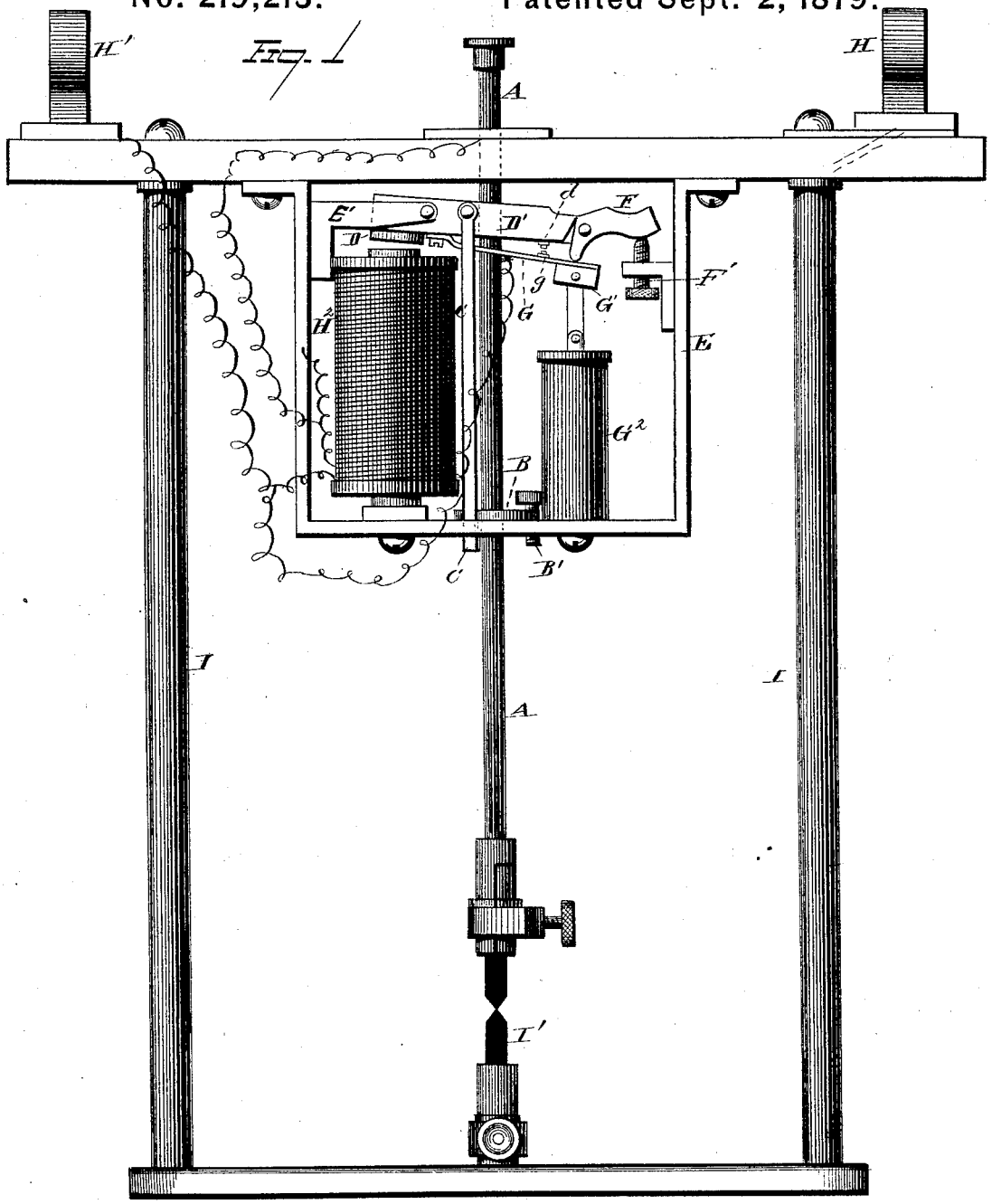
4 Sheets—Sheet 1.

C. F. BRUSH.

Regulating Device for Electric-Lamps.

No. 219,213. Patented Sept. 2, 1879.

Fig. 1



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Regulating Device for Electric-Lamps.

No. 219,213. Patented Sept. 2, 1879.

Fig. 2.

