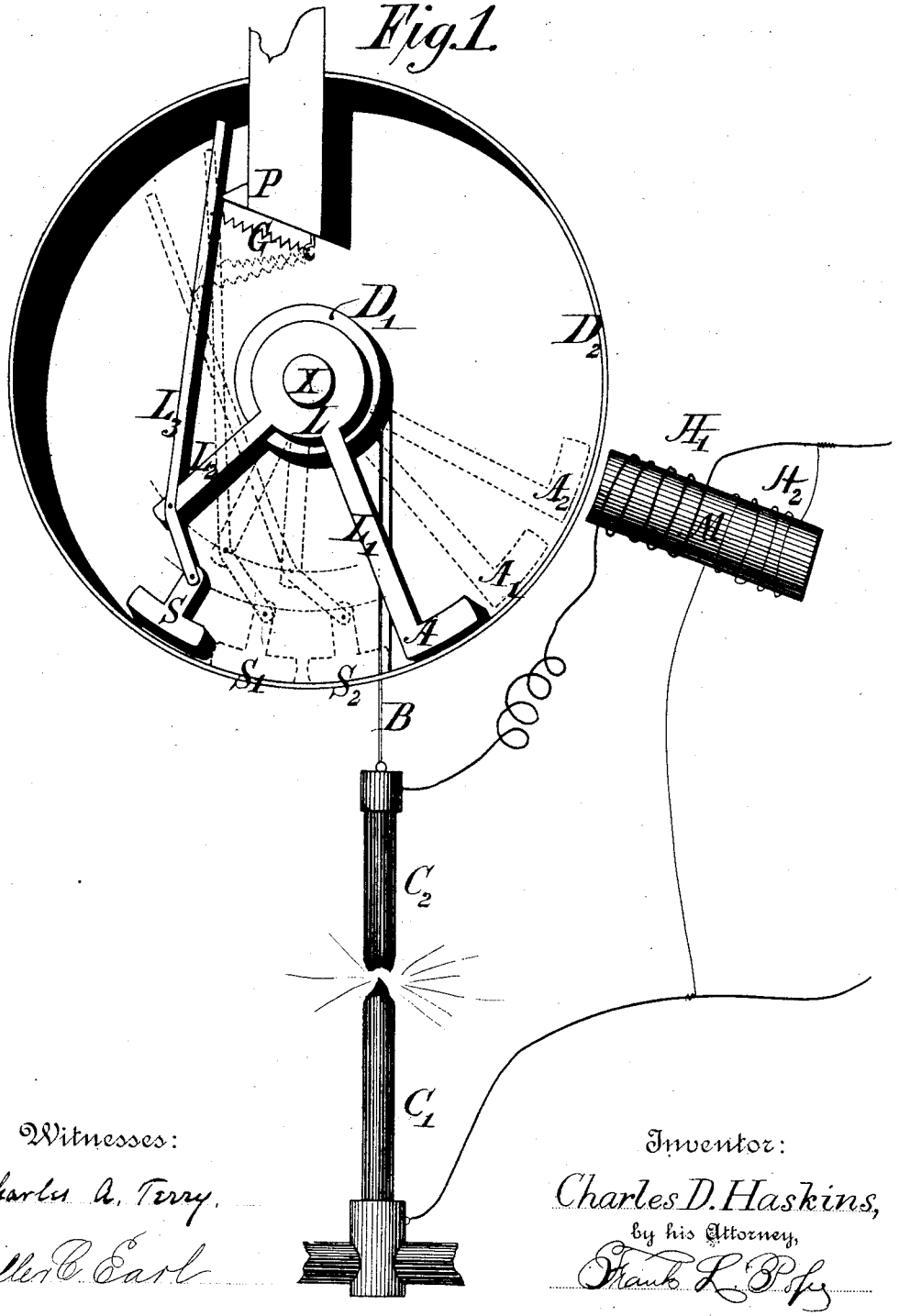
(No Model.) 2 Sheets—Sheet 1.

C. D. HASKINS.

ELECTRIC ARC LAMP.

No. 261,091. Patented July 11, 1882.

Fig. 1.



Witnesses:

Charles A. Terry.

Miller C. Earl

Inventor:

Charles D. Haskins,

by his Attorney,

Frank L. Bostwick

(No Model.) 2 Sheets—Sheet 2.

