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J. A. & C. D. JENNEY.

ELECTRIC ARC LAMP.

No. 261,815. Patented July 25, 1882.

Fig. 1

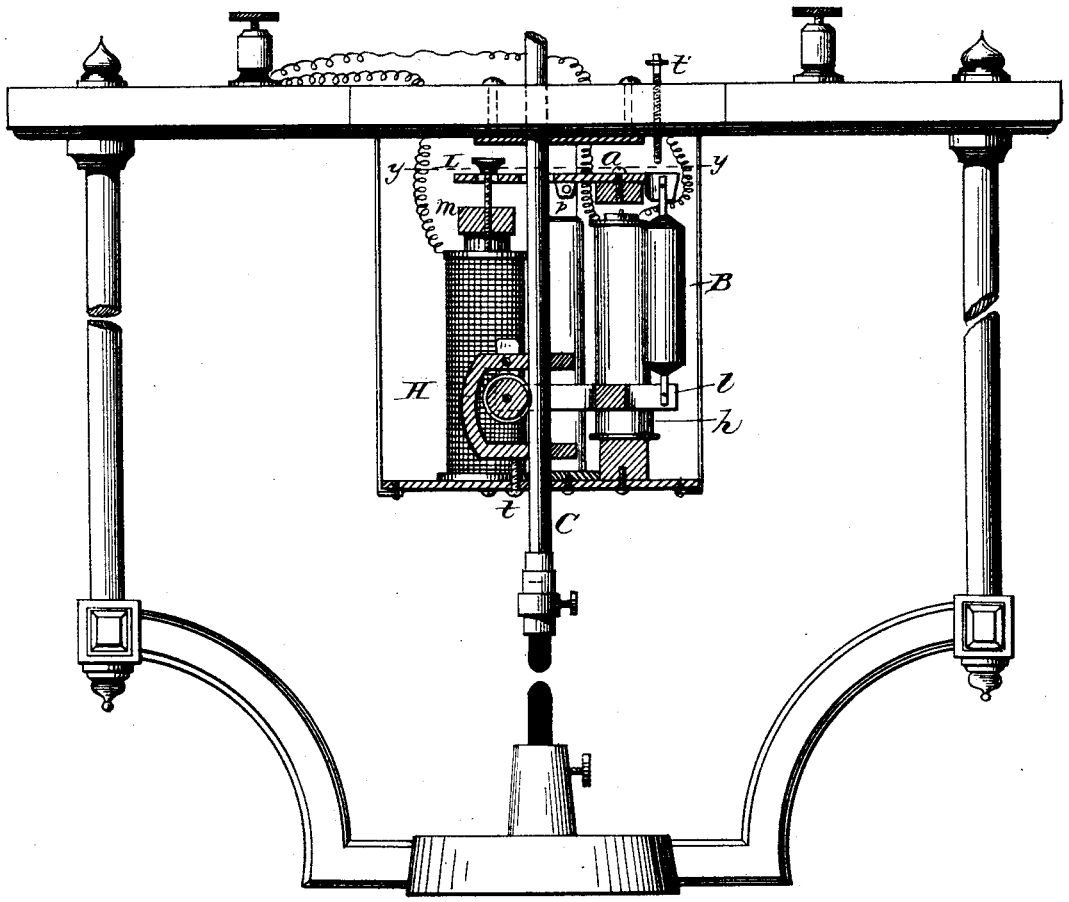

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Fig. 2.

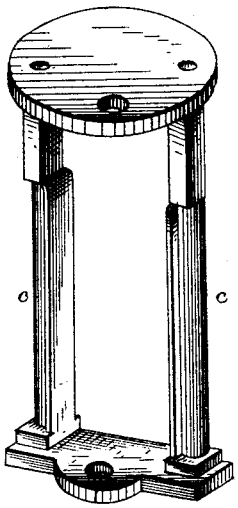
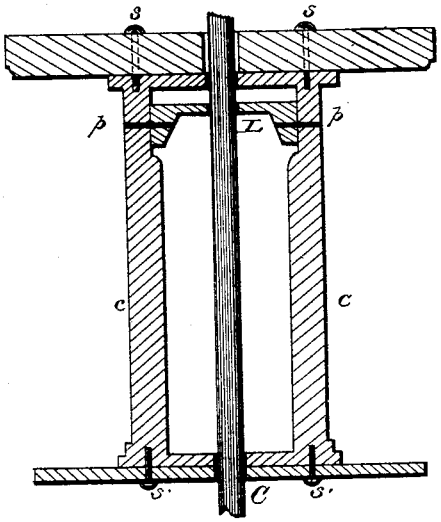


Fig. 3.