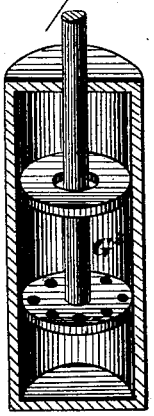


Fig. 7.

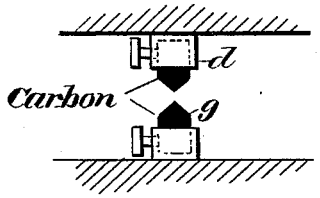
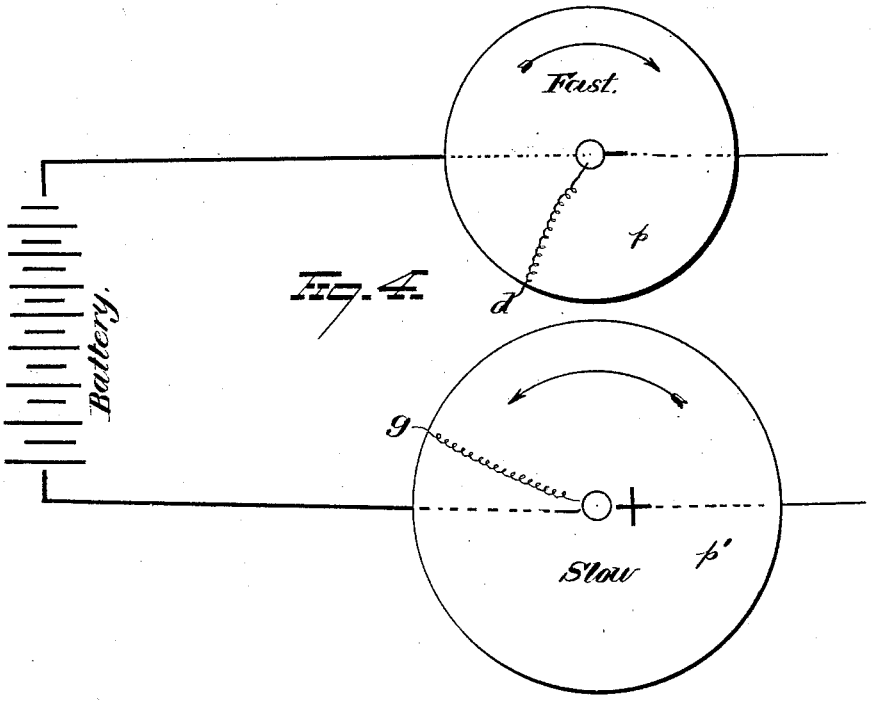


Fig. 4.



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4 Sheets—Sheet 3.

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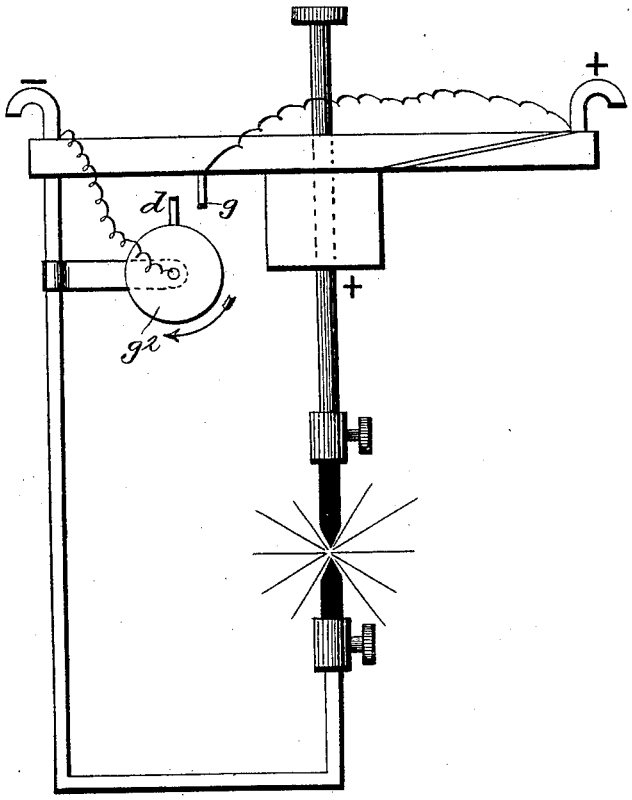
Regulating Device for Electric-Lamps.

