(No Model.)

2 Sheets—Sheet 1.

S. I. CRAIN.

ELECTRIC ARC LAMP.

No. 598,697. Patented Feb. 8, 1898.

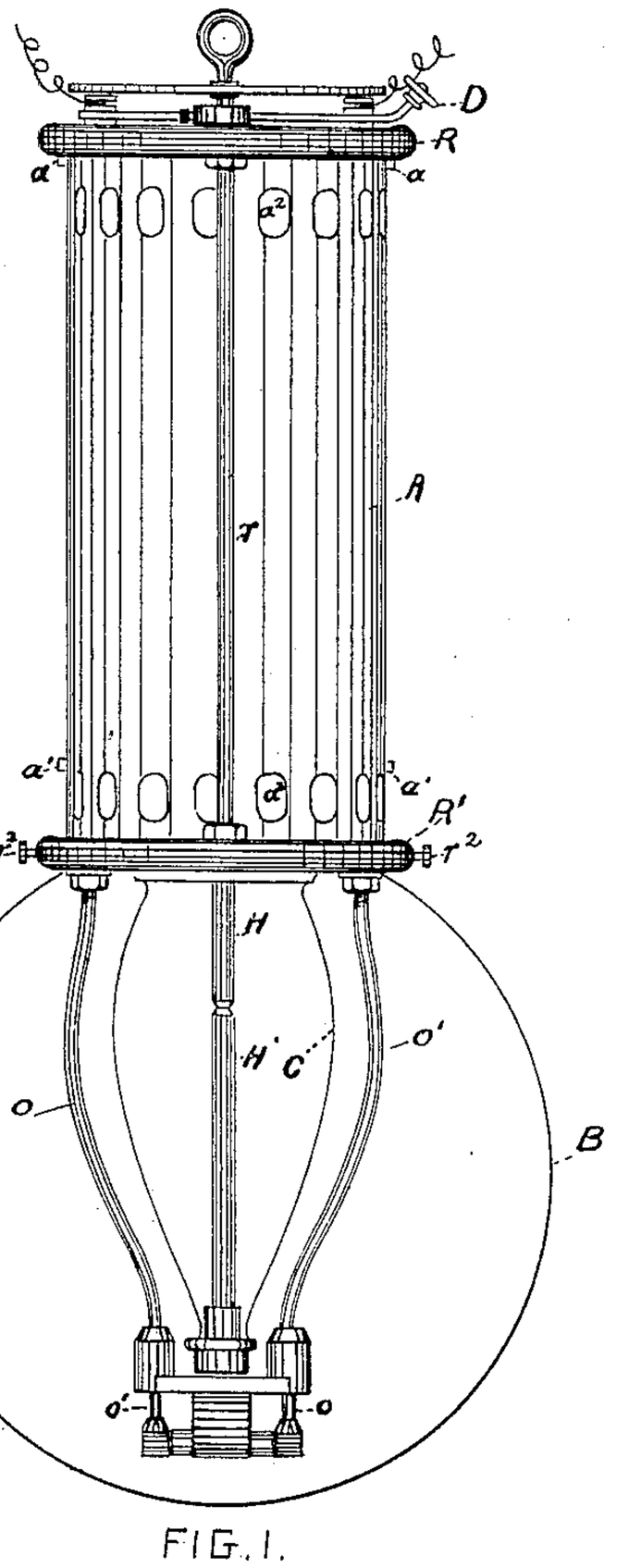

FIG. 1.

