April 3, 1962 R. C. COCHRAN 3,027,908

DOMESTIC APPLIANCE

Filed Sept. 4, 1956 5 Sheets-Sheet 1

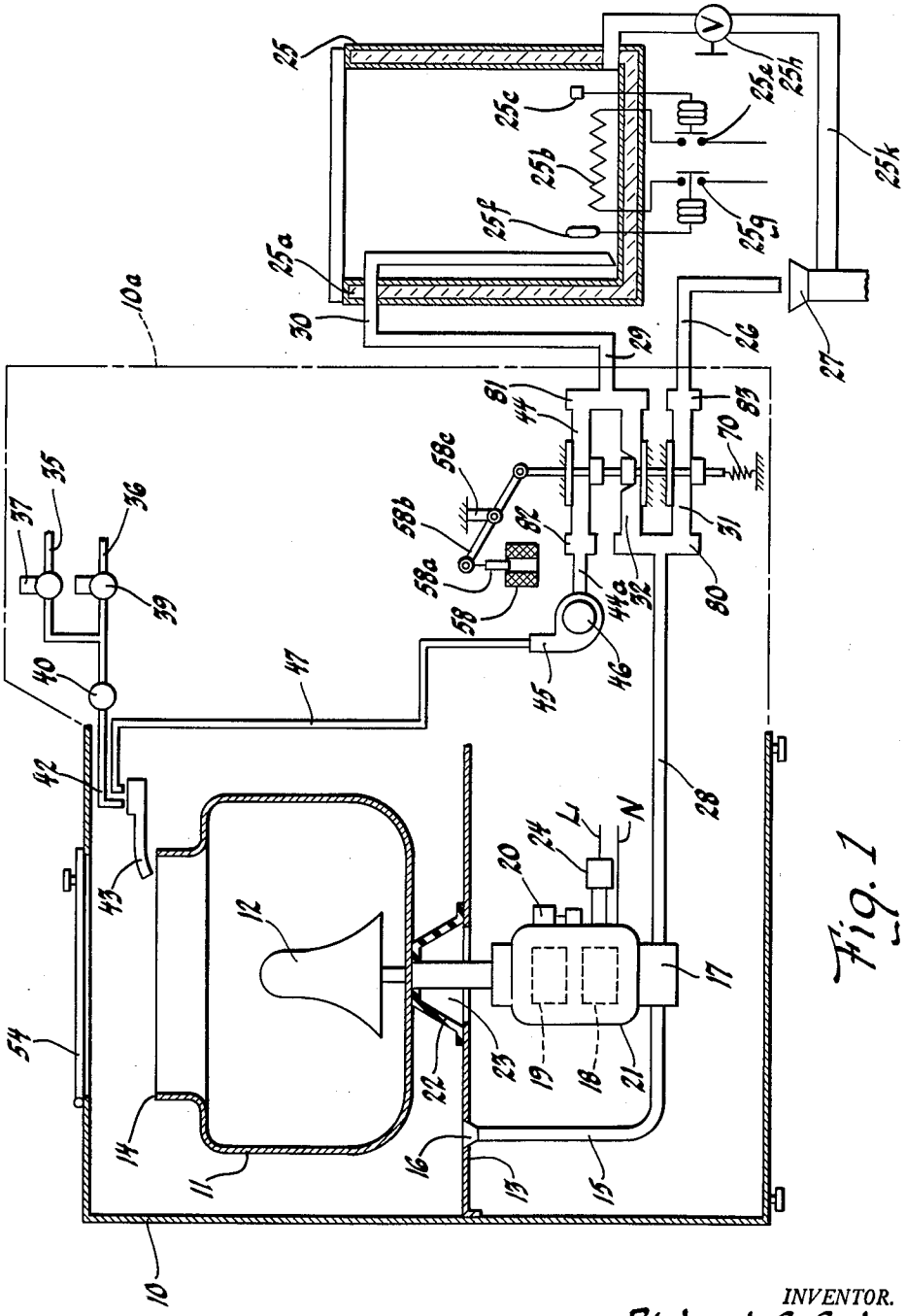


Fig. 1

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DOMESTIC APPLIANCE

