No. 767,103. PATENTED AUG. 9, 1904.

W. B. CHURCHER.

ELECTRICAL CONVERTER.

APPLICATION FILED SEPT. 21, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

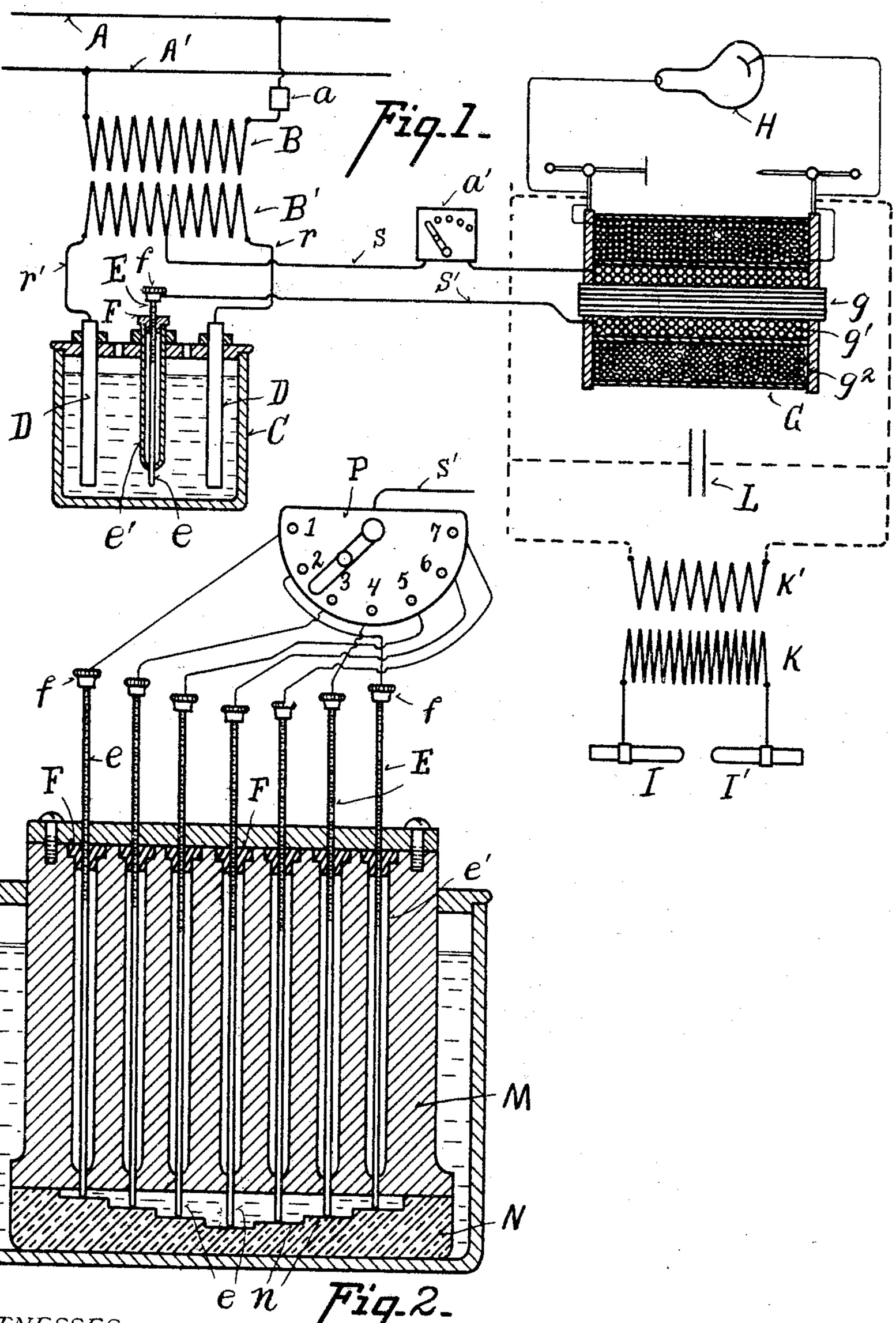

Fig. 1.

