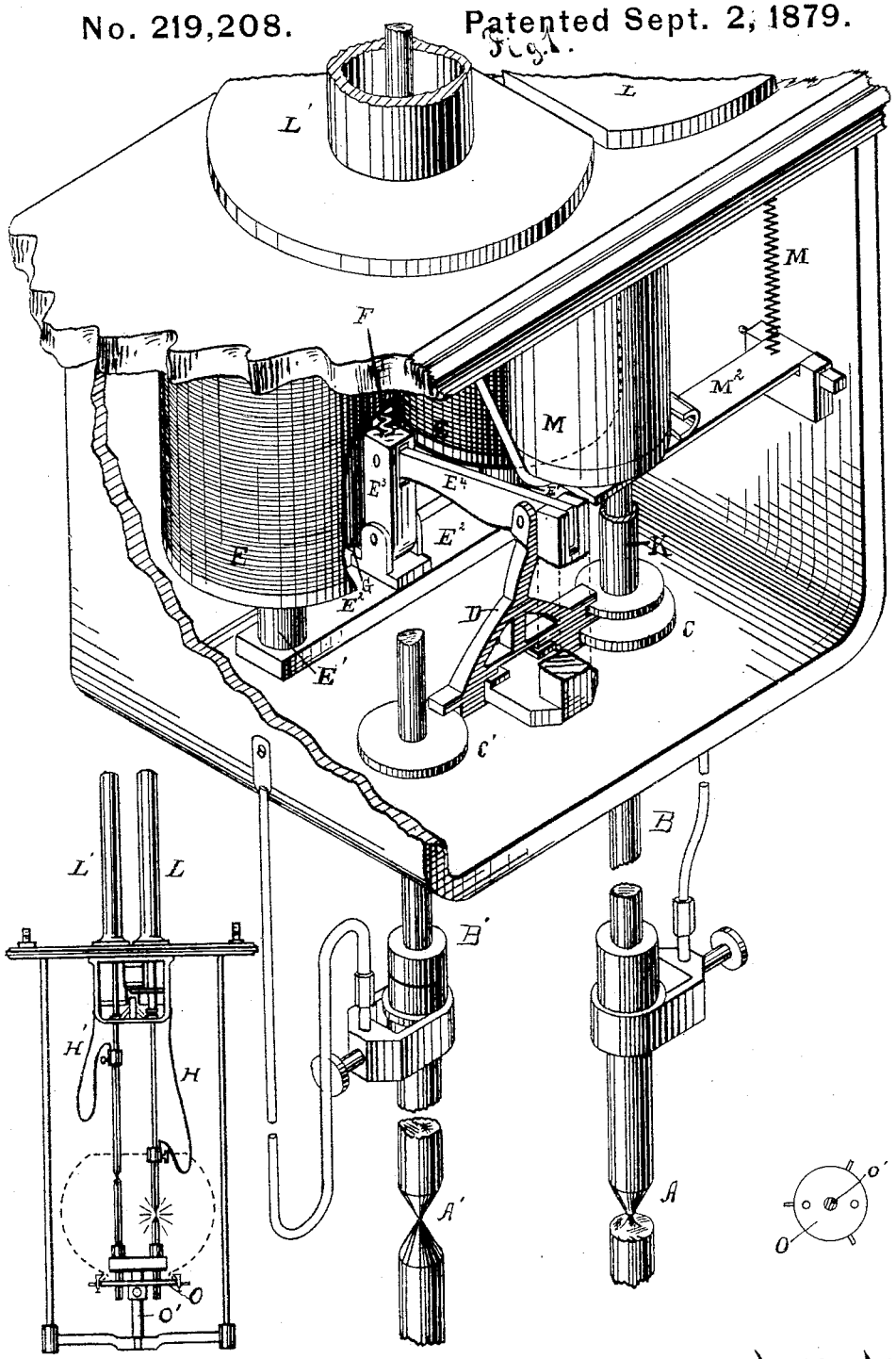
3 Sheets—Sheet1.

C. F. BRUSH.

Electric-Lamp.

