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AUTOMATIC CONTROL DEVICE

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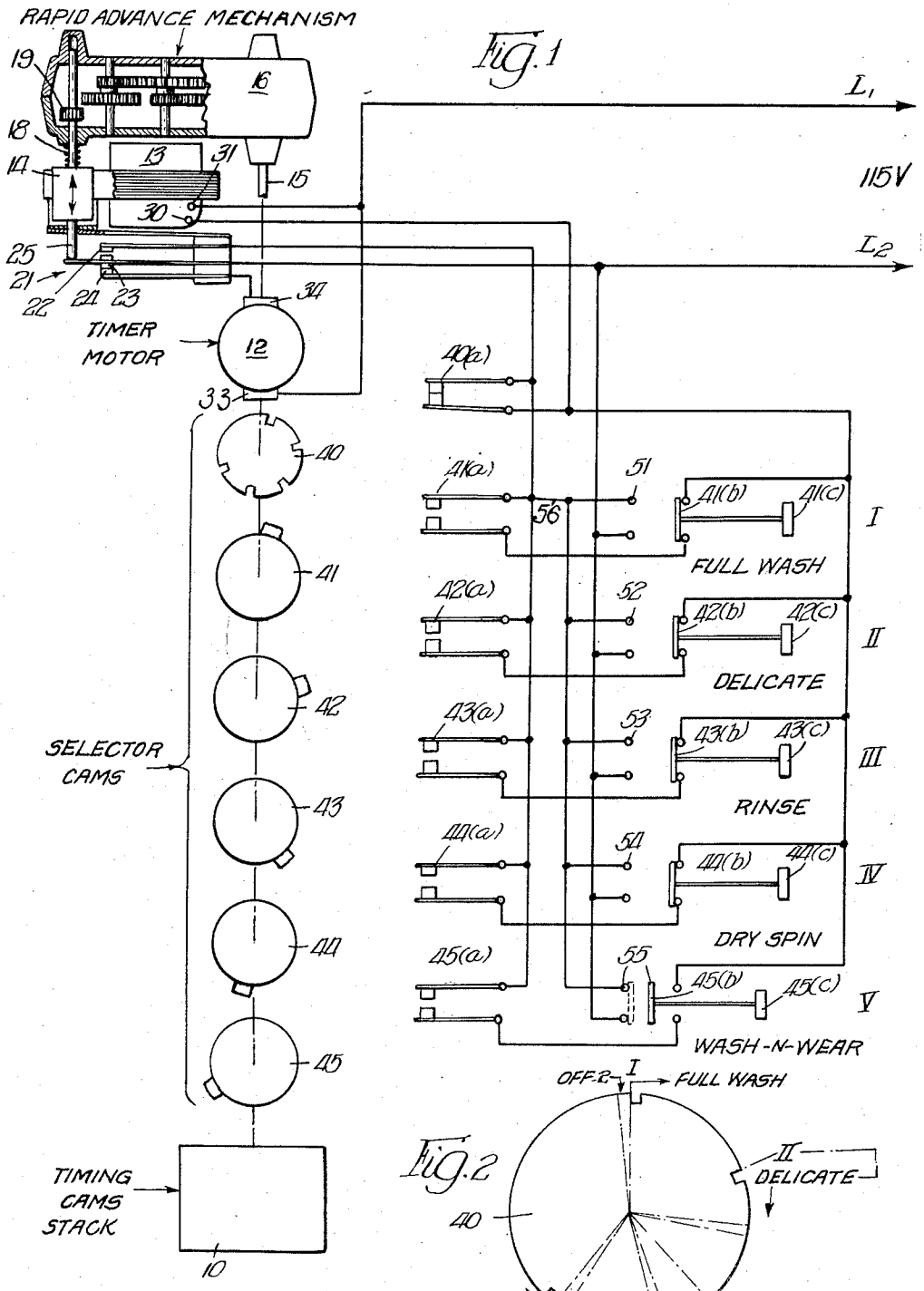


Fig. 1

Fig. 2

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AUTOMATIC CONTROL DEVICE

John C. Mellinger, Newton, Iowa, assignor to The Maytag Company, Newton, Iowa, a corporation of Delaware

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This invention relates to automatic control devices for washing machines, and more particularly, to a simplified push button selection system for obtaining a desired cycle, or group of operations, in a programmed automatic washing machine control.

