(No Model.) 2 Sheets—Sheet 1.

M. WHELESS.

ELECTRIC ARC LAMP.

No. 559,648. Patented May 5, 1896.

Fig. 1.

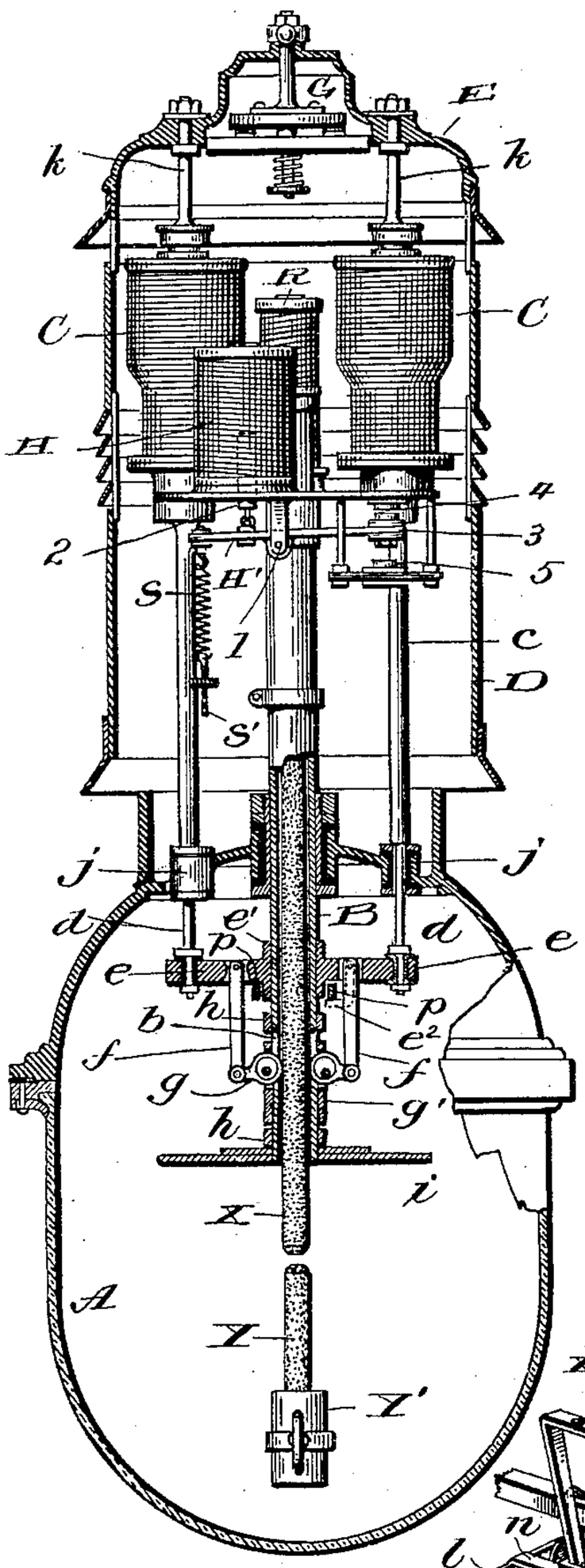


Fig. 2.

