(No Model.) 3 Sheets—Sheet 1.

# G. C. PYLE.

## ARC LAMP.

No. 422,446. Patented Mar. 4, 1890.

*Fig. 1.*

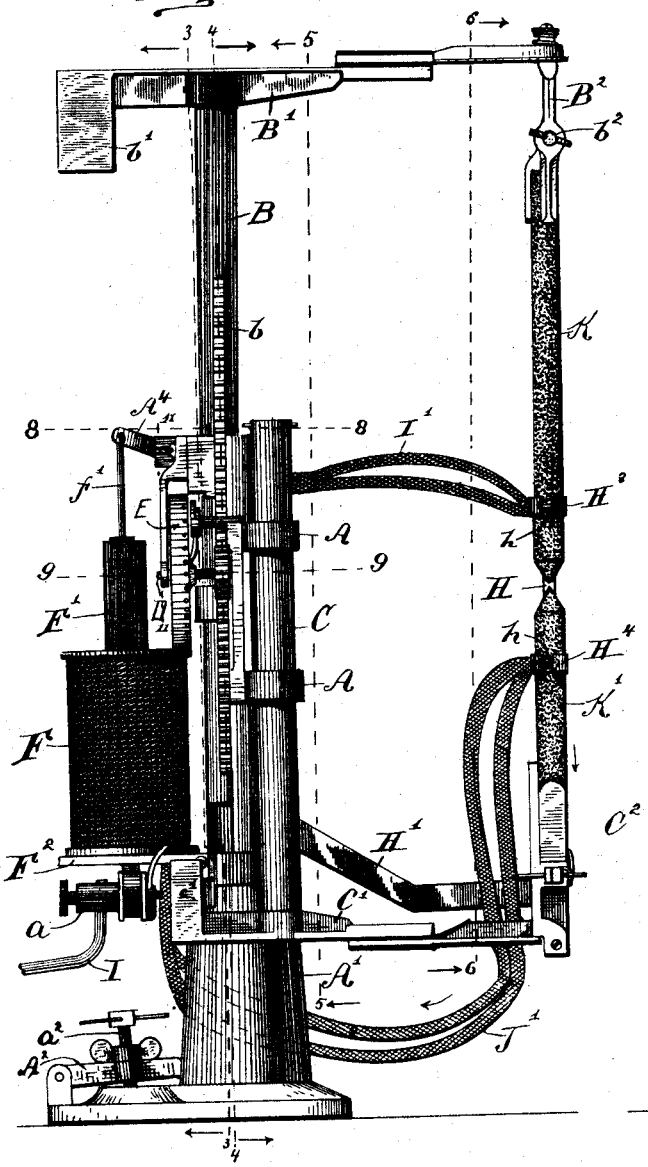
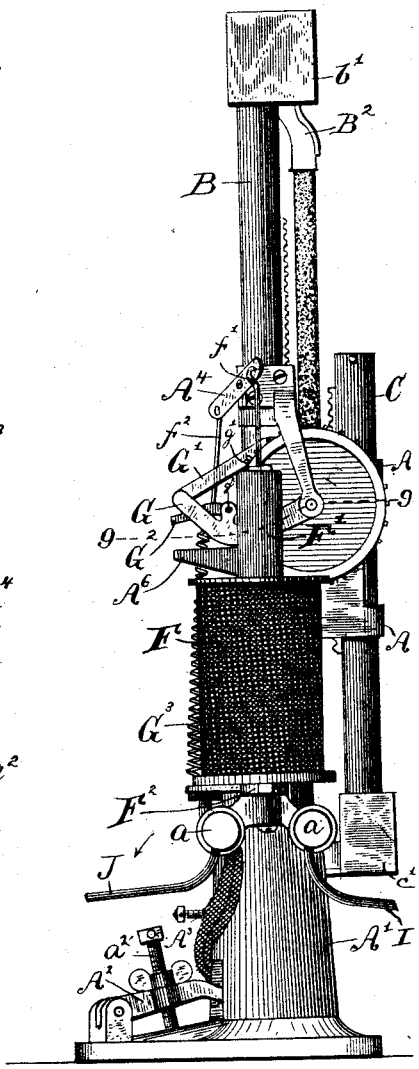


*Fig. 2.*



WITNESSES.

