

Feb. 27, 1934.

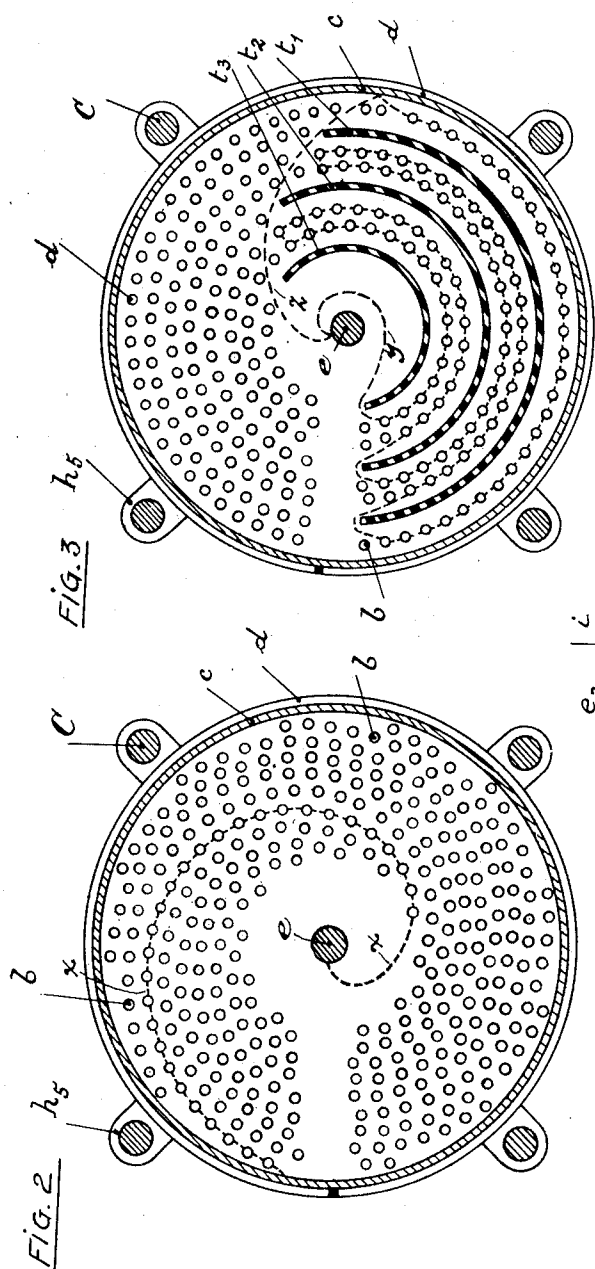
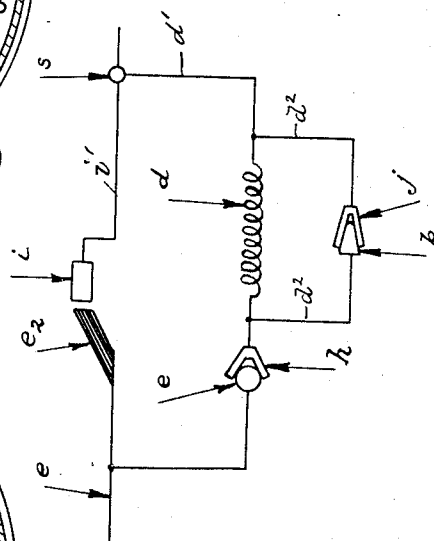
G. GERIN ET AL

1,948,658

DEVICE FOR EXTINCTION OF ELECTRIC ARCS

Filed July 7, 1930

2 Sheets-Sheet 2



Inventors
 Gaston Gerin, Paul Joseph
 Branchu and Stanislas
 Leszner
 By B. Singer, atty.

UNITED STATES PATENT OFFICE

1,948,658

DEVICE FOR EXTINCTION OF ELECTRIC ARCS

Gaston Gerin, Paul Joseph Branchu, and Stanislas Teszner, Grenoble, France

Application July 7, 1930, Serial No. 466,322
In France July 9, 1929

4 Claims. (Cl. 200-144)

This invention relates to a device for extinguishing electric arcs and to the use of this device for opening an electric circuit.

