(No Model.)

2 Sheets—Sheet 1.

T. L. DENNIS.

ELECTRIC LAMP.

No. 306,005.

Patented Sept. 30, 1884.

Fig. 1.

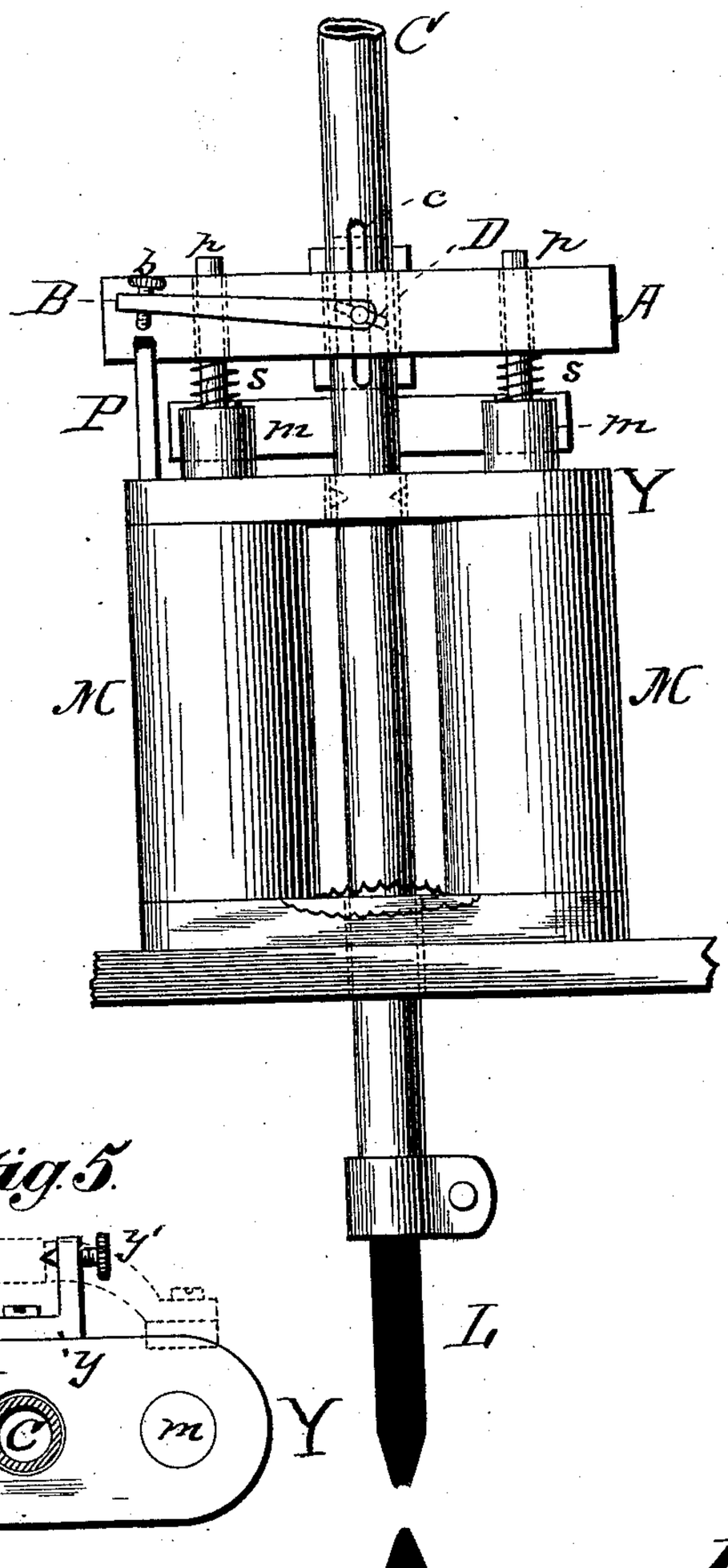

Fig. 5.

