(No Model.) 2 Sheets—Sheet 1.

E. THOMSON & E. W. RICE, Jr.

ELECTRIC ARC LAMP.

No. 370,572. Patented Sept. 27, 1887.

Fig. 1,

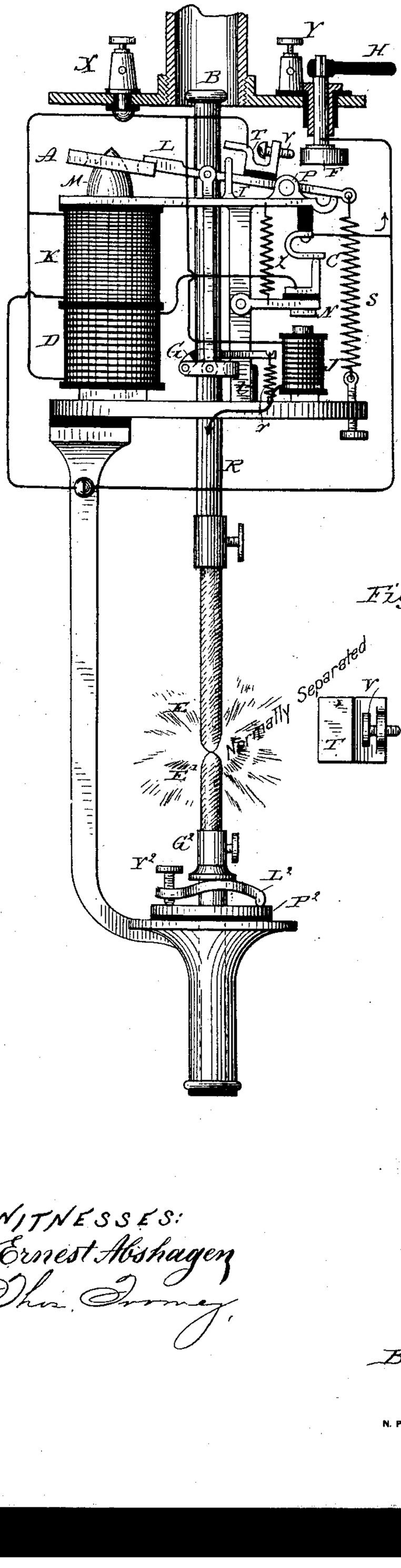


Fig. 2,

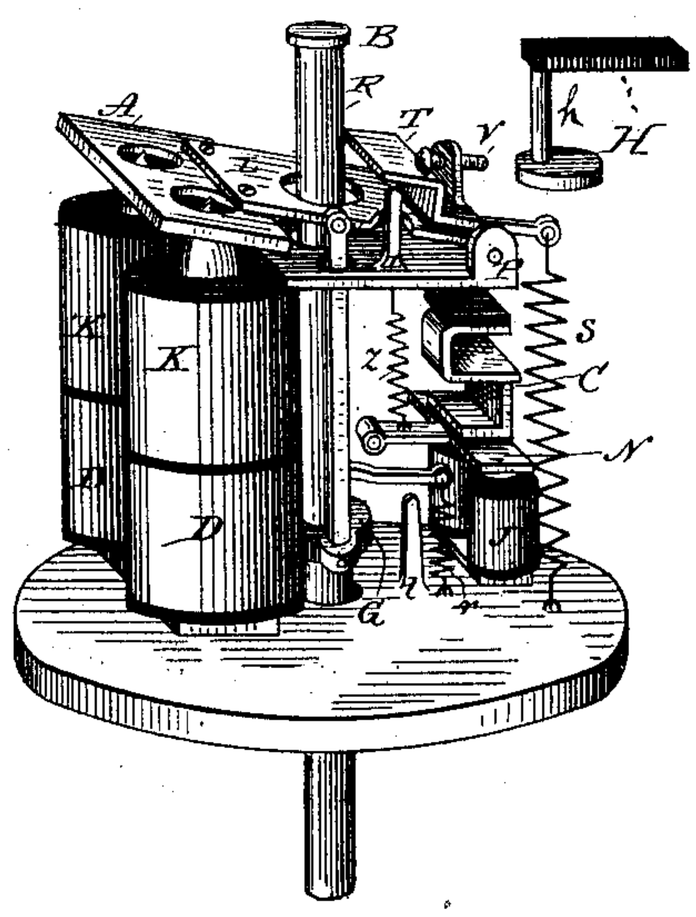
