(No Model.) 2 Sheets—Sheet 1.

J. M. PENDLETON.

ELECTRIC ARC LAMP.

No. 307,584. Patented Nov. 4, 1884.

Fig. 1.

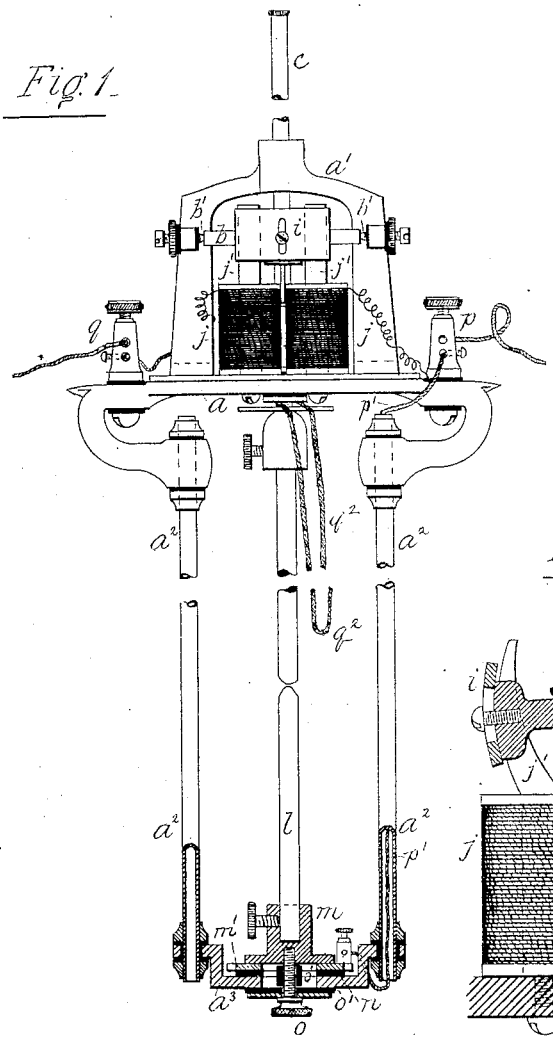


Fig. 2.

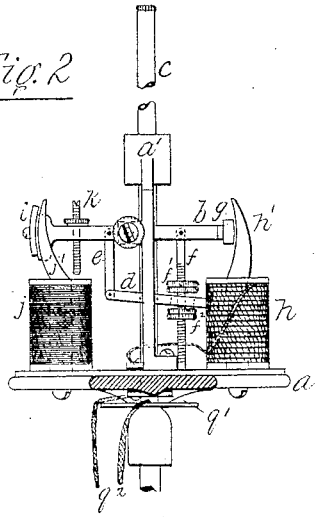


Fig. 4.

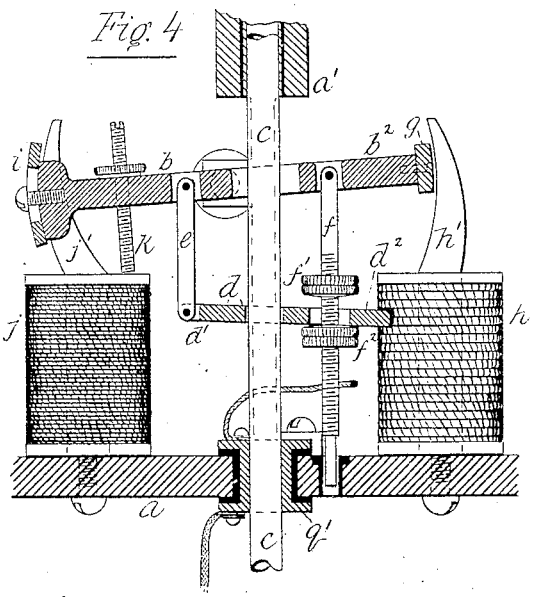


Fig. 3.

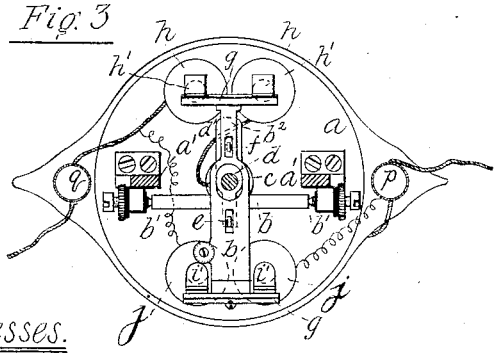
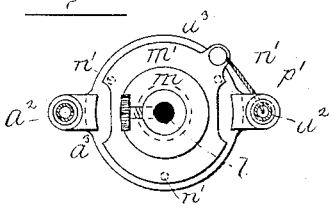


Fig. 5.



