

July 17, 1951

T. T. WOODSON

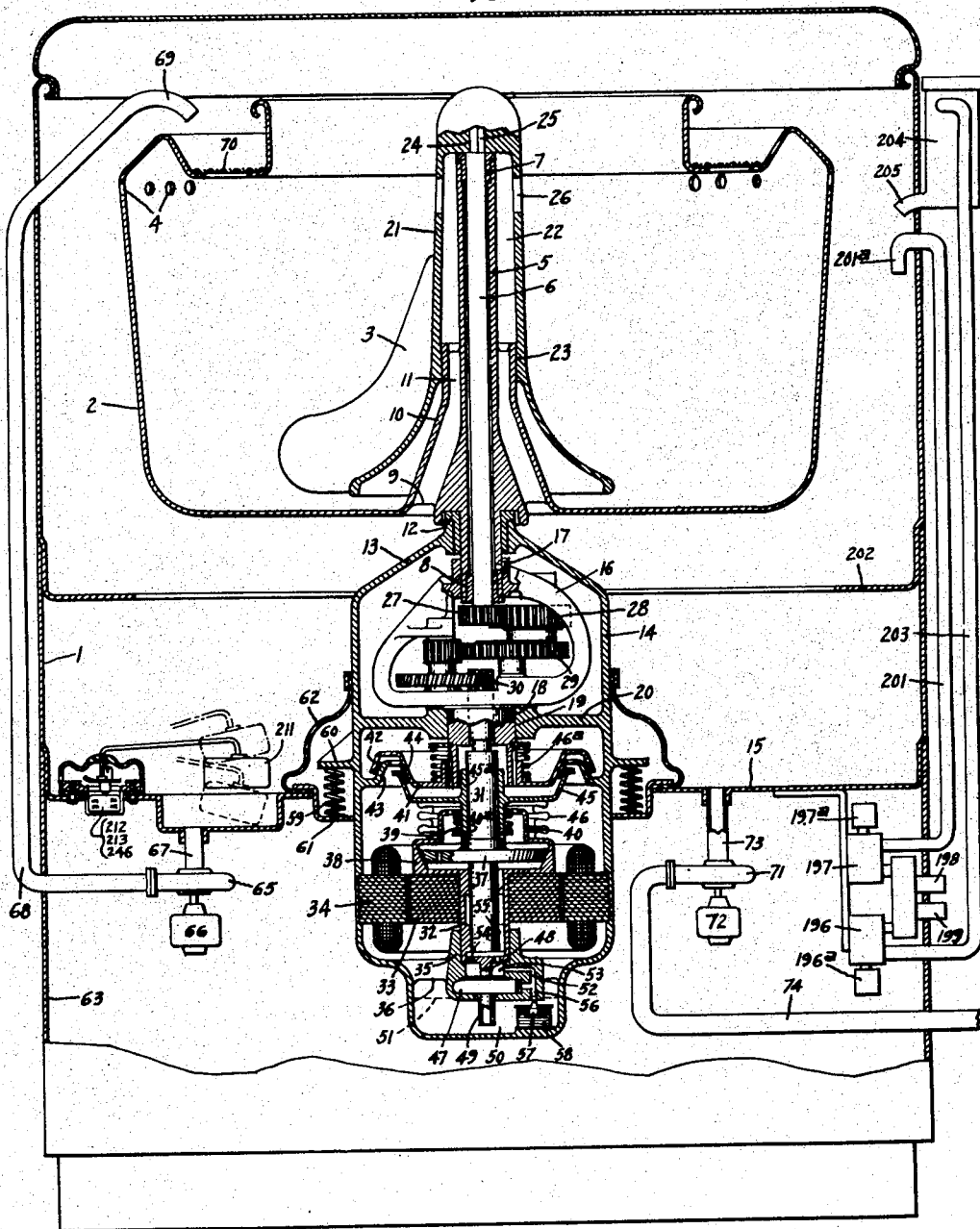
2,561,257

CONTROL FOR AUTOMATIC WASHING MACHINES

Original Filed Aug. 25, 1944

3 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

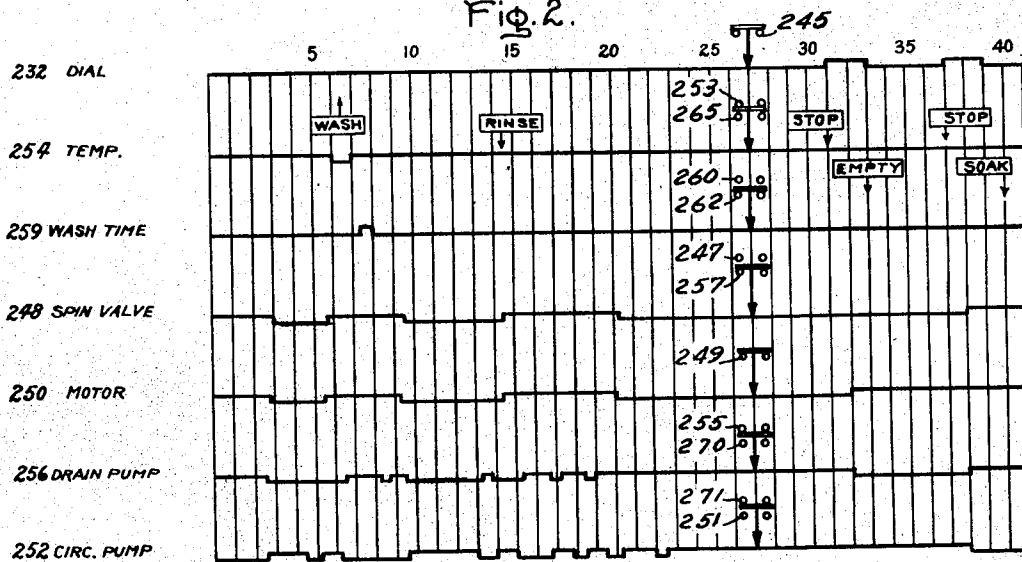
