June 3, 1952 D. L. CLARK ET AL 2,599,234

AUTOMATIC WASHING MACHINE CONTROL

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Fig. 1.

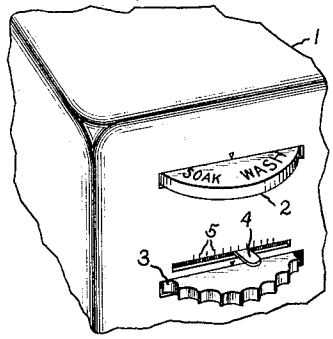


Fig. 2.

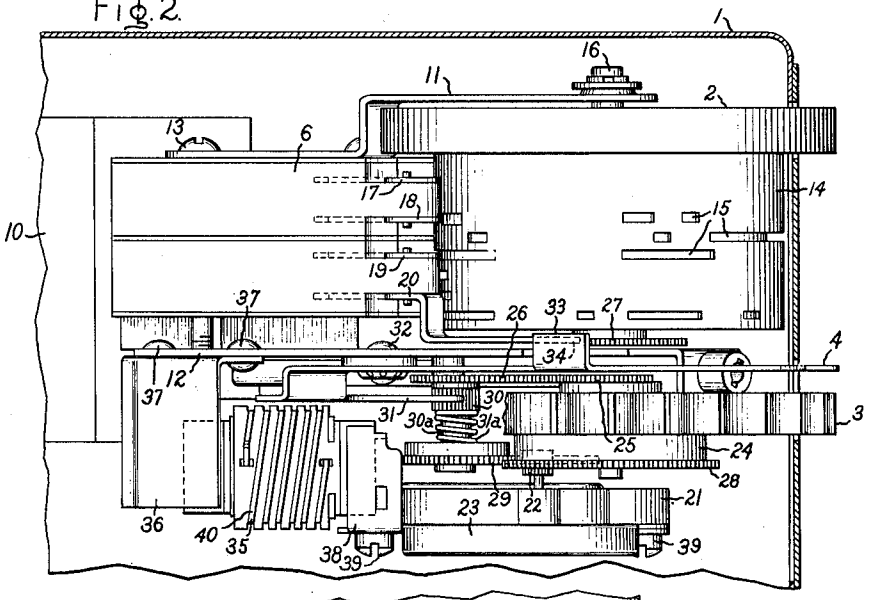
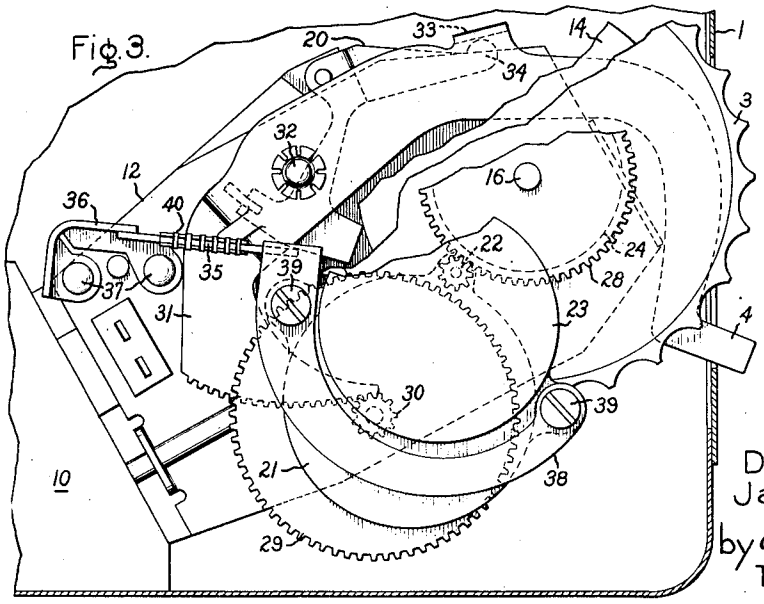


Fig. 3.



