No. 655,063. Patented July 31, 1900.

# J. E. DAVIDSON.

## ELECTRIC ARC LAMP.

(Application filed Oct. 17, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 2.

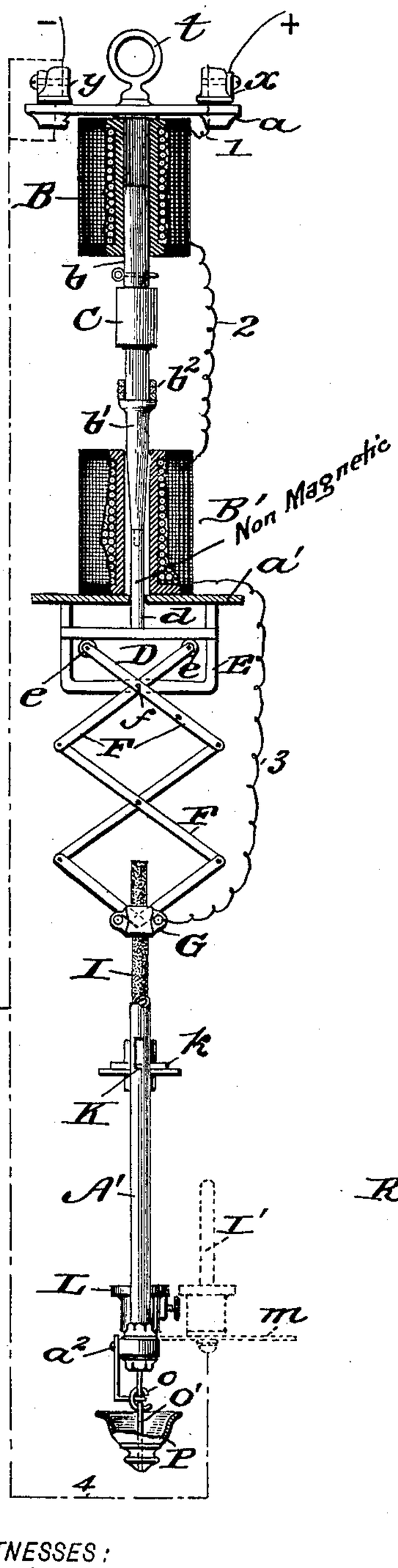


Fig. 1.

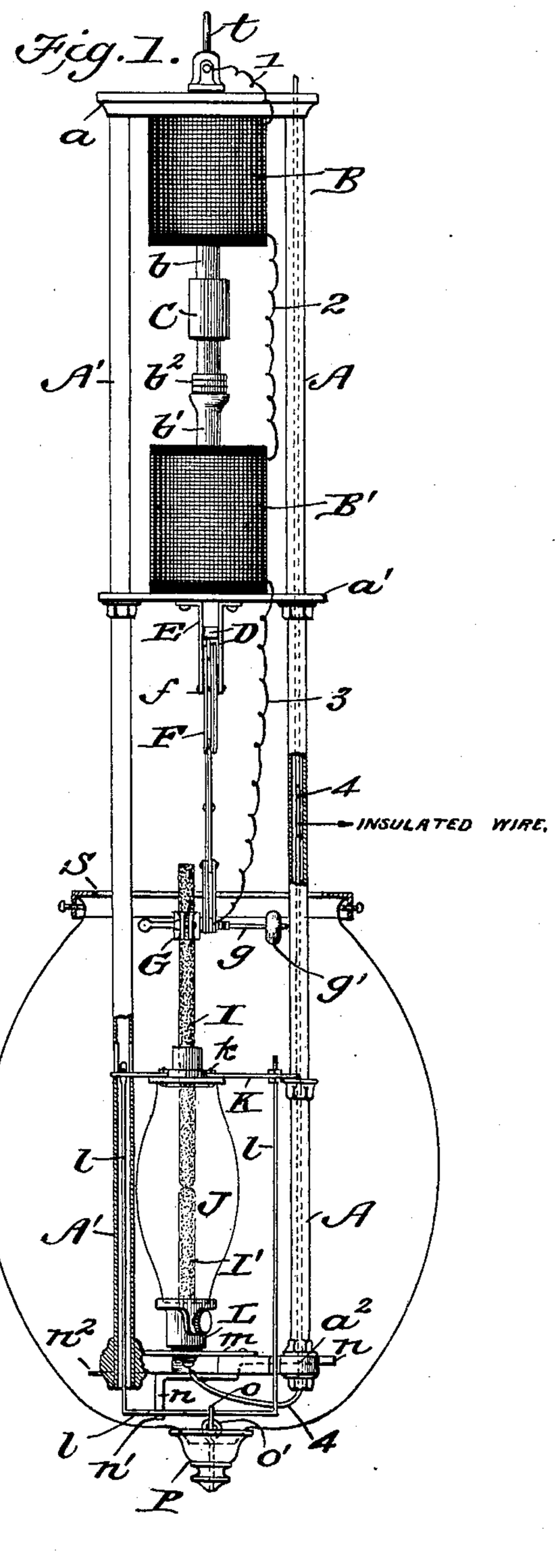


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Fig. 3.

