J. HÄRDÉN.

ARC LAMP.

APPLICATION FILED DEC. 26, 1903.

929,643.

Patented July 27, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

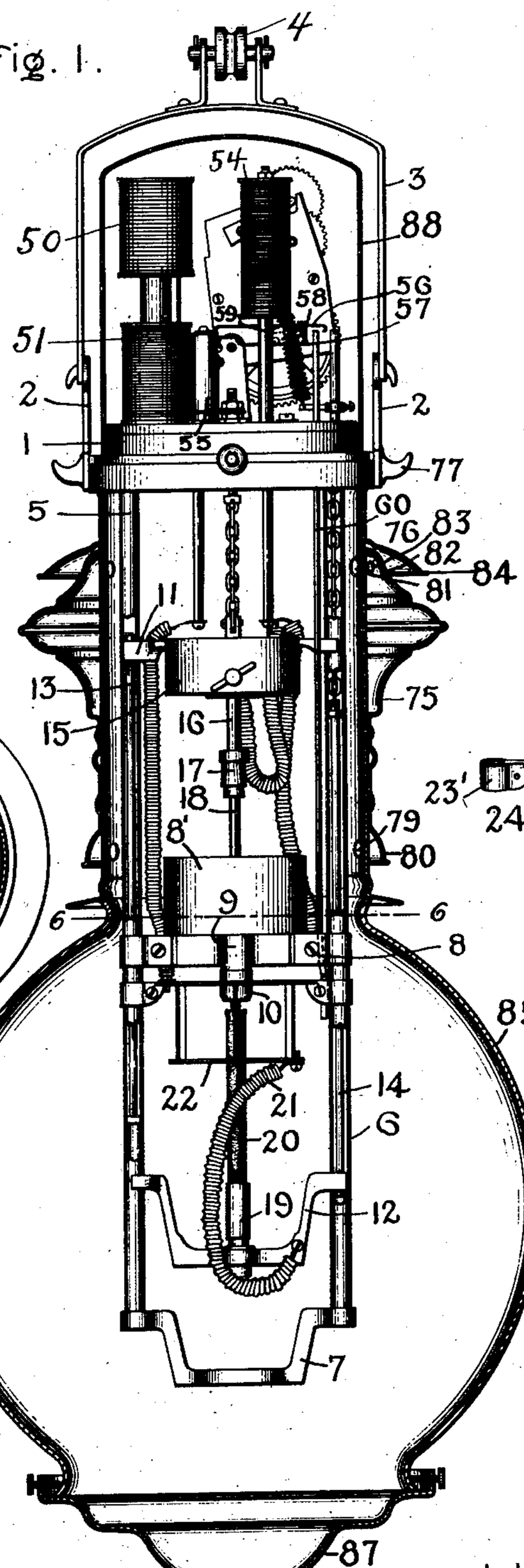


Fig. 6.

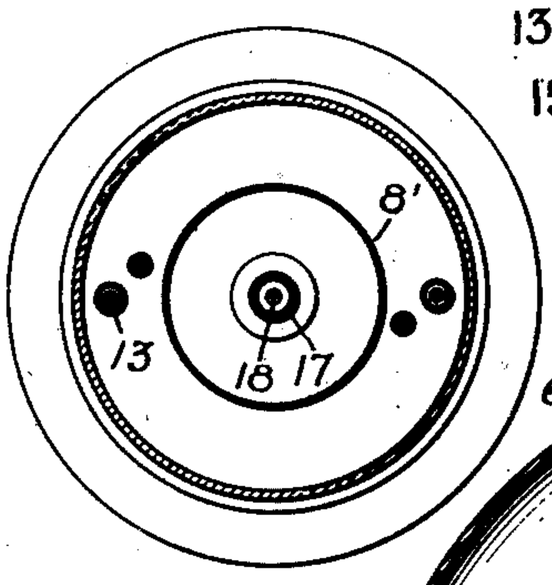
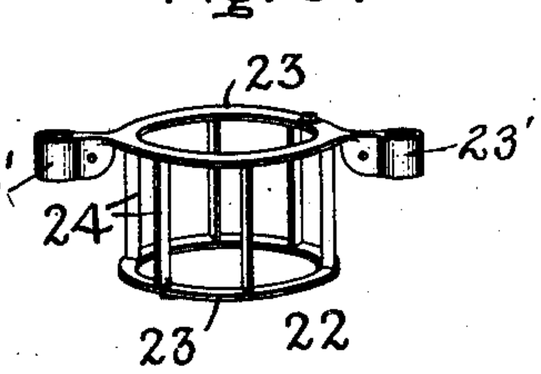


