A. C. EASTWOOD.

ELECTRIC CONTROLLER.

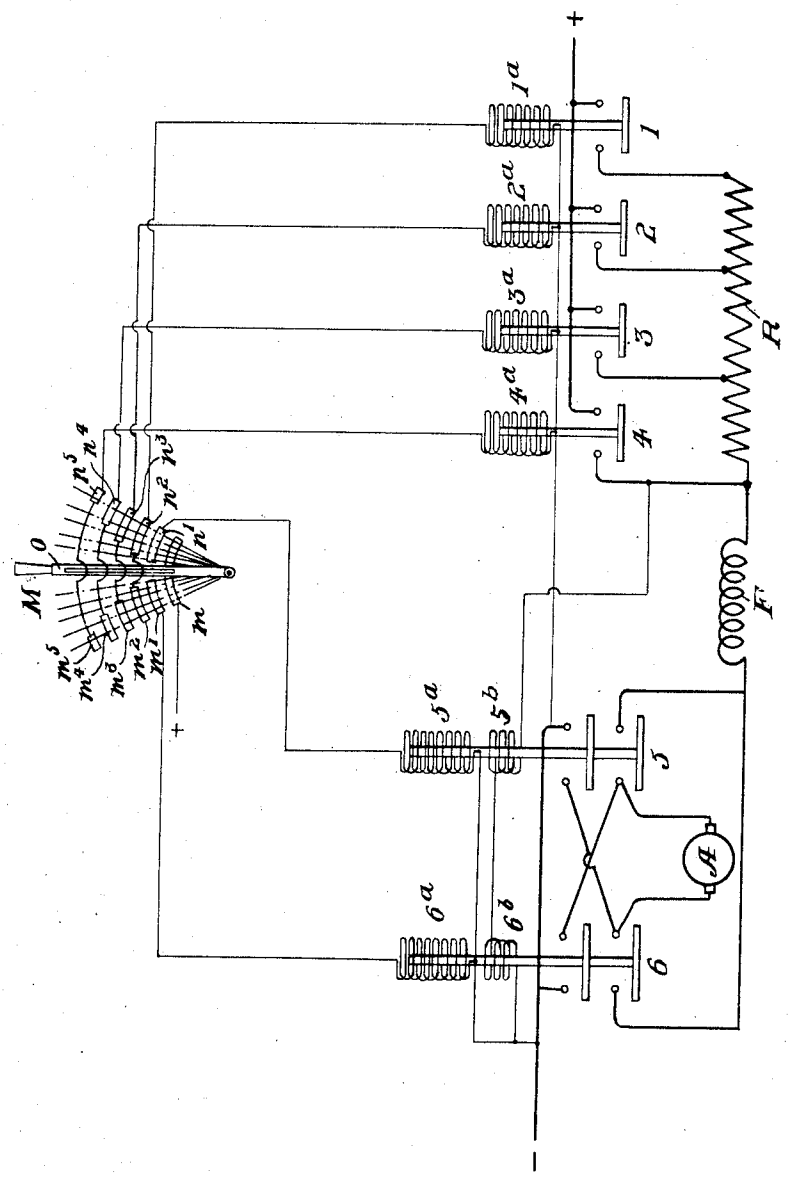
APPLICATION FILED SEPT. 22, 1910.

981,847.

Patented Jan. 17, 1911.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

FIG. 2

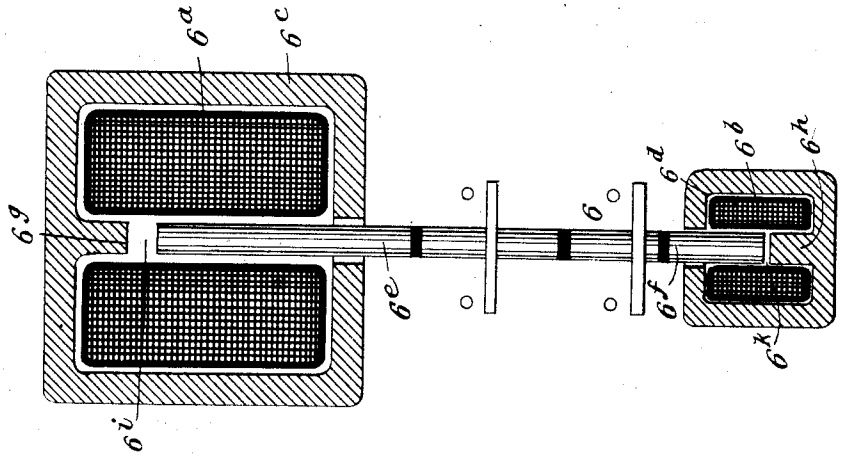
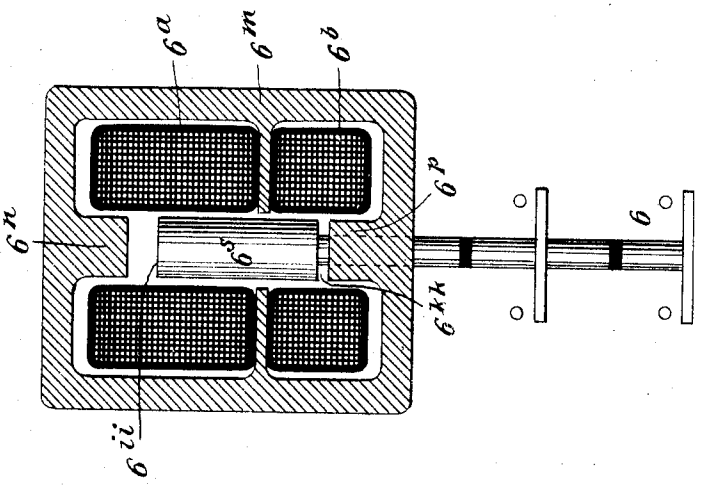


