(No Model.)

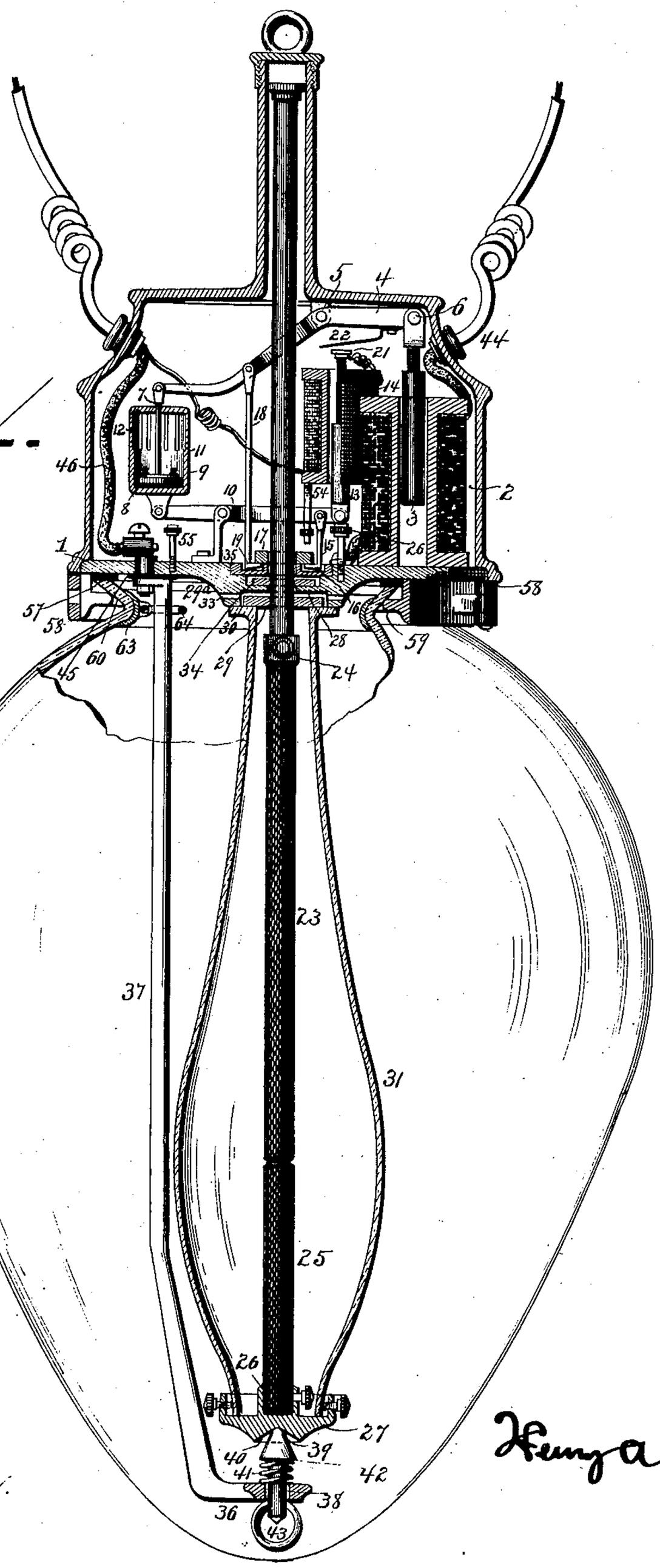
3 Sheets—Sheet 1.

H. A. SEYMOUR.

ELECTRIC ARC LAMP.

No. 574,118. Patented Dec. 29, 1896.

FIG. 1.



Witnesses
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(No Model.) 3 Sheets—Sheet 2.

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ELECTRIC ARC LAMP.