Filed Sept. 4, 1956 5 Sheets-Sheet 2

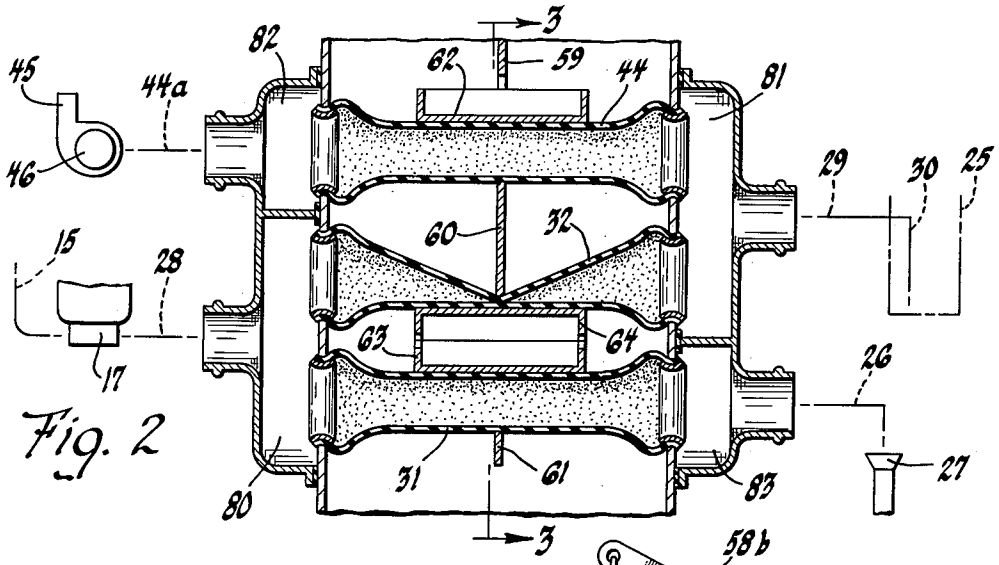


Fig. 2

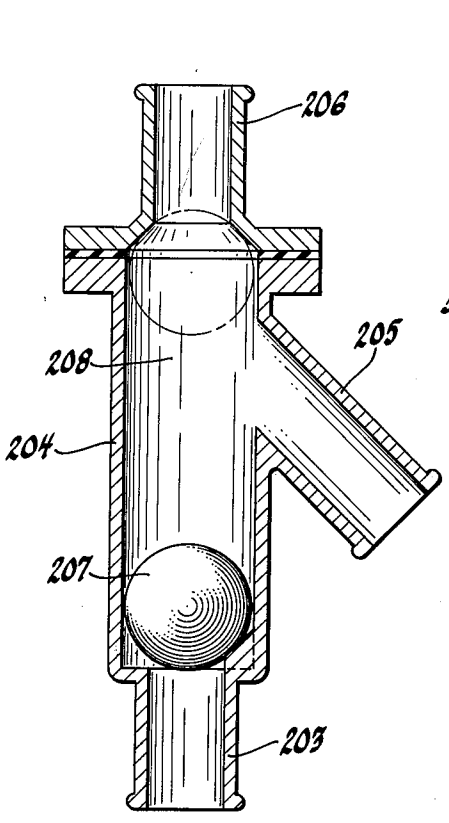


Fig. 6

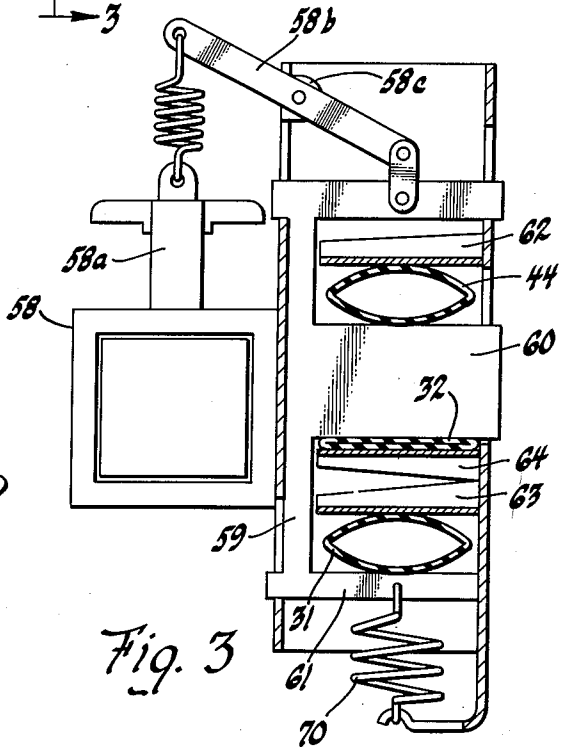


