(No Model.)

E. THOMSON & E. W. RICE.

ELECTRIC ARC LAMP.

No. 306,118. Patented Oct. 7, 1884.

Fig. 1.

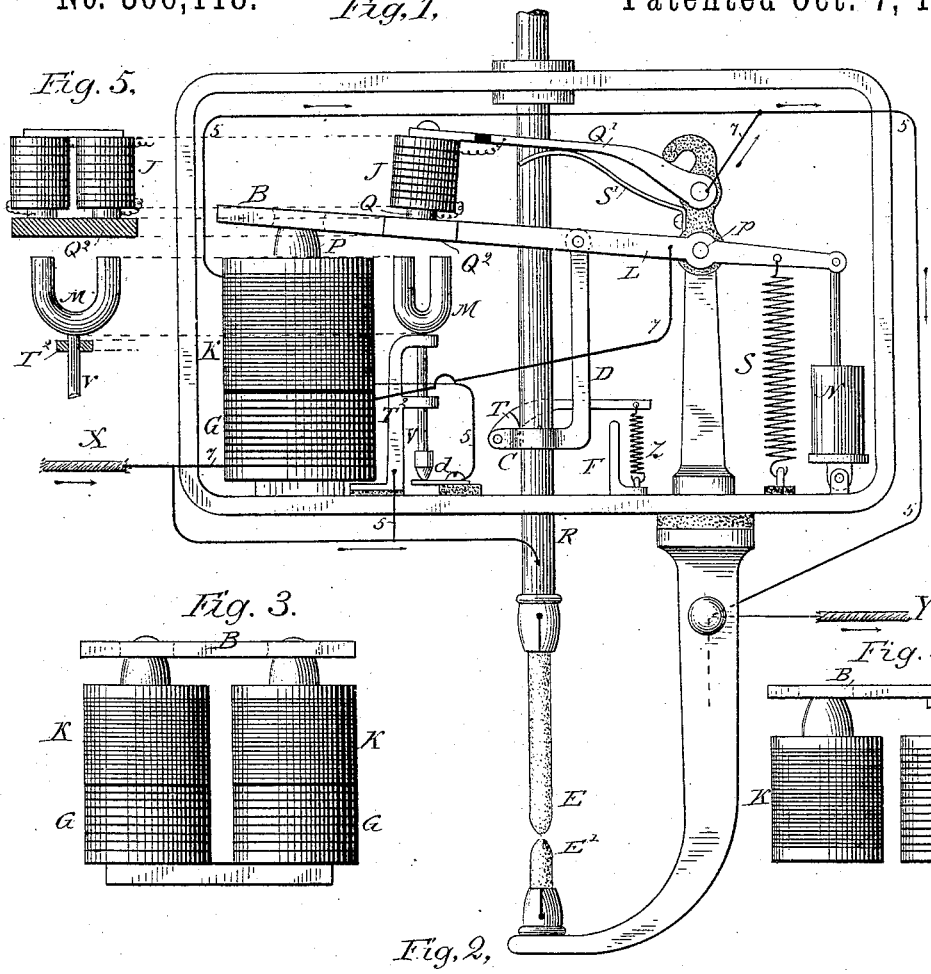
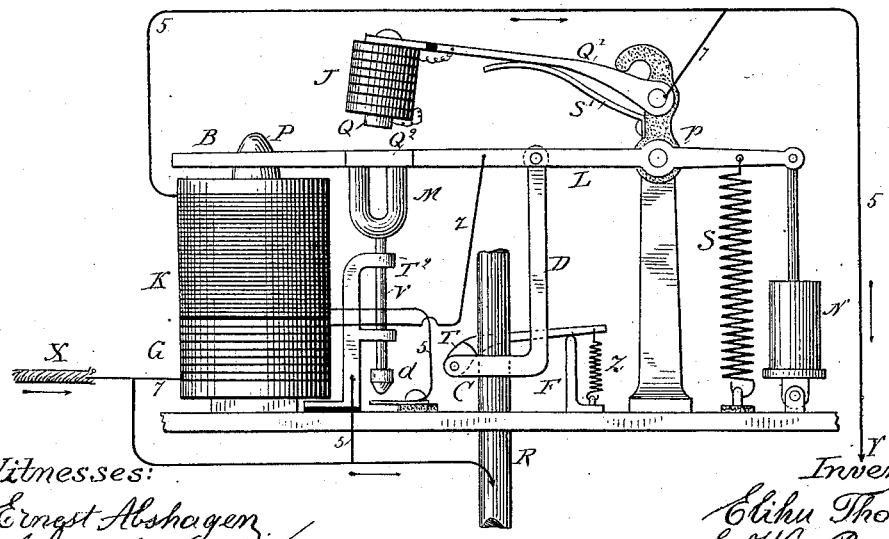


