

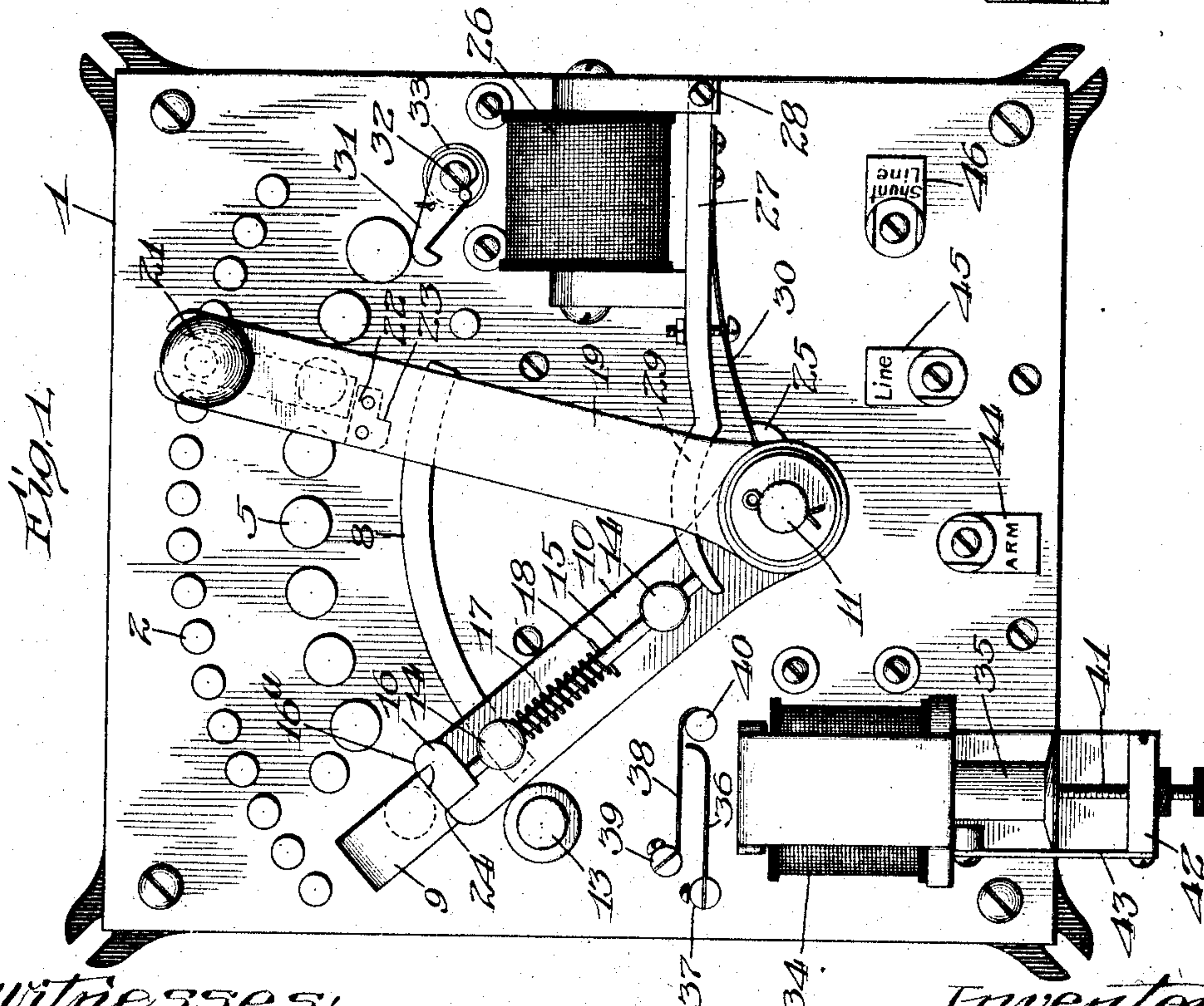
