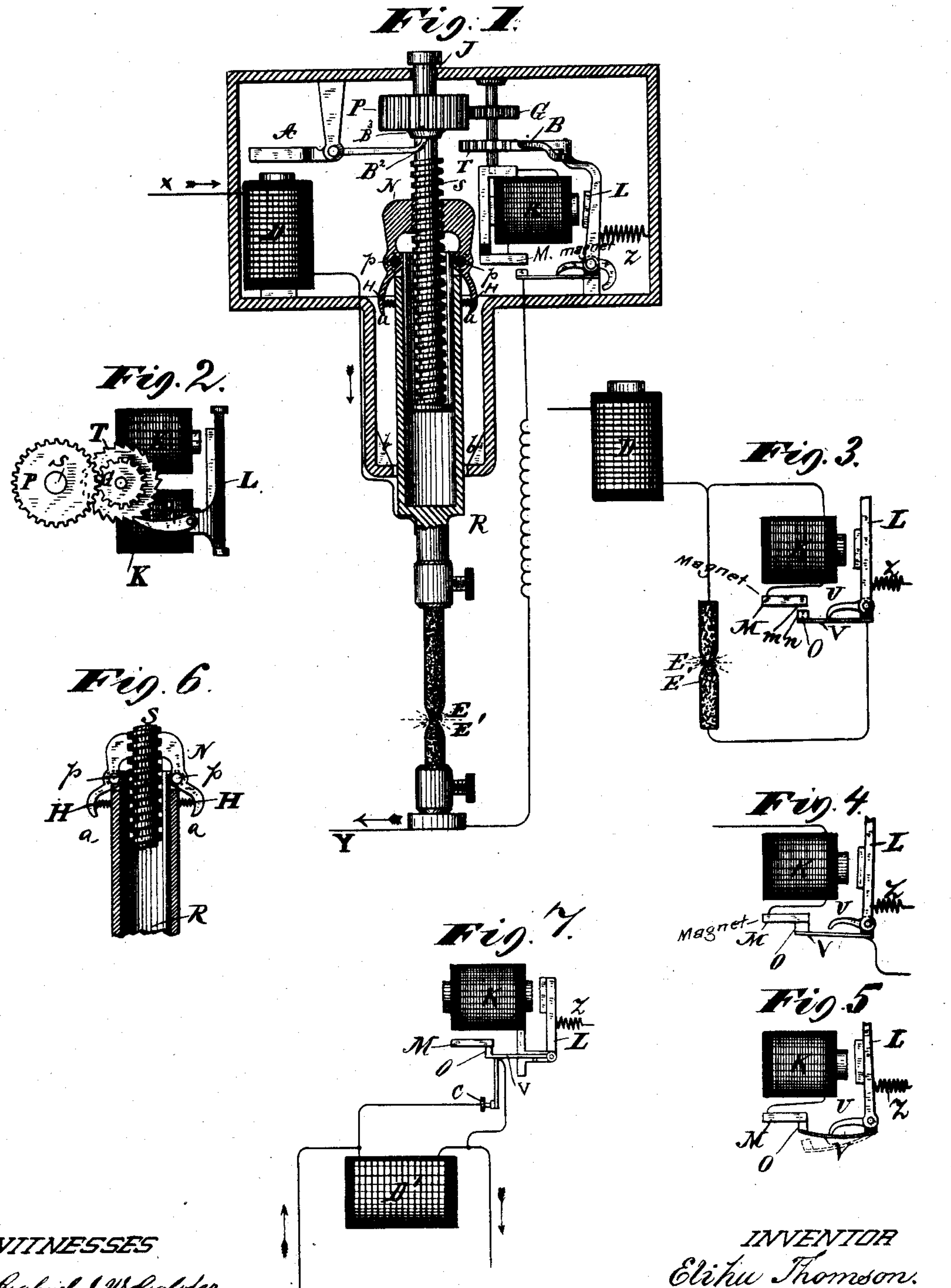
(No Model.)

# E. THOMSON.
## ELECTRIC ARC LAMP.

No. 430,357. Patented June 17, 1890.

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## ELECTRIC-ARC LAMP.

**SPECIFICATION** forming part of Letters Patent No. 430,357, dated June 17, 1890.

Application filed March 20, 1886. Serial No. 195,882. (No model.)

