

No. 816,383.

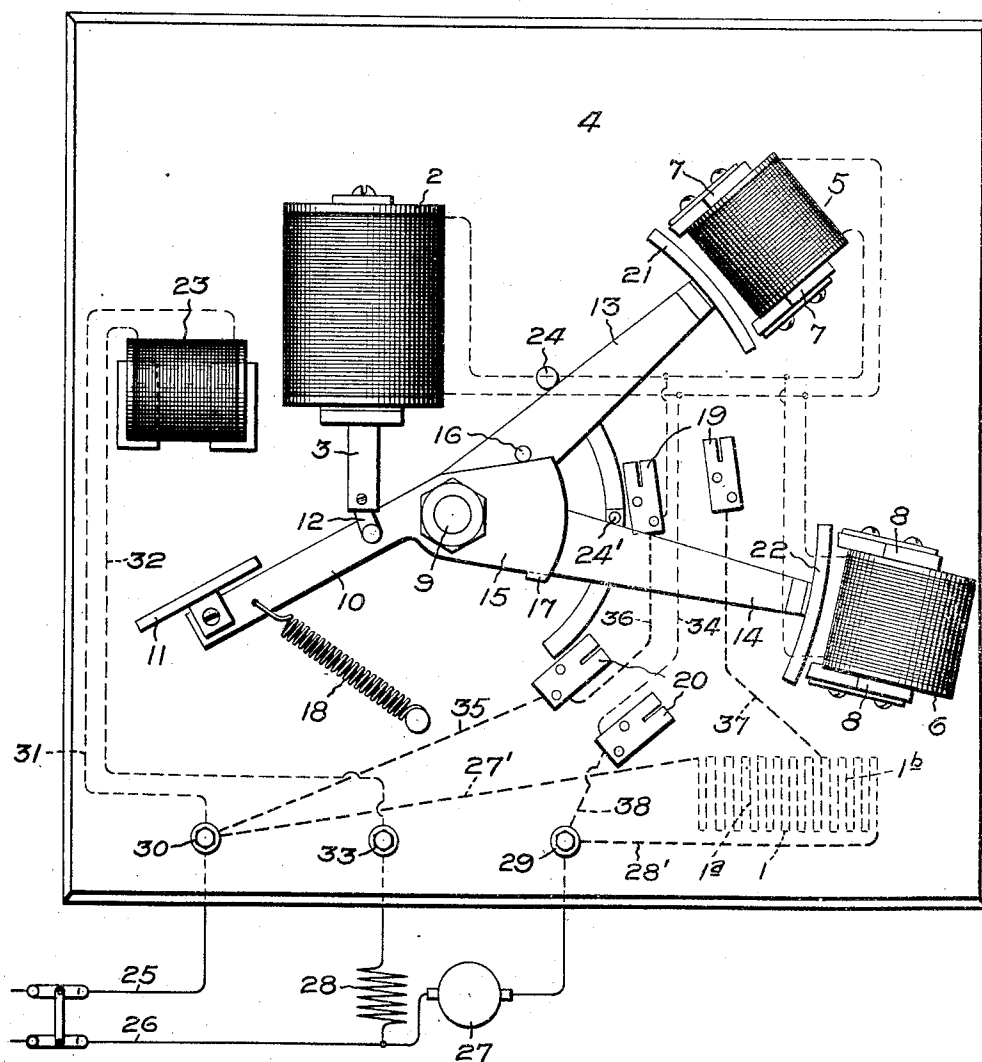
PATENTED MAR. 27, 1906.

