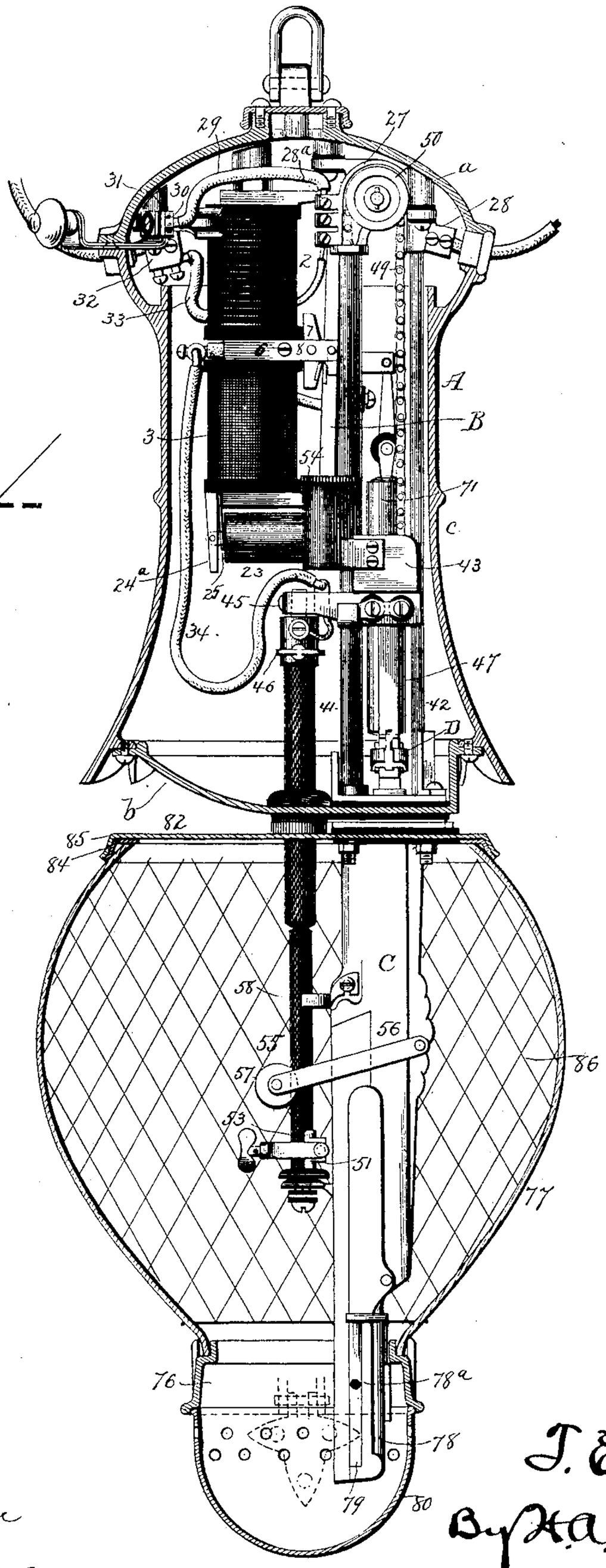
(No Model.) 5 Sheets—Sheet 1.

T. E. ADAMS.

ELECTRIC ARC LAMP.

No. 589,996. Patented Sept. 14, 1897.

Fig. 1.



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(No Model.) 5 Sheets—Sheet 2.

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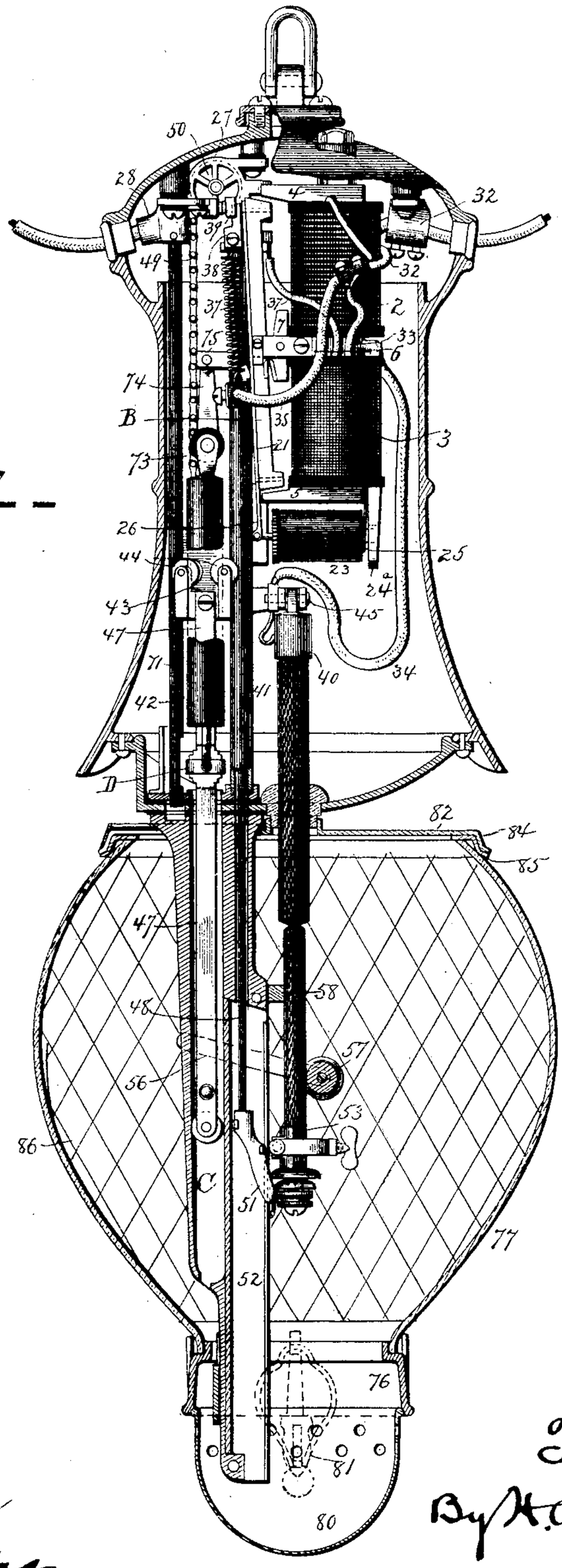
Fig. 2.



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(No Model.) 5 Sheets—Sheet 3.

