Nov. 13, 1962 V. V. MARCHI 3,064,094

PRESSURE SWITCH FOR WASHING MACHINE TUB LEVEL CONTROL

Filed Sept. 28, 1959

FIG. 1

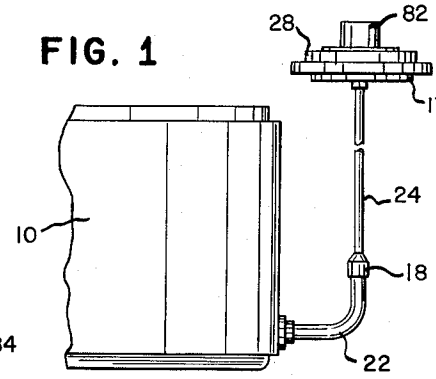
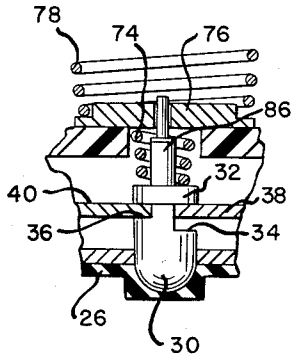


FIG. 4



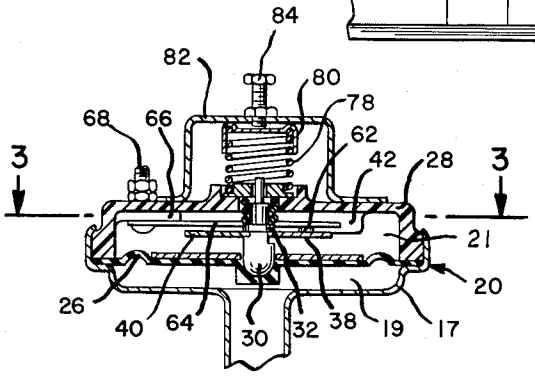


FIG. 2

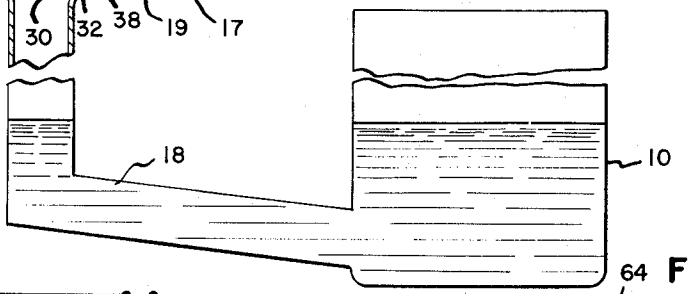


FIG. 5

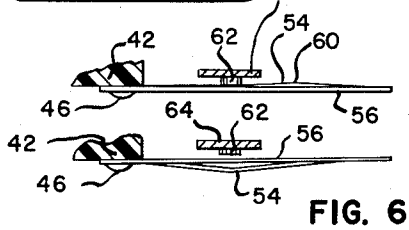


FIG. 6

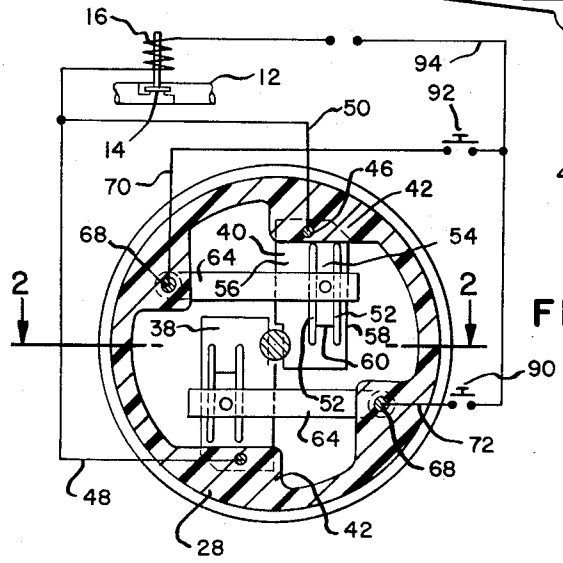


FIG. 3

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PRESSURE SWITCH FOR WASHING MACHINE TUB LEVEL CONTROL

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1 Claim. (Cl. 200—83)

This invention relates to means for controlling the filling operation of a conventional automatic washing machine, and particularly to such mechanisms for electrically selecting the quantity of water admitted to the washing machine tub during any given washing operation.

