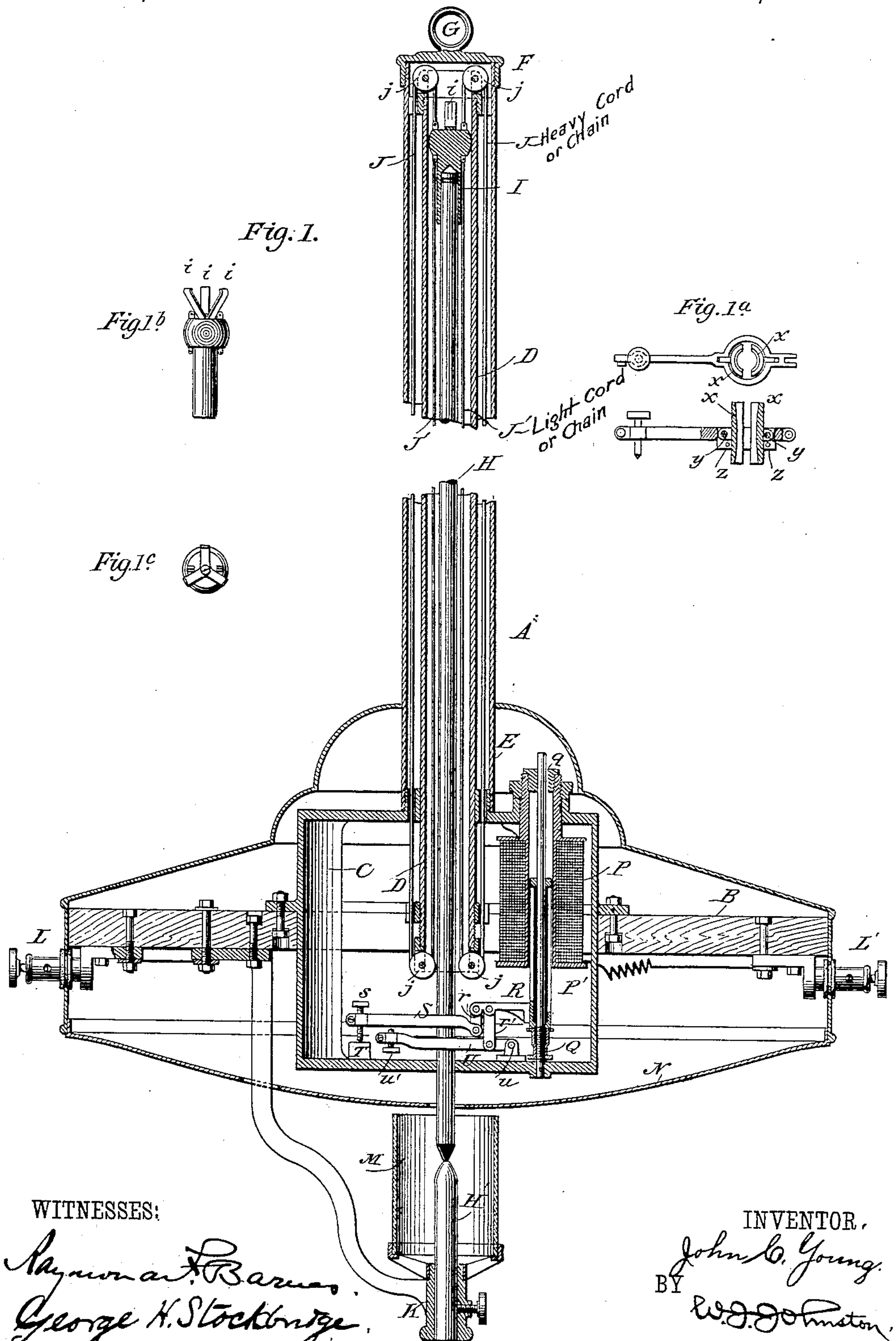
(No Model.) 3 Sheets—Sheet 1.

J. C. YOUNG.

ARC LAMP.

No. 392,393. Patented Nov. 6, 1888.

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(No Model.)