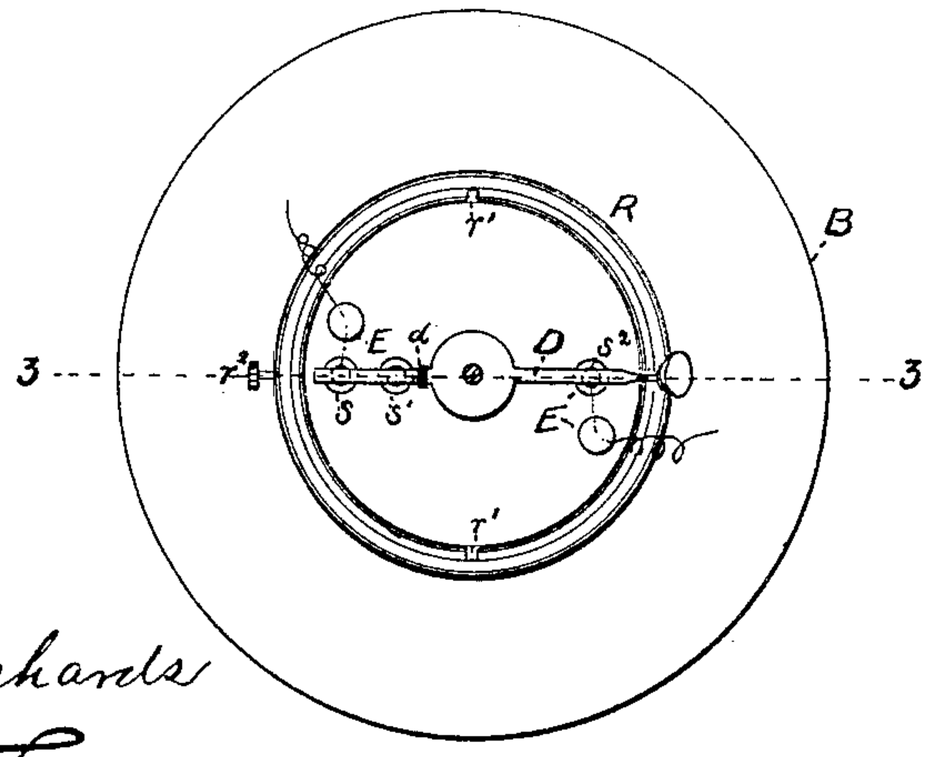

FIG. 2.

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(No Model.) 2 Sheets—Sheet 2.

S. I. CRAIN.

ELECTRIC ARC LAMP.

No. 598,697. Patented Feb. 8, 1898.

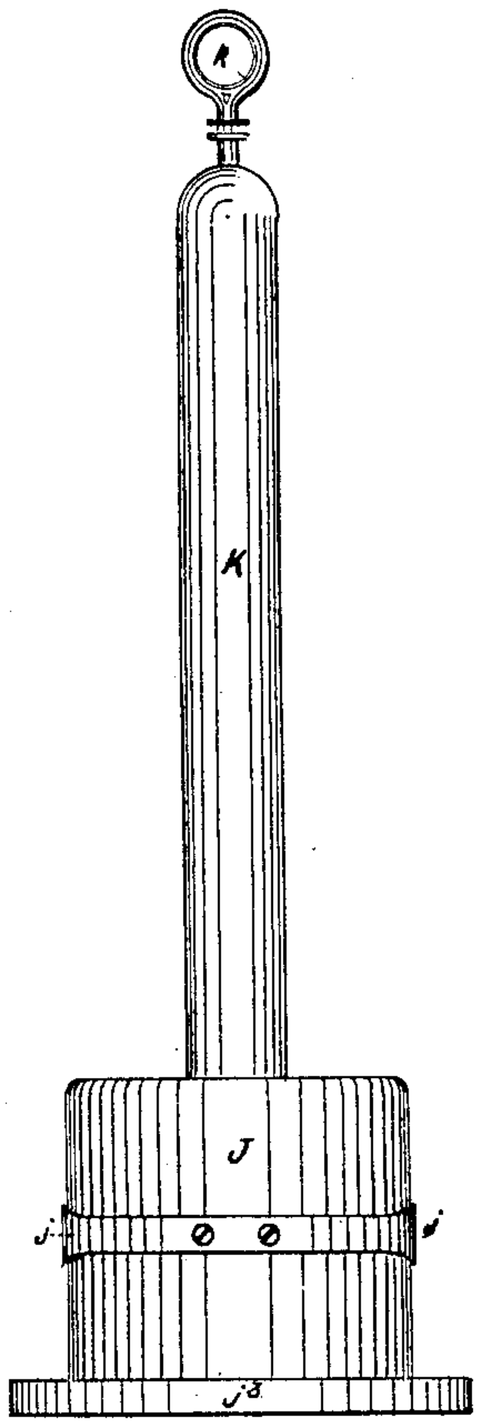

FIG. 4.

