(No Model.) 2 Sheets—Sheet 1.

J. B. ALLEN.

ELECTRIC ARC LAMP.

No. 309,816. Patented Dec. 30, 1884.

Fig. 1.

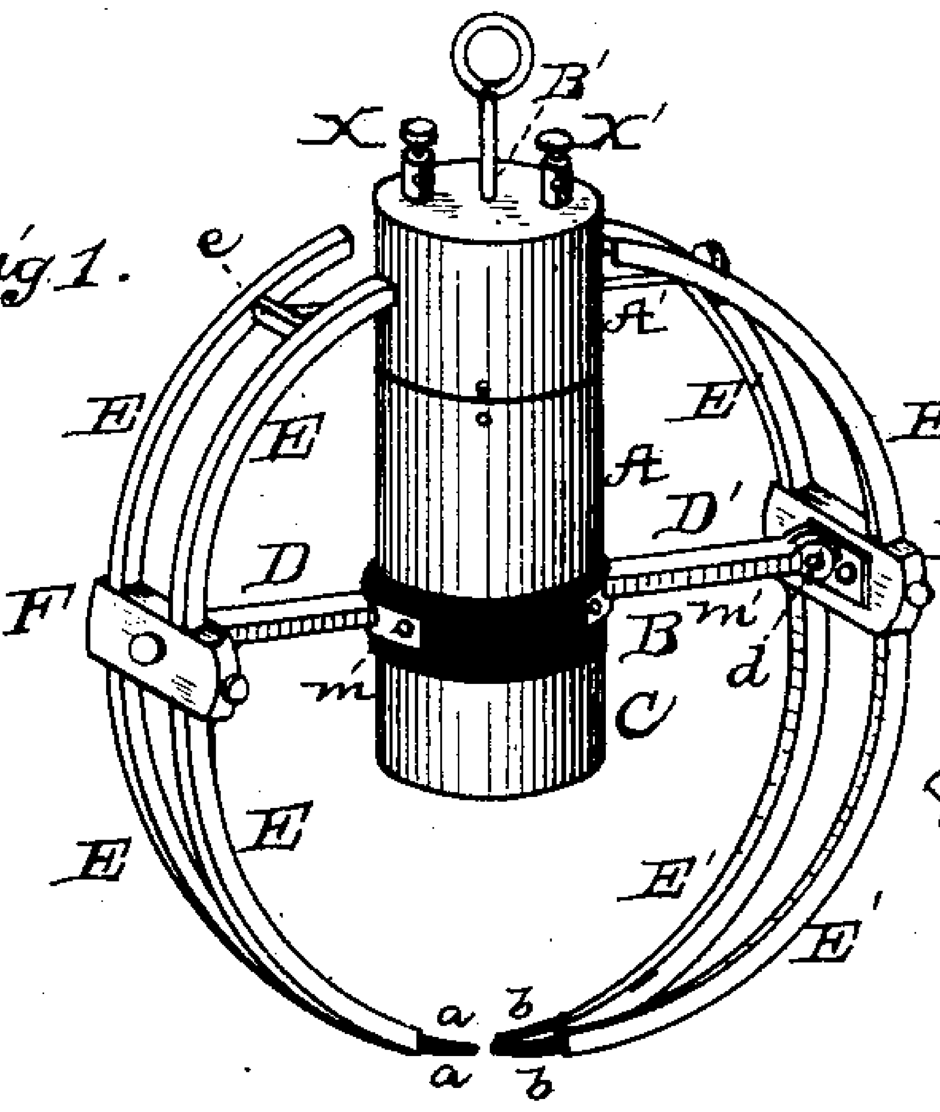


Fig. 2.