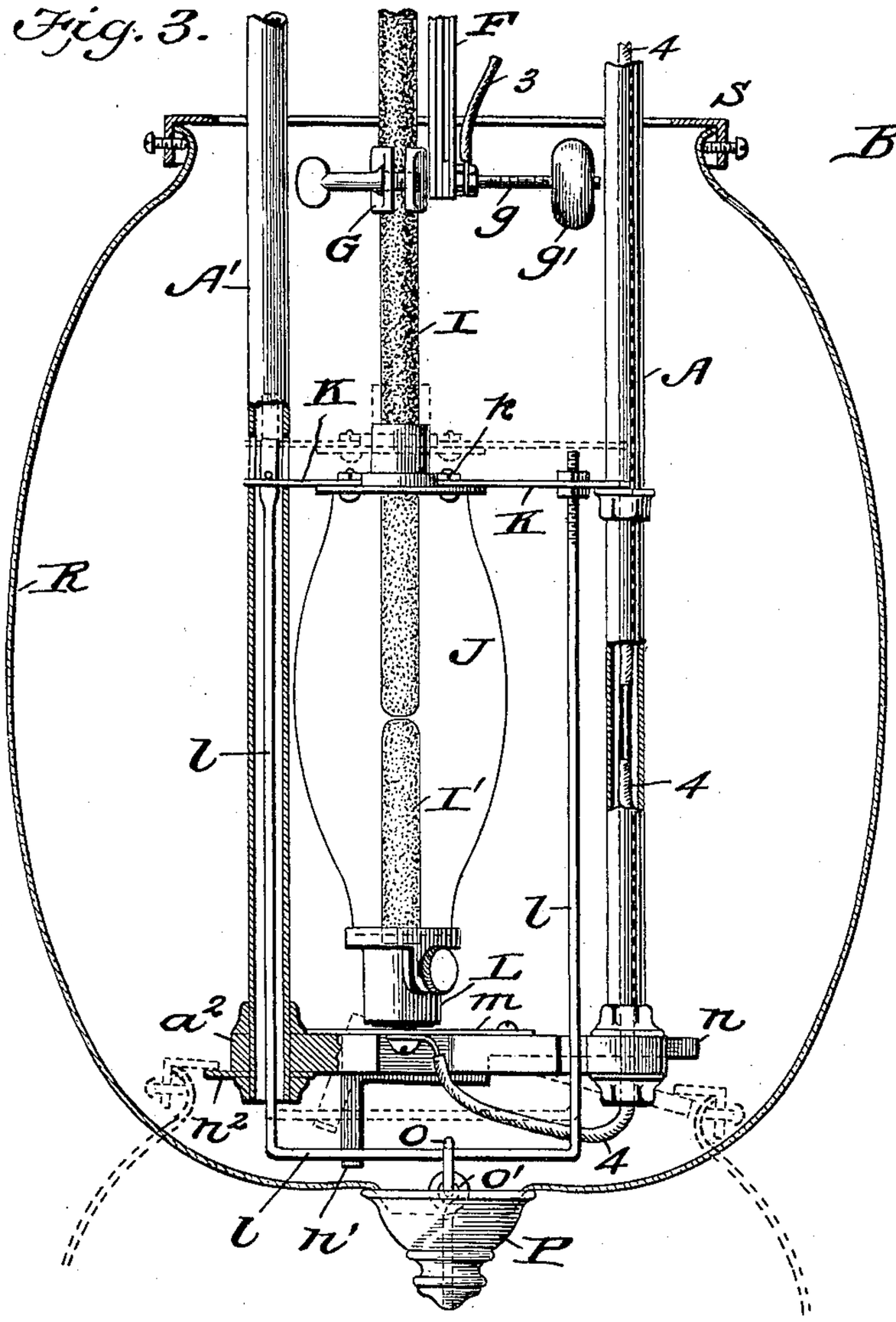



Fig. 4.