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ELECTRIC ARC LAMP.

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Fig. 4

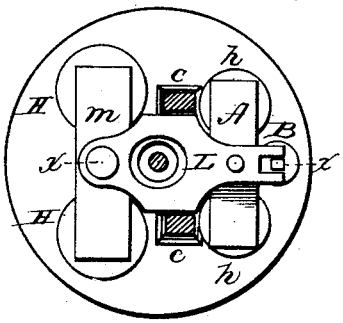


Fig. 5

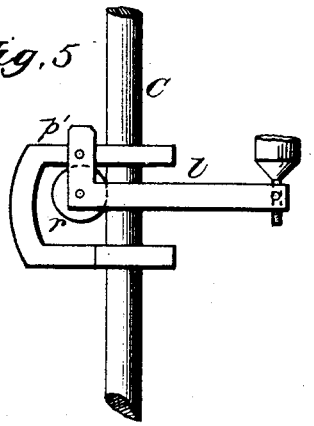
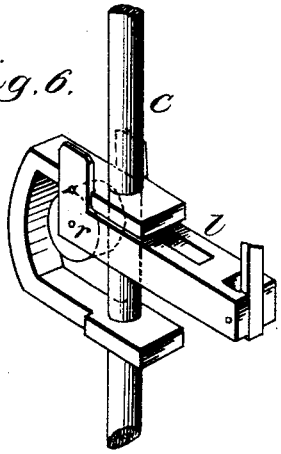


Fig. 6.



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ELECTRIC ARC LAMP.

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Fig. 7

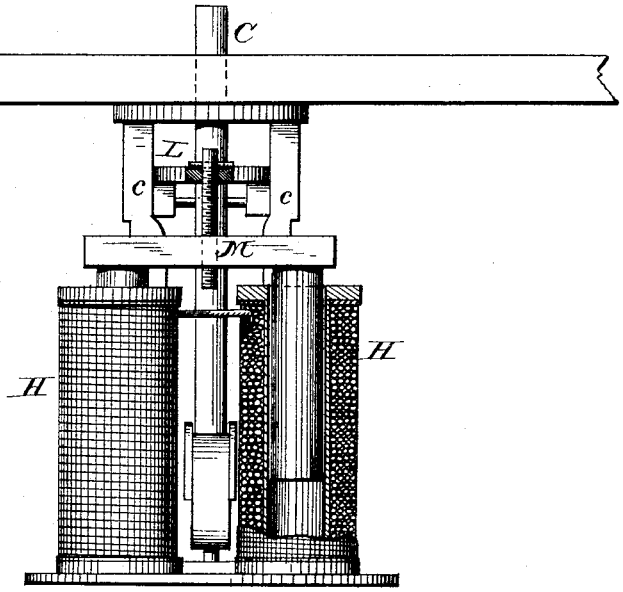
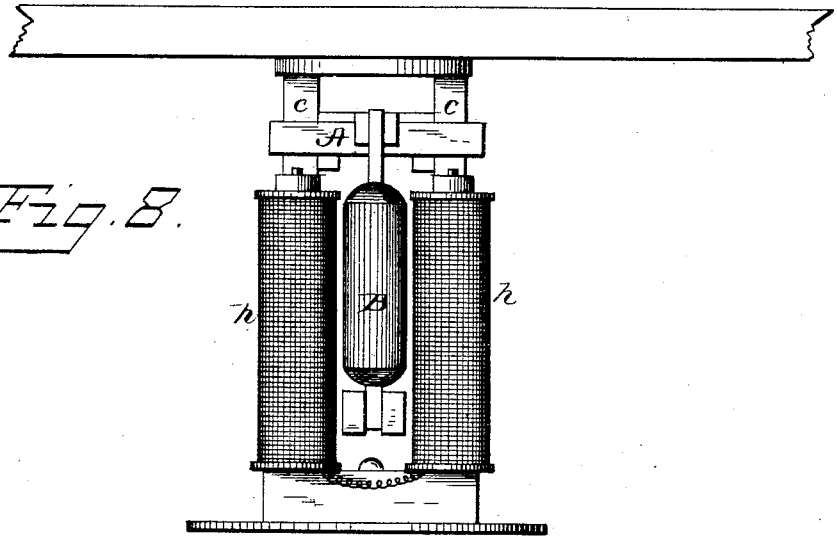


