3 Sheets—Sheet 1.

H. S. MAXIM.
Electric-Lamp.

No. 208,252. Patented Sept. 24, 1878.

Fig.1

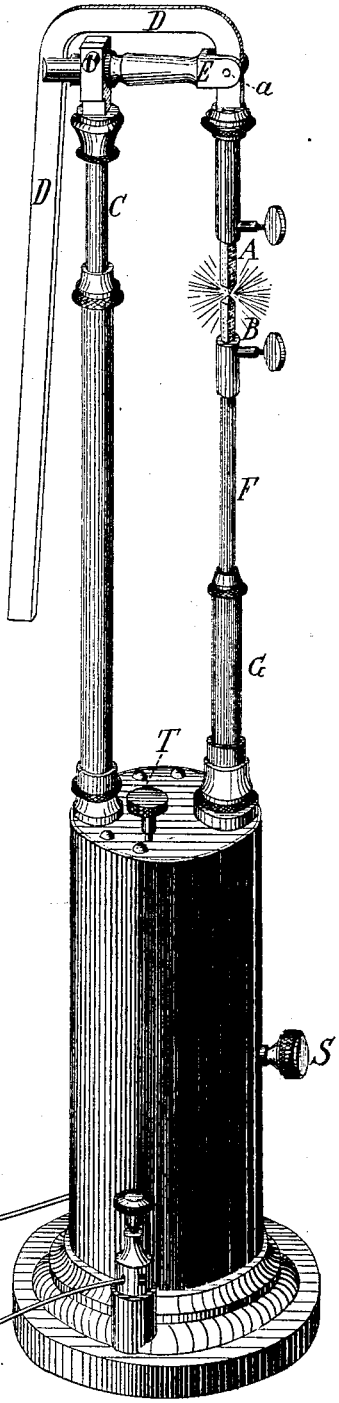


Fig.8

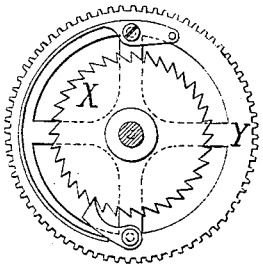
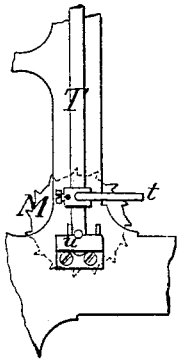


Fig.9



Witnesses;
I. S. Schuyler
George R. Williamson.

Inventor;
Hiram S. Maxim

H. S. MAXIM.
Electric-Lamp.

No. 208,252. Patented Sept. 24, 1878.

