(No Model.)

E. & F. W. HEYMANN.

ELECTRIC LAMP.

No. 348,971. Patented Sept. 14, 1886.

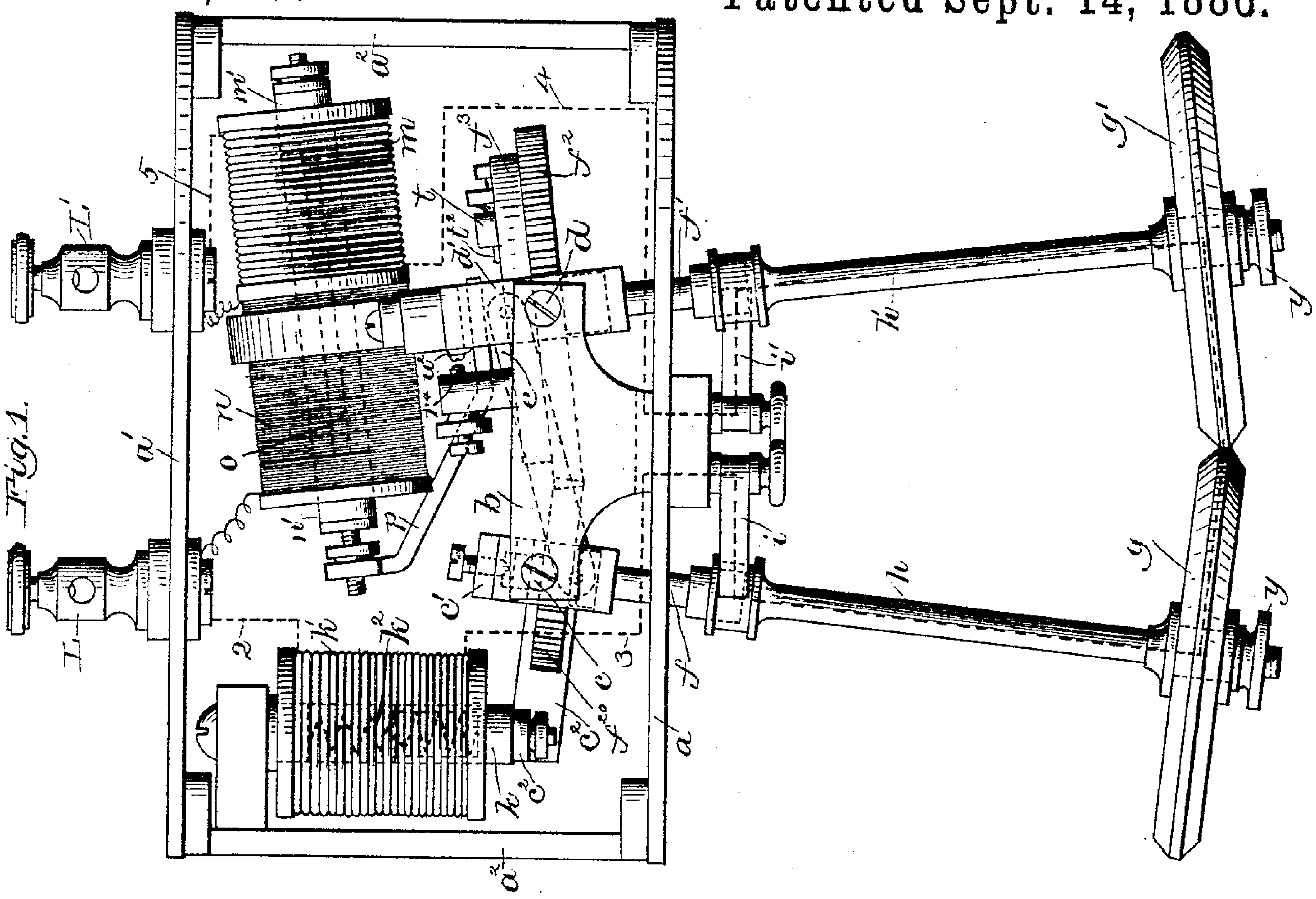

Fig. 1.

