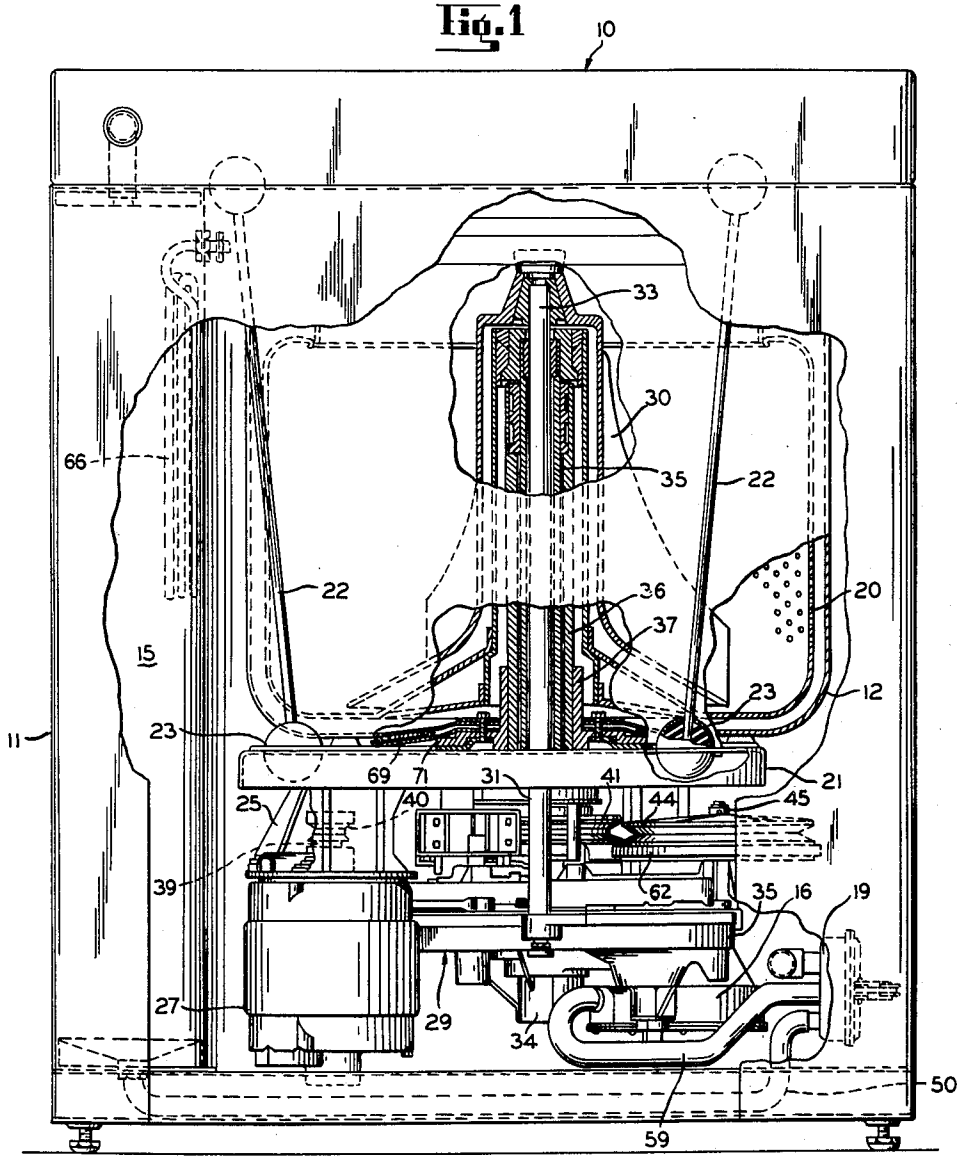
April 5, 1960 M. G. STEFFEY 2,931,199

AUTOMATIC WASHING MACHINE AND SUDS STORAGE AND RETURN SYSTEM THEREFOR

Filed May 17, 1955 4 Sheets-Sheet 1

Fig. 1



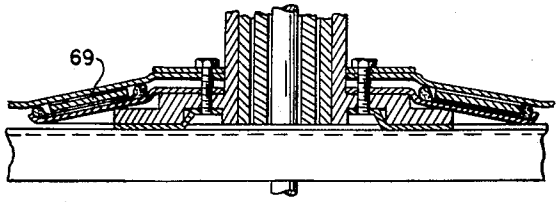


Fig. 7

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AUTOMATIC WASHING MACHINE AND SUDS STORAGE AND RETURN SYSTEM THEREFOR

