(No Model.)

E. THOMSON & E. W. RICE.

ELECTRIC ARC LAMP.

No. 306,119. Patented Oct. 7, 1884.

Fig. 1.

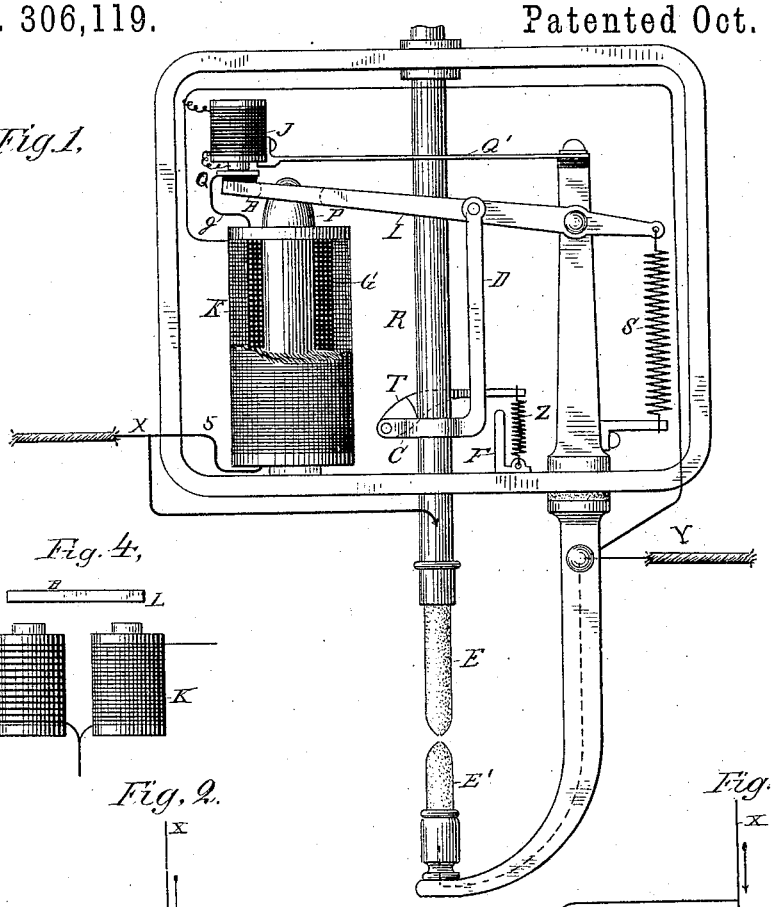


Fig. 4.

Fig. 2.

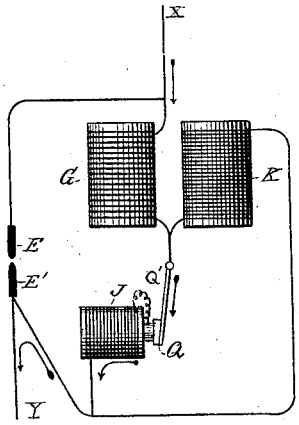


Fig. 3.

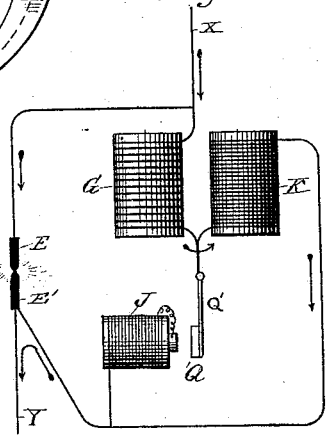
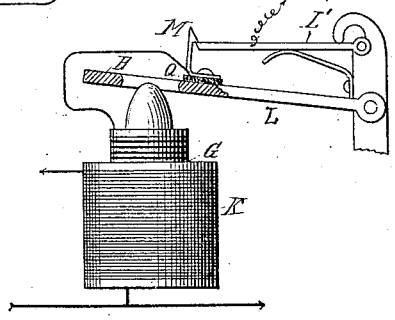


Fig. 5.



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UNITED STATES PATENT OFFICE.

ELIHU THOMSON AND E. WILBUR RICE, OF LYNN, MASS., ASSIGNORS TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF CONN.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 306,119, dated October 7, 1884.

Application filed January 4, 1884. (No model.)

To all whom it may concern:

Be it known that we, ELIHU THOMSON and E. WILBUR RICE, citizens of the United States, and residents of Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

The general object of our invention is to construct a simple and efficient electric-arc lamp in which the proper control of the carbons, while the lamp is in action, shall be dependent upon the governing action of a derived-circuit magnet or coil only, acting in opposition to a suitable retractor, in contradistinction to those lamps in which the control is dependent upon the differential action of main and derived circuit coils or magnets.

