Oct. 27, 1925. 1,559,110

G. LEDDICK

MOTOR CONTROLLER

Filed April 25, 1921 2 Sheets-Sheet 1

Fig. 1.

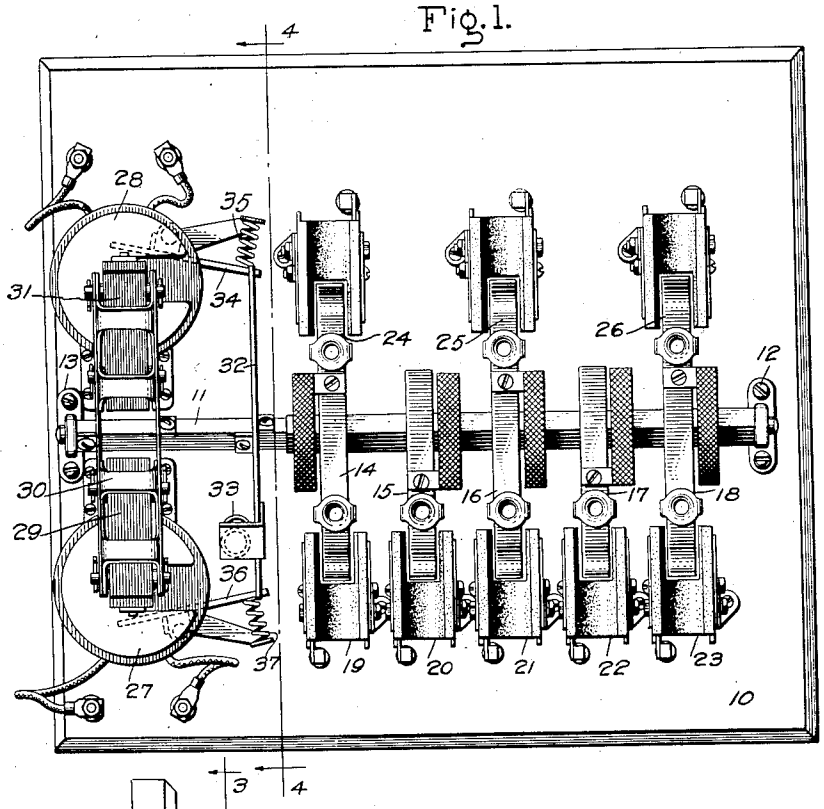


Fig. 2.

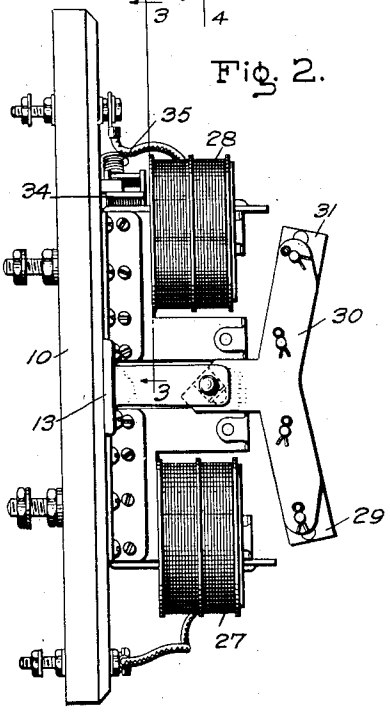
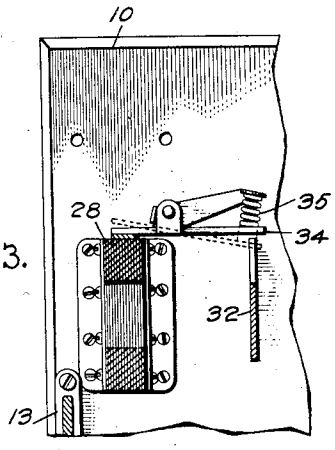


Fig. 3.



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Filed April 25, 1921 2 Sheets-Sheet 2

Fig. 4.

