(No Model.)

2 Sheets—Sheet 1.

E. & F. W. HEYMANN.

ELECTRIC LAMP.

No. 348,973. Patented Sept. 14, 1886.

Fig. 1,

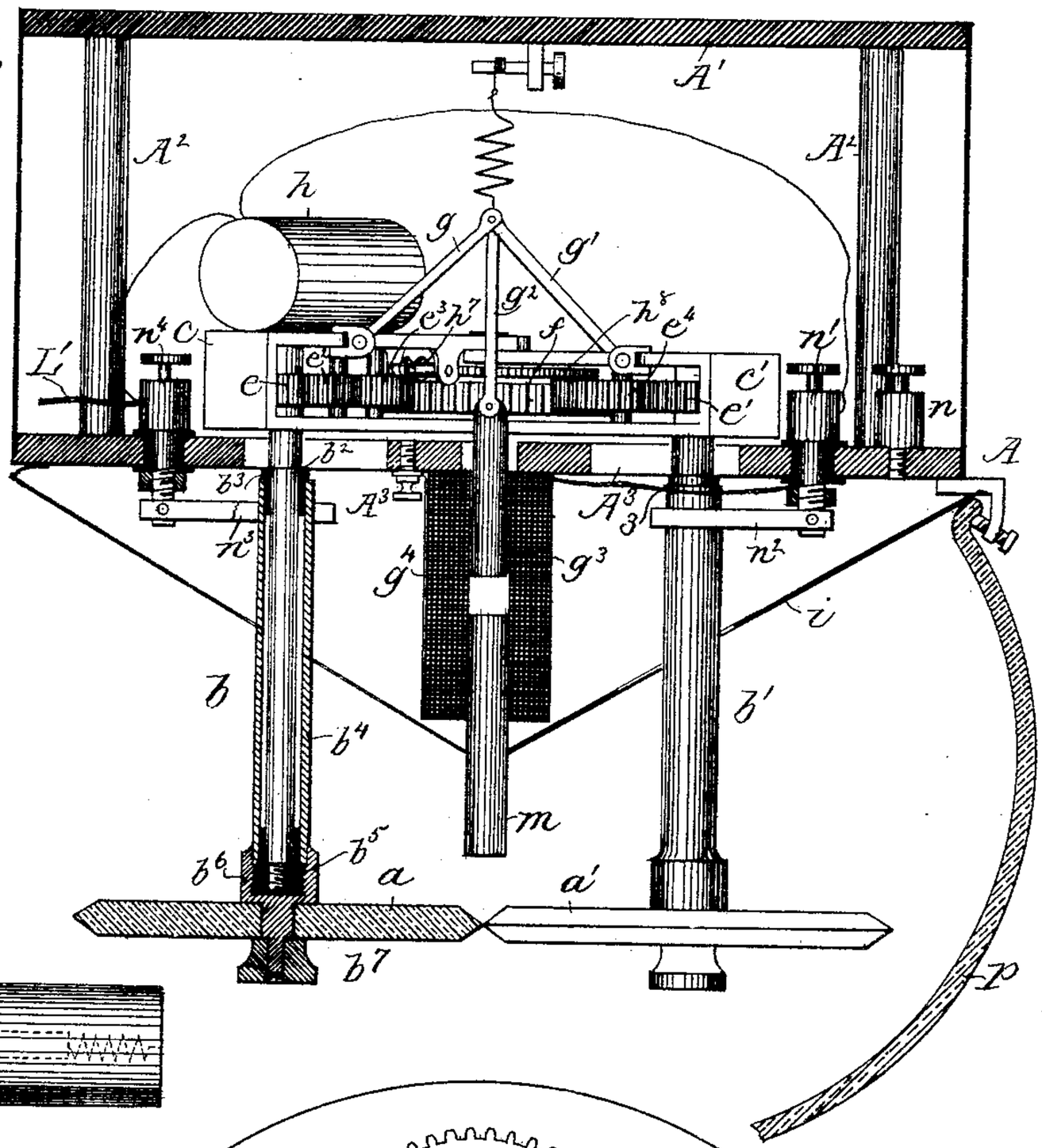


Fig. 3

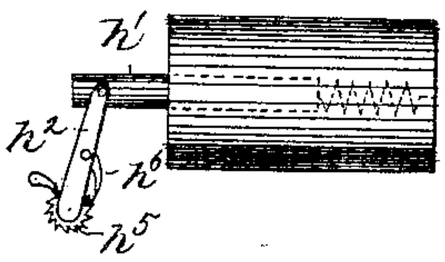
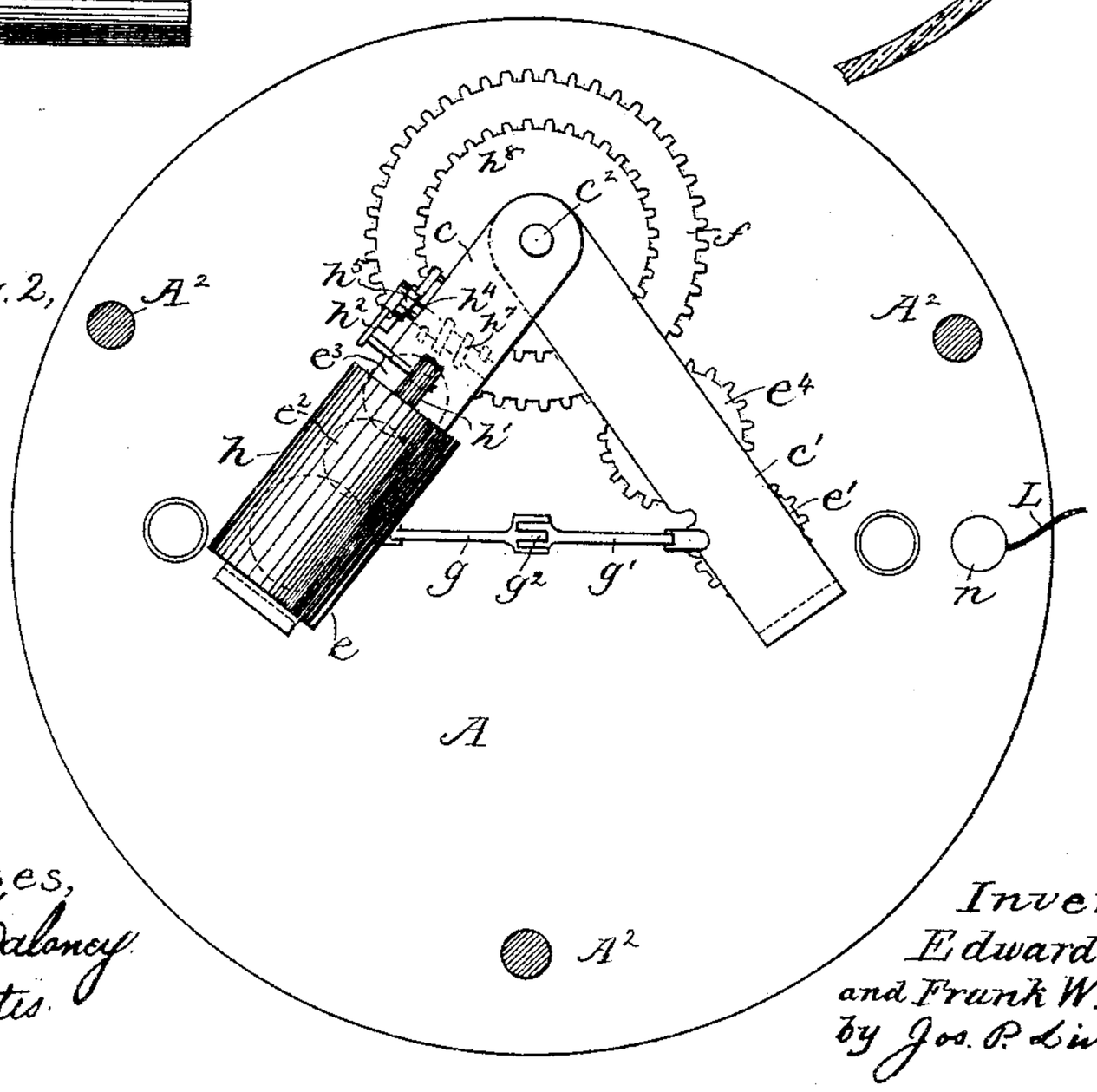


