Aug. 22, 1961 C. A. COBB ET AL 2,997,554

MULTIPLE CIRCUIT CONTROL SWITCH

Filed July 2, 1957 4 Sheets-Sheet 1

Fig. 1

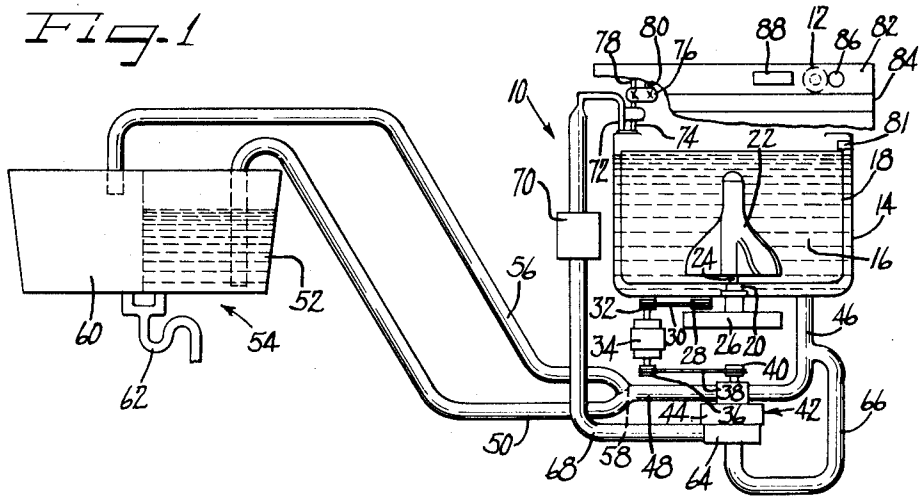
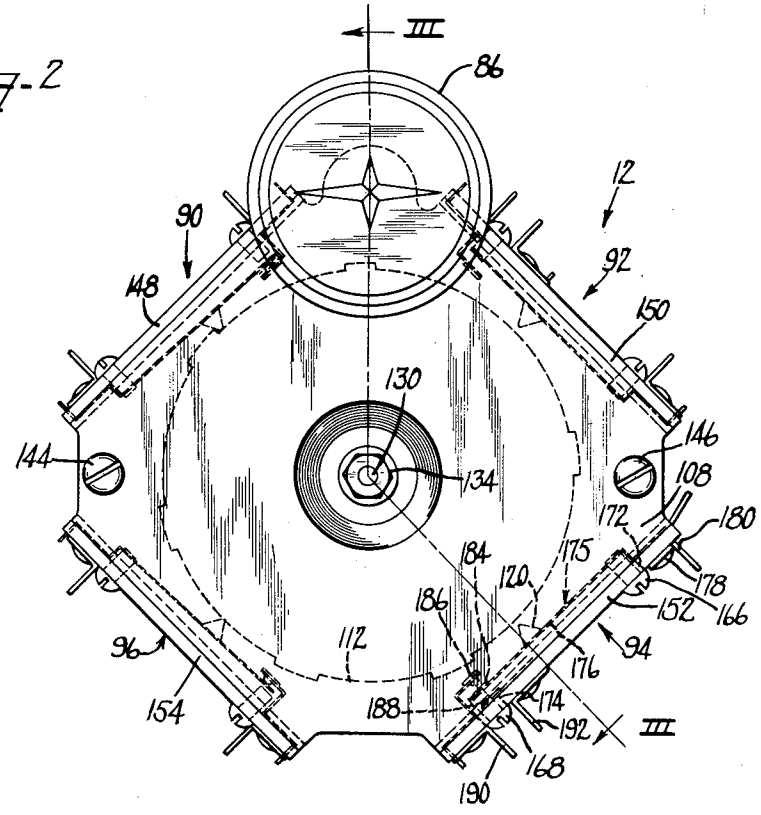


