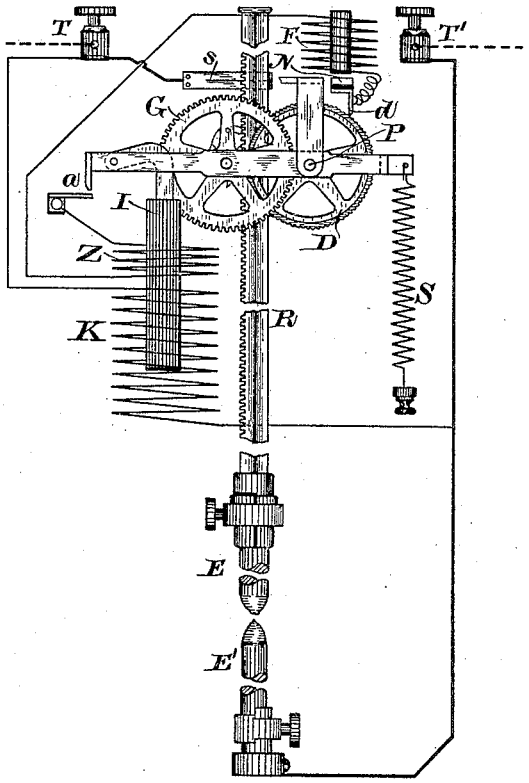
(No Model.)

E. THOMSON.

ELECTRIC ARC LAMP.

No. 525,034. Patented Aug. 28, 1894.

FIG. 1.



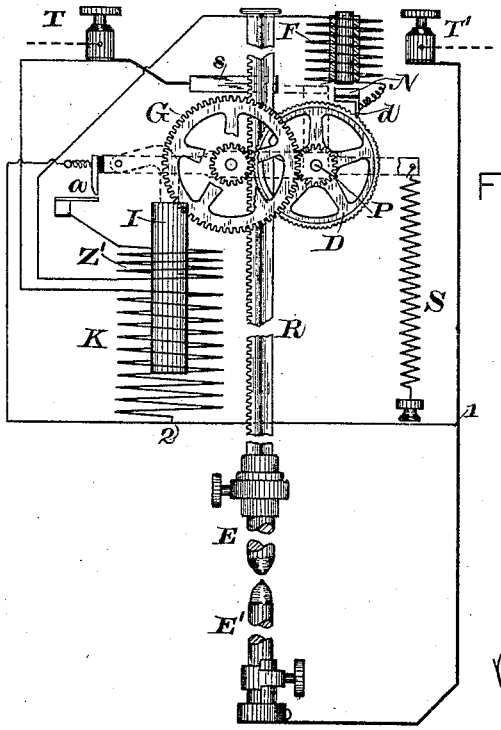


FIG. 2.

WITNESSES.
Henry C. Westendarp.
S. L. Johnston.

INVENTOR.
Elihu Thomson by
Bentley and Blodgett,
Attys.

UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF LYNN, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF BOSTON, MASSACHUSETTS.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 525,034, dated August 28, 1894.

Application filed January 24, 1894. Serial No. 497,929. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

My invention relates to electric arc lamps; and has for its object the production of a simple feeding mechanism working positively and yet with delicacy.

In my invention I employ a derived circuit coil or magnet acting against a retractor, such as a weight or spring, and a feeding circuit comparatively independent in its feeding action but dependent for the times of action on the first magnet.

My invention will be made clear by reference to the drawings which accompany this specification, wherein—

Figure 1 is a diagrammatic illustration of a lamp adapted for use on alternating current circuits, and Fig. 2 a similar view of a lamp operated by continuous currents.

The carbons E, E′ are mounted as usual, E being sustained on a rack rod R, which engages with a pinion communicating motion to a gear-wheel G, which in turn engages with a pinion on a second shaft communicating motion to a detent wheel D. These wheels are mounted in a frame which is pivoted at P, and has a retractile spring S to separate the electrodes E, E′ by raising the core I; the spring might be applied in any other suitable position. This separation of the electrodes follows from the movement upward of the shaft of the wheel G, which carries a pinion engaging with the rack rod, when the spring acts to raise the core I.

K represents a shunt magnet coil, in a derived circuit of comparatively high resistance around the arc. Its terminals are connected, as shown, to the leads or terminals of the lamp T, T′, the frame work of the lamp not being shown. The main current leaves T, passes to a contact brush *s*, then to the rack-rod R, down through the arc E, E′, and back to T′, the other terminal; while a portion goes through the coil K, and pulls down the core I, when the spring S and the power of the magnet K are properly adjusted. The pulling down of the core I and the frame to which it is attached makes a contact at *a* between a piece carried on the frame to which I is attached and a stationary piece. This closes a secondary circuit including the contact *a*, the coil Z around the coil I in inductive relation to K, the coil F on the small feeding magnet core, a contact between the the detent or catch *d* and the detent wheel D carried on the frame. The magnet F however has an armature N, suitably mounted so that it can move toward the magnet core; which, when it so moves, opens the contact between the detent *d* and the detent wheel D.