Filed May 17, 1955 4 Sheets-Sheet 2

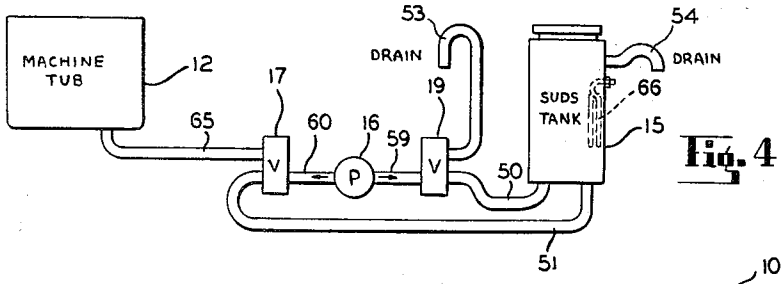


Fig. 4

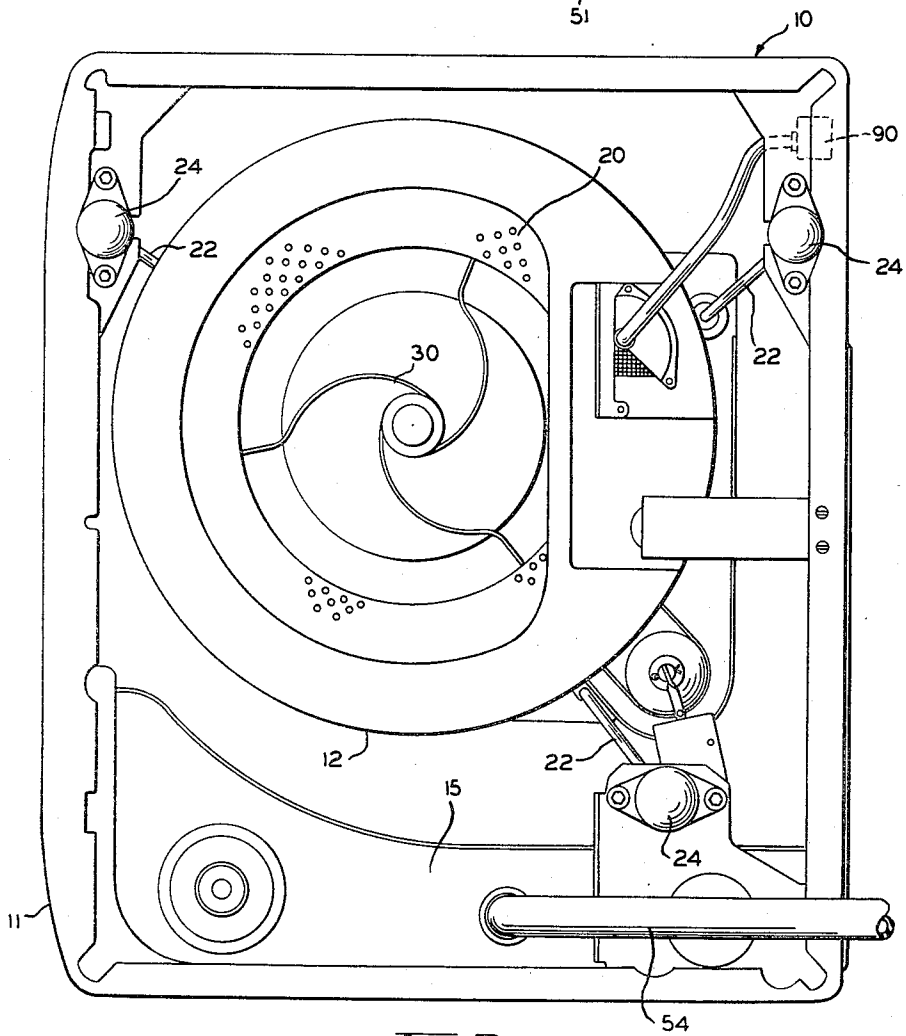


Fig. 2

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AUTOMATIC WASHING MACHINE AND SUDS STORAGE AND RETURN SYSTEM THEREFOR