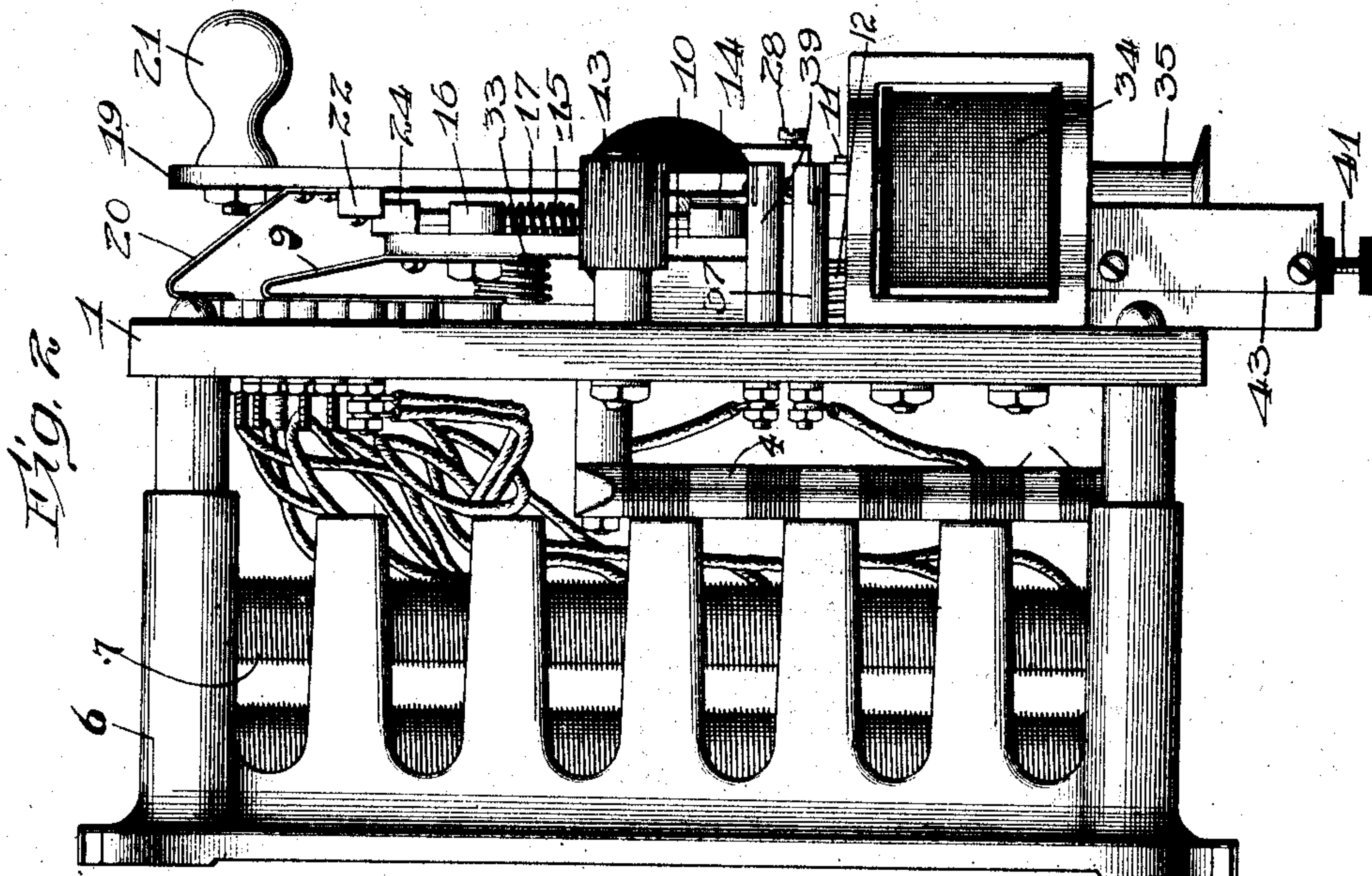
No. 883,956.