Fig. 2,



Witnesses,
Jas. J. Maloney.
H. P. Bates.

Inventors,
Edward Heymann,
and Frank W. Heymann,
by Jos. P. Livermore
Atty.

(No Model.) 2 Sheets—Sheet 2.

E. & F. W. HEYMANN.

ELECTRIC LAMP.

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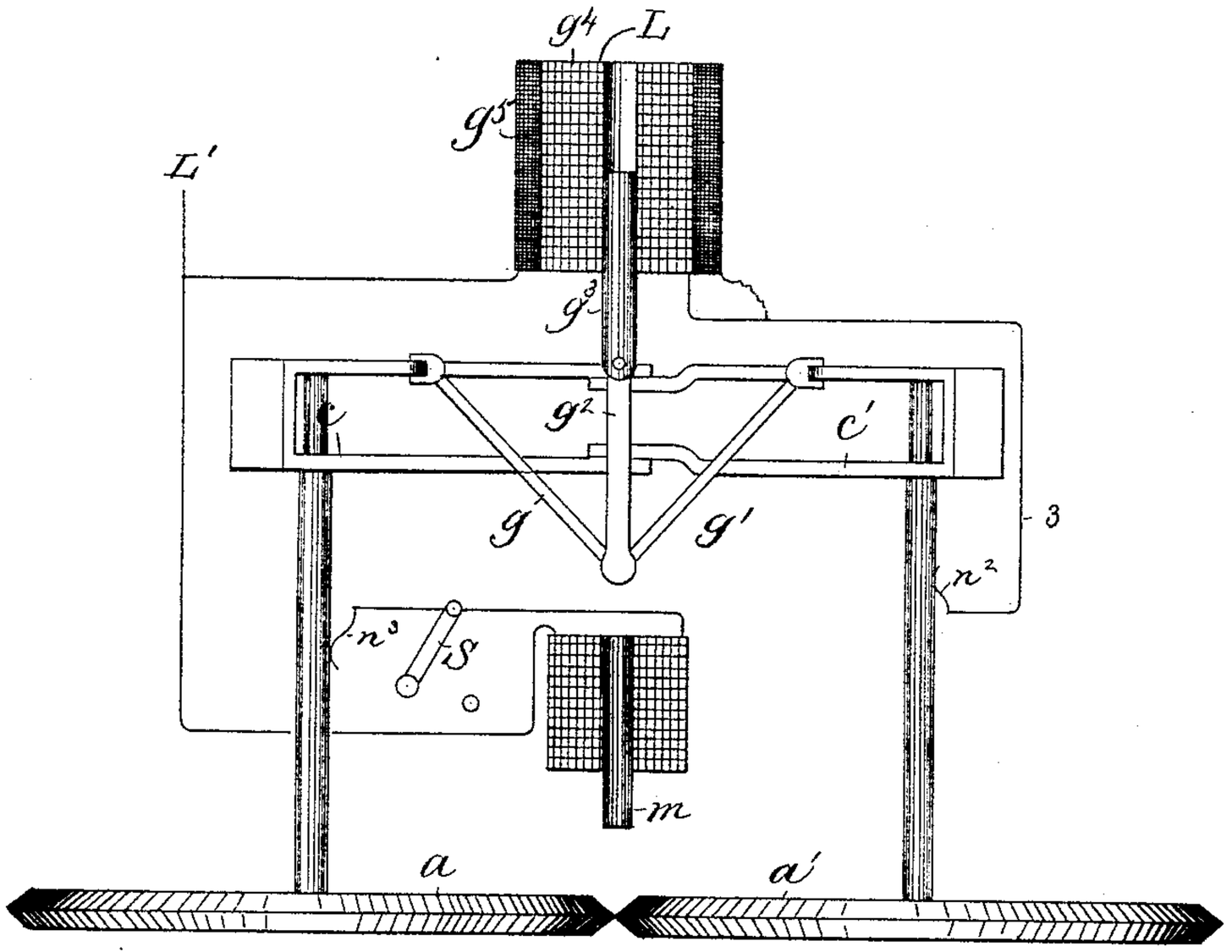
Fig. 4.