It is an object of the present invention to provide a selection system by which the operator of an automatic washing machine merely pushes a button in order to select a cycle, or a group of operations, suitable for the fabrics to be treated. It is another object of the invention to provide a selection device that utilizes cam controls and thereby simplifies the control system. It is yet another object of the invention to provide a selection control device that is inexpensively manufactured, and is, at the same time, reliable in service. Further objects and advantages of this invention will become evident as the description proceeds and from an examination of the accompanying drawing which illustrates one embodiment of the invention and in which similar numerals refer to similar parts throughout the several views.

In the drawing:

FIGURE 1 is a diagram illustrating the selection control of the present invention.

FIGURE 2 is an enlarged view of one of the selector cams.

Referring now to FIGURE 1 in the drawing, there is shown diagrammatically a timing cam stack **10** for controlling the cycles of operation in an automatic washing machine. The usual cycles of operation include washing, rinsing and spin drying of the fabrics to be cleaned. The cam stack **10** is driven by a timing motor **12** at a slow normal timing speed. When the cam stack is under the control of the timer motor, the washing machine is operated through the usual washing cycles.

In order to accomplish selection of any specific cycle, the cam stack **10** is advanced at high speeds by the rapid advance motor **13**. When the rapid advance motor is energized, the shaft **15**, to which are connected the timer motor **12** and cam stack **10**, is rotated at high speeds through the advance motor, rotor **14** and gear box **16**. The speed of the shaft **15** when rotated by the advance motor is high enough in order that the operations controlled by the cam stack **10** are effectively and quickly selected.

The rotor armature **14** of the advance motor is capable of rotary and translatory movement, and is normally biased by coil spring **18** along its longitudinal axis away from the gear box **16**. When the advance motor is energized, the rotor moves toward the gear box **16** as indicated by the arrow, so that the pinion **19** mounted on the rotor shaft engages and drives the gear train to spin shaft **15** at a high speed. However, when the rapid advance motor **13** is de-energized, spring **18** separates the gear **19** from the gear train and the rotation of the shaft **15** is immediately discontinued.

Contact **23** of switch **21** is mounted on a movable spring arm engaged by pin **25** of the rotor **14**. It will be noted that the rotor is biased by spring **18** to normally position contact **23** against contact **24**, so as to energize the timer motor **12**. In the event the advance motor is energized, rotor **14** moves toward the gear box to close

contact **23** against contact **22** to supply power to the advance motor through the selection switches until it moves to the desired position, as hereinafter described.

Energization of timer motor **12** and advance motor **13** is controlled by switch **21** having contacts **22**, **23** and **24**. When contacts **22** and **23** of switch **21** are closed, a circuit is completed for energizing the advance motor **13**, providing the switches in series with contact **22**, **23** are also closed, as will be described hereinafter. If contacts **23**, **24** of switch **21** are closed the timer motor **12** is energized by completing a circuit to power lines L_1 and L_2.

Terminal **31** of advance motor **13** is connected to line L_1 of the power source. Terminal **30** of the advance motor is connected to line L_2 of the power source through contacts **22**, **23** and the other switches in the selection system to be described hereinafter. Timer motor **12** has terminals **33**, **34** of which terminal **33** is directly connected to power line L_1 and terminal **34** is connected to power line L_2 when the circuit is completed through closing of contacts **23**, **24**.

The selection system of the invention is characterized by a number of cams which control corresponding cam switches. The cams of the selector device, and the respective switches which they control, may be divided into two groups. In the first group is the master cam **40** and the switch **40**(*a*) controlled by it. The second group includes slave cams **41** to **45** and their corresponding slave switches **41**(*a*) to **45**(*a*). The slave group may include a greater or lesser number, depending upon the desired number of selection positions in the washing machine operation. In order to illustrate the invention, five selection positions are shown the push button preselection of which are obtained by five slave circuits containing slave switches **41**(*a*) to **45**(*a*).

Master cam switch **40**(*a*) is normally closed except for a small increment of time at the beginning of each desired cycle. When the master cam switch **40**(*a*) is closed and contact **23** is against contact **22** of switch **21**, the advance motor is energized by circuit from L_2 switch contacts **23**, **22**, master cam switch **40**(*a*), and advance motor terminal **30**. The other terminal **31** of the advance motor is connected to power line L_1.

