(No Model.)

2 Sheets—Sheet 1.

E. THOMSON.

ELECTRIC LAMP.

No. 256,605. Patented Apr. 18, 1882.

Fig. 1.

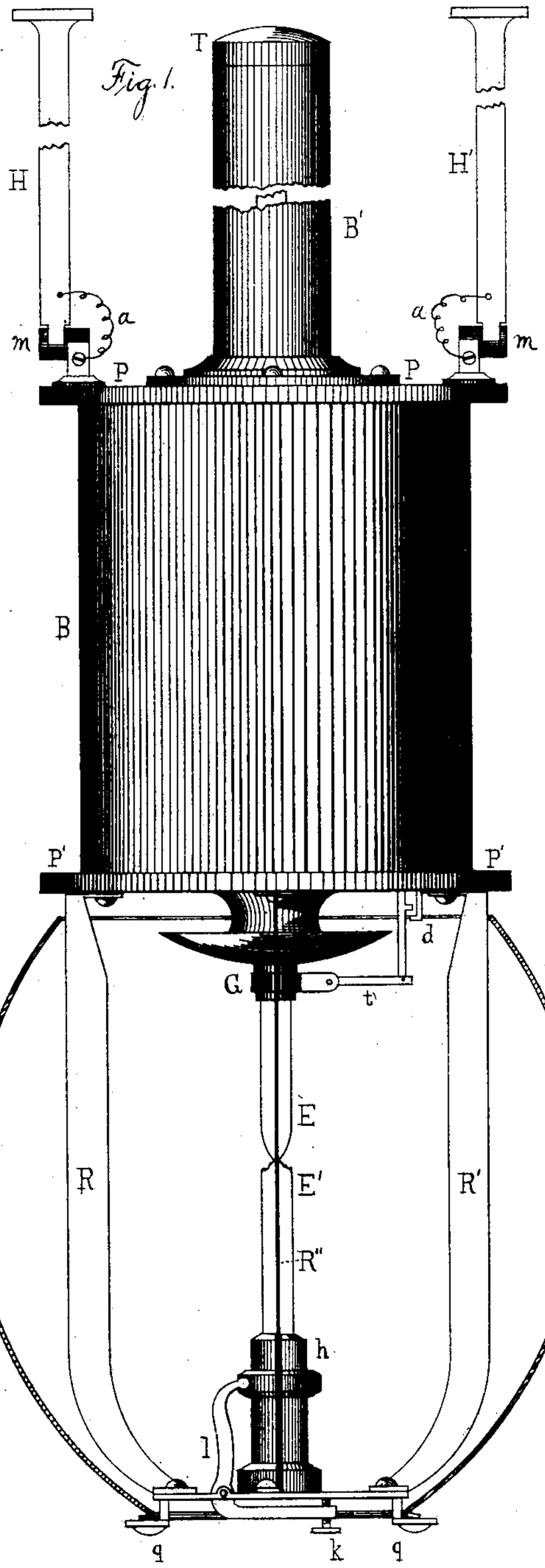
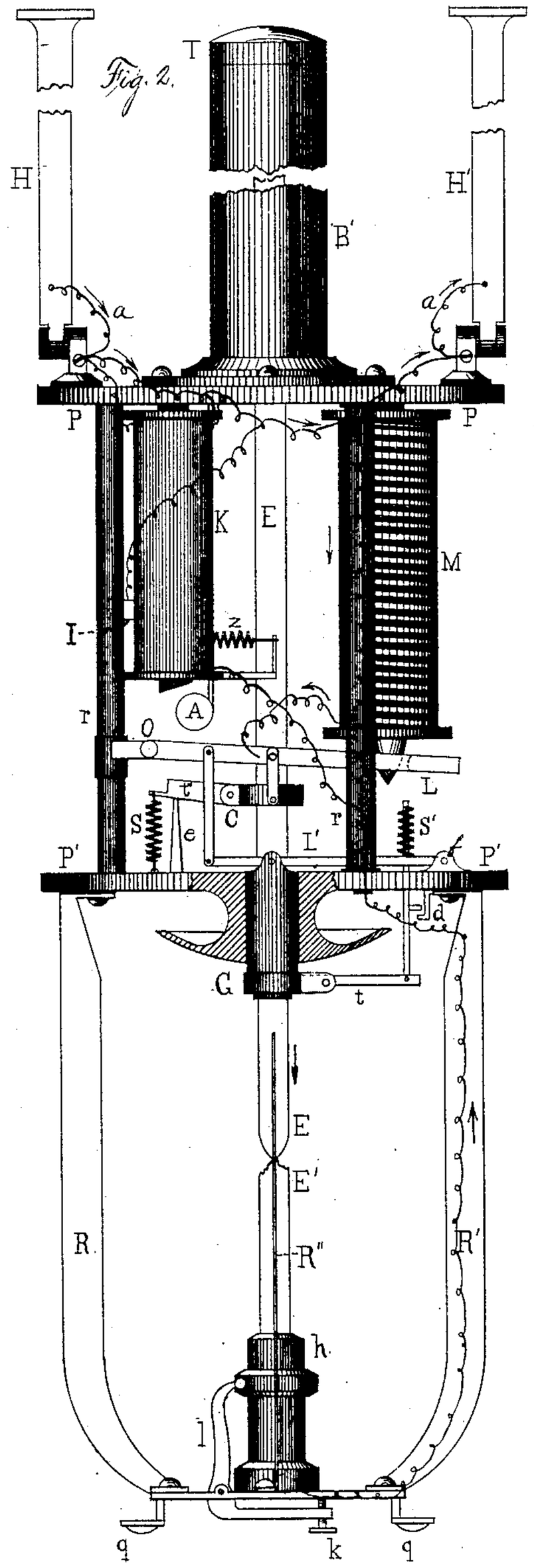


