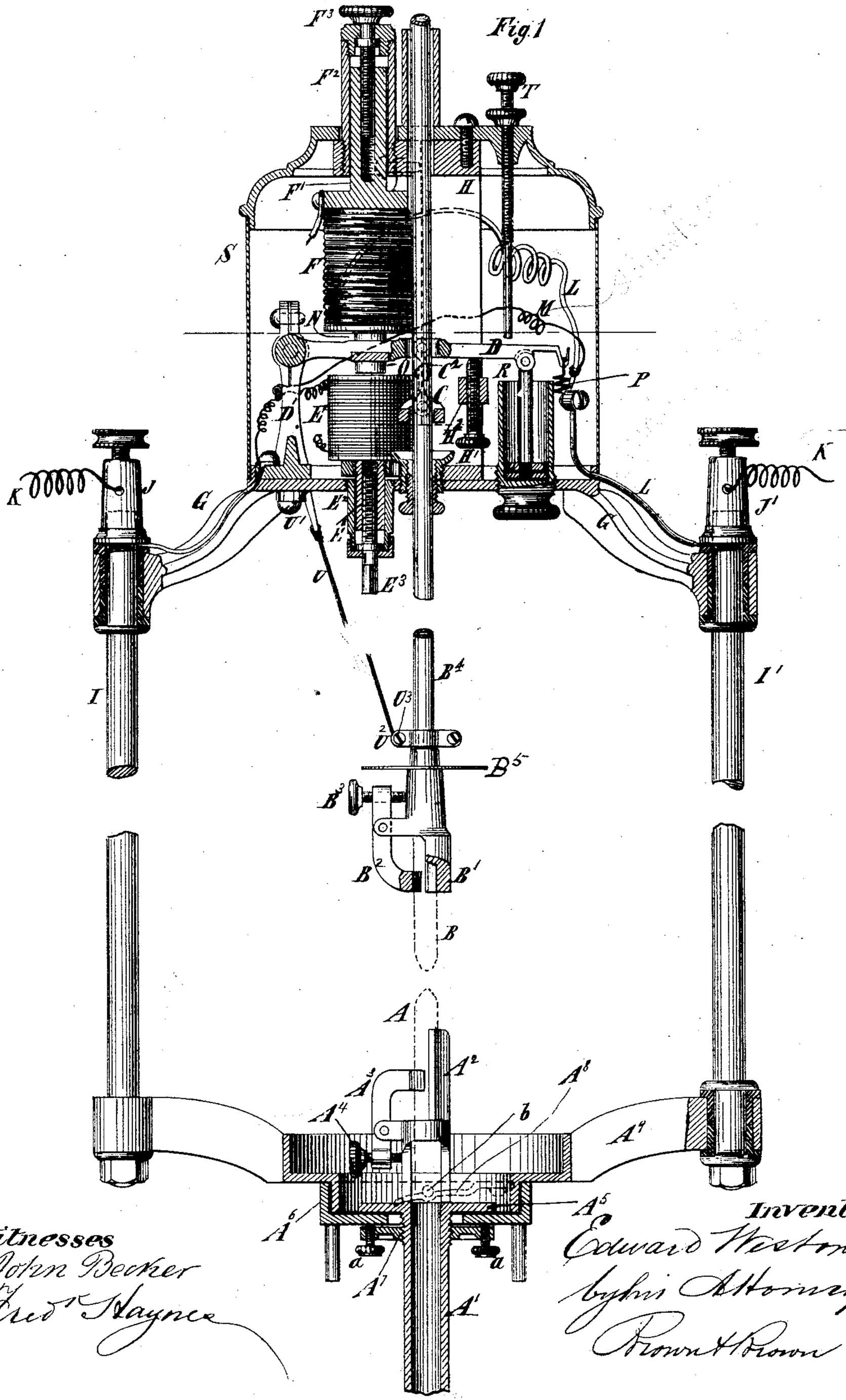
(No Model.) 2 Sheets—Sheet 1.

E. WESTON.

ELECTRIC LAMP.

No. 285,451. Patented Sept. 25, 1883.