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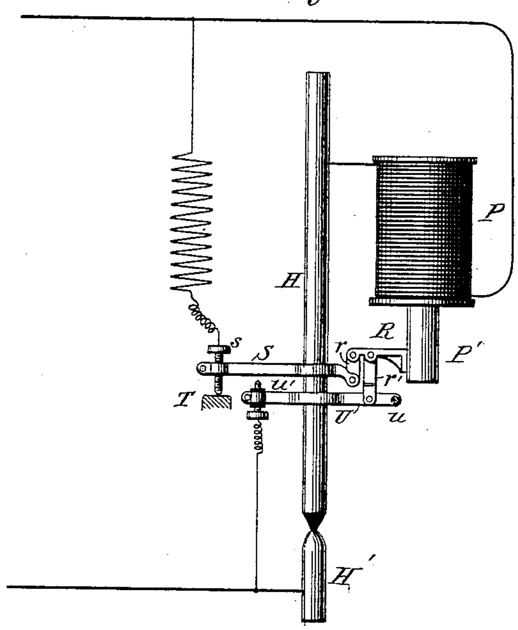
Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

# J. C. YOUNG.

## ARC LAMP.

No. 392,393. Patented Nov. 6, 1888.

*Fig. 3.*

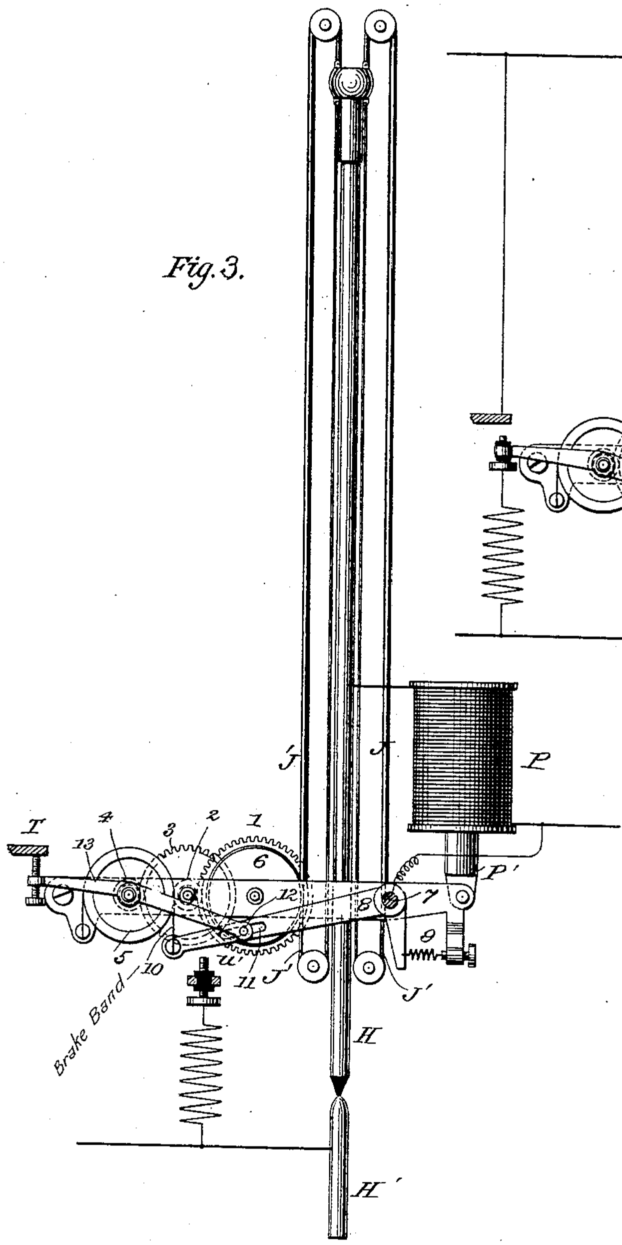



*Fig. 4.*

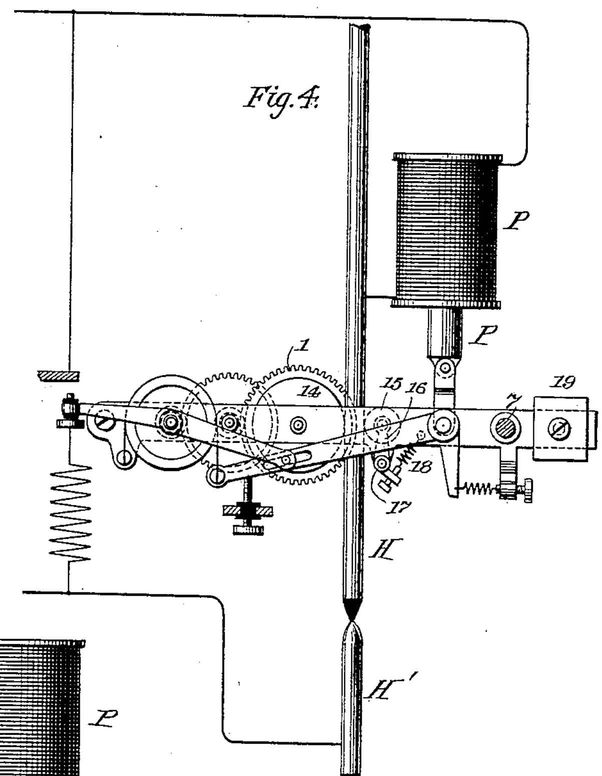
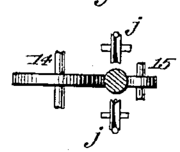


