

(No Model.)

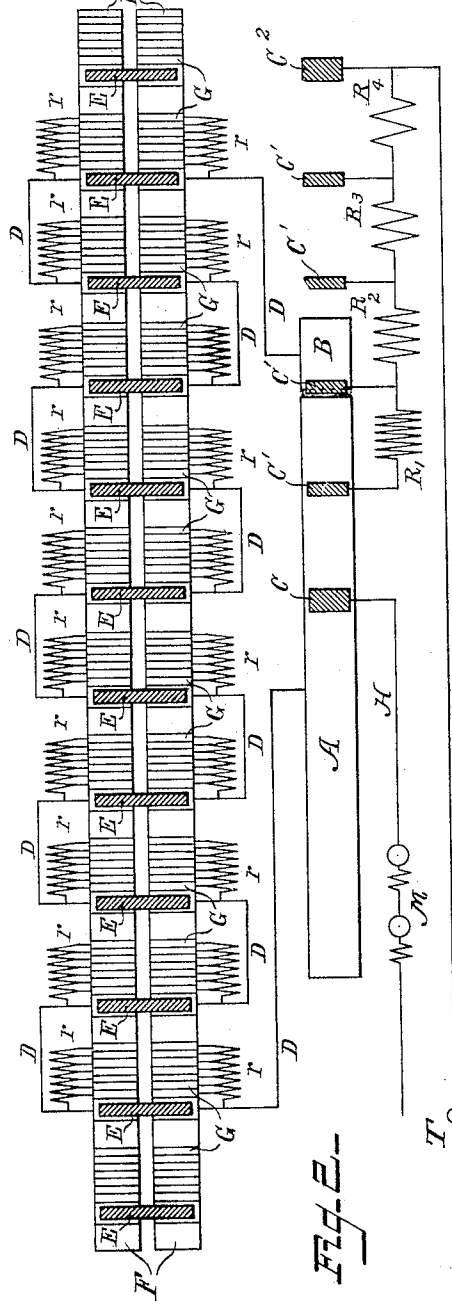
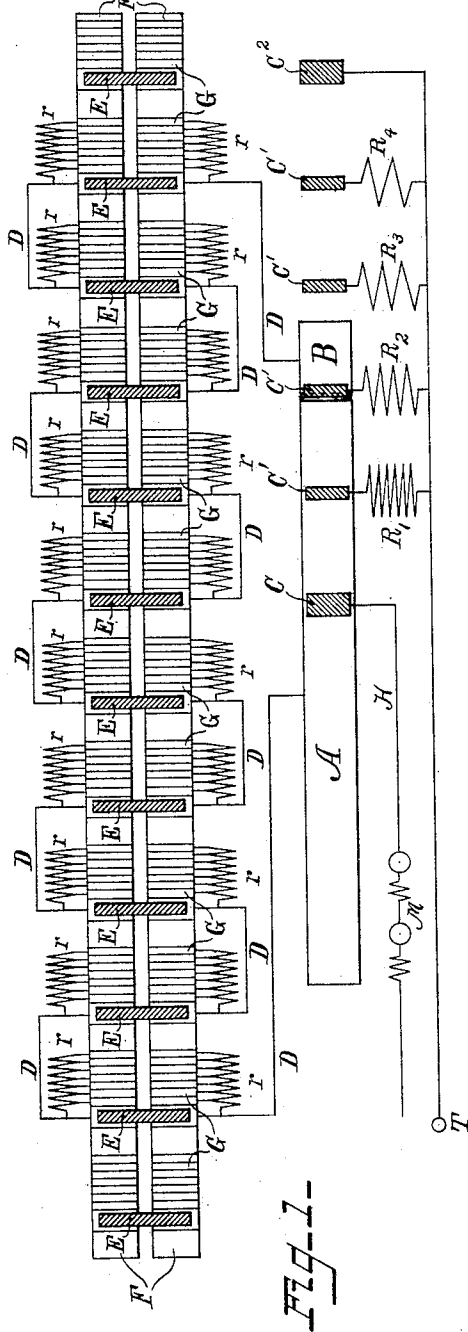
3 Sheets—Sheet 1.

T. VON ZWEIGBERGK.

METHOD OF AND APPARATUS FOR PREVENTING FORMATION OF ARCS
WHEN OPENING CIRCUITS.

No. 582,772.

Patented May 18, 1897.



Witnesses:

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(No Model.)

