

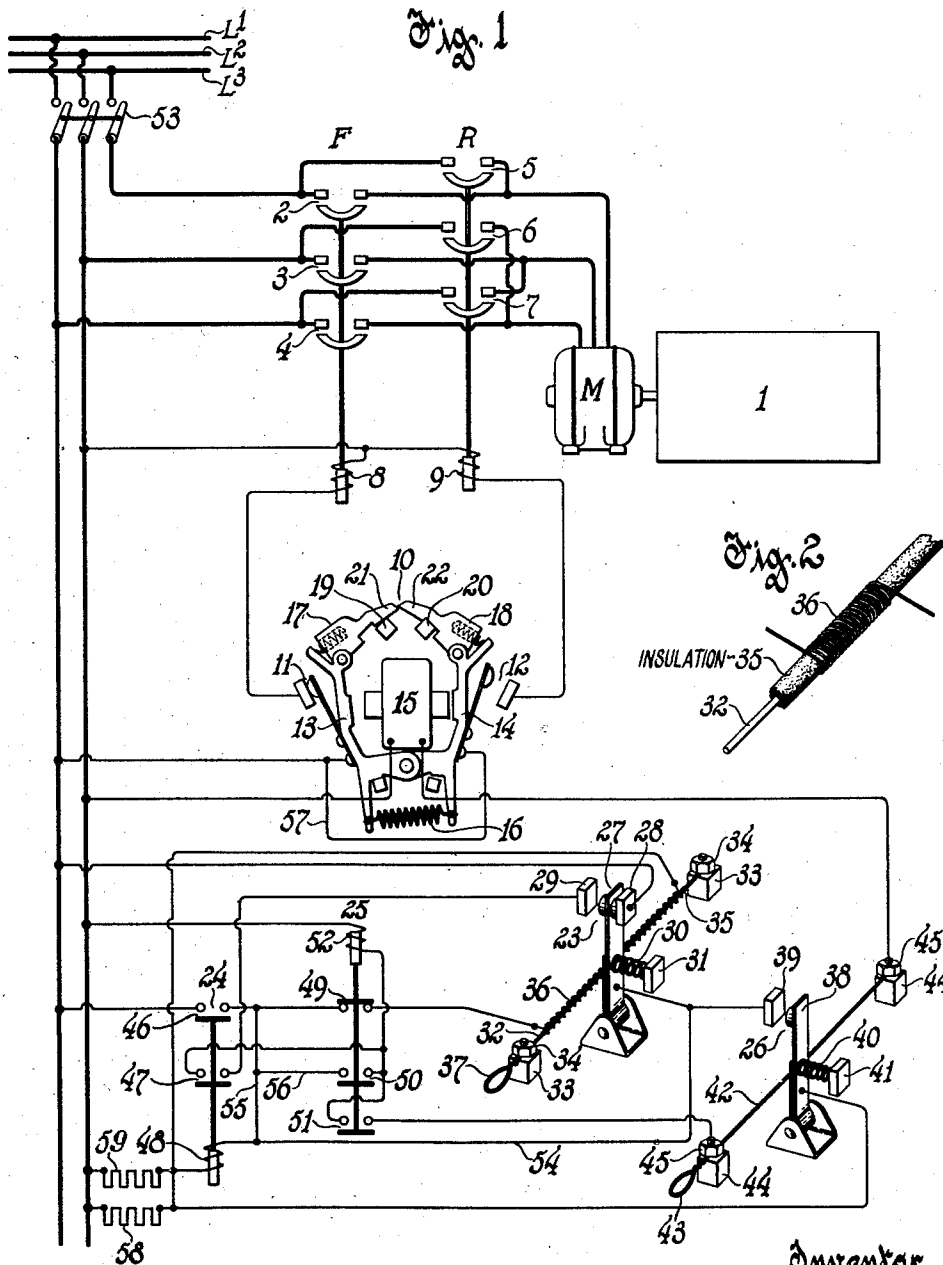
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CIRCUIT CONTROLLING DEVICE

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CIRCUIT CONTROLLING DEVICE

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This invention relates to circuit controlling devices and more particularly to electro-thermally responsive timing devices for the control of electric circuits.