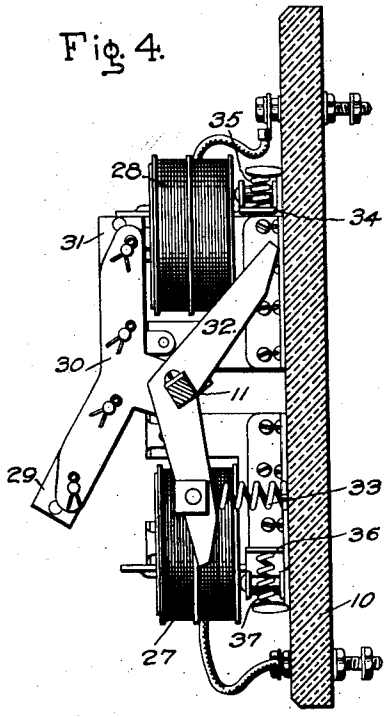


Fig. 5.

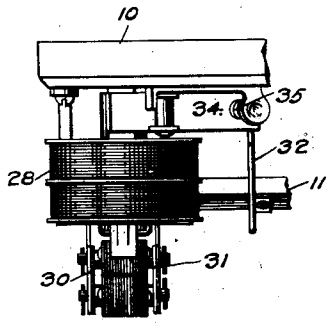
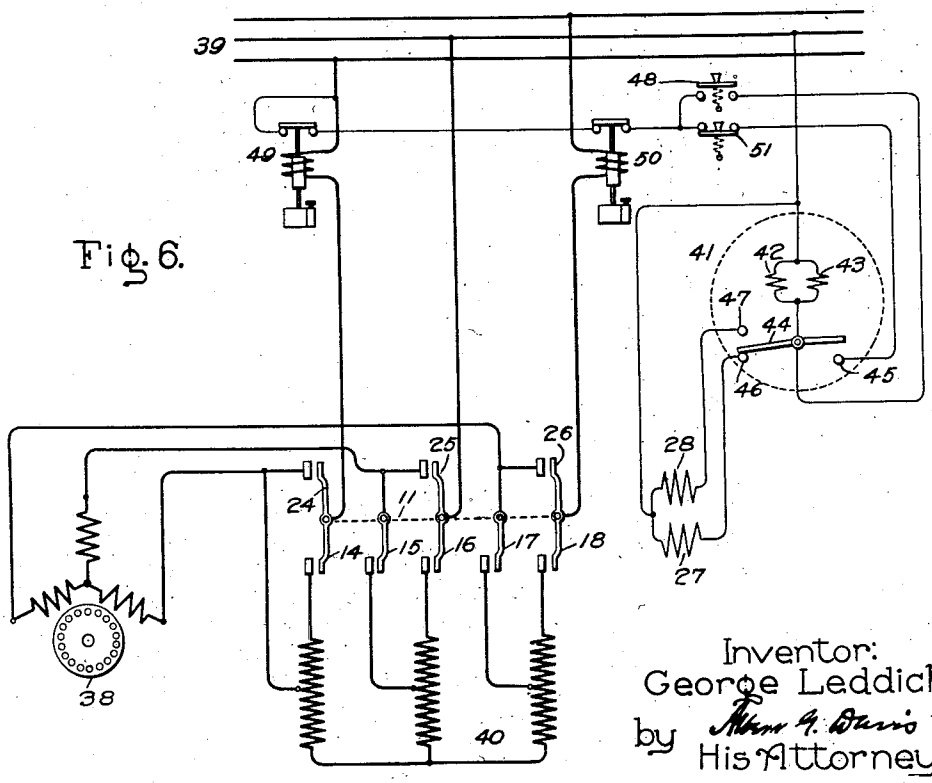


Fig. 6.



Inventor:
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Patented Oct. 27, 1925. 1,559,110

UNITED STATES PATENT OFFICE.

GEORGE LEDDICK, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MOTOR CONTROLLER.

Application filed April 25, 1921. Serial No. 464,094.