Fig. 2



Inventors
Clifton A. Cobb
James T. Williams

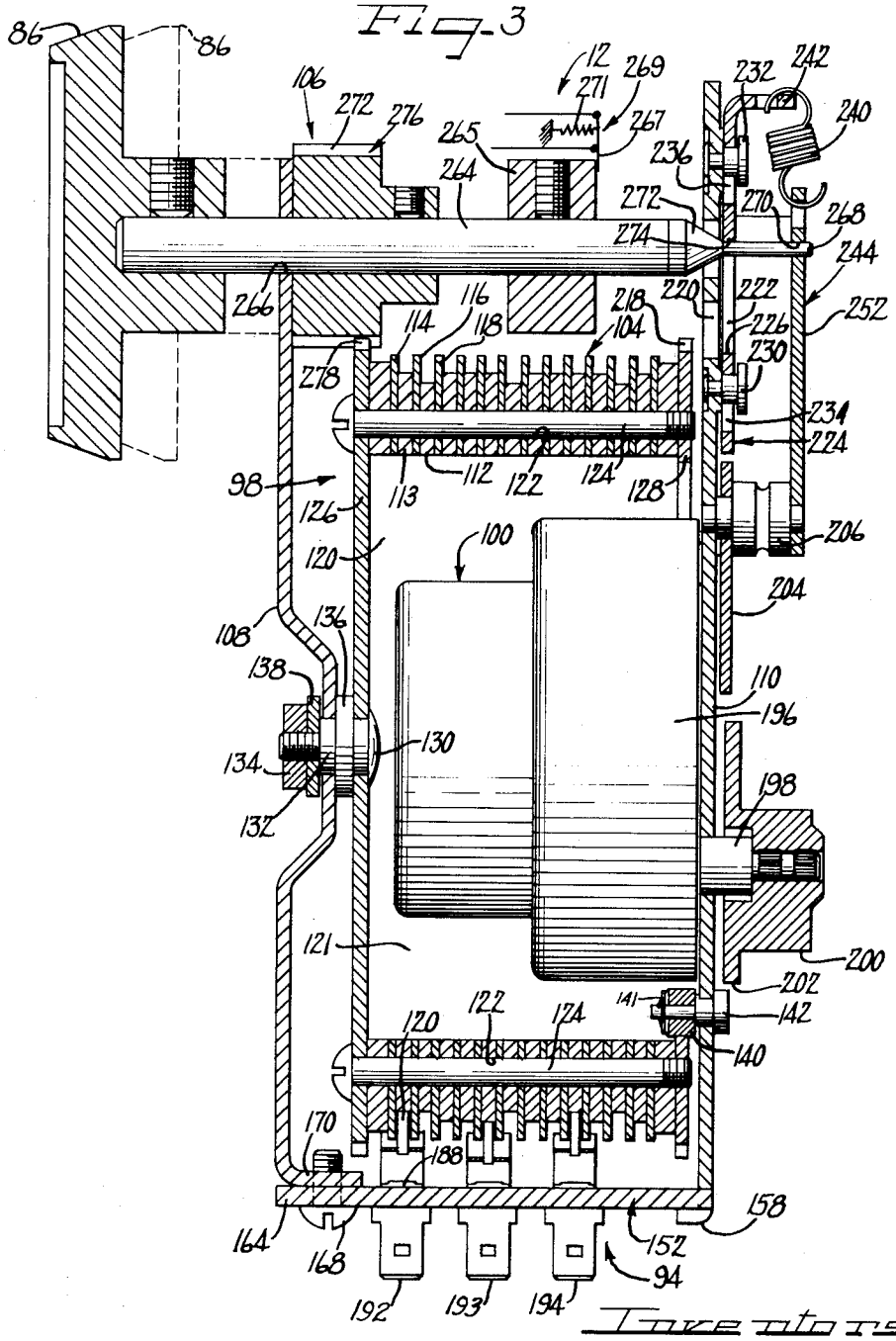
By Hill, Sherman, Meroni, Gross & Simpson Attys

Aug. 22, 1961 C. A. COBB ET AL 2,997,554

MULTIPLE CIRCUIT CONTROL SWITCH

Filed July 2, 1957 4 Sheets-Sheet 2

Fig. 3



Inventors
Clifton A. Cobb
James T. Williams

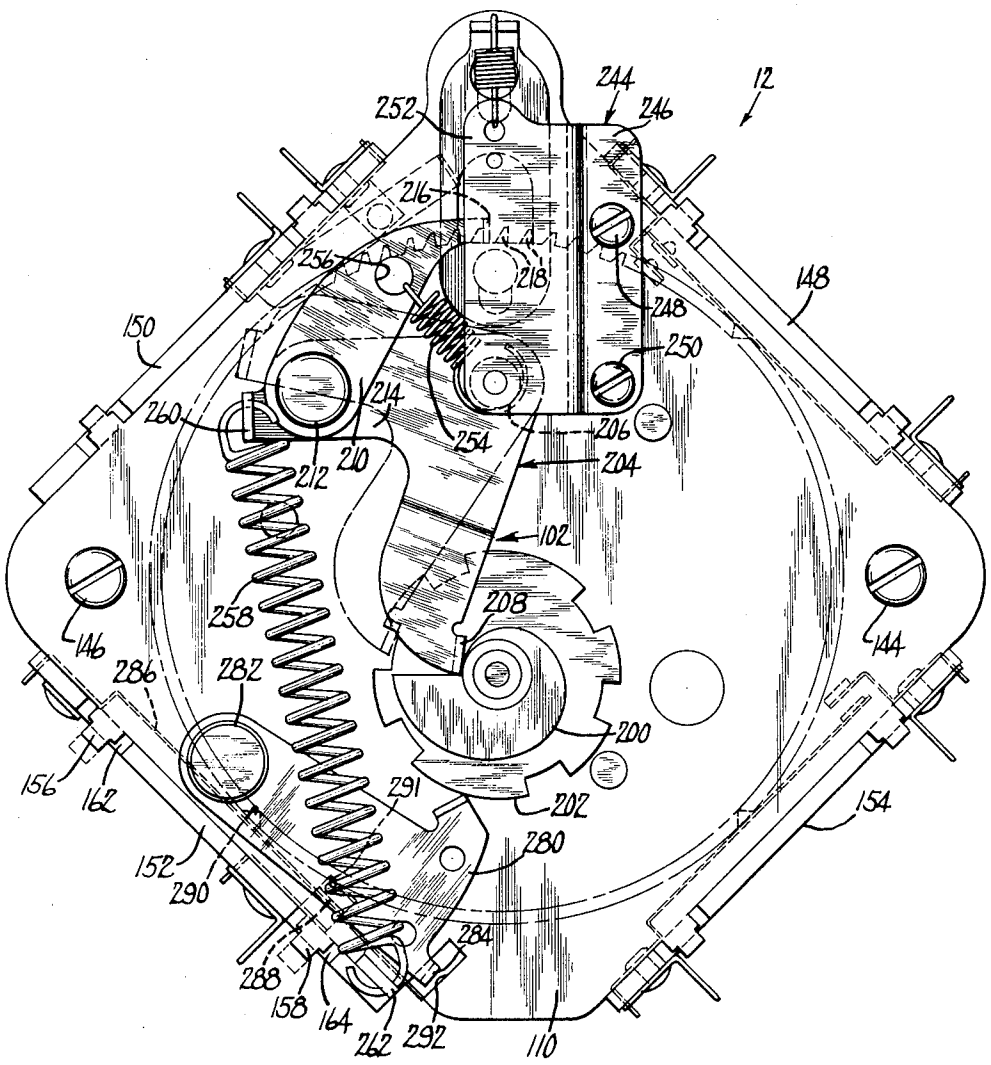
by Hill, Sherman, Meroni, Gross & Simpson Attys