C. W. H. Brown.

J. Walsh

INVENTOR.

George C. Pyle,

per Let E. W. Bradford.

ATTORNEYS.

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## ARC LAMP.

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Fig. 3.

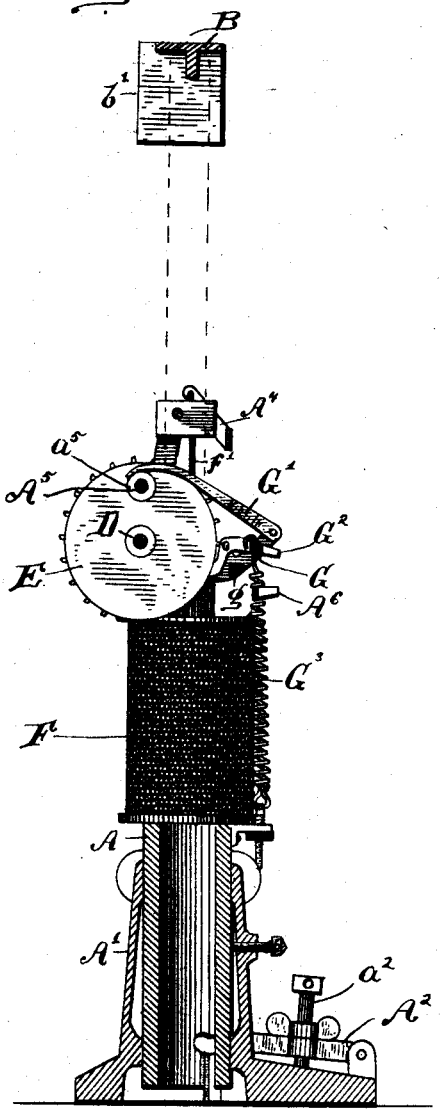
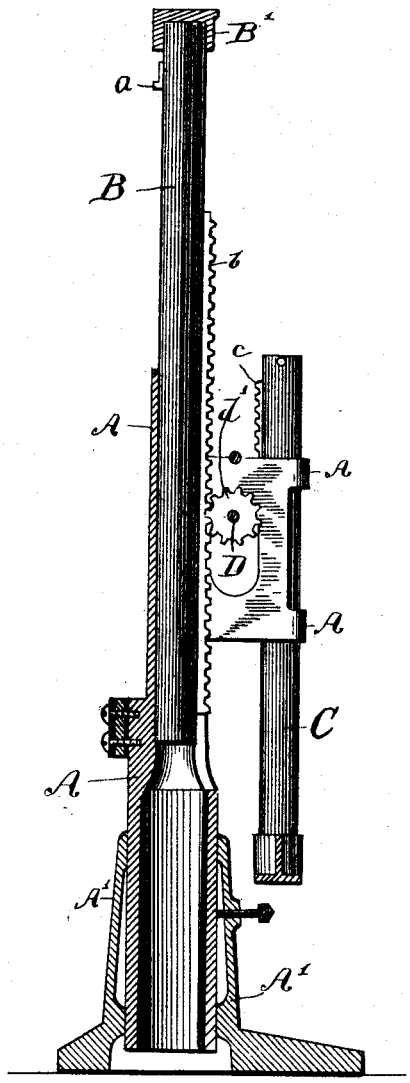
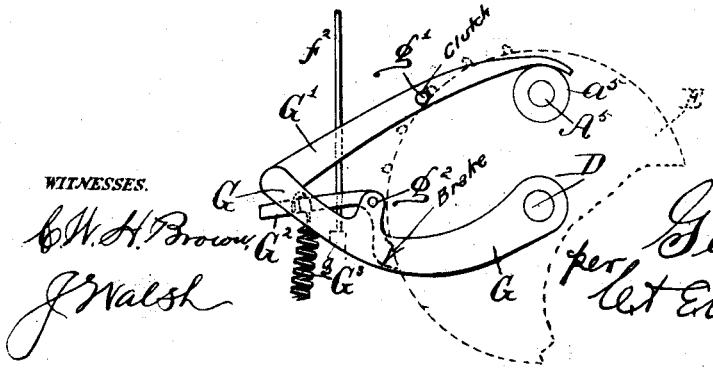



