(No Model.) 2 Sheets—Sheet 1.

# A. SHEDLOCK.

## ELECTRIC ARC LAMP.

No. 277,166. Patented May 8, 1883.

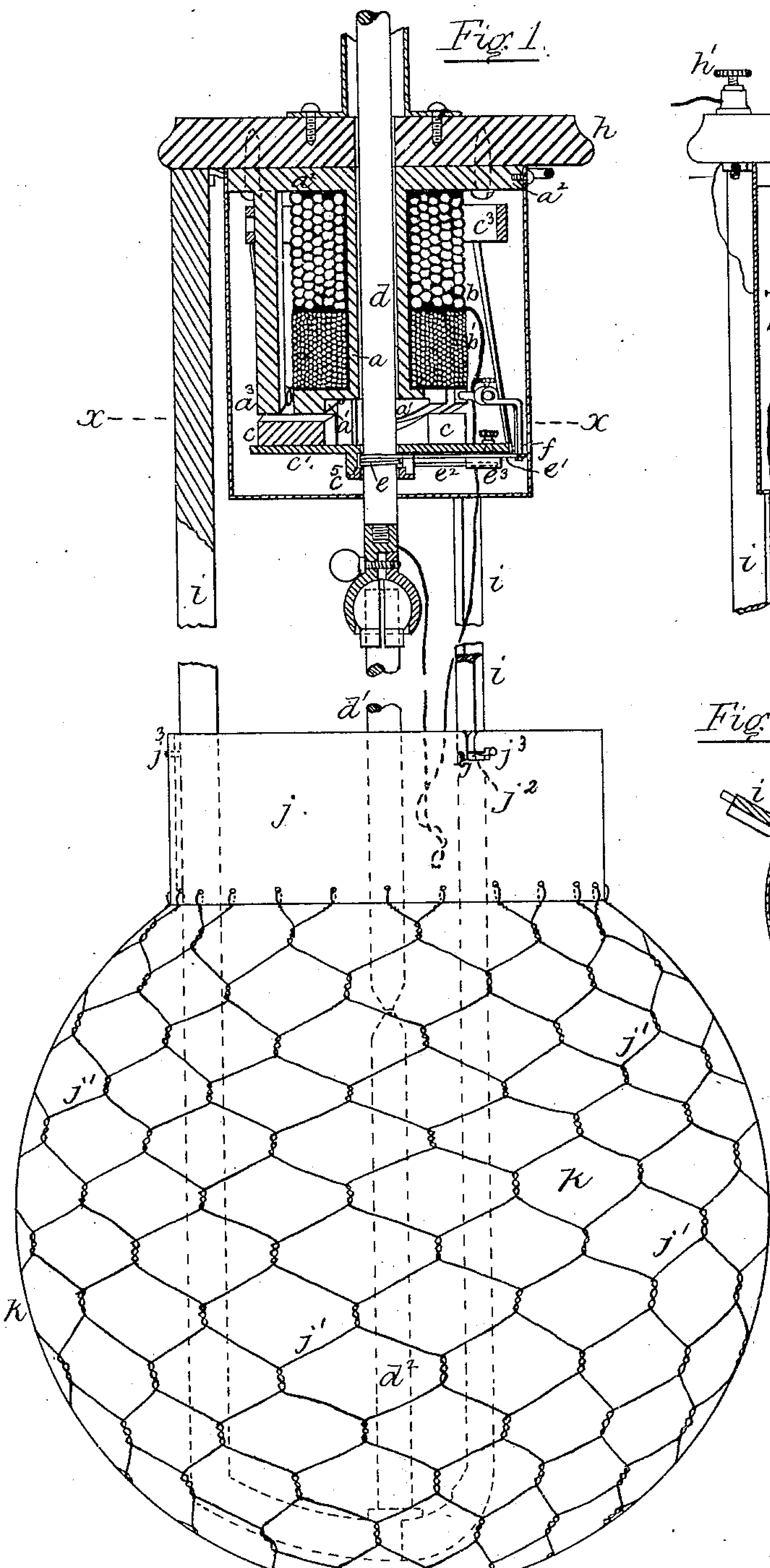


Fig. 1.