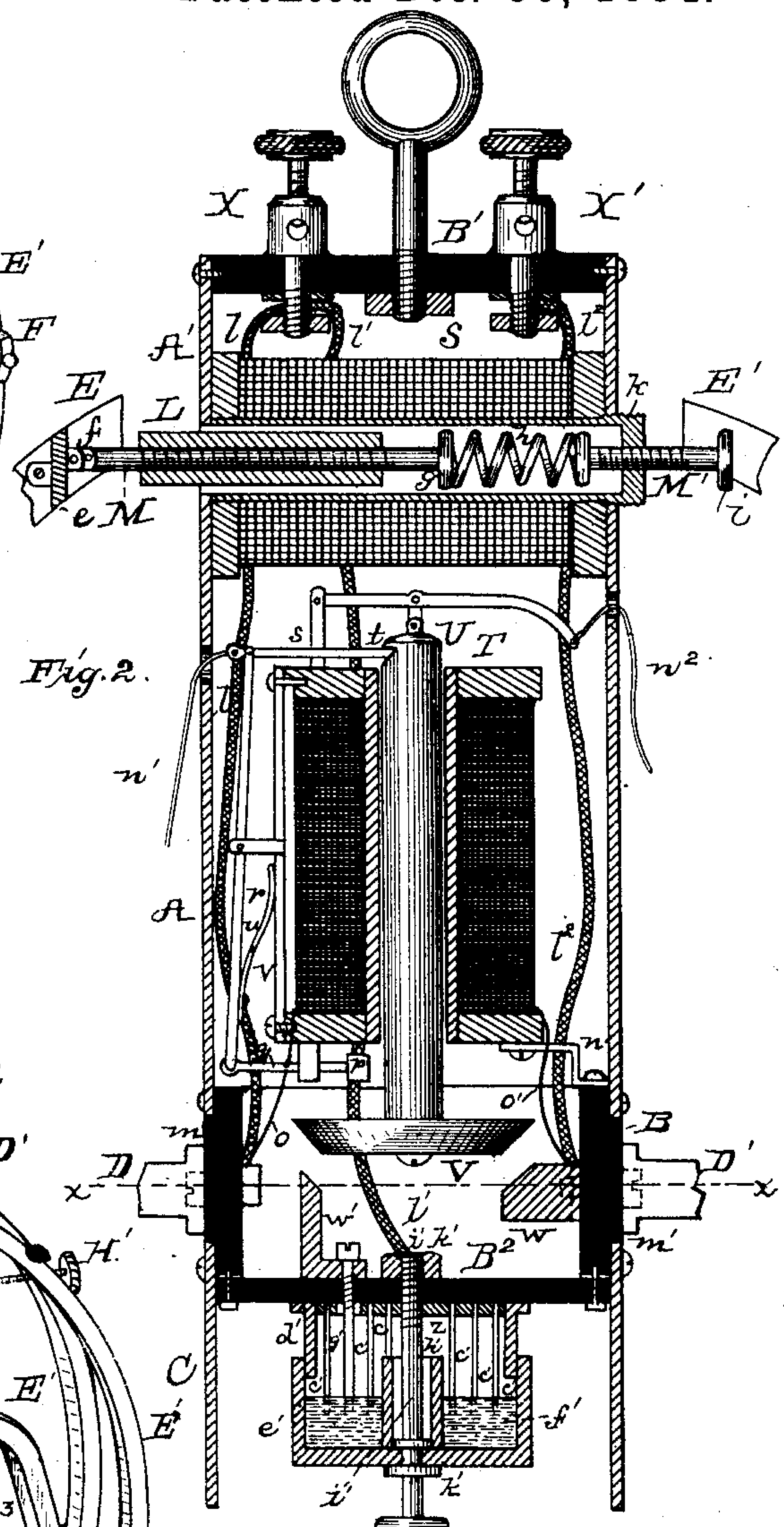


Fig. 4.

