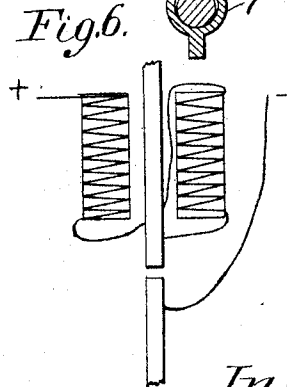
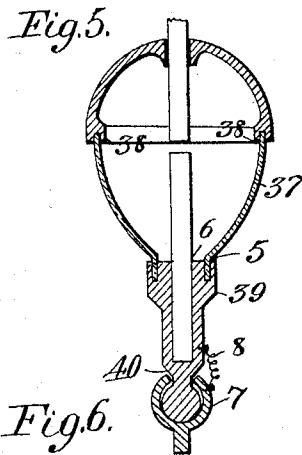
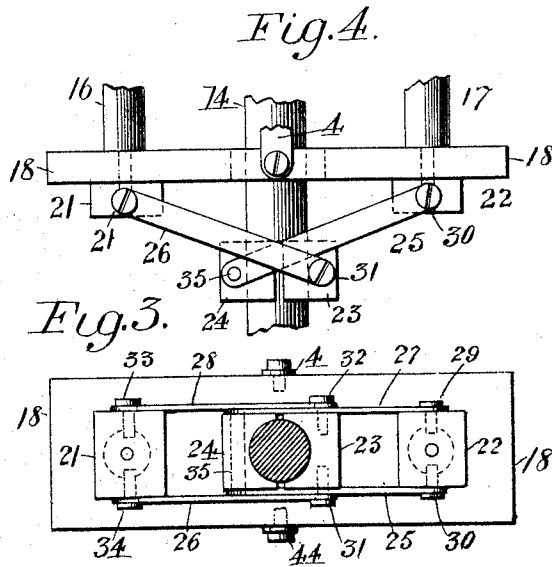
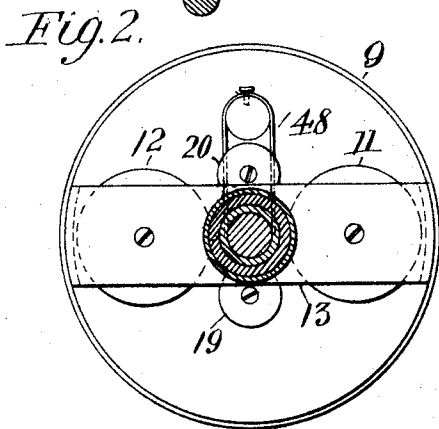
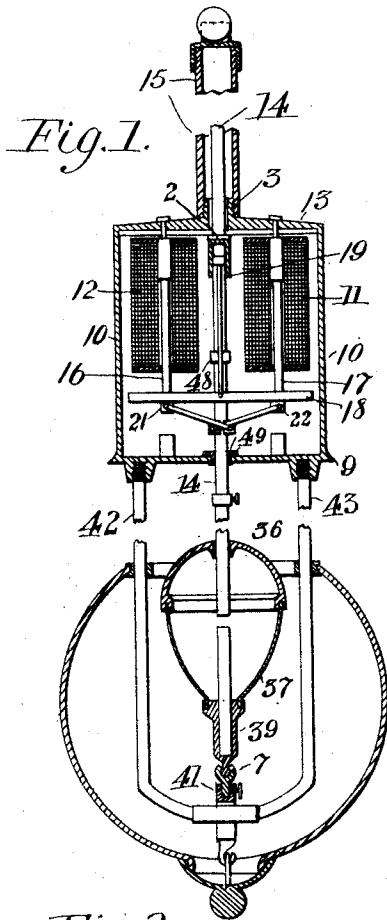


(No Model.)

C. J. TOERRING, Jr.
ELECTRIC ARC LAMP.

No. 585,603.

Patented June 29, 1897.



Witnesses
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CHRISTIAN J. TOERRING, JR., OF WASHINGTON, PENNSYLVANIA.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 585,603, dated June 29, 1897.

Application filed January 2, 1896. Serial No. 574,147. (No model.)

To all whom it may concern:

Be it known that I, CHRISTIAN J. TOERRING, Jr., a citizen of the United States, residing at Washington, in the county of Washington and State of Pennsylvania, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

My invention relates to that class of electric-arc lamps in which the arc is inclosed by a light-transmitting casing in order to prevent a free communication of the air therewith and so prolong the life of the carbons.

The objects of my invention are, first, to provide a cheap, reliable, and efficient feeding mechanism for the positive or upper carbon; secondly, to provide means whereby the life of the carbons can be greatly lengthened and thus do away with frequent and expensive renewals; thirdly, to provide a device to permit free movement of the upper carbon through the opening in the arc-inclosing globe.