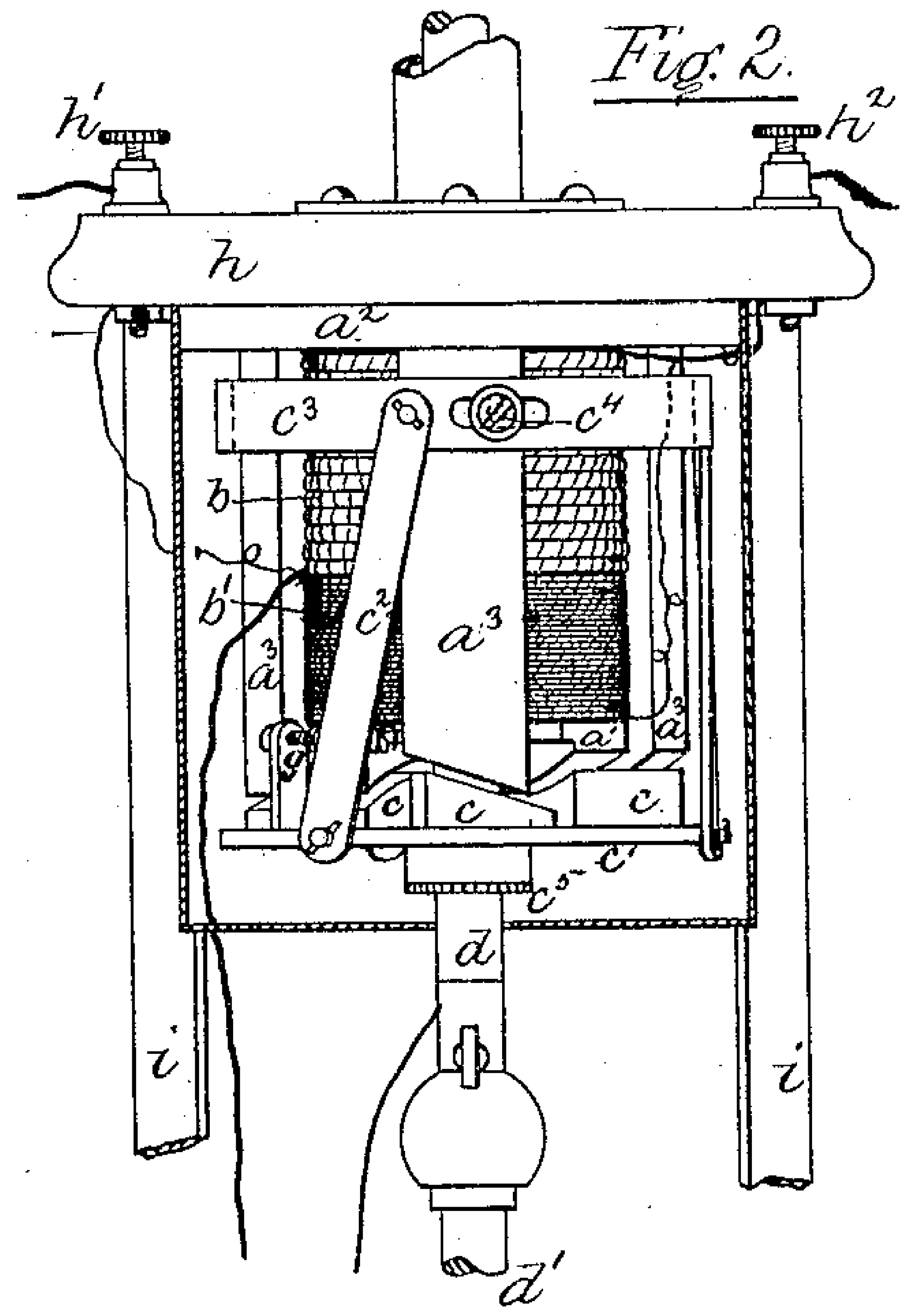


Fig. 2.

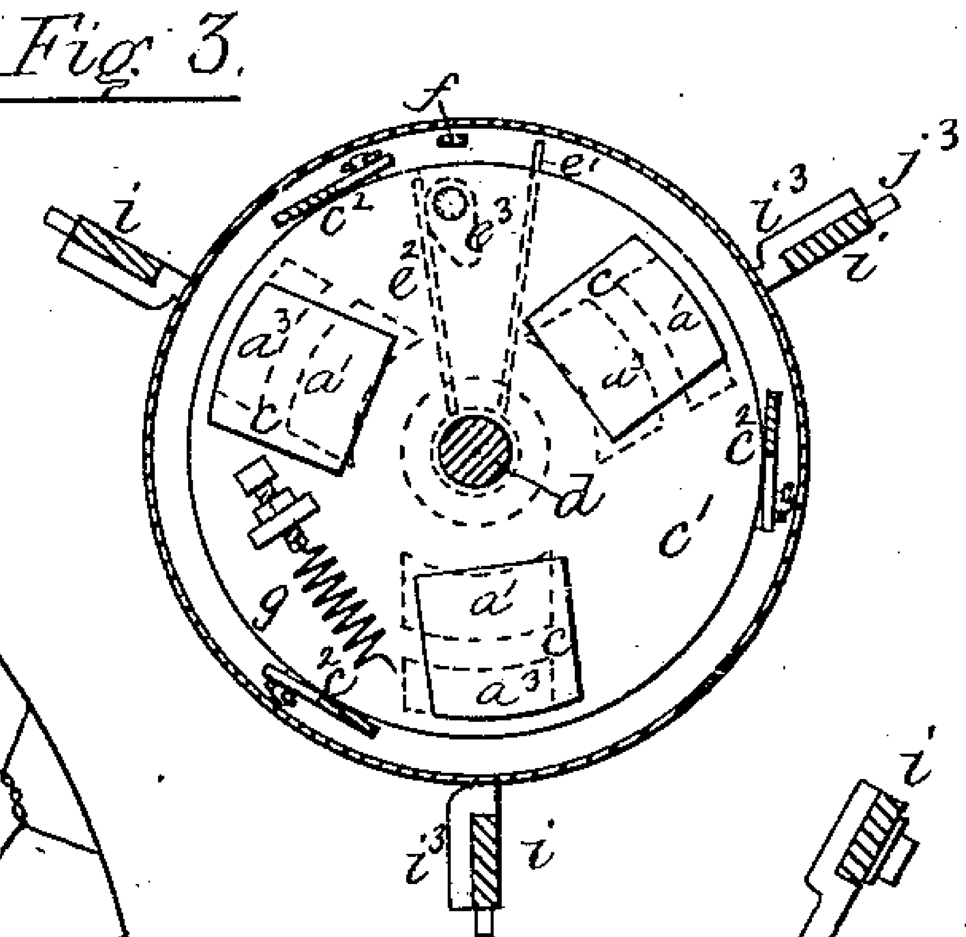


Fig. 3.

