(No Model.) 2 Sheets—Sheet 1.

E. A. SPERRY.

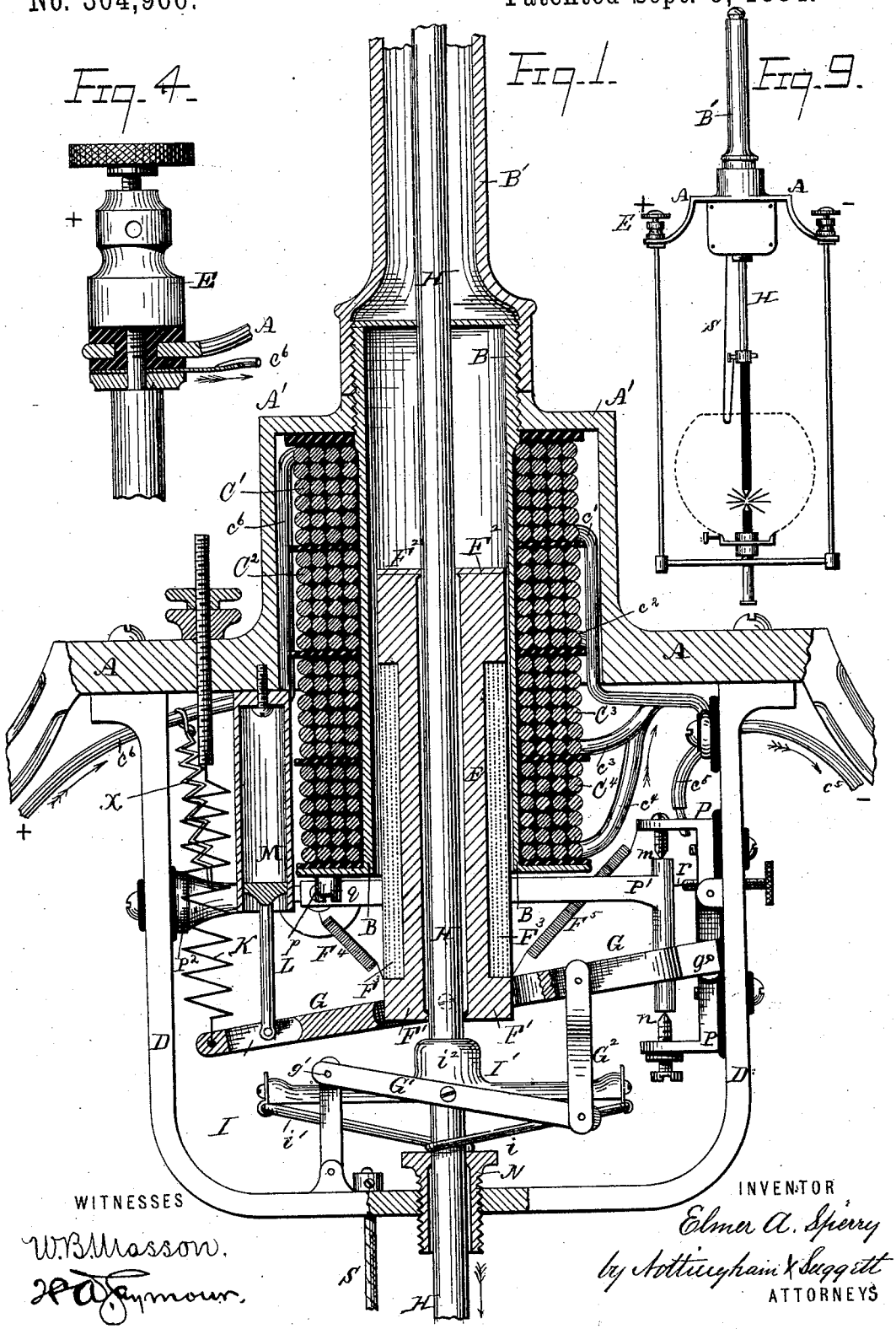
ELECTRIC ARC LAMP.

No. 304,966. Patented Sept. 9, 1884.

Fig. 4.

Fig. 1.

Fig. 9.



WITNESSES

W. B. Masson.

J. A. Seymour.

INVENTOR

Elmer A. Sperry

by Mottley, Ham & Suggett

ATTORNEYS

(No Model.) 2 Sheets—Sheet 2.