*Fig. 5.*



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# UNITED STATES PATENT OFFICE.

JOHN C. YOUNG, OF NEWARK, NEW JERSEY.

## ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 392,393, dated November 6, 1888.

Application filed December 1, 1886. Serial No. 220,402. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN C. YOUNG, a citizen of the United States, residing in Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electric-Arc Lamps; and I do hereby declare that the following is 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 has for its objects, first, to remove one cause of the unequal action of the main or lifting magnet in arc lamps by making the work which it has to do practically constant; second, to counteract the effects of current variations in arc-light circuits, and thereby to obviate the flickering or unsteadiness of the arc, which forms one of the chief difficulties in the operation of arc lamps; third, to do away, wholly or in part, with the carbon rod, and thus reduce the length of the lamp; fourth, to provide means whereby a longer carbon can be used to effect the same ends that are accomplished by double or duplex arc lamps; fifth, to make the above improvements applicable to arc lamps operated either by a clutch or clock-movement; sixth, to provide an improved clutch which shall be certain in its gripping action and at the same time shall give freedom of movement to the carbon when brought into the proper position, and, seventh, to provide a carbon-carrier which shall be so connected with the guiding-tube as to enable the carbon to find its own perpendicular and dispense with close-fitting guides for carbons or carbon rods.

In arc lamps as heretofore constructed the work to be done by the arc-establishing magnet has varied with the varying length of the feeding-carbon in the process of its consumption—that is to say, as the carbon is wasted there is constantly less weight to be lifted, and as a consequence a magnet which has been set to establish a certain length of arc when the carbon was first inserted will gradually lengthen the original normal arc by reason of the smaller resistance which it finds to its attractive power. Those who are accustomed to observing the action of arc lamps have noticed that there is a period usually near the beginning of its life when every arc lamp burns with its greatest effectiveness, while after that period there is a change in the action of the lamp, and the arc grows longer and burns with less steadiness. The means which I employ to overcome this defect consist of an endless chain passing around the wall of the tube within which the carbon is supported and attached to the carbon-carrier, the latter being at the top of the tube when the full-length carbon is inserted in place. The portion of the chain outside the tube is made substantially equal in weight to the carbon itself, and as the carbon feeds enough of the chain is fed over the top of the tube to compensate for the loss in the consumption of the carbon.

The cause above mentioned is a mechanical cause affecting the action of the main magnet in an arc lamp. This magnet is also subject to a variable action due to variations of the current on line and to variations in the mechanical construction of the magnets of different lamps. The variations of current are produced by a variety of causes originating both on the line and at the generator and are constantly going on, and every variation of current, by producing a change of resistance, causes another variation of current, and so on until some counter-action is set up. The flickering caused by these variations of the current is the main objectionable feature in arc lamps.

I am aware that many devices have been invented for restoring the arc after it gets beyond its normal length, such devices consisting usually of a clutch or the brake or pawl of a clock-work mechanism.

My improvement consists of a lever, the free end of which, when applied to a clutch-lamp, travels in the same direction as the clutch, but at a greater speed. The lever is set almost in contact with the clutch after the lamp has been adjusted to its proper length of arc, so that when the clutch is affected in such a manner as to lengthen the arc still further the lever will trip the clutch and cause it to feed while suspended. Moreover, the arrangement may be such that by the contact between the clutch and the lever a shunt-circuit of the proper resistance will be closed, shunting the superfluous current around the lifting-magnet.

My improvement may also be applied to lamps operated by clock-movement.