Our invention consists in dividing the regulating-coils of high resistance in a derived circuit around the carbons into two portions, one of which portions is shunted or cut out of circuit when the lamp is out of action, or at the moment the current is turned on, so that when the current begins to flow it flows through the unshunted portion. By reason of the comparatively small resistance of the latter as compared with the whole resistance of the derived-circuit regulating-coils, sufficient current flows in said unshunted coils to attract the regulating armature or lever from its extreme retracted position, or to otherwise act upon the lamp mechanism so as to put the lamp or its parts into working condition or relation, whereupon the shunted or cut-out portion of the coil is automatically put into circuit, and the current thereupon flows through the whole regulating-coil of high resistance in the ordinary way, and the operation of feeding the carbons or controlling the position of the same then proceeds under the controlling action of the fluctuating current in said coil in a manner well understood in the art. The means for cutting out a portion of the derived-circuit coils and leaving the other portion in, or for introducing the cut-out portion into circuit again when the lamp has started, may be largely modified, the principle being that the currents shall flow only in a portion of said coils to start the lamp, but shall afterward flow through all of said coils in the ordinary way until, by the stopping of the lamp or the abnormal decrease of current in the carbon-circuit, the lamp mechanism shall cease to act. The feed-regulating mechanism controlled by the derived-circuit magnet or coils may be of any desired construction, and may be operated by the lever or armature of the derived-circuit magnet in any desired manner. We have herein shown a clutch or clamp for this purpose, but do not limit ourselves to such device for directly controlling the movements of the carbon or carbon-carrier. The circuit-controller or switch may be actuated by the armature-lever of the derived-circuit magnet, or by any other device which shall produce the proper changes of position in said switch, so as to cut out the larger portion of the derived-circuit coil at the proper time, or to introduce it into the circuit. We have herein shown a lamp in which the clutch or feed-regulating mechanism tends to lift the carbon-carrier or to prevent the carbon-carrier from feeding down when the lamp is out of action and the feed-regulating armature is abnormally retracted; but our invention might be carried out by the employment of a lamp in which the carbons should be together at the start. In this case auxiliary means would be employed for keeping the carbon-circuit temporarily open or of great resistance, in order to force the circuit into the unshunted portion of the derived-circuit regulating-magnet.

Some of the various forms or constructions that our invention may take in practice and some of the kinds of the switching or circuit-controlling devices and methods of operating them are illustrated in the accompanying drawings, in which—

Figure 1 is an elevation of a lamp embodying our invention. Fig. 2 is a diagram illustrating the circuits of the apparatus when the lamp is out of action. Fig. 3 illustrates the condition of the circuits when the lamp is burning. Fig. 4 illustrates a modified arrangement or form of the derived-circuit magnet that controls the feed. Fig. 5 shows another form of switch or circuit-controller that may

be employed in place of the form shown in Fig. 1.

On Fig. 1, R indicates the usual carbon rod or carrier, to which the upper carbon, E, is secured, while L indicates the feed-controlling or carbon-adjusting lever or other moving device controlled by the derived-circuit magnet acting upon an armature attached to said lever and in opposition to a retractor consisting of a spring, S. In the present instance the lever L is connected by a link, D, with a clamp or clutch which is of the same general form as is shown in prior patents granted to E. Thomson, and consists, briefly speaking, of a clamp-body, C, through which the rod R moves, a pivoted clamping toe or jaw, T, a spring, Z, that tends to keep the clamp engaged with the rod R, and a releasing-stop, F, which releases the clamp from the rod and permits the latter to move downward freely whenever the clutch is lowered sufficiently to bring an arm extending from the toe against the stop. The special form of feeding mechanism is of no moment, provided it be adapted to be governed by the variations in strength of the derived-circuit magnet acting against or opposing the power of a spring or weight which tends to lift the upper carbon-carrier.

P indicates the pole of the derived-circuit magnet which acts upon the perforated armature B, connected to lever L. This construction, as described in a prior patent granted to E. Thomson, gives the same magnetic pull upon the armature in all positions of the same with the same strength of current.

K and G indicate the two portions of a derived-circuit coil of high resistance included in the ordinary derived circuit around the carbons, which circuit is indicated by the numeral 5, and, starting from a point, X, on one side of the lamp, passes through the derived-circuit coils and teminates at the point Y on the opposite side of the lamp. This circuit forms one of the general conducting-paths through the lamp, the other path being that through the carbons E E'. The derived-circuit coil is formed into two portions by taking a connection, *g*, from an intermediate part of said coils, so as to make the portion G smaller than the portion K. From the point *g* connection is made to a suitable circuit-controlling device, whereby when the lamp is out of action, or at the moment the current is turned on, the portion K of the coils will be shunted or cut out.

