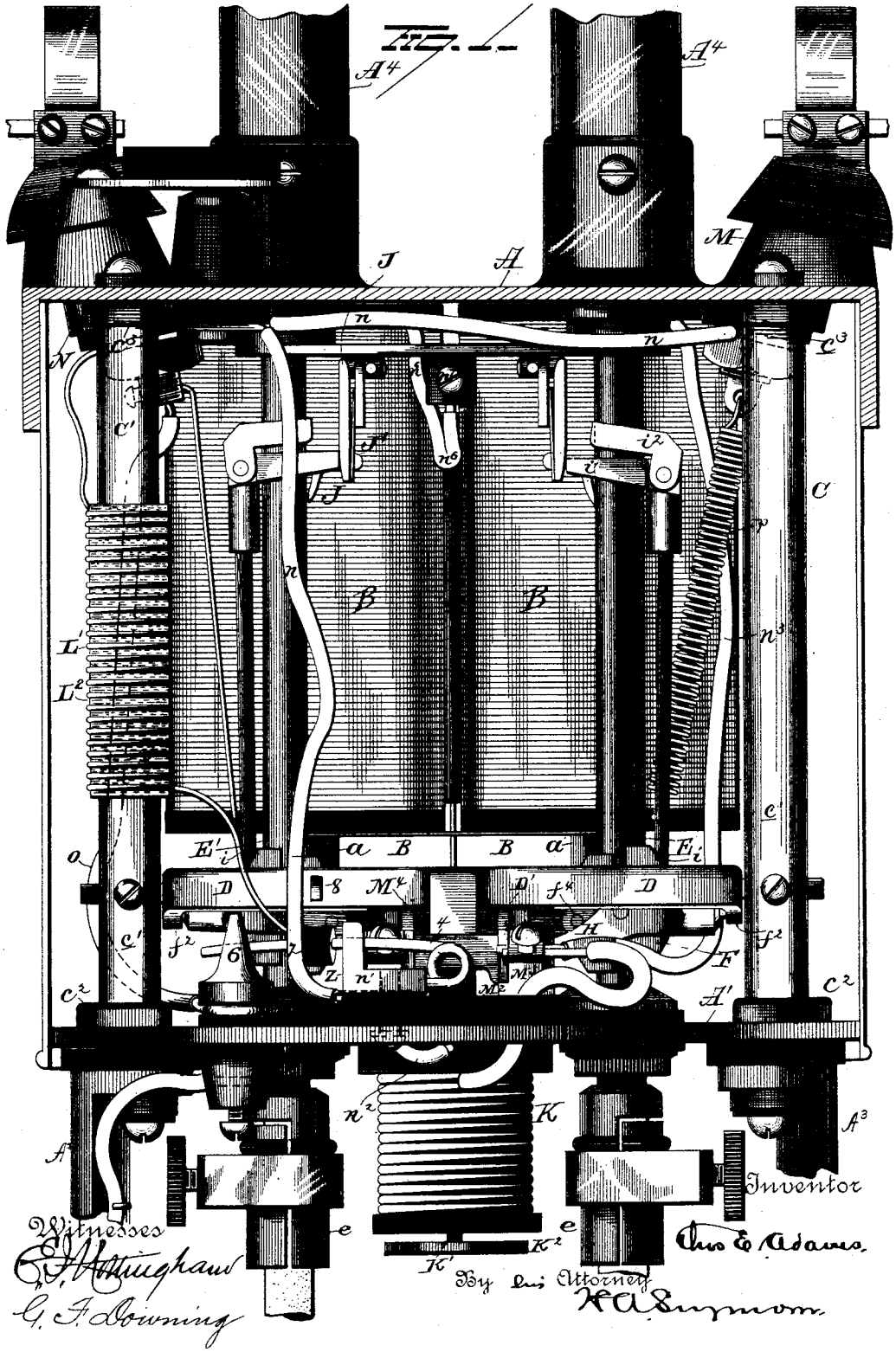
(No Model.) 5 Sheets—Sheet 1.

T. E. ADAMS.

ELECTRIC ARC LAMP.

No. 473,283. Patented Apr. 19, 1892



(No Model.) 5 Sheets—Sheet 2.

T. E. ADAMS.

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Fig. 2.