PATENTED APR. 7, 1908.

A. J. HORTON.
MOTOR STARTER.

APPLICATION FILED JUNE 13, 1906.

2 SHEETS—SHEET 1.



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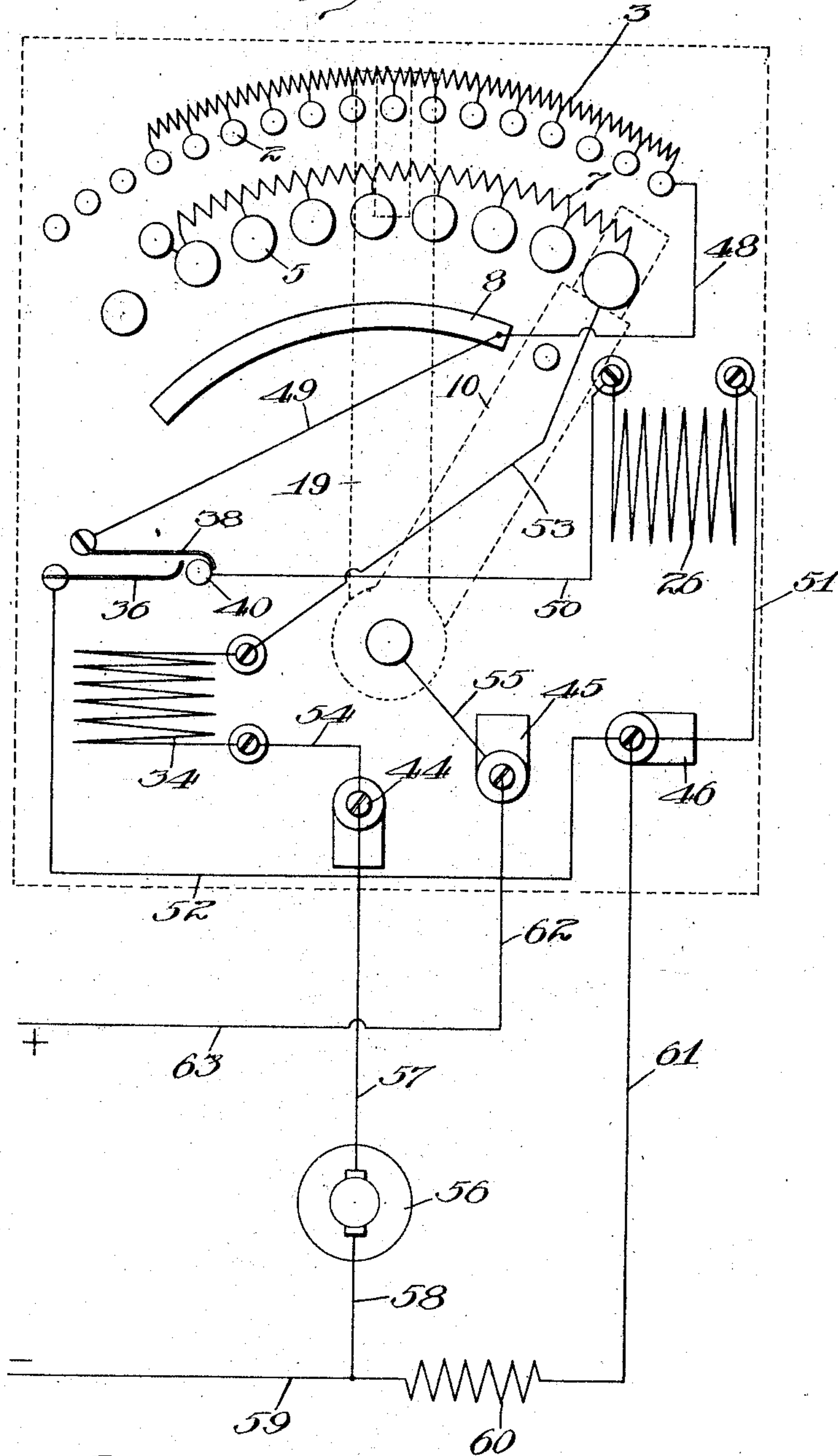
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2 SHEETS—SHEET 2.

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-STARTER.

No. 883,956.

Specification of Letters Patent.

Patented April 7, 1908.

Application filed June 13, 1906. Serial No. 321,566.

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-Starters, 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 starters, and more particularly to improvements in that type known as compound starters, which are arranged to control resistance in both the armature and shunt field circuit of the motor.

In compound motor starters heretofore constructed, it has been necessary that the operator move two distinct parts of the controller, namely, a starting lever or arm for starting the motor and bringing it to speed, and a second lever inserting resistance in circuit with the field, that is, it has been necessary for the operator to handle each of these levers separately. Under these conditions, it has been possible for the operator to leave the starting lever in an intermediate position, and move the lever controlling the field resistance to insert resistance in the field circuit, whereby the field will be weakened with resistance still in the armature circuit.

