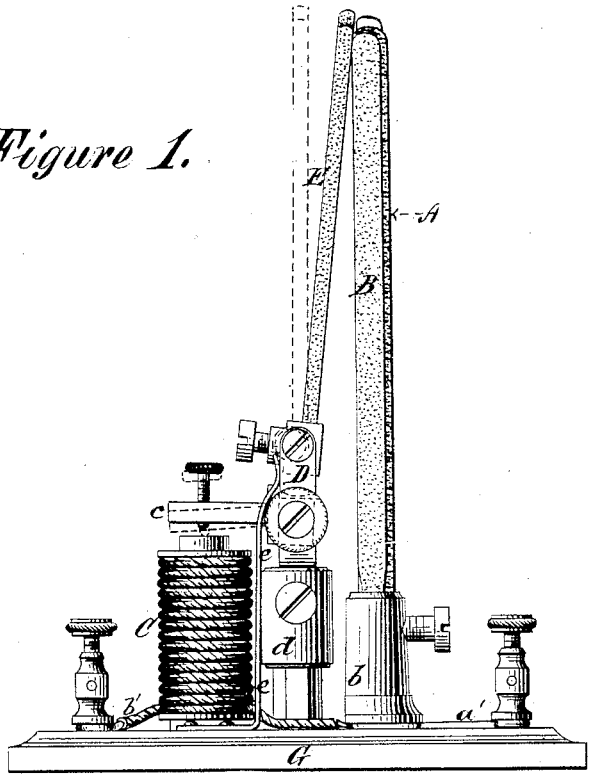
2 Sheets—Sheet 1.

E. WESTON.

Electric-Light.

No. 210,380. Patented Nov. 26, 1878.

Figure 1.



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E. WESTON.
Electric-Light.

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Figure 2.

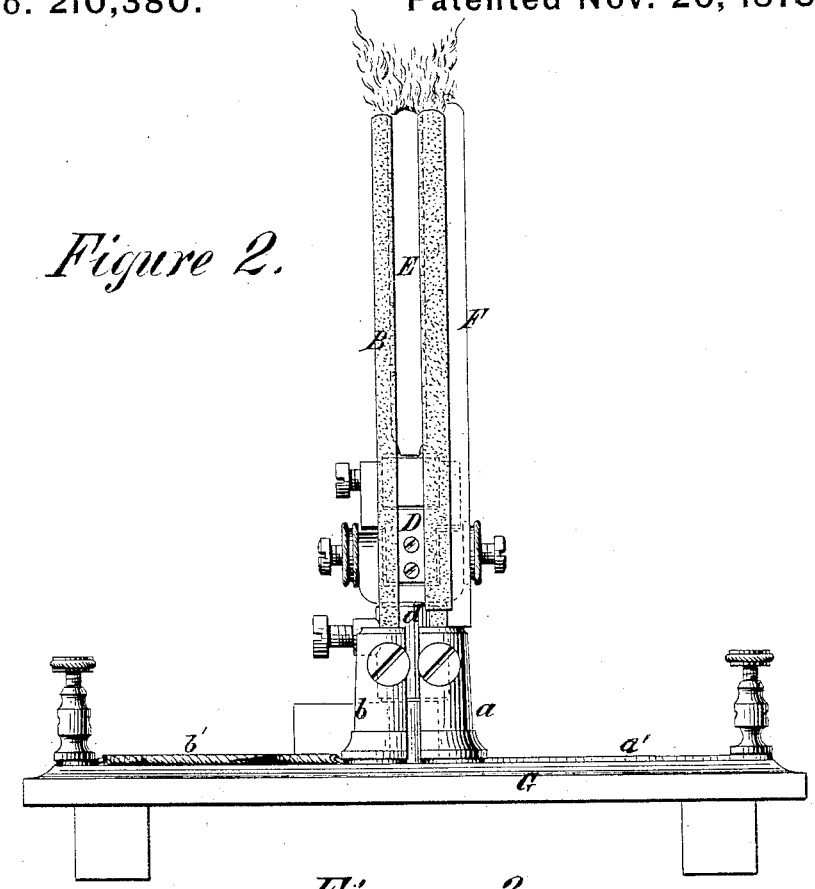
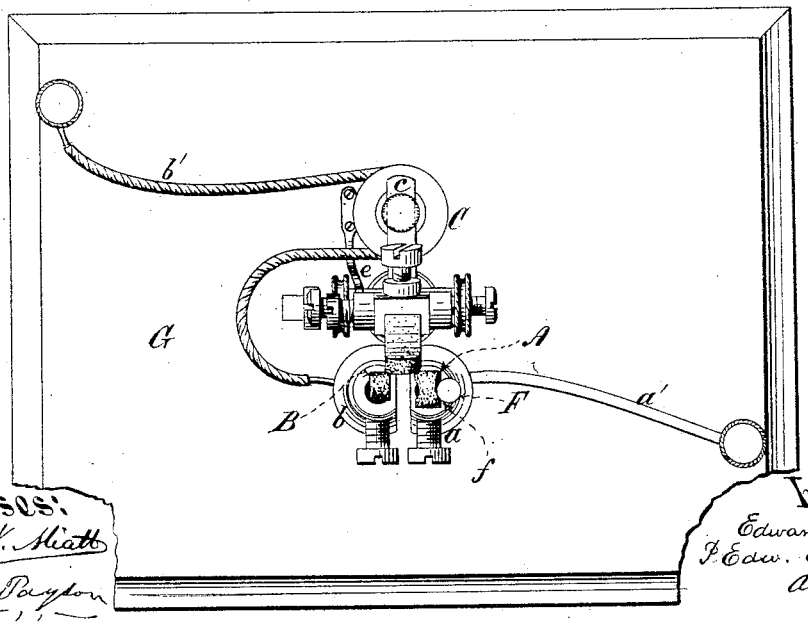