Fig. 2

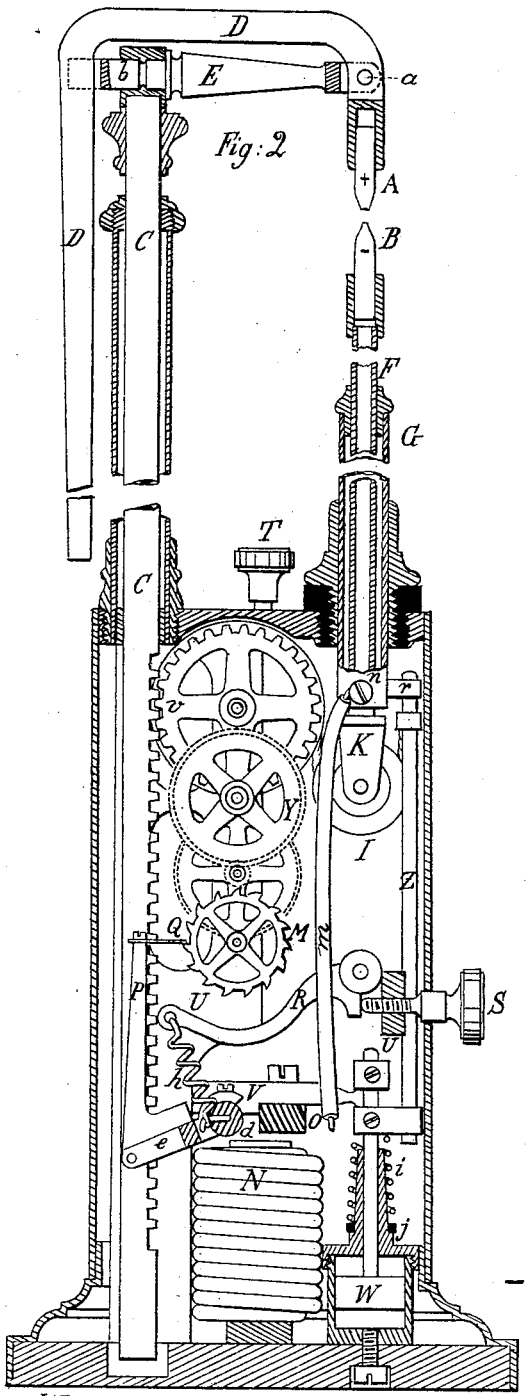
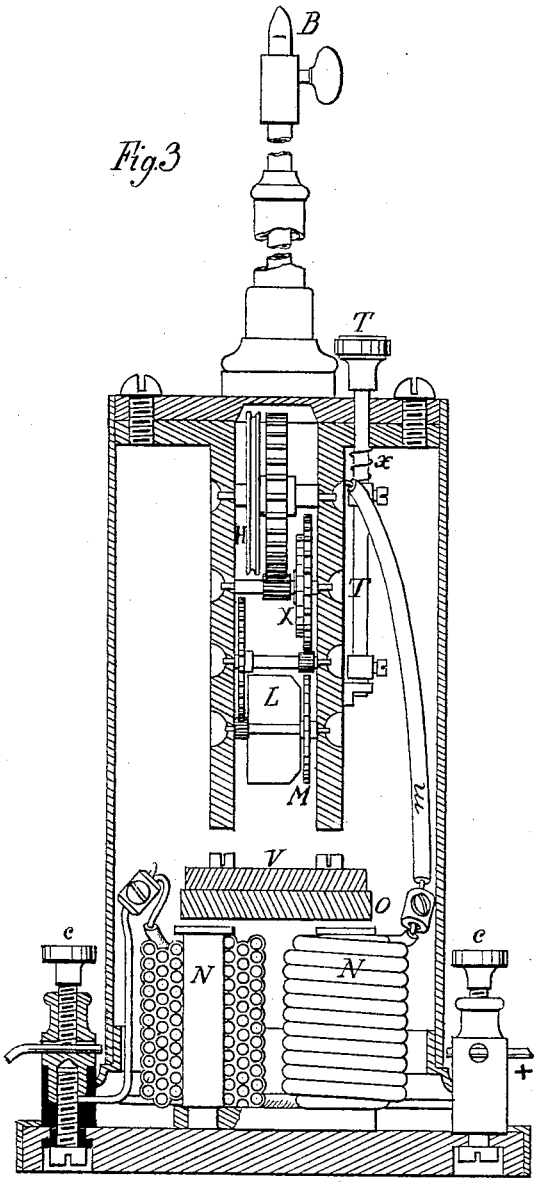


Fig. 3



Witnesses;
S. S. Schuyler
George R. Williamson.

Inventor;
Hiram S. Maxim

3 Sheets—Sheet 3.

H. S. MAXIM.
Electric-Lamp.

No. 208,252. Patented Sept. 24, 1878.