3 Sheets—Sheet 2.

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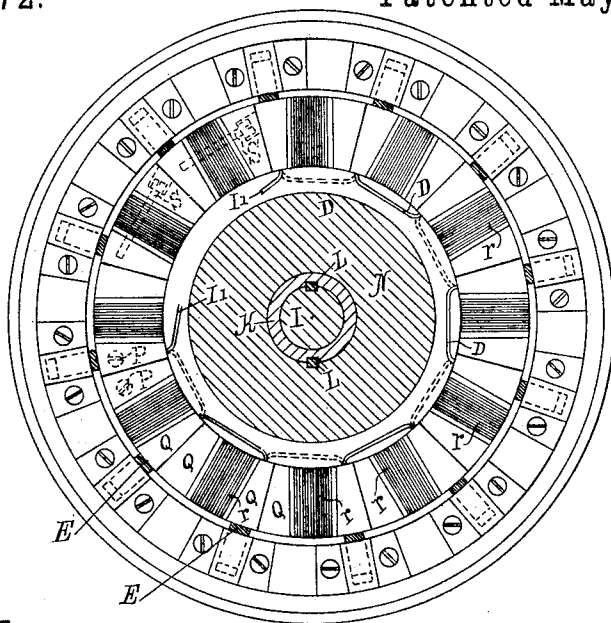
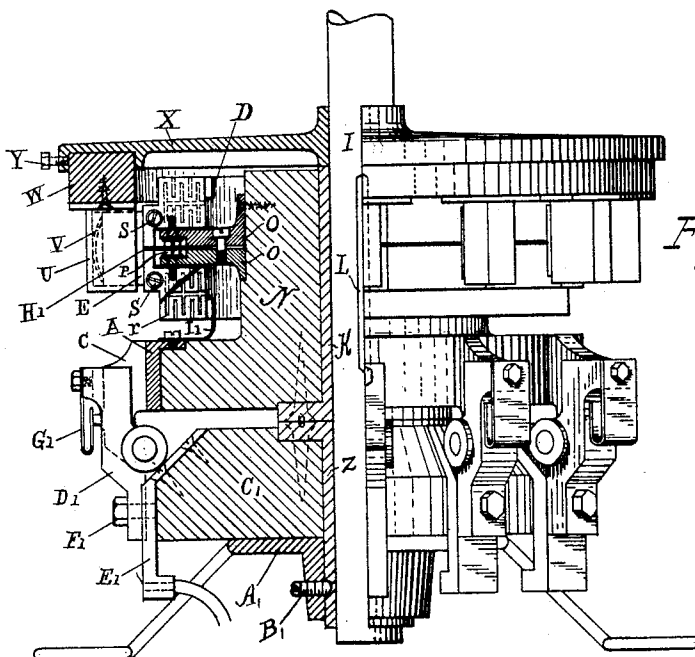


Fig. 3.



(No Model.)

3 Sheets—Sheet 3.

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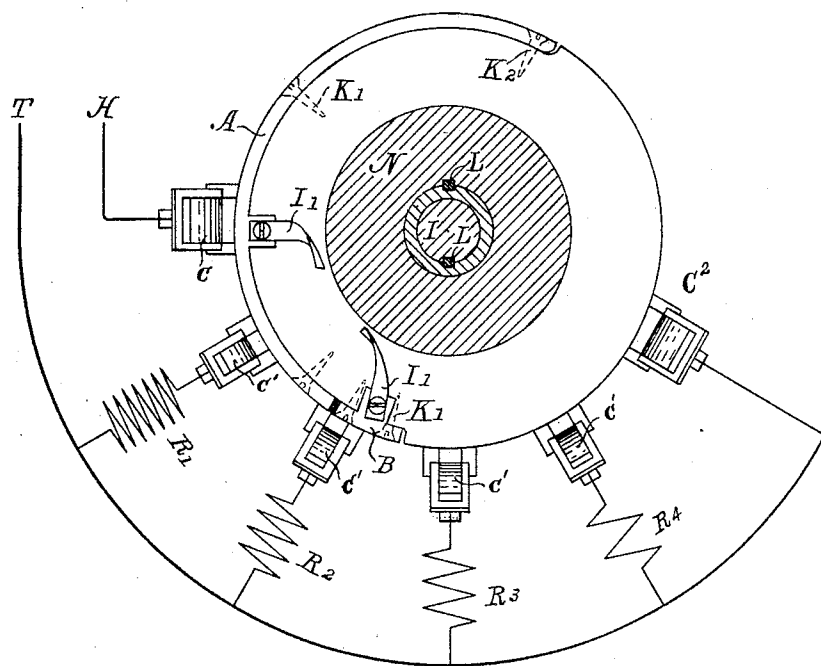


Fig. 5.