E. SCHATTNER.
MOTOR STARTER.

APPLICATION FILED JULY 20, 1905.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

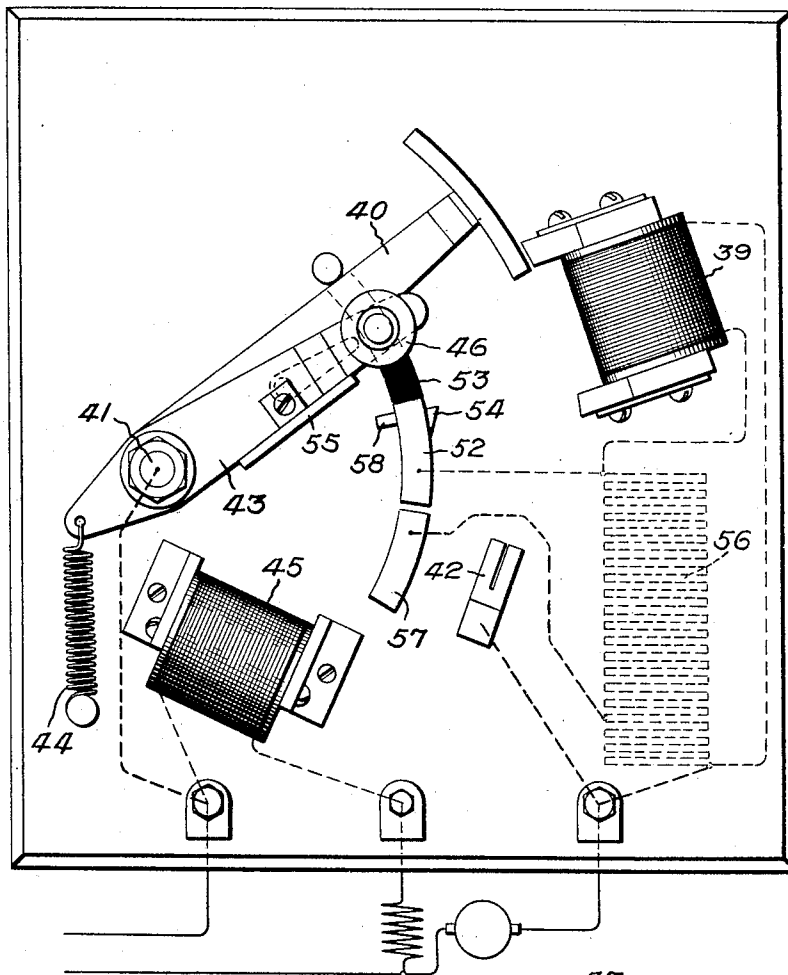
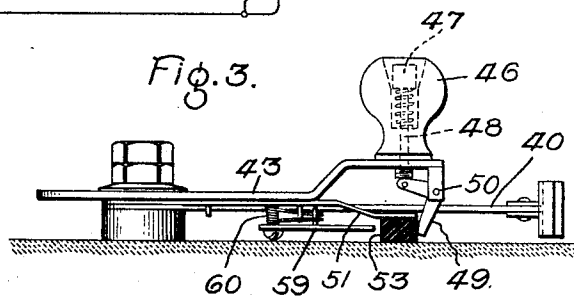


Fig. 3.



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UNITED STATES PATENT OFFICE.

ERNEST SCHATTNER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MOTOR-STARTER.

No. 816,383.

Specification of Letters Patent.

Patented March 27, 1906.

Application filed July 20, 1905. Serial No. 270,442.

To all whom it may concern:

Be it known that I, ERNEST SCHATTNER, a subject of the King of Great Britain, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Motor-Starters, of which the following is a specification.

This invention relates to devices for controlling motor-circuits, and has for its object the provision of a device of this character which is adapted for use with motors of large as well as small capacity and is at the same time cheap, durable, and efficient.