Aug. 22, 1961 C. A. COBB ET AL 2,997,554

MULTIPLE CIRCUIT CONTROL SWITCH

Filed July 2, 1957 4 Sheets-Sheet 3

Fig. 4



Inventors
Clifton A. Cobb
James T. Williams
by Hill, Sherman, Meroni, Gross & Simpson Attys

Aug. 22, 1961 C. A. COBB ET AL 2,997,554

MULTIPLE CIRCUIT CONTROL SWITCH

Filed July 2, 1957 4 Sheets-Sheet 4

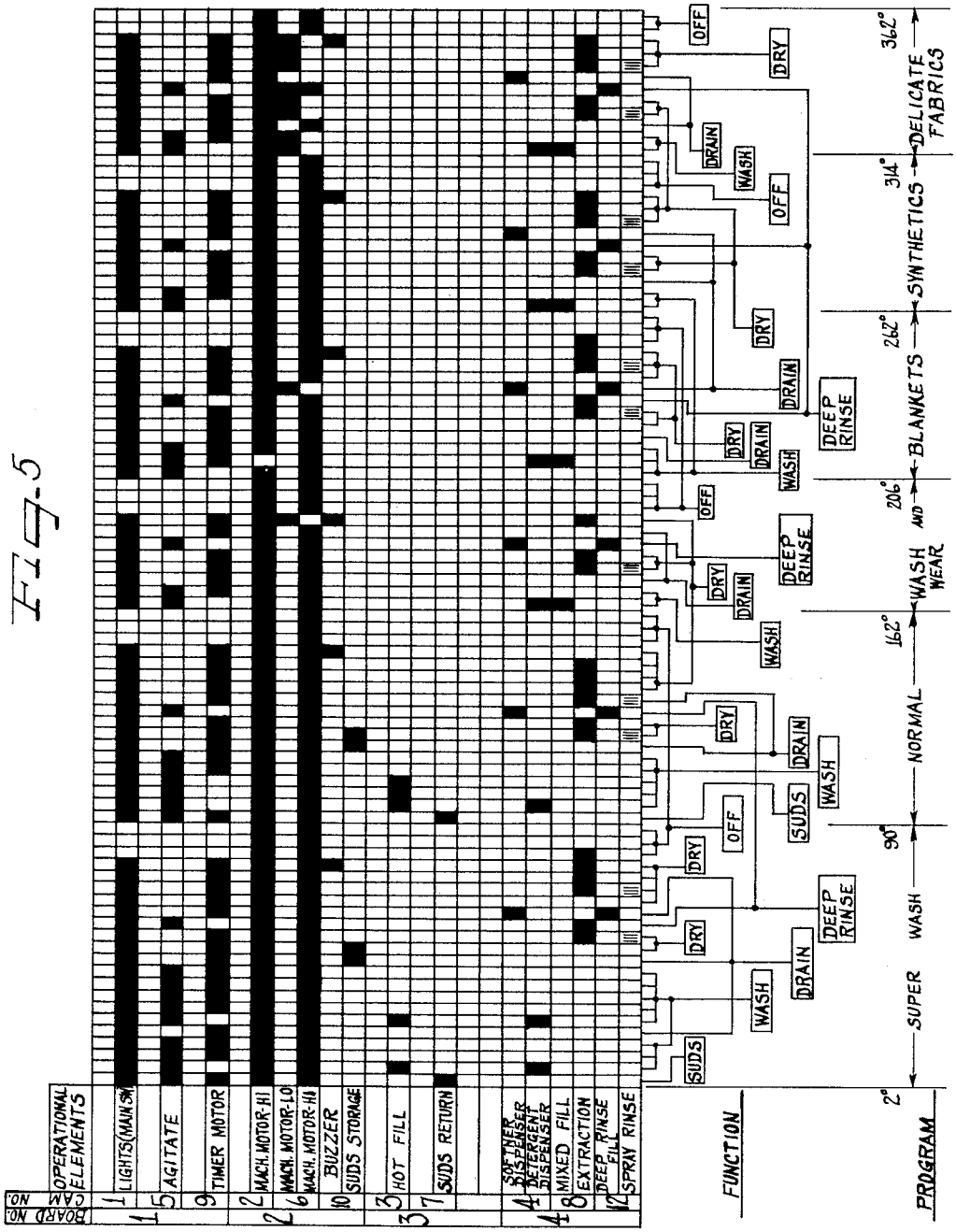


Fig-5

Inventors
Clifton A. Cobb
James T. Williams
by Hill, Sherman, Meroni, Gross & Simpson Attys

United States Patent Office 2,997,554 Patented Aug. 22, 1961

2,997,554

MULTIPLE CIRCUIT CONTROL SWITCH

Clifton A. Cobb, St. Joseph, and James T. Williams, Stevensville, Mich., assignors to Whirlpool Corporation, St. Joseph, Mich., a corporation of Delaware

Filed July 2, 1957, Ser. No. 669,685
12 Claims. (Cl. 200—38)

The present invention relates to improvements in methods and apparatus for laundering, and more specifically to an improved presettable sequential automatic time control device for selecting and automatically controlling the performance of operational programs for an automatic laundering machine.

As a particular example, the invention is embodied in a presettable sequential time control device in a home laundering machine having a laundering container defining a laundering zone therein, and provided with operational mechanism for performing a washing, rinsing and drying operation on the fabrics or materials in the container. Various operational elements may be employed in achieving these functions. In one form a container or tub contains a laundering water in which fabrics are to be laundered. An agitator oscillates in the water to agitate the fabrics and the washing water. At the end of the washing operation, the laundering fluid is drained from the tub and the fabrics are rinsed by directing a rinse water into the tub. At the termination of the washing operation and rinsing operations, water is extracted centrifugally from the fabrics, such as by spinning the container or an inner basket, which may be provided within the container for that purpose.

