(No Model.) 4 Sheets—Sheet 1.

G. C. PYLE.

ELECTRIC ARC LAMP FOR LOCOMOTIVE HEAD LIGHTS.

No. 346,561. Patented Aug. 3, 1886.

Fig. 2.

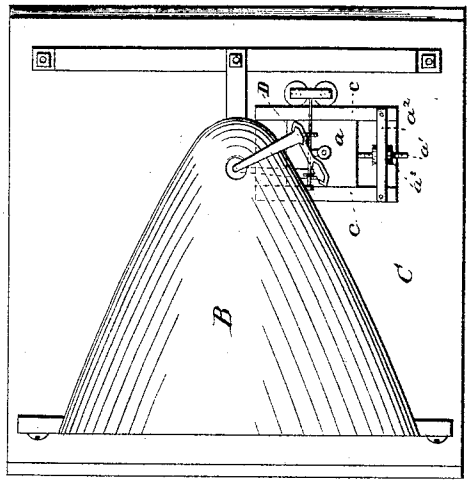


Fig. 2ª.

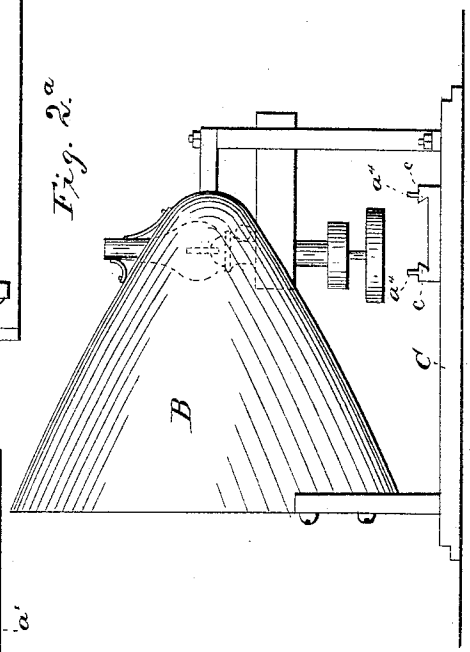
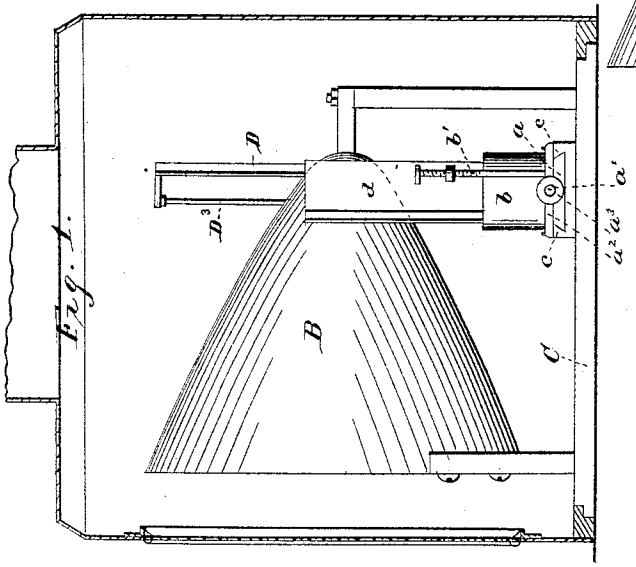


Fig. 1.



WITNESSES

Chas. R. Burr

Miralda N Lyons

INVENTOR

George C. Pyle

by Church & Church

his Attorneys

(No Model.) 4 Sheets—Sheet 2.

G. C. PYLE.

ELECTRIC ARC LAMP FOR LOCOMOTIVE HEAD LIGHTS.

No. 346,561. Patented Aug. 3, 1886.

Fig. 3.