Fig. 5.



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2 SHEETS—SHEET 2.

Fig. 4.

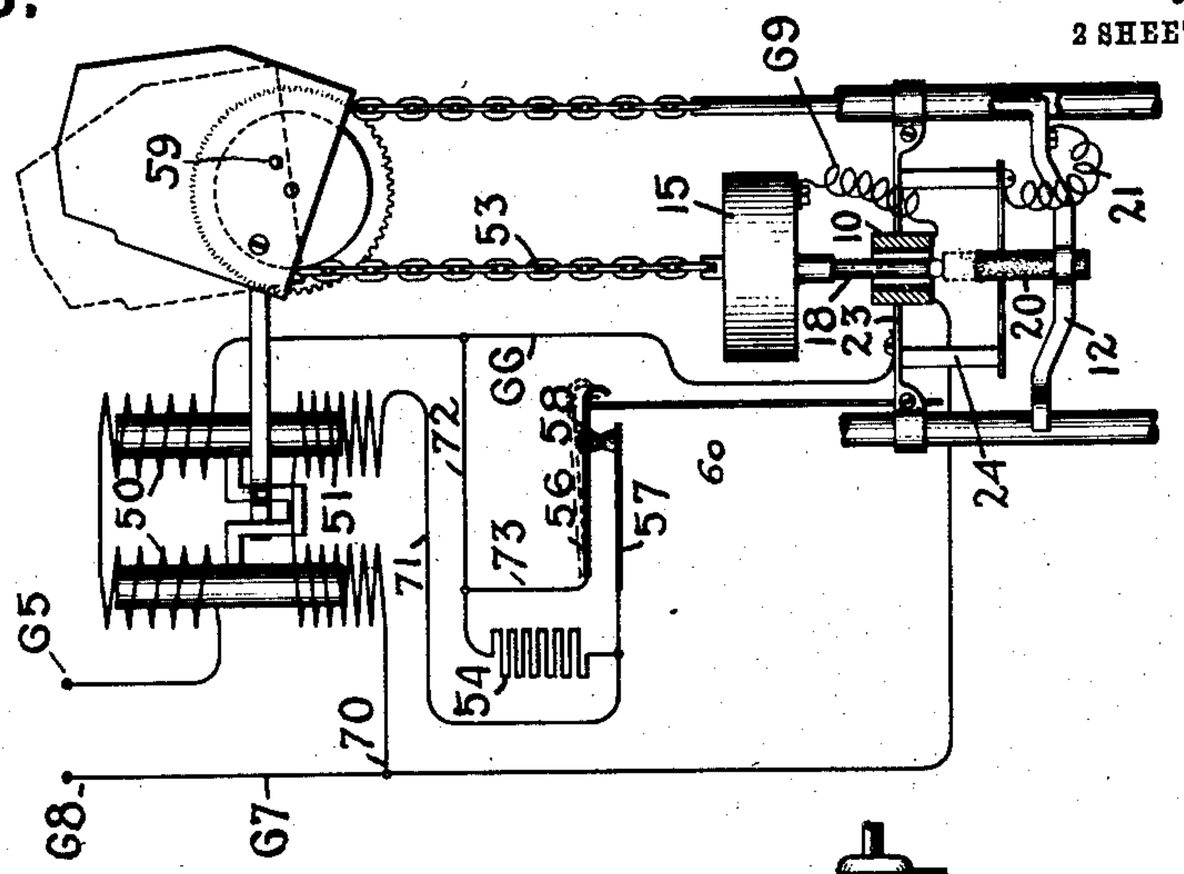


Fig. 3.