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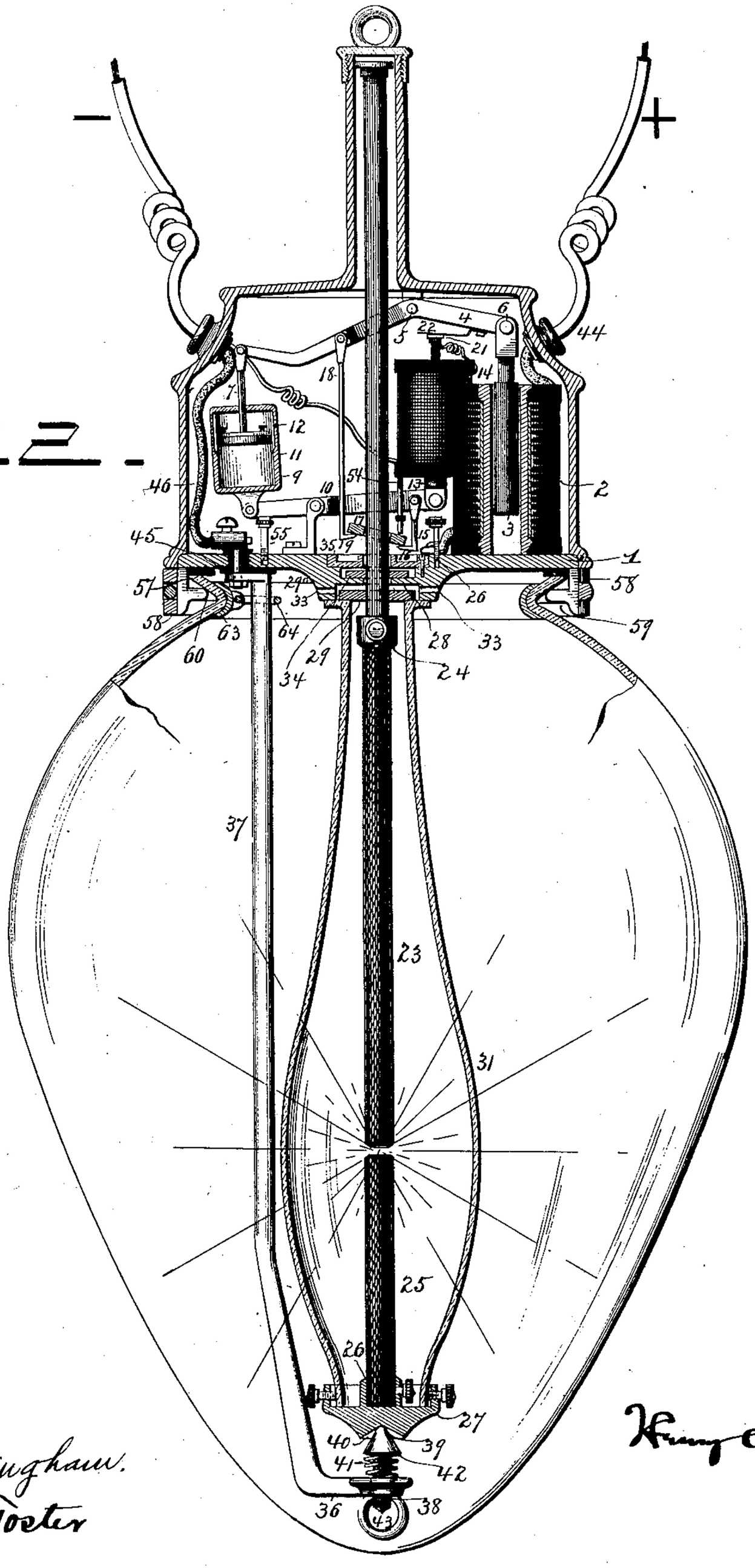
FIG. 2.



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3 Sheets—Sheet 3.

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ELECTRIC ARC LAMP.

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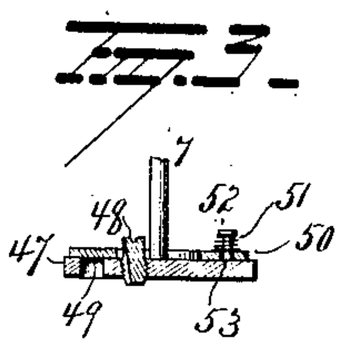
Fig. 3.



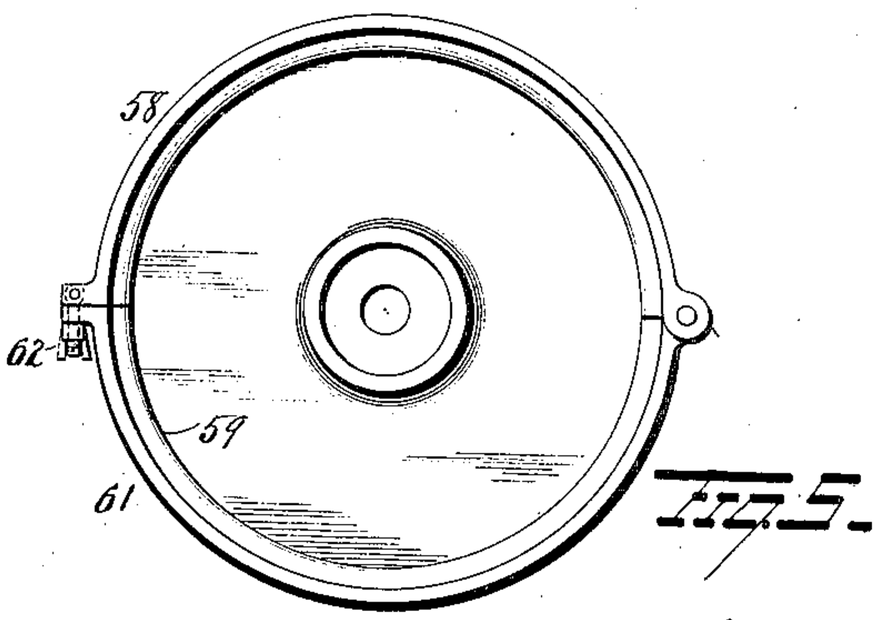
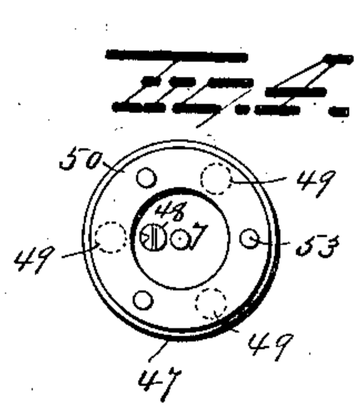