Fig. 2.



Witnesses.
W. B. Thomson.
E. Wilbur Rice.

Inventor.
Elihu Thomson

(No Model.) 2 Sheets—Sheet 2.

E. THOMSON.

ELECTRIC LAMP.

No. 256,605. Patented Apr. 18, 1882.

Fig. 3

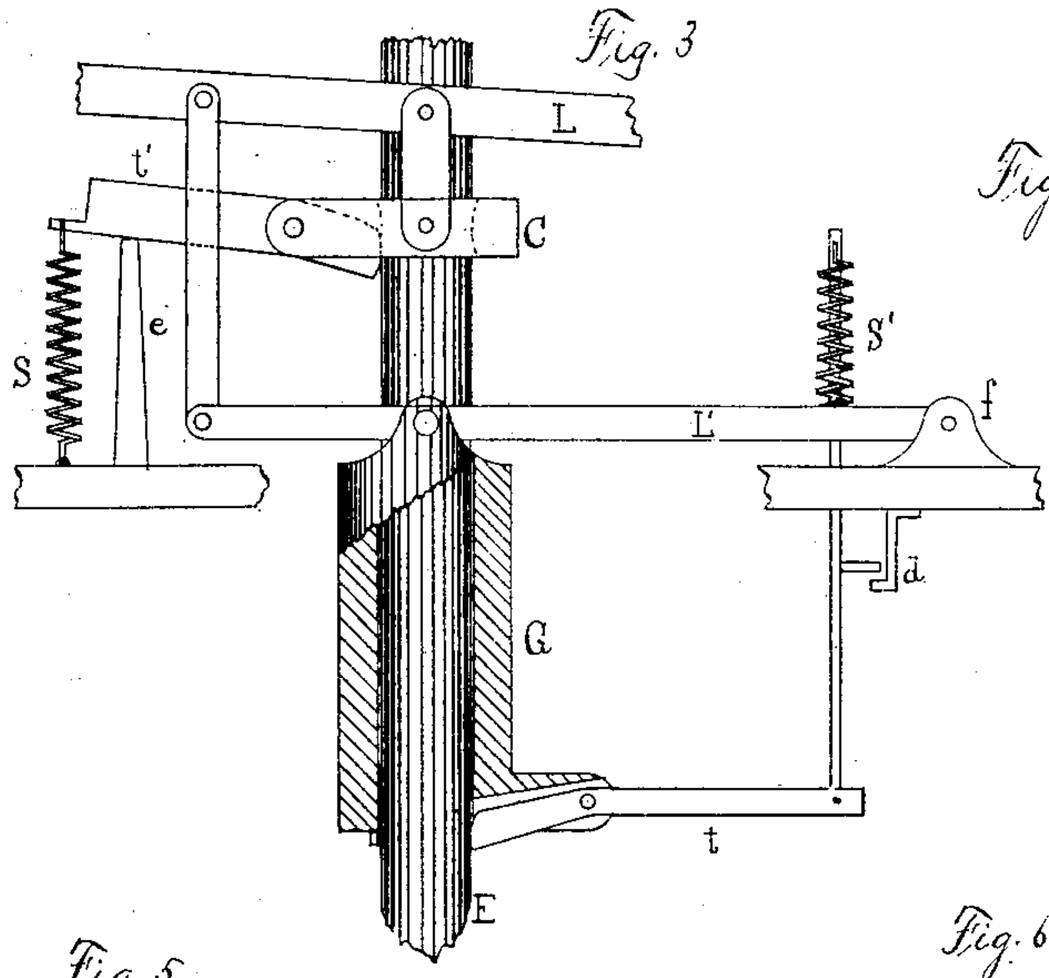


Fig. 4

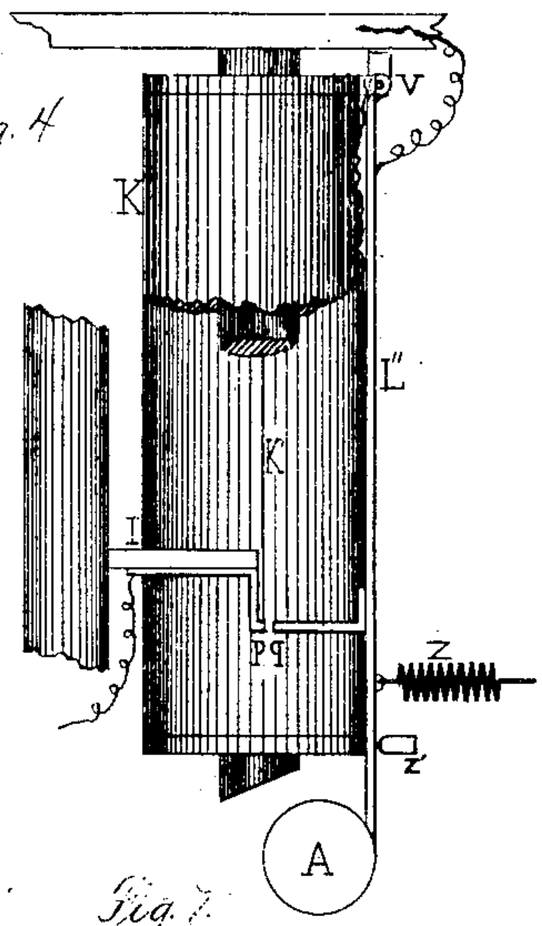


Fig. 5

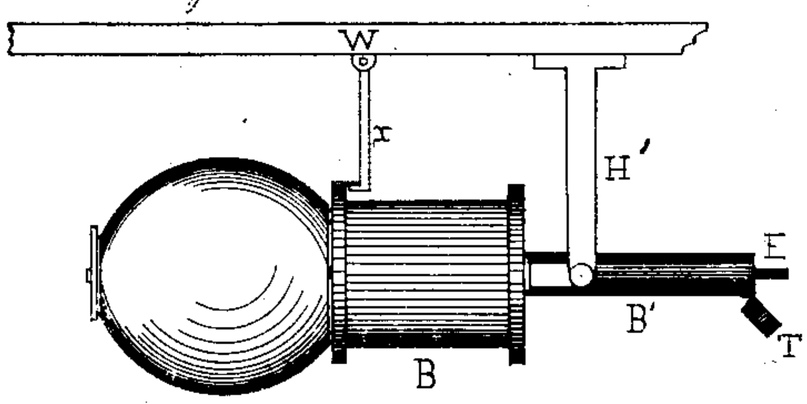


Fig. 6.

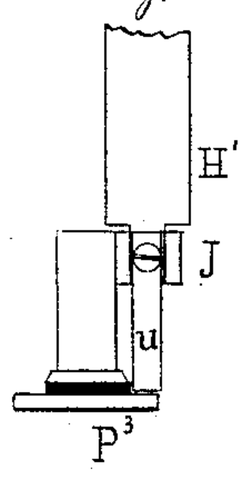


Fig. 7.

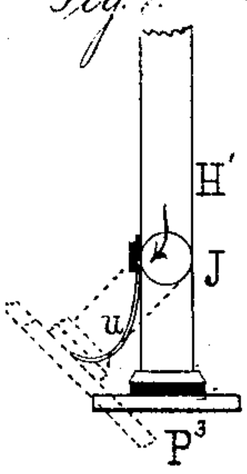
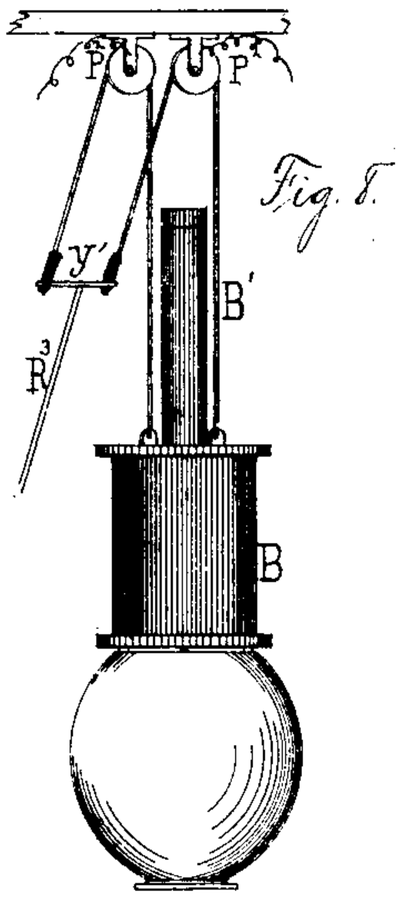


Fig. 8.



Witnesses.
W. B. Thomson.
E. Wilbur Rice.

Inventor.
Elihu Thomson

UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF NEW BRITAIN, CONNECTICUT, ASSIGNOR TO THE AMERICAN ELECTRIC COMPANY, OF SAME PLACE.

ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 256,605, dated April 18, 1882.