Fig. 4.




WITNESSES.

E. W. H. Brown

J. Walsh

INVENTOR.

George C. Pyle,

per Chas. E. W. Bradford.

ATTORNEYS.

(No Model.) 3 Sheets—Sheet 3.

# G. C. PYLE.

## ARC LAMP.

No. 422,446. Patented Mar. 4, 1890.

Fig. 7.

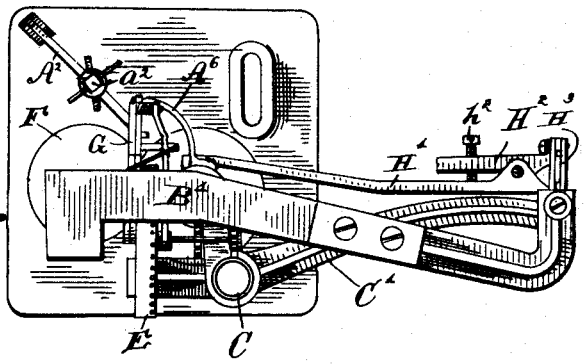


Fig. 5.

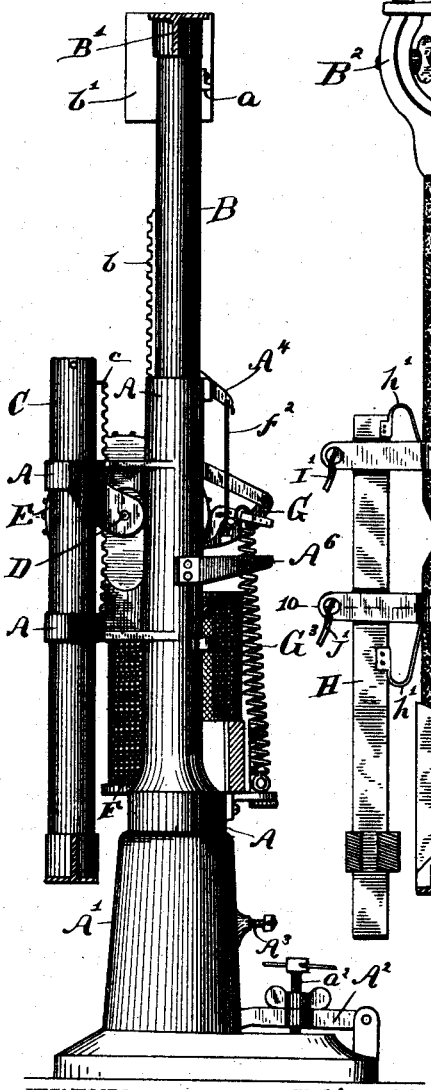


Fig. 6.

