United States Patent

Sims

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[54] **SUDS SAVING SYSTEM FOR AUTOMATIC WASHER**

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[52] **U.S. Cl.**.....**137/571,** 68/DIG. 2, 68/208

[51] **Int. Cl.**.....**D06f 39/08**

[58] **Field of Search**.....68/207, 208, DIG. 2; 137/571

[56] **References Cited**

UNITED STATES PATENTS

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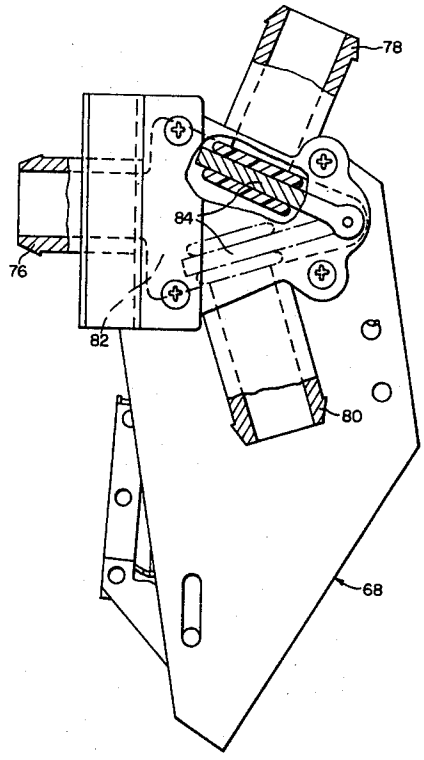
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[57] **ABSTRACT**

The instant invention provides an automatic washer which has washing, rinsing and sud saving modes. In the suds saving mode, the wash water is pumped into a supplementary laundry tub for later reuse in the automatic washer to reduce the overall wash water requirements for the washer. A purge or "burp" function is provided for in the automatic washer after the sudsy water has been pumped into the supplementary storage receptacle so as to insure the elimination of suds within the line leading to it and also within the pump. This purging action is accomplished by the pumping of rinse water, for a short time duration, towards the supplementary storage receptacle after the rinse cycle has been completed. By the use of such an extra step with the conventional suds save mode, the pumping arrangement for the pumping of sudsy water from the supplementary storage receptacle may effectively handle the returning detergent carrying water without being disabled by air locking caused by a large amount of suds initially disposed within the pump or conduit extending to the supplementary laundry tub.

