

H. H. CUTLER.

AUTOMATIC SELF STARTER FOR MOTORS.

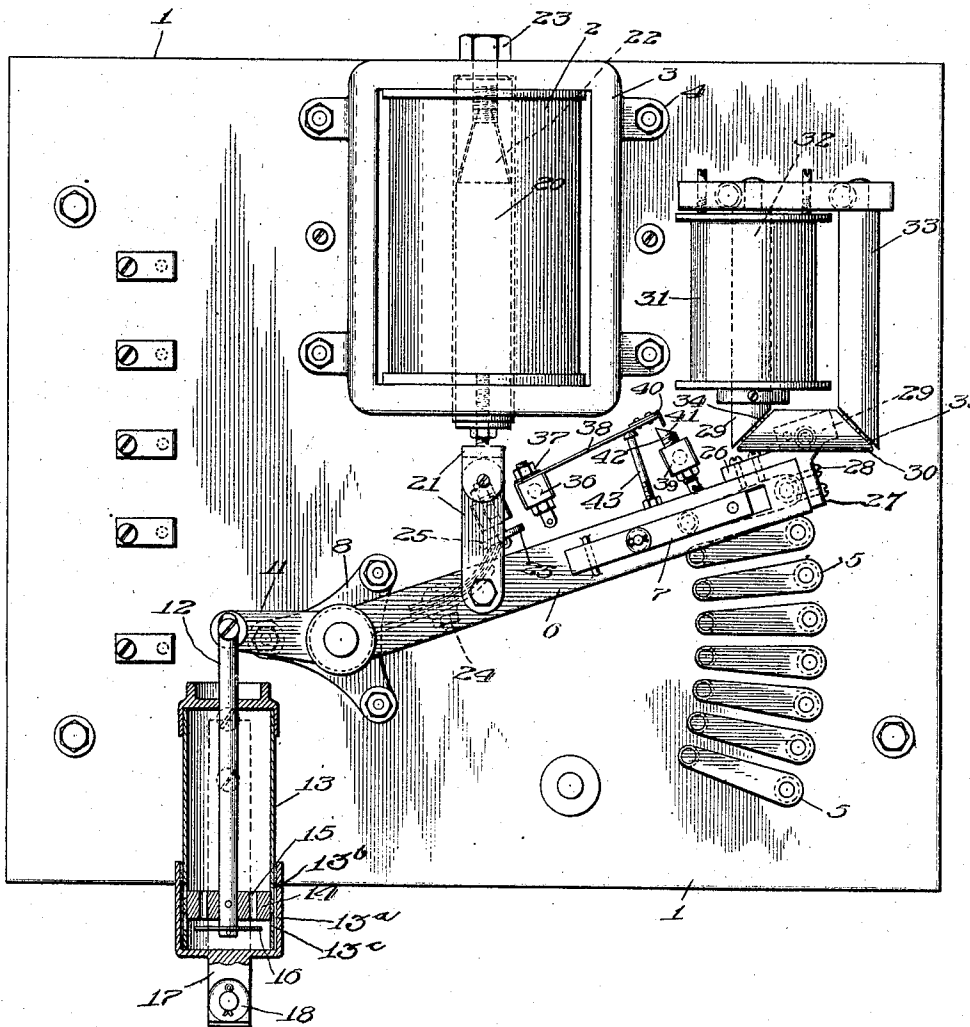
APPLICATION FILED APR. 9, 1904. RENEWED MAR. 29, 1912.

1,043,207.

Patented Nov. 5, 1912.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 3.