Fig. 5.

Fig. 3.

Fig. 4.

Fig. 2.



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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 CONNECTICUT.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 306,118, dated October 7, 1884.

Application filed January 5, 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.

Our invention relates, generally speaking, to a class of electric-arc lamps described and claimed in other applications for patent filed jointly or severally by us. In such other cases we have described a lamp in which the lamp mechanism for the purpose of producing the proper adjustment of the carbons is under the control only of the current in a high-resistance derived circuit, and the starting of the lamp or the bringing of the mechanism into proper operating position is effected by means of current in a starting coil or circuit which is closed or in operative condition when the lamp is out of action or is about to start, and is immediately and automatically opened or thrown out of condition by a circuit-controller or switch when the lamp mechanism has been brought into operative position by the agency of such starting circuit or coil, and is kept open so long as the lamp continues to operate properly. A lamp operating on this principle is described and broadly claimed in our application filed January 3, 1884, No. 116,300.

Our present invention relates more particularly to the construction and operation of the circuit-controller, whereby the starting circuit or coil is rendered ineffective or inoperative, or is made effective and kept so until its function is accomplished.

Our invention consists, briefly speaking, in keeping the circuit-controller in proper position to retain the starting-circuit in the required relation for starting the lamp when the current is turned on, by means of an electro-magnet whose coils are in a branch around the carbons closed when the current begins to flow, so that it will be energized to hold the contacts of the circuit-controller closed until the carbons are permitted to come together, whereupon said magnet-coils will be shunted, and the circuit-controller will thus be permitted to return to a position in which the starting circuit or coil will be opened or otherwise rendered ineffective, and will remain in such condition while the lamp continues to act. In the present instance we have shown our invention as applied to a lamp in which the starting circuit or coil consists of an auxiliary branch or circuit around the carbons, and contains a starting electro-magnetic coil. In such case the switch-governing magnet is naturally placed in the starting-circuit; but such arrangement is obviously not necessary, and the principle above set out may as well be carried out with other arrangements in which other arrangements of starting coils or circuits shall be employed, and in which the circuit of the controlling-magnet might be independent of or separate from that of the starting-coil or other starting device.

Our invention consists, also, in certain other combinations of devices and apparatus that will be specified more fully in the claims, the objects of such combinations being to simplify the combinations or arrangement, and to further provide means whereby the coils of the high-resistance derived-circuit magnet may be saved from injury upon the failure of the lamp to feed, the latter object being effected by automatically breaking the circuit of such coils.

In the accompanying drawings, Figure 1 is an elevation of a lamp, showing the application of our present invention to a lamp in which the starting circuit or coil is an electro-magnetic coil in a branch around the carbons closed at starting of the lamp. Fig. 2 shows the position of the parts at the instant of breaking of the circuit of the high-resistance regulating-coils. Fig. 3 shows the form of feed-regulating magnet. Fig. 4 shows a modified disposition of the starting and feed-regulating coils. Fig. 5 is a detail of construction.

Referring to Fig. 1, R indicates the ordinary carbon-holder for the upper or positive carbon of an electric-arc lamp, and E E′, respectively, the positive and negative carbons.

