(No Model.) 2 Sheets—Sheet 1.

E. THOMSON.

ELECTRIC ARC LAMP.

No. 297,200. Patented Apr. 22, 1884.

Fig. 1,

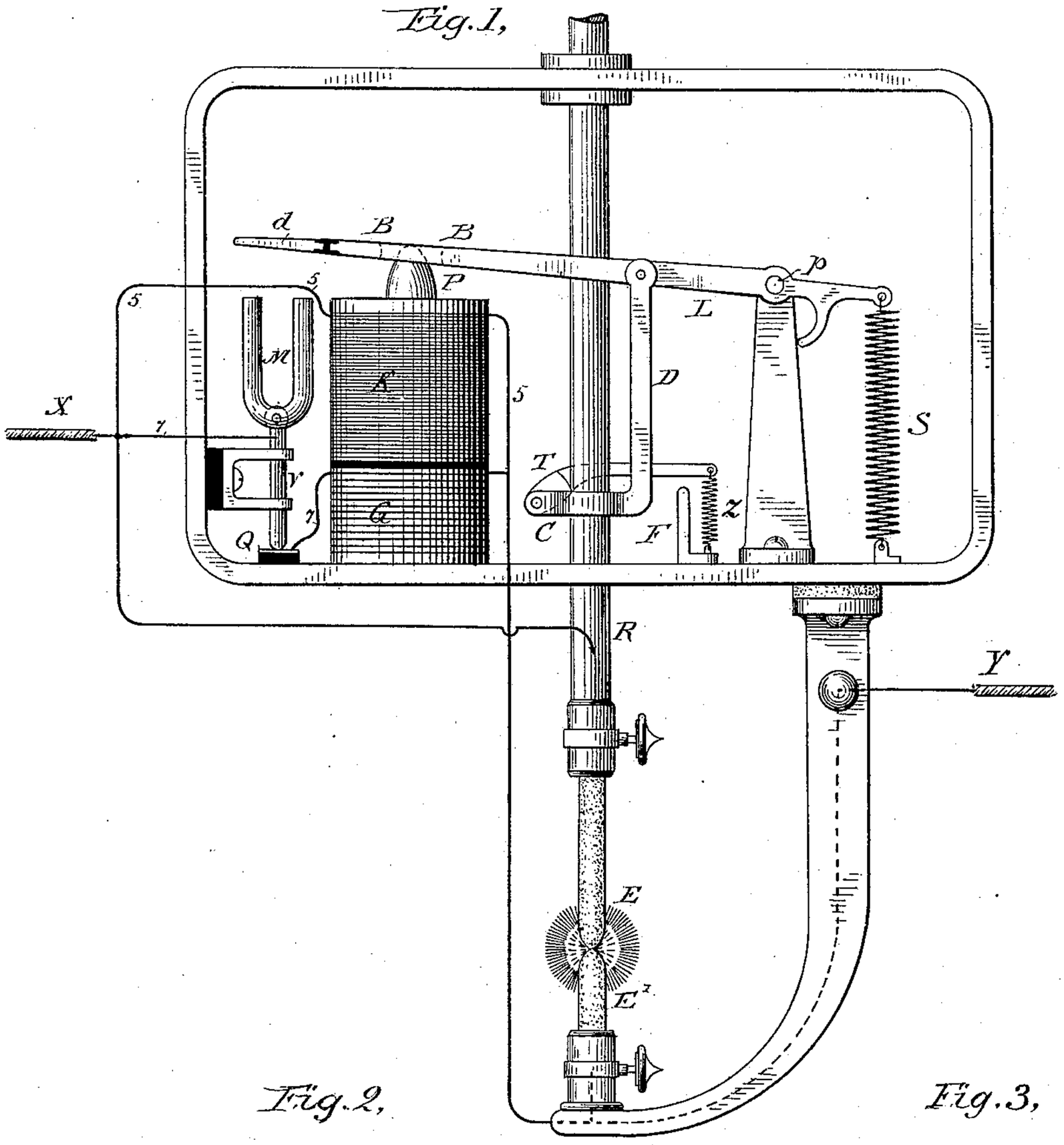


Fig. 2,

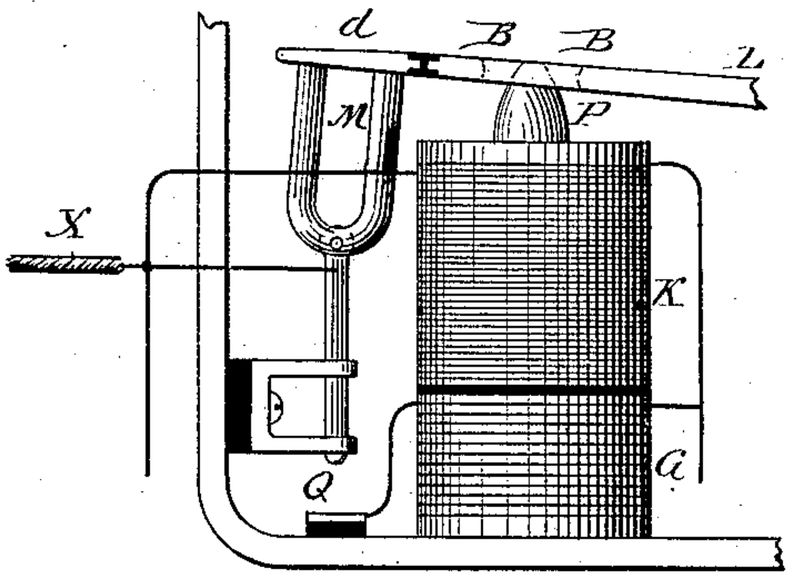
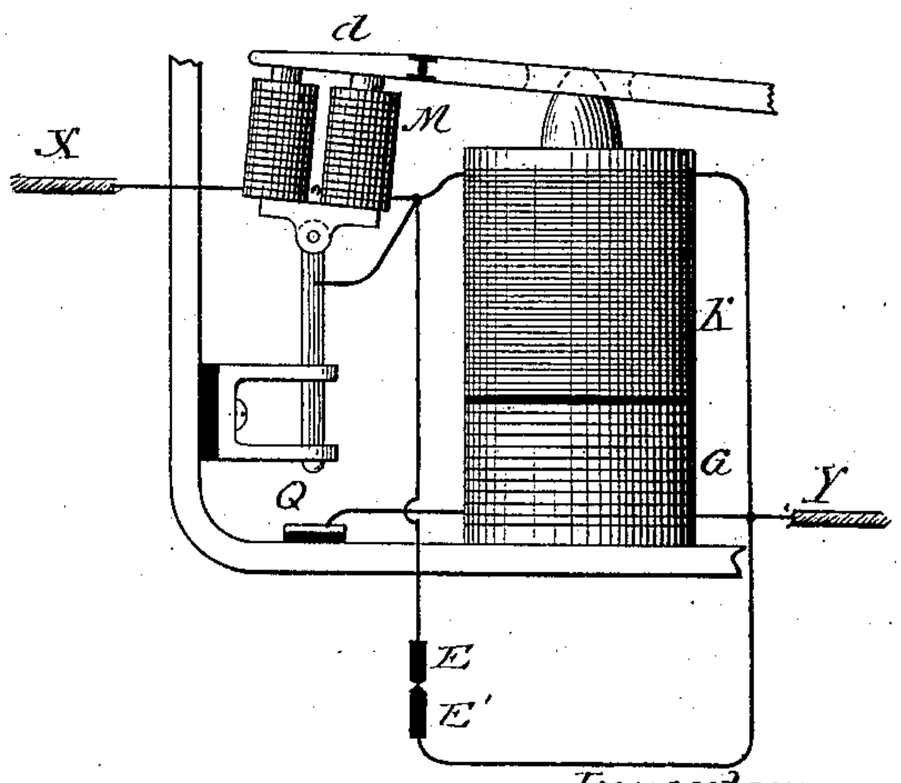


