(No Model.)

A. G. HOLCOMBE.

ELECTRIC LAMP.

No. 249,047. Patented Nov. 1, 1881.

Fig. 1

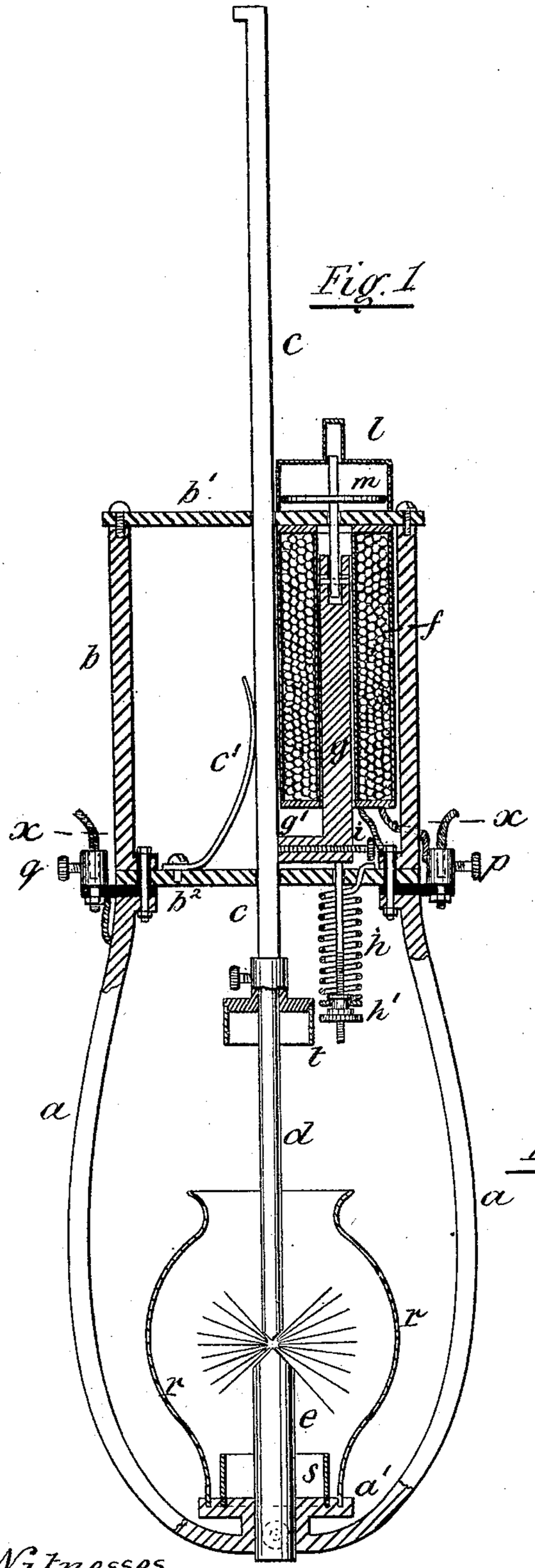


Fig. 2.

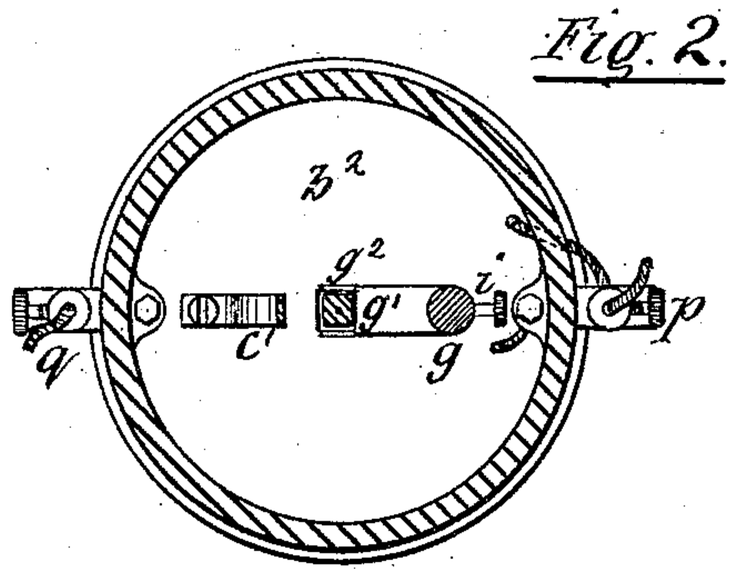


Fig. 5.