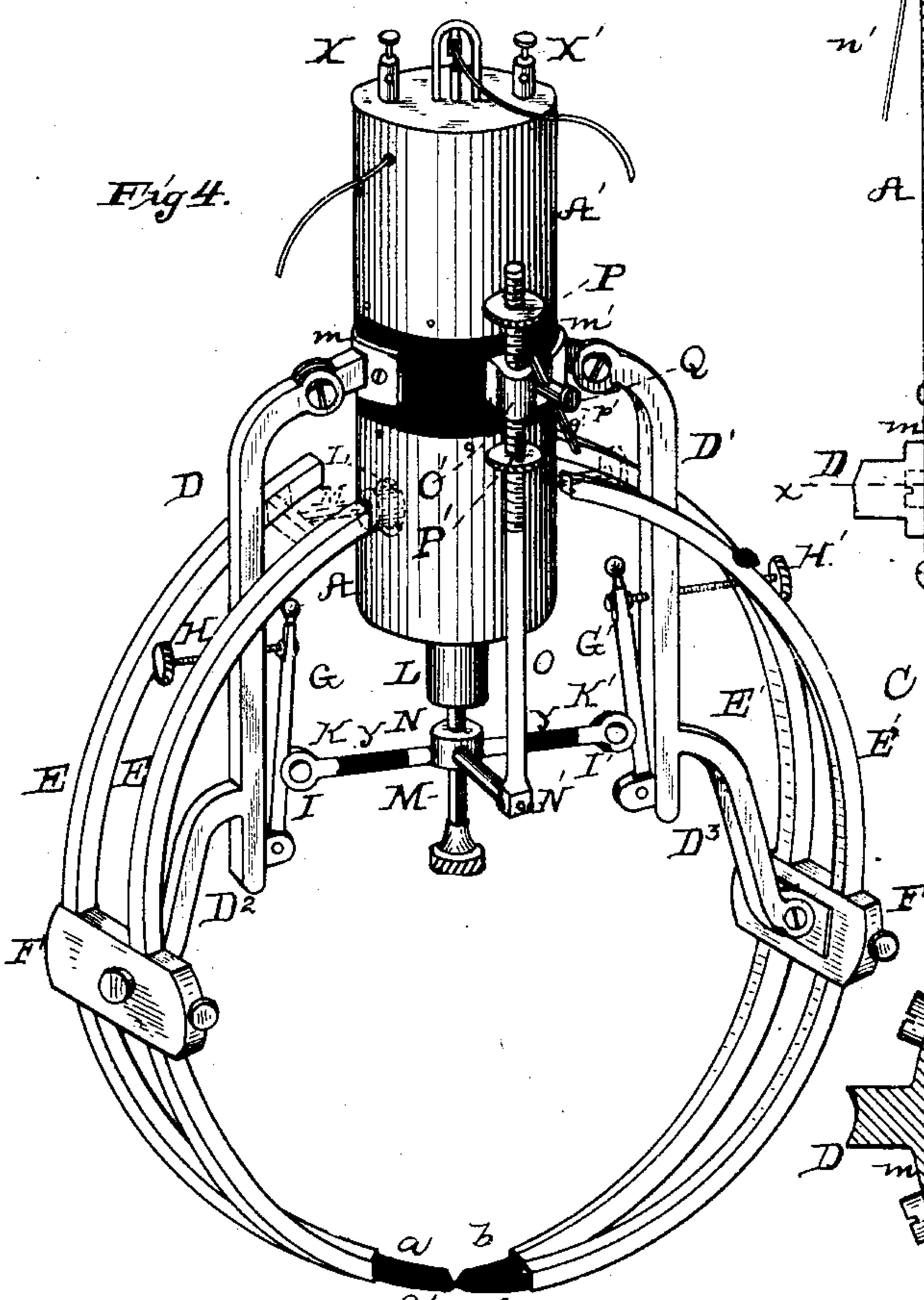
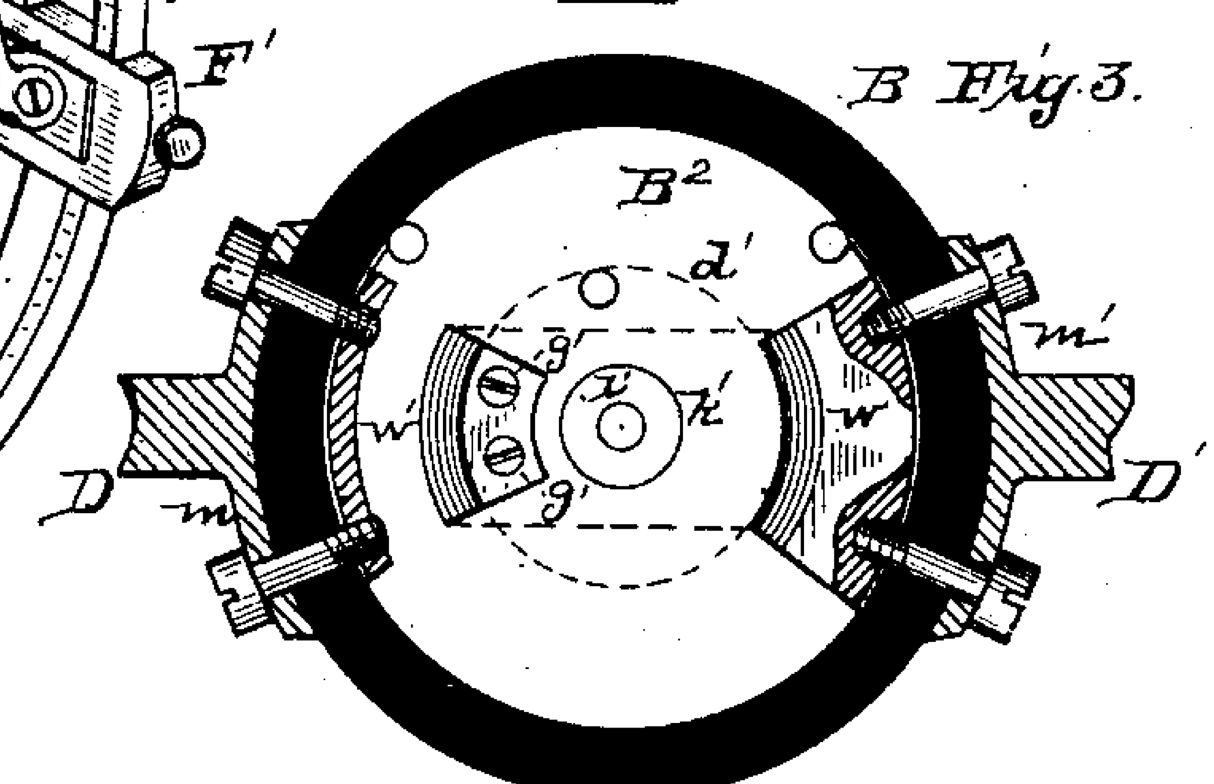


