(No Model.)

E. THOMSON.

ELECTRIC ARC LAMP.

No. 297,194. Patented Apr. 22, 1884.

Fig. 1,

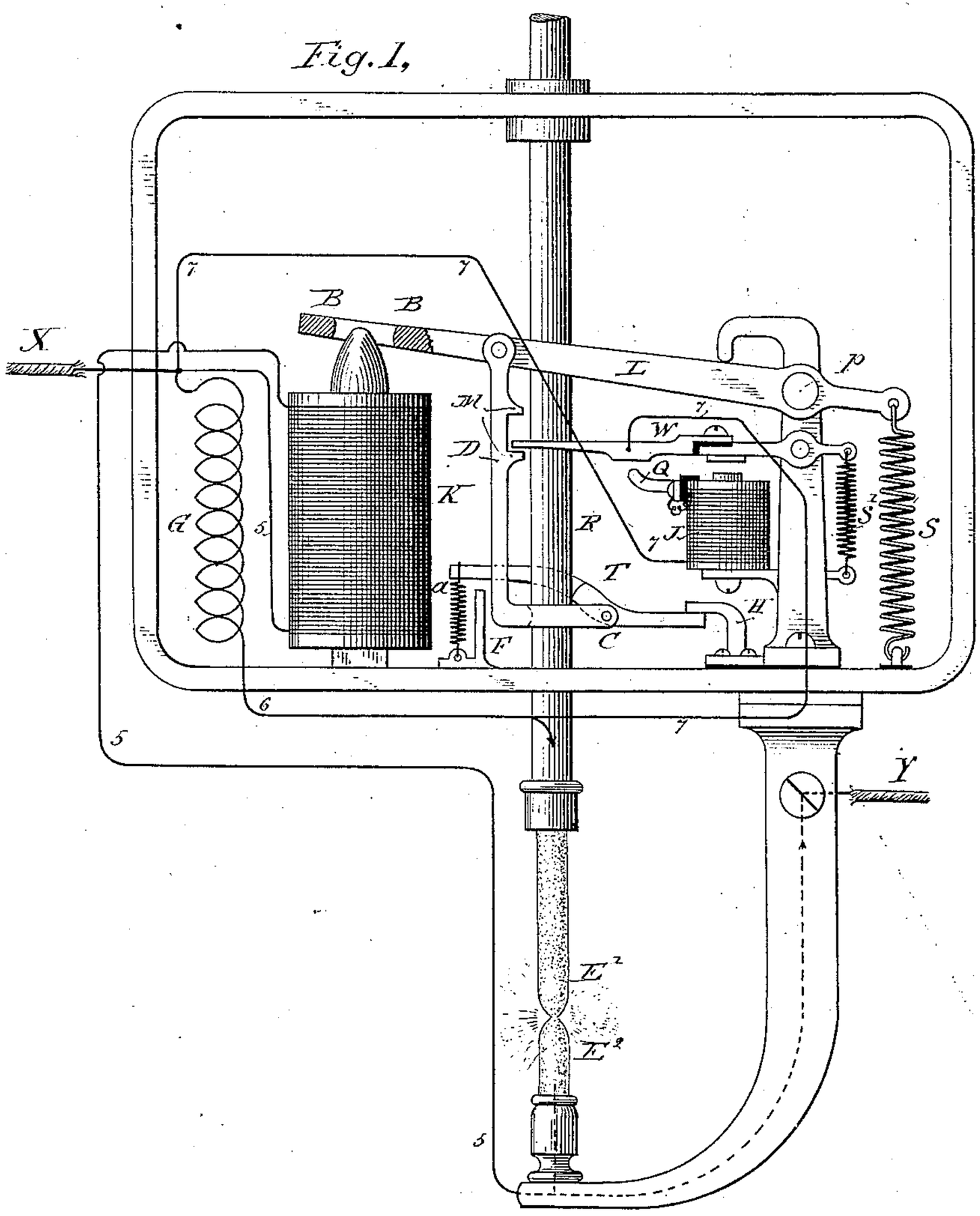


Fig. 2,

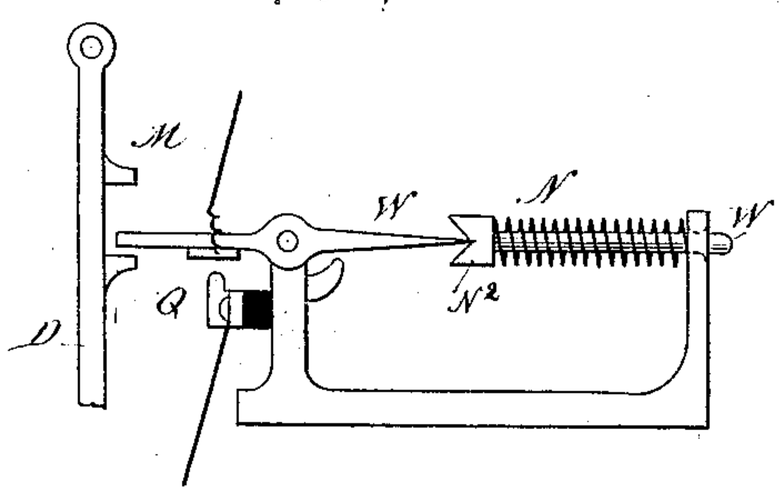
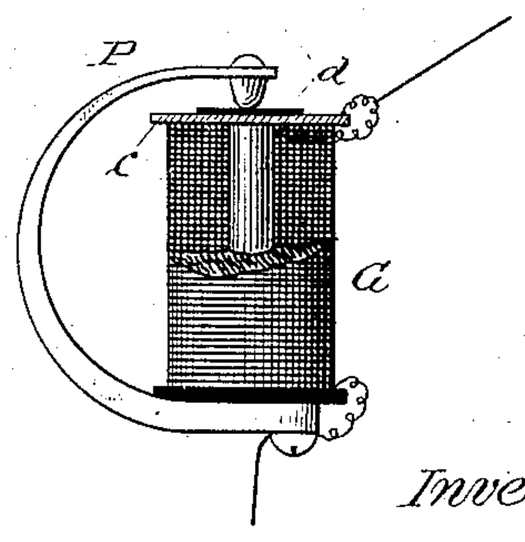


Fig. 3,



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UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF LYNN, MASSACHUSETTS, ASSIGNOR TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF CONNECTICUT.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 297,194, dated April 22, 1884.

Application filed January 4, 1884. (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 Improvements in Electric-Arc Lamps, of which the following is a specification.

My invention relates to the means for regulating the position of the carbons in electric-arc lamps. Its object is to so construct the lamp that the feed-regulating armature, whereby the feed-regulating mechanism is controlled or operated, may be under the sole control of a derived-circuit magnet and retractor, and at the same time the desired operations of separating the carbons to produce the arc and of permitting them to feed to compensate for wasting shall be properly and reliably effected. Where the feed-regulating mechanism of an electric-arc lamp is controlled solely by a derived-circuit magnet, such magnet is at starting of the lamp powerless to effect any movement of the lamp mechanism, owing to its high resistance and the comparatively low resistance of any other path which may be at such time closed through the lamp.

The essential principle of my present invention consists in giving to such magnet or to another magnet in the derived circuit at such time a power sufficient to permit it to start the lamp by means of an artificial resistance, which at starting is in a branch or circuit around the magnet, and acts to force current into said magnet, so that it may receive, for the time being, an abnormal amount of current and be effectively energized to draw up its armature or core and start the lamp. Immediately after this has been effected, I automatically shunt said resistance, so as to leave the magnet in its ordinary or normal electrical relation to the lamp-circuits, and I keep such resistance shunted, so that the feed-controlling operations may then proceed under the control of the derived-circuit magnet and its retractor in the ordinary and obvious manner. In carrying out this principle I propose, as the simplest and most effective plan, to have the carbons normally or at starting in contact, and to place the artificial resistance in the lamp branch thus formed; but I do not limit myself to such arrangement, and the resistance may be placed in any other branch or circuit closed at starting, and forming a branch around the derived-circuit magnet.