Fig. 2.

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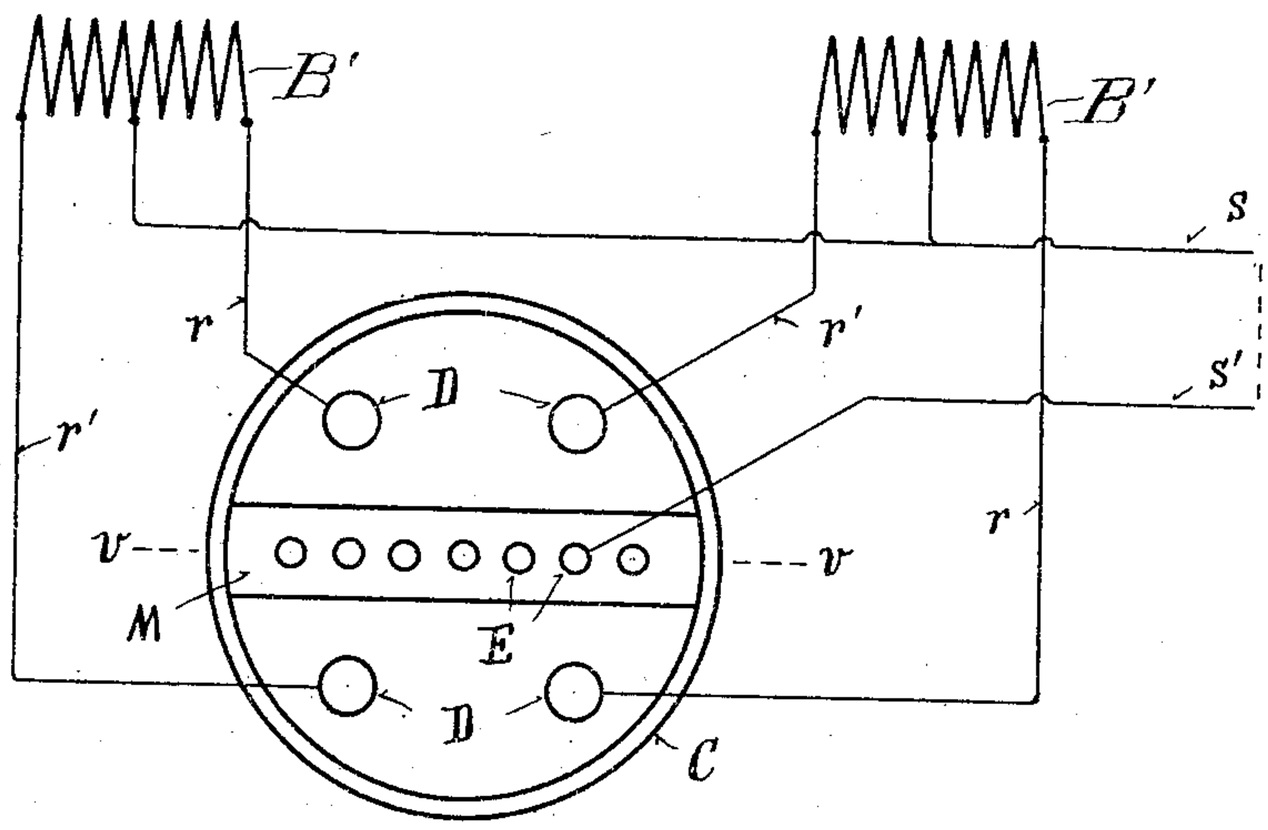
NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.



