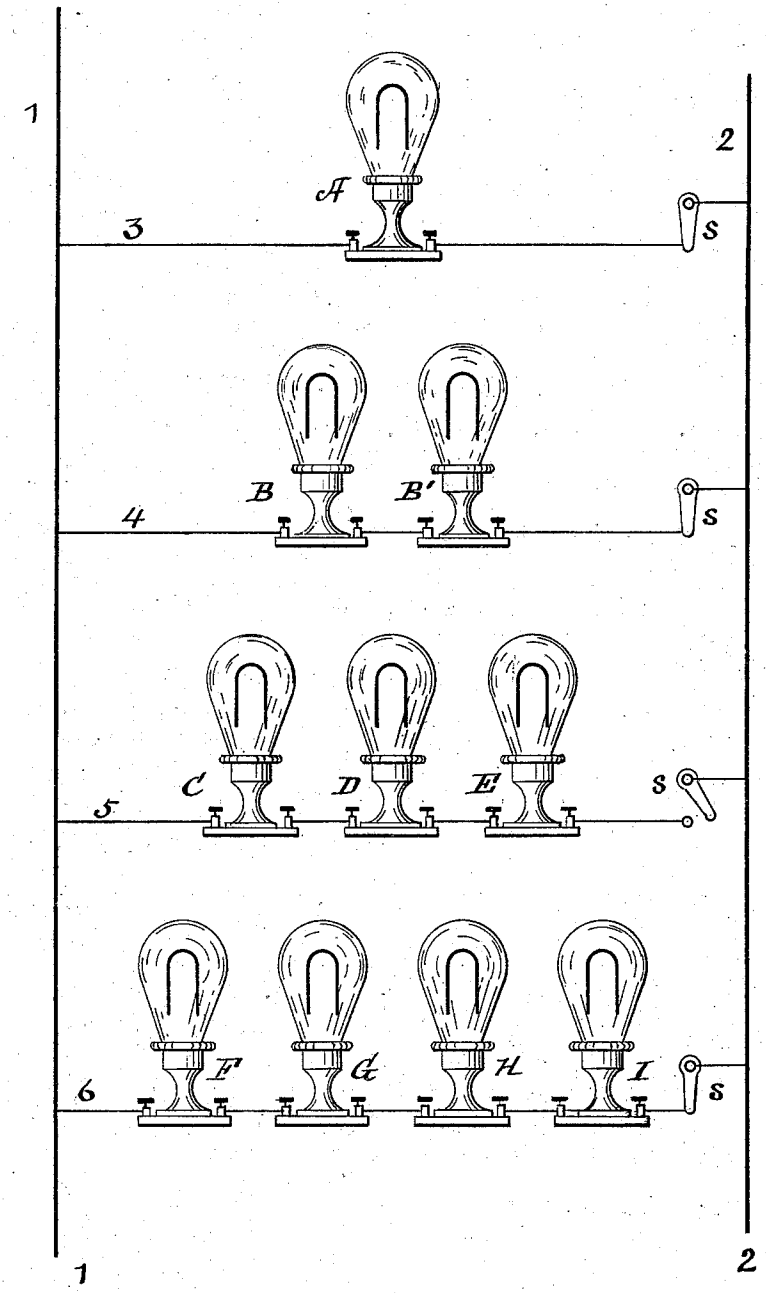
(No Model.)

# T. A. EDISON.

## Electric Lighting.

No. 242,899. Patented June 14, 1881.

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# UNITED STATES PATENT OFFICE.

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## ELECTRIC LIGHTING.

SPECIFICATION forming part of Letters Patent No. 242,899, dated June 14, 1881.

Application filed January 26, 1881. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented a new and useful Improvement in Electric Lighting, (Case No. 287;) and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

It is now well known that in my system of electric lighting lamps are used consisting of an exhausted glass globe, in which is hermetically sealed to conducting-wires passing through the glass a carbon filament, which is heated to incandescence by the electric current. In every system a lamp is adopted as a standard—that is, one having a definite area of radiating-surface and a definite resistance—so that with a current of a definite electro-motive or pressure force the standard candle-power of light shall be given by a definite amount of energy for each lamp. All the lamps used in the system being made to approximate the conditions of the standard, an approximately uniform result is attained. In such a system each lamp is placed in its own separate derived or multiple-arc circuit, and experience has shown that a lamp giving a light equal to about a sixteen-candle-power gas-jet is the best adapted to average general use. In a patent granted me March 22, 1881, No. 239,150, is shown how more than one lamp may be placed in each multiple-arc or derived circuit. In such system, however, each lamp of the series is of a definite fractional value photometrically only of the standard lamp. It is desirable, however, sometimes to connect in one multiple-arc or derived circuit a series of lamps, each giving the same amount of light as the standard lamp of the system—say sixteen or eighteen candle-power—so that all the lamps in such a circuit—say a chandelier-circuit—could be controlled by one circuit-closer.