E. A. SPERRY.

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Fig. 2.

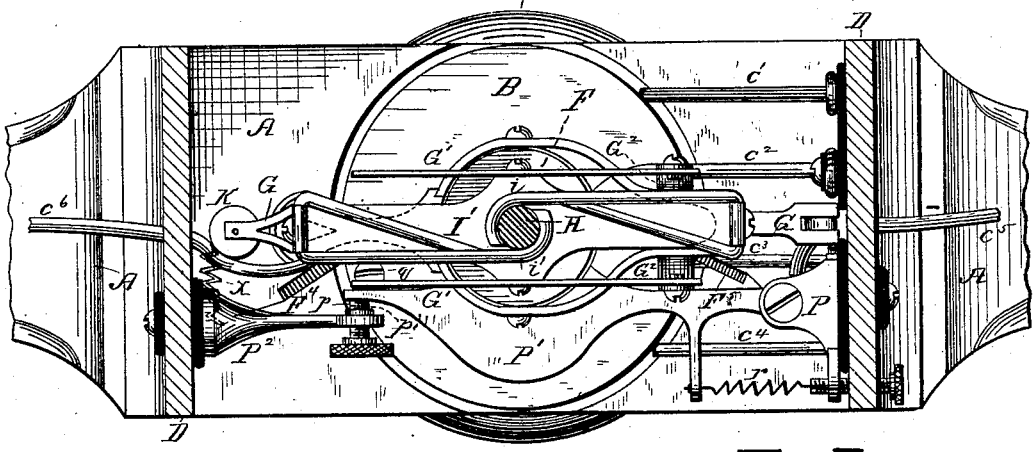


Fig. 5.

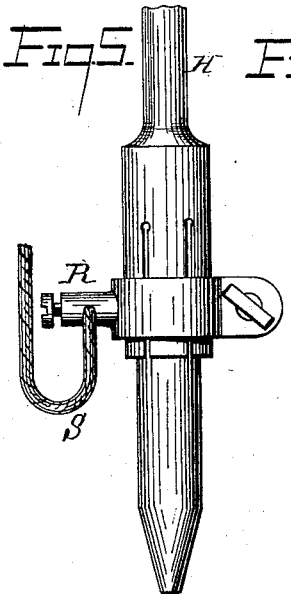


Fig. 6.

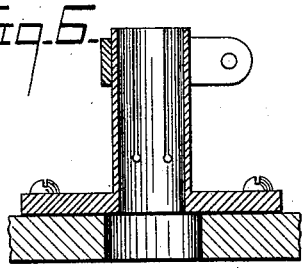


Fig. 7.

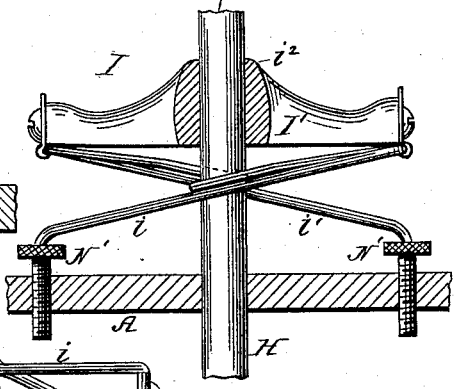


Fig. 8.

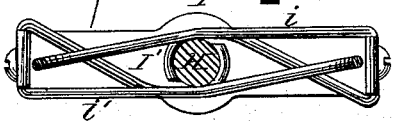
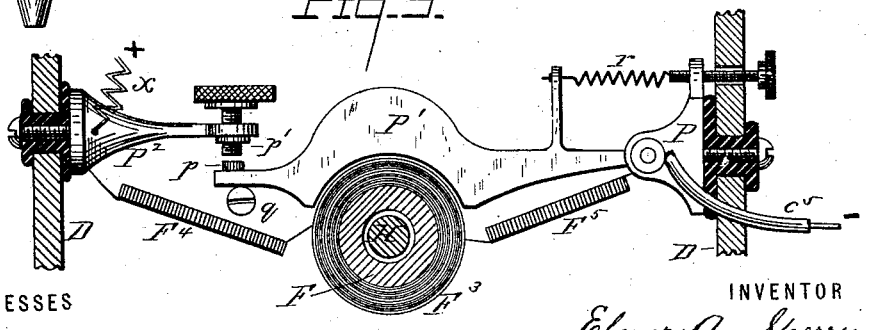


Fig. 3.