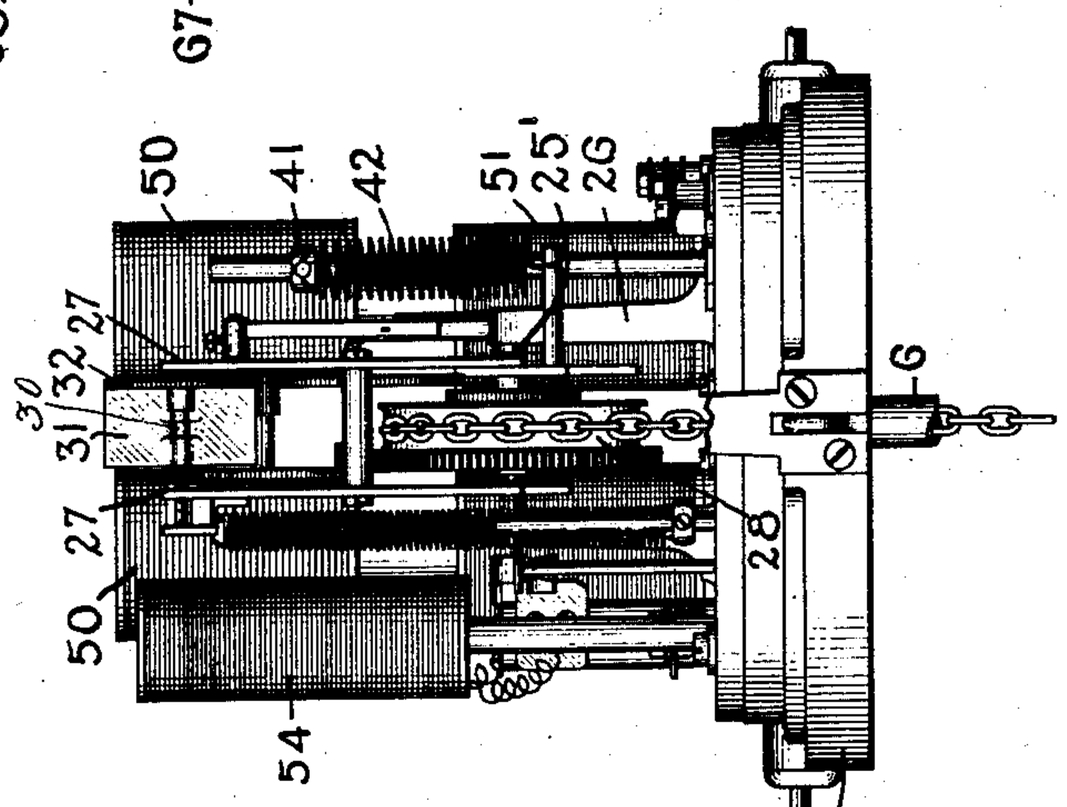
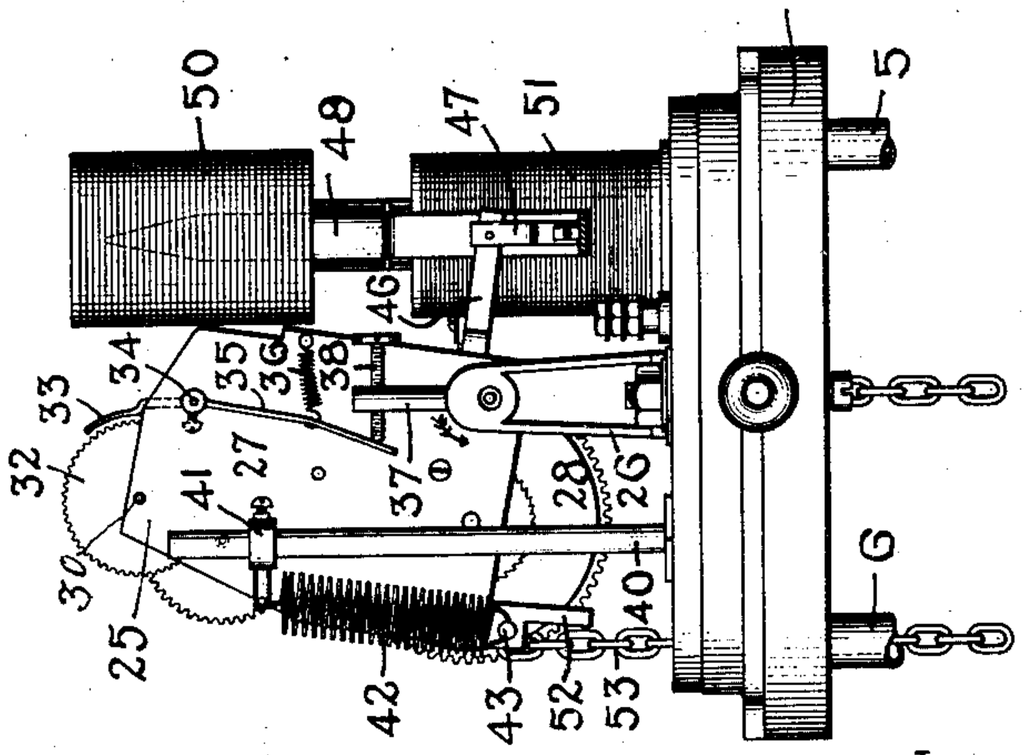