Some of the many combinations and arrangements of apparatus that may be used in carrying out my invention are shown in the accompanying drawings. To some of the special novel combinations of apparatus, circuits, and devices shown and described I have laid claim.

In the drawings, Figure 1 is an elevation of a lamp embodying my invention. Fig. 2 illustrates a modified circuit-closer for controlling the circuits of the artificial resistance. Fig. 3 illustrates a detail, the special purpose of which will be described further on.

E' E^2 indicate, respectively, the positive and negative carbons of an electric-arc lamp, and R the usual rod or holder for the upper carbon.

C indicates a clamp or clutch of any proper or desired construction, (shown here as of the form described in prior patents granted to me,) and consisting of a body or guide for the rod R and a clamping toe or dog, T, pivoted on the body or guide, and normally held against the rod R by a spring, *a*, so as to prevent the rod from moving downward.

F is the usual releasing-stop, against which the arm or extension from T impinges when the clamp is lowered to a sufficient extent, so as to release the rod when a feed of the carbons is required. These parts are of ordinary construction. Other clutches or feed-controlling devices might be employed. In addition to the stop F, there is a stop, H, arranged in the path of another extension of the toe T, so that when the clutch is raised to an abnormal extent the clutch will be released. This release takes place whenever the lamp is out of action and the armature-lever of the derived-circuit magnet is fully retracted by its spring. The clutch C is supported by a link, D, depending from a lever, L, which carries the armature B of a magnet, K, which is in the usual derived circuit of high resistance around the carbons.

S is a retractor for the armature-lever L, and acts in opposition to the magnet K, in well-known manner, to determine, in conjunction with the magnet, the position of the feed-regulating devices. When, through an increase

in the arc length, the magnet acquires increased power, the clutch is lowered and the carbons permitted to feed. If the arc-resistance decrease, the spring S acts and lifts the upper carbon. When no current is passing through the lamp, the armature-lever is retracted to the position shown, and the rod R is released by the impingement of the clutch-toe T against the stop H, so that the carbons may come together. The derived circuit, including K, is indicated by the numeral 5. The positive side of the conductor leading to and from the lamp is indicated at X, and the negative at Y.

G indicates an artificial resistance of any desired kind, which is in a circuit, 6, to the carbons, as indicated, and therefore forms a branch around the magnet K, when the carbons are in contact. The resistance G may be approximately equal to the normal arc-resistance, or may be greater or less than the same, since its function is only to force current into the magnet K when the current is turned on, so that said magnet may draw down its armature.

W indicates a circuit controller or switch of any desired construction, which controls the shunt-circuit 7 of low resistance around the resistance G; and Q indicates the contact-points of said switch. An electro-magnet, J, in the shunt-circuit serves to keep the same closed after it has been established, until it is again broken by suitable means, brought into action when the current is turned off, and the feed-regulating armature-lever recedes to an abnormal extent. The switch W is provided with an armature or other device upon which magnet J acts, and with a retractor, S′, that assists in separating and holding the contacts Q open. Positive motion is given to the switch at the proper times by lugs or projections M upon the link D, so arranged that when the clutch C has been brought down to the point where a feed or release of the rod R will be produced by the action of stop F said switch will shunt the resistance G, and when the armature-lever L is retracted beyond the ordinary limit of its movements, while the lamp is not in action, said switch will be caused to open the shunt for resistance G through the action of the lower of the two lugs M. When opened, the magnet J loses its power, and the shunt is then kept open by spring S′ until again closed at the time the lamp starts into operation.