No. 219,213. **Patented Sept. 2, 1879.**

Fig. 3



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No. 219,213. Patented Sept. 2, 1879.

Fig. 5.

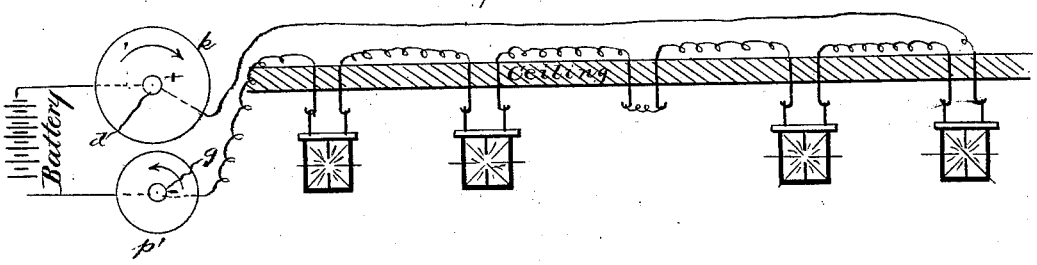
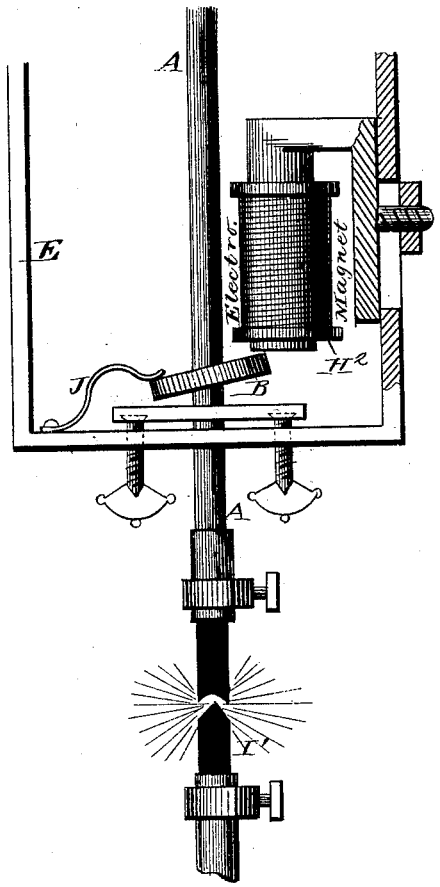


Fig. 6.



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UNITED STATES PATENT OFFICE.

CHARLES F. BRUSH, OF CLEVELAND, OHIO.

IMPROVEMENT IN REGULATING DEVICES FOR ELECTRIC LAMPS.

Specification forming part of Letters Patent No. **219,213**, dated September 2, 1879; application filed October 24, 1878.

To all whom it may concern:

Be it known that I, CHARLES F. BRUSH, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Apparatus for Producing Electric Light; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to electric lighting apparatus; and it consists in a lamp or regulator, or a system of lamps or regulators on a single circuit, adapted, by any suitable means, to separate the carbons to any given or adjusted degree, and at intervals independent of the influence of the electric current operating the lamp or lamps, to bring said carbons into contact with each other, allow them to feed, as necessary, and then immediately to separate them to said given or adjusted distance, which distance is to be previously gaged according to the amount of the electric current. This may be accomplished by a combination of mechanical and electric apparatus which may be used to perform these functions, and this, probably, would be my preferred construction; and I will herein specify one such form of device, though it is understood that I do not limit myself to any given mechanism whatever.

In the drawings, Figure 1 represents, in side elevation, one form of device according to my invention. Fig. 2 shows detached and detail views of some of the parts of such a device as set forth in Fig. 1. Fig. 4 shows another modified form of device according to my invention. Fig. 5 represents a form and arrangement of my invention where, instead of each lamp being separately and independently governed, two or more, or an entire system of lamps, are simultaneously controlled from any single point on the circuit between the lamps and source of current. Fig. 6 comprehends several figures, showing a modified form of my invention, wherein the clamp operating to separate the carbons is either attached directly to, or in fact is, the armature of an electro-magnet. Fig. 7 shows a new construction of contact points or surfaces wherein carbon is employed as a facing.

A is a carbon-holder, in the form of a metallic rod or tube, provided at its lower end with any suitable arrangement for receiving and retaining a carbon, and this rod or tube is designed to be lifted or moved in any suitable manner, preferably, however, by a clamping device, that may be made automatically to gripe, move, and release said rod, as may be required.