Fig 1



Witnesses
John Becker
Fred't Haynes

Inventor
Edward Weston
by his Attorneys
Brown & Brown

(No Model.)

2 Sheets—Sheet 2.

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Fig. 4.

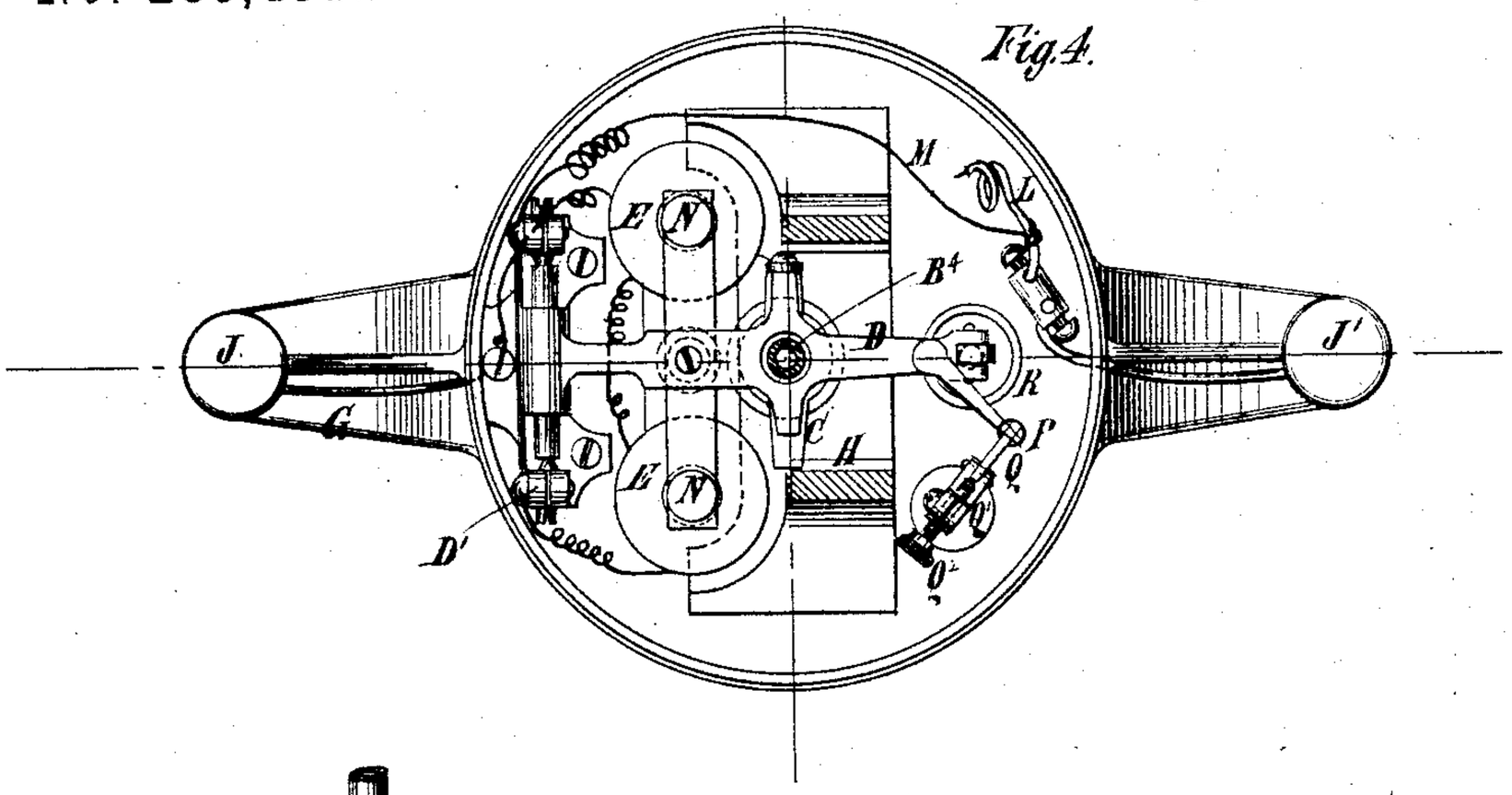


Fig. 2.