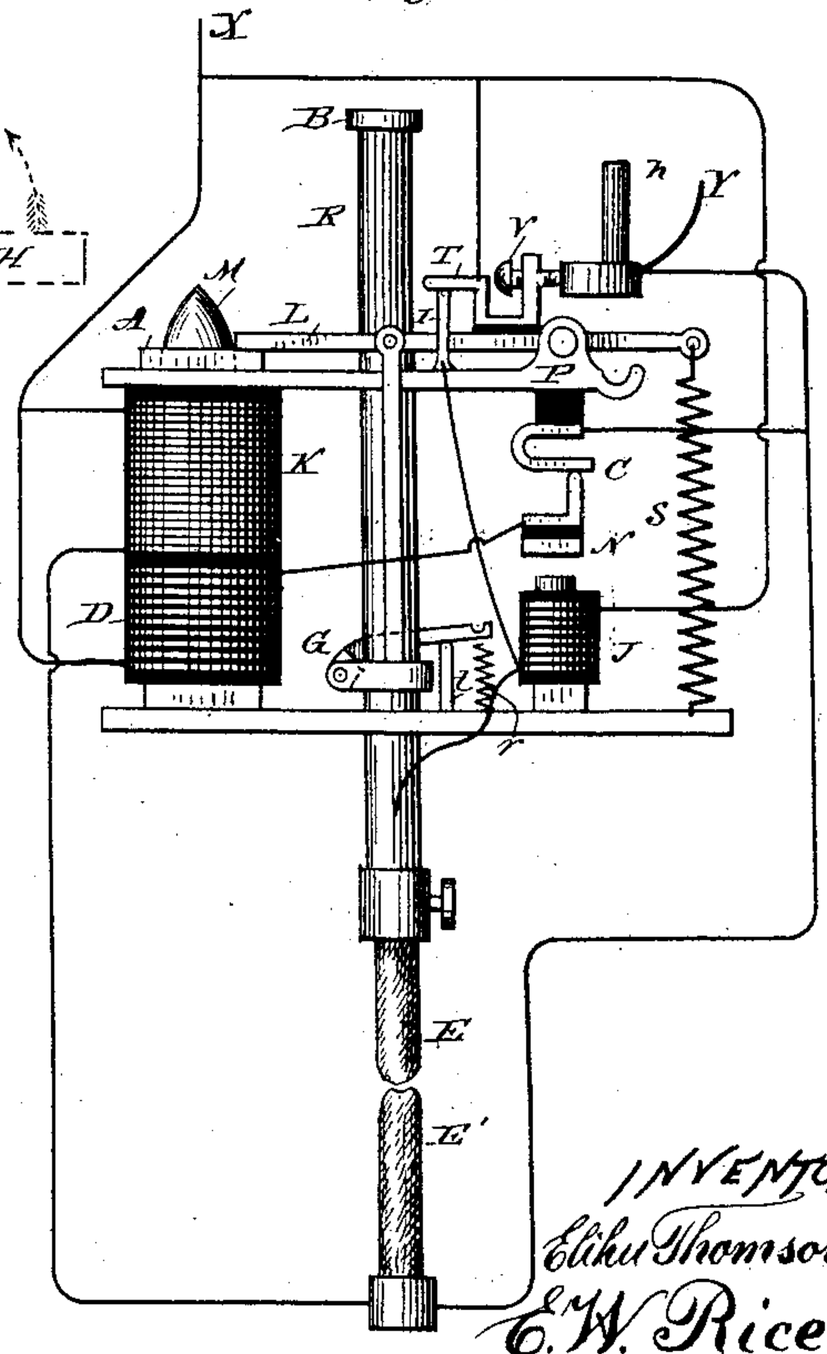


Fig. 3,

Fig. 4,



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Elihu Thomson
E. W. Rice Jr.

By their Attorney: H. L. Townsend

(No Model.) 2 Sheets—Sheet 2.