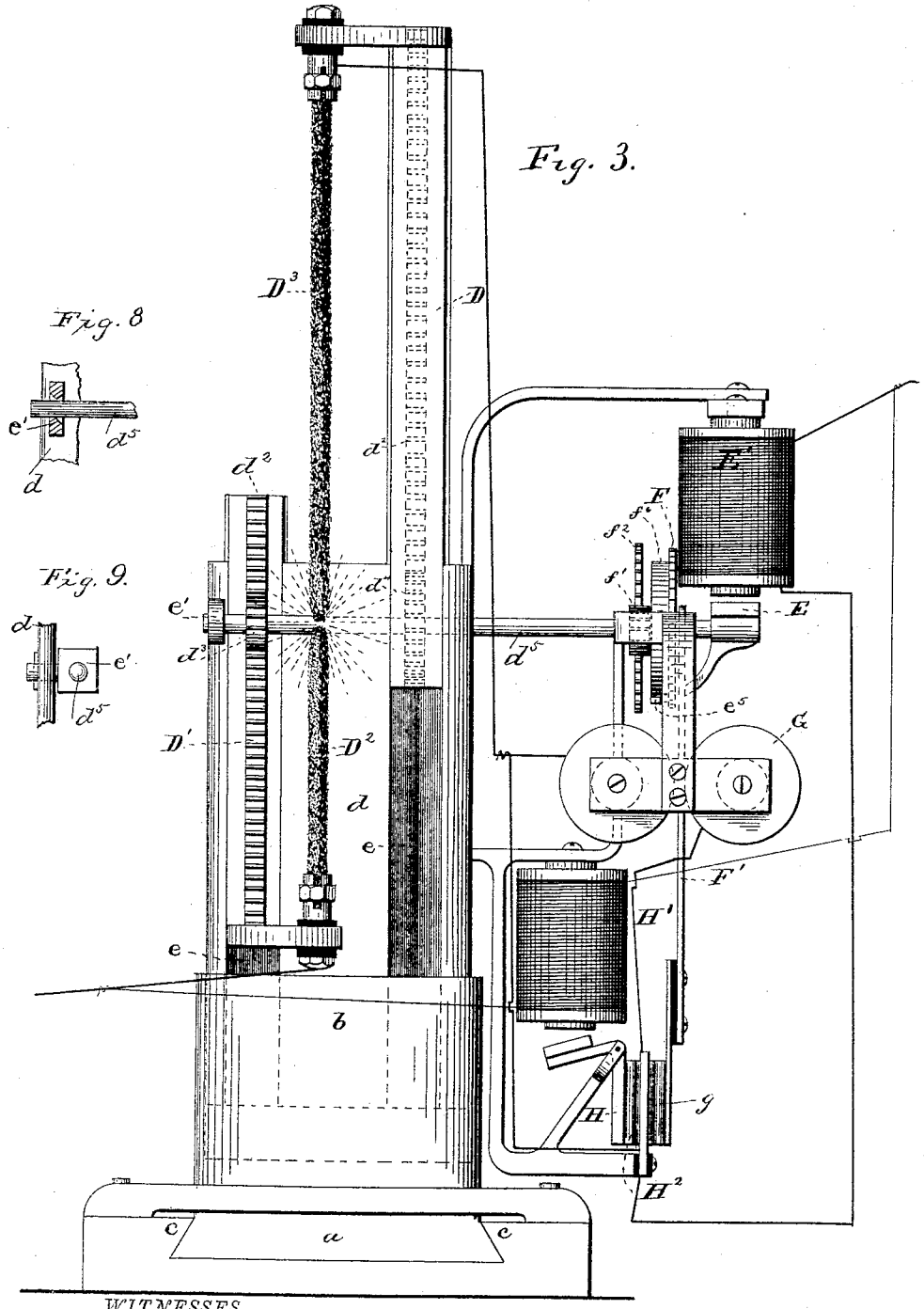


Fig. 8

Fig. 9.

WITNESSES

Chas. R. Burr

Miralda N Lyons

INVENTOR

George C. Pyle

by Church & Church

his Attorneys

(No Model.) 4 Sheets—Sheet 3.

G. C. PYLE.

ELECTRIC ARC LAMP FOR LOCOMOTIVE HEAD LIGHTS.

No. 346,561. Patented Aug. 3, 1886.