In conventional washing machines the washing machine tub has a predetermined "full tub" capacity of several gallons, as for example seventeen gallons, but in some washing operations it is not necessary to completely fill the tub with water in order to provide a proper washing operation. In practice material economies in hot water requirements can be achieved if the tub is filled only partially for these "partial load" washing operations.

Conventionally the water level control has been effected either by a float-type switch or a pressure-type switch, the action being such that as the tub is filled with water part of the water is directed into a column or tube located adjacent the tub. The upper end of this tube connects with a casing structure in which is located a pressure-operated switch or float-operated switch, the arrangement being such that a pressure is exerted to trip the switch and de-energize the water-admitting means controlled thereby.

In some arrangements provision is made for adjusting the water level to give a full or partial water level in accordance with desired washing conditions. However, such arrangements have generally operated through a mechanically operated adjustment comprising a slide lever and crank arrangement.

Many of the present day washing machines are designed to be controlled electrically by means of push buttons or similar manually-operated switch structures located on the splash-back portion of the machine, the arrangement being such that cyclic operation is obtained in response to an electric signal rather than through mechanism actuation. It is impractical to utilize the electric signal arrangements for applying manual forces onto the tub level adjustment structures of the types heretofore employed. Accordingly, under the present invention it is proposed to provide a new and different type of electrically actuated mechanism for varying the tub water level. More particularly, it is proposed to provide a simplified electrical control system in which conventional push buttons or the like can be selectively operated by the housewife to automatically control the tub water level.

A primary object of the present invention is to provide an improved electrical control for selectively varying the washing machine water level.

A further object of the invention is to provide an electrical control comprised of relatively few components, each being of relatively small compact, low-cost character whereby to adapt the control for practical use in present day washing machines.

Another object of the invention is to provide an electrical control unit which can be easily and quickly installed in a desired position within a washing machine.

A further object of the invention is to provide an electric water level control which may be factory adjusted to give a desired water level, and which is not likely to lose its adjustment after leaving the factory.

An additional object is to provide an electrical water level control which is compatible with present day "programming" systems employed in many washing machines.

An additional object of the invention is to provide an electrical water level control which can be utilized with any of several different makes of washing machines.

A still further object of the invention is to provide a water level control having a relatively long service life.

Other objects of this invention will appear in the following description and appended claim, reference being had to the accompanying drawings, forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIG. 1 is an elevational view of a conventional washing machine tub having ane embodiment of the present invention incorporated therewith;

FIG. 2 is a view showing the FIG. 1 embodiment sectioned along line 2—2 in FIG. 3, and showing the FIG. 1 tub schematically;

FIG. 3 is a sectional view taken on line 3—3 in FIG. 2;

FIG. 4 is an enlarged sectional view of part of the mechanism shown in FIG. 2;

FIG. 5 is an elevational view showing a snap switch employed in the FIG. 2 structure, said switch being shown in the circuit-closed position; and

FIG. 6 is an elevational view of the FIG. 5 snap switch showing it in a circuit-open position.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to the drawings, there is shown a conventional washing machine tub 10 adapted to be filled from a water supply line 12 (FIG. 3), said supply line having a valve 14 therein operated by a solenoid coil 16 to admit water of a desired temperature into the washing machine tub. As water is admitted into the tub it also fills the conduit 18 which extends from the lower portion of the tub upwardly to the small casing 20. As shown in FIG. 1, conduit 18 includes a hose 22 and a small diameter plastic tube 24. However, it will be appreciated that the conduit could be formed of various materials, sizes and arrangements.

It will be seen from FIG. 2 that as the tub fills with water a predetermined quantity of air is trapped in conduit 18 so as to be partially compressed. The resultant air pressure is directed against a movable wall or diaphragm 26 located within casing 20. The further the tub is filled the greater will be the compression of the air and the greater will be the air pressure on the diaphragm.

Diaphragm 26 is interposed between the two casing sections 17 and 28 to define a pressure chamber 19 and a switch chamber 21. The central portion of the diaphragm carries a thrust means in the form of a plunger 30, said plunger having an annular shoulder portion 32 and two slots which form abutments 34 and 36. The slots receive the edge portions of two similar switch blades 38 and 40. Each of the blades is mounted on a shoulder portion 42 formed integrally with the dielectric housing section 28. Securement of each blade may be effected by means of a headed stud 46 extending upwardly through housing section 28 to form a terminal for connection with lead-in wires 48 and 50 (FIG. 3).

