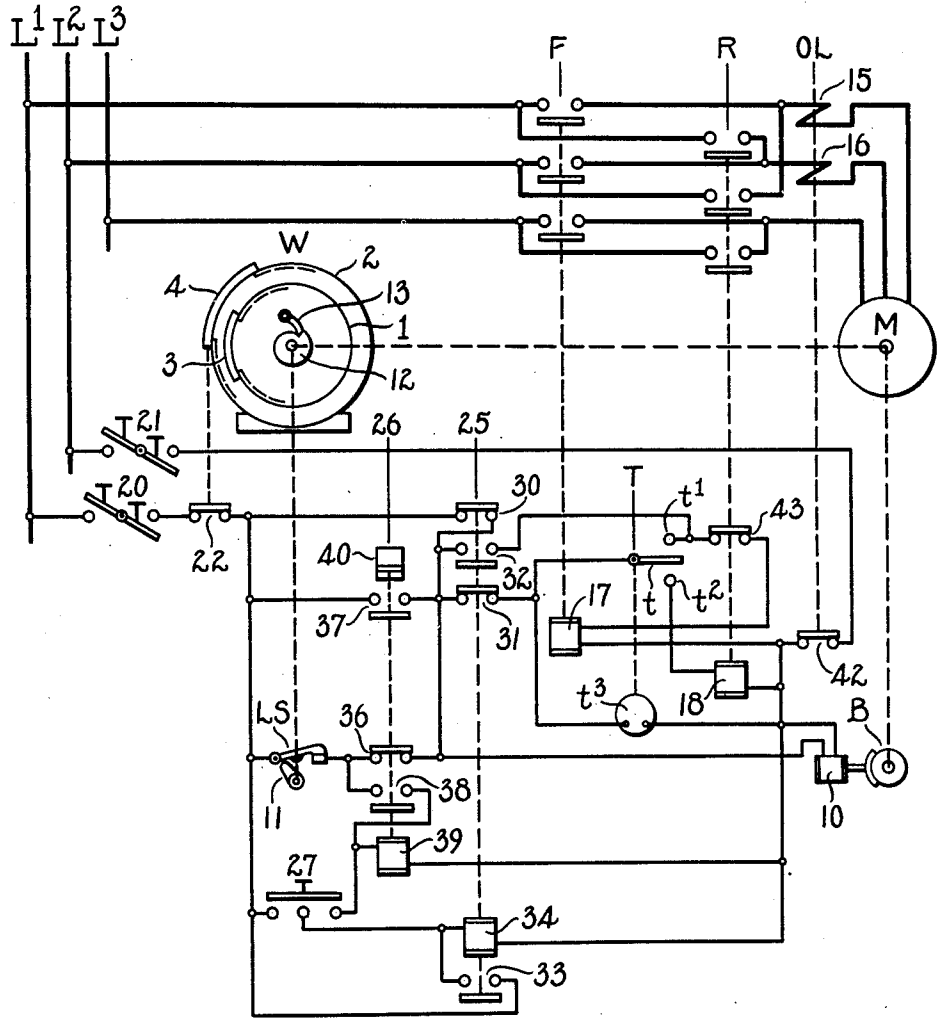
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CONTROLLER FOR ELECTRIC MOTORS

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CONTROLLER FOR ELECTRIC MOTORS

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8 Claims. (Cl. 318—265)

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This invention relates to controllers for electric motors, controllers embodying the invention being especially advantageous for motor driven washing machines although not limited to such application.

This application is a continuation of our application Serial No. 669,776, filed May 15, 1946.

In the case of a washing machine comprising a rotary cylinder and an enclosing shell each provided with a door it is important for time saving to provide for stopping with the doors in a close registering relation. Otherwise inching is required to bring the doors into registration, and the present invention has among its objects to provide improved control means of the so-called automatic door spotting type which will effect close registering relation of the doors when the cylinder comes to rest, regardless of the rotary position of the cylinder when stopping is initiated.

Another object is to provide control for the aforementioned and other applications which will be accurate, reliable, expeditious and simple.