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Fig. 5,

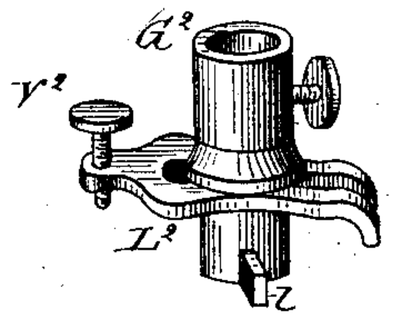


Fig. 7,

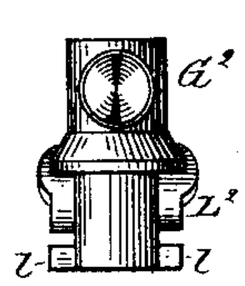


Fig. 8,

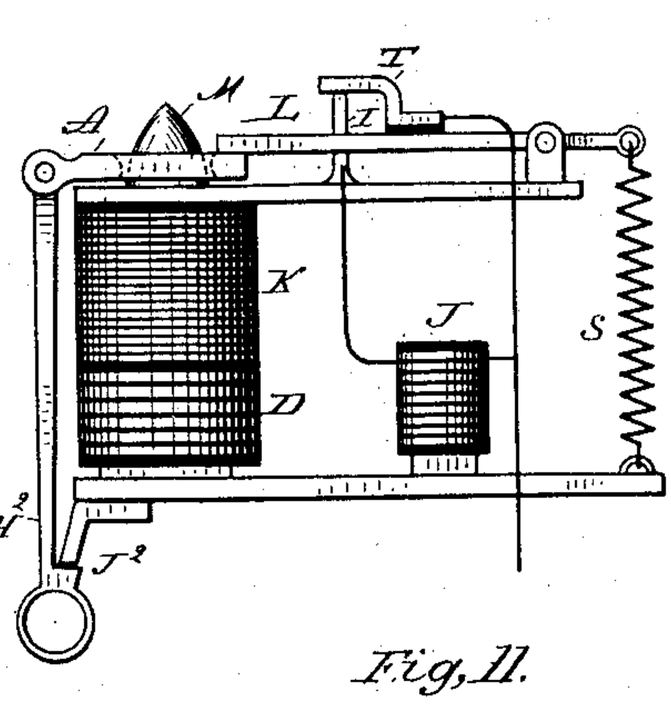


Fig. 6,

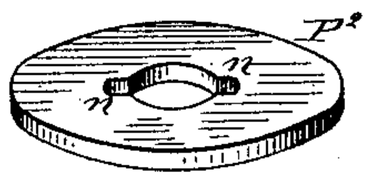


Fig. 11.