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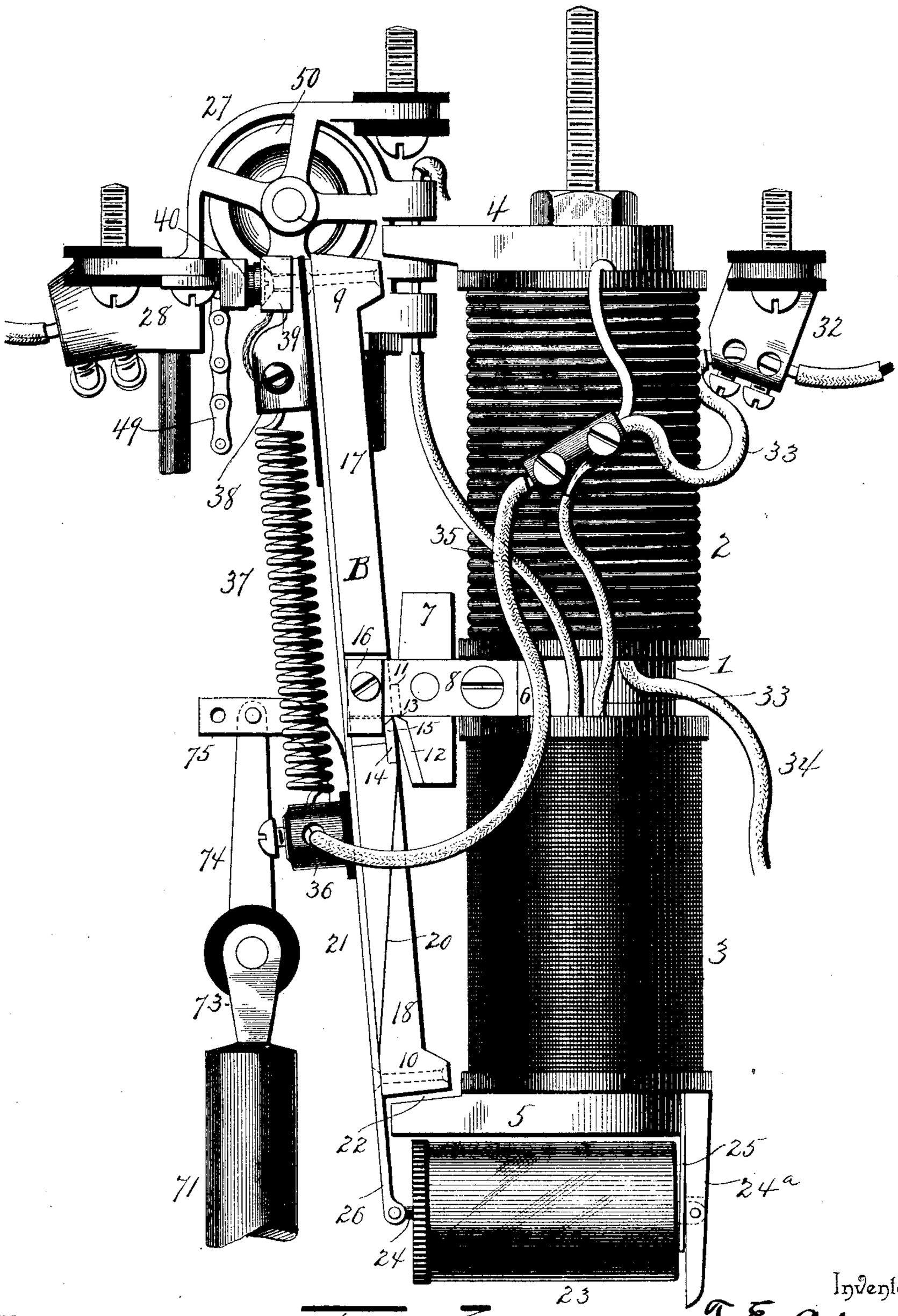

FIG. 3.

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ELECTRIC ARC LAMP.

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Fig. 4.

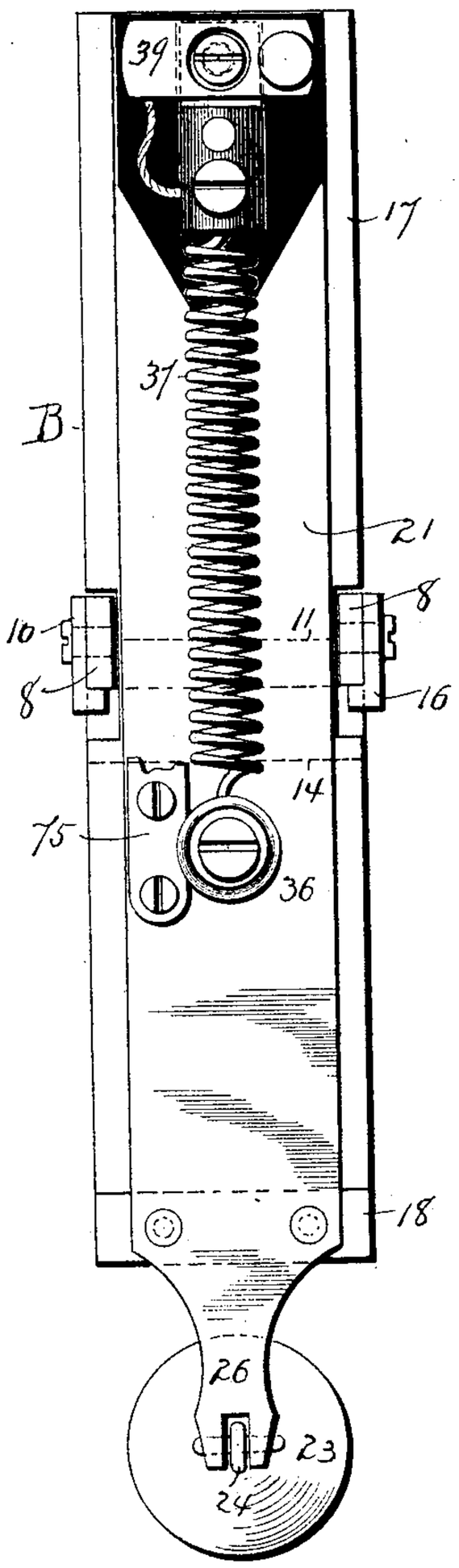
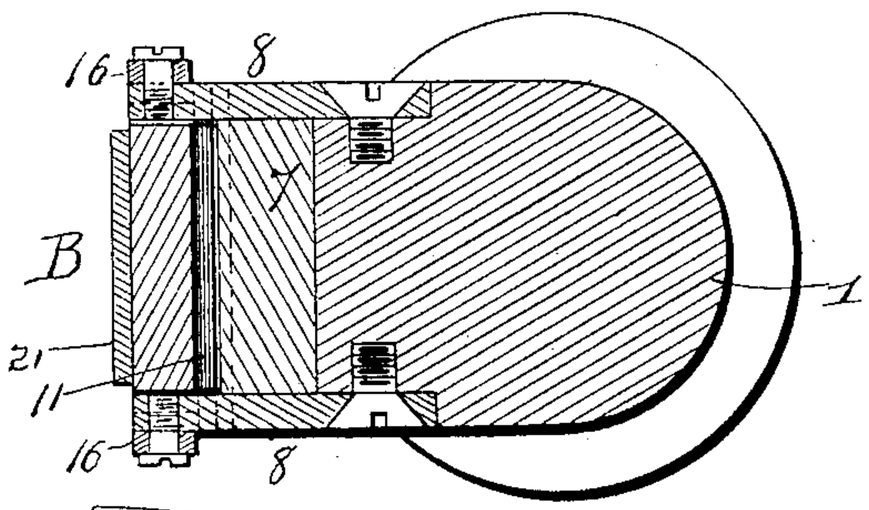