FIG. 3



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UNITED STATES PATENT OFFICE.

ARTHUR C. EASTWOOD, OF CLEVELAND, OHIO, ASSIGNOR TO THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

ELECTRIC CONTROLLER.

981,847. Specification of Letters Patent. Patented Jan. 17, 1911.

Application filed September 22, 1910. Serial No. 583,302.

To all whom it may concern:

Be it known that I, ARTHUR C. EASTWOOD, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented new and useful Improvements in Electric Controllers, of which the following is a specification.

My invention relates to electric motor controllers of that type in which separately actuated magnetic switches are used to make the proper connections for starting the motor, operate it in different directions, and vary its speed. It sometimes occurs in the operation of such controllers that when the master controller is moved to the off position some one of the resistance cutout switches may remain closed due to a heavy arc which has been formed at its contacts which welds them together.

The object of my invention is to provide a controller in which it will be impossible to operate the main switch or reverser in case any of the resistance cutout switches is closed. This may be accomplished in a number of ways, one of which is shown diagrammatically in Figure 1 of the accompanying drawings. Figs. 2 and 3 are sections of two forms of reversing switch which may be employed.

On the drawings 1, 2, 3, and 4 are resistance switches; and 5 and 6, reversing switches arranged to control a motor having the armature A and the series field F. A master switch is shown at M, which is provided with five steps for operating the motor in either direction. The operating coils on the reversing switches are shown at 5^a and 6^a, which when energized close their respective switches. At 5^b and 6^b are shown locking-out coils, which when energized prevent the operating coils 5^a and 6^a from closing their respective switches; but after the switch is closed, do not cause it to open. The operating coils 5^a and 6^a receive current from their respective contacts on the master controller, and are connected directly to the negative main. The coils 5^b and 6^b are connected in series, and receive current from the left hand end of the starting resistance R, the circuit being completed through the said coils to the negative main.

If all of the switches are open, as shown in the drawing, and the master switch is moved to the first position on either side of the center, the respective operating coil of the reverser will obviously be energized. Current now flows from the positive at the master switch through the coil 5^a or 6^a to the negative, and the reversing switch whose coil is energized closes, there being no current in the coils 5^b or 6^b to prevent this action. Further movement of the master controller to the next four steps energizes successively the coils 1^a, 2^a, 3^a, and 4^a, which close their respective switches, first connecting the motor across the line with all the resistance R in series, and then gradually short-circuiting the various sections until when the switch 4 has closed, the motor will be connected directly across the supply mains, the circuits being plainly evident from the drawing. If the master switch is now moved to the off-position, which is that shown on the drawing, all the switches 1 to 4 should open; but if for any reason one of the resistance switches 1 to 4 should remain closed, a circuit will exist from the positive through this switch, and the locking-out coils 5^b and 6^b to the negative, energizing both of the said coils. If now the master switch is moved to the first position on either side of the center, the operating coil of the corresponding reversing switch 5 or 6 becomes energized; but it cannot operate the reverser, due to the fact that its locking out coil prevents its operation. It will also be noticed that if all the switches are open and the reverser is operated in the normal manner, a circuit will be established through the coils 5^b and 6^b as soon as the first resistance switch 1 has closed. As before noted, this will not cause the reversing switch which has been operated to open, but since both locking-out coils are now energized, it will prevent the other reversing switch from operating until all of the resistance switches 1 to 4 have opened. This provides an interlock for preventing one reversing switch from operating while the other is closed.

It is seen that the electrical interlock is received without the use of auxiliary contacts.