I propose to use in place of the lower carbon a copper rod and to let the clutch act directly upon the body of the upper carbon. In that way I can dispense with the usual carbon rod and reduce the length of my lamp. If preferred, a lower carbon can be used, in which case I shall have the rod of the same diameter as the upper carbon and forming an extension of it. The length of the rod, however, instead of being, as is usual, equal to the waste of both the upper and lower carbons, will be simply equal to that of the lower carbon alone.

With my form of lamp I can employ a carbon of about twice the length of the ordinary carbons and make my lamp serve all the purposes of a double or duplex arc lamp. If I use a copper rod instead of a lower carbon, the focus will remain practically constant, owing to the almost imperceptible waste of the copper rod.

The above features of my invention, together with those not referred to in detail, will be fully set forth in this specification, and more particularly pointed out in the claims.

The construction of my lamp is illustrated in the accompanying drawings, in which—

Figure 1 represents a vertical section through my lamp. Fig. 1[a] is a detail of my clutch. Figs. 1[b] and 1[c] are details of my carbon-carrier. Fig. 2 is a diagram of the lamp-circuit, illustrating also the operation of my clutch and tripping mechanism. Figs. 3 and 4 show my improvements applied to a lamp operated by clock-work, and Fig. 5 is a detail view.

Referring to the drawings by letter, A is an arc lamp constructed in accordance with the principles of my invention. The principal part of the lamp-frame consists of an insulating plate or support, B. Upon this base and within a central aperture through the same is secured a metallic casing, C, which incloses my clutch mechanism and main operating-magnet. A tube, D, extends down into the casing, and an outer tube, E, is screwed to the top of the casing, the inner tube being secured at its upper and lower ends to supports within the tube E and the casing, respectively. A cap, F, is screwed to the top of the outer tube, and an eye, G, on the top of the cap serves as a means for attaching the lamp to a hook or other suitable support.

The upper carbon electrode, H, is supported within the tube D. The carbon is set into a carrier, I, the upper part of which is shaped like a flattened sphere or ball, or rather like a sphere or ball that has been cut away on opposite sides. The diameter of the ball is substantially the same as the diameter of the inner tube, so that the ball constitutes a bearing and at the same time offers very slight resistance to the carbon in finding its perpendicular. Upon the upper flat or cut-away part of the sphere are supported three flaring springs, *i i i*, which also pass out into contact with the inner walls of the tube D and make electrical connection therewith. The ends of the springs may be curved or rounded, as shown in Fig. 1[b], so as to make practically a ball-joint with the tube, and when they are so constructed they may, if preferred, form the only bearing for the carbon-carrier, the flattened ball being dispensed with.

To the upper side of the sphere are secured the ends of heavy cords or chains J, and to the lower side of the same sphere are secured the ends of leaders or small cords or chains J′, the latter forming extensions or continuations of the former and the whole constituting after attachment a pair of endless cords or chains secured to the sphere I. The cords extend over pulleys *j j*, pivoted at the upper and lower ends of the tube D, and the arrangement is such that the heavier part of the cord hangs outside the inner tube when the carbon is of full length, while the leader is suspended inside the said tube. It is intended that the leaders shall have no appreciable weight, while the weight of the parts J shall be exactly or substantially equal to the weight of the upper carbon and shall form a counterpoise therefor. This being the case, it is evident that when a new carbon is inserted and the carrier is close to the upper end of the tube D there will be no weight tending to carry the carbon down, except the weight of the carrier itself and its attachments. This weight will ordinarily be from four to six ounces and will be entirely sufficient to operate the carbon. When, now, the carbon is consumed, there is of course a loss of weight in carbon, which, however, is compensated for by the feeding of the cords J over the upper pulleys *j*. Thus the carbon is fed downward under an unvarying weight, and the magnet which lifts the carbon has constantly the same work to do. It will be understood that the chains J are fed into the upper end of the tube to the same extent as that to which the carbons are consumed. As the carbon and the chains are of substantially the same length and the same weight, it is evident, that the weight represented by the feeding of the cords for a given distance will counterbalance the waste of the same length of material in the carbon. The lower electrode in my lamp consists of a copper rod, H′, secured in a supporting arm or bracket, K. The bracket itself is secured to the insulating-frame B and connected with the insulated binding-post L. I prefer to use a copper rod, so as to preserve the focus of the lamp at a fixed point, the waste of my copper electrode being practically imperceptible even after long use. I am aware that it is not new to use such an electrode, and I make no claim regarding it.

