F. W. LORD & F. W. ERICKSON.

CURRENT INTERRUPTER FOR ELECTRIC CIRCUITS.

APPLICATION FILED APR. 27, 1907.

**932,481.** Patented Aug. 31, 1909.

Fig. 1.

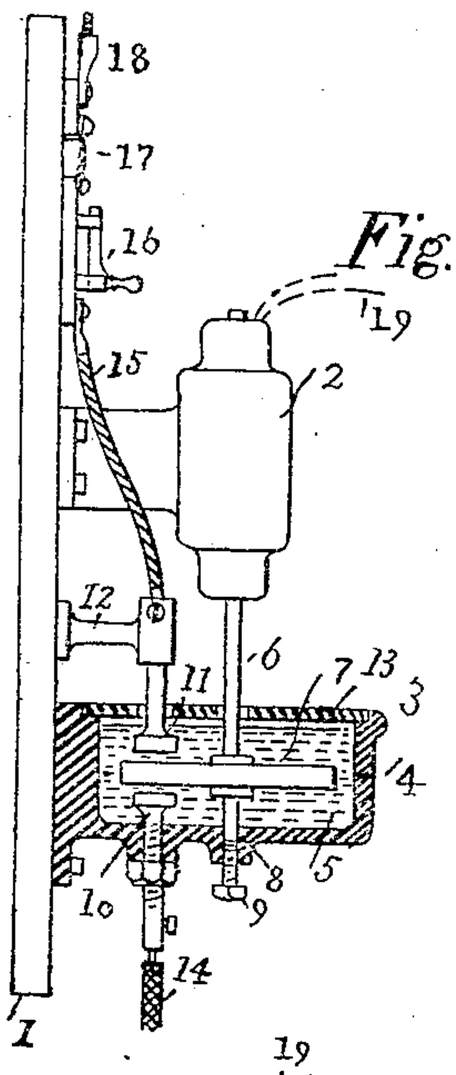



Fig. 4.

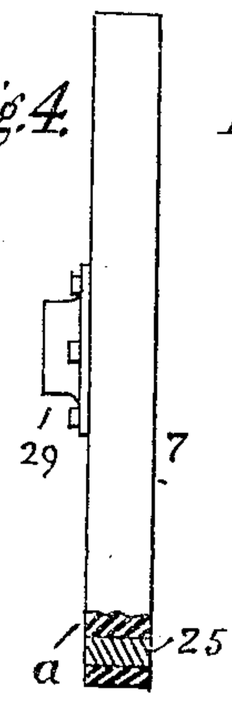



Fig. 5.

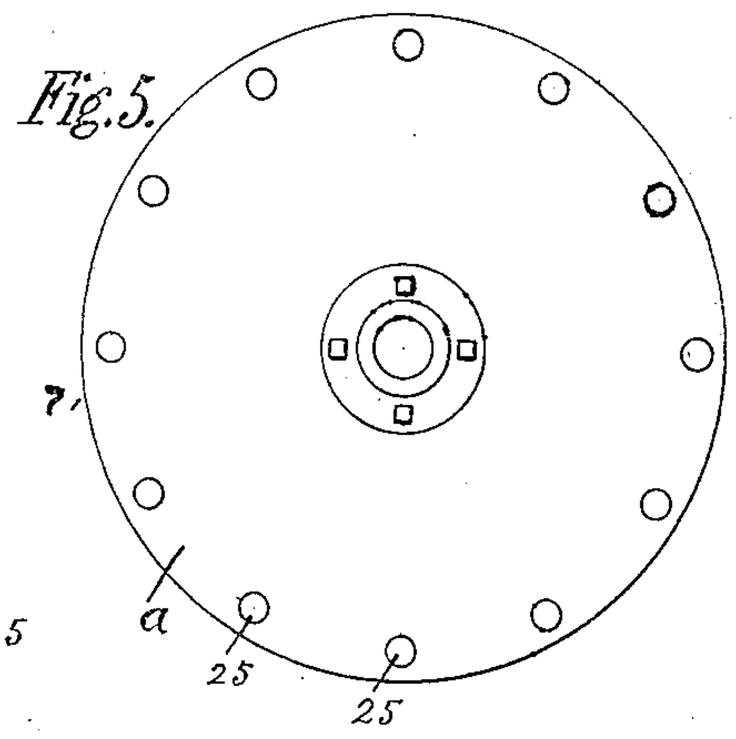



Fig. 2.