Witnesses.
Jas. J. Maloney.
Chas. A. Whitney.

Inventors,
Edward Heyman,
and Frank W. Heyman.
by Jos. P. Livermore
Atty.

UNITED STATES PATENT OFFICE.

EDWARD HEYMANN AND FRANK W. HEYMANN, OF BOSTON, MASSACHUSETTS, ASSIGNORS OF ONE-HALF TO JOHN I. CLAPP, OF SAME PLACE.

ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 348,973, dated September 14, 1886.

Application filed February 4, 1886. Serial No. 190,824. (No model.)

To all whom it may concern:

Be it known that we, EDWARD HEYMANN and FRANK W. HEYMANN, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Electric Lamps, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

Our invention is embodied in an electric lamp of that class in which the arc is maintained between the peripheries of disk-electrodes, which are revolved in order to present different portions of their edges at the arc, and also have a bodily movement toward and from one another for determining the length of the arc.

The present invention consists, mainly, in details of construction of the mechanism controlling the bodily movement of the electrodes relative to one another, and also in details of construction of the case or frame-work inclosing the electrodes and their actuating mechanism, and in the combination, with the electrodes, of a reflector properly shaped for lateral diffusion of the light, and in other combinations and details of construction and arrangement, hereinafter specified.

Figure 1 is a vertical section of an electric lamp embodying this invention, one of the carbon disks and its supporting-shaft and the mechanism controlling the movements of the disks being shown in elevation; Fig. 2, a plan view of the lamp with the top of the case removed, showing the mechanism controlling the movements of the carbon-disks; Fig. 3, a detail showing in side elevation the electromagnet and a portion of the mechanism for producing the rotary movements of the carbon disks; and Fig. 4 a diagram representing a modification, to be referred to.

The mechanism controlling the movements of the carbons is inclosed in a case, A A′, composed of upper and lower plates connected by suitable posts, A^2, and the carbon disks or electrodes *a a′* are supported upon shafts *b b′*, extending through the plate A substantially at right angles thereto, so that the disks are in a plane parallel with the said plate A, and the arc is formed at a point wholly below the lamp mechanism and its inclosing-case. The said shafts *b b′* have their bearings in frames *c c′*, pivoted at c^2 on an axis parallel with the shafts *b b′*, so that the said frames turn in a plane parallel with the carbon disks to cause the latter to approach or withdraw from one another by a movement of the shafts *b b′*, which are at all times retained parallel with one another, or at a substantially constant angle if it is preferred to mount them in a slightly-inclined position in the frames *c c′*. The shafts *b b′* pass through slots or openings A^3 in the plate A, to accommodate their bodily movement with relation to one another and to the said plate or frame-work of the lamp.