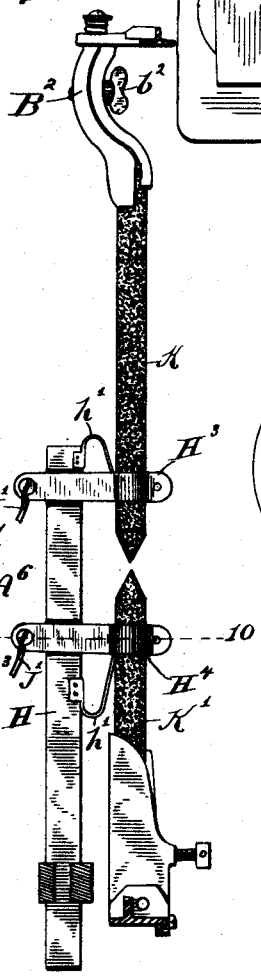


Fig. 8.

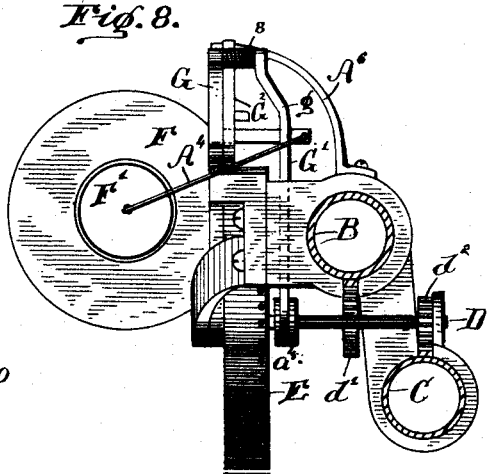


Fig. 9.

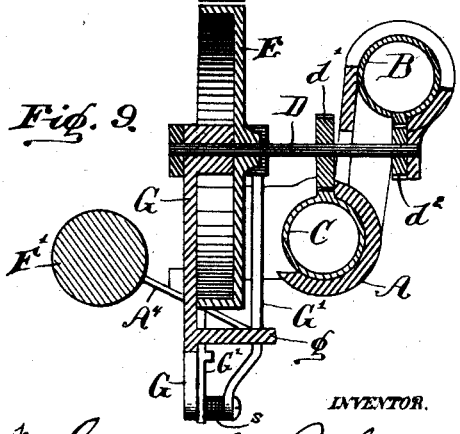
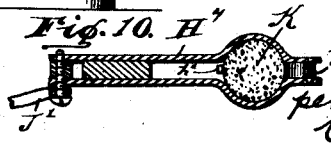


Fig. 10.



WITNESSES.

C. H. H. Brown.

J. Walsh

INVENTOR.

George C. Pyle,

per Chas. E. W. Bradford.

ATTORNEYS.

# UNITED STATES PATENT OFFICE.

GEORGE C. PYLE, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO THE NATIONAL ELECTRIC HEAD LIGHT COMPANY, OF SAME PLACE.

## ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 422,446, dated March 4, 1890.

Application filed May 28, 1889. Serial No. 312,451. (No model.)

*To all whom it may concern.*

Be it known that I, GEORGE C. PYLE, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

My said invention, while it relates to electric-arc lamps generally, is particularly designed for use in connection with those employed with locomotive electric head-lights.

It consists in certain details of construction and arrangements of parts whereby an even and regular feed of the carbons is maintained, whereby said carbons are firmly supported in proper relation, whereby an equal resistance is maintained in said carbons notwithstanding their varying lengths, and whereby the lamp is enabled to withstand sudden shocks without disarrangement of the mechanism or varying the intensity of the light, all as will be hereinafter more particularly described and claimed.

Referring to the accompanying drawings, which are made a part hereof, and on which similar letters of reference indicate similar parts, Figure 1 is a side elevation of a lamp embodying my said invention; Fig. 2, a rear elevation of the same; Fig. 3, a vertical sectional view looking toward the left from the dotted line 3 3 in Fig 1; Fig. 4, a similar view looking toward the right from the dotted line 4 4; Fig. 5, a similar view looking toward the left from the dotted line 5 5; Fig. 6, a similar view looking toward the right from the dotted line 6 6, and particularly showing the guide for the carbons; Fig. 7, a top or plan view of the lamp; Fig. 8, a horizontal sectional view, on an enlarged scale, looking downwardly from the dotted line 8 8 in Fig. 1; Fig. 9, a similar view looking upwardly from the dotted line 9 9, but diverging to include the arm G, as indicated in Fig. 2; Fig. 10, a horizontal sectional view through one of the carbons and its guide on the dotted line 10 10 in Fig. 6, and Fig. 11 a view of the clutch and brake mechanism separately, as seen from the dotted line 11 11 in Fig. 1, the adjacent parts being shown in dotted lines.

