May 26, 1959 J. BOCHAN 2,888,531

WATER LEVEL CONTROL FOR CLOTHES WASHING MACHINES

Filed Oct. 28, 1955

FIG. 1

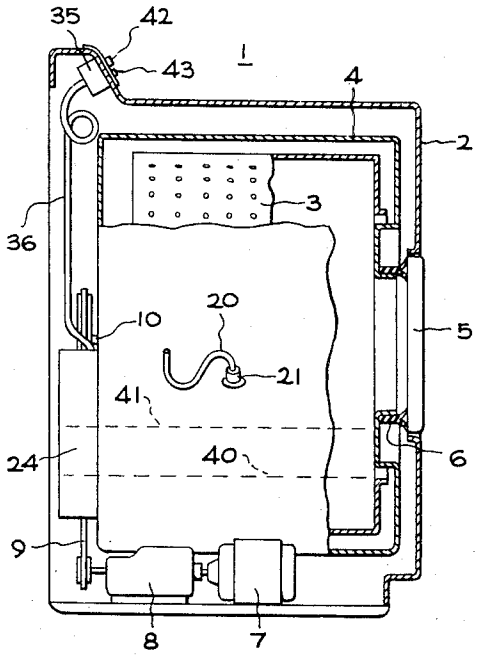


FIG. 2

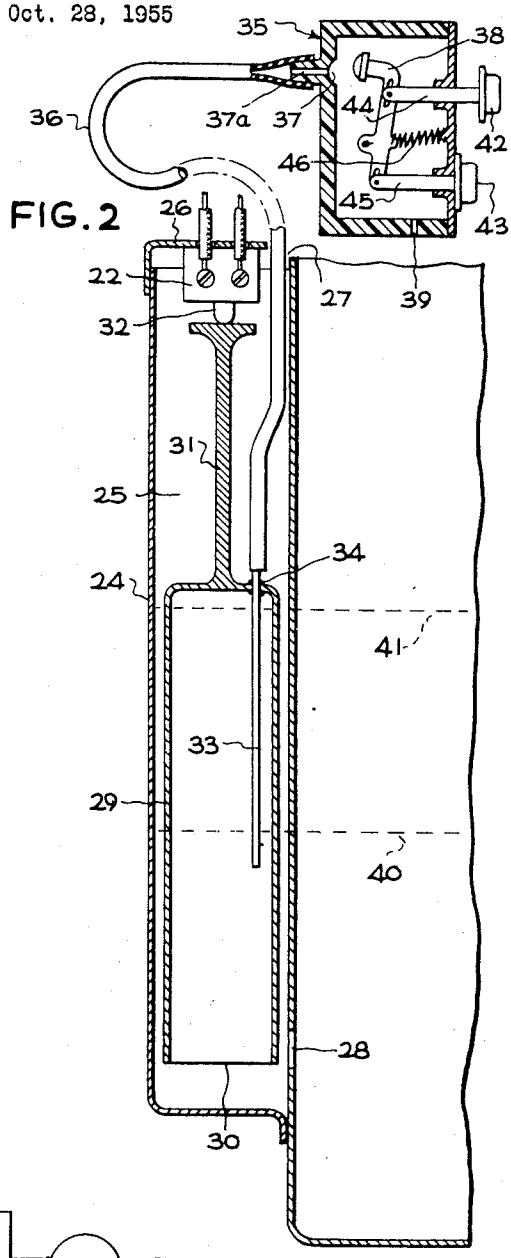
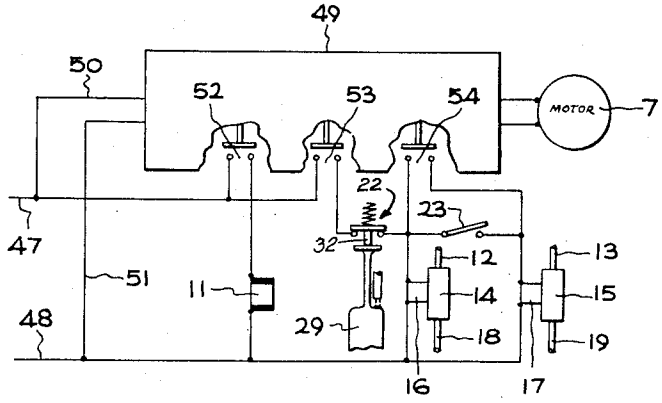