Slave cam switches **41**(*a*) and **45**(*a*) are normally open, except one switch is closed at a time for a small increment at the beginning of each desired cycle corresponding to the increment at which the master cam switch **40**(*a*) is opened. It will be noted that the rise on each of slave cams **41** to **45** corresponds to a dwell on master cam **40**, so that, when the master cam switch **40**(*a*) is opened, one of the slave cam switches **41**(*a*) to **45**(*a*) will be closed.

Push button switches **41**(*b*) to **45**(*b*) are normally closed. The push button switches are manually operated by their own push buttons **41**(*c*) to **45**(*c*) each of which bears the legend of a particular cycle selection.

Each of the slave cam switches **41**(*a*) to **45**(*a*), is connected in series with its respective push button switch, **41**(*b*) to **45**(*b*), between switch contact **22** and advance motor terminal **30**. When switch contact **23** engages contact **22** of switch **21**, and slave cam switch **41**(*a*) is closed, the advance motor is energized by a circuit from power line L_2, switch contacts **23**, **22**, slave cam switch **43**(*a*), push button switch **41**(*b*) and terminal **30** of advance motor **13**. The other terminal **31** of the advance motor is connected to power line L_1. Similarly, each of the slave cam switches will energize the advance motor under the same conditions for its own respective cycle by a parallel circuit.

It will be noted that each of the slave circuits (con-

taining a slave switch and push button switch in series) is in parallel to the master cam switch 40(*a*). The result is that the rapid advance motor will be energized if any slave switch circuit, or the master switch circuit is completed, provided contacts 23, 22 of switch 21 are closed.

The advance motor will be de-energized at the point in the cycle at which the corresponding slave switch is closed, and the master cam switch open. By way of illustration, if push button switch 45(*b*) is opened, as shown in the drawing, and the advance motor 13 is energized closing contacts 23, 22, the advance motor will continue to rotate the selector cams 40 to 45 until the interval at which the master cam switch 40(*a*) is opened and the slave cam switch 45(*a*) is closed by their respective cams. At this point, the advance motor will be de-energized since the power circuit to the advance motor is broken by the open slave circuit which has in series push button switch 45(*b*).

All of the push button switches are biased to closed position by springs (not shown). When a push button is depressed by the operator it travels to an innermost position and closes one of the momentary contact switches 51 to 55. As the push button is released by the operator the spring urges it toward closed position, but it is latched by a device (not shown) to hold it and maintain it in an open position, so that both the momentary contact switch and push button switch are open, as illustrated by the full line position of switch 45(*b*) in FIGURE 1 of the drawing.

In FIGURE 1, each push button switch 41(*b*) to 45(*b*) has a corresponding momentary contact switch 51 to 55 which is closed for a brief period of time when its respective push button is manually depressed. Referring to push button switch 45(*b*), there is illustrated in dotted lines the closing of the momentary contact switch 55 which occurs when push button 45(*c*) is manually depressed. The closing of any momentary contact switch 51 to 55 energizes the advance motor by a circuit from power line L_2 through the closed switch, such as 55, thence through line 56, master cam switch 40(*a*), to terminal 30. The other terminal 31 of the advance motor is connected to power line L_1.

If at the closing of the momentary contact switch the master cam switch 40(*a*) is open, the circuit for momentarily energizing the advance motor 13 is completed through the slave switch 41(*a*) to 45(*a*) that is closed at that instant and its corresponding preselection switch 41(*b*) to 45(*b*). The rapid advance motor 13 is energized by the momentary contact switch through the master cam switch, or one of the slave switches, as a safety feature, in order to discontinue energization of the rapid advance motor if the operator inadvertently keeps the momentary contact switch closed. It will be clear that the rapid advance motor may be directly energized by the momentary contact switch.

Although a separate momentary contact switch is shown for each push button alternative constructions may be employed. For example, a mechanical connection may be made with each push button, so that only a single momentary contact switch is closed by the depression of any of the five push buttons. The result is the same, namely, the advance motor is momentarily energized.

At the instant the advance motor is energized by the closing of a momentary contact switch through the depression of a push button, the rotor 14 is moved longitudinally to clutch pinion 19 to the gear train of gear box 16, and at the same time closes contact 23 against contact 22 of switch 21. This completes holding circuits by which the continued energization of the advance motor is under control of the selector cams 40 to 45 and their respective circuitry, explained hereinabove.