Filed May 17, 1955 4 Sheets-Sheet 3

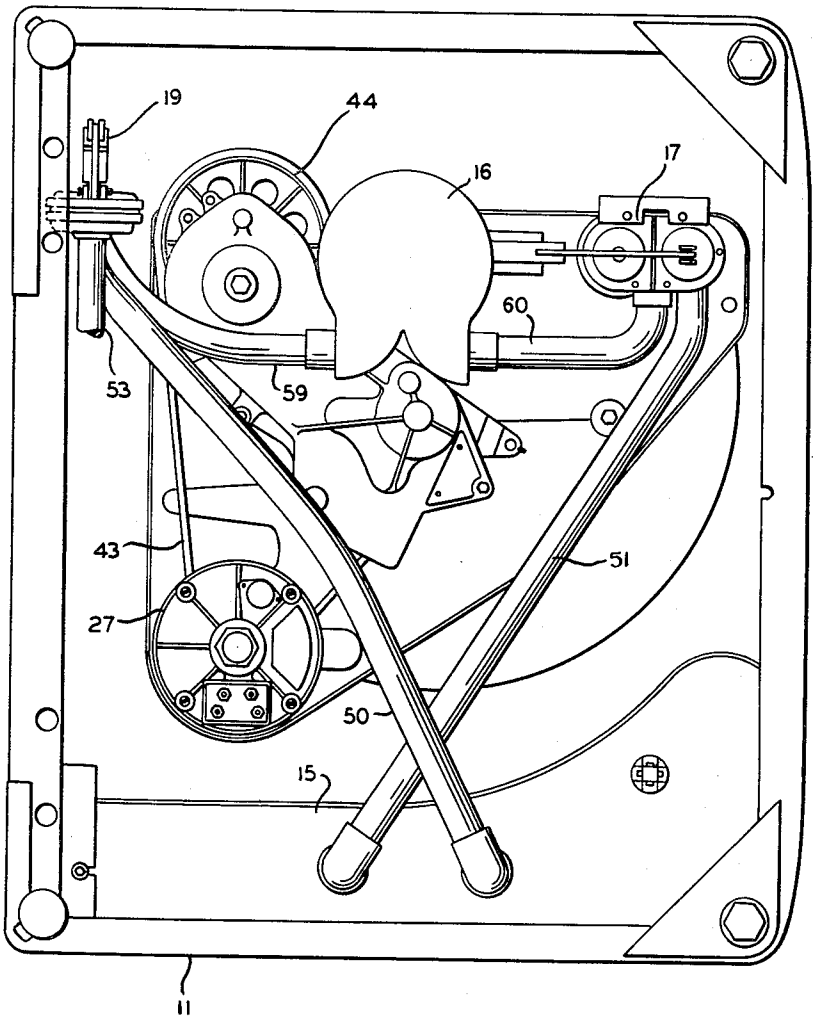


Fig. 3

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AUTOMATIC WASHING MACHINE AND SUDS STORAGE AND RETURN SYSTEM THEREFOR

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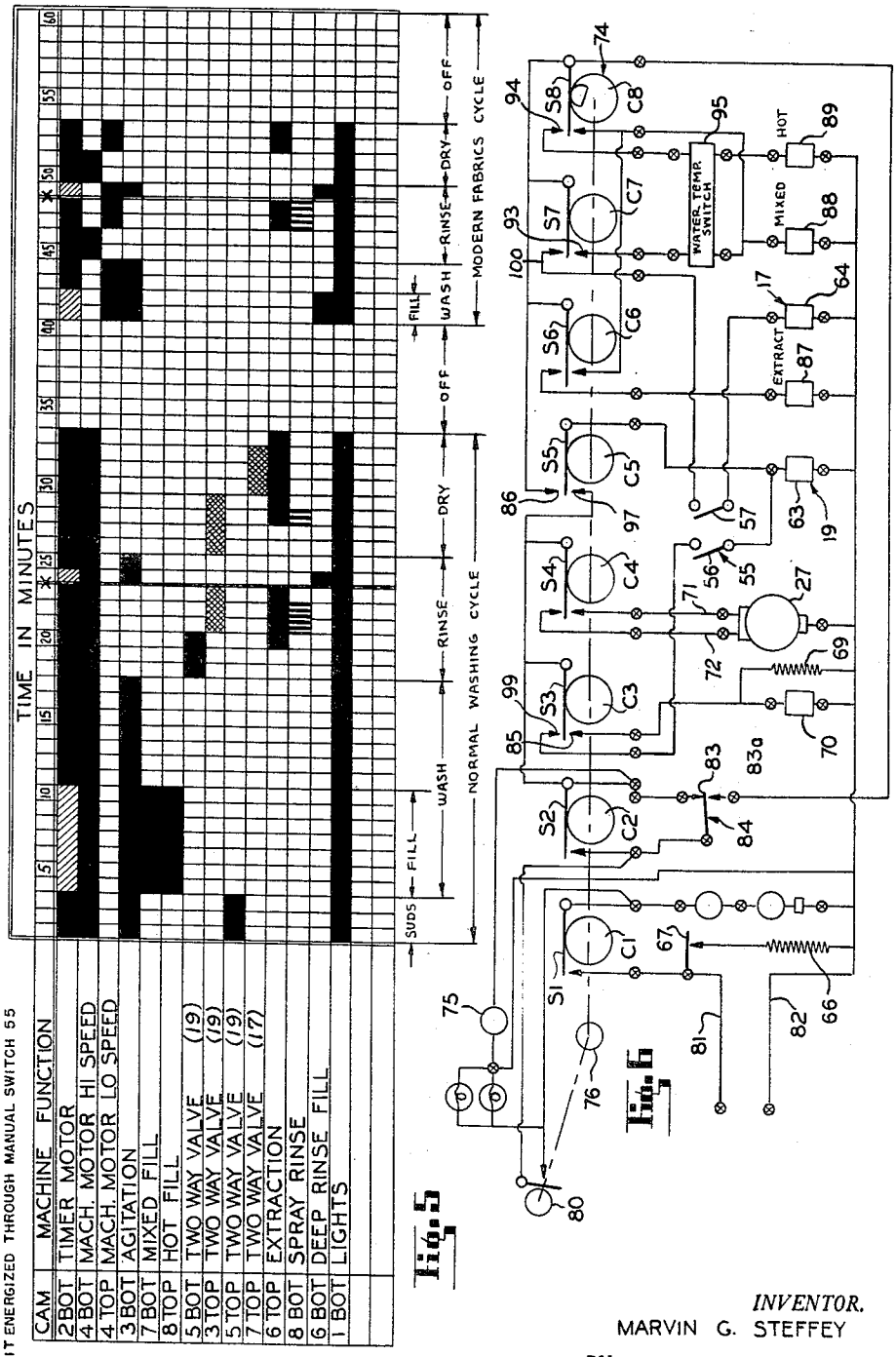


