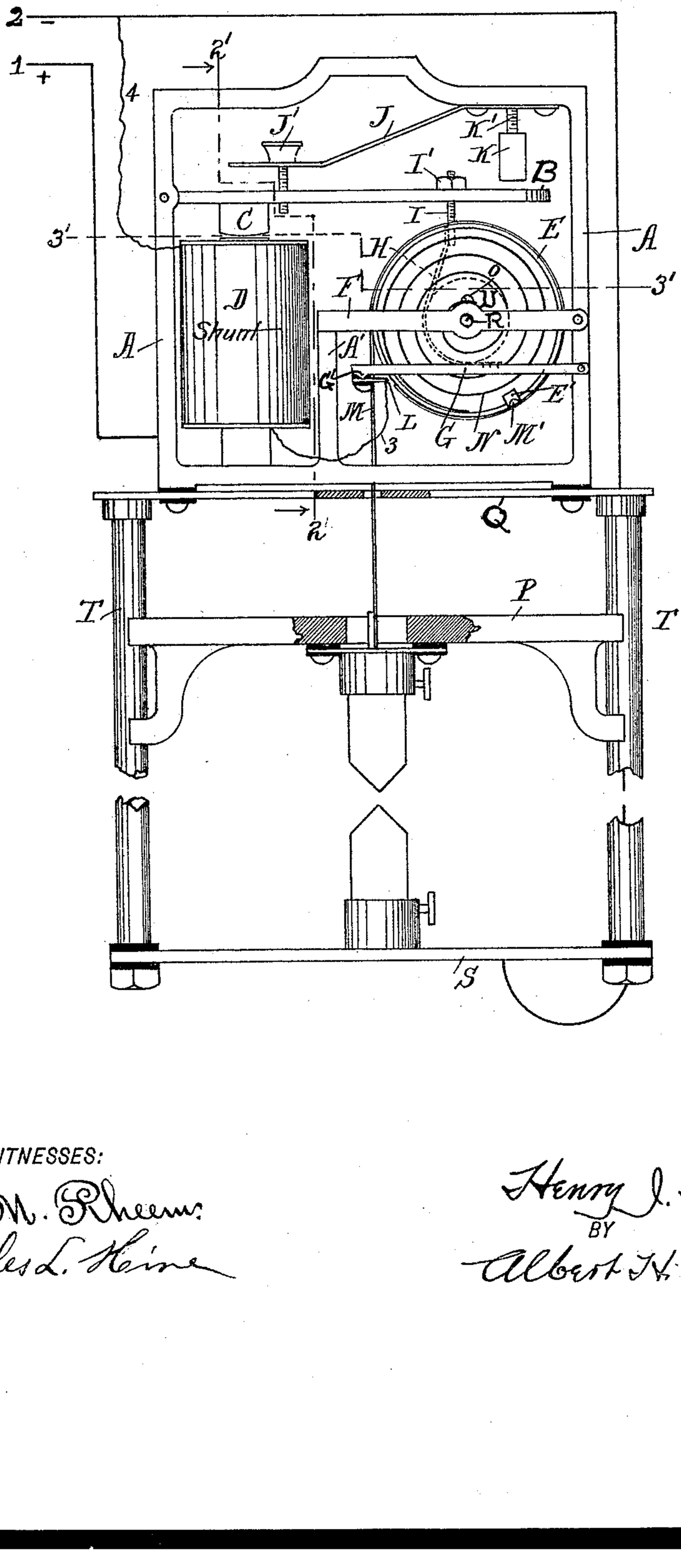
(No Model.) 2 Sheets—Sheet 1.

H. J. SAGE.

ELECTRIC ARC LAMP.

No. 543,355. Patented July 23, 1895.

Fig. 1.



WITNESSES:

