of said switch to interrupt the cycling control of the apparatus by said timing means, to open said valve to allow washing

solution to flow through said main conduit to said drain system, and simultaneously to actuate said cool water introducing means to reduce the amount of suds in said tub,

and means responsive to the deactuation of said switch upon reduction of pressure in said chamber to close said valve, deactuate said cool water introducing means, and allow said timing means to resume cycling control of the apparatus.

2. The apparatus as claimed in claim 1 and further including means responsive to said timer means for actuating said water introducing means to permit flow of cool water only into said tub during a first rinse cycle.

3. The apparatus as claimed in claim 1 wherein said fabric agitating means includes an agitating element,

first drive means for driving said agitating element at a first speed,

second drive means for driving said agitating element at a speed faster than said first speed,

overload sensing means coupled to said second drive means,

and means responsive to said overload sensing means to deenergize said second drive means and to energize said first drive means to operate said agitating element at said first speed.

References Cited by the Examiner

UNITED STATES PATENTS

2,296,263	9/42	Breckenridge	68—12
2,538,200	1/51	Johnston	68—208
2,914,935	12/59	Sampsel	68—12
3,111,017	11/63	Searle	68—12

FOREIGN PATENTS

1,120,595	4/56	France.
769,809	3/57	Great Britain.

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