Many forms of clamping device may be adopted; but that which I find to be as simple and effective as any is a loose ring or washer, B, surrounding the rod, which, when lifted from any single point, is tilted, and thereby made to firmly gripe and retain the rod A. By the use of an adjustable stop, B′, the upward movement of the clamp, and thereby the separation of the carbons, is limited to any predetermined degree. Now, supposing that it is desired to maintain substantially a one-eighth-inch voltaic arc, the apparatus is adjusted so that the carbon-holder A can only be raised to separate the carbons that distance, when it is positively stopped and there held. If retained in this position too long, the carbons would consume to such a degree that the light would be extinguished. To prevent this I cause the carbons, at intervals of suitable length, to be brought into contact independent of the influence of the current operating the lamp, by which operation the gripe of the clamp B is released and the carbons allowed to feed to the amount consumed, after which they are immediately separated one-eighth of an inch, as before, and firmly held in that relation until again made to come in contact with each other, as already specified.

It will be remembered that these operations are performed without any breaking of the electric current, while at the same time, by causing the intervals of contact of the carbons to be sufficiently frequent, there will be no probability of the light becoming extinguished.

This arrangement enables me to successfully operate more than one light upon a single electric circuit, while it also serves a useful purpose in single lights, especially in places where the lamp must be subjected to much jolting—as, for instance, if employed for a locomotive head-light.

Having now pointed out the main features

and functions of my invention, I will specify means whereby these peculiar movements of the carbons may be accomplished.

Referring to Fig. 1 of the drawings, C is a lifter for raising one edge of the clamp B. This lifter is pivoted to the rocking lever D′, which lever is pivoted to the metallic frame or casing E′.

To one end of the lever D′ is fixed an armature, D, placed in proper relation with its electro-magnet H^2 to be attracted, and thus moved by said magnet, as will hereinafter appear.

Fixed to the opposite end of the lever D′ is the tilting piece F, formed, substantially as shown, from suitable insulating material. Attached also to, but insulated from, said lever D′ is the flat spring G, headed with a block, G^1, of insulating material. The block G affords a journal-connection to the piston of a dash-pot, G^2.

The piston-head of the dash-pot is provided with suitable valve contrivance G^3, so arranged and constructed that the piston-head shall move slowly in one direction, preferably upward, and freely and quickly in the other.

H H^1 in the device here shown are hooks or other equivalents, for suspending or attaching the lamp at the locality where it is intended to be used, and these hooks represent, and are placed in electric connection respectively with, the positive and negative poles of the lamp, as and for the purpose shown in United States Patent No. 203,411, granted to me May 7, 1878.

I is a metallic rod connecting the hook H with the lower carbon, I′. *d g* are contact-points, fixed, respectively, to the lever D′ and spring G; or, as will hereinafter appear, these contact-points *d g* may be placed anywhere in the electric circuit, and made to come into occasional contact by any contrivance whatever.

Electric connections by wire or other suitable means are made as follows: First, between hook H and rod I; second, between spring G and hook H^1; third, between carbon-holder A and helix of magnet H^2; fourth, between carbon-holder A and metallic frame or casing E; fifth, between hook H^1 and helix H^2.

The device just specified will operate as follows: Before the passage of the electric current the carbons will rest in contact by the gravity of the upper carbon-holder, A, and in this position the circuit is from hook H, through rod I, carbons, carbon-holder A, frame E, helix H^2, and from thence to hook H^1. Immediately upon the passage of the electric current the armature is drawn down, thus operating to raise the lifter C, clamp B, and carbon-holder A to a height limited by the adjustable stop B′. This separates the carbons and produces the electric light. At the time the armature D is drawn down the opposite end of the lever D′ is raised and the contact-point *d* raised with it. The resistance offered by the dash-pot G^2, however, prevents the contact-point *g* from immediately following. The result is that the points *d g* are separated; but the spring G is now called into play, and it acts to slowly raise the contact-point *g*, and during the time that the points *d g* are separated is when the carbons will be held steadily and firmly apart their adjusted distance by the force of the current passing through the helix H^2. After a time, however, the spring G will bring the points *d g* into contact, and thus afford a free passage for the current independent of the helix H^2, thus diverting the greater portion of the current from said helix, without, however, affecting its passage through the carbons.

