(No Model.) 2 Sheets—Sheet 1.

F. J. PATTEN.

ELECTROMAGNETIC ARC CONTROLLING DEVICE.

No. 577,371. Patented Feb. 16, 1897.

Fig. 1.

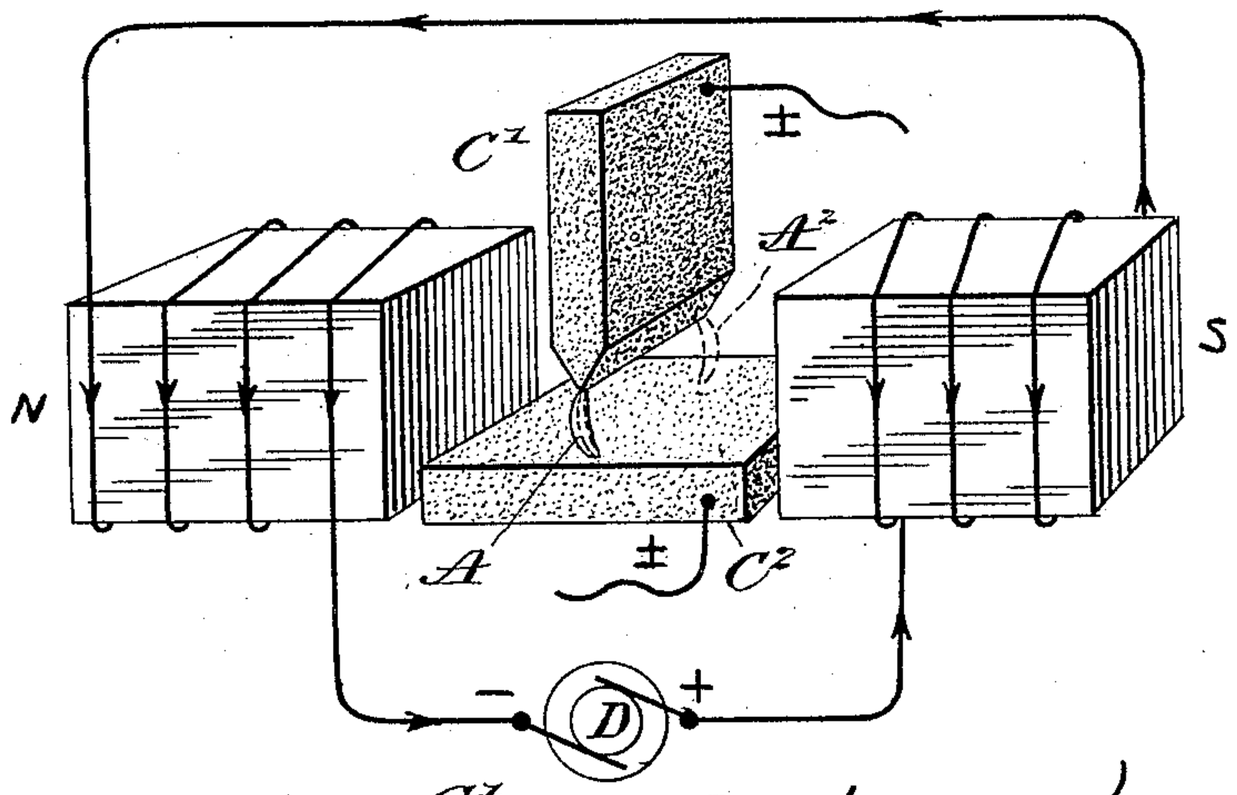


Fig. 2.