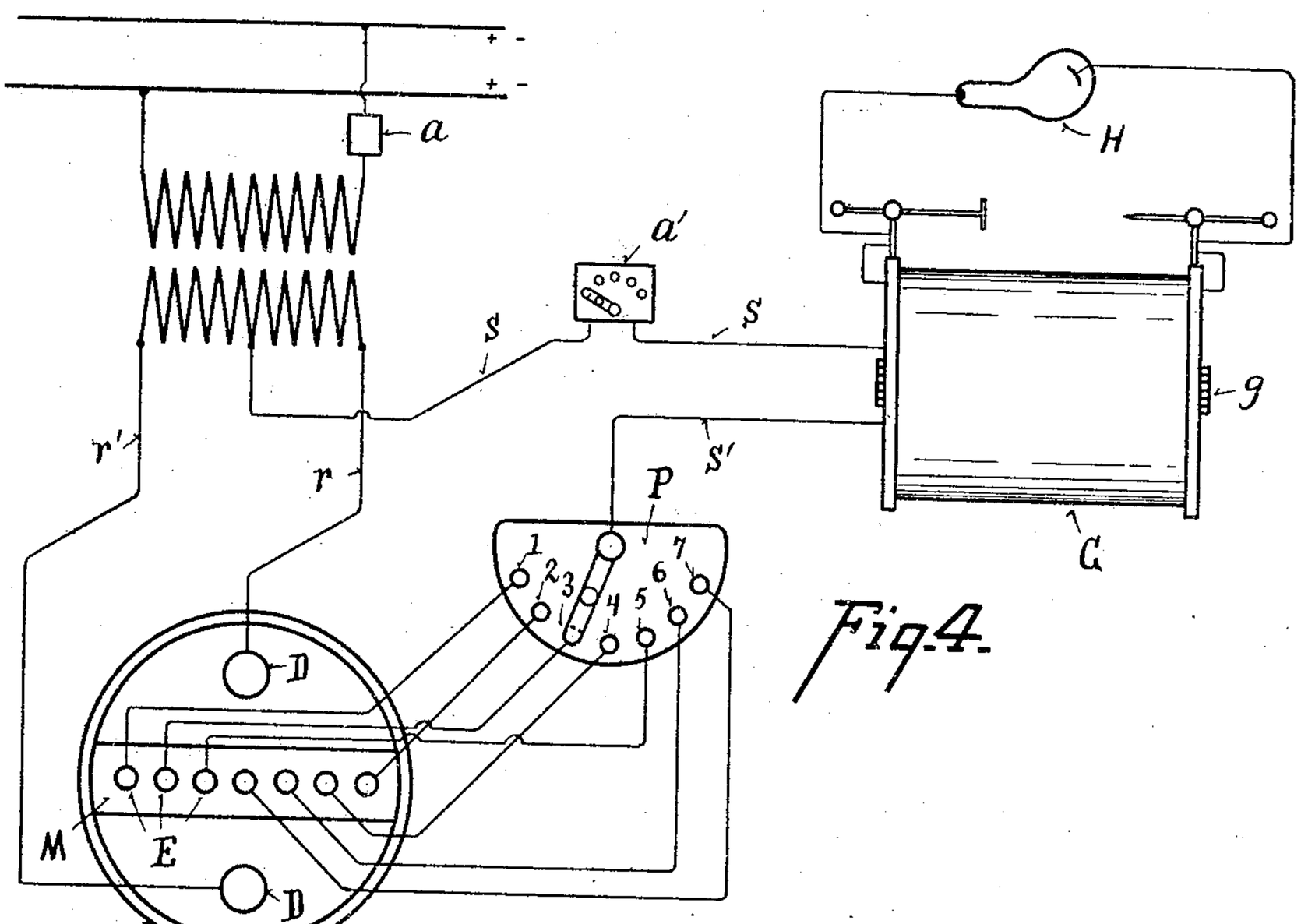


Fig. 4.

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UNITED STATES PATENT OFFICE.

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ELECTRICAL CONVERTER.

SPECIFICATION forming part of Letters Patent No. 767,103, dated August 9, 1904.

Application filed September 21, 1903. Serial No. 173,935. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. CHURCHER, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Electrical Converters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improved mechanism for producing direct from alternating currents, and is particularly adapted and intended to produce currents adapted for use in connection with X-ray bulbs or generators.

One of its objects is to produce a rapidly-interrupted direct current from an alternating source of electricity.

Another object is to provide improved means for controlling the rapidity of the interruptions and also the volume of direct current.