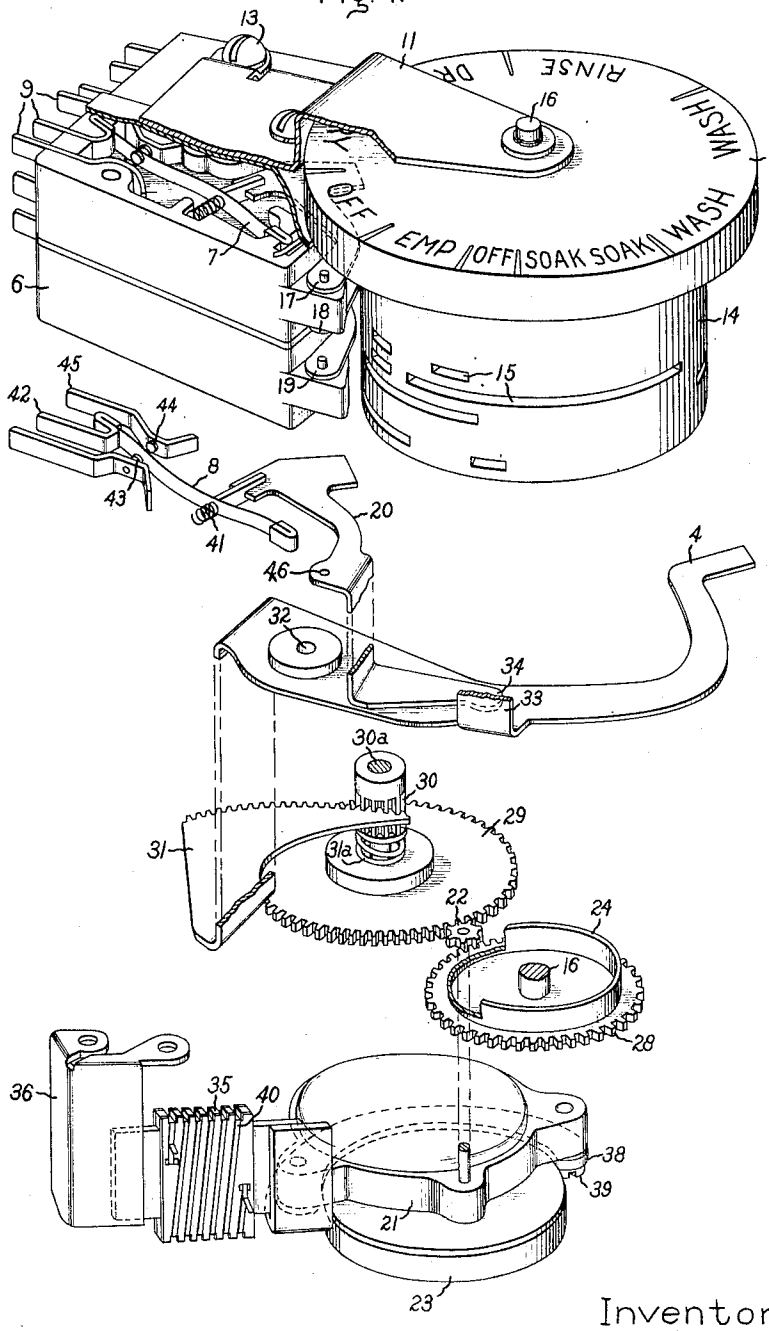
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Fig. 4.



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Fig. 5.

