Feb. 15, 1944. H. F. BARIFFI 2,341,894

WASHING MACHINE

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Fig. 1.

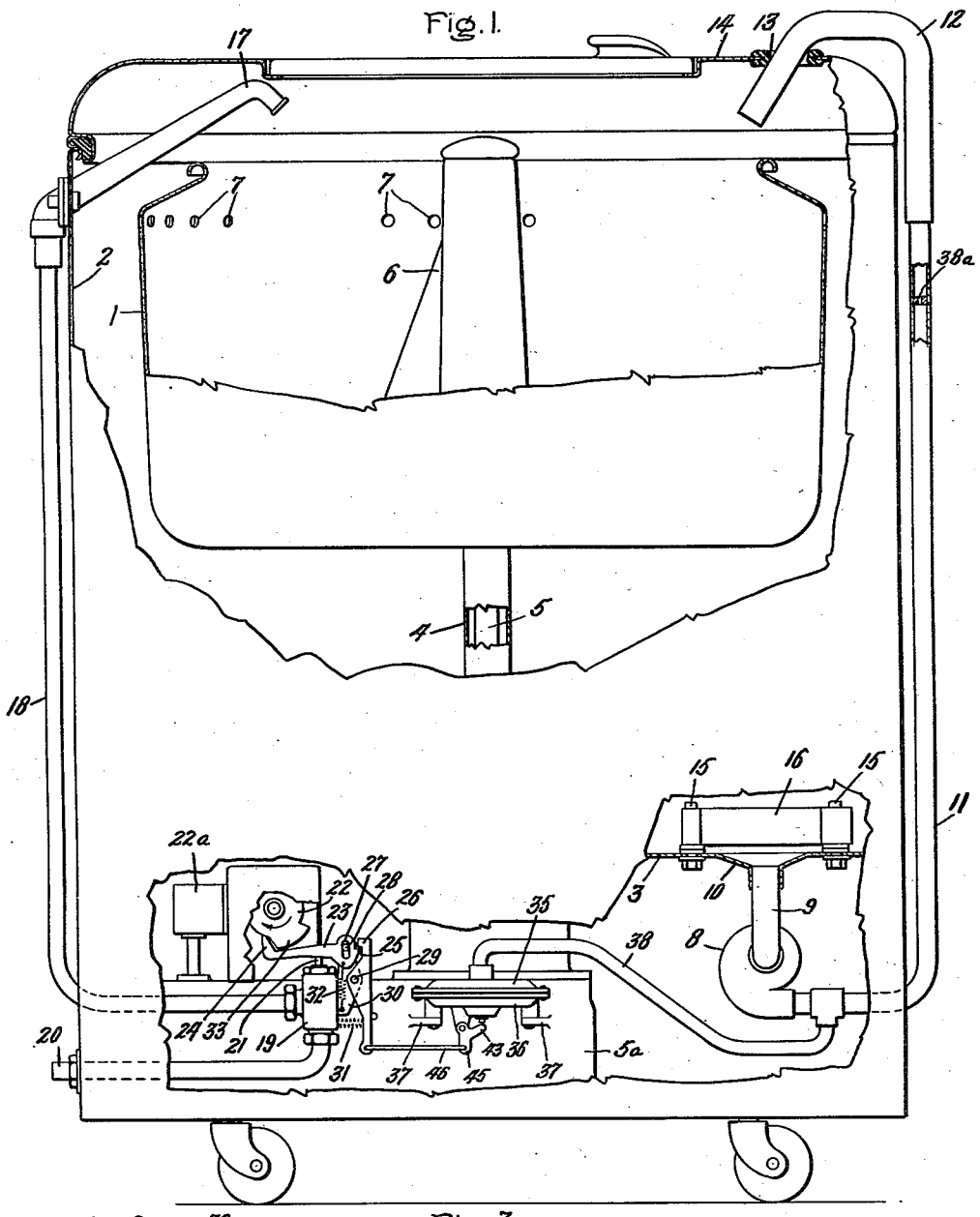


Fig. 2.

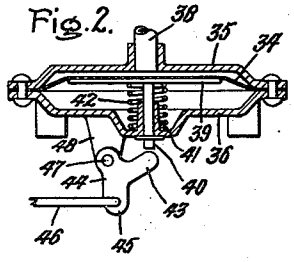
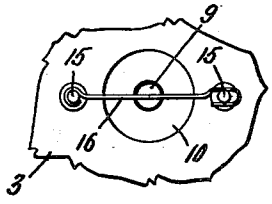


Fig. 3.