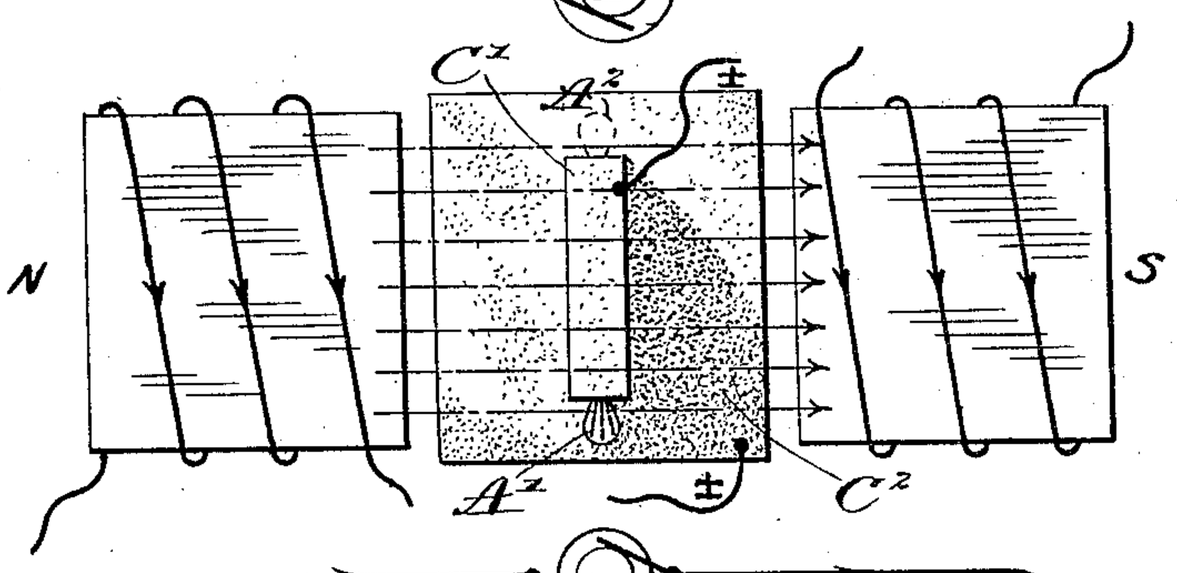


Fig. 3.

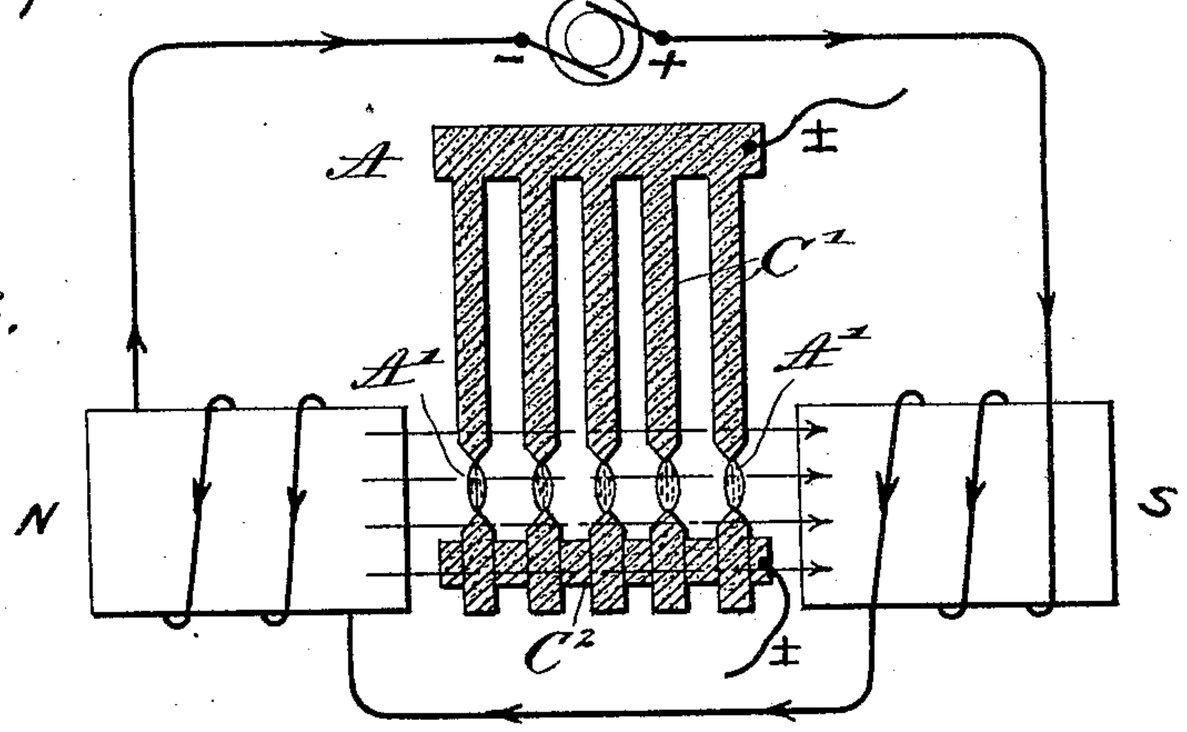
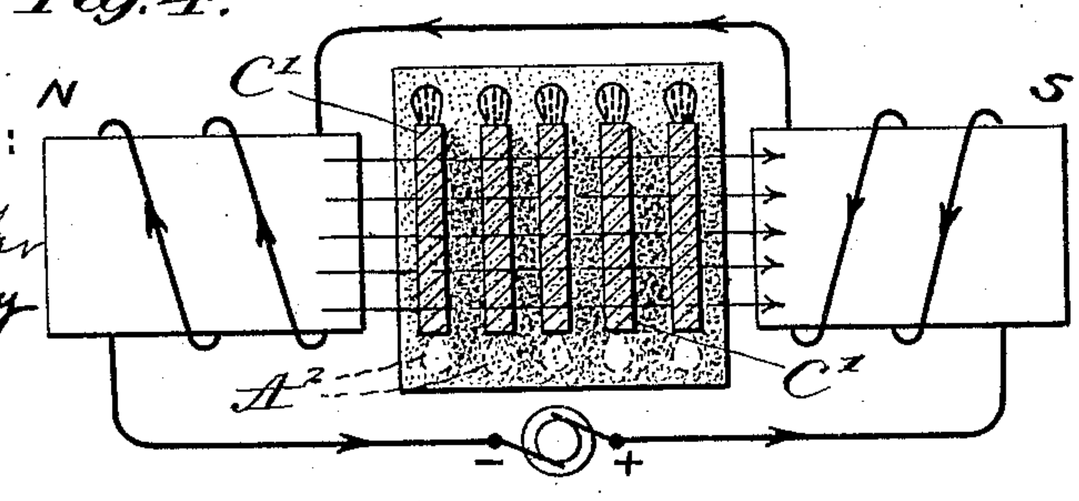