Fig. 4

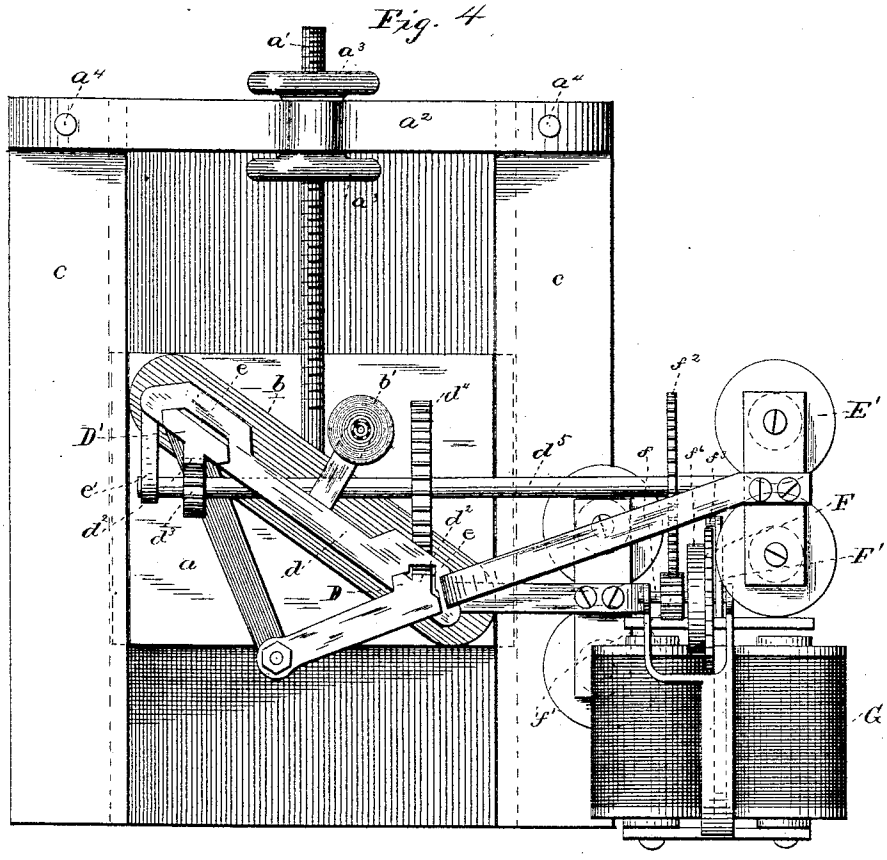
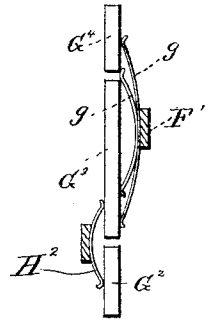


Fig. 5



WITNESSES

Chas. R. Burr

Mirabeau N Lyon

INVENTOR

George C. Pyle

by Church & Church

his Attorneys

(No Model.) 4 Sheets—Sheet 4.

G. C. PYLE.

ELECTRIC ARC LAMP FOR LOCOMOTIVE HEAD LIGHTS.

No. 346,561. Patented Aug. 3, 1886.

Fig. 6.

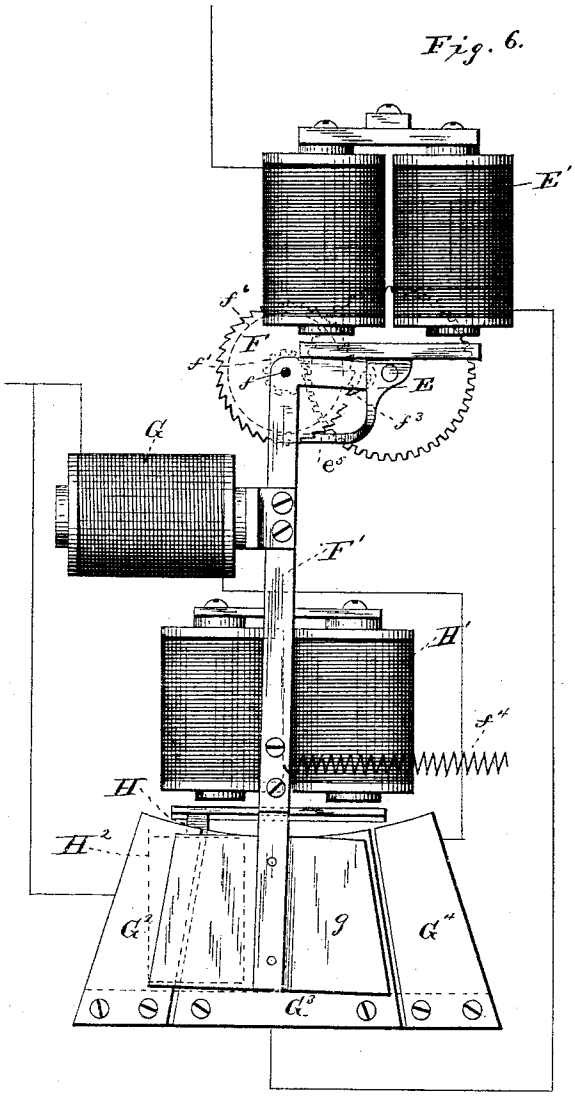
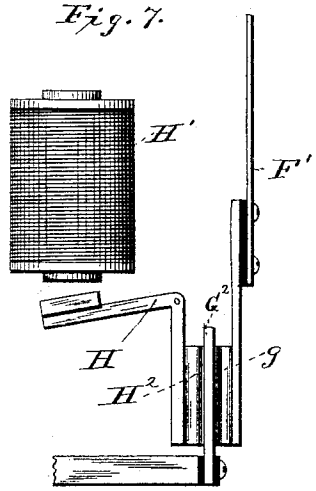


