

T. VON ZWEIGBERGK.  
HIGH TENSION BLOW-OUT.  
APPLICATION FILED NOV. 9, 1909.

1,055,850.

Patented Mar. 11, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

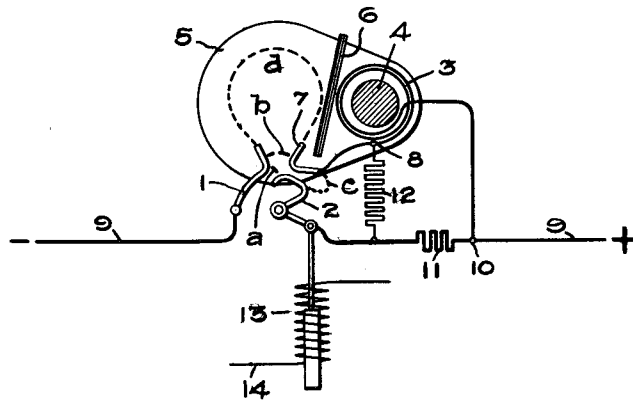
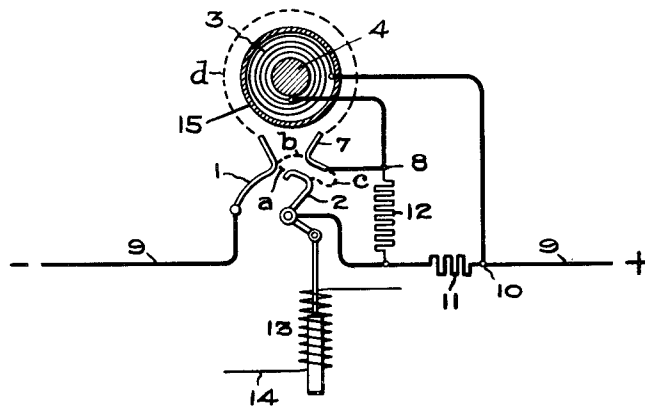


Fig. 2.



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2 SHEETS-SHEET 2.

Fig. 3.

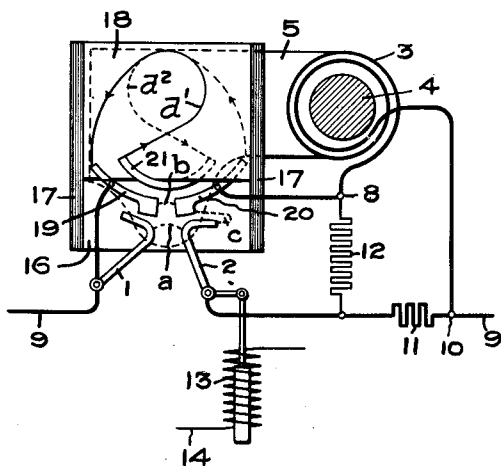


Fig. 5.

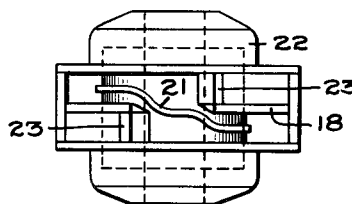


Fig. 6.

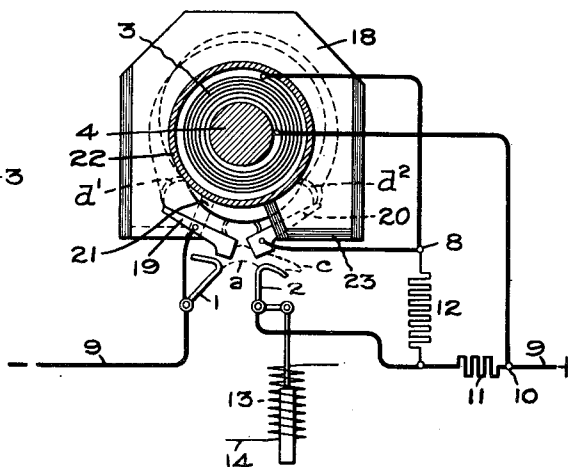
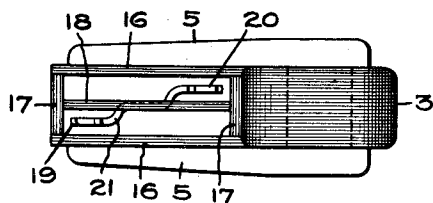


Fig. 4.



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# UNITED STATES PATENT OFFICE.

THORSTEN VON ZWEIGBERGK, OF SOUTHPORT, ENGLAND, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## HIGH-TENSION BLOW-OUT.

1,055,850.

Specification of Letters Patent.

Patented Mar. 11, 1913.

Application filed November 9, 1909. Serial No. 527,049.

*To all whom it may concern:*

Be it known that I, THORSTEN VON ZWEIGBERGK, a citizen of the United States, residing at Southport, England, have invented certain new and useful Improvements in High-Tension Blow-Outs, of which the following is a specification.

