E. THOMSON & E. J. HOUSTON.

Regulator for Electric-Lamp.

No. 220,508. Patented Oct. 14, 1879.

FIG. 1.

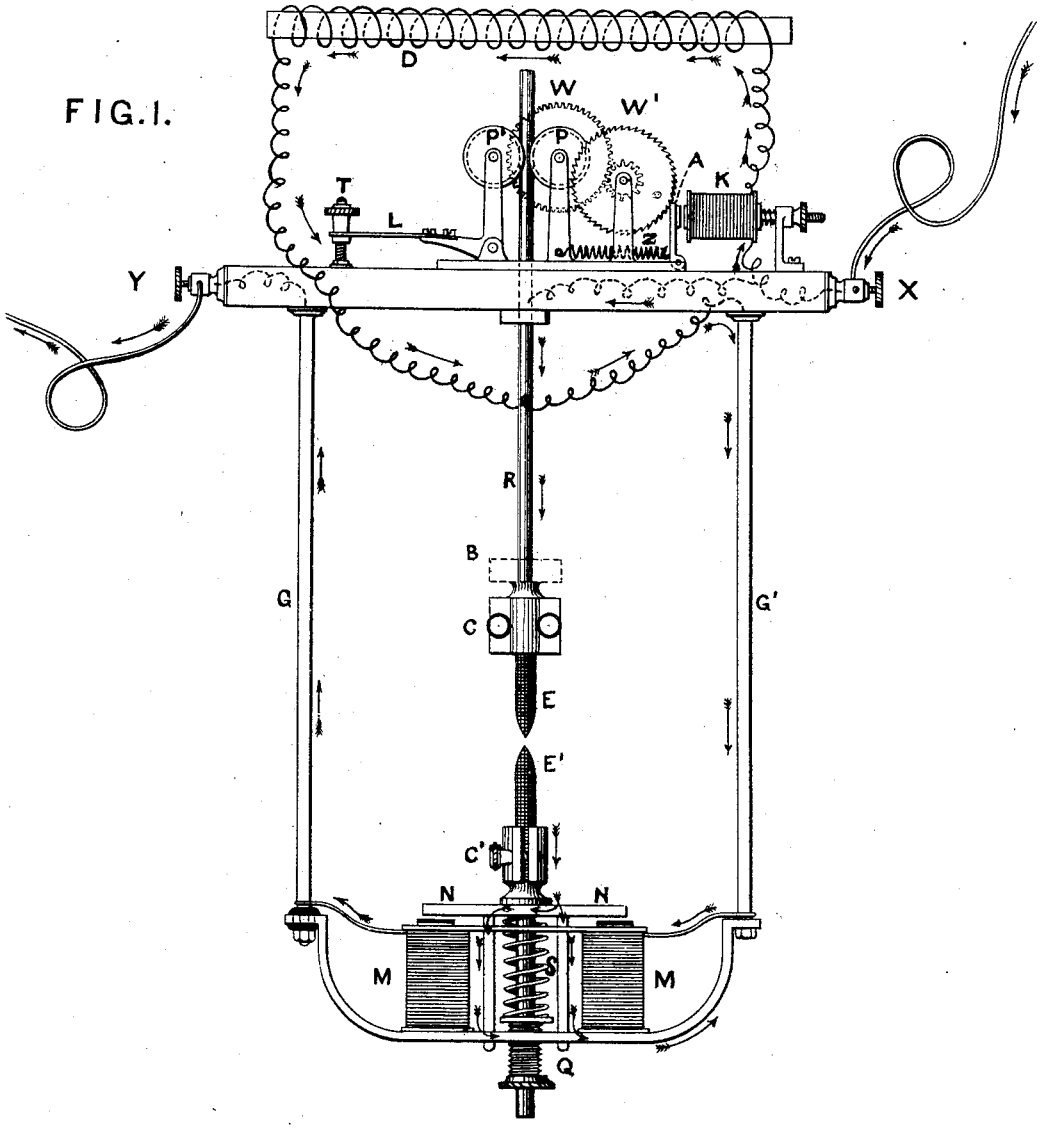
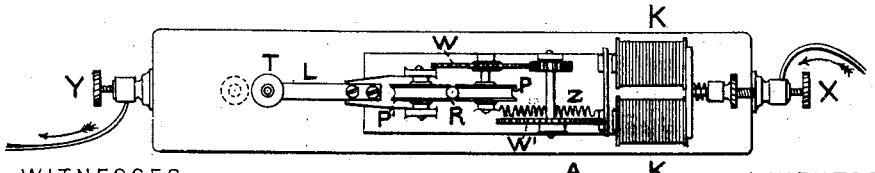


FIG. 2.