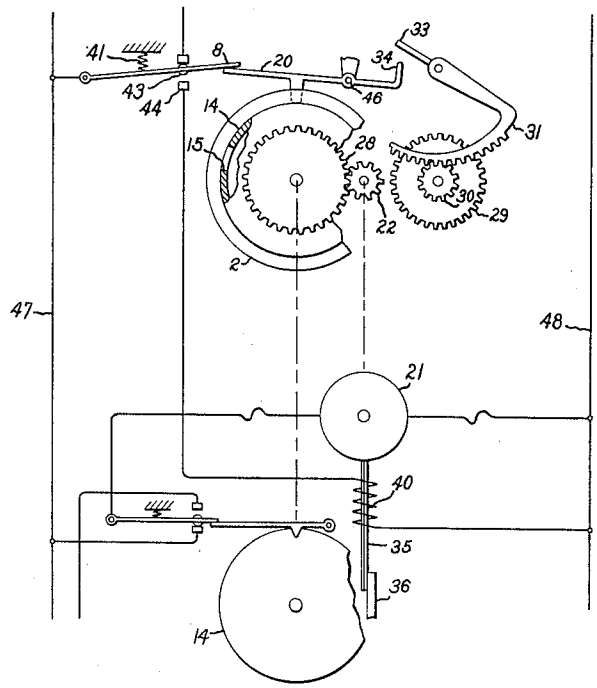
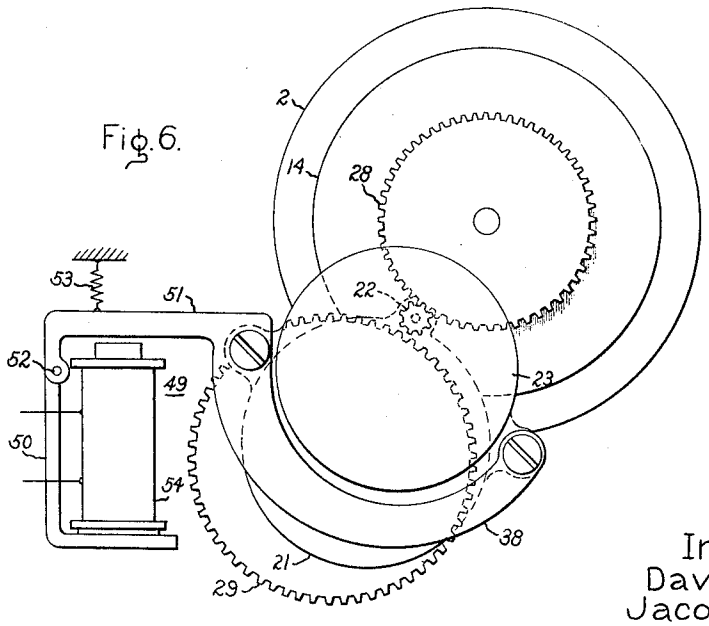


Fig. 6.



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AUTOMATIC WASHING MACHINE CONTROL

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13 Claims. (Cl. 161—1)

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This invention relates to controls for a sequence of operations and more particularly to mechanisms for controlling a series of operations of automatic washing machines.

It is an object of this invention to provide an improved control for a sequence of operations including provision for adjusting the duration of one of the operations.

It is another object of this invention to provide an improved control mechanism wherein a single motor is arranged for alternatively driving a sequential control for a series of operations and an interval control for varying the duration of one of these operations.

It is a further object of this invention to provide an improved control mechanism including a sequential control and an interval control and including means for automatically shifting a motor from one control to the other.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

For a better understanding of this invention reference may be had to the accompanying drawings in which Fig. 1 is a perspective view of a portion of an automatic washing machine cabinet incorporating the control; Fig. 2 is an elevation view of the control including a portion of the washing machine cabinet; Fig. 3 is a bottom view of the control including a portion of the washing machine cabinet; Fig. 4 is an exploded view showing details of the control; Fig. 5 is a diagrammatic view illustrating the operation of the control; and Fig. 6 shows a modified form of the control.

Referring to Fig. 1 there is shown a portion of the cabinet 1 of an automatic washing machine. The cabinet is provided near one corner with three openings. Through one of these openings projects a rotatable wheel or element 2, which is provided with a suitable inscription to indicate the particular operation for which the machine is set. A second wheel or element 3 projects through another of the openings in the cabinet and this wheel is utilized for setting a sequential control for the washing machine to the desired operation in the sequence of operations. Such a sequence of operations may, for example, be soak, wash, rinse, and dry. Through a suitable gear train, movement of the wheel 3 effects movement of the wheel 2 so that the proper portion of the wheel 2 is brought into the exposed position to indicate the operation for which the machine is set. A lever 4 projects through the third opening in the cabinet, this lever being provided for setting an interval control for varying the duration of one of the operations, namely the washing operation. Suitable indicia 5 are placed on the cabinet adjacent the opening so that the lever 4 may be set for any desired number of minutes, as indicated by the indicia.