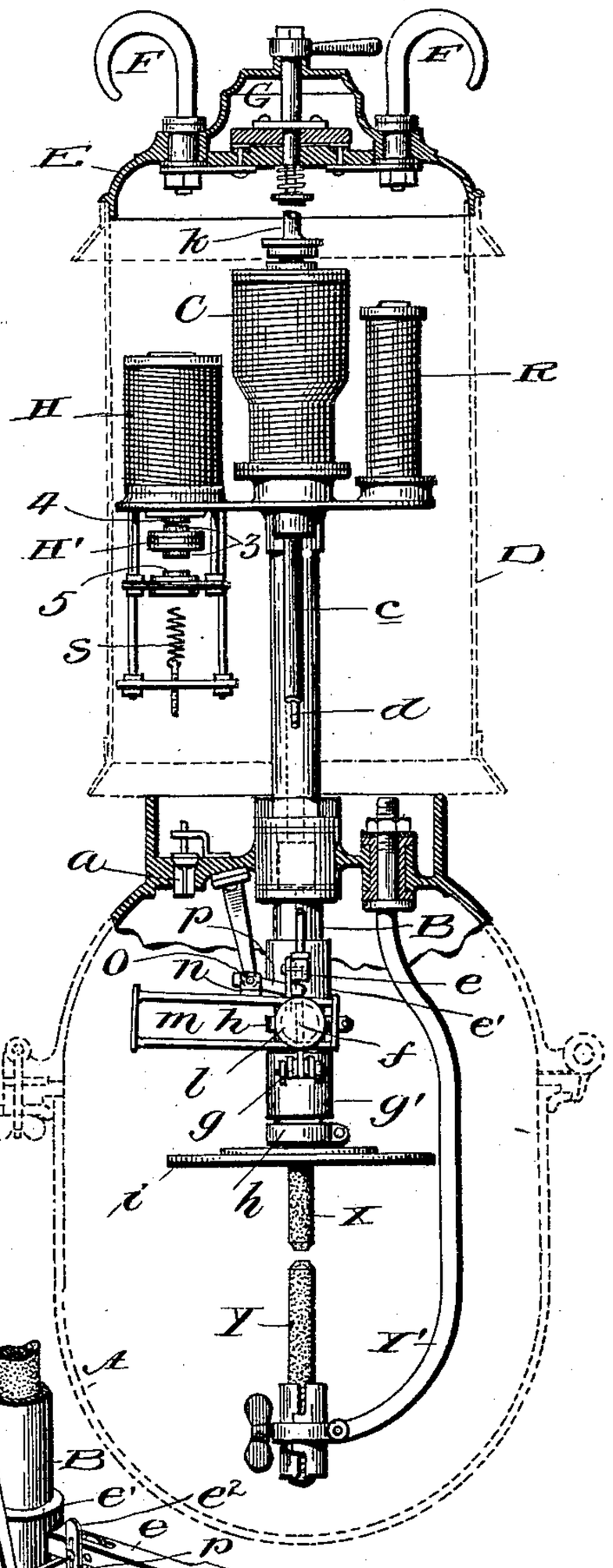
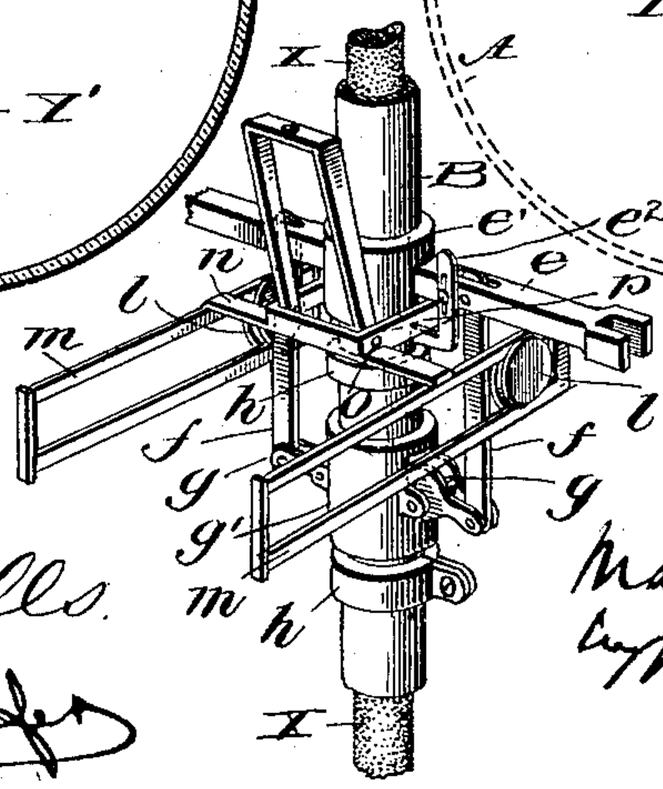


Fig. 3



Witnesses:

L. C. Hills.

Frederick B. Keeler

Inventor:

Malone Wheless

by Marcellus Dailey

his Atty.

(No Model.)

2 Sheets—Sheet 2.

M. WHELESS.

ELECTRIC ARC LAMP.

No. 559,648. Patented May 5, 1896.

Fig. 4.