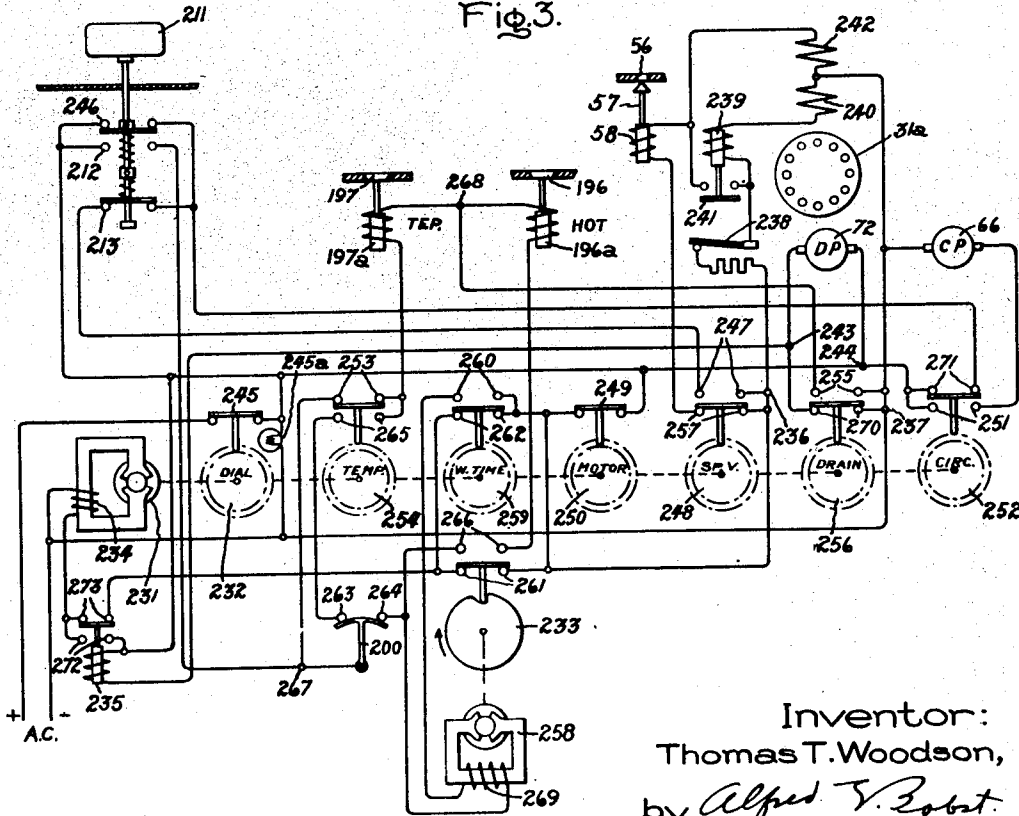


Fig. 3.



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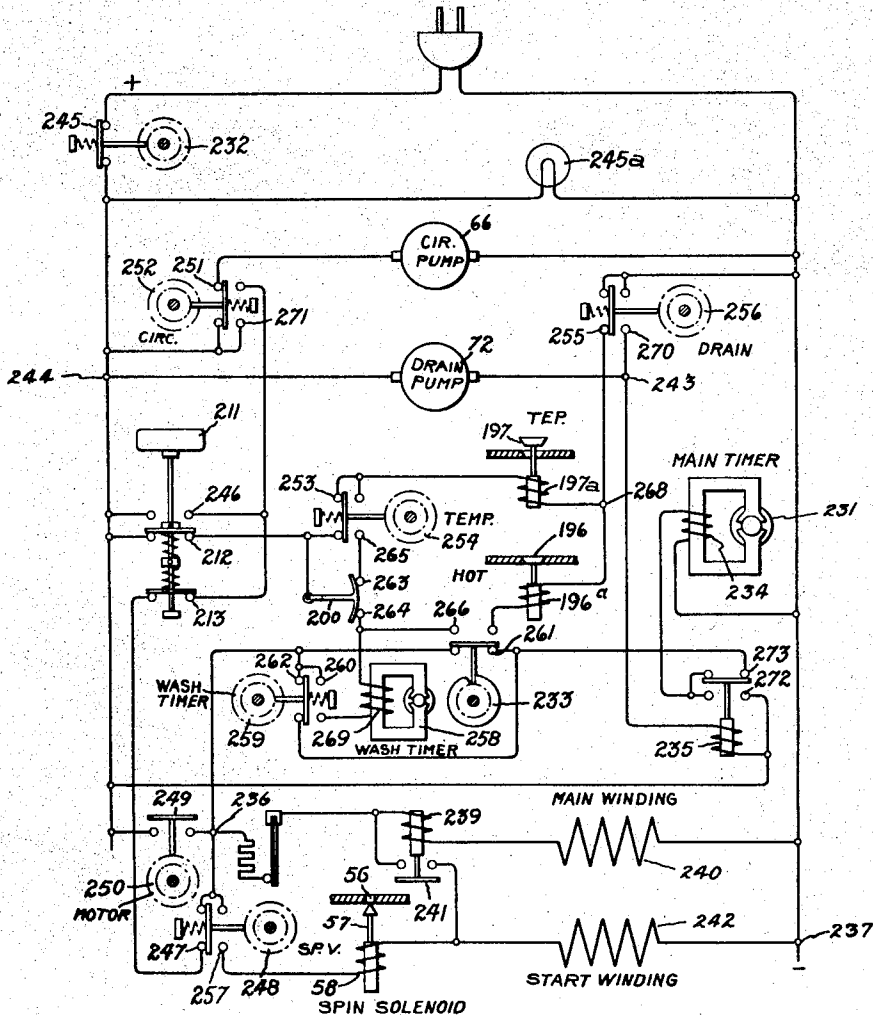
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3 Sheets-Sheet 3