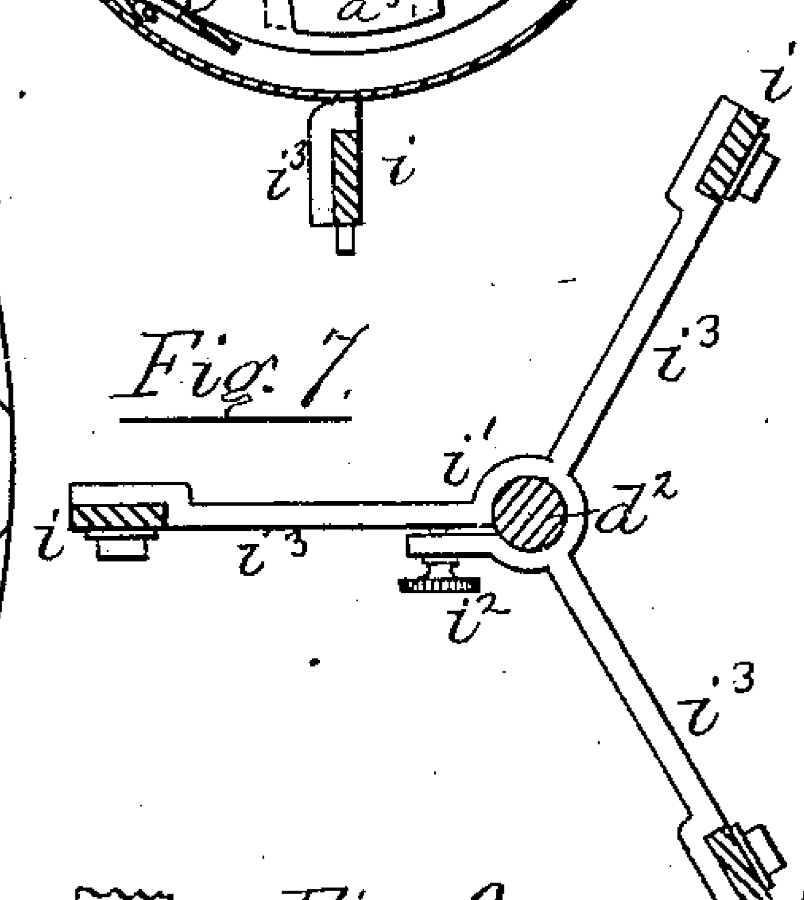


Fig. 7.

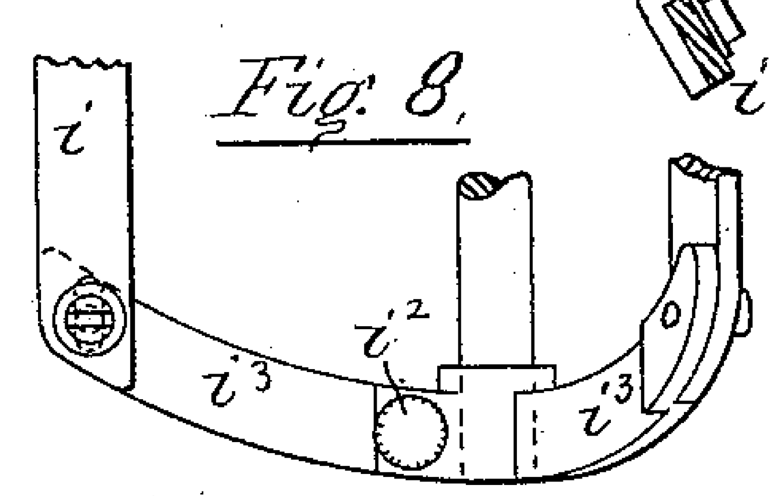


Fig. 8.

Witnesses.
H. D. Williams
E. G. Baker.

Alfred Shedlock.
Inventor.

(No Model.) 2 Sheets—Sheet 2.

A. SHEDLOCK.

ELECTRIC ARC LAMP.

No. 277,166. Patented May 8, 1883.

Fig. 9

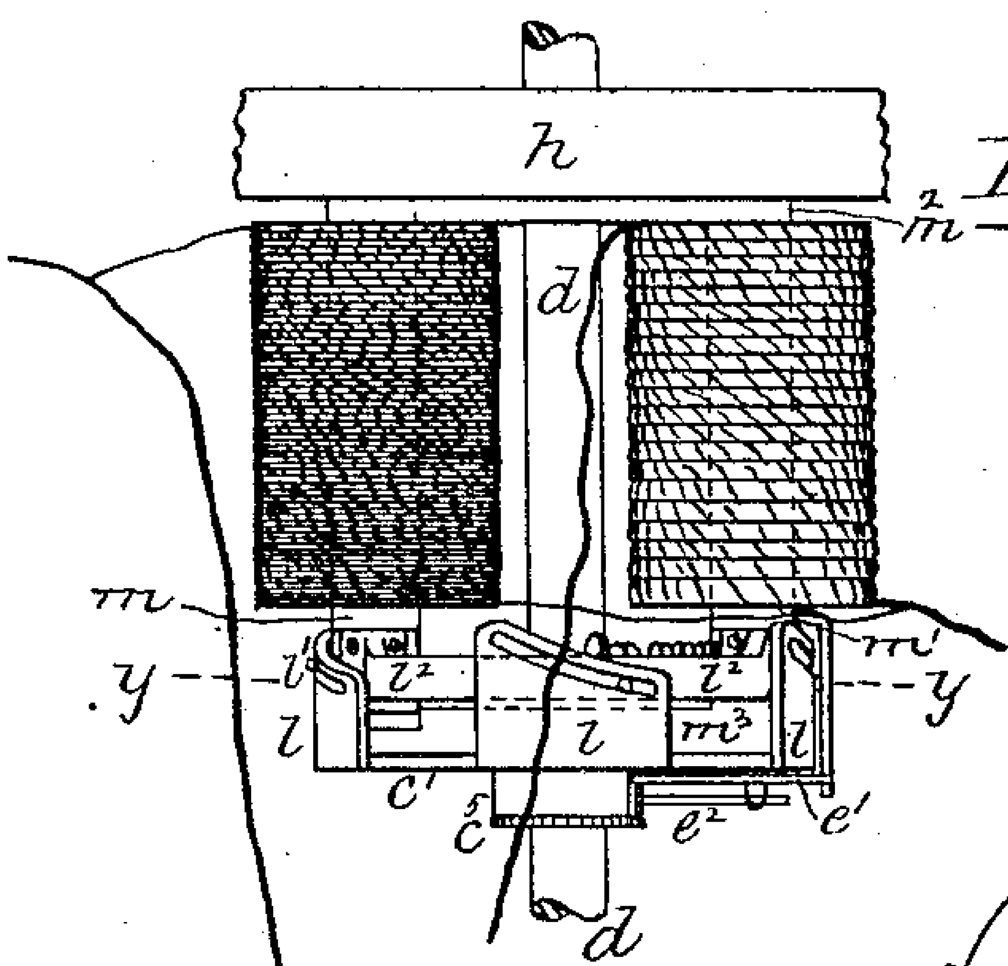


Fig. 10.

