(No Model.)

R. T. LOZIER.

AUTOMATIC CIRCUIT BREAKER FOR MOTORS.

No. 492,036. Patented Feb. 21, 1893.

Fig. 1.

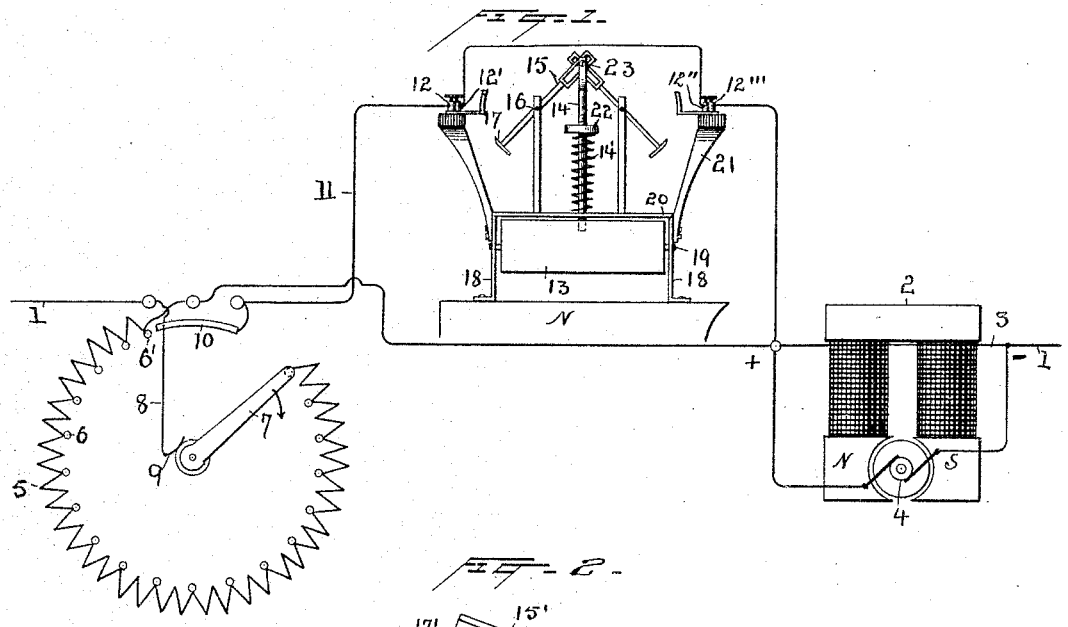


Fig. 2.

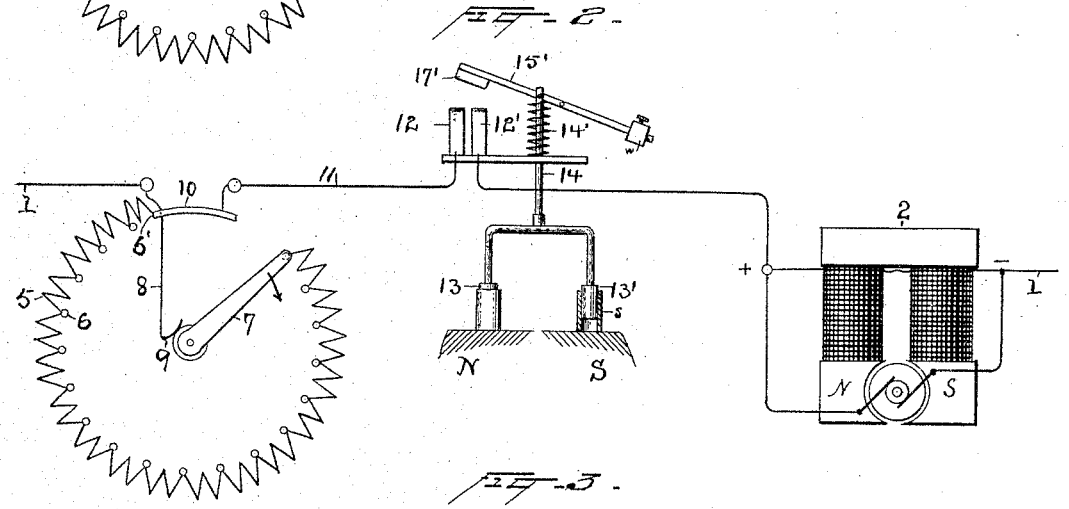
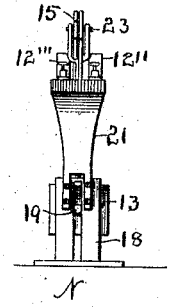


Fig. 3.



Witnesses
Norris A. Clark.
N. F. Oberle.

Inventor
R. T. Lozier
By his Attorneys
Dyer & Tuley.

UNITED STATES PATENT OFFICE.

ROBERT T. LOZIER, OF NEW YORK, N. Y., ASSIGNOR TO THE EDISON GENERAL ELECTRIC COMPANY, OF SAME PLACE.

AUTOMATIC CIRCUIT-BREAKER FOR MOTORS.

SPECIFICATION forming part of Letters Patent No. 492,036, dated February 21, 1893.