6 Claims, 3 Drawing Figures



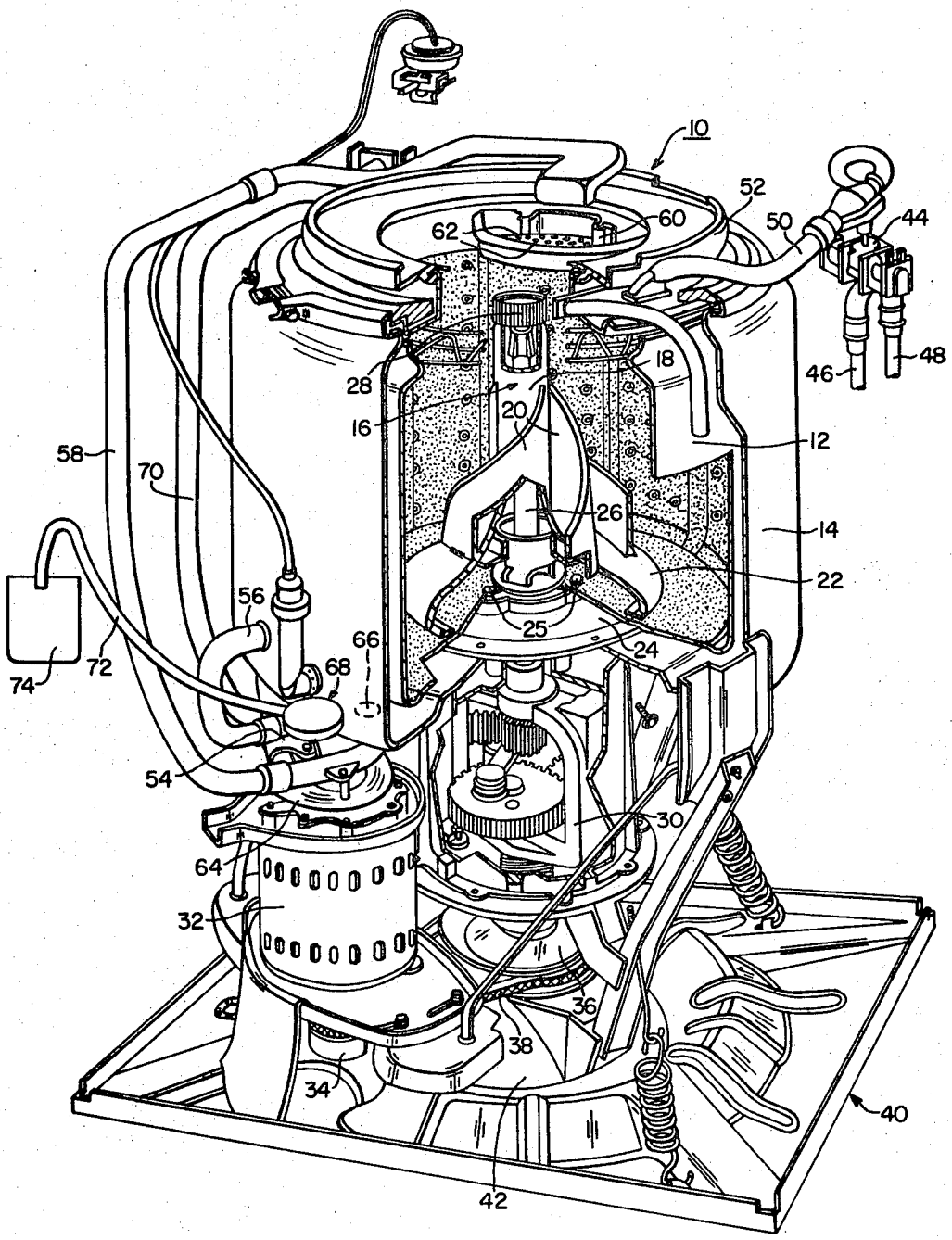


FIG. 1.

WITNESSES

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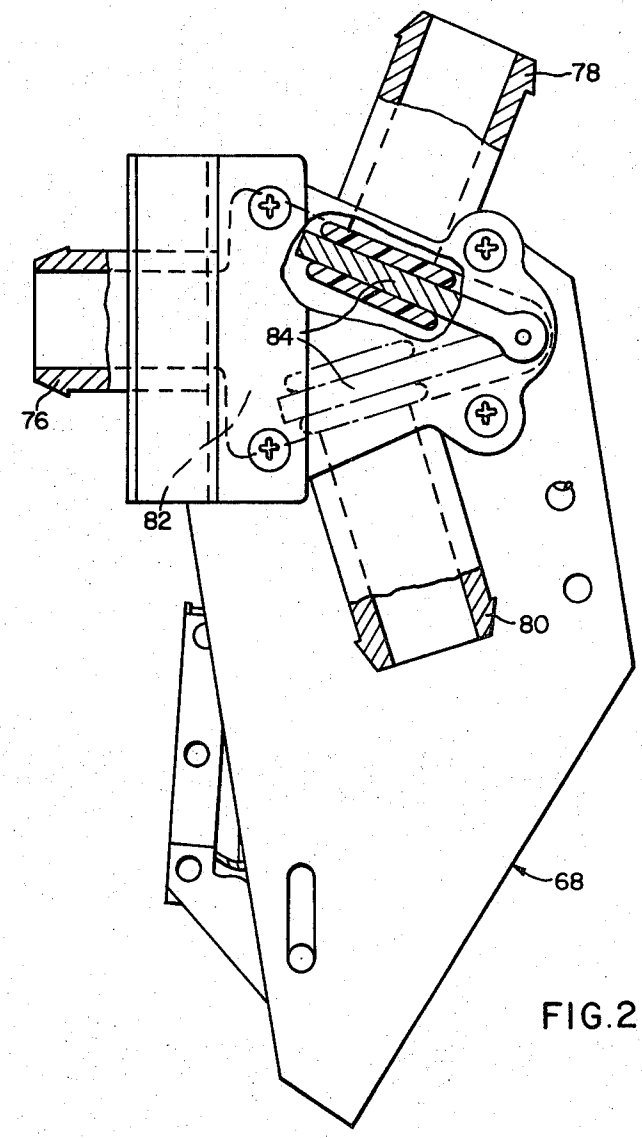
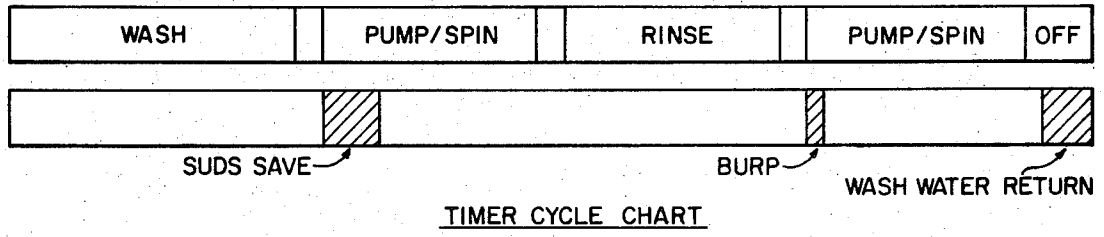