*To all whom it may concern*:

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

My invention relates to mechanism for feeding or controlling the position of the electrodes with relation to one another in an electric-arc lamp, and relates more particularly to that class of lamps in which the carbons are separated to form the arc by an electromagnet in the main circuit, whose parts maintain their position during normal action of the lamp, and in which the feed movement of the carbons is produced by an independent mechanism controlled or operated by the action of current in the derived circuit around the lamp.

The object of my invention is to produce a simple and effective mechanism for securing the desired actions.

The invention also relates to certain improvements in the commutating devices for the electric motor, which is employed for producing the feed movement of the carbon, and is controlled or operated by the current of the derived circuit.

The novel features and combinations forming my invention will be first described in connection with the accompanying drawings, and then more specifically pointed out in the claims.

In the drawings, Figure 1 is a side elevation and partial section of an electric lamp embodying my invention. Fig. 2 is a plan of the mechanism controlled or operated by a derived-circuit magnet and serving to give a step-by-step feed to the carbon. Fig. 3 is a diagram of the circuits of the lamp. Figs. 4 and 5 show the parts of the commutator and of the armature-lever acting upon the same in their two positions. Fig. 6 illustrates a detail of the construction. Fig. 7 illustrates a modified arrangement in which the motor-magnet is provided with a commutator worked by a separate magnet in the derived circuit E E′, indicating, respectively, the positive and negative carbons of an electric-arc lamp, and R the carrier for the upper carbon. Attached to said carrier is a nut N, which engages with a screw S, that is rotated by the mechanism to be described, when a feed of the carbon is to take place, and is raised bodily when the carbons are to be separated to form the arc. The nut N is preferably a separate nut, whose two portions are secured, respectively, to levers pivoted on the carrier R at *p*. Springs bearing against the lower ends of the lever serve to hold the two parts of the nut together in engagement with the screw-shaft S. By compressing the lower ends of the levers the nut may be disengaged to permit the carrier to be raised. The nut may be automatically disengaged by the impingement of the lower ends *a a* of the levers against stops or inclines *b b*, suitably supported from the frame of the lamp in position to engage with said levers when the carbon-carrier has been fed down to a point where the carbon is nearly exhausted. By means of the stops *b b* the nut is disengaged from the shaft, and the carrier R may fall to bring the two carbons into contact, thus closing and maintaining a circuit through the lamp.

The shaft S is provided at $B^3$ with a suitable collar or bearing, which rests upon a bearing $B^2$ of any suitable form, and upon which the shaft S rotates and is supported. The bearing $B^2$ is a movable bearing and is raised by the agency of the main-circuit electromagnet D, whose armature A is carried by the lever that supports the bearing $B^2$. The upper end of shaft S is guided in an opening of the frame of the lamp at J, and is at such point provided with a collar or stop to prevent it from slipping through the opening. The shaft is rotated by means of a wheel G, which engages with a wheel or pinion P upon the shaft. The wheel or pinion is made of considerable width, so as to permit a considerable longitudinal movement of the shaft without disengagement of the gear. The wheel G is rotated by the action of a pawl B, that is carried by a lever L, and that engages with a ratchet-wheel T. The pawl and lever L are reciprocated by the operation of an electro-magnet and commutator for said magnet, which latter operates to throw the magnet out of action on the completion of a movement of the lever in one or the other direction, and to bring said magnet into operative condition on a completion of a movement of the parts in the opposite direction.

The magnet which throws the lever L may be either a derived-circuit magnet or a magnet controlled by a derived-circuit magnet. In Figs. 2, 3, 4, &c., the magnet is shown as one through which current in a derived circuit around the arc circulates. The armature of said magnet is carried by the lever L, so that when the magnet is sufficiently strong to overcome the retractor Z a forward movement of the wheel T one step will be produced.

If an ordinary commutator or circuit-breaker were employed with the lever L, it would, if made to close the circuit on the back stop for the lever, break the circuit of the magnet K, as soon as the lever began to move and the latter would immediately fall back, and it would be impossible to get a full and complete movement of the operating-pawl. If, on the other hand, the contact-stop were a front-contact stop, made to shunt the magnet K or otherwise throw it out of action, the lever L would not be permitted to make any considerable backward movement before the magnet would immediately draw it up again, and the same difficulty would be present in a different shape. In order to overcome this difficulty and to permit the lever L to make free and complete movements in both directions, I propose to construct the commutator or circuit-breaker for its operating-magnet in such way that the contact-points shall not move with relation to one another until the lever has nearly completed its movement, and then shall move and become separated to their full extent, so that the return movement of the lever will be a full and complete one before the contacts of the circuit-controller are restored to their normal condition. This may be done by combining with the motor devices similar in their action to various devices shown in United States Patents Nos. 297,198 and 297,199.