Application filed April 4, 1892. Serial No. 427,607. (No model.)

To all whom it may concern:

Be it known that I, ROBERT T. LOZIER, a citizen of the United States, residing in New York city, county and State of New York, have invented a certain new and useful Improvement in Automatic Circuit-Breakers or Switches for Electric Motors, of which the following is a specification.

The present invention relates to an improved device for protecting electric motors under certain abnormal conditions hereinafter specified.

The object of the invention is to automatically open the main circuit of a motor, should the current for the motor be stopped, or abnormally diminished.

The armatures of shunt-wound motors are of such low resistance as to make it necessary, when starting said motors, to temporarily interpose in the circuit some form of resistance in series with the armatures, until the latter have reached a speed that will generate sufficient counter-electro-motive force to keep the current passing through the armatures within the limits of their capacity. This resistance, in practice, consists of a rheostat, having a sliding contact, by which the operator successively cuts out of circuit the resistance coils of the rheostat as the armature approaches its normal speed, so that when that point is reached the resistance is entirely cut out, the armature being connected directly across the line. Now, should the speed of the motor be reduced, or stopped entirely, by an interruption or diminution in the current supplied, unless the resistance is again interposed in the circuit before the normal current supply is resumed, damage may be caused by the excess of current which will be allowed to pass through the motor armature, owing to its lack of counter-electro-motive force. As it is possible that the operator will not be present to re-adjust the starting rheostat in the case of an interruption of the current supply or initial electro-motive force, I provide a switch which shall automatically open the main motor circuit when the strength of the motor's field-magnets has weakened sufficiently to reduce the counter-electro-motive force of the armature to such a point that the initial electro-motive force, when resumed, would otherwise transmit an excess of current through the armature, thus requiring or permitting the operator to properly adjust the starting rheostat before again putting the motor into operation.

In the accompanying drawings, Figure 1 is a diagrammatic view, illustrating the apparatus and the circuit connections preferred; Fig. 2 is a similar view of a modified apparatus; and Fig. 3 is a view of the switch at right angles to the view in Fig. 1.

1 is the supply circuit or wire, from which the motor 2 receives current for energizing its field-magnet coil 3 and armature 4. One terminal of the motor is connected to the resistance conductor 5 at the extremity 6', the opposite extremity of the resistance being open, and the resistance being provided with a circular series of contacts 6, with which the switch-arm 7 is adapted to make contact successively. The switch-arm is connected with the line at the left of the motor, by means of conductor 8 connected to spring 9 bearing on the hub of said arm. The long contact 10, which is entirely disconnected from the resistance, is connected by wire 11 to one of the contacts, 12, of the circuit-breaker, there being preferably three other contacts 12', 12'', 12''', the two former (12', 12'') being connected together and the latter being connected to a terminal of the motor.

13 is an armature, supported by a rod 14, having a spring 14' tending to maintain the armature away from the magnet pole N, which pole is one of the field-magnet poles, but in the figure is shown disconnected from the motor for the purpose of showing the same on a larger scale than could otherwise be done and to avoid confusion of lines.

The body on which the switch is mounted is marked N to indicate that it is the same as the pole N of the motor.

To the upper end of the rod 14 are connected two arms 15, which are in turn pivoted at 16 and which carry springs or arms 17 adapted, when moved forward, to connect the contacts 12, 12' and 12'', 12''' of the circuit-maker and breaker, the contacts being side by side, in pairs, as shown in Fig. 3. By ar-

ranging the contacts of the circuit-breaker as described, the circuit is made and broken simultaneously at two points (12, 12′ and 12″, 12‴), an excellent contact between the fixed and movable contacts is obtained, and said movable contacts are given a long throw, so that all danger of arcing is avoided. On the pole piece N are secured two non-magnetic standards 18, having central slots within which pins 19, projecting from the armature, are adapted to slide. The standards carry a non-magnetic cross-piece 20, having standards 21 and being perforated for the passage of the rod 14. The spring 14′ presses on the top of this cross-piece at its lower end, and its upper end against the adjustable nut 22. The two arms 15 are slotted at their ends, and a pin 23 passes through both at the point where they cross. The armature being mounted in the guide-way as described, is normally held in its upper position by the spring 14′, but is free to move downward when the pole N exerts the required attraction.

The switch-arm 7, when the motor is out of use stands between the contact 10 and the open end of the resistance conductor. To start the motor said arm is moved in the direction of the arrow. This puts all the resistance (which is large in relation to the armature) in series with the motor, reducing the current in the armature circuit to within the capacity for which the motor and its circuit have been designed. This current, however, is sufficient to energize the field-magnets so that they will attract armature 13, closing the circuit at the circuit-breaker, so that when the switch-arm moves onto contact 10 the circuit will be from line to the switch-arm, to contact 10, wire 11, through the contacts of the circuit-breaker, to the positive terminal of the motor, and through the motor to line. With this arrangement, the entire current which passes to the motor must pass through the circuit-breaker. As the switch-arm approaches contact 10 the armature gains in speed and resultant electro-motive force. If, now, the current on the line falls or ceases, the spring 14′ immediately raises the armature and opens the circuit. When the current is resumed, the motor will not start, because its circuit is open, but when the arm 7 is moved forward onto the resistance contacts, the motor at once starts, and as the arm is moved around the circuit-maker is again operated, as already described.