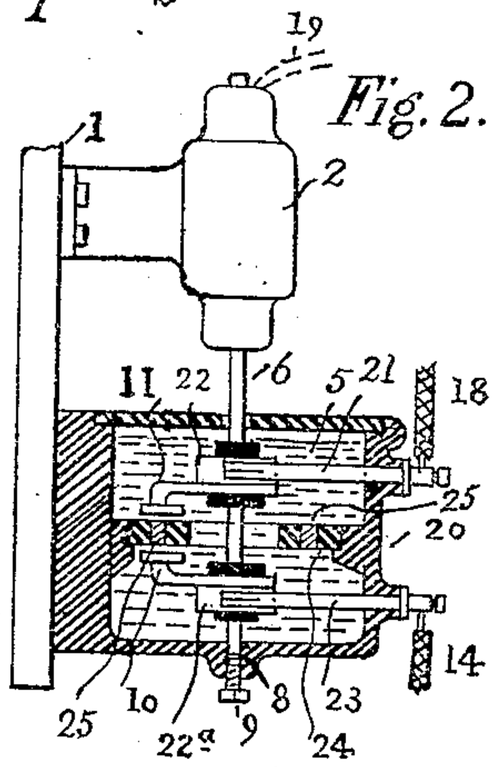



Fig. 6.

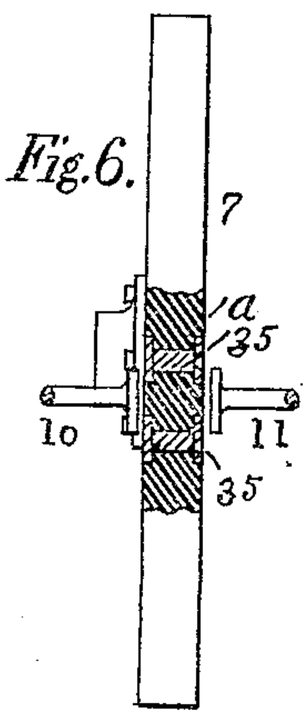



Fig. 7.

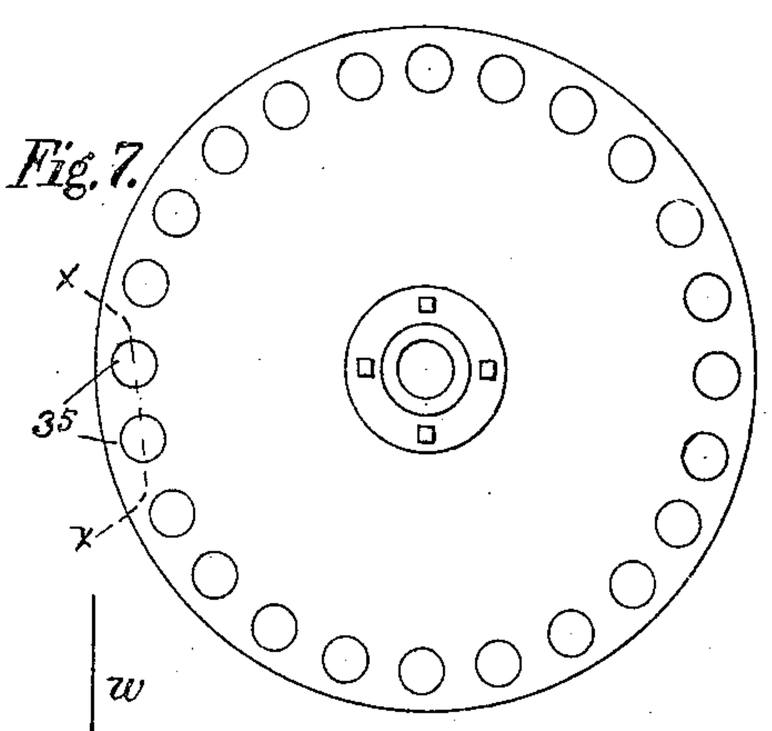



Fig. 3.