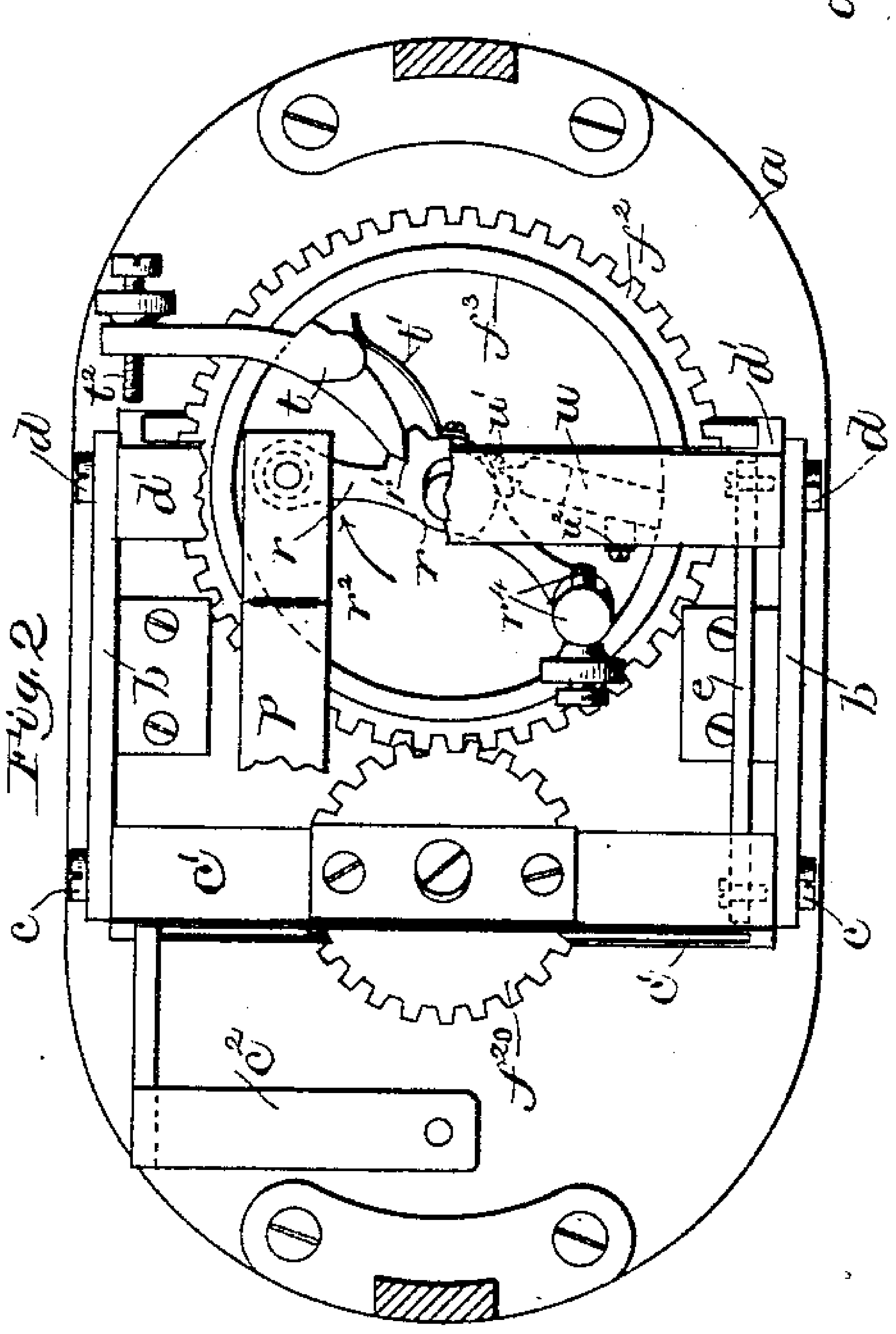

Fig. 2.