Fig. 7.



WITNESSES

Chas. R. Burr

Mirabeau N Lyon

INVENTOR

George C. Pyle

by Church & Church

his Attorneys.

UNITED STATES PATENT OFFICE.

GEORGE C. PYLE, OF DAYTON, OHIO, ASSIGNOR TO THE AMERICAN ELECTRIC HEAD LIGHT COMPANY, OF INDIANAPOLIS, INDIANA.

ELECTRIC-ARC LAMP FOR LOCOMOTIVE HEAD-LIGHTS.

SPECIFICATION forming part of Letters Patent No. 346,561, dated August 3, 1886.

Application filed May 20, 1884. Renewed April 10, 1886. Serial No. 198,511. (No model.)

To all whom it may concern:

Be it known that I, GEORGE C. PYLE, of Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Electric-Arc Lamps for Locomotive Head-Lights; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

Electric-arc lamps as ordinarily constructed are not adapted to withstand the jarring motion of a locomotive, nor to preserve and maintain the proper feed of the carbons and focal position of the arc within the reflector.

My present invention is designed to overcome these and other defects and to provide a simple and efficient form of arc lamp adapted to furnish a practically uniform and steady light, such as will meet all the requirements of a locomotive head-light; and my invention consists, primarily, in the manner of mounting and adjusting the standard carrying the lamp proper within the head-light and at the proper focal position within the reflector, also in the means and mechanism for controlling the feed of the carbons and the formation of the proper arc, all as hereinafter more fully described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side view of a head-light reflector and stand, showing the manner of applying and attaching the electric lamp. Fig. 2 is a top view of the same. Fig. 2^a is a side view showing oil-lamp in reflector. Fig. 3 is a side view of the lamp and its attachments. Fig. 4 a top view of the same. Figs. 5, 6, and 7 are detail views of the mechanism for controlling the feed of the carbons and the formation of the arc. Figs. 8 and 9 illustrate two forms of bearings suitable for supporting the end of the operating-shaft.

Similar letters of reference in the several figures indicate the same parts.

For the purpose of illustrating the principle of my invention and one mode of carrying the same into practical operation, I have shown it as applied to a head-light of ordinary and well-known construction, it being my purpose to adapt an electric-arc lamp for use in the place of and as a substitute for the usual oil-lamp heretofore employed, without in any material respect changing the structure of the head-light, at the same time rendering it possible to readily substitute one arc lamp for another, or to replace the oil-lamp should it be desirable to do so.

In the drawings, B represents the reflector mounted upon the sliding board C, the outer casing of the head-light being removed. As usually constructed, the oil-lamp is carried by or supported upon this sliding board C, so that the reflector and lamp can be readily withdrawn from or replaced within the casing and the lamp adjusted or removed. Upon the base C are formed or attached guideways *c c*, for the reception of the base-plate *a*, carrying the vertical standard *b*, which supports the operating mechanism of the lamp. The plate *a* is adjustable longitudinally in the ways *c* by means of the screw a', passing through the yoke a^2, and provided with the thumb-nuts a^3. The yoke a^2 is held to the board C by pieces a^1, or screws, if desired, passing through holes in the yoke, whereby the yoke can be readily removed and the lamp slid out and another electric lamp substituted, or the oil-lamp attached to a similar supporting-rest placed in position. Attached to the vertical standard *b* is a plate or frame, *d*, diagonally disposed, as shown, and adjustable vertically upon the standard *b* by the thumb-screw b'.