In said drawings the portions marked A represent the frame of the lamp; B, the frame carrying the upper carbon; C, the frame carrying the lower carbon; D, the shaft of the gearing by which the movement of said carrying-frames is effected; E, a clutch-wheel on said shafts by which said movement is regulated; F, the coil of the solenoid by which the mechanism is governed; G, an arm pivoted on the shaft D and carrying the brake and clutch which engage with the wheel E, and which is also attached to and governed by the core of the solenoid; H, a guide by which the points of the carbons are held at all times in proper relation; I and J, the incoming and outgoing line-wires, and K K′ the carbons.

The frame A is mounted in a base A′ and should be formed of brass or some other diamagnetic material. It is made adjustable vertically in its bearings in said base by means of lever $A^2$, operated by a screw $a^2$, which is pivoted to a boss on the base and extends through the side of its upright part to beneath the lower end of the frame A, where it fits into a notch in said frame and thus holds it from turning in its bearings. A set-screw $A^3$ is provided, by which, when the desired adjustment is effected, the frame can be secured rigidly to position. Said frame is provided with bearings for the carbon-carrying frames B and C, as well as for the mechanism by which they are operated. An arm $F^2$ on said frame carries the said solenoid F and binding-posts *a* for the incoming and outgoing line-wires I and J.

The carbon-carrying frame B consists of a rod (which is preferably hollow to secure lightness) with a cross-arm B′ on its upper end, which extends out and carries the carbon, which cross-arm is formed with an enlarged end *b′* on the opposite side to the carbon, which serves as a counter-balance therefor. Its vertical portion is mounted in a corresponding bearing in frame A, and is provided with a rack-bar *b* on one side, with which wheel *d* on the shaft D engages, whereby it is operated. The end which carries the carbon is formed in a separate piece and insulated from the other portion of the cross-arm, (see Fig. 1,) and is provided with a clamp $B^2$, by which the carbon is held, which clamp is preferably operated by a thumb-screw $b^2$. A stop *a* prevents this frame from descending too far, either when there are no carbons

in the lamp or the carbons have been burned to their practicable limit.

The frame C is very similar to the frame B, except that it is placed in a reverse position, and is geared to move in operation only about half as fast as said frame B, as is common in lamps of this character.

The shaft D is mounted in bearings in the frame A and carries the clutch-wheel E. It also carries small pinions $d'$ and $d^2$, which engage with the rack-bars on the frames B and C.

The wheel E, as shown most plainly in Fig. 8, is a combined friction and clutch wheel, and is operated (as will be presently described) by the solenoid through the medium of the brake and clutch attached thereto. Its operation will be described in connection with the operation of said brake and clutch.

The coil F and the core F′ compose an ordinary solenoid, so far as its general construction is concerned, and it is operated by the variation in the electric current in an ordinary and well-known manner. Said core is connected to the clutch and brake mechanism by a pivoted bar $A^4$ on the frame A and appropriate connecting-rods $f'$ $f^2$ attached to its ends.

