

No. 816,383.

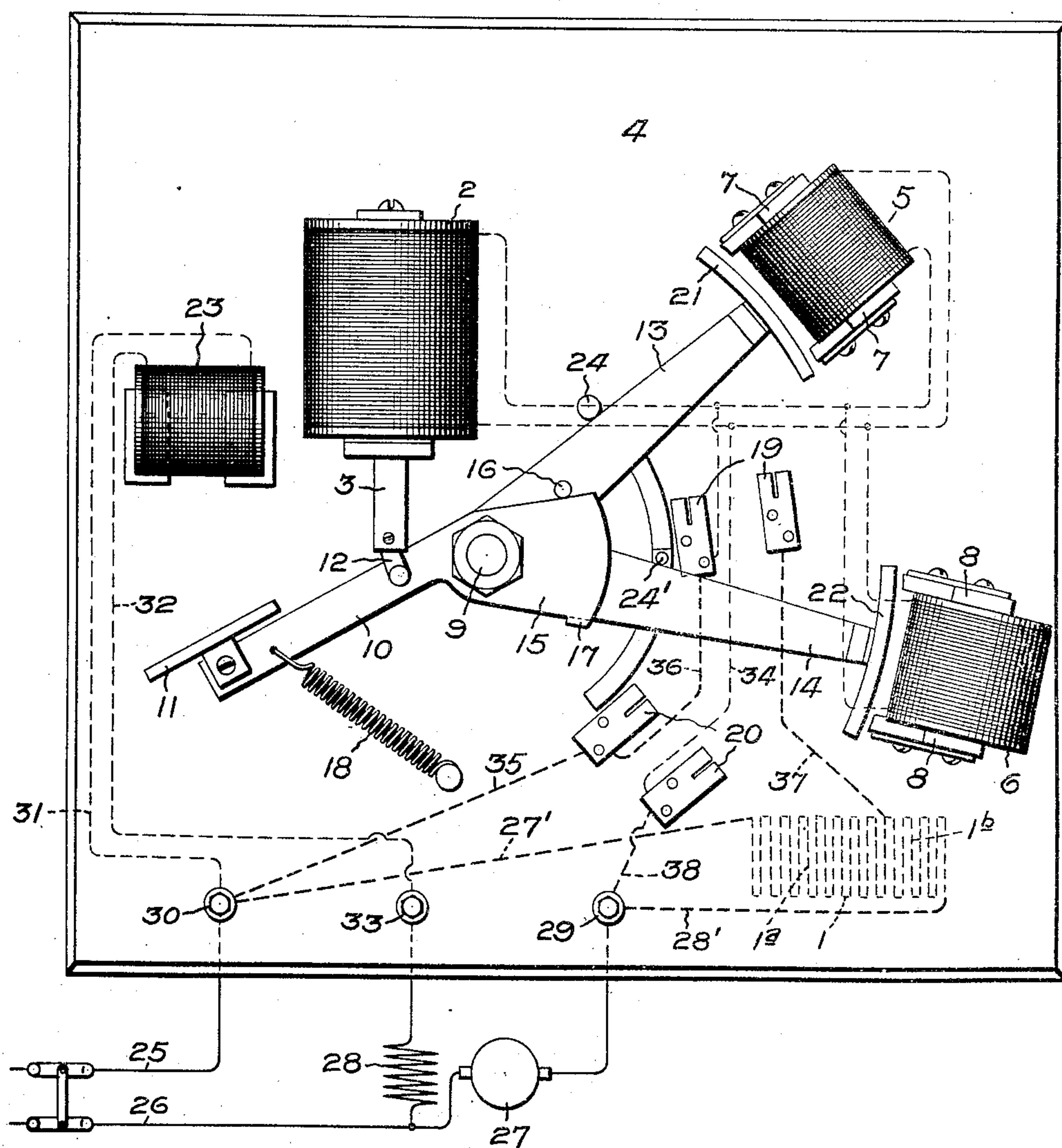
PATENTED MAR. 27, 1906.

E. SCHATTNER.
MOTOR STARTER.

APPLICATION FILED JULY 20, 1905.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Marcus L. Byng
Allen C. Ford

Inventor:

Ernest Schattner,
by *Alfred Davis*
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2 SHEETS—SHEET 2.

Fig. 2.