To all whom it may concern:

Be it known that I, GEORGE LEDDICK, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Motor Controllers, of which the following is a specification.

My invention relates to an improved motor controller, and it is particularly adapted for use with alternating current motors of the squirrel cage rotor type which are controlled by connecting them to a source of low voltage for starting and then increasing the impressed voltage for running, but my invention is not limited to this particular type of motor.

One of the objects of the invention is to provide an improved electromagnetically operated motor controller by means of which motors may be controlled from a distance either manually or in response to the operation of another device.

Another object of the invention is to provide an improved motor controller having a switch member biased to a neutral position and two electromagnets for operating the switch member, one electromagnet for operating the switch member to the starting position and the other electromagnet for operating the switch member to the running position, the arrangement being such that the switch member is prevented from being thrown from either the neutral position or from one operative position to another operative position in case the electromagnet for throwing the switch member to that position is deenergized.

Electromagnetic motor controllers have heretofore been provided in which two electromagnets operate on the same switch member for establishing either the starting or the running connections of the motor, depending upon which electromagnet is energized, but these prior arrangements have all involved the use of complicated interlocking mechanism for biasing the switch member to the neutral position and for preventing the switch member being thrown to the running position until after it has been thrown to the starting position. My invention provides a simple but nevertheless effective arrangement for biasing the switch member to the neutral position and for preventing the switch from being thrown from the neutral position to either operative position or from either operative position to the other operative position in case the electromagnet for throwing the switch to that position is deenergized.

In carrying my invention into effect in one form, I provide an electromagnetic latch associated with each electromagnet for preventing the switch member being thrown to an operative position in case the electromagnet for throwing the switch to that position is deenergized.

Furthermore, my invention relates to features of construction and arrangement which will be explained fully hereinafter, and the scope of the invention is set forth in the appended claims. For a better understanding of the invention, reference is had to the accompanying drawings, in which Fig. 1 is a plan view of my improved electromagnetic motor controller; Fig. 2 is an end view of the same with the switch mechanism in the neutral position; Fig. 3 is a cross-sectional view of Fig. 2 along the section line 3—3 when the upper or running electromagnet is energized; Fig. 4 is a cross-sectional view of Fig. 1 looking in the direction of the arrows with the upper electromagnet energized; Fig. 5 is a top detail view showing the pivoted electromagnetic latch associated with the upper electromagnet of the switch; and Fig. 6 is a very simplified motor control diagram for the purpose of explaining the operation of my invention.

Referring to the drawings, the various parts of the motor controller or electromagnetic switching arrangement are mounted upon an insulating base 10. The switch member or shaft 11 is journaled at each of its ends in the supports 12 and 13 mounted on the base 10. This shaft carries two sets of circuit making contacts. The lower set comprises the contacts 14, 15, 16, 17 and 18 which are insulated from the shaft 11 and are adapted to make engagement with stationary contacts suitably disposed in the arc chutes 19 to 23 respectively. The upper or running set of contact fingers 24, 25 and 26 are also insulated from the shaft 11 and are adapted to make engagement with corresponding stationary contacts disposed within the refractory arc

chutes shown. The arrangement of the sets of contacts is such that when one set is closed the other is opened, and vice versa.

Two electromagnets are provided for operating the switch shaft. The electromagnet 27 is provided for operating the shaft so as to close the circuits through the contacts 14 to 18 inclusive and thereby establish the starting connections of the motor, and the electromagnet 28 is provided for operating the switch shaft so as to open the starting connections and close the running connections through the switch contacts 24, 25, and 26. The electromagnet 27 is provided with an armature 29 which is cradled in a supporting member 30 secured to the shaft 11, and the electromagnet 28 is provided with an armature 31 which is also cradled in the support 30 for the armature.

In order to insure that the switch member or shaft 11 shall be biased to the neutral position, that in which neither of the sets of circuit making contacts is in the closed position, the bell crank 32 is mounted on the shaft 11, and this bell crank is biased to a position by means of the spring 33 at which the shaft 11 is in the desired neutral position when the electromagnets are deenergized.