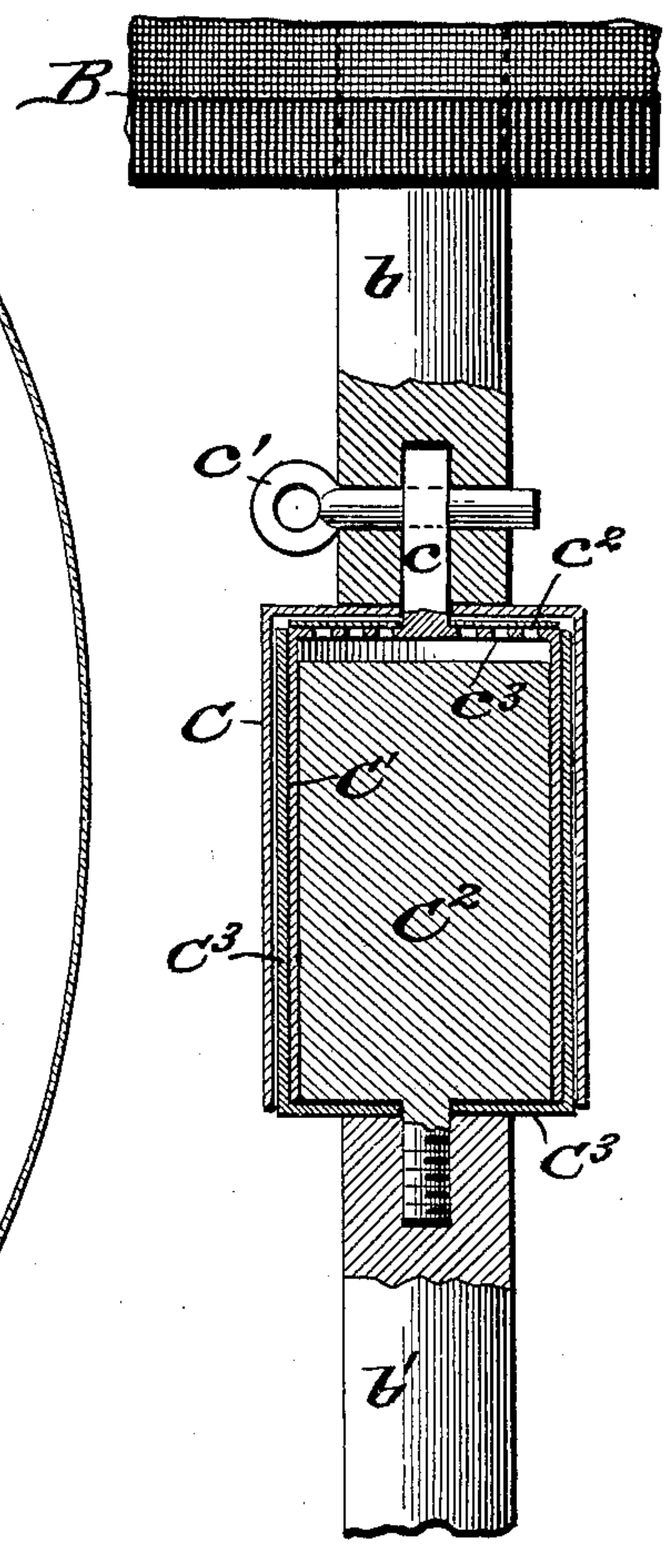



Fig. 5.

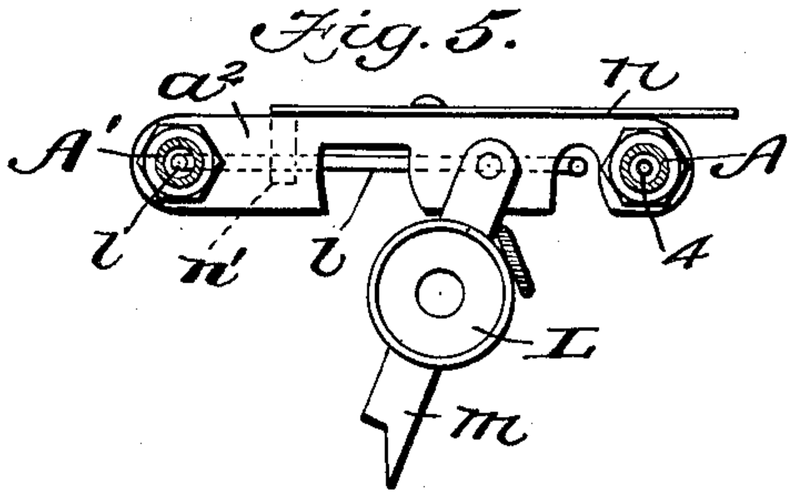
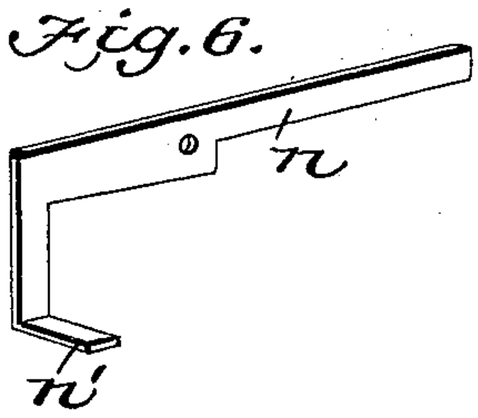