FIG.2.



TIMER CYCLE CHART

FIG.3.

SUDS SAVING SYSTEM FOR AUTOMATIC WASHER

BACKGROUND OF THE INVENTION

1. Field of the Invention:

This invention relates to automatic washers, and, more particularly, relates to automatic washers having a suds save mode of operation.

2. Description of the Prior Art:

The use of automatic washers having a sud save mode of operation which pump detergent containing wash water from the automatic washer to a set tub or the like during a portion of its operational cycle and then later reclaims this detergent carrying wash water so as to utilize it to wash an additional load of clothes has been known by the housewife for several years. However, the returning of saved wash water from the supplementary set tub to the automatic washer has been a problem for all manufacturers of sud save washing machines because of the possibility of aeration of the pump at the time when the saved water and its entrained detergent are to be pumped back into the automatic washer. More specifically, the pump utilized to pump the water containing detergent back to the automatic washer is subject to aeration and a non-primed condition based on the fact that the final portions of detergent containing wash water pumped to the supplementary set tub contained a large amount of suds. The use of a standard pump, which is adequate for drainage of wash water from within the automatic washer and also for the movement of detergent containing wash water into the supplementary set tub, to return the used wash water to the washing machine has subjected many of these automatic washing machines to an air lock when this same pump has been utilized to pump the detergent containing wash water backwardly into the automatic washer. This air locking of the drainage pump has necessitated that many manufacturers utilize a supplementary pump which is more tightly sealed and can more adequately handle water with a high suds level. However, the use of such a supplementary pump, either as an auxiliary or as a substitute pump, imparts an additional cost to the manufacturer and, if an auxiliary pump is utilized, also requires a substantially more complicated conduit arrangement so that the wash water being returned to the automatic washer finds its way through the auxiliary pump and also through the conduit arrangement for it.

Accordingly, it would be advantageous to provide an automatic washer having a suds save mode with only a single drainage pump which would perform all the pumping operations required by the automatic washer cycle except recirculation and, yet, at the same time, one which would be adapted in its operation to make provision to insure that it was not subjected to air locking by a high suds level contained in the conduit extending to the supplementary set storage tub containing detergent carrying wash water.

SUMMARY OF THE INVENTION

The instant invention contemplates an automatic washer having wash, rinse and suds save modes of operation, with a single pump utilized for circulating the wash water to the auxiliary set tube which holds the detergent carrying water, for returning this wash water to the automatic washer and for draining the wash water from the washer. A simple two-way diverter valve provides for discharge of the wash water either to the drain or the said set tub which receives the suds containing water for storage. Air locking of this standard pump, utilized with this automatic washer, is prevented by conventionally locating the diverter valve close to and higher than the pump and then insuring that the exhaust hose to the supplementary set storage tubs is a continuous slope upward to the set tub and, further, by the innovative utilization of a purge or "burp" mode of operation for the automatic washer which clears the discharge line to the supplementary tub and the interior of the pump of all suds prior to the reversal of this pump and a repumping of the saved and stored detergent carrying water back into the automatic washing machine. This purge or "burp" mode consists essentially of an additional actuation of the pump and two-way diverter valve to drain water from the automatic washer to the set tub for a short period of time after the rinse water has been utilized during the rinse mode of operation of the automatic washer. Because of the disposition of the flapper of the two-way diverter valve, the pump and the conduit from the pump to the supplementary storage tub is purged and cleared of all suds and air by the introduction of rinse water to it so that, upon reversal, the pump may easily repump the saved suds and wash water back into the automatic washer without an air lock developing within its pumping chambers. The length of time for such a mode of operation is minimal so that a large amount of rinse water is not transferred into the set tub. The time duration of operation may be set for between 5 and 20 seconds, with this time period being long enough to insure a sufficient purge of the pump and conduit leading to the set tub of all air and suds contained therein. Of course, after the completion of the purge or "burp" cycle, the conduit extending to the supplementary set tub and the pump are full of rinse water. Then this rinse water acts as a prime for the pump so that there is no problem in restarting pumping action for the opposite direction of flow.