In order to insure that the shaft 11 will not be operated to either operative position in case the electromagnet for moving the shaft to that position is deenergized, I have provided the improved electromagnetically controlled latching arrangement which I shall now describe. Associated with the upper electromagnet 28 is a pivoted armature or latch 34 which is biased to the unattracted position by means of the spring 35. The one end of this magnetic latch is normally disposed so as to be in the path of the upper arm of the bell crank 32 when the electromagnet 28 is deenergized, but when the electromagnet is energized, the latch is magnetically attracted to the position shown in Fig. 3 against the bias of the spring 35 out of engagement with the upper arm of the bell crank lever 32. This will permit the electromagnet 28 to operate the shaft 11 and thereby establish the running connections of the motor.

Associated with the lower or starting electromagnet is provided a similar electromagnetic latching arrangement which cooperates with the lower arm of the bell crank lever 32. This latching arrangement comprises the magnetic latch 36 which is biased to an unattracted position by means of the spring 37, and the arrangement is such that in case the electromagnet 27 is deenergized, the magnetic latch 36 will prevent the shaft 11 being thrown to close the circuit through the lower or starting set of switch contacts, but when the magnet 27 is energized, the latch 36 is withdrawn out of the path of the lower arm of the bell crank lever 32, and the starting connections of the motor can be established.

Referring to Fig. 6 it will be seen that I have illustrated my invention in connection with a time element automatic control for the induction motor 38 of the squirrel cage rotor type. The lower set of contacts 14, 15, 16, 17 and 18 mounted on the switch shaft 11 are adapted to connect the motor to the source of supply 39 through the reduced voltage taps of the starting compensator or auto-transformer 40. A time element relay designated by the numeral 41 is provided for controlling the electromagnets 27 and 28 which operate the switch member shaft 11. This time element relay is shown in very simplified diagram for the purpose of explaining one of the uses of my invention. The relay is provided with two windings 42 and 43, and these windings control a resilient switch member 44, the arrangement being such that when the windings are energized, the right hand end of the switch member 44 is depressed into engagement with the stationary contact 45, and after a predetermined interval of time the left hand end of the switch member 44 is permitted to break engagement with the stationary contact 46 and make engagement with the stationary contact 47, the circuit through the stationary contact 45 being maintained as long as the windings 42 and 43 are energized.

As thus constructed and arranged and with the parts in the various positions shown in Figs. 1, 2 and 6, the operation of my invention is as follows:—In order to start the motor 38, the normally open start push button 48 is depressed into engagement with its contacts either manually or in response to any predetermined condition, thereby energizing the windings 42 and 43 of the time element relay and causing the right hand end of the switch member 44 to make engagement with the contact 45. The winding of the electromagnet 27 is thereby energized through a circuit including the contacts of the overload relay 49, the overload relay 50, the start push button 48, the left hand end of the switch member 44, to the middle supply conductor. By reason of the closing of the circuit through the contact 45 through the right hand end of the switch member 44, the windings 42 and 43 of the time element relay and the electromagnet 27 are maintained energized independently of the start push button 48, so that this push button may be now released and the windings will be energized through the normally closed stop push button 51.

When the winding 27 is energized, the magnetic latch 36 is also moved to its attracted position against the bias of the spring 37, and the bell crank lever 32 is

thereby released so that the magnet 27 will operate the shaft 11 to close the circuit for the motor through the lower set of contacts 14 to 18 inclusive. This will connect the motor to the source of supply 39 through the compensator 40 at a reduced potential for starting. After a predetermined interval of time, the time element relay will operate to permit the left hand end of the resilient switch member 44 to break engagement with the contact 46 and to make engagement with the contact 47, thereby deenergizing the starting electromagnet 27 and energizing the running electromagnet 28. The armature 31 of the electromagnet 28 will thereupon be attracted to move the shaft 11 from the starting position through the neutral position to the running position. The magnetic latch 34 will interpose no objection to this movement, for the reason that the magnetic latch 34 is moved magnetically out of the way of the upper arm of the bell crank lever 32. The position of the parts will now be as shown in Figs. 3, 4 and 5, and the set of contacts 24, 25 and 26 will be closed to connect the motor directly to the source of supply 39 at full potential for running.