Another object is to provide mechanism adapted to operate X-ray bulbs of different character and to obtain X-ray and other electrical vibrations adapted for different purposes.

It further consists in certain details of form, combination, and arrangement, all of which will be more fully set forth in the description of the accompanying drawings, in which—

Figure 1 represents a diagram of my improved apparatus. Fig. 2 represents an enlarged section through the electrolytic cell on line *v v* of Fig. 3. Fig. 3 is a top plan view of the electrolytic cell, showing a modification. Fig. 4 is a diagram similar to Fig. 1, showing the connections where a plurality of interrupting-electrodes are employed.

In certain branches of X-ray work, particularly in the medical department, it is desirable to secure very rapid pulsations of the current and also to provide an interrupted direct current instead of an alternating current. It is also desirable to be able to regulate the frequency of the interruptions and also the volume of current, all of which I am enabled to accomplish with the apparatus herein illustrated and described.

A A′ represent the alternating-current line-wires.

B represents the primary of a transformer, and B′ the secondary thereof.

C represents an electrolytic cell, the electrolyte of which is preferably phosphate of soda or potassium.

D represents electrodes of aluminium or other chemically-active material adapted to pass a current of one polarity and to turn back or prevent the passage of current of the opposite polarity. There may be two or more of these electrodes D.

E represents an electrode of platinum, gold, or other metal or conducting material not easily attacked by the electrolyte.

The electrode E, of which there may be one or more in the cell, is constructed in the following manner: *e* represents the platinum wire or rod, which passes down through a tube or sheath *e′* and through an opening in the lower end of the tube, so as to project into the electrolyte below the lower end of the tube. I preferably provide means whereby the rod *e* is made vertically adjustable relative to the tube, so that the amount which projects below the tube may be regulated and increased or decreased, as desired. As shown in Figs. 1 and 2, the upper ends of the rods *e* are threaded and screwed into nuts or collars F, which are held rigid relative to the tubes, so that by turning the rods by means of the knurls *f* the rods will be screwed either up or down through the nuts F to secure the desired adjustment.

The coil G is of the ordinary construction employed in X-ray work, consisting of an iron core *g*, a primary coil *g′*, and a secondary coil g^2, to the terminals of which the X-ray bulb H may be connected, as indicated in full line.

I I′ represent light-bulbs of another character, which are preferably connected each to a single terminal of the secondary K, the primary K′ of which is energized, as indicated by dotted lines, from the terminals of secondary g^2, L being a condenser also connected in the circuit.

The operation is as follows: The alternating

current of the line-wires produces an induced current in the secondary B′, the opposite ends of which are connected to the electrodes D by wires *r r′*. S represents a wire leading from a point near the center of the secondary B′ through the primary *g′* and thence by wire S′ to the electrode E. The electrode E will therefore be positive to one of the electrodes D and negative to the other at either phase of the current. The nature of the electrodes and electrolyte is such that only negative current will flow from the electrode E to whichever of the electrodes D happens to be positive relative thereto. Therefore the current flowing through the primary *g′* will always pass in one direction only. The interruptions in the current are produced by reason of the small surface of the electrode E which is exposed to the electrolyte, which upon passage of the current produces gas at the surface of the electrode E in sufficient quantities to insulate the electrode and interrupt the current, after which contact is immediately made again, and thus a very rapid interruption of the current through primary *g′* is effected. The frequency of this interruption and also the volume of current passing can be regulated within considerable limits by varying the amount of surface of the electrode E which is exposed to the electrolyte below the end of the tube *e′*. Therefore while a single electrode E may be employed and the same adjusted to obtain the desired results, as shown in Fig. 1, I preferably provide a series of electrodes E, each mounted in a separate tube, the several tubes being preferably formed in a single block of porcelain or similar substance M, which rests upon a block of similar material N, having a series of steps *n*, so that by adjusting the several electrodes to rest upon the respective steps the electrodes have a progressively-increasing amount of surface exposed to the electrolyte, and by connecting the respective electrodes to the separate contacts 1 to 7 of the switchboard P the cell C may be located in the cellar or other convenient position, and the regulation may be made at the switchboard near the other apparatus. As the electrodes E are to a certain extent disintegrated by the action of the current, it is necessary to adjust them from time to time. They may, if desired, be allowed to gravitate downward through the tubes, but are preferably made adjustable, as shown.

