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ELECTRIC CONTROLLER APPARATUS

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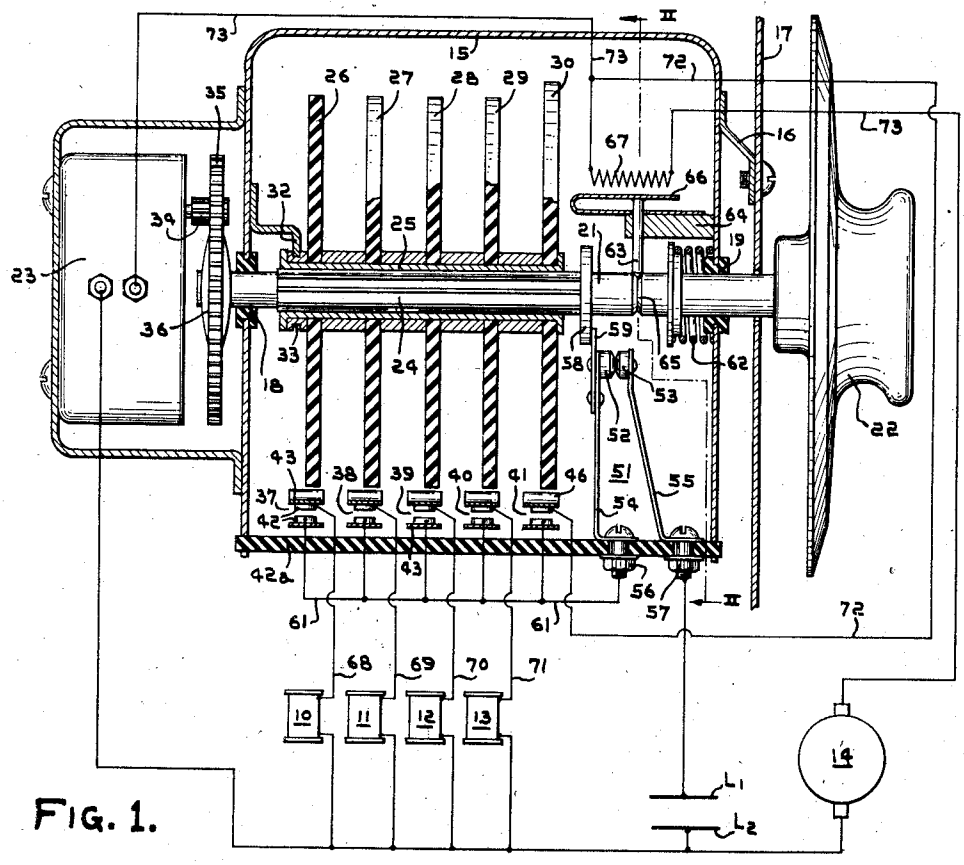

FIG. 1.

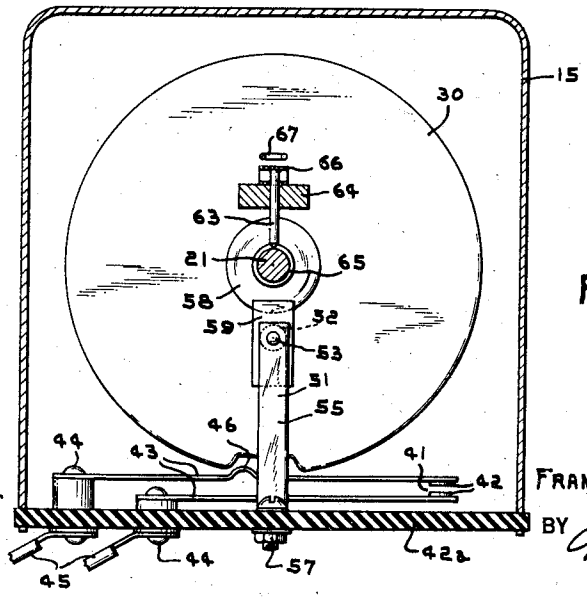

FIG. 2.

WITNESSES:
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ELECTRIC CONTROLLER APPARATUS

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6 Claims. (Cl. 200—33)

My invention relates to apparatus for sequentially energizing and deenergizing a plurality of electric circuits and has for an object to provide improved apparatus of this kind.

A further object of the invention is to provide in a time-controlled switch for sequentially energizing a plurality of electric circuits, overload protection effective to deenergize the various circuits in response to an overload in one of the circuits.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a longitudinal sectional view taken through a controller constructed and arranged in accordance with the invention and controlling a plurality of electric circuits which are diagrammatically shown, and

Fig. 2 is a transverse sectional view taken along the line II—II of Fig. 1.