It is one of the objects of my invention to overcome objections of the above character to motor starters, and to construct a starter whereby the field resistance cannot be inserted in circuit until all of the armature resistance has been removed from circuit.

Furthermore, it is one of the objects of my invention to provide a motor starter in which it is never necessary to operate more than one handle.

Another object of my invention is to provide a motor starter which will prevent the admitting of excessive current to the motor armature by too rapidly removing the resistance therefrom.

Other objects of my invention will appear more fully in the detailed description thereof, and the appended claims.

In the accompanying drawings, I have shown the construction which I have worked out as the preferred embodiment of my invention, and in said drawings, Figure 1 is a

front elevation of my device; Fig. 2 is a side elevation thereof; and Fig. 3 is a diagrammatic view of the circuit arrangement of my device.

In the construction of the device illustrated in the accompanying drawings, upon a suitable base 1, and mounted contacts 2, which extend through the base and are suitably connected with a resistance 3 wound upon a suitable supporting plate 4, which is preferably made up of porcelain or other suitable material, carried in a starting box 6, to which the base 1 is secured. The first three of these contacts, however, are not connected with the resistance and are therefore dead. A second set of contacts 5 are also mounted upon the front of the base 1, and are connected with a resistance 7 also mounted in the box 6. A third contact 8, preferably in the form of a brass sector, is also carried upon the front of the base 1, and is of such length that when the brush 9 is moved to the extreme right, it will not be in contact with the same.

A suitable brush 9 mounted upon a lever 10 is arranged to sweep over and make contact with the contacts 5, this brush being of such width that at the same time it will also engage the sector 8. The lever 10 is pivoted upon a suitable support or pivot 11, projecting from the base 1, and a spring 12; coiled around the pivot and having one end connected to the base 1, and the other connected to the lever normally holds the lever at its extreme position to the left against the stop 13, in the "off" position. Upon the upper face of the lever 10 a pair of posts 14, project which are provided with openings through which is adapted to extend a rod 15, the outer end of which carries a catch 16. The rod 15 is movably mounted in the posts or supports 14, and is held at its innermost position by a coiled spring 17, interposed between one of the stops 14 and a pin 18 passing through said rod. A second lever 19 is also pivotally mounted upon the post 11 above said lever 10 carrying a brush 20, which is arranged to sweep over the contacts 2, a handle 21 being mounted on said lever by which the same may be moved. On the underside of the lever 19 is rigidly mounted a dog 22 having a shoulder 23 which, when the catch 16 is in its outermost position, will engage the square rear

end 24 thereof, and move the lever 10 as the lever 19 is moved to the right. The lever 10 on its hub is also provided with a small outwardly projecting shoulder 25, the purpose of which will appear more fully hereinafter.

A retaining magnet 26 is mounted upon the right hand side of the base plate 1, and when energized is adapted to excite the fields thereof, between which it is mounted, and attract the armature 27 which is pivoted at 28, to one of its pole pieces. The armature 27 has an extension 29 extending between the levers 10 and 19, and the extreme end of this extension is arranged to engage the lower end of the rod 15 and move the catch to its outermost position when the armature is attracted by the magnet 26, or, when the lever 10 is at the extreme left or "off" position, the spring 30, mounted on said armature, is placed under tension by engagement with the shoulder 25, which raises the extension 29 and in turn moves the catch to its outermost position. Immediately above the retaining magnet 26 a dog 31 is pivotally mounted upon a small post 32, the dog being held at the limit of its downward movement by means of a spring 33 coiled about said post, and having one end connected to the base 1, and the other end to the dog 31. This dog when the catch 16 is in its outermost position, due to the raising of the armature 27 by the magnet 26, is adapted to engage the catch and hold the lever 10 at the limit of its movement to the right, or in the "on" position.

An overload coil 34 is mounted at the lower left-hand corner of the base 1, the core 35 of which, when attracted by the coil, is adapted to engage and move a spring switch arm 36 mounted upon a stud 37 carried by the base. A second spring switch arm 38 mounted upon a stud 39 carried by the base is adapted to be engaged by a projection on the arm 36 when the arm is raised by the core 35 and be moved out of engagement with a contact 40 also mounted upon the base 1. The extent of movement of the core 35 is controlled by the set-screw 41 passing through a support 42, carried on an arm 43 secured to the overload magnet 34. Binding posts 44, 45 and 46 are also mounted upon the base 1, to which the armature of the motor, the field of the motor, and one of the line wires may be connected.