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UNITED STATES PATENT OFFICE.

THORSTEN VON ZWEIGBERGK, OF CLEVELAND, OHIO.

METHOD OF AND APPARATUS FOR PREVENTING FORMATION OF ARCS WHEN OPENING CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 582,772, dated May 18, 1897.

Application filed October 29, 1896. Serial No. 610,502. (No model.)

To all whom it may concern:

Be it known that I, THORSTEN VON ZWEIGBERGK, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and useful Improvement in Methods of and Apparatus for Preventing the Formation of an Arc when Opening a Circuit, of which the following is a specification.

This invention relates to methods of and apparatus for preventing the formation of an arc when opening a circuit.

The object of the invention is to provide a means and method whereby arcing is prevented when a circuit is opened.

The invention consists substantially in the construction, combination, location, arrangement of parts, and mode of procedure hereinafter set forth, as shown and indicated in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings and the various views and reference-signs appearing thereon, Figure 1 is a view in diagram showing the circuit-resistances arranged in parallel. Fig. 2 is a similar view showing the circuit-resistances arranged in series. Fig. 3 is a bottom plan view, parts being in horizontal section, of the completed device embodying the principles of my invention. Fig. 4 is a view, partly in side elevation and partly in central vertical section, of the construction shown in Fig. 3. Fig. 5 is a partial top plan view of the construction shown in Fig. 4, parts being in horizontal section, the circuit-resistances being shown arranged in parallel.

In the drawings reference-sign T designates a trolley-line or other conductor, and M a motor. The conductor T is connected directly to a stationary contact C² and also at various points to the contacts C' through resistances R' R² R³ R⁴. These resistances may be arranged in parallel series with the conductor T, as shown in Fig. 1, or in series with such conductor and with each other, as shown in Fig. 2.

Reference-sign C designates a stationary contact which is included, through connection H, in the circuit of motor M. A movable contact strip or segment A is arranged to make contact with the stationary contacts C C' C², and at its end said strip or segment

carries an insulated portion B, the space between the parts A and B being less than the width of the contacts C'. The contact strips or segments A B are mounted on a suitable insulating-block N, (see Figs. 3, 4, and 5,) say of wood, which is rigidly mounted on a sleeve K, mounted on shaft I and keyed thereto by means of key L. Also carried by block N are suitable rings O O, forming a support for a series of resistances. These resistances may be of many different forms. I have shown them in the form of built-up plates suitably punched, as shown, to form resistances r. These resistance-plates are bolted to the rings O O by bolts, as P, and are firmly clamped together between the plates Q and screws S or in any other suitable or convenient manner. Between adjacent resistance-plates r I interpose a sheet of mica or other suitable insulating material, and these several resistance-plates are connected together or coupled up electrically in series, the one set being insulated from the corresponding set by means of an interposed insulating-ring II', the whole forming a large commutator.

Loosely mounted on shaft I is a disk or other suitable support upon which is mounted a ring W, of suitable non-conducting material, as wood, and which forms an insulated support for holders U, which carry a number of carbon brushes E in suitable relation to be pressed against the commutator and to bridge the space between corresponding sets of the resistance-plates r, as most clearly indicated in Figs. 1 and 2. The brushes E may be pressed into contact with the commutator formed by the resistances r in any suitable or desirable manner—as, for instance, by means of springs V. Any suitable means may be employed for holding the brushes E in fixed position during the movement of the commutator. In the form illustrated I have shown a screw Y, adapted to be attached in any suitable manner to the frame or casing containing the commutator.

The parts A and B of the contact strip or segment are electrically coupled through connection D in the following manner: from B to one part of the first set of resistances r, through a brush E, to the other and cooperating part of such set, and thence on in simi-

lar manner, the several sets of resistances r being coupled up in series and the brushes E serving to bridge the space between corresponding portions of the same set. It will also be remembered that the corresponding members of each set of resistances r are connected in series. Therefore a relative movement of the brushes E and the commutator comprising the resistances causes the individual resistances to be cut into circuit with the conductor D, thereby increasing the resistance in such circuit according to the direction of such relative movement. Of course it will be understood that either the brushes or the commutator may be moved while the other is stationary, but in the particular arrangement shown the commutator is moved relatively to the brushes.