Figure 3.



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UNITED STATES PATENT OFFICE.

EDWARD WESTON, OF NEWARK, NEW JERSEY, ASSIGNOR TO WESTON DYNAMO-ELECTRIC MACHINE COMPANY, OF SAME PLACE.

IMPROVEMENT IN ELECTRIC LIGHTS.

Specification forming part of Letters Patent No. **210,380**, dated November 26, 1878; application filed November 4, 1878.

CASE NO. 2.

To all whom it may concern:

Be it known that I, EDWARD WESTON, of Newark, New Jersey, have invented certain Improvements in Apparatus for the Production of Electric Light, of which the following is a specification:

My improvements are of twofold character. They relate, first, to devices for introducing into the electric arc a conducting-vapor, which, by lessening the resistance between the points of the electrodes, affords an effectual means of retaining the arc in a prescribed path between the electrodes, and by its combustion increases the illuminating power of the arc; and, secondly, to the combination, with electric-light apparatus in which the arc varies in position, of an automatic igniter.

The first part of my invention consists in the application to, and consequent combination with, one or each of the electrodes of an electric lamp, candle, or torch, but preferably with the positive electrode only, of a cylinder or stick of any material, which, although not placed between the electrodes, is capable of being slowly volatilized by the heat of the electric arc, and which, when volatilized, affords a vapor of better conductivity than the carbon particles, which vapor, by its combustion, effects the illuminating qualities of the arc, and by its passage to the negative electrode fixes and defines the path in which the arc is maintained.

I may embody this invention in an electric torch composed of two stationary carbons or electrodes fixed in relatively parallel positions, and respectively connected with the opposite poles of a battery or other source of electricity; and I may also embody it in the tilting electrode-lamp which forms the subject of my application for a patent filed September 28, 1878, designated as Case No. 1, as will more fully appear from the subjoined description.

The second part of my invention consists in the combination, with the electrodes of an electric lamp, candle, or torch, of an igniter, composed, preferably, of a stick of carbon, and made, by the action of gravity or a spring, when the arc is extinguished, to enter between the points of the electrodes, and by partially bridging the gap at that point to re-establish the arc, and thereupon, by the preponderating action upon it of an electro-magnet polarized in consequence of the re-establishment of the current, made to withdraw from proximity with the ends of the electrodes.