Fig. 3.



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INVENTOR:
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Attys

(No Model.)

2 Sheets—Sheet 2.

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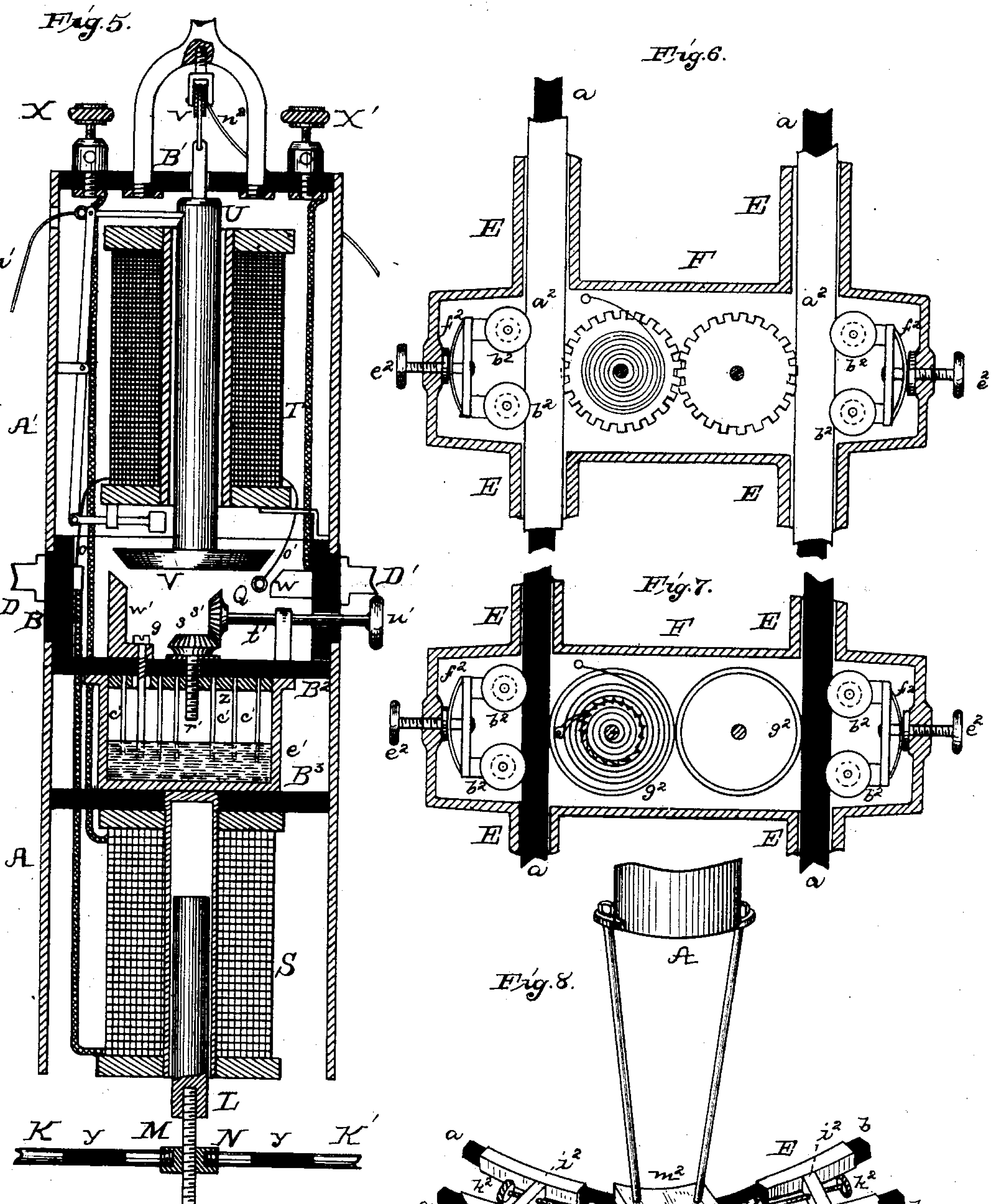