Inventor:
Herbert F. Bariffi,
by Harry E. Dunham
His Attorney.

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Fig. 4.

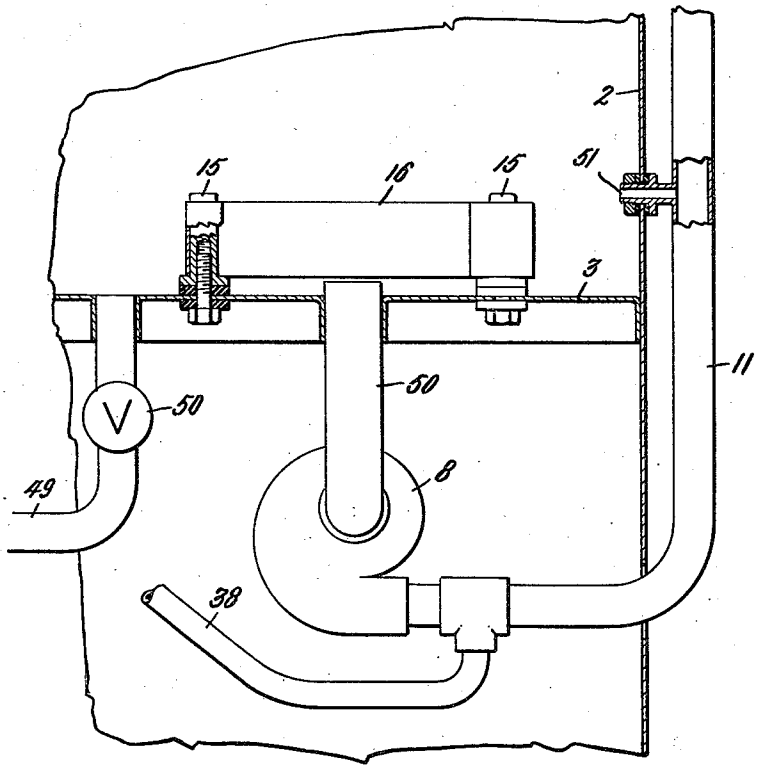
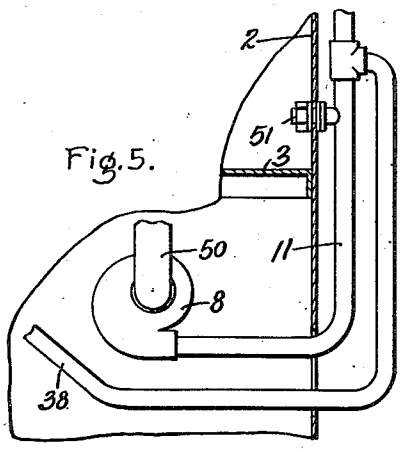


Fig. 5.



Inventor:
Herbert F. Bariffi,
by Harry E. Dunham
His Attorney.

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WASHING MACHINE

Herbert F. Bariffi, Hamden, Conn., assignor to General Electric Company, a corporation of New York

Application January 9, 1941, Serial No. 373,741

8 Claims. (Cl. 68—184)

The present invention relates to washing machines and is particularly directed to an arrangement for controlling the supply of washing liquid.

The object of my invention is to provide a construction in which a pump is utilized to control the supply of liquid to the washing machine. For a consideration of what I believe novel and my invention, attention is directed to the following description and the claims appended thereto.

In the accompanying drawings, Fig. 1 is an elevation, partly broken away, of a washing machine equipped with a control for the liquid supply embodying my invention; Fig. 2 is a sectional view of the diaphragm controlling the liquid supply valve; Fig. 3 is a top plan view of the pump inlet showing the arrangement for preventing swirling of liquid; Fig. 4 is a fragmentary view of a modification, and Fig. 5 is a fragmentary view of another modification.

Referring to the drawings there is shown a washing machine having a rotatable tub or clothes receptacle 1 in the upper part of an outer casing or tank 2. Extending up from the bottom wall 3 of the outer casing is a sleeve 4 through which extends a vertical shaft 5 driven by mechanism in a casing 5a. The shaft 5, by suitable arrangements, selectively oscillates an agitator 6 in the receptacle for washing or rotates the receptacle for centrifugal drying. Such arrangements as well as the mechanism for driving the shaft 4 are known and need not be illustrated for the purposes of the present invention.