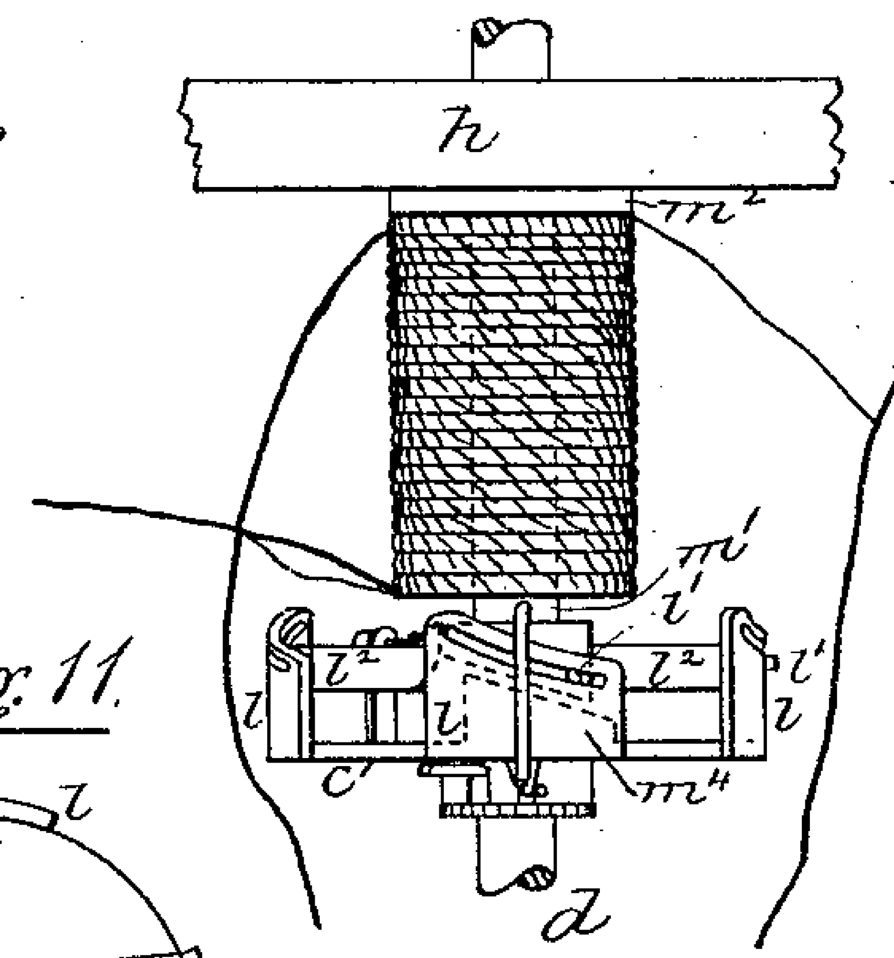


Fig. 11.

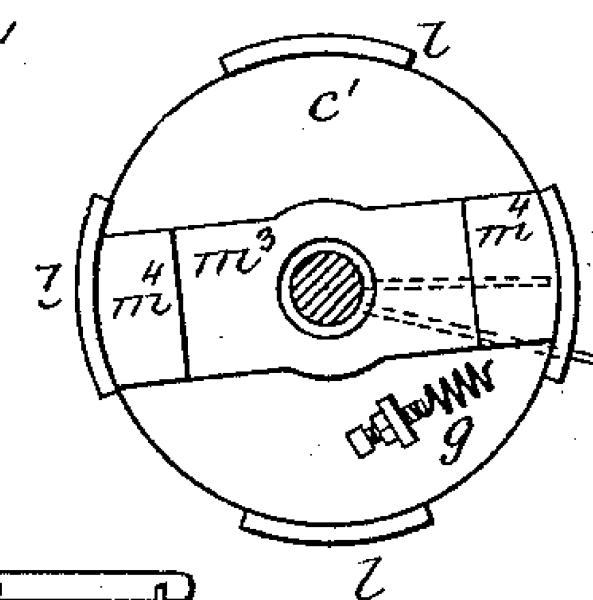


Fig. 12.

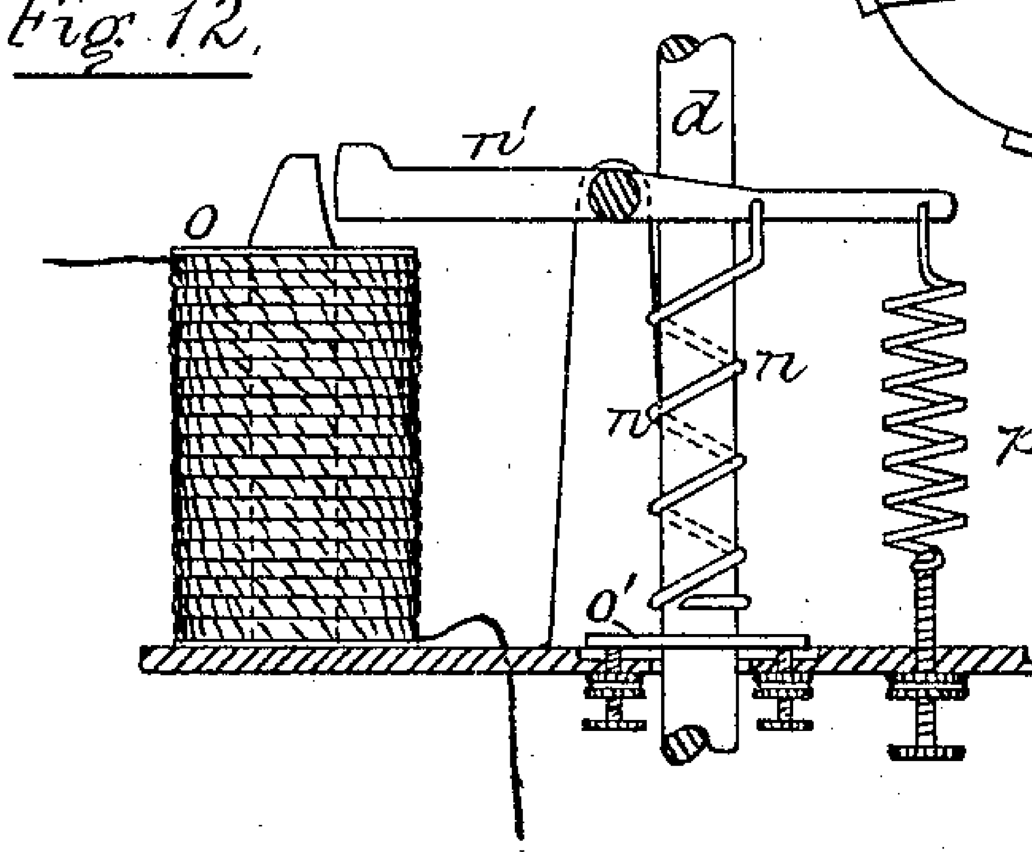


Fig. 13.