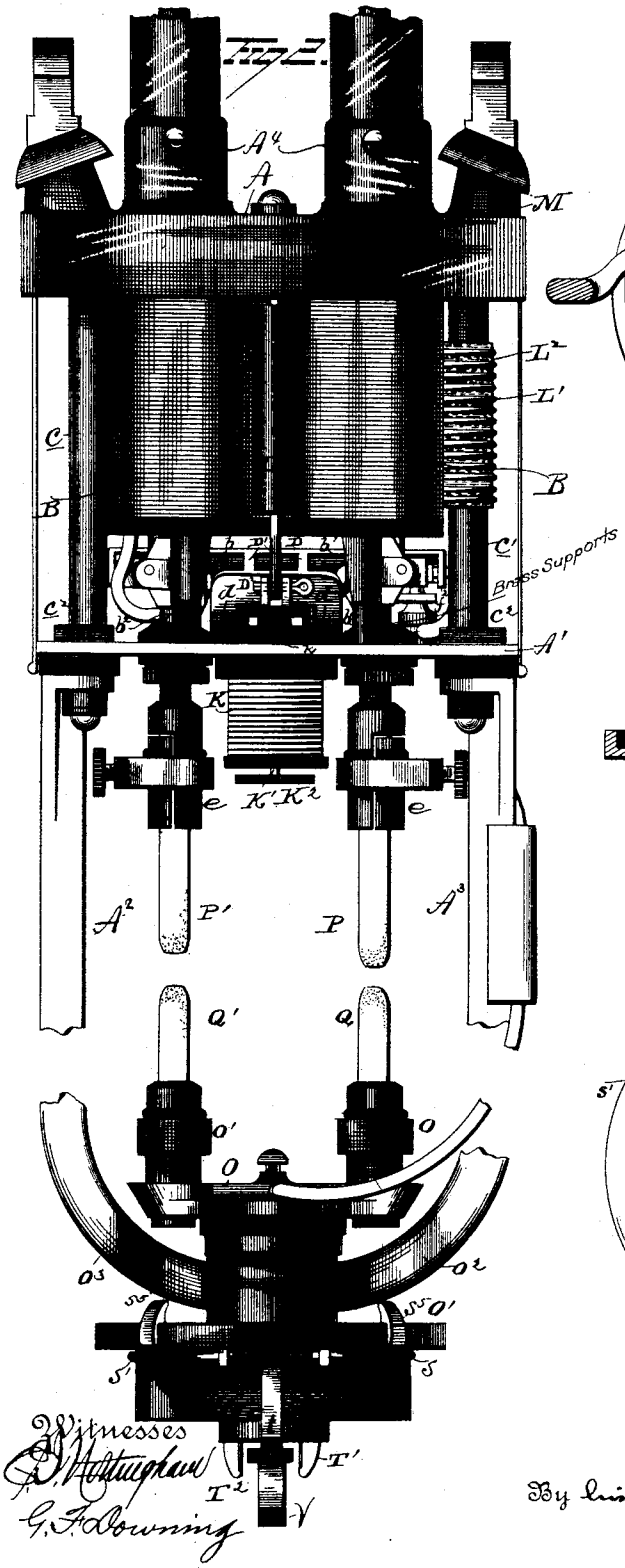


Fig. 5.

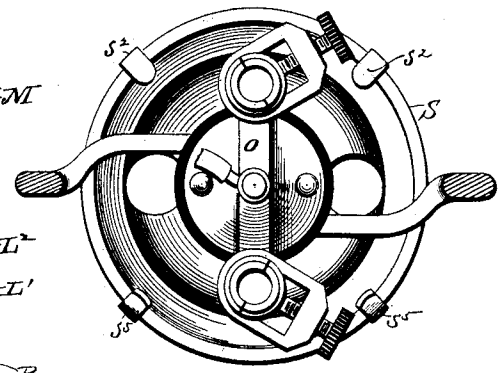


Fig. 1.

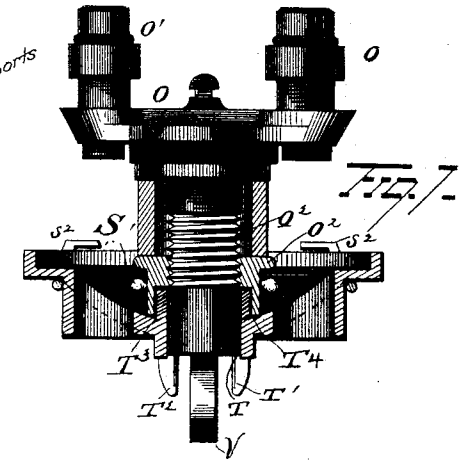
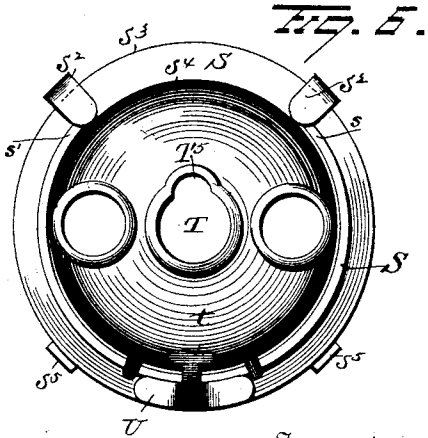


Fig. 6.



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(No Model.) 5 Sheets—Sheet 3.