Fig. 2.



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UNITED STATES PATENT OFFICE.

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ARC-LAMP.

No. 929,643. Specification of Letters Patent. Patented July 27, 1909.

Application filed December 26, 1903. Serial No. 186,632.

To all whom it may concern:

Be it known that I, JOHANNES HÄRDÉN, a subject of the King of Norway and Sweden, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Arc-Lamps, of which the following is a specification.

The object of my present invention is to improve the construction and operation of arc lamps.

More particularly my present invention relates to arc lamps in which the major portion of the illumination comes from the arc itself, which is flaming or luminous, instead of from electrode tips heated to incandescence as in the more common form of lamps. In such lamps it has been found that where negative electrodes are used which are composed of some material such as the oxids or carbid of titanium, the magnetic oxid of iron or many other materials, the positive electrode may be formed of some material such as copper which is not consumed in the normal operation of the lamp. With many of such materials which may be employed in the negative electrode to give a luminous arc the electrode tip becomes more or less non-conductive when cold due usually to the formation of a slag or film at the electrode tip. This renders it necessary, or at least desirable to provide special means for starting the arc, as merely bringing the tip of the negative consuming electrode into contact with the non-consuming positive electrode is not sufficient.

I have found that with many materials which may be employed in the negative electrode an arc can be started by causing an auxiliary electrode of some suitable substance such as carbon or other granular good conducting material to impinge directly against the arc end of the consuming negative electrode, as a sufficiently good electrical connection is made to start a flow of current. This is particularly true if the auxiliary carbon electrode is brought into contact with the negative before the latter has had time to cool much, as I have discovered that in such cases the auxiliary electrode acts as a guard or shield which seems to lessen the resistance acquired by the electrode tip. In the lamp which is hereinafter described and illustrated in detail I have devised means for suitably actuating such an auxiliary electrode. My lamp also embodies many other novel features of construction and arrangement not all of which are limited to use in connection with electrodes which yield a luminous arc.

The various novel features which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention reference may be had to the accompanying drawing in which I have illustrated one embodiment of it.

Of the drawings, Figure 1 is a side elevation of an arc lamp with the inclosing casing and globe in section; Fig. 2 is a side elevation with parts in section showing a portion of the lamp mechanism viewed from the opposite side to that from which Fig. 1 is seen; Fig. 3 is an end elevation showing the mechanism illustrated in Fig. 2; Fig. 4 is a diagram illustrating the circuits and operation of the lamp; Fig. 5 is a perspective view of a detail; and Fig. 6 is a section taken on the line 6—6 of Fig. 1.