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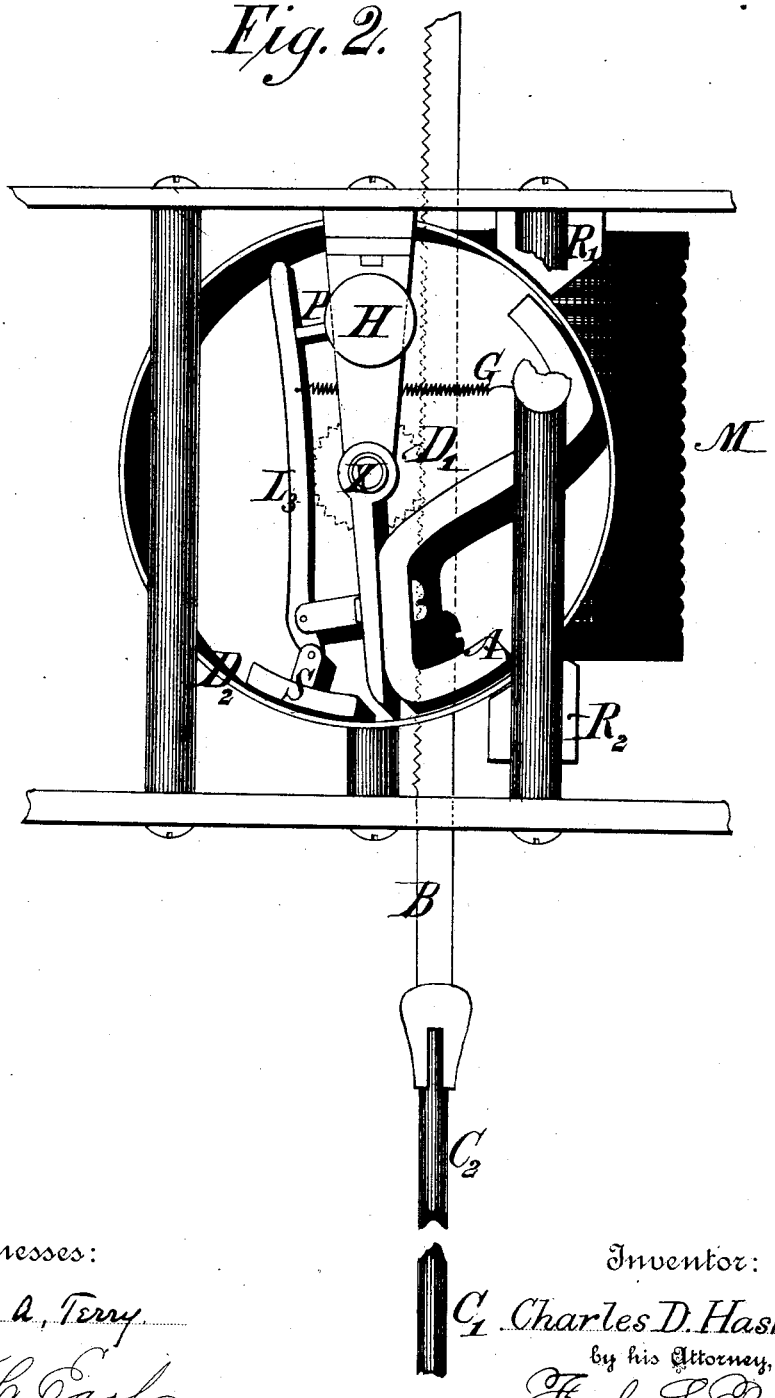
Fig. 2.



Witnesses:

Charles A. Terry

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UNITED STATES PATENT OFFICE.

CHARLES D. HASKINS, OF NEW YORK, N. Y., ASSIGNOR TO THE UNION ELECTRIC MANUFACTURING COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 261,091, dated July 11, 1882.

Application filed January 25, 1882. (No model.)

To all whom it may concern:

Be it known that I, CHARLES D. HASKINS, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

My invention relates to that class of electric lights in which the so-called "electric arc" is maintained between two carbon electrodes. It relates especially to the class of devices or appliances commonly denominated "regulators," the function of which is to automatically maintain said electrodes in that relation to each other which is essential to the production of a uniform and maximum degree of illumination.