Fig. 5

Fig. 6

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Patented Apr. 5, 1960

2,931,199

AUTOMATIC WASHING MACHINE AND SUDS STORAGE AND RETURN SYSTEM THEREFOR

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Application May 17, 1955, Serial No. 508,874

4 Claims. (Cl. 68—12)

This invention relates to improvements in automatic washing machines and suds storage and return systems therefor.

A principal object of my invention is to provide an improved suds storage and return system for automatically storing and returning the sudsy washing water of an automatic washing machine.

Another object of my invention is to provide an improved washing machine structure having an automatic suds storage and return system as a unitary part of the machine.

A further object of the present invention is to provide an improved suds storage and return system in which the suds storage tank is a unitary part of the cabinet structure of the machine and in which a pump and novel system of conduits and control valves, cooperate with the pump for automatically transferring suds from the machine to the suds storage tank at the end of a washing operation, and for returning suds to the machine at the beginning of a washing cycle, which is selectively operable to flush the suds storage tank and discharge the suds from the tank and tub to drain, at the end of a washing cycle, as selected.

A further object of the present invention is to provide an improved automatic washing machine having a built-in suds storage tank and a pumping and control valve system therefor automatically operated under control of the cyclic control for the machine, and providing a simple and effective structure and control for more efficiently storing the suds at the end of a washing cycle and for returning the same to the washing machine at the initiation of a next succeeding washing cycle.

Still another object of the invention is to provide an automatic washing machine having a built-in suds storage tank in which the suds is transferred from the machine to suds storage tank in accordance with the cyclic condition of operation of the machine and is maintained at the desired temperature for washing throughout a series of washing cycles.

A still further object of the invention is to provide a suds storage and return system for automatic washing machines in which the suds is automatically stored for reuse at the end of a washing cycle and is returned to the washing machine at the beginning of a next succeeding washing operation, in which a selectively operable valve and control system is operable to completely exhaust water from the washing machine at the end of the last washing operation and flush the suds storage tank with rinse water and then withdraw water from the washing machine and storage tank to drain.

These and other objects of the invention will appear form time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

Figure 1 is a side elevational view of an automatic laundry machine constructed in accordance with the principles of the present invention, with parts of the cabinet and tub therefor broken away and with certain other parts shown in vertical section;

Figure 2 is a top plan view of the machine shown in Figure 1, with the cover and top portion of the cabinet removed;

Figure 3 is a bottom plan view of the machine shown in Figure 1;

Figure 4 is a diagrammatic view diagrammatically showing the fluid flow between the washing machine tub and suds storage tank during the suds storage return and flushing operations;

Figure 5 is an operation schedule diagram illustrating the cycle of operation of the machine of the present invention and specifically illustrating the suds storage and return operation;

Figure 6 is an electric circuit diagram of the machine illustrated in Figure 1 and operable in accordance with the programming schedule illustrated in Figure 5; and

Figure 7 is a vertical sectional view taken through the bottom of the tub in order to show the heater therefor.

In the embodiment of my invention illustrated in the drawings, I have shown in Figure 1 an automatic washing, rinsing and drying machine **10** having a cabinet **11** forming an enclosure for a tub **12** and a suds storage tank **15**, and having a pump **16** for withdrawing water from the tub **12** through a two-way valve **17** and transferring water to the storage tank **15** through a two-way valve **19**, and returning water to the tub **12** and draining the tub **12** and storage tank **15**, all under the cyclic control of the washing machine and the two-way valves **17** and **19**, as will hereinafter more clearly appear as this specification proceeds.