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IMPROVEMENT IN REGULATORS FOR ELECTRIC LAMPS.

Specification forming part of Letters Patent No. **220,508**, dated October 14, 1879; application filed June 11, 1879.

To all whom it may concern:

Be it known that we, ELIHU THOMSON and EDWIN J. HOUSTON, both of the city and county of Philadelphia, Pennsylvania, have invented certain Improvements in Regulators for Electric Lamps, whereby we are enabled to operate one or more lamps in a circuit, and at the same time to prevent great and sudden variations in the arc-resistances, of which the following is a specification.

This we accomplish by causing the distance between the carbon electrodes to remain nearly the same while the current is passing, while one of the features of our invention is that the feeding of, and consequently the distance between, the electrodes is practically independent of the strength of the current used with the lamp, so that the adjustment of said lamp need not be changed in accordance with a change in the current strength.

An extended series of investigations conducted by us has developed the novel fact that for arcs of equal length the electrical resistance of said arcs is approximately in the inverse proportion of the current-strength, and that, consequently, with a carbon arc, the current which traverses a shunt around said arc is approximately independent of the current strength, varying with the length of the arc between the electrodes. These facts we utilize in the construction and operation of our present invention.

The principle of our present invention may be briefly stated as follows, viz: One of the carbon electrodes is attached to the armature of an electro-magnet, and, on the passage of an electric current, said armature is attracted to said electro-magnet, and then held in a fixed position in respect thereto, thus effecting separation of the electrodes. The motion of the other electrode is under the control of a separate electro-magnet, whose coils are in a shunt-circuit around the arc between the electrodes. When the distance between the electrodes is increased by their consumption, the shunted current operates an escapement, which allows the slow approach of the electrode. Said approach ceases when the distance between the electrodes has reached the normal. This cessation of feeding occurs when the escapement above referred to is thrown out of action from the weakening of the current in the shunt-magnet. These actions, as we have before stated, are independent of considerable variations in the current strength.

We are aware that shunt-circuits have before been used in connection with electric regulators; but in our invention we employ the shunt-circuit in connection with a novel arrangement of parts designed to render the feeding of the carbon electrodes, as necessitated by their consumption, dependent on their distance apart, and nearly independent of general current strength and of a changed resistance of the arc, produced by a change in the current strength.

To effect this end, we discard entirely, as a means of regulating the lamp, the general arc-current, or current traversing the arc, making said regulation entirely dependent upon the magnetic power of a constant shunt-circuit around the arc.

Some of the advantages gained by this arrangement are that the length of the arc may be set for each lamp and remain independent of variations in the current strength or resistance of the arc consequent thereon. We are also enabled to maintain the length of the arc approximately constant, and avoid, during operation, sudden movements of the electrodes toward or from each other, thus avoiding the unsteadiness which results in many common forms of electric lamps due to the electrodes being suddenly and violently thrust together when feeding of the electrodes is needed, consequent on increased length of arc.

Figure 1 is a side elevation, and Fig. 2 a top view, of a lamp embodying the principles of our invention.

Similar letters of reference are used to indicate similar parts in the figures.

The carbon electrodes E E′ are held by suitable clamps C C′, and shown as consisting of two pieces brought together by screws, and whose inner surfaces are shaped to conform to the outline of the electrodes. The lower electrode-holder is attached to a movable armature, N N, of an electro-magnet, M M, and

kept out of contact therewith, when the lamp is out of use, by the supporting-spring S, the strength and position of which is regulated by the screw Q, which is made hollow to permit the passage through it of the electrode E′, as shown.

Rods G G′ support the magnet M M and the accompanying parts, and serve as a means of attachment to the parts supporting the electrode E′.

The upper electrode, E, is supported by the rod R, and suitably guided, so as to be vertically above the electrode E′. The rod R rests in frictional contact with the rollers P P′, the surfaces of contact of which are shaped to conform to the section of the rod R. One of said rollers P is supported in a fixed standard, while the other, P′, is arranged so as to admit of adjustment to and from the rod R by a bent lever, L, and a screw, T, or other suitable adjusting device. The pressure which the rollers P P′ exert on the side of the rod R is made such that the rod cannot fall or descend without imparting rotary motion to the roller P, upon the axis of which is placed a toothed wheel W, which in turn imparts motion to a second axis, bearing a second toothed wheel, W′. A projection from a light iron armature, A, held by the spring Z against the wheel W′, serves to prevent its rotation, and consequently to prevent the fall or descent of the electrode E.