Fig. 6.

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# UNITED STATES PATENT OFFICE.

JAMES E. DAVIDSON, OF BUTTE, MONTANA.

## ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 655,063, dated July 31, 1900.

Application filed October 17, 1899. Serial No. 733,857. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES E. DAVIDSON, of Butte, in the county of Silver Bow and State of Montana, have invented a new and useful Improvement in Electric-Arc Lamps, of which the following is a specification.

My invention is in the nature of an improved electric-arc lamp designed to prevent the carbons from "bucking" or bobbing up and down, and designed also to cause the regulating-magnet to impart a greater throw, and therefore more sensitive adjustment, to the movable carbon, and also further designed to facilitate or render more convenient the act of replacing carbons or trimming the lamp.

It also consists in means for preventing the burning out of the magnets; and to these ends it consists in the construction and arrangement of the parts, which I will now proceed to describe with reference to the drawings, in which—

Figure 1 is a side elevation of the lamp with parts broken away. Fig. 2 is a view at right angles to Fig. 1 with the frame and globe removed. Fig. 3 is an enlarged view of the parts within the globe, partly broken away. Fig. 4 is an enlarged sectional view of the dash-pot. Fig. 5 is a plan view of the base of the lower carbon, and Fig. 6 is a detail of a lifting-lever hereinafter described.

In the drawings, A A′ represent the two parallel tubular frame-bars, which are connected at the top by a cross-head *a*, at the bottom by a base $a^2$, and at an intermediate point by a cross-plate *a′*. The cross-head *a* has the usual suspension hook or eye *t* and the binding-posts *x* and *y*, and in case the lamp is used in multiple a resistance-coil (not shown) is also mounted on the cross-head to bring the voltage of the line to suit the lamp.

Under the cross-head *a* at the top is secured an electromagnet B, having a tubular core adapted to receive a solenoid-armature *b*. On the cross-plate *a′* is mounted and firmly secured another electromagnet B′ in line with the one above and also made with a hollow core adapted to receive the solenoid-armature *b′*. The two solenoid-armatures are arranged to act in opposition and are connected by a dash-pot C, which serves to create a partial vacuum when the solenoid-armatures move away from each other by the attraction of their respective magnets. This dash-pot is shown in detail in Fig. 4, in which C is an outer shell, and C′ an inner shell, both detachably attached to the upper armature by a perforated stem *c* and key *c′*. These shells are open at the bottom.

$C^2$ is a piston-plunger attached by a screw-stem to the lower armature *b′* and fitting within the inner shell C′ with an air-tight suction. $C^3$ is another shell attached to and moving with the plunger and lower armature and open at the top. This shell $C^3$ fits loosely between shells C and C′. The top part of the inner shell C′ is made perforated, as shown at $c^3$, and on top of the perforated end and between it and the end of the outer shell C is loosely placed a paper disk $c^2$, which forms a check-valve. Now when the armatures *b* and *b′* are pulled apart the paper disk $c^2$ fits tightly against the holes $c^3$, and the plunger $C^2$ and shell $C^3$ moving down and the shells C and C′ moving up a partial vacuum is formed between the upper end of the plunger and the upper end of the inner shell. When, however, the armatures move toward each other, the air escapes upwardly through the holes $c^3$, lifting the paper disk like a check-valve, and escapes between the loosely-fitting side walls of the shells.