The magnet K and armature are preferably constructed so that its armature will experience the same pull in all positions for the same strength of current, and are here shown as of the form described in prior patents issued to me. The magnet K may obviously be an ordinary horseshoe-magnet.

When the lamp is out of action, the parts are in the position shown, and there are then two paths through the lamp—one a branch including the magnet K, and the other a branch including the resistance G and the carbons—so that when current is turned on the resistance G will force current into K, and the latter will thus be enabled to draw down its armature and lower the feed mechanism to operative position. In this movement the switch W is operated, and the resistance G is cut out by the closing of contact at Q at just about the time that the toe T is released by the stop F. The current now flows mainly through the carbons, and the power of the magnet K is weakened, (its relation to the circuits now being the ordinary relation,) so that the retractor S prevails, and the clutch is lifted and separates the carbons until a point is reached where, through the increased current forced into K by the drawing of the arc, the power of the magnet and the spring S are balanced. In the meantime the shunt 7 is held closed by the magnet J, and the feed and control of the upper carbon are now maintained in the well-known and obvious manner by the variations in the power of the derived-circuit magnet attendant upon variations in the length of arc. When the current is turned off, the lever L is retracted to such an extent that the shunt 7 is opened, thus putting the resistance G into circuit, and the clutch is raised, so as to come into contact with the upper releasing-stop and free the clutch from the rod R.

It is obviously within the scope of my invention to employ other devices for providing a circuit through the lamp, or the resistance G when the lamp is out of action, or to even dispense with the means for releasing the feed mechanism when the lever controlled by the derived-circuit magnet is abnormally retracted, it being only necessary in the latter case that the person renewing the carbons should place them in contact.

The shunting or switching device that controls the circuits of resistance G has in the above combination the function of closing the shunt when the lever L moves to one extremity of its path, of keeping the shunt closed so long as the lever vibrates within certain bounds, and of opening said shunt when the lever passes beyond certain limits in its reverse movement. In such arrangement the circuit closing and breaking lever W must be capable of holding the contacts closed or open, although the lever L or the parts connected with said lever are vibrating or moving and are not in engagement with the lever W.

The desired operation may be accomplished by other devices and without the employment of a magnet, J—as, for instance, by the mechanical device shown in Fig. 2, which is in principle the same as a device described and claimed in an application for patent filed by me January 4, 1884, No. 116,405. In this device the lever W is held in either position by the action of a spring, N, which, through a suitable reciprocatory piece, N^2, exerts a pressure against the end of the lever W. When the end of the lever W, moving in either direction, passes the line joining its pivot and the spring N, said lever is moved to its extreme

position, and is there held by the spring, which then acts upon the lever at an angle. The coil G, if of small wire massed together closely, would never be injured by the access of current to it in starting the lamp; but should a rupture of the coil K or its connections take place, and which sometimes does occur, the coil G would convey the entire current for some time, and would either be burned out or injured thereby. When of inexpensive make, such an accident would be of little account, provided no rupture of the main circuit was the consequence. To avoid all difficulty, however, the construction as shown in Fig. 3 is adopted. A bobbin is made and the coil G wound thereon of the desired resistance. At one end is a metal flange or plate, *c*, in close proximity to the coils of G. Upon th s flange rests a thin film of paper, of pyroxyline, or of shellac or other insulating substance, which is removed or softened by heat. A pressure-spring and button, P, rests firmly upon the film *d*. The spring P is connected to one terminal of the coil and *c* to the other, as shown. Should by accident the coil G be left in circuit, the plate *c* is heated thereby, so as to destroy the pyroxyline or melt the shellac film *d*, allowing P and *c* to make firm contact and shunt and save the coil G. To restore the parts, the film is renewed.

What I claim as my invention is—

1. The combination, in an electric lamp, of a derived-circuit magnet, an artificial resistance in a branch around said magnet, to cause said magnet to be energized when the current begins to flow, and a shunting device for automatically cutting out said resistance, as and for the purpose set forth.