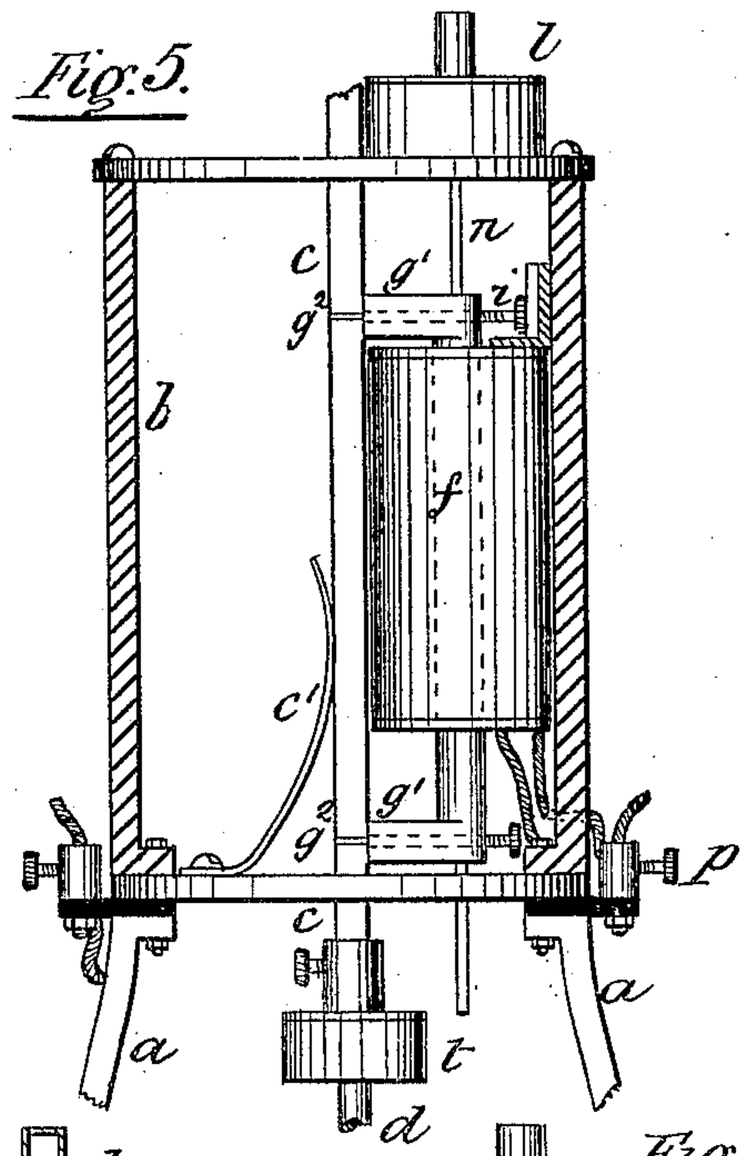


Fig. 4

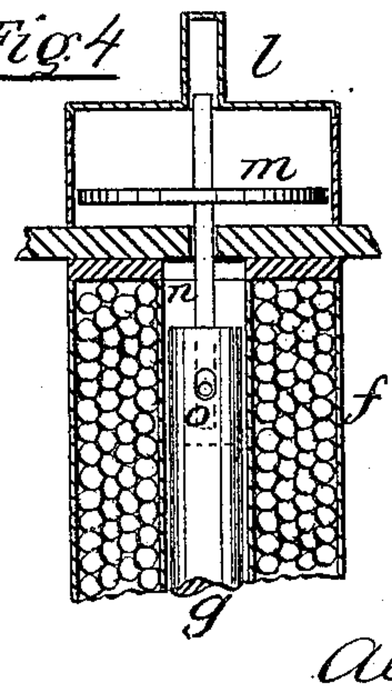
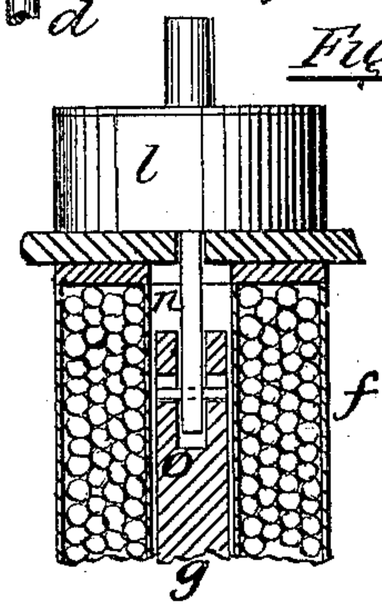


Fig. 3.



Witnesses.
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Alfred G. Holcombe.
Inventor
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UNITED STATES PATENT OFFICE.

ALFRED G. HOLCOMBE, OF DANIELSONVILLE, CONNECTICUT, ASSIGNOR TO THE STANDARD ELECTRIC LIGHT COMPANY, OF NEW YORK, N. Y.

ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 249,047, dated November 1, 1881.

Application filed October 7, 1880. (No model.)

To all whom it may concern:

Be it known that I, ALFRED G. HOLCOMBE, of Danielsonville, county of Windham, State of Connecticut, have invented certain new and useful Improvements in Electric Lamps, of which the following is a specification.

Letters Patent of the United States were granted to me for improvements in electric-light apparatus dated November 25, 1879, and numbered 221,918, in which the electric arc was controlled by means of the magnetic action of the core of an axial magnet on the periphery of a rotating soft-iron disk connected by suitable means to the carbon-carriers.

Now, this invention has for its object to construct a cheap and simple electric-light regulator, in which the electric arc is formed and controlled by the magnetic action of the core of an axial magnet or the moving armature of an electro-magnet directly on the rod to which the carbon is secured, and which for this purpose is made of soft iron; and it further consists of a simple and efficient means for indicating when the carbons require adjusting or renewal, and also in a novel application of a speed-regulator to the core of the axial magnet or the moving armature of an electro-magnet, all of which will