5 An object of the invention is to provide novel control means of the aforementioned character for automatically effecting given circuit commutations.

10 Another object of the invention is to provide automatic control means for periodically and sequentially commutating a plurality of electric circuits.

15 Another object is to provide automatic control means for effecting a preselectable and pre-adjusted periodic cycle of circuit commutations.

Another object is to provide control means of the aforementioned character wherein a single electro-thermally controlled element is utilized to effect control of a plurality of associated electric circuits.

20 Another and more specific object is to provide control means of the aforementioned character which automatically effects given periodic reversals in the direction of operation of an electric motor.

25 Another object is to provide novel control means for the reversible driving motors of washing machines and the like whereby like periods of operation of the washer cylinders in reverse directions respectively may be insured.

30 Another object is to provide for utilization of electro-thermally responsive timing means for accomplishment of the desirable results aforementioned.

35 Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawing illustrates an embodiment of the invention which will now be described, it being understood that the embodiment illustrated is susceptible of modification without departing from the spirit and scope of the appended claims.

40 In the drawing, Figure 1 schematically and diagrammatically illustrates an adaptation of my invention to the control of an electric motor, and

Fig. 2 is an enlarged fragmentary perspective view showing in detail the construction of the heating element employed in the electro-thermal device illustrated in Fig. 1.

50 Referring to Fig. 1 of the accompanying drawing, there is illustrated a motor control system for a reversible three-phase alternating current motor M which is supplied from lines L¹, L², L³ through reversing switches F and R. Motor M is shown as being operatively connected with a ro-

tatable member I such as the rotary cylinder of a washing machine, and as will be hereinafter described the illustrated system is adapted to provide automatic control for effecting given periodic reversals of the motor M.

5 The forward switch F and the reverse switch R are each triple pole switches, the same being provided with three sets of contacts 2, 3 and 4, and 5, 6 and 7, respectively. Said switches are respectively provided with operating windings 8 and 9, said windings being adapted for energization alternately through the medium of a relay 10.

10 Relay 10 includes two sets of contacts 11 and 12, which are associated with the armature levers 13 and 14, respectively, and further includes a common operating means for said armature levers. Said operating means comprises the winding and core element 15. The contacts 11 and 12 are normally biased toward closed position by a tension spring 16 which links the lower extremities of the armature levers 13 and 14, but, as will be apparent, upon deenergization of the winding 15, one or the other of said levers is held by its associated spring-biased latch, shown at 17 and 18, to prevent closure of one or the other of the two sets of contacts 11 and 12. The latches 17 and 18 are cooperable with the fixed latching pins 19 and 20, respectively, and as shown at 21 and 22 said latches are provided with interengageable projections which are adapted upon successive energizations of the winding 15 to trip the latches 17 and 18 alternately, the tripped latch being free to drop out upon deenergization of the winding 15 to effect closure of its associated set of contacts, while the tripping latch is held by its latch pin to prevent closure of its associated set of contacts.

25 Thus assuming the latch 18 to be in latched position and the latch 17 to be in unlatched position, as shown in the drawing, the contacts 12 will be prevented from closing, while the contacts 11 will be closed. The projections 21 and 22 are arranged so that in the illustrated relative positions of the armature levers 13 and 14 the projection 21 of latch 17 underlies the projection 22 of latch 18 whereby upon energization of the winding 15, the projection 21 will lift the projection 22 to trip the latch 18. The latch 17 will thereupon latch itself upon pin 19, while latching of the latch 18 is prevented by the projection 21.