Fig. 4

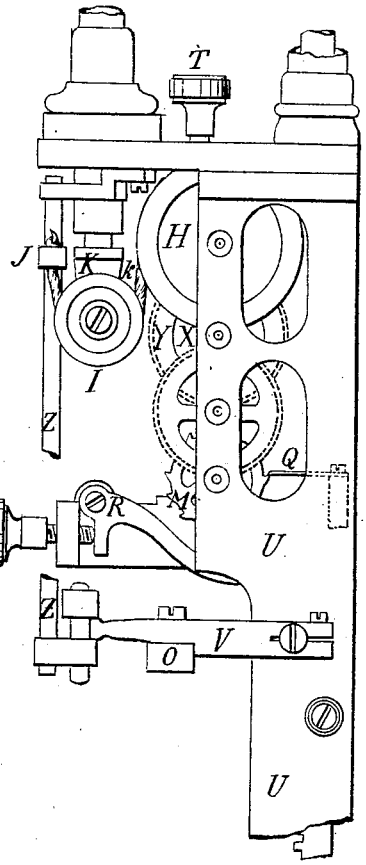


Fig. 8

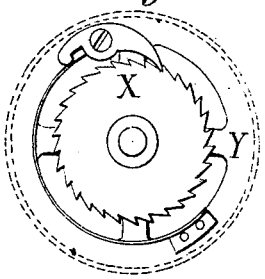


Fig. 7

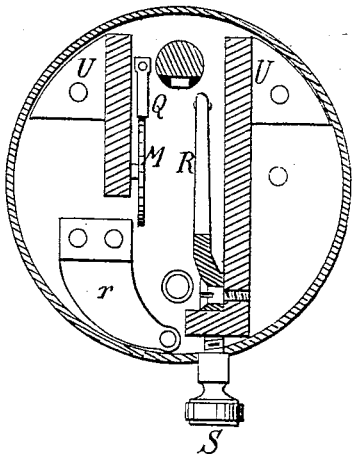


Fig. 5

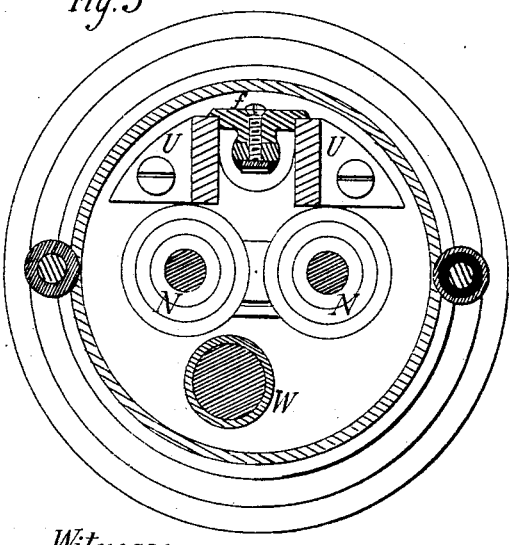
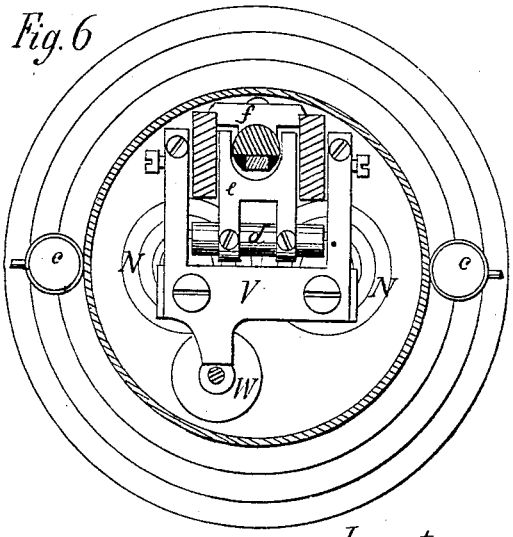


Fig. 6



Witnesses;
A. D. Schuyler
George R. Williamson.

Inventor;
Hiram S. Maxim

UNITED STATES PATENT OFFICE.

HIRAM S. MAXIM, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN ELECTRIC LAMPS.

Specification forming part of Letters Patent No. **208,252**, dated September 24, 1878; application filed August 9, 1878.

To all whom it may concern:

Be it known that I, HIRAM S. MAXIM, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Electric Lamps, which invention is fully set forth in the following specification and accompanying drawings.

The object of my invention is to produce an electric lamp or regulator which shall be compact and of small size, so as to cause very little shadow, of slight cost in construction, susceptible of very delicate adjustment, and suitable for use where great nicety and steadiness are required. It may be used either in connection with a powerful galvanic battery or a dynamo-electric machine.

This lamp belongs to a class in which the motive power operating its parts is derived from the falling force of one of the carbon-holders—usually the one conducting the positive current. All lamps of such construction, in consequence of the too great weight of the moving parts, have had too much inertia, requiring too great a change in the electro-motive force to move the parts from the point where the carbons are allowed to advance toward each other to another point where such advance is checked, and vice versa. It is also found in other lamps of this character that the great weight of the moving parts, which has to be nicely balanced by springs, takes up and maintains at times a vibratory motion, causing a very unpleasant unsteadiness in the light. This is due to the fact that the resistance of the arc is diminished and the magnetism increased by a movement of the carbons, which brings their respective points nearer together, which movement has the effect of again separating the points, and such separation again results in bringing them together. Thus cause and effect act and react each upon the other, and, in consequence, from its unsteadiness, the light is unpleasant and disagreeable.

In my lamp I so arrange the parts that the comparatively heavy work of separating the carbons is done with one armature, and the delicate work of locking and unlocking the gear is done with a light armature, which has no other work to perform.

Of the drawings, Figure 1 is a perspective view of my invention; Fig. 2, a vertical section; Fig. 3, a transverse section, its plane being perpendicular to Fig. 2; Fig. 4, an elevation, showing some of the details as viewed from the side opposite to that shown in Fig. 2; Fig. 5, a horizontal section cut near the bottom, and showing the relative positions of the dash-pot, magnet, and rods; Fig. 6, a horizontal section cut near the middle, and exhibiting the frame and armatures; Fig. 7, a horizontal section cut near the top, and showing a reversed plan of the top plate; Figs. 8 and 8′, side elevations of the ratchet and pawl; Fig. 9, the device for starting and stopping the train of gears, used to hold the gears in any desired position when the lamp is not in use.

