(No Model.)

F. BAIN.

ELECTRIC ARC LAMP.

No. 300,676. Patented June 17, 1884.

Fig. 1.

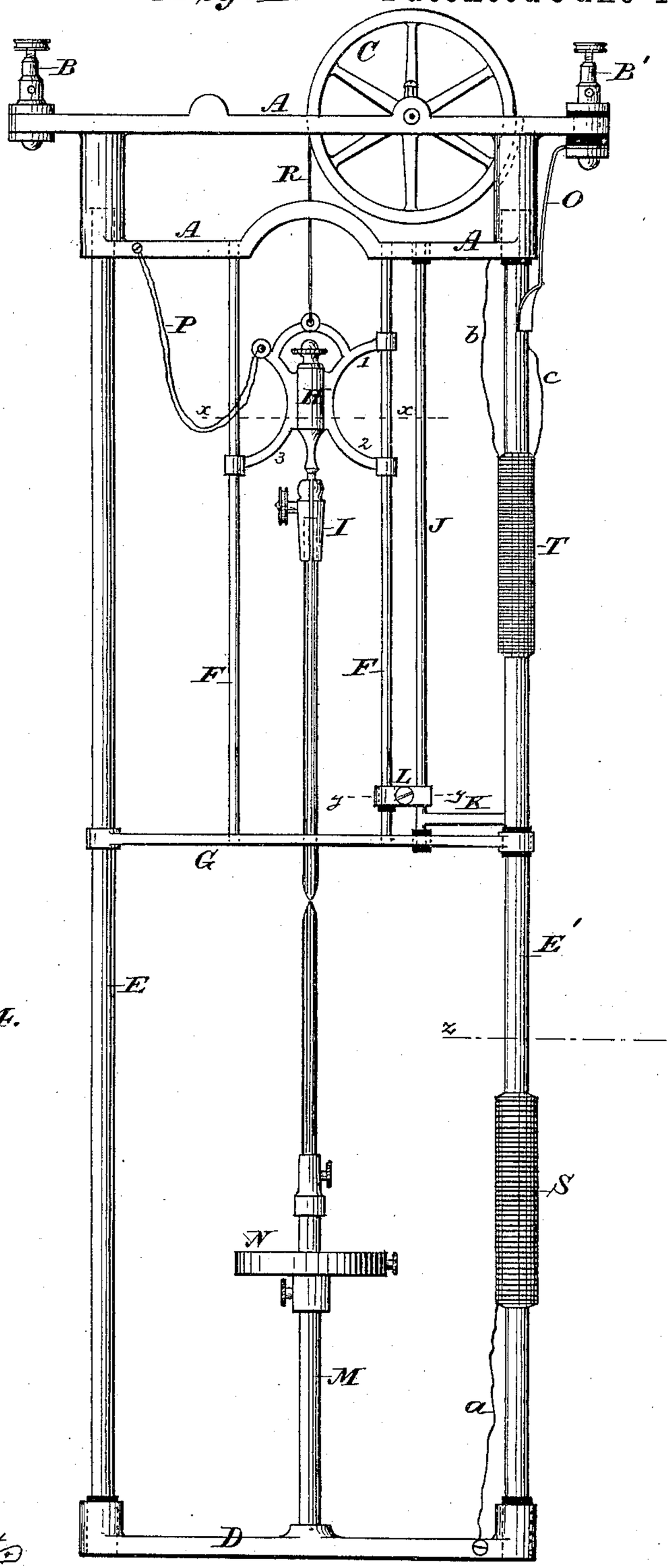


Fig. 6.

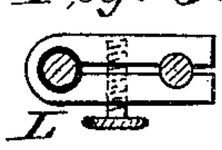


Fig. 3.

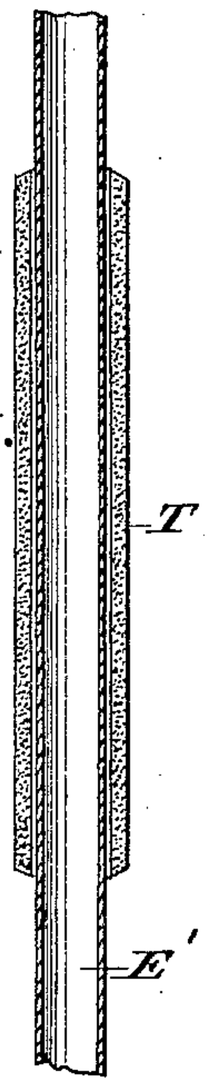


Fig. 2.

