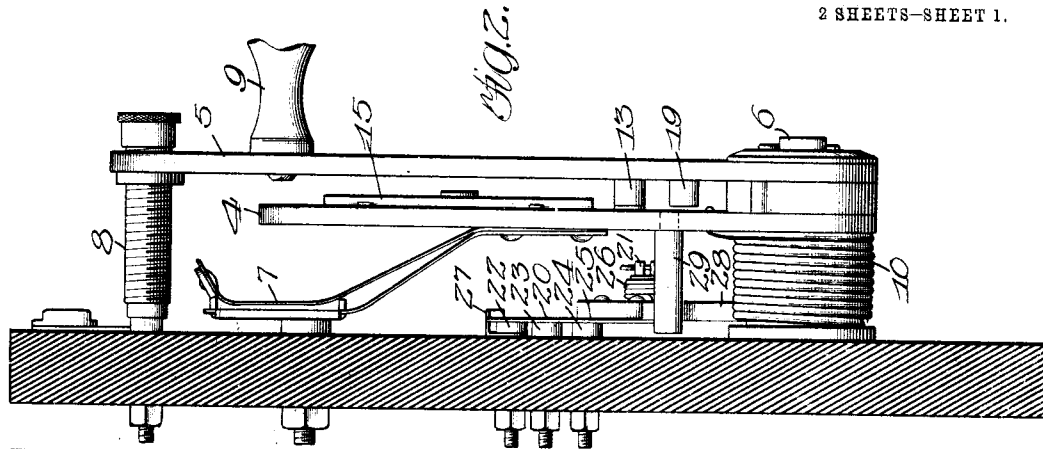
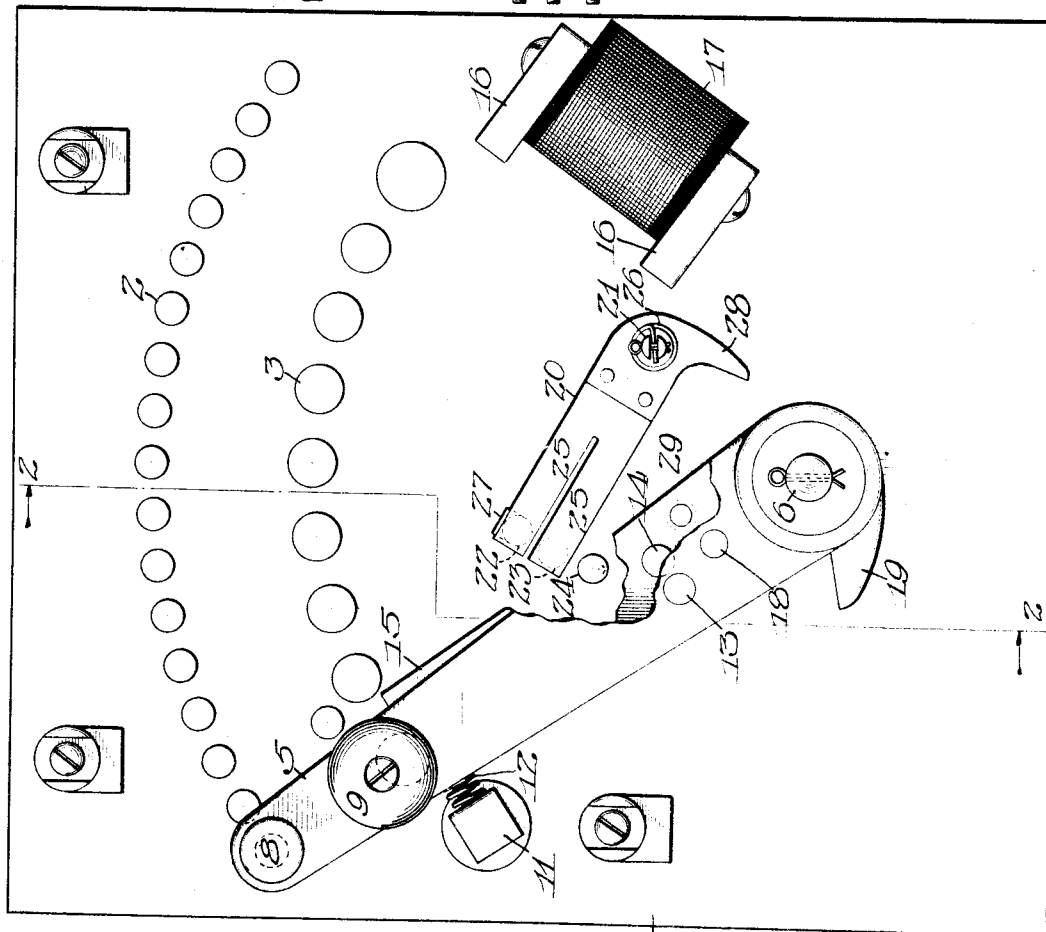