Witnesses.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

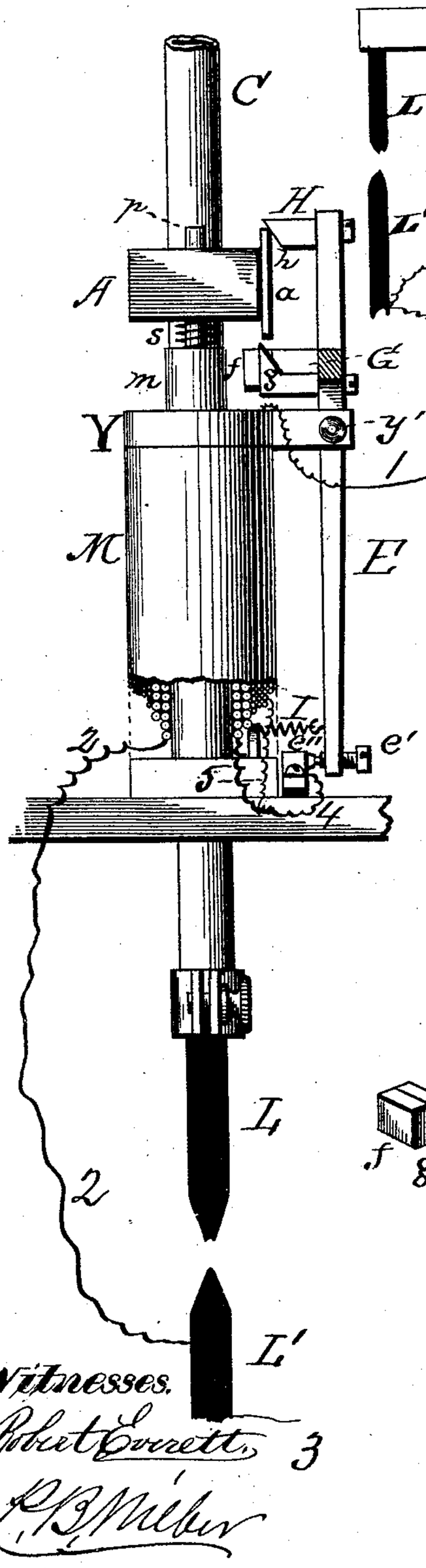


Fig. 6.

