(No Model.)

2 Sheets—Sheet 1.

N. S. KEITH.

ELECTRIC LAMP.

No. 255,794.

Patented Apr. 4, 1882.

Fig. 1.

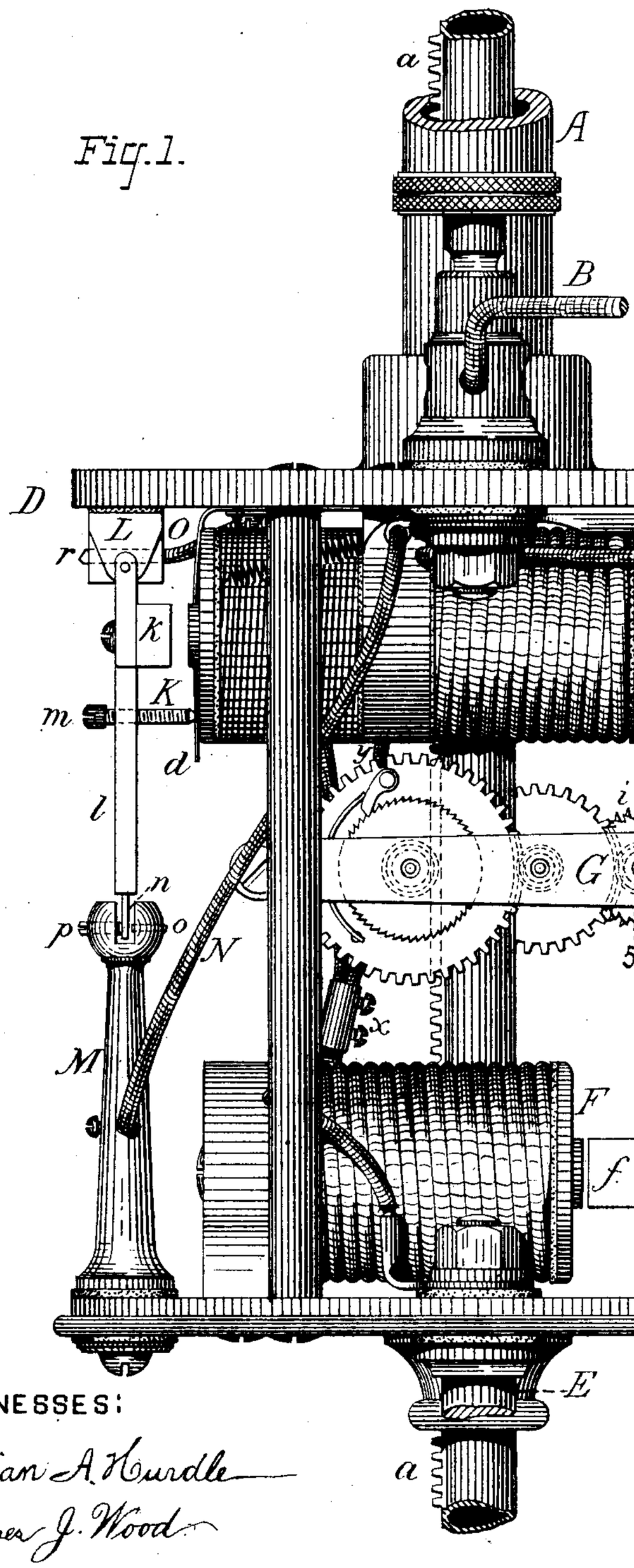


Fig. 3.

