

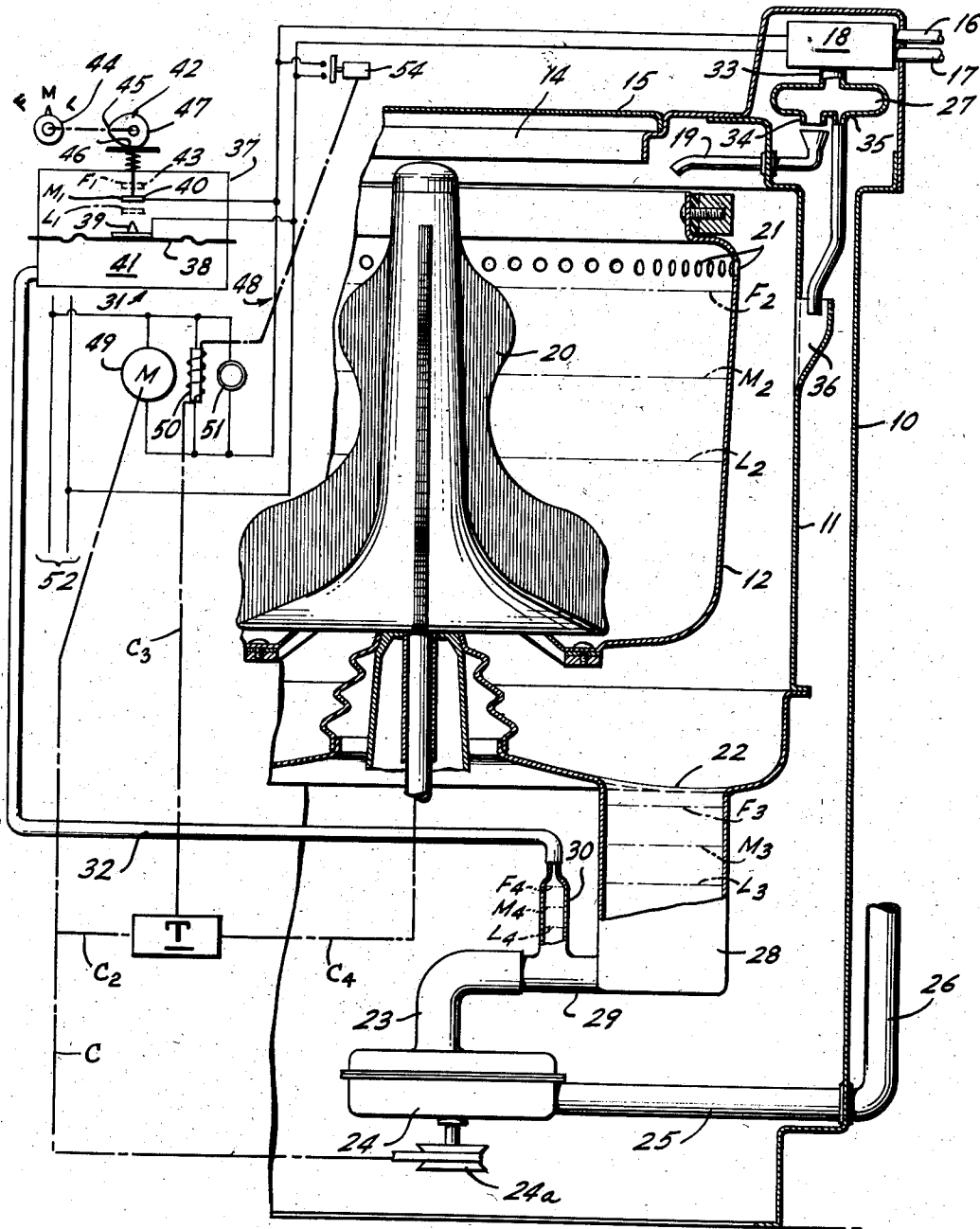
May 12, 1959

'S. B. BLOOM

2,885,879

CONTROL SYSTEM FOR WASHING MACHINES

Filed April 17, 1956



INVENTOR.
STANLEY B. BLOOM

BY

Carl H. Jernstedt
AGENT

AGENT

1

2,885,879

CONTROL SYSTEM FOR WASHING MACHINES

Stanley B. Bloom, Philadelphia, Pa., assignor to Philco Corporation, Philadelphia, Pa., a corporation of Pennsylvania