Fig. 3 illustrates diagrammatically the electrical connections between the various parts of the motor starter and the electrical connections extending between said starter and the motor. In said figure the last one of the contacts 2 which are connected to the sections of resistance 3 is connected by the conductor 48 with the contact sector 8. This contact sector in turn is connected by the conductor 49 with the switch 38. The contact 40 of this switch is connected by conductor 50 with one terminal of the retaining

magnet 26, the opposite terminal of said retaining magnet being connected by conductor 51 with the binding post 46. The switch arm 36 is connected by the conductor 52 with the binding post 46. The last one of the contacts 5, which are connected to the sections of the armature resistance 7, is connected by the conductor 53 with one terminal of the overload magnet 34, the opposite terminal of said magnet being connected by conductor 54 with the binding post 44. The hubs of the levers 10 and 19 are connected by the conductor 55 with the binding post 45.

One terminal of the armature 56 is connected by the conductor 57 with the binding post 44 on the starter, the opposite terminal of the armature being connected by conductor 58 with one side 59 of the line. One terminal of the field winding 60 of the motor is connected by conductor 61 with the binding post 46, the opposite terminal of said field winding being connected with the side 59 of the line. The binding post 45 is connected by conductor 62 with the opposite side 63 of the line.

In operation, assuming that the levers 10 and 19 are in position shown in Fig. 1, in order to start the motor the lever 19 is moved to the left until it engages the stop 13. The catch 16 being at its extreme outermost position, due to the engagement of the lug 25 with the spring 30 of the armature 27, the shoulder 24 of the catch will be engaged by the dog 23 on the lever 19, and by moving the lever 19 to the right, the lever or arm 10 will be moved over the contacts 5. The first one of these contacts being dead, circuit will be first closed from the line 63, by conductor 62, binding post 45, conductor 55, arm 10, brush 9, contact sector 8, conductor 49, switch 38, contact 40, conductor 50, through the retaining magnet 26, thence by conductor 51, binding post 46, conductor 61, through the field winding 60, and back to the opposite side 59 of the line. The closing of the circuit through the retaining magnet 26 causes the same to attract its armature 27, which will hold the catch 16 in its outermost position, although the shoulder 25, after the lever has been moved to the first of the contacts 5, will be disengaged from the spring 30. As soon as the brush 9 makes contact with the second of the contacts 5, the armature circuit will be immediately closed, this circuit being traced as follows: From the line 63, by conductor 62, binding post 45, conductor 55, arm or lever 10, brush 9, one of the contacts 5, through the resistance 7, conductor 53, through the overload magnet 34, conductor 54, binding post 44, conductor 57, through the armature 56, conductor 58, back to the opposite side 59 of the line. The circuit through the armature being closed, the motor will immediately start and build up in speed as the arm 10 is moved to the right to

cut out the resistance 7. When the arm 10 has been moved to the extreme "on" position, the dog 31 will engage the catch 16, and hold the same in this position. as long as the
 5 armature 27 is attracted by the retaining magnet 26, and maintains the catch 16 in its outermost position.

When the arm 10 has been moved to the full "on" position, the brush 9 will be moved
 10 off the sector 8 and a new field circuit will be established, which may be traced as follows: Line 63, conductor 62, binding post 45, conductor 55, lever 19, brush 20, one of the contacts 3, conductors 48 and 49, switch 38, con-
 15 ductor 50, through the retaining magnet 26, conductor 51, binding post 46, conductor 61, through the field 50 and back to the opposite side 59 of the line. Under these conditions, the lever 19 may be now moved to the
 20 left, whereby the resistance 3 will be inserted in circuit with the field, thus weakening the field and the speed of the motor will thereby be increased.