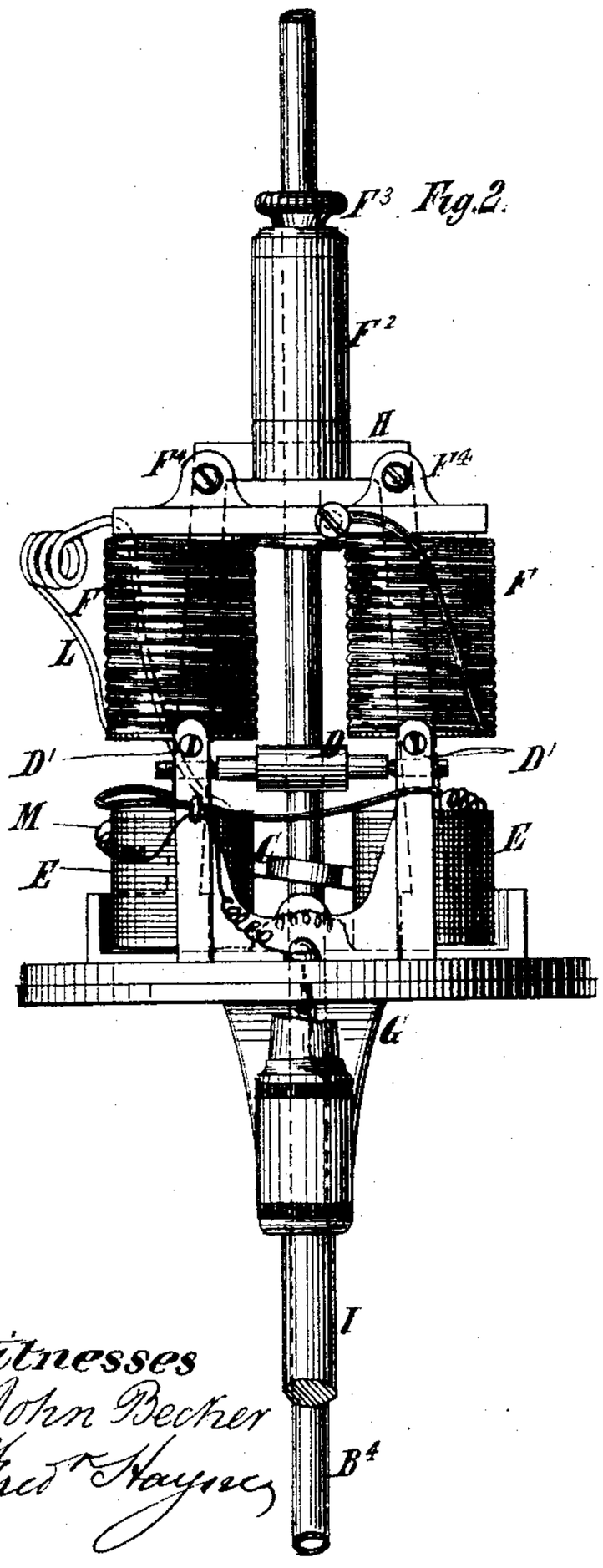
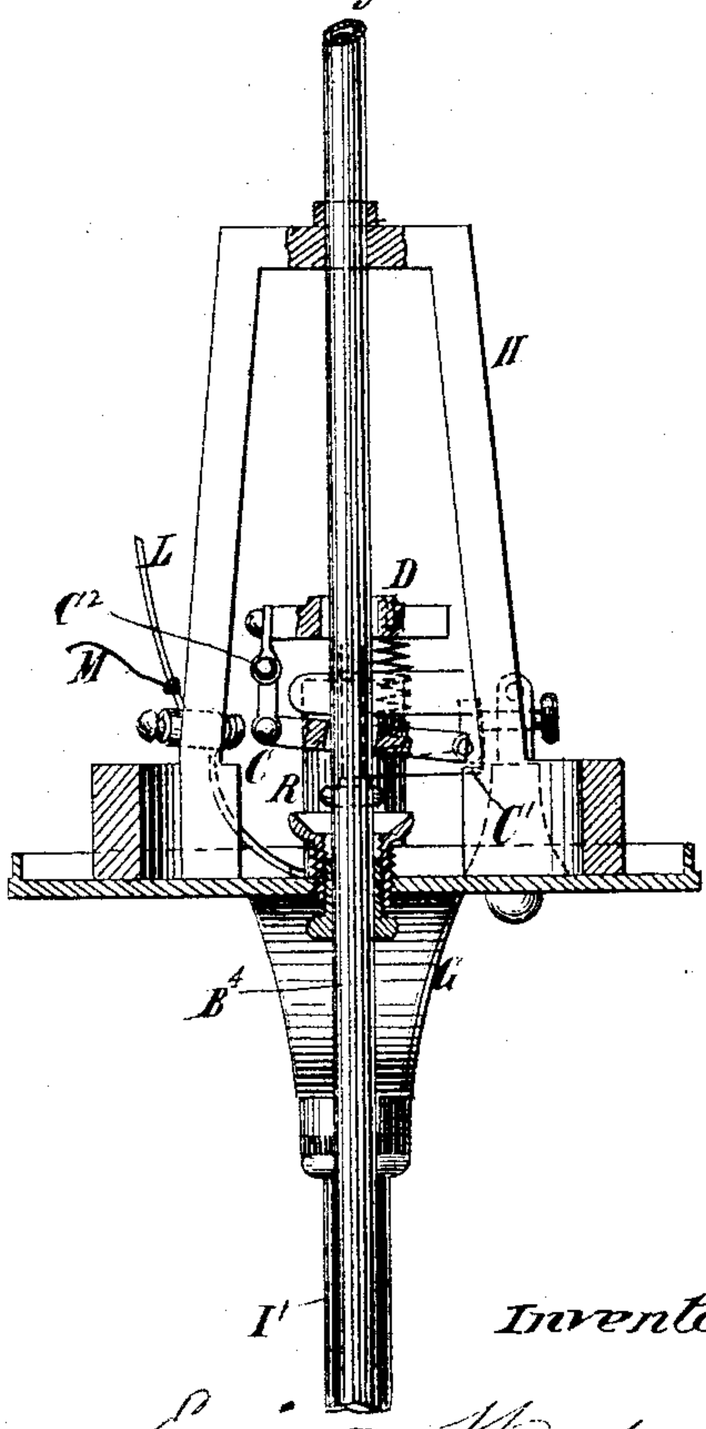


