(No Model.)

E. THOMSON.

ELECTRIC LAMP.

No. 250,463. Patented Dec. 6, 1881.

Fig. 1.

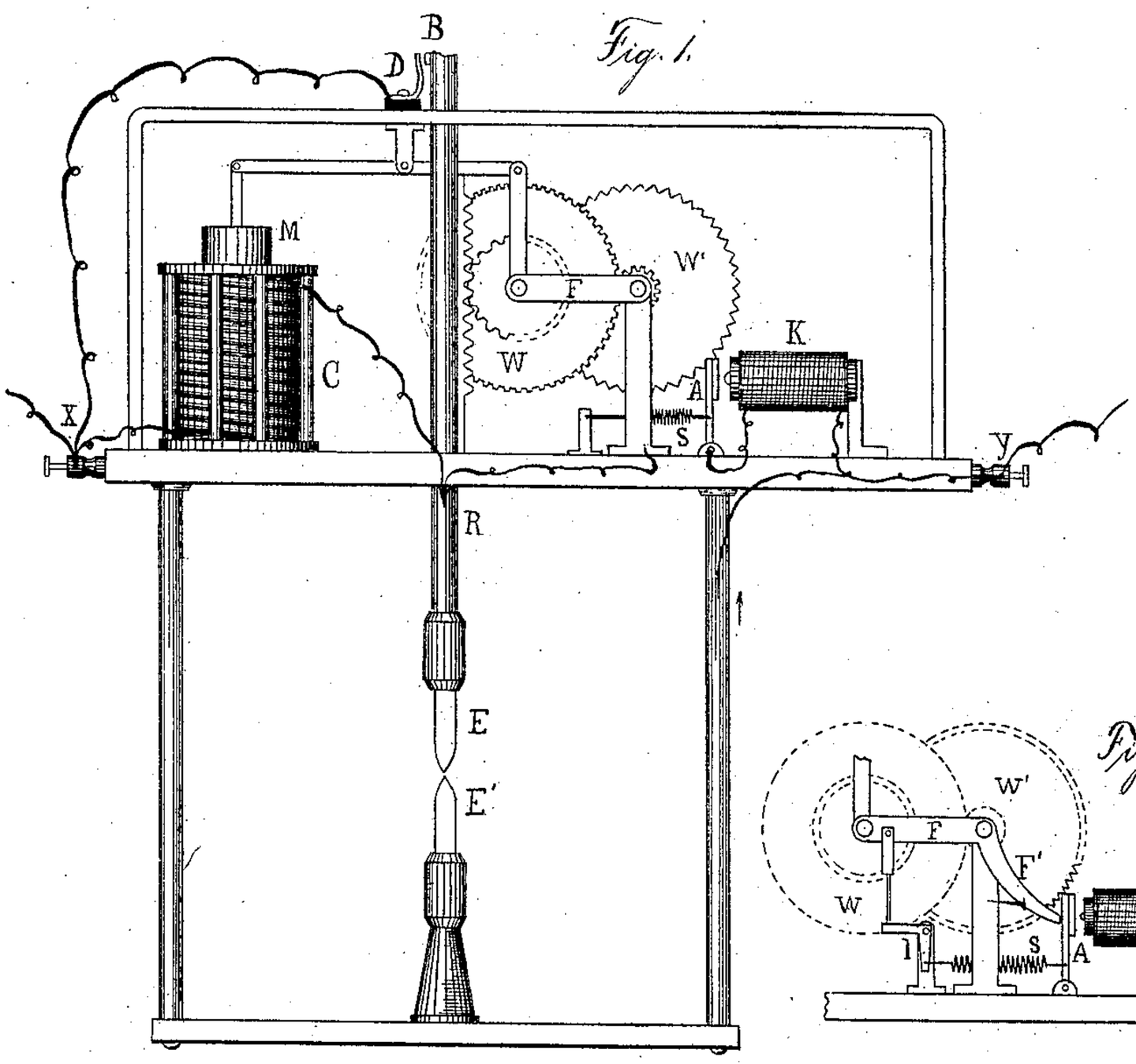


Fig. 4.

Fig. 2.

