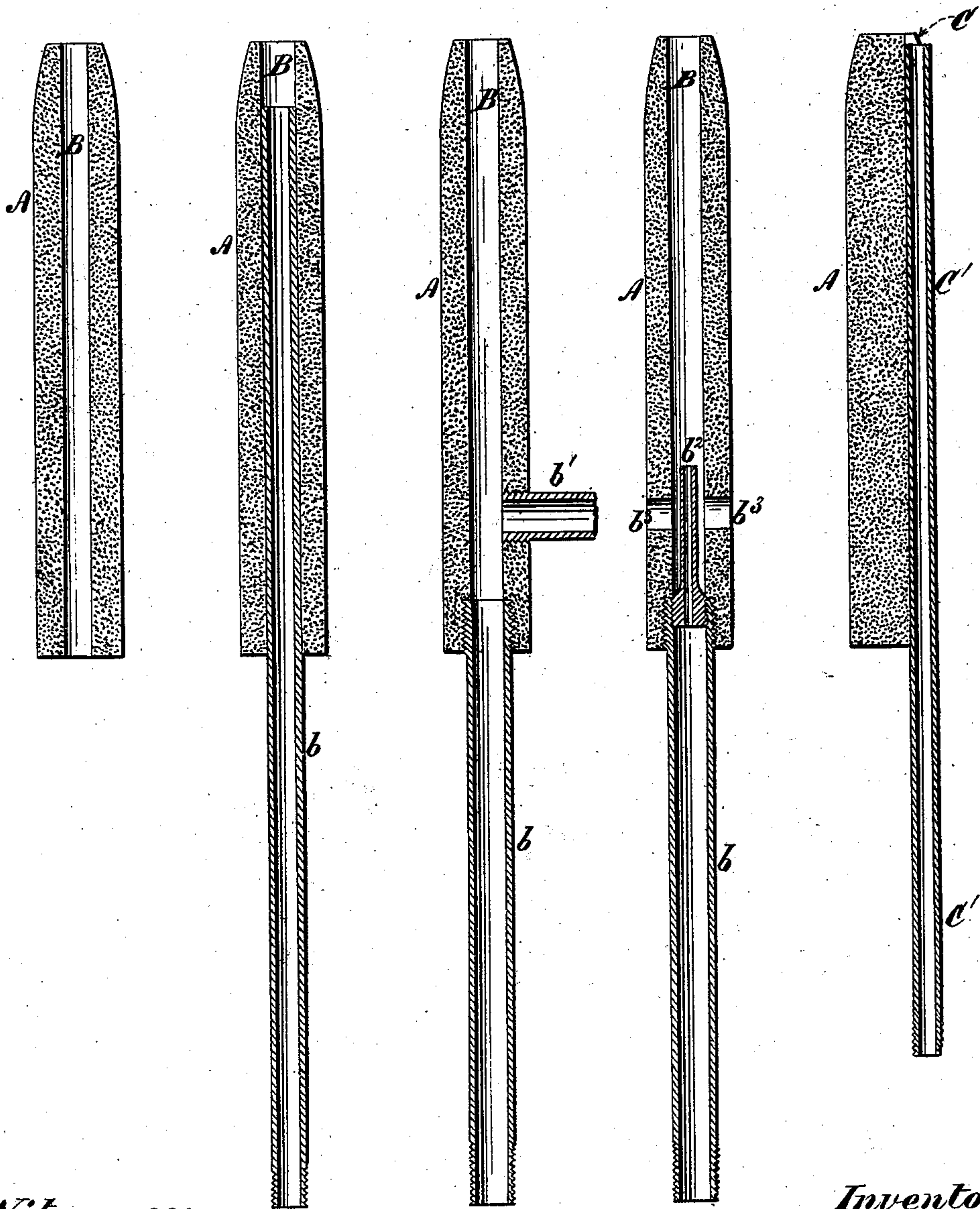


O. LUGO.  
Electrodes for Electric Lights.

No. 207,753.

Patented Sept. 3, 1878.

Figure 1. Figure 2. Figure 3. Figure 4. Figure 5.



Witnesses:

Edw. A. Payson

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Inventor:

Orazio Lugo  
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Atty.



# UNITED STATES PATENT OFFICE.

ORAZIO LUGO, OF FLUSHING, NEW YORK.

## IMPROVEMENT IN ELECTRODES FOR ELECTRIC LIGHTS.

Specification forming part of Letters Patent No. **207,753**, dated September 3, 1878; application filed August 28, 1878.

### CASE B.

*To all whom it may concern:*

Be it known that I, ORAZIO LUGO, of Flushing, Long Island, New York, have invented certain Improvements in Electrodes for Employment in the Production of Electric Light, of which the following is a specification:

My improvements relate to the introduction of air and other fluids into the electric arc; and my present invention consists in either making my electrodes tubular or in combining each of them with a tube which is wholly or partially surrounded by the carbon or other material of which the electrode is composed, for the purpose of affording a channel through which air or other fluids may be conducted and may be discharged from the points of the electrodes into the electric arc.

In another application of even date herewith, designated as "Case A," I have described the use of electrodes of porous material, and also tubular electrodes containing fibrous wicking for conveying a hydrocarbon or other combustible fluid into the electric arc by capillary action.

