(No Model.)

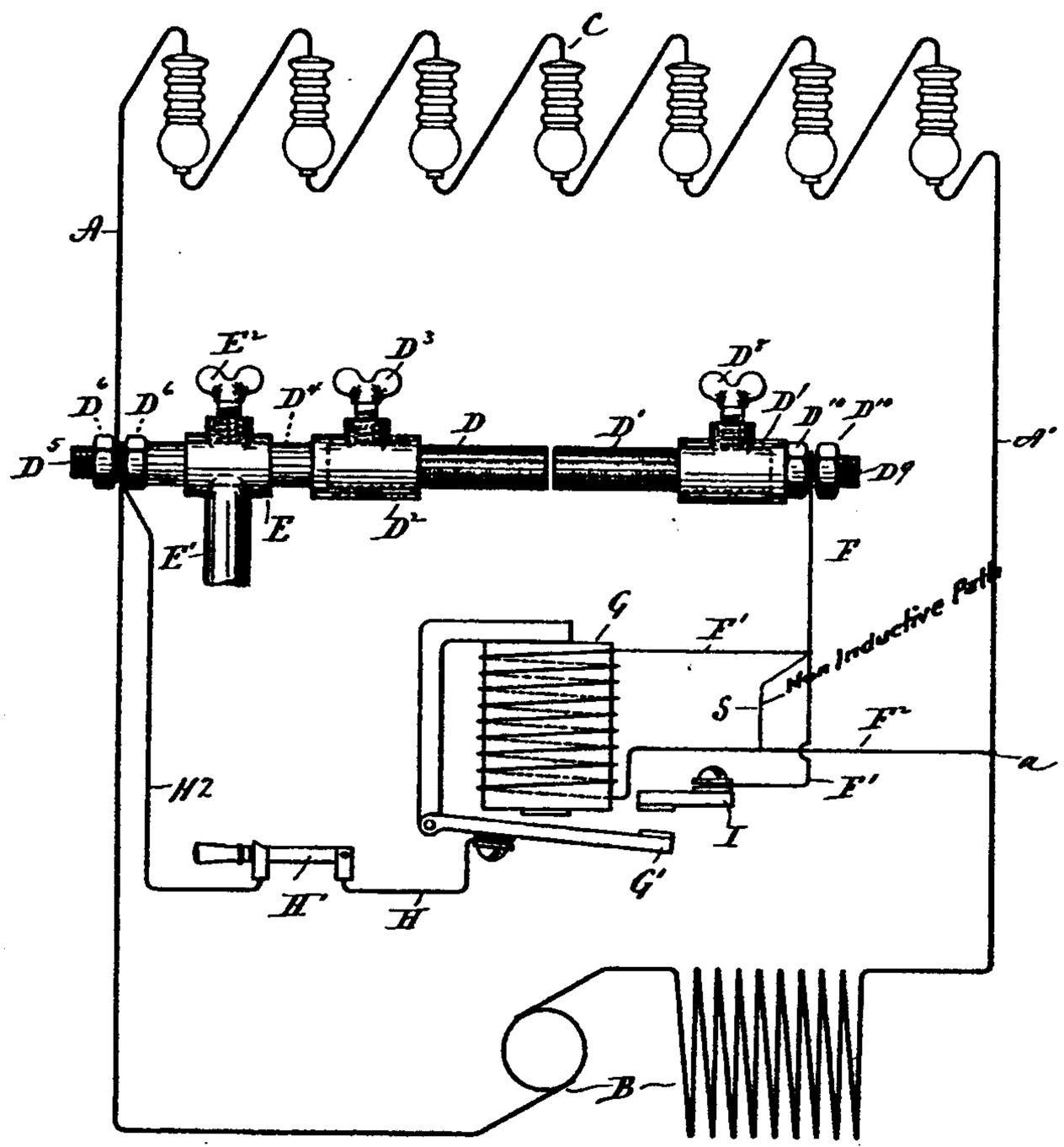
2 Sheets—Sheet 1.

C. N. BLACK.

AUTOMATIC CUT-OUT.

No. 585,904. Patented July 6, 1897.

Fig. 1.