Fig. 3.



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UNITED STATES PATENT OFFICE.

EDWARD WESTON, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE WESTON ELECTRIC LIGHT COMPANY.

ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 285,451, dated September 25, 1883.

Application filed July 16, 1880. (No model.)

To all whom it may concern:

Be it known that I, EDWARD WESTON, of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electric Lamps, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

My invention relates to that class of lamps known as "arc-lamps," and is directed principally to maintaining the carbon electrodes at the proper distance apart during the time the lamp is in operation. For this purpose I make use of two electro-magnets of different electrical resistances, through which the current is caused to pass, the one of low resistance, and included in the main circuit—that is to say, the circuit which includes the carbons—the other of high resistance, and included in a shunt or derived circuit about the lamp. With these electro-magnets I combine an armature or core which, while connected with one of the carbons or its carrier, and adapted to adjust its position relatively to the other, as customary heretofore, is in its movement controlled by and directly dependent upon the counteracting or opposing forces of the two magnets, which vary in accordance with the varying positions of the carbons relatively to one another. When the carbons are in contact or approach one another too closely, and the current through the lamp consequently becomes too strong, the electro-magnet in the main circuit acts to separate the same. When, on the other hand, the distance between the carbons becomes too great, the current passing through the lamp becomes lessened by reason of the increased resistance, and the shunt-magnet, owing to the energizing action of the increased current passing through the shunt-circuit, acts to cause the carbons to approach one another. I thus adjust the carbons to and from one another by the differential action of two electro-magnets—the one of low resistance forming a part of the main or lamp circuit, the other, of higher resistance, forming a part of a shunt or derived circuit; and it is in this feature that my invention mainly is comprised.