The other objects and advantages of my invention will more clearly appear from the following specification taken in connection with the accompanying drawings, and the scope of my invention will be more particularly pointed out in the appended claims.

In the drawings, Figure 1 is an elevation, partly in section, of the lamp and its appurtenances. Fig. 2 is a plan view of the mechanism and frame of the lamp. Figs. 3 and 4 are the plan and elevation, respectively, of the clutch mechanism used in feeding the upper carbon. Fig. 5 is a sectional view of the arc-inclosing cylinder and its holder. Fig. 6 is a diagram of the circuit of the lamp.

My improved lamp is intended for use on constant-potential circuits, but the various features of my lamp are not limited to use in this connection, but may be employed for such purposes and in such manner as may seem desirable without departing from the spirit of my invention.

It will be evident from the following description that the several devices set forth may, if desired, be applied to any arc-lamp, whether fed by a constant current or from a constant-potential circuit.

Referring to Figs. 1 and 2, it will be seen

that the frame of the lamp is formed in one piece 13 9 10, the lower portion 9 being a flat disk. From the disk 9 rises a pair of vertical supports 10 10, joined together at the top by a horizontal cross-piece 13, which supports a pair of solenoids 11 12. These solenoids may be secured to the cross-piece 13 in any suitable manner, preferably by screws, or may be screwed to a yoke, which in turn is fastened to the cross-piece 13. The cross-piece 13 is provided with an opening 2, through which projects the rod 14, carrying the upper carbon. This rod is inclosed as to its upper portion by a protecting-casing 15, which is joined to the cross-piece 13 by a screw connection 3.

The solenoids 11 12 actuate cores 16 17, which are adapted to slide loosely therein and are joined rigidly together at the bottom by an armature 18. Violent fluctuations in the movement of the armature are prevented by means of the dash-pots 19 20, which are operatively connected with the armature 18 by rods 4 and 44. These dash-pots are suitably supported from the cross-piece 13 and may be of any appropriate construction. A detailed description of the dash-pots is deemed unnecessary.

On the bottom of the yoke-piece 18 are fastened two blocks 21 22, which support the four arms of the clutch shown in Figs. 3 and 4. This clutch, which is used in feeding the upper carbon, is provided with two shoes 23 24, which are suitably grooved to fit the rod 14. These shoes are connected with the blocks 21 22 by means of four overlapping arms or links 25 26 27 28. Each of the shoes is connected with that block which lies on the opposite side of the rod 14 therefrom by means of two of the four links aforesaid. Shouldered screws 29 to 34 are used as pivots for the links, except where the links 25 27 are pivoted to the shoe 24, in which case the projecting ends of a pin 35, firmly fastened in the shoe 24, act as pivots. The ends of the pin 35 project into holes or bearings in the links 25 27 and are flush with the outside portions of the said links, so as to allow the other links 26 28 to slide over the ends of the pin 35.

Supports located immediately beneath the blocks 21 22 may be provided, if desired, in

order to relieve the clutch mechanism of the weight of the armature when the solenoids are inactive.

The shoes 23 24, through their pivotal connection with the links 25 26 27 28, are thus always capable of remaining with their working faces parallel whatever be the movements of the links themselves. Since the ends of the links overlap each other, it will be seen that when the shoes move away from a line joining the pivotal support of the links on the blocks 21 22 they move in arcs of circles which tend to intersect each other, and as a consequence the shoes tend to approach each other and thus grip the rod 14. When the rod 14 and the armature 18 move relatively to each other, so as to cause the shoes of the clutch to move away from the armature 18, the friction of the working faces of the shoes on the rod 14 causes the shoes to move away from the armature 18, and so to approach each other and thus to grip the rod 14 more firmly yet. An upward movement of the armature 18, for example, would first cause the shoes to approach each other and grip the rod 14, and a continuation of the movement of the said armature would result in a concurrent movement of the rod 14 therewith. The rod 14 would remain suspended by the clutch until released by a separation of the shoes 23 24, which would happen when the armature 18 descends sufficiently to allow the shoes to rest on the bushing 49. A brush 48 bears against the rod 14, forming a good contact for the passing of the current.