This invention relates to magnetic blow-outs by which the arc formed on breaking a contact is expanded and finally blown out.

One of the objects of the invention is to so construct a magnetic blowout that the magnetizing coil is operatively energized only after the contacts have separated and the arc has formed. I preferably arrange the parts so that the arc formed by the opening of the contacts constitutes part of the circuit connections, the arrangement being such that as the contacts separate the coil will be increasingly energized to render it more effective.

A further object is to increase the sweep of the arc without increasing the size of the blow-out coil.

In rupturing high tension direct currents of 3,000 to 4,000 volts, the density of the currents required in the coils of the blow-out will be such that the fusing point is approached, and current densities of 20,000 to 28,000 amperes per square inch are necessary in order to bring the size and cost of the blow-out sufficiently low for commercial practice. If auxiliary contacts are used in order to charge the blow-out coil just before the main contact is broken, there is always the possibility of these contacts getting out of order, and if these should fail the blow-out is instantly fused. Also the use of auxiliary contacts adds greatly to the complication of the moving parts.

In one aspect my invention consists in so arranging contacts that the current density of the blow-out coil depends on the position of the arc to be blown out.

In another aspect my invention consists in a blow-out coil so arranged that normally, when the contact is made and when the arc is short the blow-out coil is in series with a high resistance both being in parallel with a low resistance, and when the arc increases in length the coil is in parallel with the two resistances which are then in series, so that normally only a small current passes through the blow-out coil, and when re-

quired to blow out the arc a very much larger current passes.

The invention further consists in dividing the arc to be blown out into two parts and causing these parts to travel along contacts into two separate chambers whereby each arc can be expanded to the full sweep allowed by the blow-out coil and the two arcs broken separately by the same coil.

The invention further consists in providing two chambers between the flanges of the blow-out coil and in providing suitable contacts in these chambers along which the arcs travel under the action of the blow-out coil.

Referring to the accompanying drawings:—Figure 1 shows diagrammatically one form of the invention, while Fig. 2 is a modified form; Fig. 3 is an elevation; and Fig. 4 is a plan of a modified form of the invention; Fig. 5 is a plan, and Fig. 6 is an elevation of a further modification.

In the form of the invention illustrated in Fig. 1 the contacts, 1, 2, are arranged in proximity to a blow-out coil, 3, having a core, 4, and flanges 5, extending from the core to cover the sweep of the arc, suitable insulation shields such as 6, being provided to shield the coil from the arc. The contact to be broken consists of a fixed contact, 1, and a movable contact, 2, and in proximity to these two contacts is provided another contact, 7, which is fixed and is connected to one end, 8, of the blow-out coil 3. The fixed contact, 1, is connected to the line 9, as is also the movable contact 2. The other terminal of the blow-out coil is connected to the line at 10. On the side of the movable contact and between the connection 10, and the movable contact 2, there is placed in series a low resistance coil 11. A high resistance coil 12 is connected from the first mentioned terminal 8, of the blow-out coil to the line 9, near the point where it joins the movable contact 2. The fixed contact 7, is of U-shaped form and is so designed that when the movable contact is moved so as to break the connection through the line, an additional by-pass spark *c* is formed between this fixed contact and the movable contact, while as the arc *a* formed by the breaking of the contact passes upward the main part of the arc bridges between the two fixed contacts as at *b*, and is expanded by the blow-out coil in the upward direc-

tion until it breaks as at *d*. The by-pass spark, *c*, is blown out before the blow-out coil is fully energized to break the main arc.

In the above described arrangement normally the current flows through the low resistance coil 11, to the movable contact 2. The blow-out coil 3 and high resistance coil 12 are in series with each other and in shunt to the coil 11 so that little current passes through the blow-out coil. When contact 2 leaves contact 1 an arc is formed which expands until it strikes contact 7 when the two arcs *b* and *c* are formed. The resistance 12 now having the arc *c* in shunt with it the coil 3 is strengthened. The arc *c* now breaks before the arc *b* and when this happens the blow-out coil will be fully energized, the whole current passing through this coil and across the gap between the two fixed contacts, 1, 7. This arc then is rapidly expanded to the position, *d*, and blown out by the full energy of the blow-out coil.

It will be seen that in this system the blow-out can never be charged beyond its carrying capacity except when the arc is in such a position as to be rapidly expanded for rupture. As the arc at this point is moving rapidly, the time during which the blow-out coil is charged is a minimum, and it has been found by experiment that after breaking several hundred times in succession a current of 100 amperes at 4,000 volts, the blow-out was not unduly hot, although the coil was charged at the time of the rupture with a current density of over 20,000 amperes per square inch. The low resistance placed normally in parallel with the coil may be made very low and will resemble that of a shunt used for an ammeter; in fact, the blow-out works with practically no resistance in this position, because the arc itself has a tendency to lift up and thereby travel to the position between the two fixed contacts. It is not however advisable to dispense with a resistance, as the contacts become burnt owing to the blow-out being absent on the first breaking of the contact. The movable contact may be actuated by hand or, if desired, by an electromagnet 13 in a control circuit 14.