Fig. 5.

Fig. 4.



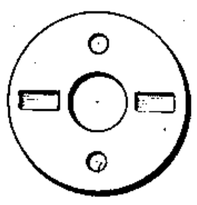
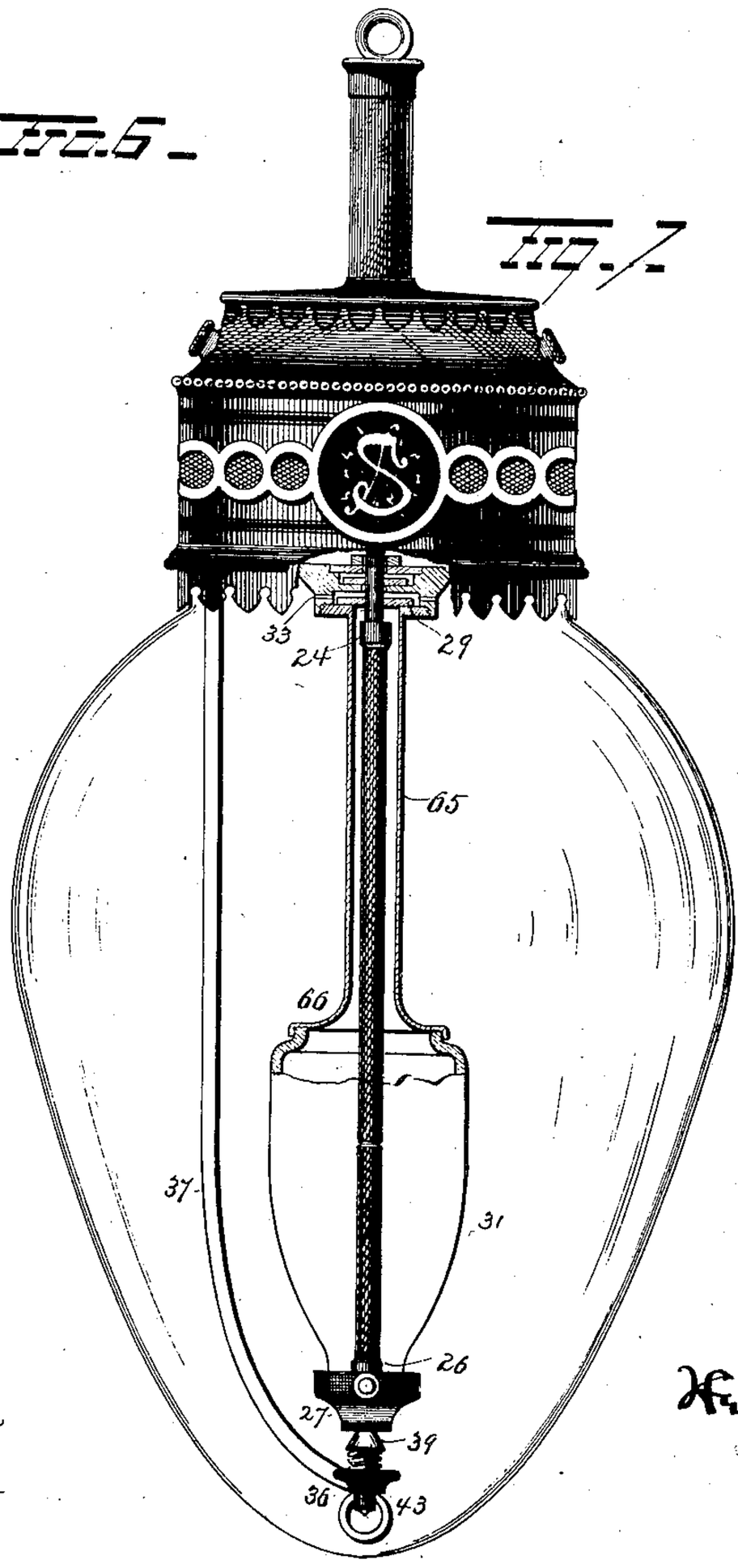


Fig. 6.