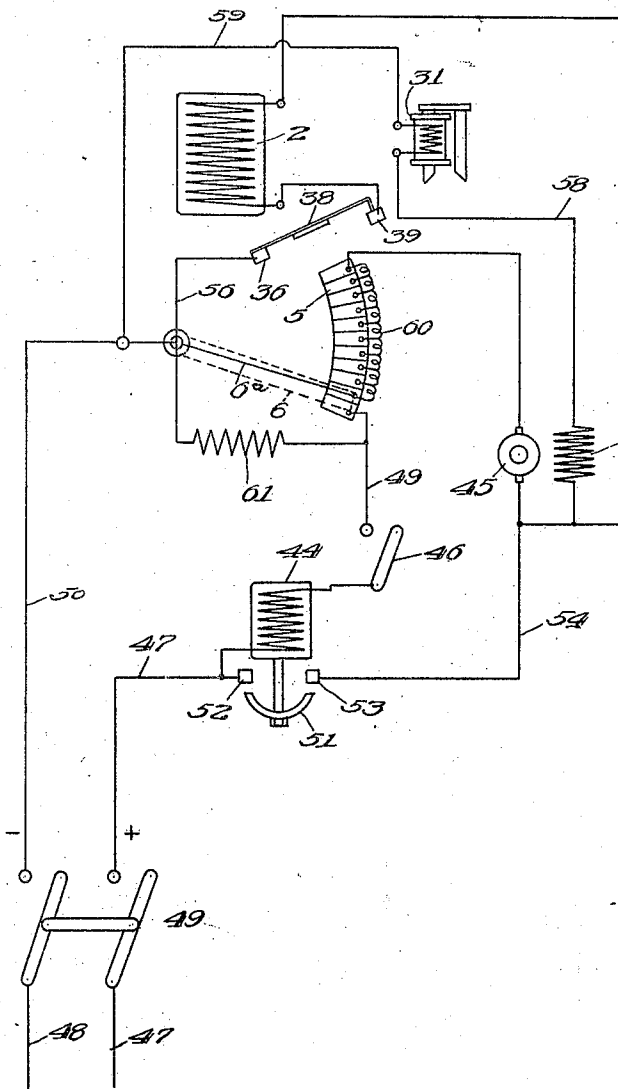
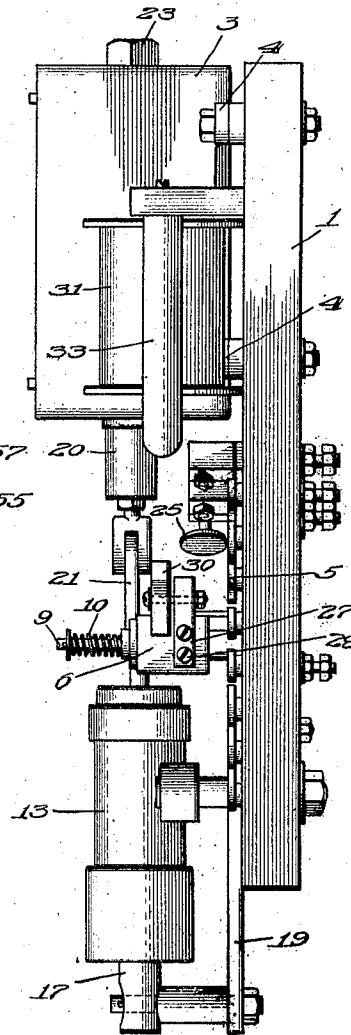


Fig. 2.



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UNITED STATES PATENT OFFICE.

HENRY H. CUTLER, OF MILWAUKEE, WISCONSIN.

AUTOMATIC SELF-STARTER FOR MOTORS.

1,043,207.

Specification of Letters Patent.

Patented Nov. 5, 1912.

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To all whom it may concern:

Be it known that I, HENRY H. CUTLER, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Automatic Self-Starters for Motors, 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 a self-starter for electric motors. In starters of this class a solenoid or electromagnet is usually employed which, when energized, is adapted to move the contact arm of the starting box or rheostat across a series of terminals to gradually remove the resistance from the armature circuit, thereby gradually starting the motor. When the contact arm has been moved to the "on" position, it is usual to provide some means for retaining the contact arm in this position without necessitating the passage of the full operating current through the windings of the solenoid.

It is the object of the present invention to provide improved means for retaining the contact arm in the "on" position after the same has been moved thereto through the agency of the operating solenoid.

In accordance with my invention I provide supplemental electromagnetic means for retaining the contact arm in the "on" position, whereby the electromagnetic means which serve to move the contact arm to the "on" position in starting the motor, may be disconnected from circuit. I preferably provide a retaining electromagnet separate and distinct from the pulling electromagnet, which serves to move the contact arm, and associate with the contact arm suitable switching mechanism, whereby the winding of the pulling magnet is removed from circuit when the working stroke of the contact arm has been completed.

One form of apparatus for carrying out my invention I have disclosed in the accompanying drawings, in which:

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 circuits employed.