L indicates a feed-regulating lever, pivoted at *p*, and acted upon by the opposing influences of a retractor, S, and of current flowing in a high-resistance derived circuit around the carbons. The influence of such current is brought to bear in the present case in the

ordinary way by means of a high-resistance magnet whose coils K are in the ordinary high-resistance shunt around the carbons indicated by the numeral 5, which magnet acts upon a core or armature connected to L. The shunt 5 includes a circuit-breaker, V, whose function is to open the circuit 5 when the armature B is drawn down close to the head of K.

The construction and operation of V will be described farther on.

P is the pole of the magnet, and B a perforated armature attached to L and embracing the conoidal or paraboloidal pole P. This form is adopted in order that the magnet may exert the same pull upon the lever L in all positions of the armature for the same strength of current. The magnet, wound with coils K, is preferably a horseshoe-magnet, as indicated in Fig. 3. It is, however, to be understood that our invention is not limited to any particular form or construction of the magnet system.

Lever L is the feed regulating or controlling lever of the lamp, and serves to adjust the position of the carbons by acting directly or indirectly upon any suitable devices that will, when moved in one direction, raise the upper carbon, and when moved in the other direction to a certain extent will permit the carbon to feed or approach the opposite carbon. As typical of such devices, we have herein shown a clamp or clutch connected with lever L by a link, D, so as to be raised or lowered by said lever, or held stationary, according to the relative strength of the current in the high-resistance regulating-circuit 5, and the strength of the retractor for the lever. Any other device or devices may be used in place of the clutch, provided they be of proper construction to cause a release of the carbon when moved in one direction, and to lift the carbon when moved in the opposite direction. The clutch here shown is of the form heretofore invented by E. Thomson, and consists, briefly speaking, of a clamp body or guide, C, through which the carbon or carbon-carrier may move, a dog or toe, T, pivoted on said body and held normally in engagement with the carbon or carrier by means of a spring, Z, applied to an arm extending from the toe, so as to prevent the carbon from moving downward through the clutch, and a stop, F, with which the arm engages to release the toe and permit the carbon to feed down whenever the clamp is lowered to a sufficient extent by the regulating-lever or other device L.

The starting-circuit is indicated by the numeral 7, and includes the coils G, of low resistance, wound preferably on the same core with coils K, as described and claimed in an application for patent filed by us January 3, 1884, No. 116,300. This circuit is completed whenever the armature-lever L is retracted to an extreme position by the contacts Q, one of which is on said lever or some other portion of the lamp mechanism moving therewith, and the other upon a switch or circuit-closing lever, Q'. The latter contact is shown as an insulated contact on the end of the core of a magnet, J, whose coils are also in the circuit 7, through the insulated circuit-closing lever Q', as indicated.

A retracting-spring for the switch Q' is indicated at S'. While the lamp is in action this spring holds the switch raised to an extreme position, such that the lever L will not close the contacts Q in its ordinary movements in adjusting the carbons. An armature, Q^2, for magnet J is attached to L, so that when the contacts Q are closed and current flows in the circuit 5, the levers Q' and L are compelled to move together, and the contact at Q is preserved by the action of said magnet during the downward movement of the lever under the action of current in the coil G. The starting-circuit 7 is a branch around the carbons, and, as is obvious, is closed by contacts Q when the lever L is retracted to its extreme position, owing to the cessation of current in K, produced either by design or accident. When thus retracted, the upper carbon is raised, and, there being no contact between the carbons, current upon the general circuit must pass in large measure through 7. If, however, the circuit between the carbons is completed, the current is shunted from the branch 7 and coils of J, so that the spring S' then opens the contacts Q and raises the lever Q', so as to leave and preserve the lamp-circuits in their ordinary or normal condition—viz., in such condition that the paths of the current consist only of a low-resistance path through the carbons, and a high-resistance regulating-path through the coils K and around the carbons. The circuit-breaker V moves in a suitable conducting-guide, T^2, and when at rest completes the circuit 5 by closing contacts *d*, the circuit from X being then through T^2, V, *d*, the coils of K, and out at Y. The circuit-breaker V carries a magnet, M, (here shown as a permanent magnet,) whose armature is armature Q^2 for magnet J. The magnet is arranged in the path of the armature, so that, as will be obvious, if said armature be lowered sufficiently, the magnet will be drawn up and will stick to Q^2, thus opening contacts *d* and breaking the circuit 5 for coils K. The adjustments are such that when B is drawn down nearly flat upon the magnet, owing to an abnormal resistance in the arc branch, the permanent magnet will be so near to Q^2 as to rise thereto and stick, opening the derived circuit at *d*. Upon an elevation of B it will continue so to stick, and, being carried upward, will keep open the derived circuit through K at *d*. The adjustments are also such that when the magnet J is attracted to Q^2 the polarization induced by it in the armature Q^2 shall be the opposite of that induced by M, the consequence being that when current flows in coils of J magnet M falls off and again closes contacts at *d*. The adjustments