WITNESSES

W. B. Masson.

J. A. Fagnoni.

INVENTOR

Elmer A. Sperry,

by Stillingham & Suggett

ATTORNEYS

UNITED STATES PATENT OFFICE.

ELMER A. SPERRY, OF CORTLAND, NEW YORK.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 304,966, dated September 9, 1884.

Application filed April 15, 1881. (No model.)

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, a citizen of the United States, residing at Cortland, in the county of Cortland and State of New York, have invented certain new and useful Improvements in Electric Lamps; and I do hereby declare the following to be 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, reference being had to the accompanying drawings, and to the letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in electric lamps; and it has for its object, first, to secure a more delicate adjustment of the regulating-magnet than has heretofore been accomplished; second, to control the carbons by mutual action of two helical systems, one of which is the moving element; third, to provide a sensitive friction-clutch, whereby the carbon-holder is delicately controlled by suitable mechanism; and, fourth, to automatically short-circuit the lamp when for any reason its arc should offer too great resistance to the current. These objects I attain by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 represents a vertical sectional view of the mechanism of my lamp; Fig. 2, a bottom plan view with portion of casting removed; Fig. 3, a top plan view of short-circuiting or "cut-out" attachment with core in section; Fig. 4, a view of the binding-post and mode of attachment to frame of lamp; Fig. 5, a detached view of positive-carbon clamp; Fig. 6, a sectional view of negative-carbon clamp; Figs. 7 and 8, a modified form of clutch, and Fig. 9 a general view of lamp.

Similar letters of reference indicate like parts throughout the several views, in which—

A indicates a casting, of any suitable material, forming the upper portion of the frame of a lamp, provided with an upward hollow cylindrical projection, A′, screw-threaded at its opening to receive the screw-threaded end of a flanged tube, B, of diamagnetic substance, which carries the solenoids or helices C' C^2 C^3 C^4. These coils are wound of a single wire, but in four separate helices, all in the same direction. The first end of the wire is placed in permanent connection with the positive binding-post of the lamp. The connection of these helices to the casting D is effected by means of wires c' c^2 c^3 c^4, which are secured to the magnet-wire at that point where it passes from one helix to the next, and are brought near the casting D, where any one of them can be placed in connection with it by a screw, as shown. The casting D forms the lower portion of the frame carrying the mechanism of the lamp, said casting or frame being secured to the frame A by means of screws, as shown. A protecting-tube, B′, is secured to the screw-threaded end of the tube B. The core or armature of this compound solenoid is formed of a cylindrical piece of soft iron, F, bored to loosely fit the carbon holder or rod H, and provided at each end with flanges F' F^2, which loosely fit the bore of tube B. Wound around this core, between the flanges, is a large number of coils of insulated fine copper wire, F^3, Figs. 1 and 3, the ends of which are placed in permanent connection by flexible conductors F^4 F^5 with the positive and negative binding-posts direct—*i. e.*, not by way of arc—in such a manner that the current will traverse the coil F^3 in opposite direction to that in the solenoids, which gives the core the form of a cylindrical electro-magnet of high resistance. The direction of winding the wire on these coils is not essential, the point being in so connecting them up or placing them in circuit as to compel the current in the coil in the armature or moving core to tend to magnetize said core of opposite polarity to or to neutralize that of the main solenoid—that is, the current would circulate in opposite directions in the two coils.

To the lower extremity of the core F is attached a lever, G, which has its fulcrum at *g*. Said lever is connected to two levers, G′, one directly opposite the other, by links G^2, said levers G′ having a fulcrum at *g′* and connected with a clutch, I, composed of a casting, I′, and two hooked levers, *i i′*. The clutch I may be directly connected to the core; but the method herein described and shown in the drawings is preferred.