If, while moving the arms 19 and 10 to the
 25 right, in removing the resistance 7 from the armature circuit, the operator should move the arms so rapidly that the current becomes too excessive, the overload magnet 34 will respond and attract its core, which will en-
 30 gage the switch 36, moving the same upward in the projection thereof, will engage the switch 38, moving the same off of the contact 40, establishing the following circuit: Line 63, conductor 62, binding post 45, conductor
 35 55, arm 10, brush 9, contact sector 8, conductor 49, switch 38, switch 36, conductor 52, binding post 46, conductor 61, through the field 60 and back to the opposite side 59 of the line. This short-circuits the magnet
 40 26, causing the same to release its armature 27, which, in turn, will permit the spring 17 to move the catch 16 inward, disengaging the same from the dog 23 and permitting the arm 10 to fly back under the impulse of the
 45 spring 12 to the "off" position. In order to bring the arm 10 forward again, it will be necessary to return the arm 19 to the "off" position and the operation of starting the motor repeated. It will thus be observed
 50 that it will be impossible for the operator to remove the armature resistance from circuit too rapidly.

In event, while the motor is operating, an overload occurs, the above circuit will be es-
 55 tablished by the operation of the overload magnet and the arm 10 will be permitted to fly back to its "off" position under the influence of the spring 12, or, in event the circuit is opened by an independent switch in the line, the retaining magnet will be deenergized, permitting the spring 17 to retract the catch 16, disengaging it from the dog 31 and the arm will fly back to its "off" position.
 60

65 Having thus described my invention what

I claim as new and desire to secure by Letters Patent is:

1. The combination with a motor, of a starting resistance therefor, a movable member for removing said resistance from the
 70 circuit, means for removing said member to a predetermined position, means independent of said first-mentioned means for holding said member in said predetermined position, and means to automatically return said
 75 member to its initial position in event said resistance is removed too rapidly from the motor circuit.

2. The combination with a motor, of a starting resistance therefor, a movable member for removing said resistance from circuit,
 80 means for removing said member to a predetermined position, means independent of said first-mentioned means for holding said member in said predetermined position, and
 85 means for automatically returning said member to its initial position in event an abnormal current flows through the motor.

3. The combination with a motor, of a resistance therefor, a movable member for con-
 90 trolling said resistance, means for moving said member to a predetermined position, means independent of said first-mentioned means for holding said member in said pre-
 95 determined position, and means for automatically returning said member to its initial position independently of the movement given thereto by the operator, in event said resistance is removed too rapidly from the
 100 motor circuit.

4. The combination with a motor, of a resistance therefor, a movable member for con-
 105 trolling said resistance, means for moving said member to a predetermined position, means independent of said first-mentioned means for holding said member in a prede-
 110 termined position, and means for removing said member from the control of the operator and automatically returning the same to its initial position, in event of an excessive
 115 flow of current through the motor.

5. The combination with a motor, of a resistance therefor, a movable member for con-
 120 trolling said resistance, means tending to keep said member in its initial position, a second movable member for operating said first member, means for operatively connect-
 125 ing said members, means for holding said first movable member in a predetermined position, and means for disconnecting said
 130 members to permit said first member to return to its initial position in event of an excessive flow of current through said motor.

6. The combination with a motor, of a resistance therefor, a movable member for con-
 125 trolling said resistance, a second movable member for operating said first movable member, electromagnetic means for operatively connecting said members, means for
 130 holding said first movable member in a pre-

determined position, and means for rendering said electromagnetic means inoperative to permit said movable member to return to its initial position in event of an excessive flow of current through said motor.

7. The combination with a motor, of a resistance therefor, a movable member for controlling said resistance, means tending to retain said movable member in its initial position, a second movable member for operating said first member, an electromagnet for operatively connecting said members, means for holding said first member in a predetermined position, and means for rendering said magnet inoperative to permit said first member to return to its initial position in event of an excessive flow of current through the motor.

8. The combination with a motor, of a resistance therefor, a movable member for controlling said resistance, means tending to retain said member in its initial position, a second movable member for operating said first mentioned member, an electromagnet for operatively connecting said members, means for holding said first member in a predetermined position, and means for deenergizing said magnet to permit said first mentioned movable member to return to its initial position in event of an excessive flow of current through the motor.

9. The combination with a motor, of a resistance therefor, a movable member for controlling said resistance, means tending to retain said member in its initial position, a movable member for operating said first member, an electromagnet for operatively connecting said members, and an overload magnet for rendering said electromagnet inoperative to permit said first member to return to its initial position in event of an overload on said motor.

10. The combination with a motor, of a resistance therefor, a movable member for controlling said resistance, means tending to retain said member in its initial position, a second movable member for operating said first member, a retaining magnet for holding said first movable member in a predetermined position, means for operatively connecting said members, and means for disconnecting said members to permit said first member to return to its initial position in event of an excessive current flowing through said motor.