Fig. 3

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DOMESTIC APPLIANCE

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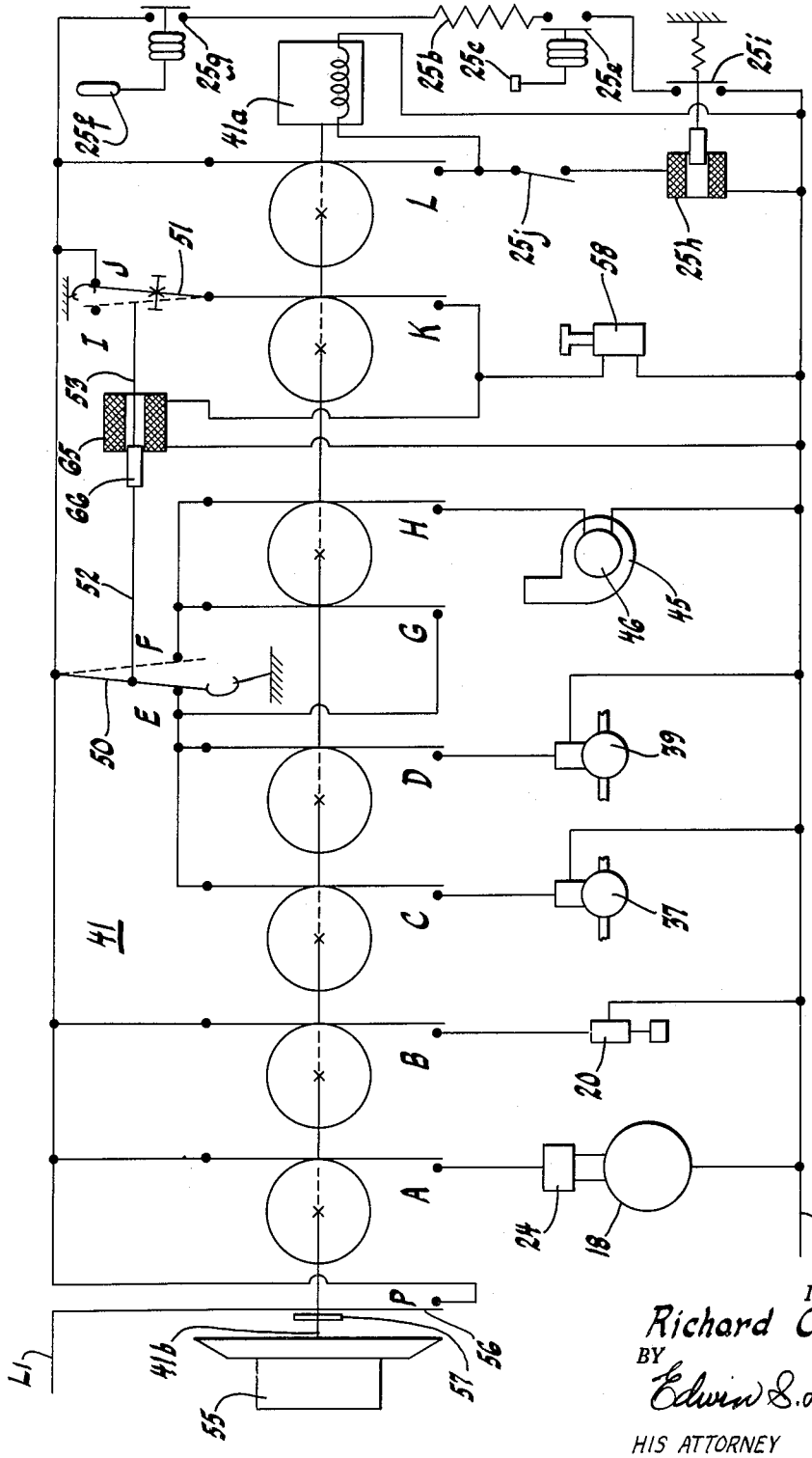