The armature D, which is thus released, allows the rod A to drop, thereby loosening the gripe of the clamp B and permitting the upper carbon to feed forward to the amount consumed during the approach of the points *d g*. A quick drop motion of the carbon-holder A is effected by the peculiar construction of the piston-head of the dash-pot, whose valvular character, as already pointed out, is such as to permit a quick free movement in one direction and a slow movement in the other.

At the moment of contact between the points *d g* the current is principally from hook H, through rod I, carbons, rod A, frame E, lever D′, contact-points *d g*, to hook H^1—a circuit offering far less resistance than one including the helix H^2. It will therefore be seen that the main portion of the current is diverted from the helix H^2, thus suddenly weakening its magnet and allowing the carbon-holder A to drop and feed its carbon forward. By this movement, however, the tilting piece F, striking against the adjustable stop F′, is, by the weight of the lever D′ and its attachments C B A, made to push down upon the spring G and separate the contact-points *d g*, thus re-establishing the main current through the helix H^2, drawing down its armature D, and separating the carbons again to their fixed limit.

The operations just described are constantly repeated in regular rotation, and the light produced is uniform and steady, excepting a slight wink or flicker at the moments when the carbons are brought in contact. When multiple lights are employed this winking, if occurring in but one lamp at a time, as may be the case, if desired, is not noticeable; and in cases where but one light is used, as in a locomotive headlight, this occasional wink is not at all objectionable, as the disturbance is but momentary, and the light only lessened, not extinguished.

In the form of device just specified the spring G is the element operating to bring the contact-points *d g* together, and thus to practically demagnetize the magnet H^2; but this function of short-circuiting the magnet H^2 may be accomplished by many devices besides the spring G; also, may the contact-points *d g* be placed in the circuit at any convenient place whatever, so long as their contact, effected as may be, operates to short-circuit the

helix H^2 or allow the carbons to come together, as already specified.

Instead of this contact being accomplished by the spring G and dash-pot arrangement, it may be done by any appropriate clock-work mechanism that shall at suitable intervals (that may, if desired, be made adjustable) operate to make and break said contact, and thus bring the carbons together, feed, and separate them, as already shown.

Fig. 3 of the drawings shows one form that might be adopted wherein a disk or wheel, g^2, is made to revolve either with a regular or an intermitting motion. A point, *d*, on its circumference is placed in the electric circuit, which, when brought into contact with the stationary point *g*, shall operate to the same effect as a contact between *d g* in Fig. 1; or, instead of this disk or wheel g^2 being moved by clock-work, it may be revolved by suitable belt-connection with any driving-shaft of a machine shop or factory where the lamp is used.

Another effective device for occasionally making and breaking the short circuit heretofore referred to would be by means of two revolving arms or disks, *p p'*, made either of different lengths or diameters, or caused to revolve with differing velocities, or both. Each arm or disk *p p'* is provided with one or more projecting contact-surfaces, *d g*. Owing to the differing velocity of rotation of these contact-surfaces *d g*, they would be brought together regularly, and at intervals of suitable length, regulated by the relative sizes of the arms or disks *p p'*, or their velocities, or both, and when they met their contact would be sufficiently short, thus not materially disturbing the light.

The arms or disks *p p'* may be revolved by clock-work or in any other way, and each lamp may be separately provided with a device, *p p*, or two or more lamps of a system; or, indeed, an entire system of lamps on a single circuit, as shown in Fig. 5 of the drawings, may be simultaneously and effectively governed by one pair of arms or disks, *p p'*, by locating said pair anywhere on the circuit between the lamps and source of current.

Each contact *d g* is placed respectively in electrical connection with the positive and negative poles of the lamp, or the positive and negative wires of the circuit, and their contact, as already sufficiently specified, will operate to cause the carbons to come together and feed.

Still another modified form of my invention is shown in Fig. 6 of the drawings.

Thus far I have shown intermediate mechanism between the magnet and clamp, whereby the magnet operates said clamp as I have shown. All this intermediate mechanism may be dispensed with, and the clamp be directly attached to, or in fact be, the armature of the electro-magnet. In this form of device the position of the magnet or the floor upon which the clamp rests, or both, should be made adjustable, so as to regulate and determine the separating motion of the carbons. When this construction is adopted, I recommend the employment of a spring, J, the office of which shall simply be to insure the griping function of the clamping device by bearing down at or near a point opposite from where the lifting-finger raises the clamp. This will prevent a liability of any loosening of the clamping contrivance on account of jolting.