Referring to the drawing, 1 represents the main platform of the lamp, which is preferably disk-shaped. From the outer periphery of the platform 1 a pair of arms 2 extend upward, to the upper end of which a yoke 3 is pivoted. Means such as pulley 4 are carried at the upper end of the yoke 3 by which the lamp may be supported. From the under side of the platform 1 a pair of parallel tubular members 5 and 6 extend downward, these members being connected at their lower ends by a cross-bar or member 7.

Intermediate the ends of members 5 and 6 a bridge member 8 is located. The ends of this member are clamped to but insulated from the members 5 and 6. The bridge member 8 is formed with a tubular portion 9 at its center. A tubular member 10 extends downward from and in line with the tubular portion 9. The tubular member 10 forms the non-consuming electrode of the lamp and is preferably formed of wrought copper and may or may not be integral with the tubular portion 9 and the bridge 8. Preferably however the member 10 is detachable and may be renewed when necessary.

On the upper side of the bridge member 8 is carried a cylindrical member 8′ formed of

sheet metal, such as copper. The purpose of this member is to aid in dissipating the heat generated in the non-consuming electrode of the lamp by the passage of current in order that the temperature of the electrode may be kept at a point which will prevent injurious oxidation of the electrode.

Above and below the bridge member 8 are located movable carriages or cross-heads 11 and 12 respectively. The right-hand end of the cross-head 11 and the left-hand end of the cross-head 12 as viewed in Fig. 1 are formed with yokes which partially surround the tubular members 6 and 5 respectively. The left-hand end of the cross-head 11 and the right-hand end of the cross-head 12 project into slots formed for the purpose in the tubular members 5 and 6 respectively, and are rigidly secured to guide-bars or members 13 and 14 respectively which slide longitudinally in the tubular members 5 and 6. The carriage 11 carries, but is insulated from, a heavy weight 15. From the under side of the weight 15 a metal rod 16 projects. The rod 16, which is carried by and extends downwardly from the weight 15, carries at its lower end a socket 17 in which a pencil 18 of carbon or the like is held. The pencil 18 forms the auxiliary electrode of the lamp and passes axially through the tubular members 9 and 10.

The lower carriage or cross-head member 12 carries on its upper side a socket 19 in which the consuming negative electrode is carried. The electrode 20 is formed of or contains some material which gives a luminous or flaming arc, such as titanium carbid or the like. An electrical connection, comprising an insulated conductor 21, extends between the carriage 12 and the lower portion of a cage 22. The cage comprises a pair of annular members 23 which are concentrically placed with respect to the electrodes of the lamp and are connected together by vertical bars or members 24. The upper member 23 is secured to the members 5 and 6 by clamps 23′ but is insulated therefrom. A suitable electrical connection is made to the upper annular member 23 from one of the terminals of the lamps and current passes to the lower electrode through all of the vertical members 24 to the lower annular member 23. The cage 22 is arranged to surround the arc between the electrodes 20 and 10 and the passage of current through the bars 24 tends to steady the arc and centralize it.

On the upper side of the platform 1 a frame 25 is pivotally supported by trunnions 25′ which are journaled in brackets 26 mounted on the upper side of the platform 1. This frame comprises a pair of side plates 27 between which is rotatively mounted a sprocket wheel 28. The sprocket wheel 28 is connected through a series of gear wheels, the journals of which are pivoted in the plates 27 to a shaft 30 also journaled in the plates, which carries a fan 31 and a brake wheel 32. A brake-shoe 33, which coöperates with the brake-wheel 32, is carried by a shaft 34 journaled in the plates 27. On the end of the shaft 34 which projects through the right-hand plate 27, as seen in Fig. 2, is secured an arm 35. A helical spring 36 having one end secured to the arm 35 and the other to a pin carried by the plate 27 normally holds the brake-shoe 33 against the brake-wheel 32 and locks it and the rest of the gearing against movement. A post 37 projecting upward from the right-hand bracket 26 is formed with a transverse threaded opening near its upper end through which a thumb screw 38 passes, one end of which engages the lower end of the arm 35 to hold the brake-shoe 33 out of engagement with the wheel 32 when the frame 25 is in the position shown in Fig. 2 and in dotted lines in Fig. 4.