Fig. 4

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DOMESTIC APPLIANCE

Filed Sept. 4, 1956 5 Sheets-Sheet 4

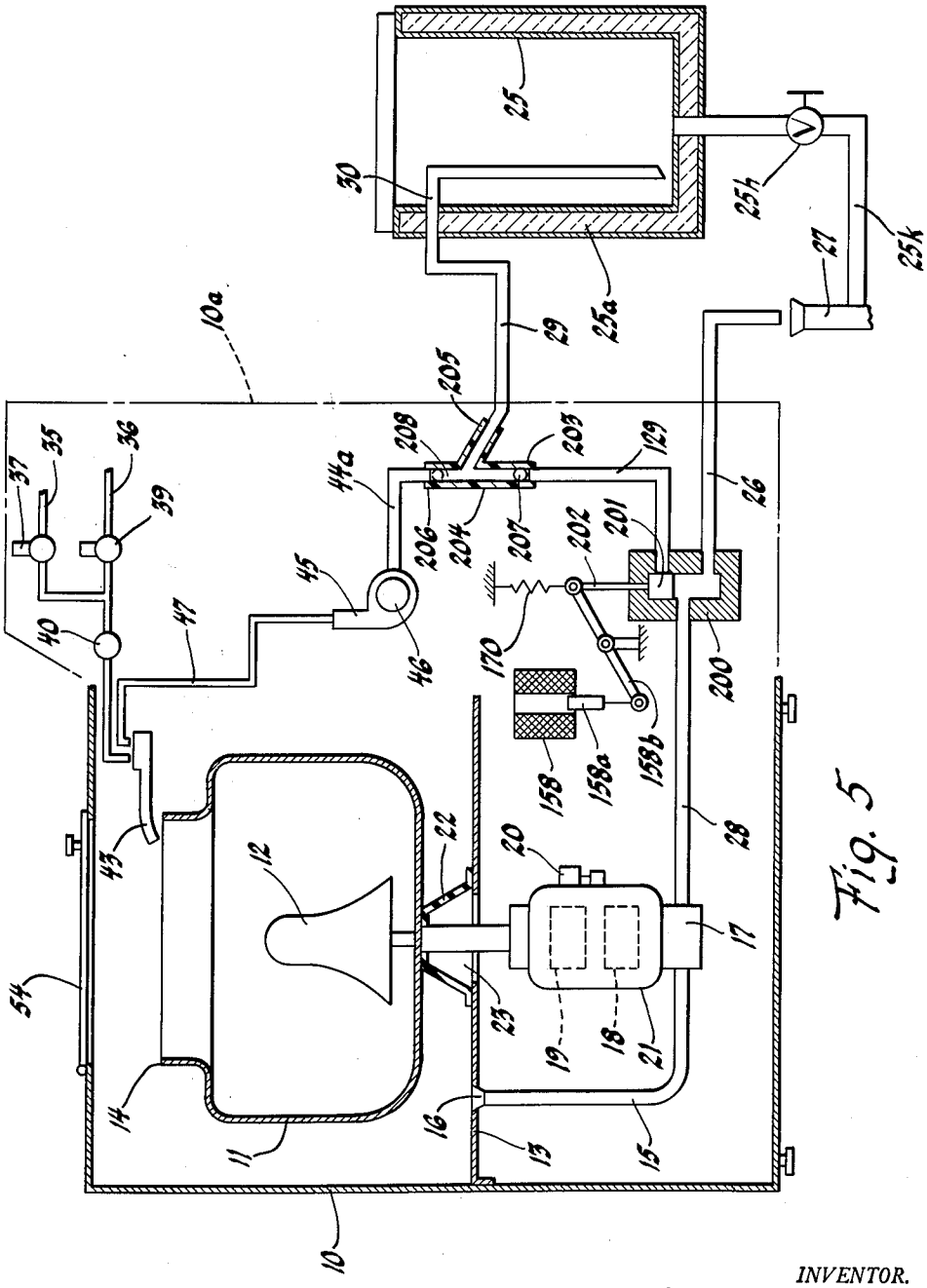


Fig. 5

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DOMESTIC APPLIANCE

Filed Sept. 4, 1956 5 Sheets-Sheet 5

TYPICAL TIMER OPERATION FOR TWO LOADS OF CLOTHES

OPERATION	FIRST LOAD (SET TO SAVE SUDS)	SECOND LOAD (WITH SAVED SUDS)
START–FILL FOR DETERGENT WASH	TIMER SWITCHES INDICATED BELOW ARE CLOSED	
	C E J L P	C F H J L P
AGITATION	A E J L P	A F J° L.P
SPIN & EMPTY	A B J K F L P	A B J(OR 1°) K F(OR E°) L P
RINSE FILL'	C D F G J L P	C D F(OR E°) G J(OR 1°) L P
AGITATION'	A F J L P	A F(OR E°) J(OR 1°) L P
SPIN & EMPTY'	A B J F L P	A B F(OR E°) J(OR 1°) L P
STOP	F J	F(OR E°) J(OR 1°)

'— ONCE OR TWICE. °— CHANGE J TO 1 MANUALLY AT THIS TIME TO DISCARD SUDS ON NEXT SPIN.