Fig. 3,



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

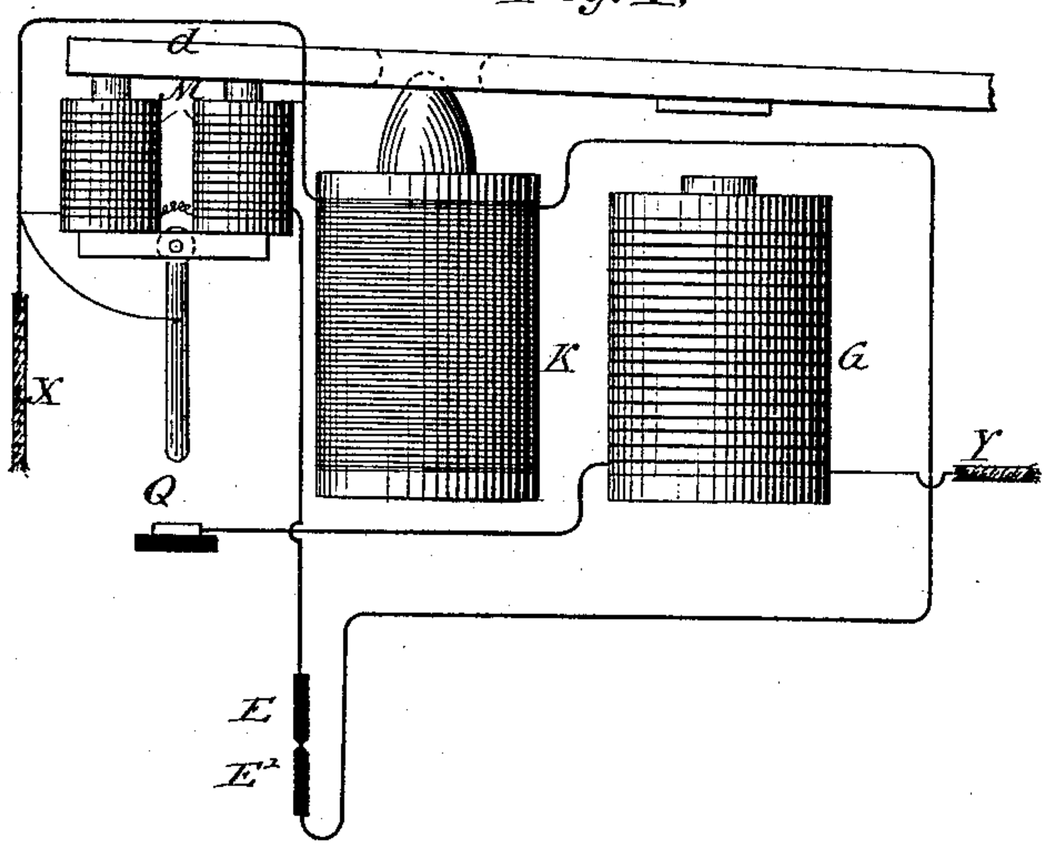


Fig. 5.