No. 219,208. Patented Sept. 2, 1879.

Fig. 1.



Witnesses.

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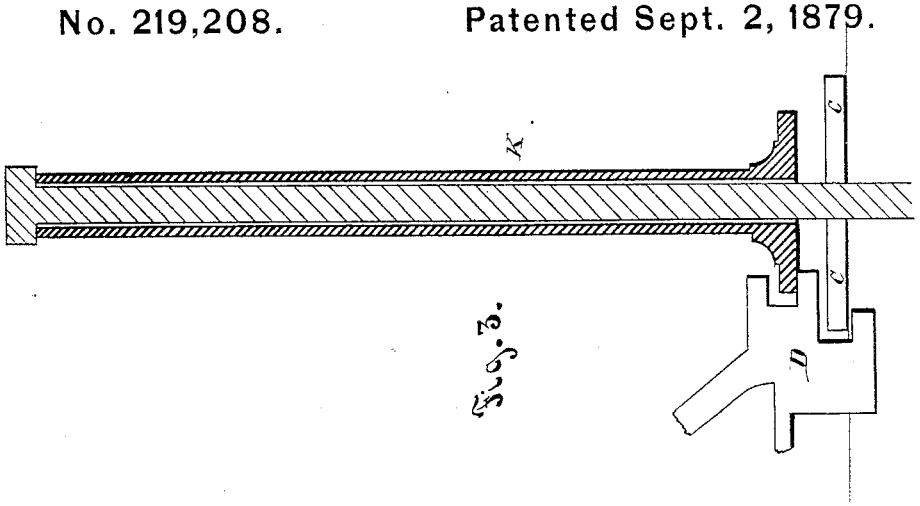

Fig. 3.

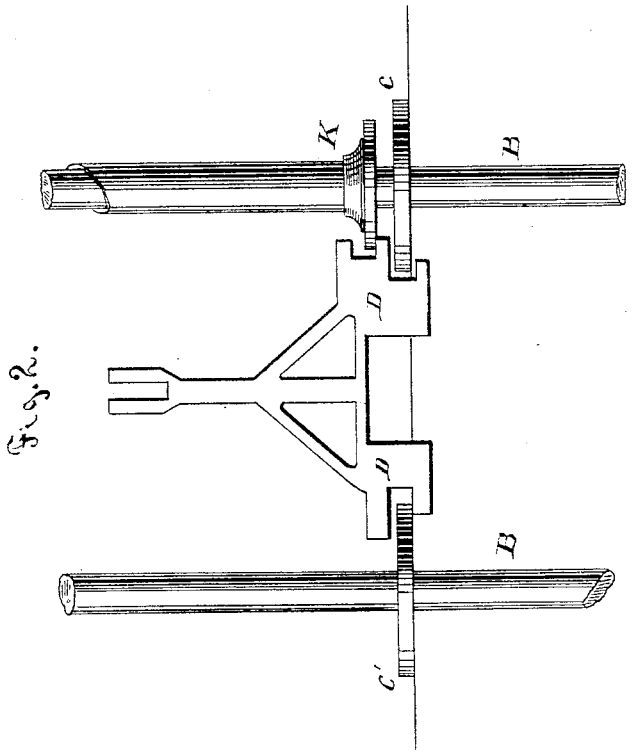

Fig. 2.