TO EMPTY SUDS CONTAINER 25 WITHOUT USE OF SUDS, TURN TIMER TO START WITHOUT CLOTHES IN BASKET AND WHEN TUB IS FILLED WITH SUDS BY F H J L P — MOVE SWITCH 51 FROM J TO 1 AND TIMER TO LAST SPIN & EMPTY. THIS CLOSES SWITCHES A B E I L P AND MACHINE WILL BE EMPTIED INTO DRAIN 27 AND TIMER WILL RUN TO STOP AND PUSH KNOB 55 TO LEFT.

Fig. 7

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DOMESTIC APPLIANCE

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Filed Sept. 4, 1956, Ser. No. 607,913
2 Claims. (Cl. 137—109)

This invention relates to domestic appliances, and more particularly to a clothes washing machine.

An object of this invention is to provide a washing machine with a suds saving means capable of automatically and selectively returning the suds, or other liquid, from a first batch of clothes for use in washing a second or subsequent batch of clothes.

Another object of this invention is to provide a washing machine with controls and connections whereby the suds from a first batch of clothes may be selectively discharged into a suds storage container or may be discharged into a drain or the like, and whereby the detergent washing liquid for a second or subsequent batch of clothes may be selectively received from a fresh water supply or from the suds previously discharged into said suds storage container.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the invention is clearly shown.

FIGURE 1 is a diagrammatic representation, partly in cross-section, of a washing machine and suds saver embodying features of my invention.

FIGURE 2 is an enlarged vertical cross-section of the selective discharge valve arrangement.

FIGURE 3 is a cross-section taken along the line 3—3 of FIGURE 2.

FIGURE 4 is a wiring diagram showing the controls for the machine shown in FIGURES 1 to 3.

FIGURE 5 is a view similar to FIGURE 1, but showing another embodiment of the invention.

FIGURE 6 is an enlarged vertical cross-section of the flow-ball valve shown in FIGURE 5.

FIGURE 7 is a chart indicating a typical suds saving operation.

Referring first to FIGURES 1 to 4, a clothes washing and centrifuging structure may be enclosed in a cabinet 10 and may include a vertical imperforate tub or basket 11 and an agitator 12, and these may be of any well known construction, as desired. For example, they may be of the type disclosed in the patents to Kendall Clark Nos. 2,725,118 and 2,502,823, patented November 29, 1955, and April 4, 1950, respectively. A liquid sump 13 may form a part of the cabinet and is associated with the tub and agitator to empty liquid used in the tub. The liquid is discharged over the rim 14 of the tub and flows into the conduit 15 connecting the discharge opening 16 of sump 13, and the intake of the pump 17.

A motor 18 and a transmission 19 drive the washing and centrifuging structure in a washing motion when the solenoid control 20 is not energized, and in a centrifugal motion when the solenoid control is energized. The washing motion may be produced by maintaining the tub 11 substantially stationary or in a slowly rotating or oscillating condition. The centrifugal motion is produced by rotating the tub 11 at relatively high speed, sufficient to extract a large amount of liquid from the clothes, which is discharged over the rim 14 along with the main body of suds produced during the detergent wash, or the rinse liquid used during subsequent rinsing operations.

The motor 18 and transmission 19 may be enclosed in a casing 21 which is suspended by the flexible, conical collar 22, which seals the opening 23 in the sump 13,

through which the drive shafts pass to the tub 11 and agitator 12. The motor 18 may have the starting relay 24, of well known construction.

A suds container 25 may be placed at any convenient place, preferably near the washing machine. It may be fully insulated at 25*a* and may be provided with an electric heater 25*b*. When the level responsive bulb 25*c* is compressed by the liquid in container 25, the switch 25*e* is closed. When the thermostatic bulb 25*f* is cool, the switch 25*g* is closed, but is opened when the bulb 25*f* and suds in container 25 reach a desired temperature. The solenoid 25*h* closes the spring opened switch 25*i*, when the manual switch 25*j* and timer switch L are closed.