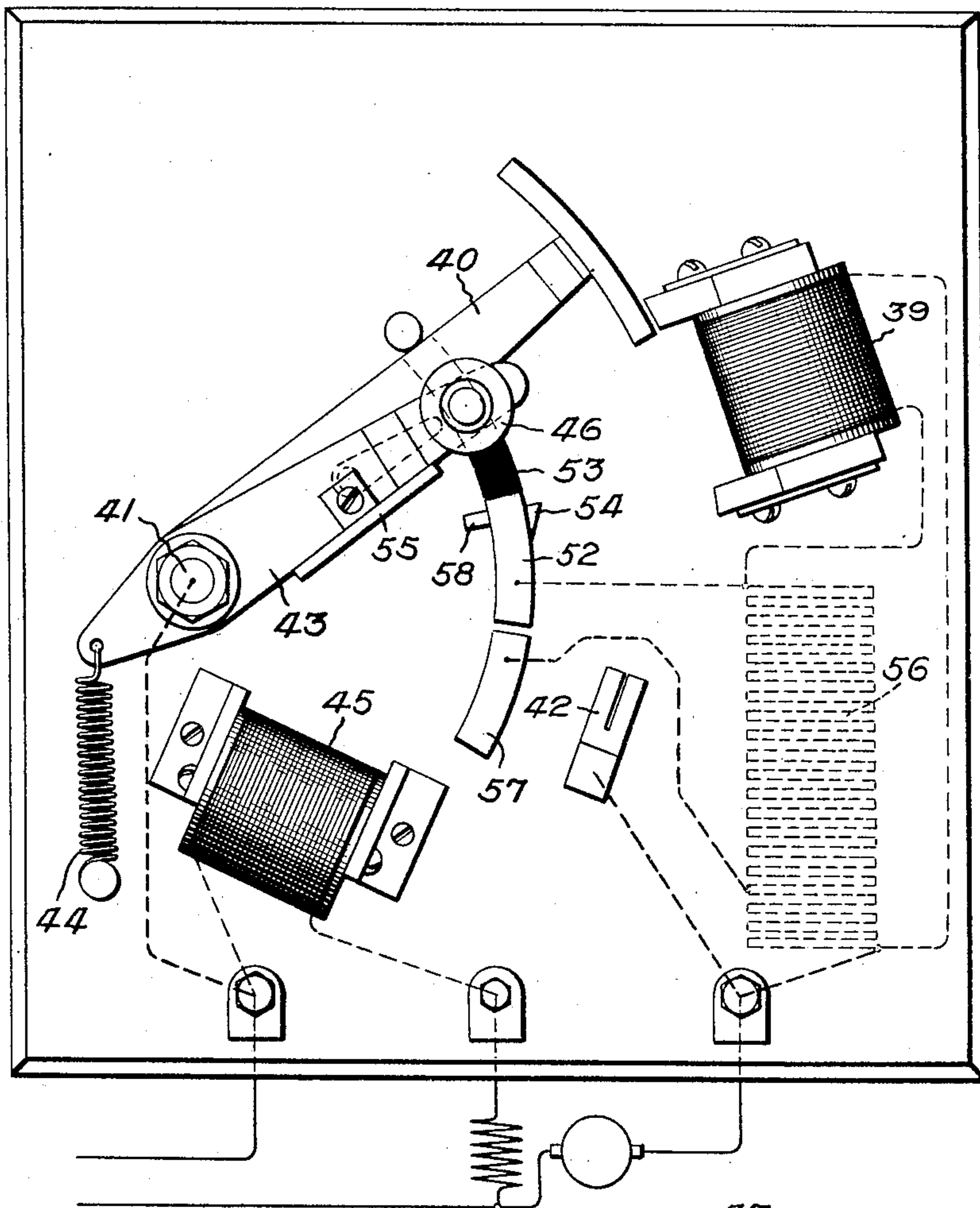
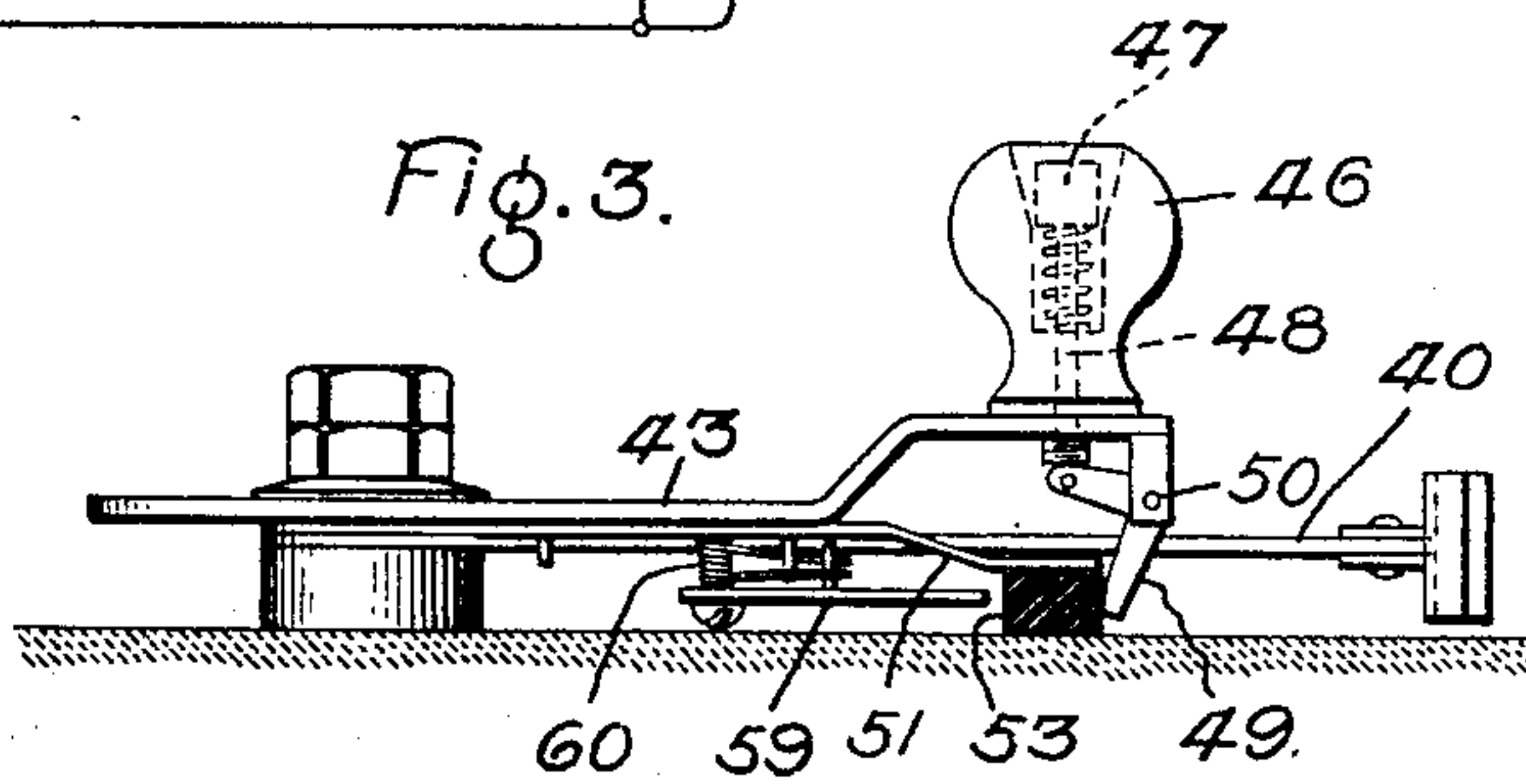


