(No Model.) 2 Sheets—Sheet 1.

E. A. SPERRY.

REGULATING DEVICE FOR ELECTRIC LAMPS.

No. 301,175. Patented July 1, 1884.

Fig. 1.

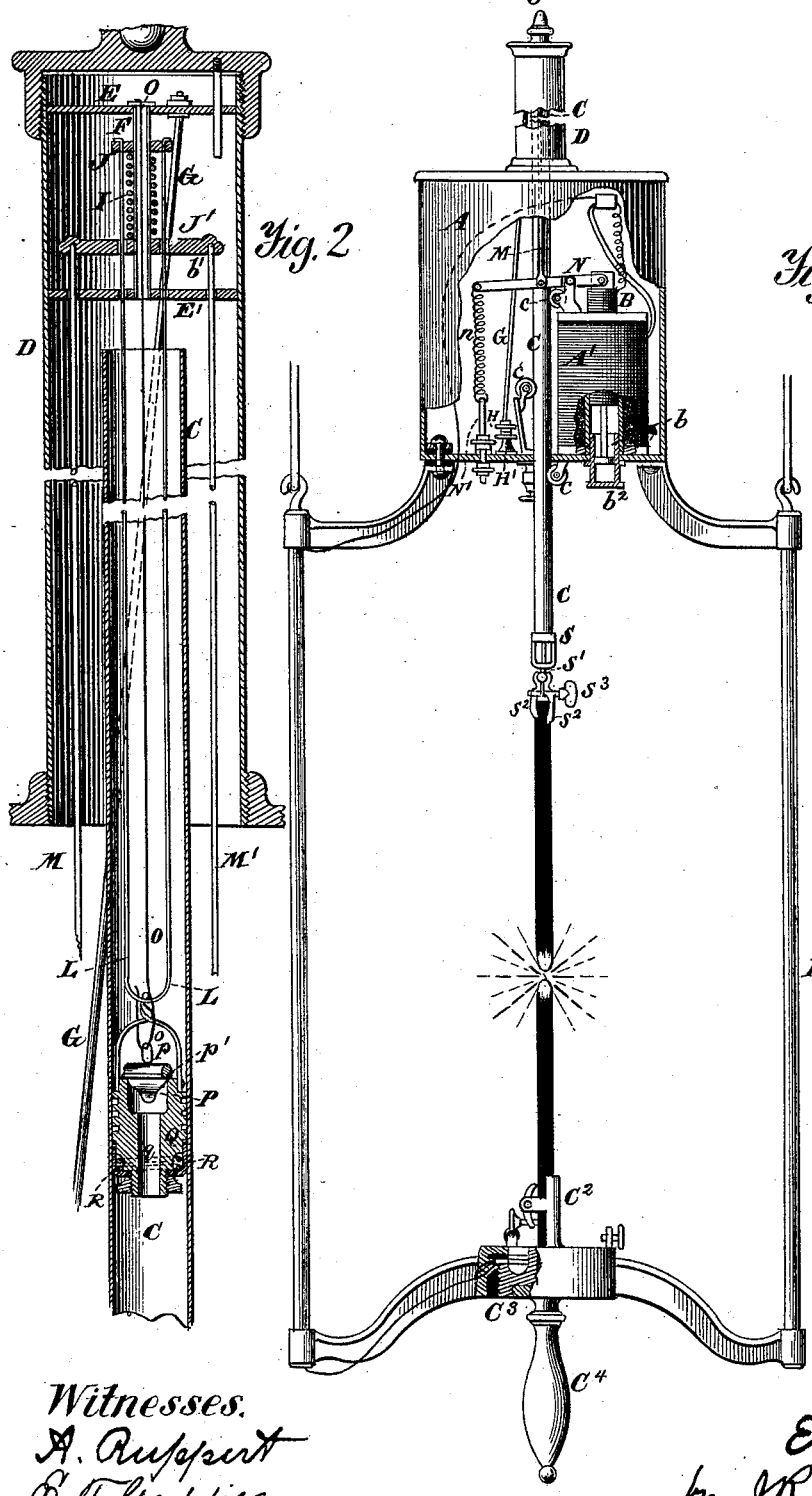
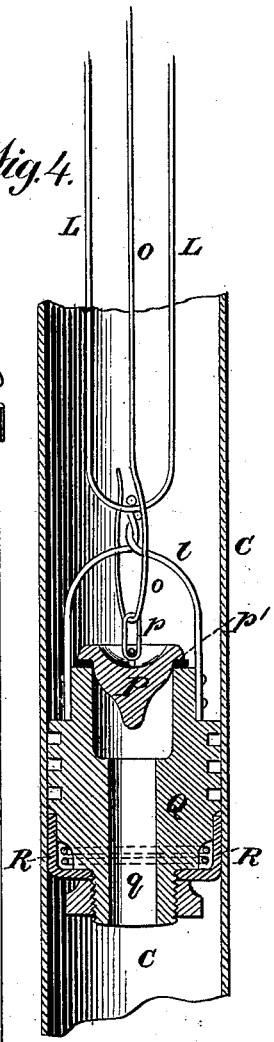


