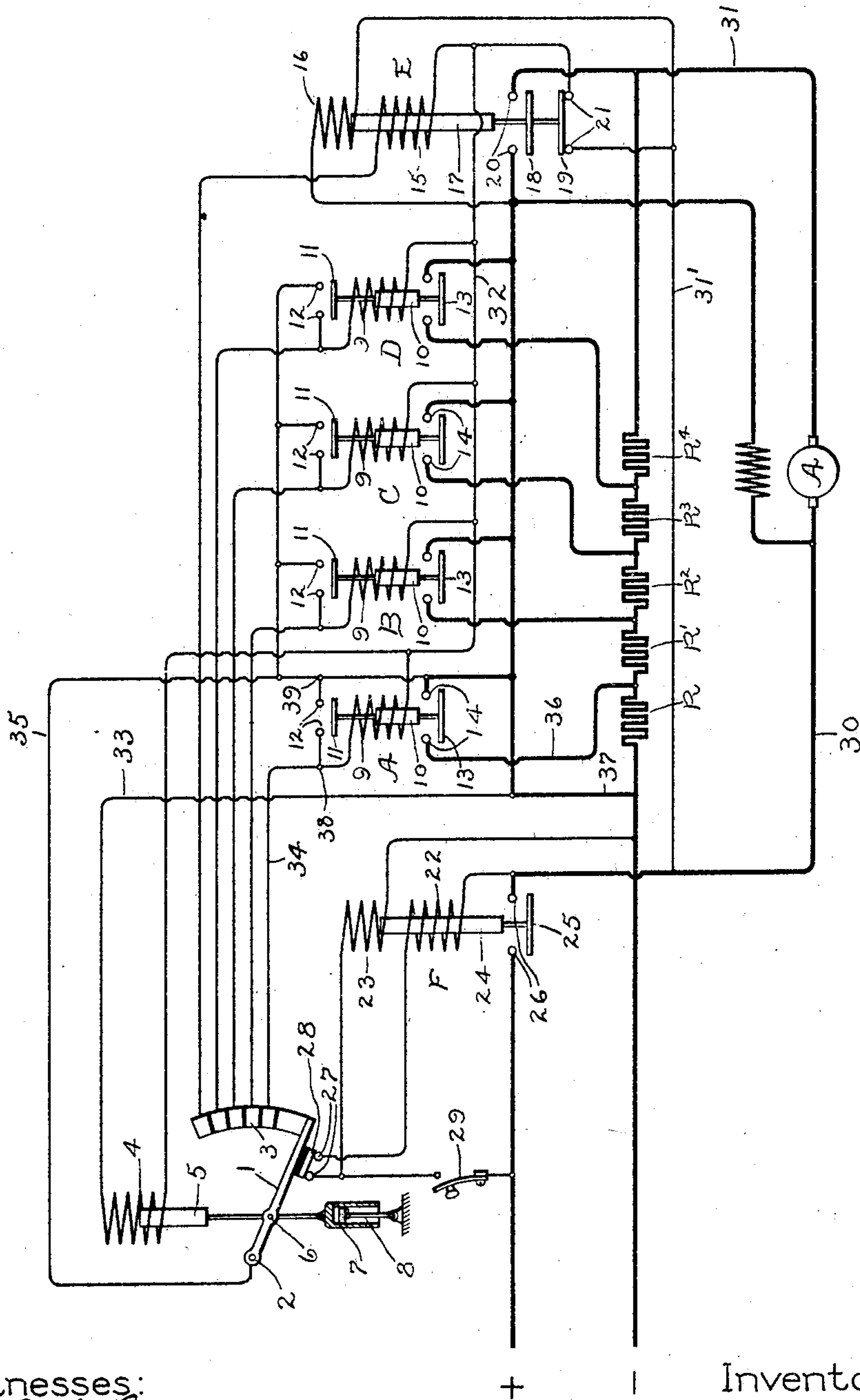


W. O. LUM.
MOTOR STARTING DEVICE.
APPLICATION FILED JULY 18, 1907.

916,343.

Patented Mar. 23, 1909.



Witnesses:

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UNITED STATES PATENT OFFICE.

WALTER O. LUM, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY,
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MOTOR-STARTING DEVICE.

No. 916,343.

Specification of Letters Patent.

Patented March 23, 1909.

Application filed July 18, 1907. Serial No. 384,438.

To all whom it may concern:

Be it known that I, WALTER O. LUM, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Motor-Starting Devices, of which the following is a specification.

This invention relates to devices for controlling electric circuits and has for its object the provision of a device of this character whereby an electric motor may be automatically controlled in a very reliable, safe and efficient manner by the simple closing of a control switch.

In carrying out my invention, I provide in connection with the starting resistance, which is included in the circuit of the motor, a controlling element which has a bias toward the initial or starting position. Upon the closing of the control circuit, the controlling element is moved by means of a solenoid against the bias to cut out the resistance. When the element reaches running position, or the point at which the resistance is all cut out of circuit, the solenoid is deenergized, and the controlling arm returns in response to its bias to the starting position. The controlling arm has in the meantime, been short-circuited so that it does not affect the resistance. With the larger type of motors, I preferably use electromagnetic switches for cutting out the resistance, and control the switches by means of the controlling element.