FIG. 3



INVENTOR.
JOHN BOCHAN
BY Harry F. Manbeck, Jr.
HIS ATTORNEY

United States Patent Office 2,888,531
Patented May 26, 1959

2,888,531

WATER LEVEL CONTROL FOR CLOTHES WASHING MACHINES

John Bochan, Louisville, Ky., assignor to General Electric Company, a corporation of New York

Application October 28, 1955, Serial No. 543,378

4 Claims. (Cl. 200—84)

My invention relates to automatic clothes washing machines and more particularly to the electrically controlled water supply means used in such machines.

It is an object of my invention to provide a new and improved arrangement for controlling the water level in a clothes washing machine.

Another object of my invention is to provide an improved water level control whereby a clothes washing machine may be selectively filled to a plurality of different levels.

A further object of my invention is to provide a float type water level control for clothes washing machines, including means for varying the buoyancy of the float so that different water levels may be maintained within the machine.

In carrying out my invention the tub of the washing machine is filled with wash water by electrically controlled water supply means; and by my invention an improved water level control is provided whereby the tub may be selectively filled to at least two different levels. The water level control includes a chamber which communicates with the tub adjacent the bottom thereof and is filled along with the tub. A bell-type float member is disposed within the chamber and electrical switch means are arranged for actuation by the float member. These switch means are connected in a suitable circuit for controlling the water supply means.

So that the switch means may be selectively operated to provide two different water levels within the tub, I provide means for varying the buoyancy of the float member. This means comprises a tube which extends downwardly within the float member and which is open at its bottom end. The upper end of the tube extends outside of the float member to a valve whereby it may be selectively opened to or closed off from the surrounding atmosphere. The tube thereby acts as a means for varying the length of the column of air trapped within the float member as the tub is filled. When the valve is open, air is not trapped until the bottom of the tube is covered, whereas when the valve is closed, air is trapped as soon as the bottom of the float member is covered. The varying of the length of the column of air varies the buoyancy of the float and thereby changes the water level at which it operates the switch means to shut off the water supply means. Thus by opening and closing the valve two different water levels may be maintained within the tub.

The features of my invention which are believed to be novel are pointed out with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, may be best understood by reference to the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a side elevational view of a clothes washing machine including a preferred embodiment of my water level control, the view being partially broken away and partially in section in order to illustrate details;

Fig. 2 is an enlarged fragmentary sectional view of the water level control itself; and

Fig. 3 is a schematic circuit diagram of a preferred electrical control for the machine of Fig. 1.

Referring now to Fig. 1, I have shown therein a clothes washing machine 1 having an outer appearance cabinet 2 within which the various operating components of the machine are mounted. The machine 1 is of the horizontal axis type. That is, it includes a perforated clothes basket or drum 3 which is mounted for rotation about a generally horizontal axis. The basket 3 is disposed within an outer imperforate tub 4, which encloses it on all sides and serves as a water container. The basket and the tub are provided respectively with openings in the front walls thereof, which are aligned with a door opening in the front wall of the appearance cabinet 2. The basket is loaded and unloaded through these openings. A hinged door 5 mounted on the appearance cabinet seals against a gasket 6 around the tub opening to close off the tub during the operation of the machine.

During the operation of the machine 1, the basket 3 is driven by means of an electric motor 7 which is mounted at the base of the machine. The motor 7 drives the basket through a gear transmission 8 which is directly connected to the motor and which is connected to the basket through a belt drive 9. The drive 9, as shown, is connected to the output shaft of the transmission 8 at its one end, and is connected to the shaft 10 mounting the basket 3 at its other end. The transmission 8 is of the type which may be shifted between two gear ratios thereby to provide two different speeds of rotation for the basket. Any suitable transmission of this type may be used, but it is preferred to use a transmission which is shifted from its lower to its higher output speed by means of a solenoid actuated plunger. A solenoid 11 for shifting the transmission is shown schematically in Fig. 3. It will be understood that when the transmission 8 is in one position or ratio, the basket 3 is driven at a suitable speed for tumbling clothes. Conversely, when the transmission is shifted to its other ratio, the basket is driven at a higher speed for centrifugally extracting water from the clothes.