A. J. HORTON.
MOTOR CONTROLLER.
APPLICATION FILED JULY 6, 1908.

1,066,616.

Patented July 8, 1913.

2 SHEETS-SHEET 1.



Witnesses
Robert A. Mer
Frank H. Hubbard

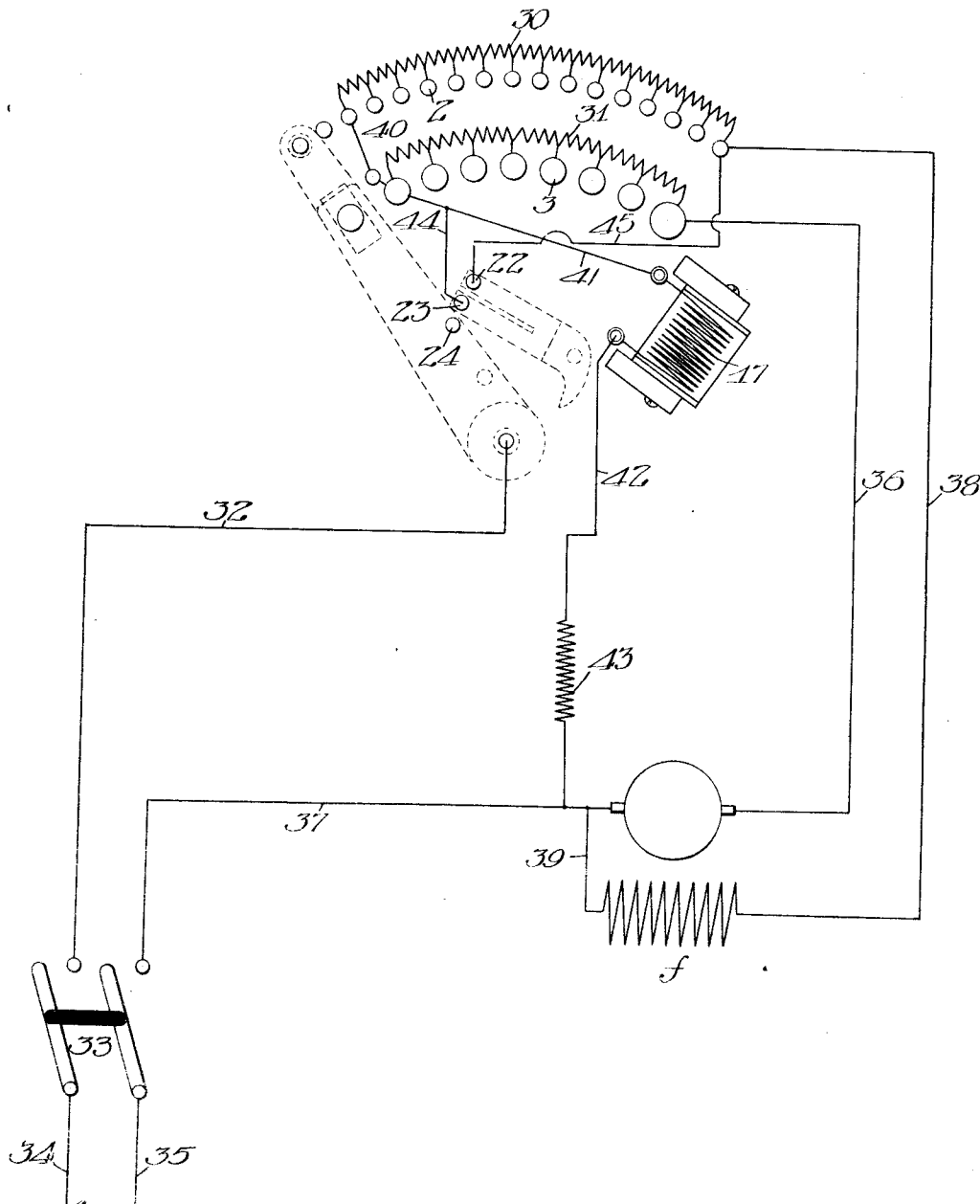
Fig. 1.
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Fig. 3.