The object of this invention is to furnish a method and means for accomplishing this result.

To this end it consists, generally speaking, in making the density of the carbons, where a series of lamps are to be used, proportionately greater than that of the standard lamp, their conductivity increasing and resistance decreasing proportionately, so that with the standard amount of energy the standard electro-motive or pressure force each lamp of such series shall give the standard amount of light, the radiating-surface of each remaining approximately at the area of radiating-surface of the standard lamp.

The proportions in which the density or conductivity must be increased and the resistance diminished, when it is desired to connect a series of lamps in one multiple-arc or derived circuit of a system, may be expressed approximately by a fraction whose numerator is one and whose denominator is the square of the number desired to be so connected.

The drawing represents, diagrammatically, a number of multiple-arc circuits.

1 2 are the main conductors. 3, 4, 5, and 6 are multiple-arc circuits. In 3 is shown one lamp which would have the standard conditions of the system. In 4, 5, and 6 two, three, and four lamps, respectively in series, are shown.

Applying the rule before stated, the density of the carbons in B B′ should be such that their resistance is one-fourth that of the standard A, while the resistance of the three in circuit 5 and the four in circuit 6 should be one-ninth and one-sixteenth that of A, respectively. By thus changing this one condition of the standard of the system, radiating-surface and electro-motive force remaining unchanged, it is possible to place in one multiple-arc a series of lamps, each giving the standard candle-power of light, and all capable of being controlled by one circuit-closer, which is typified by S in each of the multiple-arc circuits, but which may be placed in any desired and convenient position for operation. It is evident, though, that when desired a circuit controller or key may be placed at each lamp and arranged so that the operation of any one shall control all the lamps in the circuit. From this it appears that the condition to be changed is the density or mass of the incandescent conductor. This may be effected in several ways. For instance, standard carbons may be taken and carbon deposited therein from carbon vapors by heat, in the manner well known from the researches and experiments of Berthallel

upon the deposition of carbon from carbides of hydrogen and other decomposible carbon compounds until their density be so increased that their resistance is brought down to the desired degree.

Carbons may be dipped in sirup or other carbonaceous material and then recarbonized, the process being repeated until the desired density is attained, and the number of dippings or soakings in a solution of a given strength and recarbonizations to produce a definite result may be accurately determined, so that this process may be carried on with great certainty.

Where very dense carbons of great electrical conductivity are required they may be made of graphitic carbon, sometimes called "plumbago," molded under great pressure; or they may be cut by a punch and die from a sheet of molded graphite of proper thickness.

It is evident that the density or mass and resistance may be varied in many other ways, any of which may be used in practicing this invention.

It is also evident that for the result of increased conductivity for the purposes herein set forth an increase in area of cross-section is equivalent to increase of density, though the latter is preferable unless the former can be practiced without materially affecting the area of radiating-surf

The arrangement herein described is conducive, also, to economy, in that owing to the greater mass or density per unit of incandescing-surface of the carbons their life is lengthened.

What I claim is—

1. The combination, with one multiple-arc or derived circuit, of two or more incandescent electric lamps arranged in series therein, the density and electrical conductivity of the carbons of the lamps being increased proportionately, substantially as set forth.

2. The method of arranging a series of incandescent lamps in a multiple-arc or derived circuit, consisting in increasing the density and electrical conductivity of the individual carbons approximately in the proportions to the number to be placed in the one circuit, substantially as set forth.

3. The combination, with one derived circuit, of two or more lamps each of a fractional resistance of the resistance of a standard lamp, but with approximately the same radiating-surface, substantially as set forth.

4. In a system of electric lighting, the combination, with the main circuit, of several multiple-arc or derived circuits, some containing a standard lamp and some containing a series of lamps, two, three, or more, the electrical conductivity and density of the carbons in any one derived circuit in the latter instance increasing as the number of lamps used in such circuit increases, substantially as set forth.

5. The combination, with one derived circuit and one circuit-controller, of two or more lamps each of a fractional resistance of the resistance of a standard lamp, but with approximately the same radiating-surface, substantially as set forth.

This specification signed and witnessed this 19th day of January, 1881.

THOS. A. EDISON.

Witnesses:

H. W. SEELY,

WM. CARMAN.