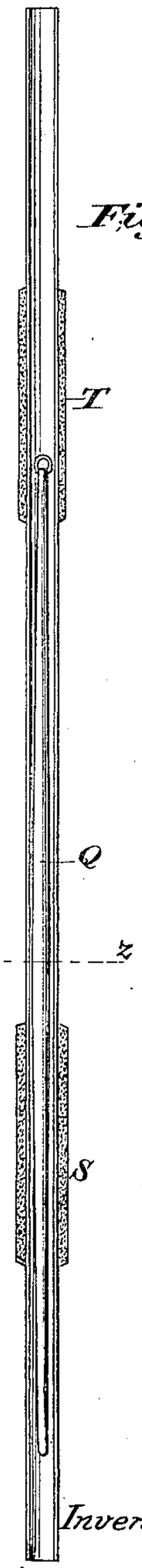


Fig. 5.

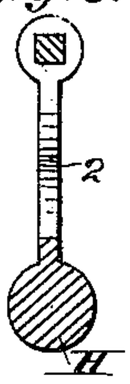
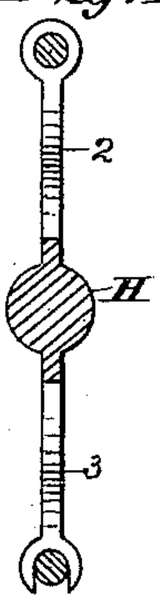


Fig. 4.



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UNITED STATES PATENT OFFICE.

FORÉE BAIN, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO THE BAIN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 300,676, dated June 17, 1884.

Application filed November 11, 1882. (No model.)

To all whom it may concern:

Be it known that I, FORÉE BAIN, a citizen of the United States, residing at Minneapolis, Hennepin county, Minnesota, have invented new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

My invention relates to certain improvements in electric-arc lamps. In most of the lamps with which I am familiar, and particularly that class known as the "clutch-lamp," where a clutch is employed to raise and lower the carbon, the feed is necessarily spasmodic or intermittent, and a like result ensues in what are known as the "regular periodical feed-lamps," thus producing in both kinds (above referred to) a very unsteady light, and this result ensues from the fact that the arc cannot be maintained at a given length, which I find from practical experience is a most essential factor to the production of a perfect light. In the class of lamps to which I have referred the unsteadiness results from the fact that the light varies with the length of the arc, and that the length of the arc varies in a lamp in some instances from one thirty-second to three-eighths of an inch, the arc being longest just before the lamp feeds and shortest just after it has fed; and in a series of lamps there is with this excessive variation an undue robbery of one lamp by another of the light-giving power. The arc varies in length by reason of the lost motion incident to the movement of the mechanical devices employed, which lost motion serves to delay the feed of the carbons, and consequently the carbons approach each other in a retarded time with reference to the neutralization of the controlling magnets, so that too great neutralization takes place, and as a result the carbons then come together absolutely and suddenly. Another objection to lamps of the class referred to is the fact that a "dash-pot" of glycerine or other liquid is employed for the purpose of preventing too rapid pulsation of the carbons in their efforts at adjustment, resulting in flickering light. While the object above stated is desirable, I have found that the means employed are ineffectual, for the reason that the contained fluid used in the dash-pots is subject to changes by reason of changes in temperature. The liquid most generally used in the dash-pots is glycerine, and, as is well known to those familiar with electric lamps, it is objectionable, also, on account of accumulation of dirt, and requiring constant attention due to waste and evaporation.

The object of my invention is to overcome all of the objections enumerated, and to provide an arc lamp in which the feed shall be absolutely regular and perfect, compensating exactly with the changed conditions of the carbons and the volume of current passing through the lamp; and with this end in view my invention consists in the peculiar features of construction designed to accomplish the ends sought, as will be hereinafter more fully described and specifically claimed.

My invention further consists in certain details of construction looking to compactness, &c., of the lamp, as will also be fully described hereinafter.

In order that those skilled in the art to which my invention appertains may fully understand the same, I will proceed to describe the construction and operation, referring by letters to the accompanying drawings, in which—

Figure 1 is a front elevation of an electric lamp embodying my invention. Fig. 2 is a detail longitudinal section of the coils and armature. Fig. 3 is a detail longitudinal section of a portion of the armature-tube with the coil arranged thereon adjustably. Fig. 4 is a cross-section, taken at the line *x x* of Fig. 1, of the "cross-head" carbon-guide. Fig. 5 is a similar view of a modified form of same, where only one vertical guide-rod is used. Fig. 6 is a cross-section at line *y y* of Fig. 1, showing a movable switch for automatically shunting the lamp at a predetermined time, or when the carbons are consumed.

Similar letters denote like parts in the several figures.

A represents the top of the frame, to which are secured the binding-posts B B′ and pulley

C. This top portion of the frame is preferably formed by casting, as is also the bottom portion, D, and the two are connected by the side tubes, E and E′, secured by screw-threads or in any other suitable manner, and insulated at the proper points of connection, as will be hereinafter explained.