In order to supply water to the tub 4 for washing clothes, the machine 1 is provided with electrically controlled, hot and cold water supply lines. The hot and cold water supply lines 12 and 13 are shown schematically in Fig. 3. As there shown, each of the supply lines is connected to a solenoid operated valve, the line 12 being connected to a valve 14 and the line 13 to a valve 15. The valves 14 and 15 are controlled respectively by actuating solenoids 16 and 17. When the solenoids 16 and 17 are energized, the valves 14 and 15 are opened whereby water passes through them respectively to the outlet conduits 18 and 19. However, when the solenoids are deenergized, the valves automatically return to the closed position so that no water flows therethrough. Any suitable type of valve may be used but it is preferred to use pilot type diaphragm valves such as are well known in the art.

The outlet conduits 18 and 19 from the valves both discharge across an air gap into a suitable funnel (not shown). This funnel is connected to a line 20 (see Fig. 1) which leads to the interior of the tub 4 through a suitable fitting 21. Thus whenever either of the valves 14 or 15 is opened, water is supplied to the interior of the tub. The water after entering the tub through the fitting 21 flows downwardly along the side wall of the tub, and forms a pool at the bottom thereof covering the lower part of the basket 3. My invention is directed to means for controlling the depth of this pool, or in other words for controlling the water level within the machine.

The water valve solenoids 16 and 17 are controlled during the filling period by means of an electrical circuit including a normally closed switch 22 (Figs. 2 and 3). When the switch 22 is closed during this period, power

is supplied to the hot water valve solenoid 16 and assuming a manually operated switch 23 is also closed, power is simultaneously supplied to the cold water solenoid 17. Both valves are therefore opened to pass water to the tub 4.

The supplying of water to the hub is terminated by the opening of the switch 22. By my invention a new and improved water level control is provided for opening the switch. This water level control provides for opening the switch at two different water levels in the tub. In other words it allows the operator of the machine to fill the tub selectively to two different levels for washing clothes. When only a few clothes are to be washed, the operator may fill the tub to a lower level; whereas when a full load of clothes is to be washed, she can fill it to a higher level.

My new and improved water level control is best shown in Fig. 2. The water level control includes a pan-shaped wall member 24 which is mounted on the rear wall of the tub 4. The member 24 together with the rear wall of the tub defines a chamber 25 which is enclosed at all sides except at its top. A cap 26 is positioned over the top of the chamber, but the cap includes an aperture 27 therein so that the chamber communicates with the surrounding atmosphere at its top. The chamber is connected to or communicates with the tub near its bottom by means of an aperture 28 in the rear wall of the tub. By reason of this aperture 28 the chamber 25 is filled along with the tub as soon as the water level in the tub rises above lower edge of the aperture.

Disposed within the chamber 25 is an elongated bell-type float member 29. As shown, the float member 29 comprises an elongated, inverted cup-like member which is open at its bottom end 30. The top of the float member is, however, completely closed off, and thus whenever water rises above the bottom of the float, a column of air is trapped within the float. The column of air trapped therein gives buoyancy to the float member and as the water continues to rise, it ultimately causes the float member to move or float upwardly. The upward movement of the float 29 is effective to operate the switch 22 by means of a vertically extending switch actuating arm 31 mounted on the top of the float. The arm 31 engages a switch operating button 32 extending downwardly from the switch and by pushing this button opens the switch contacts.

So that different water levels may be maintained in the tub at the selection of the operator, I have provided means whereby the buoyancy of the float member 29 may be varied. This means comprises a tube 33 which extends downwardly through the top of the float into the interior thereof. An air tight seal between the tube and the top of the float is formed by means of a rubber sealing member 34. The tube 33 extends vertically downward within the float to a point slightly below the middle thereof, and it is open at its bottom end.

The tube 33 provides for varying the length of the air column trapped within the float member 29. In order to effect this result the tube is connected to the surrounding atmosphere through a valve 35. Specifically, the upper end of the tube is connected to the valve by means of a conduit 36. The conduit 36 extends out of the chamber 25 through the aperture 27 and its lower portion is rigidly formed in the shape shown so that it does not interfere with the action of the float member. The upper portion of the conduit, however, includes a flexible portion in order to allow for the movement of the lower portion of the conduit along with the float member.