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Referring now to Figs. 2, 3, and 4, the control includes a switch assembly 6 which includes a plurality of column spring switches. Two of these switches are indicated by 7 and 8 in Fig. 4. A plurality of plug terminals 9 project from the switch assembly 6 and are adapted to be received within corresponding receptacles (not shown) provided in a portion 10 of the washing machine. By this arrangement the column switches control circuits for governing the various operations of the automatic washing machine.

A metal bracket 11 is secured to the top of the switch assembly and a second metal bracket 12 is secured to the bottom of the switch assembly. Screws, one of which is shown at 13, are utilized for clamping the brackets 11 and 12 to the switch assembly. A control drum 14 having a plurality of cam faces or recesses 15 is arranged between the brackets 11 and 12. The drum 14 is rotatably mounted on a shaft 16, which extends through openings in brackets 11 and 12. A plurality of cam followers 17, 18, 19, and 20 for actuating the column switches are pivotally mounted on the switch assembly and ride along the drum 14.

A motor 21 is provided for driving the drum 14 at a constant speed in order to achieve a sequential control of the various operations to be performed by the washing machine, and also for driving the interval control when the machine is performing the washing operation. The change over from one drive to the other is accomplished by moving a pinion 22 driven by the motor 21 through a gear reduction unit 23 into mesh, first with one gear train and then with another.

For driving the drum 14 to achieve sequential control we provide an upstanding cylindrical drive member 24 of an overrunning clutch (not shown) which clutch may be of any suitable conventional design. The driven member of the overrunning clutch frictionally engages and drives the wheel 3 and is secured to and drives a pinion 25. The pinion 25 serves to drive a gear 26 fixed to an upwardly extending shaft (not shown) on which is carried a second pinion (not shown) for driving a gear 27 fixed to the drum

14. In this manner power is transmitted to the sequential control when the pinion 22 is in engagement with a gear 28 formed on the clutch drive member 24.

In order to vary the duration of one of the operations of the series of operations performed by the washing machine an interval control is provided. This interval control includes a gear 29, a pinion 30, which is mounted on the same shaft 30a with the gear 29, and a sector gear 31. The shaft 30a is fixed to the bracket 12. A friction clutch, including a spring 31a, is provided between the gear 29 and the pinion 30. The sector gear 31 is connected to the lever 4, for example, by an integral structure as shown most clearly in Fig. 4, so that the position of the sector gear 31 can be varied by moving the lever 4. The integral structure including the lever 4 and the sector gear 31 is mounted on a stationary pivot 32. This structure includes an upstanding flange portion 33 which is positioned to engage a portion 34 of the cam follower 20 to actuate the switch 8 independently of the drum 14.

In order to position the motor 21 automatically for driving either the sequential control or the interval control, the motor, together with its associated gear reduction unit 23, is supported from the bracket 12 by a mounting structure including a bimetallic strip 35. This mounting structure includes a bracket 36 of L-shaped cross section which is secured to the bracket 12 by suitable fastening devices such as rivets 37. The bimetallic strip 35 is secured at one end to the L-shaped bracket 36 and at the other end to a semicircular element 38. This element 38 is secured to the combined motor and gear reduction unit structure by screws 39 for supporting the motor and gear reduction unit on the end of the bimetallic strip 35. A heating element 40 is wrapped around the bimetallic strip for varying the temperature of the strip.