Fig. 3.



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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, conduc-
 tor 28', to terminal 29, and thence through
 armature 27 and back to line. The field-
 5 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
 10 terminals 30 and 29 through clips 20, conduc-
 tor 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 resist-
 ance 1, since they have the same terminals
 at 29 and 30. The magnet 2 being energized
 15 when the control-switch x is closed draws in
 its core 3, raising the lever 10 until the arma-
 ture 11 engages the poles of the magnet 23.
 This magnet 23 being energized through the
 field-circuit retains the lever 10 in raised po-
 20 sition 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,
 25 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 in-
 creases the voltage drop on the starting re-
 30 sistance 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
 35 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
 40 resistance, conductor 28', and terminal 29,
 armature 27, and back to line. The motor
 continuing to speed up and its counter elec-
 tromotive force increasing, the voltage drop
 of the starting resistance further decreases,
 45 weakening the magnet 6 sufficiently to allow
 the switch-arm 14 to drop into the clips
 20, and thereby short-circuiting the resist-
 ance through conductor 35, switch-arm 14,
 and conductor 38, establishing the running
 50 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 op-
 55 posite 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
 60 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
 65 clip 42 to short-circuit the resistance. A

manually-operated arm 43 is likewise pivot-
 ed 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 se- 70
 ries with the motor-field. The arm 43 is pro-
 vided 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, piv- 75
 oted at 50 to the arm 43. The arm 43 is pro-
 vided with a contact-spring 51, engaging
 with the contact-segment 52, one portion of
 which, 53, is of insulating material. The con-
 ducting part of the ring 52 is provided with a 80
 stop 54, which is engaged by bell-crank lever
 49 to stop the arm 43 in its downward move-
 ment. In order to move the arm farther, the
 button 47 must be pressed downward, mov-
 ing the free end of the bell-crank outward 85
 from the segment 52, so as to clear the stop
 54. The arm 43 may then continue its move-
 ment until its armature 55 engages the poles
 of the magnet 45. The mechanism just de-
 scribed in connection with the arm 43 is to 90
 prevent the arm from being moved by a con-
 tinuous 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 95
 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 55 100
 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 105
 sufficiently to allow the arm 40 to drop into
 contact with the clip 42, thereby short-cir-
 cuiting the resistance in a manner similar to
 that described in connection with Fig. 1.
 Upon failure of voltage the arm 43 is returned 110
 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. 115
 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 120
 then cause the circuit to be broken with a
 snap. From this description, taken in con-
 nection with that of Fig. 1, it is thought that
 the description of this modified form will be
 sufficiently clear. 125

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- 130

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 SCHATTNER.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.