To the lower end of the armature *b′* there is screwed a non-magnetic stem *d*, attached to a horizontal cross-bar D, sliding vertically between the stirrup-shaped guides E, secured in pendent position to the cross-plate *a′*. This bar D rides on rollers or friction-wheels *e e* in the upper ends of the top bars of a set of lazy-tongs F, which are fulcrumed at *f* in the stirrups E. The lower ends of the lazy-tongs are loosely jointed to a stud connected to a clamp G, that secures the upper carbon I. A screw-stem *g* and adjustable counterweight *g′* balance the weight of the carbon I, which is not in the vertical line of the lazy-tongs. This carbon I passes freely through a cover-cap *k* on top of the inner globe J and rests above the lower carbon I′. This globe J and lower carbon are sustained within a lower cap or cup L, mounted upon a horizontally-swinging bar *m*, which is adapted to be turned outwardly, as seen in dotted lines in Fig. 2 and full lines in Fig. 5, when trimming or replacing the carbons.

The outer globe R is supported within a subjacent cup P and has a marginal flanged rim S at the top. The cup P has a rigidly-attached eye $o'$ in it, which is arranged to be hung upon a hook $o$, suspended upon or attached to the bottom of a U-shaped yoke or stirrup $l$. The side members of the yoke extend up to and are secured to a cross-bar K, which is attached to the cover-cap $k$ of the inner globe J, one of said members passing up through the hollow frame-tube A′ and the other one outside. On the base-bar $a^2$ of the frame there is fulcrumed to work in a vertical plane a lift-lever $n$, (see Figs. 5 and 6,) whose outer end protrudes beyond the frame-bar A and whose inner end has a foot $n'$, that underlaps the yoke $l$.

The circuit connections are made as follows, (see Fig. 2:) from binding-post $x$ to wire 1, magnet B, wire 2, magnet B′, wire 3, clamp G, and the upper carbon I. The lower carbon is connected to wire 4 and to the other binding-post $y$, as shown in dotted lines in Fig. 2. This wire 4, however, does not pass outside, but is an insulated wire extending centrally up the hollow frame-tube A, as shown in Fig. 1.

The operation of the lamp is as follows: The current passing through magnet B′ draws the armature $b'$ down within the coil, and the cross-bar D, pressing upon and spreading the upper ends of the lazy-tongs F, lifts the upper carbon and establishes the arc. If the current decreases, the pull of the magnet B′ is less, and the weight of the upper carbon and lazy-tongs allows the upper carbon to drop to a shorter arc, thus producing automatic compensation. To prevent the bucking of the carbon, the same current that passes through magnet B′ also passes through magnet B, and it makes an upward pull on the upper armature $b$ at the same time the lower magnet pulls the armature $b'$ down. This causes the dash-pot C to be pulled to an elastic vacuum and holds the upper carbon from dropping too far, with an elastic tension holding the carbon in sensitive equilibrium without allowing it to jump and yet allowing (by the check-valve in the dash-pot) the carbon and lazy-tongs to have a free drop. Furthermore, the lazy-tongs allow a very slight movement of the armature $b'$ and cross-bar D to produce a greatly-increased and more sensitive movement of the carbon.

In the common form of lamp the magnet-coils are liable to be burned out, because of slipping of the movable carbon through the feeding-clutch causing the points of carbons to come in contact with each other and allowing excess of current to pass through the coils, said coils not being able to separate the points of carbons, because of the feeding mechanism being drawn against them or their frames.

Lamps of the ribbon-feed, rack-feed, and all others having any form of clutch, brake, or escape wheels are liable to allow burning out of coils, because of derangement of feeding mechanism by allowing the carbon-points to feed beyond their range of adjustment. This cannot happen with my lamp, because the range of feed is equal to the full life of the carbon, and there is no slipping of the carbon in the clamp, as it is fixed once for all.

In trimming the lamp or replacing carbons the outer globe R is slightly lifted by its basic cup P until the eye $o'$ is off the hook $o$, and the outer globe is then lowered until the upper rim-flange S rests upon the stationary bottom plate $n^2$ on one side and on the end of the lever $n$ on the other, as shown in dotted lines in Fig. 3. The pressure on the outer end of the lever throws it down, and it in turn is made to lift the yoke $l$. Hence the cross-bar K and cover-cap $k$ of the inner globe J are raised and held up, as shown in dotted lines, by the weight of the outer globe as it hangs suspended. The inner globe J is now freed from the cover-cap at the top, and after the upper carbon is raised may be turned out, as shown in Figs. 2 and 5, by swinging the supporting-bar $m$ horizontally. When the carbons are trimmed or replaced, the cup L and bar $m$ are turned in again to bring the lower carbon into alinement, the upper carbon lowered, and the outer globe is raised by the cup P, and the eye $o'$ is again hooked over the hook $o$ of the yoke $l$, as shown in Figs. 1 and 3. When in this position, it will be seen that the weight of the outer globe is transmitted through yoke $l$ to the cross-bar K and cap $k$ of the inner globe, and the said cap is held down with its packing upon the top of the inner globe, and the inner globe is also by the same weight forced down upon its subjacent packing in the cup L. In other words, the weight of the outer globe is, in its normal position, always utilized to maintain the tight joint at the top and bottom of the inner globe, and in the other or opened position the outer globe is not only conveniently suspended during the operation, but its weight is made to automatically release and separate the retaining devices which close the inner globe.