The basic operations of washing, rinsing and drying may be accompanied by refinements which improve the laundering operation, such as controlling the temperature of the wash water used, automatically adding soap or detergents and performing different types of rinse operations. All of these operations may be performed automatically in an automatic laundry machine wherein the functions are performed by one or more operating elements which are electrically controlled usually through control switches that are operated by cams driven by a timer motor. The control mechanism usually is manually started and proceeds automatically to complete a program of operation, and the operator need merely place the clothes in the tub whereupon the machine automatically completes the washing, rinsing and drying operations.

Different materials and different fabrics have different laundering characteristics and a material having a given laundering characteristic will receive the best washing only when a given set of laundering operations are performed. For example, a certain type of fabric will be best washed in a water at a certain temperature best suited for removing soils from that fabric, and laundering will be completed within a certain time. Continuing laundering after that time will merely create wear in the fabric. An optimum relationship between the washing operation and the fabric exists for all of the functions of the laundering operation including the soap or detergent used, the type and length of rinsing performed, and the drying operation. Thus, for an optimum washing performance, the individual operation elements of a laundering machine, which contribute to perform the functions of washing, rinsing and drying, must be operated in accordance with the fabric being washed.

A feature of the present invention is the provision of an automatic laundering machine wherein the controls are selectively operable to choose a program of machine operation wherein the individual operational elements will operate to complete the functions of washing, rinsing and drying, in accordance with the type of fabric to be laundered.

It is accordingly an object of the invention to provide an improved timing apparatus which makes it possible to achieve automation in a home laundry machine and preselect a program of laundering operation in accordance with the laundering characteristics of a fabric to be washed, or in accordance with the type of laundering operation desired.

Another object of the invention is to provide a control mechanism for a home laundry machine wherein a plurality of programs of operation can be preselected which are distinguished by the operation or non-operation of certain operational elements, by the time at which the operational elements are actuated, and by the duration of time over which they operate.

A further object of the invention is to provide an automatic washing machine capable of performing different programs of operation which are determined by presettable control means, and wherein the programs include the operations "super wash," "normal wash," "wash and wear," "blankets," "synthetics" and "delicate fabrics."

Another important object of the invention is to provide a control system for an automatic laundering machine or the like, employing control switches for the individual operational elements, wherein the control switches are actuated by individual cam tracks divided into a plurality of programs with the cams being presettable to select the program of operation.

A further object of the invention is to provide a timer control switch for an automatic laundry machine or the like, wherein control switches are actuated by rotating cams carried on a cam drum, and wherein the cams are rotated only a portion of the full revolution for a complete program of operation so that a plurality of complete programs are available for a full revolution of the cam drum.

Another object of the invention is to provide an improved presettable sequential timer control switch which is capable of use for various purposes and which requires a minimum amount of installation space.

Another object of the invention is to provide a sequential time control switch with a rotating cam drum with improved manually operable presetting means for the cam drum which can turn the cam drum in a single direction only in a first position or in both directions in a second position, and which is selectively operable to discontinue operation of the timer motor during setting.

Another object of the invention is to provide an improved sequential control timer with an improved cam and switch relationship which conserves space and enhances the operation of the control and greatly improves making adjustments between the switches and cams.

A further object of the invention is to provide a time control cam drum driven by a ratchet drive with an improved means for disconnecting the ratchet drive during presetting of the cam.

Another object of the invention is to provide an improved time switch control apparatus for providing a plurality of programs of operation for an automatic laun-

dry machine or the like, wherein the operation of individual elements can be easily changed for one or more programs.

Other objects and advantages will become more apparent in the teaching of the principles of the invention in connection with the complete disclosure thereof and the illustration and description of the preferred embodiments thereof in the specification, claims and drawings, in which:

FIGURE 1 is an elevational view shown somewhat in schematic form of an automatic laundry machine of the type used in combination with the improved time control mechanism;

FIGURE 2 is a front end view of a time control mechanism embodying the principles of the present invention;

FIGURE 3 is a vertical sectional view taken along line III—III of FIGURE 2;

FIGURE 4 is a rear elevational view of a time control mechanism; and,

FIGURE 5 is a chart illustrating the timer performance and the duration of performance of the individual operational elements of the machine.

While the present invention is illustrated in the preferred embodiment of the drawings as described herein, it will be understood that the inventive features may be employed in other environments utilizing their inherent advantages. As illustrated in FIGURE 1, an automatic laundry machine **10** is illustrated employing a timer mechanism **12** which is illustrated in detail in FIGURES 2 through 4. FIGURE 5 illustrates the various programs of operation in chart form with other pertinent data which is further illustrative of the advantages and features of the invention.

The automatic laundry machine **10** is shown in FIGURE 1 having a container or tub **14** defining a laundry zone **16** therein, which is filled with a washing fluid, such as water. Within the tub **14** is a liner in the form of a basket **18**, which contains the articles or fabrics to be laundered, and which is mounted on a centrally located vertical hub **20** at its base for spinning the basket **18** at high speeds for the centrifugal extraction of fluid during the drying function of the machine. The basket **18** may be perforated for the passage of water through its walls, or if imperforate, has side walls which slant outwardly so that the water may pass over the upper edge thereof into the tube **14**.

It will be understood that the particular laundering machine is described as an example and the timer may be employed with other forms having different types of containers, washing mechanisms and the like. Further, the timer may be employed in a combination or combo machine wherein a final drying with heated air is performed automatically at the end of the spin-dry function.

For performing the washing operation, an agitator **22** is centrally located within the basket **18** and is driven in oscillation by a shaft **24**. The rotational and oscillational power for driving the basket **18** and the agitator **22** is derived from a gear transmission within a gear casing **26**. The gears are driven from a driven pulley **28** over which passes a belt **30** driven by a drive pulley **32**, which is mounted on a drive shaft of a motor **34**. The motor carries another drive pulley **36** on the drive shaft at the opposite end carrying a drive belt **38** which drives a driven pulley **40** to operate a pump **42**.