Fig. 5.



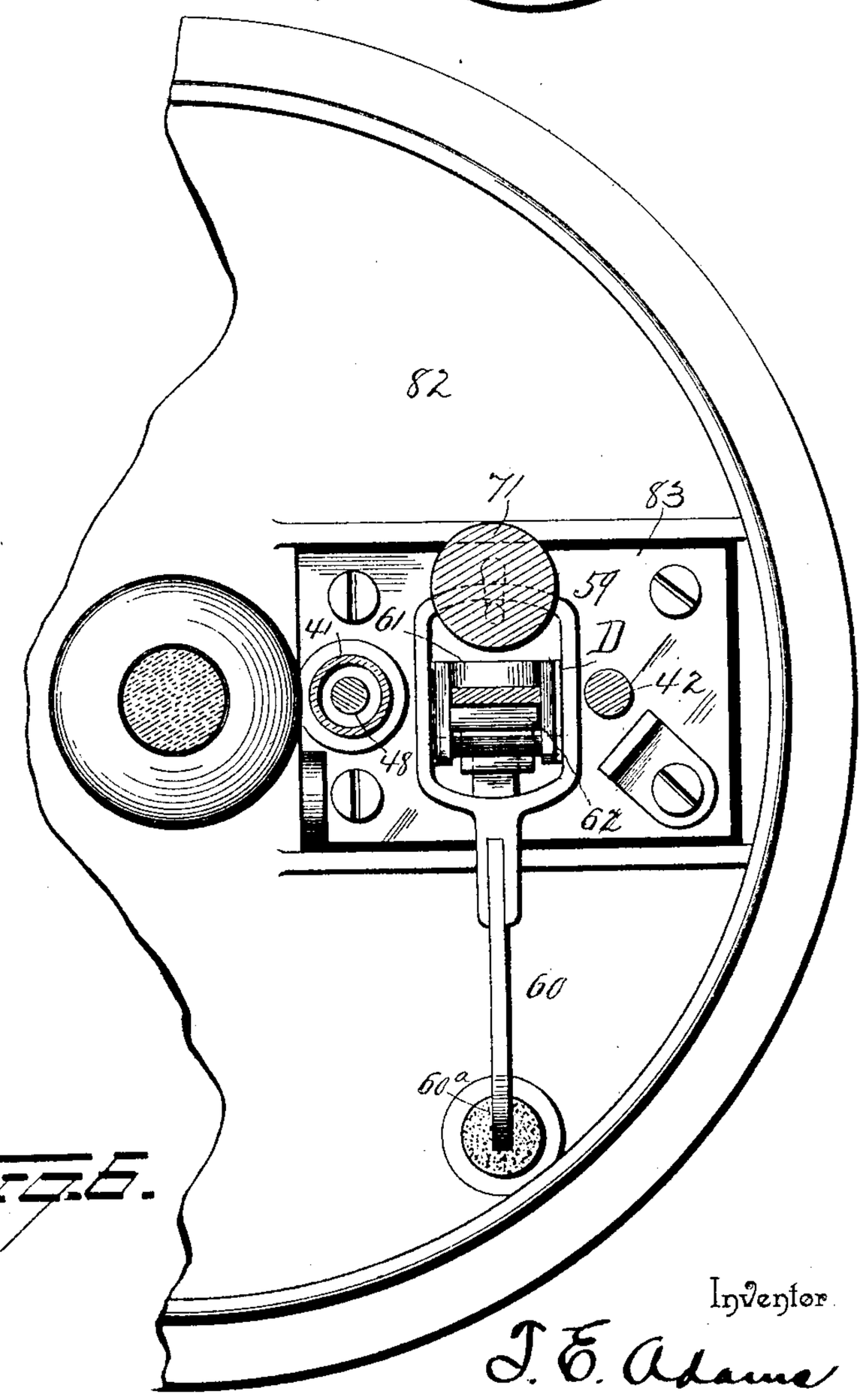


Fig. 6.

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ELECTRIC ARC LAMP.

No. 589,996. Patented Sept. 14, 1897.

Fig. 7.