In my present invention I may make my tubular electrodes open at both ends, and rely upon the natural draft for creating a current of air through them; or I may connect them with pipes, through which air or any desired fluid or fluids may be forced from a distant point or points into and through the electrodes with any given pressure.

The accompanying drawings illustrating my improved electrodes are as follows: Figure 1 is a central longitudinal section of my tubular carbon electrode. Fig. 2 is a similar section of a tubular electrode having inserted in it a metallic or other pipe for supplying it with a combustible fluid from a distant reservoir. Fig. 3 is a similar section of a tubular electrode having a metallic supply-pipe connected with its base, and a pipe inserted laterally in it near the base, for the purpose of supplying it with fluids from two different sources. Fig. 4 is a similar section of an electrode connected at its base with a pipe for supplying gas, the mouth of the pipe being provided with a Bunsen burner, and the electrode being provided with lateral openings for admitting air into the

interior of the electrode to assist in the combustion of the gas. Fig. 5 is a longitudinal section of an electrode, the material of which partially surrounds a metallic tube contained in a longitudinal groove on one side of the electrode, the tube being for connection with a distant reservoir of fluid, which is to be introduced into and burned in the electric arc.

My electrode A is made preferably of carbon, and has a central hole, B, extending longitudinally through it from end to end, as shown in Fig. 1.

If desired, a small metallic tube, *b*, may be inserted in the hole B, as shown in Fig. 2.

The tube *b* may be connected with a reservoir of fluid, placed at any convenient point, and may thus serve to conduct such fluid from the reservoir, and discharge it at any prescribed pressure from the point of the electrode into the electric arc.

The tube *b* may be inserted in the base of the electrode, as shown in Fig. 3, and another tube, *b*<sup>1</sup>, may be inserted laterally in the electrode a short distance above its base, the two tubes being for the purpose of supplying two different fluids to the electrodes, if desired.

The tube *b*, inserted in the base of the electrode, may be provided at its mouth with a Bunsen burner, *b*<sup>2</sup>, and lateral apertures *b*<sup>3</sup> may be made in the lower part of the electrode, for the admission of air when the tube *b* is connected with a reservoir of gas.

Instead of having a central hole in the electrode, it may have upon its surface the longitudinal groove C, as shown in Fig. 5, in which may be placed the connecting-pipe C' for discharging a fluid from the point of the electrode.

I preferably incase my carbon electrodes in a metallic shell, for facilitating their electrical connection with the plus and minus wires of an electric circuit supplied with a current from a battery or other source of electricity.

The passage of air or other fluid through my electrodes tends to keep them cool and retard their consumption.

My electrodes may be employed for the production of the electric arc substantially as other electrodes have heretofore been so employed; but it will, of course, be understood



that if my electrodes are fed toward each other by positive mechanical motion—as, for example, by clock-work—it will be necessary to lessen the usual rate of speed of such clock-work, because my electrodes last so much longer than those heretofore used.

Instead of arranging my electrodes vertically, one above the other, I prefer to arrange them side by side, with their upper ends inclined toward each other. The advantage of this mode of arrangement is, that stronger drafts of air are established through the electrodes when they are in an upright position. When so arranged, air is discharged into the electric arc from both electrodes; and, moreover, when the electrodes are in an upright position, fluid may be introduced into them with less danger of overflowing from their points, and the rate at which the fluid is supplied to them may be easily graduated to the rate of evaporation.

The effect of the currents of air discharged from the points of the electrodes is to promote the steadiness in position of the electric arc, and also to greatly increase its illuminating-power, and to make it practicable to considerably increase the distance between the electrodes, and consequently the length of the arc.

When my electrodes are placed in line vertically, one above the other, it will be advisable to connect the upper electrode with an air pump or blower, to force air downward through it into the electric arc. The natural upward draft will ordinarily be sufficient to supply air through the lower electrode.

I claim as my invention and desire to secure by Letters Patent of the United States—

1. In apparatus for producing the electric

light, longitudinally tubular electrodes, relatively so arranged that air or other fluids may be discharged from the opposed ends of the electrodes into the electric arc, substantially as and for the purpose set forth.

2. A tubular electrode of any suitable material, having inserted in it a pipe for supplying a combustible fluid which is capable of being evaporated and ignited in the electric arc, substantially as described.

3. An electrode of suitable material, having a hole extending longitudinally through it, and having near its base one or more lateral openings extending from the longitudinal hole to the surface of the electrode, substantially as and for the purpose set forth.

4. A tubular electrode of any suitable material, provided near its base with one or more lateral openings extending from the longitudinal hole to the surface of the electrode, in combination with a Bunsen burner affixed to a pipe inserted in the base of the electrode, the pipe being for the purpose of discharging gas into the tube of the electrode, and the lateral opening or openings for the purpose of supplying a current or currents of air to assist the combustion of such gas in the electric arc, substantially as described.

5. An electrode of any suitable material, in combination with a tube applied longitudinally thereto, and wholly or partially surrounded by the material of which the electrode is composed, substantially as shown and described.

ORAZIO LUGO.

Witnesses:

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EDWD. PAYSON.