J. C. JAMIN.
Electric Lamp.



No. 218,749. Patented Aug. 19, 1879.

Fig. 2

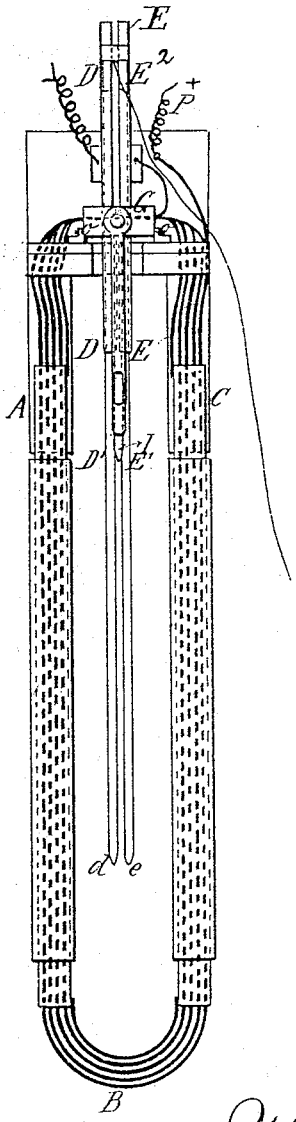



Fig. 3

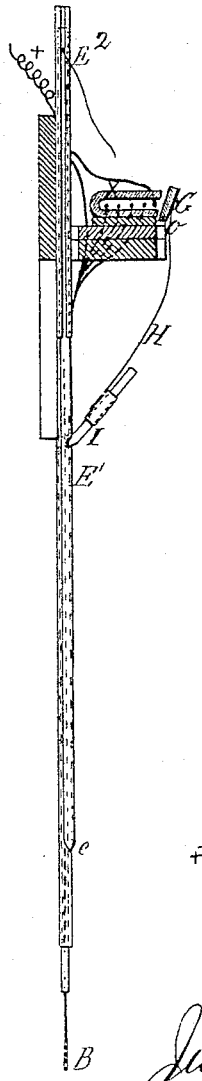
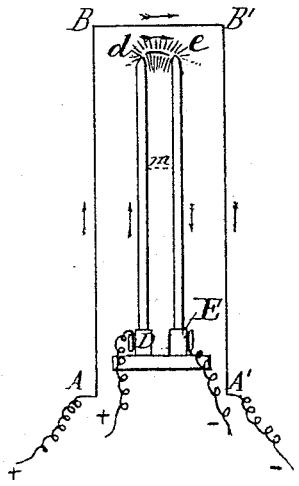



Fig. 1




Witnesses

E. A. Dick

C. J. Hedrick

Jules Celestin Jamin
by A. Pollok
his atty.

# UNITED STATES PATENT OFFICE.

JULES C. JAMIN, OF PARIS, FRANCE.

## IMPROVEMENT IN ELECTRIC LAMPS.

Specification forming part of Letters Patent No. **218,749**, dated August 19, 1879; application filed July 18, 1879.

*To all whom it may concern:*

Be it known that I, JULES CELESTIN JAMIN, member of the Institute of France, residing in Paris, in the Republic of France, have invented certain new and useful Improvements in Electric Lamps, of which improvements the following is a full, clear, and exact description.

The new system of electric lamps or burners to which this invention relates is based upon the following principle: The voltaic or electric arc which flashes between the two carbons is a true current, which, in all cases, obeys the laws called "the laws of Ampère." It can be attracted or repelled by magnets and solenoids, by currents parallel or at an angle therewith traversing metallic conductors. It can turn under their influence around an axis in the presence of these currents, magnets, or solenoids.

In the present system of lamps, I make use of this principle to fix the voltaic arc at a suitable point, and thus to protect it from all the causes which, in ordinary lamps, tend to render its position unstable. This result can be obtained by the aid of an exterior circuit, a magnet, or an electro-magnet; but it is preferred to employ a circuit as the directing means.

It is this disposition which has been found to give the best results, and I will most particularly and fully describe it, among those which I shall hereinafter point out as suitable for carrying the invention into effect.

*First disposition.*—I will begin by explaining, with the aid of the diagram, Figure 1, the operation of the directing-circuit.

The lamp, reduced to its simplest form, is composed of two carbons disposed parallel to each other and separated by a small distance, but without the interposition of any insulating material. When a current is made to enter at the base of one of these carbons and escape by the other, if the current be sufficiently intense, a voltaic arc, which emits a penetrating light, will, as is well known, flash between them; but this arc, under the action of the air-currents generated by the heat, or by reason of the variations of the intensity of the electric current, is found to oscillate lengthwise of the carbons, and thereby, in consequence thereof, a great instability is given to the luminous arc. This objection is, or may be, overcome by means of the exterior rectangle, A B B′ A′.

The current is made to pass through this rectangle, and then through the carbons, in such a way that it passes through both in the same direction.