Witnesses.

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(No Model.) 2 Sheets—Sheet 2.

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ELECTRIC ARC LAMP.

No. 307,584. Patented Nov. 4, 1884.

Fig. 6

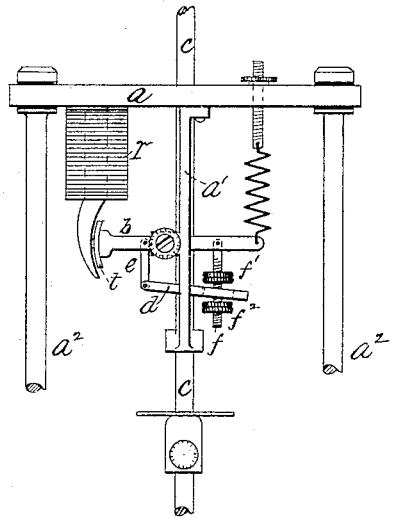
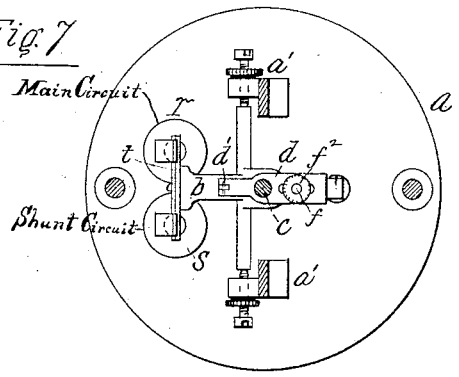


Fig. 7



Witnesses

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UNITED STATES PATENT OFFICE.

JOHN M. PENDLETON, OF NEW YORK, N. Y., ASSIGNOR TO THE EQUITABLE ELECTRIC COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 307,584, dated November 4, 1884.

Application filed February 18, 1884. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. PENDLETON, a citizen of the United States, and a resident of New York, county and State of New York, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

This invention relates, first, to an improved method of operating and regulating electric-arc lamps, which consists in suspending an annular clamp from a pivoted frame, through which and the clamp the carbon rod passes. The clamp is suspended from one side of the axis of the frame and the carbon rod, and is controlled and governed by means of a pendent rod provided with two adjustable stops connected to the pivoted frame on the other side of its axis and the carbon rod. The lower stop acts on the under side of the free tail-piece of the clamp to raise the same in relation to its position on the rod as the clamp and rod are lowered by the downward movement of the side of the lever to which the clamp is suspended, and so allows the carbon rod to feed downward, and the upper stop, by coming in contact with the upper side of the free tail-piece of the clamp, determines the height to which the carbon is raised to form the arc when the pivoted frame moves in the opposite direction. The pivoted frame is also provided with an adjustable stop, which, by coming in contact with a fixed part of the apparatus, prevents the further movement of the frame and clamp when the clamp is operated to release the carbon rod in case of an abnormal current through the fine-wire magnet.

Secondly. The invention relates to the construction of the electro-magnets and armatures, whereby the armature in its movement is caused to be always within a strong magnetic field by being maintained at a constant distance from one side of elongated polar projections of the magnet as it travels from the end of said projections upon an increase of current or toward the end of said projections upon a diminution of current flowing through the coils of the magnets. This is accomplished by making the said polar projections tapering in form from where they leave the surrounding coils to their ends, the magnetic induction on the armatures tending to move them in front of the thickest part of the polar projections.

Thirdly. It consists of the arrangement of a coarse-wire magnet included in the arc circuit, and a fine-wire magnet in a derived circuit, the respective armatures of which are secured to the ends of the pivoted frame. The elongated poles of the magnet are so located as to be on the same sides of the armatures, thereby applying all strains in a direction at right angles to the axis of the frame and on one side of its bearings, thus causing the armatures to maintain the same relative distance from their magnets should there by any play of the frame on its pivots or bearings, so that the differential action of the two magnets on the frame is constant.

The invention further embraces certain improvements in construction, which will be hereinafter explained in the following description of the accompanying drawings, in which—

Figure 1 is a front elevation of an electric-arc lamp, showing my improvements, with the lower part in section. Fig. 2 is a side elevation of the feeding mechanism. Fig. 3 is a plan view of the same. Fig. 4 is an enlarged view showing the annular clutch in its open position, and Fig. 5 is a plan view of the lower-carbon-holding device. Figs. 6 and 7, Sheet 2, are respectively a part elevation and an inverted plan of a modification in the construction of the lamp.