Referring now to FIGURE 2 of the drawing which illustrates the master cam 40, it will be noted that the cam may be divided into sections corresponding to cycles of the automatic washing operation, since the selector cams, including cam 40, are mounted on shaft 15 which drives the timing cam stack 10, the latter of which controls the cycles of the washing operation. The various cycles are indicated by the dot and dash lines corresponding to the washing operation controlled by the cam stack 10. For example, the first part of the washing operation begins with a fill and agitation period indicated by I which may continue to the dot and dash line past II. This is followed by a soak period, a spin period, a rinse III, and a final spin dry IV. While in previous devices the cycle desired was selected by rotating the shaft on which the cams were mounted to the particular position, in the present invention by merely depressing a push button, a momentary contact switch is closed which energizes a rapid advance motor under the control of the selector cams and automatically advances the cam stack to the desired cycle I, II, III, or IV. The push buttons have legends corresponding to the desired cycles. The master cam 40 has a dwell period for opening the master cam switch for a short interval of time at the beginning of each desired cycle, as indicated at I, II, III, IV, and V in FIGURE 2. It will be noted that the dwell at I, for instance, would start the washing operation at the earliest point and allow it to proceed for the maximum time. The selection of II for delicate fabrics starts the washing operation at the end of the timed period for short agitation period and then allows the washing operation to proceed to the remaining cycles. Similarly, if rinse III is selected, the cams are advanced by the rapid advance motor to that point and then the timer motor drives the cam stack 10 through the remaining cycles. The washing cycle is ended for regular fabrics at off-1 at which the power supply is interrupted by a switch in the cam stack 10 (not shown). For wash and wear fabrics V, a separate section of the cams is devoted to their washing operation, the start of which is indicated by (V) and the end at off-2.

From the foregoing, the operation of the timing control device should be apparent. As shown in FIGURE 1 of the drawing, the cam stack 10 is driven through all the cycles of the washing operation by the timer motor 12. The timer motor 12 is energized by power line L_1 to timer motor terminal 31, and by power line L_2 through switch contacts 23, 24 to timer motor terminal 34.

Let it be assumed that it is desired to wash the wash and wear type of fabric. The clothes are inserted in the machine (not shown) and the push button 45(*c*) is manually depressed to the dotted line position indicated in FIGURE 1 which closes the momentary contacts 55. This energizes the rapid advance motor by a circuit from power line L_2 through momentary contact switch 55 and cam switch 40(*a*) to the advance motor terminal 30. The other terminal 31 of the advance motor is connected to power line L_1.

Upon energization of the advance motor by the momentary contact switch, the rotor 14 is moved longitudinally against the bias of spring 18 to engage clutch pinion 19 with the gear train in box 16 to rapidly rotate the shaft 15 on which is mounted the timer motor, selector cams, and the timing cam stack 10. Axial movement of the armature rotor 14 toward the gear box 16 separates contact 23 from contact 24 in switch 21 to de-energize the timer motor. At the same time switch contact 23 engages contact 22 to maintain the rapid advance motor energized under the control of the selector cams. Since the master cam switch 40(*a*) is normally closed, the advance motor will keep rotating the cam stack 10 at a high rate of speed until the circuit is broken. At the beginning of each desired cycle, the master cam switch 40(*a*) is opened for a short interval of time. At the same interval, one of the slave cam switches is closed to maintain a rapid advance motor energized, providing its corresponding push button switch is closed. For example, if the master cam switch has rotated to start point I then the slave cam switch 41(*a*) will be closed

by cam **41** and the timer motor will be operated by a circuit from power line L_2, switch contacts **23**, **24**, slave cam switch **41**(*a*) push button switch **41**(*b*), to the advance motor terminal **30**. If, however, switch **41**(*b*) is opened by depression of the push button **41**(*c*) the advance motor will be de-energized at that point in the cycle. But if the push button **41**(*b*) is closed, the advance motor will continue to run until it locates the point in the cycle which is represented by the push button that has been depressed. In the case under consideration, since push button **45**(*c*) was depressed the rapid advance motor operates until the master cam has opened master cam switch **40**(*a*) at point V. At this same interval the slave cam switch **45**(*a*) is closed, however, the advance motor is not supplied with power because of the broken circuit due to the opening of the push button switch **45**(*b*). When the advance motor is de-energized, the armature rotor **14** is moved axially by spring **18** away from the gear box to break contacts **22**, **23** and make contacts **23**, **24**. This opens the circuit to the advance motor and completes the circuit to the timer motor which then advances the timing cam stack through the washing cycle operations remaining.