The conduit 36 is connected to the inlet port 37 of the valve 35 by means of a passage 37*a* leading through the valve housing. The valve is opened and closed by means of a pivoted valve element 38 within the valve housing, which is movable into or out of engagement with the port or seat 37 so as to close off or open up the passage 37*a* relative to the interior of the housing. The interior of the housing is connected to the surrounding atmosphere by means of an aperture or passageway 39 so that when the passage 37*a* is open, the conduit 36 and the tube 33 are connected to the surrounding atmosphere, whereas when the passage 37*a* is closed, the conduit and the tube are closed off from the surrounding atmosphere.

The effect of opening and closing the valve 35 is that the buoyancy of the float member 29 is varied. When the valve is open, the float actuates the switch at one water level within the tub 4, whereas when the valve is closed, the float actuates the valve at another water level. When the valve is closed while the tub 4 is being filled with water, a column of air is trapped within the float member 29 as soon as the water level rises above its lower end 30. The water, of course, flows from the tub into the chamber 25 through the aperture 28. Since there is no way for the air to escape from the bell float member 29 when the valve 35 is closed, the air within the float member is trapped as soon as the water rises above the bottom end 30. As the water continues to rise within the tub, this column of air trapped in the float member is continually compressed and adds buoyancy to the float member. When the water level has risen far enough, it causes the float member to rise upwardly and operate the switch button 32 to open the switch 22. Specifically, this occurs when the water level reaches the point indicated by the dotted line 40 in Figs. 1 and 2.

When the valve 35 is opened, however, air is not trapped within the float as soon as the bottom of the float is covered. Rather air may escape through the tube 33 and the valve 35 until the water rises far enough within the float to cover the lower end of the tube 33. Only when the bottom end of the tube 33 is covered is a column of air trapped in the float member 29. This column of air is, of course, shorter than that trapped when the valve 35 is closed, and thus it does not add so much buoyancy to the float member. As a result the water rises further within the tub before the float member moves upwardly to operate the switch button 32. Specifically, the water level rises to the point indicated by the dotted line 41 before the switch button is operated. Thus when the valve 35 is closed, the tub 4 is filled to a higher level for washing clothes than when the valve is opened.

In my preferred embodiment the valve 35 is controlled by means of a pair of push buttons 42 and 43. These push buttons are connected respectively to the pivoted valve member 38 by means of operating rods 44 and 45, the operating rods being connected to the valve member by means of pin and slot connections. A toggle spring 46 is disposed between the pivoted valve member and the valve housing so that the valve member is resiliently held in both its open and closed positions. In other words when it is in either of these positions, a manual force is required to move it to the other position. When the push button 42 is operated, the valve is closed and thereby the tub fills only to the level 40 before the switch 22 is opened by the float. Conversely, when the button 43 is operated (as shown in Fig. 2), the valve is opened and the tub fills to the level 41 before the switch is opened.

In my preferred embodiment the opening of the switch 22 breaks the energizing circuit for the water valve solenoids so as to terminate the filling of the machine. In Fig. 3 I have shown schematically one preferred control circuit including the switch 22 and the valve solenoids. This circuit is energized from a pair of supply conductors 47, 48 suitable for connection to a household power source, for example, an alternating current source of 110 volts. The circuit includes a timer operated sequence control 49 which is connected across the supply conductors 47 and 48 by a pair of leads 50 and 51. The sequence control 49 automatically controls the sequence of operation of the electrical components of the machine 1 and

shuts off the machine when the washing operation is completed. Timer operated sequence controls are well known in the art and thus the mechanism of control **49** will not be described herein.

As shown, the sequence control **49** includes a plurality of switches **52**, **53** and **54**. Switch **52** controls the shift solenoid **11** of the transmission **8**, and the switches **53** and **54** control the solenoids **16** and **17** of the water valves. The motor **7** is also controlled from the sequence controller by suitable switch means (not shown). It will be seen that when switch **52** is closed, the solenoid **11** is energized to shift the transmission **8** to its high speed ratio. However, when the switch **52** is open, the solenoid **11** is de-energized allowing the transmission to assume its low speed ratio. The basket speed is thus controlled by switch **52**, and it is operated at suitable periods during the machine operation to shift the basket from tumble speed to centrifugal extraction speed or vice versa.