In the modified arrangement shown in Fig. 2, the parts are numbered, as far as convenient, to correspond with Fig. 1. In this arrangement, there is but one path for the current between the resistance switch or controlling device and the positive terminal of the motor, and this path is composed of the wire 11, extending to the contacts 12, 12′ of the circuit-breaker, said contacts being adapted to be connected by the plate 17′ carried by the pivoted arm 15′ having a counter-balance weight *w* and being connected to the armatures 13, 13′ by a rod 14. Instead of one large armature, as shown in Fig. 1, I employ, in this form, two armatures, which may be round and adapted to slide in sockets *s* on the field-magnet pole. The long contact 10 of the resistance switch is, in this case, connected to the end of the resistance conductor at 6′.

When it is desired to start the motor, it is necessary to close the circuit at 12, 12′ by hand. As the switch-arm is moved around, the circuit is first closed through all the re-resistance, and then the resistance gradually removed, the field-magnet soon attaining sufficient power to hold the circuit closed at the circuit-breaker. Should the current on the line fall or cease, the main line would be at once opened, as already described.

By having the circuit-breaker exterior to the terminals of the motor, it is clear that the latter will not automatically start up on a resumption of the normal current, as would be the case, for example, if the circuit-breaker were in the armature branch of the motor, as has been heretofore proposed. In many cases, it is desirable, when the motor has been arrested, that it should only start when the operator starts it intentionally, and such action is necessary with the arrangement of apparatus described.

While I prefer to have the circuit-breaker entirely outside of the motor terminals, that is, outside of the points where the field-magnet and armature branches unite, when a shunt motor is used, it will be evident that some of the features described will be equally applicable when the circuit-breaker is in the armature branch.

What I claim is—

1. The combination of a motor, a circuit-breaker in the main motor circuit, means, such, for example, as a spring, tending to move the same to its open position, and an armature in operative relation to the field-magnet of the motor connected to said circuit-breaker so as to close the circuit when the armature is attracted, substantially as described.

2. The combination of a shunt motor, a circuit-breaker in the main motor circuit outside of the motor terminals, means, such, for example, as a spring, tending to move the same to its open position, and an armature, in operative relation to the field-magnet of the motor, connected to said circuit-breaker so as to close the circuit when the armature is attracted, substantially as described.

3. The combination of a motor, a rheostatic controlling switch therefor, said switch having considerable resistance in circuit when first moved to close the motor circuit, and being constructed to cut out resistance as the switch is moved forward, a contact connected to a circuit-breaker contact and through the same to one terminal of the motor, said first mentioned contact being connected to the line when the resistance is cut out, and a circuit-breaking device having a tendency to open

but being held closed by the current when it is of normal strength, substantially as described.

4. The combination of a circuit, a rheostatic controlling switch, and a motor interposed in said circuit, a circuit-breaker exterior to the motor terminals and having a tendency to move to its open position, and an armature connected to said circuit-breaker and in position to be attracted by the field-magnet of the motor, substantially as described.

5. The combination of a circuit, a rheostatic controlling switch and a motor interposed in said circuit, said switch consisting of a series of contacts connected by resistances, one end of the resistance being connected to one terminal of the motor, a switch-arm to which the circuit is connected, adapted to move over said contacts, beginning at the end opposite to that connected to the motor terminal, a circuit-breaker held open when the motor is out of use, and an armature in proximity to the field-magnet connected to the circuit-breaker for holding the same, substantially as described.

6. The combination of a motor field-magnet pole, a guide thereon, an armature adapted to reciprocate therein, means for holding said armature away from the magnet when the circuit is open, pivoted circuit closing arms operatively connected to said armature, and contacts in the motor circuit adapted to be connected by movement of said pivoted arms, substantially as described.

7. The combination of the field-magnet pole, slotted standards 18 carrying a cross-piece and standards, the contacts carried by the latter standards, the reciprocating armature and its supporting rod, the rods 15 slotted at their adjacent ends and connected to the armature rod, and the contacts carried by said pivoted arms and adapted to connect the first mentioned contacts, substantially as described.

8. The combination of the movable armature, a rod projecting therefrom, two pivoted arms with slotted intersecting ends, a pin connecting the rod with the arms at their intersection, connecting plates carried by the arms, and contacts adapted to be connected thereby, substantially as described.

9. The combination of a motor, a circuit-breaker in the main motor circuit having several contacts, means tending to move the circuit-breaker to its open position, an armature attracted to its forward position when the current through the motor is of normal strength, and a circuit-closing device moved by said armature and connecting said several contacts, whereby the circuit is broken at several points, substantially as described.

This specification signed and witnessed this 30th day of March, 1892.

ROBERT T. LOZIER.

Witnesses:
CHARLES M. CATLIN,
GEORGE B. BUCHANAN.