To this end my invention consists in a method of and apparatus for maintaining the proper relative position of said electrodes, which method may be generally described as follows: The lower or negative carbon remains stationary. Above it is suspended the positive carbon, which in moving co-operates, through its support, with a shaft, its descent under the action of gravity causing said shaft to revolve in one direction, while by revolving the shaft in the opposite direction it (the positive carbon) may be made to ascend. The normal and constant tendency of the upper carbon to approach the lower is counteracted and regulated by governing the revolutions of the said shaft in the following manner: The armature of an electro-magnet is carried by a system of levers loosely pivoted upon the said shaft. When the electro-magnet is inactive this armature is retained, by gravity or other constant force, at a distance from the magnet; but when the latter is vitalized the armature advances toward the pole of the magnet. Upon reaching a predetermined point it causes the levers to grasp or clamp the shaft, so that further motion of the armature will compel the shaft to revolve in the direction which separates the carbons. The movements of the positive carbon will thus be brought under the complete control of the magnet, and the distance between the carbons will be constantly governed by the variations of the attractive force of said magnet. Thus the armature in moving toward said magnet by reason of an increase in the attractive force will cause the upper carbon to recede from the lower carbon through a space and at a speed depending upon the extent and rapidity of the movements of the armature; and the armature, in subsequently receding toward said predetermined point, by reason of a decrease in the attractive force, will permit the upper carbon to approach the lower at a speed depending upon the rapidity with which the armature moves; and the armature, in receding past the said predetermined point, will then cause the levers to release their grasp of the shaft, leaving the upper carbon free to descend by gravity. By including the electro-magnet in the circuit of the electrodes its attractive force will vary correlatively with the conductivity of that circuit, and hence, as will readily be understood by those versed in the art, it will exert its force in the manner and degree required to effect the necessary regulation.

My invention further comprehends certain details of mechanism, the particular matter claimed being hereinafter specifically designated.

In the accompanying drawings, Figure 1 is a theoretical diagram designed to exhibit easily to the eye the principles of this invention. Fig. 2 is a vertical projection of one of the forms of apparatus actually employed by me. It clearly sets forth the details of construction.

Corresponding parts appearing in both figures are similarly lettered.

Referring to Fig. 1, the negative carbon C' is secured to the frame-work of the lamp. The positive carbon C^2 is shown as suspended by the cord B passing round the drum D', which is rigidly attached to the shaft X. A second drum, D^2, (shown with its front face removed in order to exhibit the interior mechanism,) is secured rigidly by its rear face to the same shaft.

The armature A of an electro-magnet, M, is carried by the arm L' of the bent lever $L' L L^2$, loosely fulcrumed upon the shaft X at the point L. To the arm L^2 of this bent lever is pivoted a clamping-lever, L^3, carrying a friction-shoe, S, the sole of which is curved to fit the inner surface of the perimeter of the drum

D^2. The electro-magnet M is wound differentially. The helix H′ is of coarse wire, and is included in the main or light circuit. The helix H^2 is of fine wire and constitutes a shunt around the light. Its office will be hereinafter explained. The figure shows the position of the parts when there is no current traversing the light-circuit. Under such condition the armature is retained by the force of gravity at a considerable distance from the magnet, and the shoe S is prevented by the stop P from binding with the said perimeter, as it would otherwise do under the action of the spring G. The axis H is therefore free to revolve, allowing the upper carbon to descend toward and meet the lower carbon. If now a current of electricity be caused to traverse the light-circuit, the magnet M will be vitalized and the armature A, under its attraction, will describe a pendulous motion. As the armature moves the shoe S will also advance in the same general direction, except that it will continually approach the perimeter of the drum D^2 under the manifest operation of the several forces acting upon it. When the armature has advanced to the position A′ (indicated by the dotted lines) the shoe S will have assumed the position S′, at which point it will bind the inner surface of the perimeter. The armature becomes in this manner rigidly attached to the perimeter, and hence, through the intermediate mechanism, to the positive carbon. The subsequent movements of the armature will therefore be transmitted to the positive carbon, the armature being still free to move under the influence of magnetic variations. The armature will come to rest at that point where the attraction of the magnet for the armature is equal to the opposing force tending to return it to its original position when not in operation. Let this point of equilibrium, which will depend upon the strength of current employed, be represented by A^2. The shoe will now be in the position S^2, the upper end of the lever L^3 having left the stop P, and the full force of the now extended spring G will be exerted in pressing the shoe against the perimeter of the drum D^2. The gradual consumption of the points of the carbons, which tends to increase the length of the arc, tends also to increase the resistance of the light-circuit. This will act to diminish the attractive force of the magnet, and the armature will recede, lowering the upper carbon at a speed depending upon its own rate of motion, and thus compensating for the material consumed. The armature will continue to recede in this manner until the position A′ and S′ (which are the normal positions during the operation of the lamp) are regained. Further consumption of the carbons will then cause the friction-shoe to release its hold of the drum and permit a small fraction of the circumference of the perimeter to slip past. This tends to diminish the length of the arc until the magnetic force is sufficiently restored to cause the shoe to again bind with the perimeter. In thus binding it not only stops the revolution of the perimeter, but it again subjects both it and the carbons to the influence of the magnet. The shoe does not therefore act as a brake for the purpose of bringing the movable carbon to absolute rest. Its functions are, first, to arrest the descent of the movable carbon, and, secondly, to bring it again within the control of the variable magnetic force. In this manner the desired relative positions of the carbon points are automatically maintained.