are also such that the spring S will, upon an abnormally-weak current in K, close the contacts Q, as before mentioned. The carbons E E′ are set a small space apart before sending current through the lamp.

The operation is as follows: When the lamp is out of action, the parts assume the position shown in Fig. 1, and contacts Q are closed. Current entering at X, not finding circuit at E E′, passes through coils G, of comparatively coarse wire, thence to L, to Q, through J to Q′, and out at Y. A very small portion of current passes from X through the very fine-wire coil K and out at Y, but its amount is insignificant or almost *nil*. The passage of the current, as just described, energizes both magnet with coils K, and magnet J S′, being a much weaker spring than S, the result is that B L descends, lowering clutch C, while magnet J still sticks to armature Q^2 and keeps contacts Q closed. When, however, the carbons are permitted to make contact by the continued lowering of clutch C, the current in large proportion leaves G and J to take the branch through E E′. This results in the springing away of Q′ under the action of S′, and the starting-circuit 7 is opened at Q. The spring S now asserts itself and separates the carbon, but is restrained in that action by the consequent energizing of the derived-circuit magnet due to the formation of an arc at E E′. The lamp is now in charge of high-resistance coil K, to regulate and feed the carbons by attracting its armature B against the action of its retractor. Should the carbons by accident slip too near together, the derived-circuit magnet will be rendered nearly inactive, the spring S will cause contact at Q, and the actions as at the start will be repeated. It is advisable that a dash-pot or other check, N, acting on L, be provided to prevent too sudden movements. Should a long arc form at E E′, due to a failure to feed, the armature B is drawn down, bringing armature Q^2 within range of magnet M, which latter jumps into contact with Q^2 and opens contacts *d*, as indicated in Fig. 2. The circuit is now complete only through the arc at E E′. The result is the retraction of B by S, followed by M until contact is established at Q, when M immediately drops off, as before described. The closing of contacts Q diverts current into G, the arc at E E′ is extinguished, and the actions as at the start of the lamp are repeated, when, should the carbons again come into contact, the arc is again re-established.

We do not limit ourselves in any particular in the application of the devices herein described to the purposes of our invention; but may variously modify them by equivalent constructions of a more or less simple character.

We have herein described a lamp in which the magnetizing effects of the current are used for producing the desired mechanical operations; but we wish it to be understood that we include as an equivalent of electro-magnetic coils any devices whereby mechanical effects may be produced by electricity.

We make no broad claim herein to the combination, with the switch, of the magnet (electro or permanent) moving with the mechanism for keeping the contacts together, as this forms the subject of claims in an application filed by E. Thomson, as sole inventor, January 8, 1884, No. 116,746.

What we claim as our invention is—

1. The combination, in an electric lamp having a starting circuit or coil in a branch around the carbons, of a circuit-controller for completing said circuit, and an electro-magnet keeping the contacts of the circuit-controller in contact until the carbons come together, and thus shunt the current from the electro-magnet.

2. The combination, in an electric lamp, of an auxiliary or starting electro-magnetic coil in a branch around the carbons, and an electro-magnet in said branch for keeping said branch closed until the carbons come together.