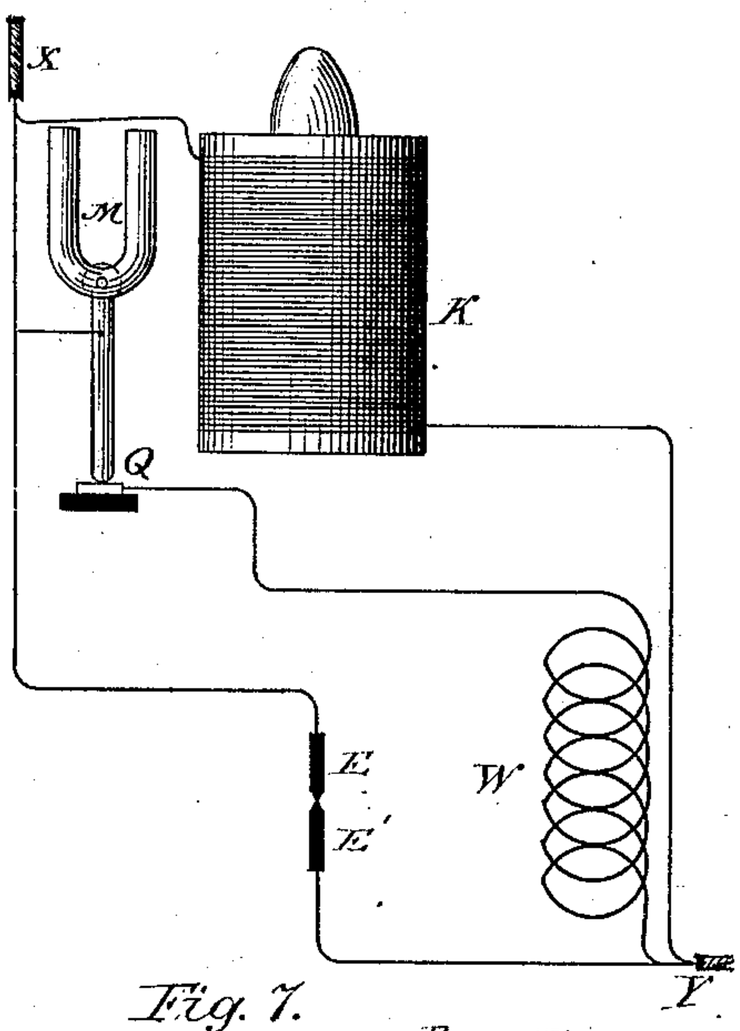
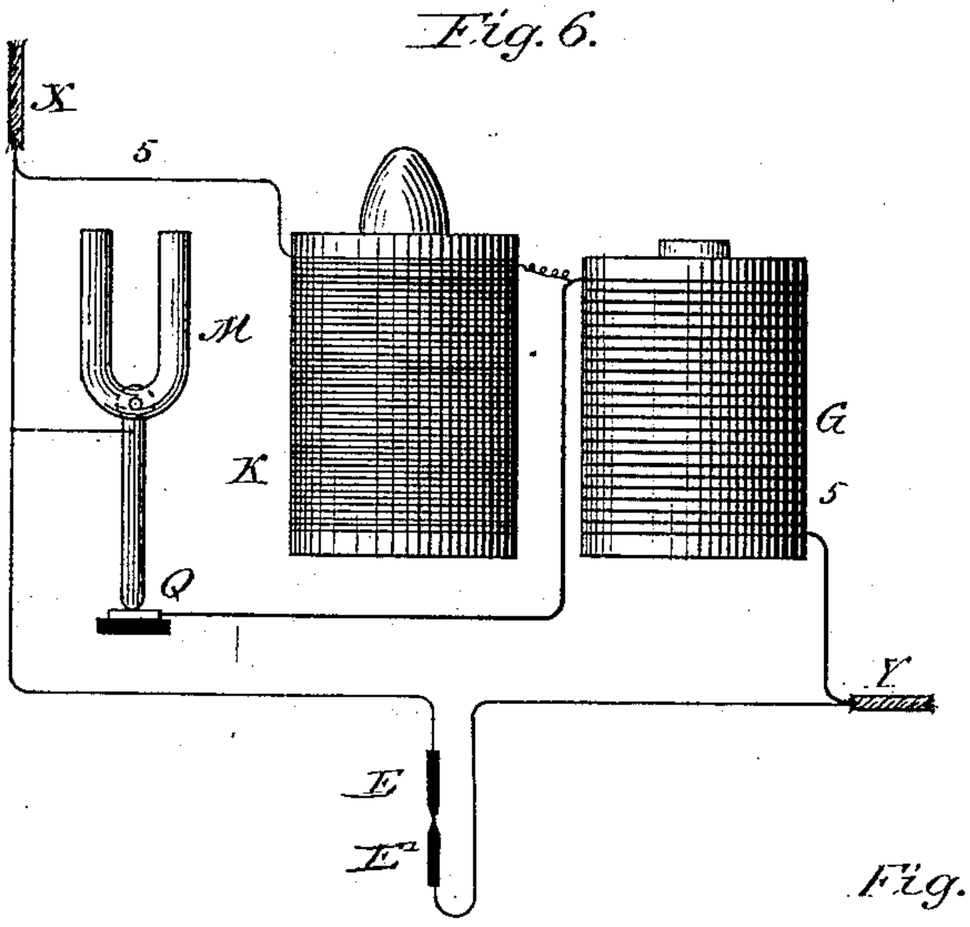


Fig. 6.