The accompanying drawings, representing apparatus embodying my invention, are as follows: Figure 1 is a side elevation of an electric torch provided with an automatically-operating igniter. Fig. 2 is a front elevation of the same. Fig. 3 is a top view.

The apparatus shown in the drawings consists of an electric torch composed of two stationary carbon sticks or electrodes, A the positive electrode and B the negative electrode, insulated from each other, and supported in respectively parallel positions in suitable holders *a* and *b*, properly affixed to the base G, and respectively connected with the opposite poles of a battery or other source of electricity by the line-wires *a'* and *b'*. Included in the circuit by proper connection with one of the line-wires is the helix of the electro-magnet C, which, when polarized, attracts the armature *c*, affixed radially to the hub D, pivoted in a post, *d*. Attached to the hub D are suitable jaws for holding the igniter E, which is a stick made of carbon or any other suitable conducting material. When the electro-magnet is polarized the igniter-stick, it will be seen, is rocked backward away from the stationary electrodes, as shown in dotted lines in Fig. 1. When the magnet is depolarized the lever D is rocked in the opposite direction, and the igniter-stick E is tilted forward between the points of the stationary electrodes, as shown by the solid lines in Fig. 1, by the action of the spring *e*. When so tilted forward the igniter partially or wholly bridges the gap between the points of the stationary electrodes, and by diminishing the resistance causes the electric arc to be established at that point. The instant the electric arc is established the electro-magnet C becomes polarized, and, exerting a force preponderating over that of the spring *e*, attracts the armature *c*, and hence tilts the igniter away from the points of the electrodes. So long as the arc continues the electro-magnet remains polarized, and when the light is extinguished from any cause it is

immediately re-ignited by the tilting forward of the igniter in obedience to the action of the spring *e*.

It will be seen that this part of my invention is applicable to that class of electric candles in which the electrodes are placed parallel to each other, and are separated by a fusible insulating material; and it will also be seen that by using only one stationary electrode, and by substituting the other electrode in the place of the igniter, the apparatus is converted into an electric lamp. In the latter case one electrode—as, for example, the positive electrode A—is stationary, and is suitably connected with the positive pole of a battery or other source of electricity, while the negative electrode is mounted in the jaws D′ of the rocking lever, and is provided with a connection with the negative pole of the battery by a wire which includes the helix of the electro-magnet, as before.

Those who are familiar with the subject will readily perceive that there are various ways in which the operation of the automatic igniter may be governed by the current other than that which I have chosen for illustration. Thus the functions of the electro-magnet and spring may be relatively reversed. The force of a spring or of gravity may be made to withdraw the igniter from proximity with the electrodes, and the force of an electro-magnet or electro-helix may be employed to move the igniter up to the electrodes for the re-establishment of the arc when required. To effect this result the line-wires will be connected directly with the two electrode-holders, and the electrode-holders will be connected by a differential circuit containing the electro-magnet or electro-helix, and also containing a rheostat of suitably-proportioned resistance. In this case the force of the electro-magnet will be insufficient to overcome the force of the spring, excepting when, by the extinguishment of the arc, the entire current is compelled to pass through the differential circuit. Instead of using an electro-magnet, two helices or coils may be employed, one being fixed in position and the other being attached to the rocking arm of the igniter. In this case the action of a spring or of gravity is enlisted to move the igniter in one direction, and the force due to the polarization of the helices or coils tending to alter their positions relatively to each other acts upon the igniter in the direction opposite to that in which the spring acts.