It is to be understood that the terms suds and suds water as used herein describe water to which soap or detergent has been added and are common terminology in the art.

A clothes container **20** is rotatably mounted within the tub **12** and is closed at its top by the top of the cabinet **11**, which also forms an enclosure for the control and drive mechanism for the machine.

The tub **12** is carried on a floating base **21**, suspended from the top portion of the cabinet on suspension links **22—22**, encased in rubber at their ends and carried in sockets **23** in the base **21** and in similar sockets **24** at the upper part of the cabinet **11**, for dampening oscillatable movement of said tub and base, as is usual with present day automatic washing and extracting machines.

Suspended from the base **21** on a hanger bracket **25** is a motor **27**, serving as a drive motor for the machine. A gear casing **29** for drive mechanism for oscillatably driving an agitator **30** is likewise suspended from the base **21** on bolts **31**, suitably secured to the base **21** and depending therefrom and maintaining the gear casing **29** in fixed parallel spaced relation with respect to the base **21**.

An oscillatable drive shaft **33** is rotatably carried in the gear casing **29** in a boss **34** depending from a lower part **35** thereof, and extends upwardly through said gear case and is journaled within a rotatable drive sleeve **35**. The agitator **30** is carried on the upper end of the shaft **33** and is suitably secured thereto, to be oscillatably driven thereby upon oscillatable movement of said shaft. The oscillatable drive shaft **33** is like that shown in the previously mentioned Patent No. 2,625,248, dated January 13, 1953, and is no part of my present invention so need not herein be shown or described further. The sleeve **35** extends within a stationary sleeve **36**, which extends upwardly from a flanged hollow center post **37**, forming a closure for the bottom of the tub **12**. The sleeve **35** has the clothes container or basket **20** supported on its upper end for spinning the same upon

rotation of said sleeve as in the aforementioned Patent No. 2,625,248, dated January 13, 1953.

The motor 27 has an upwardly projecting motor shaft 39 having a motor pulley 40 suitably secured to its upper end for driving a sheave 41 through a belt 43, to effect spinning of the basket or clothes container 20 under the control of suitable clutch means (not shown), as in the aforementioned Patent No. 2,625,248. The belt 43, trained about the motor pulley 40, is also trained around a drive sheave 44, pinned or otherwise secured to the upper end of a vertical shaft 45, forming a drive shaft for the mechanism for oscillatably driving the shaft 33 and agitator 30 through suitable clutch means (not shown), as in the aforementioned Patent No. 2,625,248.

The suds storage tank 15 extends along one side of the cabinet 11 to one side of the tub 12. The suds storage tank 15 extends for a greater part of the height of the cabinet 11 and has a pipe or conduit 50 leading from the bottom thereof and connected with the two-way valve 19, controlling transfer of suds from the laundry machine tub and back to the suds storage tank 15.

A bypass line for by-passing the inlet conduit 50 formed by a conduit or pipe 51 also leads from the bottom of the suds storage tank 15 and is connected with the two-way valve 17. Suds may be discharged from the suds tank 15 through the conduit 51 and two-way valve 17 through the pump 16 and two-way valve 19 through a drain pipe 53 upon rotation of the pump 16 in the proper direction.

The suds storage tank 15 also has an overflow drain 54 leading from the top thereof, to accommodate suds overflowed from the top of the tank 15 through the drain 54 during the last washing operation of a series of washing, rinsing, extracting and suds return operations. This is attained under the control of a manually operated switch 55 (see Figure 6), diagrammatically shown as having two ganged switch arms 56 and 57. The ganged switch arms 56 and 57 close simultaneously. The switch arm 56 controls the energization of a solenoid 63 operating the two-way valve 19 and the switch arm 57 controls the energization of a solenoid 64 operating the two-way valve 17, through the cyclic control of the machine.

The pump 16 may be of any well known form of bi-directional pump, pumping in either of two directions by reversal of the direction of the rotor of the pump (not shown). A detailed description of the pump and the control means, therefore, need not herein be repeated. It is, of course, understood that the pump 16 need not be reversible but that the same effect may be attained by reversing valve means to the pump casing if desired.

The pump 16 has a conduit 59 connected with one end thereof, having communication with the two-way valve 19. The pump 16 also has a conduit 60 leading from the other end thereof and connected with the two-way valve 17. Thus, when the pump 16 is pumping in one direction, fluid will be withdrawn from the tub 12 through the two-way valve 17 and will be supplied to the suds storage tank 15 through the conduit 59 and two-way valve 19. When the direction of pumping of the pump 16 is reversed, fluid will be transferred from the suds storage tank 15 through the two-way valve 19 to the laundry machine tub 12 through the two-way valve 17. The direction of pumping of the pump 16 is under the cyclic control of the machine and may be effected by engagement of the pump drive pulley (not shown) with a friction face 62 of the pulley 44, to effect rotation of the pump 16 to pump in one direction, and by engagement of the pump drive pulley with the belt 43 to effect pumping of the pump in an opposite direction.