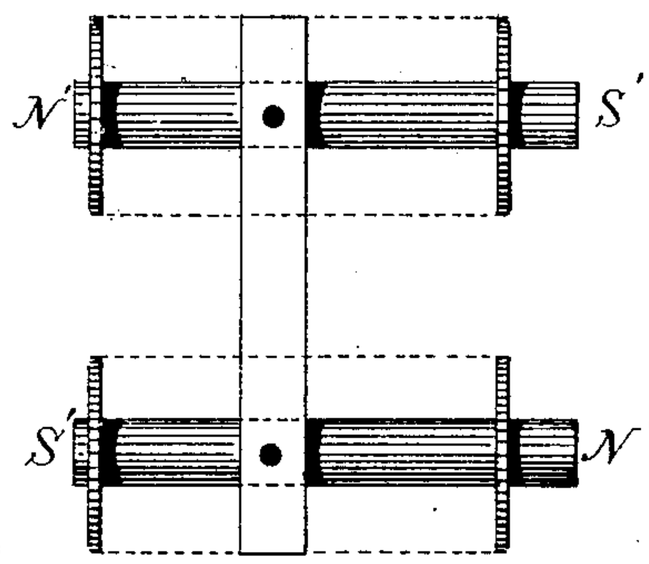
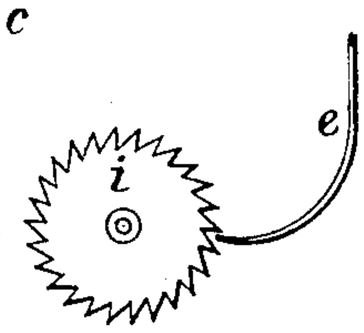


Fig. 4.



WITNESSES:

Julian A. Hurdle

James J. Wood

INVENTOR:

N. S. Keith

(No Model.) 2 Sheets—Sheet 2.

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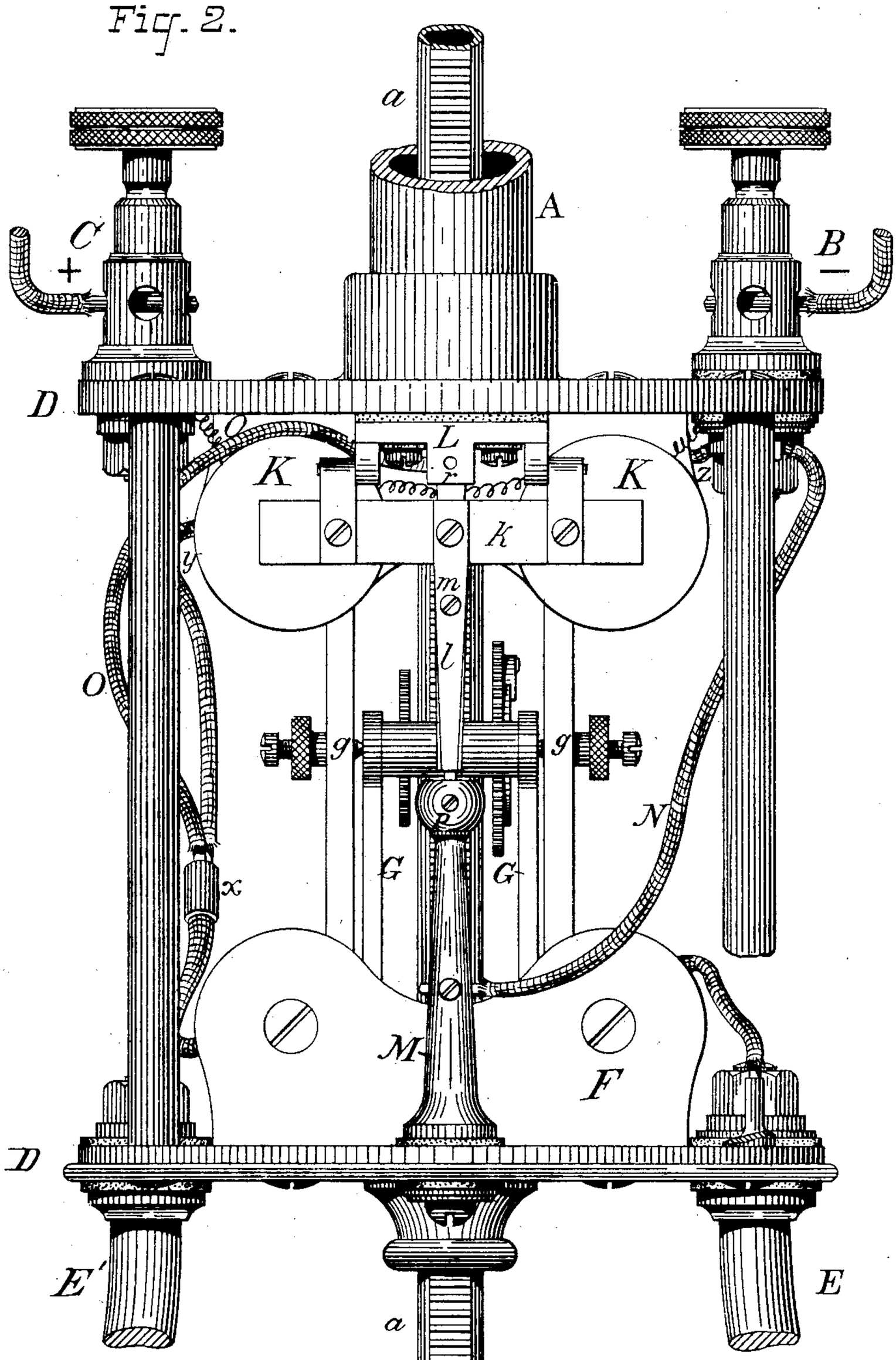
Fig. 2.