30 Thus upon subsequent deenergization of winding 15 the armature lever 13 will be retained in latched position to prevent closure of the contacts 11, while the armature lever 14 will be free to drop out to close the contacts 12. Also, the

projections 21 and 22 will have reversed their positions, the projection 22 of latch 18 underlying projection 21 of latch 17, so that upon repeated energization of the winding 15 the projection 22 will lift the projection 21 to trip the latch 17. Upon deenergization of winding 15, the armature lever 13 will be released to close contacts 11 and the armature lever 14 will be held by latch 18 to prevent closure of contacts 12; in other words, the elements of relay 10 will again assume their illustrated positions.

Relay 10 is a modified form of the relay disclosed in Patent No. 1,186,561, issued June 13, 1916 to Clarence T. Evans, and inasmuch as the operation of the relay 10 is substantially the same as that of the relay disclosed in said patent, a more detailed description thereof herein is deemed unnecessary.

Energization of the winding 15 is effected by timed impulses controlled by an electro-thermally responsive device 23 through the medium of relays 24 and 25 and a quick-acting electro-thermally responsive device 26.

They electro-thermally responsive device 23 includes a pivoted contact element 27 which is oscillatable between a pair of stationary contacts 28 and 29. A compression spring 30 mounted between the contact element 27 and an abutment 31 tends to bias said contact element into engagement with the contact 29, but a taut wire 32 restrains movement thereof and normally maintains the same in engagement with the contact 28. The taut wire 32 is strung with the desired or required degree of tension between the posts 33, 33, the ends of said wire being secured to the posts by clamping nuts 34, 34. As illustrated more clearly in Fig. 2, a high-resistance wire is wound around the taut wire 32 over a covering 35 of asbestos or other non-fusible or heat-proof insulating material to form a heating coil 36. When the wire 32 becomes heated upon passage of current through the heating coil 36 said wire lengthens, due to expansion, relaxing its tension sufficiently to permit movement of the contact element 27 under action of the spring 30 into engagement with the contact 29. The time required for movement of the contact element 27 is dependent to a considerable extent upon various factors, principally the size of the wire 32, the thickness of the covering 35, the size of the wire in the heating coil 36 and the value of the current supplied to said coil, but it is apparent that this time element may be varied by changing certain characteristics of any of these factors, or by shifting the position of the contact 29, as by means of a screw adjustment. As shown in Fig. 1 a loop 37 is provided at one end of the wire 32 to permit the attachment of some tensioning means, such as a spring, or a weight for effecting the required tensioning of said wire. It is obvious that adjusting means, such as an adjusting screw to which one end of the wire 32 is secured and upon which the wire is wound upon turning thereof, could be associated directly with the wire to adjust the tension thereof as required.

The electro-thermally responsive device 26 includes a pivoted contact element 38 which is biased to engage a contact 39 by a spring 40 which is mounted between said contact element and an abutment 41, but said contact element is normally restrained from such engagement by a taut wire 42. It will be noted that the taut wire 42 forms a part of the energizing circuit of the winding 15 of relay 10, and being a high-resistance wire, passage of a current through the same ef-

fects heating thereof, relaxing its tension to permit movement of the contact element 38 under action of the spring 40 into engagement with the contact 39. The wire 42 may be tensioned in a manner similar to that heretofore described in connection with the wire 32, a loop 43 being provided for the purpose, and said wire, as shown, may be secured to the posts 44, 44 by the clamping nuts 45, 45.

The relay 24 is provided with two sets of normally open contacts 46 and 47 and an operating winding 48. The relay 25 is provided with a set of normally closed contacts 49, two sets of normally open contacts 50 and 51, and an operating winding 52. A three pole switch 53 serves to connect the system to lines L¹, L², L³.