In order to set the apparatus to the desired operation in the sequence of operations the wheel 3 is turned, and the movement of the wheel 3 is transmitted through the gear train including pinion and gears 25, 26, and 27 to the drum 14. The wheel 3 may be turned in either direction to properly position the cam disk. The operation for which the washing machine is set is indicated by the inscription on the wheel 2, which is firmly secured to the drum 14 and projects through an opening in the front of the cabinet 1. The duration of the washing operation is set by moving the lever 4 which is accessible from the front of the cabinet 1. In setting, the lever 4 is moved in a clockwise direction as viewed in Fig. 4, that is, from right to left as viewed in Fig. 1. This moves the sector gear 31 in a clockwise direction from the position shown in Fig. 4 to any desired position. The movement of the lever 4 further shifts the portion 33 of the lever structure away from the portion 34 of the cam follower 20. The distance portion 33 is moved from the portion 34 in this setting operation determines the duration of the washing operation.

The operation of the control is as follows. In starting the washing machine, wheel 3 is moved from the off position to energize the motor. Under these circumstances the pinion 22 is in engagement with the gear portion 28 of the clutch 24 and the motor is, therefore, connected to drive the sequential control, the drum 14 being rotated at a constant speed. The drum is so constructed that when the washing operation is reached the cam follower 20 passes into one of

the recesses 15 in the face of the drum. The column spring switch 8 then snaps over center under the influence of a biasing spring 41 and a circuit is completed from a plug terminal 42 through the column spring switch contacts 43 and 44, to a plug terminal 45. The plug terminals 42 and 45 are, of course, two of the group of terminals 9 previously described. This completes a circuit for energizing the heater 40, as explained hereinafter. The energization of the heater 40 effects an increase in the temperature of the bimetallic strip 35 and a consequent bending of the bimetallic strip. Since the motor is mounted on the end of the bimetallic strip this bending of the bimetallic strip effects a movement of the motor and shifts the motor so that the pinion 22 comes into engagement with the gear 29. The pinion 22 rotates in a counterclockwise direction as viewed in Fig. 4, effecting a clockwise rotation of the gear 29 and the pinion 30. This moves the sector gear 31 and the lever structure 4 in a counterclockwise direction as viewed in Fig. 4, ultimately bringing the portion 33 of the lever structure 4 into engagement with the portion 34 of the cam follower 20. Further movement of the sector gear 31 then shifts the cam follower 20 about its pivot 46 and snaps the column spring switch 8 overcenter to the position shown in Fig. 4. This breaks the circuit of the heater 40 and allows the bimetallic strip 35 to cool. As the bimetallic strip cools the motor 21 is moved to disengage the pinion 22 from the gear 29 and to reengage the pinion with the gear portion 28 of the clutch 24. This returns the drive to the sequential control and causes the drum 14 to begin rotating again. As soon as the drum 14 rotates, it shifts the recess into which the cam follower 20 has passed, whereby this recess moves beyond the cam follower 20. The cam follower 20 then rides on the outer face of the drum and the column spring switch 8 is held in the position shown in Fig. 4, maintaining the heater deenergized, regardless of any repositioning of the lever 4. It should be noted that the duration of the washing operation may be varied at any time by shifting the lever 4. Such variation of the washing time is made possible even when the pinion 22 is in engagement with the gear 29, because of the friction clutch drive between gear 29 and pinion 30 formed by the spring 31a. It should be further noted that the cam followers 17, 18, and 19 are positioned for engaging selectively the cam faces 15 on the control drum 14 for controlling sequentially the various operations other than wash which are performed by the machine, and the interval control means of our invention may, if desired, be utilized for varying the duration of any of these operations, though shown and described as controlling only the wash period.

The arrangement for effecting the transfer of the motor from engagement with the sequential control to engagement with the interval control and vice versa is shown schematically in Fig. 5. All electrical circuit details except those affecting the energization of the heater 40 have been omitted from this diagram. The motor is connected across the electric supply lines 47, 48. The column spring switch 8 is connected to the line 47. One side of the heater 40 is connected to the line 48, and the other side of the heater is connected to contact 44 which is disposed adjacent contact 43 on the column spring switch 8. As shown schematically in this figure, the cam follower 20 rides on the drum 14 and the cam