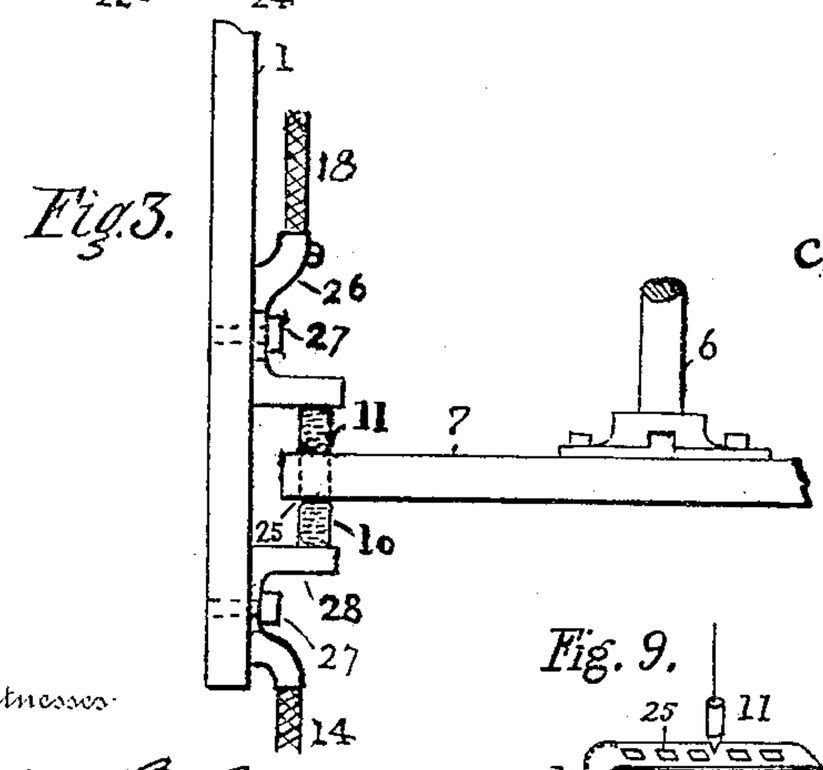



Fig. 9.

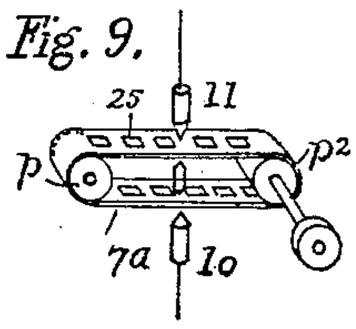
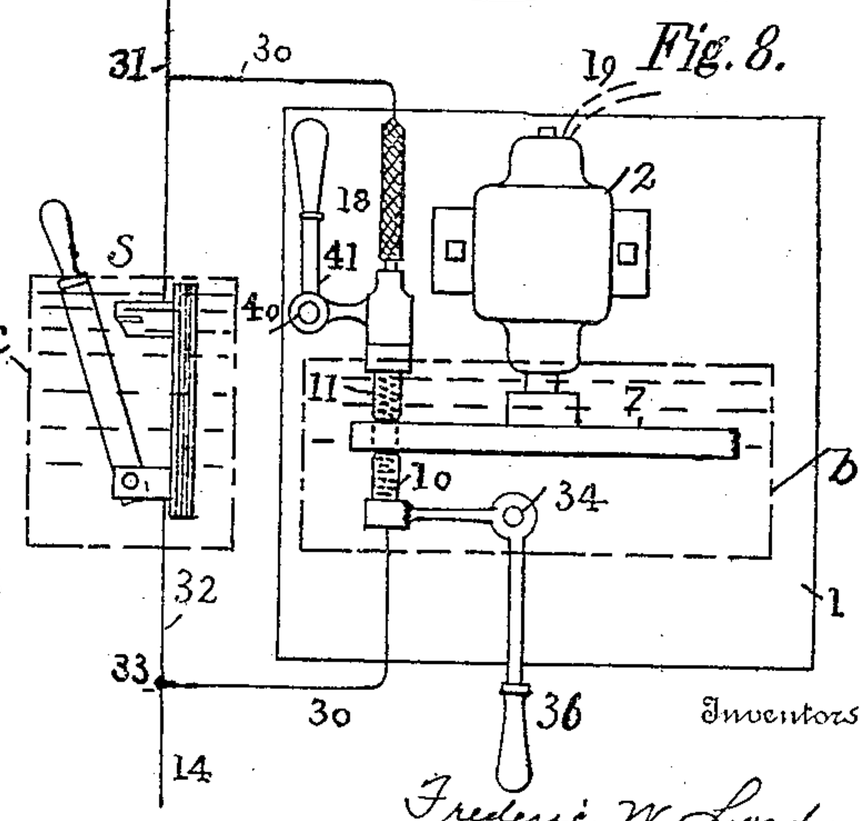