3. The combination, in an electric lamp, of a feed-regulating armature-lever, an electro-magnetic coil acting upon the same to cause a release of the carbons, and placed in an auxiliary branch around the carbons, circuit-closing contacts for completing said branch, and an electro-magnet in said branch for acting on said contacts, whereby said branch may be kept closed until the carbons come into contact, and may then be opened, owing to the shunting of current from the magnet.

4. The combination, in an electric lamp, of a high-resistance derived circuit, feed-regulating mechanism controlled by the current therein, an auxiliary branch containing an assisting-coil for bringing the lamp into action, and an electro-magnet in said branch for keeping the same closed until contact of the carbons is effected.

5. The combination, in an electric-arc lamp, of a high-resistance derived-circuit magnet, feed-regulating mechanism controlled thereby, a circuit-controller or switch for completing an auxiliary branch around the carbons and through an assisting-coil wound on the same core with the high-resistance derived-circuit magnet, and an electro-magnet in the branch for keeping the circuit-controller in position to close the branch until contact of the carbons is effected.

6. The combination, in an electric-arc lamp, of an auxiliary or starting coil in a branch around the carbons, a freely-movable circuit-closer, through which the branch is completed when the lamp mechanism is retracted to an extreme position, and an electro-magnet and armature for keeping the contact-points of the circuit-closer together during forward movement of the mechanism, the coils of said magnet being in the branch, as and for the purpose described.

7. The combination, in an electric lamp, of

an auxiliary or starting circuit or coil in a branch around the carbons, a circuit-closing lever normally held out of range of the lamp mechanism, but adapted to complete the starting-circuit when the lamp mechanism is abnormally retracted, and an electro-magnet and armature for compelling the parts of the circuit-closer to move together when the current is turned on, the coils of said magnet being in the starting-circuit, so that when the carbons come together current will be shunted from said coils, and the actuator for the circuit-closing lever may open the branch and return said lever to its normal position.

8. The combination, in an electric lamp, of a high-resistance regulating-coil, a branch closed by the armature-lever thereof when abnormally retracted, and means for breaking the circuit of said coil when the arc-resistance becomes abnormally high.

9. The combination, in an electric lamp, of a high-resistance derived-circuit regulating-coil, a circuit breaker and closer controlling the circuit thereof, and a permanent magnet and armature, one connected to the lamp mechanism and the other to the circuit-closer, or vice versa, and arranged in the manner described, to open the circuit of the regulating-coil upon an abnormal length of arc, as and for the purpose described.

10. The combination, in an electric lamp, of a circuit-breaker for breaking the circuit of the derived-circuit coils, a permanent magnet connected to said circuit-breaker, an armature carried by the feed-regulating mechanism, and an electro-magnet in an auxiliary or starting branch completed when the armature of the feed-regulating magnet is abnormally retracted, said electro-magnet being adjusted, in the manner described, to act oppositely upon the armature for the permanent magnet, so as to cause a release of the latter.

11. The combination, in an electric lamp, of a fine-wire magnet-coil, K, in a derived circuit around the carbons, a coarse-wire coil, G, on the same core and in a branch around the carbons, and a magnet whose coils are in the branch, and which acts to keep the contacts of the branch circuit closed together, all arranged as described, so that all of said coils are shunted by contact of the carbons, as and for the purpose described.

12. The combination, in an electric lamp, of a starting coil or circuit and an electro-magnet in a branch around the carbons for keeping said starting-circuit in proper condition until, by the establishment of contact between the carbons, said magnet is shunted and thus opens the starting-circuit.

13. The combination, in an electric lamp, of a starting circuit or coil, a circuit-controller whereby said coil may be thrown into or out of operative condition, and an electro-magnet for holding the parts of said circuit-controller in proper relation to keep the starting-circuit in operative condition, the coils of said magnet being in a branch around the carbons, so that the establishment of circuit between the latter will shunt current from the magnet, as and for the purpose described.

14. The armature Q, in combination with the magnet J in a branch, and the magnet M of the circuit-breaker for coils K, said magnets being arranged to polarize the armature reversely, as and for the purpose described.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 1st day of January, A. D. 1884.

ELIHU THOMSON.
E. WILBUR RICE.

Witnesses:
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