A post 40 extending upwardly from the platform 1 carries near its upper end an adjustable collar 41 to which one end of the helical spring 42 is secured. The other end of the helical spring is attached to a pin 43 carried by the pivoted frame. The spring 42 normally holds the pivoted frame in the position shown in Fig. 2 and in full lines in Fig. 4.

An arm 46 rigidly secured to the pivoted frame between the side plates 27 is pivotally connected at its free end to a yoke-shaped member 47 of magnetic material which connects a pair of magnetic cores 48 and 49 having conical ends. Each of these cores moves axially in a pair of tubular coils 50 and 51 placed one above the other. The coils 51 are mounted on the platform 1. Within each coil 51 is mounted a tubular shell of non-magnetic material the upper end of which enters into and forms a support for the corresponding coil 50. The shells form guides within which the cores 48 and 49 may slide. Portions of the shells are cut away to allow movement of the yoke-shaped member 47. It will be observed that the upper ends of the core members 48 and 49 and the yoke member 47 form an armature or core for the coils 50, while the lower end of the cores and the yoke member form an armature or core for the coils 51. Under the influence of current passing in the coils 50 the cores 48 are lifted and rock the pivoted frame in the direction indicated by the arrow in Fig. 2. The rocking movement of the frame is limited by the engagement of a stop 52 carried by the outer end of the frame with the upper side of the platform 1. One end of the chain 53, which meshes with the teeth of the sprocket wheel 28, passes through an aperture centrally located in the platform 1 and is secured to the weight 15. The other end of the chain 53 also passes

through an aperture formed in the platform 1 into the tubular member 6 and is secured to the upper end of the guide rod or bar 14.

A non-inductive resistance such as the coil 54 is supported on the upper side of the platform 1 as is clearly shown in Fig. 1. A post 55 extending upward from the platform 1 carries in its upper end a pair of flexible arms 56 and 57. The inner ends of the members 56 and 57 are insulated from each other. The outer ends of these members carry a couple of contact devices 58 which may consist of blocks of carbon. As is clearly shown in Fig. 1, the plate 27 carries a pin 59 which, engaging the under surface of the outer end of the member 56, holds the contact block or device carried by it out of engagement with the contact device carried by the member 57 when the frame is in the position shown in Fig. 1. When the frame is in the position shown in full lines in Fig. 4, however, the contact devices 58 are normally in contact with one another. A sliding rod 60, which has its lower end located just below member 56, passes through the platform 1 down to and through the clamp which supports the cage 22, being offset at its lower end to prevent it from falling through the latter. The lower end of this rod will be struck by the cross-head 12 when it approaches the upward limit of its motion. This will move the rod to separate the contacts 58.

Referring particularly to the diagram shown in Fig. 4, one terminal 65 of the lamp is connected directly to one terminal of the coils 50 which are in series with each other. A conductor 66 connects the other terminal of the coils 50 to the upper annular member 23 from which a circuit exists through the bars 24 and lower annular member 23 of the cage 22 and conductor 21 to the carriage 12 and negative electrode 20. A conductor 67 leads from the other terminal 68 of the lamp to the non-consuming electrode 10. An electrical connection between the electrode 10 and the weight 15 and thereby the auxiliary electrode 18 is indicated in the diagram by the conductor 69. One terminal of the coils 51, which are in series with each other, is connected to the conductor 67 at the point 70. The other terminal of the coils 51 is connected to one terminal of the resistance conductor 54 and to the member 57 by a conductor 71. The other terminal of the resistance conductor 50 is connected to the line 66 by the conductor 72. A conductor 73 connects the conductor 72 with the member 56.