In order to insure that the controlling arm will always be in the starting position when the armature circuit is closed, I arrange an electromagnetic switch for closing the armature circuit, which switch also controls the circuit of the operating solenoid. This switch cannot be energized until the controlling arm is in the off position. The electromagnetic switches are so arranged and connected that when they are energized and operated to cut out the resistance, they short-circuit the controlling arm and remain closed, independent of said arm. In this way the circuit is not broken at the controlling element. When the controlling element has been moved so as to energize all of the switches and cut out the resistance, the connections are such that the last switch will deenergize all of the former ones.

In the accompanying drawing, in which I have shown my invention embodied, for pur-

poses of illustration, in a concrete form, 1 is the controlling element of the master controller pivoted at 2 and operated so that its free end engages the contacts 3 to vary the resistance of the circuit of armature A. This controlling element is operated by means of a solenoid 4 acting upon a core 5, to which the arm is pivoted at 6. A dash-pot 7, the barrel of which is pivoted to the core, and the plunger 8 pivoted to a fixed support is arranged so as to retard the core and hence the arm 1 in its upward movement, but will allow the parts to drop freely.

I have shown my invention adapted for a relatively large type of motor in which it is preferable to have the resistance switches operated electromagnetically, the circuit of these switches being controlled by the controlling arm 1. These switches A, B, C, and D are all identical in construction, and each consists of a solenoid 9 operating a core 10, to the upper end of which is secured a bridging contact 11, adapted to bridge contacts 12, and at their lower end a similar bridging contact 13, bridging the contacts 14. Another electromagnetic switch E has a solenoid provided with an actuating coil 15 and a holding coil 16, while the core 17 has two contactors, 18 and 19, cooperating respectively with contacts 20 and 21. Another electromagnetic switch F, also provided with a lifting coil 22 and holding coil 23, has its core 24 provided with a bridging contactor 25 adapted to engage contacts 26. The circuit of the lifting coil 22 is controlled through contacts 27, which are arranged to be bridged by contactor 28 mounted upon, but insulated from, the controlling arm 1. A manually-operated switch 29 controls the device.

The arrangement of circuits and the mode of operation are as follows:—With the parts in the position shown in the figure, which is the position of rest, when the switch 29 is closed, the holding coil 23, which is connected across the line, and the lifting coil 22, which is energized through the contactor 28 will be energized. This will cause the contacts 26 to be bridged by contactor 25 to close the armature circuit from the + main across contacts 26 through conductor 30, armature A, conductor 31, resistances R^4 , R^3 , R^2 , R^1 and R , back to the — main. At the same time, solenoid 4 will be energized from the + main through conductor 31' across contactor 19,

conductor 32, solenoid 4 and conductor 33 back to the — main. This draws up core 5 and the arm is moved on to the first of contacts 3. When this contact is made, a circuit is completed from conductor 31', conductor 32 through the coil 9, conductor 34, contact 3, arm 1 and conductor 35, back to the — main. This causes contactor 13' to bridge contacts 14 and cut out section R of the resistance, the armature circuit now being through sections R⁴, R³, R², and R¹, thence through conductor 36, contactor 13, conductor 37 back to the — main. At the same time, the contacts 12 are bridged by the contactor 11 so that the conductor 34, arm 1 and conductor 35 are short-circuited from the point 38 across to point 39. Now, when the arm moves off of the first contact 3 and on to the second one, there will be no sparking since the arm is short-circuited. The solenoid 9 will also remain energized after the arm has passed to the next contact because of this short-circuit. A similar action occurs when the arm passes on to the second, third and fourth contacts, i. e., the solenoid switches B, C and D will be successively energized to cut out sections R⁴, R³ and R² resistance, the controlling arm each time being short-circuited as above described. When the controlling arm reaches the last of contacts 3, the lifting coil 15 of electromagnetic switch E will be energized, the holding coil 16 having been connected across the line when switch F was closed. This will cause the last section R¹ of the starting resistance to be short-circuited by the contactor 18, and at the same time bridging contact 19 will be lifted so as to open the control circuit at contacts 21. This will deenergize the coils of switches A, B, C and D and allow them to drop and will also deenergize the lifting coil 15 of switch E. This latter switch, however, will be held closed by the holding coil 16. The circuit of solenoid 4 is likewise opened, and the controlling arm drops in response to its bias back to its starting position, and the contacts 27 are bridged. The lifting coil 15 will not be energized because its circuit is opened at the contacts 21. Upon failure of voltage, holding coils 23 and 16 permit the armature circuit to be opened at switches E and F, and the motor may be stopped at any time by opening a line switch. In case the arm 1 should stick, or in any way be prevented from returning to its initial position, the motor cannot be started until the controlling arm is brought back so that the contacts 27 are bridged. In this way the controlling arm is moved positively over the contacts, and if the arm should stick, no harm would be done, since the parts are dead. I consider this, and the short-circuiting of the controlling arm by each switch so as to prevent burning of the contacts, important features of my invention.