F F are two guide-rods, which are secured at their upper ends to the frame A and at their lower ends to a cross-brace or bridge, G, arranged at a proper point between the side tubes, E E′.

Between and upon the rods F is arranged a cross-head or carbon-carrier, H, provided with any suitable grip or clamp, I, for securing the carbon. This carrier H is formed with lateral arms, 1 2, which surround and embrace one of the guide-rods F, and with a third arm, 3, bifurcated at its free end, as seen at Fig. 4, which embraces the other guide-rod F, and at the same time provides for contraction and expansion of the cross-brace or bridge G.

J is a metallic rod between the frame A and bridge G, and insulated at its ends. This rod is connected to the conducting-tube E′ by a metallic connection, K.

L is a metallic clamp adapted to be secured on the rod J at any predetermined or variable altitude, and extended toward the rod F, so that in the descent of the cross-head H the arm 2, coming in contact with L, will short-circuit the lamp in an obvious manner. This clamp L may embrace both rods J and F, as shown, in which case it must of course be insulated at its point of contact with rod F.

M is the lower-carbon holder, which is of the usual form, and upon which slides an ordinary globe-holder and ash-pan, N. The post B′ is insulated from the main frame A, and connected with the conducting-tube E′ by means of a copper strip, O. The tube E′ is insulated at both ends from the frame A D, and also at the point of juncture with the brace or bridge G, and the opposite tube, E, is insulated only at its bottom-end connection with lower frame, D.

Inasmuch as the arms 1 2 of the cross-head H are designed to travel up and down the rod F, and hence might form an imperfect contact, I provide an electrode-connection, P, consisting of a flexible copper wire connecting the cross-head with the frame A, as clearly shown at Fig. 1. In lieu of or in conjunction with the electrode-connection P, I may use a metallic brush extending from the cross-head to either of the rods F, though I prefer the plan shown.

Q is the core or armature arranged within the tube E′, and connected by means of a cord, wire, or chain, R, to the cross-head H, said cord, wire, or chain R passing over the pulley C, which is grooved to receive the same, the core and carbon-carrier tending to counterbalance each other.

S is the coil through which the prime current passes, and is connected by one end, *a*, to the bottom frame, D, and its opposite end soldered to the conducting-tube E′.

T is the differential coil, one end, *b*, of which is connected to the upper frame, A, and the opposite end, *c*, being connected to the conducting-tube E′ by solder or otherwise.

I have shown at Fig. 1 the position of the several parts of the lamp when the carbons have been partially consumed, and in which case the dotted line Z Z indicates the exact center of the core or armature. Should the carbons be of the usual unconsumed length, then the center of the core or armature would be just below the upper end of the coil S, and the upper end of the core would be on the point of entering the coil T, and the lower end of the core would have passed nearly one-fourth of its length through the coil S, and the cross-head H and carbon held by the grip I would be correspondingly raised. The length of the cord, chain, or wire R, I adjust with reference to the desired relation between the core and carbons by suitable tests before the lamp passes inspection for the market.

I desire to call especial attention to the fact that the coils and core are so arranged and bear such relation in lengths to each other that in the movement of the core its ends pass through and beyond the coils. This is done for the following important purpose—viz., to maintain the arc at a given length and prevent any sudden or spasmodic movement of the core, and consequently corresponding sudden and spasmodic adjustment of the carbons. This result is obtained because, as the attraction would otherwise increase by the introduction of more metal (the cores being biconical) within the coil, the attractive force is partially neutralized by that portion of the core which has passed through and beyond the coil, as clearly shown at Fig. 2.

The object of making the core approximately biconical is that it may assume a balanced position with reference to the coils. Though I do not claim the particular form of the magnet, I simply utilize this form in carrying out my invention.

In a lamp of ordinary size, burning twelve-inch positive carbons, I have found that the best practical length of core should be twenty-four inches, or just twice the length of the positive carbon, and that the diameter at the ends should be about half that at the center, and the coils should be about one-fourth the length of the core. The relative resistance of the coils should of course be in proportion to the tension of the current, as is well understood by those skilled in the art. While I have shown the positive carbon only as being regulated, it is of course obvious that either or both may be adjusted by the application of the principle explained. It is also obvious that the coils, cores, &c., described may be duplicated on the opposite side to make a double lamp.

As it is desirable to sometimes cut out a

lamp at a predetermined time, or when the carbons have become exhausted, I provide the movable clamp L, before described. This clamp is designed to be rigidly located at any given point on the rod J, so that when the arm 2, of the cross-head H comes in contact with the same the current is diverted thereby through a shorter path around the lamp in an obvious manner. It will therefore be understood that the lamp may thus be extinguished automatically at any predetermined time, and that if it should not be arranged so as to extinguish at any special time, and the carbons should become exhausted, the same result will follow as to the current.