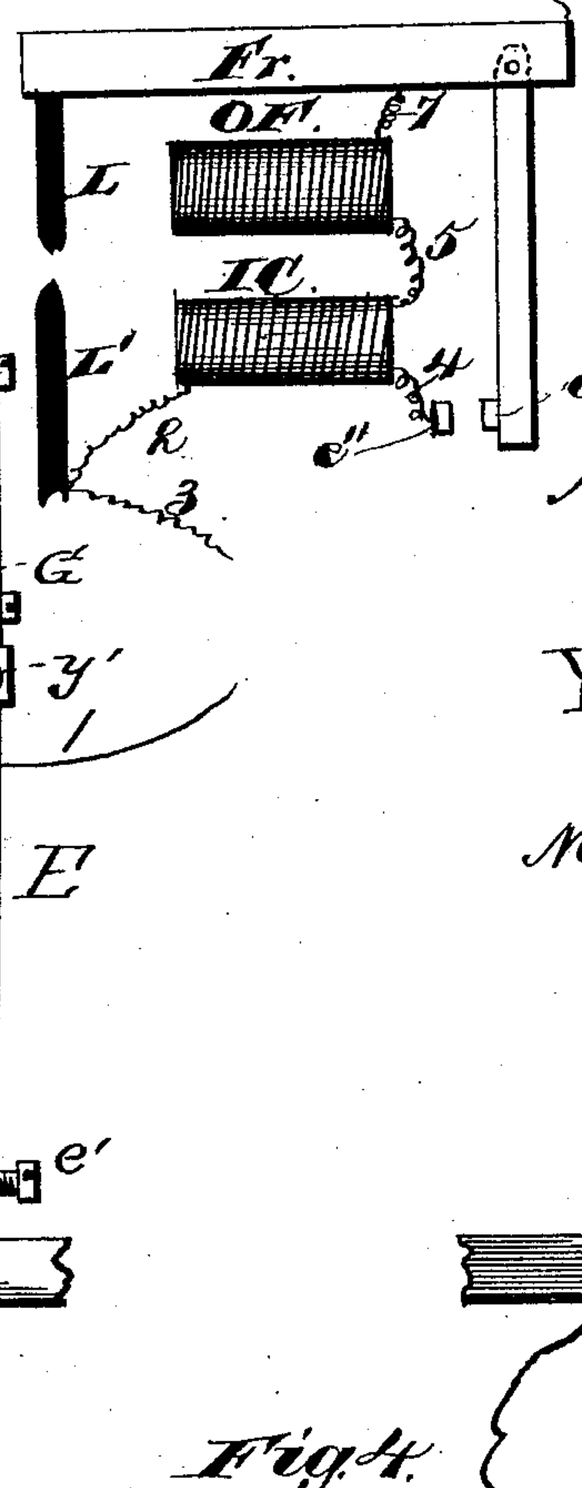


Fig. 3.

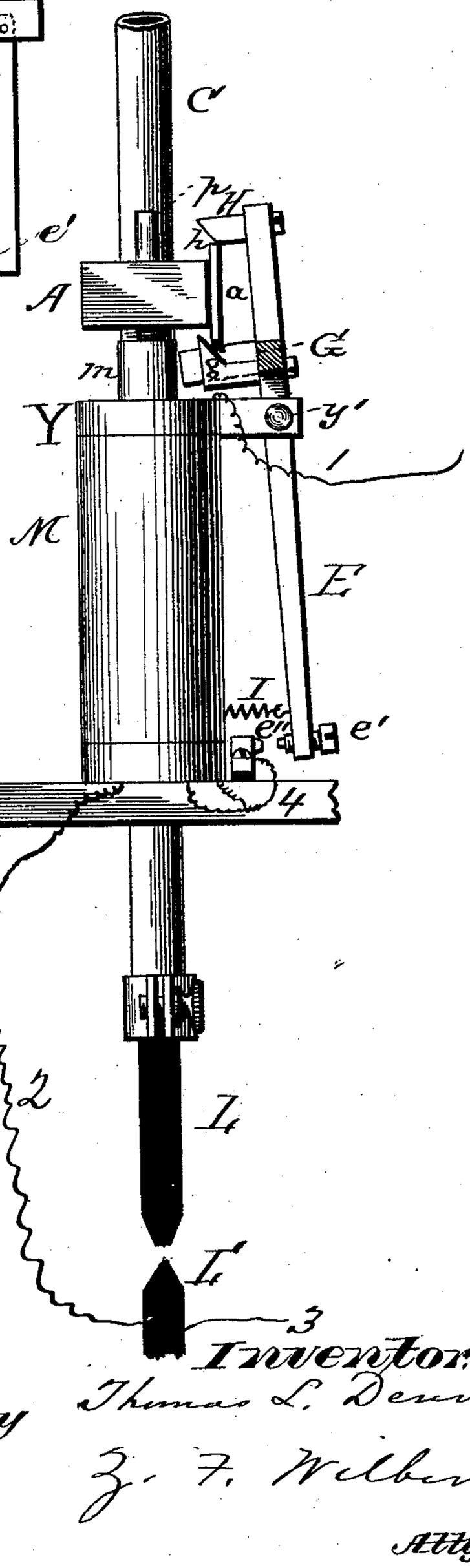
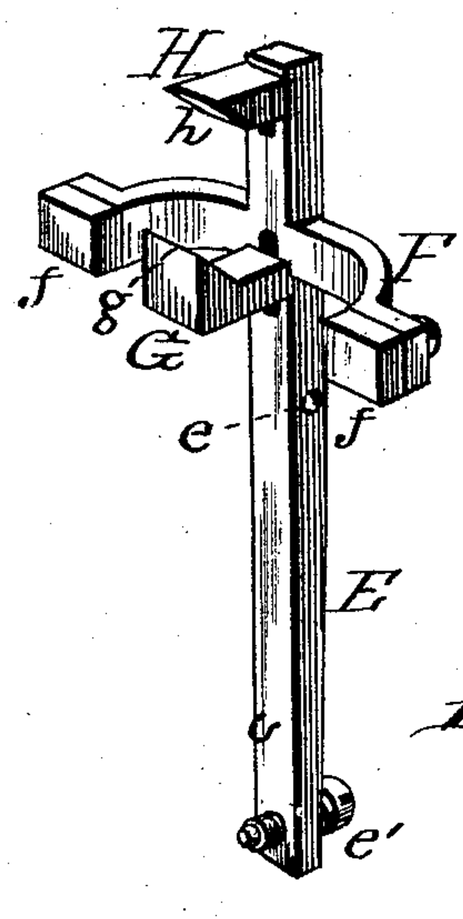


