

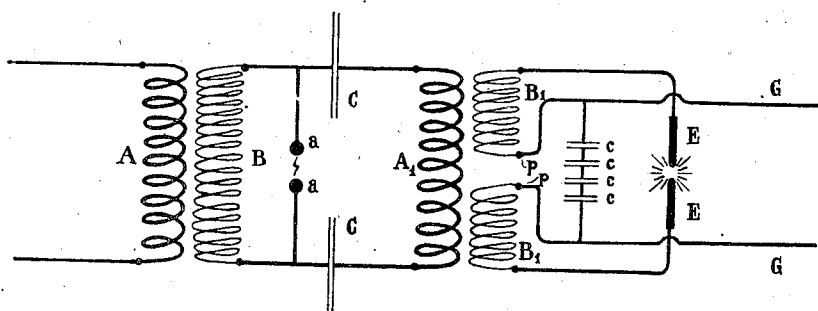
Apr. 24, 1923.

1,453,030

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MEANS FOR ESTABLISHING A VOLTAIC ARC BETWEEN ELECTRODES NOT IN CONTACT

Filed July 6, 1915



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MEANS FOR ESTABLISHING A VOLTAIC ARC BETWEEN ELECTRODES NOT IN CONTACT.

Application filed July 6, 1915. Serial No. 38,363.

To all whom it may concern:

Be it known that I, FLORENCIO COMAMALA UCAR, a subject of the King of Spain, residing at 9 Rue Libertad, Madrid, in the Kingdom of Spain, have invented a certain new and useful Means for Establishing a Voltaic Arc Between Electrodes Not in Contact, of which the following is a specification.

With the differences of potential that are ordinarily employed in electric distributing systems, it is known that the formation of a voltaic arc between carbon, metal and the like electrodes, ordinarily necessitates the previous bringing together of the electrodes to such an extent that for practical purposes they may be regarded as in contact.

In accordance with the means forming the object of the present invention, a voltaic arc is established between electrodes located at their normal operative distance at which the arc would not be started in the ordinary way unless the electrodes had previously been brought together.

The means employed in accordance with this invention are based on the use of an auxiliary high tension and frequency current at the moment at which the arc is to be established, this auxiliary current being generated in a certain region of the supply circuit, and of a power far lower than that of the low voltage current which maintains the arc, after this arc is formed between the electrodes.

A very important feature of the invention is that the auxiliary current of high voltage which serves for striking the arc cannot enter the circuit of the source furnishing the supply current for the arc, because it is prevented from doing that by a disposition of electric valves, as will be explained later on with reference to the figure.

In order to insure that the oscillatory currents of high voltage which serve for striking the arc shall never circulate in the line furnishing the current to the arc, thus rendering perfectly harmless the discharges serving to strike the voltaic arc and at the same time for the protection of the apparatus and machines that may be in electrical connection with the conductors G, G, the arrangement diagrammatically represented in the accompanying drawing is adopted.

In this arrangement A and B are two coils which constitute a transformer group. a, a is the spark gap of the coil B; A₁ and

B₁ B₁ are coils which constitute another transformer group, in which A₁ constitutes the low tension coil, while B₁ B₁ is the high tension coil. The coil B₁ B₁ is divided at its middle point and between the points of division p p a group of electrolytic valves c, c, c, c is arranged. E, E are the electrodes between which the voltaic arc is to be formed; G, G are the conductors supplying the electric current for the arc, and are connected at the points p p with the coil B₁ B₁. In view of the high tension generated in the coils A₁ and B₁ B₁, it is advisable to immerse this group in an insulating liquid. If a direct current be employed for the arc supply, the electrolytic valves are arranged in such a manner as to make an obstacle to the passage of the current. When an alternating current is to be employed as arc supply, the valves are arranged symmetrically, forming groups in opposition, or they may be constituted solely by polarizable electrodes in such manner that they make an obstacle to the passage of the alternating supply current in any direction. Electric valves of any other type may be employed instead of electrolytic valves.

The striking of the arc will take place as follows:—

Suppose that the conductors G G are connected by means of suitable switches with the arc circuit supply, the electrodes being at their normal distance; in this condition no arc will jump between the said electrodes; besides, practically no current will circulate across the valves c, c, c, c, if the number of these valves in series is proportional to the voltage of the line supply. However, if an alternating or pulsating current is sent through the primary of the coil A, the transformation factor of the system A B being sufficiently high, and at the same time the capacity, self-induction and resistance of the condensers C, C coils A₁ and B₁ B₁ and the spark gap a a are suitably established, a discharge will take place in this spark gap a a which will develop high frequency oscillating currents in the system formed by coils A₁ and B₁ B₁, electrolytic valves and electrodes E E. Therefore a high frequency discharge will take place between said electrodes E E thus striking the voltaic arc, after which the continuous or alternating current from G G will feed it, so that the current through the coil A can be switched off; the arc being maintained by

the said continuous or alternating current from G G for the time desired.

The electrolytic valves mounted between parts *p p* prevent the development of high potentials between these points and therefore between conductors G G connected therewith, thus protecting the line and apparatus connected with said conductors G G.