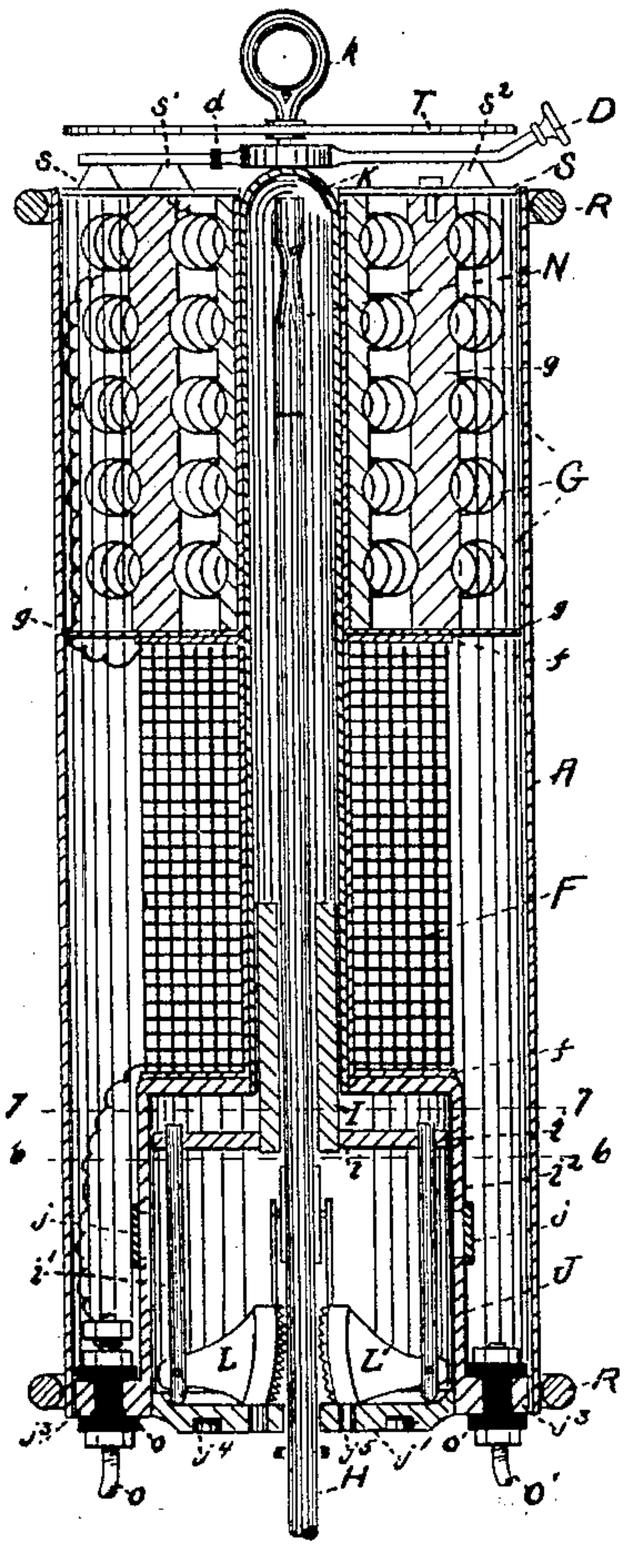

FIG. 3.