Fig. 8.

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# UNITED STATES PATENT OFFICE.

FREDERIC W. LORD AND FREDERIC WILLIAM ERICKSON, OF NEW YORK, N. Y.

## CURRENT-INTERRUPTER FOR ELECTRIC CIRCUITS.

932,481. Specification of Letters Patent. Patented Aug. 31, 1909.

Application filed April 27, 1907. Serial No. 370,568.

*To all whom it may concern:*

Be it known that we, FREDERIC W. LORD and FREDERIC WM. ERICKSON, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Current-Interrupters for Electric Circuits, of which the following is a specification.

The present invention relates to means for opening electric circuits carrying a high potential current in such a manner that the tendency of the current to maintain its contact as an arc between the separating parts of the circuit constituting the electrodes, is destroyed and eliminated.

The invention has reference to a form of current-interrupter in which lighting discharges and the powerful arcs created between the parts of a switch when it is being opened, are interrupted by a series of rapidly moving conducting-bridges spaced by insulating material, which successively reduce the arc and increase the resistance between said parts until the current is completely severed, similar to that described in the U. S. patent granted to us April 30, 1907, No. 852,186.

The invention about to be described, is an improvement in said application, and consists,—first, of a current-interrupter having a member consisting of a disk or belt located in the spark-gap of two electrodes, and movable relatively thereto, composed of insulating material having conducting segments at intervals to allow discharges through the air or oil, as the case may be, to pass freely, at the same time, by reason of its movement the insulating sections of said member will attenuate and break up the following flow of current.

Second: The invention consists in so arranging the severed parts of a current-interrupter of the type aforesaid, that the electrodes shall be movable and the interposed insulating and conducting member be stationary, the reverse of the means previously described.

Third: The invention consists in providing means, in connection with the moving and stationary members, for manually separating the members from each other.

Fourth: When the current-interrupter is employed for disconnecting the conductors of a power circuit, the members are placed in oil, and are in a shunt around the line-switch, which may also be in oil insulation.

Fifth: The invention consists of a moving member in the form of an insulating disk or belt into which are set a number of conducting segments separated from each other and adapted to pass between two electrodes and constructed so that the electrodes overlap two segments at the same time. And the invention also consists in the construction and arrangement of the details, which we will now proceed to describe and claim.

Of the drawings, which form a part of this specification and illustrate the invention,—Figure 1 is a side view partly in section of one construction of the invention. Fig. 2 is a view similar to the preceding, of a modification of the invention; as Figs. 1 and 2 are to illustrate certain features of the invention only, the means for making and maintaining the air gaps are not shown. Fig. 3 is a fragmentary side view to illustrate a modification. Figs. 4 and 5 are edge and side views of a rotating member. Figs. 6 and 7 are edge and side views of a modified rotating member. Fig. 8 is a diagram showing the circuit-interrupter in a shunt circuit, and means for making and maintaining the air gaps. Fig. 9 represents the moving member in the form of a belt.