Fig. 7.



Witnesses
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UNITED STATES PATENT OFFICE.

HENRY A. SEYMOUR, OF WASHINGTON, DISTRICT OF COLUMBIA.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 574,118, dated December 29, 1896.

Application filed July 11, 1896. Serial No. 598,879. (No model.)

To all whom it may concern:

Be it known that I, HENRY A. SEYMOUR, a resident of Washington, in the District of Columbia, have invented certain new and useful Improvements in 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 arc-lamps, and especially to that type of lamps which employ an arc-inclosing globe.

Inclosed arc-lamps are ordinarily constructed for use on constant-potential circuits, and their economical operation requires that a long arc be established and maintained between their carbons. While arc-lamps of this type have been constructed for use with a straight current, no one, so far as I am aware, has succeeded as yet in producing a lamp of this type which is adapted to be satisfactorily operated by an alternating current. The following are among the obstacles that have been encountered in the attempts that have been made to provide a successfully operative alternating-current arc-lamp of the type in question.

The establishment of an arc between the cold carbons of a lamp is effected by heating their adjacent ends to such a degree as will insure the production of a conducting-bridge of incandescent carbon vapor across the gap or space between them, over which the current may flow continuously until an arc of normal length has been established; but the establishment of an arc between the cold carbons of an alternating lamp has been attended by a violent chattering of the carbons and regulating mechanism, which has been due to the excessively rapid rise and fall of the current, causing the magnets of the lamp to be energized and deënergized in such rapid succession as to prevent the heating of the ends of the carbons to a sufficient degree to preserve the integrity of the circuit through them until quite a time has elapsed after the current has been switched through the lamp. Attempts have been made to obviate this trouble by so retarding the separation of the carbons as to insure of their being heated and gradually separated without interrupting the circuit between them; but such means rendered the action of the regulating mechanism so slow and sluggish in adjusting and feeding the carbons that the arc was frequently extinguished, and it was found impossible to maintain a long arc in continuous operation. Again, arc-inclosed lamps as ordinarily constructed have been provided with a small arc-inclosing globe having a cover through which the carbon is fed into the globe. In some constructions the opening through the cover has been so formed as to produce a gas-check around the carbon and thereby lessen the ingress of outer air to the interior of the globe. In others an annular valve has been seated upon the cover and arranged to encircle the carbon, while in other constructions provision has been made for permitting of the lateral adjustment of the globe to allow it to accommodate itself to the carbons; but all of these constructions, in which attempts have been made to pack the carbon, have proved objectionable, owing to the impossibility of preserving an air-tight joint between the carbon and the opening through which it is fed into the globe. This has been due to the fact that in the manufacture of carbons it has been found impossible to make them absolutely true and straight and with a perfectly smooth and regular outer surface. Hence to insure the free adjustment and feed of the carbons it is necessary to provide considerable play or space between them and the opening through which they are fed into the globe, in order to provide for such irregularities in their form and surface.

The object of my invention is to obviate the defects and difficulties above referred to and provide an arc-lamp adapted to be operated by an alternating current and so constructed that when switched into circuit its carbons will be separated so slowly and gradually that an arc of any desired length may be drawn between them without the chattering of the carbons or regulating mechanism, and upon the production of an arc of the desired length the regulating mechanism will be instantly released from its retarding mechanism and caused to sensitively feed the feeding carbon without materially varying the length of the arc or the steadiness of the light produced by it.

A further object is to provide an arc-in-

closed lamp of such construction that all packing about the carbons is dispensed with and the arc-inclosing globe maintained practically air-tight by packing applied to the carbon-holder.

With these ends in view my invention consists in features of construction and combinations of parts, as will be hereinafter more fully described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view, partly in vertical section and partly in side elevation, of an arc-lamp embodying the invention. Fig. 2 is a similar view representing the position of the parts when the lamp is in operation. Figs. 3 and 4 are detached views of the dash-pot. Fig. 5 is a detached view of the clamp for supporting the outer globe. Fig. 6 is a detached view of the detachable clutch-floor, and Fig. 7 is a modification.