be fully set forth by reference had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical sectional elevation of my improvement in electric lamps. Fig. 2 is a transverse section of the same cut through the line *x x*. Fig. 3 is an enlarged view of the speed-regulating device connected to the core of the axial magnet. Fig. 4 is a view of the same, taken at right angles to Fig. 3; and Fig. 5 is a sectional view of the upper part of an electric lamp, showing a modification in the form of the core of the axial magnet.

My improvements are shown in the drawings as applied to a hanging electric lamp. The frame *a a*, for holding the lower carbon and glass shade, and the case *b*, for holding the arc-regulating device, are of the ordinary construction—that is to say, the frame *a a* is electrically insulated from the case *b*.

Through the center of the case *b* is placed the soft-iron rod *c*, which by preference is made rectangular in cross-section, as shown at Fig. 2, and it is fitted to slide freely through the top and bottom plates, b' and b^2, of the case *b*. The lower end of this rod *c* is provided with a socket, in which is secured the upper carbon, *d*, the lower carbon, *e*, being in line therewith and secured in a hole made therefor in the lower part of the frame *a a* by means of a spring bearing against it, or by a set-screw, and is passed upwardly through the hole to place it in the desired position. This lower carbon, *e*, is made considerably thicker than the upper one, so that it will last a long time without readjustment, without materially changing the position of the light-focus. It is adjusted by the part of it below the frame, which may be of any desired length, thus obviating the necessity of removing the glass shade for this purpose.