Application filed June 20, 1881. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing in New Britain, county of Hartford, State of Connecticut, have invented certain new and useful Improvements in Electric Lamps, of which the following is a full specification.

My invention relates to electric lamps of the arc type, and has for its object the feeding of a carbon pencil unprovided with any supporting-rod by mechanism that shall secure great uniformity of consumption of said carbon pencil, steadiness of light, duration of light, compactness of the lamp mechanism, and other advantages.

My present invention, so far as concerns the devices for feeding the carbon pencil, is based upon the employment of two catches or clamps operating in somewhat the same way as those described in Letters Patent No. 220,287, October 7, 1879, Houston and Thomson, wherein two spring clips or catches operate upon the lower carbon, and are combined with stops set to limit the movement of the catches at different points in the movement of their actuating devices. My present invention differs from that described in the above patent in that devices are combined with the two clamps and their operating electro-magnet, whereby the strength of said magnet is intermittently varied in obedience to the changes in resistance at the arc. In my present invention, also, the two clamps act upon an upper carbon, and are combined with devices whereby they may be disengaged from the carbon and release it, so as to allow it to come into contact with the lower carbon. My present invention is also different in other respects. The differences will be apparent from the accompanying drawings and specification, and will be specified in the claims. I also employ a shunt-magnet or derived circuit around the arc for governing a shunt-contact or short circuit around a second magnet for operating the feed.