In the embodiment of my device which I have worked out as the preferred construction, upon an insulating base 1, of slate or marble, or other suitable material, adapted

to be secured to the wall or other vertical support, a resistance controlling solenoid 2 is mounted. The solenoid is provided with a frame 3, having lugs or feet 4 bolted to the base 1 to support the solenoid in position upon the base. Suitable rheostat contacts 5 are also secured upon the base 1 by means of screws or in any other desired manner. A suitable operating lever 6 carries a suitable carbon brush 7 at one end thereof, which is normally pressed upon resistance contacts 5 by the coiled spring 10 mounted upon the pin 9. The lever 6 is secured upon the plate 1 by means of a plate 8 bolted to the base plate 1, having a projecting pin upon which the lever 6 is pivoted. The lever 6 has a rearwardly projecting arm 11 to which is attached the piston rod 12 of the dash-pot 13. The piston 14 of the dash-pot 13 is provided with suitable ports 15 extending therethrough, which are adapted to be opened and closed by the movable plate or valve 16, carried upon the lower end of the piston rod 12. At the lower end of the dash-pot 13 are provided by-passes 13^a, having ports 13^b and 13^c, which open into the chamber of the dash-pot. The dash-pot 13 has a suitable projection 17, by which it is suitably pivoted, as at 18, to a downwardly extending plate 19.

The core 20 of the solenoid 2 is adjustably secured at its lower end to a connecting link 21, which is pivotally secured to the lever or arm 6 and the upper end of the core is adapted to move into engagement with a cone-shaped stop 22, secured in position by the nut 23, and which permits a uniform movement of the core and thereby the lever 6. Upon the inner face of the arm or lever 6 is mounted a suitable spring contact 24 adapted to make engagement with an adjustable contact 25 mounted upon the plate 1, which contact is electrically connected with the last of the series of contacts 5, thereby, when the lever is in its final position, relieving the lever of part of the motor current and preventing the overheating of the last contact.

Secured to the outer end of the lever 6 is a bracket, having arms 26 and 27 extending over the front end of the lever and over the upper side thereof being held in position by screws 28, 28, and having at its outer and upper end a projection 29, to which is pivoted a wedge-shaped armature member 30, which is adapted to be attracted by the

magnet 31, mounted upon the base plate 1, and having suitable magnet poles 32 and 33. The wedge-shaped armature member 28 is adapted, when attracted, to fit within the V-shaped opening formed by the tapered sides 34 and 35 of the magnet poles 32 and 33.

A binding post 36 is secured to the front face of the plate 1 and has secured thereto by nut 37 one end of a spring plate 38, which forms a switch connection with a second binding post 39. The spring plate 38 has downwardly extending projection 40 adapted to make connection with the inclined face 41, of an adjustable contact 42, secured to the binding post 39. When the lever 6 is in the full "on" position, a pin 43 carried thereby is adapted to engage the spring plate 38, and move the projection 40 out of engagement with the contact 42.

In Fig. 3 the circuits and other apparatus involved in the system are shown. A solenoid switch 44 is employed to control the circuit to the motor 45 and any suitable switch 46 controls the operation of the switch 44. The plus and minus sides of the power circuits are indicated respectively by the numerals 47 and 48. A main switch 49 is provided for closing the circuit through the several parts with the main line.

The operation of the device would be as follows: Assuming the main switch 49 and the switch 46 to be closed, circuit may be traced from the plus side of the line through conductor 47, through the winding of the solenoid 44, through switch 46, conductor 49, the first of the series of contacts 5, contact lever 6 and back to the opposite main 48, by conductor 50. This energizes the winding of the solenoid and causes contact plate 51 to connect the terminals 52, 53. Current will then flow through the conductor 47, terminal 52, contact plate 51, terminal 53, conductor 54, conductor 55, through the winding of the solenoid 2 to terminal 39, across the switch 38, through conductor 56 and thence by conductor 50 to the opposite side 48 of the main. At the same time circuit is closed by the operation of the contact 51, through the field winding 57 of the motor and the circuit may be traced by conductor 47, across the switch 51, conductor 54, field winding 57, conductor 58, through the winding of the magnet 31, thereby energizing the same through conductor 59, and thence by conductor 50 to the opposite main 48. The winding of the solenoid magnet 2 being energized, the same will attract its core and move the lever 6 across the contacts 5, 5, thereby cutting out the resistance 60 in the armature circuit and starting the motor in operation.