Referring now to the drawing, I have elected to show my invention applied to a time-controlled sequence switch of the type commonly employed for controlling the various electrical translating devices of an automatic washing and centrifuging machine of the domestic type. These machines usually employ a pair of water inlet valves which are opened and closed by solenoids, which I have shown at 10 and 11 in the drawing. A discharge valve or its equivalent is also used for draining water from the tub and this valve is operated by a solenoid indicated at 12. These machines usually wash the fabrics at a relatively low washing speed and centrifuge the same at high speed. This operation is obtained by means of a two-speed gear mechanism which is adjusted to its various speeds by an electromagnet indicated at 13. The driving motor for the machine is indicated in the drawing at 14.

These various electrical translating devices are sequentially operated by a time-control switch to provide a predetermined sequence of steps in a washing and centrifuging program. For example, the solenoids 10 and 11 are first energized to open the valves to admit water to the machine and the motor operates to drive the machine at slow speed to wash the fabrics. At the conclusion of the washing program, the drain valve is actuated by its solenoid 12 to discharge the vitiated washing water from the machine. The inlet valves may again be operated for admitting a body of rinse water to the machine and the motor operates to drive the machine at slow speed for rinsing the fabrics. At the conclusion of the rinsing period, the drain valve solenoid 12 is again operated to discharge the vitiated rinse water from the machine and the two-speed mechanism is then adjusted by its magnet 13 to operate the machine at high speed. At this time, the rinse water is centrifuged from the fabrics in the machine and, at the conclusion of the centrifuging period, all of the electrical translating devices are deenergized. The washing program is now complete. This program has been described in its simplest form, but it is sufficient to illustrate an application for a controller constructed and arranged in accordance with my invention.

The various electrical translating devices are sequentially energized and deenergized by a time switch generally of the type shown in the drawing. The cycle is initiated by the operator advancing the time switch manually to a starting position and from then on a small motor of the type commonly employed for driving clocks, actuates the various switches to carry the washing program into effect.

During the operation of a machine of this kind, the motor, which is usually of ¼ H. P. capacity in order that it might be operated from the conventional 15 ampere lighting circuits, may become overloaded particularly during the period when the apparatus is accelerated from its low washing speed to its high centrifuging speed. At this time, the fabrics in the machine may become badly distributed and the motor will have difficulty in accelerating the machine through its critical speed. In accordance with my invention, overload protection is provided, which will completely deenergize all of the translating devices employed in the apparatus in response to an overload in the circuit serving the driving motor. While the controller that I have disclosed is particularly adaptable for controlling washing apparatus of the type described, it will be understood that it may be readily applied to other forms of apparatus having circuits which are sequentially energized and wherein overload protection for the apparatus is desirable.

My improved controller includes generally a casing 15 which is supported by means of suitable brackets, one of which is shown as 16, from a suitable support 17 which, when the controller is applied to the washing machine described, may define a part of the housing of the washing machine. A pair of spaced bearings 18 and 19 are carried by the casing 15 and support a shaft 21 for rotation and axial movement. The shaft 21

may be rotated or moved axially by means of a handle structure 22 and is also rotated at relatively slow speed by means of a motor 23 carried by the casing 15.

An intermediate portion of the shaft 21 is splined, as shown at 24, to a sleeve structure 25, the latter carrying a plurality of cams 26 to 30, inclusive. The splined connection provides for rotation of the cams 26 to 30 at any time that the shaft is rotated, and also permits axial movement of the shaft 21 relative the sleeve structure 25. Axial movement of the sleeve 25 is prevented by a tongue 32 carried by the casing 15 and extending within an annular groove 33 formed in the sleeve structure 25.

The motor 23 is of the slow speed type and drives a pinion 34 which meshes with a gear 35 carried by the shaft 21. A spring-biased clutch, shown generally at 36, connects the gear 35 and the shaft 21 and defines the driving connection between the gear 35 and the shaft 21. The clutch 36 also permits manual rotation of the shaft 21 relative the gear 35 at times when the shaft 21 is rotated by the handle 22. The face of the pinion 34 is elongated in order to permit axial movement of the gear 35 relative the pinion 34 when the shaft 21 is moved axially as described hereinafter. The motor 23 operates to rotate the shaft 21 at low speed, for example, one revolution in fifty minutes.