The shunting device shown in Fig. 1 consists of insulated contacts Q—one carried by the armature B or lever L, and the other a spring-actuated contact carried by a spring, Q'—that, when free to act, will hold its contact at a sufficient height to prevent the contact on B from touching it while the armature B vibrates within the ordinary range necessary to control properly the position of the upper carbon. When, however, the lever L is retracted to an extreme position, the contacts Q are closed, and the portion K of the derived-circuit coil is shunted in obvious manner, so that when the current is turned on it passes only through the portion G of the coils, and the latter, being of low resistance as compared with the total ordinary resistance of coils K G combined, carries sufficient current to pull down the armature from an extreme retracted position and to bring the feed-regulating clutch or other device into normal operating range. In such downward movement the circuit through contacts Q is maintained by means of an electro-magnet, J, in the shunt-circuit around K, or in a suitable circuit closed simultaneously with the same, which magnet is of low resistance, is mounted upon one member of the circuit-closer, and acts upon an armature attached to the other portion, so as to keep the contacts Q closed until the lever L is drawn down so far as to release the upper carbon, thus permitting the circuit of low resistance through the carbons to be closed, and the current to be thus shunted from the magnet J. When this occurs the spring Q' separates the contacts Q, thus causing the currents to flow in the coils G and K as the coils of high resistance. When the carbons are brought into contact, as above described, and simultaneously, the current which first flowed through a portion only of a derived-circuit coil is now compelled to flow through them all, the pull upon armature B is so much lessened that the spring S prevails and lifts the clutch and upper carbon, so as to form the arc. The lifting movement continues until sufficient current flows in the derived circuit, owing to increased arc resistance, to make the pull of the derived-circuit magnet balance the pull of the spring or retractor S. When current ceases to flow through the carbons, the lever L is retracted to its extreme position, and the contacts Q are thus closed ready for the next starting of the lamp.

As shown in Fig. 1, the contacts Q are formed by the core and armature of magnet J; but this, obviously, is not necessary, as said armature might be attached to some other portion of the lever.

The operation is as follows: The carbons being held separate at the start by the spring S, the current passes, as indicated in Fig. 2, from X through G to Q, thence through J, energizing the same, and out at Y. Little or no current passes in K, and there results a lowering of L by the magnetic effect of G to a point sufficient to release the carbons and permit them to come together. At this instant the current is almost completely shunted from J and G. The spring Q', whose power is properly adjusted for this purpose, now acts to separate contacts Q. The current now passes, as in Fig. 3, from X through E E' to Y, and the effects of current in G K are so small that spring S lifts the clutch and the carbon. A small portion of the current passes through G, through K, and out at Y, this portion being

sufficient to regulate the arc formed at E E′, and being small on account of the added resistance of G and K being high. The contacts Q are now open, and the spring Q′ keeps them open during normal working of the lamp by sustaining the upper contact in an elevated position. Of course it will be seen that the two parts of the derived circuit G K may be upon separate cores and act cojointly upon L, as indicated in Fig. 4.

Instead of the shunting-switch or circuit-controller of Fig. 1, other devices may be used, such, for instance, as that shown in Fig. 5, which is purely mechanical in its action. In this case the contacts Q are unlocked or opened by the mechanical action of the parts when lever L has been drawn to a proper point. A catch, M, on lever L engages with a circuit-closing lever, L′, when the lever L is retracted to an extreme position, and the contacts Q are thus closed, and, as before, shunt or cut out the portion K of the derived-circuit coil. As the lever L moves down the catch is disengaged from L′ at a point where the clutch will have reached the releasing-point, such disengagement being brought about by reason of the fact that the point of L′ moves in the arc of a circle and gradually away from the catch M. When this occurs, the contacts Q are opened and at the same time the spring acting on L′ throws it up, so that the contacts Q will not complete the shunt-circuit around the coils K during vibrations of L in the range required of it in properly regulating the arc.

Other switch devices might be used for accomplishing the same object, and we do not limit ourselves as to this detail element of the combination. The coil K may also be rendered electrically inoperative by other arrangements of circuits and switching-contacts that will readily occur to those skilled in the art. The coils G may be of the same or of different sizes of wire. The coil G might be of coarser wire than K, but in any case it forms a portion of the derived-circuit regulating-coils in a derived circuit of high resistance around the carbons.