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

1. In an arc-lamp, a feeding mechanism for the movable carbon having a lazy-tongs interposed between the carbon and its actuating devices, the carbon being sustained by the lazy-tongs in its center line and wholly supported thereby, and the said lazy-tongs forming the means for transmitting the motion of the actuating devices to the movable carbon, substantially as and for the purpose described.

2. In an arc-lamp, the combination with the movable carbon, and the devices for holding it; of two electromagnets arranged in axial alinement with each other to act upon the devices connecting with the said carbon, armatures arranged between the electromagnets to

act in antagonism to each other from the pull of said magnets, and an elastic connection interposed between said armatures as and for the purpose described.

3. In an arc-lamp, the combination with the movable carbon, and the devices for holding it; of two electromagnets arranged to act upon the devices connecting with said carbon, armatures arranged to act in antagonism to each other from the pull of the magnets, and a pneumatic plunger and shell arranged to produce an elastic opposition between the armatures in one direction, and having an escape-valve for free action in the other direction substantially as described.

4. In an arc-lamp, the combination with the movable carbon and the devices for holding it; of two electromagnets arranged to act upon the devices connecting with said carbon, said magnets having solenoid-armatures arranged in alinement and acting in opposition to each other, and an elastic connection between the armatures substantially as and for the purpose described.

5. In an arc-lamp, the combination with the movable carbon and the devices for holding it; of two electromagnets arranged to act upon the devices connecting with said carbon, said magnets having solenoid-armatures arranged in alinement and acting in opposition, and a dash-pot arranged between and modifying the pull of said armatures as described.

6. In an arc-lamp, the combination with two magnets having solenoid-armatures arranged in alinement to act in opposition, and having an elastic connection between them, a cross-bar attached to one of said armatures, and a lazy-tongs carrying the movable carbon and acted upon by the said cross-bar substantially as and for the purpose described.

7. In an arc-lamp, the combination with the carbons, and an inner globe having a closure-cap at its upper end; of an outer globe inclosing the inner globe, and intermediate devices connecting the outer globe to said closure-cap whereby the weight of the outer globe is normally carried upon the closure-cap of the inner globe to maintain a tight joint substantially as described.

8. In an arc-lamp, the combination with the carbons, and an inner globe and suspended from the closure-cap at the top of the same having a closure-cap at the upper end; of an outer globe inclosing the inner globe, and lifting devices for said closure-cap adapted to be acted upon by the downward movement of the outer globe whereby the suspension of the outer globe when removed from its normal position is made to release the closure-caps of the inner globe substantially as described.

9. In an arc-lamp, the combination of the lower carbon and inner globe; of a horizontally-swinging bar bearing a cup carrying the said carbon and globe, a closure-cap at the top of the globe provided with and connected to a pendent yoke or stirrup, and the outer globe having a subjacent basic cup, and hook devices for connecting it to the pendent yoke or stirrup substantially as described.

10. In an electric-arc lamp, the combination of the lower carbon and inner globe; of a horizontally-swinging bar bearing a cup carrying the said carbon and globe, a closure-cap at the top of the globe provided with and connected to a pendent yoke or stirrup, the outer globe, having a subjacent basic cup and upper marginal rim, hook devices for connecting the said cup to the yoke or stirrup, and a lifting-lever fulcrumed to the framework and having one end projecting out into the range of the marginal rim of the outer globe, and having on the other end a foot lifting the said yoke or stirrup substantially as described.

11. In an electric-arc lamp, the combination with the movable carbon; of a clamp having a laterally-projecting screw-stem and adjustable screw-threaded counterweight thereon and a supporting device for the carbon placed between the carbon and counterweight substantially as described.

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

JAMES E. DAVIDSON.

Witnesses:
EDW. W. BYRN,
SOLON C. KEMON.