My invention further relates to improvements in the construction and arrangement of parts to control the access of the current to the lamp and enhance its convenience and symmetry.

Figure 1 is a front view of a lamp embodying my invention; Fig. 2, the same with the parts exposed to view and portions in section for ease of description; Fig. 3, the arrangement of catches or clamps for effecting a feed of the carbon pencil; Fig. 4, the shunt-magnet and its short-circuiting contacts and armature. Fig. 5 shows the means of suspending the lamp when out of use; Figs. 6 and 7, a simple switch attachment for short-circuiting the lamp when it is placed in the position shown in Fig. 5; Fig. 8, a modification adapting the lamp to be raised and lowered.

I will now proceed to describe my invention by reference to the figures.

In Fig. 1, B is the casing containing the regulating mechanism; B′, a tubular extension for accommodating the length of the carbon pencil E. T is a cap or covering for the latter. This cap is removed when the pencil is inserted into the lamp, as hereinafter more fully specified. Plates of iron or other metal, P P P′ P′, complete the casing of the lamp-box. Thin metal blades, preferably three in number, at one hundred and twenty degrees apart, R R′ R″, pass downward inside the lamp-globe for the support of the lower-carbon holder, *h*, the edges of the blades R R′ R″ being turned toward the carbons or light-focus E E′ to avoid shadow. Small catches *q q* are turned outward under the edge of the globe, and afford a firm support for it, but are arranged so as to be readily rotated so as to free the globe, or removed from under the edge of the globe in any well-known manner. A small bent lever, *l*, and screw *k* clamp the holder *h*, which is made in two parts, the portion to which the lever *l* is carried being movable, as usual in the art. Supports H H′, hinged to the lamp-body, are arranged to be fastened to any suitable surface for suspending the lamp. Connecting-wires flexible in character unite the two portions of the joint and convey the current, as shown at *a a*.

In Fig. 2 the working parts of the lamp are shown. An electro-magnet, M, with a paraboloidal pole is traversed by the current and attracts its armature L, pivoted at O, the open-

ing in the armature corresponding to the pole of the magnet M. This form of magnet is described in a prior application for Letters Patent, and is the form I prefer to employ, although a simple electro magnet and armature or axial coil and core may be used, when suitably arranged, to take its place. The armature-lever L, which may be provided with a dash-pot or other check motion to prevent sudden changes of position, serves to raise and lower a clamp, C, provided with a movable or pivoted clamping-toe, t', or catch, and by which the carbon rod E is gripped and moved downward. A spring, S, holds the toe or catch t' in place, except when the clamp C and armature L are lowered so far as to bring the prolonged end of the toe t' in contact with the stop e. When the prolonged end of the toe t' strikes the stop e the clamp C is loosened and free of the carbon rod E. A second clutch or clamp, G, suitably guided, as through a central opening in the plate P′ P′, and likewise provided with a toe, t, stop d, and spring S′, occupies a position as shown, and forms the lower guide for the carbon pencil E. The clutch G is also elevated and depressed by the armature L acting on a second lever, L′, pivoted at f, to which it is linked, and the toe t is opened by the stop d. When the armature-lever L and lever L′ are down the spring S′ closes the toe t of the clamp G, when the armature is raised by the attraction of the magnet M.

Any other clamping devices, many of which are now known and used in the art, may be substituted for those shown, provided they admit of the action as above described.