11. The combination with a motor, of a resistance therefor, a movable member for controlling said resistance, means tending to retain said member in its initial position, a second movable member for operating said first member, a retaining magnet for holding said first member in a predetermined position, and means operated by said retaining magnet for operatively connecting said movable members.

12. The combination with a motor, of a re-

sistance therefor, a movable member for controlling said resistance, means tending to retain said member in its initial position, a second movable member for operating said first member, a retaining magnet for retaining said first movable member in a predetermined position, means operated by said retaining magnet for operatively connecting said movable members, and means for rendering said magnet inoperative to permit said first member to return to its initial position in event of an excessive flow of current through said motor.

13. The combination with a motor, of a resistance therefor, a movable member for controlling said resistance, means tending to retain said member in its initial position, a second movable member for operating said first member, a retaining magnet for holding said first member in a predetermined position, means operated by said magnet for operatively connecting said members, and means for deenergizing said retaining magnet and permitting said first movable member to return to its initial position under predetermined conditions.

14. The combination with a motor, of an armature resistance, and a field resistance therefor, a movable member for controlling said armature resistance and a second movable member for controlling said field resistance, means tending to retain said first member in its initial position, means for operatively connecting said members for causing said second mentioned member to move said first member in one direction, while permitting said second member to move in an opposite direction independently thereof, and means for disconnecting said members when removing the armature resistance from circuit to permit said member to return to its initial position, in event of an excessive flow of current through the motor.

15. The combination with a motor, of an armature resistance, and a field resistance therefor, a movable member for controlling said armature resistance, a second movable member for controlling said field resistance, electromagnetic means for connecting said members to cause said first member to move in one direction with said second member, while permitting said second member to move in an opposite direction independently thereof, and means for rendering said electromagnetic means inoperative to permit said first mentioned member to move to its initial position in event of an excessive flow of current through the motor.

16. The combination with a motor, of an armature resistance and a field resistance therefor, a movable member for controlling said armature resistance, and a second movable member for controlling said field resistance, an electromagnet for operatively connecting said members to cause said first men-

tioned member to move in one direction with said second mentioned member, while permitting said second mentioned member to move in an opposite direction independently thereof, and means for rendering said magnet inoperative to permit said first member to return to its initial position in event of an excessive flow of current through the motor.

17. The combination with a motor, of an armature resistance and a field resistance therefor, a movable member for controlling said armature resistance, a second member for controlling said field resistance, an electromagnet for operatively connecting said members to cause said first mentioned member to move in one direction with said second member, while permitting said second member to move in an opposite direction independently thereof, and means for deenergizing said magnet to permit said first member to move to its initial position in event of excessive flow of current through said motor.

18. The combination with a motor, of an armature resistance and a field resistance therefor, a movable member for controlling said armature resistance, a second member for controlling said field resistance, an electromagnet for operatively connecting said members to cause said first member to move in one direction with said second member, while permitting said second member to move in an opposite direction independently thereof, and an overload magnet for rendering said electromagnet inoperative to permit said first member to return to its initial position in event of an overload on said motor.

19. The combination with a motor, of an armature resistance and a field resistance therefor, a movable member for controlling said armature resistance, a second movable member for controlling said field resistance, a retaining magnet for holding said first member in a predetermined position, means for connecting said members to cause said first member to move in one direction with the second member, while permitting the said second member to move in an opposite direction independently thereof, and means for disconnecting said members to permit said first member to return to its initial position in event of excess flow of current through the motor.

20. The combination with a motor, of an armature resistance and a field resistance therefor, a movable member for controlling said armature resistance, a second movable member for controlling said field resistance, a retaining magnet for holding said first member in a predetermined position, and means operated by said retaining magnet for connecting said members to cause said first member to move in one direction with said second member, while permitting said second member to move in an opposite direction independently thereof.

21. The combination with a motor, of an armature resistance and a field resistance therefor, a movable member for controlling said armature resistance, a second movable member for controlling said field resistance, a retaining magnet for holding said first movable member in a predetermined position, means operated by said retaining magnet for operatively connecting said movable members to cause said first mentioned member to move in one direction with said second member, while permitting said second member to move in an opposite direction independently thereof, and means for rendering said magnet inoperative in event of an excessive flow of current through said motor to permit said first movable member to return to its initial position.