Application April 17, 1956, Serial No. 578,676

4 Claims. (Cl. 68—207)

The invention herein described and claimed relates generally to control systems and pertains more particularly to means for controlling the quantity of liquid delivered to a container. Specifically, the invention has to do with adjustable means for automatically shutting off the flow of liquid to a container when the liquid fed thereto reaches a predetermined level.

Although suitable for use with various types of equipment adapted to fill different kinds of receptacles or containers with most any kind of liquid, the novel arrangement of this invention is especially useful when applied to clothes washing machines of the variety in which water is introduced into a washing basket to fill the same to a predetermined level, whereupon the machine proceeds to function automatically to wash and damp-dry clothes by going through successive agitating, rinsing and liquid-extracting cycles.

In a machine of this type, it is important that the washing basket be supplied with water in an amount sufficient to insure adequate washing of the clothes. It is also important, for economical reasons, that the supply of water be automatically shut off when it reaches a level which is selectively determined for proper washing of clothes in given average loads.

Different known arrangements employing either floats or pressure-responsive devices as means for controlling the water level in washing machines, have been devised to realize these desirable ends. While many of these known arrangements serve their purpose adequately, nevertheless they have certain disadvantages, mostly due to the fact that such known arrangements depend on wash water being brought into direct contact with the float or pressure-responsive control means. As a result, scum, dirt and the like, tend to accumulate about the control means and to interfere with its proper function.

Accordingly, it is an object of the present invention to overcome the above mentioned disadvantages by providing a novel arrangement which, although controlled in response to water in the washing machine, obviates the necessity of subjecting the control means to direct contact with the water.

It is also an object of the present invention to provide an improved arrangement for controlling the level of water in an automatic washing machine, the arrangement being such that it requires few parts and necessitates no major structural changes in the basic construction of the machine.

A characteristic feature of the invention resides in the provision of a novel combination of elements in which simplified control means function to effect automatic interruption of the flow of water to the washing machine when the clothes washing tub or basket thereof is filled to a predetermined level, said device being responsive to a small proportion of the water supplied to the machine so as to effect an appreciable saving in water consumption.

The invention is further characterized in that the novel combination of elements includes a pressure activated

2

flow-controlling device operating in response to air rather than water displacement thereby alleviating possible ill-effects resulting from inundation of delicate parts of such a device.

5 An arrangement according to the present invention has the further advantage that the circuit or system employed to effect operation of the pressure-responsive device, does not require sealed gas-containing conduit means. The arrangement is such that the operating system is recharged 10 with air at atmospheric pressure after each operation, so that minor leakage does not present a problem.

Generally stated, the above noted objects and features of the invention are achieved by a novel cooperative arrangement of water-flow dividing means, water accumulating means, air trapping means and air pressure sensing means. In this arrangement, the sensing means operates to stop delivery of water to the flow dividing means in response to an increase in air pressure due to displacement of air in the trapping means by reason of water 20 fed thereto from the accumulating means.

According to a specific embodiment of the invention, the water accumulating means and air trapping means communicate with the inlet side of a drain pump which, when operating, removes the water to release the increased pressure within the sensing means.

In a more subordinate aspect, the invention includes improved and advantageous features of construction, combination and arrangement of parts, all of which will be fully set forth hereinafter.

As indicated hereinabove, the liquid feed control arrangement contemplated by the present invention may be utilized with various types of equipment. However, because the principles of the invention are particularly applicable to clothes washing machines, the specific embodiment herein given by way of example, is illustrated and will be described in connection with such a machine.

Accordingly, the single figure in the accompanying drawing is a fragmentary sectional view of a portion of an automatic agitator-type washing machine, certain elements of the control arrangement being represented diagrammatically for simplicity of illustration.