The means for carrying the armature N are omitted, as they can be varied indefinitely; a spring may be applied to give a suitable retractile force when necessary. On the opening of the contact between *d* and D, the local circuit through Z, *a*, F, *d*, D, is broken; one or more teeth of the wheel D escape the detent *d* and a feeding action is thereby produced, as the detent *d* is all that prevents the turning of the wheels and descent of the rack-rod R.

The current which actuates the feeding magnet F is set up by induction from the coil K around the coil Z, which is a secondary to the coil K upon the same core; and since this is a circuit local to the lamp it can be selected of such small current as to give little or no spark at the contacts. When the lamp has fed its carbons and forms an arc in the usual manner, that is by the magnet K pulling down the core and allowing the carbons to feed together, and the spring S reasserts itself to separate the carbons after they touch (by reason of the diminished current in the coil K, the current being diverted from it into the path formed by the carbons), the arc will continue burning until, by its resistance, due to its increased length, the magnet K is again sufficiently energized to pull down the frame, close the contact *a*, thereby closing the local feed circuit through Z and F, lift the armature N, pull up the detent *d* and allow the wheel D to rotate tooth by tooth, and so feed the carbons until the force of the magnet K again weakens and allows the contact *a* to be

opened by the retractile action of the spring S. These actions continue at intervals during the working of the lamp.

The rim of the wheel D is preferably made of a thin strip of corrugated silver and the detent or catch *d* is also made of silver, as described in my application, Serial No. 497,928, filed January 24, 1894.

Fig. 2 represents the lamp mechanism as it is arranged to work with continuous currents, either in a separate circuit or in series with other lamps. It differs but little from the mechanism of Fig. 1; the feeding circuit in this case being not a local circuit inductively operated, but a second shunt of high resistance around the arc; the magnet K being also of high resistance. From the terminal T', or the negative terminal of the lamp, connection is taken at 1, which branches through coil K at 2, then passes to the upper or movable contact at *a*, which in this case is insulated from the frame which carries the wheel work. The lower or stationary contact is connected to one end of a coil Z', wound around the core I in a direction to oppose the magnetic force of K, and the other terminal of the coil Z' goes to the feeding magnet coil F, the armature of which, as before, is connected to the detent *d* of the wheel D. The frame of the lamp, however, has communication with the entering terminal T, and the derived circuit, which has just been traced, is connected through said frame, as indicated, by the wheel D. The coil Z' may be dispensed with in some cases, though it is conducive to a delicate action of the feeding mechanism. If omitted, the lower contact at *a* is connected directly to a terminal of the feeding magnet F. The action is as follows. Under the influence of the spring S the carbons E, E' are separated at the start. Connecting the lamp with a potential difference between the carbons E, E' sufficient to more than maintain a normal arc, energizes the shunt magnet K, pulling down the core I or armature of the magnet against the action of the spring S, and closing the contact at *a*, thus establishing the secondary shunt through this contact, coil Z', feeding magnet F, detent *d* and wheel D. In this case F is arranged to attract its armature N and raise the detent *d* from the wheel D to allow a tooth to pass, but as the contact between *d* and D is in circuit with the magnet F, the opening of such contacts interrupts the circuit, drops the detent *d* on the wheel D. The magnet F is again energized, breaks the connection and raises the detent, and so, tooth by tooth, the wheel D escapes the detent, and slowly the carbons E, E' move together. When they touch the magnet K is weakened or shunted, thereby releasing its armature I, which is pulled up by the spring S and opens the contact at *a*, thus stopping the feeding action; at the same time it goes far enough to separate the carbons and form an arc. This continues until gradually the magnet K regains its strength as the arc lengthens, and at last closes the contact at *a*, throwing on the feeding magnet F, which, as before, controls not only the feed of the wheel D but its own circuit; thus a very gradual feeding action is obtained, and this continues until the carbon has been fed sufficiently.

The purpose of the coil Z' is to make the action of the feeding more precise and delicate. As it is wound to oppose the magetization given by the coil K on the core I, it tends to release this core the instant the contact *a* is closed, and thereby open said contact. Under such circumstances the feeding action becomes more delicate, and tooth by tooth the wheel D escapes the detent or catch *d* and the carbon rod is correspondingly and gradually given its feeding movement, while the feeding action is at the same time continued until the arc has been brought to its normal condition. The feeding action is therefore perfectly positive and gradual, and the mechanism of Figs. 1 and 2 agree in this particular,—that each of them uses for the main regulation a derived circuit; each of them uses a supplemental opposing circuit Z, Z', and a feeding magnet F interrupting its own circuit as well as allowing the teeth of the wheel D to escape.