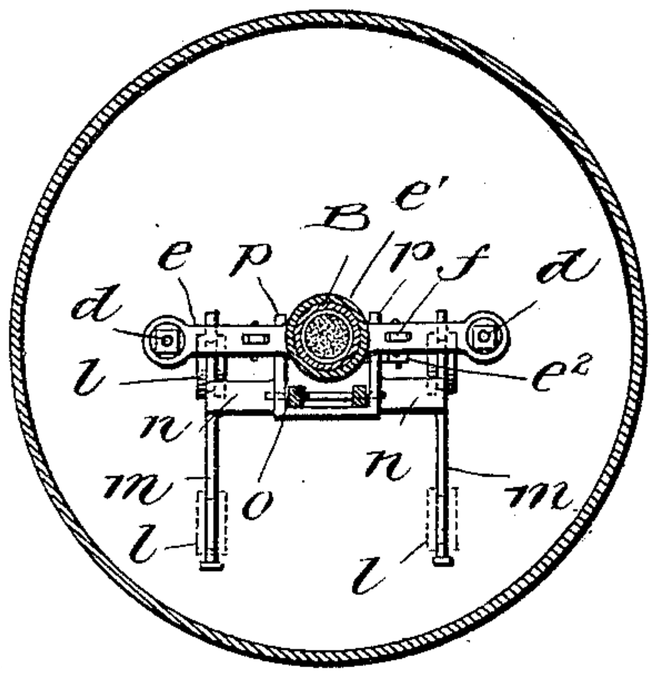
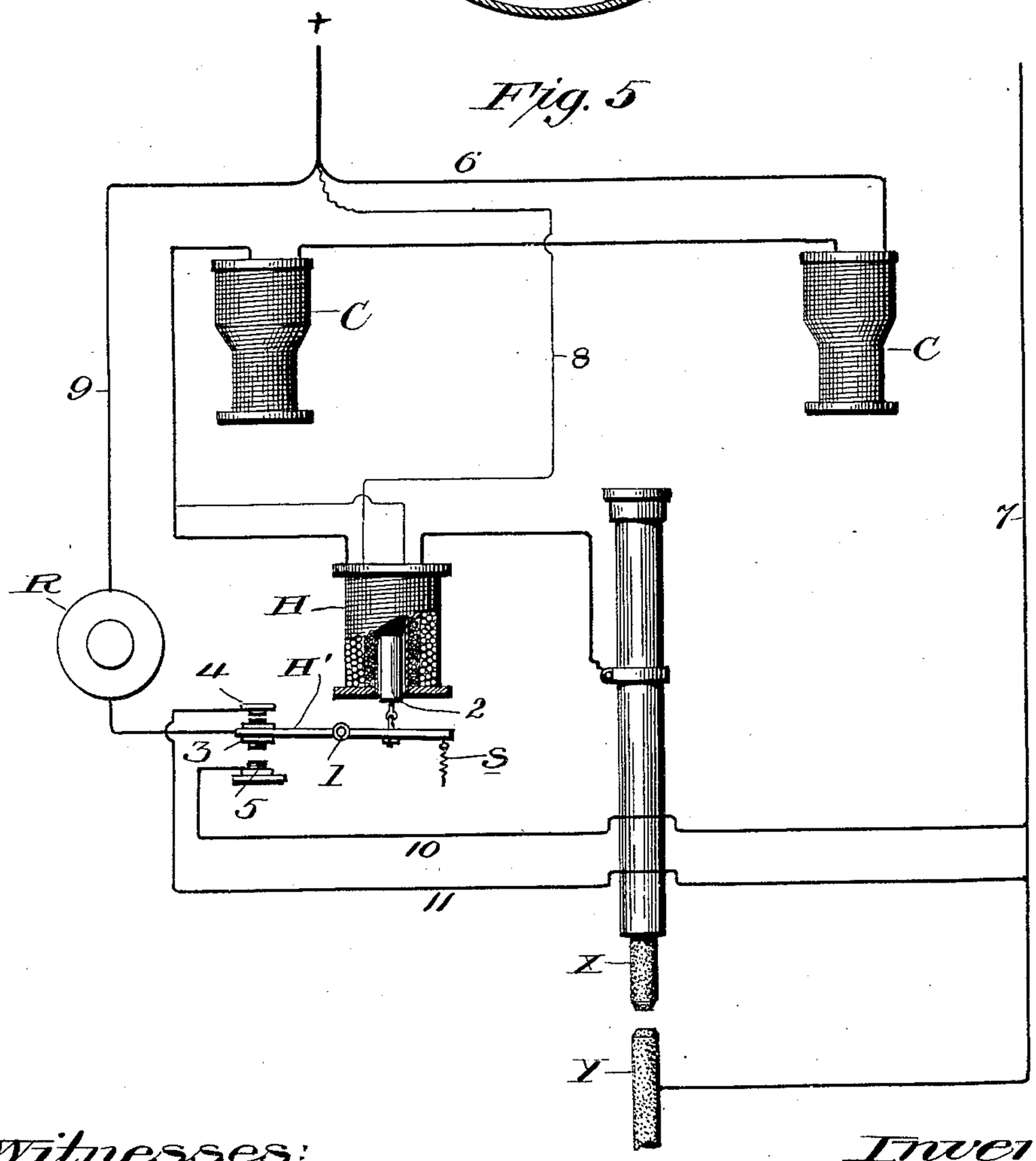