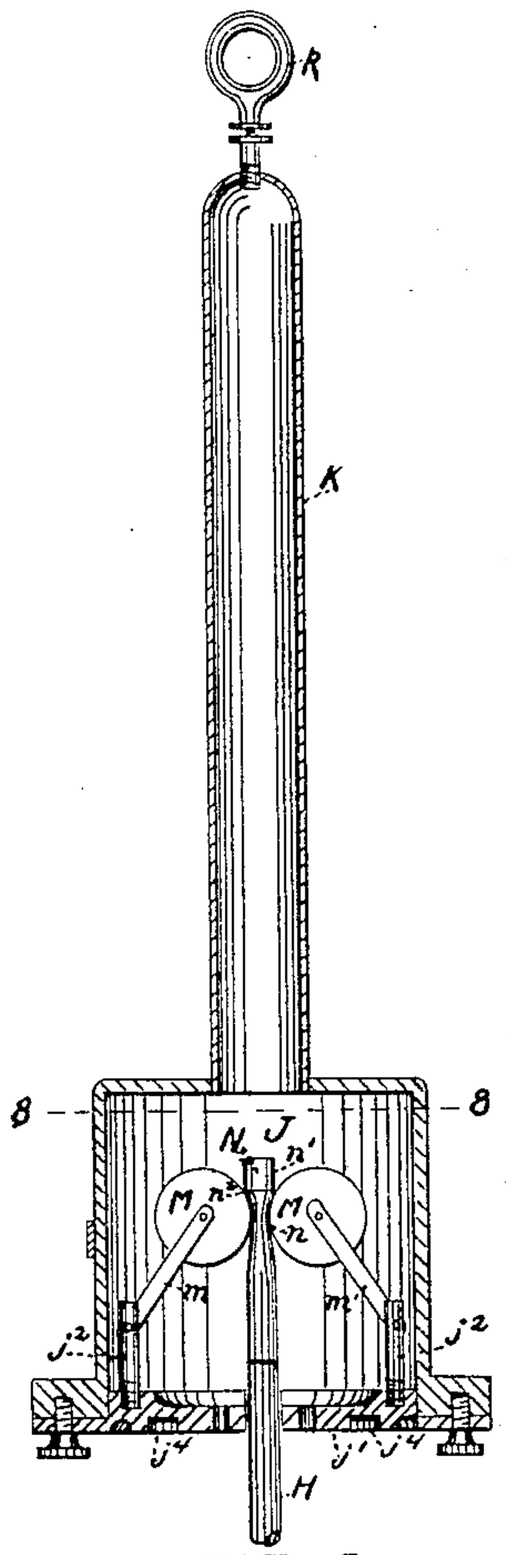

FIG. 5.

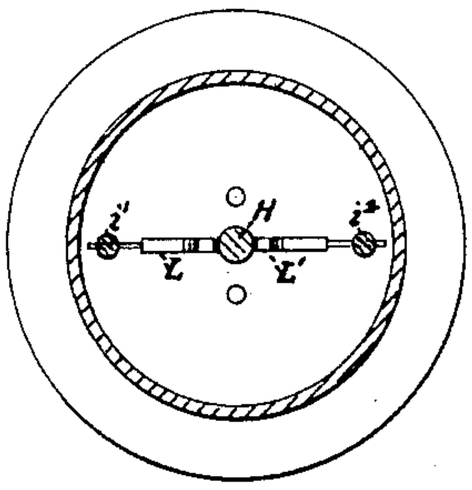

FIG. 6.

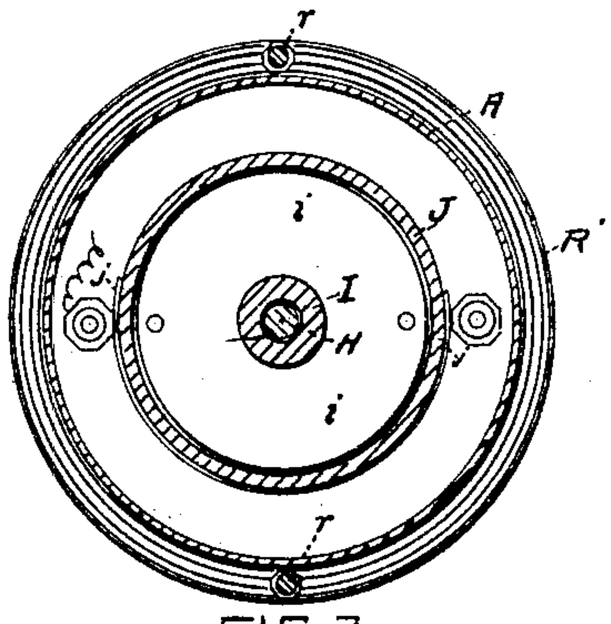

FIG. 7.