The shafts *b b′* are provided with gears *e e′*, connected by intermediates, e^2 e^3 e^4, with a gear, *f*, concentric with the axis c^2, on which the frames *c c′* are pivoted, so that by rotating any one of the gears a corresponding rotary movement will be imparted to both of the shafts *b b′* and the carbon disks supported thereon. The train of gearing between the gears *e e′*, connected with the respective carbon-shafts, is shown as so proportioned that one turns with double the speed of the other, which is about the proportion of the consumption of the said disks when the current traverses the arc continuously in the same direction.

The bodily movement of the disks with relation to one another is produced, as shown in this instance, by a toggle-lever, *g g′*, having its ends connected with the said frames, and its joint connected by a link, g^2, with the movable core or armature g^3 of a magnet, g^4, which is included in the main circuit with the arc, and provided with a retractor, (shown as a spring, g^5,) acting on the toggle-lever, with a tendency to draw the frames and carbons together, so that the said carbons will be normally in contact when no current is flowing, as is required for the establishment of the arc. When the current begins to flow, the magnet g^4 will be energized, causing it to attract its armature g^3, and through the toggle-lever, to separate the carbons until the attractive force of the magnet is brought by the increased resistance of the arc into equilibrium with its retractor, which takes place when the arc is of normal

[redacted]

length in the usual manner. If there is to be but a single lamp in the circuit, the magnet g^4 in the main circuit will be sufficient to control the length of the arc; but if the lamp is to be one of a series the magnet g^4 may be differential, having a coil in a shunt-circuit around the arc, or may be used in conjunction with a separate shunt-magnet acting in the opposite direction on the toggle-lever, or may be wholly in the shunt, in which case it will be arranged to draw the frames together by its attractive force, instead of drawing them apart, as herein shown. All these different devices are well known, and the movement of the joint of the toggle-lever for controlling the length of the arc is exactly analogous to that of the clutch in lamps, in which the arc is maintained between pencils placed end to end, so that any of the devices for controlling the movement of a clutch might be used for controlling the movement of the toggle-joint and of the carbon disks $a\ a'$ with relation to one another.

Fig. 4 represents an arrangement which may be used when the lamps are to burn in series. As shown in this figure, the magnet g^4, that operates to separate the carbons and establish the arc, is differential, having a coil of coarse wire in the main circuit with the carbons, and a coil, g^5, of fine wire in a shunt around the carbons, and said magnet is placed above the frames $c\ c'$ of the carbon-carrying shafts. The devices for rotating the carbons are omitted in this figure, as they may be exactly the same as shown in the other figures.

The rotary movement of the carbon disks to present new portions of their periphery at the arc as they burn away is produced by a magnet, h, shown as supported on one of the frames $c\ c'$, and having its armature h' connected with a pawl-carrying arm, h^2, (see Fig. 3,) which turns loosely on a shaft, h^4, provided with a ratchet, h^5, engaged by the pawl h^6 of the pawl-carrier h^2, so that it is rotated by the movement of the armature or core h' toward the magnet. The shaft h^5 is provided with a worm, h^7, meshing with a worm-gear, h^8, connected to rotate with the gear f, and thus causing the latter, through the intermediate gearing, to turn the shafts $b\ b'$ and carbon disks thereon. The magnet h is placed in a shunt around the arc, and is consequently more strongly magnetized as the arc lengthens by the burning away of the edges of the disks, and thus turns the disks to present a new part at the arc, which turning will tend to shorten and weaken the magnet h, so that its armature will be retracted, ready for the next feeding movement.

The lamp is provided with a reflector, i, which is substantially conical in shape, although its sides may be slightly concave, if desired, the base of the reflector coinciding with the lower plate, A, of the lamp-frame, and its apex being just over the arc, so that the light which passes upward toward the lamp-case, and would naturally be absorbed thereby, is reflected laterally and downwardly, increasing the useful illuminating-power of the lamp.

A magnet-pole, m, is placed just over the arc, in such position as to deflect and lengthen the same and increase its illuminating-power. This magnet is shown as a stationary core of the magnet g^4, which controls the bodily movement of the carbons toward and from one another; but it is obvious that an independent magnet might be used for this purpose, as shown in Fig. 4, in which case a switch, S, might be used to cut it out of circuit, if desired.