The operation of the valves 17 and 19 and of the pump 16 is correlated automatically by the sequential control means so that after a washing cycle the laundry liquid from the tub 12 is temporarily stored in the suds tank 15, passing therebetween via the conduit 65, the valve 17, the conduit 60, the pump 16, the conduit 59, the valve 19 and the conduit 50. The fluid can be returned to the tub 12 from the suds storage tank 15 via the same plumbing connections.

I have also shown an immersion heater 66 in the suds storage tank 15, which may be manually turned on under the control of a manually operated switch 67 (see Figure 6).

A heating element 69 is also shown as being provided to maintain the suds wash water at the required temperature during the washing operation. The heating element 69 is shown in Figure 6 as being connected in the energizing circuit for carrying out of the various washing steps, in parallel with a solenoid 70 controlling operation of the agitator 30, to effect energization of the heater 69 whenever the agitator 30 is in operation. While the heater 69 may also be an immersion heater in the bottom of the tub 12, said heater is herein shown as being a resistance heater of the pancake type, carried beneath the tub 12 and abutting the bottom thereof and encircling the flange of the flanged center post 37.

Referring now to Figures 5 and 6 and the operation of the machine and the sequential control circuit for carrying out the suds storage and return operations, the motor 27 is shown in Figure 6 as being a two-speed motor of the induction-type with a fixed field structure and a squirrel cage armature or rotor within the field structure, to carry out a normal washing operation at a normal or regular speed, and to carry out a modern fabrics washing operation at a considerably slower speed.

The field structure has a first field winding (not shown) energized through a conductor 71 and a second field winding (not shown) energized through a conductor 72. The first field winding, when energized through the conductor 71, effects rotation of the armature at a relatively high rate of speed and the second winding when energized through the conductor 72 effects rotation of the armature at a predetermined slower speed for washing modern fabrics, as diagrammatically indicated in Figure 5.

A sequential controller or timer unit 74 is shown in Figure 6 as having a series of timer cams C1, C2, C3, C4, C5, C6, C7 and C8 for controlling the sequential operation of the machine. The timer unit 74 is rotated to an "on" position to initiate the carrying out of the washing, rinsing and drying cycles under the operation of a knob 76, provided with suitable indicia thereon, to indicate the point on the operating cycle at which the timer cams have been set.

Figure 5 shows two distinct programming schedules, the first of which is indicated as a normal washing schedule carried out by rotation of the motor 27 at a normal speed, and the second of which is identified as a modern fabrics schedule or cycle carried out by rotation of the motor 27 at a slower speed. This is effected by rotation of the cams C1 through C8, upon energization of the timer motor 75. The cams C1 through C8 have high and low and intermediate camming surfaces (not shown) engageable with switch arms S1 through S8, respectively. Thus, whenever the knob 76 is adjusted through a sector of movement corresponding to approximately 220° of arc, all of the electrical equipment will be conditioned in accordance with the programming specifications of the normal washing cycle. Whenever the knob 76 is aligned and positioned in a different sector covering approximately 95°, all of the electrical equipment will be conditioned in accordance with the program schedule determined in the modern fabrics cycle.

A hand switch 80 operated by depression of the knob 76 is provided to initially close an energizing circuit to the various operating parts of the machine. The hand switch 80 may be operated by depressing the knob 76 after the knob 76 is rotated to a position corresponding to the desired length of washing time or to the desired washing cycle.

Main line conductors 81 and 82 connected with a

source of current supply provide current to energize the electrically operated parts of the machine when the cam switch S1 and the manually operated switch 80 are closed. When nob 76 has been turned to a suds return position representing the first three increments of the cycle, the timer motor 75 is energized through conductor 81, switch S1, manually operated switch 80, switch S2 and conductor 82. This will effect rotation of the timer cams and energization of the agitator solenoid 70 through a lower contact 85 of the cam operated switch S3. The heater 69 in parallel with the agitator solenoid 70 will also be energized. At the same time the solenoid 63 of the two-way valve 19 will be energized through an upper contact 86 of a cam-operated switch S5, and the lower contact 83*a* of the water level switch 84 when tub 12 is empty. This will open the valve 19 to the conduit 50 and provide fluid communication between the suds storage tank 15 and the pump 16. Water level switch 84 moves to close upper contact 83 when tub 12 is filled.

Energization of the agitator solenoid 70 will effect rotation of the pump 16 in a direction to return suds from the suds storage tank 15 to the tub 12.

After the timer has advanced an interval of time, which in Figure 5 is shown as being three minutes, the solenoid 63 of the valve 19 is deenergized. This will close said valve to the passage of fluid from the suds storage tank 15 and will open said valve to the drain 53. The pump 16, however, will continue to rotate, but will pump no fluid.

