No. 608,134. Patented July 26, 1898.

# R. LUNDELL.

## ELECTRICAL CIRCUIT CONTROLLER.

(Application filed Feb. 1, 1898.)

(No Model.)

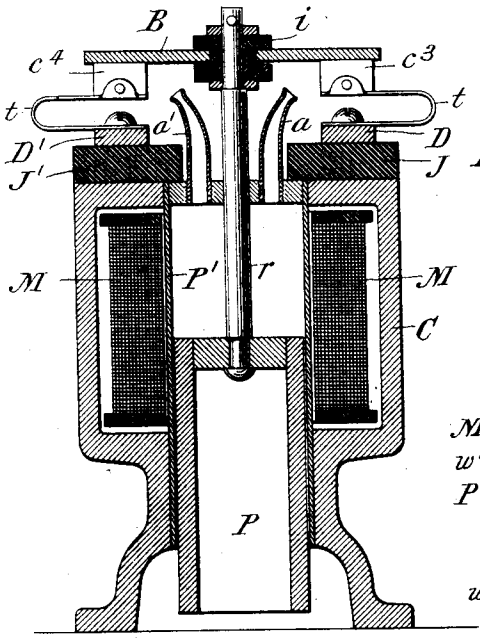
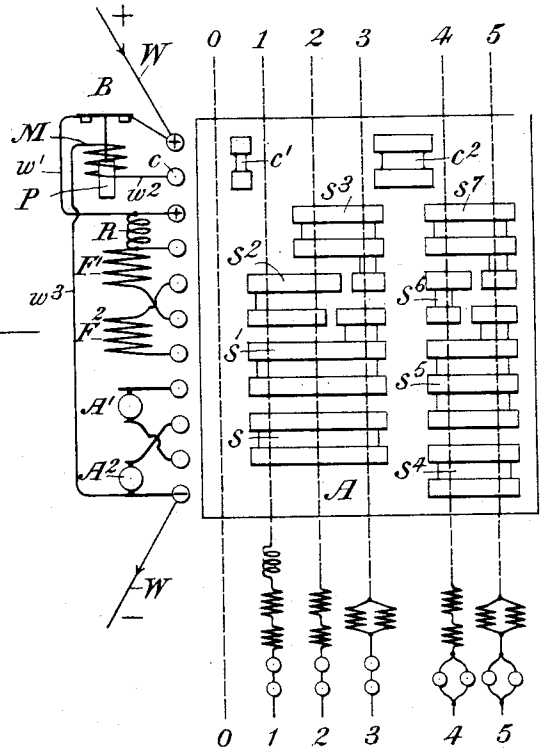



Fig. 2,

Fig. 1,



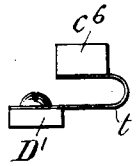
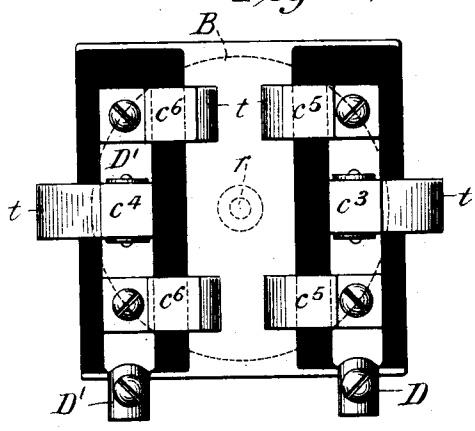




Fig. 4,

Fig. 3,




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# UNITED STATES PATENT OFFICE.

ROBERT LUNDELL, OF NEW YORK, N. Y., ASSIGNOR OF TWO-THIRDS TO THE INTERIOR CONDUIT AND INSULATION COMPANY, OF SAME PLACE.

## ELECTRICAL-CIRCUIT CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 608,134, dated July 26, 1898.

Application filed February 1, 1898. Serial No. 668,703. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT LUNDELL, a citizen of the United States, residing at New York, (Brooklyn,) in the county of Kings and State of New York, have made a new and useful invention in Circuit-Controllers for Controlling the Application or Use of Electrical Currents of High Tension and Great Quantity, of which the following is a specification.