Witnesses.
Lewis P. Bell.
J. H. Thumm
Ellen Scarborough

Charles N. Black
Inventor.

by his Attorneys
Earle & Seymour

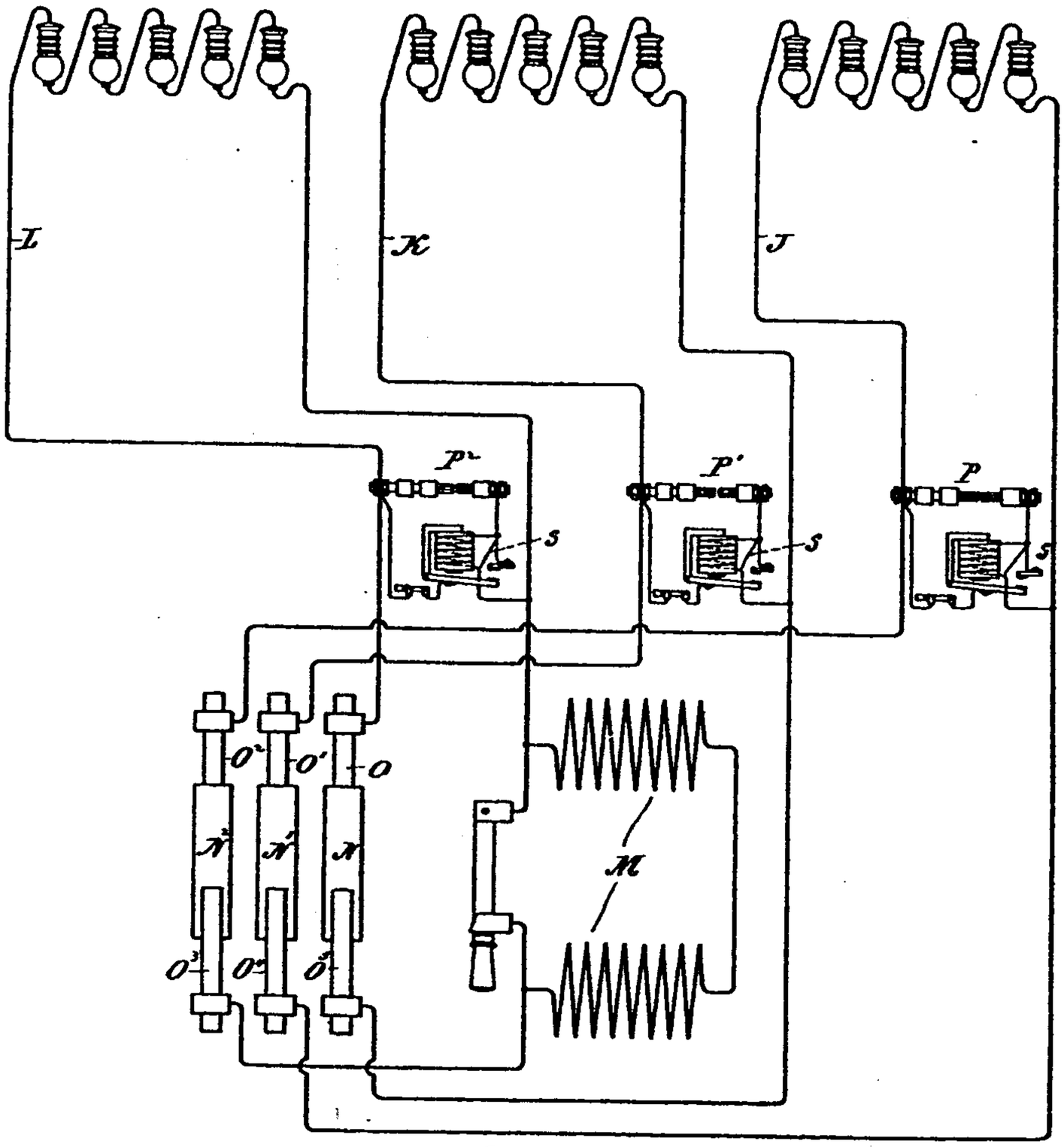
(No Model.) 2 Sheets—Sheet 2.

C. N. BLACK.

AUTOMATIC CUT-OUT.

No. 585,904. Patented July 6, 1897.

Fig. 2.



WITNESSES:

Lewis P. Bell.

J. H. Shumway

Ellen Scarborough

Charles N. Black INVENTOR

BY

Earle & Seymour

ATTORNEYS.

UNITED STATES PATENT OFFICE.

CHARLES N. BLACK, OF NEW HAVEN, CONNECTICUT.

AUTOMATIC CUT-OUT.

SPECIFICATION forming part of Letters Patent No. 585,904, dated July 6, 1897.

Application filed March 15, 1897. Serial No. 627,478. (No model.)