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

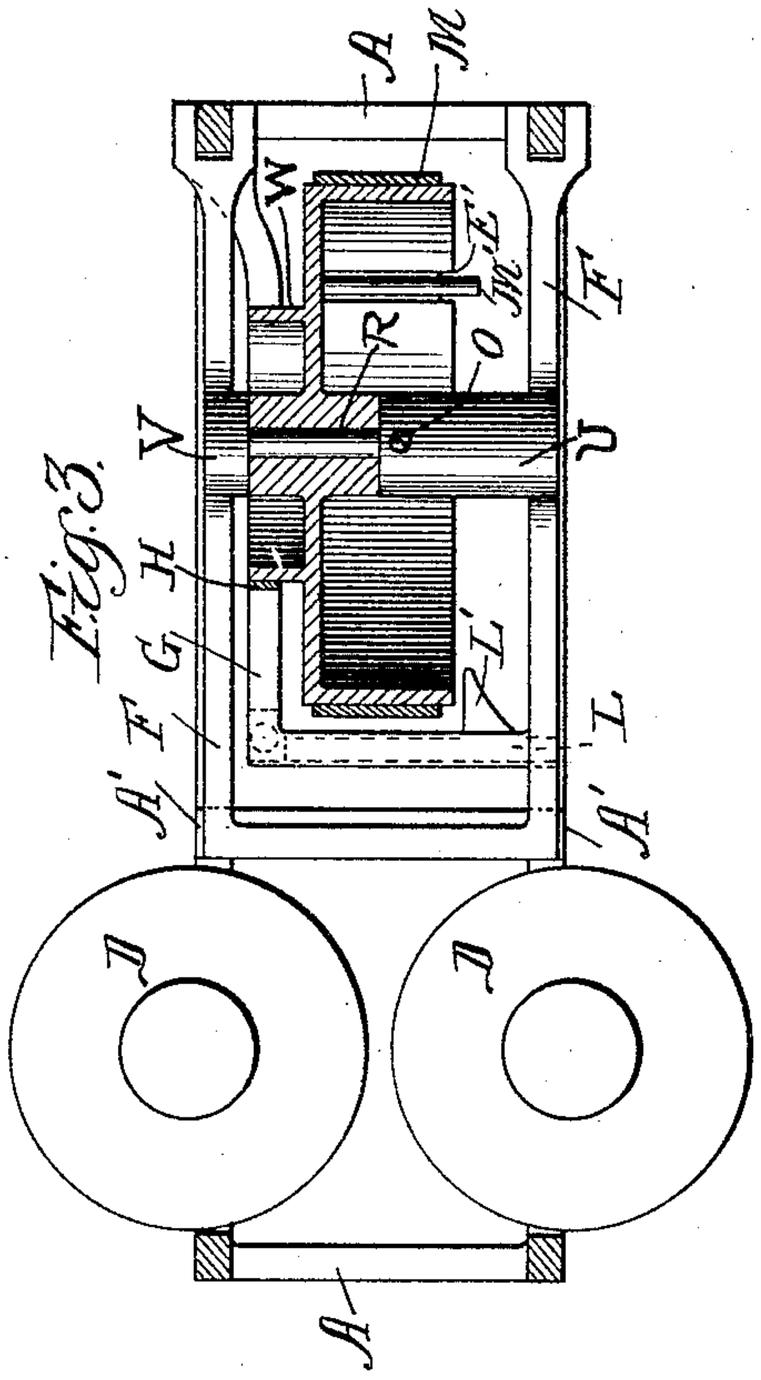


Fig. 4.

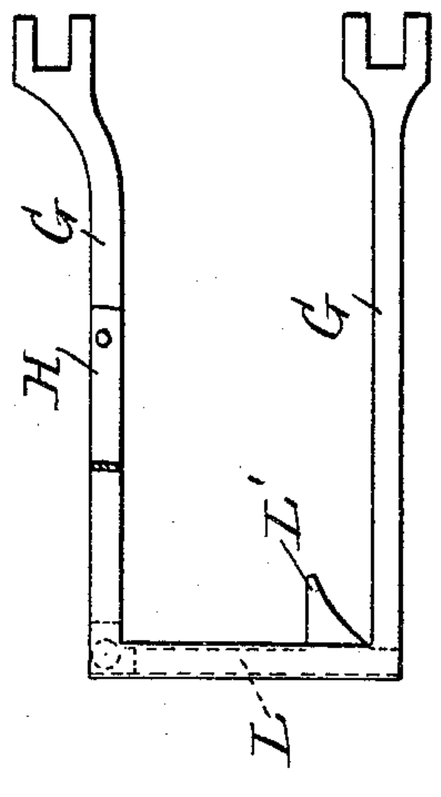


Fig. 5.