A drain connector 26, such as a flexible hose, may receive liquid from pump 17 and discharge it into the drain 27, or laundry tub, in the dwelling.

Liquid conduits 15, 28, 29 and 30 are connected between the sump 13, pump 17, container 25 and connector 26.

Emptying controls cause liquid to flow automatically from the sump 13 and pump 17 selectively to the drain 27 or to the suds container 25. Such controls may include suitable valve structure such as the flexible conduits 31 and 32 which are selectively, alternatively and automatically opened and closed to direct the liquid flowing through conduit 28 either to the drain 27 or to the suds container 25. Further details of the controls are more fully hereafter described.

Fresh liquid filling means for the tub 11 may include a hot water supply line 35, cold water supply line 36, hot water solenoid valve 37 and cold water solenoid valve 39. A constant volume control 40 is provided which delivers a constant volume of liquid per unit of time into the tub 11 under the control of the timer 41 shown in FIGURE 4. The timer automatically delivers the correct volume of water into the tub at each fresh water fill. The control 40 delivers the liquid to a nozzle 42 which discharges into the flexible funnel 43 feeding the tub 11.

Liquid return means connect the suds container 25 and the tub 11 of the washing structure. Such liquid return means may include the conduits 29 and 30, flexible conduit 44, conduit 44*a*, return pump 45, driven either by motor 18 or by a separate motor 46, and conduit 47 from the discharge of pump 45 to the funnel 43 and/or tub 11.

Filling controls to cause the tub 11 of the washing structure to be filled automatically and selectively by the fresh liquid filling means heretofore described, and including nozzle 42, or by said liquid return means previously described and including conduit 47. Such filling controls may also include valve construction to introduce the fresh liquid, when desired, as by the solenoid valves 37 and/or 39 under the control of timer 41, and valve structure, such as flexible conduit 44, and pumping means, such as pump 45, also under the control of timer 41.

The filling controls and the emptying controls preferably are coordinated so the user may select to cause liquid used with a first batch of clothes selectively to flow to the drain 27 or to the suds container 25. If the selection is to cause flow to the container 25, then the user, when washing a second batch of clothes, may select the use of fresh liquid or may cause return of liquid from the suds container. This may be accomplished by placing the snap switches 50 and 51, FIGURE 4, respectively at E and I for use of fresh liquid with both batches of clothes. When the user desires fresh liquid with the first batch of clothes and suds from the suds container 25 for the second batch of clothes, he or she moves switches 50 and 51 to E and I, if not already there (switch 51 is a manual snap switch which pushes switch 50 to E by pushing of the rod 52, 53, which is attached to switch 50

and not to switch 51). Thereafter, he moves switch 51 to J, leaving switch 50 temporarily at E. Detergent is then inserted in tub 11 by opening lid 54 and the timer knob 55 is turned to "start" and is pushed in, to the right in FIGURE 4. The sequence in FIGURE 7 is a typical sequence of closing of the timer switches, the closed switches being listed and the open switches being unlisted.

During the detergent fill for the first batch, with detergent inserted in tub 11 through the opening of lid 54, fresh liquid, such as hot water, is introduced through hot water solenoid valve 37 by the closing of timer switch C as indicated in FIGURE 7. The timer of well known construction, was started by turning knob 55 to "start" and pushing it in (to the right in FIGURE 4), which pushed leftwardly biased blade 56 by pin or disk 57 and closed power switch P. Timer motor 41*a* was energized to drive the shaft 41*b*. Thereafter, motor 18 is energized by the timer for agitation by closing A. After sufficient agitation, spin solenoid 20 is energized by closing B and A. The spin centrifuges the suds over rim 14 into pump 17. At this time, switch K has been closed, energizing suds saving solenoid 58 to open flexible conduit or valve 32 and close flexible conduit or valve 44 (and 31) by the upward movement of frame 59 with its cross pieces 60 and 61 against the stationary cross pieces 62 and 63 and away from the stationary cross piece 64. Solenoid 58 has an armature 58*a* which pulls down on one end of lever 58*b*, fulcrumed at 58*c* and connected to frame 59, to move frame 59 upward when solenoid 58 is energized. The tension spring 70 pulls the frame 59 when the solenoid 58 is not energized. The suds are forced by the pump 17 through conduits 28, 32, 29 and 30 into suds container 25. The closing of switch K also energizes the switch throwing solenoid 65, moving armature 66 and rod 52, 53 to the right to snap switch 50 from E to F (51 had already been moved to J by the user). Rinse fill, with fresh mixed water is controlled by current from F, through G, C and D to solenoid valves 37 and 39. Rinse agitation is by A to motor 18. Spin and emptying of rinse water to drain 27 is by motor 18 and pump 17 with valve or conduit 31 open and valve or conduit 32 closed by the pull of tension spring 70 acting to pull the frame 59 down. A second rinse and spin may follow. Timer 41 then reaches "stop" and the first batch of clothes is removed and the second batch is inserted, after which the timer knob 55 is turned to "start" and is pushed in which fills the tub with suds from container 25. This is accomplished by current from F and H to motor 46 and pump 45 with solenoid 58 deenergized thus opening valve or conduit 44 while closing valve or conduit 32. After the suds fill agitation is produced by energization of motor 18. At this time, the user may select that there will be no further suds saving or discharge into suds container 25 for use with a third batch of clothes. The user manually snaps switch 51 from J to I, which also pushes switch 50 from F to E so suds saving solenoid 58 can not be energized by current from J nor pump motor 45 by current from F. If such selection is made, all liquid discharges from sump 13 will be to the drain 27. However, if no such selection is made, then the detergent liquid will be saved by discharge into container 25 for use with a third or subsequent batch of clothes, as will be apparent from the chart.