Fig. 2

Fig. 4.



Witnesses.
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E. T. Gaddis

Inventor.
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(No Model.) 2 Sheets—Sheet 2.

E. A. SPERRY.

REGULATING DEVICE FOR ELECTRIC LAMPS.

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Fig. 5.

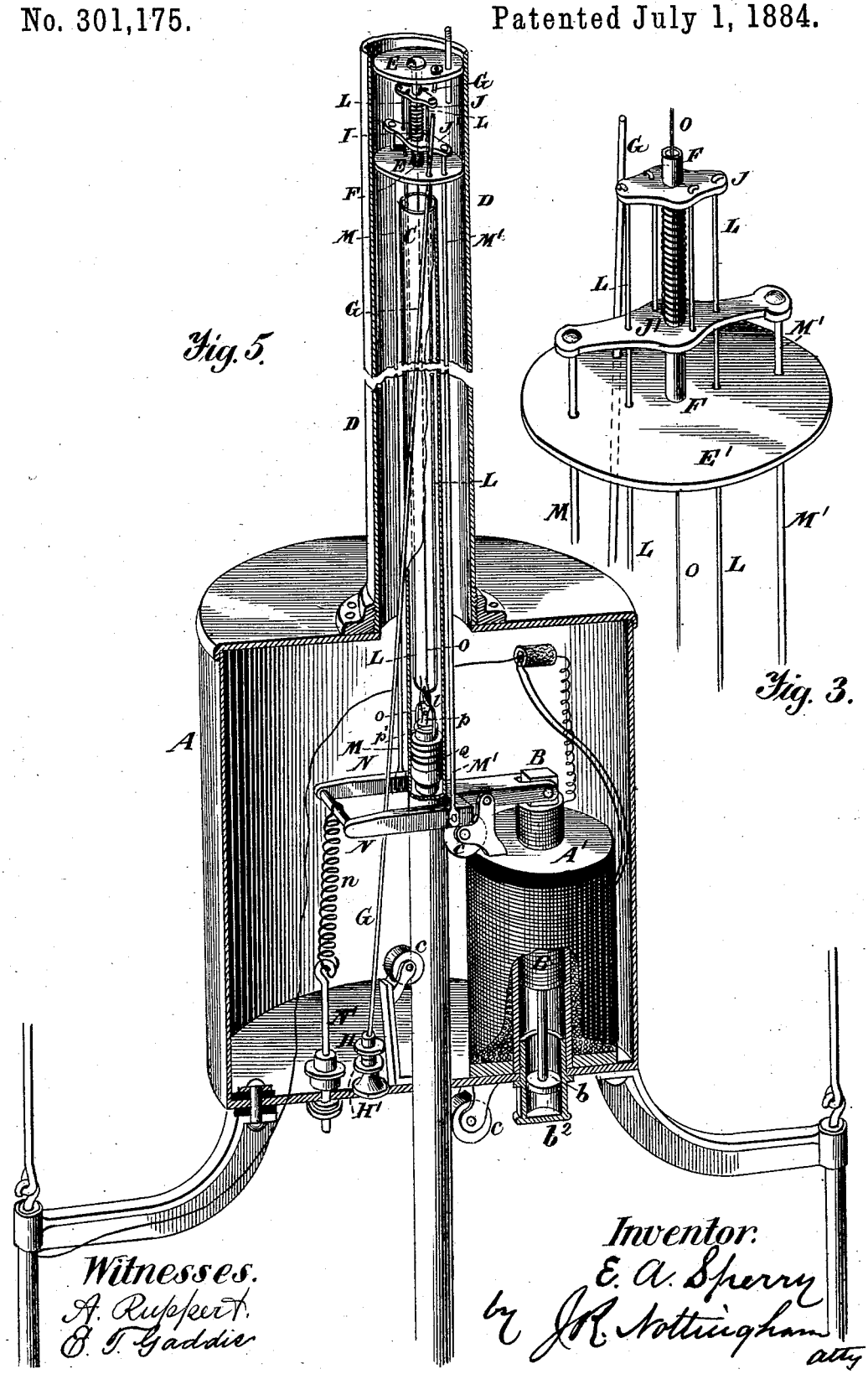

Fig. 3.

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UNITED STATES PATENT OFFICE.

ELMER A. SPERRY, OF CHICAGO, ILLINOIS.

REGULATING DEVICE FOR ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 301,175, dated July 1, 1884.

Application filed March 30, 1883. (No model.)

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Regulating Devices for Electric Lamps, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to regulating devices for electrical lamps of the arc type; and it has for its object the automatic control and regulation of the carbon electrodes in such manner that a uniform arc and steady light will be maintained during the entire time a lamp is in operation.

The invention consists in certain novel constructions and combinations of devices, which will be more fully understood from the following particular description, in connection with the accompanying drawings, and will be definitely pointed out in the appended claims.

In the drawings, Figure 1 is a side elevation, partially in section, of an electric lamp provided with my improvements. Fig. 2 is a vertical central section of an upper tubular extension of the lamp-casing and the upper portion of the upper-carbon holder and their contained