At the middle point of primary coil A may occur a tension node and a current loop. The presence of any tension node at the middle point of the coil B depends upon the relations between the constants of the circuit and the electrical length of the circuit. A tension node at the point *p* is not necessarily inherent in this system but the latter is so designed that a tension node may be obtained at this point. The second oscillator B₁ E B₁ connected to the first or primary oscillator symmetrically with the coil A₁ will have at a middle point of the secondary coil B₁ a tension node. The effect of the second oscillator on the first or of the first on the second may vary in many ways. The frequency, strength of current for a given tension, the damping factor, are all variants but the conditions at the tension node will remain constant. It is therefore evident that if we cut the coil B₁ B₁ at the point *p* and connect up the several ends by means of a conductor which may be exemplified by the electrolytic cells C and their connections there will be no variation in the oscillator thus made. If we now connect up the line wires at the points *p p*, formed by the division of the coil at the tension node there will be produced between the line conductors no difference of potential other than that between said nodes. The conductor *c* must be of such a nature as to permit the passage of the high potential oscillatory current and to prevent the passage of the low potential supply current for the arc and to this end includes a convenient number of electrolytic cells, the arrangement of which depends upon the use of A. C. or D. C. for the arc supply as hereinafter described.

It will be seen that I have accomplished therefore the following:

(1) The very high frequency of the oscillating currents intended for the lighting of the voltaic arc, resulting from the fact that in the second oscillator shown in the device the frequency is much higher than in the first oscillator. This circumstance renders such oscillating currents harmless.

(2) The conductors of the supply system are connected at points in the circuit of the currents of high frequency formed by the division of said circuit at a node, from which it follows that the network of supply is protected from the said currents which are of high voltage.

The electrical valves *c, c, c, c* constitute a non-inductive polarization resistance, and

for the sake of clearness we will suppose for example that they are formed with electrodes of aluminium and an electrolyte of sodium phosphate. It is known the counter electro-motive force of aluminium in an aqueous solution of phosphate of sodium may reach 140 volts, while the ohmic resistance of the bath can be made as small as necessary, its inductance being substantially nil. Under these circumstances it will be easily understood that if the voltage of the supply leads is 220 volts, and if two valves are employed, these will not allow the passage of the main supply current through them, but at the same time they will permit the passage through them of the oscillatory currents of high voltage created in the coil B₁ B₁, due to the condenser action of the cells.

The same method can be employed for polyphase current in adopting the arrangements indicated for each of the phases.

I claim:—

1. In apparatus for establishing arcs between non-contacting electrodes, in combination, a supply circuit for supplying current to said electrodes, means for introducing an oscillatory current of high frequency into the supply circuit, and as part of said means a divided coil through the divisions of which the oscillatory current is introduced into the main circuit, a conductor connected across the divided coil circuit and, in the said cross connecting conductor, electric means for checking the passage of the main current while permitting the passage of the oscillatory current.

2. In apparatus for striking an arc between electrodes, in combination, a transformer, a second transformer, the low tension coil of which is in circuit with the high tension coil of the first named transformer, the high tension coil of the second transformer being divided, the said divisions being connected with the main conductors, one on each side, and means between said conductors across the divisions of said divided high tension coil, said means being adapted to prevent the passage of the supply current, but to permit the passage of the high tension current induced in the said divided coil.

3. In an apparatus for striking an arc between separated electrodes, in combination, means for supplying current, an induction coil for inducing current of high frequency into said circuit supplying means, to bridge any gap between the electrodes the secondary coil of said induction coil being divided, and the parts thereof insulated from each other but connected each in the circuit through the electrodes and means for checking the passage of the main current while permitting the passage of the high frequency current.

4. In apparatus for striking an arc of or-

ordinary potential between electrodes separated too far to permit passage of a line current of ordinary or low potential across the gap, in combination, means for inducing a current of high frequency and potential high enough to bridge a gap which the low potential current will not bridge, means for leading the current of low potential into the inducing means, whereby the two currents are led through the same conductors, and a condenser in the inducing means between the line or low potential current wires adapted to permit the passage of an induced current of high potential, but to prevent the passage of the line current of low potential.

5. In combination, in an apparatus for striking a spark across a gap formed between spaced electrodes, a transformer group, a second transformer group, the low potential coil of which second group is in circuit with the high frequency coil of the first group, the high potential coil of the second group being divided into two divisions which are in circuit with the conductors of a low potential supply circuit connected to said electrodes, one on each side, and a series of electric valves arranged across the divisions of the said high potential divided coil, whereby current of high potential may be induced in said coil, but the supply current of low potential may be prevented from passing.

6. In combination in an apparatus for bridging and thereby effecting the passage of a line current between separated electrodes, an induction coil, an oscillator fed by said induction coil, a second oscillator connected to the first named oscillator said second oscillator being divided at a tension node and said line wires being connected one to each division of said divided oscillator each division being thus made a part of the main circuit, electric means for checking the passage of the main current while permitting the passage of the oscillatory current.

7. In apparatus for striking an arc between separated electrodes connected with the wires of a line current of low potential, in combination, means for inducing between said electrodes a bridging current of high potential, said means including an oscillating circuit connected at a nodal point in said circuit to said line wires and said last named circuit including means between the line wires permitting the current of high frequency to pass in said circuit but preventing the passage of the low potential current.

8. In an apparatus for effecting the striking of an arc between the separated electrodes connected to line wires, means for introducing a gap bridging current of high frequency comprising a coil the middle part of which is a nodal point said means including an induction member and said induction member being connected to the line at its nodal point on each side the gap, electric means for checking the passage of the main current while permitting the passage of the oscillatory current.

9. In an apparatus for effecting the striking of an arc between the separated electrodes connected to line wires and means for introducing a gap bridging current of high tension, said means including a secondary coil having a tension node at its middle point, means for inducing in said coil, currents of high frequency, said secondary coil being divided at its tension node and having the nodal ends thus formed connected up to the current wires, and a connection around the electrodes including means adapted to permit the passage of the high frequency current, to permit oscillation in the circuit including the secondary coil vibrations, but to stop the passage of line current.

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