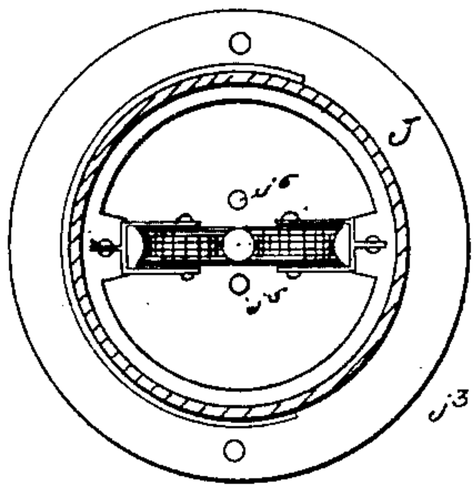

FIG. 8.

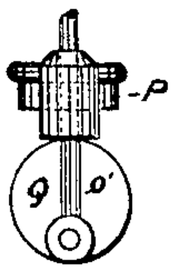

FIG. 9.

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George B. Gardiner

UNITED STATES PATENT OFFICE.

SIDNEY I. CRAIN, OF CINCINNATI, OHIO, ASSIGNOR OF TWO-THIRDS TO STEWART SHILLITO AND CHARLES A. IRWIN, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 598,697, dated February 8, 1898.

Application filed July 24, 1897. Serial No. 645,832. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY I. CRAIN, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

The object of my invention is to produce an improved arc-lamp of the long-burning type in which the maximum efficiency and duration of the carbons is obtained in the minimum space and in which the parts can be easily assembled and are readily accessible for attention, repair, or replacement; and the invention consists in the parts and construction and arrangement of parts hereinafter described and claimed.

In the drawings, Figure 1 is an elevation of a lamp embodying my invention. Fig. 2 is a horizontal section on line 2 2 of Fig. 1. Fig. 3 is a vertical section on line 3 3 of Fig. 2. Fig. 4 is an elevation of a casing and tube which inclose the armature, the upper carbon, and the carbon-feeding mechanism; Fig. 5, a detail section of same; Fig. 6, a horizontal section on line 6 6 of Fig. 3; Fig. 7, a horizontal section on line 7 7 of Fig. 3. Fig. 8 is a horizontal section on line 8 8 of Fig. 5; Fig. 9, an elevation showing a combined lower-carbon holder and globe-support.

A represents a casing, preferably cylindrical in form, inclosing the working mechanism of the lamp; B, the outer globe; C, the inner globe; D, a switch for turning the current on or off, and E and E′ the positive and negative electrical connection.

F, Fig. 3, is a solenoid-magnet; G, the resistance-coil; H, the upper carbon; H′, the lower carbon, and I the armature.

Within the lower part of the casing A and below the magnet is a casing J, preferably cylindrical, inclosing the carbon-feeding mechanism. This casing is provided with relief-valves *j*, adapted to permit the gases to escape if the pressure becomes too great, but to prevent the admission of air. The casing is provided with a bottom plate *j′*, having a central opening through which the upper carbon passes. Extending upwardly from the top of this casing and having an air-tight connection therewith is a tube K, to the top of which may be fastened a ring *k*, by which the lamp may be supported. The armature I works in the tube K and carries a piston *i*, which works in casing J and serves to prevent sudden movement of the armature by reason of the limited passage for air from one side of the piston to the other. Depending from the piston *i* are arms *i′* and *i²*, to the lower ends of which are pivoted clutch-jaws L and L′, adapted to engage with the upper carbon. These jaws are so arranged that the upward movement of the armature and its connections brings them into engagement with opposite sides of the carbon, which is thereby grasped and carried upward with the armature, while downward movement of the armature beyond a certain limit brings the jaws into engagement with the bottom plate *j′*, which serves as a fulcrum and releases their grip upon the carbon, leaving it free to fall. The mechanism above described constitutes the automatic regulator for the length of the arc.