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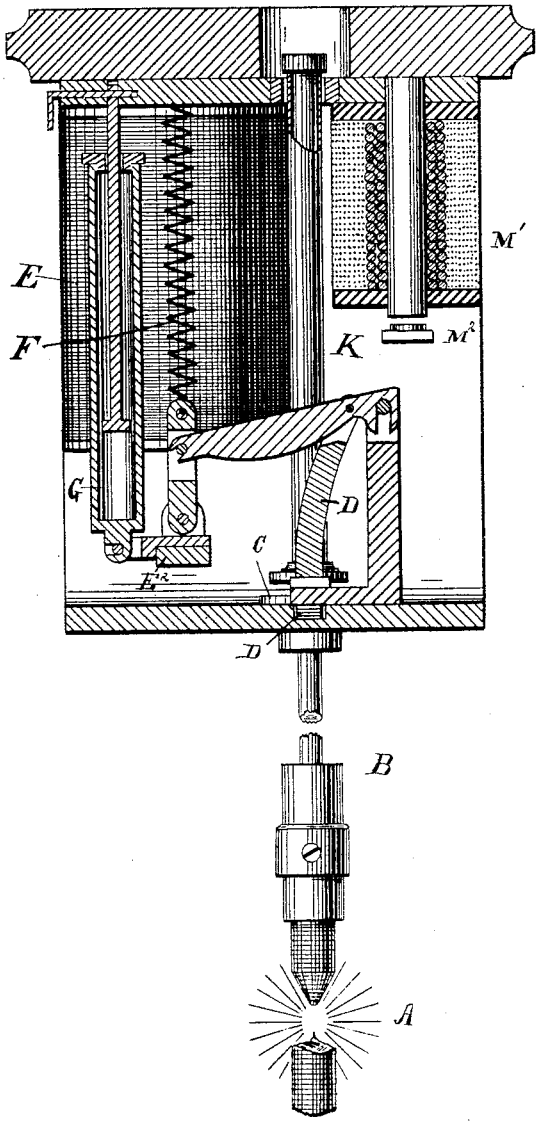
Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLES F. BRUSH, OF CLEVELAND, OHIO.

IMPROVEMENT IN ELECTRIC LAMPS.

Specification forming part of Letters Patent No. **219,208**, dated September 2, 1879; application filed May 15, 1879.

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 Electric Lamps; 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 lamps or light-regulators; and it consists, first, in a lamp having two or more sets of carbons adapted, by any suitable means, to burn successively—that is, one set after another; second, in a lamp having two or more sets of carbons, each set adapted to move independently in burning and feeding; third, in a lamp having two or more sets of carbons adapted each to have independent movements, and each operated and influenced by the same electric current; fourth, in a lamp having two or more sets of carbons, said carbons, by any suitable means, being adapted to be separated dissimultaneously, whereby the voltaic arc between but a single set of carbons is produced; fifth, in the combination, with one of the carbons or carbon-holders of a lamp employing two or more sets of carbons, as above mentioned, of a suitable collar, tube, or extended support, within or upon which the carbon or carbon-holder to which it is applied shall rest and be supported.

In the drawings, Figure 1 is an isometrical view of a lamp embodying my invention, the said lamp operating two sets of carbons. Accompanying Fig. 1 is a diminished view of the lamp, showing its general appearance and proportions. In this figure of drawings appears mechanism (marked M M^1 M^2) representing a device for automatically shunting or cutting the lamp from circuit when, from any cause, said lamp shall offer an abnormally great resistance to the current operating it; but I do not here lay any claim to this or any other device or method for accomplishing the function just referred to, as I have made that the subject of another application. Fig. 2 is a detached view of the parts operating to lift the carbon-rods, and thus to dissimultaneously separate the carbons of the two sets there shown. Fig. 3 is a detached view, showing a supporting device (here appearing as a tube surrounding a carbon-holder) between the carbon lifting or separating apparatus and one of the lifted carbons; and Fig. 4, a section view of the device shown in Fig. 1.

I desire to state at the outstart that my invention is not limited in its application to any specific form of lamp. It may be used in any form of voltaic-arc light-regulator, and would need but a mere modification in mechanical form to be adaptable to an indefinite variety of the present known forms of electric lamps.

My invention comprehends, broadly, any lamp or light-regulator where more than one set of carbons are employed, wherein—say in a lamp having two sets of carbons—one set of carbons will separate before the other.

For the purpose merely of showing and explaining the principles of operation and use of my invention, I shall describe it, in the form shown in the drawings, as applied to an electric lamp of the general type shown in United States Letters Patent No. 203,411 granted to me May 7, 1878, reissued May 20, 1879, and numbered 8,718. The leading feature of this type of regulator is that the carbon-holder has a rod or tube which slides through or past a friction-clutch, which clutch is operated upon to grasp and move said carbon rod or holder, and thus to separate the carbons and produce the voltaic arc light; and I shall refer to such a lamp in my following description.