1 represents the lamp-floor; 2, a coarse-wire solenoid; 3, the core of the solenoid; 4, a lever pivoted at 5 and to which the core is pivotally connected at 6. To the opposite end of the lever is pivotally connected the piston-rod 7 of the dash-pot 8, the cylinder 9 of which is pivoted to one end of a lever 10. The bore of cylinder 9 is made smooth from its bottom up to the point 11, and from thence to its top it is formed with open grooves 12. Piston 47 of the dash-pot snugly fits within the lower portion of the cylinder and is provided with an adjustable screw-valve 48, by which its movement may be regulated. Any desired number of passages 49 extend through the piston and are covered by an annular valve 50, seated on the upper side of the piston and retained against its seat by spiral springs 51, which rest at their lower ends against the valve and at their upper ends against the heads 52 on the guide-pins 53, which pass through the piston. By means of this construction of piston its upward movement may be retarded and checked to any desired extent by varying the adjustment of the screw-valve, while the yielding annular valve allows of its quick and prompt downward movement.

The core 13 of a high-resistance shunt-solenoid 14 is pivoted to one end of the lever 10. Depending from one end of lever 10 is a rod 15, provided with a lateral projection 16 at its lower end, which enters a recess in the lamp-floor and projects beneath one edge of the ring-clamp 17. The projection 16 is, in effect, an adjustable floor for the ring-clamp. Lifter 18 is pivotally connected at its upper end to lever 4, while its lower end is formed with a finger 19, which enters a recess in the lamp-floor and projects beneath the edge of the ring-clamp at a point opposite the adjustable support or floor 16. An adjustable stop 20, attached to the floor of the lamp, projects beneath one end of lever 10 and serves to limit the upward movement of the cylinder of the dash-pot.

21 is an insulated contact block or strip which is electrically connected with one end of the helix of the shunt-solenoid, the opposite end of which is connected with the negative binding-post of the lamp. A spring-contact 22 is connected with lever 4 and is arranged so as to engage the contact 21 when lever 4 is drawn down by the coarse-wire solenoid.

The feeding carbon 23 is secured within the socket 24, attached to the carbon-holder, while the non-feeding carbon 25 is fastened in the socket 26, formed on the plate 27. The under side of the lamp-floor is countersunk around the opening 28, through which the carbon-holder passes. Within the countersunk opening is placed an annular valve 29, which is seated upon the flanged upper end 30 of the arc-inclosing globe 31. The upper end of the arc-inclosing globe is formed with a ground or perfectly flat surface which seats against the annular seat 32 on the under side of the lamp-floor and forms practically an air-tight joint therewith. Annular valve 29 snugly fits the smooth cylindrical carbon-holder and forms practically an air-tight joint therewith.

Any desired number of passages 33 are provided in the lamp-floor, through which any gases that may escape from the arc-inclosing globe will flow into the outer globe.

34 is an annular valve which encircles the carbon-holder and serves to prevent the escape of gases from the arc-inclosing globe into the casing containing the regulating mechanism.

A detachable clutch-floor 35 (shown in detail in Fig. 6) is fitted within a recess formed in the upper side of the lamp-floor and is secured against rotary displacement by means of screws or other means. The lower end of the arc-inclosing globe is secured in an air-tight or practically air-tight manner to the plate 27. In the lateral arm 36 of the depending arm 37 of the lamp is mounted a vertically-movable rod 38, the upper end 39 of which is pointed or rounded and rests against a conical or rounded seat 40, formed on the under side of the plate. Spiral spring 41 encircles the rod, its lower end seating upon the arm 36, while its upper end engages a shoulder 42 on the rod. The spring-pressed rod serves to force the arc-inclosing globe upwardly and cause its upper end to fit snugly against its seat and form practically an air-tight joint therewith. The pointed bearing and conical seat enable the upper end of the globe to adjust itself to its seat. By pulling down on the ring 43 and disengaging the pointed bearing from its conical seat the arc-inclosing globe may be removed to allow of the retrimming of the lamp.

The operation of the lamp is as follows: When no current is passing through the lamp, its carbons are in contact and the parts of its regulating mechanism are in the position illustrated in Fig. 1. On the passage of current through the lamp it enters through conductor 44 and passes through the coarse-wire solenoid to the lamp-floor, from which it