The switches 5 and 6 and their operating and locking devices may be constructed and arranged in various ways. I have shown but two ways in Figs. 2 and 3. In Fig. 2, the coils 6^a and 6^b have separate magnetic circuits through their frames 6^c and 6^d, their plungers 6^e and 6^f, and the lugs 6^g and 6^h

projecting from one end of the frames into their coils. When the switch 6 is open, the air gap 6^i in the coil 6^a is open or large while the air gap 6^k in the coil 6^b is closed or small. The excitation of the coil 6^a without the excitation of the coil 6^b will cause the switch 6 to close its contacts, which are carried by the plungers 6^e and 6^f and insulated therefrom. The subsequent excitation of the coil 6^b cannot open the switch 6 because the air gap 6^i is now closed or small while the air gap 6^k is open or large. The switch 5 is constructed and operated the same as the switch 6. In case the master switch M is opened and one of the resistance switches 1 to 4 remains closed, the switch 5 or 6 would open, causing the air gaps of the coils 5^b and 6^b to be smaller than those of the coils 5^a and 6^a, and it would obviously be impossible to close the switch 5 or 6 by any operation of the master switch.

In Fig. 3, the movable switch contacts are connected to a single plunger 6^s which is reciprocable with the coils 6^a and 6^b placed near each other and have their magnetic circuits in the same frame 6^m having the projections 6^n and 6^p extending respectively into the upper end of the coil 6^a and the lower end of the coil 6^b. When the switch 6 is open the air gap 6^{kk} of the coil 6^b is closed or small while the air gap 6^{ii} of the coil 6^a is open or large. When the coil 6^a alone is energized, the plunger 6^s rises and closes the switch 6 and the air gap 6^{ii}, and opens or lengthens the air gap 6^{kk}, rendering it impossible for a subsequent energization of the coil 6^b to open the switch 6. If the switch 6 is opened and one of the resistance switches fails to open, the subsequent energization of the coil 6^a, could not close the switch because the air gap 6^{kk} is smaller than the air gap 6^{ii}. The switch 5 may be constructed in a similar manner.

I claim—

1. In a system of motor control, a magnetically controlled main switch or reverser for connecting the motor to one side of a source of current supply, a resistance, and a series of resistance controlling switches for connecting the motor to the other side of the source of supply through varying portions of said resistance, electro-magnetically operated locking-out mechanism associated with said main switch or reverser adapted, when energized, to prevent the operation of said main switch or reverser, the energizing winding of said locking-out mechanism being so connected as to be energized when one or more of said resistance controlling switches is closed.

2. In a system of motor control, a magnetically operated main switch or reverser for connecting a motor to one side of a source of current supply, electro-magnetically operated locking-out mechanism associated with said main switch or reverser, one end of the winding of said locking-out winding being connected to the side of the source of current supply controlled by the said main switch or reverser, a resistance, and a series of switches for connecting the motor to the other side of the said source of current through varying portions of the said resistance, the other end of the winding of the said locking-out mechanism being connected to said resistance so that, when any of the said resistance controlling switches is closed, the said winding will be energized.

3. In a system of motor control, a set of resistance sections in circuit therewith, a main switch whose contacts are in the said circuit, a second switch for connecting the said circuit to the opposite side of a source of current supply to which the motor is connected when the said main switch is closed, an operating coil for the said main switch, and a locking-out coil for the said switch which prevents the operation of the said switch when the said second switch is closed.

4. In a switch adapted to connect a resistance to one side of a source of current supply, a locking-out coil for preventing the operation of said switch, the said coil being energized when the contacts of a second switch are closed, the said second switch being adapted to connect the said resistance to the other side of said source.

5. In a current varying controller, a circuit, a resistance for controlling the said circuit, a main switch for connecting the said resistance to one side of a source of current supply, one or more resistance switches for connecting the said resistance to the other side of the said source, operating coils for all of the said switches, means for energizing the said coils successively, a locking-out coil on the said main switch which, when energized, prevents said switch from closing, the said locking-out coil being so connected that it will be energized whenever any of the said resistance switches is closed.

6. In a system of motor control, a resistance, a main switch for connecting the said resistance to one side of a source of current supply through the windings of the motor, one or more resistance switches for connecting the resistance to the other side of the said source, an energizing winding for operating the said main switch, a master switch for controlling the said winding, and a locking-out winding on the said main switch for preventing its operation when any of the said resistance switches is closed, one end of said locking-out winding being connected to the said resistance, the other end being connected to the source of supply to which the main switch is connected.

7. In a system of motor control, a re-

verser for connecting the motor to one side of a source of current supply in one direction or the other, a second switch for connecting the motor to the other side of the said source, operating windings for the said reverser, means for energizing them, locking-out windings which when energized prevent either winding from operating the reverser, and means for energizing the said locking-out coils when said second switch is closed.

Signed at Cleveland, Ohio, this 19th day of Sept., 1910.

ARTHUR C. EASTWOOD.

Witnesses:
J. H. HALL,
H. M. DIEMER.