As the parts are arranged the clamp C moves for a given movement of the armature L through about twice the space that the clamp G is at the same time moved, and as the two clamps act to pull the carbon pencil E downward the effect is that for every upward and downward movement of the armature L a portion of the pencil E is carried downward through the clamps toward the lower carbon, E′, and the carbon pencil E is free to drop only when the two stops e and d have acted to open the toes t' and t of the respective clamps C and G. In the latter case, which takes place when the current in the magnet M fails for a sufficient interval of time, and allows the armature L to be sufficiently lowered, the carbon rod E falls freely. This occurs at the stoppage of the lamp-current itself, or of the current in the magnet M alone for a suitable interval. The carbons are therefore always free to fall into contact before the current traverses the lamp.

It is obvious that the clamp C might be connected with its operating devices at such a point that its movement would be greater or less than twice the movement of G. It is also to be understood that other devices might be employed for imparting different rates of movement to the clamps under the same movement of the devices operated by the electro-magnet.

An electro-magnet, K, is provided, traversed by a derived current-circuit around the arc, and the variations of its power, acting on a movable armature, A, serve to close electric contacts, which form a shunt or short circuit around the lifting-magnet M, while the spring Z opposes the movement of the armature A toward the magnet K. Reference is had to Figs. 3 and 4 for more detailed views of the parts, which will be hereinafter described.

The circuit-connections are as follows: The current enters on the side of the lamp at H a, and passes from thence to the coils of the magnet M, with a branch to one of the contacts, p, Fig. 4, controlled by the shunt-magnet K. The other end of the magnet-coil M is carried to its core, and from there the current passes to the upper metal work of the lamp to which said core is attached, and finds its way through various connections and metallic contacts among the moving parts to the two clamps C and G, from which it passes to the carbon pencil E through the surfaces in contact. When these are insufficient, as with a very heavy current, contact-springs are placed at any convenient points, bearing against the carbon pencil in a well-known manner. The current passes the arc from E to E′ and up through one of the blades R R′ R″, which are suitably insulated to prevent electrical connection between the supports of the upper carbon and those of the lower, except through the circuit-paths, as described herein. The current passes up the blade R′ to a vertical rod, r, suitably insulated from the supports of the upper carbon and out at a H′. Insulation is provided at all points where necessary in a manner well understood in the art and indicated in black, Fig. 2. The connections of the magnet K are any convenient contacts of the two extremities of its coils with the upper and lower carbons, respectively. In the figure, one contact is made to the rod r in metallic connection with the lower carbon, as shown, and the other to the magnet-core of K itself, which is in metallic connection with the upper carbon.

The operation of the lamp as thus constituted is as follows: By the removal of the cap T the long carbon E is inserted into the clamps C and G, while the carbon E′ is inserted below the bottom plate bearing the holder h, and which plate has the usual opening for the purpose. The lengths are such that the contact at E E′ will be quite near the clamp G at the start. The globe of the lamp may or may not be in place when the carbons are inserted. When the current is sent through the lamp the magnet M attracts its armature L, raising the latter, which in turn lifts the clamps C and G; but G is only lifted a portion of the distance that C is lifted, this difference of range being due to the connections of parts, as shown in Figs. 2 and 3, and will be understood by any skilled mechanician.

The relation of the clamps to the carbon rod will be readily understood from an inspection of Fig. 3. The clamping-toes of both clutches bear upon the rod in such a way that an at-