Assuming the elements of the aforescribed system to be in the positions illustrated in Fig. 1, operation thereof will be as follows: Upon closure of the line switch 53 the system is connected to lines L¹, L², L³, and an energizing circuit for the operating winding 8 of the forward switch F is established from line L¹ through the contacts 11 of relay 10 and through said winding to line L². Response of switch F closes its contacts 2, 3 and 4 to establish connections from lines L¹, L², L³ to effect operation of the motor M in its forward direction. Circuits are also established upon closure of the switch 53 for the heater coil 36 of the electro-thermally responsive device 23 and for the operating winding 48 of the relay 24, the former circuit extending from line L¹ to and through contact 28 and contact element 27 of the thermally responsive device 23, by conductors 54 and 55, to and through the normally closed contacts 49 of the relay 25 and through the heater coil 36 and through the resistances 58 and 59, which are connected in parallel, to line L²; and the latter circuit also extending through the contact 28 and the contact element 27, by conductor 54 through said winding 48 and the resistances 58 and 59 to line L². The passage of current through the heater coil 36 heats the taut wire 32 relatively slowly, due to the factors hereinbefore described, and as the wire slackens, the contact element 27 is moved out of engagement with the contact 28 under the action of spring 30. The circuit for the heater coil 36 is maintained, upon separation of the contacts 27 and 28, through the contacts 46 of relay 24, and a maintaining circuit for the operating winding 48 of said relay is also provided, said circuit extending from line L¹ through the contacts 46 and conductor 55 through said winding and resistances 58 and 59 to line L².

After a predetermined interval of time the wire 32 will have become slackened sufficiently to permit engagement of the contact 29 by the contact element 27, whereupon an energizing circuit for the winding 52 of the relay 25 is established, said circuit extending from line L¹ through the contacts 46 of relay 24 by conductors 55 and 54, to and through the contact element 27 and contact 29, to and through contacts 47 of relay 24 and through the winding 52 to line L². Relay 25 responds to close its normally open contacts 50 and 51, and to open its normally closed contacts 49 thus interrupting the circuit of the heater coil 36, the energizing circuit for the winding 52 being maintained upon separation of the contacts 27 70 and 29 by a circuit extending from line L¹ through the contacts 46 of relay 24 by conductors 55 and 54, through the contacts 50 of relay 25 and through said winding 52 to line L². Closure of contacts 50 and 51 of relay 25 establishes an en- 75

energizing circuit for the winding 15 of relay 10 through the taut wire 42 of the thermal relay 26, which circuit extends from line L¹ through contacts 46 of relay 24, by conductors 55 and 56, through contacts 50 and 51, and through the taut wire 42 and winding 15 to line L². Relay 10 responds, and as hereinbefore described, the projection 21 of latch 17 lifts the projection 22 to trip the latch 18, and upon further movement of the armature lever 13 the latch 17 engages the pin 19. Separation of the contacts 11 upon response of the relay 10 deenergizes the operating winding 8 of the forward switch F, causing said switch to open its contacts 2, 3 and 4 to disconnect the motor M from lines L¹, L², L³, whereupon the motor coasts until reverse operating connections are established by reverse switch R, response of which is effected as follows:

The wire 42 of the electro-thermally responsive device 26 is adapted to heat relatively quickly, whereupon the tension thereof is relaxed to permit engagement of the contact 39 by the contact element 38 under the action of spring 40, which establishes a short circuit around the operating winding 48 of relay 24, said circuit extending from line L¹ through contacts 46 of said relay, by conductors 55 and 54, to and through the contact 39 and contact element 38 of thermal relay 26 and through the resistances 58 and 59 to line L². Upon deenergization of winding 48 relay 24 opens its contacts 46 and 47, interrupting the energizing circuit for the winding 52 of the relay 25 which closes its contacts 49 and opens its contacts 50 and 51, interrupting the energizing circuit for the winding 15 of relay 10, which circuit includes the heater wire 42.