WITNESSES:

Julian A. Hurdle.

James J. Wood.

INVENTOR:

N. S. Keith

UNITED STATES PATENT OFFICE.

NATHANIEL S. KEITH, OF NEW YORK, N. Y.

ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 255,794, dated April 4, 1882.

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

To all whom it may concern:

Be it known that I, NATHANIEL S. KEITH, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Regulators; 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 the class of electric lamps or regulators which are so far automatic as to be controlled in a degree by variations in the electric current which produces the light, more precisely, however, to that class which depends upon variations in the strength of magnets within derived circuits of comparatively high resistance.

Heretofore in this class of lamps there has existed a difficulty, which I here point out, and which my invention overcomes or obviates. Take, for one instance, those lamps which depend in working upon the variations in the currents existing in an electro-magnet having two derived circuits in electric and magnetic opposition, and, for another instance, lamps wherein two electro-magnets upon derived circuits work in opposition upon one armature, which is moved by variations in the relative strength of the magnets. It is found in practice that in these classes of lamps, in which the carbon and its carrier are indirectly supported, in whole or in part, by the electro-magnet, precision of action depends upon the exact adjustment of the weights of the several movable parts to suit the normal amount of available magnetism, so that the two forces—gravity and magnetism—are in equilibrium. In these two kinds of lamps the changes in weight of the movable parts due to the combustion of the carbons destroy the necessary equilibrium, so that the light produced is not of equal steadiness and power throughout the time of the burning of a carbon pencil.

There is another kind of lamp which is controlled in its feed by the action of an electro-magnet in a derived circuit upon an armature carrying a detent, which engages and disengages one wheel of a train of gear-wheels actuated by the weight of a rod carrying one of the carbons. In this case the pressure on the detent by the tooth of the wheel makes it necessary that the strength of the magnetic attraction for the detent-armature should be considerably increased above what would be otherwise needful to disengage it, and when moved the change is correspondingly great before it can resume its engagement. Furthermore, the momentum of the carbon rod and train of wheels prevents the ready re-engagement of the detent by throwing it off until the change becomes sufficiently great to force a stop. This class does not permit the feed movement early enough and does not stop it soon enough, from the causes explained.

My improvement, which I now proceed to describe, overcomes these difficulties.

In the accompanying drawings like letters refer to like parts.

Figure 1 is a side elevation of a lamp made after my improvement, and Fig. 2 is another side elevation at an angle of ninety degrees to that of Fig. 1.

The lower parts of the lamp, the carbons, and holders are not shown, as their arrangement is well known and does not form part of my invention.