Having more particular reference to the drawing, there is illustrated a domestic clothes washing machine which includes an outer casing or cabinet 10 housing a fixed 45 tub 11 which encircles a rotatable imperforate washing basket 12. The cabinet has an open top portion 14 which is provided with a cover 15 to give access to said washing basket.

Water at proper temperature is supplied to the washing 50 basket through conventional means including a hot-water conduit 16, a cold-water conduit 17, a self-closing water valve 18 and a discharge nozzle 19, the latter directing water into the basket 12 through the open top thereof. Clothes are washed in the basket 12 by action of a bladed 55 agitator 20 and after washing, are rinsed and then damp-dried by spinning of the basket. During spinning, water is expelled from the basket 12 into tub 11 through a row of apertures 21 adjacent the top portion of said basket. From the tub 11, water passes out through a drain opening 22 into an inlet 23 of a pump 24, the outlet 25 of 60 which communicates with a discharge duct 26, the pump being motor driven by means of belt-and-pulley means 24a.

According to the present invention, there is provided 65 a selectively adjustable control arrangement for automatically terminating the feed of water to the basket 12 when the water therein reaches a predetermined higher or lower level to accommodate a full or less than full load of clothes to be washed in said basket. In particular accordance with the invention, the control arrangement includes: a water flow-dividing chamber 27 disposed between the solenoid-operated mixing valve 18 and the

3

discharging nozzle 19; a water-accumulating chamber 28 communicating with the drain opening 22 of the tub 11 and having passageway 29 leading to the inlet 23 of the pump 24; an air-trapping chamber 30 interposed in the passageway 29 between the water-accumulating chamber 28 and the drain pump 24; and an air-pressure responsive switch device 31 connected with the air-trapping chamber through an air line 32.

As shown in the drawing, the flow-dividing chamber is formed with an inlet 33 and with a larger outlet 34 and a smaller outlet 35, the inlet 33 communicating with the mixing valve 18 to receive water therefrom. The larger outlet 34 is disposed to discharge part of the water from the valve 18 into the nozzle 19, and the smaller outlet 35 communicates with an opening 36 in the machine tub 11 to discharge another part of the water from said valve into said tub. The smaller outlet is such that the amount of water flowing therefrom is proportionate to the amount of water which flows out of the larger outlet and, in practice, the size and position of these outlets with respect to each other are such that the level of the water in the relatively small accumulating chamber 28 and trapping chamber 30 rises at approximately the same rate as the level of the water in the relatively large basket 12.

The switch device 31 functions to effect stoppage of the water flow to the machine. This switch device comprises a housing 37 enclosing a flexible diaphragm 38 and a pair of electrical contacts 39 and 40. As represented in the drawing, the switch device is of the normally open variety in which the contact 39 is conveniently associated with one side of the diaphragm 38 so as to be moved into engagement with the other contact 40 in response to air displacement within an enclosed space 41 on the other side of the diaphragm. The contact 40, as also represented in the drawing, is adjustable in various positions with respect to the contact 39, so that the pressure, and therefore the time required to effect closing of the switch is increased or decreased. For that purpose, there is conveniently provided a rotatable stepped cam 42 arranged to bear upon a spring-urged slidable plunger 43 associated with the contact 40, said cam being advantageously rotated by means of a manually operable knob or dial 44, associated with suitable indicating means bearing appropriate position-designating marks.

In the illustrated embodiment, three such marks are represented by the alphabetical characters F, M and L, and the cam 42 has three step portions 45, 46 and 47 of different radial displacement to locate the contact 40 in three different operating positions F_1 , M_1 and L_1 corresponding to the setting positions of the dial 44, to effect selective adjustment for automatically terminating the feed of water when it reaches the proper level required for adequately washing a full, a medium or a light load of clothes. With an arrangement of this kind, the feed of water would stop when water in the tub 12 reaches one of three levels which are represented at F_2 , M_2 and L_2 .