At the present time the type of motor-starting device in common use for small motors is the dial type of rheostat in which a controlling-arm is moved over a series of studs which form the terminals of starting resistance to gradually cut out said resistance. This type of device is not well adapted for large work, and the common practice in connection with large motors is to have a series of successively-operated switches arranged to cut out the resistance. In carrying out my invention I provide a device of the latter type which is so simple in construction and efficient in its action as to render its use desirable in connection with small motors as well. I provide a series of pivoted switch-arms which are held suspended when the circuit is first closed through the starting-resistance, but which are successively released to cut out sections of the resistance as the counter electromotive force of the motor builds up. The switch-arms are mechanically suspended, and upon the closing of the circuit the mechanical suspension is removed and suspension-magnets are energized to retain the arms in a raised position. As the motor speeds up the arms successively drop, and upon failure of voltage the arms are simultaneously moved to their suspended position.

My invention consists in certain features of construction and in the arrangement of a combination of elements hereinafter set forth, and particularly pointed out in the claims annexed to and forming a part of this application.

In the drawings, Figure 1 shows a plan view of a rheostat embodying the preferred form of my invention. Fig. 2 shows a similar view of a modified form, and Fig. 3 shows a detail of the starting-handle used on the modified form.

Referring to the drawings, 1 is a starting resistance divided into any desired number of sections. I have shown but two sections in the drawings, giving three steps, which is sufficient for motors up to about fifteen-horse power. The resistance is preferably so arranged that about eighty per cent. is short-circuited after the motor starts, and then when the motor speeds up sufficiently the other twenty per cent. is cut out. The number of starting steps, however, and the portion of the resistance cut out at each step form no part of my invention and will be varied greatly for different classes of motors. A solenoid 2, having an armature-core 3, is mounted upon the insulating-base 4. The magnets 5 and 6, having, respectively, pole-pieces 7 and 8, are mounted in a similar manner. The windings of the magnets 2, 5, and 6 are in shunt to each other and to the resistance 1. Pivoted at 9 is a lever 10, having at its outer extremity an armature 11. Arm 10 is pivoted to core 3 by a link 12. Concentric with the lever 10 are two switch-levers 13 and 14, loosely mounted upon the pivot 9. The lever 10 has a projecting portion 15, which extends partly over the switch-arms, and a stop-pin 16 is provided on the lever 13 to be engaged by this projecting portion. The projection 15 is provided with a lug 17 for engaging the arm 14. The spring 18 normally retracts the lever 10, so as to hold the switch-arms in raised position, as shown. Clips 19 and 20 are mounted upon the base, so as to be engaged by the arms 13 and 14, respectively, when the latter are released and fall by gravity. The arms 13 and 14 are provided with curved armature portions 21 and 22, which extend into proximity to the poles of the magnets 5 and 6. A no-voltage magnet 23 is mounted upon the base, so as to retain the armature 11 when the lever 10 is moved by the core 3 against the tension of the spring 18. A stop 24 limits the upward movement of the arm 13, and hence limits the movement of the lever 10 in response to the spring 18. Stop 24' is provided to limit the movement of the arm 14.

The arrangement of the circuit is as follows: 25 and 26 represent leads supplying power to a motor having an armature 27 and field 28. The magnet 23 is preferably connected in series with the field. With the parts as shown in Fig. 1 when the motor-cir-