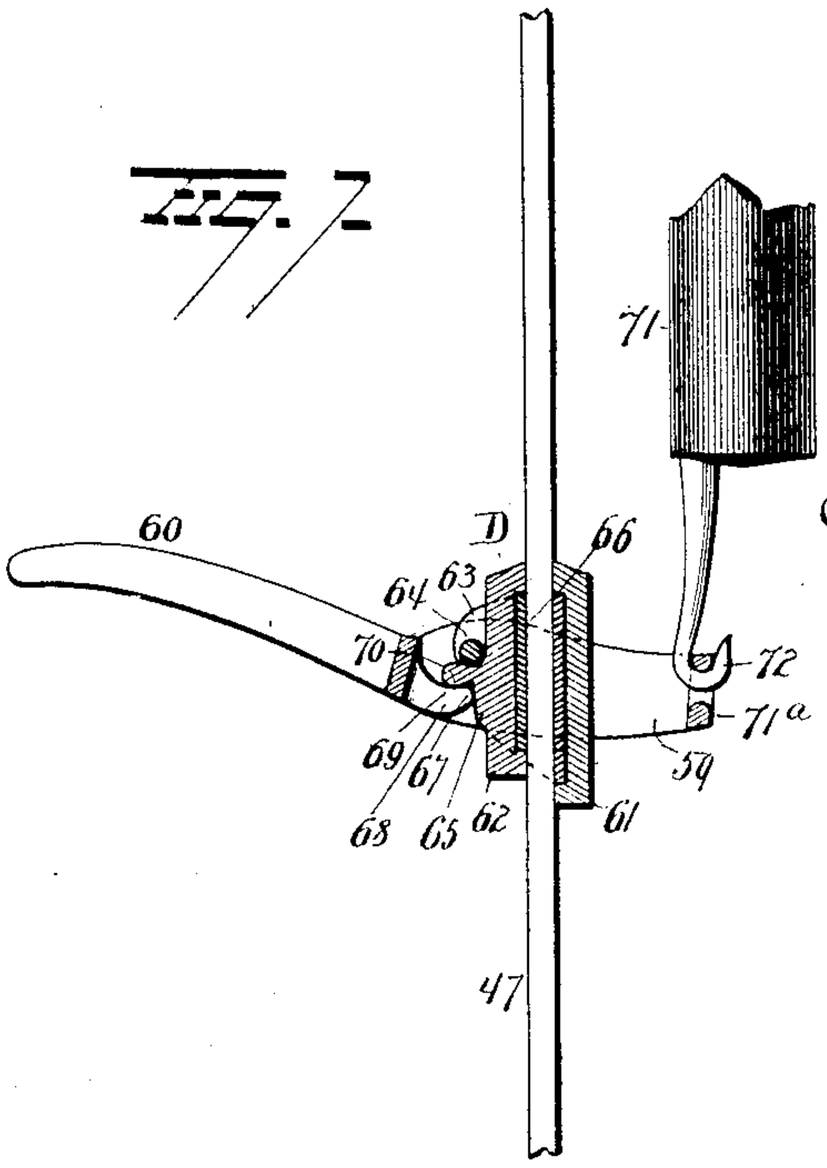


Fig. 8.

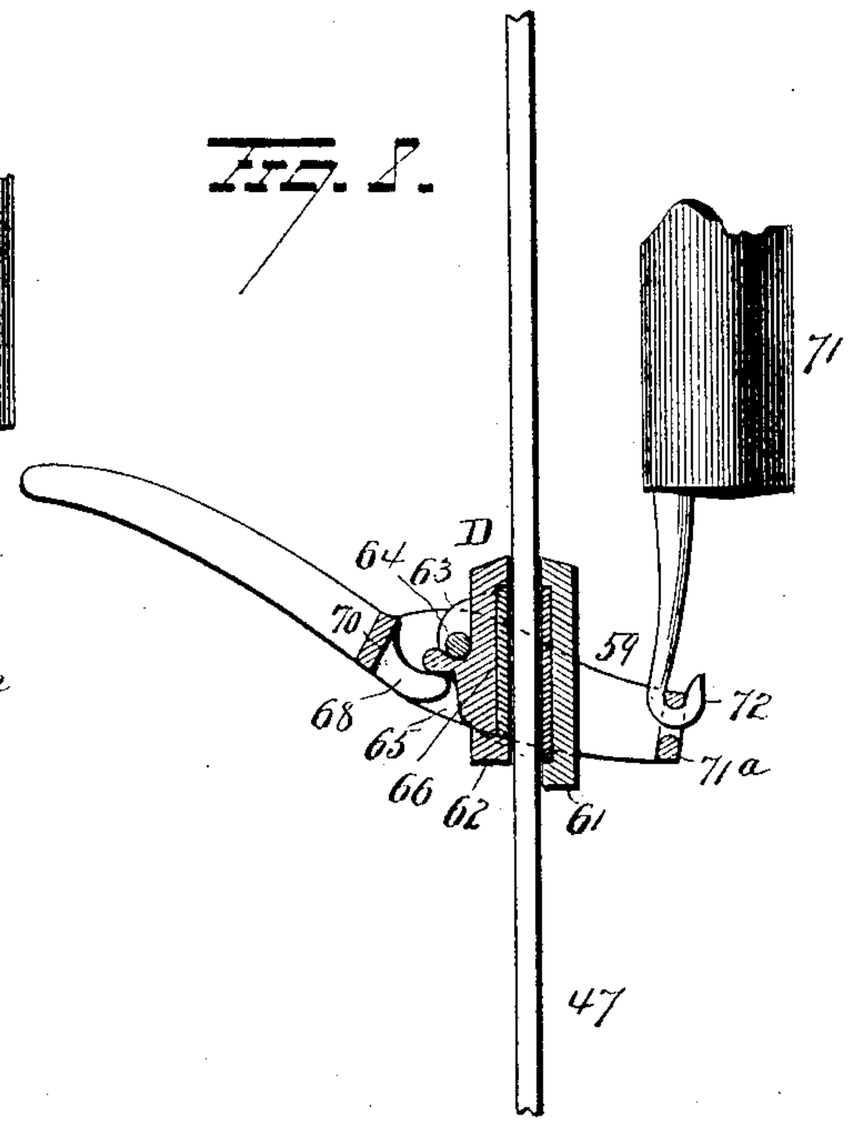
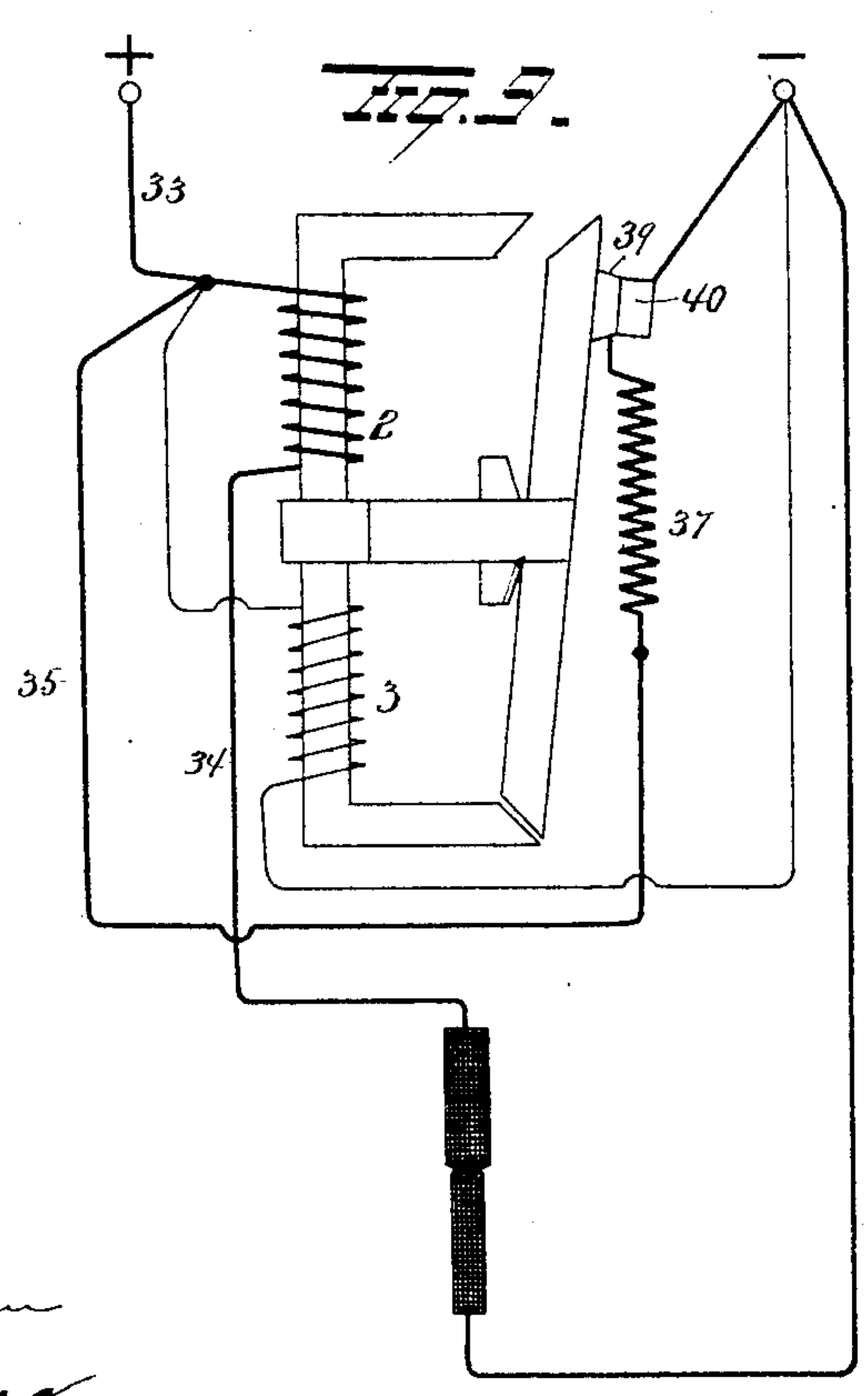