From the foregoing description and by reference to the relative location of parts shown in Fig. 1 it will be seen that all the resistances are cut out when the parts occupy the relative position shown in such figure, the brushes E forming a short circuit of little or no resistance between the various sections or portions of line D. If, however, the commutator is moved to the left from the position shown in Fig. 1 and past the brushes E the resistances are gradually or successively cut into the circuit of line D. Therefore the parts A and B of the contact strip or segment are included in circuit with each other, but through a resistance which may be very small—as, for instance, when the parts occupy the relative positions shown in Fig. 1—or which may be increased as desired by a relative movement of the brushes and commutator or which may be broken entirely, as by moving the commutator to the right from the position thereof as shown in Fig. 1.

The resistances R' , R^2 , R^3 , and R^4 may all be equal, though I prefer to make them variable, and usually resistance R' will be greater than resistance R^2 , and so on.

By reference to the resistance of the parts shown in Fig. 1 it will be seen that circuit is made from conductor T to portion B of the contact strip or segment through resistance R^2 and from such conductor to portion A of the contact strip or segment through resistance R' . Now by a relative movement of contacts C C' C² and the contact strips or segments A B—say, for instance, a movement of such strip or segment to the right from the position thereof shown in Fig. 1—so as to cause the portions A and B to make successive contact with the contacts C' C² until finally the portion B contacts with contact C², then the resistance of that portion of the circuit from the conductor T which includes the portion B is successively reduced and that portion of the circuit from the conductor T which includes the portion A is also reduced by successively cutting into parallel relation therewith the resistances R^2 , R^3 , &c. In case the resistances R' , R^2 , &c., are in series with each other, as shown in Fig. 2, the same result is

obtained, as will be readily seen and understood by persons skilled in the art.

From the motor M the circuit goes to earth in any suitable or desirable manner.

Any suitable arrangement may be provided for securing a relative movement of the contact strips or segments A and B and the contacts C, C', and C². In the particular form shown, to which, however, I do not desire to be limited or restricted, I support the contacts C, C', and C² in fixed position and move the strips or segments A B. To this end I loosely mount on shaft I a sleeve Z, which may be fixed to the frame or casing A' by set-screws B' or in any other suitable or convenient manner. Carried by the sleeve Z is a suitable block C' of insulation—for instance, of wood—upon which are mounted the brackets E' and to which are secured the holders D' by means of screws F' or otherwise. The contacts C C' C² are mounted in the holders in position to contact with strips A B. Suitable means, such as springs G', serve to press the contacts C C' C² into efficient electrical contact with the segments A B.

The operation of my invention will be readily seen and understood from the foregoing description. When the segments A B are moved to the right from the positions thereof indicated in Figs. 1 and 2, the resistances R' , R^2 , &c., are gradually reduced or cut out until current flows from the conductor T to segments A B through all the resistances, as in Fig. 1, or through no resistance, as in Fig. 2. From segment A the current flows through the motor-circuit to ground, and from segment B the current flows through connection D and the brushes E to segment A and thence through the motor-circuit to ground. Initially this circuit is broken by the segments E occupying such position relative to the commutator as to break the circuit through such brushes. The initial movement of such commutator brings a conducting-section of the commutator into contact with the brush E, thereby establishing circuit therethrough including all the resistances. Further relative movement of the commutator and brushes successively cuts out of circuit the successive resistances until finally all are cut out and the circuit is again broken, and so on until the contact strip or segment B reaches contact C², which is the limit of its movement. Now suppose the contact-segments A B, and coincidentally therewith the commutator, are moved toward the left from this final or ultimate position. The initial movement cuts into the shunt-circuit the first sections of each set of the resistances r , thereby commutating the current down to such a low point, as the movement of the commutator continues, that the said circuit may be broken by the brushes E, leaving the conducting portions of the commutator practically without arcing. This break occurs before the segment B leaves contact C², and hence arcing at contact C² is avoided. A continuation of the movement

of segments A B toward the left causes segment B to make contact with the successive contacts C' before segment A leaves such contacts, thereby avoiding arcing when said segment A successively breaks contact therewith, and before segment B leaves each contact the current is commutated down, as before described, by the gradual introduction of the resistances r until practically no arcing occurs at the brushes E when said brushes finally break the shunt-circuit, which break in the shunt-circuit occurs before the contact-segment B leaves the contact C', until finally the entire circuit is broken by segment B passing the last contact C'. Thus it will be seen that all the breaking is effected through the branch or shunt circuit, and that, too, without arcing.