In order to stop the motor, the push button 51 will be depressed, either manually or in response to any predetermined condition, thereby deenergizing the windings 42 and 43 of the relay and also the running eletromagnet 28. The running connection of the motor will be opened by the action of gravity acting on the starting contacts 14 to 18 inclusive and the armature 29 of the starting electromagnet, and the switch will return to its biased or neutral position. The magnetic latching arrangement associated with the electromagnet 27 will prevent the starting connections of the motor being reestablished by the rebound of the switch shaft 11 because of the fact that the starting eletromagnet is deenergized and the latch 36 will arrest the movement of the bell crank lever 32 and thereby arrest the movement of the switch shaft 11. The running connections for the motor cannot be established either because of the fact that the latching arrangement associated with the electromagnet 28 will prevent the set of running contacts being closed until the running electromagnet is energized. Although I have shown my invention in connection with a time element control for an electric motor, it is to be understood that my invention is not limited thereto nor to the particular type of time element control shown, but is applicable generally to electromagnetic motor controllers having a neutral and two operative positions. Thus, for instance, my invention is equally applicable to either current limit control or to manual control of the electromagnets 27 and 28.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

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

1. The combination in a motor controller of a switch having a neutral position between two operative positions, an electromagnet for throwing the switch to and magnetically holding the same in the first operative position, a second electromagnet for throwing the switch to and magnetically holding the same in the second operative position, biasing means for returning the switch from each operative position to the neutral position upon the deenergization of the corresponding electromagnet, and latching mechanism comprising a pair of cooperating latches controlled by said electromagnets for stopping and holding the switch in the neutral position.

2. The combination in a motor controller of a switch biased to a neutral position between two operative positions, an electromagnet for throwing the switch to and magnetically holding the same in the first operative position, a second electromagnet for throwing the switch to and magnetically holding the same in the second operative position and an electromagnetically controlled latching arrangement comprising a pair of separately operable latches of magnetic material, each magnetically controlled by a corresponding one of said electromagnets and biased upon the deenergization thereof into latching relation with the said switch to prevent movement thereof from the neutral position to the corresponding operative position.

3. The combination in a motor controller of a switch biased to a neutral position and having two operative positions, an electromagnet for throwing the switch to the first operative position, a second electromagnet for throwing the switch to the second operative position, and a latch associated with each of said electromagnets and operated thereby for preventing the said switch being thrown from the neutral position to an operative position in case the electromagnet for throwing the switch to that position is deenergized.

4. The combination in a motor controller of a switch shaft, oppositely disposed sets of circuit making contacts mounted on said shaft, an electromagnet having an armature mounted on said shaft for moving the one set of contacts to an operative position, an electromagnet having an armature

mounted on said shaft for moving the other set of said contacts to another operative position, means for biasing the said shaft to a neutral position, and an electro-magnetically controlled latching arrangement comprising a pair of separately operable latches of magnetic material, each magnetically controlled by a corresponding one of said electromagnets and biased upon the deenergization thereof into latching relation with the said switch shaft to prevent movement thereof from the neutral position to the corresponding operative position.

5. The combination in a motor controller of a switch shaft, oppositely disposed sets of circuit making contacts mounted on said shaft, an electromagnet having an armature mounted on said shaft for moving the one set of contacts to an operative position, an electromagnet having an armature mounted on said shaft for moving the other set of said contacts to another operative position, means for biasing the said shaft to a neutral position, a bell crank connected to said shaft, and a pivoted electromagnetic latch associated with each of said electromagnets cooperating with the said bell crank for preventing moving the said shaft to either operative position in case the electromagnet for moving the shaft to that position is deenergized.

In witness whereof I have hereunto set my hand this 22nd day of April, 1921.

GEORGE LEDDICK