(No Model.)

S. BORDEN.

ELECTRIC ARC LAMP.

No. 260,647. Patented July 4, 1882.

Fig. 1

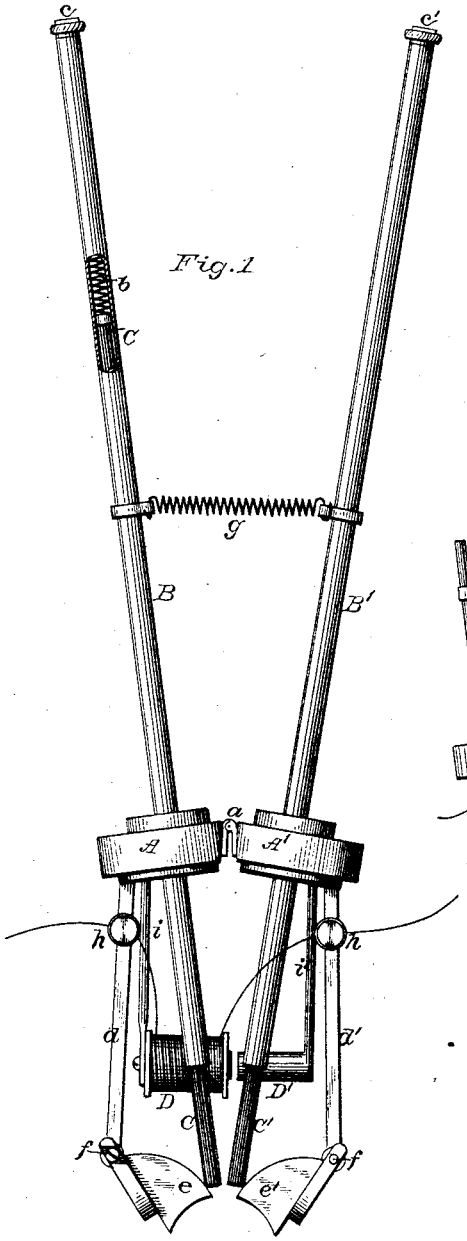
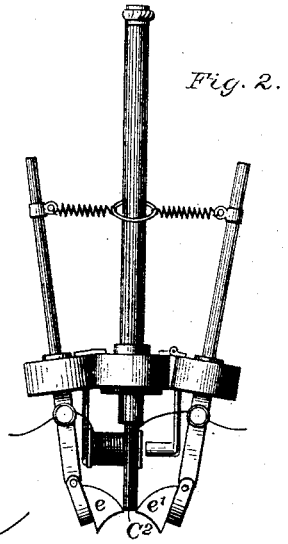


Fig. 2.



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ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 260,647, dated July 4, 1882.

Application filed September 27, 1881. (No model.)

To all whom it may concern:

Be it known that I, SPENCER BORDEN, of the city of Fall River, in the county of Bristol and State of Massachusetts, have invented certain new and useful Improvements in Electric-Arc Lamps; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of my invention.

My improvements relate to that class of lamps in which carbons are used; and they have for their object the reduction of internal resistance to a minimum, a capacity to be readily operated by either an alternating current or a direct current, a capacity for automatically regulating the relations of the carbons to each other, and a modification or softening of the light developed at the arc.

After a full description of a lamp embodying my improvements, the features deemed novel will be specified in the several claims hereunto annexed.

In the drawings, Figure 1, I have shown in side view one of my improved lamps having two carbons. Fig. 2 illustrates one of my lamps having a single carbon candle.

The main frame of the lamp, Fig. 1, is composed in this instance of two semicircular blocks, A A′, of wood or other good insulating material, hinged together, as at *a*, at the upper edge of their straight sides, and it may be provided at or near said hinge with eyebolts or other suitable devices, whereby the lamp may be attached to ropes, rods, or chains for purposes of suspension as in use.

The hinged frame-pieces are preferably limited in their outward movement, which is readily provided for either by having the hinge-joint shouldered, or by means of a short link, cord, or small wire beneath the frame, and so connecting the two parts as to limit their movements outwardly. Two carbon tubes, B B′, are pivotally mounted with relation to each other because mounted in the hinged frame-blocks, and they are well insulated with relation to each other. Within these tubes are springs or weights *b*, pressing downwardly from the upper end upon the ends of the candles or carbons C C′, which are loosely located within the tubes, and are fed downwardly by the springs, these latter having for their upper abutments the screw-caps *c c′* in the upper ends of said tubes.