On the bracket K, I support a globe or chimney, M, for purposes well understood. Above the arc a curved sheet or disk of metal, N, extends across the lamp and is secured around its edge to a rim, O. The latter is attached to the frame B, and extends over the casing C, and is closed around the outer tube, E. The object of the parts last mentioned is to give a symmetrical contour to the lamp and to protect the parts. The lower sheet or disk, N, may serve as a reflector for the light from the arc.

P is the main or arc-establishing magnet of my lamp. It is located, as has been said already, within the casing C, and the ends of its coil are secured, respectively, to the said casing and to an insulated binding-post, L′. I have chosen the solenoid form for my magnet, and have constructed its core P′ to be movable up and down upon a central guide-rod, Q, secured in the bottom of the casing and supported at the top in a hollow screw, $q$, which passes into one end of the solenoid-frame. The core P′ is rigidly connected with a horizontal arm, R, which has two links, $r$ $r'$, pivoted to it. The former and outer link is attached to one end of a clutch, S, the other end of which is adjustably supported upon a stop or floor, T. The means of adjustment consists of a screw, $s$. The other link, $r'$, is attached to a trip lever or chaser, U, between its pivot $u$ and its outer free end. This lever or chaser has a central opening, which surrounds the upper carbon, H, and leaves it free to play back and forth without interference from the carbon. Its free end stands beneath the clutch-lever, as shown, and is provided with an adjustable screw, $u'$, which can be brought into any desired degree of proximity with the clutch-lever.

It is evident that the lifting of the core P′ will operate both the clutch-lever to establish the arc and the chaser. It is also evident that the free end of the latter will move faster than the clutch-lever, owing to its mode of connection with the arm R. Suppose now that the lamp is put in operation and the arc established. After this has happened the screw $u'$ is turned until it comes in contact with or in very close proximity to the under side of the clutch-lever. Assuming that it is brought in contact with the said lever when the arc is burning at its normal length, it is plain that the clutch cannot be lifted to lengthen the arc by any of the current variations referred to above without being tripped while suspended by the end of the screw and caused to feed at once; or, rather, the chaser will be likely to prevent altogether the lifting of the clutch, and will insure that the arc will never exceed its normal length, while the proper feeding of the carbon will be accomplished in the usual way. I thus eliminate one element of unsteadiness in the operation of arc lamps. It will be observed that whereas in arc lamps as ordinarily constructed the clutch seeks its floor in order to be released, in my lamp the chaser itself may be regarded as a movable floor, which releases the clutch-lever by following it and impinging against it. In general, when the construction is that described above, I prefer to adjust the screw $u'$ so that it will make absolute contact with the clutch-lever after the establishment of the arc. I sometimes, however, adjust the screw in close proximity to the clutch-lever and introduce a shunt-circuit of a suitable resistance connecting with the clutch-lever and with the screw $u'$, which in this instance is insulated from its lever. This construction is shown in Fig. 2. When the arc begins to lengthen beyond the normal, contact is made between the screws $u'$ and the clutch-lever, and a part of the current is drawn off from the magnet P, thereby decreasing its tendency to lift.

The details of my clutch are shown in Fig. 1ª. It consists, essentially, of a split tube, each half $x$ of which is provided with a lug, $y$, which extends into a slot in the clutch-lever and is pivoted there. The split tube passes through a circular opening in the clutch-lever. Stops $z$ $z$ are provided for limiting the play of the tube halves and prevent the binding of the clutch. The inside of the tube-halves is slightly rounded from end to end for a similar reason.