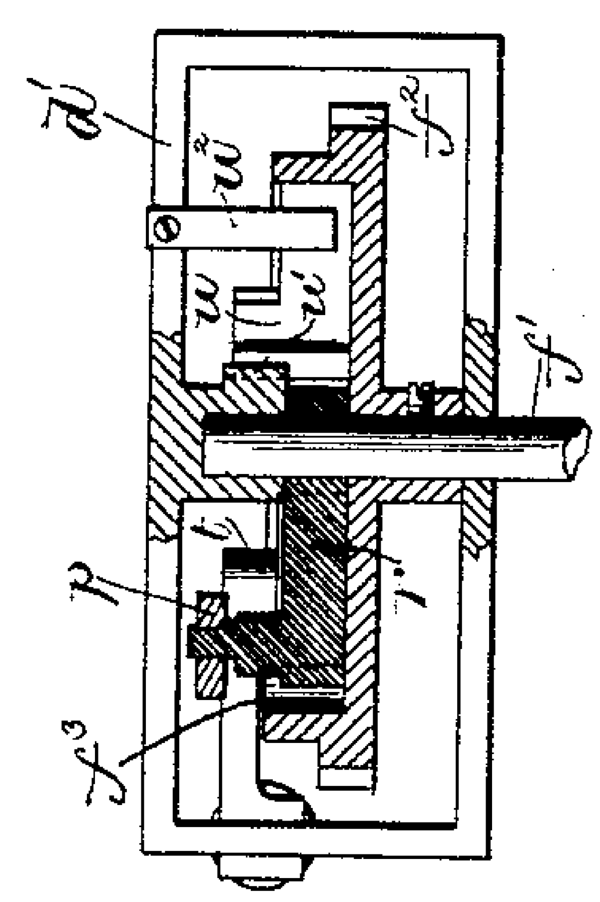

Fig. 3.

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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. 348,971, dated September 14, 1886.

Application filed March 18, 1885. Serial No. 159,305. (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 relates to an electric lamp of that class in which the arc is maintained between the peripheries of two disks composed of carbon or any suitable material.

The invention consists, essentially, in the means employed for separating the disks in order to establish the arc, and for subsequently rotating the disks in proportion as they burn away at their edges. The disks are supported on shafts having bearings in pivoted frames having a rocking movement, by which the said disks are caused to approach or to recede from one another, their bearing frames being connected by a suitable link or connection, so that both rock or swing together. The carbon-carrying shafts are provided with gears meshing together, so that the rotary movement of one causes a rotary movement of the other, the gears being preferably so proportioned that one disk turns about twice as fast as the other or in proportion as its combustion is more rapid. One of the carbon-supporting frames is connected with the armature or core of an electro-magnet or solenoid in the main circuit, which, when energized, operates upon the frame to separate the carbon disks, and thus establish the arc between them, the said disks being normally kept in contact with one another while no current is flowing by the retractor of said armature or core. Connected with the other frame and movable with it is an electromotor for rotating the carbons, the said motor being shown in this instance as composed of two magnets or solenoids—one in the main circuit through the arc and the other in a shunt around the arc—the said magnets acting in opposition to one another upon connected armatures or cores which are moved in one or the other direction, according as the strength of one or the other of said magnets prevails. The said armatures are connected with suitable mechanism which produces from the to-and-fro movement of the armature a rotary movement of one of the carbon-carrying shafts, thus causing both carbons to rotate at the proper rate of speed in proportion as one part of the periphery of said carbons burns away, causing the arc to lengthen, and thus increasing the strength of the magnet which shunts the arc.

Figure 1 is a side elevation of an electric lamp embodying this invention; Fig. 2, a horizontal section thereof, showing the connecting mechanism between the actuating-armature and the carbon-carrying shaft by which the latter is rotated; and Fig. 3 a sectional detail of said mechanism.