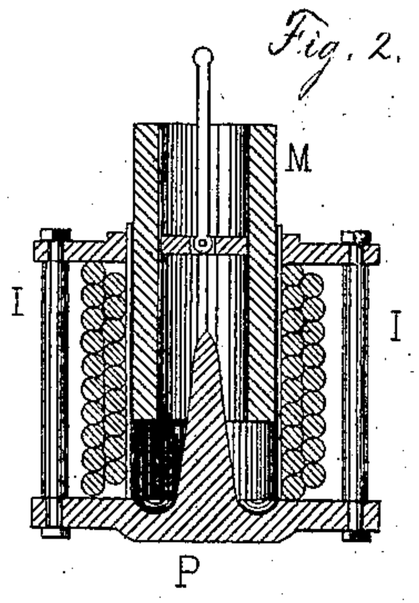
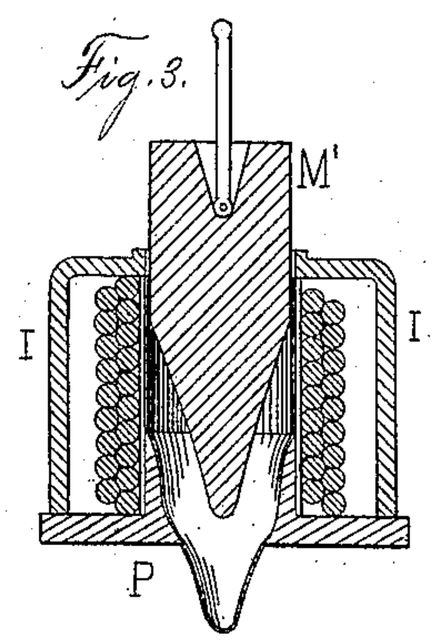


Fig. 3.



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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. 250,463, dated December 6, 1881.

Application filed March 2, 1881. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at New Britain, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Electric Lamps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to that class of electric lamps in which the separation of the carbon electrodes is under the control of the direct current, while the feeding of the electrodes as consumed is controlled by a shunt or derived circuit around the arc.

The object of my invention is to secure a perfectly steady light and to so adjust the feed of the carbons as to render the movement imperceptible, and to maintain with a constant current a practically constant length of arc, at the same time to allow an adjustment of the length of arc by the mechanism itself to compensate for changes in the resistance of the circuit upon which said lamp is operated.

Figure 1 is a front view of the lamp mechanism, where E E′ are the carbon electrodes, R the carbon-holding rod, C the separating-magnet coil, K the shunt-magnet. Fig. 2 shows the preferred construction of the separating-magnet. Fig. 3 is another equivalent form of separating-magnet. Fig. 4 shows an additional feature to adapt the lamps to be used upon a circuit whose resistance may change suddenly and cause the lamp to compensate for such changes.

The upper carbon rod, R, Fig. 1, is mounted so that in its descent it imparts rotary motion to a wheel, W. This is accomplished by a rack and pinion or by friction-rollers, as well known. The shaft of the wheel W is borne in a frame, F, pivoted at one end and adapted to be raised together with the wheel W and rod R by the magnetic force of an electric current traversing a coil, C, acting on its core M. The teeth of the large wheel W engage in those of a pinion concentric with the wheel W′ and the support of the frame F, as shown. The wheel W′ is provided with teeth, in which a projection of the lever carrying the armature A of the shunt-magnet K engages. The shaft of the wheel W′ is upheld by a suitable support fixed to the lamp. A spring, S, serves to hold the armature A of the shunt-magnet away, and so prevent rotation of the wheel W′. The current enters at the binding-post X, passes through the coil C, and then to the rod R, and since the wheels W and W′ are in metallic connection with said rod R, a division of said current takes place through the wheel W′ to the armature A, then through the magnet K of high resistance. Both branches of the current—that through the carbons E E′ and that through K—unite before reaching the post Y, where the current leaves the lamp, as shown.

The operation of the lamp, as thus constituted, is as follows: The core M is by passage of the current through the coil C attracted into it, thereby raising the frame F, wheel W, and rod R, since the pinion and wheel W′ are prevented from rotating by the armature A and spring S. The rod is thus lifted to a greater or less distance, depending on the current-strength in the coil C, and the separation or arc between E E′ is formed. The arc now continues to lengthen by the consumption of the electrodes until the arc-resistance is such as to cause the magnet K to attract its armature A and release the wheel W′. The rod R now descends, imparting motion to the wheel W′. The descent of the rod R is arrested when the carbons have approached sufficiently to render inactive the magnet K, when the spring S again acts, throwing into action the detent to prevent rotation of the wheel W′; but I find in practice that when the construction is such that the current continually circulates through the magnet K it sometimes happens that too many teeth of the wheel W′ escape the armature A acting as a catch, and the feed may therefore occasionally be excessive, and the carbons approach too near one another. I completely obviate this difficulty by causing the

armature A, when it leaves the wheel W′, to open the shunt-circuit through the magnet K. The armature then falls back, re-establishes contact through the shunt, but always strikes into the next tooth. The armature A then continues its oscillatory movement allowing tooth after tooth to escape it until the carbons are accurately adjusted.