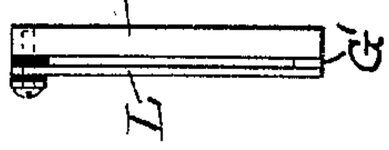
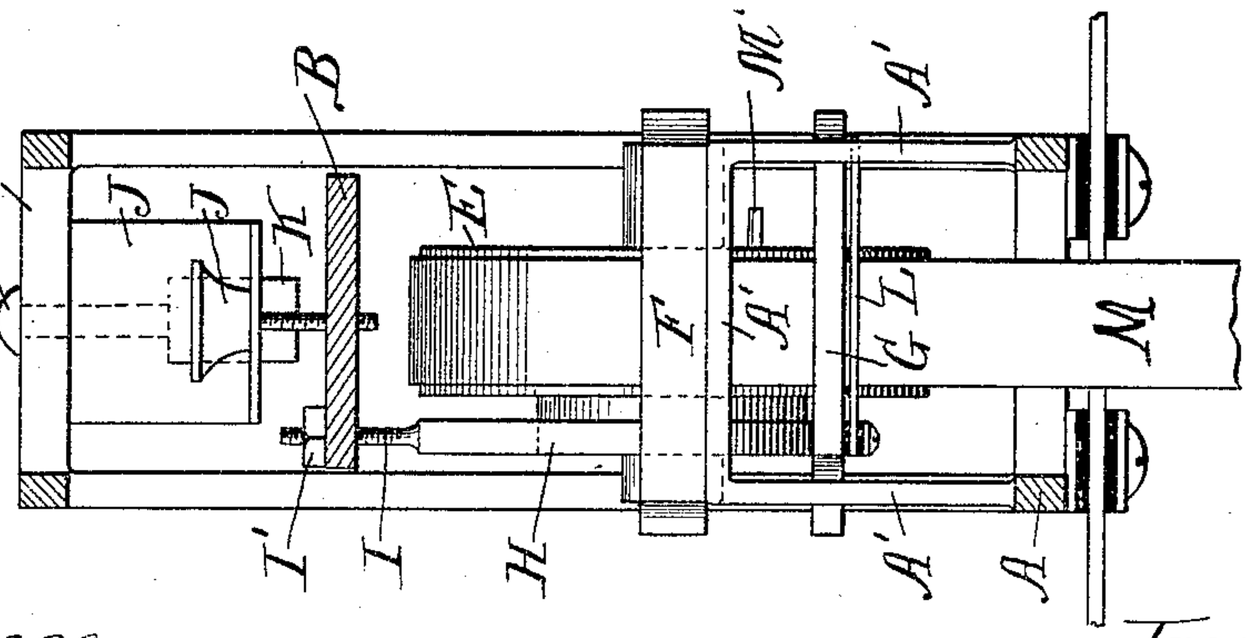


Fig. 2.



Witnesses

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UNITED STATES PATENT OFFICE.

HENRY J. SAGE, OF CHICAGO, ILLINOIS.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 543,355, dated July 23, 1895.

Application filed February 13, 1895. Serial No. 538,274. (No model.)

To all whom it may concern:

Be it known that I, HENRY J. SAGE, a citizen of the United States, residing at Chicago, in the county of Cook, State of Illinois, have invented a certain new and useful Improvement in Electric-Arc Lamps, of which the following is a specification.

The object of my invention is to provide an electric-arc lamp for use on a constant potential circuit, in which the upper carbon shall be supported by a ribbon or other flexible member wound around a drum.

The invention consists in the novel mechanism employed for so supporting the upper carbon and for automatically regulating the distance between the carbons.

The drawings show the best embodiment of my invention at present known to me.

Figure 1 is an elevation of my improved lamp, the covering of the regulating mechanism being removed and the circuits being shown somewhat diagrammatically. Fig. 2 is a vertical section of the regulating mechanism, taken on the line 2′ 2′ of Fig. 1, looking in the direction of the arrow. Fig. 3 is a horizontal section on the line 3′ 3′ of Fig. 1, the ribbon-drum being, however, shown on a section through the center thereof. Figs. 4 and 5 are views of one of the details of mechanism. The last four figures are on an enlarged scale.

Similar letters and numerals of reference designate similar parts in each figure.

A is the frame for holding the regulating mechanism. It is insulated from the plate Q, to which it is attached. Secured to this plate are the legs T, which support a bar or plate S, to which the lower-carbon holder is attached. This bar or plate is preferably insulated from the legs.

Suitably supported by the frame A is the regulating-magnet D formed of two helices of fine wire. The armature of this magnet is secured to the lever B. A flat spring J, connected to the lever B by the adjusting-screw J′, tends to raise the lever. A nut K on the screw K′ forms an adjustable stop for limiting the upward movement of the lever.