Fig. 4.



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UNITED STATES PATENT OFFICE

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CONTROL FOR AUTOMATIC WASHING
MACHINES

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New York

Original application August 25, 1944, Serial No.
551,096. Divided and this application January
8, 1946, Serial No. 639,816

4 Claims. (Cl. 68—12)

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This application is a division of my application, Serial No. 551,096, filed August 25, 1944, now Patent No. 2,527,238, issued October 24, 1950.

The invention relates to washing machines of the type wherein the successive steps of the washing cycle are carried out automatically.

The object of the invention is to provide an improved control which is relatively simple in structure and comprises a minimum number of parts but which at the same time performs all the needed functions in a satisfactory and reliable manner.

For a consideration of what I believe to be novel and my invention, attention is directed to the following specification and to the claims appended thereto.

In the drawing, Fig. 1 is a diagrammatic view of a washing machine in connection with which my improved control may be used; Fig. 2 is a developed view of a control cam, i. e., cam chart, on which is indicated the relative positions of the switches at successive points in the cycle of operation; Fig. 3 is a wiring diagram showing the positions of the elements of the control at the beginning of a washing cycle, and Fig. 4 is a cross diagram of the wiring shown in Fig. 3, the several switches being in the position they occupy when the machine is being filled with tepid water.

Referring to Fig. 1 of the drawings, 1 indicates the tub of a clothes washing machine, 2 the spin basket in which the clothes are placed to be cleansed, and 3 the agitator which is oscillated on its vertical axis to perform the washing operation. The cleansing liquid is centrifugally extracted from the clothes by rotating the spin basket at high speed. During the washing operation, the spin basket is held stationary. During the centrifugal extraction operation, the spin basket and agitator are rotated as a unit and the liquid is discharged through the openings 4 at the upper edge of the spin basket.

The spin basket is attached to and carried by an outer tubular shaft 5. The agitator is attached to and carried by an inner shaft 6 journaled in shaft 5, the bearings being indicated at 7 and 8. The spin basket is shown as being connected to shaft 5 by a plurality of circumferentially spaced, vertically extending webs 9 formed integral with shaft 5 and with a sleeve 10 projecting upwardly from the bottom of basket 2 in spaced relation to shaft 5, thus providing vertically extending passages 11 between the sleeve and shaft 5. At its lower end, shaft 5 projects through and is journaled in a combined thrust

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and sleeve bearing 12 carried by the top wall 13 of a sealed casing 14 which in turn projects through and is supported on the bottom wall 15 of the tub 1. Inside casing 14 the end of tubular shaft 5 is fixed to the upper end of a gear frame 16 by a set screw 17. Gear frame 16 has a downwardly projecting hub 18 journaled in a combined thrust and sleeve bearing 19 carried by a wall 20 which extends across casing 14.

Agitator 3 has a tubular center post 21 which fits over tubular shaft 5 in spaced relation thereto to provide an annular passage 22. At its lower end, post 21 is journaled on the upper end of sleeve 10 as is indicated at 23. The top of post 21 has a head provided with a rectangular opening 24 which fits over a rectangular projection 25 on the upper end of shaft 6 to connect the agitator to the shaft. At the upper end of post 21 are openings 26 which connect the space within spin basket 2 with passages 22 and 11. Openings 26 serve to define the water level in basket 2. On the lower end of shaft 6 is a pinion 27 which through a sector gear 28 and intermediate gearing 29 carried by gear frame 16 is connected to a pinion 30 on the upper end of a drive shaft 31. Shaft 31 is journaled at its upper end in hub 18 and at its lower end in a tubular shaft 32 which forms the shaft of a motor rotor 33 of a main driving motor 31a, the stator of which is indicated at 34. Stator 34 is suitably mounted in the lower end of casing 14. The lower end of shaft 32 is carried in and supported by a combined sleeve and thrust bearing 35 supported by web 36 integral with casing 14.

On drive shaft 31 is fixed a clutch disk 37 adapted to engage a clutch ring 38 carried by the motor rotor. Clutch disk 37 is biased toward engagement with clutch ring 38 by a spring 39.