The contacts 39 and 40 of the switch 31 are electrically connected in the control circuit 48 of the machine, which circuit includes the usual driving motor 49 and a solenoid 50, the latter serving to control operation of the agitator 20, through the agency of transmission means which is diagrammatically shown at T, said transmission means being driven in any convenient fashion, by the motor 49. The motor is coupled in the usual manner with the pump 24 and with the transmission means, as is diagrammatically represented at C and C_2 , respectively. As is also customary, the transmission is connected with the control solenoid 50 and with the shaft of the agitator 20, as is diagrammatically represented at C_3 and C_4 , respectively. As seen in the drawing, said switch contacts are in shunt with the solenoid valve 18 which is in series with said motor 49 and said solenoid 50. It will be understood that when the switch 31 is open, the relatively high impedance of the motor circuit causes most of the voltage

4

supplied by A.C. line 52 to be applied to the solenoid valve 18 which is thereby maintained in open position for admitting water to the machine. During this condition of operation current flows through the motor 49 and clutch solenoid 50, but the voltage is insufficient to operate the same. However, when the switch 31 is closed, the solenoid of the self-closing valve 18 is by-passed so that said valve closes to interrupt the flow of water to the machine, whereas the motor 49 and agitator solenoid 50 are placed across the line 52 and operate in parallel under the full voltage supplied by said line.

As is customary, control of the machine through its washing, rinsing and spinning cycles is governed by means of a timer 51 of known construction. This timer is coupled in the circuit 48 to become energized upon closing of the switch 31. The timer is in shunt with motor and with the agitator solenoid. Therefore, the timer runs whenever said motor and solenoid are energized, that is, when the series impedance of solenoid valve 18 is removed. Suitable linkage connects the agitator solenoid with an auxiliary switch 54 which serves to insure disruption of the flow of current to the solenoid valve 18 when the pressure on the bellows 38 drops as a result of operation of the pump 24 by the motor 49, and which also serves to reestablish the flow of current to said valve when the time comes for water to be again fed to the machine.

When using a washing machine incorporating the water-feed controlling arrangement of this invention, the dial 44 is normally moved to the position corresponding to the load of clothes to be washed. In the drawing, the dial 44 is set at the intermediate position M which is the position for washing a medium load of clothes. In this position, the step 46 of the cam 42 adjusts the plunger 43 to locate the contact 40 in the intermediate position M_1 .

Upon starting the machine, the solenoid valve 18 is energized so that water flows into the chamber 27. From this chamber, a greater part of the water passes through the larger outlet 34 and nozzle 19 into the washing basket 12, and a proportionately lesser part of the water flows out through the restricted outlet 35 into the tub 11 and thence through the drain outlet 22 into the accumulating chamber 28. During the time that water is introduced into the machine, the pump 24 remains idle so that water from said accumulating chamber backs up into the air-trapping chamber 30. As the water level rises in the washing basket and in the accumulating chamber, a proportionate water rise occurs in said trapping chamber 30 causing displacement of the air therein to increase the pressure within the enclosed space 41 behind the flexible diaphragm 38 of the switch device 31. Thus, in the operational setting illustrated, when the level M_2 in the basket 12, the level M_3 in the accumulating chamber 28 and the level M_4 in the trapping chamber 30 are reached, then the pressure on the flexible diaphragm 38 causes contact 39 to come into engagement with the contact 40 adjusted in position M_1 . When this occurs, the valve 18 shuts off the flow of water to the washing basket, and the timer 51 takes over so that the washing machine goes through its usual washing, rinsing and spinning cycles.

When the pump 24 is energized, water is withdrawn from the accumulating chamber 28 as well as from the air trapping chamber 30, thus reducing the pressure on the diaphragm 38 so that the switch 31 is automatically reset for subsequent use. This pressure reduction would normally act to cause reenergization of the solenoid valve 18, however, this action is prevented by function of the auxiliary switch 54 under control of the agitator solenoid 50.