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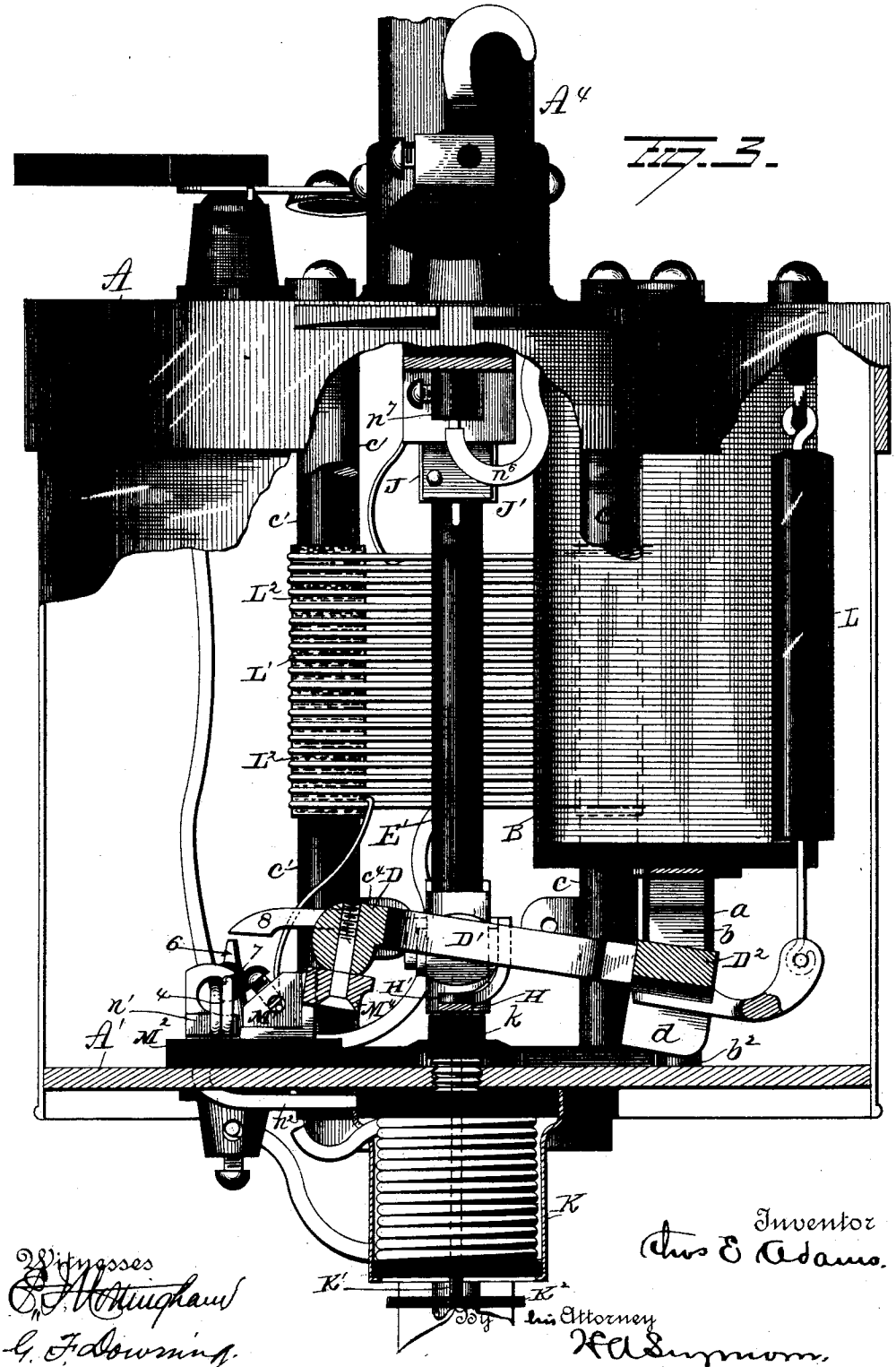

Fig. 3.

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(No Model.) 5 Sheets—Sheet 4.

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Fig. 4.

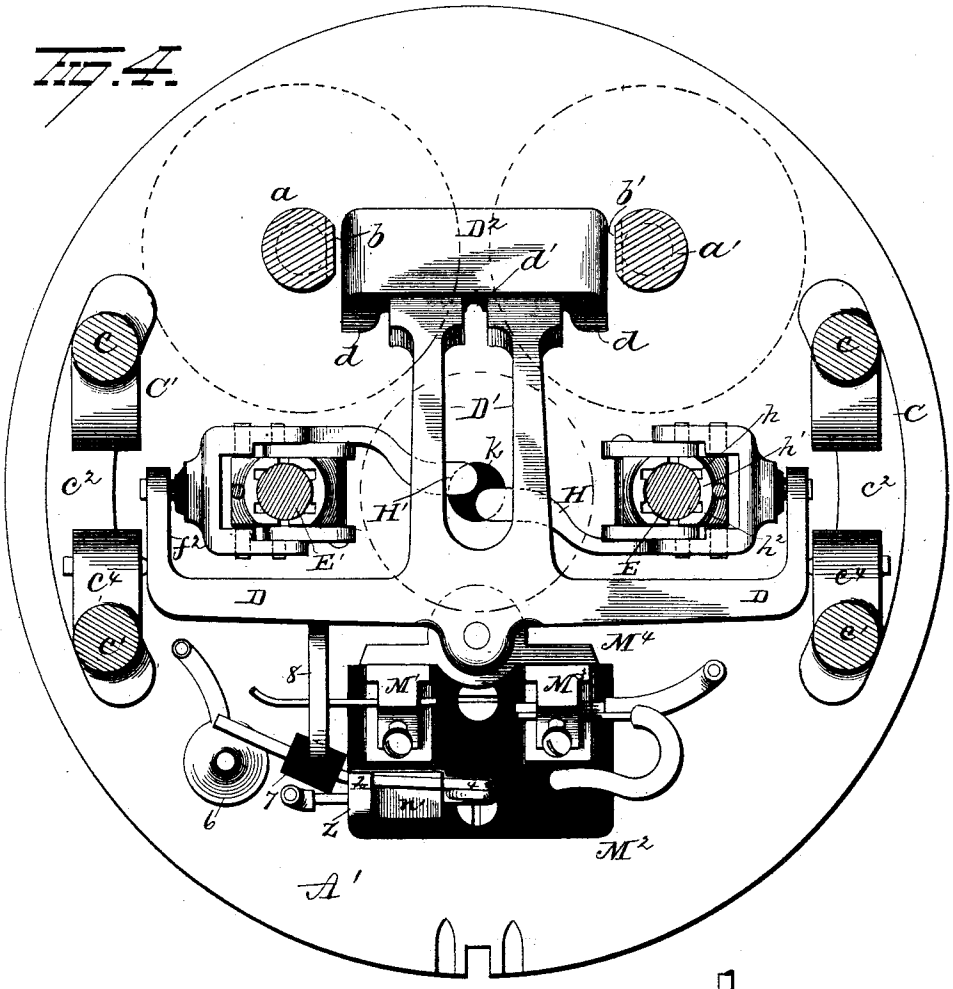
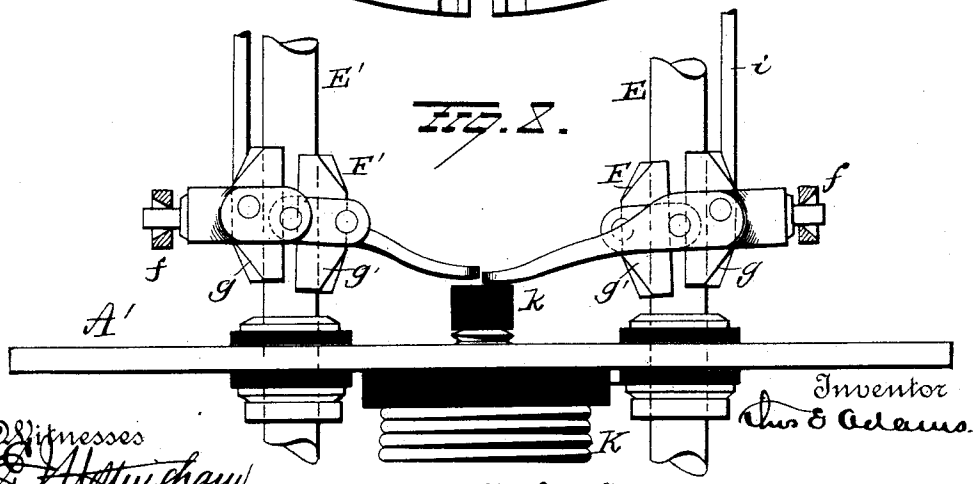