To all whom it may concern:

Be it known that I, CHARLES N. BLACK, of New Haven, in the county of New Haven and State of Connecticut, have invented a new Improvement in Automatic Cut-Outs; and I do hereby declare the following, when taken in connection with the accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a view of one form which my improved automatic cut-out may assume, the same being located in a diagrammatically-represented lamp-circuit and in conjunction with a similarly-represented dynamo; Fig. 2, a diagrammatic representation of three of my cut-outs when used in conjunction with a dynamo having three independent lamp-circuits connected with it in series on the multicircuit plan.

My invention relates to devices primarily designed to protect the insulation of an electric circuit, but also to prevent the voltage or pressure on the circuit from exceeding a predetermined safe limit.

My invention is particulary applicable to the protection of the insulation of one or more lamp-circuits connected with a dynamo-electric machine, but may also be used in a great variety of situations and for the protection of circuits containing other translating devices than lamps and guarding them against a rise of potential resulting from an overload of lamps or from the breaking of the circuit from any cause whatever.

With these ends in view my invention consists in the combination, with an electric circuit, of an automatic cut-out providing a non-inductive path and operating as an instantaneous short circuit when the voltage on the line exceeds a predetermined safe limit.

My invention further consists in the combination, with a dynamo-electric machine having two or more independent armature-circuits, of two or more independent lamp-circuits connected in series with and interposed between the said independent armature-circuits and automatic cut-outs respectively located across the said lamp-circuits and operating to instantaneously short-circuit the same when the voltage in any one of them from any cause rises above a predetermined safe working limit.

My invention further consists in certain details of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

My improved automatic cut-out may assume a variety of forms, and I would have it understood that I do not limit myself to using the form chosen for illustration, though that is the form which I now prefer.

In Fig. 1 of the drawings I have shown one form which my improved automatic cut-out may assume, the same being represented as located in a lamp-circuit A and connected to a diagrammatically-represented arc-dynamo B and containing six lamps C. It will be understood, of course, that the arc-dynamo and lamps may be of any approved construction and that the lamps may be varied in number, as desired. Across said lamp-circuit A, I locate my improved cut-out, which comprises two electrodes D D′, separated by a dielectric forming a non-inductive path. I may, however, prefer to connect the electrodes of my cut-out by a suitable connection which shall be non-inductive.

One of the electrodes D D′ is adjustable toward and away from the other, although both may be adjustable, if desired. Preferably, though not necessarily, these electrodes consist of carbon pencils. Metal electrodes might be used in their place. It will be understood that the said electrodes are set relatively close together or far apart, according to the predetermined safe limit of voltage and so that that voltage shall break down the dielectric which separates them when that limit is passed. The electrode D is mounted, as shown, in a socket-like clamp D^2, having a thumb-screw D^3 and an outwardly-projecting stem D^4, which is passed through a tubular bearing E, formed at the upper end of a vertical clamp-support E′, the said bearing E containing a thumb-screw E^2, which impinges upon the stem D^4 and holds the same against endwise displacement in the bearing, in which the stem is longitudinally adjustable for moving the pencil or rod D toward or away from the electrode D′. The stem D^4 terminates in a binding-post D^5, furnished with clamping-nuts D^6 D^6. The electrode D′

is mounted in a socket-like clamp D^7, provided with a thumb-screw D^8 and with a binding-post D^9, having clamping-nuts D^{10} D^{10}. The support of the clamp D^7 has not been shown, but it will be understood to be of any approved construction and is thought not to need illustration. The portion or leg A of the lamp-circuit is connected to the binding-post D^5 between the clamping-nuts D^6 D^6 thereof, whereby the electrode D is connected to the lamp-circuit. On the other hand, the electrode D' is connected with the leg or portion A' of the lamp-circuit by means of a wire F, connected with its binding-post D, and the wire F'', the electromagnet G, and the wire F^2, which is connected to the said portion or leg A' of the lamp-circuit at the point *a*.

In order to make the main-circuit cut-out absolutely non-inductive, I employ a non-inductive path S around the magnet G. This path may be formed of a non-inductively-wound wire or any other conductor of sufficient resistance to cause a sufficient amount of the current to flow around the electromagnet to make it operative.