tempt to draw the carbon rod upward through either of them would cause the toes to bind against the side of the rod and thus prevent the rod from slipping through the clutch. Conversely a movement downward of the support or clamp for either clutching-toe would cause said toe to engage with or lock positively against the side of the rod, so that the rod would be compelled to move with the toe. The springs which act upon the toes hold them in sufficient frictional contact with the rod to allow either clamp and clutching-toe to lift the rod; but as will be readily understood the rod cannot move any faster than the more slowly moving of the two clutches, owing to the locking action which occurs upon an attempt to move the carbon rod bodily upward through the clutch. When the armature L rises both toes *t'* and *t*, being freed of their stops *e* and *d*, fall into place against the carbon pencil E, being assisted by the springs S S'. A further movement of the clamp G upward allows a separation of the carbons at E E' and the formation of an arc. The movement, however, is only that of the lower clamp, since the lower clamp does not allow the carbon to slip upward through it, and therefore the upper clamp moves upon the carbon instead of carrying the carbon with it, as it would otherwise do, and assumes a position in readiness for propelling the carbon downward. When the arc has slightly increased in length from combustion of the carbons, the shunt-magnet K becoming active, the armature A is attracted, shunts the current from the magnet M, and the latter losing its magnetism, the armature L descends, lowering the clamps C and G at the same time; but the clamp C moves through more space than G. Hence the carbon pencil is pushed down through the clamp G an amount equal to the difference of their ranges. This feeding action is rendered certain by the arrangement of the toes *t' t* of the clamps, which admit motion of the pencil downward only. Thus at every movement of the armature L a feed of the carbon E is effected.

When the carbon E is so far consumed that its upper end reaches the clamp C the feeding, as above described, ceases, but is supplanted by a succession of drops and lifts of the carbon by the clamp G acting alone. The change in the manner of feeding is noticeable in the light evolved, and serves as an indication that the carbons need replacing. In this latter case a new carbon, E, is introduced and the piece of upper carbon unconsumed utilized as a lower carbon, E'. By this plan the waste of stub ends of carbon is greatly reduced. The stub end which is thus utilized for a lower carbon may be electroplated with copper, or otherwise coated to increase its durability.

Fig. 3 shows the relation of the clamps C and G more fully, where similar letters are used to indicate the same parts as in Fig. 2. The action of the parts has been before described, but the form of the toes *t' t* is here shown; and it will be evident to a skilled mechanic that, as shown, a downward movement of the carbon pencil will be much more easily effected through the clamps than an upward movement. It results from this that any difference of range in the movements of the two clamps C and G is accompanied by a downward feed of the pencil E.

Fig. 4 shows the arrangement of the magnet K and its accompanying parts. The magnet-pole is sloped, and an armature, A, as a piece of bar-iron suspended upon a lever, L'', pivoted at V, and when attracted makes contact at *p q* in opposition to the spring Z. The contacts *p q* are respectively connected to the extremities of the magnet-coil M, so that when in contact but little current passes through the coils M, it being shunted by the contacts. A very small increase of arc-resistance will, with the parts as described, effect a closing of the contacts and consequent feed of the carbon pencil E, as before described. A suitable stop, Z', prevents the armature A from moving, except through quite small range.

The use of the swinging hinge-joints *m m*, Fig. 1, may now be described.

Fig. 5 shows the lamp in position when the carbon E is being inserted, the lamp turned into a horizontal position, and the cap T off the end of the tubular extension B'. The cap T is preferably hinged to B', as shown. A hook, *x*, may be provided to secure and retain the nearly horizontal position, a proper projection from the lamp-case B being likewise provided for engagement of said hook *x*. When the carbon E is inserted, as just described, it is essential that no current be allowed to pass through the circuit, or that the lamp should be switched out of circuit. This I effect by attaching a contact-spring, U, Figs. 6 and 7, to the joint H' in metallic connection with the exit-point of the current from the lamp, and providing a contact-surface, P^3, in connection with the entrance-point of the current to the lamp. When the lamp is hung vertically the surface P^3 is out of contact with U, as in solid lines, Figs. 6 and 7; but when thrown out of this position the spring U and surface P^3 contact with each other and allow the current to pass without entering the carbons of the lamp. Any equivalent short-circuiting device may be used whose opening and closing are dependent on the position of the lamp. When, however, the lamp is hung at an inconvenient height it may be lowered for attention to its carbons, and afterward raised into position. This is accomplished, as in Fig. 8, by replacing the pieces H H', Fig. 1, by copper-wire ropes running over metallic pulleys P^2 P^2, connected to the circuit in which the lamp is placed and insulated from each other. A yoke, Y', of metal, has the ends of these wire ropes H H' not attached to the lamp fastened to its ends, but insulated from said yoke Y', as shown in black in the figure. A cord or rope, R^3, is attached to the center of said yoke, by which its position may be controlled and the

lamp raised and lowered. When fully lowered the yoke Y′ comes into contact with the pulleys or their supports and connects them metallically, thus shunting the current around the lamp.