It will be observed that when the member 56 is in such position that the contacts 58 engage one another, the members 56 and 57 and conductor 73 form a low resistance shunt about the resistance coil 54. It will also be observed that the coils 50 are in series with an arc between the electrodes 10 and 20 while the coils 51 are in shunt with the arc between the electrodes 10 and 20. Assuming the initial out-of-service condition of the lamp to be that indicated in Figs. 1 and 2 in full lines and in Fig. 4 by dotted lines, it will be observed that the electrodes 18 and 20 are in contact with each other. Upon connecting the terminals 65 and 68 into a suitable circuit current will begin to flow between the terminals starting from terminal 68, through conductors 67, electrode 10, electrode 20, carriage 12, conductor 21, cage 22, conductor 66, coils 50 to terminal 65. Passage of current through the series coils 50 will cause the cores 48 to be raised, and this will oscillate the pivoted frame in the direction indicated by the arrow in Fig. 2. As the frame 25 begins to move, the brake-shoe 33 will be moved into engagement with the brake-wheel by the spring 36. This will prevent rotation of the sprocket wheel 28 relative to the frame. As is clearly shown in Figs. 2 and 4, the trunnions 25′ about which the frame 25 turns are located within the periphery of the sprocket wheel 28. As the trunnions are near the right-hand edge of the sprocket wheel 28, the effect of rocking the frame 25 is to lower the electrode 20 a considerable distance and to elevate the auxiliary electrode 18 a much smaller distance. The movement of the electrodes 18 and 20 as the frame 25 rocks is indicated in Fig. 4 by the difference between the full- and dotted-line positions of the electrodes. As the electrodes 18 and 20 separate an arc is drawn between them. When the electrode 18 is drawn up into the tubular member 10, the upper end of the arc ordinarily will be immediately transferred from the electrode 18 to the non-consuming tubular electrode 10. Upon an increase of voltage of the arc the shunt coils 51 and the spring 42 will more or less overbalance the action of the series coil 50 and the frame 25 will move from the full-line position shown in Fig. 4 toward the dotted-line position. When the movement of the frame 25 is sufficient to cause an engagement between the screws 38 and the arm 35 the brake-shoe 33 will release the wheel 32 and the electrodes 18 and 20 will be moved together under the action of the weight 15 sufficiently to allow an arc of proper length to be maintained. The fan 31 acts as a retarding device to prevent a too rapid movement of the electrode when the brake-wheel is released.

The electrode 18 should be proportioned to consume during the feeding operation somewhat slower than the electrode 20 consumes in the regular operation of the lamp, as it is thereby certain that the electrode 18 will be long enough to operate properly. If the electrode 18 does not consume rapidly enough so that after the feeding operation it is withdrawn within the tubular member 10,

the arc will be maintained from it long enough to shorten it the proper amount.

The pin 59 carried by the frame 25 engages the member 56 to separate the contact blocks 58 and cut the resistance 54 into circuit with the shunt coils whenever the frame 25 moves into the position shown in the dotted lines in Fig. 4. The carriage 12 engages the rod 60 and causes it to separate the contacts, cutting the resistance into circuit whenever the electrode 20 becomes too short to be operative. The effect of cutting the resistance 50 into series with the shunt coils is to reduce the current flowing through these coils for a given potential and lessen the danger of their destruction when the lamp gets out of order or the operative portion of the electrode 20 is entirely consumed. This allows the use of less expensive shunt coils, as they do not have to be constructed to sustain a voltage considerably higher than the working voltage of the coil, which would be the case in constant-potential lamps where the lamp might remain in circuit for some time after the arc had been interrupted.

As before stated, when the lamp is put out of circuit, the carbon electrode 18 moves into engagement with the arc end of the electrode 20. By reason of the gearing and fan 31 the engagement between the electrodes 18 and 20 does not occur until a short time has elapsed after the lamp is cut out of circuit; this gives the electrode 20 time to cool slightly, thereby avoiding the liability of the electrodes sticking together. The period will be so short however that the end of the pencil 18 will act as a guard or shield which will prevent in some measure the formation of a film or slag at the electrode tip which is non-conductive when cold.