The operation of the feeding mechanism is as follows: Upon closing the circuit the current passes in series through the solenoids and through the carbons, as shown diagrammatically in Fig. 6. A resistance (not shown) is placed in this circuit, so as to prevent a short circuit and a consequent burning out of the lamp before the feeding mechanism has had an opportunity to act. The current passing through the solenoids 11 12 causes the cores to be attracted and the armature 18 to rise. When the armature is lifted, the weight of the clutch causes the shoes 23 24 to approach each other and to grip the rod 14. The friction between the shoes and the rod tends to cause a still greater movement of the shoes away from the armature 18, and the shoes obtain a still firmer hold on the carbon-feeding rod. The weight of the carbon-feeding rod thus reacts to increase the friction of the shoes until the friction becomes sufficient to overbalance the weight of the said rod, which then rises or falls in accordance with the movement of the armature 18 until this relation is disturbed by a separation of the clutch-shoes, due to a sufficient downward movement of the armature to cause the shoes to rest on the bushing 49. The current passing through the solenoids thus causes the carbon-feeding rod to rise and spring the arc. The arc having been sprung, its length is regulated by the current passing through the

solenoids, which are so proportioned that with the desired length of arc the current passing therethrough is of such value as to cause the solenoids to exert an attractive force upon their cores of a value exactly sufficient to balance the weight of the cores, armature, clutch, and parts supported thereby. As the carbons burn away the arc lengthens, the current decreases, the balance is disturbed, and the armature descends until the arc has been shortened sufficiently to cause an increase of the current to its normal value. This increase in current immediately checks any further downward movement of the upper carbon, which then remains stationary until further consumption thereof at the arc causes these operations to be repeated. As the carbons are consumed the armature 18 slowly drops until the shoes 23 24 rest upon the bushing 49, which causes them to spread and allows the carbon-holding rod to slip, after which the armature 18 is again attracted and the action is repeated. The dash-pots 19 20 cause a slow and even movement of the armature 18 and its attachments, and thus insure an even feeding of the carbons and effectually prevents what is known as "pumping," a fault which consists in a violent reciprocating movement of the upper or positive carbon.

The second portion of my invention relates to means for increasing the life of the carbons; and it consists in a peculiarly-constructed globe for inclosing the arc.

In arc-lamps of the type in which the air is partially excluded from contact with the arc I have found that the positive carbon loses a definite amount of carbon dependent on the C^2R loss in the arc; also, that by increasing the temperature of the arc its ohmic resistance (as distinguished from its apparent resistance) is diminished. Hence an increased temperature, by decreasing the ohmic resistance, causes a decrease in the amount of carbon lost by the positive carbon.

The amount of carbon deposited from the positive carbon on the negative, supposing the amount of carbon liberated per second from the positive constant, is dependent upon the length of arc. By shortening the arc the life is increased. The deposit of carbon from the positive on the negative is increased, and this deposit is very nearly sufficient to build up the negative carbon as fast as it is consumed, it being understood, of course, that in an inclosed arc the consumption of the carbons is much slower than in the ordinary form of arc-lamp, in which the arc is in free communication with the air. If the arc is long, a larger amount of carbon will be thrown off from the positive without being caught by the negative. Now with a given difference of potential of the arc the length of the arc is shortened if its apparent resistance be first caused to increase by increasing the temperature of the surrounding inert gases. These experimentally-discovered facts indicate a

means for increasing the life of both the positive and the negative carbon. This means consists in raising the temperature of the gases within the arc-inclosing cylinder in some suitable manner. This I do by forming the arc-inclosing cylinder of a light-conducting portion and of a heat-retaining portion. The cylinder is at the same time made of as small size as convenient in order to reduce the radiating-surface.

In Figs. 1 and 5 I have shown a concrete embodiment of this part of my invention, but it will be understood that I do not limit myself to the particular details of construction therein shown. The arc-inclosing cylinder is made of two parts 36 and 37. The upper part 36 is made of any suitable substance which is a poor conductor of heat, preferably porcelain, and of a thickness sufficient to prevent any considerable escape of heat there-through. The part 37 of the cylinder is made of a transparent or translucent substance, preferably glass.

The connection between the parts 36 and 37 is made by a joint 38, which is not air-tight. The hole in the heat-retaining portion of the cylinder closely fits the carbon, and the peculiar inside contour of this portion of the cylinder aids the convection-currents in the cylinder in still further keeping out air from above; but as it is necessary that a definite amount of air should enter the cylinder in order to prevent a coating of carbon on the inner surface of the cylinder, which coating is due to small particles of carbon emanating from the arc and carbon points, I allow a limited entrance of air at a point best suited to prevent such a coating—viz., at the joint 38.

The peculiar construction of the upper part of the cylinder limits the amount of air entering at the top very largely, because the convection-currents in the cylinder flow counter to that of any air that might enter through the opening in the upper part of the cylinder. For this reason it is desirable to have a certain amount of air enter at the side, producing at the same time a more efficient light by adding at the place where it will do the most good the heat due to chemical combination of the oxygen of the air admitted with the particles of carbon thrown off by the arc. This construction has the further advantage of giving freer access to the inside of the cylinder for the purpose of cleaning.