Let it be supposed that a pressure of six thousand volts has been decided upon as the maximum safe working voltage over the lamp-circuit. That predetermined safe working limit having been fixed upon the electrodes D and D' are set so that it requires a pressure of six thousand volts to break through the dielectric or air-space between them. Obviously now the cut-out will be normally open, but the instant the potential rises, from whatever cause, above six thousand volts the dielectric between the electrodes is broken down and a circuit is established through them and the lamp-circuit short-circuited. Its current will then flow from the leg A of the lamp-circuit through the binding-post D^5, the stem D^4, the clamp D^2, the electrode D, the electrode D', the clamp D^3, the binding-post D^9, the wires F and F', the electromagnet G, and thence through the wire F^2 to the leg A' of the lamp-circuit, which will thus be cut out at the instant the circuit is established through the electrodes.

The short-circuiting of the current through the electrodes takes place the instant the predetermined voltage limit is reached and before any damage can be done to the insulation of the line. In this respect my device is superior to any cut-outs which require even a brief space of time for their operation. Here I may explain that in cut-outs as ordinarily constructed a short space of time elapses between the time when they begin to act and before they perform their cutting-out function. This time, it is true, is short, but it is long enough to give opportunity to a current to break down the insulation of a line or do other serious damage. On the other hand, the operation of my improved cut-out is practically instantaneous and so quick that the time required for the current, when of proper intensity to break through the dielectric, cannot be measured. The advantage of my cut-out is that it operates so instantaneously that the lamp or other circuit is cut out before the current has had any chance to break through the insulation of the line or do any other damage. Inasmuch, however, as the continued passage of the current through the electrodes would disintegrate them or wear them away, I prefer to cut them out just as soon as they have cut out the lamp-circuit. I do this by employing a secondary short circuit comprising the armature G' of the magnet G, before mentioned, the said armature G' being connected by a wire H to a switch H', which is connected by a wire H^2 to the binding-post D^5, which is connected with the leg A of the lamp-circuit. The said armature G' coacts with a contact-point I, connected with the wire F, which, as before mentioned, is wound about the binding-post D of the electrode D'. It will be understood that the closing of a circuit through the electrodes, as described, and hence through the magnet G, causes the same to be energized, whereby the armature G' is lifted into engagement with the contact-point I and whereby the electrodes are immediately cut out, the current taking the path of the least resistance and flowing from the leg A of the lamp-circuit through the wire H^2, the switch H', the wire H, the armature G', the contact-point I, the wires F and F', the magnet G, and thence through the wire F^2 to the leg A' of the lamp-circuit, which will then be short-circuited, the current taking the path last described until the switch H' is opened for starting up the lamps again. It will thus be seen that the electrodes are used for the primary short-circuiting of the lamp-circuit and that then a secondary short circuit is brought into play, whereby the electrodes are preserved. The switch H' might, if desired, be inserted in the line F^2, but I prefer to locate it in the line H, as then the continuity of the circuit across the electrodes between the legs A and A' is retained, so that in case the voltage again rises above the safe limit the current will jump across the dielectric between the electrodes and the insulation of the lamp-circuit will not be endangered.

It is a well-known fact that on long circuits there is a considerable rise of potential, depending upon the amount of self-induction, when a circuit is suddenly interrupted, and consequently an extra strain is put upon the insulation of the machine and circuits, whereby the insulation of the machine and circuits frequently breaks down and causes considerable trouble and expense. My improved cut-out takes care of this source of trouble.

In Fig. 2 of the drawings I have shown three of my improved automatic cut-outs, the same being respectively located across as many independent lamp-circuits J, K, and L, which are connected in series with and virtually interposed between the independent armature-circuits of a constant-current arc-dynamo

diagrammatically represented, and having three commutator-rings N, N', and N², the brushes O, O', O², O³, O⁴, and O⁵ of which have the terminals of the several electric circuits connected with them, so that the lamp-circuits will be virtually interposed between the independent armature-circuits, as already explained. It will be understood that the operation of my improved cut-out is the same in principle when applied as shown in Fig. 2 as when applied as shown in Fig. 1. However, on a machine connected in the manner shown by Fig. 2 the rise in potential in case of open circuit on any one of the three lamp-circuits is far greater than would be the case if there was only one circuit of lamps operated from the machine, as in Fig. 1. For example, let it be supposed that one hundred lamps are located in each of the circuits J, K, and L, and that there will be a difference in potential of five thousand volts between the terminals of each of these circuits, and that there will not be a greater difference of potential than five thousand volts between any two points in the entire system. If a break occurs in any one of the three circuits, however, the potential or pressure will instantly reach a value of fifteen thousand volts at least, and if the circuits contain self-induction it may reach a far higher value. The insulation of the circuits under normal conditions has only to withstand a strain of five thousand volts, as will be clear from the above, and obviously it would be very expensive to construct these circuits to withstand a pressure of fifteen or twenty thousand volts, as would be necessary to protect the insulation against being broken down by the enormous rise in potential consequent upon a break in any one of the circuits. It is therefore imperative that the danger of this abnormal rise in potential shall be eliminated, and I accomplish that result by locating one of my improved automatic cut-outs across each of the three circuits, the cut-outs being diagrammatically illustrated and designated by the letters P, P', and P². These automatic cut-outs act instantly in case a break or overload occurs in any of the circuits and short-circuits the current before the voltage has risen to a degree dangerous to the insulation or otherwise.