Fig. 8.



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UNITED STATES PATENT OFFICE.

JAMES A. JENNEY AND CHARLES D. JENNEY, OF FORT WAYNE, INDIANA, ASSIGNORS TO THE FORT WAYNE ELECTRIC LIGHT COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 261,815, dated July 25, 1882.

Application filed March 11, 1882. (No model.)

To all whom it may concern:

Be it known that we, JAMES A. JENNEY and CHARLES D. JENNEY, of Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Electric-Arc Lamps; and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

Our invention is an improved automatic electric carbon arc lamp regulator, by means of which, in the operation of the lamp, the separation and approximation of the carbons may be automatically produced, controlled, and regulated by the same electric current which produces the light, so as to secure a uniform and steady feed-motion of the upper carbon and a constant and uniform light without the intervention of springs, gear-wheels, or dash-pot.

The working parts of our improved regulator embrace two coarse-wire helices of low resistance, a soft iron U-magnet fitted to play in their hollow centers, two fine-wire helices of high resistance, containing soft iron cores fixed in their centers, a soft-iron armature fitting the upper polar surfaces of those cores, a centrally-pivoted lever, called hereinafter the "armature-lever," carrying at one end the U-magnet aforesaid and at the other the armature aforesaid, a balancing-weight, a clutch, a supporting-frame, and suitable adjusting and fastening screws.

In the annexed drawings, Figure 1 represents a portion of the working parts of the regulator in their relations to each other and the whole lamp. In this figure one of the coarse and one of the fine wire helices and half of the supporting-frame are removed in order to expose the interior parts to view. The U-magnet, armature, armature-lever, and clutch are shown in section, taken at the line *x x* in Fig. 4. Fig. 2 shows the supporting-frame detached. Fig. 3 shows in cross-section the wooden lamp-top, supporting-frame, armature-lever, regulator-base, and carbon-holder in position. Fig. 4 shows the working parts in a horizontal cross-section at the line *y y* in Fig. 1, exposing to view the tops of the four helices, balancing-weight, and armature-lever in position, the columns of the supporting-frame in cross-section, and the outline of the regulator-base. Figs. 5 and 6 show our improved roller-clutch, which may be used in our improved regulator. Fig. 7 shows in detail the coarse-wire helices, the soft-iron U-magnet, and the relations of said magnet to its helices and the armature-lever. Fig. 8 shows the fine-wire helices and their armature and the balancing-weight.

In all the drawings, C denotes the carbon holder or rod; H H, denote the coarse-wire helices; *h h*, denote the fine-wire helices; B, the balancing-weight; M, the U-magnet; A, the fine-wire helices' armature; L, the armature-lever; *l*, the clutch-lever; *p p*, the armature-lever pivots; *c c*, the columns of the supporting-frame, and other characters as stated.

The supporting-frame, Fig. 2, consists of two parallel plates connected by two perpendicular columns, *c c*. It is made of conducting metal, preferably of brass, cast in one piece. Its plates are perforated with holes, through which the carbon holder or rod has free perpendicular play, and by which it is directed in the line of its proper movement to meet the lower carbon.

At Fig. 3 is shown this supporting-frame attached to the wooden top piece of the lamp by the screws S S and to its base of iron or other material at *s' s'*, also a cross-section of the armature-lever L, pivoted at *p p*, and the carbon-holder C in position.

At Fig. 4 are shown in top view and in position the coarse-wire helices H H, the fine-wire helices *h h*, the balancing-weight B, the soft-iron U-magnet M, the armature A, the armature-lever L, and the cut sections of the columns *c c*.