Fig. 7.



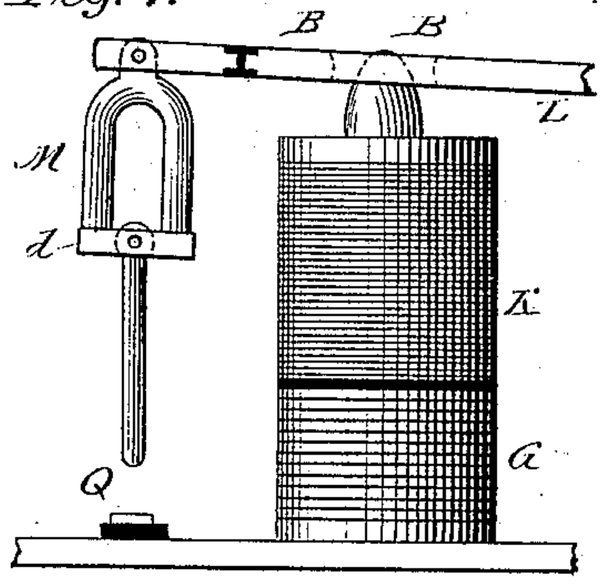
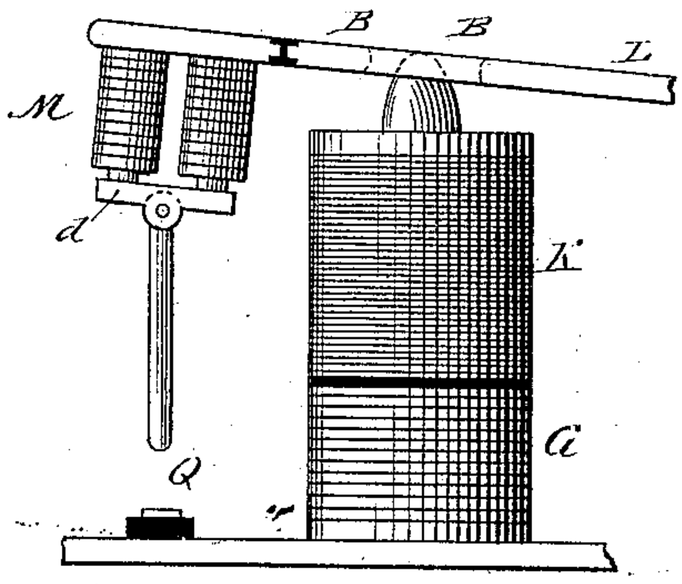


Fig. 8.



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Thos. Dowmey.

Inventor:
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By his Attorney: W. L. Turnend

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. 297,200, dated April 22, 1884.

Application filed January 8, 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 in general to electric-arc lamps of the kind claimed in an application for patent filed by myself and E. W. Rice as joint inventors, January 3, 1884, No. 116,300, and in which the feed-regulating operations are controlled solely by the varying current in a high-resistance branch around the carbons acting in opposition to a suitable retracting spring or weight, and in which a starting coil or circuit is employed for bringing the feed-regulating mechanism into operative position, and is immediately thereafter automatically cut out or otherwise rendered ineffective by a suitable circuit-controller or switch, and is kept out so long as the lamp shall continue to act, so that the ordinary operations may progress under the action of the high-resistance derived-circuit coil only.

In other applications for patent filed jointly by E. Wilbur Rice and myself, and by myself as sole inventor, there are described various kinds of starting circuits or coils and various arrangements and methods of operating the circuit-controller or switch whereby said starting coil or circuit is controlled.