Splined on the lower end of hub 18 so as to turn with hub 18 and be capable of axial movement thereon is the hub of a brake and clutch disk 41 having a brake ring portion 42 adapted to engage a stationary brake ring 43 and a clutch portion 44 adapted to be engaged by a clutch disk 45 fixed to the upper end of an axially expandible corrugated bellows 46. Clutch disk 45 has a relatively long hub 45a journaled on shaft 31. Spring 39 surrounds the lower end of hub 45a and is positioned between a flange on the upper end of a sleeve 40 fixed to the motor rotor and a projecting ring 40a on hub 45a. The lower end of hub 45a engages the top of the hub of clutch disk 37 so that spring 39 acts both to move clutch disk 45 from engagement with clutch disk 41 and to seat clutch disk 37. Brake and clutch

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disk 41 is biased to a position wherein brake ring portion 42 engages stationary brake ring 43 by a spring 46a positioned between the disk 41 and a snap ring on hub 18. The lower end of bellows 46 is fixed to clutch ring 38 thus attaching the bellows to the motor rotor so it turns therewith. The bellows encloses clutch disk 37. Fluid pressure for expanding bellows 46 is supplied by a fluid pump 47 driven by motor shaft 32. Pump 47 may be of any suitable type. It is shown as being carried by the lower end of bearing 35 and as having its rotor connected to shaft 32 by a shaft extension 48. Its suction inlet 49 projects down into a liquid reservoir 50 at the lower end of casing 14, the liquid level being indicated at 51. Its discharge is connected by a passage 52 to a reservoir 53 which in turn is connected through openings 54 to the end of shaft 32 and vertical grooves 55 in the inner wall of shaft 32 to the space beneath clutch disk 37. At 56 is a by-pass which connects the discharge side of pump 47 to reservoir 50. By-pass 56 is normally open. It is adapted to be closed by a plunger 57 operated by a solenoid 58 when the solenoid is energized.

Normally, when the motor is not running, the parts stand in the positions shown in the drawing, clutch disk 37 being in engagement with clutch ring 38, clutch disk 45 being out of engagement with brake and clutch disk 41, and clutch and brake disk 41 being in engagement with the brake ring 43. The engagement of brake and clutch disk 41 with brake ring 43 serves to hold stationary the frame 16. Solenoid 58 is deenergized so that plunger 57 stands in a position in which by-pass 56 is uncovered. If now the circuit on the motor is closed, the motor rotates and through clutch disk 37 rotates the drive shaft 31 which in turn through the gearing carried by gear frame 16 oscillates shaft 6 to effect the washing operation. At this time, pump 47 operates to supply fluid but no pressure is built up in reservoir 53 since by-pass 56 is open permitting the fluid pumped to escape back to the reservoir 50.

When the washing operation is completed, an electric circuit is closed on solenoid 58 energizing it to effect movement of plunger 57 to close by-pass 56, thus shutting off the by-pass. Pressure now builds up in reservoir 53 effecting flow of fluid under pressure through openings 54 and grooves 55 to the underside of the clutch disk 37. The pressure effects vertical movement of clutch disk 37 and shaft 31 to disconnect clutch disk 37 from clutch ring 38, thus disconnecting the motor armature from the agitator shaft 6. Axial movement of clutch disk 37 and shaft 31 is limited by a shoulder on the shaft engaging the lower end of the bearing 18. Fluid now flows around the periphery of clutch disk 37 to the interior of bellows 46, effecting expansion of the bellows to slide hub 45a axially along shaft 31 and lift clutch disk 45 into engagement with brake and clutch disk 41, thus connecting the motor armature to tubular shaft 5 through bellows 46, clutch disk 45, brake and clutch disk 41 and frame 16. At the same time, expansion of the bellows lifts brake and clutch disk 41 from engagement with brake ring 43. By friction between clutch disks 45 and 41, the motor now rotates the mechanism as a unit to turn the spin basket at high speed to extract water from the clothes in the spin basket. After the spinning operation is completed, the circuit on solenoid 58 is opened permitting the plunger 57 to uncover by-pass 56. This permits the fluid pressure to escape from within bellows

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46 to permit the bellows to collapse and permit springs 39 and 46a to return the clutch disks to the positions shown on the drawing.

From the foregoing description, it will be seen that to effect washing, the motor alone is energized and to effect extraction, the motor and solenoid 58 are both energized.

The mechanism so far described is illustrated to a large extent diagrammatically and is to be taken as typical of any suitable mechanism which requires the energizing of a motor to effect washing and the energizing of a motor and either the energizing or deenergizing of another circuit to effect centrifugal extraction.

In the present instance, the casing 14 with the mechanism therein is shown as being supported by springs 59 located between flange 60 on casing 14 and a flange 61 supported in an opening in the bottom wall 15. The space between casing 14 and the opening in wall 15 may be sealed by a suitable rubber sleeve 62. Tub 1 may be supported by a skirt 63 which in turn may have attached thereto casters adapted to rest on a floor.

For circulating water from the bottom of tub 1 to the spin basket during the washing operation, there is provided a circulating pump 65 driven by an electric motor 66. Pump 65 has its inlet 67 connected to the bottom 15 of the tub and its discharge connected by a pipe 68 to a nozzle 69 which discharges water onto a screen 70 at the upper end of spin basket 2 above openings 4. For emptying tub 1, there is provided a drain pump 71 driven by an electric motor 72. The inlet of pump 71 is connected by a pipe 73 to the bottom wall 15 of the tub 1. The discharge side of pump 71 is connected to a discharge pipe 74 leading to a suitable drain.