passes through both carbons to the frame of the lamp, which is insulated at 45 from the lamp-floor, and through conductor 46 to line. Instantly the lamp is switched into circuit. The coarse-wire solenoid is energized and pulls down its core and, through lifter 18, tilts the ring-clamp and causes it to grip and raise the upper carbon, and thus establish an arc between the carbons; but owing to the retarding effect of the dash-pot the initial separating action of the two carbons will be very slow and gradual, and hence the result will be that an exceedingly minute arc will be first established, which will offer such a resistance to the passage of the current that the adjacent ends of the carbons will be sufficiently heated to form a conducting-bridge of incandescent carbon vapor across the very narrow space or gap between them, and thus preserve the integrity of the circuit through the lamp. The upper carbon continues to be so slowly and gradually lifted as will insure the maintenance of the arc, and this action continues until the arc has been drawn to its desired length. When this point has been reached, the piston of the dash-pot will have reached the upper end of the smooth portion of the bore of the cylinder of the dash-pot, and the spring-contact 22 will engage contact 21, carried by the core of the shunt-magnet, with the result that a small portion of the current will be diverted through the shunt-magnet and cause it to lift its core and tilt lever 10, and thereby simultaneously move the dash-pot cylinder downwardly and the adjustable floor or stop 16 upwardly, as shown in Fig. 2. It will now be observed that the adjustable floor or support 16 is lifted into close proximity to the under side of the ring-clamp after the latter has been lifted to the height necessary to establish the desired length of arc, and hence a slight downward movement of the ring-clamp will now suffice to insure the adjustment and feed of the carbon. It will also be noted that the relative adjustment of the cylinder and piston of the dash-pot has been so changed that the piston is free to move upwardly and downwardly and throughout such a distance as will suffice to insure the sensitive adjustment and feeding of the upper carbon, this freedom of action being insured by the grooves 12, formed in the upper portion of the cylinder, which allow the checking fluid to flow around the piston as it is moved in either direction. In order to prevent the sudden lengthening of the arc, which might result in its extinguishment, an adjustable stop 54 is provided which limits the upward movement of the ring-clamp and carbon-holder, and hence restricts the length of the arc. To insure the free action of the ring-clamp in its elevated position, an adjustable stop 55 is located beneath the lever 10 and serves as a stop to limit the upward movement of the adjustable floor or support 16. As the arc continues to burn it gradually elongates and its resistance increases, with the result that the pull of the coarse-wire solenoid is weakened and allows the carbon-holder and feeding carbon to descend until the ring-clamp, by its engagement with support 16, relaxes its grip on the carbon-holder and allows the latter to gradually slide through it and feed the carbon. This action shortens the arc, decreases its resistance, and correspondingly strengthens the coarse-wire solenoid, which instantly tilts the ring-clamp and causes it to grip and uphold the carbon-holder to which the feeding-carbon is secured. In this manner the carbons are adjusted and fed until consumed, all of the adjustments necessary to the control and feed of the feeding-carbon being effected by the slight and sensitive action of the regulating mechanism, which, being at all times subject to the slight retarding action of the dash-pot, insures a perfectly steady and reliable light. Owing to the fact that after the spring-contact 22 engages the contact 21 the latter is instantly raised and compresses the spring, as shown in Fig. 2, these contacts are retained in engagement, during the operation of the regulating mechanism, until the carbons have been consumed. While the spring-contact is amply sufficient in size and conductivity to maintain the integrity of the circuit through the shunt-solenoid, it is altogether too weak to interfere with the proper operation of the regulating mechanism, and the slight movement of one contact on the other will keep their engaging surfaces always bright and clean and in good condition for reliable operation.

The opposite ends of the arc-inclosing globe are rendered practically air-tight, the lower end by its fastening to the plate 27 and the upper end by its engagement with its seat on the under side of the lamp-floor and the packing encircling the carbon-holder. The spring-pressed rod upon which the globe is supported is loosely mounted in the arm 36, so that it will permit the upper end of the globe to adjust itself to its seat.

To retrim the lamp, it is simply necessary to depress the spring-actuated rod 38, which will allow the arc-inclosing globe and lower carbon to be removed, and thereby permit the carbon-holder to be cleaned and the carbons to be removed.

By applying the annular valve to the carbon-holder a much tighter and better joint can be secured than is possible when the valve is applied to the feeding carbon. The carbon-holder is a polished-metal rod, which is perfectly true and smooth, and hence will work evenly and reliably within a comparatively tight-fitting packing-ring, while or the other hand a carbon-rod presents an irregular abrasive surface, which will not admit of the employment of a tight-fitting annular valve around it and will soon wear the packing and allow of the ingress of more or less air to the globe.

The outer globe 56 is provided at its upper

end with a flat ground-seat 57, which seats against the under side of the lamp-floor and is retained in snug contact therewith by means of the two-part depending flange 58 on the casing. This flange is constructed with an inwardly-projecting rounded bearing 59, which bears against the outwardly-flaring flange 60 on the globe. The hinged portion 61 of the flange is opened for the reception of the globe, and when closed and fastened by the clamping-screw 62 the upper end of the globe will be forced into snug contact with its seat. Within the upper end of the globe is placed an expansible metal band 63, provided with a ring 64, which encircles the side support 37 and slides thereon. In trimming the lamp the clamp-screw 62 is loosened and the hinged section 61 of the flange is swung open, which permits the globe to be lowered and suspended by its ring from the lower end of the depending arm 37.