A mixed water solenoid 88, or a hot water solenoid 89 of a mixing valve 90 will then be energized through conductor 81, switch S1, hand switch 80, lower contact 83*a* of water level switch 84 and through bottom contact 93 of the cam switch S7, or a top contact 94 of the cam switch S8, depending upon the temperature selected by a water temperature switch 95. The tub will then be filled with mixed or hot water as selected, until the water within the tub reaches the required level, it being understood that the level of the water is under the control of the water level switch 84, and that hot or mixed water is only added to bring the level of the washing fluid in the tub to the required level for efficient washing, and that the solenoids 88 and 89 are deenergized by opening contact 83*a* as soon as the level of water in the tub 12 comes up to the required level. The washing operation is then carried out.

At the end of the agitation process represented in Figure 5 at the end of interval 17, the agitator solenoid 70 will be deenergized and the solenoid 63 of the two-way valve 19 is energized through a bottom contact 97 of the cam operated switch S5 and the bottom contact of switch S2, hand switch 80 and switch S1. The valve 19 is then opened for the storage of suds in the suds storage tank 15. Deenergization of agitator solenoid 70 will effect rotation of the bi-directional pump 16 in a direction to transfer suds from the tub 12 to the suds storage tank 15. An extractor solenoid 87 controlling the extracting operation is then energized a predetermined time interval after energization of the solenoid 63, to effect spinning of the clothes container 20. Current flow through solenoid 87 follows conductor 81, switch S1, hand switch 80, bottom contact 83*a* of water level switch 84 and the upper contact of switch S6, solenoid 87 and conductor 82. After a one minute period of the extracting operation, the solenoid 63 is deenergized (assuming switch 55 to be open) and the valve 19 is closed, holding suds in the suds storage tank 15. The rinsing and extracting cycle is then carried out, it being understood that the pump 16 is driven during the entire rinsing and extracting operations and pumps washing liquid extracted from the clothes through the drain 53.

The foregoing washing, rinsing and extracting or drying cycles are carried out during each laundering operation, the suds being transferred from the tub 12 to the storage

tank 15 at the end of the first agitation or washing cycle and being returned to the machine tub 12 at the initiation of a next succeeding washing cycle or laundering operation, as previously described.

If it is not desired to salvage any of the washing fluid from the first washing step or operation by temporary storage of this fluid in tank 15, but is instead desirable to flush and completely drain tank 15 at the end of the complete normal fabrics washing cycle, switch 55 may be moved into its closed position at any time prior to the end of interval 20 which normally marks the beginning of the diversion of fluid pumped from tub 12 through drain hose 53 rather than through hose 50 as illustrated in Figures 4 and 5.

In the prior described cycle of operations wherein fluid was diverted through drain conduit 53, solenoid 63 was deenergized at the end of interval 20 by the opening of the bottom contact 97 of switch S5 to cause valve 19 to terminate communication between conduits 59 and 50 and to establish communication between conduits 59 and 53. In this alternate cycle of operation wherein all fluid is pumped to said storage tank 15, solenoid 63 remains energized during intervals 21, 22 and 23 through an alternate shunt circuit provided from conductor 81, switch S1, hand switch 80, switch S2, top contact 99 of switch S3, contact 56 of switch 55, solenoid 63 and conductor 82.

The spray rinse fluid discharged into tub 12 during intervals 21 and 22 is, therefore, diverted into suds tank 15 and dilutes the fluid previously discharged to tank 15 following the end of the first agitational washing process. The deep rinse period, which is initiated at the beginning of interval 24, as illustrated in the accompanying drawings, provides for a tub filling operation and two intervals of agitation. Instead of the rinsing fluid directed into tub 12 being pumped through drain hose 53, as in the previously described cycle, the alternate energization circuit for solenoid 63 causes valve 19 to be positioned so as to cause all such rinsing fluids as well as fluid from a short spray rinse occurring in intervals 28 to be discharged into tank 15. The conventional final extraction operation is also initiated at the beginning of interval 28 and continues until the end of interval 33 which marks the termination of the complete normal fabrics washing operation.

The total quantity of fluid diverted into tank 15 is such as to cause a dilution, flooding and overflow through conduit 54 of tub 15 so as to produce a desired cleaning action of inner wall surfaces of tank 15 which might otherwise accumulate soap and scum at the various high water marks within tank 15.