Fig. 4.



Witnesses.
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Inventor:
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UNITED STATES PATENT OFFICE.

THOMAS L. DENNIS, OF NEWBURYPORT, MASSACHUSETTS, ASSIGNOR TO THE COLUMBIA ELECTRIC LIGHT AND MANUFACTURING COMPANY, OF NEW YORK, N. Y.

ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 306,005, dated September 30, 1884.

Application filed September 26, 1883. (No model.)

To all whom it may concern:

Be it known that I, THOMAS L. DENNIS, of Newburyport, in the county of Essex and State of Massachusetts, have invented a new and useful Improvement in Electric Lamps; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

In a prior application made by me (Serial No. 76,030 of 1882) I have shown an electric lamp in which the feed is controlled by a single magnet in a shunt to the carbons and a resilient spring, and to that application reference is made for the general principles involved in this application.

This invention is an improvement upon the invention shown in that case, the object hereof being to provide such an arrangement of devices as shall furnish an efficient and reliable "starter" for the lamp when the current is thrown therethrough, automatic in its action, and also improve the feed of the carbons necessary upon their consumption in giving the required light. In this case I divide the wire of the magnet into two or more sections, with a connection between them, controlled by a lever or key contact controlled in turn by the magnet itself, so that the amount of wire of the coil or resistance in the magnet-circuit is automatically adjusted to meet the requirements of the lamp. This is fully explained hereinafter, and illustrated in the drawings, in which—

Figure 1 is a front view of the feeding devices of a lamp embodying my invention, while Fig. 2 is a side view, partly in section, of the same, the carbons being in their normal inactive position; and Fig. 3, the same with the carbons brought together to form the arc. Figs. 4 and 5 are views of details of construction. Fig. 6 is a diagrammatic view showing the circuits in the lamp.

L L′ represent the upper and lower carbons, respectively—L the carbon to be fed to compensate for waste, being secured in the carbon-holder C, while the holder of L′ is not shown, it, as well as the general framing of the lamp, involving no feature of the invention. The upper-carbon holder, C, passes through suitable supports between the legs of the magnet M M. The magnet M M is in a shunt-circuit to the carbons L L′, and is provided with extended poles *m m*, from which project guide-pins *p p* for its armature A, capable of a vertical motion thereon, this armature being kept normally away from these poles by any suitable springs, here typified by the springs *s s*, placed around the pins *p* and between it and the poles. The carbon-holder C is formed as a tube, in the periphery of which is formed at a suitable point, as shown, the elongated slot *c*. Within this tube is an arm or circle, D, of slightly larger diameter than the interior diameter of this tube C, so that it may clamp the sides thereof when in proper position. The pivot of this arm or circle passes into and through the armature A, and supports at one end an arm or lever, B, rigidly affixed to it, so that both B and D move together. The outer end of B carries an adjusting-screw, *b*, the end of which is arranged to take upon the top of a pin, P, projecting upwardly from the yoke Y, supporting the upper ends of the magnet M M. This yoke Y is shown in detail in Fig. 5. Fastened to the top of the magnet M M, it secures its limbs in position, is provided with a central opening, through which the holder C passes, and end openings, through which pass the poles *m m*. At its rear is fastened a yoke or support, *y*, in which, by means of the screws *y′* or other suitable devices, the arm or lever contact-key E is pivoted, which arm or lever contact-key is shown in detail in Fig. 4. This lever E should be made of non or dia magnetic material, and is pivoted at *e*, above which pivot, and in the plane of the polar extensions *m m*, when the lever is in position, is the curved yoke F, of similar material, the ends, however, of this yoke being faced with iron, *f f*, to form armatures for the sides of the polar extensions.