Fig. 5. Fig. 6. Fig. 7. Fig. 8.

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UNITED STATES PATENT OFFICE.

JOSEPH B. ALLEN, OF SPRINGFIELD, ILLINOIS.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 309,816, dated December 30, 1884.

Application filed September 21, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH B. ALLEN, of Springfield, in the county of Sangamon and State of Illinois, have invented a certain new and useful Improvement in Electric-Arc Lights, of which the following is a specification.

The object of this invention is to produce an electric light of the voltaic-arc type which shall be simple and compact in its construction and efficient in operation; and said invention consists in the novel devices and combinations of devices employed by me in accomplishing this object, as hereinafter set forth and claimed.

My invention is illustrated in the accompanying drawings, in which Figure 1 is a perspective view of a complete lamp embodying the preferred form of the invention; Fig. 2, an enlarged vertical section of the cylinder which incloses the regulating and cut-out devices; Fig. 3, a transverse section of the same on the line *x x* of Fig. 2; Fig. 4, a perspective view of a modified form of my lamp; Fig. 5, a vertical section of the cylinder in such modified form. Figs. 6 and 7 are details of mechanism for controlling the movement of the carbons, and Fig. 8 illustrates the use of pieces of refractory material for assisting the light.

Referring, first, more especially to Figs. 1, 2, and 3, the lamp consists of a cylinder composed of metal sections A A′ C, which form a casing, and a section, B, of insulating material.