Firmly attached to the under side of each of the frame-pieces is a rigid pendent metallic conducting-arm, *d d′*, each having at its lower end an electrode, *e e′*, of copper, (or carbon may be used.) These electrodes are hinged to the pendent arms and provided with a clamping-screw, *f*, whereby they may be adjusted angularly with relation to the arms. The upper surface of each electrode is curved, and both project inwardly toward each other. In their normal position the lower or arc ends of the carbons are separated by the tension of the spring *g* between them and above the frame, and they respectively rest upon the curved upper surface of an electrode, and by moving the frame-pieces on their hinge-joint the lower ends of the carbons are moved toward and from each other, each resting at one end upon and moving with its electrode. The pendent arms *d d′* are carefully insulated from the carbon tubes, and each has a screw-post, *h*, whereat the electric connections are made, as indicated.

The automatic regulation of the carbons is effected partially by the springs in the tubes and partially by an electro-magnet, D, and armature D′, which are oppositely suspended from the hinged frame upon rigid arms *i i′* at one side of the carbon tubes. The electro-magnet coil has a higher resistance than is offered by the carbons, and it is electrically connected with the screw-posts *h*, as shown, in shunt-circuit. When no current is passing to the lamp the spring *g* (which is insulated from the carbon tubes) maintains the working ends of the carbons in a separated condition; but when the current is applied a portion thereof traverses the shunt-circuit through the electro-magnet and causes it to attract its armature D′, thus moving both carbons toward each other to form the arc, whereupon the current mainly passes from electrode to electrode through the extreme lower ends of the carbons, the magnet continuing to maintain them in proper working relations, while the springs force them downward upon the electrodes. The resistance offered by the carbons being much less than that of the electro-magnet, the latter

is much weakened after the arc has been established, whereupon the spring *g*, acting against the magnet, separates the magnet and armature, thus balancing the magnet with the spring and holding the carbons in such relation to each other as to maintain a steady light. The portions of the carbon in contact with the electrode are maintained in an incandescent state, the yellow light from which, blending with the brilliant light from the arc, so modifies or softens the latter as to greatly deprive it of its objectionable dazzling quality.

The armature D′ may with good results be faced in a manner well known, to obviate metallic contact with the core of the magnet.

The spring *g* is secured at each end to the carbon tubes by an insulating-ring, and the tensile power of said spring may be varied, if desired, by sliding said rings up or down on the tubes; or the adjustment of the tension may be varied by means of a screw and tap at one end of the spring, applied in a manner well known.

The lamp, as here illustrated, is intended for use with alternating currents, as usually employed in connection with many so-called electric candles; but, if a direct current is only available or desired, it is preferable that one of the carbons be removed, so that one of the electrodes will serve as the negative and the remaining carbon as the positive electrode. The lamp shown in Fig. 2 has a single carbon candle c^2, which, at its lower end, rests upon one of the two electrodes *e e′*, which, as before herein indicated, may be either composed of copper or of carbon. If copper be used for both electrodes, and the tip of the candle be interposed between them, the light will be soft or yellow; and if one of said electrodes be composed of carbon and the other of copper, the light afforded will be the usual arc light modified by the yellow light, as hereinbefore indicated; and if both electrodes be of carbon, they, with the candle, will produce the usual dazzling light. A number of such lamps may be located in the circuit of a single-current machine, each lamp occupying a shunt-circuit, or they may be used in multiple circuit. As here shown, the carbons are above the arc, as is desirable usually in a suspended lamp; but it is obvious that they may, if desired, be reversed in position and the lamp mounted upon a standard.

I am aware that tubes containing carbon candles have heretofore been employed as electric conductors, and that wheels or rollers have been connected with said tubes for guiding the carbons and serving as electric connections therewith, so that the currents passed longitudinally along the candles from or adjacent to the ends of their tubes to the tips of the candles, and also that said tubes have each been provided with a conductor projecting therefrom and engaging in electric contact with the adjacent carbon above but near its tip. In my lamp the carbon tubes are wholly free from electric currents, and said currents do not pass longitudinally through any portion of the carbon candles.

I am also aware that it is not new to combine with carbon candles a spring, an electro-magnet, and a shunt-circuit, for controlling the relative positions of the carbon tips or points; but, so far as I know, I am the first to employ such a magnet and spring in combination with what I have termed "electrodes," which support the carbons, and therefore cause the electric current to traverse only the extreme tip of each carbon candle. My lamps are operated with a minimum of internal resistance, and, as before indicated, when either or both of the electrodes *e e′* are of metal a portion of the candle-tip is maintained in an incandescent state, thus affording a yellow light, which agreeably modifies the dazzling light developed at the arc.

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

1. In an electric-arc lamp, the combination, with a carbon candle, its tube, and feeding devices, of an electrode which is independent of the candle-tube, and serves as a support for the tip of the candle and as a conductor for delivering the electric current to the extreme tip of said candle, substantially as described.

2. The combination of the jointed frame, the carbon tubes mounted therein, the springs for forcing the carbons downward angularly toward each other, the electrodes which support the carbons at their lower ends, the separating-spring, and the electro-magnet for counterbalancing the spring and drawing the electrodes and carbons toward each other for forming the arc.

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