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

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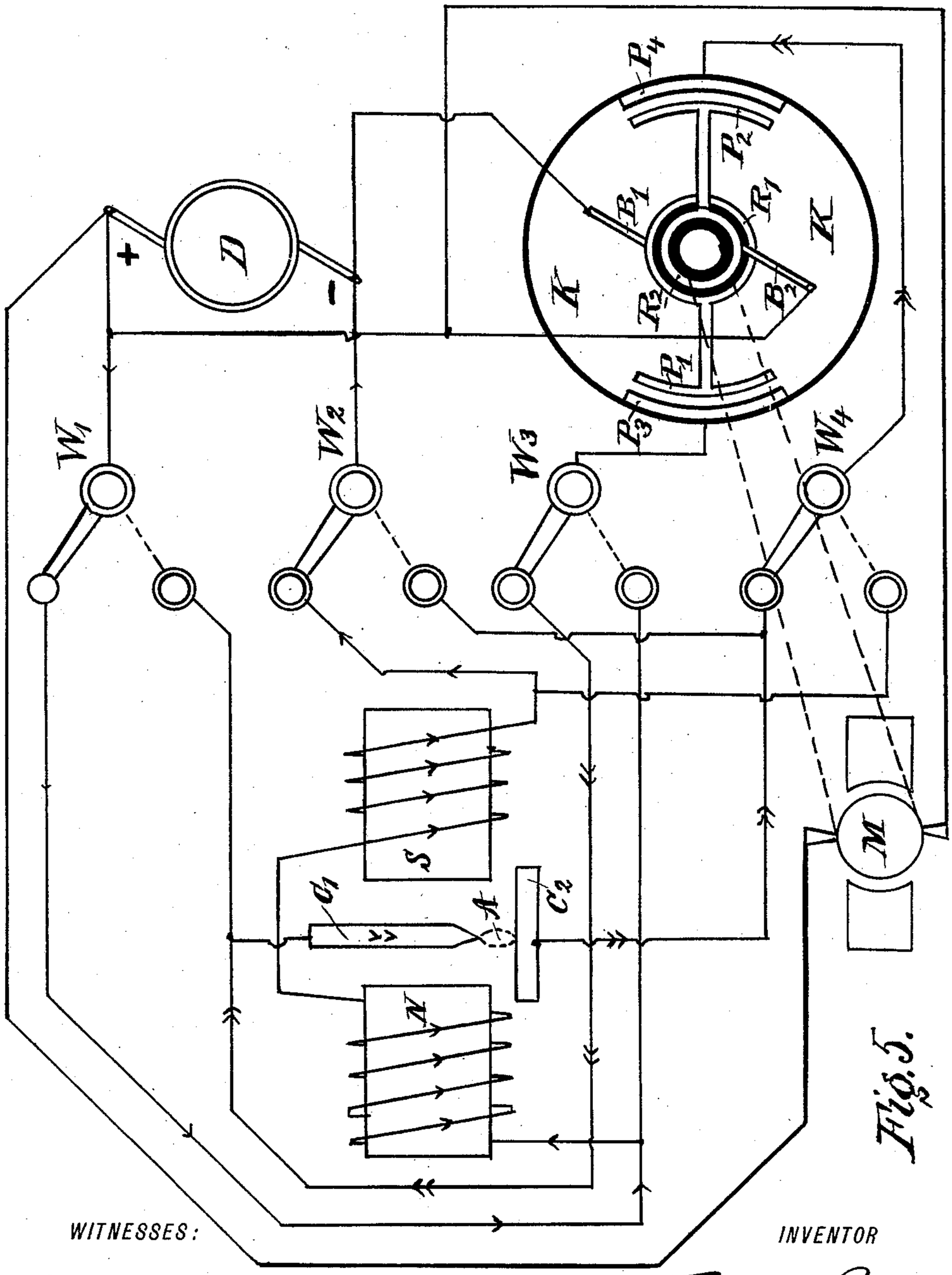