The lever 6 normally bridges the first two contacts and short circuits a resistance 61, which is inserted in the circuit of the wind-

ing of the solenoid 44, but as soon as the lever is moved off the first of the series of contacts 5, the resistance 61 is inserted in circuit, thereby decreasing the strength of the winding of the solenoid 44 to such a degree that while it will serve to maintain the contact 51 in a closed position, if, for any reason, the current is cut off, it will not again operate to close the switch. When the lever 6 reaches the last position, cutting out all the resistance 60 in the motor armature circuit, the pin 43 mounted thereon will engage the switch 38, moving the same out of contact with the terminal 42 and thereby open the circuit through the winding of the solenoid 2. By this means only the retaining magnet 31 is retained in circuit across the line and this magnet is only of sufficient strength to hold the lever in its "on" position. A conductor 6^a connects the hub of the contact arm 6 with the second contact, so that in case the contact between the contact arm and the contacts should be defective the armature current will still find a path through conductor 6 and the resistance coils.

As the lever 6 moves across the series of contacts 5 the piston 15 will move downwardly into the dash-pot 13 and as the ports 15 are closed by this movement the movement of the lever will be retarded as the oil cannot freely pass around the piston. As soon, however, as the piston reaches a point intermediate of the ports 13^b and 13^c, the oil will pass freely through the by-pass 13^a from one side of the piston to the other, allowing the piston to move rapidly to the end of its stroke. At the same time the armature 30 carried by the lever 6 will be near the poles of the magnet 32 which will exert a slight pull on the armature, thereby assisting the solenoid 2. This causes a rapid movement of the lever over the last part of its movement and the switch arm 38 is rapidly caused to break contact with its contact 42, thereby preventing arcing at this point.

It will thus be seen that I have provided means for automatically starting the motor as soon as the switch 46 is closed, but as soon as the motor is started, the pulling magnet is cut out of circuit and a retaining magnet only serves to hold the controller arm in the "on" position. By this arrangement, as soon as the current, for any reason, is cut off from the field windings, the retaining magnet 31 will be deenergized and the same will permit the controller arm 6 to move to its initial position, through its own weight, the piston 14 offering but little resistance in this movement as the ports 15 are opened by the downward movement of the lever and the oil is permitted to freely pass there-through.

While I have shown and described one form of my invention, it will be understood

that I do not wish to limit myself to this particular construction as there are many changes which may be made without departing from the spirit of my invention.

5 I have shown the retaining magnet permanently connected in circuit with the shunt field windings, the windings serving to reduce the current through the magnet to such a degree that the same is only of sufficient
10 strength to hold the operating lever in position, but it will be understood that I do not wish to limit myself to this construction as there are numerous other ways of arranging the retaining magnet and the pulling
15 magnet without departing from the spirit of my invention. For instance, the retaining magnet may be connected in an independent circuit and suitable resistance inserted to reduce its strength, or the retaining magnet
20 may be so arranged that its circuit may be closed only when the circuit is opened through the pulling magnet, or the retaining magnet may be arranged in an independent circuit which is normally open, but which is
25 adapted to be closed when the circuit of the pulling magnet is opened. The above arrangements are cited merely to show the general changes which may be made in my device and are not intended to be an exhaustive enumeration of the various changes
30 which may be made.

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

35 1. In a starting device for electric motors, in combination, a supporting panel, a series of resistance contacts mounted thereon, a resistance varying element pivoted upon said base and carrying at one end a spring
40 pressed contact adapted to engage and move over said series of contacts a solenoid

mounted vertically on said panel and having a movable plunger connected to said element for operating the same, a dashpot having its piston connected to a rearward extension on said element for retarding the
45 operation of said element in one direction, a switch mounted on said panel between said element and said solenoid and arranged to be actuated by said element as it reaches the
50 limit of its movement to deenergize said solenoid, a retaining magnet mounted on said base contiguous to said solenoid, and a pivoted armature carried at the forward end of said element and arranged to be attracted
55 by said retaining magnet to hold said element at the limit of its movement after deenergization of said solenoid.

2. In a starting device for electric motors, in combination, a series of contacts, a starting
60 resistance connected thereto, an electromagnetically operated switch arm movable over said contacts to control said starting resistance, an electromagnetically operated main switch, said switch arm, when in its
65 initial position, being included in and adapted to complete the circuit of the operating winding of said main switch, a resistance arranged to be short-circuited by said switch arm when in initial position, and to be inserted
70 in circuit with the operating winding of said main switch when said switch arm is actuated to prevent reclosure of said main switch until said switch arm is returned to initial position.
75

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

HENRY H. CUTLER.

Witnesses:

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F. R. BACON.