The lamps may be suspended from the ceiling or other convenient place by the tube A, which incloses the upper part of the positive carbon rod *a*. The positive wire from the generator is fastened in the binding-post C and the negative wire in the binding-post B. The binding-post C is in direct electric contact with the body of the lamp D, while the binding-post B is insulated therefrom and from all other parts except the wire circuits, as hereinafter explained. We may consider the electric current as entering the lamp at the binding-post C, and thence passing through the body of the lamp to the rod *a*, thence to the voltaic arc, and thence to the coils of the magnets by the rod E, which is, with the rod E′, electrically insulated from the body of the lamp. The current passing through the coils of the electro-magnet F pro-

duces magnetism, which attracts the armature *f*. As this armature is attached to the L-shaped frame G, carrying a train of gears actuated by the weight of the rod *a* through its rack in a well-known manner, and as the frame is pivoted at *g*, the resulting movement of the armature *f* raises the other end of the frame and the rod and its attachments, thus forming the arc.

The rod *a* is prevented from descending by the detent *e*, which simultaneously engages the wheel *i* by its movement, resulting from the attraction of the electro-magnet H for its armature *h*. The detent is shown in detail in Fig. 4. The wheel *i* is fixed to the same shaft with an escapement-wheel, 5, which imparts movement to a vibrating weighted escapement, 6, whose pallets are shown in dotted lines. The electro-magnet H acquires its magnetism from the current passing from the electro-magnet F through the course *x* and *y* and the coils of the magnet, and at Z to the binding-post B.

The armature *h* is pivoted at *b*, and is controlled as to the length of vibration by the stop *c*. There is a spring, *d'*, which operates to move the armature *h* away from the magnet H when *h* is not strongly enough attracted to overcome its force. This spring is like that shown at *d*, and is made to act more or less strongly by the set-screw *j* in obvious manner.

K is an electro-magnet, the coils of which are of comparatively high resistance and compose a derived circuit, which branches at the two binding-posts B and C. This electro-magnet acts upon the armature *k* and its attachments.

Attached to the body of the lamp, but electrically insulated therefrom, is the block L, which serves to suspend the armature *k* and the rod *l*. The rod *l* has a screw, of ivory, *m*, or other non-conducting material, which serves to regulate the tension of the spring *d*, which operates against the attraction of the electro-magnet K for the armature *k*.

At *n* and *o* are platina contact-pins. The screw *p* is of ivory or other non-conducting material, which serves to adjust the length of vibration of the rod *l* and the armature *k*. The post M is insulated from the body of the lamp, but is electrically connected with one end of the coil of the electro-magnet H through wire N and binding-post B. The block L is electrically connected with the other end of the coil of the electro-magnet H at *x* through the wire O, which is fastened to the block at *r*.

I have described the operation of the lamp in forming the arc, and will now proceed to describe its action in keeping the voltaic arc at approximately its normal length and resistance.

When the resistance at the voltaic arc increases the current of electricity and magnetism of the electro-magnet K increases in obedience to the law of derived circuits and moves the armature *k*, so that the contact-pieces *n* and *o* touch and close the shunt-circuit, which allows a considerable part of the current, which before flowed in the coils of the electro-magnet H, to flow in said shunt-circuit. The magnetism of H is thus much decreased, so that the armature *h* and detent *e* move away to allow the movement of the train of gears, and the rod *a* restores the normal arc and decreases the magnetism of K, so that the armature *k*, and through it the contact-piece *n*, moves so as to break the shunt-circuit and again restore the normal magnetism of H, which again attracts the armature *h* and engages the detent *e* with the wheel. This operation is repeated with the recurrence of the conditions. The changes of magnetism of the magnet H are so great and decided that the friction on the detent and the momentum of the parts are so far counteracted as to be of no appreciable consequence. As the movement of the parts connected with the armature *k* requires only the slightest change in the equilibrium of the forces, (the spring and magnetism of the magnet K,) the sensitiveness of the mechanism is secured, so that no reasonable changes in the weight of the rod *a* or its attachments have the slightest appreciable influence on the character of the light.