Each switch blade is provided with two slots 52 which

cooperate together to form a central blade section 54 and two edge blade sections 56 and 58. During its formation, each blade has its central section 54 deformed out of the blade plane, as at 60, so as to put the edge blade sections 54 and 56 in tension. After the blades have been installed into the switch casing 28, upward movement of plunger 30 causes the abutment (34 or 36) to lift the free end of the blade so as to move the blade sections 56 and 58 upwardly with an over-center action, thereby causing the central blade section 54 to snap or quickly buckle downwardly toward the FIG. 6 position spaced away from contact 62. Each contact is carried by a fixed metallic mounting arm 64 which is rigidly mounted on a shoulder 66 formed integrally with the dielectric housing section 28. Each mounting arm is anchored by means of a headed stud 68 which extends upwardly through the casing section 28 to form a terminal for connection with the lead-in wires 70 and 72 (FIG. 3). It will thus be seen that upward movement of the plunger 30 is effective to snap each of the blades 38 and 40 to a circuit-opening position.

By reference to FIG. 4 it will be noted that the spacing between abutment 34 and switch blade 38 is greater than the spacing between abutment 36 and switch blade 40. As a result, during upward movement of diaphragm 26 the switch blade 40 will be moved to a circuit-open position before switch blade 38. As previously explained, the upward stroking of plunger 30 is obtained by the graduated increase in air pressure within the pressure chamber 19 obtained during the filling of washing machine tub 10. The arrangement is such that switch blade 40 is utilized to obtain a "partial filling" of the tub and blade 38 is utilized to obtain a complete filling of the tub.

During the periods when tub 10 is empty the light compression spring 74 is effective to bias the plunger and diaphragm 26 downwardly to the FIG. 2 position. Spring 74 is engaged between shoulder 32 and a disc 76, said disc also serving to seat one end of a relatively stiff compression spring 78. The upper end of spring 78 is seated within a retainer structure 80 which is floatably carried within a casing 82, said casing being suitably affixed to the dielectric housing section 28. An adjustment screw 84 extends through the upper wall of casing 82 into abutment with the retainer structure 80, the arrangement being such that screw 84 may be turned upwardly or downwardly to adjust the position of retainer structure 80 for thereby varying the force of spring 78.

Spring 78 serves to control the total amount of water which may be introduced into the tub during any "full load" washing machine operation. Thus, by reference to FIG. 4 it will be seen that during upward movement of diaphragm 26 shoulder 86 contacts disc 76 prior to blade-deflecting engagement of abutment 34 with blade 38. As a result plunger 30 is required to overcome the force of spring 78 before it can deflect the blade 38 to a circuit-open position. By adjusting the screw 84 the force of spring 78 can be varied so as to vary the resistance offered to plunger 30 in the final stages of its upward movement. This resistance will of course determine the amount of air pressure within chamber 19 which is required to open the blade 30, and since the air pressure in chamber 19 is controlled by the water level in tub 10 the screw 84 will serve as a means for controlling the "full load water level" of the machine. The partial load water level is controlled by blade 40.

In order to control the initiating time of admission of water into the tub there are provided two manually operable push button switches 90 and 92. These push button switches may be located at any point on the washing machine, but it is preferred to have them located on the splash-back portion of the machine as part of a conventional push button "programming" system. Such systems are commonly provided for selection of water temperature, wash time, wash speed and rinse temperature by manual actuation of a single button. In a particular installation there may be provided four or five different manual push buttons, each push button serving to actuate a series of switches for selecting a combination of washing variables. For example, a given push button actuator may select a combination of normal wash speed, hot wash water, warm rinse water, and slow spin speed. The use of manually operable switches to select the water level as proposed herein is compatible with this programming type of control.

In operation of the illustrated apparatus, the housewife begins the washing cycle by manually actuating either of the push button switches 90 or 92, depending on whether she wishes to have a full water level (switch 90) or a partial water level (switch 92). Assuming that she wishes a partial water level, she closes switch 92, whereby an electrical current is fed from supply line 94 through line 70, arm 64, switch blade 40, terminal 46, line 50 and solenoid 16. Energization of the solenoid opens the valve 14 to admit water from the line 12 into the tub 10. As the tub begins to be filled with water, part of the water is directed into conduit 18 where it rises so as to partially compress the trapped air. An upward air pressure is thereby developed on diaphragm 26 which causes the plunger 30 to lift the free edge of blade 40 so as to snap it from the circuit-closed position shown in FIG. 5 to the circuit-open position shown in FIG. 6. As the circuit is opened the solenoid 16 is de-energized and the valve 14 is thereby moved to a closed position by a conventional spring means or pilot arrangement (not shown). In this manner the tub water level is controlled at a predetermined partial load level.