The arc-inclosing globe is shielded against the weather and additionally protected against the ingress of outer air thereto by means of the outer globe, into which is received any gases that may escape from the arc-inclosing globe. By retaining the latter against its seat by spring-pressure it will yield to any abnormal pressure therein and allow of the escape of gas into the outer globe.

Instead of making the arc-inclosing globe of one piece it may be made of two pieces, both of which may be of glass, or the upper section may be made of metal. Fig. 7 illustrates a two-part globe, the upper section of which is screwed into the lamp-floor around the recess in which is located the annular valve, while the lower section is provided with an outwardly-projecting flange 66, against which is seated the upper end of the lower section of the globe. This construction of globe enables its interior capacity to be reduced, because the inner diameter of the upper section 65 need only be just sufficient to admit the carbon holder and socket.

While I have only shown and described my invention as applied to one type of regulating mechanism, it is obvious that it can be applied to other types of regulators, as, for instance, to the shunt-magnet regulator, in which the adjustment and feed of the carbon are effected by the coaction of a shunt-magnet and spring, and also to a series regulator, in which the establishment of the arc and the adjustment and feed of the carbons are effected by the coaction of a coarse-wire magnet in the main circuit and a shunt-magnet in a circuit around the arc. Hence I do not restrict my invention in its application to the particular type of regulator shown and described. Again, I have shown and described an annular ring-valve as a suitable packing for the carbon-holder, but it is evident that other forms of packing may be employed for the same purpose, and hence I do not limit my invention to the particular form of packing shown and described.

The words "arc-inclosing globe," as employed in the claims, will comprehend a globe made in one piece or in sections.

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

1. In an arc-lamp, the combination with its carbons, and means for causing the carbons to be separated by a slow and gradual movement until an arc of normal length has been established, of means for automatically releasing the regulating mechanism from the action of such retarding mechanism and causing the feeding carbon to be sensitively adjusted and fed until consumed, substantially as set forth.

2. In an arc-lamp, the combination with the feeding carbon, means for retarding its initial separating movement, and means for checking its action while the lamp is burning an arc of normal length, of means for automatically releasing the feeding carbon from the action of its retarding mechanism and subjecting it to the action of its checking mechanism, substantially as set forth.

3. In an arc-lamp, the combination with its feeding carbon and means for slowly and gradually separating it from the non-feeding carbon and slowly drawing the arc to any desired length, of means for automatically relieving the regulating mechanism from the action of such retarding mechanism and means for adjusting the clutch-tripping mechanism, so as to insure the sensitive adjustment and feed of the carbon, and maintain an arc of predetermined length, substantially as set forth.

4. In an arc-lamp, the combination with its feeding carbon, means for slowly and gradually separating the feeding carbon from its mate and slowly drawing the arc to any desired length, and means for slightly checking the movement of the feeding carbon while the lamp is burning a normal arc, of means for automatically relieving the regulating mechanism from the action of such arc-drawing retarding mechanism, and means for automatically adjusting the clutch-tripping floor or device, to insure the maintenance of a normal arc, substantially as set forth.

5. In an arc-lamp, the combination with means for retarding the movement of the feeding carbon in establishing an arc of normal length, and an adjustable feed-releasing mechanism, of an electromagnet for automatically and simultaneously throwing the said retarding mechanism out of operation and the adjustable carbon-feeding mechanism into position when the arc has been drawn to its desired length, substantially as set forth.

6. In an arc-lamp the combination with its feeding carbon and regulating mechanism for establishing the arc and feeding the carbon, of a dash-pot constructed to retard the separation of the carbons in establishing the arc and render such separating movement slow and gradual, and means for automatically relieving the regulating mechanism of such arc-

drawing retarding mechanism, when the arc shall have been drawn to its normal length, substantially as set forth.

7. In an arc-lamp, the combination with the feeding carbon, and a dash-pot for retarding and controlling the movement of the carbon in drawing and in regulating the arc, of an electromagnet for automatically varying the degree of retardation of the dash-pot, substantially as set forth.

8. In an arc-lamp the combination with its feeding carbon and electromagnet-regulating mechanism, of a dash-pot the cylinder of which is provided with grooves throughout a portion of its length, and means for automatically adjusting the relative positions of the dash-pot cylinder and its piston, and thereby vary the retarding effect of the dash-pot on the action of the regulating mechanism, substantially as set forth.