I have placed the post M, platina pin *n*, and the rod *l* in the lamp in a vertical position and the screw *p* and pin *o* in a position at right angles, to prevent the accidental introduction and retention of foreign substances between the contact-points, which would either close the circuit, if conductors, or prevent the closing of the circuit, if non-conductors—a condition which readily occurs in cases where such contact-surfaces lie horizontally.

For economy in manufacture and for ease in attachment to the body of the lamp, I attach the magnets H and K together, so that in form they are somewhat like a letter H, the cross-bar being the neutral part of both magnets and the place of attachment to the lamp. The coils are so wound that the poles are as shown in Fig. 3 by the letters N' and S', these meaning respectively north and south.

In place of stopping the movement of the wheels by the detent *e* engaging the teeth of one of the wheels, I have so arranged the detent that it engages and stops the double vibrating pendulum *t* in obvious manner. This does away with the friction of the teeth of the wheel and the detent and substitutes the pressure of the pendulum against the detent, which can be somewhat more easily compensated.

Broadly considered, the mode of shunting the current for controlling the feed movement of electric lamps is the subject of another application by me for Letters Patent.

As my invention consists broadly in causing marked changes in the electro-magnet controlling the detent mechanism by means of switch devices actuated by an electro-magnet in a derived circuit around the carbons, it is obviously within the scope of the invention to control the flow of the current through the detent electro-magnet by other arrangements of

the circuits passing through the switch and electro-magnet besides the particular arrangement described.

What I claim as my invention is—

1. In an electric-light regulator, the combination of a feeding-train, detent mechanism therefor, an electro-magnet controlling the detent mechanism, a shunt-circuit to the electro-magnet, and devices to automatically open and close said circuit to regulate the feed.

2. In an electric-light regulator, a main-circuit electro-magnet acting upon mechanism to separate the carbons for the purpose of forming the arc, in combination with a second electro-magnet provided with an automatically-controlled shunt or derived circuit, and acting upon the detent mechanism of the feeding-train, substantially as described.

3. The combination, in an electric-light regulator, of an electro-magnet in circuit with the carbons and acting upon mechanism to separate the carbons and form the arc, an electro-magnet controlling the detent mechanism of the feeding-train, a shunt-circuit around the detent electro-magnet, and a third electro-magnet in a derived circuit controlling the shunt, substantially as described.

4. In an electric-light regulator, the combination of a feeding-train, detent mechanism therefor controlled by an electro-magnet in the main circuit, and a shunt-circuit around said electro-magnet, which is opened and closed by a second electro-magnet, whose magnetic strength is varied by fluctuations in the length of arc.

5. In an electric-light regulator, the combination of a releasing or feed mechanism, detent devices for said mechanism, an electro-magnet in the main circuit controlling said detent devices and provided with a shunt-circuit, and an electro-magnet in a derived circuit of comparatively high resistance around the arc, serving to open and close said shunt-circuit, substantially as described.

6. In an electric-light regulator, the combination of an electro-magnet in the main or light circuit, acting upon mechanism to separate the carbons and form the arc, a second electro-magnet in the same circuit, controlling the detent mechanism of the feeding-train, a shunt-circuit to said second electro-magnet in a derived circuit around the two first-named electro-magnets and the arc, and acting through suitable switch devices to make and break the shunt-circuit around the second electro-magnet, substantially as described.

7. In an electric-light regulator, the combination of a detent electro-magnet, a derived-circuit electro-magnet, and intermediate switch devices serving to control the flow of current through said detent electro-magnets.

8. In an electric-light regulator, the combination of a releasing-train carried by the armature-lever of an electro-magnet in the main or light circuit, and a detent device operated by a second electro-magnet, which is provided with a shunt-circuit automatically opened and closed to regulate the feed.

9. The combination of electro-magnet H K, constructed in H form, as described, and provided at each end with two free polar extensions, armatures acted upon by said extensions, and regulating devices of an electric lamp.

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

N. S. KEITH.

Witnesses:
H. C. TOWNSEND,
JNO. DIFFLEY.