DRAWING DESCRIPTION

For a better understanding of the invention, reference may be had to the preferred embodiment, exemplary of the invention, shown in the accompanying drawings in which:

FIG. 1 is a perspective and partial sectional view of an automatic washer which incorporates the principles of the invention;

FIG. 2 is a cross sectional view of a two-way diverter valve utilized in the practice of this invention; and

FIG. 3 is an illustration, in graphical form, of the various modes of operation of the automatic washer as it goes through one whole cycle.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, therein is shown an agitator type automatic clothes washing machine **10** including a perforated clothes basket **12**. The clothes basket **12** is disposed within an outer imperforate casing or tub **14** that serves to retain the wash water within the automatic washer **10**, while, at the same time the clothes which are to be washed are maintained in the per-

forated basket 12. A vertical axis agitator 16 that includes a centerpost 18 and a plurality of radially extending vanes 20 is disposed at the center of wash basket 12 so as to provide oscillation and agitation of the wash water as the agitator 16 rotates about its vertical axis formed essentially by the axis of the centerpost 18. A skirt 22 is joined to the radially extending vanes 20 at the bottom of the agitator 16 to provide for general strength and rigidity for the assemblage of the agitator 16.

A hub 24 mounts the basket 12 within the tub or casing 14 for rotation by being boltingly attached thereto by a series of bolts 25. The agitator 16 receives its rotational drive through a shaft 26 extending upwardly through the centerpost 18 and having a nut at its upper termination attaching the centerpost 18 to the shaft 26. Both the agitator 16 and basket 12 are driven by a transmission 30 disposed below the tub 14, with the agitator 16 driven by the transmission in one direction of rotation of it through the shaft 26 and the hub 24 rotating the basket 12 in the other direction of rotation of the transmission. This transmission is substantially conventional and forms no part of the instant invention, so no additional details of it are given herein.

The transmission 30 is driven through a conventional reversible electric motor 32 that has a pulley 34 mounted with and rotated by it. Pulley 34, in turn, provides a rotational drive to a pulley 36 directly connected to transmission 30, with this pulley mounted outwardly of the main housing for the transmission so as to readily receive a belt 38 or the like so that it extends around both it and the pulley 34. Thus, the transmission 30 can be driven in either direction of rotation, dependent entirely upon the direction of rotation of the electric motor 32.

A base frame 40 is provided for the automatic washer 10 to support its other elements. This frame has a globular surface (not shown) forming a dome on which the remainder of the operating and supporting parts of the automatic clothes washer are disposed. A similarly shaped flange 42 supports the already described operating elements directly from the base frame 40 by connection to a series of struts fixed to and extending upwardly to the tub or casing 14. This mounting arrangement is described in more detailed form in U.S. Pat. No. 3,277,742, issued Oct. 11, 1966 and owned by a common assignee. Reference may be made to this patent for a fuller understanding of the aforementioned mounting arrangement.

A water inlet valve 44 of conventional character is provided so as to receive hot and cold water from a pair of conduits 46, 48 attached, respectively, to hot and cold water supplies (not shown). This valve functions through a pair of solenoid means to provide the clothes washer 10 with proper temperature water for the wash and rinse cycles. A conduit 50 attached to water inlet valve 44 on its discharge side provides a flow path from the valve 44 to the automatic washing machine 10, with the discharge from this conduit being situated below a splash guard 52 of washing machine 10.

A pump 54 is disposed above electric motor 32 to be driven thereby so as to provide for recirculating water for the washing machine 10. This pump is provided with an inlet conduit 56 which is attached to the automatic washer 10 slightly above the bottom of the tub or casing 14 so as to provide the recirculating pump 54 with a positive flow of water. The conduit 56, at its lower end connects to the inlet side of the recirculating pump 54, while a conduit 58 leads the discharge flow from the recirculating pump 54 upwardly so that the recirculating wash water is discharged over a filter 60 of the clothes washing machine 10. Water drains therefrom by gravity through a series of perforations 62 contained in the filter 60 and backwardly into the basket 12 so that clothes being washed in automatic washer 10 are continually supplied with a wash water supply which is free of large dirt particles and lint.