Water is supplied to the machine through two solenoid thermostatic mixing valves 196, 197 having fittings 198, 199 for connection with the hot and cold water supply lines. The valve 196 is adjusted to supply hot, and the valve 197 is adjusted to supply tepid, water. When both valves are operating, water of an intermediate temperature is supplied. The temperature of the water is controlled by a contact 200 (Fig. 3) manually adjustable to energize either or both of the solenoids 196a, 197a for the valves 196, 197 to obtain tepid, hot, or intermediate temperature water. The tepid water valve 197 has a discharge conduit 201 terminating in a nozzle 201a directing a stream against a splash ring or flange 202 projecting inwardly from the outer casing 1 slightly below the bottom of the spinner basket. The spattering of water discharged from nozzle 201a against the flange 202 and the outer walls of the spinner basket at the desired time breaks up any soap suds which may accumulate during washing and reduces the friction drag during drying which in extreme cases might be enough to keep the basket from coming up to speed. The hot water valve has a discharge conduit 203 leading to a soap box 204 having a discharge nozzle 205 directed to the space between the tank wall and the spinner basket. The soap box is arranged to receive granular or flake soap which is flushed out of the soap box by the water and falls into the bottom of the outer casing. The soap is thoroughly mixed or dissolved in the circulating pump 65 as the water is pumped from the bottom of the outer casing into the spinner basket. The hot water is led into the soap box through a tangential inlet so as to set up a vortical motion of the water which thoroughly washes the side walls of the soap box. The

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soap box discharge nozzle 205, which is open at all times, projects outward a sufficient distance so that dry soap will not fall out due to the natural angle of repose of the soap.

The water is shut off by a float 211 responsive to the accumulation of water in the bottom of the outer casing which, when the basket is filled to overflowing and a small amount of water accumulates in the casing, opens a switch 212 in series with the solenoid of the solenoid valves 196, 197. If the water rises to a higher level in the casing, a switch 213 is opened for a purpose hereinafter described.

In Figs. 2, 3 and 4 is shown an automatic control for the machine having the mechanism of Fig. 1 although the control is obviously applicable to other machines. Fig. 3 is a wiring diagram and Fig. 2 is a developed view of the control cams which are rotated in unison by a timing motor 231 at a speed of one revolution in 40 minutes. The cams are also manually rotatable by a dial 232 which is also driven by the timing motor and indicates the position of the cams. By manually adjusting the dial, the operator can omit, shorten, lengthen, or repeat any of the operations to be automatically performed. All of the switches controlled by the cams are single pole, double throw snap switches so that the switches can not dwell in an intermediate position. They may be of any suitable construction.

The full cycle of automatic operation of the machine starts with a "soak" cycle in which the spinner basket is filled with tepid water, the agitator is operated for a short time (3 minutes) to remove water soluble stains, the spinner basket is rotated to centrifugally dry the clothes and the "soak" water is pumped to the drain. Immediately following the "soak" cycle is a "wash" cycle in which the tub is filled with soapy water at a temperature selected by adjustment of the water temperature control contact 200, the agitator is operated for a period determined by the preadjustment of the wash time cam 233 (from 3 to 20 minutes) and the spinner basket is rotated to centrifugally discharge the wash water which is pumped to the drain. The "wash" cycle is followed by a "rinse" cycle in which the basket is filled with tepid water, the agitator is oscillated for about 5 minutes, the spinner basket is rotated for a relatively long time (10 minutes) to thoroughly dry the clothes, and the centrifugally discharged water is stored in the bottom of the outer casing. At the end of the centrifugal drying, the machine automatically stops so the operator may remove the clothes. The operator may either turn the dial 232 to "empty" if there is no further washing to be done, or to "soak" if the stored rinse water is to be used to soak a succeeding load of clothes, or to "wash" if the "soak" cycle is to be omitted. During the operation of the agitator for rinsing, the drain pump is started twice to pump water from the bottom of the outer casing to the drain and fresh water is automatically added to dilute and flush the water in which the clothes are being rinsed.

The timer motor winding 234 is energized by the operation of either the main motor 31a or the drain motor 72, all of the control power being conditional upon the main switch 245 controlled by the dial cam 232 indicated by a pilot light 245a. One side of the winding 234 is connected directly to one line (—) and the other goes to the other line (+) alternatively through con-

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tacts 272 of relay 235 or through contacts 273 of the same relay in series either with contacts 261 of wash timer cam 233 and contacts 249 of cam 250, or with contacts 262 of cam 259 and contacts 249 of cam 250, or with contacts 261 of wash timer cam 233 and contacts 247 of cam 248 and contacts 213 and 246 of the float 211.

Relay 235 provides the bi-lateral control of the timer motor 234, by connecting 234 to the line if the drain pump is running or connecting 234 to the main motor feed circuits when the drain pump is stopped.