As hereinbefore described, upon deenergization of the winding 15, the latch 17 being latched, the armature lever 13 is held to prevent closure of the contacts 11, while the latch 18, being tripped, permits release of the armature lever 14 to close the contacts 12, whereupon the operating winding 9 of reverse switch R is energized through a circuit extending from line L¹ by conductor 57, through contacts 12 and through said winding to line L². Switch R responds to close its contacts 5, 6 and 7 to establish connections from lines L¹, L², L³ to effect operation of the motor M in the reverse direction.

The wire 32 becomes tensioned upon cooling, the cooling time being dependent upon one or more of the factors mentioned herein, and as the wire tightens it moves the contact element 27 into engagement with the contact 28, whereupon the aforescribed circuits are again established to effect response of relay 24 and to effect energization of heater coil 36. Thereafter the electro-thermally responsive device 23 operates in the manner aforescribed to effect response of the relay 25, thereby again establishing an energizing circuit through the heater wire 42 for the operating winding 15 of relay 10. Response of relay 10 opens contacts 12, interrupting the energizing circuit for the winding 9 of reverse switch R which opens to interrupt the reverse operating connections to the motor M. Said motor again coasts until the electro-thermally responsive device 26 operates to drop out relays 24, 25 and 10, whereupon the armature lever 13 of the latter is released to close contacts 11, effecting response of the forward switch F, which again establishes said forward operating connections for motor M.

It will be apparent that the aforescribed system operates automatically to effect given periodic reversals in the direction of operation of the mo-

tor M and that the periods of forward and reverse operation of said motor are substantially equal since the duration of the same is determined by the cycle of movement of the contact element 27, that is, each successive engagement of the contact element 27 with the contact 29 results in response of the relay 10 through the medium of relay 25 and the heater wire 42 of thermal relay 26, and as hereinabove described, the relay 10 is adapted to effect alternate response of the motor 10 switches F and R upon successive operations of said relay.

What I claim as new and desire to secure by Letters Patent is:

1. In a circuit controlling device, in combination, a contact element mounted for pivotal movement between two circuit-closing positions, thermally responsive means comprising a wire having its end portions fixed under a predetermined degree of tension and arranged to normally hold said element in one of said positions, means for biasing said element to the other of said positions, an electric heating coil associated with said wire and adapted when energized to provide for expansion of said wire with consequent movement of said element to said last mentioned position thereof, and said element being adapted upon movement thereof to said last mentioned position to effect deenergization of said heating coil.

2. In a circuit controlling device, in combination, a contact element mounted for pivotal movement between two circuit-closing positions, thermally responsive means comprising a wire having its end portions fixed under a predetermined degree of tension and adapted to normally hold said element in one of said positions, means for biasing said element to the other of said positions, an electric heating coil associated with said wire and adapted when energized to provide for expansion of said wire with consequent movement of said element to the last mentioned position thereof, said element being adapted when in said first mentioned position to effect energization of said heating coil and when in said last mentioned position to effect deenergization thereof.

3. In a device of the character described, in combination, a reversible electric motor, switching means for said motor and automatic control means for effecting periodic operation of said motor alternately in opposite directions for predetermined substantially equal intervals of time, said control means comprising a pivoted contact element arranged for reciprocal movement between two spaced stationary contacts, a taut wire acting against said contact element on one side thereof to normally hold the same in engagement with one of said stationary contacts, a spring adapted to bias said contact element toward the other of said stationary contacts, and means adapted upon engagement of said contact element with said first mentioned contact to effect heating of said wire to increase the length thereof whereby movement of said element under the action of said spring into engagement with said second mentioned stationary contact is effected.

4. In a device of the character described, in combination, a reversible electric motor, switching means for said motor and automatic control means for effecting periodic operation of said motor alternately in opposite directions for predetermined substantially equal intervals of time, said control means comprising a pivoted contact element arranged for reciprocal movement be-

tween two spaced stationary contacts, a taut wire acting against said contact element on one side thereof to normally hold the same in engagement with one of said stationary contacts, a spring adapted to bias said contact element toward the other of said stationary contacts, said wire having a covering of electrical insulating material, and a heating coil comprising a wire helix surrounding said covering, said coil being adapted upon engagement of said contact element with said first mentioned contact to effect heating of said wire to provide for gradual lengthening of the same whereby movement of said element under the action of said spring into engagement with said second mentioned stationary contact is effected.