The user may select not to have any suds saving by pushing snap switch 51 to position I, which automatically also pushes snap switch 50 to position E. The machine will then operate with fresh liquid for every fill in the same manner as if no suds savings feature were provided.

Preferably substantially all of the elements described in connection with this invention are placed in the stationary cabinet 10 which preferably is rectangular in cross-section. In order to show the parts on the single plane of FIGURE 1, the cabinet 10 is shown extended sidewise by the dotted line 10*a* to indicate the elements which may be placed within the cabinet 10, such as behind the motor-transmission casing 21. The suds saving container 25 preferably is in a cabinet of its own, outside the cabinet 10. Portions of conduit 30 and drain connector 26 are outside of the cabinet 10, as indicated in FIGURE 1.

Referring to FIGURES 2 and 3, the conduits 31, 32 and 44 and certain other parts may be connected structurally to form a unitary valve structure. The conduits 31 and 32 are connected to a header 80 at the lefthand end, which in turn is connected to conduit 28. Conduits 32 and 44 are connected to header 81 at the righthand end, which in turn is connected to conduit 29. Header 82 is connected to the lefthand end of conduit 44 and to the conduit 44*a* leading to the intake of pump 46. The header 83 is connected to the righthand end of conduit 31, which in turn is connected to the drain connector 26. The headers 80—83, conduits 31, 32, 44, frame 59, solenoid 58, etc., may be mounted in a unitary box or frame (not shown) adapted to be mounted within the cabinet 10.

In the embodiment shown in FIGURES 5 and 6, all of the elements may be substantially the same as the corresponding elements in FIGURES 1 to 4, except as hereafter described. Reference numerals have been placed on some of such elements to aid in establishing the identity of the elements, but other elements, without such reference numerals, are understood also to be identical, as is evident. Where elements are slightly different, they have been identified with the prefix numeral 1 of 100 followed by the reference numeral of the nearly corresponding element of FIGURES 1 to 4. Certain other elements are indicated by reference numerals of 200 or over. The wiring diagram of FIGURE 4 is applicable to FIGURES 5 and 6 with the substitution of solenoid 158 of FIGURE 5 for the solenoid 58 of FIGURES 1 to 4. The method of operation and typical diagram shown in FIGURE 7 is also applicable to FIGURES 5 and 6 with the changes hereafter described.