A second pump 64 is also mounted so as to be directly driven by electric motor 32 with this pump being provided with a supply of water on its normal suction side through a drain 66 disposed in the bottom of the tub or casing 14. On the discharge side of the pump 64, it is connected to a diverter valve 68 which provides for discharge of the water from the pump 64 to either a discharge conduit 70 connected to the diverter valve 68 and extending to a conventional drain (not shown) or to a discharge conduit 72 connected to the diverter valve 68 and extending to a supplementary set tub 74 that is provided to maintain and save the detergent carrying wash water at a location apart from the washing machine 10. The discharge conduit 72 leading to set tub 74 also functions as a suction or inlet conduit when the detergent carrying wash water, maintained in set tub 74, is pumped backwardly into automatic washing machine 10 when the second pump 64 is reversed in direction due to a reversal of rotational direction of electric motor 32.

A more detailed description of the operation of diverter valve 68 will now be given. Referring now to FIG. 2 of the Drawings, it can be seen to include a single inlet 76 and a pair of outlets 78 and 80, with the inlet 76 connected to the discharge or suction side of the second pump 64 (dependent upon pump rotation). With the pump 64 operating to discharge water from the inlet 76, detergent carrying wash water flows therefrom into a chamber 82 of diverter valve 68 to which both the outlets 78 and 80 are confluently connected. Water passes, alternatively from chamber 82 into outlet 78 or outlet 80, dependent upon the position of a solenoid operated flapper valve 84.

As illustrated, the solenoid operated flapper 84 is shown in both a full line and a dash-dotted line position. In the full line position of this flapper valve it closes the outlet 78 which leads to the room drain so the discharge conduit 70 is obstructed and the flow of detergent carrying wash water through the diverter valves 68 is then from inlet 76 to outlet 80 and from there into conduit 72 so that the wash water flow is directed to the set tub storage means 74. In the dotted line position of the solenoid operated flapper valve 84, flow of water from the chamber 82 is outwardly through the outlet 78 to the drain provided for the automatic washing machine 10. It should also be noted that, with the solenoid operated flapper valve 84 in its full line position and the pump rotating in an opposite direction from that described immediately above, that the wash water flow is then inwardly through the outlet 80 so that it serves as an inlet means to the diverter valve 68. During this stage of operation, with stored water being pumped backwardly into the automatic

washer **10**, the flow of water is through the chamber **82** and inlet **76** to the second pump **64** and from thence backwardly into the tub or casing **14** through the drain **66**. The operation of the diverter valve **68** is substantially conventional for valves of this type with the solenoid operated flapper valve urged in one direction by means of a compressed spring arrangement (not shown) and in the other direction against the force of the compressed spring by solenoid-offered magnetic attraction.

In carrying out the principles of the invention, the diverter valve **68** is disposed immediately above the second pump **64** and the conduit **72** connected thereto extends at an angle upwardly to the set tub **74** so that provision can be made for providing a pressure head of water above the pump **64** during and immediately before operation of the pump **64** in a direction to return detergent carrying wash water back into the automatic washing machine **10**.

The operation of washing machine **10** is illustrated graphically in FIG. **3** wherein the conventional modes of Wash, Pump/Spin, Rinse, Pump/Spin and Off are shown. Superimposed on these modes are the Suds Save, Wash Water Return and "Burp" or Purge modes with the last of these three modes being the innovative step in the operation of the washing machine **10**. Each of these modes, in activation and time duration, is controlled by a selector switch (not shown) having a series of contacts (not shown), some movable and some fixed, with the movable contacts actuated in their movement by a series of timer-motor driven cams having high and low points on their profiles. Such a selector switch means is conventional and well known, the same being typically shown, for example, in U.S. Pat. Nos. 3,267,703 and 3,269,153 so that no further description of the selector switch is herein given the description proceeding instead to a description of the operating cycle of washing machine **10**.

Once the Wash mode of operation has been initiated through the aforesaid selector switch, the washing machine **10** fills to the desired level with wash water through water inlet valve **44** and then agitator **16** is activated to oscillate the water and clothes within washing machine **10**. At the same time, recirculation pump **54** pumps wash water upwardly for discharge into filter **60** so as to provide a continuous supply of substantially lint and dirt free wash water for the washing of clothes in basket **12**.