If we suppose that the arc has been before lit at *m*, it is evident that the part A B will tend to displace it and carry it toward *d e*, in virtue of the action of the two currents upon each other. The same will be the case with the branch B′ A′. They will both act to bring the arc to the same point. The portion B B′ will attract the arc which is parallel to it and of the same polarity.

The arc will therefore move so as to place itself at the ends of the carbons, and will there come to rest. It will, however, descend as the carbons are burned.

It is better in practice to reverse the apparatus—that is to say, to turn the carbons downward, instead of placing them upright, as is the case commonly with lamps in use.

The disposition represented in Fig. 2 in elevation, and Fig. 3 in vertical section, is preferably adopted. The directing-circuit is formed by means of a support with hollow sides, in the shape of a letter U, and made of thin copper, C B A.

The current arriving at P follows throughout its length an insulated copper wire, which is wrapped a number of times (say, four or five) in the hollow of the support, in which it is protected and hidden, being shown on the drawings by dotted lines. The current passes from the wire to the copper support, up one side and down the other, the two sides being connected at the bottom, as shown in the drawings. The support should have approximately the same thickness as the wire—that is, about four millimeters—so as to throw the least possible shadow. The coils of the wire are or may be insulated by silk or asbestus paper impregnated with silicate of potash.

The carbons B′ E′ are or may be from four to eight millimeters in diameter. They are set in two copper tubes, D E, fixed in a par-

allel position. These tubes are slit, and end, preferably, in six or eight small tongues, which press upon the carbons, so as to sustain and cause the currents to pass into and out of them. After passing through the directory circuit the current enters through the tube E, passes through the carbons $E^1$ $D'$, and off by a wire connected with the tube D. The carbons extend down to the points marked *d* and *e*, and it is at this lower end that the arc burns and maintains itself under the action of the directing-current. The arc is remarkably steady, and only moves upward from the effect of outward agitation, and then it returns at once to its position.

The consumption of these carbons is in inverse proportion to their cross-section. If their diameter is equal to four millimeters, it is very rapid—say, fourteen to fifteen centimeters per hour; if the diameter is six millimeters, the consumption will be reduced to seven centimeters; for eight millimeters diameter, it is not more than four or five centimeters. These numbers are relative, corresponding to the case when six burners are lit, with one of the two circuits of a Gramme machine, or twelve burners with the two circuits.

The consumption of the carbons causes the arc to ascend. It is advantageous to lower them proportionately. To this end the tubes D E are made long, to contain, say, a meter of carbon. They are split lengthwise from top to bottom, and an ivory follower, $E^2$, is placed at the top. A silk thread is attached to the central portion thereof, between the tubes, and hangs downward. By pulling the thread the follower is caused to descend, and carries with it the carbons, without interfering with the light. Thus when, at the end of two hours, the arc has ascended, say, fifteen centimeters, the carbons are drawn down fifteen centimeters, and the arc resumes its original position.

It will be seen that under ordinary conditions the same carbons can last fourteen hours, which is longer than is in practice required.

The descent of the carbons can be automatically regulated by any suitable means—for example, by attaching the silk thread to a floating piston in a cylinder filled with water which is allowed to run out through a stop-cock, so that the descent of the water-level is equal to the consumption of the carbons in the same time. These conditions need not be exactly fulfilled. It is sufficient if they are approximately.

For the purpose of lighting and relighting the lamps, I have employed several methods. The first consists in connecting by a band of thin rubber the ends of the two carbons, and placing between them a fine iron wire or some carbon. The passage of the currents renders the wire or carbon incandescent, burns the rubber, and the carbons flash into light.

This method is more perfect if, after having proceeded as above, the ends of the carbons are dipped into a vessel containing a paste of sirup and powdered carbon. I may also employ, however, a thicker paste of carbon and gelatine or carbon and gum-lac with alcohol, which can be placed between the carbons without connecting them beforehand.

These methods do not, however, permit the ready relighting of the lamp, and I therefore prefer to employ the following means when a number of lights are used:

The wire coils of the directing body are at the top wound around the branches of a magnet, K, the armature G of which is pivoted at *o*, and arranged so that by its own weight it drops when the current is interrupted. By this last-named movement a small carbon pencil, I, carried at the end of the lever-arm H is introduced thereby between the carbons $D'$ $E^1$ which are to be lit. This lighting apparatus being placed entirely above the lower ends of the copper tubes D E, Fig. 2, in no way hinders the emission of the light. As soon as the circuit is closed the current passes through the electro-magnet and the two carbons, passing from one to the other across the lighter I, which becomes heated. When contact is broken and it is relieved the lighter I springs away and the arc is lit near the top of the carbons; but under the action of the directing-circuit it descends gradually to the ends *d e* thereof. So long as the current passes the lighter I is held out of contact; but if the arc fails it falls again, re-establishes the communication, and relights all the lamps.