Attached to the free end of the lever G is an adjustable spring, K, and a plunger, L, said plunger working in a dash-pot, M, connected to the frame A. The casting I′ of clutch

I is provided at its center with a boss, i^2, bored to loosely fit the rod H, and to its extremities are pivoted the hooked levers $i\ i'$, the hooked ends of which clutch the rod H on opposite sides—a short distance below casting I—by mutual impingement, which impingement is due to the angular movement about their pivots. An adjustable stop, N, forms a guide for the rod H. The clutch I may be varied by prolonging the levers beyond their point of contact with the rod H, as shown in Figs. 7 and 8, an adjustable stop, N′, being placed under the extremity of each of the levers. By this construction a more sensitive device than the preceding one is obtained, with which, however, satisfactory results have been obtained.

The "cut-out" attachment, Figs. 1, 2, and 3, is composed of a casting, P, attached permanently to but insulated from frame D, connected with negative binding-post by wire c^5, and provided with two pivot-points, $m\ n$, on which vibrates a casting, P′, made of iron, and so shaped as to fit around a portion of the core, but not in contact with it, being prevented by an insulated stop, q. Said vibrating casting is provided with a suitable contact-point, p, and an adjustable retractile spring, r, connected to casting P. A casting, P^2, is secured opposite to casting P to the frame D, but insulated therefrom, and is placed in connection with a wire, c^6, by a resistance, X, equal to the normal arc of the lamp, or thereabout, said casting P^2 being provided with an adjustable contact, p'. The positive and negative carbon clamps are of usual form, the former being provided with a binder, R, for the flexible conductor S, the latter being adjustable laterally to bring the carbon rods in line.

The operation of the devices above described is as follows: The current, entering at the positive binding-post, flows on wire c^6 through such a portion of the compound solenoid as is determined by that wire which is placed in connection with the frame D, giving an adjusting principle which is found to be valuable, the same lamp being equally adapted for strong or weak currents. From frame D the current follows the rod H to the positive and thence to the negative carbon, and along the lamp-frame to the negative binding-post. In traversing the solenoid the core F is magnetized and attracted upward, transmitting its motion by means of the levers G and G′ to the clutch I, raising it until the hooked levers—by being lifted from the stop N—clamp the rod H and raise it, thus separating the carbons and forming the arc.

It will readily be seen that there are two passages for the current through the lamp—one of high resistance passing through the coil F^3 on the movable core, and the other, of comparatively low resistance, passing through the compound solenoid, carbons, and arc. Now, the amount of current flowing in each of these divisions of the circuit depends upon their comparative resistance, and any increase of resistance of one is attended by an increase of current passing in the other. Now, in the above instance, should the core be raised too far, separating the carbons, or by the consumption of the carbon on the part of the arc, it tends to become abnormal, thus increasing the resistance of this, one of the two branch circuits, the current in the other branch—*i. e.*, the coil F^3—would be increased, and, owing to its opposite effects on the core, a portion of the magnetism induced by the solenoid would be neutralized and the attractive effect of the latter be decreased, thereby causing the core to descend, depressing the carbon until the resistance of the main light-circuit again becomes normal.

It may be here stated that the resistance of the coil F^3 is so adjusted that while the arc is normal its magnetizing effect on the core F is small as compared with that of the solenoid. These circuits are so arranged that the core or armature in its movements never changes its relative position to the shunt-circuit or coil F^3, because of its being wound and secured thereon, whereas it is constantly changing its position as regards the main circuit or solenoid, and the wire in the shunt-circuit or coil F^3 being wound on the core, as above stated, and moving with it, it is obvious that it also changes its relative position to the said main circuit or solenoid. This arrangement has the advantage of having the neutralizing-coil F^3 in the most favorable position on the core at all positions thereof, so that its office can be performed by the least possible percentage of current in the "by-pass" circuit. The movement of the rod H above referred to is accomplished by permitting the hooked levers of the clutch to rest upon the adjustable stop N, releasing the rod, and allowing it to descend until the arc is normal, when they again impinge upon the rod by an upward movement of the core F, thus acting only as a friction-brake, controlling the feed of the positive carbon, while at any time, should it drop through too far, it is instantly raised and a normal arc thereby constantly maintained. The dash-pot M prevents too rapid and excessive movement of the core F and carbon-holder H. Said dash-pot, being situated as shown, has a great leverage over both core and carbon-holder, and needs no liquid to make it less sensitive.

The adjustable spring K is for the purpose of balancing the weight of parts more or less, as the intensity of the current requires.

The adjustable stops N N′ are important features of my invention.