A represents one set of carbons; A′, another set, each carbon having an independent holder, B B′.

The carbon-holders B B′ may either be in the form of a rod or tube, and each of them is made to pass through a clamping and lifting device, C C′, respectively. These clamps and lifters C C′ are shown in the present instance in the shape of rings surrounding their respective carbon-holders B B′. This form, while I have found it for general purposes the best, is not necessarily the only form of clamp that may be used in carrying out my present invention.

Each ring-clamp C C′ is adapted to be lifted from a single point, thus tilting it and causing it to grasp and lift its inclosed carbon-

holder. This tilting and lifting movement is imparted to the clamps C C′ by any suitable lifter, D, and this lifter may have its movement imparted either by magnetic attraction due to the current operating the lamp, or by the expansive action of heat upon any suitable apparatus connected with the lamp, said heat generated by the electric current operating the lamp.

I do not in any degree limit myself to any specific method or mechanism for lifting, moving, or separating the carbon points or their holders, so long as the peculiar functions and results hereinafter to be specified shall be accomplished.

The lifter D, in the present instance, is so formed that when it is raised it shall not operate upon the clamps C C′ simultaneously, but shall lift first one and then the other, (preferably the clamp C first and C′ second, for reasons which will hereinafter appear.) This function of dissimultaneous action upon the carbons or their holders, whereby one set of carbons shall be separated in advance of the other, constitutes the principal and most important feature of my present invention.

In the lamp shown in the drawings the lifter D is actuated and controlled through the agency of magnetic attraction due to the influence of the current operating the lamp, and this is accomplished as follows: One, two, or more spools or hollow helices, E, of insulated wire, are placed in the circuit, within whose cavities freely move cores E^1. The electric current, passing through the helices E, operate to strongly draw up within their cavities their respective cores E^1 in the same manner as specified in my former patent above referred to.

The cores E^1 are rigidly attached to a common bar, E^2, and the upward and downward movement of this bar, due to the varying attraction of the helices E, is imparted by a suitable link-and-lever connection, E^3 E^4, to the lifter D. By this connection the lifter will have an up-and-down movement in exact concert with the cores E^1; and it is apparent that this connection between magnet and lifter may be indefinitely varied without any departure from my invention; and therefore, while preferring for many purposes the construction just specified, I do not propose to limit myself to its use.

The lifter D may be so constructed and applied as to separate the carbons A and A′ successively or dissimultaneously by being so balanced that any difference, however slight, between the weights of the carbons A A′ or their holders B B′ shall result in one being lifted and separated before the other.

In order properly to balance the attractive force of the magnets, a coil-spring, F, or its equivalent, may be employed, substantially as shown; and to insure a steady motion to the magnets and to the carbon points A A′, a dash-pot, G, or its equivalent, should be employed, as this prevents any too sudden, abrupt, or excessive movement of parts.

H H′ are metallic cables, through which the current is conducted from above the clamps C C′ to the carbons A A′. By this provision is not only insured a good connection between the upper carbon points and the mechanism above it, but another important advantage is obtained, and that is the prevention of sparks due to any interruption of the current between the carbon-holder B B′ and its clamp or bearings. This spark, if occurring too frequently, is liable to burn and roughen the rods B B′, or their bearings or clamps, and thereby render their operation uncertain, because it is important that a free movement to any degree, however minute, may be allowed the carbon-holder. These cables H H′, while operating as just specified, are sufficiently flexible and yielding not to interfere with any movement of their respective carbons or carbon-holders.

The operation of my device, as thus far specified, is as follows: When the current is not passing through the lamp the positive and negative carbons of each set A A′ are in actual contact. When, now, a current is passed through the lamp, the magnetic attraction of the helices E will operate to raise the lifter D. This lifter, operating upon the clamps C and C′, tilts them and causes them to clamp and lift the carbon-holders B B′, and thus separate the carbons and produce the voltaic-arc light; but it will be especially noticed that the lifting and separation of these carbons is not simultaneous. One pair is separated before the other, it matters not how little nor how short a time before. This separation breaks the circuit at that point, and the entire current is now passing through the unseparated pair of carbons A′; and now when the lifter, continuing to rise, separates these points, the voltaic arc will be established between them and the light thus produced.