The cams 26 to 30 operate respective switches 37 to 41, inclusive, which are carried by an insulating wall 42a defining a portion of the casing 15. As shown in Fig. 2, each of the switches 37 to 41 include relatively movable contacts 42 carried by respective springs 43, which also define current conductors and are connected by rivets 44 to terminals 45 on the exterior of the casing. The upper spring 44 may be embossed, as shown at 46, to provide a projection engageable with the cam associated therewith. It will be understood that the peripheries of the cams 26 to 30, inclusive, are suitably formed to provide the desired sequence of operation of the switches 37 to 41, inclusive.

Arranged within the casing 15 and supported by the insulating wall 42a is a line switch 51, including contacts 52 and 53 which are carried by respective supports 54 and 55. The supports 54 and 55 define current-carrying members and are secured to binding posts 56 and 57. The support 54 is resilient and biases the contact 52 away from the contact 53 at all times. The contact 52 is maintained in engagement with the contact 53 in the axial position of the shaft 21, as shown in the drawing, by means of a collar 58 carried by the shaft and engageable with an insulating member 59 fixed to the resilient support 54. It will be apparent that when the knob is manually moved to the left from the position shown in the drawing, the collar 58 will be followed by the support 54 and member 59 so that the contacts 52 and 53 will be disengaged. The line switch 51 is connected in series with all of the switches 37 to 41, inclusive, by means of a conductor 61 extending from the binding post 56 to one side of all of the switches 37 to 41. Accordingly, when the line switch 51 is open, all of the circuits controlled by the switches 37 to 41, inclusive, are deenergized.

In accordance with my invention, the shaft 21 is biased at all times to its second axial position, wherein the line switch 51 is open, by means of a compression spring 62. The shaft 21 is retained in the position shown by means of a pin 63 which is guided within a bracket 64 and which has a tapered end fitted within a groove 65, which may have sloping sides, as clearly shown in Fig. 1. The pin is biased downwardly into the groove by means of a bimetallic member 66, the bias of which is sufficient to prevent the spring 62 from moving the shaft 21 to the left and thereby forcing the pin 63 upwardly out of the groove 65. However, if the operator manually forces the knob 22 and shaft 21 to the left, this additional force will be sufficient to cause the pin 63 to ride up upon the sloped side walls of the groove and thereby allow the shaft 21 to move to the left sufficiently to open the line switch 51.

An electric heater 67 is arranged in heat transfer relation with the bimetal element 66 and is connected in series, as pointed out hereinafter, with the driving motor 14, so that the motor current traverses the heater 67. When heated, the bimetal element 66 tends to move upwardly and therefore reduces the bias on the pin 63. During normal operation, however, the bimetal element 66 is not heated sufficiently to reduce the bias to such a point where the spring 62 would force the shaft 21 to the left, causing the pin 63 to ride out of the slot 65. However, upon an overload on the motor 14, the heater 67 would impart sufficient heat to the bimetal element 66 and so reduce the bias imposed upon the pin 63, that the spring 62 would effect movement of the pin 63 out of the slot 65 and movement of the shaft 21 to the left and therefore open the line switch 51.

The source of power for the various electrical translating devices which I have shown is defined by line conductors L_1 and L_2, the former of which is connected to the binding post 57 of the line switch 51. As set forth heretofore, the binding post 56 of the line switch 51 is connected to one side of all of the switches 37 to 41 by the common conductor 61. The opposite sides of the switches 37 to 40, inclusive, are connected respectively by conductors 68 to 71, inclusive, to terminals of the solenoids 10 to 13. The opposite terminals of the solenoids 10 to 13, inclusive, are directly connected to the line conductor L_2 as shown.

One side of the switch 41 is connected by means of a conductor 72 to one terminal of the heater 67, the opposite terminal of which is connected by means of a conductor 73 to one side of the motor 14. The opposite side of the motor 14 is directly connected to the line conductor L_2. The conductor 72 leading from the switch 41 is connected by means of a conductor 73 to one side of the timer motor 23, the opposite side of which is directly connected to the line conductor L_2.

It will be seen from the foregoing description that the heater 67 of the overload mechanism is traversed only by the current of the driving motor 14, and that the line switch 51 being connected in series with all of the switches 37 to 41 controls all of the circuits illustrated, including the circuits of the motor 14 and timer motor 23. Upon occurrence of an overload, the heater 67 is heated sufficiently to cause the line switch 51 to open, as described heretofore, whereby all of the apparatus is rendered inactive. In order to restore operation of the apparatus, the operator must pull the handle 22 outwardly to the position shown in the drawing, whereupon the pin 63 is again returned to the slot 65 for holding the shaft 21 in this axial position wherein the line switch is closed.