Fig. 9.



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UNITED STATES PATENT OFFICE.

THOMAS EDGAR ADAMS, OF CLEVELAND, OHIO.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 589,996, dated September 14, 1897.

Application filed July 28, 1896. Serial No. 600,778. (No model.)

To all whom it may concern:

Be it known that I, THOMAS EDGAR ADAMS, a resident 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, one object of the invention being to provide an accurate and durable electromotor-regulating mechanism whereby to move both carbons for separating them and establishing the arc and regulating its length and brilliancy.

A further object is to provide an electromagnet having one or more circuits so disposed and arranged upon a single core having three pole-pieces that the latter will act upon an iron bar as an armature and form consequent and salient poles, said armature being mounted so as to move freely and in such manner that the magnetic lines will pass from the central pole of the magnet to said armature and tend to retain the latter in proper position.

A further object is to so mount an air-pot and connect it with the armature of the magnet as to reduce friction on the piston and its rod to a minimum.

A further object is to provide a self-contained electromagnet—*i. e.*, one having its armature supported upon itself, such support comprising hardened knife-edges and the magnetism assisting in such support and permitting movement of the armature with minimum friction and with freedom from clogging with dirt.

A further object is to provide means for automatically switching a faulty lamp out of circuit.

A further object is to provide an improved clutch for an electric-arc lamp.

A further object is to provide improved means for supporting the globe.

A further object is to provide an improved guide for the lower carbon.

A further object is to guard against the entrance of rain, snow, or insects into the globe to a troublesome degree.

A further object is to provide means at the top of the globe to prevent the same from breaking and also aid in supporting the globe-net.

A further object is to so construct an electric-arc lamp that heat and cold will not practically change the length of the arc.

With these objects in view the invention consists in an electromagnet constructed with two salient poles of one and the same polarity and an intermediate or consequent pole of polarity different from that of the salient poles, and an armature pivotally supported by the intermediate or consequent pole and adapted to be turned on its fulcrum by the salient poles.

The invention further consists in the combination with a magnet having salient poles of like polarity and a consequent pole of the other polarity, of an armature pivotally supported between its end by the consequent pole within the path of the lines of force, said armature being constructed and adapted to be vibrated by the action of the salient poles.

The invention further consists in an electromagnet having salient poles of like polarity and a consequent pole of the other polarity, of a pole-shoe on the consequent pole, an armature having knife-edge bearings between its ends on said pole-shoe, said armature being adapted to be vibrated by the action of the salient poles of the magnet.

The invention further consists in the combination, with a magnet, of an armature made in separate sections and a yielding thermostatic strip secured to and connecting said sections.

The invention further consists in certain novel features of construction and combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a front elevation of my improved lamp with the casing in section. Fig. 2 is a rear elevation showing the operating mechanism. Figs. 3, 4, 5, 6, 7, and 8 are views illustrating various details. Fig. 9 is a diagrammatical view.

A represents the casing for the operating mechanism of the lamp, which casing is preferably made of cast metal and comprises a top *a*, a floor or bottom *b*, and upright walls *c*, made in sections and secured to the top *a* and

bottom *b*, some of said sections being hinged to form doors whereby to permit ready access to the interior of the casing.