My present invention relates more particularly to to the means of operating said switch or circuit-controller, and is designed to furnish a simple and effective device for this purpose.

Briefly stated, my invention consists in the employment of a magnet and armature, one carried by the lamp mechanism and the other by the switch, and so arranged that when the lamp mechanism has been brought into operating position through the influence of the starting coil or circuit the switch shall be picked up by the mutual attraction of the magnet and armature, thus opening or rendering the starting circuit or coil of no further effect, and shall be held up so as to keep the contacts of the switch open or in unchanged electrical relation during the further operation of the lamp.

My invention consists, further, in certain combinations that will be set forth in detail in the claims.

I have in the accompanying drawings shown some of the ways of carrying out the invention, and have in Fig. 1 illustrated it as applied to the form of lamp in which an auxiliary or assisting electro-magnet coil in a branch around the carbons is employed for assisting the ordinary high-resistance derived-circuit regulating-magnet in bringing the lamp mechanism to proper starting position, and is then automatically cut out or open-circuited, and kept cut out, so as to leave the mechanism under the control of said high-resistance magnet and its retractor. Fig. 2 illustrates the position of the parts while the lamp is in operation. Figs. 3 and 4 illustrate the preferred magnetic arrangement for operating the circuit-controller according to my invention. Fig. 5 illustrates the application of the invention to a lamp in which a resistance in a branch around the carbons and closed at the start is employed for forcing current into the high-resistance magnet, so that it may have sufficient power to pull down the feed-regulating armature-lever to proper position. Fig. 6 illustrates the application of the invention to another form of lamp. Figs. 7 and 8 illustrate modifications of the invention.

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, K, whose coils 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.

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. It is, however, to be understood that my 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, I 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 feed-release of the carbon when moved in the opposite directions. The clutch here shown is of the form heretofore invented by me, and consisting, 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.

G indicates the starting or assisting coil, which is preferably wound upon the same core with K, and is in a circuit, 7, which forms a branch of low resistance around the carbons, as indicated, and is completed when the lamp is out of action by the contacts Q of a switch or circuit-controller V, whose function is to open said starting-circuit 7 when the lever L has been pulled down to a predetermined point by the action of the current in the coils G, and to keep said starting-circuit open during the operation of the lamp. Circuit 7 is of low resistance. Coils G may be wound on the same core with K, or on a separate core arranged to act on the lever L.

The placing of the starting-coil on the same core with the derived-circuit coil forms the subject for claims in the application for patent filed by myself and E. W. Rice as joint inventors, January 3, 1884, No. 116,300.

The switch V is of any desired construction. In the present instance it is shown as consisting of a bar capable of free movement up and down in guides, and as completing the circuit 7 by resting of its own weight upon an anvil forming one of the contacts Q, the other being upon the end of said bar.

M indicates a magnet (permanent or electro, but here shown as permanent) attached to the circuit-controller V, and arranged in the path of an armature, *d*, upon the lever L, so that when the latter has moved down to a predetermined point, such that the armature and magnet are in close proximity, the magnet M will jump and stick to the armature, carrying the bar V with it, and thus opening the contacts Q. The point at which this action shall take place is below that at which the clutch will have been released by impinging against stop F, and is such that a falling of the upper carbon into contact with the lower shall have been insured before the clutch or clamp can pick up and raise the carbon-carrier R. When the armature M is attached to the magnet, it remains attached, and, moving up and down with the lever L, keeps the contacts Q in unchanged electrical relation—that is, open—so long as the lamp continues to operate and until forcibly detached by hand or otherwise.