I claim—

1. The combination, with the upper carbon electrode in an electric lamp, of two differentially-moving clamps, each arranged so that its clamping edges or jaws tend to propel the carbon downward or to prevent movement of the carbon upward through the clamp, and means for disengaging said clamps to allow the carbons to come together upon an abnormal increase in the length of arc.

2. The combination, substantially as described, with an armature-lever, of two lifting-clamps connected thereto at different distances from its fulcrum, so that said clamps may have a different range of movement with a given movement of the armature.

3. The combination, substantially as described, with a carbon electrode, of two differentially-moving clamps and an operating-armature provided with supporting-links or similar rigid supporting devices for both clamps.

4. The combination, substantially as described, with the upper carbon in an electric lamp, of differentially-moving clamps arranged, as described, to move at different speeds, and each consisting of a movable body and pivoted clamping-toe, said clamping-toes being arranged with relation to the carbon, as described, to lock against the carbon, so as to prevent a movement upward of the carbon through a clamp or to move the carbon downward positively with a clamp.

5. The combination, substantially as described, with a carbon rod, of two differentially-moving clamp-bodies, clamping-toes arranged as described, so that a shifting downward of the clamp with relation to the carbon rod is prevented by the locking of the toe upon the rod, springs for holding the clamping-toes in engagement with the carbon, and stops arranged to release said clamping-toes.

6. In an electric lamp, clamps C and G, movable toes t' t, springs S S′, and stops e and d, in combination with a movable armature or its equivalent, and means for giving a differential movement to the clamps, whereby the following actions upon a carbon pencil are effected, viz: a free release of said carbon pencil when said armature is unacted upon by its controlling-magnet, a lift of said pencil from contact with the other carbon pencil when said armature is acted upon by its controlling-magnet, and a downward feed due to a difference of range of said clamps when said armature is again released from said magnet.

7. The combination, substantially as described, with two lifting or propelling clamps having a different range of movement, of a propelling electro-magnet for said clamps, a derived-circuit electro-magnet, and a circuit closer and breaker for intermittently controlling the flow of a current through the propelling electro-magnet in obedience to the changes of arc-resistance.

8. The combination, substantially as described, with the plate P′, supporting the lamp mechanism and its inclosing-case B, of the depending ribs R R′ R″, placed with their edges to the light, clamping devices for the lower carbon carried by said ribs, supports q q, and the globe carried by said supports and surrounding the ribs and the light-giving focus.

9. In an electric lamp, a hanging support consisting of the parts H H′, substantially such as described, and movable joints m m, whereby a rapid change of the position of said lamp is effected, in combination with a lamp-body, B, and extension B′, and removable cap thereto, T, whereby a renewal of carbons may be rapidly and conveniently effected, as described.

10. The combination, substantially as described, of an electric lamp hung on pivoted supports, and a shunt-circuit closer for completing a path around the lamp when the lamp is changed from its vertical position.

11. The combination, substantially as described, of the rigid supporting-arms, the hinged hanging arms, and a shunt-circuit closer, all combined in the manner set forth, so that when the lamp is swung from the vertical said lamp is cut out of circuit.

12. The combination, substantially as described, of the main frame of the lamp, the jointed supports H H′, casing and tubular extension B B′, removable cap T, and automatic cut-out for completing a circuit around the lamp when the latter is swung into a horizontal position for the purpose of inserting a new carbon.

ELIHU THOMSON.

Witnesses:
W. B. THOMSON,
E. WILBUR RICE.