The operative mechanism of the lamp is supported on a frame consisting of plates a a', connected by uprights a^2. The plate a has fastened upon it brackets b, upon which are pivoted, at c d, frames c' d', provided with bearings for shafts f f', upon which the carbon disks g g' are fastened, the said disks being insulated from the shafts f f', but electrically connected with sleeves h h' upon said shafts, through which sleeves the current is conveyed from contact-springs i i' to the carbon disks. The frames c' d' are connected by a link, e, attached to said frames at opposite sides of their pivotal points, respectively, so that the pivotal movement of one of the said frames, as c', in one direction causes a corresponding pivotal movement of the other frame in the opposite direction, by which the carbons g g' are caused to approach or recede from one another simultaneously. The frame c' has rigidly attached to it an arm, c^2, connected with the armature or core k of an electro-magnet or solenoid k', included in the main circuit, the said armature or core being acted upon by a spring, k^2, tending to move the core away from the magnet, and to thus move the connected frames c' d' in the direction to bring the disks g g' together, the said disks normally being in contact with one another, as shown in Fig. 1, when no current is flowing. The frame d' has supported upon it an electromotor consisting of two magnets or solenoids, m n, the former in the main circuit with the carbons and the latter in a shunt around the carbons and the arc. The said magnets or solenoids m n act, respectively, on armatures or cores m' n', mechanically connected together by a rod, o, of non-magnetic material, the attraction of the magnets m and n tending to move the said armatures m' n' in opposite directions and producing such movement from time to time according as the relative strength of said magnets varies. The armatures m' n' are connected by a link or connecting-piece, p, with a yoke, r, mounted to turn freely upon the carbon-carrying shaft f' above the gear-wheel f^2, which is fixed on said shaft. The said gear-wheel has a flange, f^3, between which and the central or hub portion of the yoke r is placed a dog, t, bearing at one end in a notch, r', in the yoke r at a point slightly one side of a radial line from the axis of the shaft to the point of contact with the flange f^3, so that as the yoke r turns in the direction of the arrow r^2 when the armatures m' n' are moved by the magnet n prevailing over the magnet m, the dog t will first be pressed into contact with the flange f^3, taking hold thereof frictionally, so that in the further movement of the said yoke the wheel f^2 will also be turned. A retaining-dog, u, placed in an inclined position between a stationary projection, u', on the frame d' and the flange f^3, and acted upon by a spring, u^3, will engage the flange f^3 and prevent rotation thereof in the opposite direction to that in which it is moved by the yoke r and dog t. A spring, t', connected with the yoke r, tends to keep the dog t in contact with the flange f^3, and causes the said dog to accompany the yoke r in its return movement in the direction opposite to the arrow r^2. A stop, t^2, connected with dog t, limits, by its engagement with the frame d', the backward movement of said dog, and a stop, r^4, limits the backward movement of the yoke r. The gear f^2 meshes with a gear, f^{20}, connected with the shaft f, carrying the other carbon, and the diameter of the gear f^2 is preferably about twice that of the gear f^{20}, so that the latter and disk g are rotated twice as fast as the gear f^2 and disk g'. The circuit-wires entering and leaving the lamp are preferably connected with binding-posts L L', between which the circuit is completed, as shown in dotted lines, by a conductor, 2, leading to the solenoid k', and conductor 3, leading from said solenoid to the spring i, from which the circuit is continued through tube h, disk g, the arc, the disk g', tube h', spring i', and conductor 4 to one terminal of the solenoid m, the other terminal of which is connected by conductor 5 to the binding-post L'. The solenoid n is of very fine wire and high resistance, and its terminals are connected directly with the binding-posts L L'.