To the outside of the insulating section B are rigidly attached, as shown at *m m′*, the arms D D′. Each arm D has near its outer end a hinged joint, *d*, and the hinged end piece of each is attached to one of the boxes F F′. Each box F connects two carbon-holding tubes, E E or E′ E′. Such tubes are of semicircular shape, and the two tubes, with the box F, form a carbon-carrying frame. Tubes E E converge toward their lower ends, and tubes E′ E′ likewise converge, so that the curved carbons *a a*, carried by tubes E E, form one electrode of the lamp, and carbons *b b*, carried by E′ E′, form the other electrode. The position of frames E and E′ is adjustable at *d d*, so that the proper position for the arc can be attained; but before the lamp is put in operation frame E′ is fixed by tightening the screw at the hinge so that the regulation of the arc is accomplished by the movement of one electrode alone. The semicircular carbons *a a b b* may be of any suitable section, flat, half-cylindrical, or square, and those of each pair forming one electrode converge at an acute angle touching at their ends. A point of consumption is thus formed for the electrode which remains constant, being determined by the geometrical intersection of two fixed lines and not by any regulating mechanism. If the carbons are not burning, each pair is prevented from moving forward by the contact at the points; but when the lamp is in operation they will move forward just as fast as they are consumed, and the points will always be in contact. The tubes E E, which are movable in the operation of the lamp, are connected near their upper ends by a cross-piece, *e*. To the middle of this cross-piece a long screw, M, is attached by a link-joint, *f*. Upon this screw M is screwed the movable soft-iron core L of a magnet or solenoid, S, supported horizontally in the upper part of the cylinder and having its coils included in the main circuit. Screw M terminates in a round head, *g*, from which a spring, *h*, extends and is connected with screw M′, which passes through a piece, *k*, in the side of the casing and has a milled head, *i*. Spring *h* opposes the attraction of magnet S, and its tension is adjusted by screw M′. Core L is adjustable upon screw M, and the amount of play of such core in and out of S can thus be adjusted for the different currents with which the lamp may be used. These parts form the whole of the regulating apparatus in this form of lamp, and their operation is as follows: The electrodes being together when current passes to the lamp, magnet S draws core L and screw M toward it, and thus moving the pivoted frame E E separates the electrodes at their lower ends and starts the arc. If the arc becomes too long the magnet weakens, and spring *h* causes the frame to move in the opposite direction and bring the electrodes to their proper position again.

The cut-out mechanism shown in Figs. 1, 2, and 3 is, in general, similar to that set forth in my Patent No. 275,345. In the present case, however, instead of simply closing circuit around the lamp, I close circuit through a resistance equal to that of the lamp, and I provide an adjustable resistance, so that it can be altered for use under different conditions.

The circuits through the lamp are as follows: From binding-post X two wires, l and l', extend. Wire l includes the coils of magnet S, and thence extends to the metal piece m. Thus connection is made through arm D and tubes E E to electrode a a. From binding-post X′ wire l^2 extends direct to m', and is thus connected with electrode b b. The binding-posts are inserted in the piece of insulating material B′, which closes the cylinder at the top. The high-resistance magnet or solenoid T, which operates the cut-out, is supported from B by piece n. Its coils are in the fine-wire shunt o o', extending from m and m'. Below it is placed the soft-iron armature p, supported at the end of rod q, and from the other end of q the vertical rod r extends to above the magnet, and projecting from it is the catch s, whose edge enters a notch, t, near the top of the movable core U of magnet T. To the lower end of U is secured the metal piece, **V**-shaped, as a part of a cone. A flat spring, u, secured to r, presses against piece v, secured to the side of the magnet.

Within the insulating-section B on one side is secured the curved metal block w, beveled on the upper edge of its inner side. The lower end of B is closed by the insulating-disk B^2, and this supports the metal piece w', which also is of curved form and beveled at its top.

Upon the lower side of disk B^2 is secured a metal plate, z. From this plate extend downwardly a number of carbon rods, c' c', of different lengths. An insulating-cylinder, d', extends down from disk B^2, and upon it fits a cup, e', of insulating material containing mercury f'. Long screws g' g', which attach piece w' to piece B^2, extend through apertures in plate z without touching the plate, and dip into the mercury. A hollow tube, h', of insulating material is in the center of cup e', and through the bottom of the cup, through tube h', and through disk B^2 extends the screw i', having nuts k'. By turning screw i' the cup e' is moved up or down, so that more or less of the carbon pencils dip into the mercury. The wire l' from binding-post X is connected at the upper end of screw i'. The parts being in the position shown, if the carbons break or current through them ceases from any other cause, current will pass through the high-resistance shunt o o', the magnet T will be energized, and the magnetism of core U will attract armature p forward, so that the catch s will be withdrawn from the notch and the core U will drop, its weight being too great to be upheld by the magnet. The piece W then bridges the contacts w and w', and circuit is closed from binding-post X, through wire l', screw i', plate z, carbon pencils c', mercury f', screws g' g', contact-piece w', cut-out V, contact w, and wire l^2, to binding-post X′. A circuit of equal resistance to the lamp is thus closed around the arc, and this resistance is adjustable by varying the number of carbon rods in contact with the mercury.