The axial magnet *f* is secured in the case *b* in the position shown, and its core *g* projects beyond the lower end of it. The projecting end of the core *g* is bent at right angles, so that its extreme end g' is in close proximity to the soft-iron rod *c*, and through this bent end is fitted the brass screw *i*, the point of which may be set to come in contact with the rod *c*. The soft-iron core *g* and the soft-iron rod *c* are covered with a coating of platinum or nickel by electrical deposition thereon, or by other suitable means, to prevent oxidation of their surfaces. The iron core *g* is supported and balanced by means of the adjustable spring *h*, one end of which is secured to the plate b^2 of the case *b*, and the other end to a washer held in a groove formed in the stem of the thumb-nut h', which is tapped to fit on a screw-rod projecting downwardly through the plate b^2 from the core *g*. The strength of the spring *h* is regulated by the position of the nut h' on the screw-rod. To prevent the core *g* moving up into the helix of the axial magnet too suddenly when an electric current traverses said helix, but to allow it to fall suddenly when the current becomes lessened or is shut entirely off, I provide a retarding or regulating device, consisting of the pneumatic cylinder *l*, into which fits the piston *m*, sufficiently free to allow the air in the cylinder above the piston to slowly escape when the piston is raised. This piston *m* is connected to the core *g* by means of the rod *n*, in the following manner: The rod *n* passes down in a central hole (made some-

what larger than it) in the upper end of the core *g*, and transversely through the core *g* and rod *n* is passed the pin *o*, which fits tight in the rod *n*, the hole therefor in the core *g* being elongated longitudinally to the core, or considerably enlarged, as shown at Figs. 3 and 4, allowing some longitudinal play between the core *g* and the piston *m*, the object of which will be hereinafter explained.

The electric current enters the lamp by the binding-post *p*, connected to one of the insulating-blocks which separate the case *b* from the frame *a a*. From the post *p* it passes through the helix of the axial magnet, and from it through the plate b^2 to the rod *c*, passing through the upper carbon, *d*, to the lower carbon, *e*, and from it by the frame *a* to the binding-post *q*, which is secured to the other insulating-block separating the frame *a a* and case *b*.

The spring *c'* is for the purpose of insuring perfect electrical contact between the rod *c* and the plate b^2. The side of the rod *c* against which the spring *c'* bears may be provided with a plate of copper or other conducting metal, if deemed necessary.

Inside the glass shade *r* is placed the cylindrical shade *s*, held in a groove made therefor in the cup *a'*, which holds the glass shade. This cylindrical shield *s*, I propose to make of colored glass—red, for instance—or it may be made of any refractory substance, the object of it being to indicate by changing the color of the light of the arc, or by obstructing it entirely before the lower carbon becomes consumed sufficiently for the arc to destroy the metal socket or frame holding it, giving plenty of time to prevent such destruction of the frame of the lamp by resetting or renewing the carbon. A similar cylindrical shade, *t*, is held in the socket which carries the upper carbon, *d*, to shade or change the color of the arc when the upper carbon is burning dangerously close to the socket; and if colored glass or other colored material be used for these cylindrical shades, then I propose to color the upper one, *t*, differently to that of the lower one, *s*, so that the distinctive change of color of the light will indicate the carbon requiring attention; and should both carbons be consumed at the same time, the shades *t* and *s* meet and shade the light entirely, or show a light of two colors.

The operation of the lamp is as follows: The carbons being in contact, upon an electric current being caused to pass through the helix of the electro-magnet *f*, the core *g* becomes magnetized, and by induction first firmly adheres to the iron rod *c*. The core *g* is also set out of the center of the helix, so that its tendency to assume a central position therein causes its end *g'* to move toward and bear on the rod *c*. The core *g* then moves up into the helix, carrying the rod *c* with it, and so separates the carbons to form an arc between their ends. With a powerful current it may be necessary to prevent too close a contact between the end *g'* of the core and the rod *c*. The brass screw *i* is for this purpose, and may be regulated as desired. To overcome the sudden upward movement of the core *c* and carbon *d*, the pneumatic resistance cylinder and piston *l m* come into play as the pin *o* is in contact with the bottom side of the enlarged transverse hole in the core *c* when the lamp is first started, as shown at Figs. 3 and 4; but as the arc increases beyond its proper limit, and consequently decreases the current, the core *g*, with the rod *c*, is allowed to fall suddenly to bring the arc to its right working length, as it is not retarded by the piston *m*, for the reason that the enlarged transverse hole allows it to so fall some distance before the top side of the hole comes in contact with the pin *o;* but before the core is again ready to rise the slower-moving piston *m* has brought the pin *o* again in contact with the bottom side of the enlarged transverse hole in the core to again retard the upward movement of the core. When the resistance of the arc increases sufficiently to decrease the current and reduce the magnetism of the core, and thus weaken its hold on the rod *c*, the rod *c*, by its weight, slides over the end of the core to again bring the ends of the carbons within the proper arc distance, where it is held by a corresponding increase of magnetism in the core, caused by the increase of current passing through the helix, by which combination of simple devices I am enabled to make a perfect electric-light regulator at very low cost, and one that is not liable to get out of order.