In this last-named form of device either the adjustable magnet or the adjustable floor, as above specified, or both, will operate as the adjustable stop B', to limit the separation of the carbons, as may be desired.

Fig. 7 of the drawings represents an effective form of construction of the contact-points *d g*. In this construction the said contact-points are either formed entirely from carbon or are faced with this material. Thus formed the points *d g* will be cheap, durable, and effective.

I have sufficiently demonstrated the fact that carbon contact-points, such as *d g*, are not only superior to, but in many essential respects different from, the ordinary contact-points of platinum and similar substances heretofore in common use.

In contact-points as heretofore made the electric spark which is apt to be created by interruption of the current much more rapidly destroys even a platinum-surface than it will a carbon surface.

Another and equally important advantage that I have discovered in favor of carbon contact-points is the fact that grease and dirt are far less liable to be deposited upon a carbon than upon a metallic surface, and this deposition of foreign matter between the contact-points is a well-recognized cause of faulty and unreliable operation. Moreover, besides the inherent superiority and advantage of carbon over any metallic substance for contact-points, it can be produced and applied at a greatly-reduced expense, and is, moreover, more readily renewed when necessary than contact-points as hitherto constructed.

What I claim is—

1. In combination with the carbons, or their equivalent, of an electric lamp, a device for governing and controlling the carbons in the following manner, to wit: to separate said carbons to a distance required for the desired length of voltaic arc, and to maintain them in a separated relation excepting at momentary intervals of suitable frequency, when the said carbons are arbitrarily caused to feed and come into contact with each other by the shunting of a portion or the whole of the electric current from the magnet operating to separate said carbons, substantially as and for the purpose specified.

2. In combination with the carbons, or their equivalent, of an electric lamp, a device for governing and controlling the carbons in the following manner, to wit: to separate said carbons to a distance required for the desired length of voltaic arc, and to maintain them in

a separated relation excepting at momentary intervals of suitable frequency, when the said carbons are arbitrarily caused to feed and come into contact with each other without an interruption of the passage of the electric current through the carbons by the shunting of a portion or the whole of the electric current from the magnet operating to separate said carbons, substantially as shown.

3. In combination with the carbons, or their equivalent, of an electric lamp, a device for governing and controlling the carbons in the following manner, to wit: to separate said carbons to a distance required for the desired length of voltaic arc, and to maintain them in a separated relation excepting at momentary intervals of suitable frequency, when the said carbons are arbitrarily caused to feed and come into contact with each other without interruption of the electric current in the battery or other source of current by the shunting of a portion or the whole of the electric current from the magnet operating to separate said carbons, substantially as shown.

4. An electric lamp wherein the combined clamp and lifting device B′, or its equivalent, is directly attached to, or in fact is, the armature of an electro-magnet, substantially as shown.

5. In an electric lamp wherein the clamp B′, or its equivalent, is directly attached to, or in fact is, the armature of an electro-magnet, a vertically-adjustable floor or rest for said clamp, substantially as and for the purpose specified.

6. In an electric lamp wherein the clamp B′, or its equivalent, is directly attached to, or in fact is, the armature of an electro-magnet, a suitable arrangement and device for making said electro-magnet adjustable in its position, substantially as and for the purpose shown.

7. The contact points or surfaces *d g*, placed in electrical connection respectively with the positive and negative wires (or other conductors) of a circuit upon which one or more electric lamps are placed, in combination with suitable device for occasionally bringing said points or surfaces into momentary electrical connection, for the purpose, at the times of said contact or connection, of permitting the carbons or illuminating points of said lamp or lamps, as consumed, to feed, substantially as shown.

8. In combination with the mechanism of an electric lamp, the contact points or surfaces *d g*, or their equivalent, and a suitable device for effecting an occasional momentary electrical connection between said points or surfaces, for the purpose, at the times of said connection, of permitting the illuminating points or carbons of said lamp, as consumed, to feed, substantially as shown.

9. The contact points or surfaces *d g*, consisting of or faced with carbon, substantially as and for the purpose shown.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES F. BRUSH.

Witnesses:

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LEVERETT L. LEGGETT.