In the drawings, 1 represents an insulating slab to which the members of the current-interrupter are attached; 2 is an electric motor with conductors 19 leading to a generator, and 6 is a vertical shaft extending downward into the case 4 of insulating material and has a bearing 8 in the floor of the same, and is provided with an adjusting screw 9.

7 is a disk on the shaft 6, and rotates between the electrodes 10 and 11. The former extends through the floor of the case and terminates in a screw post into which is secured the conductor 14 which is connected to line. The upper electrode 11 extends through the insulating cover 13 of the case and is held by the standard 12 attached to the slab 1, and its upper end forms a socket for the conductor 15 which connects with the switch 16 from which the fuse 17 makes connection with the line conductor 18. The case 4 contains insulating oil in which are submerged the electrodes and rotating members. The disk may be of any of the constructions represented in the other figures. For example, similar to Figs. 4 and 5, in which the main disk 7 is formed of solid insulating material as fiber or slate, having a

series of holes in its edge in which are inserted metal plugs 25.

In Fig. 3 the disk 7 rotates in the air, and electrodes 10 and 11 are terminal brushes and are held by supports 28 and 26 respectively, which are attached to the back or slab 1 by bolts 27, there being slots in the supports so that the electrodes can be adjusted relative to the disk, and the line and ground conductors 14 and 18 form continuations of the electrodes 10 and 11.

Fig. 8 shows the disk 7 adapted to rotate between terminal brushes or electrodes 10 and 11 preferably of carbon, by means of the motor 2, and the electrodes are in the shunt 30 between the points 31 and 33 on the conductor 32, which includes the knife-switch S. Conductor 32 continues by *w* to the line, and by 14 to the line. In this figure I represent by a heavy dotted line an oil-case *b* to inclose the switch S, and by a similar dotted line represent an oil-case *c*, inclosing the current-interrupter; a common oil case may be used. The electrode 10 is upon one arm of a bell-crank lever pivoted at 34 and provided with a heavily weighted handle 36, so that normally the point 10 is kept at a predetermined distance from the disk, and the electrode 11 is upon a similar lever 40 pivoted at 41. An alternate method will be whereby both terminals will be readily moved.

Figs. 6 and 7 represent a disk of insulating material, preferably of solid construction as fiber or porcelain, having metal plugs in the form of rivets 35 inserted at frequent intervals near its edge, the head of each rivet being flush with the face of the disk and having a washer upon its end flush with the opposite side of the disk, the rivets or plugs forming conducting segments. The ends of the electrodes 10 and 11 are of such diameter that they overlap from one plug to another, whereby a continuous spark-gap of the same dimension is maintained; for if the electrodes came in close proximity to but one of the segments the distance between the segment and the electrode would vary according to the position of the rotor in its revolution, whereas if it spans two segments, one segment will always be between the electrodes so that the clearance between the segments and the electrodes will always be the same. In this form of rotor the arc is suppressed only by reason of withdrawing the conducting material from the circuit.

Fig. 2 indicates a modified arrangement of the members in which the electrodes are connected to and insulated from the shaft 6, and rotate therewith, while the member 24 in which may be provided metal plugs 35, is stationary and held in the sides of the case. In this case commutators 22 and $22^a$ are provided upon which bear the brushes 21 and 23, extending through the wall of the case and terminating in screw-posts and hold the conductors 18 and 14.

Fig. 9 represents the moving member $7^a$ in the form of a belt carried over pulleys $p$ $p^2$ one of which is rotated by any suitable motor, so that the points of least resistance, 25 or 35 as the case may be, pass between the electrodes 10 and 11.