Its first object is to provide means to deaden the arc in the interior of an interrupting chamber or close to the same, by forcing the arc to enter a chamber, which is formed by a central electrode and an outer electrode and metallic rods or pieces which are insulated relatively to each other, and are interposed between these terminal electrodes and form the intermediary electrodes for the purpose of cooling the same, and of subdividing the arc or rupture into a plurality of serial arcs. Another object is to provide means for blowing out the arc and adapted to elongate the arc and impart to the arc a rotary movement and force the arc to assume the shape of a spiral or a conical spiral.

Another object is to provide metallic parts corresponding to the form which the arc assumes when being rotatably displaced, and to assure the gradual increasing subdivision of the arc while it is being simultaneously elongated.

Another object is to so dimension and space said metallic parts as to assure a uniform distribution of the potential within the gap comprised between the two electrodes.

Another object is to interpose between the terminal electrodes and between the metallic parts serving as intermediary electrodes, insulating parts forming segments of circles separated from each other and arranged concentrically in order to break certain parts of the arc and to amplify its elongation.

In the drawings
Figure 1 is a vertical central section of an interrupter constructed and arranged in accordance with this invention.

Figure 1* is a detail transverse sectional view of the lever *h*₁ and lever *j*₁ and their connections.

Figure 2 is a section of the same on line 2-2 of Figure 1.

Figure 3 is a similar section of a modification.

Figure 4 is a diagram of the electric circuit.

Figure 5 is a detail sectional view of mechanism for actuating the shunting contacts.

The circuit interrupter shown in Figure 1 is composed primarily of a base socket *S* on which are fixed by means of insulators *I*, four posts *C* which carry the device for extinguishing the arc. This comprises a conical mass *g* of insulating material supported by the posts *C*. Said element *g* extends across and closes the upper end of an extinguishing chamber, the wall of which is formed by a metallic cylinder *c* on which is wound

the coil *d* constituting the blowout coil, which is connected on the one hand with the cylinder *c* and on the other hand with the clamp *s*, as shown in Figure 4.

In the center of the mass *g* is also fixed a core *e*₁ which carries a conducting tube *e*, which tube serves as the main fixed contact. A brush *e*₂ mounted at the lower end of said tube *e*. Said tube forms the first electrode of the chamber *a* for extinguishing an arc produced in the center of the cylinder *c*.

The core *e*₁ is located in the center of an opening *f* in the part *g*, which opening serves as a draft chimney for cooling the apparatus and for improving in this manner the heat conditions.

Movable contacts *h* and *i* mounted on a lever *h*₁ contact with the tube *e* and the brush *e*₂ respectively.

The first portion *h*₂ of this lever which extends up to the level of the contact *e*₂, is formed of two metallic jaws *i*₁₀ (Fig. 5). The second portion is composed of a metallic member *h*₃ separated from the jaws *i* by the insulating blades *h*₈. This member *h*₃ is cranked or bent at its inner end and constitutes a first auxiliary contact *k*.

The lever *h*₁ is freely pivoted about a shaft *h*₄ carried by bearings which are arranged within a frame *h*₅ fixed on the columns *C* by means of rings or collars.

The lever *h*₁ is controlled by a link rod *A*₁ of insulating material and a metallic handle *A*₂, which is pivotally mounted as shown.

Another lever *j*₁ is keyed on the shaft *h*₄ and carries the second auxiliary contact *j* which is adapted to engage the first auxiliary contact *k*, carried by the lever *h*₁. These two auxiliary contacts serve for short circuiting the blowout coil *d*.

The lever *h*₁ may turn freely about the shaft *h*₄ while the lever *j*₁ turns with the shaft *h*₄ and it is advisable to slightly brake the same to avoid that the lever *j*₁ should be carried along at the beginning of the movement of the lever *h*₁. The lever *j*₂ is braked by blocking the same against the surface of the bearing by means of the small ring washer *j*₅ (Fig. 5).

On this last named lever *h*₁ there is fixed an abutment *h*₆ adapted to come into interhook engagement with another abutment *j*₂ fixed on the lever *j*₁ when the lever *h*₁ is slightly actuated.