As previously mentioned, the electro-magnet M is wound with differential helices, one of which, H′, is of low resistance and is included in the main or light circuit, and the other, H^2, is of high resistance and forms a shunt-circuit around the light. By this device the process of demagnetization is quickly accomplished when required, for during the normal operation of the lamp the light-circuit is of low resistance and the current traversing the helix H^2 will be feeble in proportion to that which passes through the helix M′, and the strength of the magnet will not be materially weakened by its influence. If, however, an abnormal resistance is created in the arc, (as by the breakage of one of the carbons, or from other cause,) the proportion of current traversing the helix H^2 will be correspondingly increased and the magnetizing effects of the currents will be more nearly equal, and, being opposite, will tend to neutralize each other, thus freeing the armature, causing the descent of the upper carbon, and re-establishing the arc.

In Fig. 2 I have shown the details of construction of a practical working apparatus. For a given strength of current the distance between the carbons should remain constant; but this distance should be varied when it is proposed to use a current of different strength. As the length of the arc must depend upon the position of the point S′, and as the latter depends on the position of the stop P, the distance between the electrodes may be varied by means of an adjustable stop. The figure shows a radial projection from the axle of the adjusting-screw H. By turning this screw the normal distance between the carbons may be suited to the strength of any current employed.

In practice I find it advantageous to utilize both poles of the magnet M, thereby increasing the sensitiveness of the apparatus. This is effected by giving to the soft-iron armature the peculiar shape shown in Fig. 2, the two ends being simultaneously and respectively attracted by the polar extensions R′ and R^2.

In place of the cord B it is evident that any equivalent may be substituted. I have shown in Fig. 2 a rack and pinion operating upon the same principle as the device shown in Fig. 1.

It is also apparent that by an extended application of this invention both the electrodes may be made movable and their relative positions made the subject of regulation in the manner set forth.

I am aware that pendulous clamping devices have been used heretofore; but all such have been subject to the fatal objection that the pendulums have been fulcrumed at a fixed point, and therefore a clamping-shoe carried by such a pendulum would operate as a brake, the only function of which would be to bring the carbons to absolute rest, after which the normal length of arc could only be restored by the slow combustion of the carbons—a process which occupies so long a period as to destroy the efficiency of the lamp.

I am also aware that with a pendulous device so fulcrumed a dog has been used instead of a shoe, and in place of the smooth perimeter a toothed wheel has been employed, the dog co-operating with the said teeth; but at best the light furnished by such a device would vary abruptly in brilliancy every time a tooth escaped, and at all other times would be constantly varying as the carbons consumed away.

I claim as my invention—

The combination, substantially as hereinbefore set forth, of the movable electrode of an arc-lamp, an electro-magnet vitalized by the light-producing current, and an intermediate regulating mechanism consisting of a drum mechanically connected with said electrode, and an armature and a clamping-lever connected together and pendulously suspended from the axis of said drum, said clamping-lever being adapted to act against the inner periphery of said drum.

In testimony whereof I have hereunto subscribed my name this 20th day of January, A. D. 1882.

CHARLES D. HASKINS.

Witnesses:
MILLER C. EARL,
WILLIAM H. KENYON.