Adjustably attached to the lever B by means of the screw I and nut I′ is the friction-band H, made of leather or other suitable material. The lower end of this band is secured to and supports the lever G, pivoted at one end to the frame. The band lies part way of its length around the periphery of a friction-drum W, secured to the ribbon-drum E, the said portion of contact being preferably something over one-quarter of the circumference of the friction-drum. The ribbon-drum E is secured to a shaft R, revoluble in suitable bearings U and V, formed on the U-shaped lever F, which is pivoted to the frame. The downward movement of this lever is limited to the support A′, upon which the free end thereof may rest.

Secured to the ribbon-drum and passing around its periphery is the ribbon M, which supports the upper-carbon holder and carbon, together with the cross-head P, to which the former is secured, and which is capable of sliding up and down along the legs T as guides. I have shown the upper-carbon holder insulated from the cross-head, and such is the preferable construction, though it is not absolutely necessary to insulate both this carbon-holder and the plate S, hereinbefore referred to. The weight of the cross-head and its attached parts is counterbalanced to some extent, though not entirely, by a spring N, which is coiled around the hub of the ribbon-drum on the inside of the latter, one end being secured by the screw O to the outside of the bearing U and the other to the inside of the periphery of the drum. This spring is made very long, so as to be practically constant in its rotative force upon the ribbon-drum. I have found that a spring eight or ten feet long gives good results.

As the current flows through the magnet D it draws the armature C and the lever B downward against the force of the spring J, the force of the full current through the magnet causing the lever B to assume the position shown in Fig. 1. This allows the lever G to descend. During the first part of the descent of the lever G the drum E and the lever F descend with it and the upper carbon is lowered somewhat; but after the lever F has come in contact with the support A′ a continuance of the descent of the lever G allows the band H to loosen around its friction-drum W and the ribbon-drum is allowed to rotate, the upper carbon descending until it contacts with the lower carbon. The magnet is in a shunt circuit

which passes from the frame (to which the main positive conductor is connected) through the lever G, and through the platinum contact-point G′ thereon to the strip L, secured to said lever, but insulated from it except at said point G′. From this strip L the current passes through the wire 3 and the magnet D, from whence the wire 4 carries it to the main negative conductor. When the drum has become unwound to a certain predetermined limit—namely, when the effective portion of either carbon has been consumed—a projecting point M′, attached to the ribbon and lying, when the ribbon is wound up, in the notch E′, impinges against the projecting lip L′ of the strip L and draws it out of contact with the lever G. This breaks the circuit through the magnet and allows the spring J to draw up the lever B and thereby raise the ribbon-drum and the upper carbon and break the arc between the carbons.

The operation of my improved lamp is as follows: The current passes in from the positive conductor 1 through the frame and, the carbons being separated, its full strength passes by way of the lever G, strip L, and wire 3 through the magnet D. This causes the magnet to attract the armature strongly and the lever B is thereby lowered until the lever F rests upon the support A′ and the lever G drops sufficiently to relieve the friction on the drum W and allow it to rotate, whereby the upper carbon is lowered into contact with the lower. As soon as this takes place, the circuit through the magnet being of very high resistance as compared to that through the carbons when in contact, by far the greater part of the current flows through the frame, the lever F, the drum, the ribbon, the carbons, and out through the main negative conductor 2. The magnet thereupon loses its strength, the spring J draws up the lever B, which operates as described to raise the upper carbon, whereupon the arc is established between the carbons. The spring J continues to raise the upper carbon until the resistance of the arc becomes such that enough current passes through the magnet to cause its attraction to counterbalance the force of the spring. As the carbons burn away and the resistance of the arc becomes greater more current passes through the magnet, which causes the upper carbon to be fed which in turn decreases the resistance through the arc and weakens the magnet. Thus equilibrium is maintained and the upper carbon is fed smoothly and evenly. When either of the carbons has become practically consumed the ribbon will have unwound so far as that projecting pin M bears upon the strip L and breaks the circuit through the magnet, as explained. This allows the spring J to act upward with its full force and separate the carbons sufficiently to break the arc. In this condition the lamp remains until new carbons are put in position, which is done by shoving up the cross-head (the spring N winding up the ribbon) and securing the carbons in the carbon-holders in the usual manner.

It will be seen that by means of the adjusting-screws the force of the spring J may be regulated and thus the lamp may be set to feed whenever the counter electromotive force of the arc shall reach a certain predetermined amount. After adjustment the spring J exerts a practically-constant upward pull, the value of which is apparent when two lamps are placed in series upon a constant potential circuit, as is the usual custom, for the counter electromotive force of the arc of each lamp being thus determined each will take its proper voltage irrespective of the other and the two will not seesaw.