When the lamp is not in use, it may be cut out of circuit by pulling the cord n', and thus withdrawing catch s and allowing U and V to fall, and it is replaced in circuit by pulling cord n^2, which raises U and V and drops armature p.

The modified form of regulator shown in Figs. 4 and 5 allows a very delicate adjustment of the distance between the electrodes, permitting a wide range of movement of the core of the controlling-magnet for producing very slight changes in the distance between the electrodes.

The main-circuit magnet or solenoid S is placed vertically in the cylinder, being supported from the insulating-disk B^3, and its movable core L projects below the cylinder. In this case the core is solid, and is placed upon the end of screw M, which passes through the block N, and by turning the screw the position of the core relative to the magnet is adjusted. From block N the two arms K K′ extend, each having an interposed section, y, of insulating material. At the ends of these arms, respectively, are carried the grooved wheels I I′, which run on rods G G′, which rods are hinged at their lower ends to the main arms D D′ of the lamp, which in this case are hinged at their inner ends, and are curved downwardly and connected with the boxes F F′ of the carbon-carrying frames by arms D^2 D^3, which in fact form parts of the main arms. Screws H and H′ pass through arms D D′ and rods G G′, by turning which the inclination of the latter is changed. A third arm, N′, extends from block N at right angles to K K′, and carries at its end a rod, O, which extends up through guide O′, supported from insulating-section B, the upper portion of which rod is screw-threaded, and has upon it the two nuts P and P′. A metal strip, p', extends from guide O′ to plate m', from which arm D′ extends. A binding-post, Q, projects from the insulating-section and carries two small metal strips or rods, q', extending up beneath the nut P. Within the cylinder from binding-post Q wire o' extends to the high-resistance helix T of the cut-out. The other connection, o, of helix T is to m. By adjusting the nuts upon screw O the extent of movement of core L is determined.

The cut-out mechanism is substantially like that previously described; but it is placed in the upper part of the cylinder, and instead of mercury-cup e' being adjustable, the plate Z, which carries the carbon-resistance rods c' c', is movable relative to the cup by turning screw r' through the bevel-gears s' s', by means of spindle t', whose head u' is without the case. Further, the cord n^2, by which core U is raised, in this case extends over a pulley, v', at the top of the cylinder, as in my patent above referred to.

The operation of these regulating and cut-out devices is as follows: Circuit being closed to the lamp, when the electrodes are together, the drawing up of core L moves the grooved rollers I I′ up the rods G G′ and forces the arms D D′ out, thus forming the arc, and the arc is then regulated by the movement of the rollers on the rods, caused by changes in strength of magnet S. If the arc-circuit is interrupted in any way, core L falls, and with it rod O, and nut P′ strikes q', closing circuit through O′, p', Q, and o' to solenoid T, when the cut-out acts to throw the carbon-resistance rods into circuit, as previously explained.

A mode of combining the two forms of regulating apparatus above set forth is illustrated by the dotted lines in Fig. 4. The magnet S is placed horizontally, and core L and screw M are arranged as in Figs. 1 and 2. The carbon-carrying frames are then hinged upon arms D D′, as in Figs. 1 and 2, and said arms are not themselves hinged, as in Figs. 4 and 5. The cut-out devices are placed in the lower end of the cylinder, below the horizontal magnet, precisely as seen in Figs. 2 and 3.

Devices for assisting the feeding forward of the carbons in the tubes are illustrated in Figs. 6 and 7. In the form shown in Fig. 6 the carbons are inclosed in separate rack-tubes a^2 a^2, which pass through the boxes F. On one side of each tube the two grooved rollers b^2 b^2 bear, while between the tubes are the two cog-wheels c^2 c^2, driven by the spring d^2, which assists the force of gravity to drive the carbons down as they are consumed. When new carbons are put in, the racks are pushed up again, and the spring is thus wound up. The pressure of rollers b^2 is adjusted by set-screw e^2 and spring f^2.

In Fig. 7, instead of the cog-wheels and racks, wheels g^2 g^2, having rubber tires which bear directly upon the carbons themselves, are used.