Fig. 8.



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(No Model.) 5 Sheets—Sheet 5.

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ELECTRIC ARC LAMP.

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Fig. 11.

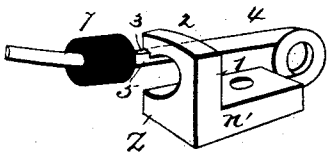


Fig. 9.

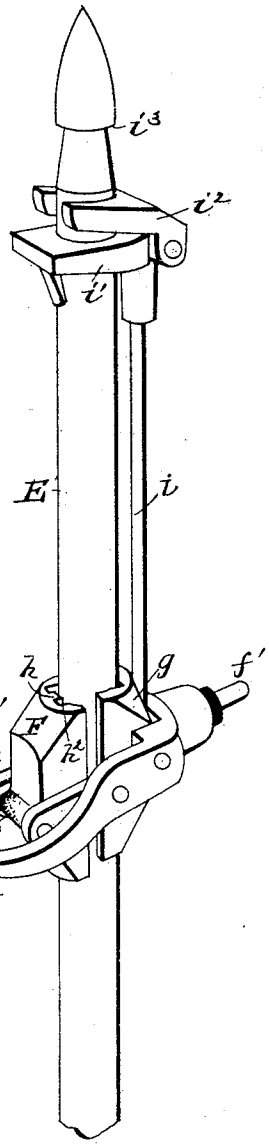


Fig. 10.

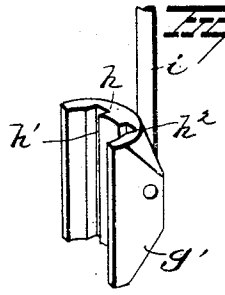


Fig. 12.

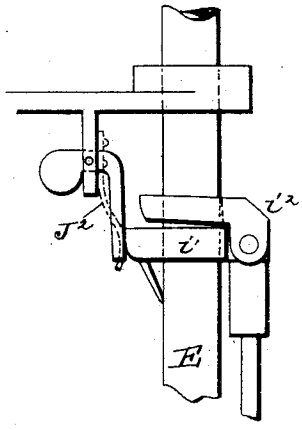
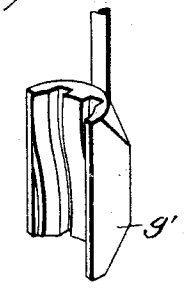


Fig. 13.



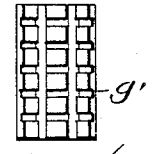
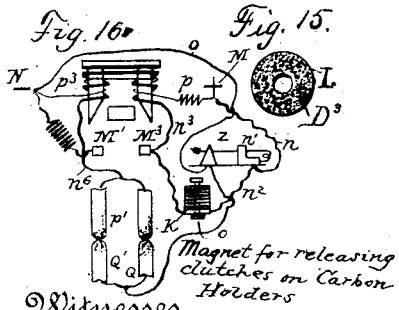


Fig. 14.

Fig. 16.

Fig. 15.



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Inventor
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By his Attorney
F. C. Symmes

UNITED STATES PATENT OFFICE.

THOMAS E. ADAMS, OF CLEVELAND, OHIO, ASSIGNOR TO THE BRUSH ELECTRIC COMPANY.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 473,283, dated April 19, 1892.

Application filed July 8, 1890. Serial No. 358,037. (No model.)