A magnet is disposed within the casing and supported from the top *a*. This magnet comprises a core 1 and two coils 2 3, spaced apart on said core and so wound as to form a magnet having salient poles 4 5 and a consequent pole 6, the salient pole-pieces being made to project laterally at right angles from the core. In other words, the magnet is constructed to have ends of one and the same polarity and an intermediate portion of an opposite polarity from the ends. The coil 2 is of coarse wire and included in series with the electrodes, while the coil 3 is of fine wire and included in a shunt-circuit around the electrodes. To the consequent pole of the magnet a shoe or pole-piece 7 is secured by means of arms 8 and made with an outer curved face. The arms 8 project outwardly beyond the curved face of the shoe or pole-piece 7, and between them an armature B is disposed and provided at points centrally, or nearly so, between its ends with recesses for the accommodation of said arms 8, the respective ends 9 10 of said armature being somewhat enlarged and beveled, so as to be attracted by the respective salient poles 4 5 of the magnet.

A plate or strip 11 (preferably of steel) is secured to the inner face of the armature B nearly centrally between the ends of the latter, and to the lower portion of the curved face of the shoe or consequent pole-piece 7 a steel plate 12 is secured, said plate being beveled so as to form a knife-edge 13, upon which the lower edge of the plate 11 has its bearings. Another steel plate or strip 14 is secured to the inner face of the armature and made with a knife-edge 15, which bears against the under edges of the arms 8 in close proximity to the knife-edge 13 of plate 12, and said arms 8 may, if desired, be made of steel.

To prevent accidental outward displacement of the armature, stops 16 are secured to the arms 8 and depend behind the ends of the steel plate or strip 14.

From this construction and arrangement of parts it will be seen that the armature will be delicately mounted on knife-edges and that the magnetism from the consequent pole of the magnet will act upon the armature and thus tend to maintain it in proper position. In other words, a self-contained electromagnet is provided—*i. e.*, one having its armature supported upon itself, such support being hardened knife-edges and the magnetism assisting in such support, permitting movement of the armature with minimum friction and with freedom from clogging with dirt.

As the movements of the armature B control the regulation of the carbons, (as will be hereinafter explained in detail,) it is very desirable that the armature be so constructed as to compensate for varying temperatures, and thereby insure the maintenance of an equal or constant length of arc in cold and warm weather. To accomplish this, the armature is made thermostatic, so that the end thereof, which is attracted by the pole surrounded by the shunt-coil, will always bear the same relation to said pole, regardless of the temperature of the weather to which the lamp may be subjected, and thus insure the uniform sensitiveness of the regulating mechanism and the length of the arc in all kinds of weather.

For the reasons above explained the armature B is constructed in two parts—viz., a main part 17 and a smaller movable part 18—each preferably having inclined meeting edges 20, and these parts are connected together by a thin plate or blade 21, (preferably of brass,) which is disposed on the back of the armature, being secured at one end to the upper end of the main part 17 thereof and at or near the other end to the movable part 18 of the armature. From this construction it is clear that when the brass blade 21 expands or contracts more than the part 17 of the armature the air-gap 22 between the part 18 of the armature and the lower pole 5 of the magnet will be extended or diminished. As slight changes in the air-gap 22 will affect the pull of the magnet, it is apparent that if said air-gap can be maintained of irregular proportions under varying conditions of the temperature to which the lamp is exposed the maintenance of an arc of normal length under the varying degrees of temperature to which the lamp may be exposed at different seasons of the year or when placed in different locations will be assured. When the shunt is hot, less current will pass. Air-gap should then be smaller to compensate for weakened spool.

In order to prevent armature B and parts actuated by it from moving too suddenly during the separation and feeding of the carbons, an air-pot 23 is provided. It is desirable that the piston and piston-rod 24 of the air-pot be subjected to a minimum amount of friction, so that the operation of the regulating mechanism shall be smooth and easy, and for this reason said air-pot is disposed in a horizontal position under the lower pole-piece 5 of the magnet and pivotally supported at one end in a bifurcated arm 24ª, depending from said pole-piece. A spring 25, also depending from the pole-piece 5, bears against the pivoted end of the air-pot at a point below the pivotal support of the latter, and said air-pot is thus yieldingly supported in a horizontal position, permitting the plunger and its rod to move smoothly and without binding in the least when the end of the armature, to which the plunger-rod is attached, moves in the arc of a circle. The connection between the plunger-rod and armature is formed by an arm 26, which may, if desired, be a continuation of the brass plate 21.

A hood or casting 27 is secured to the under side of the top *a* of casing A at or near one side thereof, and is made with a binding-

post 28 for the reception of the negative leading-in wire of the lamp. The hood is also made with a binding-post 28ª, into which one end of a conductor 29 is inserted, the other end of said conductor being attached to the switch-arm 30 of a manual cut-out, said switch-arm being adapted to engage a contact-plate 31, secured to the binding-post 32, to which the positive leading-in wire is connected. Thus it will be seen that by moving the switch-arm 30 into contact with the plate 31 the lamp will be short-circuited.

A conductor 33 extends from the positive binding-post 32 to the coarse-wire coil of the magnet, and from said coil a conductor 34 extends to the upper-carbon holder. A conductor 35 is attached to the conductor 33 and to a binding-post 36, secured to but insulated from the armature B. A coil 37 of low resistance is attached at one end to the binding-post 36 and at the other end to a casting 38. A contact-plate 39 is loosely attached to the casting 38 and electrically connected therewith, said plate being adapted to engage a contact-arm 40, projecting from the casting 27, which forms the negative binding-post. Thus when the plate 39 and arm 40 are in contact, a shunt-circuit of low resistance around the magnet will be closed, the purpose of which is to cut out the lamp should it be faulty and refuse to operate. This low-resistance shunt is preferably so constructed as to offer somewhat more resistance to the passage of the current than the circuit through the coarse wire and the carbons when the current is first turned on, (the carbons being normally in contact,) so that if the lamp is not faulty but in condition to operate properly the coarse-wire end of the magnet will be energized and attract the upper end of the armature, thus opening the low-resistance shunt and allowing all the current (except a minimum amount which will pass through the shunt fine-wire coil) to flow through the coarse-wire coil and the carbons, the same movement of the armature serving to separate the carbons and establish the arc through the medium of the clutch devices and connections hereinafter described.

One end of the fine-wire coil 3 is connected with the conductor 33 from the positive binding-post of the lamp, and the other end of said fine-wire coil is connected with the negative binding-post of the lamp.