It will be apparent by the foregoing that it is impossible that both pairs of carbons A A′ should burn at once, for any inequality of weight or balance between them would result in one pair being separated before the other, and the voltaic arc would appear between the last-separated pair. This function, so far as I am aware, has never been accomplished by any previous invention; and by thus being able to burn independently and one at a time two or more carbons in a single lamp, it is evident that a light may be constantly maintained for a prolonged period without replacing the carbons or other manual interference.

In the form of lamp shown I can, with twelve-inch carbons, maintain a steady and reliable light without any manual interference whatever for a period varying from fourteen to twenty hours.

It is for some reasons desirable that one set of carbons—say the set A—should be consumed before the other set commences to burn, al-

though it is not essential, in carrying out my invention, that the carbons should be consumed in this manner, inasmuch as, if desirable, they may be arranged to burn alternately instead of successively.

It is apparent, however, if one set of carbons can be made to entirely consume before another set begins to burn, that there will be less interruption of the light than if the different pairs were allowed to consume in frequent alternation. I have therefore shown in the present invention one method of securing a consumption of one set of carbons before another shall begin to burn. This I accomplish through any suitable support K, and in such a construction of the lifter D that it shall be positive in its function of separating one set of carbons before the other; or, in case where more than two sets of carbons are employed, to separate said sets successively.

In the lamp as shown in the drawings the support K is in the form of a tube surrounding the carbon-holder B, and this support K is made of such a length that when the carbons A′ shall have been sufficiently consumed a head upon the carbon-holder B will rest upon the top of the support K, whereby the weight of the carbon-holder B and its support K shall at all times and under any circumstance be supported by the lifter D.

Besides the carbon-holder B, with its carbon, and the support K, the lifter D (when the lamp is in operation) should also be made to carry the carbon-holder B′ and its carbon.

The lamp is primarily adjusted so that the magnets through the lifter D shall always carry a definite load, to wit, (in the lamp shown,) the carbon-holders B and B′ and support K.

The desirability of this construction and arrangement may be explained as follows: Supposing, as is designed in the present instance, the carbons A are first consumed. During that time, of course, the magnets are lifting both carbon-holders B B′. Now, when the carbons A are consumed, if no provision was made to the contrary, the carbon-holder B would not be lifted during the consumption of the carbons A′, and this diminishment of the weight carried by the magnets would be liable to materially disturb the adjustment of the lamp and impair its operation accordingly.

To obviate this difficulty I have provided the support K, by which provision the magnets shall always be made to carry both carbon-holders B B′ and the support K.

The difference in weight, owing to the consumption of the carbons, is a practically unimportant matter, and does not materially interfere with the operation of the lamp.

In the case of a lamp where the carbon-holders B B′ are very light, and where the weight of one might be relieved from the magnet (or other moving agent) without material disturbance, the support K might be dispensed with. Said support K might also be omitted, if desired, in a lamp where the lifter is actuated through the agency of the expansion of a metal wire or bar by the action of heat generated by the current operating the lamp, inasmuch as, the force due to said expansion being practically irresistible it would not be so necessary to obtain a balance between various parts as is the case with a lamp as shown in the drawings.

I have incidentally mentioned in the foregoing specification a lamp wherein the voltaic arc is produced by a separation of the carbons due to the expansive action of heat, however generated, upon a metal wire or bar. It is my intention to apply for a patent upon a lamp involving this principle, and I therefore do not waive, by anything contained in this specification, any right of application for patent upon such a type of regulator.

Thus far I have mentioned but two ways of imparting dissimultaneous motion to the carbons of an electric lamp—viz., through magnetic attraction and through the expansive action of heat. This function of my device may be accomplished by clock-work or equivalent mechanical contrivance; and in this respect, as before stated, I do not limit my invention.