In the accompanying drawings I have represented an electric lamp embodying my invention in one of its forms. In this lamp I have also embodied an improved form of carbon-holder and other features which conduce to the practical utility of the lamp, and will be hereinafter described.

Figure 1 is a front view of an electric lamp embodying my improvements. Fig. 2 is a view of a portion of the same, taken at right angles thereto. Fig. 3 is a central vertical section of the feed-regulating mechanism; Fig. 4, a horizontal section thereof, taken just below the upper magnet.

Similar letters of reference indicate corresponding parts in all the figures.

Fig. 1 illustrates a lamp-frame of simple construction, consisting, in the main, of side bars, I I′, properly insulated, and cross-pieces G and A^9—the former widened at its center to form a supporting-base for the feed-regulating devices, the latter provided with a carbon-holder of improved construction, the nature of which will hereinafter be more fully set forth.

Secured within a cover or frame upon the cross-piece G, as above stated, are the devices for effecting the proper relative adjustment and feed of the carbons. These consist, in the main, of an electro-magnet, F, wound with course wire of low resistance, included in the main or arc circuit. An electro-magnet, E, wound with fine wire, and consequently of high resistance, which forms part of a shunt or derived circuit about the arc, a pivoted armature-lever, D, provided with an armature or armatures, N and O, and a clutch or gripping device, C, serving as a means of connection between the armature and the upper-carbon holder, B^4. In the present instance the two magnets above described are shown, the main magnet above, the shunt directly under it and below the armature-lever, this arrangement of the parts named being selected as a convenient and practicable illustration of the principle involved in my invention. The main magnet F is secured to the frame in a vertical position by an extension of its core F′, which is screw-threaded on its interior and

fitted in a cylindrical shell, F^2, in which it is arranged to be adjusted by means of the long adjusting-screw F^3.

In line with the main magnet the shunt-magnet E is fixed by substantially equivalent means—viz., an internally-screw-threaded shank, E′, a cylindrical shell, E^2, forming a stationary support, and a screw, E^3, fitting in the shell E^2 and engaging with the shank E′.

To permit the ready adjustment of the two magnets with respect to the armature-lever D, the top of electro-magnet F is provided, as shown in Fig. 2, with lugs F^4, in which are inserted screws that bear against the frame H, and serve as guides that prevent the said magnet from being twisted or turned while the cross-piece G is extended up around the bottom of magnet E for the same purpose.

The armature-lever D is pivoted at its end to a stationary upright, D′. At a point upon it so as to be most powerfully affected by the magnets E and F are fixed the armature or armatures N and O. These latter, together with the corresponding cores of the magnets, might be of any ordinary construction; but I prefer the form shown in Fig. 1, where N and O designate cylindrical projections from a plate or plates fixed to the lever D, the cores of the two magnets in this case being tubular, so that the said projections may be drawn in and out of them, thus permitting a greater range of motion without diminished attractive power—a result not attainable to a sufficient degree for the successful operation of an electric lamp by the ordinary flat armature.

The upward and downward movements of the lever D are limited by the set-screws T and H′, respectively, the former passing through the frame H, the latter through a support, H^2, secured thereto.

In order to prevent too rapid movement of the lever D, I employ a retarding device, preferably a dash-pot, R, the piston-rod of which is connected with the end of the lever, or an extension therefrom.

A tension-spring, P, may also be connected to the free end of the lever, or to an extension therefrom, and to one arm of an elbow-lever, Q, pivoted to a post or standard, Q′. A set-screw, Q^2, bearing against the other arm of the lever Q, provides for easily and nicely adjusting it to regulate the tension of the spring P. The purpose of the spring is mainly to assist the shunt-magnet in drawing the armature away from the main magnet F.

The lever D is constructed with an opening or ring, through which the carbon-carrier B^4 passes. Attached to the lever by a link, C^2, is a hinged or swinging plate or lever, C, having an opening through which the carbon-carrier slides, and the sides of which grip the carrier when the plate or lever is tilted, thus serving as a clamp to raise or lower the carrier, or allow the same to slip for feeding, according to the relative attractive forces of the feed-controlling magnets, and the consequent position with reference thereto of the armature-lever D.