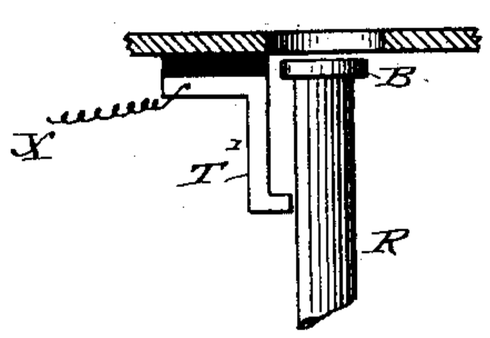


Fig. 9,

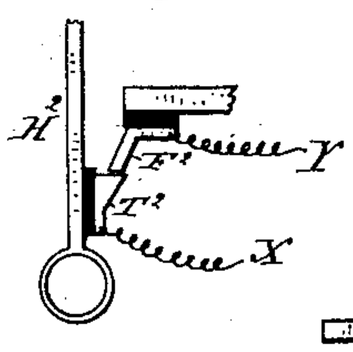


Fig. 10

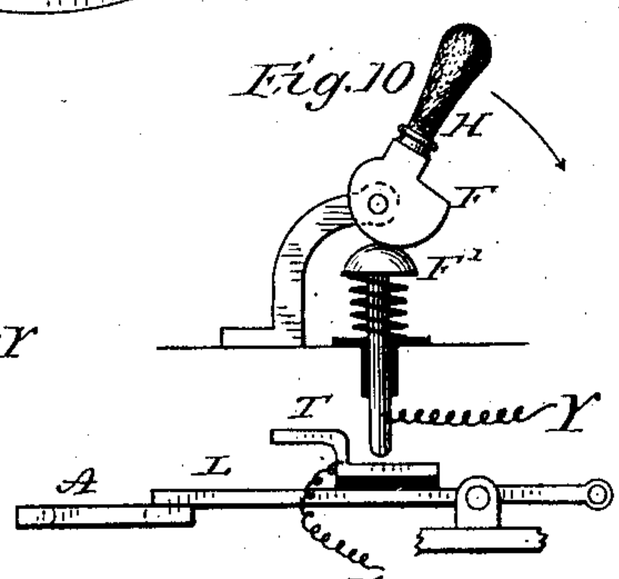


Fig. 12,

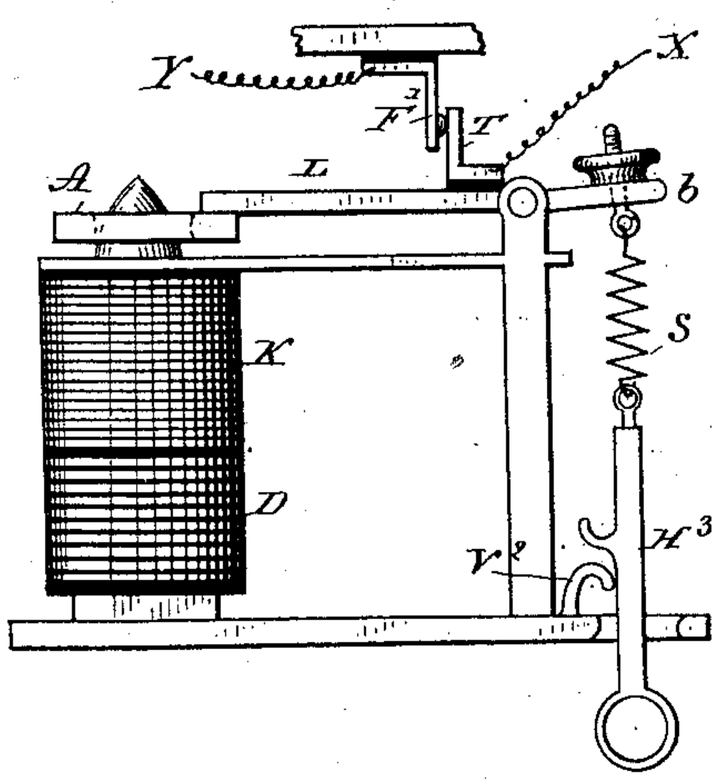
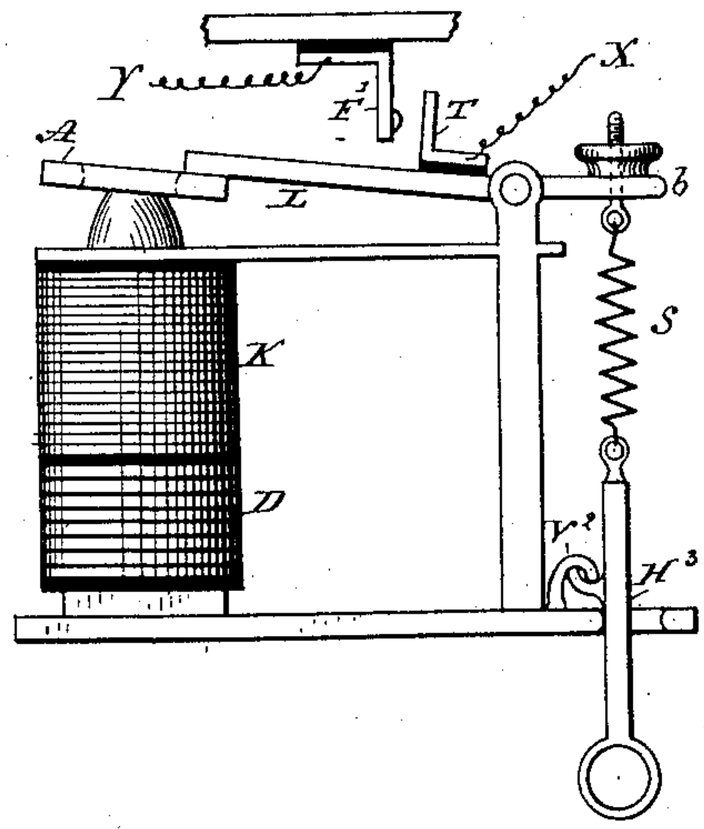


Fig. 13,



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By their Attorney: Wm. Townsend

UNITED STATES PATENT OFFICE.