The plate *d* is provided with two guides or ways, *e e*, in which slide the posts D D', carrying the carbons D^2 D^3. The carbons are secured in suitable holders attached to the arms or extensions projecting from the sliding posts D D', and are caused to approach or recede from each other to feed the carbons or form the arc by any suitable feeding mechanism acting upon or through said posts.

The feeding mechanism, which I have designed with especial reference to this form of lamp, and which I prefer to employ in connection therewith, is constructed substantially as follows: The back of the upper post, D, and the front of the lower post, D', are each furnished with a toothed section or rack, d^2, with which engage the teeth of the pinions d^3 d^4, secured to the shaft d^5. The pinions d^3 d^4 are of different diameters, that controlling the

movements of the positive electrode being about twice the size of the other to compensate for the unequal consumption of the carbons and to maintain the arc in substantially the same focal position. If desired, the pinions may be connected to the shaft through a backing-ratchet, so that either or both of the carbons may be raised or lowered independently of the rotation of said shaft, and the holders and slides are of such relative weight and proportion as, in connection with the shaft and pinions, to establish a practical balance. The shaft d^5, carrying the pinions, passes between the vertical posts D D', and has a bearing at one end in the frame, as at e', and at the other in the armature E of the electro-magnet E'. By thus supporting the operating-shaft on the armature of the electro-magnet the separation of the carbons to form and within certain limits maintain the arc is effected by the direct application of the current, for as the armature is raised by the attractive force of the electro-magnet the shaft is tilted, thus raising the upper-carbon holder. The carbon-feeding mechanism is applied to or operates upon the shaft d^5, and is made preferably in the form hereinafter described. Upon a shaft, f, is secured a ratchet-wheel, F, and pinion f', the latter engaging a larger pinion, f^2, on the operating-shaft d^5. On the side of the ratchet-wheel is formed a flange, f^6, against which bears an extension, e^5, of the armature E, the two constituting a brake mechanism for the shaft d^5. A bell-crank lever, F', is pivoted upon the shaft f, and carries at one extremity the pawl f^3, engaging the teeth of the ratchet-wheel F, and at the other the contact plates or brushes $g\,g$. The armature or core of the electro-magnet G is suitably attached to one side of the vertical arm of the lever F', and an adjustable spring, f^4, is applied to the other side, acting in opposition to the electro-magnet. The brushes $g\,g$ are fastened to an extension of the lever F, but insulated therefrom, as shown in Figs. 3 and 7, and are arranged to make contact with the plates $G^2\,G^3\,G^4$ as the lever is moved from side to side. These plates are insulated from each other and from their support. The middle plate, G^3, is connected to the coils of the electro-magnet E'. The plate G^2 is connected directly to the upper-carbon holder, and the plate G^4 to the same carbon holder through the coils of the electro-magnet G. A pivoted lever, H, carries at one end the armature of the electro-magnet H', of relatively high resistance and located in a shunt around the lamp, and at the other a contact-spring, H^2, for making the connection between the plates G^3 and G^4. The resistance of the shunt-circuit is proportioned so that the armature of the electro-magnet H' will not be raised until the resistance of the circuit through the carbons is abnormally increased and the relative tension of the spring f^4 and power of the electro-magnet G is such that the brushes will not be entirely withdrawn from contact with the plate G^2 so long as the resistance of the arc remains uniform or within certain limits, the main portion of the current being directed through the spring H^2 and plate G^2.