The motor or separating-magnet is preferably a coil, C, surrounded by an iron casing, I I, Fig. 2, covering, or partly covering, its exterior, a plate, P, with a conical extension into the interior of the coil, and a movable hollow core, M, axially attracted into said coil. With various modifications of this construction any desired properties may be given to the axially attractive force, and it may be made to so elongate or diminish the arc of the lamp that a constant current is maintained flowing through it.

Fig. 3 shows an equivalent construction, where the core M′ is solid with a conical extension below, and the plate P has a tubular extension into the coil.

Fig. 4 shows the manner in which an adjustment of the force of the shunt-spring S is obtained, depending on the length of the arc between the electrodes. Such adjustment is necessary when the length of arc drawn in any lamp is subject to variations from any cause independently of consumption of the carbons. Instead of attaching the spring S at one end to the armature A, and at the other to a fixed support, as in Fig. 1, it is attached to A and to a small lever, *l*, acted on by the movement of the frame F in such a manner that when a long arc is drawn by the rising of the frame F a tightening of the spring S occurs, and when a short arc is drawn the spring S is slackened. This compensation is by me embodied in another application for Letters Patent.

Should a sudden break occur in the circuit or a piece of one of the carbons break off, a quick and sure descent of the carbons is secured by providing the frame F with a projection, F′, Fig. 4, which on a sudden weakening of the force of the separating-magnet strikes the armature A, and frees the wheel W′ from its restraint. A rapid descent of the electrode E is the result.

When the carbons E E′ are sufficiently consumed I prefer to cause them to fall freely together and prevent the arc reaching either of the carbon-holders and injuring it, and also to maintain a closed circuit through the lamp. This I effect by causing the descent of the rod R to a suitable point to close a contact, and so cut out the coil C when the carbons in each holder are short. Various modified devices may be employed to this end, but that shown in Fig. 1 is quite simple and effective. A projection, B, from the rod R, Fig. 1, strikes a stationary spring, D, connected to the post X, and thereby shunts around or cuts out the coil C. The core M being released the carbons immediately drop together and remain in close contact. To allow this free drop the part D is made elastic, so that B may slide by it and preserve contact.

I am aware that it is not new to cause a derived circuit-magnet controlling the movements of the carbons to break its own circuit in the act of releasing an arm attached to the train of an electro-magnet motor which feeds the carbon. In such a device, however, a complete revolution of the wheel carrying the arm is necessary before the train is stopped. By my improved arrangement, in which the detent controlled by the derived circuit-magnet engages with or impinges against the periphery of a wheel through which the derived circuit passes, the re-engagement and stoppage of the train are made instantaneous.

What I claim as my invention is—

1. The combination, in an electric lamp, of an upper carbon rod, a wheel rotated by a downward motion of said rod, a frame supporting said wheel and movable in position with it, an electro-magnet in the main or principal circuit acting upon said frame to separate the carbons, a wheel or wheels the shaft of which is stationary, an electro-magnet in a derived circuit around the carbons, and a locking detent controlled by said magnet and acting to prevent the rotation of the stationary wheel or wheels, substantially as described.

2. The combination, substantially as described, with the feeding-train of an electric-light regulator, of a detent device engaging with the periphery of a wheel of the train, and an electro-magnet controlling said detent the circuit of which is through the periphery of the wheel and the detent, substantially as described.

3. In an electric light regulator, a derived circuit electro-magnet, a detent controlled thereby, and a releasing-wheel which is in the derived circuit with the electro-magnet and with whose periphery the detent engages, substantially as described.

4. In an electric-light regulator, the combination, with the lifting mechanism acting upon the carbon-carrier and the locking device of the feeding-train, of intermediate devices acting upon said locking device to release the train when the lifting mechanism is lowered, substantially as and for the purpose described.

5. The combination, with the swinging frame carrying the feeding-gear, and serving to separate the carbons to form the arc of a projecting part acting upon the detent of said feeding-gear, substantially as described.

6. The projection F′ of the frame F, in combination with the detent device, whereby the electrodes are allowed to run together by the release of a detent when the current through the lamp ceases from any cause, as described.

7. In combination with a shunt-circuit around the lifting electro-magnet, circuit-closing devices adapted to be brought into action by the

descent of the carbon-carrier when the carbons are consumed, substantially as described.

8. The combination, with the descending carbon-rod R, of contact-points D and B, one of which is carried by the rod, and which are adapted to form a cut-out of the direct magnet-coil C, whereby, when the carbon points are nearly consumed they drop together and remain in contact, as described.

In testimony whereof I affix my signature in presence of two witnesses.

ELIHU THOMSON.

Witnesses:
G. W. HART,
E. W. RICE.