The side walls of the receptacle 1 flare outward toward the top and at the region of greatest diameter are provided with openings 7 which serve as overflow openings to define the liquid level in the receptacle during washing and which serve as centrifugal discharge openings during drying. During washing, the liquid overflowing the receptacle 1 falls into the bottom of the outer casing 2 and is returned to the receptacle by a pump 8 having its intake conduit 9 connected to a well 10 in the bottom wall of the outer casing and having its discharge conduit 11 directed into the receptacle through a gooseneck 12 which extends through an opening 13 in a cover 14 for the outer casing. By removing the gooseneck and positioning it to discharge to a drain, the pump may be used to empty the outer casing. During washing, the gooseneck is positioned as illustrated and there is a continuous circulation of the liquid overflowing the receptacle 1. This circulation maintains the liquid level in the receptacle during washing.

On diametrically opposite sides of the well 10 are vertical studs 15 fixed to the bottom wall 3 of the outer casing and serving as supports for a plate 16 extending diametrically across the well 10. The plate 16 serves the purpose of preventing swirling or cavitation of the liquid above the pump inlet, thereby preventing surging of the liquid discharged from the pump when there is only a small amount of liquid in the bottom of the outer casing.

Liquid is supplied to the receptacle 1 through a nozzle 17 connected through a conduit 18 and a valve 19 to a water supply conduit 20. The valve is operated by a plunger 21 spring biased to the closed position of the valve. When depressed from the position illustrated, the plunger 21 opens the valve. The valve is controlled by a cam 22 which may, for example, be rotated in the direction of the arrow by suitable timing mechanism located in a housing 22a. Cooperating with the cam 22 is a lever 23 having at one end a projection 24 bearing on the cam, having the intermediate portion bearing on the plunger 21, and having the other end provided with a shoulder 25 engageable by a latch 26. Adjacent the shoulder 25 the lever 23 is provided with an elongated slot 27 through which extends a guide pin 28. The latch 26 is pivoted at 29 on a plate 30 integral with the valve 19, and the latch is biased into engagement with the shoulder 25 by a compression spring 31 arranged between the valve 19 and the lower end of the latch 26. The lever 23 is lightly held against the valve operating plunger 21 by a light tension spring 32 arranged between the lever 23 and the plate 30. If, while the parts are in the position illustrated, cam 22 is turned in a clockwise direction until the projection 33 on the cam engages the projection 24 on the lever 23, the lever 23 pivots in a counterclockwise direction about the point of contact between the shoulder 25 and the latch 26, moving the plunger 21 downward and opening the valve. If, while the valve is open, the latch 26 is pivoted in a clockwise direction about its pivot 29 until it is clear of the shoulder 25, the lever 23 will be released (or from another aspect the latch will be tripped) and the valve operating plunger 21 will move upward to the closed position under its spring bias. The closing of the valve upon tripping of the latch is possible due to the fact that the spring bias for the plunger 21 is stronger than the spring 32. After the latch has been tripped as described above, the valve

cannot be reclosed until the cam is turned so that the projection 33 is clear of the end 24 of the lever 23.