In Fig. 4 the position to be occupied by the switch P is indicated. The volume of the current is regulated within certain limits by switch P, and any further regulation desired may be effected either by a variable inductive resistance *a* or by the rheostat *a′*.

With the apparatus here shown the interruptions in the current are too rapid to be detected by the eye, and the character of current is such as to produce a strong steady light not heretofore attained in the bulbs. If desired, two or more pairs of electrodes D may be employed, each pair of electrodes being connected to the terminals of a separate secondary B′, as indicated in Fig. 3.

Having described my invention, what I claim is—

1. In an electrical converter, a primary connected to a source of alternating current, an electrolytic cell having a plurality of active electrodes permitting the passage of current in one direction, and an electrode having a restricted surface in contact with the electrolyte to interrupt the current, a secondary having its terminals connected to said active electrodes, and a circuit formed between an intermediate point on said secondary and the interrupting-electrode.

2. In combination with a source of alternating current, an electrolytic cell having a plurality of electrodes through which current of one polarity passes, and an electrode exposing a restricted surface to the electrolyte and adapted to rapidly interrupt the current.

3. In combination with a source of alternating current, an electrolytic cell having a plurality of electrodes alternately in use through which current of one polarity passes, and an electrode exposing a restricted surface to the electrolyte and adapted to rapidly interrupt the current.

4. In combination with a source of alternating current, an electrolytic cell having a plurality of electrodes alternately in use through which current of one polarity passes, an electrode exposing a restricted surface to the electrolyte and adapted to rapidly interrupt the current, a transformer the secondary of which has terminal connections with the alternately-active electrodes, and a circuit leading from an intermediate point of the secondary to the interrupting-electrode.

5. In combination with a source of alternating current, an electrolytic cell having a plurality of electrodes through which current of one polarity passes, a plurality of electrodes each exposing a restricted surface to the electrolyte to rapidly interrupt the current, and means for selectively passing the current through any one of said interrupting-electrodes.

6. In combination with a source of alternating current, an electrolytic cell having a plurality of electrodes alternately in use, through which current of one polarity passes, a plurality of electrodes exposing restricted, but relatively different surfaces to the electrolyte to rapidly interrupt the current, and means for selectively employing any one of said interrupting-electrodes.

7. In combination with a source of alternating current, an electrolytic cell having a plurality of electrodes alternately in use through which current of one polarity passes, a plurality of electrodes exposing restricted but relatively different surfaces to the electrolyte

to rapidly interrupt the current, a transformer, the secondary-terminals of which are connected to the alternately-active electrodes, a circuit formed between an intermediate point on the secondary and the interrupting-electrodes, and a switch interposed in said circuit to selectively bring into use different interrupting-electrodes.

8. An electrolytic cell, an interrupter composed of a series of independent electrodes exposing restricted but relatively different surfaces to the electrolyte to rapidly interrupt the current, a circuit leading from the interrupter to another electrode in said cell, and means for selectively employing different interrupting-electrodes.

9. In an electrical converter, an electrolytic cell, an electrode through which current of one polarity passes, a plurality of electrodes exposing restricted but relatively different surfaces to the electrolyte to rapidly interrupt the current, and means for selectively employing different interrupting-electrodes.

10. An electrolytic cell, an interrupting-electrode composed of a series of independent electrodes exposing restricted but relatively different surfaces to the electrolyte, mechanism for independently adjusting said interrupting-electrodes, a circuit leading from the interrupting-electrodes to another electrode in said cell, and means for selectively employing different interrupting-electrodes.

In testimony whereof I have affixed my signature in presence of two witnesses.

WILLIAM B. CHURCHER.

Witnesses:

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C. W. MILES.