In the drawing and specification there has been set forth a preferred embodiment of the invention, and although specific terms are employed, these are used in a generic and descriptive sense only, and not for purposes of limitation. Changes in form and the proportion of parts, as well as the substitution of equivalents are contemplated, as circumstances may suggest or render expedient, without departing from the spirit or scope of this invention as further defined in the following claims.

I claim:

1. In an automatic control for washing machines the combination comprising a sequential timer including timing control means for controlling selectable cycles of operation and a timing motor for driving said timing control means through the selected cycle at a slow speed, a rapid advance means for advancing said timing control means at a high speed, manually operable momentary contact switch means, circuit means under the control of said momentary contact switch means to initiate operation of said rapid advance means for a short period, manually operable preselection means for choosing a desired cycle, cam switches operable by said rapid advance means, holding circuit means for maintaining said rapid advance means energized under the control of said cam switches and said manually operable preselection means after said momentary contact switch means has been operated.

2. In an automatic control for washing machines the combination comprising a sequential timer including timing control means for controlling selectable cycles of operation and a timing motor for driving said timing control means through the selected cycle at a slow speed, a rapid advance mechanism for advancing said timing control means at a high speed, manually operable preselection means for registering a desired cycle, preselection switches controlled by said preselection means, momentary contact switch means operable by said preselection means, cam switches controlled by said rapid advance mechanism, circuit means under the control of said momentary contact switch means to initiate operation of said rapid advance mechanism for a short period, and holding circuit means having said cam switches and said preselection switches for maintaining said rapid advance mechanism energized under the direct control of said cam switches after said momentary contact switch means has been operated.

3. In an automatic control for washing machines the combination comprising a sequential timer including a timing control means for controlling selectable cycles of operation and timing motor for driving said timing control means through the selected cycle at a slow speed, a rapid advance mechanism for advancing said timing control means at a high speed, a plurality of preselection buttons manually operable to choose a desired cycle, momentary contact switch means operable by said preselection buttons, circuit means under the control of said momentary contact switch means to initiate operation of said rapid advance mechanism for a short period, preselection switches controlled by said preselection buttons, cam switches operable by said rapid advance mechanism, and holding circuit means for maintaining said rapid advance mechanism energized under the control of said cam switches in series with said preselection switches after said momentary contact switch means has been operated until the rapid advance mechanism has rotated said sequential timer to the cycle registered by a preselection switch.

4. In an automatic control for washing machines the combination comprising a sequential timer including timing control means for controlling selectable cycles of operation and a timing motor for driving said timing control means through the selected cycle at a slow speed, a plurality of manually operable preselection members to choose a desired cycle, a rapid advance means for advancing said timing control means at a high speed, momentary contact switch means operable by said preselection members, circuit means under the control of said momentary contact switch means to initiate operation of said rapid advance means for a short period, and holding circuit means for maintaining said rapid advance means energized after said momentary contact switch means has been operated, and cam switch means for placing said holding circuit means successively and separately under the control of each of said preselection members, whereby the rapid advance means is energized until a cycle is reached at which the preselection member has been manually operated in order to break the holding circuit and de-energize said rapid advance means.

5. In an automatic control for washing machines the combination comprising a sequential timer including timing control means for controlling selectable cycles of operation and a timing motor for driving said timing control means through the selected cycle at a slow speed, a rapid advance means for advancing said timing control means at a high speed, preselection buttons manually operable to choose a desired cycle, preselection switches controlled by said buttons, momentary contact switch means operable by said preselection buttons, circuit means under the control of said momentary contact switch means to initiate operation of said rapid advance means for a short period, and holding circuit means for maintaining said rapid advance means energized after said momentary contact switch means has been operated, and can switch means for successively placing said holding circuit means under the separate control of each of said preselection switches at certain points during operation whereby the rapid advance means remains energized until a cycle is reached at which the preselection switch has been operated by a said preselection button.