It can readily be seen that there are zones of vibration in the solenoids at which the core is more sensitively controlled than at a position either above or below, and that this so-called "zone" will vary its relative position as more or less of the coils are used. It therefore becomes necessary to vary the working position of the core, which is done by varying the relative

position of that point at which the clutch releases its carbon-holder, or by adjusting stop N.

The short-circuiting or cut-out device acts as follows: The retractile spring *r* holds the contact-point *p* against that of *p'*, forming a passage for the current direct from positive to negative binding-post; but, owing to the resistance *x*, a portion of the current passes by way of the solenoid and carbons. The core by this means is magnetized, as hereinabove described. The part P' (being of magnetic material) is attracted by the induced magnetism of core F, and on an increase of the same overcomes the spring *r*, breaking the contact and drawing the part P' against the insulated stop *q*, thus sending all the current normally through the lamp and carbons; but when for any reason whatever—as the arc becoming extinguished, or the positive-carbon holder catching or being hindered from dropping—the arc should offer too great resistance, the core F, owing to the weakening of the current in the solenoid, together with the neutralizing effect of the coil F^s, would lose a certain amount of its magnetism, and therefore its attractive force on the part P', permitting the retractile spring *r* to again establish contact between points *p* and *p'*, giving a free passage to the current through the lamp, and in no way interfering with the working of the remaining lamps in circuit or the running of the machine, and on the arc becoming again normal the lamp is automatically thrown in circuit without any interruption. This, it will be observed, is accomplished without any extra magnet or coil other than that used in the regulator before an entire break in the circuit has occurred, or even any undue resistance is encountered by the current. This result, it can readily be seen, will be accomplished when for any reason whatever the movable core of the regulating-magnet of the lamp has lost a certain prescribed amount of its magnetism, due to causes either internal or external to the lamp.

The lamp hereinabove described is equally adapted to be used singly in circuit or in series.

The mutual action and reaction of electro-magnets as the controlling element of the lamp I have applied in various ways—such, for instance, as placing both in circuit with the carbons, either in multiple arc or in series, or placing both either in series or multiple arc in the shunt-circuit, forming the only regulating-magnets of lamp. These, however, I will make the subject of a future application.

I disclaim, first, an electro-magnet in the main circuit of an electric lamp having its armature wound with a helix of fine wire of high resistance in a shunt-circuit, in such a manner that when an increased resistance of the main circuit diverts the electric current into the shunt-circuit it will tend to convert the armature into a magnet with poles similar to the opposite poles of the electro-magnet; second, in an electric lamp, the combination of an electro-magnet whose helix is in the main circuit, having an armature with a helix thereon in a shunt-circuit, the main and subsidiary currents passing through said helices in opposite directions, with suitable mechanism for connecting the free end of the armature with the upper carbon.

I am aware that in an electric lamp a short-circuiting lever controlled by a magnet has been arranged to shunt the current around the carbons and magnet-coils when the arc ceases; and I do not claim such an arrangement, broadly.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an arc electric lamp, a helix in a main circuit which includes the carbons, in combination with a helix in a circuit derived from said main circuit, and a movable core common to both helices, and upon which one of the same is wound and movable therewith, said core being arranged to be moved by electro-magnetic induction and to control the carbon-feed, substantially as described.

2. In an arc electric lamp, a helix in a main circuit which includes the carbons, in combination with a helix of higher resistance in a circuit derived from said main circuit, and a movable core common to both said helices, and upon which the helix of higher resistance is wound and movable therewith, the other helix being stationary, and the said core adapted to control the devices for separating the carbons and controlling the feed, substantially as described.

3. In an electric-arc lamp, a stationary helix in a main circuit which includes the carbons, in combination with a helix of higher resistance in a circuit derived from said main circuit, and a movable core common to both helices, and upon which the helix of higher resistance is wound, substantially as described.

4. In an electric lamp, the hereinbefore-described friction-clutch, consisting of a casting, I', and hooked levers *i i'*, and operating mechanism, substantially as and for the purpose described.

5. In an electric lamp, two electrical helices surrounding a common movable core, said helices having different resistances, one of said helices being in a circuit with the carbons, and the other in a shunt of said circuit, and one of said helices being secured to the core and movable therewith, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ELMER A. SPERRY.

Witnesses:
M. STANLEY BIERCE,
JOHN W. SUGGETT.