In Fig. 8 are shown more in detail the two coarse-wire helices as they are placed in the completed lamp, one of them being drawn in partial section to show the soft-iron core or magnet-pole, which plays freely in its center. These round soft-iron cores are joined to-

gether as one piece by the rectangular soft-iron bar, as shown, and the integral part thus constructed being at all times, when the lamp is in operation, an electro-magnet, having its poles in the two soft-iron cores, moving freely in the centers of the inducing helices. It is designated throughout this specification as a "soft-iron U-magnet." The rectangular form of this part shown in the drawings is convenient; but any form may be used which will permit free play of the straight magnet-poles in the helix-centers. It is convenient to make these cores or magnet-poles about two-thirds the length of the helices; but the exact ratio is not important.

In the operation of the lamp the polar extremities of the U-magnet are made to play from a point at or below the centers of the helices downward. The depth of their penetration into the helices is regulated by an adjustable attachment connecting the said soft-iron U-magnet and the armature-lever. Two slightly-differing forms of this attachment are shown in Figs. 1 and 8. Near the other end of the armature-lever L are the two fine-wire helices *h h*, with their armature A fastened at its center to the lever, and pivoted at the extremity of the lever is the balancing-weight B. These parts are all shown in various points of view in Figs. 1, 4, and 9.

The helices *h h* are made of fine insulated copper wire, and are preferably but not necessarily wound in opposite directions, as compared with each other, and contain soft-iron cores fixed in their centers. Their armature A is so adjusted that it can approach very near to the upper polar surfaces of those cores, but cannot come in contact with them. Such contact may be most conveniently prevented by non-magnetic stops set in the ends of the two magnet-cores.

In the construction of the helices we have found insulated copper wire, size No. 9, American standard, for the coarse-wire helices and No. 32 for the fine-wire helices to be convenient sizes; but the exact size of either is not material.

In Fig. 5 is shown our improved roller-clutch. It consists of a double collar formed in one piece, as shown, preferably of brass, perforated with holes, through which the carbon-holder moves vertically, and a roller, *r*, with a grooved or concave circumferential surface fitting the surface of the carbon-holder and pivoted at the angle or apex of the rectangularly-bent lever *l*, which is itself pivoted by its short arm to the collar at *p'* in such manner that the elevation of its long arm will cause the grooved surface of the roller to press against the carbon-holder, as shown by the dotted lines in Fig. 6.

We are aware of the patent granted to Charles D. Jenney on the 4th day of April, 1882, No. 255,999, and we do not claim any device embraced in that invention.

Our invention consists in the application of the bent lever or elbow to the carrying of the roller instead of the straight lever employed in the invention described in said patent.

The advantages gained by our improvement in the form and application of the clutch-lever are greater range of movement of the clutch-roller and a more delicate graduation of its pressure upon the carbon-holder rod.

In the combination and adjustment of the parts described the balancing-weight B, which is preferably of lead, and serves also as a connecting-link between the armature-lever L and the clutch-lever *l*, is made of such weight that when no electric current is passing through the lamp the armature-lever will poise in equilibrium, or substantially so, though a slight variation from this condition is not material.

The clutch-collar is adjusted by means of the adjustable screw-stop *t*, Fig. 1, so that the armature-lever being poised in equilibrium, and the carbon-holder perpendicular in position, the carbon-holder can slip through the four holes through which it passes, the carbon-holder being a round straight rod or tube of brass or other conducting material, and the holes through which it passes being made to fit it as closely as may be without impeding its free vertical movement. By the adjustable screw-stop *t'*, Fig. 1, the motion of the armature-lever is restricted within such limits as to prevent too wide separation of the carbons.

The coarse-wire helices H H are electrically connected with the main circuit, passing through the lamp and carbons, and the fine-wire helices *h h* are set in a shunt-circuit, which is electrically connected with the main circuit at the points of its entrance into and exit from the lamp.