Projecting inwardly from E are the lugs H and G, as shown, each being beveled inwardly, as shown at *h g*, between which takes the arm or pin *a*, attached to the rear of the armature A. At its lower end this arm E carries an electric contact, *e′*, made preferably as a screw, so that it may be adjusted therein, and adapted to take, when E is in proper position, upon the contact *e″* upon the frame of the lamp and form electrical contact therewith. The coil of the magnet *m m* is made in two or more sec-

tions wound in the same direction, two being herein shown, distinguished for convenience by difference in the size of wire of each, although each may be of the same size wire. From the contact *e''* a connection leads directly to the inner or larger wire section by a wire, 4, while from 4 a connection, 5, is made to the smaller or outer section. The wire 1 coming from the line connects with the frame of the apparatus, and with lever or arm E, and with the outer or smaller wire section, this section being preferably of somewhat greater resistance than the inner or larger wire section of the coil. The end 2 of the larger or inner wire section has a connection, 2, to the lower carbon or its holder. The path of the circuits is shown in Fig. 6, the coils of the magnet M being there disassociated for clearness of illustration, the inner or coarse or low-resistance coil being marked I C, and the outer or high-resistance coil, O F, while Fr indicates arbitrarily the frame of the lamp. Line 1 connects to the frame, while line 3 connects to the lower carbon or its support. A connection, 4, leads from *e' e''* to I C, whence a connection, 4, is made to 3. From the frame is a connection, 7, to O F, whence there is a connection, 5, to I C. From this it will be seen that the magnet M, as a unit, is in a shunt to the carbons, and that there is a shunt through I C (E *e' e''* 4 2) to O F.

The operation is as follows: Normally after being "trimmed," as it is technically termed—that is, the carbons L L' properly placed therein, which would be at too great a distance to permit the formation of an arc between them, and no current passing through the circuit of the lamp—the springs *s s* or their equivalents force the armature A away from the poles *m m* of M. The armature carries with it the arm B, the weight or gravity of whose outer end causes it to turn on its pivot, and so turning to turn the arm or circle D until the ends or edges of the latter impinge and bind upon the inner side of the tube C, thereby holding the same in the position shown in Figs. 1 and 2—that is, with the carbons L L' too far removed to make an arc effective for the production of light. In this condition the contact *e'* on E is in contact with *e''*, so as to form a circuit, 1 E *e' e''* 4, the inner coarse coil, (I C in Fig. 6,) 2, to line 3. If, now, the current be turned on, it first passes through this circuit, causing the coil I C to magnetize the poles *m* strongly, whereupon A is attracted. As it moves down it carries the arm B until *b* strikes upon P, whereupon the movement of the outer end of B is arrested, its inner end, however, attached to the axis or pivot of D, continuing in motion, so that D is released from impingement with C, allowing C and the carbon attached thereto to fall by their gravity until the carbons contact or about contact. At the same time E has been moved so that the connection *e' e''* is broken, breaking the shunt 4 I C 2 to O F and throwing O F into circuit with I C, increasing largely the resistance of the magnet-circuit, which is now 7 O F 5 I C 2 line 3. This increase of resistance causes a weakening of attractive force in the magnet, and, owing to the resilience of the springs, there is a slight rebound of A, causing the upper carbon, L, to be lifted sufficiently to form the requisite arc. There is, however, sufficient magnetism in the polar extensions exerted on *f f* to hold E in position to keep the connections *e' e''* broken until the entire or line circuit be absolutely broken, when E would be released and the circuits restored to their original condition.