2. The combination, in an electric lamp, of a derived-circuit magnet controlling the feed-regulating armature, an artificial resistance in the carbon branch, and means for automatically shunting said resistance when the magnet has acquired a predetermined power, substantially as set forth.

3. The combination, in an electric lamp, of a derived-circuit magnet, an artificial resistance in the carbon-circuit, means for permitting the carbons to come together when the lever of the feed-regulating mechanism is abnormally retracted, and a shunting device for shunting said resistance when the feed-regulating lever has been moved to a predetermined point by the magnet in its abnormally-strengthened condition.

4. In an electric-arc lamp, the combination of a derived-circuit magnet for controlling the feeding and separating mechanism, an artificial resistance in a branch around said magnet, a shunting device for shunting the magnet at a predetermined point in the movement of the feed mechanism, and means for holding said shunting device stationary during the operation of the lamp.

5. In an electric lamp, the combination of a derived-circuit magnet for controlling the feeding and separating mechanism, an artificial resistance arranged in the manner described, so as to cause a flow of current in the magnet at starting the lamp, a shunting device for shunting said resistance automatically, as described, and an electro-magnet in the shunt-circuit for holding said shunt closed during normal operation of the lamp.

6. In an electric-arc lamp, the combination of a derived-circuit magnet, an artificial resistance in the carbon branch around the same, a circuit-controller actuated when the lamp mechanism has been moved to a predetermined point, whereby said resistance may be shunted out of circuit, and an electro-magnet in the cut-out circuit for holding the circuit-controller in position to keep the shunted-out circuit closed.

7. The combination, in an electric lamp, of a derived-circuit magnet, a feed-controlling and carbon-separating lever actuated thereby, an artificial resistance in a branch around the magnet, and a shunting device which in one position of the lever places said resistance in circuit, and in another position shunts it.

8. The combination, in an electric lamp, of a derived-circuit magnet, feed-controlling mechanism that releases the carbon when the magnet's armature is abnormally retracted, as well as when the magnet's strength is increased by an increase of arc-resistance requiring a feed, an artificial resistance in a branch around the magnet, closed when the magnet's armature is in an extreme retracted position, and means for shunting said resistance and holding it shunted while the armature is in normal or feed-regulating position.

9. The combination, in an electric lamp, of a derived-circuit magnet, an artificial resistance in a branch around the same, feed-regulating mechanism provided with releasing stops or detents which permit the carbon to feed both when the feed-regulating armature is abnormally retracted and when it is attracted to the required degree, and means for cutting out said resistance automatically at a predetermined point in the armature's movement.

10. The combination, in an electric lamp, of a derived-circuit feed-regulating coil of high resistance, an artificial resistance in a branch around said coil, for forcing current into the coil at the start, and a circuit-controller for automatically throwing the artificial resistance out of action, as and for the purpose described.

11. The combination, in an electric lamp, of a derived-circuit magnet, a feed mechanism actuated thereby and released in its two extreme positions, an artificial resistance in a branch around the magnet, and an automatic shunting device, as and for the purpose described.

12. In an electric-arc lamp, a derived-circuit magnet, feed-regulating mechanism brought into operative position by said magnet when sufficiently energized, an artificial resistance

in a branch around said magnet, and means for automatically shunting said resistance, as and for the purpose described.

13. The combination, in an electric lamp, of a derived-circuit feed-controlling magnet, an artificial resistance in a branch around the same, a circuit-controller governing the flow of current through the artificial resistance and actuated by the feed-regulating lever, and a magnet for holding said circuit-controller stationary while the lamp is in operation.

14. The combination, in an electric lamp, of a derived-circuit feed-regulating magnet, an artificial resistance in a branch around the same, a shunt-circuit closer for automatically shunting said resistance when the lamp mechanism has been brought to feed-regulating position, and a device energized by the lamp-current for keeping said cut-out circuit closed.

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

ELIHU THOMSON.

Witnesses:
E. WILBUR RICE,
HARRY B. ROGERS.