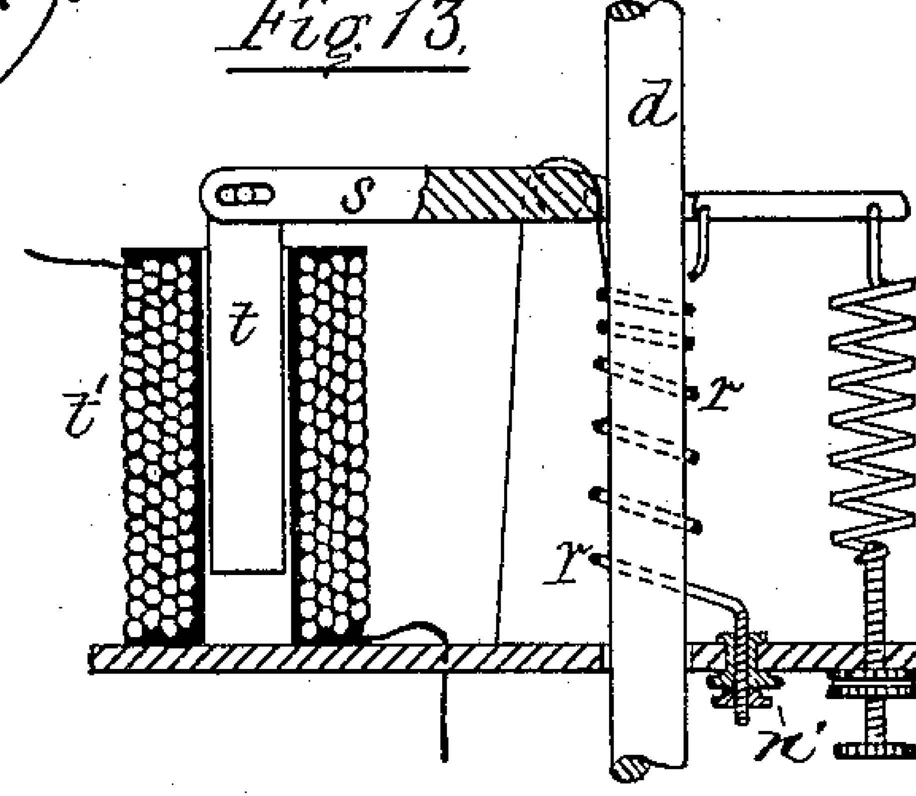


Fig. 4,

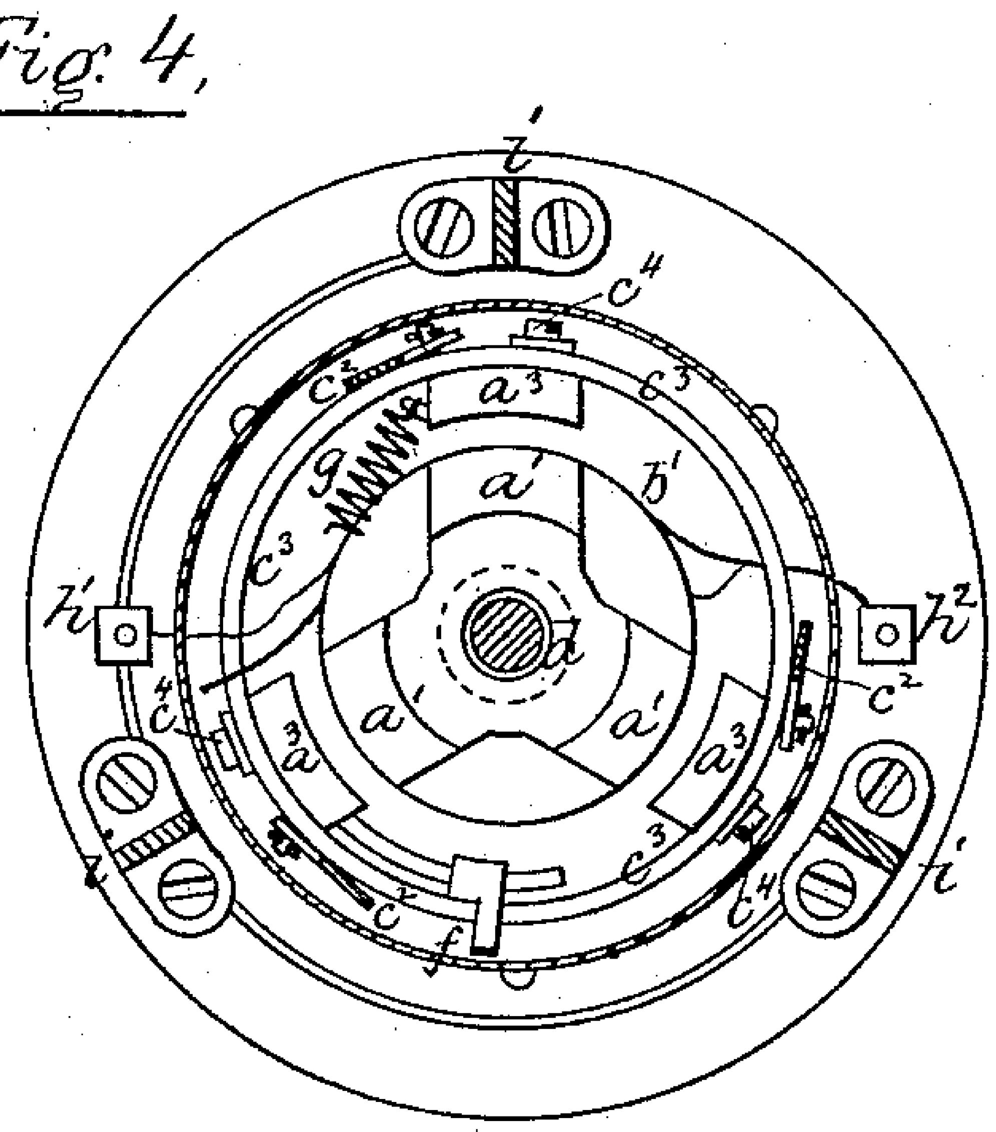


Fig. 5

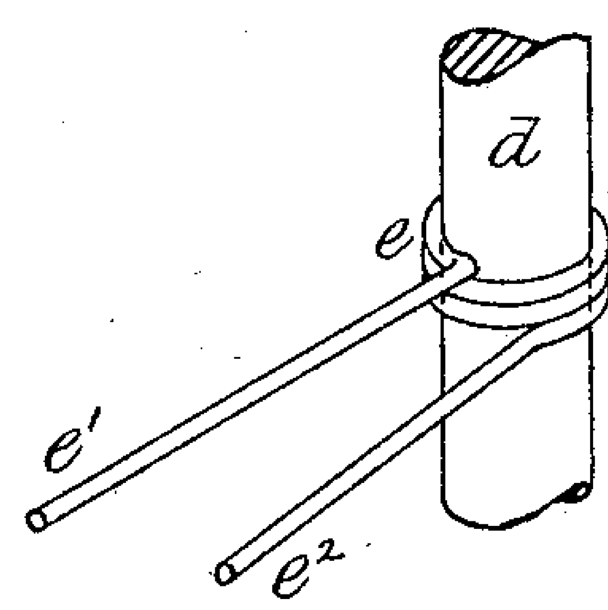
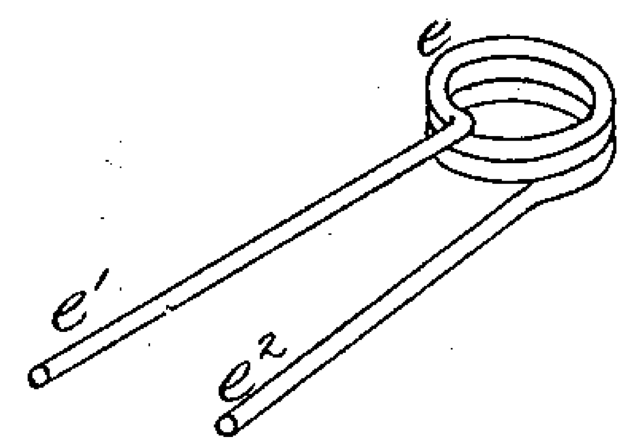


Fig. 6



Witnesses.

H. D. Williams

E. G. Baker.

Alfred Shedlock.

Inventor.

# UNITED STATES PATENT OFFICE.

ALFRED SHEDLOCK, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE STAR ELECTRIC LIGHT AND POWER COMPANY OF THE UNITED STATES.

## ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 277,166, dated May 8, 1883.

Application filed October 28, 1882. (No model.)

*To all whom it may concern:*

Be it known that I, ALFRED SHEDLOCK, of Brooklyn, county of Kings, State of New York, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

This invention relates to electric-arc lamps, and covers, principally, a new clutch or clamp for controlling the upper-carbon rod, and an electro-magnetic device for operating the same.

The main object of the invention is the application of a simple and effective mechanical device adapted to more perfectly govern and control the movement of the upper-carbon rod, to raise the same to form the arc, and to allow it to fall as fast as the carbons are consumed, than is accomplished by the devices now in use for this purpose. In this class of lamps—viz., those having a smooth rod carrying the upper carbon, and by which the regulation of the arc, &c., is produced by moving the upper carbon only—it is essential to the perfect working of such lamps that the clutch or clamp which holds the smooth rod should free the same at the right time gradually, and when the rod is at rest as regards longitudinal movement. To this end I utilize the gripping properties of a spiral spring on a smooth rod, either by making the spring smaller than the rod, thereby causing it to grip by its resilience, the rod being released by increasing the internal diameter of the coils of the spring by turning one or both of its ends which is or are free, thus loosening the grip of its various coils on the rod gradually until the weight of the rod and carbon is just sufficient to overcome the