The casing 75 is secured to the platform 1 by means of pivoted yokes 76 which hook over lugs 77 extending upward from the platform 1. The casing 75 which extends from a distance slightly above the bridge member 8 to the platform 1 may be formed out of sheet metal spun into any suitable form. Apertures 79, protected by a hood or guard 80, are located near the lower end of the casing. Similar apertures 81 are formed near the upper end of the casing proper which is surrounded by an annular member 82 at this point. The annular member 82 may be a continuation of the hood 80. Apertures 83 substantially in line with the apertures 81 are formed in the upper portion of the annular member 82. A hood 84 prevents the passage of moisture or dust through the apertures 83 and 81. Air for ventilating the lamp mechanism may enter the apertures 80 and pass out of the apertures 81 and 83. Some of the arc products may be condensed and fall within the chamber formed between the annular member 82 and the casing proper.

A globe 85 incloses the lower portion of the lamp mechanism, being supported from the casing 75 in any suitable manner. Spaces, through which more or less air necessary for the proper operation of the arc may enter the globe, exist between the lower edge of the globe and a member 87 which partially closes it. The lamp mechanism located above the platform 1 may be inclosed in a suitable sheet-metal casing 88. Preferably the platform 1 is so made that it does not transmit heat readily and may embody in its construction several layers of asbestos or the like. Provision should be made for preventing the admission of dust into the lamp mechanism located above the platform through the central aperture through which the chain passes.

The lamp which I have hereinbefore described and illustrated in detail is but one of the many forms in which my invention may be embodied, and it will be readily understood by those skilled in the art that many changes can be made in the form of this embodiment without departing in any manner from the spirit of my invention.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an arc lamp, a non-consuming electrode, a consuming electrode formed of a material which tends to become superficially non-conducting when cooled after being heated, an auxiliary electrode movable into contact with the arcing end of the consuming electrode and of such size as to cover a substantial portion of the latter, and means for causing the auxiliary electrode to engage the consuming electrode shortly after current is cut off from the lamp.

2. In an arc lamp, the combination of a positive non-consuming electrode, a negative consuming electrode of such composition as to be liable to form a film or coating on its tip which is non-conducting when cold, an auxiliary electrode of powdered or granulated material, and means for making contact between the auxiliary electrode and the arcing end of the negative electrode when the lamp is cut out of circuit and before said negative electrode becomes cold, whereby the formation of a non-conducting film is prevented.

3. In an arc lamp, a frame, a wheel pivotally mounted therein, a flexible member passing over said wheel, a pair of electrodes secured one to each end of the flexible member, means for moving the frame in one direction to raise one electrode and lower the other electrode to bring the electrodes together, and means for moving said frame in the opposite direction to lower said one electrode and raise the said other electrode to strike an arc, a third electrode in coöperative relation with said pair of electrodes, said frame turning means being arranged to vary the position of one of said pair of elec-

trodes more than the other of said pair with reference to the third electrode.

4. In an arc lamp, a frame, a wheel pivotally mounted therein, a flexible member passing over said wheel, a pair of electrodes secured one to each end of the flexible member, means for moving the frame in one direction to raise one electrode and lower the other electrode to bring the electrodes together, means for moving the frame to lower said one electrode and raise said other electrode to strike an arc, means for rotating the wheel to compensate for the electrode portions consumed in the arc, and a third electrode in coöperative relation with said pair of electrodes, said frame moving means being arranged to vary the position of one of said pair of electrodes more than the other with respect to said third electrode.

5. In an arc lamp, a main positive electrode formed of copper, a negative main electrode containing titanium, an auxiliary electrode formed of carbon, and means for starting the arc between the carbon electrode and the electrode containing titanium and for thereafter maintaining the arc between the two main electrodes.

6. In an arc lamp, a stationary non-consuming positive electrode, a coöperating consuming negative electrode, an auxiliary consuming positive electrode, and means for feeding said consuming electrodes to compensate for their consumption.

In witness whereof, I have hereunto set my hand this 7th day of December, 1903.

JOHANNES HÄRDÉN.

Witnesses:
JOHN C. ROWE,
JAMES S. ANTHONY.