After the end of interval 29 during the final extraction operation, solenoid 63 is deenergized by the opening of contact 99 of switch S3. This terminates communication between conduits 59 and 50 and provides communication between conduits 59 and 53 instead. Simultaneously with the deenergization of solenoid 63, solenoid 64 is energized through conductor 81, switch S1, hand switch 80, lower contact 83*a* of the water level switch 84, upper contact 100, of switch S7, contact 57 of switch 55, solenoid 64 and conductor 82. This terminates communication between conduits 65 and 60 and instead establishes communication between conduits 51 and 60 so that pump 16 pumps all of the fluid contents of tank 15 to drain through conduit 51, valve 17, conduit 60, pump 16, conduit 59, valve 19 and drain conduit 53. By means of this dilution, flooding and overflow operation of tank 15 and subsequent complete pumpout, the inner wall surfaces of tank 15 are prevented from accumulating layer upon layer of soap deposits which might otherwise normally accumulate.

It will be understood that various modifications and variations of the present invention may be effected without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. In a combined clothes washing and extracting machine, a cabinet, a tub, a clothes container rotatably mounted within said tub, a suds storage tank, a motor, a sequential controller, mechanism driven by said motor and operated under the control of said sequential controller for carrying out a washing step and a series of extracting and rinsing steps in said clothes container, a pump driven by said motor for pumping water in one direction during a washing step and in an opposite direction at the termination of a washing step, first and second two-way valve means and conduit means associated with said tub, pump and suds storage tank to conduct fluid in one direction for washing and in an opposite direction for storage, depending upon the direction of rotation of said pump, said first two-way valve means being connected between said tub and said pump, said second two-way valve means being connected between said pump and said suds storage tank, said conduit means including a by-pass line connected from said first two-way valve means to said suds storage tank to drain the storage tank, said storage tank having means forming an overflow drain, said sequential control mechanism including a plurality of timer switches controlling operation of said valve means, and manually operable switch means cooperating with said timer switches to effect operation of said second two-way valve means to supply rinse water to said suds storage tank to overflow suds into said overflow drain, and to drain water from said tub into said storage tank for flushing, and to then effect operation of said first two-way valve means to effect the draining of water from said suds storage tank.

2. In a combined clothes washing and extracting machine, a cabinet, a tub within said cabinet, a rotatable clothes container within said tub, a suds storage tank, a motor within said cabinet, means including a pump driven by said motor through which water may be pumped in two directions as selected comprising a first two-way valve connected between said tub and said pump, a second two-way valve connected between said suds storage tank and said pump, separate means connecting said second two-way valve to drain and forming an overflow drain for said suds storage tank, means forming a by-pass between said first two-way valve and said suds storage tank, a sequential controller including at least two timer operated switches, and manually operable switch means cooperating with said controller and having electrical connection with said timer operated switches to effect operation of said second two-way valve under the cyclic control of said sequential controller to supply rinse water to said suds storage tank thereby to overflow suds from said suds storage tank to said overflow drain, and to operate said first two-way valve and said pump to discharge water from said suds storage tank through said by-pass and said second two-way valve to drain at the end of the laundering operation.

3. In a combined clothes washing and extracting machine, a cabinet, a tub within said cabinet, a rotatable clothes container within said tub, an agitator within said clothes container, a suds storage tank, a motor within said cabinet and mechanism selectively driven thereby for oscillatable driving said agitator and rotatably driving said clothes container to extract water from the clothes therein, means including a pump driven by said motor through which water may be pumped in two directions as selected comprising a two-way valve connected between said tub and said pump, a second two-way valve connected between said suds storage tank and said pump, conduit means forming separate connections to drain from said suds storage tank and from one of said two-way valves, presettable sequential control means for operating said machine through a series of washing, rinsing and extracting periods of a preselected program and regulating said valves and said pump to temporarily store laundry liquid from said tub in said storage tank after a washing period and to return the laundry liquid to said tub to begin a new program, a by-pass line connected between said suds storage tank and said first two-way valve, and manually operable switch means conditioning said sequential control means to effect opening of said second two-way valve during the next extracting period of the machine following actuation of said manually operable switch means to discharge rinse water and water extracted from the clothes from said tub to said suds storage tank to overflow suds to overflow drain and to discharge all of the liquid in said suds storage tank to drain at the end of the laundering program.

4. In an automatic washing machine having a sequential controller to automatically operate the machine through a pre-selected laundering program including a washing period and a rinsing period, the improvement of a suds storage tank having a lower inlet and an upper drain, a tub in which washing and rinsing occurs, a separate drain for said tub, conduit means including a pump and interconnecting said tub, said lower inlet of said tank, and said separate drain and including valve means regulated by said sequential controller to normally temporarily store laundry liquid from said tub in said suds storage tank after a washing period and to discharge rinse liquid to said separate drain, and pre-settable switch means conditioning said sequential controller upon operation of said presettable switch means to discharge rinse liquid into said lower inlet and overflow the laundry liquid then contained in said suds storage tank through said upper drain and after such rinsing period to discharge all of the contents of said suds storage tank to said separate drain.

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