To all whom it may concern:

Be it known that I, THOMAS E. ADAMS, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Electric-Arc Lamps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in electric-arc lamps, the object being to provide an arc lamp of such construction that when once adjusted for any given current its adjustment will remain fixed and certain and cannot be changed or modified by a lamp trimmer or attendant, whereby each lamp under normal conditions will give a light of a certain and predetermined candle-power.

A further object is to provide a clutch of such construction that it will, by its varying frictional contact with the smooth round carbon rod, promptly grasp and raise it in establishing the arc and will feed it so gradually as to maintain the arc uniform in its length and brilliancy, and, further, will be self-cleaning, so that as the lamp-trimmer inserts a new set of carbons the simple act of rotating the carbon rods to bring the carbons into alignment will operate to clean the wearing-surfaces of the clutch.

A further object is to provide an improved globe-holder of such construction that the globe will be securely held in place and when removed may be supported by the lamp-frame and allow of the ready cleaning of the globe.

A further object of my invention is to provide a supplemental cut-out for preventing the burning out of the fine-wire spools in the event that an abnormal amount of current should flow through them.

A further object is to provide a self-cleansing contact for conducting the current from the lamp-frame to the carbon-holders. Certain other features of invention are also attained by my invention; and, with all of the several objects above stated in view, my invention consists in the several features of improvement which will be hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in front elevation of a double-carbon lamp embodying my invention. Fig. 2 is a view in rear elevation. Fig. 3 is a view in elevation and partly in section of the lamp provided with the resistance-coil. Fig. 4 is a view of the regulating mechanism of the lamp. Fig. 5 is a detached view of the lower-carbon socket adjusted to allow of the removal of the carbon rods. Fig. 6 is a bottom view of the globe-holder. Fig. 7 is a vertical section of the lower-carbon holder and globe-holder. Fig. 8 is a detached view of the clutches. Figs. 9 and 10 are detached perspective views of one of the clutches. Fig. 11 is a detached view of the supplemental cut-out. Figs. 12, 13, and 14 are views of modifications. Fig. 15 is a bottom plan view of the dash-pot, showing the dust-guard. Fig. 16 is a view illustrating a diagram of the circuits of the lamp.

A A′ represent the upper and lower plates of the lamp-frame.

A^2 A^3 are the side rods, and A^4 the chimneys.

B B are electro-magnets, the cores *a a′* of which are connected to the top plate A of the lamp, which is preferably made of iron, and thus forms a yoke-piece connecting the two cores. Should the top plate be made of brass, the cores may be connected by a separate yoke-piece. Cores *a a′* are extended downwardly a considerable distance, and are flattened, as at *b b′*, on their inner adjacent sides, while their lower ends are supported by brass pillars b^2, attached to the lower plate A′. Thus the cores of the electro-magnets are firmly secured against displacement and serve as pillars to strengthen the frame-work of the lamp.

C C′ are the side supports of the lamp-frame, each consisting of two pillars *c c′*, a lower cross-piece c^2, which is seated upon the lower plate A′ and is secured thereto by screws, an upper cross-piece c^3, and an intermediate cross-piece c^4. An oscillating bar D is pivoted at its opposite ends in the cross-pieces c^4 of the side frame and is provided with laterally-projecting arms D′, to the outer ends of which is secured the armature D^2. The armature is constructed with downwardly-projecting flanges *d d*, which are located adjacent to

the flattened faces on the projecting cores or pole-pieces of the electro-magnets, whereby the armature will move through a magnetic field of force which is practically uniform in its strength, and thus enable the armature to assume an infinite number of positions of rest or adjustment, and thus enable the regulator to properly control and regulate the feed of the carbons.

In order to permit the armature to be swaged longer when desired, it is provided at its center with a groove d'. By this means the armature D may be bent more or less, so as to vary the angle of the flanges relatively to the flat or beveled faces of the pole-pieces of the electro-magnets. Thus it will be seen that by bending the flanges d of the armature to a greater or less extent the angle formed by them relatively to the pole-pieces will be increased or diminished and the amount of surface of the flanges exposed to a corresponding amount of the surface of the flat faces of the pole-pieces of the electro-magnets will be varied, thereby weakening or strengthening the pull through certain parts of the travel of the armature.

E E′ are two independently-adjustable carbon-holders or carbon-rods, each consisting of a smooth round rod of brass or other metal, provided at its lower end with a socket e, in which a carbon is fastened. Carbon-rods E E′ are encircled by friction-clutches F F′, which are constructed as follows:

f is a yoke-piece, the outer end of which is provided with a trunnion f', which is supported in a bearing formed in an arm f^2, formed on the end of the oscillating bar D. Thus the clutch is raised and lowered by the oscillating bar and is permitted a free rocking movement, so as to prevent it from binding on the carbon-rod. Between the arms f^3 of the yoke is pivoted the fixed portion g of the clutch, while between the outer ends of the arms of the yoke are pivoted the arms f^4, attached to the adjustable portions g' of the clutch. In applying a clutch to a carbon-rod and to insure a snug and reliable adjustment thereon the two parts of the clutch are applied to the rod, the portion g' being disconnected from the arms f^4. I then squeeze the portion g' firmly against the rod, so as to take up for any inequalities or spring of the arms, and when the parts are snugly fitted to the rod I then apply solder g^2 between the pin g^3 and side arms and the rear surface of portion g' of the clutch, and thus secure a perfect-fitting clutch.