The arm G is pivoted at its inner end on the shaft D. To an arm $g$ on one side is secured the connecting-rod $f^2$, by which through the bar $A^4$ it is connected to the core of the solenoid. To its extreme outer end is secured the clutch-bar G′, and to a projection $g^2$ is secured the brake $G^2$. The clutch-bar G′ extends up alongside the wheel E, and has a curved end which rests on a small roller $a^5$, which is mounted on a stud-shaft $A^5$ on the frame A. About midway its length it is provided with a clutch pin or pawl $g'$, which engages with the teeth on the clutch-wheel E. It is held into contact with the roller $a^5$ or the surface of the wheel E, according to its location, by a small spring $s$. The face of the brake $G^2$ should be armed with a piece of leather or other fabric which will adhere to the surface of the wheel when in contact therewith and retard its motion. An arm $A^6$, which projects out from the frame A, supports this mechanism when not sustained by the force of the solenoid, and a spring $G^3$, attached to the brake $G^2$, not only holds this brake in contact with the periphery of the wheel E, but also holds the brake and clutch mechanism so that it rests upon the arm $A^6$ when not raised by the action of the solenoid. The curvature of the inner end of the clutch-bar G′ is such that when it is held down in this position said inner end will be raised sufficiently by its contact with the roller $a^5$ so that clutch-pin $g'$ will be above the points of the teeth of the clutch-wheel, thus permitting said clutch-wheel to revolve without obstruction from such clutch-pin. When, however, the solenoid is energized by the increase of the electric current passing through it, its core is drawn down in the ordinary manner, bringing the clutch-pin $g'$ into contact with a tooth of said wheel and preventing its further rotation. In practice the current passing through the coil of the solenoid is just strong enough, when the carbons are in proper relation, to hold the clutch parts into engagement, but when the carbons are burned away the current becomes weakened, permitting the clutch mechanism to drop and disengage, and allowing the weight of the carbon-carrying frames, acting through the shaft D and gear-wheels thereon, to revolve said shaft, together with the clutch-wheel, whereby the carbons are enabled to approach each other and re-establish their normal condition.

An important feature in the construction of my lamp is the balancing of parts by making the lower carbon-carrying frame and the core of such weight that the leverage on the arm G will enable them to operate as though of substantially equal weight with the upper carbon-carrying frame, so that except for the spring $G^3$ the parts would remain in any position in which they might be placed. This result is accomplished by means of the gearing which engages with the vertical portions of the carbon-carrying frames, through which gearing the weight of the core of the solenoid is enabled to operate thereon, said core being connected to said gearing through the bar $A^4$, the rod $f^2$, the arm G, and the parts immediately connected therewith. When the spring $G^3$ is removed, the weight of said solenoid-core holds the mechanism in such a position that the clutch-pin $g'$ is held constantly into engagement with a tooth on the wheel E, and the sizes of said wheel and the other gearing are so proportioned that when the weight of said core is thus added to the periphery of said wheel (through said wheel, the pinions, and their common shaft) the exact balancing between the two carbon-carrying frames, before described, is secured. When, however, the spring $G^3$ is attached, it operates against the weight of said core, raising it, relieving the wheel E and permitting the carbon-carrying frames to approach each other, except when the solenoid is energized sufficiently to counteract the force of the spring and hold the devices into engagement, as before described. Thus, except at the times when the current has operated to disengage these parts, they are exactly balanced, and no jar upon the lamp, however violent, is capable of varying the arc unless the mechanism is at the same time injured.

The guide H is held in an arm H′, which is secured on the frame A by an insulated connection. It consists, substantially, of a vertical bar carrying two loops $H^3$ $H^4$, through which the points of the carbons extend, between which loops said carbons come together to form the arc. Said loops are attached to said bar by an insulated connection, and are also preferably covered with an insulating preparation, as well as that portion of the bar adjacent to them. In the point of each loop

is an anti-friction roller $h$, against which one side of the carbon rests, and between the arms of said loops, opposite to said rollers, are small springs $h'$, which hold them in contact therewith. Said guide may be varied in its vertical position, as it is held upon the arm H′ by a clamp $H^2$, having a clamp-screw $h^2$.