The general operation is as follows: When the lamp is out of action or no current flowing, the parts are in the position shown in Fig. 1, the circuit 7 being closed at Q and the carbons held out of contact by the retracting-spring S. When the current is turned on, it finds no passage at E E', but passes in greater part through the coils G, thus strongly energizing the magnet and drawing down the lever, so as to lower the clutch and release the upper carbon. The lever continues its movement until the armature *d* is near enough to magnet M to cause the latter to jump and open the starting-circuit 7 at Q. A diversion of current to the carbons now takes place, while the coil G, being open-circuited, leaves the lever L to the sole control of current in coils K and of retractor S. Owing to the short-circuiting of the current through the carbons, but little current flows in K, and the retractor S therefore asserts itself and lifts the clutch and upper carbon, so as to form the arc, the movement in this direction stopping when the arc is so long as to force enough current into K to balance the retractor S. The lamp continues in action in the usual way under the control of the varying current in K, the magnet M in the meantime remaining suspended, as in Fig. 2, and keeping the starting-circuit open. By making the magnet M an electro-magnet, as indicated in Fig. 3, it is made automatic in its action both in closing and breaking contacts Q, and the necessity of any manipulation by an attendant is done away with. In this instance the coils on M are in the circuit with the lamp, as indicated, and the core of said coils is of soft iron, so that when the current ceases to flow on the circuit the magnet will drop away from its armature, and thus automatically reclose the contacts Q, ready for the next operation.

In Fig. 4 the coils on M, instead of being in the general circuit, are in the carbon branch from *x* to *y*, including the carbons. In this case the magnet is not energized until contact between the carbons is established, after

which, when the armature *d* is brought sufficiently close, the starting-circuit will be opened at Q. This arrangement is preferable to that of the other figures, in that in the arrangements of Figs. 1 and 3 the magnet will be drawn up when the armature is lowered sufficiently, whether the carbons have come into contact or not, while in the arrangement of Fig. 4 contact of the carbons is the prerequisite to the opening of the starting-circuit 7.

In Fig. 4 the contacts Q are kept open so long as the lamp continues to act or current to flow through the carbons; but if current be turned off from the general circuit, or if the arc be extinguished, the magnet M will let go of its armature, and the switch will drop and again close the starting-circuit.

Fig. 4 also illustrates how the coils K and G may be wound on separate cores, each of which acts on its own armature attached to L.

By adopting the arrangement shown in Fig. 5 the magnet-coil G may be dispensed with. In this arrangement the starting-circuit 7, which passes through contacts Q, includes an artificial resistance, W, preferably a little greater than the normal arc resistance. At the start, when contacts Q are closed, there being no circuit between the carbons, because they are separated by the retractor S, the current divides between W and K; but a sufficient amount is forced into K by resistance W to cause the core of K to draw down the lever L, so as to permit the carbon to feed into contact with the opposite carbon. After this occurs the magnet M rises and opens the circuit 7, leaving the lamp to the control of the current in K and the retractor S.

The employment of the resistance W in the manner here shown, as well as the special arrangement shown in Fig. 6, where a portion of the coils in the high-resistance derived circuit are cut out and the current in the remaining portion starts the lamp, are claimed, respectively, in applications for patent filed by me January 5, 1884, Serial No. 116,512, and by myself jointly with E. W. Rice, January 4, 1884, No. 116,414.

In my application No. 116,404, filed January 4, 1884, I have claimed, broadly, the resistance W, in a branch around the lamp-magnet, whether such branch pass around the carbons also or not.

In the arrangement shown in Fig. 6 the coils G form a portion of the feed-regulating coils in the high-resistance derived circuit 5, and are wound on the same core with coils K, or on a separate core. Contacts Q, at the start, close a shunt around coils K, leaving coils G only in circuit, so that the branch around the carbons is of comparatively low resistance as compared with the whole resistance of the high-resistance derived circuit, and current enough flows in G to pull down the lever and effect the results before described. When contacts Q are thus opened, the circuits are restored to their normal or feed-regulating condition, and the lamp is under the control of the varying current flowing in, and acting by means of coils G and K, forming together the ordinary high-resistance derived-circuit coils of the lamp.

Figs. 7 and 8 simply show that the magnet M (permanent or electro) and its armature may be transposed, the magnet being in these cases carried by the armature or armature-lever for the lamp mechanism and its armature *d*, attached to the circuit-controller or switch. The arrangements may be modified in many other ways without departing from the spirit of the invention.