Projecting upwardly from the bottom plate *j′* of casing J are studs *j²*, upon which are pivotally mounted arms *m*, which carry rollers M, adapted to engage with the upper carbon H. The upper carbon is provided with a cap N, having a reduced portion or neck *n* and a head *n′*, the outward flare *n²* between the neck and head being somewhat pronounced. In operation the upper carbon feeds downwardly until it is practically consumed, when the head of the cap engages with the rollers, and the cap and the carbon it carries are held against further downward motion. This breaks the circuit, puts out the light, and serves notice upon the attendant that a new carbon is required. A slight pull on the carbon throws the rollers H far enough apart to permit the enlarged portion *n′* of the cap N to pass through and be removed from the lamp, after which the rollers fall together. In inserting the new carbon the cap N strikes the rollers and, forcing them apart, passes between them and into the tube K. The tube K, casing J, studs *j²*, arms *m*, and rollers M are all made of metal or other material which is a good electrical conductor, and the

tube K is connected with a switch D, so that an electrical path is provided between the switch and the upper carbon. By this arrangement the current connection with the upper carbon is made not far from its lower end, so that a long carbon may be used without the electrical resistance which would result if the current passed through the entire length of the carbon.

O and O′ are supporting-rods secured to an annular flange j^3, extending outwardly from casing J, but insulated therefrom by insulators *o*. These rods have at their lower ends straight parts *o*′, upon which the support P for the inner globe and lower-carbon holder is adapted to slide. The lower ends of the rods are connected by means of a bar carrying an eccentric Q, adapted to engage with and raise or lower the globe and carbon-support P. The bottom plate *j*′ of the casing J is provided with an annular groove j^4, adapted to receive and hold in position the upper end of the inner globe. This groove is preferably provided with a lining j^5, adapted to render the connection air-tight. It will be seen that by turning the eccentric the inner globe may be raised or lowered, thus giving easy access to its interior and permitting the globe or carbons, or both, to be readily removed.

R and R′ are rings surrounding the upper and lower parts of casing A and connected by rods *r*. The casing A is provided with lugs *a* and *a*′, adapted to support ring R, and ring R is provided at suitable intervals with slots or grooves *r*′, adapted to permit the ring to slip over the lugs. The outer globe B is secured to the lower ring R′ by means of set-screws r^2. It will be seen that the rings R and R′, with their connecting-rods, constitute a rotatable frame which supports the outer globe. By rotating this frame until the grooves *r*′ register with the lugs *a* the frame can be slipped downward from the casing, thereby giving free access to the interior without the necessity of detaching the outer globe. If desired, the frame may be supported upon lugs *a*′ or it may be slipped over those lugs and entirely removed.

The solenoid F is preferably wound on a spool-frame *f*, adapted to slide down over tube K and rest upon casing J, and the resistance-coil G is wound on a spool-frame *g*, also adapted to slide over tube K and rest upon the magnet-frame. The protecting-casing A is provided with a series of apertures a^5 for ventilation, and its top is closed by a plate S, preferably supported by the resistance-frame *g*.

The switch D and its connections are protected by a cap-plate T.