The operation of the feeding mechanism as thus constructed and arranged is substantially as follows: The carbons being brought into contact, the lever F' held to one side by its spring, and the spring H^2 in contact with the plates $G^3\,G^4$, the main current, entering through the electro-magnet E, passes to the plate G^3, where it divides, part going through the spring H^2, plate G^4, and electro-magnet G to the upper carbon, and part through the brushes $g\,g$ and plate G^2 to the same carbon. As soon as the circuit is established through the electro-magnet E', the armature E will be raised, causing the shaft d^5 to be tilted, raising the upper carbon, and thus forming the arc. As the armature E rises, the extension e^5 (which may be provided with an elastic cushion, if desired) is brought against the flange f^6 and prevents the rotation of the shaft f so long as the armature remains attracted. When the arc elongates, owing to the consumption of the carbons, and the resistance of the main circuit is abnormally increased, the armature of the electro-magnet E' falls and the electro-magnet H' becomes engaged sufficiently to withdraw the spring H^2 from contact with the plates G^3 and G^4. When open, the direct circuit between the plates G^3 and the carbon is broken and the current diverted through the electro-magnet G. The electro-magnet G being energized sufficiently to overcome the spring f^4, the lever is attracted, and the pawl thereon engaging the ratchet-wheel causes a partial rotation of the shaft d^5 in a direction to feed the carbons together. As the lever is attracted toward the electro-magnet G, the brushes are caused to pass from the plate G^4 to plate G^2, thus breaking the circuit through magnet G and establishing it through the plate G^2. The spring immediately draws the lever back, when the same operation is repeated, until the carbons are fed a sufficient distance to reduce the resistance of the main circuit and establish the arc. As soon as this is accomplished, the armature of the shunt-magnet is released, the connection between the plates G^3 and G^4 re-established, and the armature of the electro-magnet E' again raised. In order to avoid breaking the main circuit entirely as the brushes move from one of the outer sections to the other, I construct the said brushes or contact-makers in two parts, one of which is longer than the other, and as the lever is moved from side to side contact is established between the two outer sections, G^2 and G^4, before passing from either and onto the middle plate, G^3. It will thus be seen that the plate G^3, representing the terminal of the entering circuit, is at all times connected with one or both of the plates $G^2\,G^4$, and hence the circuit through the carbons is maintained during the entire excursion of the lever.

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

1. The sliding board of a locomotive-head-light, provided with ways, in combination with the vertical plate carrying the electric lamp, the adjusting-screw, thumb-nuts, and removable yoke, substantially as described, whereby the lamp can be readily applied or removed from the head-light, as set forth.

2. In combination with the reflector for a locomotive head-light, an electric lamp the working parts whereof are supported upon a single plate diagonally disposed in rear and to one side of the reflector, substantially as described.

3. In combination with the reflector of a head-light, a diagonally-arranged support disposed in rear and to one side of the reflector, two slides carrying the carbons, and a shaft connected to the said slides and actuated by the operating mechanism, substantially as described.

4. In combination with the reflector secured to the sliding board and located within the inclosing-case of a head-light, a focusing electric lamp the operating parts whereof are all mounted upon a vertically-adjustable plate supported on a horizontally adjustable and removable plate, substantially as described.

5. In a locomotive head-light, and in combination with the ways secured to the sliding board and the removable yoke, the adjustable plate carrying the lamp-operating mechanism, and provided with detachable adjusting devices engaging said yoke to permit the removal of the yoke and the withdrawal of the lamp, substantially as described.

6. In combination with the reflector, the diagonally-arranged plate, the slides mounted and sustained upon said plate, and provided with carbon-carriers projecting the one above and the other beneath the reflector, and mechanism for controlling the movements of said slides to feed the carbons and form the arc, substantially as described.

7. In combination with the vertical plate provided with guides or ways, the carbon-carriers working therein, and provided with teeth, as described, and the rotating operating-shaft passing diagonally between said slides and carrying the pinions for engagement therewith, as and for the purpose set forth.

8. In combination with the movable carbons and their holders, a tilting and rotating driving-shaft supported at one end by the armature of an electro-magnet included in the lamp-circuit, substantially as described.

9. In combination with the movable carbons and their holders, a rotating shaft for controlling their movements and pivotally supported at one end, and adapted, when tilted, to separate the carbons and form the arc, substantially as described.

10. In combination with the sliding carbon-holders provided with teeth, the pinions engaging therewith and mounted upon a tilting and rotating shaft, substantially as described.