ELIHU THOMSON AND E. WILBUR RICE, JR., OF LYNN, MASSACHUSETTS.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 370,572, dated September 27, 1887.

Application filed April 9, 1885. Serial No. 161,634. (No model.)

To all whom it may concern:

Be it known that we, ELIHU THOMSON and E. WILBUR RICE, Jr., 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 present invention relates to certain improvements in the mechanism of arc lamps of the type shown in prior patents and applications filed jointly or severally by us, and comprising, in combination, a regulating magnet-coil in a derived circuit around the arc, a suitable retractor acting in opposition thereto to lift or separate the carbon, and a supporting or assisting coil or branch operating through the intervention of suitable devices to start the lamp into action, proper switch appliances being employed to throw the starting or assisting coil or circuit out of action when the lamp begins to operate properly.

In some of our aforesaid patent applications, as also in the patents of C. O. Malloux, Nos. 313,436 and 313,437, the starting or assisting coil or circuit is controlled by a magnet in the carbon or arc branch, and it is to this special form of the invention that our present invention more especially applies. In many particulars, however, it is not limited to such application, and may be used with other forms of our aforesaid invention, as well as with other constructions of arc lamp.

The object of our present invention is to provide suitable switch appliances, whereby the lamp may be shunted, and at the same time the carbons of the lamp, which are ordinarily separated by the action of clutch or feed regulating mechanism when no current is flowing, may be released, so as to permit easy manipulation of the parts for renewal of the carbons.

Our present invention is also designed to provide a means for automatically shunting or cutting out the carbons and the arc when from any cause the carbon fails to feed properly.

Our invention consists, primarily, in combining with the feed-regulating lever or other part that is acted upon by the retractor, and also supports the feed-regulating clutch or other mechanism, suitable devices whereby the force of the retractor may be overcome or nullified, and said support may be thereby lowered into position, where the carbon rod or carrier will be released from the engagement of the lifting or feed-regulating mechanism, as will be hereinafter described.

Our invention consists, further, in the combination, with the lever which supports the carbon-feeding mechanism, of a suitable device for depressing said lever when the lamp is out of action sufficiently to cause a disengagement of the carbon rod from the clutch or other feeding mechanism and a suitable shunting-switch properly connected with said lever, or with the device which is employed for lowering the same, so as to automatically shunt the lamp simultaneously with the operation of lowering the feed-regulating appliance.

Our invention consists, further, in the combination, with the carbon rod or carrier, of suitable switch appliances brought into action when the carbon shall have fed to a predetermined point, and acting to complete a shunt around the carbons by throwing out of action the magnet for the starting coil or circuit, so that the armature of said magnet will drop back and complete the normal starting branch, which is of low resistance, and practically forms a branch of low resistance around the lamp.

Our invention consists, further, in certain combinations of devices and parts, which will be more particularly specified in the claims.

Referring to the accompanying drawings, Figure 1 is a side elevation of a lamp embodying one form of our invention, and showing the lamp mechanism and switch appliances in position before the lamp starts into action. The upper plate of the lamp is shown in section for clearness. Fig. 2 is a perspective view of the operative portions of the lamp removed from the lamp-frame. Fig. 3 is a plan of one form of mechanism for lowering the lever or support for the feed-regulating mechanism. Fig. 4 illustrates the position of the parts when the lamp is switched out of circuit. Figs. 5, 6, and 7 show the construction of the lower-carbon holder in perspective, elevation, and detail. Fig. 8 illustrates an equivalent arrangement of the devices for lowering the lever and simultaneously completing a shunt-circuit. Figs. 9 and 10 show other equivalent arrangements. Fig. 11 illustrates a modification in the ar-

rangement of the switch or shunting devices brought into action when the carbon rod has fed to a predetermined point. Figs. 12 and 13 illustrate another form of the invention, in which devices are employed for relieving the regulating-lever or other support from the preponderating influence of its retractor, instead of positively overcoming the force of said retractor.