Fig. 5



Witnesses:
L. C. Hills.
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Inventor:
Malone Wheless,
by Marcellus Bailey
his Atty.

UNITED STATES PATENT OFFICE.

MALONE WHELESS, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE WHELESS ELECTRIC LAMP COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 559,648, dated May 5, 1896.

Application filed December 7, 1895. Serial No. 571,379. (No model.)

To all whom it may concern:

Be it known that I, MALONE WHELESS, of the city of Washington, in the District of Columbia, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

My invention has relation to the feed and regulating devices of electric-arc lamps. The feed mechanism which I have represented in the drawings accompanying this specification is modeled after the general plan illustrated in my Patents Nos. 548,682 and 548,683, of October 29, 1895. I have devised an improvement in the counterweight of my Patent No. 548,683 for lightening the strain on the devices which lift the positive carbon. I have also devised a form and arrangement of regulator designed particularly for use in a "series" lamp, so called, by which the lamp is made more sensitive and quick to respond to variations in the potential of the current and is enabled more quickly and with greater certainty to adapt and adjust itself to such changes.

My improvements will first be described by reference to the accompanying drawings, and will then be more specifically pointed out in the claims.

In the drawings, Figure 1 is a sectional side elevation of a lamp embodying my invention. Fig. 2 is a side elevation, partly in section, of the same in a plane at right angles to the plane of section in Fig. 1. Fig. 3 is an enlarged perspective view of the counterweight arrangement. Fig. 4 is a cross-section showing a top plan of the counterweight arrangement. Fig. 5 is a diagram of the circuit connections of the lamp.

The arc or light-giving part of the lamp is inclosed in a globe A of any suitable kind. That shown in the drawings is of the same general type as that of the well-known "Pinsch" lamp, now so generally in use on railway-cars, the lower part of the globe, made of glass or other translucent or transparent material, being hinged on a horizontal axis to a metallic dome, in which is an outwardly-opening relief-valve *a* to give vent to the heated and expanded air. The feed-regulating works of the lamp extend down through this dome. These works consist in the main of the central tubular carbon-holder B for the upper movable and positive carbon X, the two solenoids C, the tubular stems *c*, and the rods *d*, vertically movable in said stems, attached at their upper ends to the cores of the solenoids and at their lower ends to opposite ends of the yoke or cross-bar *e*, provided with a central hub or sleeve *e'*, fitting and vertically movable on the upper-carbon holder B. The yoke, by links *f*, is attached to the arms of gripping-cams *g*, pivoted in a sleeve *g'*, fitting and vertically movable upon the carbon-holder and adapted to work through slots *b* in the carbon-holder against the carbon X therein. Stop-rings *h*, one above and one below the sleeve *g'* and adjustable upon the carbon-holder B, limit the extent to which the sleeve can move up and down thereon.

At the lower end of the positive-carbon holder is a disk *i* of asbestos or other refractory material to shield the works from the heat and from carbon deposit.

Thus far there is nothing new in the lamp over the lamps of my aforesaid patents.

The works above the globe A are surrounded by a ventilated case or shell D, attached to and surmounted by a cap E.

The stems *c* are attached at their upper ends to the spools of the solenoids C and at their lower ends to insulated bosses *j* to the dome of globe A. The solenoids at their upper ends are suspended from the lamp-cap E by rods *k*, and thus the globe and all parts of the lamp are supported from said cap. The current enters and passes out from the lamp by the hooks F for suspending the lamp. An ordinary manually-operated switch G is provided in the cap, by which the lamp can be cut out whenever desired and the current sent direct from one hook to the other.