cuit is closed the current passes from lead 25 through conductor 27', resistance 1, conductor 28', to terminal 29, and thence through armature 27 and back to line. The field-circuit passes from lead 25 to terminal 30, thence through conductor 31, magnet 23, conductor 32, and terminal 33 to field 28 and back to line. The current also passes from terminals 30 and 29 through clips 20, conductor 36, and one of the clips 19 to the magnets 2, 5, and 6, all of which are in shunt to each other and they are also in shunt to the resistance 1, since they have the same terminals at 29 and 30. The magnet 2 being energized when the control-switch x is closed draws in its core 3, raising the lever 10 until the armature 11 engages the poles of the magnet 23. This magnet 23 being energized through the field-circuit retains the lever 10 in raised position against the tension of the spring 18. At the same time the downward movement of the projection 15 removes the support from the arms 13 and 14. The arms, however, do not fall by gravity, since the magnets 5 and 6, which were energized simultaneously with magnet 2 hold the armatures 21 and 22 in magnetic suspension. As the motor speeds up and its counter electromotive force increases the voltage drop on the starting resistance decreases, whereby the magnets 5 and 6 are weakened. These magnets are so calibrated that they will release the arms successively. As shown in Fig. 1, the arm 13 is first released, cutting out section 1^a of the resistance. The armature-current then passes from lead 25 through conductor 35, clip 20, conductor 36, clip 19, thence through switch-blade 13, which has dropped into the clips 19, to conductor 37, section 1^b of the resistance, conductor 28', and terminal 29, armature 27, and back to line. The motor continuing to speed up and its counter electromotive force increasing, the voltage drop of the starting resistance further decreases, weakening the magnet 6 sufficiently to allow the switch-arm 14 to drop into the clips 20, and thereby short-circuiting the resistance through conductor 35, switch-arm 14, and conductor 38, establishing the running connections of the motor. Upon failure of voltage magnet 23 releases armature 11, and the spring 18 retracts the lever 10, lifting the arms 13 and 14 out of their respective clips, so that the armatures 21 and 22 are again opposite the poles of the magnets 5 and 6 and the arms 13 and 14 against the stops 24 and 24', respectively.

In Fig. 2 I have shown a device which is semi-automatic, a portion of the resistance being cut out manually, while the remainder is cut out automatically. In this case I have shown only one magnet 39 in shunt with the starting resistance and a single switch-arm 40, pivoted at 41 and adapted to engage the clip 42 to short-circuit the resistance. A

manually-operated arm 43 is likewise pivoted at 41 and is retracted to a raised position by means of a spring 44. The arm 43 is locked in short-circuited position by means of the no-voltage magnet 45, connected in series with the motor-field. The arm 43 is provided with a handle 46, (see Fig. 3,) having mounted therein a spring-pressed button 47, having a long shank 48, the extremity of which engages with bell-crank lever 49, pivoted at 50 to the arm 43. The arm 43 is provided with a contact-spring 51, engaging with the contact-segment 52, one portion of which, 53, is of insulating material. The conducting part of the ring 52 is provided with a stop 54, which is engaged by bell-crank lever 49 to stop the arm 43 in its downward movement. In order to move the arm farther, the button 47 must be pressed downward, moving the free end of the bell-crank outward from the segment 52, so as to clear the stop 54. The arm 43 may then continue its movement until its armature 55 engages the poles of the magnet 45. The mechanism just described in connection with the arm 43 is to prevent the arm from being moved by a continuous movement into a short-circuiting position. When the arm reaches the stop 54 and the motor-circuit is closed through the segment 52, the operator must pause long enough to push the button 43 and clear the stop 54. By this time the magnet 39 is energized so as to suspend the arm 40, while the arm 43 is moved downward against the tension of the spring 44 until its armature 55 is retained by the magnet 45. Section 56 of the starting resistance is thus cut out, the arm 43 being in contact with ring-segment 57. After the motor has speeded up the proper amount the magnet 39 is weakened sufficiently to allow the arm 40 to drop into contact with the clip 42, thereby short-circuiting the resistance in a manner similar to that described in connection with Fig. 1. Upon failure of voltage the arm 43 is returned by its spring 44, carrying with it the arm 40. In order not to damage the contacts upon the interrupting of the circuit, I have provided a quick-break switch consisting of the contact 58 and a spring-actuated switch-arm 59. The tension of the spring and the frictional contact between the arm 59 and the contact 58 are so adjusted that the circuit will not be broken until the arm 43 has passed on to the insulation. The tension of the spring 60 will then cause the circuit to be broken with a snap. From this description, taken in connection with that of Fig. 1, it is thought that the description of this modified form will be sufficiently clear.

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

1. The combination with a motor-circuit, of a starting-switch therefor comprising a magnetically-suspended switch-arm mount-

ed to establish the running connections of the motor when released, and means dependent upon the speed of the motor for releasing said arm.