The electro-magnet K, whose position with respect to its armature A is adjustable, is placed in a branch or shunt circuit around the electrodes E E′.

When desired the wheel W′ may be dispensed with, and the armature A act directly on the teeth of the wheel W.

The circuit-connections are as follows, viz: The current entering at the binding-post X passes to the rod R, to the electrode E, through the arc to E′; thence through the coils of the electro-magnet M M to the rod G and to the binding-post Y. The current entering the lamp is, however, branched through a shunt, D, of high resistance, of which the coils of the electro-magnet K form a part, and the extremities of which shunt are in electrical connection with the rod R, supporting the upper electrode, E, and the armature supporting the lower electrode, E′. The resistance of the shunt D is made two or three hundred times that of the arc which it controls, and thus but one two-hundredth or less of the work of the current is lost in the shunt-circuit.

The operation is as follows: The spring S maintains the armature N N in an elevated position, and consequently the electrodes E E′ in contact, when the lamp is not in use. On the passage of the current the armature N N is drawn down closely to the magnet-cores M M, being prevented from coming into actual contact therewith by a thin layer of interposed non-magnetic material. During the passage of the current through the lamp the electrode E′ is thus held in a fixed position, and is not free to oscillate, this result being secured by the proper regulation of the spring S by the screw Q.

Assuming a separation of the electrodes E E′ to have taken place, the upper electrode, E, being prevented from falling by the armature A catching in the teeth of the wheel W′, as before described, the position of the electrodes remains constant until the length of the arc has been increased by the consumption of the electrodes, and the current traversing the shunt-circuit D likewise increased, at which moment the electro-magnet K attracts its armature A, so that it no longer catches in the teeth of the wheel W′. At this moment the electrode E begins to descend slowly, giving rotation to the wheels W W′, a weight, B, the amount of which can be varied, permitting the rapidity of descent to be regulated.

Several of the teeth of the wheel W′ escape the armature A until, by the approach of the electrodes, the distance between them has become normal, the current traversing the shunt-circuit has become normal, the armature A catching in the teeth of the wheel W′, as at first, arrests the downward movement.

It is not essential that the shunt D have permanent attachment with the main circuit, as it will perform its office almost equally well if brought into periodical contact therewith, as every minute, any suitable device being employed to effect such periodical contact. In this case a saving of power in operating the shunt-circuit results.

It is evident to those versed in the art that by causing the movement of the upper electrode to give a corresponding upward movement to the lower electrode, the relative rapidity of whose motion is less than that of the upper electrode, the lamp will regulate both electrodes, and the position of the arc between the electrodes will remain practically constant, the regulation of the lamp still being effected by the same method as hereinbefore described.

We claim—

1. In an electric lamp, a rod, R, bearing the upper electrode, in combination with rollers P P′, resting in frictional contact with said rod, so arranged that during the fall of said electrode the supporting-rod R imparts rotary motion to the rollers P P′, which in turn impart motion to the toothed wheel W′, or its equivalent, substantially as described, and for the purpose specified.

2. In an electric lamp, the rod R, supporting the upper electrode, prevented from descending by the frictional contact of the rollers P P′, which rollers, acting in combination with the armature A, as described, are prevented from rotating when the magnetic attraction upon said armature is weakened, substantially in the manner described.

3. In an electric lamp, friction-rollers P P′, resting in contact with the rod R, supporting the upper electrode, the pressure of which contact is adjustable, substantially in the manner described, so that by the upward or downward

movement of said rod rotary motion is imparted to said rollers P P′, or their equivalent, for the purpose specified.

4. In an electric lamp, the combination of an armature, A, of a shunt-magnet, K, with a train of wheels, W W′, in such a manner that when the power of the shunt-magnet increases, the armature, acting as an escapement, allows rotation of said wheels, and when the power of the shunt-magnet decreases the armature acts to check such rotation, in the manner substantially as described.

5. In an electric lamp, the combination, with the electrode E, of the rod R, friction-rollers P P′, or their equivalents, wheel W′, armature A, acting as an escapement to said wheel, and shunt-magnet K, all operating together as a means of regulating and controlling the downward motion or feeding of said electrode, in the manner substantially as described.

6. In an electric lamp, the combination of the rod R, the friction-rollers P P′, wheel W′, armature A, and shunt-magnet K, for the purpose of controlling and regulating the position of the upper electrode, E, in the manner described, with the armature N N, the electromagnet M M, for the purpose of effecting the separation of the electrodes and maintaining the electrode E′ in a fixed position during the operation of the lamp.

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