In FIGURES 5 and 6, the detergent wash water flowing through conduit 28 is discharged into drain 27 when the solenoid 158 is not energized, and flows to the suds container 25 when the solenoid 158 is energized. To this end, the conduit 28 is connected to the inlet of two-way valve 200, having outlets connected to conduits 129 and 26 respectively. The valve plunger 201 and plunger stem 202 are pulled up by the tension spring 170 when the solenoid 158 is not energized and are pushed down by the armature 158*a* and lever 158*b* when the solenoid 158 is energized. The pipe 129 is connected to the lower end 203 of the ball valve 204. A side branch 205 is connected to pipe 29 leading to suds container 25. The upper end 206 is connected to the pipe 44*a* leading to the intake of pump 46. A ball 207 is placed within the passageway 208 slightly larger in diameter than the lower and upper ends 203 and 206. The ball 207 is approximately 10% to 20% heavier than water and is larger in diameter than any of the openings at 203, 205 and 206. Preferably, it is made of rubber, or rubber-like material, such as neoprene. When there is an upward flow of liquid from pipe 129 (when solenoid 158 is energized), the ball 207 is forced to the upper end 206 and hence the liquid is forced through side branch 205, pipes or conduits 29 and 30 into suds container 25 (which may have the heater construction and controls 25*b*—25*j* previously described, if so desired). When the upward flow of liquid in pipe 129 stops, because of upward movement of valve plunger 201 when solenoid 158 is deenergized, the ball 207 sinks through the liquid in passageway 208 to the lower end 203. When pump motor 46 is energized to create a suction by pump 45 in passageway 44*a*, while the solenoid 158 remains deenergized, the ball 207 remains at lower end 203 because of its specific gravity, and the liquid in suds container 25 may be withdrawn by pump 45 through conduits 30, 29 and 44*a* and is delivered through pipe 47 and funnel 43 into tub 11.

From the foregoing description of FIGURES 5 and 6 taken with the previous description of corresponding parts in FIGURES 1 to 4 and 7, it becomes apparent that the same sequence of washing, centrifuging, and rinsing may be performed in the embodiment of FIGURES 5 and 6 that are possible with the embodiment of FIGURES 1 to 4 and 7. The same selection of suds saving or suds discarding is also possible.

If desired, the control system shown in FIGURE 4 may be changed by omitting the solenoid **65**, its armature **66** and its operating connections **52** and **53**. Switch **50** becomes a simple manually operable double throw switch. Also if desired, the switch **51** may be omitted and replaced by a single conductor connection corresponding to the connection provided by the switch **51** when in its J or closed position as illustrated in FIGURE 4. Switches G and H are alternately closed and opened by the timer cam shown in FIGURE 4 with switch H being closed during the wash fill period and switch G being closed during the rinse fill periods as indicated in FIGURE 7.

The switch **50** is manually positioned throughout the complete cycle in position E when no suds are to be saved or reused. For suds saving and reuse, the switch **50** remains in position E until after the initial wash fill period of the first load. At any time before the beginning of the second load cycle, the switch **50** is manually moved to position F where it remains as long as the suds are to be reused. Thus whenever switch **50** is in position F, the switch H will be closed during the wash fill period to energize the motor **46** to operate the pump **45** to return the suds from the container **25** to the tub **11**.

With this modified system, the suds container **25** must be provided with a drain valve **25***h* or a stopper and a drain conduit **25***k* connecting with the drain **27**. Instead of using the timer **41** and the switch **51** to empty the suds container **25**, this is accomplished by opening the drain valve **25***h* or removing a corresponding stopper to permit the gravity flow of the liquid in the container **25** through the drain conduit **25***k* into the drain **27**.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A suds return system for use with an auxiliary container and a washing machine having wash and rinse operations including a pump having an inlet for receiving liquid from the machine and an outlet, a two-way double outlet valve provided with a drain connection connected to one of its outlets and an inlet connected to the outlet of said pump, a liquid flow and gravity actuated valve having an upper connection and a lower connection and an intermediate connection, a liquid flow responsive valve member within said flow and gravity valve movable solely by liquid flow and gravity to alternately substantially close said upper and lower connections, conduit means connecting the second outlet of said double outlet valve and said lower connection, a return pump having its inlet connected to said upper connection and its outlet connected for discharge into the machine, and conduit means connected to said intermediate connection for discharging liquid to and withdrawing liquid from said auxiliary container.

2. A suds return system for use wth an auxiliary container and a washing machine having wash and rinse operations including a pump having an inlet for receiving liquid from the machine and an outlet, a two-way double outlet valve provided with a drain connection and an inlet connected to the outlet of said pump, a liquid flow and gravity actuated valve having an upper connection and a lower connection and an intermediate connection, a liquid flow and gravity responsive member within said flow valve movable solely by liquid flow and gravity to alternately substantially close said upper and lower connections, said flow and gravity responsive member being freely movable between said upper and lower connections and having a weight between 110 percent and 120 percent of the water it displaces, conduit means connecting the second outlet of said double outlet valve and said lower connection, a return pump having its inlet connected to said upper connection and its outlet connected for discharge into the machine, and conduit means connected to said intermediate connection for discharging liquid to and withdrawing liquid from said auxiliary container.

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