For making or breaking the electrical connections I prefer to employ the following mechanism: The top plate S is provided with three contact-points *s*, *s*′, and s^2. The contact *s* is connected with the positive terminal, s^2 with the negative, and *s*′ with the resistance-coil. The switch-lever D is pivoted to the top of the tube K and adapted to be swung into simultaneous engagement with all three of the contact-points. The switch-lever is electrically divided by means of insulating material at *d*, so that when it is in engagement with the three contact-points points *s* and *s*′ are electrically connected with each other through the switch, and s^2 is electrically connected with the tube K through the switch, but the current cannot pass through the switch from *s* and *s*′ to s^2 or the tube K, because of the insulation at *d*. When the current is turned on by means of the switch, the carbons being in contact, the current passes from the main wire through the contact-point *s*, switch D, contact *s*′, resistance-coil G, solenoid F, supporting-rod O, and carbon-support P to the lower carbon; thence through the upper carbon, rollers M, arms *m*, studs j^2, casing J, tube K, switch D, and contact-points s^2 to the main wire.

My lamp operates on the same general plan as other arc-lamps—that is to say, when the current is turned on and the circuit established the armature is attracted upward, throwing the clutch-jaws into engagement with the upper carbon and raising it sufficiently to afford the required arc. As the carbons burn away and the resistance increases the armature and the parts connected therewith drop, the upper carbon is released and drops until the resistance is decreased sufficiently to cause the armature to be again attracted upwardly, and to thereby again bring the clutch-jaws into engagement with the carbon.

The bottom plate *j*′ of casing J is provided with apertures j^5, which permit the passage of air between the space inclosed by the casing and that inclosed by the inner globe. It will be seen that the space inclosed by the inner globe C, the casing J, and the tube K is practically air-tight. When the current is turned on and the light started, the oxygen in the air inclosed in this space is converted into other gases, and as no more air can enter the arc is produced in a non-combustion supporting medium and the duration of the carbons is greatly increased.

The bottom plate *j*′ is detachably secured to the casing by means of thumb-screws j^6. By removing this plate all of the mechanism within the casing and tube may be removed.

I claim—

1. The combination, in an arc-lamp, of the magnet, F; the casing, J; the tube, K; the armature, I, adapted to work in the tube, K; the piston, *i*, carried by the armature and adapted to work in the casing, J; the arms, *i*′, depending from the piston and rigidly attached thereto; and the clutch-jaws, L, pivoted to the arms, substantially as and for the purpose set forth.

2. The combination, in an arc-lamp, of a pair of pivoted arms carrying rollers adapted to engage with the upper carbon at or near its point of support and electrical connection

between the rollers and the main, substantially as and for the purpose set forth.

3. The combination, in an arc-lamp, of a cap for the upper carbon having a head or knob; a pair of pivoted arms carrying rollers adapted to contact with opposite sides of the carbon during its downward travel and to engage with the head or knob of the cap and arrest its downward travel, substantially as and for the purpose set forth.

4. The combination, in an arc-lamp, of the casing, J; the tube, K; the bottom plate, j', having groove, j^4, adapted to receive the top of the inner globe, C; a packing, j^5, in the groove adapted to make an air-tight connection between the casing and the globe; ports, j^6, adapted to permit passage of air between the casing and the globe; the supporting-rods, O and O'; the globe-support, P; and the eccentric, Q, adapted to raise or lower the globe, substantially as and for the purpose set forth.

5. The combination, in an arc-lamp, of the casing, A, having lugs, *a;* the ring, R, having grooves adapted to pass over the lugs, the rings, R', adapted to support the outer globe; and the connecting-rods, *r*, substantially as and for the purpose set forth.

6. The combination, in an arc-lamp, of the casing, A, having lugs, *a;* the ring, R, having grooves adapted to pass over the lugs; the ring, R', adapted to support the outer globe; the connecting-rods, *r;* the supporting-rods, O and O'; the globe-support, P; and the eccentric, Q, adapted to raise or lower the globe, substantially as and for the purpose set forth.

7. The combination, in an arc-lamp, of an outer casing, an inner casing inclosing the carbon-operating mechanism, and having a removable bottom plate, a tube extending upwardly from the inner casing, and a magnet-frame and a resistance-frame, both having bores adapted to take over the upwardly-extending tube and held in position by gravity, substantially as and for the purpose set forth.

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