It will be seen, on reference to the drawings, that the positive electrode A is provided upon the side farthest from the negative electrode with the rod or stick F, which is cemented or otherwise secured in the longitudinal groove *f* formed in the side of the electrode. This rod or stick may be made of various materials—as, for example, of so-called "lime glass," or of compounds of infusible earths and metallic salts, silicates, double silicates, mixtures of the silicates with other salts of metals, fluorides, double fluorides, mixtures of the double fluorides, fusible oxides, or combinations of the fusible oxides with the silicates, the requirements, so far as the material is concerned, being that it shall be capable of volatilization when placed on the outer side of the electrode to which it is attached, and that its vapor shall be of greater conductivity than the vapor or particles of carbon disengaged from the carbon electrodes. The foreign material added to the carbon may be incorporated into the electrode by being mixed with the carbon of which the electrode is composed, or it may be introduced into a tubular carbon; but I have found it best to place it in a groove formed longitudinally in the side of the electrode, as shown. When the foreign material is applied to the positive electrode only the positive electrode is made of about twice the area in cross-section of the negative electrode.

One of the essential features of this part of my invention, considered by itself, and without reference to the igniter, consists in placing the stick F upon the side of the positive electrode opposite to the side adjacent to the negative electrode; and the object of this arrangement is to insure that the vapor generated from the material composing the stick F, by the heat of the electric arc, shall be obliged to pass over the upper end of the positive electrode in order to reach the negative electrode, and hence that the path of least resistance shall be definitely fixed in a curved line the crown of which is slightly distant from the electrodes, so that the electrodes will burn evenly at their ends, and there will be no possibility of a change in the position of the arc by which it shall be established otherwise than at the ends of the electrodes.

So-called electric candles have heretofore been made with parallel electrodes which have been insulated from each other by having introduced between and around them a fusible material, serving as a shield, which prevented the combustion of the carbon electrodes until, by the heat of the arc, such material was melted and cleared away from the points of the carbons, setting them free as the wick of a candle is set free when the wax of which it is composed is melted; and it has also heretofore been proposed to incorporate into the insulating material so employed certain substances which, by their combustion, would change the color or shade of the light.

It will, of course, be seen that my igniter can be as readily employed with such candles as it can be with my electric torch, which differs from the electric candles heretofore used, first, because, considered broadly, it consists in the combination, with one or both of the electrodes, of a material which, when volatilized, affords a vapor of greater conductivity than the vapor of carbon; and, secondly, because the foreign material which I combine with my electrodes is placed on the outside of one or both of the electrodes, and not between them, being so placed for the purpose of main-

taining the arc in a curved path slightly distant from the points of the electrodes, as I have explained. This part of my invention greatly increases the steadiness of the light, and may be embodied in my electric torches, which are constructed of two stationary electrodes in electric lamps in which one or both of the electrodes are movable, and especially in my tilting electrode-lamp.

I claim as my invention—

1. In an electric lamp or torch, the combination of one or each of the electrodes with a rod or cylinder composed of lime glass or other material the vapor of which is combustible, and is of greater conductivity than the vapor of carbon, substantially as and for the purpose set forth.

2. An electric torch composed of two stationary electrodes fixed in relatively parallel positions, and respectively connected with the opposite poles of a battery or other source of electricity, and having cemented or otherwise attached to the outer side of one or each electrode a rod or cylinder of lime glass or other material the vapor of which is combustible, and is of greater conductivity than the vapor of carbon, substantially as and for the purpose set forth.

3. In combination with an electric lamp, candle, or torch in which the position of the arc is varied by the combustion of the electrodes, an automatic igniter composed of a movable conducting body, a spring, and an electro-magnet, the helix of which is included in the circuit which supplies the current for the arc, the spring operating to move and hold the igniter against or between the points of the electrodes when the arc is extinguished, and the electro-magnet operating to move and hold the igniter away from the points of the electrodes when the arc is established, substantially as described.

4. In combination with the negative electrode B, of an electric lamp or torch, the positive electrode A having twice the area of the negative electrode in cross-section, and being provided with the longitudinal groove *f*, in which is cemented or otherwise secured the stick F of lime glass or other material, as and for the purposes set forth.

5. Broadly, in combination with an electric candle or torch in which the position of the arc is varied by the combustion of the electrodes, a movable igniter having a variable range of motion automatically governed in its operation by the current, substantially as described.

EDWARD WESTON.

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