5. In a circuit controlling device, in combination, a pair of spaced stationary contacts, a pivoted contact element arranged for reciprocal movement between said stationary contacts, a taut wire engaging said element on one side thereof to normally hold the same in engagement with one of said stationary contacts, a spring biasing said element toward the other of said stationary contacts, said wire having an electrical insulating covering, a helical wire heating coil positioned externally of said covering, said coil being adapted when energized to heat said wire to effect gradual lengthening of the same whereby movement of said element under the action of said spring into engagement with said second mentioned contact is effected, and means associated with said contact element and adapted in the last mentioned position thereof to effect deenergization of said heating coil.

6. In a device of the character described, the combination with a pair of spaced stationary contacts, a pivotally mounted contact element arranged for reciprocal movement between said stationary contacts to control separate associated circuits, an abutment, a compression spring located between one side of said element and said abutment, said spring being arranged to bias said element toward one of said stationary contacts, a taut wire engaging the other side of said element to restrain the same against movement by said spring, a pair of spaced stationary posts to which said wire is attached and between which the same is stretched to a predetermined degree of tension, and electrical means adapted when energized to heat said wire to increase the length thereof whereby movement of said element into engagement with said one of said stationary contacts under the biasing action of said spring is effected, said means comprising a helically wound wire heating coil surrounding said taut wire, a covering of electrical insulating material interposed between said wire and said heating coil to provide for gradual conduction of heat to said wire, and associated means adapted in the last mentioned position of said element to effect deenergization of said heating coil.

7. In a circuit controlling system, in combination, an element arranged for reciprocal movement between two circuit-closing positions, electro-thermally responsive means adapted to normally hold said element in one of said positions, said electro-thermally responsive means being adapted when energized to effect movement of said element into the other of said positions, and means controlled by said element in said second mentioned position to effect deenergization of said electro-thermally responsive means.

8. In a motor circuit-controlling system, in combination, an element arranged for reciprocal

cal movement between two circuit-closing positions, electro-thermally responsive means adapted when deenergized to hold said element in one of said positions and when energized to effect movement of said element into the other of said positions, means controlled by said element in said first mentioned position and operable to effect energization of said electro-thermally responsive means, and means controlled by said element in said second mentioned position to effect deenergization of said electro-thermally responsive means.

9. In a motor circuit-controlling system, in combination, a reversible electric motor, switching means for said motor and automatic control means for effecting periodic operation of said switching means to provide for operation of said motor alternately in opposite directions for predetermined substantially equal intervals of time, said control means comprising a contact element arranged for reciprocal movement between two circuit-closing positions, electro-thermally responsive means adapted upon de-energization thereof to normally hold said element in one of said positions and when energized to effect movement of said element into the other of said positions, means controlled by said element in said first mentioned position to effect energization of said electro-thermally responsive means, and means controlled by said element in said second mentioned position to effect deenergization of said electro-thermally responsive means and to also thereby effect a predetermined operation of said switching means.

10. In a motor control system, in combination, a reversible electric motor, a pair of electromagnetically operable control switches to effect operation of said motor in forward and reverse directions selectively, a control relay adapted to render said switches effective alternately upon successive operations of the former, an electro-thermally responsive device comprising a pair of spaced stationary contacts, a contact element arranged for reciprocal movement therebetween, electro-thermally responsive means normally biasing said element into engagement with one of said stationary contacts, means for rendering said element responsive to a thermal action of said former means to effect engagement of said element with the other of said stationary contacts, means controlled by said element and operable upon engagement of the same with said first mentioned contact for effecting said thermal action, and means operative upon engagement of said element with said second mentioned contact for effecting operation of said control relay and for simultaneously interrupting said thermal action.