The pump illustrated is a dual level arrangement with an upper section **44** to which is connected an outlet line **46** leading from the bottom of the tub **14**. At the other side of the upper section **44** of the pump is a pump line **48** and the upper section **44** is dual-directional so as to pump water in either direction while the pump is driven constantly in the same direction by a drive pulley **40**.

At the end of a washing operation, the pump will be set by a control (not shown) to pump water from the outlet line **46** through the pump line **48** through a suds saver line **50** to a suds saving chamber **52** in a laundry sink **54**. During succeeding rinsing operations, the pump section **42** pumps the drain water into a drain line **56**, and for this purpose a valve **58** is controlled to direct the water into either line **50** or line **56**. The drain water in line **56** enters a sink compartment **60** and flows out through a drain **62**. For a succeeding washing operation, the pump section **44** is controlled to pump water in the opposite direction, and the sudsy water is returned from the suds saving section **52** to the tub **14**.

A lower section **64** of the pump **42** is devoted to recirculating the laundering water for purposes of filtering. The pump section **64** has an inlet line **66** which leads from the tub outlet line **46**. The pump section **64** discharges to a filtering line **68** which leads through a filter **70** and discharges at **72** into the tub.

Fresh water for performing the rinsing and washing operation is supplied to the tub through an inlet nozzle **74** which is fed water from a control mixing valve **76** connected to a hot water line **78** and a cold water line **80**.

Various other appendages may be used in connection with the laundry machine for enhancing the operation, such as an automatic softener dispenser or a detergent dispenser shown schematically at **81**.

The aforedescribed operational elements are each operated at a predetermined time and for a predetermined length of time to complete a washing operation. The operating elements are controlled through the time control switch **12** which is mounted on a control panel **82** of a cabinet **84** which encloses the laundering machine. In accordance with the present invention, the time cycle control mechanism **12** is presettable to select a program of operation for the machine which suits the type of material being washed. The program is selected by presetting the timer **12** with a manual control knob **86** which is exposed on the control panel **82**. The control timer **12** may be suitably connected to an indicating mechanism which will show through a dial **88** the program which is selected and the time expired in the particular program during operation of the machine.

Individual operating elements of the machine are electrically operated and their operation is controlled by the sequential timer control **12**. For this purpose, a plurality of individual switches are provided which are actuated by cams. In FIGURE 2, switches are shown arranged in four circumferentially spaced banks **90**, **92**, **94** and **96**. The switches, arranged in the banks, are actuated by a cam drum **98**, as shown in FIGURE 3. The cam drum is rotatably driven by a timer motor **100** located within the hollow cam drum **98** and driving the cam drum through a drive mechanism shown generally at **102** in FIGURE 4. The cam drum **98** has an outer cam surface **104** which operates the switches and the cam surface is divided into a plurality of program lengths with each program length actuating the switches to perform a full laundering operation. The cam drum is presettable to selectively choose the operational program by a presetting means **106**, as shown in FIGURE 3.

Turning to the more specific elements of the preferred embodiment, the cam drum **98** and switch banks, **90**, **92**, **94** and **96** are supported on a pair of parallel spaced plates **108** and **110**, as shown in FIGURE 3.

The cam drum includes a plurality of individual cams such as **112** and **113** separated by spacers such as **114**, **116** and **118** which also provide guides for the switch operating followers **120** that ride against the cams. The cams and the separators are annular in shape so as to make available the hollow space **121** within the cam drum wherein the timer motor **100** is housed. The spacers and cams have axially extending holes **122** bored therethrough to receive axially extending connecting bolts **124**. The bolts extend through a hole in the front plate **126** of the cam drum and are threaded into an annular rear plate **128** of the drum to secure the cams and spacers together to form a unitary cam drum **98**.

The front cam plate **126** carries a bolt **130** at its axial center that supports a bearing sleeve **132** for journaling the front end of the cam drum in the plate **108**. A nut **134** is threaded onto the bolt **130** to hold the bearing and the spacer washers **136** and **138** in place.

The rear end of the cam drum is journaled on supporting rollers **140** which are carried on studs **142** secured to the plate **110** of the timer frame. Metal fasteners **141** are pressed onto the outer end portions of studs **142** to maintain the supporting rollers **140** in alignment. The inner surface of the annular rear plate **128** of the cam drum rotatably rides on the rollers **140**.

The frame plates **108** and **110** are held in their fixed spaced position by cross bolts **144** and **146**, FIGURES 2 and 4, which are provided with suitable spacers between the plates to hold them in their relative axial positions.

The switch banks **90**, **92**, **94** and **96** include flat plates **148**, **150**, **152** and **154** which are formed of an insulating material so as to carry the switches. The switches are mounted on each of the plates in the same manner, and, therefore, the mounting of only one plate will be described.

In the arrangement illustrated, twelve cams are shown to operate twelve individual switches. It will be understood that varying numbers of cams and switches may be provided, and in accordance with the present invention, one cam is provided for each switch and the switch is reactuated in a different manner, in accordance with the operational program through which the machine is operated. The operational program is performed over a predetermined portion of a total rotation of the cam drum.

The switch supporting plates, such as plate **152**, are attached at their rear edge by ears **156** and **158** projecting outwardly from the rear frame plate **110** and bent inwardly to overlie the outer surface of the switch plate **152** in the manner shown in FIGURE 3. To permit the ears **156** and **158** to project beyond the plate, the plate is provided with notches **162** and **164**. These notches are wider than is necessary to permit passage of the ears **156** and **158** in order that the plate may be adjusted circumferentially with respect to the cam drum **98**.

The front end **164** of the plate **152** is secured to the front frame plate **108** by bolts **166** and **168** threaded into threaded openings in an axially turned flange portion **170** of the front frame plate **108**. The bolts pass through elongated slots **172** and **174** in the switch plate to permit the circumferential adjustment of the switch plates.