Two rods 41 42 are secured at their upper ends to the hood or casting 27 and at their lower ends to the floor of the casing, the rod 41 being made tubular. A cross-head 43 is disposed between the rods 41 42 and provided with rollers 44 to run on said rods.

An arm 45, secured to and insulated from the cross-head 43, projects laterally therefrom, and to the free end of said arm the upper-carbon holder 46 is loosely connected. A clutch-blade 47 is secured to the cross-head 43, and, depending therefrom, passes through the floor of the casing and enters a hollow flat shield, which constitutes the arm C of the lamp.

A rod 48 is adapted to have a vertical movement in the shield or arm C and the tubular rod 41. One end of a chain 49 is attached at one end to the upper end of the rod 48, and after passing over a pulley 50, mounted in the hood or casting 27, said chain is attached at its other end to the cross-head 43. To the lower end of the rod 48 a slide or bracket 51 is attached and adapted to be guided in ways 52 at the front edge of the shield or arm C.

To the slide or bracket 52 a holder 53 for the lower carbon is loosely attached. In order to insure the maintenance of the lower carbon in proper relation to the upper carbon, a guide 55 is provided. This guide consists of two arms 56, pivotally attached to the lamp-arm and of a length to project beyond the carbon, a roller 57 being mounted in the free ends of said arms and adapted to bear against the carbon. The length of the guide is such that it will normally assume a downward inclined position, and the weight of the roller 57 will cause the same to bear against the carbon with sufficient pressure to retain the upper part of the carbon in a socket-piece 58, secured to the lamp-arm C.

It will be seen that when the cross-head 43 moves the carbons will be made to approach or recede from each other according to the direction of movement of said cross-head. A friction-clutch D is adapted to engage the clutch-blade 47, and in order to permit the carbons to feed the clutch will be operated to permit the cross-head to descend and thus cause the carbons to be fed by the gravity of said cross-head and attached carbon-holder and upper carbon. In order to insure the overbalancing by these parts of the lower carbon, its holder, and intermediate connections, the cross-head is provided with a weight 54. This weight is preferably composed of a box containing shot or other small particles, whereby the weight can be readily adjusted.

In constructing the clutch D, I employ a yoke 59, having an arm 60 to engage a stop 60ª on the floor of the lamp, and in this yoke the two jaws 61 62 of the clutch are mounted and provided with flat inner faces to engage the clutch-blade 47. The jaw 61 is provided at its edges with ears 63, which are perforated at their free ends for the free passage of a rod 64, the latter being secured at its ends to the yoke 59. The jaw 62 of the clutch is disposed between the ears 63 and provided on its back with an enlargement 65, the upper face 66 of which is adapted to ride on the fixed rod 64. The under face of the enlargement 65 is made with a recess 67, (preferably V-shaped,) and in this recess a hook-shaped tongue 68, projecting from the yoke 59, bears. The extreme end of the tongue 68 bears in the bottom of the recess, while the forward face 69 of said tongue is adapted to bear against the forward wall 70 of the recess 67. Thus it will be seen that when the inner end

71ª of the yoke 59 is raised the movable jaw will be forced toward the clutch-blade and the latter will be clamped between the two jaws 61 and 62.

In connecting the clutch D and armature B a metal bar or weight 71 is provided at its lower end with a hook 72 to engage the inner end of the yoke 59, and to the other end a coupling 73 is attached. A plate 74 is attached at one end to but insulated from the coupling 73, and at its other end said plate is pivotally attached to an arm 75, projecting from the armature B at a point in proximity to the center of the latter. The bar or weight 71 also tends to move the armature when the latter is released by the coarse-wire magnet.

The holder 76 for the globe 77 is provided internally with a socket-piece 78, adapted to receive the lower end of the lamp-arm C and be retained in position thereon by means of a set-screw 78ª. The globe and holder can be moved vertically to facilitate the trimming of the lamp by loosening the screw 78ª, but will be prevented from falling by the engagement of said screw with a shoulder 79 at the lower end of the lamp-arm C. The globe-holder is provided with a hinged ash-receiver 80, provided with a locking device 81.

In order to prevent the entrance of rain, snow, and insects into the globe, a cover 82 is provided therefor and secured to the lamp-casing. The cover 82 is made with a central hole, through which the upper carbon passes, and to one side of this hole the cover is made with an opening appreciably larger than the lamp-arm for the accommodation of the latter. The opening in the cover is closed by an insulated plate 83, provided with a slot for the passage of the lamp-arm. The cover 82 is provided with a depending flange 84, adapted to receive a ring 85 on the upper edge of the globe, and the connection of the globe and cover is thus made sufficiently tight to prevent the entrance of rain, snow, and insects into the globe. The ring 85 also serves as a convenient support for a wire-netting 86, placed on the globe, and also to prevent the globe from breaking.

The lamp operates as follows: When current first enters the lamp, it will pass through the coarse-wire coil and the carbons, thus moving the armature B and opening the low-resistance shunt-circuit, at the same time operating the clutch in the manner above explained and raising the clutch-blade slowly to separate the carbons and establish the arc. Should the lamp be faulty and refuse or fail to start, the low-resistance shunt-circuit will remain closed, and thus cut out the lamp. As the lamp continues to burn and the arc increases in length the consequent increased resistance in the lamp-circuit will cause more current to flow through the shunt-circuit, including the fine-wire coil, and the armature will be actuated to operate the clutch and permit the carbons to feed.

Various changes might be made in the details of construction of my invention without departing from the spirit thereof or limiting its scope, and hence I do not wish to limit myself to the precise details herein set forth.

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 magnet constructed with two salient poles of one and the same polarity and an intermediate or consequent pole of polarity different from that of the salient poles, and an armature pivotally supported by the intermediate or consequent pole and adapted to be turned on its fulcrum by the salient poles, substantially as set forth.

2. In an arc-lamp, the combination with a magnet having salient poles of like polarity and a consequent pole of the other polarity, of an armature pivotally supported between its ends by the consequent pole within the path of the lines of force, said armature being constructed and adapted to be vibrated by the action of the salient poles, substantially as set forth.

3. In an arc-lamp, the combination with an electromagnet having salient poles of like polarity and a consequent pole of the other polarity, of a pole-shoe on the consequent pole, an armature having knife-edge bearings between its ends on said pole-shoe, said armature being adapted to be operated by the action of the salient poles of the magnet, substantially as set forth.