11. In an arc lamp, and in combination with the movable carbons thereof, a rotating tilting shaft carrying pinions for engagement with the carbon-holders, supported at one end in a movable bearing whose position is determined by the attraction of an electro-magnet in the lamp-circuit, substantially as described.

12. In an arc lamp, and in combination with the driving-shaft therefor, the armature supporting one end of the said shaft and provided with a brake for engagement with a drum fastened to the counter-shaft, and intermediate gearing between the counter-shaft and driving-shaft, whereby the rotation of the counter-shaft is prevented when the armature is raised, substantially as described.

13. In an arc lamp, the combination of the main driving-shaft supported at one end in the armature of an electro-magnet, the counter-shaft geared to the main shaft and operated upon by the feed mechanism, and a clutch connected to said armature, as and for the purpose set forth.

14. In combination with a tilting main driving-shaft, a counter-shaft mounted in fixed bearings and geared to said main driving-shaft, and mechanism, such as indicated, for intermittingly rotating the said counter-shaft, and through it the main driving-shaft, as and for the purpose set forth.

15. The combination, in an arc lamp, of a divided circuit, in one branch of which is located an electro-magnet for effecting the feeding of the carbons, and a switch operated upon by said electro-magnet to alternately divert the current through each branch, substantially as described.

16. The combination, in an arc lamp, of a divided main circuit, in one branch of which is located an electro-magnet for controlling the feed of the carbons, a switch operated upon by said electro-magnet for alternately diverting the current through the two branches, and an electro-magnet of relatively high resistance located in a circuit around the lamp and operating to shunt the main current through the branch containing the electro-magnet when the resistance of the arc is increased, substantially as described.

17. In an electric lamp, and as a means for regulating the feed of the carbons, a divided main circuit, a feed-actuating electro-magnet located in one of said branches, a cut-out located in the other branch, and a switch actuated by the said electro-magnet to alternately direct the main current through the two branches, substantially as described.

18. In an electric lamp, and as a means for regulating the feed of the carbons, a divided main circuit, a feed-actuating electro-magnet located in one of said branches and a cut-out in the other, an electro-magnet of relatively high resistance located in a shunt-circuit

around the lamp and controlling the said cut-out, and a switch mechanism controlled by the first-mentioned electro-magnet, for alternately directing the current through either branch when the cut-out is raised, substantially as described.

19. In an electric lamp, and in combination with the feed-actuating mechanism and a divided main circuit, an electro-magnet located in one of said branches and a cut-out in the other, an electro-magnet located in a shunt-circuit around the lamp and operating the cut-out, and a switch operated by the electro-magnet in the branch of the main circuit, to transfer the current from that branch to the other branch, substantially as described.

20. In combination with the movable carbons and feeding mechanism therefor, and as a means for actuating said feeding mechanism, the divided circuit, the electro-magnet in one branch, the second branch of relatively low resistance containing a cut-out operated by an electro-magnet in a shunt-circuit, a switch operated by the electro-magnet in the branch circuit to disconnect the said branch and divert the main current into the other branch without interrupting the same, and the feeding mechanism operated by the switch-lever, substantially as described.

21. In an arc lamp, and in combination with the carbon-carrying devices, the pivoted shaft connected to the armature of an electro-magnet in the main circuit, the electro-magnet in one branch circuit and a second branch circuit of less resistance, a cut-out located in the branch of less resistance and operated upon by an electro-magnet in a shunt-circuit, a switch operated by the electro-magnet in the branch circuit to disconnect the said branch and divert the current into the other branch without interrupting the main current, and a feeding mechanism operated upon by the switch-lever, substantially as described.

22. In combination with the feeding mechanism and with the lever operating the same, the branch circuits, the electro-magnet located in one of said branches and operating on the lever, the contact-springs carried by said lever, the three contact-plates connected, respectively, with the branch circuits and the main line, whereby as the lever is attracted by the electro-magnet the main current is gradually diverted from one branch to the other, substantially as described.

23. In an electric lamp, and in combination with the vibrating lever for actuating the feed mechanism, the three switch-plates insulated from each other, and connected, the two outer ones to the respective branch circuits and the middle one to the main circuit, and the double contact-springs, arranged and operating substantially as described.

GEO. C. PYLE.

Witnesses:
D. L. WHITTIER,
MIRABEAU N. LYNN.