To insure the proper electrical contact between the frame of the lamp and the upper carbon, I employ a flexible conductor, U, composed, generally, of a number of fine braided or plaited wires, which is connected both to the frame and to a collar, U^2, on the upper carbon-carrier, the former connection being conveniently obtained by a screw, U′, on the yoke G, the latter by a screw, U^3, which provides for an easy means of detaching the conductor from the carrier.

B^5 is a shield or deflector, of metal or suitable material, fixed to the upper-carbon carrier, B^4, near its end. It is designed to protect the carrier from the dust and other impurities that would otherwise be carried up and deposited upon it by the ascending current of heated air from the neighborhood of the arc.

Immediately below the deflector is shown the upper-carbon holder, consisting of a socket, B′, for the reception of pencil B, a pivoted lever, B^2, and a binding-screw, B^3.

In Fig. 1 is shown in section an improved form of holder or socket for the lower carbon. This consists of a hollow rod, A′, an extension-piece, A^2, and a lever, A^3, which may be adjusted by means of a screw, A^4, to clamp and hold or to release the carbon. The hollow rod A′ is provided with a flange or disk, A^5. The rod A′ passes through a large opening in a circular flanged plate, A^6. The disk A^5 rests above it, and another disk, A^7, connected by a screw-thread or otherwise to the rod A′, bears against the lower side of the flanged plate A^6, and provides for securing the rod A′ to the plate A^6 in any position into which it may be adjusted. The plate A^6 is provided with radial pins *b*, which may be slipped over springs A^8, extending from a yoke or cross-bar, A^9, to secure the said rod A′ detachably to it.

I have now described the mechanical elements comprising the operative portions of my invention. Before proceeding to a description of the operation of the same, I desire to make the following statements, an acquaintance with the principles involved in which is requisite to an understanding of the invention:

It is well known that the distribution of the electric current between two branches of the same circuit depends upon the respective resistances of the branches, and is inversely proportional thereto. This has been taken advantage of in the construction of electric lamps by employing a shunt-magnet of high resistance in the place of a retractile spring for an armature actuated by an electro-magnet in the main circuit, and operating to effect the release of the means for impelling one of the carbons toward the other. A second application of the same principle is illustrated in a lamp in which a helix in the main circuit and a reversely-coiled helix in the shunt-circuit are employed to vary the attractive

force of a magnetic core for an armature connected with one of the carbon-carriers, and thus control the position of same and its attached electrode relatively to the other. In such cases, however, the mechanism connected with the carbon-carrier is only actuated by the electro-magnet in the direction to cause it to bind and raise the carbon-carrier, while gravity, or a force such as a spring, is constantly applied as a retractile power, which asserts itself when the attraction of the main magnet becomes weakened or neutralized. By my invention, however, I provide for actuating the mechanism supporting the carbon-holder positively in both directions, as will more clearly appear from the following description of the operation of the devices or their equivalents composing the lamp:

Assuming that the carbons are in contact, and that the lamp is included in an electric circuit from a powerful generating source, if the circuit be closed, the current enters by wire K to binding-post J'. Thence by wire L it passes to and through the coils of magnet F, and thence by the frame of the lamp and flexible conductor U to the carbons, and out by side bar, I, post J, and wire K. Before reaching the magnet F the circuit branches, one branch being that just traced, the other being by a fine wire, M, through coils of magnet E, and thence to line. As soon as the circuit is completed the magnet F becomes active and raises the armature-lever D, causing clamp C to bind and lift the carrier B^1 until the length of the arc formed by the separation of the carbons causes the magnet E to become sufficiently active to check the further movement of the armature-lever. As the ends of the pencils are eaten away by the action of the current an increasing resistance is interposed in the main circuit and diverts a corresponding amount of current through the coils of magnet E. The power of this latter begins, in consequence, to increase, while that of magnet F decreases. Lever D is therefore drawn downward, and with it the carbon, until the position of the lever and clamp allows the carbon-carrier to feed or slip, upon which the magnet F reasserts itself, and the original conditions are again established. To assist the shunt-magnet E an adjustable spiral spring, P, is employed, as above set forth, and to prevent too rapid movement or vibration of the lever D, a retarding device—in this case a dash-pot, R—is connected therewith.