What we claim as our invention is—

1. The combination, in an electric-arc lamp, of a feed-regulating coil in a derived circuit of high resistance, and having a portion of its coils cut out or ineffective at the time that current begins to flow, and means for automatically restoring said portion of the coils to their normal or feed-regulating relation when the lamp has been started, as and for the purpose described.

2. In an electric lamp, the combination of a feed-regulating magnet whose coils are in a circuit of high resistance around the carbons during operation of the lamp, a circuit closer or controller whereby at starting a portion of said coils are cut out, leaving another portion in circuit to act upon the feed-regulating devices, and means for automatically restoring said first-named portion of the coils to their normal or feed-regulating relation when the lamp has been started, as and for the purpose described.

3. An electric lamp constructed to offer two paths for the current, one through the carbons and the other through a derived-circuit magnet of high resistance, the major portion of whose coils before the lamp is started is shunted or cut out, in combination with a circuit-controller or switch controlling said major portion, as and for the purpose described.

4. In an electric lamp constructed to offer two conducting-paths to the current, one through the carbons and the other through a derived circuit of high resistance containing a regulating-magnet, a circuit-controller or switch that normally, or when the lamp is out of action, shunts a portion of the coils, in combination with means whereby the said shunt may be opened when the feed mechanism has reached a point where the carbons may come into contact, as and for the purpose described.

5. The combination, in an electric lamp, of a feed-regulating magnet in a derived circuit of high resistance, a circuit-controller or switch through which the major portion of said coils are shunted, and means whereby said shunt may be broken when the current circulating in the coils remaining in circuit has moved the magnet-armature to a point where the lamp may continue to operate under the combined action of the current circulating in all of the derived-circuit coils, and of a suitable retractor or opposing device.

6. The combination, in an electric lamp, of a derived-circuit magnet wound with coarse and fine wire, forming together the derived-circuit regulating-helix of high resistance around the carbons when the lamp is in action, and means for automatically cutting the fine-wire portion of said coil in and out of circuit, as and for the purpose described, so that the lamp may be started into action by the current flowing in the coarse-wire portion of said coils, and after starting may continue in operation by the action of the current circulating in all of the coils, as and for the purpose described.

7. In an electric-arc lamp, the combination of a derived-circuit regulating magnet or coil of high resistance, a feed-regulating mechanism actuated by a connection with the lever of said magnet, and means for cutting out a portion of the coils on said magnet when the feed-regulating armature is retracted to its extreme position, as and for the purpose described.

8. In an electric lamp constructed to offer two conducting-paths to the electric current, one path through the carbons and the other through the feed-regulating magnet or coil in a derived circuit of high resistance, a circuit-controller or switch that cuts out a portion of the derived-circuit coils when the feed-regulating armature is retracted beyond its ordinary

range in the operation of controlling the feed, and means for breaking the cut-out circuit when the armature or lever has been drawn into its feed-regulating range by the action of current circulating through the portion of coils that remain constantly in circuit.

9. The combination, in an electric lamp, of a derived-circuit magnet of high resistance, a circuit-controller or switch that completes a circuit around a portion of the coils when the feed-regulating armature or lever is retracted out of its ordinary or feed-regulating range, and a magnet in a circuit completed by the armature of lever when retracted to an abnormal extent, for keeping the cut-out circuit temporarily closed.

10. The combination, in an electric lamp having a double-coil derived-circuit magnet, one of which coils is shunted when the feed-regulating armature is abnormally retracted while the other remains in circuit, of a magnet energized by the current flowing in such shunt for holding said shunt temporarily closed at starting the lamp, feed mechanism that engages with the carbon-carrier to keep the carbons separated when no current is passing, and means to release the carbon when the feed-regulating lever is drawn forward by the current flowing in the unshunted portion of the derived-circuit coil, so as to permit the carbon-circuit to be formed and the temporary shunt to be opened by the shunting of current from the magnet in it.

11. The combination, in an electric lamp, of a derived-circuit feed-regulating magnet, a feed-regulating armature or lever controlled thereby, a clamp or clutch actuated by said lever, a circuit-closer for shunting a portion of the derived-circuit coils when the feed-regulating lever is abnormally retracted, a magnet for temporarily keeping said shunt closed, a retractor for the lever that, when the lamp is out of action, holds the carbons apart, and a releasing stop or detent that permits a release of the carbon when the lever is actuated by the unshunted portion of the derived-circuit coils, as and for the purpose described.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 21st day of December, A. D. 1883.

ELIHU THOMSON.
E. WILBUR RICE.

Witnesses:
HARRY B. ROGERS,
MATTIE S. WALKER.