11. In a motor control system, in combination, a reversible electric motor, a pair of electromagnetically operable control switches to effect operation of said motor in forward and reverse directions selectively, a control relay adapted to render said switches effective alternately upon successive operations thereof, an electro-thermally responsive device comprising a pair of spaced stationary contacts, a pivoted contact element located therebetween, a taut wire engaging said element to normally hold the same in engagement with one of said stationary contacts, a spring biasing said element toward the other of said stationary contacts, said wire having an insulating covering and a helical wire coil wound externally of said covering, said coil being adapted to heat said wire to effect lengthening of the

latter whereby engagement of said element with said second mentioned contact is effected, means including an electro-responsive relay operable upon engagement of said element with said first mentioned contact to effect energization of said heating coil, means including another electro-responsive relay operative upon engagement of said element with said second mentioned contact for effecting operation of said control relay and de-energization of said heating coil, and associated means operable automatically for interrupting the circuits initiated by said electro-thermally responsive device.

12. In a motor control system, in combination, a reversible electric motor for driving the cylinder of a washing machine or the like, a pair of electromagnetically operable control switches to effect operation of said motor in forward and reverse directions selectively, a control relay for said switches comprising a stationary magnetic core surrounded by an energizing coil, a pair of pivoted armature members arranged to cooperate with the opposite ends of said magnetic core, a latch pivoted at the free end of each of said armature members and biased by a spring into cooperative engagement with a stationary latch pin, a contact finger carried by each of said armature members and adapted upon engagement thereof with an associated stationary contact to render one of said control switches effective, said contact fingers and said contacts being separated during energization of said coil, the arrangement of said latches and said latch pins being such that upon successive deenergizations of said coil the armature members are released alternately to effect engagement with their associated contacts, an electro-thermally responsive device comprising a pair of spaced stationary contacts, a contact element pivotally mounted between said contacts, a compression spring located on one side of said element and a taut wire engaging the same on the other side to normally hold the same in engagement with one of said stationary contacts, said wire having a covering of asbestos with a heating coil wound externally of the latter, said coil being adapted to heat said wire to effect gradual lengthening of the same whereby movement of said element by said spring into engagement with the other of said stationary contacts is effected, a pair of electromagnetically operable relays, one of which is responsive to a circuit through said element and said first mentioned stationary contact to effect energization of said heating coil, the other of which is responsive to a circuit through said element and said second mentioned stationary contact to effect operation of said control relay and to interrupt the circuit of said heating coil, a second electro-thermally responsive device comprising a stationary contact, a pivoted contact element, a compression spring engaging the latter on one side and a taut resistance wire engaging the same on the other side to normally hold said element out of engagement with said stationary contact, said resistance wire forming part of the energizing circuit of the coil of said control relay, the same being adapted to heat relatively quickly upon energization of the latter to effect rapid lengthening thereof whereby engagement of said element with said stationary contact under the action of said spring is effected and whereby interruption of the energizing circuits of said electromagnetic relays is effected to deenergize said control relay.