The tripping of the latch 26 to cause the closing of the valve 19 to shut off the supply of liquid to the receptacle 1 is effected through a diaphragm 34 clamped at its periphery between the adjacent edges of dished plates 35 and 36 supported on bosses 37 on the gear casing 5a. The upper plate 35 is connected through a conduit 38 to the pump discharge conduit 11 so that the pressure between the plate 35 and the upper side of the diaphragm 34 is the discharge pressure of the pump 8. On the lower side of the diaphragm 34 is a rigid metal disk 39 fixed to a plunger 40 slidable in a boss 41 on the plate 36. The disk 39 is biased upward by a compression spring 42 surrounding the plunger 40 and the boss 41. This causes the diaphragm 34 to be bowed upwardly as illustrated in Fig. 2 when there is no discharge pressure in the pump 8. The lower end of the plunger 40 cooperates with an arm 43 of a bell crank lever 44, the other arm 45 of which is connected through a link 46 to the latch 26. The bell crank lever 44 is pivoted at 47 on a bracket 48 on the under side of the plate 36. When the pump discharge pressure acting on the upper side of the diaphragm 34 is sufficient to overcome the force of the biasing spring 42, the diaphragm moves the plunger 40 downward, causing pivoting of the bell crank lever 44 in a clockwise direction and thereby moving the latch 26 clear of the shoulder 25 so that the valve 19 closes to shut off the water supply. When there is no liquid in the bottom of the outer casing the discharge pressure of the pump is low, being due solely to the surging of the liquid which may remain in the pump. The pump pressure remains at this low figure until the receptacle 1 is filled and sufficient liquid has overflowed through the openings 7 so that the pump and its discharge conduit 11 are filled. At this time a continuous circulation of liquid is set up between the bottom of the outer casing and the receptacle. The pump pressure now rises, and the rise in pressure acts through the conduit 38 on the diaphragm 34 and causes the closing of the valve 19 in the manner described above. The pressure is increased by a restriction 38a in the conduit 11. The supply of liquid to the receptacle is accordingly controlled by a flow condition of the pump 8. This eliminates the need for complicated and delicate liquid level control devices.

Although the diaphragm 34 is primarily responsive to the pump 8, it is also responsive to the total height of liquid in the outer casing 2. For example, if the pump does not operate while the valve 19 is open, the static head on the diaphragm 34 due to the liquid in the casing will act through the diaphragm to close the valve before the outer casing is filled to overflowing.

In the use of the machine the receptacle is initially filled by turning the cam 22 so that the projection 24 on the lever 23 cooperates with the cam projection 33. Although the pump 8 is running at this time, the pump pressure is insufficient to trip the latch 26 so that the valve 19 is opened by the resulting pivoting of the lever 23 about the shoulder 25. Water is now discharged into the receptacle through the nozzle 17 until the water overflows through the openings 7. This is the desired liquid level for washing. When sufficient liquid has overflowed through the openings 7, the pump sets up a circulation from the bottom of the outer casing through the discharge conduit 11 and gooseneck 12 to the receptacle. This causes a rise in the pump pressure which acts through the conduit 38 and diaphragm 34 to trip the latch 26 and shut off the water supply. The clothes may now be washed by oscillation of the agitator 6 and, at the conclusion of the washing, may be centrifugally dried by rotation of the receptacle 1. During centrifugal drying the liquid is discharged through the openings 7 and falls into the bottom of the outer casing, and is there stored below the receptacle. This liquid may be returned to the receptacle to wash a succeeding batch of clothes. While this liquid is in the bottom of the outer casing, it is not possible to supply additional liquid to the receptacle since upon starting the pump and moving the cam 22 to the position for opening the valve 19, the pump pressure will immediately be sufficient to trip the latch 26.

The water supply valve 19 is shut off in response to the difference between the no-load and full-load pressure of the circulating pump 8. The no-load pressure of the pump is due to liquid which may be trapped in the pump casing. No-load pressure is not steady and may under some conditions surge to a high enough value so as to cut down the practical working differential between no-load and full-load pressure. The difference between no-load and full-load pressure is substantially increased by preventing swirling of the liquid or cavitation above the pump inlet. This prevents surging in the full-load pump pressure and accordingly increases the differential between no-load and full-load pressure.

In Fig. 4 is shown a construction for increasing the differential between the no-load and full-load pressure by decreasing the no-load pressure. This construction is shown applied to the previously described machine, corresponding parts of which are designated by the same reference numerals. In the present construction a separate drain for the outer casing is provided which is diagrammatically illustrated as a conduit 49 controlled by a valve 50. There is no well provided in the bottom wall 3 of the outer casing, and the inlet conduit 50 of the pump is connected to the bottom wall of the outer casing so as to project slightly above the minimum water level. In the discharge conduit 11 of the pump is arranged a small by-pass conduit 51 discharging into the outer casing slightly above the bottom thereof. After the outer casing has been drained through the conduit 49 there will remain a small amount of liquid trapped in the casing of the pump 8. Upon starting of the pump this liquid surges up the discharge conduit 11 and spills over into the outer casing 2 through the by-pass conduit 51. After a short period of operation of the pump 8, practically all of the liquid trapped in the pump casing has surged through the by-pass conduit 51 into the casing. The liquid level in the outer casing is now below the upper end of the intake conduit 50. From one aspect the by-pass conduit 51 serves to bleed the pump discharge so as to remove the liquid trapped in the pump casing. During the full-load operation of the pump, when it is circulating liquid to the receptacle, the by-pass conduit 51 is substantially ineffective. In fact, the injector action of the liquid flowing in the discharge conduit 11 past the inner end of the by-pass conduit 51 may be sufficient to completely prevent flow through the by-pass conduit. The bleeding of the liquid trapped in the pump cas-