The main frame consists of the plate a, the arch a', the tubular side bars, a^2 a^2, connected to the plate a, but electrically insulated therefrom, and the bottom plate, a^3, secured to the lower end of the side bars, a^2 a^2.

Between the pointed bearings b' b', fitted in insulated plugs on the arch a', is held the frame or lever b, through which the upper-carbon-holding rod c passes. Said rod c also passes through guide-bearings in the arch a' and plate a, which are also insulated. The annular clutch d, surrounding the rod c, has two tail-pieces or extensions, d' d^2, and is supported from the lever b by means of the link e on the opposite side of its axis to that occupied by the carbon-rod c, and to the other arm, b^2, of the lever is pivoted the rod f, the lower part of which fits freely in an insulated plug in

the plate *a*. This rod *f* passes through an elongated hole in the free tail-piece d^2 of the clamp, and on it are fitted the adjustable stop-nuts *f'* and f^2. The armature *g* of the coarse-wire magnet *h*, which is in the arc circuit, is secured to the end of the arm b^2 of the lever in front of the elongated taper poles *h'*, the adjacent faces of the poles being concentric to the axis of the lever *b*, and on the end of the other arm of the lever *b* is adjustably secured the armature *i* of the fine-wire magnet *j*, included in a derived circuit. The poles *j'* of this magnet are also elongated and tapering, and are located inside the armature *i*, their outer faces being curved concentric to the arms of the lever *b*. This end of the lever *b* is weighted, so that when in its normal position the stop *k* rests on the insulated contact-plate on the end of one of the spools of the magnet *j*, as shown in Fig. 4.

To allow for lateral adjustment of the lower carbon, *l*, and to maintain a perfect insulation of the frame of the lamp from the working parts, the socket *m* rests on the metal plate *m'*, between which and the bottom plate, a^3, of the frame is placed the washer of insulating material, *n*, said plate *m'* being held in position by means of the insulated pins *n'*, which pass through it and into the bottom plate, a^3. A large opening is made through the plate *m'*, washer *n*, and bottom plate, a^3, and the thumb-screw *o*, having an insulated sleeve and washer, *o'*, passes therethrough and screws into the bottom of the socket *m*. By this arrangement it will be seen that all danger of the socket *m* coming in metallic contact with the plate a^3 is entirely avoided. The plate *m'* is connected to the negative terminal *p* of the lamp by means of the insulated conductor *p'*, which is placed within one of the tubular side bars, a^2. One end of the wire of the magnet *h* is connected to the positive terminal *q*, and the other end to the insulated guide-bearing *q'* of the rod *c*, electrical connection with the rod being assisted by means of the flexible conductor q^2, secured to the guide-bearing *q'* and the rod *c*. When the magnets *h* and *j* are energized, they each tend to pull their armatures opposite the thickest part of their taper-poles, and, as the magnet *h* is the stronger of the two upon the first passage of the current through the lamp, the armature *g* moves downward, and the clutch *d* is raised, first gripping the rod *c*, and then lifting it, the height to which it is raised to form the arc between the carbons being determined by the relative adjustment of the armatures on the lever, and the extreme limit of rise ever desired to be given to the upper carbon may be govered by the adjustment of the stop *f'* on the rod *f*, said stop preventing further movement of the lever *b* when it comes in contact with the upper side of the tail-piece d^2 of the clutch, as shown at Fig. 2. As the arc lengthens, the power of the derived magnet *j* overcomes that of the magnet *h*, and so draws down the armature *i* and lowers the clutch *d* and the rod *c* until the stop-nut f^2 comes in contact with the under side of the tail-piece d^2 of the clutch, thus raising it and allowing the rod *c* and upper carbon to fall until the arc is normal, when the magnet *h* has again the ascendancy and causes the clutch to grip the rod. By reason of the pivots on which the lever *b* rocks being located on a line between the point of suspension of the link *e* and the carbon-holding rod *c*, and the adjustment-controlling rod *f* being pivoted to the lever *b* on the other side of the rod *c*, the link *e* and rod *f* being about equidistant from the rod *c*, the rod *f*, with its adjustable nuts, moves upwardly when the link *e* and clutch *d* move downwardly, but at a much higher rate of speed, due to the differences of the respective distances of their points of suspension from the axis of the lever *b*, so that the clutch *d* is tripped when the link *e* falls a very short distance, and that, too, in a steady and positive manner, by the nut f^2, thus enabling the upper carbon to be fed and controlled in a short range of motion, thereby maintaining the arc uniform, the lack of which uniformity is the principal objectionable feature of electric-arc lighting. The screw *k*, passing through the lever *b*, is adjusted to come in contact with the insulated top of one of the spools of the magnet *j* when the stop-nut f^2 opens the clutch to prevent further downward movement of the end of the lever *b*. The armature *i* has a certain amount of adjustment on the lever *b*, to regulate and determine the positions of the armatures relatively to the taper-poles of their respective magnets. The poles *h'* are opposite the outer side of the armature *g*, and the poles *j'* are opposite the inner side of the armature *i*, by which arrangement it will be seen that the direct pull of the magnets on the two armatures is in the same direction, so that their relative distances from the poles remain constant, thus maintaining a uniform differential action of the magnets on them after the lamp is once set and adjusted, whereas if the two pairs of poles were both opposite the inner or the outer sides of the armatures an excess of pull on one of them would, if there were any play in the bearings of the lever, change the relative positions of the armatures to the taper-poles.