Thus, with the switches being provided in a plurality of banks arranged circumferentially around the cam drum, the individual switch groups can be adjusted with respect to the cam drum to a mean adjustment without necessitating adjustment of the entire group of switches. The adjustment is performed merely by loosening the bolts **166** and **168**, and sliding the switch plate in a circumferential direction and retightening the bolts when the proper adjustment is reached.

The switches are mounted on the switch plates, as shown in FIGURES 2 and 3. The switch assembly **175** which is one of the switch assemblies of switch plate **152** includes a movable switch arm **176**, which is supported by bolt **178** at its base. An electrically connecting terminal **180** is provided for the attachment, such as by soldering, of electrical leads leading to the operating element of the laundering machine which is controlled by the switch. The switch arm **176** is biased toward the cam drum **98** and carries a follower **120** which engages the surface of one of the cams to control the position of the switch contact **184** at the end of the switch arm **176**. Depending on the surface contour of the cam, the switch contact **184** will engage one of the fixed contacts **186** or **188**. These contacts are provided with terminals **190** and **192** for the connection of leads and, dependent on the position of the movable switch arm **176**, the circuit will be completed from the terminal **180** to either of the terminals **190** or **192**.

As shown in FIGURE 3 the terminals **193** and **194** correspond to the terminal **192** of the switch assembly **175** and are part of the two other switch assemblies of the switch plate **152**, both of which are similar to the switch assembly **175**. Further, each of the switches mounted on the remaining boards **148**, **150** and **154** is of a similar construction and, therefore, the description of switch **175** will suffice for understanding the remaining switches.

Rotation of the cam drum **98** to cause operation of the switches, is achieved through a timer motor **100** which preferably operates at a constant speed. The timer motor **100** contains a gear reduction within the housing **196** which has an output shaft **198** to which is secured an involute cam **200**. The involute cam **200** also carries a notched cam **202**, which controls the rinsing operation of the laundering machine in a manner which will be later described.

The involute cam **200** forms part of the drive train **102** for rotating the cam drum and its involute surface rocks a pawl arm **204**. The pawl arm is shaped in the form of a bell-crank and is pivoted on a support pin **206**. A lower arm of the pawl arm **204** carries a follower end **208** which rides against the involute cam **200** to rock the pawl arm and give reciprocation to a pawl **210**, which is pivotally supported on a pin **212** carried on the arm **214** of the pawl arm **204**. In the rocking motion caused by the involute cam **200**, the pawl arm **204** will move between the solid line and dotted line position shown in FIGURE 4, and will index the cam drum **98** forward in stepwise fashion by the finger **216** at the end of the pawl **210** engaging successive teeth **218** of the ratchet which is the outer portion of the cam plate **128**.

As illustrated in FIGURES 3 and 4, the finger **216** at the end of the pawl **210** will project through the opening **220** in the frame plate **110** of the timer assembly to engage the teeth **218**.

The pawl finger **216** will thus pass through the opening **222** in the shuttle plate **224**, which functions to disengage the pawl. When the shuttle plate **224** is lifted, the surface **226** at the base of the opening **222** will lift upwardly on the pawl finger **216** to disengage it from the pawl teeth **218**. This permits free rotation of the cam drum **98** in either direction.

The shuttle plate **224** is slidably held by headed pins **230** and **232** which project through slots **234** and **236** in the shuttle plate. The shuttle plate is normally held in its lowermost position by shuttle spring **240**, which is connected between an ear **242** on the shuttle plate and an opening in the upper end of the support plate **244**.

As shown in FIGURE 4, the support plate **244** is offset along its edge **246** to connect it by screws **248** and **250** to the rear frame plate **110**. Another side **252** of the support plate **244** is connected to the pin **206** and provides a moving space for the pawl **210** and space for the pawl spring **254**, which is connected between an opening **256** in the pawl and the pin **206** to urge the pawl to engagement with the ratchet teeth **218**.

The pawl moves forwardly to catch a new tooth **218** in the ratchet when the pawl arm **204** is pivoted by the involute cam, and pulls the cam drum forwardly by the action of the pawl arm spring **258**. The pawl arm spring **258** is connected between an ear **260** on the pawl arm and an ear **262** projecting from the frame plate **110**.

The cam drum **98** is rotated to preset the cam position and select the program of operation by rotating the manually operable knob **86**, FIGURES 2 and 3. The knob is secured to a presetting shaft **264** which is rotatably supported at its front end in an opening **266** in the front frame plate **108** and at its rear end **268** in an opening **270** in the support plate **244**. The rear end **268** is reduced in size and joins the main portion of the shaft in a tapered cam surface **272** which is conically shaped to act in an upward direction in any rotational position of the shaft **264**. The cam **272** engages the upper edge **274** of the slot **222** in the shuttle plate **224**.

The presetting shaft **264** is axially movable between a first position, shown by the knob **86** in the solid line position in FIGURE 3, and a second position shown by the dotted line position of the knob in FIGURE 3. In the first position the cam drum **98** may be turned in one direction only, which advances the cam drum to a succeeding program. Rotation of the cam drum is achieved by a pinion gear **276** secured to the presetting shaft **264** and in mesh with the teeth **278** in the outer peripheral edge of the front plate **126** of the cam drum. The pinion gear **276** is elongated so that its teeth **277** will remain in mesh with the teeth **278** in both the first and second positions of the presettable shaft **264**.

When the shaft is pushed axially to the second position, the cam **272** will raise the shuttle plate **224**, thus lifting the pawl finger **216** out of engagement with the pawl teeth **218**. This will free the cam drum **98** and permit rotation in either direction to rotate or advance the cams with respect to their switches and select a program either in advance of or following the program then in position to operate.