The cam 30 is formed to maintain the switch 41 closed during substantially a complete revolu-

tion of the cam 30, as shown in Fig. 2. Accordingly, the motors 14 and 23 operate continuously during the cycle of operations. The remaining cams 26 to 29 are shaped to sequentially operate their respective switches 37 to 40, inclusive, in the desired manner. Operation of the apparatus is initiated by turning the dial or knob 22 sufficiently to close switch 41 and then the timing motor 23 is effective to drive the cams and complete the sequence of switching operations. The knob 22 may have indicia thereon to indicate the operation being performed by the controlled apparatus. The cycling of the apparatus may be advanced at any time by manually advancing the cams and the cycle may be terminated during any step by manually pushing the knob 22 inwardly and opening the line switch 51 as described. When operation of the apparatus is terminated by an overload in the motor, as described, manual attention is required to restore operation.

From the foregoing description, it will be apparent that I have provided an improved controller for sequentially energizing a plurality of circuits and having overload provisions built therein which will deenergize the various controlled circuits in response to an overload in one of the circuits. The apparatus is constructed as a self-contained unit which may be readily manufactured and applied to the controlled apparatus with a minimum of wiring connections.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In a controller, the combination of a support, a member movably carried by the support, a plurality of switch structures actuated by said member, a timing motor for moving said member, a handle for moving the member independently of the timing motor, a line switch carried by the support and connected in series with said switch structures, means connecting the line switch to said handle for operation thereby and means for opening the line switch independently of the handle in response to a predetermined high current conducted by at least a portion of said switch structures.

2. In a controller, the combination of a support, a shaft journalled therein, a plurality of rotary switch structures actuated by the shaft, a timing motor for rotating the shaft, a handle for rotating the shaft independently of the timing motor, a line switch carried by the support and connected in series with said switch structures, means connecting the line switch to said handle for operation thereby and means for opening the line switch independently of the handle in response to a predetermined high current conducted by at least a portion of said rotary switch structures.

3. In a controller, the combination of a support, a shaft rotatably carried by the support and movable axially therein, a plurality of rotary switching devices carried by the shaft, a timing motor for rotating the shaft, a handle carried by the shaft for rotating the same and for moving the shaft axially between first and second positions, a line switch carried by the support and connected in series with said plurality of switching devices, means carried by the shaft for opening the line switch as the shaft is moved axially from its first to its second position and means responsive to an abnormally high current conducted by at least a portion of the switching devices for actuating the line switch to its open position.

4. In a controller, the combination of a support, a shaft mounted in the support for rotation and axial movement relative thereto, a plurality of rotary switching devices actuated by the shaft, a timing motor for rotating the shaft, a handle carried by the shaft for rotating the same and for moving the shaft axially between first and second positions, a line switch connected in series with said switching devices, an actuator movable axially with said shaft for operating the line switch, said line switch being closed in said first axial position of the shaft and said actuator effecting the opening of the line switch when the shaft is moved to its second axial position and means responsive to a predetermined high abnormal current conducted by at least a portion of said switching devices for actuating the shaft from its first to its second position.

5. In a controller, the combination of a support, a shaft carried by the support for rotation and axial movement, a plurality of rotary switching devices actuated by the shaft, a timing motor for rotating the shaft, a handle carried by the shaft for rotating the same and for moving the shaft axially between first and second positions, a line switch connected in series with said switching devices and biased to its open position, means carried by the shaft for maintaining the line switch closed in opposition to the bias thereof when the shaft is in its first axial position, said last-named means permitting opening of the line switch as the shaft is moved axially from its first to its second position, means for biasing the shaft from its first to its second axial positions, means for retaining the shaft in its first axial position and means responsive to an abnormally high current conducted by at least a portion of the switching devices for rendering said retaining means inactive.

6. In a controller, the combination of a casing, a shaft mounted in the casing for rotary and axial movement with respect thereto, said shaft having an annular groove therein, a plurality of cams carried by the shaft, a plurality of switches actuated by the cams, a timing motor for rotating the shaft, a handle fixed to the shaft for rotating the shaft and for moving the shaft axially from a first axial position to a second axial position, a line switch within the casing and connected in series with said switches, said line switch being actuated by axial movement of the shaft, said line switch being closed in the first axial position of the shaft and open in the second axial position thereof, means biasing the shaft to its second axial position, a pin disposed within said annular groove for holding the shaft in its first axial position in opposition to said biasing means, a temperature-responsive element biasing the pin toward the shaft and a heater arranged adjacent said element for heating the same and for reducing the bias imposed upon the pin, said heater being connected in circuit with one of said switches.

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