A construction and arrangement of circuit-controller for governing the action of the magnet working the lever L and suitable for producing the operation just described, is shown in detail in Figs. 3, 4, and 5. The two contacts or electrodes of the circuit-controller are indicated at *m n*, respectively. They are carried or formed, one by a spring-support V and the other on a suitable fixed support, and are normally held together through the action of the permanent or other magnet M and an armature therefor (indicated at O) and carried by the spring V. In the present case the two electrodes are formed or supported directly on the magnet and armature, but might be supported and carried in other positions. The electrodes are separated by the operation of lever L, which is connected with the spring V in the manner shown in Fig. 7, or, preferably, carries an arm or projection U, adapted to engage with said spring at some distance from the point at which the armature O is supported. When the lever L is in the position shown in Fig. 4, where it is held by the action of spring Z, the parts of the circuit-controller are held together by the attraction of the magnet M and armature O, which are in contact with one another. When the magnet K draws the lever forward, the lever moves to some extent before the arm U engages with the spring V, and even after engagement does not immediately separate the electrodes, inasmuch as the spring gives under the action of the lever and is subjected to considerable strain by the pull of the magnet. This continues until sufficient force is brought to bear to disengage the armature O from magnet M, when the spring V throws the lower of the two electrodes away from the opposite electrode into the position shown in dotted lines in Fig. 5. As the armature moves back under the action of the spring Z the spring V follows it up and finally brings the armature O into contact with its magnet M and restores the connection.

Instead of mounting the spring V and armature-lever L independently, as shown in Figs. 3, 4, and 5, said spring V might be attached to the lever L, as shown in Fig. 7. There would be in this case essentially the same principle of action, since the lever L could make a considerable movement before straining the spring V sufficient to separate the electrodes, and when the separation is effected the spring would throw the lower electrode away to its full extent, and contact would only be re-established after the retraction of the lever L to or near its original starting position.

It is of course to be understood that the circuit-controller referred to is the one by which the magnet K is thrown into and out of action to give the reciprocating movements to the lever L, and to constitute, in connection with said magnet and armature lever, with its pawl, the essential parts of an electric motor having a vibratory or reciprocating action.

As will presently appear the constructions and arrangements are such that when the electrodes of the circuit-controller are in contact the magnet K or other magnet operating on the lever L is in condition to draw the same up when said magnet acquires sufficient power, while when the electrodes are separated the lever L is subjected only to the superior retracting force of its retracting-spring Z.

One arrangement of circuit that may be employed in practice for securing the desired arc-forming and carbon-feeding actions is illustrated in Fig. 3.

The electro-magnet D is of low resistance, and is placed in the main circuit to the carbons in any desired manner. The electro-magnet K is in a derived circuit of high resistance, which includes the coils of the magnet and the electrodes $m$ $n$ of the circuit-controller. When no current is passing, the electro-magnet D, not being energized, does not exert any supporting influence upon the bearings $B^2$ for the shaft S, and the latter being down the carbons are in contact. The circuit through the coils K is completed through the circuit-controller, and the lever L is retracted by its spring Z. When the current passes, electro-magnet D raises the bearings $B^2$ for the shaft S and lifts the shaft so as to carry with it the carrier R and the upper carbon E, thus forming the arc. As the arc lengthens, the magnet K draws the lever L forward, and the pawl B turns the wheel T and the shaft S, thus causing the nut to move downward and the upper carbon to approach the lower. The movement of the lever L continues until the points of the circuit-controller are separated, as before explained, and it is then drawn back by the spring Z, so that its pawl B will take a fresh hold on the ratchet-wheel T. If the feed of the carbon has not been sufficient to produce equilibrium of the retractor Z and the force of the derived-circuit magnet K, the lever L will be drawn up again and the operation will be repeated until the arc is restored to normal length. In these actions the movements of the lever and pawl are full and complete in both directions, because separation of the points of the electrodes does not occur until the lever has completed its forward movement, and when separation is effected the electrodes are drawn so far apart by the action of the spring V that they do not come together into contact until the lever L has completed a movement backward to such an extent as to permit the pawl B to engage with a fresh tooth.