The burner which has just been described is intended to be operated by means of alternating currents; but with some modifications it can be used with the Gramme machine for continuous currents or with a battery.

The battery should be a strong one, and the machine should have a greater tension than ordinarily, which can be easily accomplished.

Two lights, or as many as desired, can be obtained by increasing the length and fineness of the wire of the machine. The only difficulty remaining will be the unequal consumption of the two carbons. This may be readily overcome, first, by the use of carbons of unequal diameter which is regulated by experience, the difference of the diameters being not very great; second, by the interposition of a commutator fixed on the machine or on the motor, which changes the polarity of the current at regular intervals of five or six minutes or more, care being taken that the commutation is made gradually, not sharply, so as to avoid the extra currents.

I will now describe certain other dispositions which may be adopted in carrying my invention into effect.

*Second disposition.*—In the foregoing description the carbons have been considered as fixed and parallel. They may be, however, movable about two joints, and inclined toward the center until they touch at their ends, and the current may be made to enter and leave by two mercury-cups or by flexible wires. The

apparatus can be employed with continuous or alternating currents.

This disposition allows the distance and dimensions of the carbons to be diminished at will and the electric light to be very much divided. In place of a rectangle surrounding the carbons, a pole of a magnet may be placed opposite and in a plane at right angles thereto. The magnetic pole acting in a line at right angles to the plane of the carbons maintains the arc at their extremities.

*Third disposition.*—The two vertical carbons are placed so that one forms a prolongation of the other, as in the old form of regulator-lamps, and the two opposite poles of a magnet or a solenoid are arranged in a plane at right angles therewith, one before and the other behind. They will displace the arc and project it horizontally in the form of an aureole or halo. Then if the arc is very hot, it is rendered but slightly luminous; it is the carbons which give the light. I arrange, however, in the displaced arc a strip, pencil, or piece of lime, magnesia, or of carbon, and it soon reaches a temperature sufficiently high to soften. It becomes, as in the Drummond light, very bright, and transforms the violet light of the arc into perfectly white rays. The whole radiation of light is considerably enlarged and improved.

A similar result may be more simply obtained by using the candle of Mr. Jablochkoff, covering one of the two carbons with a mass of plaster instead of simply separating them by a thin layer of this substance.

*Fourth disposition.*—I place opposite each other two carbons, one formed by a large and not very thick strip, receiving the current by the base, and the other fixed at the top. From this latter the current is carried off through a wire in the opposite direction to that in which it passes through the carbons.

*Fifth disposition.*—The arc between the two carbons in the ordinary lamp governed by a regulator is almost always eccentric, and its situation changes from time to time, so that oscillations of the light are produced; and this is one of the great disadvantages in the light. I place around one of the carbons, or about both of them, a solenoid, which causes the arc to turn with a rapid and regular movement, which overcomes the irregularity of consumption of the carbons and gives illumination equally in all directions.

*Sixth disposition.*—I do away with the regulator, and replace the lower carbon by a carbon-tube filled with a core of lime or of an infusible insulating material; then I wind the whole with a wire in the form of a solenoid, which the same current traverses. Finally, I place above a carbon pencil in the same axis, which is pressed down simply by its weight. When once lit the arc turns around the lower end of the pencil, and the insulating material is made luminous and gradually volatilized.

Having thus fully described my said invention, and the manner in which the same is or may be carried into effect, what I claim, and desire to secure by Letters Patent, is—

1. The method herein described of fixing and regulating the position of the electric arc for the production of electric light, consisting in exposing the arc to the influence of electric currents parallel or at an angle therewith, of magnets, or of solenoids, substantially as set forth.

2. The combination, with the carbons of an electric light, of a directing-body, circuit, magnet, or solenoid, for regulating and fixing the position of the electric arc, substantially as described.

3. The combination, with an electric lamp of any ordinary or suitable construction, of a directing body or circuit, composed of a number of coils, through which the current is sent before passing through the carbons of the lamp, whereby the arc may be retained in position, substantially as described.

4. The combination of a directing body or circuit with the carbons or conductors of an electric lamp, placed near together and parallel, the said carbons being separated by the interval desired for the flashing across of the voltaic arc, but without the interposition of any separating, insulating, or conducting material, and being also, by preference, turned downward, substantially as described.

5. The combination, with the carbons of an electric lamp and a directing body or circuit, of means, substantially as described, for lighting and relighting, when required, the lamp by means of the currents traversing the aforesaid carbons and directing body or circuit, as set forth.

6. The combination, in an electric lamp, of the carbons, an electro-magnet, a piece of carbon or other conducting material connected with the armature of said magnet, and a directing body or circuit, substantially as described, whereby the voltaic arc may be established at a point distant from its ultimate position, and then carried thereto by the aid of the directing body or circuit, as set forth.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

J. JAMIN.

Witnesses:
ROBT. M. HOOPER,
J. ARMENGAUD, Jeune.