At the completion of the timed Wash mode, the pump **64** is activated to drain detergent carrying wash water from washing machine **10** with the solenoid of diverter valve **68** energized so as to place outlet **80** of it into communication with the set tub **74** and thereby permit the pumping of the detergent carrying wash water over into the set tub. After a period of time, (a sufficient length of time to recover substantially all the wash water from the automatic washing machine **10**) diverter valve **68** is permitted to go to a deenergized state thereby permitting the solenoid operated flapper valve **84** to resume the dotted line position of FIG. **2** as urged thereto by spring biasing. Any remaining wash water then present in automatic washer **10** is pumped outwardly therefrom through diverter valve **68** into the household drain.

After initial pump out but prior to completion of the Pumping portion of the Pump/Spin mode, the basket **12** begins its centrifuging action by spinning to remove water from the clothes in the basket **12**. As is conventional, initiation of the Spin portion of the Pump/Spin mode occurs after initial pump out to insure that electric motor **32** is not subject to an overload based on a full level of water in washing machine **10** during spinning.

After the Spin operation of the Pump/Spin mode has been completed, automatic washing machine **10** is then in condition for the operation of the conventional Rinse mode, the rinse water being again provided for washing machine **10** through water inlet valve **44**. As is conventional, once filled to a sufficient level of rinse water, automatic washing machine **10** circulates this rinse water through the aegis of the circulating pump **54** so as to maintain substantially clean rinse water for rinsing purposes by this circulating rinse water draining downwardly through filter **60**. At the completion of the Rinse mode for automatic washing machine **10**, the Purge mode of operation occurs so as to insure that the pump **64** is properly primed at that time when returned wash water is pumped backwardly into automatic washer **10** for the initiation of another wash cycle.

At the completion of the Rinse mode of operation, washing machine **10** contains a high level of rinse water which is substantially suds free. The pump **64** is then initiated to momentarily force a slug of rinse water into the again energized diverter valve **68** and through it to the set tub **74**. This fills the conduit **72**, the diverter valve **68** and the inlet to the pump **64** and its pumping chamber with a substantially foamless and suds free water so that a later initiation of the pump **64** to reclaim the stored detergent containing wash water maintained in the tub **74** results in no air locking the pump. The pump **64**, initially, is thereby fully primed so that it may, at a later time, without becoming air locked, pump the saved detergent carrying wash water back into the washing machine **10**. Such a mode of operation can be considered a "Burp" mode since its duration is small and, yet, entrained air is fully removed from the passage ways leading to the set tub **74**. The purging effect, then, is provided solely by the rinse water which is pumped toward the tub **74** to eliminate air containing suds and any air bubbles in the means serving as conduit between pump **64** and set tub **74**.

Initiation of the "Burp" or Purge mode is accomplished in the following manner: Diverter valve **68** is set to provide a flow path for water from the set tub **74** through the sud saver diverter valve **68** by actuation of its solenoid (not shown) to move the solenoid operated flapper valve **84** against spring bias to the proper position for maintaining a flow path to the set tub **74**. The electric motor **32** is also energized during this time so as to drive the second pump **64** to move a portion of the rinse water contained in automatic washing machine **10** toward the set tub **74**.

As can be seen in FIG. **3**, the Purge or Burp mode of operation is extremely limited relative to the length of time duration of the other modes of automatic washing machine **10**. This mode may have a time duration of 5 to 20 seconds, actual practice having shown this as a sufficient time duration for purging, so that only a small amount of rinse water need be pumped into and

through the means forming the conduit between the washing machine **10** and the set tub **74** to eliminate suds and bubbles and to provide a full purge and thereby a prime for the pump **64**.

At the completion of the five to **20** seconds time period which is required for the "Burp" mode of operation, the pump **64** continues to be in an active pumping condition, but the diverter valve **68** returns to its de-energized waste drainage position so that the flapper valve member **84** now closes off the outlet to the supplementary tub **74** and all water pumped by the pump **64** is directed to the household drain which is located, advantageously, adjacent to washing machine **10**.