In all of the drawings, A shows the positive carbon; B, the negative carbon; C, a rod provided with a rack and operating freely in tube about it; D, a bent lever, pivoted at *a;* E, an arm turning on the axis *b;* F, a tube sliding freely in tube G, and constituting the negative-carbon holder; H, a drum for winding the cord *k*. It is secured firmly to the same shaft that carries the pinion *v*. I, a small pulley attached to arm K, which is an extension of tube F; L, a flier of a fan; M, a toothed-wheel escapement; N, a strong electro-magnet; O, an armature attached to the arm V; P, an arm attached to the small armature *d*, and operating the stop catch or detent Q; R, an arm for regulating the tension of the spiral spring (retractile) *h*. Its position may be changed, and consequently the tension of the spring, by the thumb-nut S from the outside of the case. T, a thumb-nut, provided with a rod, also marked T, which may be turned so as to bring the projection *t* against the escapemant M, and so stop the movement of the gears.

The operation of my lamp is as follows: The wires being attached as shown in Fig. 1, and the carbons placed in the holders, the thumb-nut T may be so turned that the projection *t* is removed from contact with the escapement-wheel. When this is done the weight of the positive-carbon holder will cause the flier and escapement-wheel to revolve, and by turning the drum H will wind up the cord *k* and draw up the negative carbon one-half the distance traveled by the positive carbon, it being observed that one end of the cord is attached to arm J on rod Z. When the points of the two

carbons are quite near, and before actual contact is made, the points should be brought into the same line by the lever D. When the two carbons touch each other an electrical contact is made, and a strong current is passed through the bobbins on the electro-magnet N, which becomes excited and draws down the two armatures O and *d*. The downward movement of O separates the carbons by dropping the negative carbon, as it will be seen that this armature is attached to the arm J, which holds one end of the cord-supporting holder. This movement establishes the arc, while the downward movement of the smaller armature locks the gear by bringing the detent Q in contact with the escapement-wheel M. The thumb-nut S may now be turned and the tension of the retractile spring increased or diminished until the strength of the magnetism and the tension of the spring are balanced for a certain length of arc.

As the carbons are consumed the distance between them increases, and consequently the resistance in the arc. This diminishes the current and also the strength of the magnet N. The spring *h* will now draw away the armature *d* from the magnet. This movement unlocks the train of gears by removing the detent from the wheel M, when the carbons will slowly approach each other, the positive traveling just twice the distance that the negative travels. When the arc is sufficiently shortened the strength of the magnet will have increased and the detent once more brought against the wheel, when no further movement will be possible until the magnetism is again diminished by the increased length of the arc.

Should the arc be blown away, then the large armature O will be liberated, and the spring *i* will push up the negative, make contact and establish the arc and restore magnetism instantly, before the positive carbon has had time to change its position.

It will be seen that no movement of the armature O, however quick, can interfere with the working of the train of gears or throw the positive, which produces light, out of focus. A dash-pot, W, is attached to the armature to prevent too great a shock.

The rod T has a peculiar step, *u*, at its bottom end, and is provided with a projecting arm, which fits in grooves in the step, the arm being pressed into them by the spring *x* on the upper end of the rod. One of the grooves corresponds with the position required to stop the train of gears and the other to start the same, the object being to hold the rod in either of the positions without danger of changing.

The tension of the spring *i* may be regulated by the nut *j*. The relation of the parts should be so adjusted that the armatures can never touch the magnet, and the small one, *d*, should never come nearer than one-eighth of an inch to the magnet.

In actual use the lamp is often placed much above the operator, and in such cases, with the old devices, it is impossible to adjust the carbons in the same vertical line; but with the improved combination of the lever D and the arm E the adjustment is applied below the focus, and, as the carbon moves in the same direction as the lever, it is a simple matter to place it in any position required.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of the lever D, arm E, pivot *a*, and spindle *b*, when constructed as and operating in the manner and for the purpose herein shown and set forth.

2. The combination of the electro-magnet N, dash-pot W, armatures *d* and O, spring *i*, and nut *j*, as shown, in connection with a drum, cord, and pulley, substantially as and for the purpose herein shown and specified.

3. The combination of drum H, cord *k*, movable arm J, and pulley I, when said pulley is attached to and moves with the anode-holder, in the manner and for the purpose herein shown and specified.

4. The combination of rod T, spring *x*, step *u* and arm *t*, when constructed substantially as and operated in the manner and for the purpose herein shown and specified.

5. The combination of electro-magnet N, armature O, arm J, cord *k*, drum H, and pulley I, when said pulley is attached to and moves with the anode-holder, as herein shown and described.

HIRAM S. MAXIM.

Witnesses:
S. D. SCHUYLER,
GEORGE R. WILLIAMSON.