My invention is directed particularly to apparatus for use in connection with electric motors, dynamo-electric machines, or analogous electric translating devices which utilize electrical currents of high potential and large quantity—such, for instance, as is disclosed in a prior patent granted to me by the United States Patent Office on the 24th day of October, 1893, and bearing No. 507,144; and its objects are, first, to provide means whereby arcing at the circuit-controlling contacts may be effectually avoided while the various circuit changes are being effected by the controller in connecting up the circuits in any prearranged order for which the translating device, such as a motor, may be devised, and, second, to provide means whereby arcing at the circuit-breaker itself is reduced to a minimum.

My invention will be fully understood by referring to the accompanying drawings, in which—

Figure 1 illustrates in diagrammatic view a controller for an electric motor having a starting-coil, two field-magnet coils, two armature-coils, a drum carrying circuit-changing contacts, and my improved means for automatically interrupting the circuit before certain current changes are effected in the motor-circuits as the controller-drum is rotated in either direction. Fig. 2 is a longitudinal sectional view taken through my improved automatic circuit-breaker, illustrating the controlling-magnet therefor, its plunger, the arc-extinguishing means, and the switching-contacts; and Fig. 3 is a plan view thereof as seen looking at Fig. 2 from the top toward the bottom of the drawings, Fig. 4 being a detail view of one of the spring-supporter contacts of the automatic circuit-breaker.

In my prior patent above referred to there is disclosed means for simultaneously interrupting the circuit at a number of points before the current changes are effected through the motor and for then connecting up the circuit again after the desired changes have been so completed. My present invention is much more simple in structure and effective in operation in that I substitute for the more complicated apparatus disclosed in my prior patent a single electromagnetic circuit-breaker and so arrange its circuit connections with those of the controller that it (the circuit-breaker) will automatically interrupt the circuit before certain current changes occur where arcing might result, and in the application of such an automatic circuit-breaker to a current-controller for preventing damaging arcing lies the essence of my invention.

Referring now to the drawings in detail for a full and clear understanding of my invention, such as will enable others skilled in the art to construct and use the same, and first to Fig. 1, A represents a developed controller-drum having a number of circuit-controlling contact-strips $s$ $s'$ $s^2$, &c., to $s^7$ arranged thereon for effecting the proper current changes in any prearranged order through a starting resistance R, field-magnet coils $F'$ $F^2$, and armatures $A'$ and $A^2$, a series of binding-posts being provided with contact-brushes, (not shown,) but adapted to bear upon the strips $s$ to $s^7$, inclusive, as the controller-drum is rotated. $c'$ and $c^2$ are controller-contacts located, as shown, near the upper end of the drum or cylinder A, $c'$ being slightly in advance of contact-strips $s$, $s'$, and $s^2$, and $c^2$ of greater width than $c'$ for a purpose to be hereinafter described. Brushes (not shown) are also provided for the binding-posts $c$ $c$ and adapted to bear on the contacts $c'$ and $c^2$ as said contacts pass under the free ends thereof. 0 0, 1 1, 2 2, 3 3, 4 4, and 5 5 are broken lines illustrating the different positions of the controller-drum and the circuit relations which

the field and armature coils assume for said positions.

Referring now to Figs. 2, 3, and 4 for a detailed description of the automatic circuit-breaker, C represents a rectangular iron casing with a substantially cylindrical base provided with means for securing it adjacent to the controller. M is a solenoid-coil of comparatively small dimensions, it being only used momentarily when the current changes are being effected by the controller, and hence having ample time to cool off. One end of this coil is connected by a conductor $w^2$ to binding-post $c$ and the other by a second conductor $w^3$, running to the negative binding-post of the controller. (See Fig. 1.) P′ is a brass tube secured in the casing C and provided at its upper end with an air-tight head having air vents or tubes $a$ $a'$. P is an iron plunger or solenoid-core fitting snugly within the tube P′, and $r$ a steel rod secured thereto and fitting snugly in the head of the tube. To the upper end of the rod $r$ is secured a copper circuit-breaking plate B, but insulated therefrom by washers $i$, said plate resting normally on a number of pairs of carbon and copper contact-blocks $c^3$ $c^4$ $c^5$ $c^5$ $c^6$ $c^6$, supported yieldingly on conducting-springs $t$ $t$, which in turn are connected to binding-posts D D′, supported by insulating material J J′, secured to the top of the casing C.