Fig. 5.

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ELECTROMAGNETIC ARC-CONTROLLING DEVICE.

SPECIFICATION forming part of Letters Patent No. 577,371, dated February 16, 1897.

Original application filed September 8, 1896, Serial No. 605,146. Divided and this application filed January 15, 1897. Serial No. 619,367. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS JARVIS PATTEN, a citizen of the United States, residing at New York, in the county and State of New York, have invented an Improved Electromagnetic Device, of which the following is a clear description.

My invention consists in a device and method for controlling the movement of an electric arc and will be readily understood by reference to the accompanying drawings, the different figures indicating the device and method of operation, and in which—

Figure 1 illustrates the principle upon which the operation of the device is based. Fig. 2 shows in horizontal projection the apparatus shown in Fig. 1. Fig. 3 shows an amplification of the device shown in Fig. 1. Fig. 4 shows in horizontal projection the device shown in Fig. 3, and Fig. 5 shows a diagram of complete electric circuits adapted to operate the device shown in Fig. 1 in either of two different ways.

My device for and method of controlling the movement of an electric arc may find many applications in the electric arts. One that is almost obvious lies in the improvement of electric furnaces of the arc type in which by controlling the movement and position of the arc I expect to increase the efficiency of such machines. This will be more apparent upon further detailed description of the apparatus.

Referring now to Figs. 1 and 2, the latter being a projection on a horizontal plane of the device or apparatus shown in the former in perspective, C′ is a vertically-placed carbon slab or block which may be regarded as an "upper," or, if the term be preferred, a "positive," electrode. Another block C^2, of carbon or other suitable conducting substance, is placed in a position at right angles to the former and at a suitable arcing distance therefrom. These two are connected as electrodes to an alternating-current electric circuit, as indicated, and an arc A, Fig. 1, is established between them. Under such conditions the arc will generally fluctuate about in an irregular manner along the lower edge of the upper carbon in its endeavor to remain at the point of least electrical resistance and will thus have an irregular movement. If now this system of electrodes with arc-producing current, as described, be placed in a magnetic field of constant direction, as indicated by the magnet-poles N and S, Fig. 1, then with positive lines of force in the direction of the arrows and current between electrodes flowing from the upper to the lower one the arc between them will take the position A and remain at that side of the upper carbon. If, however, while the magnetism remains unchanged in direction the current between electrodes be reversed in direction, the arc A will instantly move over to the position A^2 at the other side of the upper carbon, and it may be inferred that if the current remained unchanged in direction and the magnetism were reversed the same result would follow.