In Fig. 1 E indicates the carbon rod or pencil, which is secured in a vertical carbon-holding rod, R, terminating at its upper extremity in a button, lug, or projection, B, and suitably guided in the lamp-frame. A suitable clutch device for separating, feeding, and regulating the movement of the rod and controlling the arc is indicated at G, but may be replaced by any suitable feeding mechanism capable of being operated by the regulating-magnet armature A. As shown, the armature A is attached to a lever, L, pivoted at P, and is held retracted, when no current passes, by the spring S, regulable or not. The armature A is acted upon by a suitable magnet, M, wound with a coil, K, in derived circuit around the arc, and with a section of wire, D, devoted to starting the lamp by bringing the carbons together, so as to permit the arc to be formed. The small switch-magnet J, in circuit with the arc branch, when energized, attracts its armature N, and opens the contact C, which otherwise is held closed by the spring Z. These parts or their equivalent modifications have been described by us in prior applications. The operation of these parts alone may be briefly described, after which the features of the present invention will be referred to.

The carbons being apart at the start, current entering at X passes to the coil D, and from thence through the contacts C Z to the exit-post Y. The current in the magnet-coil D under such conditions energizes the magnet-core on which it is wound, and lowers the clutch, so as to permit the upper carbon, E, to come into contact with the lower carbon, E^2. This is followed by the energizing of the magnet J, which is in circuit from X through E E′ and out to Y, and the consequent opening of the contacts C by the movement of the armature N toward its magnet. The opening of the contact C breaks the circuit through D, thus releasing the armature A, so that the retractile spring S reasserts itself, and by raising the lever L and armature operates to produce the arc through the agency of the clutch or other mechanism. The separation at E E′ continues until the power of the derived-circuit magnet K restrains the spring and balances it. A consumption of carbons causes the magnet K to so act as to feed the carbons.

It is desirable that when the current is off the lamp the clutch mechanism, or mechanism replacing it, shall be disengaged, so as to allow free handling of the rod R for cleaning and replacement of carbons. This might be accomplished by simply throwing the clutch G itself into releasing position, thus disengaging it. We, however, find it better to effect the disengagement by devices which shall move the clutch or feeding apparatus and retain it so placed that its release will be effected as in the normal action of feeding of the lamp during burning. This we accomplish by an attachment to the armature-lever L, such that the latter can be thrown downward to and beyond the feeding position and there retained. We prefer, however, to simultaneously with the depression of the lever, cause switching of current from the carbons, though we wish it understood that we do not limit ourselves to the combined function of the switch and disengaging devices, but may employ devices for either effect alone.

In Fig. 1 there is shown secured to the lever L a post or projection, T, so placed and shaped that the rotation of the cam F by its lever or handle H shall press the surface of said cam against the post T, so as to cause the depression of the lever L. The post T may carry an adjusting-screw, V, when desired. The cam impinges upon the end of the screw. The position of this screw determines the point at which, in its rotation, the cam F shall engage. Referring to Fig. 2, the relations of the cam F to the piece T V will be more clearly apprehended. The cam is carried by a stem or axis, *h*, suitably guided or mounted, and to this the handle H, preferably insulated, is fastened at right angles, as shown.

In Fig. 3 a top view of the parts T, V, F, and H is seen, and the rotation of stem *h* in the direction of the arrow will bring the cam-surface of F against V T, and tend to force it farther to the left.

Fig. 4 shows the parts in position assumed after accomplishment of this action, the armature A being down, the carbons E E′ in contact, and the rod R free from the clutch of the feeding devices G, so that it may be readily manipulated.

The part T is preferably insulated and flexible, and is connected to the entrance wire or post X, while the cam F is also insulated, but in connection with the negative wire or post Y, through its stem or otherwise. It will now be understood that the rotation of the cam will not only displace the lever L and drop the carbons, but also shunt the lamp by a shunt of very low resistance. This will be seen to be the case from an inspection of Fig. 4, the connection from X to Y existing through short conductors.

In Fig. 1 is shown a device affording provision against a long and dangerous arc, due to failure of the feed mechanism to disengage the carbon rod or other failure of the carbons to feed. The insulated piece T, carried by lever L, and in connection with the post X, has a projection which, should the attraction of the armature A by the magnet K continue further than that necessary to feed the carbons, as will occur upon the failure to feed properly, is brought into contact with a portion of the frame, such as the pillar or contact-pillar I,

or any other part of the lamp in connection with the rod R. The parts T and I, when in contact by reason of the failure of the carbons to feed, constitute a shunt around the magnet-coils J, since one end of the coil on J goes to X, to which T is also connected, and the other end goes to the armature of the lamp and rod R, of which I forms a part or to which it is connected.