In operation, when the current begins to flow, the magnets k' m will be strongly energized, and the former will attract its armature k, and through the arm c^2 and connections between the frames c c' will turn the latter on their pivots in the direction to separate the disks g g', establishing the arc between the periphery of the said disks which were retained in contact by the action of spring k^2 before the magnet k' was energized. The magnet m', being at this time relatively stronger than the magnet n, will move the connected armatures m' n' in the direction to turn the yoke r in the direction opposite to arrow r^2 until arrested by the stop r^4. Then as the light continues to burn and consumes a portion of the periphery of the disks g g' the arc is lengthened and a larger amount of current caused to traverse the magnet n, which will become strong enough to overcome the magnet m and move the yoke r in the direction of arrow r^2, and thus cause the gears f^2 f^{20} and the carbon-disks g g' to rotate. This rotation will bring the unconsumed portions of the carbons opposite one another, shortening the arc, and causing the magnet m to again prevail over the magnet n and move the yoke r back to its original position, where it will remain until the consumption of the disk is sufficient to again strengthen the magnet n, so as to produce another rotary movement of the carbon disks. By having the actuating mechanism supported on a frame-work or inclosed in a case, and the carbons at the ends of long shafts at right angles to the planes of the said disks extending out from said case, the arc is maintained at a point where its light will pass downward wholly unobstructed by the mechanism of the lamp, and, furthermore, a lamp of this kind may be used in any position, although it will generally be used in a vertical position, as shown in Fig. 1. The carbon-carrying shafts f f' extend through slots in the plate a of the frame-work, affording sufficient space for the angular or pivotal movement of the shafts, and said disks are fastened at the ends of the shafts in electrical connection with the sleeves h by nuts y, enabling them to be quickly replaced when consumed. By having both shafts angularly movable with relation to the frame-work of the lamp the arc may be maintained very nearly at one point, and the distance of the points of attachment of the link e from the pivotal points of the frames c' d' may be so proportioned as to cause the disks to approach one another by the pivotal movements of the shafts in the same ratio as the edges of said disk are burned away. The plates a a' will receive upon them a suitable side piece (not shown) constituting an inclosing-case for the operative parts of the lamp.

We claim—

1. The carbon disks and shafts supporting them having a rotary movement and an angular movement, combined with connecting mechanism by which angular movement of one imparts a corresponding angular movement to the other, and an electro-magnet and connecting mechanism for producing an angular movement in one of the said shafts, and an independent electro-magnetic device and con-

necting mechanism which produces a rotary movement of the said shafts, substantially as described.

2. The rotary shafts and carbon disks supported thereon, combined with frames having bearings for said shafts, pivoted to rock on an axis at right angles to that of said shafts, a link connecting the said frames at opposite sides of their pivots, and an electro-magnet and armature therefor connected with the said frames, substantially as described.

3. The carbon disks and shafts therefor provied with gears meshing together, combined with a frame having bearings for one of the said shafts and itself pivoted to turn on an axis at right angles to the shaft and in the plane of rotation of the gear, whereby the said shaft may have an angular movement without disengaging the gears on the two shafts, substantially as described.

4. The carbon-carrying shafts provided with gears meshing together and connected pivoted frames having bearings for the said shafts, combined with a stationary magnet and armature therefor connected with the said frames for producing a pivotal movement thereof, and an electro-magnetic device supported on one of the said frames and movable therewith, and connecting mechanism whereby it produces a rotary movement of the said shafts, substantially as described.

5. A carbon-carrying shaft having a rotary movement, combined with electro-magnets, one in circuit with the arc and the other in a shunt around the same, and connected armatures operated by the varying opposing forces of the said magnets, and connecting mechanism between the said armatures and shaft, whereby the latter is rotated, substantially as described.

6. An electric lamp in which the arc is maintained between the edges of disks, the said lamp comprising a case or frame-work and carbon-carrying shafts extending out from the said frame-work and provided at their extremities with carbon disks or plates, the planes of which are at right angles to the corresponding shafts, and actuating mechanism within the said case or frame-work for producing an angular and rotary movement of the said shafts, substantially as described.

7. The pivotally and angularly movable carbon shafts and carbon disks supported thereon at right angles to the said shafts, combined with the sleeves surrounding the said shafts and insulated therefrom, and the contact-springs bearing against the said sleeves, 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,
H. P. BATES.