The circuit of the lamp is as follows: The main line L is connected by binding-post n with the frame-work of the lamp, which is connected with one terminal of the magnet g^4, the other terminal of which is connected by wire 3 with a binding-post, n', having springs n^2, which bear on the lower part of the carbon-shaft b', which is insulated from the frame-work of the lamp, as will be described. From the brush or contact-spring n^2 the circuit is continued through the shaft b' and the carbons $a'\ a$ and the arc to the shaft b, which is connected with a similar brush, n^3, and binding-post n^4, insulated from the frame-work of the lamp, from which the main circuit is continued, as indicated at L'.

The portions of the carbon-carrying shafts that are connected with the gears $e\ e'$ are provided with a shoulder, as shown at b^2, which engages a sleeve, b^3, of insulating material, having an external shoulder, to receive one end of a tube, b^4, of metal, the other end of which is engaged by a nut, b^5, of insulating material, screwed upon the end of the main part of the shaft that is connected with the gear e, thus insulating the said tube b^4 from the said shaft. A head, b^6, is screwed upon the nut b^5 in electrical connection with the tube b^4, and to this head the carbon-disk is secured by a suitable nut, b^7, thus placing said carbon disk in electrical connection with the tube b^4 and springs $n^2\ n^3$, bearing thereon, but insulating it from the frame-work of the lamp. The magnet h is in circuit between the binding-posts $n'\ n^4$, and thus forms a shunt around the arc.

It is obvious that a reflector, i, such as described, might be used advantageously with a lamp employing straight pencils or other form of electrodes for the arc, and that the straight pencil might pass through the apex of the mirror in substantially the same position as the core of the arc-deflecting magnet m.

The carbons may be inclosed in a glass globe or cover, p, having its mouth or opening connected with the base-plate A by any suitable fastening devices, and it will be seen that there is nothing below the arc to impede the passage of light downward or cast a shadow below the lamp.

I claim—

1. The combination of the case or frame-work with the pivoted frames therein, turning

on an axis in a plane substantially parallel with the main plate or base of the frame-work, the carbon-carrying shafts provided with carbon-disks and having bearings in the said pivoted frames, and extending through openings to the outside of the case or frame-work inclosing the said frames, and actuating mechanism within the case for moving the said frames on their pivot and for rotating the carbon-carrying shafts, substantially as described.

2. In an electric-arc lamp, the combination of the case or frame-work and movable frames thereon with carbon disks and supporting-shafts therefor, having their bearings in said frames, actuating mechanism to move said frames and to rotate the carbon-carrying shafts, and a magnet supported on the main frame, with its pole over the point at which the arc is maintained between the rotating disks for the purpose of increasing the extent of the arc, substantially as described.

3. The combination of the main case or frame-work and movable frames supported thereon, and disk carbons and carbon-carrying shafts having bearings in said movable frames, and actuating mechanism for moving the said frames and rotating the carbon-carrying shafts, and a reflector, substantially conical in shape, with its apex over the arc, the said reflector being interposed between the carbon disks and their actuating mechanism, and provided with openings through which the carbon carrying shafts extend, substantially as described.

4. The combination of the carbon-shafts and movable bearing-frames therefor with a toggle-lever connected with said frames, and an electro-magnet and its armature and retractor connected with the said toggle-lever, for the purpose of actuating the same and controlling the position of the frames, substantially as described.

5. The combination of the rotating shafts and carbon disks supported thereon with the worm-gear and connecting mechanism between it and the said shafts, a worm meshing the said gear, and a ratchet and pawl, and actuating electro-magnet for said pawl, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

EDWARD HEYMANN.
FRANK W. HEYMANN.

Witnesses:
JOS. P. LIVERMORE,
JAS. J. MALONEY.