follower presses against the column spring switch 8. In the position shown in this figure the follower 20 rides on the outer face of the drum 14, and the end of the follower holds the contact 43 separated from the contact 44. Under these circumstances the circuit of the heater 40 is interrupted at the contacts 43, 44, and the heater is deenergized. As the motor drives the drum 14 through the pinion 22 and the gear train previously described, the recess 15 in the face of the drum comes beneath the cam follower 20 and the follower 20 moves away from the column spring switch 8. The column spring switch 8 shifts under the influence of the spring 41 to close the contacts 43, 44, energizing the heater 40. The heat transmitted to the bimetallic strip 35 causes this strip to bend, moving the pinion 22 to the right into engagement with the gear 29 of the interval control and out of engagement with the sequential control. The gear 29 and pinion 30 are then rotated in a clockwise direction while the sequential control remains stationary. Rotation of the gear 30 carries the sector gear 31 in a counterclockwise direction, moving the portion 33 into engagement with the portion 34 of the cam follower 20. This effects a clockwise movement of the cam follower 20 about its pivot 46 (as represented in Fig. 5), and the end of the cam follower shifts the column spring switch 8 to break the circuit of the heater 40. As the bimetallic strip 35 then cools, it bends back to its original position, shifting the pinion 22 into engagement with the gear 28 to drive the sequential control and at the same time moving the pinion out of engagement with the gear 29 of the interval control. When the drum 14 of the sequential control is moved by the pinion 22, the recess 15 shown in Fig. 5 moves beyond the follower 20. The follower 20 then rides on the outer face of the drum 14, holding the column spring switch 8 in the position shown and maintaining the circuit of the heater 40 open.

In Fig. 6 there is illustrated an alternative arrangement for shifting the pinion 22 for alternatively driving either the sequential control or the interval control. In this modification an electromagnet 49 is utilized in lieu of the bimetallic strip-heater combination 35, 40 illustrated in the previously described form of this invention. Only a portion of the control mechanism is illustrated in Fig. 6, since substantially all of the mechanism is identical with that previously illustrated and described. The same numerals have been used for corresponding parts in Figs. 6 and in Figs. 1–5.

Referring now to Fig. 6, there is shown the drum 14 which is driven by the pinion 22 through the gear 28 and a train of gears (not shown) in the manner previously described. The pinion 22 normally occupies a position in engagement with the gear 28. The electromagnet 49, which is utilized to shift the motor-gear reduction unit assembly 21, 23 and the pinion 22 to a second position wherein the pinion engages the gear 29, is secured to a bracket 50. The bracket 50 is fixed in position, as by being secured to the mounting plate 12 (not shown). As in the form previously described, the motor-gear reduction unit assembly is supported on a semicircular element 38. This element is secured to a pivoted arm 51 in any suitable manner, as by welding. If desired, the arm 51 may be formed as an integral extension of the semicircular element 38. The arm 51 is pivoted by a pin 52 on bracket 50 and is biased upwardly by a spring 53 so as to normally hold the pinion 22 in engagement with the gear 28.

When the washing operation is reached during the rotation of the sequential control a circuit is completed from the lines 47, 48 to the coil 54 of the electromagnet 49. The circuit for controlling the energization of the coil 54 is the same as that illustrated in Fig. 5 for controlling the energization of the heater 40. When the coil 54 is energized the electromagnet attracts the arm 51, moving the arm downwardly and shifting the pinion 22 into engagement with the gear 29 to drive the interval control. The electromagnet is deenergized to return the drive to the sequential control in the same manner as the heater 40 is deenergized in the form shown in Fig. 5.

Although, as shown and described, the motor is preferably biased into driving engagement with the sequential control by the spring 53 and is shifted into driving engagement with the interval control by energization of the electromagnet, it will be apparent that this arrangement may be reversed if desired so that the electromagnet holds the motor in normal driving engagement with the sequential control and is deenergized to permit a spring to shift the motor into driving engagement with the interval control.

While specific embodiments of this invention have been shown and described, it is not desired that the invention be limited to the particular construction shown, and it is intended, by the appended claims, to cover all modifications within the spirit and scope of this invention.