At the completion of the Pump/Spin mode of operation after the Rinse mode, automatic washing machine **10** has completed sufficient modes to provide a load of clean and rinsed clothes. Automatic washing machine **10** then goes to its Off mode of operation which is a timed portion of the cycle as dictated by the timer motor (not shown). Near the end of the Off mode of operation, the Wash Water Return mode of operation is actuated. At this time, the electric motor **32** drives pump **64** in the opposite direction of rotation then that previously described. Simultaneously, the diverter valve **68** is energized so as to provide a communication between the set tub **74** and automatic washing machine **10**. Because of the presence of rinse water in the means forming the conduit between the tub and automatic washer, pump **64** is fully primed and immediately starts pumping. A flow of the small slug of rinse water immediately followed by detergent carrying wash water in set tub **74** is returned to automatic washing machine **10**. The Wash Water Return mode of operation has a time duration of sufficient length to insure that substantially all of the detergent carrying wash water stored in set tub **74** is again moved into automatic washing machine **10** and the tub **14** thereof. At the completion of the need for dumping, the automatic washing machine **10** is moved to a full off position by the operator. An additional complete wash cycle for it may be initiated by the operator thereof moving the selector switch (not shown) back into the Wash mode of operation. Any make-up water required for the operation of automatic washing machine **10** will be supplied through water inlet valve **44**, with this make-up water placing the washing machine **10** in condition for the reception of additional dirty clothes and the completion of another wash cycle.

It should be clear to one skilled in the art that the above described invention provides a cycle of operation for a washing machine which insures that there is no air lock of the pump utilized to return saved wash water to the washing machine and the same may be easily applied to a conventional wash cycle arrangement for a washing machine. Further, it should be obvious to one skilled in the art that many modifications can be made to the details of the foregoing invention which still fall within its spirit and scope and the description offered.

What is claimed is:

1. In an automatic washing machine including a pump and having a suds-saving operation in which used washing water is pumped at the end of a wash operation through communicating passage means from said pump to a separate storage tub for subsequent reuse in the machine, an arrangement for promoting the subsequent return of said used wash water to said machine, comprising;

means diverting sufficient rinse water into said communicating passage means to clear said passage means of suds and air during a rinse pump out operation that said pump is adequately primed to draw said used wash water from said storage tub during said subsequent return of said used wash water to said machine.

2. In a washing machine according to claim **1** wherein:

said diverting means diverts said rinse water during a final rinse pump-out operation.

3. In an automatic washing machine including a pump and having a suds-saving operation in which used washing water is pumped at the end of a wash operation through communicating passage means from said pump to a separate storage tub for subsequent reuse in the machine, an arrangement for promoting the subsequent return of said used wash water to said machine, comprising:

a diverting valve in said communicating passage means having one position for directing pump-out water to said storage tub, and another position for directing pump-out water to drain;

means for operating said valve to said one position for a short but sufficient period during a rinse pump-out operation to purge said communicating passage means of air and suds, so that upon a subsequent operation of said pump to return said used wash water to said machine, said pump will be continuously primed during said return.

4. In an automatic clothes washing machine adapted for an operational mode which includes a suds-saving operation in which used washing water is stored in a separate storage tub for subsequent return of the machine:

a reversible pump;

a diverter valve having one open port and a pair of alternatively open and closed ports;

first conduit means connecting said one port of said pump to the washing chamber of said machine;

second conduit means connecting another port of said pump to said open port of said diverter valve;

third conduit means connecting one of said pair of ports of said valve to said storage tub;

fourth conduit means connecting the other of said pair of ports to drain;

motor means to drive said pump in one direction to pump water from said machine, and in the opposite direction to pump water to said machine from said storage tub;

means controlling the operation of said motor means and said diverter valve, in a cycle including said suds-saving operation, to pump used wash water from said washing chamber through a path including said first conduit means, said pump, said second conduit means, said diverter valve and said third conduit means to said storage tub, at the end of a washing operation and, during a subsequent rinse pump-out operation, to pump sufficient rinse water through said same path to substantially purge said same path of air and suds residual from said washing water pump-out, so that upon a sub-

sequent operation of said pump in said opposite direction to return said used water to said machine, locking quantities of air in said path and pump are absent.

5. In a washing machine according to claim 4 wherein:

said diverter valve is located in the lower portion of said machine so that said third conduit means slopes upwardly from said valve to said storage tub.

6. In a washing machine according to claim 4 wherein:

said controlling means limits the duration of said purging of said same path to a minor portion of the period of said rinse pump-out operation to prevent an undue quantity of rinse water from being added to said used wash water.

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