2. The combination with a motor-circuit, of a starting-switch therefor comprising a switch-arm adapted to establish running connections of the motor, means whereby said arm is suspended upon closing the motor-circuit, and means dependent upon the speed of the motor for releasing said arm.

3. The combination with a motor-circuit and means for closing the same, of a starting-switch comprising a contact, a switch-arm arranged to fall by gravity into engagement therewith to establish running connections of the motor, a magnet-winding adapted to retard said switch-arm, and means dependent upon the speed of the motor for releasing said arm.

4. The combination with a motor-circuit and means for closing the same, of a starting-switch comprising a movable switch-arm adapted when moved to establish the running connections of the motor, an armature carried by said switch-arm, an electromagnet having its poles in proximity to the path of movement of said armature whereby movement of the switch-arm is retarded, and means dependent upon the speed of the motor for impressing upon the terminals of said electromagnet a continuously-decreasing electromotive force.

5. The combination with a motor-circuit, of a starting-switch therefor comprising a starting resistance, a plurality of switch-arms adapted to successively cut out sections of said resistance, means whereby said arms are suspended upon closing the motor-circuit, and means dependent upon the speed of the motor for releasing said arms.

6. The combination with a motor-circuit, of a starting-switch therefor comprising a starting resistance, a plurality of switch-arms adapted to successively cut out sections of said resistance, means whereby said arms are magnetically suspended upon closing the motor-circuit, and means dependent upon the speed of the motor for releasing said arms.

7. The combination with a motor-circuit, of a starting-switch therefor comprising a plurality of pivoted switch-arms normally supported in raised position, means for automatically removing said support upon closing the motor-circuit and simultaneously producing a magnetic suspension for said arms, and means for releasing said arms.

8. The combination with a motor-circuit, of a starting-switch therefor comprising a plurality of pivoted switch-arms, means for mechanically supporting said arms in raised position, means for automatically removing said support upon the closing of the motor-

circuit and simultaneously producing a magnetic suspension for said arms, and means for releasing said arms.

9. The combination with a motor-circuit, of a starting-switch therefor comprising a starting resistance, a switch-arm pivoted to fall by gravity when released to cut out a section of said resistance, means for suspending said arm, and means dependent upon the speed of the motor for releasing the same.

10. The combination with a motor-circuit, of a starting-switch therefor comprising a plurality of pivoted switch-arms, means for mechanically supporting said arms in raised position, means for automatically removing said support upon the closing of the motor-circuit and simultaneously producing a magnetic suspension for said arms, and means dependent upon the speed of the motor for releasing said arms.

11. The combination with a motor-circuit, of a starting-switch comprising a resistance and contacts therefor, a plurality of pivoted switch-arms having a bias toward engagement with said contacts, means for mechanically supporting said arms in raised position, electromagnetic means for automatically removing said support and simultaneously producing a magnetic suspension for said arms, and means dependent upon the speed of the motor for releasing said arms to successively cut out sections of said resistance.

12. A starting-switch comprising a resistance and contacts therefor, a plurality of movable contacts having a bias toward engagement with said contacts, a spring-retained support for said movable contacts, electromagnetic means for automatically moving said support against the tension of its spring and simultaneously producing a magnetic suspension for said movable contacts, a no-voltage magnet for holding said support in retracted position, and means dependent upon the speed of the motor for releasing said arms to successively cut out sections of said resistance.

13. A motor-starter comprising a spring-retracted circuit-closer, a resistance, a plurality of movable contacts adapted to gradually cut out said resistance and normally held in open-circuit position by the circuit-closer, a no-voltage magnet for holding the circuit-closer in closed position, and magnetic means governed by the counter electromotive force of the motor for successively releasing the movable contacts to cut out resistance.

In witness whereof I have hereunto set my hand this 14th day of July, 1905.

ERNEST SCHATNER.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.