clamping friction of the remaining coils; or the spiral spring may be made so that its action is reversed—that is, its resilience frees the rod—the diameter of the coils, when the spring is in its normal condition, being larger than the rod—and it is caused to grip the rod by bringing its ends nearer together to reduce the internal diameter of its coils. To obviate the cause for the sudden changing in the arc and the jumping of the upper carbon in this class of lamps, due to the movement imparted to the upper carbon during the time that the clutch or clamp which holds the smooth rod is being opened to free the rod, I so construct the actuating electro-magnetic mechanism which carries and controls the clutch that the distance through which its armature moves greatly exceeds that of the upper carbon, and that at the time of the part of the movement of the armature when the clutch is being opened to release the smooth rod no perceptible vertical movement of the rod is caused by that of the armature. To accomplish this desirable result the armature or armatures are carried by a plate, which also carries the spiral spring clutch or clamp at its central part, through which the smooth rod passes. Said plate is adapted to move helically, which movement may be applied to it by suspending it by means of three (3) or more links, and the armatures are so acted upon by the electro-magnets as to cause the plate to partly rotate on its center, said rotation causing the links to assume angular positions, and consequently the plate is raised equal to the versed sines of the angles assumed by the links. This raising of the plate separates the upper from the lower carbon, and the spring clutch or clamp is opened when the plate is moving back into its lowest position. Considerable movement of the plate is required to free the smooth rod. The actuation of the clutch, as will be readily seen, occurs when the hanging links are moving a few degrees to or from the vertical, as the versed sine of such angular movement is so small that no perceptible vertical movement is imparted to the upper carbon.