In my Letters Patent No. 548,683 I describe and claim a counterweight which is jointed both to the dome of the globe and to the cross-bar or yoke *e*. I employ this same general plan in my present lamp, but so modify it that the weight can shift so as to increase or decrease its leverage. To this end the weight is made in the form of a roller or the like, which is mounted on and free to move along a track that can be tilted, so as to cause the roller to move thereon in one di-

rection or the other at pleasure. I make use, in the present instance, of two such rolling weights, (shown plainly at *l l*, Fig. 3,) having the form of flanged rollers, each of which runs on and is held in a track *m*, which is embraced by its flanges. The two tracks are fast to a cross-piece *n*, the whole forming a track-frame, pivoted at *o* to a suitable bracket or hanger attached to and depending from the dome of the globe A, as seen in Fig. 2. From the track-frame project forward two steady-arms *p* beneath the yoke *e*, one on each side of the central hub or sleeve *e'*. One of these arms *p* is confined between the adjoining end of the yoke *e* above and an angle-piece e^2, attached to the yoke and provided at its lower end with a bent portion, which extends under the arm *p*, as seen plainly in Fig. 3. This is the joint between the counterweight track-frame and the yoke *e* by which the frame is caused to tilt upon its axis or pivot *o*. The angle-piece e^2 is made vertically adjustable, so that it may be so set as not to cramp or bind the arm *p*. Under this arrangement, when the cross-bar or yoke *e* is drawn up the track-frame will be caused to tilt outwardly and downwardly, and the roller-weights will consequently run to the outer end of the frame, and by this increase of leverage will relieve the solenoid-rods *d* of much of the strain of lifting. On the other hand, when the yoke *e*, after rising, starts to descend for any cause then the track-frame will tilt in the opposite direction and the roller-weights will run inwardly, thus decreasing the resistance of the counterweight to the descent of the yoke. In practice, and while the lamp is running, the roller-weights rarely, if ever, traverse the full extent of their tracks, but remain somewhat centrally located therein, moving slightly back and forth according to the fluctuations of the lamp and the consequent movement of the feed-regulating mechanism. By this provision of a shifting counterweight the mechanism is made more sensitive as well as more accurate in operation.

The next feature of my improvements is designed more particularly for a "series" lamp, so called, and is designed to take care of and correct the effects which might otherwise manifest themselves in the lamp due to irregularities in the potential of the current. The means employed by me for this purpose consists of a magnet, termed by me the "regulator-magnet," preferably of the solenoid type, which controls the action of an armature-lever for closing a shunt around the arc whenever the potential of the current materially rises above or falls below the normal, thus de-energizing the main or feed solenoids of the lamp sufficiently to permit the feed to drop and the positive or movable carbon to readjust itself. This magnet is shown at H. The armature-lever controlled by it is shown at H'. The lever (pivoted at 1) is attached at one end to the core 2 of the solenoid H, and at the other end it carries an insulated contact 3, which plays between two stationary contacts 4 5. The lower carbon of the lamp is shown at Y, held by any suitable holder Y'.

The circuit connections (referring to Fig. 5) are as follows: Entering the lamp at the + pole the current passes by wire 6 through the two feed-solenoids C in succession, thence through the coarse winding of the regulator-solenoid, and thence to the positive carbon X, the negative carbon Y, and out from the lamp by wire 7. This is the normal or arc circuit. The fine-wire winding of the regulator-magnet H is connected up in the arc-circuit by wire 8. When the lamp is in normal operation, the current is largely through the coarse winding of the regulator-magnet, and the power thus developed is sufficient to hold the armature-lever in a position where its contact 3 will be about midway between and out of connection with the stationary contacts 4 5. Under these conditions but little current will pass through the fine-wire high-resistance winding; but if the voltage or potential of the current be increased for any cause—as, for instance, by the cutting of several other lamps into the circuit—then current will be forced through the fine-wire winding by the consequent increase in voltage, thus increasing the power of the magnet and causing it to pull the armature-lever from its central position into one in which it will approach and finally contact with the lower fixed contact 5. On the other hand, decrease from any cause in the potential of the current will decrease the power of the regulator-solenoid H and permit its core to drop, with the effect of tilting the armature-lever up toward and in contact with the upper fixed contact 4. A spring *s*, attached to the outer end of the armature-lever and adjustable as to tension by a set-screw *s'*, serves to steady the lever and to assure the accurate action of the parts.