22. The combination with a motor, of an armature resistance and a field resistance therefor, a movable member for controlling said armature resistance, a second movable member for controlling said field resistance, a retaining magnet for holding said first member in a predetermined position, means operated by said retaining magnet for operatively connecting said members to cause said first member to move in one direction with said second member, while permitting said second member to move in an opposite direction independently thereof, and means for short circuiting said magnet to permit said first member to move to its initial position from any position to which it may have been moved.

23. The combination with a motor, of an armature resistance and a field resistance therefor, a movable member for controlling said armature resistance, and a second movable member for controlling said field resistance, electromagnetic means for operatively connecting said members to cause said first mentioned member to move in one direction with said second member, while permitting said second member to move in an opposite direction independently thereof, means for rendering said second mentioned member ineffective in controlling its resistance when the two members are moved together, and means for rendering said electromagnetic means inoperative to permit said first member to return to its initial position from any position to which it may have been moved in event of an excessive flow of current through said motor.

24. The combination with a motor, of an armature resistance and a field resistance thereof, for a movable member for controlling said armature resistance, a second movable member for controlling said field resistance, electromagnetic means for operatively connecting said members, to cause said first member to move in one direction with said second member while permitting said second member to move in an opposite

direction independently thereof, means controlled by said first member for rendering said second member ineffective in controlling its resistance when the two members are
 5 moved together, and means for rendering said electromagnetic means inoperative to permit said first movable member to return to its initial position from any position to which it may be moved in event of an excessive flow of current through said motor.
 10

25. The combination with a motor, of an armature resistance and a field resistance therefor, a movable member for controlling said armature resistance, a second movable
 15 member for controlling said field resistance, means for operatively connecting said members to cause said first member to move the said second member in one direction, while permitting said second member to move in
 20 an opposite direction independently thereof, means for short circuiting said field resistance, while the two members are being moved together, and means for disconnecting said members to permit said first member to
 25 return to its initial position from any position it may have assumed in event of an excessive flow of current through said motor or failure of the line voltage.

26. The combination with a motor, of an armature resistance and a field resistance therefor, a movable member for controlling said armature resistance, a second movable
 30 member for controlling said field resistance, means for connecting said members to cause said first member to move in one direction with said second member, while permitting said second member to move in an opposite
 35 direction independently thereof, means controlled by said first member for short circuiting the field resistance while the two members are being moved together, and
 40 means for disconnecting said members to permit said first member to return to its initial position from any position to which it may have been moved in event of an excessive flow of current through the said motor or failure of the line voltage.
 45

27. The combination with a motor, of an armature resistance and a field resistance therefor, of a movable member for controlling said armature resistance and a second
 50 movable member for controlling said field resistance, a retaining magnet for holding said first member in a predetermined position,

means operated by said retaining magnet for operatively connecting said members to cause said first member to move in one direction with said second member while permitting said second member to move in a
 reverse direction independently thereof, and
 60 means for rendering said retaining magnet inoperative to permit said first member to move to its initial position from any position to which it may have been moved in event of an excessive flow of current through the
 65 motor or failure of the line voltage.

28. The combination with a motor, of a resistance therefor, a movable member for controlling said resistance, means for operating said movable member, and means for
 70 retaining said movable member in a predetermined position, engaging means carried by said movable member for engaging either said operating or retaining means, means for moving and holding said engaging means in
 75 operative position, and means for rendering the same inoperative to permit said engaging means to be disconnected and allow said movable member to return to its initial position from any position to which it may
 80 have been moved in event of an excessive flow of current through the motor or failure of the line voltage.

29. The combination with a motor, of a resistance therefor, a movable member for
 85 controlling said resistance, means for operating said movable member, means for retaining said movable member in a predetermined position, engaging means carried by said movable member for engaging either
 90 said operating means or retaining means, an electromagnet for moving and holding said engaging means in operative position and means for rendering said electromagnet inoperative, to permit said engaging means to
 95 disconnect from either of said moving or holding means and allow said movable member to return to its initial position from any position it may have assumed, in event of an excessive flow of current through said
 100 motor or failure of the line voltage.

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

ALBERT J. HORTON.

Witnesses:

CHARLES B. BAKER,
 FAUK DELLAVIC.