The invention embraces other improvements in the construction of the lamp, which, with the foregoing improvements, will be fully understood by reference had to the accompanying drawings, in which—

Figure 1, Sheet 1, represents an arc-lamp embodying my improvements, with the upper part in section. Fig. 2, Sheet 1, shows a side view of the actuating mechanism, looking from the left at Fig. 1. Fig. 3, Sheet 1, is a plan view of the armatures taken on line $x$ $x$, Fig. 1. Fig. 4, Sheet 2, is a view, looking toward the poles of the electro-magnet, also taken on the line $x$ $x$, Fig. 1. Fig. 5, Sheet 2, represents the portion of the upper-carbon rod, with the spring-clamp thereon enlarged. Fig. 6, Sheet 2, is a detached view of the spring-clamp enlarged. Fig. 7, Sheet 1, is a plan view of the lower-carbon-rod-holding frame. Fig. 8, Sheet

1, is an elevation of the same. Fig. 9, Sheet 2, represents a front view of a modification of the electro-magnetic device. Fig. 10, Sheet 2, is a side view of the same. Fig. 11, Sheet 2, is a plan view of the armature taken on the line *y y*, Fig. 9. Fig. 12, Sheet 2, shows the application of a modified form of a spring-clamp to electric lamps; and Fig. 13, Sheet 2, shows another modification of the spring-clamp.

The actuating electro-magnet consists of a hollow core, *a*, provided at its free pole with a polar plate having three inclined projections, $a'$ $a'$ $a'$, (see Fig. 4,) and connected to the base-plate $a^2$, to which base-plate are secured the three polar projections $a^3$ $a^3$ $a^3$, whose ends are opposite to and inclined like the polar projections $a'$ $a'$ $a'$, and are over the armature-blocks, as shown by the dotted lines in Fig. 3. Insulated wire coils are placed on the core *a*, the one *b*, being of coarse wire, included in the arc-circuit, and the one $b'$, of fine wire, in a derived circuit around the arc, connected up on the differential principle in the ordinary manner. The coils are shown separate, but may be wound, the one over the other, if desired.

The armature consists of three inclined blocks, *c c c*, secured to or forming a part of the plate $c'$. This plate $c'$ is suspended by means of the three links $c^2$ $c^2$ $c^2$, whose upper ends are fitted on studs on the ring $c^3$, which is held on the polar projections $a^3$ $a^3$ $a^3$ by means of screws $c^4$ $c^4$, passing through slots in the ring to permit of the adjustment of the armature-blocks *c c c* in relation to the two sets of polar projections $a'$ and $a^3$ of the magnet. Through the center of the plate $c'$ and the core of the magnet passes the upper-carbon-carrying rod *d*, provided with an adjustable clutch for holding the upper carbon, $d'$. In a recess in the center of the plate $c'$ is placed the spring-clamp *e*, formed simply of steel wire, which may be either round, square, or flat, coiled in a spiral, so as to grip the rod *d* with sufficient friction, when in its normal condition, to sustain the rod and the carbon carried thereby. The ends of the spring *e* are bent radially, as clearly shown at $e'$ $e^2$, Figs. 5 and 6, and the side of the recess in which the spring is placed in the plate $c'$ is cut away for the reception of said ends of the spring, and a screw-cap, $c^5$, holds the spring in the recess. On the under side of the plate $c'$ is held, by means of a screw, a small cam-plate, $e^3$, against which the end $e^2$ of the spring bears when the end $e'$ is being acted on to open the spring to release the rod *d*. By turning the cam-plate $e^3$ the free end $e'$ of the spring may be adjusted to come in contact with the fixed stop *f* at the right time. This stop *f* is also shown adjustable to regulate the time of the opening of the spring, by being held by means of a set-screw on a rod projecting from one of the polar projections $a^3$. The weight of the armature *c*, plate $c'$, rod *d*, and carbon $d'$ are generally sufficient to bring the end $e'$ of the spring *e* with sufficient pressure against the fixed stop *f* to open the spring; but to insure such action taking place, and to balance the magnetic action on the armatures, the spring *g* is provided, one end of which is secured to one of the polar projections $a^3$ and the other end to an adjusting-screw passing through a bracket on the plate $c'$. By referring again to Figs. 5 and 6 the simplicity of this spring-clamp is seen, its cost being nominal, so that no material expense is incurred when from any cause it becomes necessary to place a new one in the lamp, which is done by unscrewing the cap $c^5$, sliding the rod *d* out of the plate, and substituting a new spring for the old one, and replacing the rod *d* and screw-cap $c^5$. The operation of the spring may also be readily understood, it being evident that if the end $e^2$ is held and the end $e'$ moved away from it the coils expand, and that such expansion is gradual and uniform, freeing the grip of the spring on the rod *d* in a very gentle manner. It is also evident that by modifications of the magnetic actuating device the spring may be closed to grip the rod to hold it up, the normal condition of the spring then being such as to allow the rod *d* to fall freely through it. The electro-magnet is inverted, as shown, and its base-plate $a^2$ secured to the plate *h* of the frame of the lamp. This plate *h* is made of insulating material, and the side bars, *i i i*, are secured thereto and are connected to the negative terminal $h'$. The base-plate of the magnet may form the upper plate of the frame, in which case the terminals $h'$ and $h^2$ and the side bars, *i i i*, would be insulated in their connections thereto. The lower part of the frame is a plain socket, $i'$, adapted to hold the lower carbon, $d^2$, by being split, and its sides drawn together by means of the screw $i^2$. It has three arms, $i^3$ $i^3$ $i^3$, to the ends of which the lower ends of the side bars, *i i i*, are secured by means of set-screws, and the holes through which these set-screws pass are enlarged, so that the lower part of the frame may be adjusted to set the lower carbon as nearly as possible in line with the upper one.

In another application for Letters Patent filed by me the 7th day of October, 1882, is shown and described an improved form of globe for electric lamps, having only one opening, through which the side bars of the lamp pass. An improved method of supporting such a globe is here shown, consisting of the metal ring *j* and wire-netting $j'$, connected to the lower end of the ring by the ends of the wire being twisted in holes made therein. The globe *k* is supported only by the netting $j'$, which entirely surrounds it, with the exception of its opening, which is arranged opposite the metal ring *j*, the whole being held up by means of bayonet-slots $j^2$, formed in the upper edge of the ring *j*, and pins $j^3$ $j^3$ $j^3$, projecting from the side bars, *i i i*. Said bayonet-slots $j^2$ hold the globe firmly in position and enable it to be readily removed for the purpose of fixing the carbons, &c.