The presetting shaft **264** carries a switch operating block **265**, which engages the switch arm **267** to open the switch **269** against the spring **271**. This switch is in circuit with the timer motor **100** which will automatically be stopped with all the electrical circuitry when the shaft is pushed to its second position.

The chart of FIGURE 5 illustrates the operation of the individual operational elements for each of the programs of the cam drum. As illustrated, the cams are divided to complete six programs for a complete 360° of revolution. The individual cams, of course, are rotationally staggered so that each of the individual switches will be at the starting point of a chosen program relative to its operating cam when the program begins.

It will also be seen, that the operational element will be actuated at a time relative to the beginning of the program and for a period of operational time determined by the cam. The same operational elements will perform and will be actuated by the same switches for each program, but they will operate in accordance with the laundering characteristic of the fabric or material being washed, and this laundering characteristic is supplied to the machine by presetting the control to the program which represents either the type of material being washed, or the type of program desired.

The cams may be arranged to provide a substantial number of programs, each of a different nature. However, if one of the programs is to be altered, the time at which any one operational element is actuated or the time period for which it is in any one or more programs can be changed by merely removing the cam section for the element and replacing it with another cam section which obtains the performance desired. This will change the operating performance of the particular operational element irrespective of the other elements and of the other programs.

In some instances, certain operational elements will perform during certain programs, but will remain inoperative during other programs. For example, with reference to FIGURE 5, it will be noted that the operational element marked "hot fill" which supplies hot water to the machine, is operative only during the "super wash" and the "normal" programs of the machine. The other programs utilize wash water of a lower temperature and the "hot fill" element, therefore, is not actuated.

It will also be noted that the total laundering period of the different programs vary in accordance with the program. Thus, the "super wash" program is the longest and the "wash and wear" program is the shortest of the programs provided. The number of programs which are provided may be varied in accordance with the types of materials or fabrics which are encountered by the machine so that a program is available for each type of operation desired. More programs can be provided by reducing the speed of the cam and shortening the length of the cam which rotates past the switches for a full program or also by enlarging the diameter of the cam drum.

The chart of FIGURE 5 shows the operational elements as they are assigned to the various switches with the cams for operating the switches being numbered along the cam shaft. The switches are indicated by the board number with the switches mounted on board number 1 being assigned the first, the fifth, and the ninth cams along the cam drum. With the arrangement indicated, the switches are spaced so that switches on the same board need not engage adjacent cams.

The spray rinse is applied in the laundry tub **14** in intermittent sprays or spurts. To accomplish this effect, the spray rinse cam **202** is provided to operate a spray rinse arm **280**, FIG. 4, which is pivotally mounted on a support pin **282** on the frame plate **110**. As the spray rinse cam **202** rotates, the spray rinse arm **280** will be pivotally oscillated and a switch operating finger **284** on the arm **280** will alternately permit a biased switch arm **286** to move its contact **288** toward a fixed contact **291** in order to close the circuit and electrically actuate the spray rinse.

The movable spray rinse switch arm **286** is mounted on the switch plate **152**. The switch arm is provided with a follower **290** which rides on a cam carried with the main drum. Thus, the position of the spring biased switch arm **286** is under the influence of both the spray rinse cam **202** and the main cam which actuates the follower **290**. The spray rinse cam **202** rotates at a much higher speed to intermittently release the spring arm, but the arm will be released only when also released by the main cam **290** which determines when the spray rinse period is to occur. To permit the switch operating finger **284** to engage the spray rinse switch arm, a slot **292** is cut in the plate **110**.

Thus, it will be seen that we have provided an improved automatic laundry machine which provides for automation in performing laundering operations, and which meets the objectives and advantages hereinbefore set forth. The arrangement makes it possible for the operator to selectively choose the program of operation with a simple rotation of a selector knob, whereupon the machine will automatically complete the full cycle of operation, in accordance with the program selected.

The time control switch for controlling the laundry machine is of improved construction and is arranged to require a small installation space and be capable of installing in the limited space available on the control panel for a laundry machine. Further, numerous operational programs are provided and an indefinite combination of operations of the operational elements can be achieved without requiring considerable installation space or complicated elaborate control mechanism.

We have, in the drawings and specification, presented a detailed disclosure of the preferred embodiment of our invention, but it is to be understood that we do not intend to limit the invention to the specific form disclosed, but intend to cover all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by our invention.

We claim as our invention:

1. A time cycle control switch comprising a rotary cam having an axial row of separate circumferentially extending cam tracks, said tracks divided circumferentially into individual program arcs, a longitudinal row of switches positioned to be in individual engagement with said cam tracks so as to be actuated in a predetermined sequence and for a predetermined length of time with rotation of said cam through a program arc, a ratchet gear connected to the cam, a pawl positioned to drive the ratchet gear in a forward direction and preventing movement of the ratchet gear in a reverse direction, drive means connected to the pawl for indexing the cam,

a shuttle member movable in a path to disengage the pawl from the ratchet, axially shiftable and manually rotatable presetting means connected to the cam for manually rotating the cam to preselect a program of operation through which the drive means will move the cam, and a shuttle engaging cam connected to the presetting means to move the shuttle upon axial shifting of said presenting means to cause the pawl to be disengaged from the ratchet gear.

2. A time cycle control switch comprising a rotary cam having a plurality of separate circumferentially extending cam tracks, said tracks divided into individual program arcs, switches positioned to be in individual engagement with said cam tracks so as to be actuated in a predetermined sequence and for a predetermined length of time with rotation of said cam through a program arc, a ratchet gear connected to the cam, a pawl positioned to drive the ratchet gear in a forward direction and preventing movement of the ratchet gear in a reverse direction, drive means connected to the pawl for indexing the cam, a presetting gear attached to the cam, a manually operable rotatable and axially shiftable presetting shaft, a pinion gear mounted on the shaft and in mesh with said presetting gear, one of said gears having elongated teeth to remain in mesh with the other gear with axial shifting of said shaft, a tapered cam on said shaft, and a member positioned to be moved by said cam with axial shifting of said presetting shaft and connected so that the pawl will be disengaged from the ratchet with said shifting of said presetting shaft.