The main driving motor 31a is connected to the terminals 236, 237 through a thermal overload relay 238 and a solenoid 239 connected in series with the motor running winding 240. When the motor starts, a heavy current is drawn through the solenoid 239 which closes a switch 241 connecting the motor starting winding 242 across the terminals 236, 237. As the motor comes up to speed, the current through the solenoid 239 decreases, opening the switch 241 and disconnecting the starting winding 242. The main driving motor terminal 237 is connected directly to one side of the line (—). The other terminal 236 is energized through a switch 245 controlled by the dial cam 232 which is closed during soak, wash, and empty cycles and alternatively (1) through float switches 246 and 213, and contacts 247 closed by the spin valve cam 248 during agitation, or (2) through a switch 249 closed by the motor cam 250 during spinning. The switch 249 is open during washing so that the main driving motor and the timing motor cannot operate until there is sufficient water in the bottom of the outer casing to raise the float and close the switch 246. Since the timing motor is stopped while the machine is being filled with water, the automatic operation is not affected by variations in the water pressure. The switch 213 is a safety switch which opens when there is an excess of water in the bottom of the outer casing and prevents operation of the agitator under conditions which will be hereinafter described. The operation of the agitator for washing accordingly does not start until the spinner basket is filled with wash water to the proper level. During spinning, the main driving motor and the timing motor winding 234 are energized through the switch 249 which by-passes the float control switches 213 and 246 and hence allows spinning independent of tub water level.

At the beginning of the cycles during which the agitator is to be oscillated, the soak, wash, and rinse cycles, the circulating pump motor 66 is energized through the switch 245 and the contacts 251 which are closed by cam 252 during these cycles so the circulating pump is effective to pump water from the bottom of the outer casing to the spinner basket. While the machine is being filled with water, the water discharged from the nozzles 201a and 205 is pumped to the basket. After the machine is filled, the water overflowing through the openings 4 and 26 is continuously circulated from the bottom of the outer casing through the filter 70 to the spinner basket. The circulating pump motor is also energized through the above circuit by the cam 252 during the centrifugal extracting operations, forming part of the soak, wash and rinse cycles, to discharge water from the bottom of the outer casing onto the filter 70 on the upper rim of the spinner basket. Because the filter is rotating, the water discharged onto the filter does not flow through the filter but is centrifugally

moved across the upper surface of the filter, scouring or flushing lint and solid particles from the filter. During the soak and rinse cycles, the solenoid 197a of the tepid water supply valve 197 is energized through the dial contacts 245, contacts 212 which are closed by the float 211 whenever there is insufficient water in the bottom of the outer casing, contacts 253 which are closed by the temperature control cam 254, and contacts 255 which are closed by the drain pump cam 256. This circuit is interrupted as soon as the accumulation of water in the bottom of the outer casing raises the float 211 and opens the contacts 212. Due to a snap action the contacts 246 are closed simultaneously with the opening of the contacts 212 to close the circuit to the main driving and timing motors. Since at this time the contacts 257 are held open by the spin cam 248, the solenoid 58 is deenergized, opening the port 56 and relieving the oil pressure in the bellows 46 so that the brake surfaces 42 and 43 are engaged to hold the frame 16 stationary and cause oscillation of the agitator. Oscillation of the agitator therefore starts at the instant that the proper amount of water is supplied to the machine.

The control is designed so that the operator can preselect the water temperature and washing time for the wash cycle. The water temperature is adjusted by the contact 200 which can be moved to contact either or both of the contacts 263 or 264 connected respectively to the tepid valve solenoid 197a through contacts 265 controlled by the cam 254 and to the hot valve solenoid 196a through contacts 266 controlled by the wash timer cam 233. Tepid or hot water is supplied respectively when the solenoids 197a or 196a are energized and water of intermediate temperature is supplied when both solenoids are energized. This gives sufficient range of temperature adjustment. The adjustable temperature circuit extends between terminals 267 and 268 on the previously described circuit for automatically supplying tepid water during the soak and rinse cycles so the adjustable temperature water is also supplied under the control of the float 211.

The washing time is adjusted by the cam 233 driven by a wash timing motor 258. The cam 233, which is manually adjustable in a clockwise direction to preselect the washing time, is driven in a counterclockwise direction by a wash timing motor 258. The circuit to the wash timing motor 258 is controlled by the cam 259 which opens the contacts 262 in the circuit of the main timing motor winding 234 and closes contacts 260, closing a circuit from one side of the wash timer motor winding 269 through the contacts 260 to the motor terminal 236. The other side of the wash timer motor winding 269 is connected through contacts 266 through the low impedance of solenoid 196a, terminal 268, contacts 255 to the motor terminal 237. The current flowing through the winding 269 is insufficient to energize the solenoid 196a. The wash timer motor comes into operation shortly after the beginning of agitation in the wash cycle so that the main driving motor 31a is running and line potential is accordingly applied across the motor terminals 236 and 237. At some prior time the operator has adjusted the cam 233 for the desired washing time so that the contacts 266 are closed. The closing of the contacts 260 by the cam 259 breaks the circuit to the winding 234 of the main timing motor and stops the rotation of

the main control cams. Simultaneously with the stopping of the main timing motor the wash timing motor 258 is started by the closure of contacts 260, turning the cam 233 in a counterclockwise direction until the contacts 266 are opened and the contacts 261 are closed, restarting the main timing motor. The wash timer motor is effective to add an adjustable interval to the washing operation only during the wash cycle. At the conclusion of the added interval the washing is completed under the control of the cams driven by the main timing motor. The spinning or centrifugal drying of the clothes is under the control of the cams 248 and 250 which close the contacts 257 and 249 during spinning. The closing of contacts 249 completes a circuit to the main driving motor extending through contacts 245 and contacts 249 to the motor terminal 236. The other motor terminal 237 is permanently connected to the other (—) side of the power line. The closing of the contacts 257 completes a circuit to the solenoid valve 58 from contacts 249 connected to one side of the power line through contacts 257, valve 58 and the low impedance of starting winding 242 to the other motor terminal 237 connected to the other side of the power line, energizing the solenoid valve 58 which closes the port 56 and permits oil pressure to build up inside the bellows 46 to expand the bellows and disengage the brake 42, 43 and engage the clutch 44, 45, coupling the motor shaft directly to the spinner basket. The spinning starts after the spin valve is energized, which, as will be noted from Fig. 2, takes place shortly after the main motor 31a has been energized so the starting solenoid 239 opens contacts 241 before the solenoid 58 can be energized. Thus it follows that when starting contacts 241 are closed, it is not possible to energize spin solenoid 58. The presence of starting winding 242 in series with solenoid 58 does not affect the operation of the latter.