In the modification shown at Fig. 5 the construction and operation of the lamp are the same as just described, with the exception that both ends of the core *g* are bent at right angles to act on the rod *c* by induction, as thereby a closed magnetic circuit is formed in the core *g*, giving a firmer hold on the rod *c*, and causing the core *g* to actuate the rod *c* with greater certainty than when only one end of the core is set to act by induction on the rod; and I would here mention that the principle of moving the carbon rod of an electric lamp by the magnetic induction thereon of the core of an axial magnet is not new with me, such an electric lamp being described in the French Patent of Genet, No. 25,176, dated November 8, 1859.

Small brass pins g^2 are fixed in the ends of the core *g*, to embrace the sides of the rod *c*, as shown at Figs. 2 and 5, to prevent the core *g* swinging around and away from the rod *c*.

It is obvious that the form of connection between the moving core and the pneumatic retarding or regulating device may be used with other forms of regulating devices; also, that other modifications may be made without departing from the nature of my invention—as, for instance, to admit of the case *b* being made much smaller, the lower end of the rod *c* may be bent at right angles to it to bring the carbon-holding socket centrally under the axial

magnet *f*, the adjustable spring *h* being placed to one side of it. So I do not wish to confine myself to the particular construction and arrangement of the various devices shown and described; but

What I claim, and desire to secure by Letters Patent, is—

1. The core of an axial magnet having both of its ends formed at right angles to project beyond the side of the helix, in combination with a soft-iron carbon-carrying rod adapted to slide near the side of the helix in direction parallel to the axis thereof, substantially as hereinbefore set forth.

2. The combination of the soft-iron carbon-carrying rod *c* with the core *g* of an axial magnet, and the contact-adjusting screw *i*, substantially as hereinbefore set forth.

3. In combination, the core *g*, pneumatic resistance device *l m*, rod *n*, and pin *o*, working in the slot in the core *g*, substantially as hereinbefore set forth.

4. In combination, the rod *c*, core *g*, having one of its ends formed at right angles to its body, and the pneumatic resistance device *l*, *m*, and *n*, connected to the other end of the core *g*, substantially as hereinbefore set forth.

5. In combination, the pneumatic resistance device *l m n*, the core *g*, constructed as described, the adjustable spring *h*, and the carbon-carrying rod *c*, substantially as hereinbefore set forth.

6. In an electric-light apparatus, the combination of the shade *s* with the lower-carbon-holding cup *a'* and carbon rods *e* and *d*, substantially as and for the purpose hereinbefore set forth.

7. The combination, with the upper-carbon-carrying socket and carbon rods *d* and *e* of an electric-light apparatus, of a shade, *t*, substantially as and for the purpose hereinbefore set forth.

8. In an electric lamp, the combination of the carbon rod *d*, its holding-socket, and transparent shade *t*, of one color, with the carbon rod *e*, its holding-cup *a'*, and transparent shade *s*, of another color, substantially as and for the purpose hereinbefore set forth.

In testimony whereof I have hereunto set my hand this 6th day of October, A. D. 1880.

ALFRED G. HOLCOMBE.

Witnesses:

ALFRED SHEDLOCK,

H. D. WILLIAMS.