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UNITED STATES PATENT OFFICE.

ALBERT J. HORTON, OF WHITE PLAINS, NEW YORK, ASSIGNOR TO THE CUTLER-HAMMER MFG. CO., OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

MOTOR-CONTROLLER.

1,066,616.

Specification of Letters Patent.

Patented July 8, 1913.

Application filed July 6, 1908. Serial No. 442,175.

To all whom it may concern:

Be it known that I, ALBERT J. HORTON, a citizen of the United States, residing at White Plains, in the county of Westchester and State of New York, have invented new and useful Improvements in Motor-Controllers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in motor controllers, and more particularly to compound starters and field regulators.

In controllers for regulating both an armature resistance and a field resistance, the controlling member, or members, are sometimes arranged to pass over both sets of resistance contacts during the removal of the armature resistance from circuit.

My invention has for its object to provide an auxiliary switch for such controllers which will remove the field resistance from circuit until the controlling member, or members, have been moved to cut out all of the armature resistance from circuit.

For the purpose of illustrating my invention I have shown the preferred form thereof embodied in a motor controller of the same general construction as that shown in my former Patent No. 792,658. It should be understood, however, that my invention is applicable to other forms of controllers than that shown in the drawing.

The views shown in the accompanying drawings are as follows:

Figure 1 is a front elevation of my device, parts thereof being broken away for the purpose of better illustrating the construction thereof. Fig. 2 is a vertical sectional view taken on line 2-2, Fig. 1, with the resistance controlling arms moved to the central position. Fig. 3 shows one circuit arrangement for my device.

As before stated, the device shown in the drawing is of the same general construction as that shown in my former patent, the several parts thereof being mounted on an insulating base or panel 1. The supporting panel carries a series of contacts 2, adapted to be connected to a field regulating resistance and a series of contacts 3, adapted to be connected to an armature resistance. The controlling element comprises two members 4 and 5 fulcrumed on a pin 6, protruding from the panel 1. The member 4 carries

a brush 7 adapted to sweep over the contacts 3, while the member 5 carries a brush 8 adapted to sweep over the contacts 2. The brushes 7 and 8 may be of any desired construction. An operating handle 9 is secured to the member 5, adjacent to its free end. A coil spring 10 tends to move the member 4 against a stop 11 which is provided with a spring buffer 12. The member 5 carries a pin 13 adapted to engage with a pin 14 carried by the member 4, whereby, the members 4 and 5 will move together in one direction against the action of the spring 10. The member 4 carries an armature 15 adapted to engage with the pole pieces 16 of a retaining magnet 17. When the magnet 17 is energized it holds the member 4 in its final position after the removal of the armature resistance from circuit, thus permitting the member 5 to be moved in an opposite direction, independently of the member 4. A pin 18, carried by the member 5, is adapted to engage a lug 19, carried by the member 4, to limit the movement of the member 5 when moved back over the contacts 2.