3. A time cycle control switch comprising a rotary cam having a row of separate axially spaced circumferentially extending cam tracks, said tracks divided into individual program arcs, a longitudinal row of switches positioned to be in individual engagement with said cam tracks so as to be actuated in a predetermined sequence and for a predetermined length of time with rotation of said cam through a program arc, a ratchet gear connected to the cam, a pawl positioned to drive the ratchet gear in a forward direction and preventing movement of the ratchet gear in a reverse direction, a pivotally mounted pawl arm carrying the pawl, a power driven ratchet-operating cam positioned to rock the pawl arm and drive the ratchet gear, a presetting gear attached to the cam, a manually rotatable and axially shiftable shaft geared to the presetting gear for rotating the cam to a preset program position through which the drive means will move the cam, means operable by axial movement of said shaft to disengage said ratchet from said ratchet gear whereby the cam may be rotated in either direction, an auxiliary switch, a follower member connected to operate said auxiliary switch, and an auxiliary cam connected to be driven with said ratchet operating cam.

4. A time cycle control switch in accordance with claim 3 wherein a common spring means is connected between said pawl arm and said follower member urging them against their respective cams.

5. A switch controller comprising a housing, an electric motor in said housing, a ring-shaped cam drum having plural cams and being journaled in said housing in surrounding disposition relative to said motor, a manually operable rotatable and axially shiftable presetting shaft supported in said housing adjacent one side of said drum, means forming a rotating driving connection between said cam drum and said presetting shaft, a ratchet drive between said motor and said cam drum to rotatably drive said cam drum in one direction, a shuttle plate on said housing, and a cone-shaped cam on said presetting shaft cooperating with said shuttle plate, said shuttle plate operatively connected to said ratchet drive to disengage the ratchet drive during presetting of said cam drum by operation of said presetting shaft.

6. A switch control comprising a housing, an electric motor in said housing, a ring-shaped cam drum having plural cams and being journaled in said housing in surrounding disposition relative to said motor, a manually operable rotatable and axially shiftable presetting shaft supported in said housing, means forming a rotating driving connection between said cam drum and said presetting shaft, a ratchet drive between said motor and said cam drum to rotatably drive said cam drum in one direction, a cam on said presetting shaft, and means actuated by said cam and operatively connected to said ratchet drive to disengage said ratchet drive during presetting of said cam drum by operation of said presetting shaft.

7. A switch controller as defined in claim 6, said ratchet drive including a pawl arm and finger interconnecting said electric motor and said cam drum to step-index the cam drum angularly about its axis.

8. A switch controller as defined in claim 6, said cam drum comprising a plurality of annular cam rings, with the outer surface of said rings shaped to actuate followers in engagement with the rings, spacer rings between each of the cam rings having an outer diameter greater than the ring to provide guides for followers bearing against said individual rings, means for axially clamping said rings together, and a plurality of switches arranged circumferentially around said rings and having switch operating followers in engagement with said rings to be actuated thereby.

9. A switch controller as defined in claim 6, said cam drum having a row of separate axially spaced circumferentially extending cam tracks, said tracks divided into individual program arcs.

10. A switch controller as defined in claim 9, and a longitudinal row of switches positioned to be in individual engagement with said cam tracks for actuation in a predetermined sequence and for a predetermined length of time upon rotation of said cam drum through a program arc.

11. A timer assembly for an automatic laundry machine or the like comprising a plurality of control switches adapted to be connected to control individual operating elements of the laundry machine to complete the functions of washing, rinsing and drying, and a switch controller for regulating said switches comprising a housing, an electric motor in said housing, a ring-shaped cam drum having plural cams operatively associated with said switches and being journaled in said housing in surrounding disposition relative to said motor, a manually operable rotatable and axially shiftable presetting shaft supported in said housing, means forming a rotating driving connection between said cam drum and said presetting shaft, a ratchet drive between said motor and said cam drum to rotatably drive said cam drum in one direction, a cam on said presetting shaft, and means actuated by said cam and operatively connected to said ratchet drive to disengage said ratchet drive during presetting of said cam drum by operation of said presetting shaft.

12. A switch controller as defined in claim 5, said plural cams each providing a circumferentially extending cam track, said housing including plural banks of switches spaced circumferentially around said cam drum, and each switch having a follower arm engaging a corresponding cam track of a cam, said cam drum having means forming teeth thereon and said presetting shaft carrying a gear meshing with said teeth to form said rotating driving connection to preset said cam drum relative to said switches.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 22,375	Chamberlin et al.	Sept. 14, 1943
2,045,251	Raber	June 23, 1936
2,055,031	Hutchings	Sept. 22, 1936
2,436,714	De Moss	Feb. 24, 1948
2,537,929	Daley et al.	Jan. 9, 1951
2,603,725	Dietrich	July 15, 1952

(Other references on following page)

11

UNITED STATES PATENTS

2,619,557	Illian	Nov. 25, 1952
2,656,424	Frerer et al.	Oct. 20, 1953
2,703,347	Constantine	Mar. 1, 1955
2,737,548	Mead	Mar. 6, 1956
2,742,540	Whitlock	Apr. 17, 1956
2,758,166	Aust	Aug. 7, 1956
2,821,585	Harris	Jan. 28, 1958

12

2,844,670	Witte	July 22, 1958
2,869,375	Lewis	Jan. 20, 1959
2,874,773	Lorenz	Feb. 24, 1959
2,918,969	Kull	Dec. 29, 1959
2,938,970	Constantine	May 31, 1960

FOREIGN PATENTS

368,891	Great Britain	Mar. 17, 1932