The magnet M of Figs. 5 and 6 is best constructed and arranged as the electro-magnet M of Fig. 4, for the reasons set forth in the description of said figure, it acting on contact of carbons.

What I claim as my invention is—

1. The combination, in an electric-arc lamp, of a starting circuit or coil, a circuit-controller or switch therefor, and a magnet and armature for operating said switch, one carried by the lamp mechanism or devices moving therewith and the other by the switch, said magnet and armature being arranged, in the manner described, so that they will be brought into operative proximity when the lamp mechanism has been moved to a predetermined extent by the action of the starting circuit or coil.

2. The combination, in an electric lamp provided with a starting circuit or coil closed when the lamp is out of action, of a circuit-controller and a magnet and armature for actuating the same, arranged, in the manner described, so as to be brought within attractive distance of each other on the forward movement of the regulating-lever from an extreme retracted position.

3. The combination, with the regulating or feed-controlling armature-lever and the switch V, of a magnet and armature, one carried by the lever and the other by the switch, and arranged, in the manner described, so as to be brought into proximity by the forward movement of the lever under the action of the feed-regulating lever, as and for the purpose described.

4. The combination, substantially as described, in an electric lamp, of a switch or circuit-controller controlling the starting-circuit, and a magnet and armature for operating the circuit-controller when they have been brought into suitable proximity by the movement of the lamp mechanism toward feed-regulating position, said magnet being wound with coils in the lamp-circuit, so that it may continue to act upon the circuit-controller while the lamp is in operation.

5. The combination, in an electric lamp having a starting circuit or coil, as described, of a circuit-controller or switch and a magnet and armature, one carried by the lamp mechanism

and the other by the circuit-controller, the coils of said magnet being in the carbon circuit, as and for the purpose described.

6. The combination, in an electric lamp having a starting circuit or coil, as described, of a circuit-controller or switch, a magnet and armature, one moving with the lamp mechanism and the other carried by the switch, and arranged, in the manner described, to be brought into proximity by the movement of the lamp mechanism under the influence of the starting-circuit, and a coil for said magnet placed in the circuit with the carbons.

7. The combination, in an electric lamp, of a feed-regulating derived circuit of high resistance, a feed-regulating lever controlled thereby, a starting circuit or coil, a switch or circuit-controller therefor, and an armature and magnet, one carried by the lever and the other by the switch, and arranged, in the manner described, so as to be out of proximity when the lever is retracted, but to be brought into proximity by the movement of the lever to feed-regulating position.

8. The combination, substantially as described, of the switch controlling the starting-circuit, the magnet whose coils are in the carbon-circuit, and the armature carried by the switch or the lamp mechanism for holding the switch elevated or out of position for closing the starting-circuit while the lamp continues in operation.

9. The combination, in an electric lamp, of a feed-regulating magnet whose coils are in a high-resistance derived circuit, an auxiliary branch around the carbons containing an artificial resistance, a circuit-controller for said branch, carrying a magnet or its equivalent, as described, an armature, and an armature or magnet carried by the lamp mechanism, and arranged to act upon the circuit-controller when said lamp mechanism shall have moved to a predetermined extent under the action of the current forced into the derived circuit by the artificial resistance.

10. The combination, in an electric lamp having a starting coil or circuit, as described, of a circuit-controller therefor, and a magnet movable with the lamp mechanism, for holding the contacts of said controller in unchanged electrical relation during operation of the lamp, said magnet being wound with coils connected to the lamp-circuits.

11. The combination, in an electric lamp having a starting coil or circuit, as described, of a circuit-controller or switch therefor, and a magnet and armature movable with the lamp mechanism, for holding the switch-contacts in unchanged electrical relation during operation of the lamp, said magnet being wound with coils in the principal circuit.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 4th day of January, A. D. 1884.

ELIHU THOMSON.

Witnesses:
W. O. WAKEFIELD,
E. B. DOEN.