It will thus be seen that the armature-lever, for the purpose of adjusting the carbons relatively to one another, is positively moved in both directions and controlled by the varying attractive forces, or, in other words, by the differential action of two electro-magnets—the one in the main or lamp circuit, the other in a shunt about the lamp.

It is to be observed that "adjusting," as used in this connection, implies not the feeding downward of the upper carbon as it is consumed alone, but the changes of position relatively to the other carbon, which are necessary for maintaining a light of unvarying intensity.

It is obvious that the mechanical arrangement, structure, and disposition of the parts which conduce to this result can be considerably varied without departure from my invention. The two magnets may, for instance, be placed both opposite the same face of the armature-lever, but on opposite sides of its fulcrum; or, in lieu of electro-magnets and armatures, as described, helices and cores can be used. I wish it therefore to be understood that I do not restrict myself to the details herein described by reference to the accompanying drawings in illustration of my invention. The construction of the lamp may be varied in many particulars, though that shown herein will be found a highly efficient and useful form. The constructions and combinations not herein claimed, but shown or described, I reserve the right to make the subject of other applications for Letters Patent; nor do I herein specifically claim electro-magnets or solenoids arranged in the manner herein shown, in combination with a clutch actuated by the same and adapted to grip and move the carbon-holder to establish and regulate the length of the arc and to feed the carbon, as I make the same subject-matter of another application for Letters Patent; but

What I claim as of my own invention is—

1. In an electric lamp, in combination with the carbon electrodes, two solenoids or electro-magnets, one of which has a coil of low resistance, forming a part of the lamp-circuit, and the other has a coil of higher resistance, forming a part of a shunt or derived circuit about the lamp, by the differential action of which the carbons are adjusted relatively to each other.

2. The combination, in an electric lamp, with the carbon electrodes, of two opposed electro-magnets or helices, one in the main circuit and the other in a shunt or derived circuit, and a movable armature or its equivalent, arranged to be actuated positively in both directions by the differential action of the said magnets for adjusting the carbons relatively to each other, substantially as described.

3. The combination, in an electric lamp, with the carbon electrodes, of two electro-magnets, one in the main circuit and the other in a shunt or derived circuit, and an armature adapted to adjust, by the differential action of said magnets, the carbons relatively to one another, the electro-magnets, either or both, having hollow cores, and the armature being provided with projections capable of entering the said hollow cores, substantially as set forth.

4. The combination, in an electric lamp, with the carbon electrodes, of two opposed electro-magnets or helices, one in the main circuit and the other in a shunt or derived cir-

cuit, a movable armature or its equivalent arranged to be actuated positively in both directions by the differential action of the said magnets for adjusting the carbons relatively to each other, and a retarding device—such as a dash-pot—connected with the said armature, substantially as and for the purpose set forth.

5. The combination, in an electric lamp, with the carbon electrodes, of two opposed electro-magnets or helices, one in the main and the other in a shunt or derived circuit, a movable armature or its equivalent arranged to be actuated positively in both directions by the differential action of said magnets for adjusting the carbons relatively to each other, and a spring exerting an influence upon said armature in the same direction as that exerted upon it by one of the said magnets or helices, substantially as specified.

6. The combination, in an electric lamp, with the carbon electrodes, of two opposed electro-magnets or helices, one in the main circuit and the other in a shunt or derived circuit, an armature or its equivalent arranged to be actuated positively in both directions by the differential action of said magnets for adjusting the carbons relatively to each other, a lever supporting said armature, means for forcing the lever in one direction, and an adjusting device whereby the force exerted upon said lever may be varied, as desired, substantially as set forth.

7. The combination, in an electric lamp, with the carbon electrodes, of two opposed electro-magnets or helices, one in the main circuit, the other in a shunt or derived circuit, an armature or its equivalent arranged to be actuated positively in both directions by the differential action of the magnets, a lever supporting the armature, a retarding device—such as a dash-pot—connected with the lever or its armature, and a spring for exerting an influence upon the armature in the same direction as one of the magnets, as herein set forth.

EDWARD WESTON.

Witnesses:
EDWIN H. BROWN,
T. J. KEANE.