If then an alternating current be used for producing the arc and the arcing-space be embraced in a fixed or unchanged magnetic field, the arc will pass from the position A, Fig. 1, to the position A^2, and back at each reversal of current. In other words, under the conditions named I have in such a device a method of giving an electric arc a traversing or to-and-fro movement between electrodes. The movement will be of a uniform and regular character in a constant field if the reversals of current between electrodes are uniformly timed.

Evidently by maintaining the current constant in direction between electrodes and reversing the exciting-current of the magnet uniformly would produce the same effect. These seem to be simply two ways of doing the same thing, one of which is the obvious consequence of the other.

Fig. 2, regarded as a horizontal projection of the device shown in Fig. 1, requires no special description.

Fig. 3 represents only a modification of the device shown in Fig. 1. In it a number of parallel upper slabs C′, Figs. 3 and 4, form as many arcs between their lower edges and the lower slab or electrode C^2, and as the current is reversed these several arcs move from side to side of their respective slabs or electrodes, thus making a sort of traversing sheet of flame across the surface of the lower carbon slab. These two figures illustrate the application of

my method to the improvement of electric furnaces of the arc type.

It is evidently immaterial, so far as the action of the arc is concerned, whether the arcing-current be reversed and the field magnetism held constant or the magnetism be reversed and the arcing-current be maintained of constant direction.

In Fig. 5 I show a complete system of circuits for a device like that shown in Fig. 1. In it the operative parts of Fig. 1 are readily recognized. C′ and C² are the electrodes; N and S, the magnet-poles, embracing the arcing-space, both provided with their respective independent circuits.

D, Fig. 5, represents a direct-current dynamo or source of current, and the apparatus K K is a liquid-commutator or current-reverser adapted, when driven by the motor M, to slowly reverse or alternate the polarity of the current of the dynamo given to it and delivered by it to any external circuit connected to its terminals P³ P⁴. I claim no new feature in this current-reverser and assume it is well known in the electric arts.

The positive and negative terminals of the dynamo, + —, are connected also to the center points of the switches W′ W², and the terminals of the current-reverser K K are connected to the center points of two other switches W³ W⁴. Any circuit connected to the first pair of switches will receive a direct current and any circuit connected to the second pair will receive a reversing current.

The circuit through the electrodes C′ C² has a pair of terminals at W′ W² for receiving direct current and a pair at W³ W⁴ for receiving alternating current. Likewise the exciting-circuit of the magnet N S has a pair of terminals at each pair of switches.

In the position of the four switches shown in Fig. 5 the electrodes C′ C² receive a slowly-reversing current and the magnetizing-circuit of the magnet N S a direct current. Now if all four switches be thrown to the dotted positions of each the conditions will be changed in both circuits, the electrodes C′ C² will be in a direct-current circuit, and the field magnetism will be periodically reversed. The two systems of operation are therefore a mere question of throwing switches in a properly-devised system of circuits.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is the following:

1. The method of imparting a reciprocating movement to an arc between electrodes which consists in causing the arc to traverse a magnetic field in which the lines of force are substantially transverse to the direction of the arc, and reversing or alternating either the arc-producing current or the magnetic field, substantially as described.

2. The method of imparting a reciprocating movement to an arc between electrodes which consists in causing the arc to traverse a fixed magnetic field, the lines of force of which are substantially transverse to the direction of the arc-producing current and reversing or alternating the arc-producing current, substantially as described.

3. The combination with means for producing a magnetic field, of electrodes arranged to produce an arc across said field, and means for reversing or alternating either the arc-producing current or the magnetic field, whereby the arc between the electrodes will be reciprocated, substantially as described.

4. The combination with the electromagnet having separated poles of opposite polarity, and an exciting-circuit therefor, of electrodes located between said poles and arranged transversely to the direction of the magnetic lines of force, a circuit for producing an arc between the electrodes, and means for reversing or alternating either the arc-producing current or the magnet-exciting current, whereby the arc will be reciprocated, substantially as described.

5. The combination with an electromagnet having separated poles of opposite polarity, and a constant exciting-current therefor, of electrodes located between said poles and arranged transversely to the direction of the magnetic lines of force, a circuit for producing an arc between the electrodes, and means for reversing or alternating the current in said arc-producing circuit, substantially as described.

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

FRANCIS JARVIS PATTEN.

Witnesses:
GEORGE NORRIS,
O. J. MORA.