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

1. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor for driving said sequential control and said interval control, said motor being normally positioned in driving engagement with said sequential control, electro-responsive means including an energizing electric circuit therefor which when energized shifts said motor into driving engagement with said interval control, means responsive to said sequential control for energizing said electroresponsive means in one of said series of operations, and means operated by said interval control as it is driven by said motor to interrupt said circuit.

2. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor for driving said sequential control and said interval control, and a temperature-responsive element for positioning said motor alternatively to drive either said sequential control or said interval control.

3. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor for driving said sequential control and said interval control, a temperature-responsive element for positioning said motor alternatively in driving engagement with said sequential control or said interval control, and a heater for said temperature-responsive element.

4. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor for driving said sequential control and said interval control, a temperature-responsive element for positioning said motor alternatively in driving engagement with said sequential control or said interval control, a heater for said temperature-responsive element, and means operated by said sequential control for energizing said heater.

5. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor for driving said sequential control and said interval control, a temperature-responsive element for positioning said motor alternatively in driving engagement with said sequential control or said interval control, a heater for said temperature-responsive element, and means operated by said interval control for deenergizing said heater.

6. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor for driving said sequential control and said interval control, a temperature-responsive element for positioning said motor alternatively in driving engagement with said sequential control or said interval control, a heater for said temperature-responsive element, means operated by said sequential control for energizing said heater, and means operated by said interval control for deenergizing said heater.

7. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor for driving said sequential control and said interval control, a temperature-responsive element, a heater for said temperature-responsive element, means operated by said sequential control for energizing said heater to position said motor in driving engagement with said interval control, and means operated by said interval control for deenergizing said heater to position said motor in driving engagement with said sequential control.

8. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor, a bimetallic strip for mounting said motor in position to engage alternatively either said sequential control or said interval control, and means for heating said bimetallic strip to move said motor into driving engagement with one of said controls.

9. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor, a bimetallic strip for mounting said motor in position alternatively to drive either said sequential control or said interval control, a heater for said bimetallic strip, a switch actuated by said sequential control for energizing said heater to position said motor in driving engagement with said interval control, and means operated by said interval control for actuating said switch to deenergize said heater for positioning said motor in driving engagement with said sequential control.

10. In combination, a sequential control including a control drum for controlling a series of operations, a plurality of switches adapted to be actuated by said drum, an interval control for varying the duration of one of said series of operations, a motor for driving said sequential control and said interval control, means including a bimetallic strip for mounting said motor in position alternatively to drive either said sequential control or said interval control, and a heater adjacent said bimetallic strip, one of said plurality of switches being actuated by said drum to engize said heater for positioning said motor in driving engagement with said interval control, said one of said plurality of switches being actuated by said interval control to deenergize said heater for positioning said motor in driving engagement with said sequential control.

11. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor for driving said sequential control and said interval control, said motor being normally positioned in driving engagement with said sequential control, electromagnetic means including an energizing electric circuit which, upon energization, shifts said motor into driving engagement wth said interval control, means responsive to said sequential control for energizing said electromagnetic means in one of said series of operations, and means operated by said interval control as it is driven by said motor to interrupt said circuit.

12. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor for driving said sequential control and said interval control, a spring for normally positioning said motor in driving engagement with said sequential control, an electromagnet and an energizing electric circuit therefor which, upon energization, shifts said motor into driving engagement with said interval control, means responsive to said sequential control for energizing said electromagnet in one of said series of operations, and means operated by said interval control as it is driven by said motor to interrupt said circuit.

13. In combination, a sequential control for a series of operations, an interval control for varying the duration of one of said series of operations, a motor for driving said sequential control and said interval control, a spring for normally positioning said motor in driving engagement with said sequential control, an electromagnet for shifting said motor into driving engagement with said interval control, an energizing electric circuit for said electromagnet, a switch in said circuit actuated by said sequential control for energizing said electromagnet, and means operated by said interval control as it is driven by said motor for actuating said switch to deenergize said electromagnet whereby said motor is moved by said spring into driving engagement with said sequential control.

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