L L′ are metallic hoods or protectors for inclosing and shielding the upper projecting ends of the carbon-holders B B′.

In the form of lamp shown in the drawings I obtain very satisfactory results by constructing the helices E according to Letters Patent No. 212,183, granted to me February 11, 1879. In each helix E two independent wires surround the lifting-magnets E′, one of fine and one of coarse wire, and each placed in the general circuit operating the lamp. These two wires (the fine and the coarse) are constructed and connected in such a manner as to carry current in opposite directions around the inclosed core, thus exerting a neutralizing influence upon each other, whereby a governing function is secured, for a better description and understanding of which reference is made to said Patent No. 212,183.

The poles of the lamp shown in the drawings are constructed in the form of suspending hooks or loops, from which the lamp is suspended, and the corresponding hooks or loops, with which they engage in the ceiling, (or other locality where the lamps are used,) are the positive and negative poles of the current-generating apparatus. Thus by the simple act of suspension the lamp is placed in circuit.

I will now specify a construction whereby the protecting-globe surrounding the light can be raised and lowered for convenience in renewing carbons and handling the lamp. This I accomplish by making the platform or gallery O, upon which the globe rests, vertically adjustable upon a rod, O′, attached to the lamp-frame in any convenient manner. A set-screw should be provided, whereby the globe can be adjusted to any desired position. By this arrangement the work of renewing carbons and the reliable adjustment of the

globe in relation to the voltaic arc are materially assisted.

In order to accommodate long sticks of carbon, the platform or gallery O should be perforated to allow passage down through it of said carbon sticks. I prefer making the platform or gallery O of metal, and of such shape as that globules of molten copper from the coverings of the carbons, in dropping away, shall not escape to do damage.

It will be particularly observed that in the form of dash-pot employed the cylinder is the movable and the piston or plunger the stationary element. This construction implies more than a mere reversal of the usual make and operation of the dash-pot, for by making the cylinder the movable element the general construction of a lamp can very often be materially simplified, as in the present instance. This form of dash-pot is designed to be employed in connection with any of the moving parts of the mechanism of an electric lamp where it is desired to retard a downward movement.

What I claim is—

1. In an electric lamp, two or more pairs or sets of carbons, in combination with mechanism constructed to separate said pairs dissimultaneously or successively, substantially as and for the purpose specified.

2. In an electric lamp, two or more pairs or sets of carbons, in combination with mechanism constructed to separate said pairs dissimultaneously or successively and establish the electric light between the members of but one pair, (to wit, the pair last separated,) while the members of the remaining pair or pairs are maintained in a separated relation, substantially as shown.

3. In an electric lamp having more than one pair or set of carbons, the combination, with said carbon sets or pairs, of mechanism constructed to impart to them independent and dissimultaneous separating and feeding movements, whereby the electric light will be established between the members of but one of said pairs or sets at a time, while the members of the remaining pair or pairs are maintained in a separated relation, substantially as shown.

4. In a single electric lamp, two or more pairs or sets of carbons, all placed in circuit, so that when their members are in contact the current may pass freely through all said pairs alike, in combination with mechanism constructed to separate said pairs dissimultaneously or successively, substantially as and for the purpose shown.

5. In an electric lamp wherein more than one set or pair of carbons are employed, the lifter D or its equivalent, moved by any suitable means, and constructed to act upon said carbons or carbon-holders dissimultaneously or successively, substantially as and for the purpose shown.

6. In an electric lamp wherein more than one pair or set of carbons are employed, a clamp, C, or its equivalent, for each said pair or set, said clamps C adapted to grasp and move said carbons or carbon-holders dissimultaneously or successively, substantially as and for the purpose shown.

7. In an electric lamp, the combination, with a carbon-holder and the mechanism moving said carbon-holder, of a lifter or support, K, or its equivalent, constructed to operate in compelling the said moving mechanism to sustain the weight of the carbon-holder after its carbon is sufficiently consumed or removed, substantially as and for the purpose described.

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

CHARLES F. BRUSH.

Witnesses:

LEVERETT L. LEGGETT,

JNO. CROWELL, Jr.