The drain pump motor 72 is energized by contacts 270 closed by the drain pump control cam 256 to connect the drain pump motor terminal 243 to the (—) side of the power line. The other drain pump motor terminal 244 is connected through the contacts 245 to the (+) side of the power line. The winding 234 of the main timer motor 231 is energized in parallel with the drain pump motor by means of relay 235 and contacts 272 so the "empty" cycle is automatically performed.

During rinsing while the agitator is oscillating, the drain pump is started at two spaced intervals to pump the water in the bottom of the outer casing to the drain. While the drain pump operates, the liquid level in the outer casing drops, opening the float switch 246 and closing the float switch 212. Opening the float switch 246 opens a circuit to the main driving motor through the switch 246 but another circuit to the main driving motor is closed through contacts 245, contacts 271 closed by the circulating pump cam 252, switch contacts 213 and 247 to the motor terminal 236 so the motor does not stop while the drain pump runs and oscillation of the agitator continues. The circulating pump does not run while the drain pump is running. When the drain pump stops due to the opening of the contacts 270, the circulating pump contacts 251 are closed and the contacts 246 are open due to the drop in the water level in the bottom of the outer casing and the contacts 212 are closed so that water is supplied to the bottom of the outer

casing as soon as the drain pump stops. This water fills the bottom of the outer casing to close the float switch 246 and complete the circuit to the main motor 31a. The circulating pump has already been started to pump this water into the basket. The starting of the drain pump during the rinse cycle results in the addition of a small quantity of fresh water to the machine and the pumping to the drain of the lint and solid particles which have accumulated in the bottom of the outer casing.

To facilitate determination of the condition of the machine at any part of the cycle, legends have been placed on Fig. 2 indicating the condition of the control contacts corresponding to the control cam surfaces. By the use of these legends it is believed that the operating condition of the machine at any point can readily be ascertained.

The dial cam 232 controls the power supply to the machine through contacts 245 which are closed while the machine is operating. It will be noted that the dial cam switch 245 is closed throughout the soak, wash, rinse, and empty cycles and is open before and after the empty cycle. After going through the soak, wash, and rinse cycles the machine automatically stops. The dial must be manually turned to start the empty cycle and the machine will automatically stop at the end of the empty cycle.

The temperature control cam 254 has two positions, one in which the contacts 253 are closed and the other in which the contacts 265 are closed. While the contacts 253 are closed, only tepid water can be supplied to the machine. The supply of water is possible only when the float switch contacts 212 and the drain pump cam contacts 255 are closed. The water supply stops as soon as the float switch contacts 212 are opened by the accumulation of a small amount of water in the outer casing. When the contacts 265 are closed, the temperature of the water supply is determined by the adjustment of the contact arm 200 which controls the circuit to the hot water valve 196 through contacts 266 controlled by the wash time adjusting cam 233 and contacts 255 controlled by the drain pump cam 256. The temperature cam is conditioned for the supply of hot water only during the wash cycle, and the higher temperature water desirable for the wash cycle is supplied under the control of the float switch contacts 212. Throughout that part of the operation when the agitator is oscillated, except during the part of the rinse cycle, water of the temperature determined by the temperature cam is supplied under the control of the float. During the supplying of water (except in spin and part of rinse agitate), the main and timing motors are deenergized. The supply of water is therefore independent of failure of the power or water supply. The rate of water supply is less than the capacity of the circulating pump so the water supplied to the machine is pumped into the spinner basket and the float switch shuts off the water supply after the basket is filled to overflowing and a small amount has accumulated in the bottom of the outer casing. Oscillation of the agitator starts simultaneously with the opening of contacts 212 and the closing of contacts 246 to complete the circuits to the main and timing motors. If for any reason the water level in the spinner basket drops during agitation, additional water is automatically supplied.

The wash time cam 259 controls the circuit to the wash timer motor 258 through contacts 260.

While the contacts 260 are closed, the circuit to the main timer motor through the contacts 261 is interrupted for an interval dependent upon the adjustment of the cam 233. While the circuit to the main timer motor is interrupted, all of the cams except the cam 233 are stationary. The adjustment of the washing time is desirable only during the washing operation, and therefore the wash time cam 259 closes the contacts 260 only during the part of the wash cycle in which the agitator is oscillating. At all other times the contacts 260 are open and the contacts 262 are closed.

The spin valve cam 248 closes the contacts 257 in circuit with the spin solenoid 58 during the intervals at which centrifugal extracting is desired. The circuit to the solenoid 58 is through contacts 249 closed by the motor control cam 250 so that the solenoid 58 is energized only when both the contacts 257 and 249 are closed. In the other position of the spin valve cam 248, the contacts 247 are closed which are in the power circuit for the motor 31a through the float control switches 213 and 246. When the switches 213, 246 and 247 are closed, the motor 31a is energized and, since at this time the solenoid 58 is deenergized, the agitator is oscillated.