It is to be understood that the relative length of *a* and the distance apart of beveled surfaces *h g* is such that A may have some considerable play without *a* impinging on either, it being necessary that A shall go to its extreme limit of motion in either direction before *a* takes upon either. So long, then, as current flows through 1, lamp, to 3, the armature will be held in some position intermediate of its extremes of movement and the connection *e' e''* remain broken, while the position of A within such intermediate limits will be determined by the relative amounts of current in the circuits 7 M 2 and L L', which in turn will depend upon their relative resistances, that in L L' increasing as the carbon is consumed, more current passing through M, and calling the feeding mechanism into operation. This arrangement makes an exceedingly effective "starter" (as it may be termed) for a single-magnet arc-lamp, the magnet being of low resistance to start the lamp, then starting immediately and automatically changing the magnet to one of high resistance, so as to throw normally through the carbons the greatest possible percentage of the current.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A magnet for controlling the feed of an electric lamp, having its coil formed of sections wound in the same direction, in combination with means controlled by its armature for forming a shunt-circuit around a portion of said coils, substantially as set forth.

2. The combination, with the magnet and its main armature, controlling the stop or clutch mechanism of the feeding carbon-carrier, of a key controlled by said main armature and subsidiary armatures carried by said key and operated on by the magnet to assist the main armature in its action upon said key, substantially as set forth.

3. The combination of the magnet, its armature, and the key or lever provided with the beveled surfaces arranged to be acted on by the armature, substantially as set forth.

4. The combination, with the magnet, of the key or lever provided with subsidiary armatures, and with the lugs or arms arranged and adapted to be acted on by the main armature of the magnet, substantially as set forth.

5. In an electric lamp, the combination, with the feeding mechanism for controlling

the movement of the carbons, of a single magnet placed in a shunt-circuit to the carbons, and formed of a low-resistance section and a high-resistance section and a shunt-circuit connection, the first section adapted to act as a shunt to the second section when the lamp is not in action, and means controlled by the armature of the magnet to break the shunt-connection around the high-resistance section when the lamp is put in operation, and thereby increase the resistance of the shunt-circuit containing the magnet, substantially as set forth.

6. In an electric lamp, the combination of a single magnet controlling the feed thereof, and made in two sections coiled in the same direction, one of low resistance and one of high resistance relatively to each other, and placed in a shunt-circuit to the carbons, an armature for said magnet, and a lever arm or key, and suitable contacts or connections therefor, controlled by the armature, and controlling in turn the shunting out of circuit the high-resistance section when the lamp is not in operation, and the throwing into circuit thereof when the lamp is in operation, so as to vary and control the relative resistances of the carbon-circuit and the shunt-circuit through the magnet, substantially as set forth.

7. In an electric lamp, the combination of a magnet controlling the feed mechanism, made with high and low resistance sections of coil relatively to each other, and means controlled by the armature thereof for normally, when the circuit is not complete or is broken, shunting out the high-resistance section and automatically breaking the shunt while the circuit is complete, substantially as set forth.

8. The combination of the lever or key E, yoke F, polar extensions *m m*, and magnet M, substantially as set forth.

9. The combination of the lever or key E, provided with lugs or projections H G, having beveled faces *h g*, armature A, having arm or pin *a*, and magnet M, substantially as set forth.

10. The combination of the magnet M, having coils O F and I C, the key E, and connections 2 4 5 7, substantially as set forth.

11. In an electric lamp having a single magnet controlling the feed mechanism therefor, the magnet being made of high and low resistance sections relatively to each other, the combination of a main-line circuit, circuit-connections therefrom through the carbons, a shunt-circuit around the carbons and through the magnet, and a circuit through the low-resistance section, which is a shunt-circuit to the circuit through the high-resistance section, and means for automatically controlling the last-named shunt-circuit, substantially as set forth.

This specification signed and witnessed this 25th day of September, 1883.

THOMAS L. DENNIS.

Witnesses:
W. C. LANGAN,
E. A. DICK.