In order to adapt the machine for washing a full load of clothes, the dial is set to the F position thereby moving the contact 40 to the F_1 position, farther away from contact 39, so that water in the tub 12 will rise to the higher level before interruption of the water flow, there-

5

by providing sufficient water to wash a full load of clothes.

To wash a light load of clothes, the dial is set to the L position thereby moving the contact 40 to the L₁ position, nearer to the contact 39, so that the valve 18 closes when the water in the tub 12 reaches the lowermost level.

While a dial has been described as convenient means for adjusting or setting the operation of the water flow control mechanism, it will be appreciated that other suitable means, for instance, push-button arrangements, lever operated devices or similarly known contrivances, may be employed for that purpose. Also, it will be apparent that the flow dividing chamber herein described as a separate element, could be readily incorporated in the body of the water inlet valve. Moreover, while three positions of the control device have been described, it will be recognized that the number of positions can be varied to provide for filling of the tub to any one of several desirable predetermined levels to accommodate various loads of clothes. It will furthermore be understood that the air trapping chamber can be arranged to communicate with a lower part of the water accumulating chamber without being interposed in a conduit leading from said accumulating chamber to the drain pump.

I claim:

1. A level control system comprising a receptacle adapted to retain liquid, a liquid accumulating chamber separated from said receptacle, an electrically operated liquid supplying valve, flow dividing means for delivering liquid from said valve to said receptacle and chamber, said dividing means including two outlets of different size, the outlet of larger size being disposed to discharge liquid in a greater amount to said receptacle and the outlet of smaller size being disposed to discharge liquid in a proportionately lesser amount to said chamber, a pressure responsive switch for controlling the operation of said valve, an air trap communicating with said switch and with a lower portion of said chamber in such manner that liquid in said chamber passes into said trap and displaces the air therein to cause actuation of said switch to control the operation of said valve, means for withdrawing the liquid from said trap and chamber, and means for rendering said withdrawing means ineffective during liquid-delivering operation of said valve and for rendering said withdrawing means effective upon cessation of said operation.

2. A system as set forth in claim 1, in which the means for withdrawing the liquid includes a motor and

6

a pump driven thereby, said motor being electrically associated with the mentioned switch.

3. In a washing machine, the combination of a rotatable basket adapted to retain water and to receive clothes to be washed, a tub surrounding said basket and having a water accumulating portion, an electrically operated water supplying valve, a water flow dividing chamber for delivering water from said valve to said basket and tub, said chamber having a larger outlet to discharge a larger amount of water for delivery to said basket and also having another outlet of predetermined smaller size as compared to said larger outlet to discharge a proportionately lesser amount of water for delivery to said tub portion, a pump for withdrawing the water from said tub portion, a pressure responsive switch, an air trap communicating with said switch, means for passing water from said tub portion to said trap to increase the air pressure on said switch, a motor for driving said pump, and circuit means electrically connecting said switch with said valve and motor to initiate operation of said pump simultaneously with termination of the operation of said valve.

4. In a washing machine, the combination of a rotatable basket adapted to retain water and to receive clothes to be washed, a tub surrounding said basket and having a water accumulating portion, an electrically operated water supplying valve, a water flow dividing chamber for delivering water from said valve to said basket and tub, said chamber having a larger outlet to discharge a larger amount of water for delivery to said basket and also having another outlet of predetermined smaller size as compared to said larger outlet to discharge a proportionately lesser amount of water for delivery to said tub portion, a pressure responsive switch, an air trap communicating with said switch, means for passing water from said tub portion to said trap to vary the air pressure on said switch and thereby operate the same, and circuit means electrically connecting said switch with said valve to actuate the latter in response to operation of said switch.

References Cited in the file of this patent

UNITED STATES PATENTS

1,223,584	Huebsch et al.	Apr. 24, 1917
2,326,067	Rohr	Aug. 3, 1943
2,563,738	Oliver	Aug. 7, 1951
2,592,314	Morton	Apr. 8, 1952
2,752,769	Clark	July 3, 1956
2,812,152	Wyatt	Nov. 5, 1957