Referring again to Fig. 1, suppose the controller to be on open circuit with the contact-springs free from contact with the contact-strips on the cylinder or drum A, as shown by the dotted line 0 0. Upon rotating the controller-cylinder from the position indicated by line 0 0 to position 1 1 the operation is as follows: Owing to the advanced position of contact-strip $c'$, the upper contact-brushes first close a circuit through the shunt-coil M of the circuit-breaker, causing the contact-plate B to suddenly break connection between the carbon and copper contacts $c^3$, $c^4$, $c^5$, and $c^6$. Upon a further rotation of the cylinder the lower contact springs or brushes establish connection between the various field-coils and armatures in the manner indicated at line 1 1, and when position 1 1 is finally reached the circuit through the shunt-coil M is broken and the circuit-breaker has again closed connection between the contact-blocks $c^3$, $c^4$, $c^5$, and $c^6$, causing the line-current to flow as indicated at line 1 1. When the cylinder is rotated from position 1 1 to 2 2, the starting resistance is merely cut out, and when position 3 3 is reached the field-coils F′ and F² are coupled in parallel. Continuing the rotation of the controller-cylinder to position 4 4 the circuit-breaker is again brought into action and is caused by contact-strip $c^3$ to break the line-current before the contact springs or brushes are disconnected from the contact-strips $s$, $s'$, and $s^3$ and to keep the line-current broken until position 4 4 is reached. Position 5 5 will be reached without any action of the circuit-breaker. Upon reversing the controller-cylinder from position 5 5 the operation is substantially the same. The circuit-breaker will interrupt the line-current before the contact-springs are disconnected from contact-strips $s^4$, $s^5$, $s^6$, and $s^7$ and will keep the line-current interrupted until position 3 3 is reached. The circuit-breaker is again brought into action before the contact-springs have become disconnected from the contact-strips $s$, $s'$, and $s^2$, thus breaking the line-current at contact-blocks $c^3$, $c^4$, $c^5$, and $c^6$.

Referring now to Fig. 2 of the drawings for a clear understanding of the operation of the arc-extinguishing means by which any arc at the switch-breaking contacts is extinguished, it will be apparent that when the shunt-coil M is energized the plunger P is drawn suddenly upward, so that the circuit-breaking plate B interrupts the circuit by being first lifted from the spring-supported copper contact-blocks $c^5$ $c^5$ and $c^6$ $c^6$ and afterward from the carbon contact-blocks $c^3$ $c^4$. At the same instant blasts of air are ejected from the tube P′ above the head of plunger P through the air-vents $a$ $a'$ with such force and volume as to suddenly blow out or extinguish any arc which might result at the last points of rupture.

I do not limit myself to the specific apparatus hereinbefore described for obtaining the results attributable thereto.

I believe I am broadly entitled to claim means in the nature of a normally-closed electromagnetic circuit-breaker which automatically interrupts the circuit to a translating device, such as an electric motor, having means for varying the resultant effects of high-potential currents therethrough and maintains the circuit interrupted until the changes are effected therein and then automatically reëstablishes the current therethrough, thereby avoiding dangerous arcing.

I believe it is also broadly new with me to devise a circuit-breaking switch provided with electromagnetic circuit-breaking means adapted to automatically break an electric circuit and provided with means controlled thereby whereby a draft of air may be caused to blow out or extinguish any arc which occurs at the circuit-breaking contacts, and my claims in this particular refer to electric switches in general for use with high-potential circuits.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. A normally-closed electromagnetic circuit-breaker in combination with a current-changing device and a translating device such as an electric motor, said circuit-breaker being arranged to momentarily interrupt the current-supply for the purpose of preventing arcing at the current-changing device, substantially as described.

2. A circuit-breaker consisting of electromagnetic means for interrupting an electric circuit, in combination with means controlled by the movable part of the circuit-breaker and adapted to force or eject a blast of air around the circuit-breaking contacts thereof, substantially as described.

In testimony whereof I have hereunto subscribed my name this 31st day of January, 1898.

ROBERT LUNDELL.

Witnesses:
C. J. KINTNER,
W. L. WILLIAMS.