Numerous equivalents and modifications within the spirit of my invention will occur to one skilled in this art. For instance, in place of a flat band, one or more wires or a chain might be used for supporting the upper carbon. I intend the term "ribbon" or "flexible band" herein to include all such forms. In some cases it may be desirable to carry the current to the upper carbon by other conductors than the supporting-ribbon.

Although I have described the lamp as used with a direct current by laminating the magnet in the usual way, it is adapted to an alternating circuit.

In general I do not wish to be understood as limiting myself to the specific construction shown further than is definitely pointed out in the claims.

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

1. In an electric arc lamp, in combination, a regulating magnet placed in a shunt circuit, a lever actuated by said magnet, a friction brake operated by said lever, a drum around which a ribbon supporting the upper carbon is wound, said drum being capable of a bodily translation as well as rotation, said friction brake operating upon said drum and serving to sustain it in a position which corresponds to an elevated position of the upper carbon and at the same time prevent its rotation, a stop serving to limit the movement of said drum in the direction to lower the upper carbon, whereby a current through the magnet allows the friction brake and drum to be moved in the direction to lower the upper carbon without rotation of the drum and an increase in the current strength after the drum's translation has been stopped allows a further movement of the friction brake which reduces the friction and allows the drum to unwind, for the purpose specified.

2. In an electric arc lamp, in combination, a regulating magnet in a shunt circuit, a lever adapted to be attracted by said magnet, a spring opposing said attraction, a drum around which a ribbon supporting the upper carbon is wound, said drum being revolubly supported by a pivoted lever, a stop limiting the movement of said lever in one direction,

and friction brake mechanism connecting said first mentioned lever with said drum, whereby a current of sufficient strength through the magnet first allows the drum to be moved in the direction to lower the upper carbon until the drum's supporting lever contacts with the said stop and then reduces the friction of the brake and allows the drum to unwind, for the purpose specified.

3. In an electric arc-lamp, in combination, a revoluble drum around the periphery of which a ribbon supporting the upper carbon is wound, a friction drum concentric with said first mentioned drum and revolving therewith, said drums being so supported as to be capable of an up and down movement, a friction band in contact with said friction drum and so arranged as to be capable of raising and lowering said drum as well as of supplying friction sufficient to prevent rotation thereof, and operating mechanism connecting said friction band with an electro-magnet whereby the latter is capable of controlling the movements of the ribbon-drum and allowing it to be first lowered and then unwound, for the purpose specified.

4. In an electric arc lamp, in combination, a regulating magnet D placed upon a shunt circuit, a lever B adapted to be attracted by said magnet, a revoluble drum E around which a ribbon supporting the upper carbon is wound, a lever F which supports said drum, a stop A′ limiting the movement of said lever in one direction, a friction drum W concentric with said drum E and revolving therewith, a lever G, a flexible band H secured at one end to the lever G and at the other to the lever B, said band being for a portion of its length in contact with the periphery of the friction drum W, for the purpose specified.

5. In an electric arc lamp, in combination, a lower carbon, an upper carbon secured to a cross-head P which is guided in its movement by the guides T, a flexible band or ribbon supporting the cross-head and upper carbon and attached to a revoluble drum, said drum being also capable of an up and down movement, a spring tending to rotate said drum in a direction to wind up the ribbon thereon, a friction-drum concentric with said ribbon-drum and revolving therewith, a friction band in contact with said friction-drum and serving to support said drums, said band being connected to a lever adapted to be operated by an electro-magnet placed in a shunt circuit, a spring whose retractive force is independent of the strength of the current opposing the attraction of said magnet, whereby said spring operates to draw up said friction band and thereby raise the drums and a current through said magnet operates to slacken said friction band, lowering the drums, and then further slackens the friction band and allows the drum to rotate, for the purpose specified.

6. In an electric arc lamp, in combination, an upper carbon supported by a flexible band wound upon a revoluble drum, an electro-magnet capable of controlling the revolution of said drum, a projecting pin which moves as said drum revolves, a movable strip forming one of the conductors of the circuit through said magnet, being normally in contact with another conductor, said strip and pin being so placed that when the drum shall have unwound a certain predetermined distance the pin will force the strip out of contact with the conductor which it touched and thereby break the circuit through the magnet, for the purpose specified.

HENRY J. SAGE.

Witnesses:
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CHARLES L. HINE.