While I have shown a specific construction and arrangement for carrying into effect the principle of the mode of operation set forth, I desire it to be understood that I do not limit or restrict myself to the specific form of apparatus, as many other forms of apparatus may be employed for carrying the same into practical operation; but,

Having now set forth the object and purpose of my invention and the mode of operation of the principles thereof and a form of apparatus for carrying the same into practical operation, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent of the United States, is—

1. The herein-described method of reducing arcing in breaking an electric circuit which consists in establishing a shunt-circuit around the contact to be broken, then breaking the main circuit, then gradually commutating the current through the shunt-circuit, and finally breaking said shunt-circuit, as and for the purpose set forth.

2. The herein-described method of reducing arcing in opening an electric circuit, which consists in placing the contact to be broken in a shunt-circuit, then breaking the main circuit, then gradually interposing high resistance in such shunt-circuit, and finally breaking such shunt-circuit, as and for the purpose set forth.

3. The herein-described method of reducing arcing when breaking an electric circuit, which consists in dividing the current between two circuits at the point where the break is to be made, then breaking one of said circuits at such point, then gradually interposing resistances in the other of said circuits, then breaking the circuit through the resistances, as and for the purpose set forth.

4. An arc-reducing apparatus, consisting of a two-part circuit-breaker, one part of which is always in the main circuit and connected to the other by a shunt-circuit, means for cutting resistances into said shunt-circuit and means for moving said circuit-breaker, whereby the circuit is always broken in said shunt-circuit, as and for the purpose set forth.

5. A device for reducing arcing when open-

ing an electric circuit, which consists of a movable segment adapted to make and break contact with stationary contact-points, an insulated end piece on said segment, a line connection between said segment and its insulated end piece, resistances in said line connection, and means for cutting said resistances in and out of said line connection, as and for the purpose set forth.

6. A device for diminishing arcing when opening an electric circuit, consisting of a movable segment adapted to make and break contact with stationary contacts, an insulated end piece on said segment, a line connection between said segment and its insulated end piece, and means for breaking the circuit in said line connection, as and for the purpose set forth.

7. A device for diminishing arcing when opening an electric circuit, which consists of a number of stationary contact-points, a movable two-part segment adapted to connect with said contact-points, a line connecting the two parts of said segment, means for cutting resistances into said line at the time of break, and means for breaking the circuit through said resistances, as and for the purpose set forth.

8. A device for reducing arcing when opening an electric circuit, which consists of a number of stationary contact-points, a movable segment adapted to make contact with said contact-points and therethrough include resistances in or remove them from the circuit, a second segment movable with the first, but insulated therefrom, and adapted to make contact with said contact-points, a connection between said segments, and means for interposing resistances in series between said segments at the time of break, as and for the purpose set forth.

9. In a device for reducing arcing when opening an electric circuit, the combination of a movable segment having an insulated end segment, a circuit connecting said segment and its end, a number of resistances in series in said circuit, and means for cutting in said resistances gradually, as and for the purpose set forth.

10. In combination with a conductor T, contacts C, C' and C², resistances between said conductor and said points C', a movable two-part segment, A, B, a connection, D, between said segments, resistances r , in said connection D, and brushes, E, whereby the arc which tends to form between said segments and contacts is commuted and thus suppressed, as and for the purpose set forth.

11. An apparatus for reducing arcing when breaking an electric circuit, comprising a main circuit, means for shunting a portion of the current around the contact to be broken before breaking such contact, means for commuting the shunted current and means for finally breaking the shunted circuit, as and for the purpose set forth.

12. An apparatus for reducing arcing when

breaking an electric circuit, comprising a contact, a two-part segment, a shunt-circuit connecting the two parts of said segment, resistances arranged in said shunt-circuit, means
5 for relatively moving said segment and contact whereby said shunt-circuit is established before the main circuit is broken through said contact, and means for gradually interposing

resistances in said shunt-circuit, and finally breaking said shunt-circuit, as and for the purpose set forth. 10

THORSTEN VON ZWEIGBERGK.

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