ing through the by-pass conduit 51 takes place very rapidly when the pump is started, and substantially all of this liquid is returned through the by-pass conduit to the outer casing before the pump pressure has risen to an objectionable value. However, if there should be any trouble due to surging of the pump pressure before the residual liquid has been bled through the by-pass conduit 51, this could be avoided by connecting the conduit 38 above the by-pass conduit as shown in Fig. 5. The arrangement shown in Fig. 4 increases the differential between the no-load and full-load pump pressure by decreasing the no-load pressure by means of the intake conduit 50 and by-pass conduit 51 and by decreasing surging of the full-load pressure by means of the plate 16 which prevents swirling of the liquid or cavitation above the pump inlet.

This application is an improvement on application Serial No. 391,113, filed April 30, 1941, which should be considered as prior art.

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

1. In a washing machine, a casing, a clothes receptacle within the casing, overflow openings defining the liquid level in the receptacle, a pump having its inlet connected to the bottom of the casing and its discharge directed into the receptacle, means for reducing swirling of the liquid in the casing at the pump inlet, a liquid supply conduit discharging to the receptacle, and means responsive to the pump pressure for shutting off the liquid supply.

2. In a washing machine, a casing, a clothes receptacle within the casing, overflow openings defining the liquid level in the receptacle, a centrifugal pump, an inlet conduit for the pump having its upper end slightly above the minimum liquid level in the casing, a discharge conduit for the pump directed into the receptacle, a by-pass conduit from the discharge conduit to the casing for returning to the casing any residual liquid which surges up the discharge conduit, a liquid supply conduit discharging to the receptacle, and means responsive to the pump pressure for shutting off the liquid supply.

3. In a washing machine, a casing, a clothes receptacle within the casing, overflow openings defining the liquid level in the receptacle, a centrifugal pump having its inlet connected to the bottom of the casing and its discharge directed into the receptacle, means for reducing swirling of the liquid in the tub above the pump inlet, a diaphragm connected to the pump discharge, a liquid supply conduit, a valve in said conduit, and means responsive to the pressure on said diaphragm for shutting said valve.

4. In a washing machine, a casing, a clothes receptacle within the casing, overflow openings defining the liquid level in the receptacle, a pump having an inlet connected to the casing and a discharge directed into the receptacle, a liquid supply conduit discharging to the receptacle, and means responsive to the circulation by said pump of liquid from the casing to the receptacle for shutting off the supply of liquid to the receptacle.

5. In a washing machine, a casing, a clothes receptacle within the casing, overflow openings defining the liquid level in the receptacle, a pump having its inlet connected to the bottom of the casing and its discharge directed into the receptacle, means for reducing swirling of the liquid in the casing at the pump inlet, a liquid supply conduit discharging to the receptacle, and means responsive to the circulation by said pump of liquid from the casing to the receptacle for shutting off the supply of liquid to the receptacle.

6. In apparatus for filling a tub or the like to a predetermined liquid level, a liquid supply conduit discharging into the tub, a pump, provisions for conducting from the tub to the pump liquid in excess of that required to fill the tub to said liquid level, and means operated by the pump discharge pressure for shutting off the supply of liquid to the tub.

7. In a washing machine, an outer casing, a clothes receptacle in which clothes are washed and centrifugally dried, said receptacle being above the liquid level in the casing and overflowing to the casing, a water supply conduit discharging to the receptacle, a valve in said conduit, a pump for pumping liquid from the casing to the receptacle, a control member for opening said valve, and means responsive to the circulation by the pump of liquid from the casing to the receptacle for shutting the valve.

8. In a washing machine, a casing, a clothes receptacle within the casing, overflow openings defining the liquid level in the receptacle, a pump having an inlet connected to the casing and a discharge, a liquid supply conduit discharging to the receptacle, and means responsive to the pump discharge pressure for shutting off the liquid supply.

HERBERT F. BARIFFI.