Another object is to provide control of the aforementioned type which in the case of motor driven machines subjected to reverse operations will provide for operation always in a given direction for door spotting, thereby to afford greater accuracy.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawing illustrates diagrammatically one embodiment of the invention which will now be described, it being understood that the embodiment illustrated is susceptible of various modifications without departing from the scope of the appended claims.

Referring to the drawing, the same depicts a washing machine application of the control, the drawing illustrating diagrammatically a washing machine W to be driven by a polyphase alternating current motor M. The machine W is shown as comprising a cylinder 1 to be oscillated within a shell 2, the cylinder 1 having a door 3, and the shell having a door 4. The connection of the cylinder 1 to motor M is indicated by a broken line, and as will later appear oscillation of the cylinder is accomplished by reverse operations of motor M. As is customary, the motor M is provided with an electromagnetically controlled brake B, the connection of the brake to the motor being indicated by a broken line. The brake B preferably is of the well known type which sets automatically and which is releasable by an electromagnet 10.

For a purpose hereinafter set forth the cylinder

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1 of machine W has mechanically connected thereto as indicated by a broken line a limit switch LS. The switch is operable by a cam 11 driven by the cylinder 1 to momentarily disengage its contacts on each revolution of the cylinder and in a given rotary position of the cylinder. Preferably the switch LS is of a well known design for intermittent opening only when the machine operates in forward direction, which may be assumed to be in clockwise direction. For illustration the cam 11 is shown as coupled to a single tooth ratchet wheel 12 engageable by a pawl 13 on the cyclinder 1, the arrangement being such as to effect drive of cam 11 by the cylinder only when the latter rotates clockwise and only after the cylinder and cam have assumed a given relationship. Thus it will be understood that switch LS is to be closed throughout counterclockwise rotation of cylinder 1.

The motor M is adapted to be connected to supply lines L^1, L^2 and L^3 for reverse operations selectively by suitable switches F and R, shown as triple pole electromagnetic switches. The reversing connections controlled by switches F and R are of a well known type and hence require no description, said connections including in series with two terminals of the motor respectively windings 15 and 16 of an overload relay OL.

The operating windings 17 and 18 of switches F and R, respectively, are shown as being under the control of a suitable timer T comprising a contactor t movable alternately into engagement with contacts t^1 and t^2 by electromagnetic operating means t^3. This timer which may be of any one of the well known types tends by engagement of contacts t and t^1 to energize winding 17 of switch F and alternatively by engagement of contacts t and t^2 tends to effect energization of winding 18 of switch R.

In accordance with common practice in washing machine control the controller illustrated comprises two push button switches 20 and 21 included in control connections to lines L^1 and L^2, respectively. Also a door switch 22 is included in the control connections to line L^1, this switch being operatively connected, as indicated by a broken line, to the door 4 of machine W, to be closed when and only when door 4 is closed.

The means for accomplishing stopping and door spotting comprises in addition to the limit switch LS aforementioned electromagnetic relays 25 and 26, energizable by push button stopping or spotting switch 27. As will later be explained in greater detail, depression of the push button switch 27 energizes both relays, relay 25 estab-

lishing for itself a maintaining circuit independent of push button switch 27, and relay 26 establishing for itself independent of switch 27 a maintaining circuit through limit switch LS. Response of relays 25 and 26 effects energization of switch F independently of the timer T, and also effects continued energization of the releasing magnet 10 of brake B until the limit switch LS is twice opened, its first opening being only effective to deenergize relay 26. The limit switch LS after opening then recloses and during the momentary opening thereof certain of the contacts of relay 26 due to retarded opening maintain the switch F and the brake magnet 10 energized until the limit switch LS against opens. Then the switch F is deenergized to disconnect the motor from circuit, whereas at the same time the brake magnet 10 is deenergized to permit the brake B to set to bring the motor and machine W to rest. When the switch R is energized at the time relays 25 and 26 respond said relays first deenergize switch R and then energize switch F. It will thus be seen that as switch LS must open twice for stopping and opens only when the cylinder 1 is operating under control of switch F and is in a given rotary position accurate automatic stopping with the doors 3 and 4 of machine W in a close registering relation may be reliably effected regardless of the rotary position of cylinder 1 when the stop switch 27 is pressed. Also inasmuch as the relay 25 upon responding opens contacts which must be reclosed prior to restarting, automatic restarting will be blocked by the self-maintaining relay 25. On the other hand, relay 25 may be deenergized preparatory to restarting by opening of the door 4 and consequent opening of door switch 22, or by opening either or both of push button switches 20 and 21.