It is sometimes desirable to make the feeding magnet F in the case of continuous working a little sluggish in its action on the armature, and this is accomplished by surrounding the magnet core of F with a closed copper circuit or band.

The lamp here shown is dependent upon derived circuit coils for the regulation of the arc. It starts with the carbons separated and has the so-called "floating" electrodes, which gives it the power of recovery in case overfeeding occurs. It is not dependent upon the strength of the main current passing through the carbons, but only on the voltage in the arc, while it secures the same kind or character of feeding as other lamps. I point out the derived circuit magnet K as having control of a contact which is in the feeding magnet circuit, as is also the contact *d*, and wheel D, and that there are also opposing coils Z, Z', respectively, Z for alternating currents having a secondary which generates by induction opposing currents and weakens the magnetism of the core, while Z' is connected in a second shunt and wound to oppose the coil K.

Many variations of the arrangements here shown may be made; for instance, in Fig. 1, the secondary Z might be wound upon a separate transformer core, the primary of which was fed by alternating currents either in circuit with K or in any other relation to the line. So in Fig. 2, the opposing coil Z' might be omitted and the feeding magnet F fed by

a battery current, if at hand, or, as is shown, in a second shunt of high resistance around the arc.

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

1. In an electric arc lamp, a derived circuit coil tending to draw the electrodes together, a spring opposing the coil, a contact actuated by the coil and the spring, a circuit controlled by the contact, a magnet in such circuit, and a detent actuated by the magnet, such detent controlling the feed of the electrode.

2. In an electric arc lamp, a derived circuit coil tending to draw the electrodes together, a spring opposing the coil, a contact operated by the coil and the spring, a circuit controlled by the contact, a coil in such circuit opposing the action of the derived circuit feeding coil, a magnet also included in the same circuit, and a detent controlled by the magnet and controlling the feed of the lamp.

3. In an electric arc lamp, a derived circuit coil tending to draw the electrodes together, a spring opposing the coil, a contact operated by the coil and the spring, a local circuit controlled by the contact and including a second coil energized by induction from the derived circuit coil when its local circuit is closed, and a magnet operated by the current induced in the second coil and actuating a detent controlling the feed of the lamp.

4. In an electric arc lamp, a derived circuit coil tending to draw the electrodes together, a spring opposing the coil, a contact actuated by the coil and the spring, a circuit controlled by the contact, a coil in such circuit wound to oppose the derived circuit coil and energized by induction therefrom, a magnet also in such circuit energized by the current induced in the second coil, and a detent operated by such magnet controlling the feed of the lamp.

5. In an electric arc lamp, a derived circuit coil tending to draw the electrodes together, a spring opposing the coil, a contact actuated by the coil and the spring, a circuit controlled by the contact, a second coil in such circuit energized by induction from the derived circuit coil, a magnet also included in such circuit energized by the current induced in the second coil, and a detent controlling the feed of the lamp and operated by the magnet, such detent forming a part of the induced circuit and acting to break the circuit when attracted by the magnet.

6. In an electric arc lamp, a derived circuit coil tending to draw the electrodes together, a spring opposing the coil, a contact actuated by the coil and the spring, a circuit controlled by the contact, a magnet in such circuit, and a detent operated by the magnet and controlling the feed of the lamp; such detent forming a part of the circuit and acting to open the circuit when attracted by the magnet.

7. In an electric arc lamp, a derived circuit coil tending to draw the electrodes together, a spring opposing the coil, a contact actuated by the coil and the spring, a circuit controlled by the contact, a second coil in such circuit energized by induction from the derived circuit coil and wound in a direction to oppose such derived circuit coil, a magnet also included in such circuit and energized by the currents induced in the second coil, and a detent controlling the feed of the lamp, forming part of the circuit, and operated by the magnet, substantially as set out herein.

8. In an electric arc lamp, a derived circuit coil tending to draw the electrodes together, a spring opposing the coil, a contact actuated by the coil and the spring, a second derived circuit controlled by the contact, a magnet in such circuit, and a detent actuated by such magnet controlling the feed of the lamp and forming part of the circuit.

9. In an electric arc lamp, a derived circuit coil tending to draw the electrodes together, a spring opposing the coil, a contact actuated by the coil and the spring, a second derived circuit controlled by the contact, a coil wound to oppose the first coil included in such second derived circuit, a magnet also included in the second derived circuit, and a detent operated by the magnet, forming part of the derived circuit, and controlling the feed of the lamp, substantially as set out and described herein.

In witness whereof I have hereunto set my hand this 20th day of January, 1894.

ELIHU THOMSON.

Witnesses:
JOHN W. GIBBONEY,
BENJAMIN B. HULL.