The float control switch 246 is closed only when there is sufficient water in the bottom of the outer casing to indicate that the spinner basket is filled to the proper level. The switch 213, which is opened at a higher water level in the outer casing, is a safety switch to prevent oscillation of the agitator with insufficient water in the spinner basket. The safety switch will not come into action during the normal operation of the machine but, since the control cams may be manually moved to any position, it is possible for the operator to obtain a condition in which the float switch contacts 246 are closed when the spinner basket is not filled to the proper water level. One way of obtaining this condition is to turn the control cams to the spinning position and then turn the control cams to the washing position before the spinner basket is completely emptied. Regardless of whether the drain pump is running, the water level in the bottom of the outer casing will rise during spinning above the level sufficient to close the float switch 246 so that if this switch alone were depended upon to initiate the oscillation of the agitator, the agitator would be oscillated when the spinner basket was only partly full of water. However, under this condition the high water level in the outer casing causes the opening of the contacts 213, preventing oscillation of the agitator until the water level had dropped due to the operation of the circulating pump. While this arrangement is not a perfect protection against any oscillation of the agitator with insufficient water in the spinner basket, it is sufficient for practical purposes.

The drain pump cam 256 controls contacts 270 which energize drain pump motor 72 and contacts 255 which form part of the circuit to the water valve solenoids 196a and 197a. The circulating pump cam 252 controls contacts 251 which close the circuit to the circulating pump motor 66 while water is to be supplied to the machine and throughout that part of the cycle in which the agitator oscillates and during part of the spinning operations so as to discharge a stream of water onto the filter to centrifugally flush or clean the filter. The cam 252 also controls con-

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tacts 271 which control the circuit to the main driving motor during that part of the rinse cycle when the drain pump is operating. During this time the drain pump is removing water from the bottom of the outer casing, and, unless the motor circuit was completed through the contacts 271, oscillation of the agitator would stop due to the opening of the float switch contacts 246.

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

1. In a washing machine, a spinner basket for receiving liquid and clothes to be washed and centrifugally dried, washing means in the basket, a tub for receiving in its lower part liquid from the spinner basket, said basket having an overflow to the tub defining the basket water level for washing, mechanism for actuating the washing means and for spinning the basket, an electric motor for driving said mechanism, means for shifting the mechanism between washing and spinning, a two-position switch controlling said shifting means having one position for washing and the other for centrifugal drying, means for supplying water to the tub, means for pumping water from the tub to the basket for washing, the capacity of said pumping means being greater than the rate of water supply to the tub, a float switch responsive to a predetermined accumulation of water in the tub for closing a circuit to the motor through the washing position of the two-position switch and for interrupting the water supply, and a float switch responsive to a greater accumulation of water in the tub for breaking said circuit to prevent washing.

2. In a washing machine, a spinner basket for receiving liquid and clothes to be washed and centrifugally dried, washing means in the basket, a tub for receiving in its lower part liquid from the spinner basket, said basket having an overflow to the tub defining the basket water level for washing, mechanism for actuating the washing means and for spinning the basket, an electric motor for driving said mechanism, a two-position switch for controlling said mechanism having one position for effecting actuation of the washing means and the other position for effecting spinning of the basket, means for supplying water to the tub, means for pumping water from the tub to the basket for washing, the capacity of the pumping means being greater than the rate of water supply to the tub, a float switch responsive to a predetermined accumulation of water in the tub for closing a circuit to the motor through the washing position of the first switch and for interrupting the water supply, and a float switch responsive to a greater accumulation of water in the tub for breaking said circuit to prevent washing.

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3. In a washing machine, a spinner basket for receiving liquid and clothes to be washed and centrifugally dried, washing means in the basket, a tub for receiving in its lower part liquid from the spinner basket, said basket having an overflow to the tub defining the basket water level for washing, mechanism for actuating the washing means and for spinning the basket, an electric motor for driving said mechanism, means for supplying water to the tub, means for pumping water from the tub to the basket for washing, said pumping means having a greater capacity than the rate of water supply to the tub, means responsive to a predetermined accumulation of water in the tub for conditioning the machine so that the driving mechanism may actuate the washing means and interrupting the water supply, and means responsive to a greater accumulation of water in the tub to prevent the driving mechanism from operating the washing means.

4. In a washing machine, a spinner basket for receiving liquid and clothes to be washed and centrifugally dried, washing means in the basket, a tub for receiving in its lower part liquid from the spinner basket, said basket having an overflow to the tub defining the basket water level for washing, mechanism for actuating said washing means and for spinning the basket, an electric motor for driving said mechanism, means for shifting the mechanism between washing and spinning, a two-position switch controlling said last-named means having one position for washing and the other for centrifugal drying, means for supplying water to the tub, means for pumping water from the tub to the basket for washing, said pumping means having a capacity greater than the rate of water supply to the tub, and a float switch responsive to a predetermined accumulation of water in the tub for closing a circuit to the motor through the washing position of said two-position switch and for interrupting the water supply.

THOMAS T. WOODSON.

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Certificate of Correction

Patent No. 2,561,257

July 17, 1951

THOMAS T. WOODSON

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 12, line 8, for "for", first occurrence, read *and*; line 9, after the syllable "tric" insert *motor*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 26th day of February, A. D. 1952.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.