Considering in further detail the means disclosed, the relay 25 comprises two sets of normally engaged contacts 30 and 31, and two sets of normally disengaged contacts 32 and 33, and an operating winding 34. The relay 26 comprises normally engaged contacts 36, two sets of normally disengaged contacts 37 and 38, and an operating winding 39. The contacts 37 of relay 26 have associated therewith a timing device such as a dashpot 40 which has no effect on said contacts in closing upon response of said relay, but which effects delayed opening of said contacts upon deenergization of said relay. The time element thus provided for contacts 37 is preferably just enough to cover reliably the period required for opening and reclosing of the limit switch LS.

Upon closure of the door switch 22 and closure of the push button switches 20 and 21 starting is effected, assuming relays 25 and 26 to be deenergized. Circuit is completed from line L^1 through switches 20 and 22, and contacts 30 and 31 of relay 25 to and through the operating means t^3 of timer T, to and through contacts 42 of the overload relay and push button switch 21 to line L^2. This effects operation of the timer and at the same time release of brake B is effected by completion of circuit from contacts 30 of relay 25 to and through brake magnet 10 to line L^2 through contacts 42 of the overload relay and switch 21. Then when the timer contact t engages contact t^1 circuit is completed from contacts 31 of relay 25 to and through said timer contacts and normally closed contacts 43 of switch R to and through the winding 17 of switch F to line L^2 through the overload relay contacts

and switch 21. Alternatively when the timer contact t engages contact t^2 circuit is completed from contacts 31 of relay 25 to and through said timer contacts to and through the winding 18 of switch R to line L^2. With these connections the machine W will be operated pending emergency stopping by the operation of switch 20, 21 or 22 or normal stopping by operation of push button switch 27.

Operation of switch 27 completes circuit from the door switch 22 through the left hand pair of contacts of switch 27 to and through the winding 34 of relay 25 to overload relay contacts 42. Additionally switch 27 completes circuit through its right hand pair of contacts to and through the winding 39 of relay 26 to overload relay contacts 42. Contacts 33 of relay 25 shunt the left hand pair of contacts of switch 27 to render relay 25 self-maintaining, and contacts 38 of relay 26 shunt the right hand pair of contacts of switch 27, establishing a maintaining circuit for winding 39 through limit switch LS. With relay 25 and 26 energized the brake magnet 10 is maintained energized by a connection through contacts 37 of relay 26 to door switch 22, which connection shunts the contacts 30 of relay 25 but the feed for the timer T is interrupted by the contacts 31 of relay 25. Thus switch R, if energized, becomes deenergized, whereas switch F is rendered responsive by a connection from contact t^1 of the timer through contacts 32 of relay 25 and contacts 37 of relay 26 to door switch 22. Such connections for switch F and brake magnet 10 are maintained by the contacts 37 of relay 26 until after contacts 37 upon release of said relay are shunted through the relay contacts 36 and limit switch LS. Thus as aforeindicated switch F and brake magnet 10 remain energized until both are deenergized by opening of limit switch LS after disengagement of contacts 37 of relay 26.

We claim:

1. The combination with a motor driven machine, of control means therefor affording it periodic reversals and comprising an element actuable to direct stopping, and means under the control of said element immediately to restrict said machine to operation in a single and predetermined direction when stopping is directed, means operated intermittently by said machine as parts thereof are repeatedly brought into a given relation, and stopping means under the control of said element to be inactive during normal operation of said machine and to be subject to control by said intermittently operated means when stopping is directed by said element, said stopping means including means always rendering ineffective for any influence on said machine a first coaction of said intermittently operated means and said stopping means but rendering a repeat coaction thereof effective for stopping.