I have shown at Figs. 1 and 4 the peculiar construction of the cross-head H and vertical guide-rods F, which I prefer to use; but I may dispense with one of the rods F and make the remaining one square or suitable shape in cross-section, to prevent turning thereon of the cross-head arm, and from said arm with a corresponding square or other shaped orifice, as seen in the modification shown at Fig. 5. The coils, as shown at Fig. 3, I wind upon a paper or other non-conducting tube shown by the heavy line, in order that said coil so wound may be adjusted vertically upon the armature-tube E′, so as to be able to increase or decrease the attraction of the core, when necessary, without alteration of the current.

The operation of my improved lamp is as follows: The current enters the post B, follows the electrode P to the cross-head H, thence down the carbons to the bottom frame, D, thence up the wire *a*, through the coil S, thence to the tube E′, to the binding-post B′, through the copper strip O, and out to the line.

The path of the differential or shunt circuit is as follows: The current enters from the frame A, down wire *b* of coil T, through said coil, out at *c* to binding-post B′. When the prime current passes through the coil S, it attracts the armature Q within the tube E′, and, through the medium of chain or cord R, separates the carbons. After this separation of the carbons begins, a small portion (about one per cent. in practice) begins to pass through the coil T, which partially neutralizes, in an obvious manner, the effect of the coil S on the core or armature Q. This action is directly felt by the carbons because of the gradual neutralization of the armature as regards the influence of the coil S. A result of this action is a slow and gradual but constant movement of the core Q, and an obvious corresponding movement of the carbons, so that no fluttering or spasmodic light ensues. Now, in order that this necessary relation of the carbons shall continue throughout their consumption, the important feature of my invention comes into play, and is apparent—viz., the relation of the core and coils as to lengths and the consequent projection of one and the other ends of the core through the coils. For instance, as shown more particularly at Fig. 2, (which illustrates the upward movement of the core to compensate for consumption of the carbons,) the lower end of the core is approaching the coil S, and that portion of the core above the center of said coil is receding from said coil; hence it is apparent that from the time the core begins its upward movement until it ceases the effect of the coil upon the core is the same, taking into consideration the decreased weight resulting from consumption of carbon, which is compensated for in the first instance by the adjustment of position of the coil T, so that the neutralizing effect of the coil T upon the core is not so great at the beginning as it will be proportionately to the wasting away of the carbons and the consequent rise of the core. The proper adjustment is established in the first instance by the relation of the core to the coil S, as clearly shown at Fig. 2, and the constant and regular pull of the coil upon the core is maintained, as before stated, by the fact that the end of the core projects beyond the coil.

I am aware of the existence of the lamp known as the "Pilsen" lamp, and do not wish to lay claim to the broad principle of feed therein shown and described; but

What I claim as new, and desire to secure by Letters Patent, is—

1. In an electric-arc lamp having a constant feed, as described, the combination, with the core of a magnet located within the side frame, of the actuating-coil located outside of said frame, substantially as described.

2. In an electric-arc lamp having a constant feed, substantially as described, the combination, with the core of the magnet located within the side frame, of the actuating-coil located on the outside of the frame and adapted to vertical adjustment thereon, substantially as described.

3. In an electric-arc lamp such substantially as described, the combination, with a carbon-carrier, of a core of an electro-magnet connected thereto by a cord or chain, the core and carbon-carrier being attached to the opposite ends of the chain or cord, whereby they tend to counterbalance each other, substantially as described.

4. In the frame of an electric-arc lamp such substantially as described, the carbon and carbon-carrier arranged below the top or head of the frame, in combination with vertical guide rod or rods, an independent conductor-rod, J, connection between said rod and the side frame, and an adjustable clamp arranged upon said rod in the line of travel of the carbon-carrier, substantially as described.

5. In an electric-arc lamp, the combination, substantially as herein set forth, of a carbon-carrier and guide therefor, arranged below the head of the frame, side rods or tubes for supporting the lower carbon, a core arranged within one of said side tubes, coils

connected with the circuit and adapted to control said core, arranged outside of the tube, and connections between the carbon-carrier and the core.

6. The combination, substantially as herein set forth, of a carbon-carrier and guide therefor, arranged below the head of the frame, electrical-circuit connections between the carbon-carrier and the frame, rods or tubes connected to the head of the frame, for supporting the lower carbon, one of the tubes being insulated from the frame, a core arranged inside of one of the tubes and connected to the carbon-carrier, and coils connected to the circuit and supported upon the tube, as set forth.

7. The combination, substantially as herein set forth, with a tube forming part of the frame of the lamp, of a core inside of said tube, and two coils connected to the main and shunt circuits of the lamp, respectively, and made adjustable upon the tube, whereby the movement of the core may be controlled.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FORÉE BAIN.

Witnesses:
F. L. BROWNE,
A. B. BROWNE.