Stops *h*₇ and *j*₃ are fixed on the frame *h*₅ and are offset in such manner that at the end of the stroke of the levers *h*₁ and *j*₁, the auxiliary contact between *j* and *k* remains open as shown by

the positions of the levers in dotted lines in Figure 1.

The auxiliary contact j is connected with the jaws h_2 of the lever through a shunt j_4 .

5 The extinguishing device is completed by rods b , the upper ends of which are embedded in the insulating mass g .

In one embodiment shown in Figure 2, the said rods are arranged spirally. In the same figure there is shown a form of arc also of spiral shape at x , and it will be seen that in this case, the number of small arcs serially aligned between certain of the rods b which constitute the path of the entire arc is considerably greater than if the entire arc extended in the form of an ordinary straight ray from e to c .

Such of the rods as are arranged in concentric circles form a series of condensers which are connected in cascade form. The capacities of these condensers may either be made equal through proper selection of the dimensions of the rods, or they may be equalized by proper selection of their number, assuring a uniform distribution of the electrostatic potential between the terminal electrodes e , c .

Figure 3 shows another embodiment of the arc extinguishing chamber where in addition to the metallic rods b , there are provided concentrically arranged arcuate insulating partition walls t_1 , t_2 , t_3 . In this case, the form of the arc assumed by the latter at one instant while it is being shifted, will be that form which is shown in full lines at y . The shape of the spiral arc z with which it may be compared is shown in dotted lines.

35 The means for moving the contacts may be of any suitable construction. For the purposes of this specification suitable mechanism for this purpose is shown in Figure 5, and comprises an auxiliary contact j which is under frictional control of a spring m locked by the nut n and thereby locking the lever j_1 against the bracket h_5 . It will usually remain stationary as long as it is not actuated by the tappet h_4 which is mounted on the extension of the lever h_3 .

45 As shown by the electric wiring diagram, Figures 1 and 4, the current when the circuit is closed passes through the central tube e and the principal contacts e_2 and i , and leaves through conductor i_1 and the bushing s . If, however, the brushes are opened, the current passes through the spark protectors e and h and through the conductors h_3 and auxiliary contacts k and j which are arranged for short circuiting the coil d so as to deprive the coil of current. When, however, these also are opened, the current passes through the spark protectors e and h through the conductor d_2 and through the blowout coil d , conductor d_1 and bushing s .

In all cases the spark protectors h are always insulated with respect to the principal contact e_2 because the lever which carries it is formed of two parts h_2 and h_3 which are insulated from each other.

65 The operation of the device is extremely simple and will readily be understood. The destruction of the arc takes place between the central rod e and the spark protector h , after the principal contacts e_2 and i have been opened. This arc is subjected to an electrodynamic blow produced by the coil d after the short circuit of the latter has been relieved through the auxiliary contacts j and k .

70 The operation of the auxiliary contact calls for some further statement. The contacts k are displaced with the lever h_1 while the contact j

is displaced with the lever j_1 , and lags, for it is not actuated directly. It is advisable to make sure that this lagging effect as has been stated above, should be produced by a supplementary friction engagement for slowing down the rotation of the shaft h_4 .

Owing to this condition, the auxiliary contacts j , k are open after a very short stroke of the lever h_1 . However, the lever j_1 is operated by means of abutments h_5 , j_2 which are fixed on the levers h_1 and j_1 respectively. At the end of the stroke of the lever h_1 the auxiliary contacts j , k remain open owing to the disengagement of the stop abutments h_7 and j_3 corresponding respectively to the levers h_1 and j_1 . The opening position is shown in dotted lines.

It will be understood that upon closure of the lever h_1 the auxiliary contacts j , k are closed immediately and that the electrodynamic blow-out becomes effective only on the extinguishing spark. Upon closure the lever j_1 resting originally in stationary condition and the lever h_2 being shifted, the auxiliary contact h , j will be closed almost immediately. The coil is thereby short-circuited and it has no effect on the arc, which will be extinguished between the lightning arresters h , e .