The operation of the regulator is as follows: The electric circuit being open, the upper carbon and holder drop down by their own gravity until the points of the two carbons are in contact. Upon the closing of the circuit the current flows freely through the helices H H, and they draw the poles of the U-magnet M downward in their hollow centers by the axial attraction created by the electric current in their coils. The motion thus produced is communicated in contrary direction by means of the armature-lever L and balancing-weight B and its connections to the clutch-lever *l*. The clutch is tightened upon the carbon-holder, and the carbon-holder and carbon lifted up. Between the points of the carbons thus separated the electric arc is formed. As the combustion of the carbons increases the length of the arc, and its consequent resistance to the passage of the electric current, a portion of the current is forced through the shunt-circuit round the fine-wire helices *h h*, in consequence of which the armature A is attracted downward by their magnetized cores. At the same time the attracting force of the helices H H is gradually weakened by the diminution of the current in their coils, and by both causes operating together the pressure of the clutch upon the carbon-holder is relaxed with the utmost delicacy

of graduation and the carbon-holder allowed to slip downward. Upon the least approximation of the carbon points the pressure of the clutch is tightened by a reverse process in a degree exactly graduated to the diminution of resistance in the arc. The result of this delicate and reciprocal play of parts and forces is to preserve a constant relation between the length of the arc and the grasp of the clutch upon the carbon-holder, and to keep the points of the carbons at a nearly constant and unvarying distance apart.

One important principle embraced in our invention is the application of the axial motion of the U-magnet M through a field of decreasing force in the coarse-wire-helix centers to the lifting and sustaining of the carbon-holder, in combination with the motion of the armature A in close proximity to the poles of the fine-wire-helix cores in a field of intense and varying magnetic attraction—a force which is exactly adapted to interrupt and counteract any tendency of the U-magnet to separate the carbon points too far apart. It is obvious that this principle may be applied by means of other devices and combinations besides those employed in the regulator, as herein specially described; and we do not limit ourselves in the application of this principle to the precise forms, devices, and combinations described. For example, instead of four helices, as described, two might be employed, one of coarse and one of fine wire, with suitable modifications of the connecting and working parts, such modifications being too simple and obvious to require description; or, instead of either of the clutches described, any other form of clutch fitted to grasp and lift the carbon-holder by upward movement and relax its pressure upon the carbon-holder by downward movement may be used; or the clutch of whatever form might be applied directly to the carbon instead of to a carbon-holder, as we have described.

We are aware that in the construction of electric-arc lamp regulators by others heretofore helices of conducting-wire electro-magnets, armatures, and clutches have been made and used in various forms and combinations for the purpose of producing and regulating automatically the separation and approximation of the carbons, and we do not claim broadly to be the inventors of such helices, magnets, armatures or clutches, or their application generally to the construction of an automatic electric-arc-lamp regulator, but only of the specific devices and combinations herein specifically stated and claimed.

Having fully described our invention, that which we claim as novel and useful, and desire to secure by Letters Patent, is the following, viz:

1. In electric-arc-lamp regulators, and in combination, a solenoid whose core has an adjustable connection with one end of a pivoted lever, and a weight and shunt-helix at the other end of said lever, substantially as and for the purposes set forth.

2. In electric-arc-lamp regulators, the combination of a solenoid whose core has an adjustable connection with one end of a pivoted lever, a weight and shunt-helix at the other end of said lever, and a carbon-clutch, substantially as and for the purposes set forth.

3. In an automatic electric-arc-lamp regulator, the coarse-wire helices H H, the fine-wire helices *h h*, with soft-iron cores fixed in their centers, the pivoted lever L, the soft-iron U-magnet M, the soft-iron armature A, the balancing-weight B, the clutch, the adjustable screw-stops *t* and *t'*, and the supporting-frame, combined and operating substantially as described and set forth.

4. In a roller-clutch to be applied to the carbon or carbon-holder in an automatic electric-arc-lamp regulator, a bent lever pivoted to the clutch-collar by its shorter arm, and to the lifting-piece, lever, or other device of the regulator by the other or longer arm, and to the roller at its angle or apex, substantially as described and set forth.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in presence of two witnesses.

JAMES A. JENNEY.
CHARLES D. JENNEY.

Witnesses:
S. U. WEBB,
JAMES T. A. BAKER.