In the operation of the invention, for example as a switching device in a 20,000 volt circuit, as indicated in Fig. 8, the apparatus is placed in a shunt with the line, and to open the circuit, the motor 2 is started, after which the switch *s* is opened; whereupon the rotor or disk 7 will, by its low discharge distance, assume the arc which would ordinarily pass across the jaws of the switch; then by the rotation of the rotor, the arc will become attenuated or dissipated by reason of the large number of successively-arranged conducting segments which pass successively into and out of the gap between the electrodes to form interrupting segments traveling through a cooling path of air or oil at a very rapid rate. After the rotor has been under way and the switch opened, the levers 36 and 40 are turned, thereby increasing the gap on opposite sides of the rotor, this movement being continued until the circuit is completely broken, the dissipation of the arc continuing in the manner indicated.

The modification shown in Fig. 9, in which the movable member is composed of a perforated belt, which perforations are closed by metal plugs, it will be seen to be an operative device, and may in some cases be specially serviceable.

As shown in the drawings, the dissipating member has its faces in parallel planes which are substantially unchanged during the relative movement of the terminal members and dissipating member; and the axis of the moving member is out of alinement with or spaced from the line of shortest distance between the opposing faces of the terminals, said axis being in parallelism with such line. By means of this construction the faces of the terminals may be located relatively close together so that an excessive arc-gap is not produced irrespective of the dissipating member therebetween. Furthermore, there is no requirement of varying this space between the terminals if a disk of larger diameter is provided. There is a particular advantage resulting from this construction in that the size of the disk may be controlled in such manner as to insure that the portion of the disk which has just passed out of the current path will have a maximum length of time in which to become cooled prior to being again brought into the path and thereby provide a more efficient structure for the purpose intended.

We claim as our invention:—

1. The combination in a current-inter-

rupter of two electrodes and an intervening member composed of insulation and alternate independent and separate successively arranged conductors, said conductors having their axes extending in a direction corresponding in direction to the line of shortest distance between the electrodes, with means for rapidly changing the relative positions of the electrodes and conductors and maintaining a gap between said electrodes and member, the length of the axis of each conductor being substantially equal to the thickness of the member.

2. As a means for dissipating a "following-arc", a circuit including spaced opposing terminals, a rotor extending into the arc-gap between said terminals and having conducting segments adapted to be rapidly and successively brought within the arc-gap, and means for varying the position of the terminals relative to the rotor during the movement of the latter.

3. As a means for dissipating a "following-arc", a circuit including spaced opposing terminals, an element extending into the arc-gap between said terminals and having conducting segments adapted to be rapidly and successively brought within the arc-gap between the terminals, means being provided for varying the position of the terminals relative to the segment-carrying element during the movement of passing the segments through the arc-gap.

4. As a means for dissipating a "following-arc", a circuit including spaced opposing terminals, an element extending into the arc-gap between said terminals and having spaced conducting segments adapted to be rapidly and successively brought within and passed through the arc-gap between the terminals, means being provided for manually varying the position of the terminals relative to the segment-carrying element during the movement of passing the segments through the arc-gap.

5. As a means for dissipating a "following-arc", two elements located within a current path, one of said elements comprising spaced opposing terminals, the other element comprising an arc-dissipating device extending within the current path and having a plurality of spaced conductors adapted to be successively brought into the arc-gap, said conductors having their axes extending in a direction to the line of shortest distance between the terminals, one of said elements being rapidly movable with respect to the other element, the spaced conductors being arranged to present a continuous conducting path in the zone of the arc-gap regardless of the relative change in position of the parts, the successive positioning of any given conductor within the current path being at spaced time intervals of sufficient length to permit the remaining conductors to be positioned within the current path.

6. The combination in a circuit-interrupter of two electrodes in a line, and an intervening member composed of a disk supported upon a shaft provided with a series of separate insulated metallic segments extending through the disk near its perimeter, with means for rapidly changing the relative positions of the electrodes and sections, the latter being so constructed that the electrodes overlap two contiguous segments at the same time.

In testimony whereof, we have signed our names to this specification in the presence of two subscribing witnesses, this 22d day of April 1907.

FREDERIC W. LORD.
FREDERIC WM. ERICKSON.

Witnesses:
HARRY A. CURTIS,
FRANK W. GARRISON.