In Figs. 4, 5, and 6 I have illustrated means whereby my improvements may be applied to a lamp operated by a clock-movement. In Fig. 4, 1 is a wheel or pinion connected with the feed of an arc lamp in any suitable manner. Connected with it is a drum or pulley, 6, around which the lower end of one of the leaders J′ is wound. The cords J′, as before, form a counter-balance for the carbon, but the carbon-carrier and its attachments form a weight tending to revolve the wheel 1. The latter engages with the pinion 2 on the wheel-shaft of a wheel, 3, which latter engages in turn with a pinion, 4, on the shaft of a drum or brake-wheel, 5. All these wheels are supported on a suitable frame, which is pivoted at 7 and connected beyond the pivot to the core of the magnet P; also pivoted at 7 is an angular lever, 8, to one end of which is attached an adjustable retractile spring, 9, secured to a downward projection of the frame. The other end of the lever 8 has attached to it a brake belt or band, 10, which passes over the brake-wheel 5 and is secured to the frame. Within a slot, 11, in the lever 8 plays a pin, 12, projecting from an angular lever, 13, pivoted to the frame, and carrying at its outer end an adjustable screw corresponding to the screw in the outer end of the clutch-lever in Fig. 1. This screw, when the electrodes are in contact, touches its floor T. Below the outer end of the lever 8 is located an adjustable screw, $u'$. The clock-work will be released and the carbon fed whenever the brake-wheel is relieved of the pressure of the band 10, which happens when the outer end of the lever is lifted. This lifting will take place when the lever is drawn down against the screw $u'$ by the pull of the magnet P, and also when for any reason the frame passes so far in the other direction as to cause the screw in the outer end of the lever 13 to be pressed against the floor T. In the latter case the lever 8 will be lifted by the pin 12 in the slot 11. The frame and the screw $u'$ may or may not form portions of a shunt-circuit. If they do, however, the action will be the same as in the apparatus illustrated in Fig. 2. In Fig. 5 the frame is pivoted at 7 outside the magnet-core, the tendency of the magnet being to lift the clock-work instead of depressing it. In this construction I cause the carbon to be lifted by two friction-wheels, 14 and 15—one on the shaft of the wheel 1 and the other on a shaft yieldingly supported on the opposite side of the carbon, as shown. The support consists of an angular lever, 16, pivoted at 17, and under the influence of a spring, 18, attached to the frame. When the frame is lifted too far by the action of the magnet, the carbon is fed and a short circuit is formed having the proper resistance. 19 is a counterbalance for the clock-work frame.

By reference to Fig. 6 it will be seen that the counterbalance-cord is wound on pulleys *j j*, standing at right angles to the friction-wheels 14 and 15. The action of the cord will be readily understood from what has gone before.

It will be understood that a single cord or chain, J, and a single leader, J′, may be employed instead of the two shown, the necessary feature being that the outside cord shall practically counterbalance the carbon electrode.

By using the form of lamp shown in Fig. 1 I do away with a shunt-magnet altogether and produce at the same time an efficient lamp.

I do not claim herein the details of the construction shown in Figs. 4, 5, and 6, as I contemplate making them the subjects of separate applications for Letters Patent.

Having now described my invention, what I claim is—

1. In an electric-arc lamp, the combination, with the consuming electrode, its carrier, and a suitable guide therefor, of an endless cord or cords connected with the carrier and passing around the guides, the said cord or cords having an inner portion of very slight weight and an outer portion of substantially the same weight as the electrode, as set forth.

2. In an electric-arc lamp, the combination, with the consuming electrode, its carrier, and a guiding-tube therefor, of an endless cord or cords attached to the carrier and passing over pulleys at the top and bottom of the tube, the said cord or cords having the part within the tube of very slight weight and the part outside of substantially the same weight as the electrode, substantially as set forth.

3. In an electric-arc lamp, the combination, with the clutch-lever resting at one end on a floor or stop and pivoted at the other to the main-magnet armature, of a trip lever or "chaser" whose free end is in contact with the clutch-lever when the arc is established, the said trip-lever being swiveled to the said armature between its free end and its fulcrum, as and for the purpose set forth.

4. In an electric-arc lamp, the combination, with the clutch-lever and a trip-lever adapted to trip it in suspense, of a shunt-circuit which is closed by the contact of the clutch and trip levers.

5. The combination of the feed-controlling magnet and its armature with a clutch-lever pivotally connected at one point with the armature and an independent trip interposed between the armature and another point of the clutch-lever, substantially as described, whereby the clutch-lever will be tripped in suspense on an abnormal increase of the arc.

6. The combination of the feed-controlling magnet and its armature with a clutch-lever pivotally connected at one point with the armature and an independent trip interposed between the armature and another point of the clutch-lever, substantially as described, whereby the clutch-lever will be tripped in suspense on an abnormal increase of the arc, and a stationary stop for the said clutch, substantially as described.

7. The combination of the feed-controlling magnet and its armature with arc-establishing devices pivoted to one point of the armature and a trip interposed between the armature and another point of the arc-establishing devices, substantially as set forth.

8. The combination of the feed-controlling magnet and its armature with a clutch-lever pivoted to the armature, and a trip-lever, the said trip-lever being interposed between the armature and another point of the clutch and pivoted to an independent support and swiveled to the armature at a point between its pivot and its free end.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JOHN C. YOUNG.

Witnesses:
GEORGE H. STOCKRIDGE,
CHARLES A. SAAL.