As previously stated, my invention has for its object to provide means for removing the field resistance from circuit until all of the armature resistance is removed from circuit. The means which I have shown for accomplishing this result comprises an auxiliary switch 20, fulcrumed on a pin 21 carried by the base, and adapted to move over a series of three contacts 22, 23 and 24. The switch 20 carries a spring contact plate preferably slotted to form two contact fingers 25. A coiled spring 26, carried by the pin 21, is connected at one end to said pin and at its other end to the switch 20. This spring tends to move the switch 20 against a stop 27 carried by the contact 22. It should be understood that the auxiliary switch may assume various forms. In this position of the switch the contact fingers 25 thereof engage and electrically connect the contacts 22 and 23. As will be hereinafter set forth, the contacts 22 and 23 are adapted to be connected in a shunt-circuit around the field regulating resistance, and, therefore, when said contacts are bridged by the switch 20, the field resistance will be short-circuited. The contact 24 is dead. The switch 20 is provided with an extension or tail piece 28 which projects into the

path of a pin 29, carried by the member 4. The switch 20 is so located that the pin 29 will strike its tail piece 28 just as the controlling element reaches the limit of its movement. When the pin 29 strikes the tail piece 28 it causes the switch 20 to turn upon its fulcrum until the contact fingers thereof move from contacts 22 and 23 onto contacts 23 and 24, thereby opening the short-circuit around the field resistance.

I shall now describe the circuit arrangement shown in Fig. 3. The first two contacts of the series of contacts 2 are dead, while the remainder of said contacts are connected to a field regulating resistance 30. The first contact of the series of contacts 3 is dead, while the remainder of said contacts are connected to an armature resistance 31. Both members of the controlling element are connected by conductor 32 through main line switch 33 to the main line 34. The last of the series of contacts 3 is connected by conductor 36 to one terminal of the motor armature *a*, while the other terminal of the armature is connected by conductor 37 through switch 33 to main line 35. The last of the series of contacts 2 is connected by conductor 38 to one terminal of the shunt field winding *f* of the motor, while the other terminal of said winding is connected by conductor 39 to conductor 37. The first live contact 2 is connected by conductor 40 to the first live contact 3 which is connected by conductor 41 to one terminal of the winding of the retaining magnet 17. The other terminal of the winding 17 is connected by conductor 42 through a resistance 43 to conductor 37. Contact 23 is connected by conductor 44 to conductor 41. Contact 22 is connected by conductor 45 to the last of the series of contacts 2.

In operation, the main line switch 33 is first closed and then the controlling element moved to the right. As already explained, when the controlling element is moved to the right, both of the members 4 and 5 are actuated. As soon as the brush 7, carried by the member 4, moves off of the dead contact and onto the second contact of the series of contacts 3, circuit is closed through the motor armature. This circuit may be traced from conductor 34, through switch 33 by conductor 32, through member 4 and brush 7 to contact 3, through the resistance 31 by conductor 36, through the motor armature *a* and by conductor 37 to the main line 35. At the same time that the armature circuit is closed the shunt field circuit is also closed. This circuit may be traced, as already described, to the member 4, thence to contact 3, by conductors 41 and 44 to contact 23, through the contact fingers of switch 20 to contact 22, by conductor 45 to the last of the series of contacts 2, and then by conductor 38 through shunt field winding