When under the effect of this electrodynamic blowout produced by the coil d , the arc is deformed, producing hence a band which is prolonged and which very rapidly reaches the cylinder c . At this instant the arc jumps approximately in radial direction between e and c .

On the other hand, the convolutions of the coil being axial, the arc necessarily must be shifted on a circular path by turning about the central rod e . During this rotary movement, it is wound up in the form of a spiral or of a conical spiral, a form which corresponds to the dynamic curve of equilibrium.

As the arc gets gradually longer, its breaking up into small parts also becomes gradually more pronounced.

Finally, if between the end electrodes not only the metallic rods b are in the path, but also insulating partition walls t_1 , t_2 , t_3 , there is produced an amplification of the elongated arc as indicated in Figure 3 at y' and this elongation also gradually increases. In this case, however, the breaking up does not proceed quite that far and for this reason, this device itself is not applied as often as when there is obtained an elongation of the arc sufficient to make sure the cutting of the arc under a predetermined intensity and a certain voltage.

By the use of metallic rods, combined with the rotary movement of the arc into spiral shape, it will be seen that in the same scope or frame, there may be produced a much greater length of arc than that which corresponds to the distance between the electrodes, and, therefore, it is feasible to interpose in its path, a number of electrodes of intermediary character and this number is much greater than the number which could be applied to the ordinary path of the arc in the interrupting chamber.

In other words, considering that the power of breakage of a device of this character is dependent upon the increase in breaking up and elongating the arc, we have obtained a power of cutting off the arc, which is practically more important than that with the devices heretofore employed by means of the interrupter of great power and small dimensions.

The essential advantage of the device forming

the subject of the present invention with respect to what is known in this line, is that the elongation of the arc obtainable while it is rotatively displaced, is a very great one without making necessary the provision of an interrupting chamber having extremely large dimensions for this purpose. The arc is elongated more and more in proportion to the degree of its rotary displacement. Furthermore, due to the combination described, there is produced simultaneously with the subdivision of the arc due to the interposition of intermediately electrodes between the terminal electrodes, intermediary electrodes, it results that the breakage should be more and more abrupt in proportion to the elongation of the arc, due to the fact of such elongation and also to the arrangement of the intermediary electrodes.

What we claim, is:

1. In a device for extinction of an electric arc, a chamber for the rupture of the arc having a conducting wall forming a first electrode, a second electrode in said chamber to produce an arc between same and the wall of the chamber, a blowout coil on said first electrode producing an axial field in the space between the said two electrodes, one electrode enveloping the other and the length of the arc path for one revolution of the arc being greater on one electrode than the other, so that the path traversed by the arc at one turn under the effect of the blowout field is greater on the enveloping electrode than on the enveloped electrode, and is spiral.

2. In a device for extinction of an electric arc, a cylinder to form an arc-breaking chamber and having a wall forming one electrode of the arc,

a central fixed contact, a movable contact, means to close and to open said contacts, windings around said cylinder, means to energize said windings while the said contacts are in opened position, and means in said cylinder between said fixed contact and said wall for elongating the spiral arc resulting from the electrodynamic blow produced by the windings after the short circuit of the latter has been relieved.

3. In a circuit breaker, an arc-rupture chamber, comprising a conducting wall forming an electrode and an insulating mass extending across the chamber at one end of said wall, metal rods arranged in said chamber to effect distribution of the electro-static potential in said chamber, one end of each of said rods being embedded in said insulating mass, said insulating mass having a central opening, fixed contacts, a central rod to support the fixed contacts and to form one electrode of the arc, and windings around said wall of said chamber, to ensure the electrodynamic blasting and the winding up of the arc in the shape of a spiral line.

4. In a circuit breaker, an arc-rupture chamber, a central rod, therein forming one electrode, insulating tubular partitions in the said chamber arranged to provide tortuous paths to amplify the elongation of the arc, and means to create an electrodynamic field in said chamber and to spirally force the arc around said electrode rod.

GASTON GERIN.
PAUL JOSEPH BRANCHU.
STANISLAS TESZNER.

110

115

120

125

130

135

140

145

150

40

45

50

55

60

65

70

75