To further increase the steadiness and uniformity of the light, as well as to render it softer and less trying to the eye, I place a triangular piece of highly-refractory insulating material, h^2, Fig. 8, between the carbons of each electrode. It is supported adjustably from cross-piece i^2 by screw k^2, and fits the angle closely. Besides, by its incandescence, rendering the light steadier and brighter, this refractory piece keeps the air from the inner surfaces of the carbons, and thereby prevents them from being consumed back of the point of contact, thereby keeping the angle of intersection of the inner surfaces fixed, and preventing any change in the distance between the carbons. I employ, also, a third refractory piece, m^2, placed on top of the two electrodes and supported from the cylinder. The bottom of this piece is curved to fit the curved carbons, and the arc plays along it, so that it becomes heated to incandescence, and thus makes the light more brilliant, steadier, and softer.

The carbons which I use I prefer to make in the following manner: I cut paper or cloth, or other suitable carbonizable material, into pieces of the proper curved shape, soak these in a tarry or resinous material and pack them in a mold, sifting over each a small quantity of coke-dust, and pressing them all tightly together, and then carbonize. This form of carbon disintegrates rapidly, and thus more incandescent particles are thrown into the arc, and it is made more luminous.

It is evident that more than two carbons, all converging at acute angles, may be used for each electrode, and may be arranged and regulated in the manner described.

What I claim is—

1. In an electric-arc lamp, an electrode consisting of two or more curved carbons situated side by side and meeting at an acute angle or angles, substantially as set forth.

2. The electrodes of an electric-arc lamp, each consisting of two or more curved carbons situated side by side and meeting at an acute angle or angles, substantially as set forth.

3. In an electric-arc lamp, the combination of two curved pivoted frames carrying the electrodes, an electro-magnet or solenoid having its coils in the main circuit, its movable core or armature, and suitable mechanical connections from said core or armature to said frames, substantially as set forth.

4. In an electric-arc lamp, the combination, with a supporting-body, of two pivoted frames, each consisting of two curved tubes converging toward their lower ends, and each tube holding a curved carbon, substantially as set forth.

5. In an electric-arc lamp, the cylinder inclosing the regulating mechanism and supporting the electrode-carriers, having an insulating section to which such carriers are attached, substantially as set forth.

6. In an electric-arc lamp, the combination of the central cylinder having an insulating-section; the pivoted curved carbon-holding frames attached to opposite sides of said insulating-section, the regulating magnet or solenoid within said cylinder, its movable core, and suitable mechanical connections from said core to said carbon-holders, substantially as set forth.

7. In an electric-arc lamp, the combination, with the converging carbons of a compound electrode, of a triangular piece of refractory insulating material situated in the angle at the meeting-point of said carbons, substantially as set forth.

8. In an electric-arc lamp, the combination, with curved electrodes meeting at their ends, of a similarly-curved piece of refractory insulating material in contact with their ends above the arc, substantially as set forth.

9. In an electric-arc lamp, the combination, with curved electrodes meeting at their ends, each composed of two curved carbons converging at an acute angle, of triangular pieces of refractory insulating material in the angle or

angles of each electrode, and a curved piece of refractory material in contact with the ends of the electrodes above the arc, substantially as set forth.

10. The combination, with an electric-arc lamp, of an adjustable resistance in a shunt around the arc, and means actuated by the cessation of current in the arc-circuit for closing circuit through said adjustable resistance, substantially as set forth.

11. The combination, with an electric-arc lamp, of a mercury-cup and a number of resistance-rods in a shunt around the arc, means for placing more or less of said resistance-rods in contact with the mercury, and means actuated by the cessation of current in the arc-circuit for closing said shunt-circuit, substantially as set forth.

12. The combination of the insulating-disk supported in the cylinder, the plate attached beneath the same and carrying the resistance-rods, the mercury-cup, and the screw for moving said cup up and down, substantially as set forth.

13. The combination of the cut-out magnet or solenoid in a shunt around the arc, the movable core thereof, the catch supporting said core, and adapted to be withdrawn by the attraction of said magnet or solenoid, the contacts bridged by said core when it falls, the plate carrying the resistance-rods, the mercury-cup, and connections from the mercury, and the resistance-rods through such bridged contacts, forming a shunt around the arc, substantially as set forth.

In testimony whereof I have hereunto subscribed my name this 1st day of September, 1883.

JOSEPH B. ALLEN.

Witnesses:

JOEL B. BROWN,

SAM H. GWYMAN.