13. The combination with a washing machine of the rotary cylinder type, of an electric motor for driving the same, a pair of electromagnetically operable reversing switches, said switches being adapted to be energized selectively to effect operation of said motor in reverse directions respectively, an electromagnetically operable relay for effecting energization of said reversing switches, said relay having two sets of normally closed contacts, one set for each of said reversing switches, said contacts being adapted to open upon energization of said relay, latching means associated with each of said sets of contacts and tending to hold the latter in open position upon deenergization of said relay, interengageable tripping means associated with the respective latching means whereby the latter are alternately rendered ineffective for holding their associated sets of contacts in open position, means for effecting energization and deenergization of said relay at predetermined intervals of time, said last mentioned means comprising a pair of spaced stationary contacts, a contact element pivotally mounted between said contacts, spring means associated with said element to bias the same toward one of said contacts, a taut wire associated with said element and arranged to normally hold the same in engagement with the other of said contacts against the bias of said spring means, electrical heating means associated with said wire to provide for lengthening of the latter whereby said element is moved by said spring into engagement with said first mentioned contact, means controlled by said element when engaged with said second mentioned contact and operable to effect energization of said heating means, means controlled by said element when engaged with said first mentioned contact and operable to effect energization of said electromagnetically operable relay and to simultaneously effect deenergization of said heating means, the aforementioned means for energizing and deenergizing said relay including a stationary contact, a pivotally mounted contact element, spring means associated with said element and tending to move the same into engagement with said contact whereby deenergization of said electromagnetically operable relay is effected, and a taut wire associated with said last mentioned element and arranged to normally hold the same out of engagement with said contact, said wire being adapted to be heated electrically upon energization of said electromagnetically operable relay whereby said wire is lengthened to provide for engagement of said last mentioned element with its associated contact.

14. In a motor control system, in combination, a reversible electric motor for driving the cylinder of a washing machine or the like, a pair of electromagnetically operable control switches to effect operation of said motor in forward and reverse directions respectively, a control relay for said switches comprising a stationary magnetic core surrounded by an energizing coil, a pair of pivoted armature members arranged to cooperate with the opposite ends of said magnetic core, a latch pivoted at the free end of each of said armature members and biased by a spring into cooperative engagement with a stationary latch pin, a contact finger carried by each of said armature members and adapted upon engagement thereof with an associated stationary contact to render one of said control switches effective, said contact fingers and said

contacts being separated during energization of said coil, the arrangement of said latches and said latch pins being such that upon successive deenergizations of said coil the armature members are released alternately to effect engagement with their associated contacts, an electrothermally responsive device comprising a pair of spaced stationary contacts, a contact element pivotally mounted between said contacts, a compression spring located on one side of said element and a taut wire engaging the same on the other side to normally hold the same in engagement with one of said stationary contacts, said wire having a covering of fibrous insulating material with a heating coil wound externally of the latter, said coil being adapted to heat said wire to effect gradual lengthening of the same whereby movement of said element by said spring into engagement with the other of said stationary contacts is effected, a pair of electromagnetically operable relays, one of which is responsive to a circuit through said element and said first mentioned stationary contact to effect energization of said heating coil, the other of which is responsive to a circuit through said element and said second mentioned stationary contact to effect operation of said control relay and to interrupt the circuit of said heating coil.

15. The combination with a reversible electric motor, of a rotary device connected therewith to be driven thereby, a pair of electromagnetically operable reversing switches, said switches being adapted to be energized alternately to effect operation of said motor in reverse directions respectively, an electromagnetically operable relay for effecting energization of said reversing

switches, said relay having two sets of normally closed contacts, one set for each of said reversing switches, said contacts being adapted to open upon energization of said relay, latching means associated with each of said sets of contacts and tending to hold the latter in open position upon deenergization of said relay, interengageable tripping means associated with the respective latching means whereby the latter are alternately rendered ineffective for holding their associated sets of contacts in open position, means for effecting energization and deenergization of said relay at predetermined intervals of time, said last mentioned means comprising a pair of spaced stationary contacts, a contact element pivotally mounted between said contacts, spring means associated with said element to bias the same toward one of said contacts, a thermally responsive member associated with said element and arranged to normally hold the latter in engagement with the other of said contacts against the bias of said spring means, electrical heating means associated with said thermally responsive member to provide for operation of the latter whereby said element is moved by said spring means into engagement with said first mentioned contact, means controlled by said element when engaged with said second mentioned contact and operable to effect energization of said heating means, and means controlled by said element when engaged with said first mentioned contact and operable to effect energization of said electromagnetically operable relay and to simultaneously effect deenergization of said heating means.

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