Assuming that the housewife desires a full water level she actuates switch 90 to a circuit-closed position, whereupon current is supplied from line 94 through line 72, arm 64 (lowermost in FIG. 3), switch blade 38, line 48 and solenoid 16. As the tub fills up with water an air pressure is developed in chamber 19 so as to stroke the diaphragm 26 upwardly. During this upward stroking the switch blade 40 will be deflected to a circuit-open position, but such action will be immaterial, since the push button switch 92 has already rendered the circuit through blade 40 inoperative. Also, during the upward stroke of diaphragm 26 the shoulder 86 (FIG. 4) will contact the disc 76 and thereby add the resistance of spring 78 to the system. Thereafter, further filling of tub 10 will require an increased air pressure to move the plunger 30 and disc 76 as a unit to snap the switch blade 38 to the FIG. 6 circuit-open position. Opening of the circuit de-energizes solenoid 16 and closes the valve 14 for discontinuing the admission of water to the tub.

At conclusion of the washing cycle, the tube 10 is drained of water and the diaphragm 26 returns to its FIG. 2 position under the influence of springs 78 and 74, and the weight of the diaphragm and its associated mechanisms. The position of shoulder 32 is the same with respect to both of the blades 38 and 40, and thus the circuit will be reset at the same time in the cycle, irrespective of whether a partial tub water level or a full tub water level was used during the preceding period. The resetting of the cycle takes place as the diaphragm 26 nears its FIG. 2 position, i.e., when the tub is substantially completely drained of water. By this arrangement the water filling cycle cannot be reinitiated while the tub is filled with any substantial quantity of water.

The drawings illustrate a construction employing two switch structures for electrically obtaining two different water levels. However, it will be appreciated that three or more switches could be employed if desired, so as to obtain a larger number of selected water levels. Also, the specific type of switch blade could be varied while still obtaining advantageous operational features of the invention.

It is preferred to employ an easily flexed diaphragm,

such as shown in FIG. 6 for the pressure-responsive wall means. However, it is contemplated that other types of movable walls such as a piston or bellows, could be substituted for the diaphragm if desired. The drawings illustrate a simplified water-admitting means at **14**. However, it will be appreciated that in practice different electrically-energized diaphragm valves and various water mixing devices and systems could be employed to effect the water-admitting operation.

The invention is adapted for use with different type washing machines, since the components are of relatively small size and can be easily accommodated in the present models of most manufacturers. The arrangement of parts is simplified and susceptible of relatively low cost manufacture so as to eliminate much of the expense which is usually required in producing a mechanically-actuated water level selection mechanism.

The invention in its broader aspects contemplates a series of manually operated current controllers **90** and **92** in parallel with one another for feeding current to a series of switches operated by predetermined movements of a pressure responsive mechanism, the arrangement being such that after the housewife has caused one of the circuits to be energized, the resultant pressure developed by the admission of water into the tub is effective to automatically de-energize a selected switch for obtaining the desired water level. It will be appreciated that the features of construction illustrated in the drawings can be varied without departing from the spirit of the invention as explained herein and as defined in the appended claim.

I claim:

In a washing machine having a water-containing tub and a conduit having one end connected with a lower

portion of the tub and extending upwardly to a point above the full water level, the improvement of an air pressure actuated electric switch adapted to provide partial or complete filling of the tub, a casing, said casing having a bottom, and a top of dielectric material, a flexible diaphragm in said casing defining a pressure chamber and a switch chamber, an elongated plunger in said switch chamber and having its one end in engaging relation with said diaphragm, a first slot on said plunger, a first plate-like switch blade having one end mounted on said casing top and a portion fitting in snugly engaging relation in said first slot, a second slot on said plunger, a second plate-like switch blade, said second slot having a width larger than the thickness of said second switch blade, said second switch blade having one end mounted on said casing top and a portion fitting into said second slot in spaced relation, electrical contacts engageable by each of said switch blades, and means biasing said plunger to move said switch blades into normally engaging relation with said contacts, whereby partial movement of said plunger by increased air pressure in said pressure chamber resulting from water in the tub compressing air in the conduit, is effective to actuate said first switch blade to non-engaging relation with an associated contact and subsequent movement of said plunger is effective to actuate said second switch blade to non-engaging relation with an associated contact.

References Cited in the file of this patent

UNITED STATES PATENTS

2,302,923	Zimarik	Nov. 24, 1942
2,592,314	Morton	Apr. 8, 1952
2,636,093	Clark et al.	Apr. 21, 1953