2. The combination with a motor driven machine, of control means therefor affording it periodic reversals and comprising an element actuable to direct stopping and means under the control of said element immediately to restrict said machine to operation in a single and predetermined direction when stopping is directed, means operated intermittently by said machine as parts thereof are repeatedly brought into a given relation, an electromagnetically controlled mechanical brake for said machine controlled by the first mentioned means to free said machine for motor operation, and stopping means to termi-

nate motor operation of said machine and effect application of said brake under control of said intermittently operated means when stopping is directed by said element, said stopping means including means rendering a first coaction between said intermittently operated means and said stopping means of no effect on operation of said machine but effective to adjust said stopping means for stopping action including application of said brake upon repeat coaction of said intermittently operated means and said stopping means.

3. The combination with a motor driven machine, of an element operable thereby as parts thereof are repeatedly brought into a given relation, and means controlling the operation of said machine and comprising stopping means to stop the machine always with its said parts in substantially said given relation, said stopping means comprising electroresponsive relays and means placing said relay under the control of said intermittently operated element when stopping is desired, stopping being dependent upon given conditioning of said relays by said element and said element after operation to effect such given conditioning of one of said relays requiring a repeat operation to effect such given conditioning of another of said relays.

4. The combination with a motor driven machine, of control means therefor affording it periodic reversals and comprising for stopping, a first relay, a second relay and means to effect given positioning of said relays when stopping is desired, said control means when so positioning said relays restricting said machine to operation in a single and predetermined direction until stopped, and means operable by said machine in cycles and effective at a predetermined point in one cycle to effect change in position of said first relay and at the some point in the next cycle to effect dependently upon the change in position of said first relay change in the position of said second relay for stopping.

5. The combination with a motor driven machine, of an element operable thereby as parts thereof are repeatedly brought into given relation, and means controlling the operation of said machine and comprising stopping means to stop the machine always with its said parts in substantially said given relation, said stopping means comprising relays and energizing means therefor to place them under the control of said intermittently operated element when stopping is desired, stopping being dependent upon deenergization of said relays by said element and said element after operation to deenergize one of said relays requiring a repeat operation to deenergize another of said relays.

6. The combination with a motor driven machine, of a switch operable intermittently by said machine for momentary opening, and control means for said machine comprising for stopping, a first relay, a second relay and means to energize said relays and place them under the control of said intermittently operable switch, said

first relay being deenergizable by the next opening of said switch but having contacts which disengage only after affording said switch time to reclose and which maintain said second relay energized subject to deenergization by repeat operation of said switch.

7. The combination with a motor driven machine, of control means therefor affording it periodic reversals and comprising for stopping, a first relay, a second relay and means to energize said relays when stopping is desired, said control means upon response of said relays restricting said machine to operation in a single and predetermined direction until stopped, and means operable by said machine in cycles and effective at a predetermined point in one cycle to deenergize said first relay and at the same point in the next cycle to deenergize said second relay to effect stopping, said first relay affording said second relay for a transient period after deenergization of the former a maintaining circuit independent of said means operable by said machine.

8. A controller for a motor driven machine comprising in combination a controller to effect power operation of the machine and reversals thereof, an electrically controlled mechanical brake for the machine having control connections controlled by said controller to provide for brake free power operation of the machine in either direction, switch means having connections with said controller such as to restrict operation of the machine to a single and predetermined direction immediately upon a given adjustment of said switch means regardless of the condition and direction of operation of the machine when such adjustment is made, a device having means for operating the same intermittently and switch means normally free from influence by said device but being subjected to control thereby by the former switch means upon said given adjustment thereof, the second mentioned switch means having interconnections with said controller such that given adjustment of the second switch means effects machine stopping with application of said brake as an incident and the second mentioned switch means comprising means necessitating making of said given adjustment of the second mentioned switching means in steps respectively dependent upon and effectable by a first operation and a repeat operation of said intermittently operable device prior to exercise of any slow down action by the second mentioned switching means.

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