The contacts 3 4 5 are in a shunt around the arc, the feed-solenoids, and regulator-magnet. This shunt consists of a wire 9, which leads from the + binding-post of the lamp to the movable contact 3, and of two wires 10 11, one of which leads from one fixed contact 4 and the other of which leads from the other fixed contact 5 to the − binding-post of the lamp. Thus whichever contact 4 or 5 is met by the movable contact 3 a shunt will be formed around the arc and the feed-magnets. The result is that whenever, by reason of undue increase or decrease in the voltage of the circuit, the contact 3 is caused to meet contact 4 or 5, as the case may be, the feed-solenoids C will be short-circuited, and the feed mechanism will permit the movable carbon X to drop; but as the latter drops the resistance of the arc, and consequently the voltage of the circuit, is diminished, more current flows through the feed-solenoids, the feed mechanism is again active, and at the same time the regulator-magnet takes on its normal condition. Indeed, so quick is the action of the

parts in practice that the short-circuiting due to the regulator-magnet is momentarily only, and the movable carbon is caught and held before it descends to the full extent, so that there is no suppression, even momentary, of the arc, but the only visible effect is a slight fluctuation in the latter.

In the wire 9, forming part of the circuit around the arc, I introduce a resistance-coil R, so adjusted that it will permit the passage only of current enough to weaken the feed-solenoids sufficiently to allow the feed mechanism to descend. In this way I avoid sending over the shunt the whole current, which if it should be permitted to pass that way would injure and speedily burn out the contacts 3 4 5. By using this regulating mechanism I am enabled to employ single-wound solenoids as feed-solenoids instead of the differentially-wound solenoids, which at present are so extensively used.

In lieu of the pair of feed-solenoids and their adjuncts I may use a single feed-solenoid, as in my Letters Patent No. 549,083, of October 29, 1895.

Having described my improvements and the best way now known to me of carrying the same into effect, I state in conclusion that I do not restrict myself narrowly to the details hereinbefore set forth in illustration of my invention; but

What I claim herein as new, and desire to secure by Letters Patent, is as follows:

1. In an electric-arc lamp and in combination with the carbon-feed mechanism, a counterweight-track, a counterweight freely movable thereon and connections whereby said track is tilted in one direction or the other according to the direction of movement of the feed mechanism, substantially as and for the purposes hereinbefore set forth.

2. The combination of the feed-yoke, the cap or dome, the counterweight-track jointed to both the dome and the yoke, and the counterweight carried by and freely movable on said track, substantially as and for the purposes hereinbefore set forth.

3. The feed magnet or magnets included in the arc-circuit of the lamp and the feed mechanism controlled thereby in combination with the regulator-magnet included also in said circuit, a shunt or short circuit around the arc, and the feed and regulator magnets, completed through either one of two fixed contacts, and a contact controlled by the armature of the regulator-magnet for closing the shunt-circuit through one or the other of the two fixed contacts according as the potential of the arc-circuit materially exceeds or falls below normal, substantially as and for the purposes hereinbefore set forth.

4. The feed magnet or magnets included in the arc-circuit of the lamp and the feed mechanism controlled thereby; the regulator-magnet included also in said circuit and provided with two windings—a fine and a course winding—connected up in the circuit as hereinbefore described; an armature-lever carrying a contact and controlled by the regulator-magnet, a shunt or short circuit around the feed and regulator magnets and the arc, completed through either one of two fixed contacts with one or the other of which the movable contact controlled by the regulator-magnet contacts according as, and only when, the potential of the arc-circuit materially exceeds or falls below normal—these parts being combined and adapted to operate substantially as hereinbefore set forth.

5. The combination with the feed magnet or magnets in the arc-circuit and feed mechanism controlled thereby, of the regulator-magnet, the armature-lever controlled thereby carrying the movable contact 3, the shunt or short circuit around the arc and feed and regulator magnets; the fixed contacts 4, 5, in said shunt, between which the movable contact 3 is located, the adjustable spring *s* and circuit connections substantially as described for the feed and regulator magnets, whereby when the lamp is in operation at the normal voltage or potential for which it is designed, the contact 3 will be held out of contact with both contacts 4, 5, but whenever that voltage materially exceeds, or falls below, normal, then the contact 3 will complete the shunt or short circuit through one or the other of the two contacts 4, 5, as the case may be, substantially as and for the purposes hereinbefore set forth.

In testimony whereof I have hereunto set my hand this 5th day of December, 1895.

MALONE WHELESS.

Witnesses:
F. B. KEEFER,
EWELL A. DICK.