To insure perfect fitting of the wire-netting on the globe, and to produce perfect and more intimate contact between the glass and the wire, the netting is first made and placed in a suitable mold or former and the glass then blown therein. This method of providing glass globes with protective wire-netting is not claimed in this application, but will form the subject-matter of another application.

The operation of the lamp is as follows: With the lamp at rest, the armature-plate $c'$, with its load, falls down, so that the end $e'$ of the spring clamp or clutch $e$ is in contact with the stop $f$, thereby allowing the upper carbon to rest on the lower one. As soon as the current is caused to flow through the lamp the poles $a'$ $a^3$ of the magnet attract the armatures $c$ $c$ to them and cause the plate $c'$ to rotate, (moving the end $e'$ of the spring-clamp away from the stop $f$,) and also to move up, carrying with it the upper carbon, and so forms the arc. The plate $c'$ gradually falls back as the resistance of the arc increases until the end $e'$ of the spring-clutch comes in contact with the stop $f$. This is the normal working position of the parts, and, as before described, no perceptible movement of the plate $c'$ and carbon $d'$ takes place while the spring-clamp is being opened, and the action of the clamp to free the rod is so gradual and gentle that carbon falls down to maintain the arc constant at a steady and uniform rate of speed, thus avoiding all sudden changes in the arc.

In the modifications illustrated at Figs. 9, 10, and 11 the spring-clamp $e$ is carried by the plate $c'$, to be operated by means of the fixed stop $f$, as before described; but the plate, instead of being governed in its helical movement by means of suspension-links, is provided with slotted flange projections $l$ $l$, in which fit pins or small rollers $l'$ $l'$, projecting from a frame, $l^2$, attached to the poles of the electro-magnet. The electro-magnet consists of two cores, $m$ and $m'$, secured to the plate $m^2$, with the upper-carbon rod $d$ between them. One of these cores is provided with a coarse-wire helix and the other one with a fine-wire helix, connected up on the ordinary differential principle. The armature $m^3$ is secured to the plate $c'$, and is a straight bar with a central hole, through which the rod $d$ passes, and has two inclined poles, $m^4$ $m^4$, arranged in proximity to the ends of the cores $m$ and $m'$, to be acted upon by the magnetism induced therein, the helical movement of the armature and plate $c'$ being produced by the form of the slots in the flange projections $l$ $l$.

Fig. 12 illustrates another modification, in which a helical spring may be made to control the carbon rod $d$. The spring $n$ is wound open, and grips the rod with sufficient force to sustain it when the spring is raised up by the action of the magnet $o$ on the end of the lever $n'$, which carries the spring; but when the lower coil of the spring is allowed to rest on plate $o'$, which is made adjustable, the weight of the rod $d$ causes the coils to come closer together, and so enlarges the internal diameter of the spring sufficiently to allow the rod to slide downward. $p$ is an adjusting-spring to regulate the action of the magnet $o$ on the lever $n'$.

Another form of helical spring-clamp is shown at Fig. 13. In this the spring $r$, in its normal condition, has barely enough grip on the rod $d$ to sustain it. The upper coils are more closely wound than the lower ones, and the two ends are so held as to prevent them turning when the spring is stretched. The upper end is connected to the lever $s$, to the other side of which is suspended the core $t$ of the axial magnet $t'$, and the lower end is connected and controlled by the adjustable screw-sleeve. When the core $t$ is drawn down in the axial magnet $t'$ the spring $r$ is stretched, which reduces the internal diameter of the coils, causing the upper ones to grip the rod. The lower ones, being free from the rod, act on the lever $s$ against the force of the axial magnet.

Although I have here shown and described several modifications of the helical spring-clamp as applied to electric lamps in which the carbon rod feeds by gravity, I wish it understood that I do not claim, broadly, such form of clamp as shown in the application for Letters Patent of John R. Tibbets, No. 72,826, filed September 27, 1882.

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

1. The combination, with a round rod, of a spiral spring-clamp surrounding the same and having its coils closely wound and its free end or ends projecting at right angles to its axis, and means, substantially as described, whereby the free end or ends of the spring are moved transversely to its axis, and its coils thereby caused to contract to firmly grip the rod and to expand to release the same, as set forth.

2. In combination, a spiral spring-clamp, a carrying-plate for the same adapted to be moved helically, a smooth rod passed through and upheld by the spring, and a stop to open the spring to free the rod when the plate is in its lowest position, substantially as set forth.

3. In combination, an inverted electro-magnet, armatures attached to a plate supported by hanging links, a smooth carbon-carrying rod passing through the plate and magnet, and a clamp carried by the armature-plate, adapted to uphold the rod, but release the same by coming in contact with a stop when the plate is in its lowest position, substantially as set forth.

4. In combination, the spring-clamp $e$, rod $d$, cam-plate $e^3$, plate $c'$, adapted to be moved in a helical path, and the stop $f$, substantially as set forth.

5. In combination, the electro-magnet $a'$ $a'$ $a^2$ $a^3$ $b$ $b'$, the armatures $c$, plate $c'$, links $c^2$ $c^2$, and adjustable ring $c^3$, substantially as set forth.

6. In combination, the plate $c'$, provided with an opened side recess, the spring-clamp $e$, the rod $d$, and the screw-cap $c^5$, substantially as set forth.

7. In combination, the electro-magnet $a'$ $a'$

$a^2$ $a^3$ $b$ $b'$, the armatures $c$, plate $c'$, links $c^2$ $c^2$, and adjustable ring $c^3$, the spring-clamp $e$, rod $d$, and spring $g$, substantially as set forth.

8. In combination, the side bars, $i$ $i$, the lower-carbon holder, having the split socket $i'$ and arms $i^3$ $i^3$ $i^3$, and adjustably connected to the side bars, substantially as set forth.

9. In combination, the globe $k$, wire-netting $j'$, supporting the globe, metal ring $j$, provided with bayonet-slots $j^2$ $j^2$ $j^2$, and the side bars, $i$ $i$ $i$, provided with pins $j^3$ $j^3$ $j^3$, substantially as set forth.

In witness whereof I have hereunto set my hand, at New York, county and state of New York, this 27th day of October, A. D. 1882.

ALFRED SHEDLOCK.

In presence of—
H. D. WILLIAMS,
E. G. BAKER.