In Fig. 4 the parts T and I are represented in contact, and it will be seen that a short path exists from X through the contact at T I to the rod R irrespective of the coils of the magnet J. This shunts the magnet J, releases the armature end, and closes the contact C, thus completing the low-resistance branch circuit through D and contacts C from X to Y, breaking the arc at E E', which continues so broken until the carbons either come together or are brought together. We thus secure, without doing more to the mechanism than to supply a simple contact and connection, an efficient safety device coming into action upon the failure of the carbon to feed.

A further safety device is provided for the case of complete consumption of carbons as far as desired. This is accomplished by a device such that when the rod R has descended to a sufficient distance the arc will be shunted. This result is secured by causing the rod R to effect a contact on its complete descent which shall shunt the magnet J, as before, thus bringing about a completion of the circuit through D and C. Various devices might be applied to effect this shunting; but the simplest is to provide a lug or button, B, upon the rod R, which, upon the descent of the latter, will make contact upon T or other part connected with one side or terminal of the magnet J, the carbon rod being in connection with the other terminal. By the arrangement shown the button B will act precisely as projection I, before described, and the subsequent shunting will be effected in a similar way.

A convenient arrangement of the lower carbon holder G^2 is shown in Figs. 5, 6, 7. The holder proper, G^2, has an extension downward, with two lateral projections, ears, or lugs, *l l*. The lower fixed plate, P^2, has a central opening and two notches, *n n*, as shown. This allows the insertion of the part G^2 and its partial rotation, so that the projections *e e* catch on the under side of the plate P^2. The fixed lever L^2, whose two arms take under a flange in the holder and clamping-screw V^2, are provided to afford a firm grip of the parts, as in Fig. 1. The advantages of the construction shown are the simplicity and the ease of replacement and adjustment.

In Fig. 8 the switching devices are shown modified, so that instead of the contact of the cam F and piece T V the contact at T I can be made at any time by an attachment, H^2, hung to the armature-lever A L, and provided with a catch or hook for engagement with the retaining piece or edge J^2 upon the lamp-frame. The lamp in this case is switched by the shunting of magnet J, due to the closing of the contacts T I, as before described, the said shunting occurring through the branch D and contact C. By modifying the engaging portions of the attachment H^2, as shown in Fig. 9, a complete shunting, as in Figs. 1, 2, 4, can be effected. This consists in insulating the engaging portions T^2 F^2 and connecting one of them to the post X or entering wire, and the other to the post Y or leaving wire. The armature-lever may then be held in a position to disengage the feeding mechanism at the same time that the lamp is shunted completely from X to Y by the contacts T^2 F^2.

Fig. 10 shows the cam F in Fig. 1 modified so as to act intermediately upon a properly-placed button or bar, F', which is connected to Y, and to force it into contact with the piece T upon the armature-lever L.

Fig. 11 shows how the button B or the rod R, instead of striking in its descent the movable piece T upon the armature-lever, may strike a similarly-connected stationary contact, T', and produce like results to those before described—viz., the shunting of the magnet J and extinction of the light.

Fig. 12 shows another mode of effecting a closure of contacts, serving to shunt the lamp between X and Y, or to call into action the shunting device, as heretofore explained. It consists in providing a means of releasing the force of the retractile spring S, so that the contact T, carried by L, and contact F, fixed in position, may be brought together by the descent of the armature A and lever L by their own superior gravity. At *b* an ordinary adjusting device for the spring S may be applied. The other end of the spring is held by a bar, H^3, provided with a hook or projection, enabling it to be put in the position shown in Fig. 13, where the projection from H^3 is engaged with a stationary lug or projection, V^2, as seen. In this position the parts are in operative relation, and the contacts T and F will remain open during the operation of the lamp.

Should it be desired to switch the lamp and at the same time release the feeding device by dropping the armature A and the lever L, it is only necessary to disconnect the piece H^3 at V^2 and allow the parts to take the position as shown in Fig. 12.

What we claim as our invention is—

1. The combination, with an electric-arc lamp in which the carbon-supporting lever is provided with a retractor which raises said lever so as to lift the carbon when the lamp is out of action, of devices for lowering and holding down said lever against the influence of the retractor, so as to permit the carbon to be released and come into contact with the opposite carbon, and a shunting-switch for closing a shunt around the lamp simultaneously with the operation of the devices by which the lowering of the lever is produced.