f, by conductors 39 and 37, to the main line 31. It will thus be seen that as long as the switch 20 bridges contacts 23 and 22, the field regulating resistance 30 will be short-circuited and the movement of the member 5, during the removal of the armature resistance from circuit, will not affect the strength of the shunt field winding *f*. As the controlling element is moved to the right the member 4 thereof gradually removes the resistance 31 from the armature circuit until all of the same is finally removed from circuit and the armature 15, carried by the member is attracted by the retaining magnet 17. The circuit for the retaining magnet may be traced from the second contact of the series of contacts 3 by conductor 41, through the winding 17, by conductor 42, through resistance 43 to conductor 37 and thence to the main line 35. As the last section of the resistance 31 is removed from circuit, the pin 29, carried by the member 4, engages the extension or tail piece 28 of the switch 20, and moves said switch out of engagement with the contact 22, and into engagement with contacts 23 and 24. As soon as the switch 20 is moved out of engagement with the contact 22 the short-circuit around the resistance 30 is opened. After the member 4 has been locked in its final position by the retaining magnet 17, the member 5 may be moved back over the series of contacts 2 to regulate the field resistance 30 to cause the motor to operate at the desired speed. If, for instance, the brush 8 of the member 5 is moved into engagement with the central contact of the series of contacts 2, the field circuit may be traced from member 5 through half of the resistance 30 by conductor 38 through the field winding to main line 35. Inasmuch as the member 5 is no longer under the influence of the spring 10, it will remain in any desired position until manually moved to another position. It will thus be seen that the motor may be caused to operate at any predetermined speed within the limits provided by the field regulation. However, it is impossible to move the member 5 into engagement with the dead contacts 2, inasmuch as the pin 18, carried thereby, will engage the lug 19 carried by the member 4, when said member 5 has been moved into engagement with the first live contact 2. If, from any cause, the voltage of the main line fails, the magnet 17 will release the member 4, which, under the influence of the spring 10, will fly back to its initial position. In returning to its initial position, the pin 14 thereby will engage the pin 13, carried by the member 5, and also return the same to its initial position, thus opening both the armature circuit and the field circuit. Also, as soon as the member 4 is released and returns to its initial position, the switch 20 will be re-

turned to its initial position, or, in other words, will be moved by the spring 26 into engagement with the contacts 23 and 22, thus again short-circuiting the field resistance 30.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a controller for electric motors, in combination, a controlling element comprising two members, a resistance controlled by each of said members, said members being movable together in one direction and one of said members being movable in the opposite direction independently of the other of said members, and an auxiliary switch for short-circuiting the resistance controlled by said independently movable member during the joint movement of said members, said auxiliary switch being arranged to be actuated by said element when in a predetermined position to open said short circuit.

2. In a controller for electric motors, in combination, a controlling element comprising two members, a resistance regulated by each of said members, said members being movable together in one direction and one of said members being movable independently of the other in an opposite direction, an auxiliary switch tending to stand in position to short-circuit the resistance controlled by said independently movable member, said switch being adapted to be actuated by said controlling element when in a predetermined position to open the short-circuit, and a retaining magnet for holding said switch after the same has been actuated.

3. In a controller for electric motors, in combination, a controlling element comprising two members, an armature resistance adapted to be regulated by one of said members, a field resistance adapted to be controlled by the other of said members, said members being movable together in one direction, to remove said armature resistance from circuit, an auxiliary switch tending to stand in position to short-circuit said field resistance, and adapted to be actuated by the armature resistance controlling member, when in a predetermined position, to open said short-circuit and a retaining magnet for holding said armature resistance controlling member upon the removal of said armature resistance from circuit.

4. In a controller for electric motors, in combination, two resistance regulating members movable simultaneously to start the motor, one of said members being movable independently of the other thereafter and a switch rendering said independently movable member ineffective during the simultaneous operation of said members and arranged to be actuated by the other of said members when in a predetermined position to render said independent member effective.

5. In a controller for electric motors, in combination, two resistance regulating members movable together in one direction to start the motor and one being independently movable of the other thereafter and a switch rendering said independently movable member ineffective during the joint movement of both members, said switch being operated by the other of said members when in a predetermined position to render said independently movable member effective.

6. In a controller for electric motors, in combination, an armature resistance, a field resistance, a switch normally short-circuiting said field resistance, an armature resistance controlling member adapted when in a predetermined position to actuate said switch to open said short-circuit around said field resistance and a field resistance controlling member movable with said armature resistance controlling member to said predetermined position and movable independently thereof thereafter.

7. In a controller for electric motors, in combination, an armature resistance, a field resistance, a switch normally short-circuiting said field resistance, an armature resistance controlling member adapted when in a predetermined position to actuate said switch to open said short-circuit around said field resistance and a field resistance controlling member movable with said armature resistance controlling member to said predetermined position and movable independently thereof in an opposite direction to regulate said field resistance.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

ALBERT J. HORTON.

Witnesses:

WILLIAM L. CULLY,
CHARLES B. BAKER.