The switch **53** is closed by the sequence control during the period when wash water is to be supplied to the machine. The closing of switch **53** completes a circuit from line **47** through switch **22** to the hot water valve solenoid **16**. The solenoid **16** is connected directly to the line **48** on its other side so that the solenoid **16** is energized through this circuit so long as switch **22** remains closed. The energizing of solenoid **16**, of course, opens the hot water valve **14** and thus hot water is sent to the machine so long as the switch **22** remains closed. Cold water may be also supplied to the machine during this period if the manually operated switch **23** is closed. If switch **23** is closed, the solenoid **17** of the cold water valve is connected in parallel with the hot water solenoid **16** and thus the valve **15** is opened also. The filling of the tub by means of this circuit continues until such time as the switch **22** is opened by the float **29**. The opening of switch **22** de-energizes both solenoids **16** and **17** and thereby terminates the filling operation. The water level within the tub at which the filling is terminated depends, of course, upon whether or not the air valve **35** is opened or closed. If the valve **35** is opened, the filling will be terminated at the level **41**, whereas, if the valve is closed, it will be terminated at the level **40**.

The switch **53** is also closed when rinse water is to be supplied to the machine for rinsing the clothes after they have been washed. During the addition of rinse water the switch **54** is closed simultaneously with the switch **53**. As shown, the switch **54** is in parallel with the manually operated switch **23** and thus the cold water solenoid **17** is positively connected in the circuit during the supplying of rinse water. In other words both the solenoids **16** and **17** are energized during the rinse fill period so that a mixture of hot and cold waters, i.e. warm water, is fed to the machine. Both valve solenoids are, of course, energized through the switch **22** during this period just as in the wash fill period so that the valves remain open only so long as switch **22** remains closed. When the float **29** rises and opens switch **22**, the solenoids are de-energized and the valves **14** and **15** are closed. Thus the condition of the float determines the amount of water added during the rinse fill period just as it did during the wash fill period.

It will be understood that the machine **1** may contain other electrical components besides those illustrated, for example, a drain pump, electrical heating elements, etc. However, since those elements and their control form no part of the present invention I have not shown or described them.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and I, therefore, aim in the appended claims to cover all such equivalent variations as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A bell type float member including means for varying the buoyancy thereof, said means including a tube extending through a wall of said float member downwardly within said float member and open at its bottom end, a valve for connecting the upper end of said tube to the surrounding atmosphere, and means for selectively opening and closing said valve thereby to vary the length of the column of air trapped in said float member and thus the buoyancy of said float member.

2. An inverted cup-like float member including means for varying the buoyancy thereof, said means including a tube extending into said float member through the top thereof and extending downwardly for a distance within said float member, said tube being open at its bottom end, a valve for connecting the upper end of said tube to the surrounding atmosphere and manually controlled means for selectively opening and closing said valve thereby to vary the length of column of air trapped in said float member and thus the buoyancy of said float member.

3. An elongated bell type float member including means for varying the buoyancy thereof, said means including a tube extending into said float member through the top thereof and extending downwardly inside of said float member past the middle thereof, said tube being open at its bottom end, and a valve for connecting the upper end of said tube to the surrounding atmosphere, whereby said tube may be opened or closed to the atmosphere for varying the column of air trapped in said float member, said valve including a pivoted valve member having an open and closed position, a toggle spring for resiliently holding said valve member in either of said positions, and a pair of switch buttons for operating said valve member between said positions.

4. A water level control comprising a chamber, a bell type float member disposed within said chamber, switch means secured in stationary relation to said chamber and positioned to be engaged by said float member at a predetermined liquid level within said chamber for controlling the introduction of liquid to said chamber, and means for varying the buoyancy of said float member thereby to vary the water level in said chamber at which said float member engages said switch means, said varying means including a tube extending downwardly within said float member and open at its bottom end, a valve for connecting the upper end of said tube to the surrounding atmosphere, and means for selectively opening and closing said valve thereby to vary the length of the column of air trapped in said float member and thus the buoyancy of said float member.

References Cited in the file of this patent

UNITED STATES PATENTS

726,317	Lockwood	Apr. 28, 1903
2,249,418	Chambers	July 15, 1941
2,445,268	Hodgins	July 13, 1948
2,563,738	Oliver	Aug. 7, 1951
2,619,824	Condon	Dec. 2, 1952
2,839,627	Sackett	June 17, 1958