The interior surface of each half of the clutch is provided with a longitudinal rib or bearing h, having a concave bearing-surface h', which fits against the surface of the rod and provided with transverse grooves. On each side of the longitudinal bearing h is formed a longitudinal groove h^2. The object of this construction of clutch is to prevent the lodgment of dirt or dust between the clutch and carbon-rod, as in the event that dirt or dust should collect between the clutch and rod it will seriously interfere with the delicate and sensitive adjustment and control of the carbons and will cause the carbons to be fed irregularly and by jerky movements. When the trimmer inserts a new pair or carbons, he of necessity rotates the carbon rods to bring the upper and lower carbons into exact alignment, and the very act of rotating the carbon-rods serves to clean the wearing-surfaces of the clutch and scrape any dust or dirt that may have collected thereon into the side grooves h^2. Again, by providing the clutch with long and narrow wearing surfaces that engage the rod the latter will be engaged by a small circumferential bearing and with an extended longitudinal bearing, so that in the event the rod is roughened or slightly irregular or bent the elongated bearings of the clutches will engage the high or most prominent surface of the rod and insure its being properly fed in the operation of the lamp. Instead of providing a straight wearing-rib, it may be made spiral, as shown in Fig. 13. The yoke-pieces of the clutches are provided with laterally-projecting arms H H′, which serve as trips and which project inwardly and rest upon the insulated pin or support K′. To the fixed portion g of the clutch is secured the lower end of a balance-rod i, to the upper end of which is rigidly secured a perforated metal contact-plate i', through which the carbon-rod slides. A locking-dog i^2 is pivoted to the plate i' and serves to engage the annular shoulder i^3 on the upper end of carbon-rod E′, when the latter has descended to the limit of its downward movement, and thus hold carbon rod E′ suspended during the burning of the other pair of carbons. By raising the pivoted dog it may be moved out of engagement with the shoulder on the carbon-rod, and thus permit the removal of the latter for cleaning or repair.

J is a pivotal contact-plate pressed outwardly by a spring J′. The lower and beveled end of contact-plate J engages the perforated contact-plate i', and thus forms a circuit from the lamp-frame to each one of the carbon-rods. The almost vertical movement of the contact-plate J against the yielding contact-plate J′ insures a rubbing action, which insures a perfectly good contact and prevents the formation of arc, which burn and roughen the carbon-rods and render them inefficient for steady operation.

Instead of employing a spring-pressed contact-plate J, I may use a spring J^2, or I may use a gravity-contact, as illustrated in Fig. 10.

K is an electro-magnet included in the main circuit of the lamp. Within the magnet-spool is located a vertically-movable non-magnetic rod K′, to the lower end of which is secured an iron disk K^2, while an insulated block k is secured to its upper end. The insulated block k serves as an adjustable support for the arms or tail-pieces H H′

of the friction-clutches, as will be hereinafter explained.

L is an air dash-pot connected with the armature D^2 and serving to steady its action, said dash-pot being provided with a fur or hair guard D^3.

L′ is a resistance, which may consist of German-silver wire, and is wound around the side pillars *c c′*, a piece of asbestus or other suitable material L^2 being interposed between the wire and the pillars. This method of combining a resistance with a lamp is very simple and inexpensive, and it further has the advantage of disposing the coils or folds of the resistance in small compass, while affording a good ventilation for all the folds. One end of the resistance is connected with the binding-post N of the lamp, while the other end is connected with the contact-block M′, which is mounted on a piece of vulcabeston M^2 and thus insulated from the lamp-frame. Upon the vulcabeston block or support M^2 is also mounted another contact-block M^3, which is electrically connected with the main circuit, as will be hereinafter explained. A movable contact M^4 is connected to the oscillating bar D, preferably by a joint which will permit a slight rocking movement of the contact M^4. When no current is flowing through the lamp, the broad flat faces at the opposite ends of the contact M^4 engage the broad vertical faces of the stationary contact-blocks M′ and M^3, and thus form a path for the passage of the main current or a considerable portion of it from the binding-post M of the lamp through resistance L′ to the other binding-post N.

O is a disk mounted in the ring or socket O′, formed in the lower portion of the lamp-frame. This disk is provided with two carbon-sockets *o o′*, within which are secured the lower carbons of two pairs or sets. Disk O is provided with a screw-threaded shank o^2, on which is placed a canopy-nut C^2. By loosening the nut the disk may be partly rotated, and owing to the bends O^3 O^2, formed in the lower ends of the side bars of the lamp, sufficient space is thus formed between the frame and lower sockets for the passage of the upper sockets and carbon-holders when it is desired to remove the latter from the lamp.

P P′ and Q Q′ represent the two pair of carbons, the carbons of each pair being in contact when no current is flowing through the lamp.

Current enters the binding-post M and flows through the conductor *n* to the switch-post *n′*, and from thence through the conductor n^2, the spool of the electro-magnet K to the stationary contact-block M^3, and from thence through the conductor n^3 and through the coarse-wire spools of electro-magnets B B, said spools being connected in series, and from thence through conductor n^6 to the cross-bar at n^7. The current flows from the cross-bar through the yielding contacts J to both carbon-rods and passes through both pairs of carbons P P′ and Q Q′, and then flows through conductor *o* to binding-post N of the lamp. A small percentage of the current also flows from the binding-post M through the spiral conductor *p*, the fine-wire helices, which encircle the coarse-wire helices or spools, through the wire p^3 to the other binding-post N of the lamp. As the action of the differentially-wound magnets in automatically regulating the length of the arc by the variations in the strength of the current flowing through the shunt-circuit, due to the varying resistance of the arc, is now so well known, it will be unnecessary for me to explain it herein.