The magnet M, and armature O, by which the points of the electrodes are held together constitutes a detent device which normally holds the electrodes together by positive mechanical action, while the spring V is a means for separating the electrodes to their full extent when the armature O is detached.

It obviously would not change the essential character of the mechanism if the operating-pawl B, instead of being carried by the lever L, were operated by another magnet whose circuit should be controlled by the circuit-controller that is operated by lever L. Such an arrangement is indicated in Fig. 7, where the separate or independent motor-magnet for operating the pawl is indicated at D′, and is connected with the circuit-controller in such way that the latter, when its electrodes are in contact, shunts current from the magnet D′. The magnet K, in this case is in an uninterrupted derived circuit, and the action of the magnet D′, in operating the pawl is made sufficient to feed the carbon to such extent that the magnet K shall decrease in power sufficiently to permit the retractor Z to draw the lever L back.

The electrodes of the circuit-controller are carried, one by a fixed support or screw-contact C, while the other is carried from the end of the spring V, supporting the armature O. Spring V, as before stated, is attached directly to the lever L, but is employed to permit the lever L to move to a considerable extent without separating the contacts of the electrodes and to also operate to remove the electrodes to a considerable distance when the lever L has imparted a considerable strain to the spring. The derived-circuit magnet K, Fig. 7, might also have an interrupter, as in Fig. 3, in order to produce a repetition of the feeding action.

It is not necessary that any means be provided for preventing the rod R from rotating, although in some instances it may be desirable to apply a key, slot, or spline. In general the inertia of the carrier and its parts will be sufficient to cause the screw S to turn in the nut M during the feeding action, so as to produce a lowering of the upper-carbon carrier R.

It is to be understood that the power of the magnet D is sufficient to sustain the bearings $B^2$ and the shaft S in fixed position during normal operation of the lamp, the feed motion or compensation for wasting of the carbons being produced by the rotating movement of the shaft S on said bearings.

In place of the pawl B and ratchet-wheel G other mechanical devices might be employed and operated by the electro-magnet energized or controlled by the derived-circuit current, and other means or mechanical devices might be used for imparting a rotating movement to the shaft from the mechanism operated by the electric-motor devices or other mechanism controlled or operated by the derived-circuit magnet.

What I claim as my invention is—

1. The combination, substantially as described, of the nut end, to which the carbon-carrier is attached, the screw-shaft S, extending downwardly through the same, a bearing $B^2$ for said shaft above the nut, a main-circuit magnet for lifting the shaft, a wheel or pinion P on said shaft, a second wheel or pinion G, gearing therewith, and an actuating-pawl and derived-circuit magnet for operating the latter, as and for the purpose described.

2. The combination, in an electric lamp, of mechanism for feeding the carbon step by step, an operating electro-magnet for said mechanism, a circuit-controller, one part of which is mounted in a support adapted to move independently of its actuating-lever, and a magnet and armature, one of which is carried by the movable portion of the circuit-controller while the other is mounted on a fixed support, whereby the parts of the circuit-controller are held temporarily in contact, as and for the purpose described.

3. The combination, with the mechanism

for feeding the carbon, of an impelling electro-magnet, a reciprocating pawl worked thereby, a circuit-controller held in one of its positions by a positively-acting detaining mechanism, and a spring for throwing the circuit-controller when it is disengaged from said detaining mechanism.

4. The combination, with the vibratory electric motor having a reciprocating impelling device, of a circuit-controller having a magnet and armature by whose contact the parts are held in one position, and a spring interposed between said magnet or armature and the device which acts to disengage them.

5. The combination, with the feed mechanism and the motor-magnet for moving the same step by step, of a circuit-controller, a detaining device for holding the parts of the circuit-controller from movement with relation to one another, and means for giving the parts their full relative movement after disengagement of the detaining device when the motor-magnet armature has nearly completed its movement.

6. The combination, with the step-by-step feed mechanism, of the vibratory armature, a driving-pawl, a circuit-controller for the motor-magnet, a magnet and armature by whose contacts the electrodes of the circuit-controller are held from movement during movement of the armature, and a spring for producing a separation of the electrodes to their full extent and independently of the motion of the parts by which the magnet and armature are detached.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 16th day of March, A. D. 1886.

ELIHU THOMSON.

Witnesses:
M. L. THOMSON,
WM. F. NOONAN.