2. The combination, with the starting coil or circuit in a low-resistance branch closed at

the start and the magnet and circuit-controller switch controlling said branch, so as to keep the same broken during action of the lamp, of an electric switch governing the operation of said magnet for automatically throwing the same out of action in case the carbons fail to feed, as and for the purpose described.

3. The combination, with the magnet in the carbon-circuit and controlling the circuit or branch of low resistance closed at the start, of an electric switch for throwing the said magnet out of action, said switch being operated by the derived-circuit magnet, by which the carbon is released, and arranged in the manner described to come into action when the derived-circuit magnet acquires abnormal power through abnormal increase in the length of arc.

4. The combination, with the feed-regulating lever acted upon by a derived-circuit magnet in a direction to lower the carbon, and having a retractor applied so as to tend to hold the feed mechanism lifted, of a shunting-switch contact moving with said lever and a second opposing contact placed in the path of the former, but out of contact therewith during normal operation of the lamp, whereby on the lever being moved abnormally against the influence of the retractor a shunt around the starting-magnet may be effected.

5. The combination, with the magnet placed in the arc-circuit and serving to hold a low-resistance branch open while an arc exists, of a switch controlled by the carbon-carrier, so as to come into action after a feed of the carbon to a predetermined extent, said switch serving to throw the magnet in the carbon-circuit out of action.

6. The combination, in an electric-arc lamp, of a feed-regulating lever, derived-circuit magnet, and retractor, operating together to produce the separation and feed of the carbons, and locking devices, whereby said lever may be lowered and held in position whereby the clutch or feed mechanism will be released.

7. The combination, with a regulating-lever, a feed mechanism suspended therefrom, and a retractor tending to raise the lever and the suspended feed mechanism, so as to hold the carbons apart, of a cam, F, or its equivalent, as described, as and for the purpose described.

8. In an electric lamp, the combination of the feed-regulating lever or support, which carries the feed clamp or clutch, a retractor acting on said lever in a direction to lift the carbon when the lamp is out of action, a disengaging device for actuating the parts to permit the release of the carbon rod when the lamp is out of action, a short-circuiting switch, and means for actuating the same, as described, simultaneously with the operation of releasing the carbon, so as to effect an automatic short-circuit of the lamp, as and for the purpose set forth.

9. In an electric lamp, an electric switch and actuating appliance independent of the lamp-magnets for lowering the lever or support for the feed mechanism, consisting of a piece, T, of any desired form, carried by said lever or support and connected with one pole of the lamp, and a second piece connected with the other pole of the lamp and located in position to be out of contact with the first during normal operation of the lamp.

10. In an electric lamp, the combination of an actuating device independent of the regulating-magnets for depressing the regulating lever or support and holding it depressed against the force of an opposing spring or weight, and shunting-contacts brought into electrical connection simultaneously with said operation to shunt the lamp, as and for the purpose described.

11. The combination, with the carbon rod or holder and a magnet acting upon a carbon-shunting switch to hold the shunt open during operation, of a switch-contact for shunting said magnet and devices controlled by the descent of the carbon rod or holder to a predetermined point for bringing said switch-contact into operation.

12. The combination, in an electric lamp having the connection described, of a movable contact operated by the regulating-lever, with a second contact closed upon a movement of the regulating-armature beyond that necessary to feed the carbons, an electro-magnet shunted through said contacts, and a second set of contacts closed when the magnet is shunted and its armature retracted for completing a branch or circuit of low resistance around the carbons, as described.

13. The combination, with the lower-carbon holder having lugs or projections $l\ l'$, of plate P^2, having corresponding notches or openings, and a lever, L^2, resting on the top of said plate and bearing against the under side of the projection upon the carbon-holder, as and for the purpose described.

14. The combination, with a switch controlling a shunt around the carbons, of an electro-magnet normally holding the same open and two sets of contacts for throwing said magnet out of action, one set controlled by the armature-lever of the regulating-magnet, and the other operated by the carbon rod or carrier when the same has fed down to a predetermined point.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 6th day of April, A. D. 1885.

ELIHU THOMSON.
E. WILBUR RICE, JR.

Witnesses:
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W. O. WAKEFIELD.