Should one of the carbons break off or be broken while the lamp is in operation, the ordinary cut-out of the lamp could not operate as the polarity of the solenoid or electro-magnet cores would be immediately reversed and the shunt-helix would operate to pull up and maintain upheld the cores or armature, the result of which would be to burn out the lamp and open-circuit the entire plant or series of lamps. Now in the event that the carbon should break off or fall out and the polarity of the solenoid cores be reversed it will operate to release a mechanical cut-out Z, presently to be described, and thus short-circuit the lamp and prevent the burning out of the shunt-helices. To produce this mechanical cut-out, the switch-post *n′* is provided with an upwardly-projecting arm 1, having a hook 2 at its upper end, said hook being provided on its under face with a recess 3. Secured to the end of the switch-post *n′* opposite to the hook 2 is a spring-arm 4, which is coiled at a point in proximity to its connection with said switch-post and extends forwardly under the hook 2, being provided at the point where it passes said hook with a squared portion 5, adapted to enter the recess 3. The free end of the spring-arm 4 is bent slightly, and when in the recess 3 is maintained at a point in proximity to a preferably-conical metallic post 6, secured to the bottom plate A′ of the lamp and included in the circuit of conductor *o*. Secured to the spring-arm 4, at a point between its ends, is a collar 7 of insulating material, and projecting from the oscillating bar D is an arm 8, which terminates at its free end immediately over the collar 7. Should, now, a carbon break or fall out, the polarity of the solenoid-cores would be immediately reversed and the shunt-helix would operate to pull up and maintain upheld the cores or armatures. This will cause the bar D to oscillate and bring the arm 8 in contact with the collar 7 on spring-arm 4 and free said spring-arm from the recess 3 of hook 2, whereupon the spring-arm 4 will engage the conical post 6, and thus short-circuit the lamp, and thereby relieve the shunt-coils of the excessive current which would otherwise burn said coils and open-circuit the entire plant.

S is a combined globe-holder and ash-pan. To its under side is fastened a spring S′ in such manner that the free ends *s s′* may have

a lateral movement. To the free ends of the spring are fastened the flanges s^2, which project over the rim s^3, that encircles the annular globe-seat s^4 of the holder. The rim is also provided with two fixed flanges s^5. By passing outwardly on the flanges s^2 the flanged bottom of the globe may be inserted within the rim s^3, and then by releasing the flanges the springs force them in over the globe-flange, and, in connection with the flanges s^5, securely hold the globe in place.

By the employment of my fastening the globe is not only securely retained in place; but the danger of breaking it in securing it in place and removing it is reduced to the minimum.

The ash-pan is provided with an opening T for the passage of the spring-catches T′ T^2, which hold it in place. Around the opening T is formed an upright flange T^3, which is received within the recess T^4 in the canopy-nut, whereby any ashes that drop into the ash-pan are prevented from gathering around the spring-catches T T^2 or the shank to which they are connected, thus insuring the ready removal of the ash-pan and globe.

The ash-pan or globe-holder is provided with a hook U, having a transverse bar t at its outer end. By turning the globe-holder so that the bar t is in alignment with the elongated ring V on the bottom of the shank and the spring-catch T′ or T^2 is in alignment with the recess T^5 in the wall of the opening T the globe-holder or ash-pan can be removed, after which the hook U may be inserted in the elongated ring or loop V, and the globe-holder or ash-pin will be supported by the elongated ring or loop V at the end of the shank o^2. This I consider an important improvement, as it offers a lamp-trimmer a ready and always accessible support for the globe while cleaning and trimming a lamp. Further, when the globe is supported in this manner the ashes or dirt that may have lodged therein will fall out, and, finally, the globe when supported may be readily cleaned.

The operation of the lamp is briefly as follows: When no current is passing through the lamp, the cut-out is closed, and hence the current will pass from the binding-post M through the electro-magnet K, and from thence through the cut-out contacts, and the resistance L′ to the other binding-post N of the lamp. The current will instantly energize electro-magnet K, causing it to attract and raise its armature and the insulated support and trip both clutches, causing both of the upper carbons to descend and come into contact with the lower carbons in the event that they have not been so adjusted by the trimmer. At this point I will state that by the use of the electro-magnet K, in connection with its insulated support or block k, the clutches will serve to grip their carbon-rods whenever the circuit is broken or the current ceases and hold the feeding carbons separated from the lower or stationary carbons, and thus prevent the breakage of the carbons or their slipping past and wedging together, which is frequently the case in lamps so constructed that the feeding carbons are released and drop into contact with the lower carbons whenever the current ceases or is switched off from the lamps. When the feeding carbons are thus brought into contact with the lower carbons, two circuits are established through the lamp, the resistance of which or of either of which is less than that of the circuit, including resistance L′, and hence a certain amount of current is diverted through the magnets B B and the two pairs of carbons and flows upwardly through a conductor to the binding-post N. This action of the current energizes the magnets B B, whereby they attract and raise the armature, the effect of which is to open the cut-out and cause the entire current, less the small percentage passing through the shunt helices, to flow through the carbons, and the continued raising of the armature operates the clutches and separates both pair of carbons. Owing to the construction of the clutch mechanism, the two pairs of carbons are separated dissimultaneously and the arc is established between the pair last separated. The pair of carbons between which the arc is formed is regulated and fed until they have been consumed or sufficiently consumed, when the carbons of the other pair are automatically brought into contact and then separated, whereby the arc is formed and maintained between them until they have been consumed.