In the form of the invention shown in Fig. 2 adapted to the metallic shield form of blow-out, a similar arrangement of resistance and contacts is employed. The main arc in this case is divided into two when it strikes the metallic shield, 15 of the blow-out coil, the two parts being then swept upward to the position *d*, so that the blow-out effect is greatly increased by dividing the arcs into two in series. This form of the invention is preferable for high tension blowouts, as the blow-out effect is greatly increased.

In the form of the invention illustrated in

Figs. 3 and 4 the contacts 1, 2, between which the arc to be broken occurs, are placed in proximity to the blow-out coil 3 which is provided with a core 4 and flanges 5 in the usual manner. Insulation partitions 16, 17 are provided for protection from the arcs and in addition to the usual insulation, an additional insulation guard 18 is placed parallel with the flanges 5, in the center of the air gap. In electrical connection with the stationary main contact 1, there is provided a metallic plate 19 and a similar metallic plate 20 is provided in proximity to the movable main contact 2, this metallic plate being connected directly to one terminal of the blow-out coil. These two metallic plates are placed so that they extend on the two sides of the partition 18, dividing the air space between the flanges 5, of the blow-out coil. Resistances 11 12 may be connected to the blow-out coil as described hereinbefore. A curved metallic bar 21 is provided above the metallic plates 19 20, and the arc is forced by the action of the blow-out coil along these plates and expands in the two air chambers on the two sides of the guard 18.

The operation of the above described arrangement is as follows: When the arc *a* is established between the two main contacts 1, 2, it is forced upward until it passes between the metallic plates 19, 20, a by-pass spark *c* passing between the plate 20, and the movable contact 2. This by-pass spark *c* is then blown out and the blow-out coil 3 becomes fully energized, as described above; the metallic plate 20 from which the by-pass spark passes being connected directly to one terminal of the blow-out coil. The main spark *b* now passes upward between the two metallic plates 19, 20 and splits into two. One part *d'* of the arc passes between one of the metallic plates 19 and curved bar 21, and the other part *d''* between the other metallic plate 20 and the other end of the curved bar. The arcs now travel along the metallic plates 19 20 and the two ends of the curved bar 21, and move up into the chambers on the two sides of the insulation guard 18, and are blown out after reaching the ends of the bar and plates.

In the form of the invention shown in Figs. 5 and 6 applied to a metallic shield blow-out the main contacts 1 2 and metallic plates 19 20 are arranged in a similar manner to that above described, while the curved metallic piece 21 is fastened to the metallic ring 22, which incloses the blow-out coil 3. In this case the operation is similar to that above described and the arc enters the two chambers on the sides of the dividing insulation 18, in a similar manner, being finally ruptured when the two arcs in series inclose the blow-out coil nearly twice. Suitable guards 23 are provided to prevent the arcs

from blowing downward and flashing over to the main contacts.

What I claim as new and desire to secure by Letters Patent of the United States, is,

5 1. In a magnetic blowout, the combination with separable contacts, of a magnetizing coil and means whereby the energy of the magnetizing coil is increased after the formation of the arc due to the separation of  
10 said contacts.

2. In a magnetic blowout, the combination with separable contacts, of a magnetizing coil and means whereby the energy of the magnetizing coil is increased as the arc  
15 formed by the separation of the contacts lengthens.

3. In a magnetic blowout, the combination with separable contacts, of means whereby the current path of the magnetizing coil is  
20 changed as the arc forms due to the separation of the contacts so as to increase the energizing force of the magnetizing coil.

4. In a magnetic blowout, the combination of separable contacts, means for forming an  
25 auxiliary arc during the opening of said contacts, a magnetizing coil shunted by said arc, and means whereby the energy of said coil is increased by the blowing out of said arc.

30 5. In a magnetic blowout, the combination with separable main contacts, an auxiliary

contact cooperating with one of said main contacts during the separation thereof to form an arc, a magnetizing coil for blowing out said arc, and means whereby the energy  
35 of said coil is increased by the blowing out of said arc.

6. In a magnetic blowout, the combination with separable contacts, of a magnetizing coil, a resistance normally shunting the  
40 same, means for forming an auxiliary arc in shunt to said resistance during the separation of said contacts, and connections whereby said arc is maintained for an interval and is finally blown out to fully energize the magnetizing coil.  
45

7. In a magnetic blowout, the combination with separable main contacts, an auxiliary contact arranged to cooperate with one of said main contacts during the separation  
50 thereof to form an auxiliary arc, and a magnetizing coil shunted by said arc, said coil being located so as to blow out the auxiliary arc and thereby fully energize the coil for blowing out the main arc.  
55

In witness whereof, I have hereunto set my hand this 9th day of October, 1909.

THORSTEN VON ZWEIGBERGK.

Witnesses:

WM. PIERCE,

K. VON ZWEIGBERGK.