The wires I and J are the ordinary outgoing and incoming line-wires. The extensions of I′ J′ of said wires, which run from the solenoid to the carbons, are connected to said carbons through the loops $H^3$ $H^4$ instead of to the upper and lower carbon-carrying frames, as is common. By this means exactly the same amount of resistance is maintained at all times, so far as the carbons are concerned, as the current enters them always at a uniform distance from their points.

The carbons K K′ are ordinary carbons for the purpose, such as are commonly used in electric-arc lamps.

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

1. The combination, in an electric-arc lamp, of upper and lower carbon-carrying frames arranged to feed toward each other, interposed gearing engaging with both frames, a clutch-wheel mounted on the same shaft as said gearing, a clutch-arm pivoted on said shaft, a solenoid, a pivoted lever and connections extending thereto from said solenoid and said clutch-arm, and a spring operating to oppose the force of the solenoid, substantially as set forth.

2. The combination, in an electric-arc lamp, of a combined clutch and friction-wheel, an arm pivoted to the same shaft therewith and carrying both a clutch and a brake, the solenoid, and a connection between said arm and said solenoid, whereby said clutch and said brake are operated, substantially as set forth.

3. The combination, in an electric-arc lamp, of the clutch-wheel, the clutch, the spring for retracting said clutch, and an arm $A^6$, whereby the movement caused by said spring is limited, substantially as set forth.

4. The combination, in an electric-arc lamp, of the clutch-wheel, the clutch-bar having a curved end, and a roller or support extending from the frame underneath said clutch-bar, whereby as the operated end of the clutch-bar descends the contact between its curved end and said support will throw the clutch out of engagement, substantially as set forth.

5. The combination, in an electric-arc lamp, of a clutch-wheel mounted on the shaft which also carries the gearing whereby the carbon-carrying frames are operated, an arm also pivoted on said shaft, a clutch pivoted to said arm, a brake also pivoted to said arm, and a solenoid by which the whole is operated, substantially as set forth.

6. The combination, in an electric-arc lamp, of the upper and lower carbon-carrying frames constructed of different weights, and arranged to feed toward and from each other, interposed feeding mechanism, and a solenoid-core connected to said mechanism, (the movement of said carbon-carrying frames being thus controlled,) said solenoid-core being made of the proper weight to balance said carbon-carrying frames notwithstanding the difference in their weight, substantially as set forth.

7. The combination, in an electric-arc lamp, of the carbon-carrying frames, interposed gearing, clutch mechanism engaging with said gearing, and a solenoid the core of which is connected to said clutch mechanism by means of levers, said core being of an adjusted weight, whereby the difference in weight between said carbon-carrying frames is compensated for, substantially as set forth.

8. The combination, in a carbon-guide for electric-arc lamps, of the main bar to said guide, two arms containing loops or ways for the carbons, anti-friction rollers in said loops or ways, and springs, whereby said carbons are held into contact with said rollers, substantially as set forth.

9. The combination, in an electric-arc lamp, of the main frame, the upper and lower carbon-carrying frames, the mechanism for feeding said carbon-carrying frames toward and from each other, a guide-arm extending up alongside the carbons, and two guides mounted on said guide-arms, but insulated therefrom and extending out therefrom and embracing the carbons at substantially equal distances from their points, and the conductor-wires connected to said guides, substantially as set forth.

10. The combination, with an electric-arc lamp, of a base embodying a socket into which the lower end of the lamp-frame is fitted and extends, a lever mounted on a pivot in ears on said base, the inner end of which extends through the side of said base below the lower end of said lamp-frame, and an adjusting-screw, whereby said lever may be moved up and down, and the lamp-frame thus raised or lowered in relation to said base, substantially as shown and described.

In witness whereof I have hereunto set my hand and seal at Indianapolis, Indiana, this 24th day of May, A. D. 1889.

GEORGE C. PYLE. [L. S.]

Witnesses:
C. BRADFORD,
C. W. H. BROWN.