As before stated, I may obtain the same results by connecting the two electrodes directly across the terminals of the circuits without the introduction of the auxiliary electromagnet and the second circuit, which I employ to prevent the electrodes from being impaired.

I make no claim in this application to the multicircuit connection for dynamo-electric machines shown in Fig. 2, and which consists in two or more alternate circuits connected between and included in series with the separate groups of armature coils or bobbins of a dynamo-electric machine, as that idea is broadly claimed in a pending application of prior date.

It is apparent that in carrying out my invention some changes from the construction herein shown and described may be made, and I would therefore have it understood that I do not limit myself to the exact construction shown, but hold myself at liberty to make such changes and alterations as fairly fall within the spirit and scope of my invention. Thus I do not limit myself to the use of a normally open cut-out, for in case I connected the electrodes by a non-inductive connection the cut-out would, strictly speaking, be closed through operating as an instantaneous short circuit on account of providing a non-inductive path corresponding in function to a dielectric.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a dynamo-electric machine having two or more independent armature-circuits, of two or more independent lamp-circuits connected in series with and between the independent armature-circuits of the machine, and automatic cut-outs corresponding in number to the independent lamp-circuits which they are placed across and each providing a non-inductive path and operating to instantaneously short-circuit the respective lamp-circuits when the voltage therein exceeds a predetermined safe working limit.

2. The combination with a dynamo-electric machine having two or more independent armature-circuits, of two or more independent lamp-circuits connected in series with and between the independent armature-circuits of the machine, automatic cut-outs located across the said lamp-circuit which they short-circuit when the voltage exceeds a predetermined safe working limit, and switches located in the said cut-outs.

3. The combination with a dynamo-electric machine, having two or more independent armature-circuits, of two or more independent lamp-circuits connected in series with and between the independent armature-circuits of the machine, automatic cut-outs located across the said lamp-circuits which they short-circuit when the voltage exceeds a predetermined safe working limit, and comprising a primary circuit providing a non-inductive path, and also comprising a second circuit arranged in shunt with the primary circuit, and brought into operation by the passage of a current through the primary circuit, whereby the primary circuit closes the second circuit and cuts itself out.

4. The combination with a dynamo-electric machine having two or more independent armature-circuits, of two or more independent lamp-circuits connected in series with and between the independent armature-circuits of the machine, and automatic cut-outs lo-

cated across the said lamp-circuits which they short-circuit when the voltage exceeds a predetermined safe working limit, and each comprising two electrodes separated from each other by a non-inductive path, and also comprising a second circuit which is cut into action by the passage of a current through the electrodes which thus operate to cut themselves out.

5. The combination with a dynamo-electric machine having two or more independent armature-circuits, of two or more independent lamp-circuits connected in series with and between the independent armature-circuits of the machine, and automatic cut-outs located across the said lamp-circuits which they short-circuit when the voltage exceeds a predetermined safe working limit, and comprising a primary circuit having an electromagnet connected with it in series, and also comprising a second circuit which automatically short-circuits the primary circuit but not the magnet, and a non-inductive shunt around the said magnet, making the primary circuit non-inductive.

6. The combination with a dynamo-electric machine having two or more independent armature-circuits, of two or more independent lamp-circuits connected in series with and between the independent armature-circuits of the machine, and automatic cut-outs located across the said lamp-circuits which they short-circuit when the voltage exceeds a predetermined safe working limit, and each comprising two carbon pencils or rods which are set with their ends separated more or less according to the voltage at which the cut-out is designed to act, and which have an electromagnet connected in series with them, and a second circuit which is closed by the passage of a current through the pencils and the said electromagnet, and short-circuiting the pencils but not the magnet.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHAS. N. BLACK.

Witnesses:
GEORGE DUDLEY SEYMOUR,
FRED. C. EARLE.