The tripping-arms of the two clutches are so bent and adjusted that when the two pairs of carbons are separated the tripping-arm of the clutch supporting the idle and non-burning pairs of carbons will be located at a greater distance from the block K than the tripping-arm of the clutch supporting the feeding and burning carbon, whereby the clutch supporting the idle carbon is prevented from tripping and feeding its carbon until the other pair has been consumed. Hence it will be observed that the two pairs of carbons are dissimultaneously or successively separated in establishing the arc between one pair only of the carbons, while the successive burning of the two pairs of carbons, if effected by the dissimultaneous or successive arc, forms separations of the two pairs of carbons.

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

1. In an electric-arc lamp, a sectional friction-clutch provided with a narrow and elongated wearing-surface and an adjoining groove for the reception of dirt or dust, substantially as set forth.

2. In an electric-arc lamp, a sectional friction-clutch constructed with a narrow vertical wearing-surface formed concave transversely its length and having a narrow groove adjacent thereto, substantially as set forth.

3. In an electric-arc lamp, a sectional fric-

tion-clutch consisting of a yoke having one portion of the clutch pivoted thereto, in combination with pivoted arms having the other portion of the clutch soldered thereto, substantially as set forth.

4. In an electric-arc lamp, the combination, with a clutch and a contact-plate connected and adapted to move therewith, of a contact-plate electrically connected with the lamp and adapted to have a rubbing contact with the contact-plate connected to the clutch, substantially as set forth.

5. In an electric-arc lamp, the combination, with a friction-clutch, of a balance-rod and a contact-plate, substantially as set forth.

6. In an electric-arc lamp, the combination, with a friction-clutch and balance-rod, of a pivoted dog for supporting the carbon-rod, substantially as set forth.

7. In an electric lamp, the combination, with a clutch, of a perforated contact-plate encircling the carbon-rod and a yielding contact-plate electrically connected with the lamp-frame, substantially as set forth.

8. In an electric-arc lamp, the combination, with the top and bottom plates, of electro-magnets fastened to the top plate and provided with extended pole-pieces and diamagnetic pillars connecting such extended pole-pieces with the bottom plate, substantially as set forth.

9. In an electric-arc lamp, the combination, with electro-magnets having extended pole-pieces provided with flattened adjacent faces and an armature having a swage-groove and extended side flanges, substantially as set forth.

10. In an electric-arc lamp, the combination, with two independently-adjustable carbon-rods and their clutches, the latter being each provided with a tripping-arm, of an electro-magnet having an insulated support for both of said tripping-arms, substantially as set forth.

11. In an electric lamp, the combination, with the shunt-helices, of a mechanical cut-out adapted to automatically cut said shunt-helices out of circuit when an excessive current passes through them, said mechanical cut-out comprising a post having a hooked arm, a spring-arm secured to the base of said post and adapted to normally engage the hooked arm of the post, a contact-post with which said spring is adapted to make contact, a collar of insulating material on said spring-arm, and an arm on a moving part of the lamp mechanism adapted to strike said collar and force the spring-arm into contact with the contact-post, substantially as set forth.

12. In an electric lamp, the combination, with the shunt-helices, of a mechanical cut-out adapted to automatically cut said shunt-helices out of circuit when an excessive current passes through them, said mechanical cut-out comprising a post, a hooked arm projecting from said post and having a notch therein, a spring-arm having an angular portion adapted to engage said notch, a conical contact-post arranged in proximity to said spring-arm, a collar of insulating material on the spring-arm, and an arm carried by a moving part of the mechanism of the lamp and adapted to engage the insulating-collar and force the spring-arm into contact with the conical contact-post, substantially as set forth.

13. In an electric lamp, the combination, with the side bars bent substantially as shown, of an adjustable disk having a screw-threaded shank and a nut on said shank adapted to bear against the lower ends of the side bars, substantially as set forth.

14. In an electric-arc lamp, the combination, with a globe-holder, of a spring having flanges attached to both of its free ends, said flanges being arranged to lock the globe against accidental displacement, substantially as set forth.

15. In an electric lamp, the combination, with a lamp-frame, a portion of which is provided with an elongated slot, of a globe-holder provided with a hook having a transverse bar on its free end, whereby said globe-holder can be attached to the frame of the lamp during the operation of trimming, substantially as set forth.

16. In an electric-arc lamp, the combination, with the ash-pan having a raised rim around the opening therein, of a canopy-nut within which said rim is received, substantially as set forth.

17. In an electric-arc lamp, a sectional friction-clutch provided with a narrow and elongated wearing-surface having transverse grooves and an adjoining groove for the reception of dirt and dust, substantially as set forth.

18. In an electric-arc lamp, the combination, with a gravity-feeding carbon-rod holder, a clutch, and magnets adapted to act differentially in controlling the arc and feeding the carbon, of a supplemental electro-magnet, and an armature for said supplemental electro-magnet, adapted to release the clutch, said clutch being constructed and arranged in such manner as to maintain the carbon elevated when no current is passing through the lamp, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

THOMAS E. ADAMS.

Witnesses:
A. B. CALHOUN,
W. A. PALLANT.