It will be understood, of course, that various modifications of my invention will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

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

1. An automatic motor starter, comprising a series of contacts, a circuit-controlling element therefor having a bias to starting position, an electrically controlled device for moving said element to running position, and means for deenergizing said device and releasing said element when the latter reaches running position.

2. An automatic motor starter, comprising a series of contacts, a circuit-controlling element therefor having a bias to starting position, an electrically controlled device for moving said element to running position, means for retarding said element during said movement, and means for deenergizing said device and releasing said element when the latter reaches running position.

3. An automatic motor starter, comprising a series of contacts, a circuit-controlling element therefor having a bias to starting position, an electromagnetic switch arranged to close the armature circuit only when the element is in said position, an electrically controlled device for moving said element to running position, and means for deenergizing said device and releasing said element when the latter reaches running position.

4. An automatic motor starter, comprising a series of contacts, a circuit-controlling element therefor having a bias to starting position, an electromagnetic switch arranged to close the armature circuit and the circuit of said device only when the element is in said position, an electrically controlled device for moving said element to running position, and means for deenergizing said device and releasing said element when the latter reaches running position.

5. An automatic motor starter, comprising a series of contacts, a circuit-controlling element therefor having a bias to starting position, an electromagnetic switch arranged to close the armature circuit only when the element is in said position, an electrically controlled device for moving said element to running position, means for retarding said element during said movement, and means for deenergizing said device and releasing said element when the latter reaches running position.

6. An automatic motor starter, comprising a series of contacts, a circuit-controlling element therefor having a bias to starting position, an electrically controlled device for moving said element to running

position, an electromagnetic switch arranged to close the armature circuit and energize said electrically controlled device only when the element is in starting position, and means for deenergizing said electrically controlled device and releasing said element when the latter reaches running position.

7. An automatic motor starter, comprising a plurality of electromagnetic resistance-varying switches, a circuit-controlling element therefor having a bias to starting position, an electrically controlled device for moving said element to successively energize said switches, and means for deenergizing said device and releasing said element when the latter reaches running position.

8. An automatic motor starter, comprising a plurality of electromagnetic resistance-varying switches, a circuit-controlling element therefor having a bias to starting position, an electromagnetic switch arranged to close the motor circuit only when the controlling element is in starting position, an electrically controlled device for moving said element to successively energize said switches, and means for deenergizing said device and releasing said element when the latter reaches running position.

9. An automatic motor starter, comprising a plurality of electromagnetic resistance-varying switches, a circuit-controlling element therefor having a bias to starting position, an electrically controlled device for moving said element to successively energize said switches, an electromagnetic switch arranged to close the motor circuit and energize said device only when the controlling element is in the starting position, and means for deenergizing said device and releasing said element when the latter reaches running position.

10. An automatic motor starter, comprising a plurality of electromagnetic resistance-varying switches, a master controlling element biased to an initial position, an electrically controlled device for moving said element to successively energize said switches, and connections whereby each of said switches is operated to short-circuit the controlling element and is kept energized independently of said element.

11. An automatic motor starter comprising a plurality of electromagnetic resistance-varying switches, a master controlling element biased to an initial position, an electrically controlled device for moving said element to successively energize said switches, connections whereby each of said switches is operated to short-circuit the controlling element and is kept energized independently of said element, and means for deenergizing said device when said element has been moved to energize said switches.

12. An automatic motor starter, comprising a plurality of electromagnetic resistance-varying switches, a master controlling element biased to an initial position, an electrically controlled device for moving said element to successively energize said switches, an electromagnetic switch arranged to close the motor circuit and energize said device only when the controlling arm is in the initial position, connections whereby each of said switches is operated to short circuit the controlling element and is kept energized independently of said element, and means for deenergizing said device when said element has been moved to energize said switches.

13. An automatic motor starter, comprising a plurality of electromagnetic resistance-varying switches, a master controlling element biased to an initial position, an electrically controlled device to move said element to successively energize said switches, connections whereby each of said switches is operated to short-circuit the controlling element and is kept energized independently of said element, and means whereby the closing of the last of said switches deenergizes the others.

14. An automatic motor starter, comprising a plurality of electromagnetic resistance-varying switches, a master controlling element biased to an initial position, an electrically controlled device for moving said element to successively energize said switches, connections whereby each of said switches is operated to short-circuit the controlling element and is kept energized independently of said element, means for deenergizing said device when said element has been moved to energize said switches, and means whereby the closing of the last of said switches deenergizes the others.

15. An automatic motor starter, comprising a plurality of electromagnetic resistance-varying switches, a master controlling element biased to an initial position, an electrically controlled device for moving said element to successively energize said switches, an electromagnetic switch arranged to close the motor circuit and energize said device only when the controlling element is in the initial position, connections whereby each of said switches is operated to short-circuit the controlling element and is kept energized independently of said element, means for deenergizing said device when said element has been moved to energize said switches, and means whereby the closing of the last of said switches deenergizes the others.

In witness whereof, I have hereunto set my hand this 16th day of July, 1907.

WALTER O. LUM.

Witnesses:

BENJAMIN B. HULL.

HELEN ORFORD.