9. In an arc-lamp the combination with its feeding carbon, and regulating mechanism for establishing the arc and feeding the carbon, of a dash-pot constructed to retard the movement of its position throughout a portion of its stroke, and to relieve the piston from a portion of such retarding action throughout the remaining portion of its stroke, and means for automatically varying the position of the cylinder of the dash-pot and its piston, substantially as set forth.

10. In an arc-lamp the combination with a friction-clutch and regulating mechanism adapted to raise the friction-clutch out of contact with the lamp-floor in the operation of establishing an arc of normal length, of an adjustable floor or support for the friction-clutch, an electromagnet; means for automatically switching said magnet into circuit when the arc has been drawn to its normal length and causing it to raise the adjustable floor or support, and means for restricting the upward movement of said floor or support and maintaining it in a position to actuate the friction-clutch and insure the gradual feeding of the carbon and the maintenance of an arc of normal length, substantially as set forth.

11. The combination with the regulating mechanism of an arc-lamp, an adjustable floor or support for a ring-clamp or friction-clutch, and an electromagnet for lifting said floor or support, of means whereby said electromagnet is retained out of circuit until an arc of normal length has been established and retained in circuit throughout the operation of the regulating mechanism in adjusting and feeding the carbon, substantially as set forth.

12. The combination with the regulating mechanism of an arc-lamp, an adjustable floor or support for a ring-clamp or friction-clutch and an electromagnet for lifting said floor or support, of a contact carried by the regulating mechanism, and a contact carried by the movable portion of the electromagnet, said contacts being constructed and arranged to remain separated until an arc of normal length has been established, and then to be brought into and retained in contact and maintain the electromagnet in circuit throughout the burning of the carbons, substantially as set forth.

13. The combination with the regulating mechanism of an arc-lamp, and an adjustable floor or support for a ring-clamp or friction-clutch, of a shunt-magnet included in a high-resistance circuit around the arc, and means associated therewith for automatically switching the shunt-magnet into circuit and causing it to lift the adjustable floor or support after the arc has been drawn to the desired length, substantially as set forth.

14. The combination with the regulating mechanism of an arc-lamp, a lever, a dash-pot cylinder connected with one of its ends, and a friction-clutch floor or support with its other end, of an electromagnet for tilting said lever and simultaneously adjusting the dash-pot cylinder and the friction-clutch floor or support, substantially as set forth.

15. The combination with the regulating mechanism of an arc-lamp, an adjustable friction-clutch floor or support, and a shunt-magnet, of a contact mounted on a movable portion of the regulating mechanism, and a contact mounted on the movable portion of the electromagnet, one of said contacts being yielding, the parts being arranged to switch the electromagnet into circuit and cause it to lift the floor or support when an arc of predetermined length has been established, and to maintain the magnet in circuit throughout the burning of the carbons, substantially as set forth.

16. In an arc-lamp the combination with its carbons, carbon-holder or carbon-rod, and socket on the lower end of the rod, of an arc-inclosing globe, a seat against which the upper end of the globe snugly fits, an upwardly-spring-pressed support upon which the globe is mounted and a packing snugly encircling the carbon-rod and permanently retained thereon at a point above the socket in which the upper carbon is secured, substantially as set forth.

17. In an arc-lamp the combination with its feeding carbon, carbon rod or holder, arc-inclosing globe constructed and adapted to receive both carbons throughout their maximum length, the non-feeding carbon being secured to the cap upon the lower end of the globe, of an upwardly-spring-pressed support upon which the arc-inclosing globe is supported and by means of which its upper end is pressed against a stationary seat, and packing encircling the carbon rod or holder, substantially as set forth.

18. In an arc-lamp the combination with its carbons, carbon rod or holder and arc-inclosing globe the latter being constructed to receive both carbons throughout their maximum length, of a cover mounted on the upper end of the globe and provided with a hole through which the carbon-rod passes and

within which it snugly fits and an independent annular packing-ring seated on the lamp-floor and encircling the carbon-rod and serving to exclude the entrance of gases to the interior of the casing containing the regulating mechanism.

19. In an arc-lamp the combination with the lamp-floor and a globe provided with an outwardly-flaring flange at its upper end, the upper edge of the flange forming a seat, of a sectional depending flange on the lamp-casing, said flanges being provided with bearings which engage the flange on the globe, and means for contracting the sectional flange and forcing the upper end of the globe against its seat on the under side of the lamp-floor, substantially as set forth.

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

HENRY A. SEYMOUR.

Witnesses:
S. W. FOSTER,
S. G. NOTTINGHAM.