4. In an arc-lamp, the combination with a magnet having salient poles of like polarity and a consequent pole of opposite polarity, of a pole-shoe secured to the consequent pole, an armature, a plate secured to the armature centrally between its ends, and a plate secured to the pole-shoe and having a knife-edge to receive the under edge of the plate on the armature, substantially as set forth.

5. In an arc-lamp, the combination with a magnet having salient and consequent poles, of a pole-shoe secured to the consequent pole, arms projecting from the ends of the said shoe, an armature, a steel plate secured to the armature approximately centrally between its ends, a steel plate secured to the shoe and having a knife-edge to receive the steel plate on the armature, and a steel plate on the armature, having knife-edges to bear against the arms projecting from the shoe, substantially as set forth.

6. The combination with a magnet, of an armature made in separate sections and a yieldable thermostatic strip secured to and connecting said sections, substantially as set forth.

7. In an arc-lamp, the combination with a magnet, of an armature pivotally supported between its ends and adapted to be actuated by the poles of said magnet, said armature being made in two parts connected together by a thermostatic strip, substantially as set forth.

8. In an arc-lamp, the combination with a

magnet, of an armature made in two parts, the meeting ends of said sections being inclined, and a yieldable thermostatic strip secured at one end to one end of one section of the armature and at the other end to the other section of the armature, substantially as set forth.

9. In an arc-lamp, the combination with a coarse-wire magnet and the carbons in series therewith, of an armature, a low resistance carried by said armature and included in a shunt-circuit around said magnet, and a switch included in said shunt-circuit and operated by said armature, substantially as set forth.

10. In an arc-lamp, the combination with a coarse-wire magnet and the carbons included in series therewith, of an armature, a low resistance secured to and carried by said armature and included in a shunt-circuit around the magnet, a contact-arm secured to a terminal of the lamp, and a contact block or plate carried by the armature and adapted to engage said contact-arm, substantially as set forth.

11. In an arc-lamp, the combination with a magnet, its armature and carbons, of a horizontally-disposed air-pot having its plunger-rod connected with said armature, one end of said air-pot being pivotally supported, and a spring fixed at one end and bearing at its free end against the pivoted end of the air-pot at a point below said pivotal support, substantially as set forth.

12. In an arc-lamp, the combination with a magnet and its armature, of a vertically-movable cross-head, an upper-carbon holder carried thereby, a movable carbon-holder, flexibly connected between the cross-head and lower-carbon holder, a clutch-blade attached to the cross-head, a clutch connected with the armature, and an adjustable weight secured to the cross-head whereby to insure the proper overbalancing by the cross-head, of the lower-carbon holder and attached devices, substantially as set forth.

13. In an arc-lamp, the combination with a magnet having salient and consequent poles, and a vertically-movable cross-head, of an armature pivotally supported between its ends by the consequent pole of the magnet, upper and lower carbon holders connected with said cross-head, a clutch-blade connected with said cross-head, a clutch and connections between said clutch and armature, substantially as set forth.

14. In an arc-lamp, the combination with a magnet and its armature, of a weighted connection between said armature and said clutch, said weighted connection being adapted to transmit motion from the armature to the clutch and also to move said armature when released by the magnet, substantially as set forth.

15. A clutch comprising a yoke having an inwardly-projecting tongue, a jaw pivotally supported within said yoke, and a movable jaw adapted to be engaged and moved toward the pivoted jaw by said tongue, substantially as set forth.

16. A clutch comprising a yoke, a jaw pivotally supported within said yoke, a movable jaw having a recessed projection on its back, and a tongue on the yoke adapted to enter the recess in said projection on the movable jaw whereby to move the latter toward the pivoted jaw, substantially as set forth.

17. In a clutch, the combination with a yoke having an arm projecting therefrom, and a rod extending transversely through said yoke, of a jaw having ears pivotally connected to said rod, a movable jaw disposed between said ears, an enlargement on the back of said movable jaw and adapted to ride against said rod, said enlargement having a recess in its under face, and a hook-shaped tongue projecting from the said yoke and entering said recess whereby to move the movable jaw toward the pivoted jaw, substantially as set forth.

18. In an arc-lamp, the combination with the carbons and a clutch, of a magnet comprising a core, a coarse-wire coil on one end of said core included in the lamp-circuit, and a fine-wire coil on the other end of the core included in a shunt-circuit, a consequent pole between said coils, an armature supported between its ends by said consequent pole and adapted to be actuated by poles at the respective ends of said core, and connections between said armature and clutch, substantially as set forth.

19. The combination with an arc-lamp having a movable lower carbon, of a guide for said carbon consisting of arms pivoted at one end to the lamp-arm and having a roller mounted in their free ends adapted to bear against said lower carbon, substantially as set forth.

20. The combination with an arc-lamp having a movable lower carbon, of a guide for said lower carbon, said guide consisting of arms pivoted at one end to the lamp-arm and a roller carried in the free ends of said arms, said arms being of such length as to project farther beyond the carbon than is necessary to cause the roller to bear against the latter, whereby said roller can have a vertical movement and prevent the possibility of the carbon binding in its guide, substantially as set forth.

21. The combination with an arc-lamp having a movable lower carbon, of a guide for said carbon, said guide consisting of pivoted arms and a roller carried by said arms and a socket-piece above said guide, to receive the carbon, substantially as set forth.

22. In an arc-lamp, the combination with the lamp-casing and lamp-arm, of a globe-holder attached to the lamp-arm, a globe supported by said holder, a ring mounted on the upper edge of the globe and having a depending flange, a netting on the globe and secured to said depending flange of the ring, and a

cover for said globe secured to the casing and having an annular depending flange to receive and inclose the ring on the globe, substantially as set forth.

23. In an arc-lamp, the combination with the lamp-arm, of a globe-holder, a socket-piece in said globe-holder, adapted to receive the lamp-arm and to be moved vertically thereon and means for retaining said globe-holder in a fixed position at any desired adjustment, substantially as set forth.

24. In an arc-lamp, the combination with the lamp-arm, of a globe-holder, a socket-piece in said globe-holder adapted to receive and be guided vertically on said lamp-arm, a set-screw for securing the globe-holder in a fixed position on the lamp-arm, and a shoulder on the lamp-arm against which said set-screw will rest when the globe-holder is lowered, substantially as set forth.

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

THOMAS EDGAR ADAMS.

Witnesses:
PERRY NORRIS,
P. G. KASSULKER.