The arc-inclosing cylinder is supported by a holder 39, the lower portion of the cylinder 37 being set therein and forming a joint 5 therewith. This joint may be either air-tight or nearly so, as may be desired. The holder 39 has an opening 6 for the insertion of the negative carbon.

The lower portion of the holder 39 is made in the form of a ball, which forms one part of a universal joint 40. This joint permits the cylinder to move so as to accommodate itself automatically to the crookedness or irregu-

larities in the contour of the positive or upper carbon. Shoulders 7 on the socket-piece allow but a limited movement of the globe, and so hold it in an approximately upright position when the upper carbon is removed during the operation of trimming. The socket-piece of the universal joint is rigidly held in the negative-holder 41 of the lamp, this holder being supported by the depending rods 42 43. The globe-holder 39 and the lower part of the universal joint 7 are electrically connected by a wire 8, so as not to be dependent upon the contact between the surfaces of the members of the universal joint, these surfaces being liable to oxidation.

It is evident that many changes may be made in the construction I have shown without departing from the spirit of my invention, and I therefore desire it understood that I do not limit myself to the precise forms which I have shown; but

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

1. In an electric-arc lamp, the combination with an arc-inclosing globe, a mounting for the same permitting lateral movement of the upper end of the globe, and a cover having a hole for the passage of the upper carbon, substantially as described.

2. In an electric-arc lamp, the combination with an arc-inclosing globe, a universally-mounted globe-support therefor, and a cover having a hole for the passage of the feeding carbon, substantially as described.

3. In a feeding mechanism, the combination of a feeding-rod, an armature, oppositely-disposed shoes adapted to grip said feeding-rod, each shoe having a link connection with said armature, one end of said link connection being pivoted to said shoe and the other to said armature, substantially as described.

4. In a feeding mechanism, the combination of a feeding-rod, an armature, oppositely-disposed shoes adapted to grip said feeding-rod, each shoe having a separate link connection with said armature, one end of said link connection being pivoted to said shoe and the other to said armature, said link connections overlapping, substantially as described.

5. In an arc-inclosing envelop, the combination of a light-transmitting part and a heat-retaining part, the parts being connected by an interlocking joint, substantially as described.

6. An arc-inclosing envelop composed of a light-transmitting part and a heat-retaining part, the two parts being of such relative proportions as to cause a considerable rise in temperature of the electrodes when the lamp is in operation, substantially as described.

7. An arc-inclosing envelop composed of a light-transmitting part and a heat-retaining part, the heat-retaining part being made of a poorer conductor of heat than the light-transmitting part and also of greater thickness, substantially as described.

8. An arc-inclosing envelop composed of two parts, one of said parts being of glass and the other of porcelain, said envelop being adapted to maintain the gases surrounding the arc at a high temperature, substantially as described.

9. An arc-inclosing envelop composed of a heat-retaining part and a light-transmitting part, said heat-retaining part being made of a poorer conductor of heat than the light-transmitting part, the whole operating to maintain the gases surrounding the arc at a high temperature, substantially as described.

10. The combination of the positive and negative electrodes of an arc-lamp, an inclosing envelop for said electrodes and a support for said envelop, part of said support forming one element of a universal joint, substantially as described.

11. In an electric-arc lamp, the combination of electrodes, an arc-inclosing envelop in movable relation to one of said electrodes, and a support for said envelop, said support allowing said envelop to automatically adjust itself to compensate for irregularities in contour of said electrode, substantially as described.

12. In an electric-arc lamp, the combination of electrodes, an arc-inclosing envelop, and a support for said envelop normally permitting

universal movement thereof, substantially as described.

13. In an electric-arc lamp, the combination of electrodes, an arc-inclosing envelop, a support for said envelop normally permitting universal movement thereof, and means for limiting the range of said universal movement, substantially as described.

14. In an electric-arc lamp the combination of the electrodes and an arc-inclosing envelop, said arc-inclosing envelop being provided with air-inlets between its top and bottom, substantially as described.

15. The combination of the electrodes of an electric-arc lamp and an arc-inclosing envelop therefor, said envelop being made in two readily-separable parts, the joint between said parts being located between the top and bottom of said envelop, said joint adapted to allow the admission of a limited amount of air to the interior of the envelop, substantially as described.

In testimony whereof I have set my hand this 26th day of December, 1895.

CHRISTIAN J. TOERRING, JR.

Witnesses:

CHAS. C. STERRETT,
LIZZIE B. MCCONAUGHY.