The operating mechanism, instead of being on top of the plate *a* of the frame, may be placed beneath the same, with the magnets inverted; or the pivoted lever may be actuated by means of one differential horseshoe-magnet having curved taper-poles, as shown in Figs. 6 and 7, with a coarse-wire coil, *r*, on one limb, and a fine-wire coil, *s*, on the other limb, acting on an armature, *t*, secured to one end of the lever.

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

1. In an electric-arc lamp, a pivoted frame or lever actuated by means of an electro-magnetic device, in combination with an annular clamp supported thereby on one side of its

axis and the carbon rod, and controlled by means of a double-adjusting device carried by the lever on the opposite side of the axis and the carbon rod, the distance between the axis of the lever and the link being much less than that between it and the adjustable controlling device, substantially as and for the purpose set forth.

2. In an electric-arc lamp, in combination, a pivoted frame or lever, a carbon-holding rod passing vertically through it on one side of its axis, an annular clamp having two tail-pieces or extensions, by one of which it is suspended from the lever on one side of its axis by means of a link, and a rod having two adjustable stops suspended from the lever on the other side of its axis, the said stops acting on and controlling the free tail-piece of the clamp, one to free the rod and the other to determine the distance it is raised, substantially as and for the purpose set forth.

3. In an electric-arc lamp, in combination, a system of electro-magnets having extended polar projections gradually decreasing in thickness toward their free ends, one or more armatures carried by a rocking lever so as to move alongside the polar projections in close proximity thereto, and a clutch suspended from the lever on one side of its axis, with two adjustable stops suspended on the other side of its axis, substantially as and for the purpose set forth.

4. The combination of a pivoted frame or lever and two armatures carried thereby—one on either side of its axis—with two electro-magnets arranged with one of their poles opposite the outside face of its armature, and the other opposite the inside face of its armature, thereby applying side strains due to their action always on one side of the bearings of the lever, substantially as set forth.

5. In an electric-arc lamp, two electro-magnets having curved taper-poles, the conducting-wire of one being in the main circuit, and that of the other in a derived circuit, in combination with two armatures carried by a pivoted frame, the axis of which lies between the two magnets, so that while the armatures maintain a constant distance from the adjacent faces of the poles of their respective magnets the one moves into a field of greater action by approaching the thicker part of its poles as the other moves into a field of lesser action by approaching the thinner part of its poles, substantially as described.

6. In combination, the lower plate, a^3, of an electric-lamp frame, the plate m', secured thereto, but insulated therefrom, the lower-carbon socket m, resting on the plate m', and the thumb-screw o, provided with the insulated washer and sleeve o', substantially as set forth.

7. The electro-magnets h and j, having curved taper-poles h' and j', in combination with the armatures g and i, secured to the ends of the pivoted frame or lever b, substantially as and for the purpose set forth.

8. In combination, the pivoted lever b, carbon-holding rod c, passing through the lever on one side of its axis, link e, pivoted to the lever on the side of the axis opposite to that at which the rod is located, clutch d, and rod f, provided with two adjustable stops, f' and f^2, and pivoted to the lever on the same side as that at which the rod c passes through it, substantially as and for the purpose set forth.

9. The adjustable stop k, in combination with the pivoted lever b, link e, clutch d, and adjustable stop f^2, carried by the rod f, substantially as and for the purpose set forth.

10. In combination, the electro-magnets h and j, the pivoted lever b, provided with the armatures g and i, the clutch d, suspended from the lever b by the link e at one side of the axis of the lever, the rod f, pivoted to the lever b at the other side of its axis, and provided with the adjustable stop-nut f^2, and the carbon-holding rod c, located about midway between the link e and rod f, and passing through the lever between its axis and the rod f, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand, at New York, county and State of New York, this 15th day of February, A. D. 1884.

JOHN M. PENDLETON.

Witnesses:
H. D. WILLIAMS,
A. G. HOLCOMB.