6. In an automatic control for washing machines the combination comprising a sequential timer having a timing control means for controlling selectable cycles of operation and a timing motor for driving said timing control means through the selected cycle at a slow speed, a rapid advance mechanism for advancing said timing control means at a high speed, manually operable preselection members for choosing a desired cycle, normally closed preselection switches opened by said preselection members upon manual operation, a momentary contact switch means operable by said preselection members, circuit means under the control of said momentary contact switch means to initiate operation of said rapid advance mechanism for a short period, and holding circuit means for maintaining said rapid advance mechanism energized after said momentary contact switch means has been operated, and cam switch means for successively placing said holding circuit means under the separate control of each of said preselection switches at certain points during

operation whereby the rapid advance mechanism remains energized until a preselection switch is reached which has been opened.

7. In an automatic control for washing machines the combination comprising a sequential timer having timing control means for controlling selectable cycles of operation and a timing motor for driving said timing control means through the selected cycle at a slow speed, rapid advance means for advancing said timing control means at a high speed, manually operable preselection means for choosing a desired cycle, momentary contact switch means operable by said preselection means, circuit means under the control of said momentary contact switch means for initiating operation of said rapid advance means for a short period, holding circuit means for maintaining said rapid advance means energized after said momentary contact switch means has initiated operation, switch means for energizing said holding circuit means after said momentary contact switch means has been operated, master cam switch means for breaking said holding circuit means a short time period at the beginning of each selectable cycle, and slave cam circuit means in parallel to said master cam means for maintaining said rapid advance means energized when said master cam switch means breaks said holding circuit means until the desired cycle registered by manual preselection means has been reached.

8. In an automatic control for washing machines the combination comprising a sequential timer having timing control means for controlling selectable cycles of operation and a timing motor for driving said timing control means through the selected cycle at a slow speed, rapid advance means for advancing said timing control means at a high speed, manually operable preselection means for choosing a desired cycle, momentary contact switch means operable by said preselection means, circuit means under the control of said momentary contact switch means for initiating operation of said rapid advance means for a short period, holding circuit means for maintaining said rapid advance means energized after said momentary contact switch means has initiated operation, switch means for energizing said holding circuit means after said momentary contact switch means has been operated, cam switch means including master cam switch means for breaking said holding circuit means a short time period at the beginning of each desired cycle and slave cam switch means under the control of said preselection means and in parallel to said master cam means for maintaining said rapid advance means energized when said master cam means breaks said holding circuit means until the desired cycle registered by manual preselection means has been reached.

9. In an automatic control for washing machines the combination comprising a sequential timer having timing control means for controlling selectable cycles of operation and a timing motor for driving said timing control means through the selected cycle at a slow speed, rapid advancve means for advancing said timing control means at a high speed, manually operable preselection means for choosing a desired cycle, momentary contact switch means operable by said preselection means, circuit means under the control of said momentary contact switch means for initiating operation of said rapid advance means for a short period, selector cam switch means, holding circuit means for maintaining said rapid advance means energized under the control of said selector cam switch means and said manual preselection means after said momentary contact switch means has initiated operation, switch means for energizing said holding circuit means after said momentary contact switch means has been operated, said selector cam switch means including first master cam switch means for breaking a circuit to said rapid advance means and said holding circuit means a short time period at the beginning of the selectable cycles and second cam switch means in parallel to said first cam switch means for maintaining said rapid advance means and holding circuit means energized when said master cam switch means breaks until the desired cycle registered by manual preselection means has been reached.

10. In an automatic control for washing machines the combination comprising a sequential timer having timing control means for controlling selectable cycles of operation and a timing motor for driving said timing control means through the selected cycle at a slow speed, rapid advance means for advancing said timing control means at a high speed, manually operable preselection means for choosing a desired cycle, momentary contact switch means operable by said preselection means, circuit means under the control of said momentary contact switch means for initiating operation of said rapid advance means for a short period, selector cam switch means, holding circuit means for maintaining said rapid advance means energized after said momentary contact switch means has initiated operation, switch means in said holding circuit means for energizing said holding circuit means after said momentary contact switch means has been operated, cam switch means operable by said rapid advance means for successively placing said holding circuit means and rapid advance means under the control of said manually operable preselection means to maintain said rapid advance means energized until the desired cycle registered by manually operable preselection means has been reached.

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