mechanism. Fig. 3 is a detailed perspective view illustrating the devices in the upper portion of the tubular extension of the casing. Fig. 4 is an enlarged vertical central section of a portion of the upper-carbon carrying cylinder and the plunger and valve therein. Fig. 5 is an enlarged perspective view of the interior parts of the lamp, the casing being partly omitted.

Referring to Fig. 1, the letter A indicates the main inclosing-casing of the regulating devices, and D is an upward tubular extension of said casing.

A′ is a hollow helix in the main circuit, and B is a soft-iron core, wound with a fine wire coil in a shunt-circuit. The lower end of the soft-iron core B is provided with a stem carrying a plunger, *b*, which plays in a dash-pot, b^2. This hollow helix A′ and its core, carrying a coil in a shunt, are constructed and operate substantially as described in an application for patent filed by me on the 15th day of April, 1881, and numbered 30,916.

C indicates the upper-carbon carrier, which is a hollow cylinder, which passes vertically through an opening in the bottom of the casing, and is guided by three friction-rollers, *c c c*. This cylinder is closed at its lower end, and carries an open-work cap, from the bottom of which extends a small stem, carrying a ball, S′, which is held between the socket-shaped faces at the upper ends of two clamping-jaws, S^2, which are operated by a thumb-screw, S^3. By attaching the upper carbon to its carrier by means of a clamp of this construction, and the intermediate open-work cup, I secure a circulation of air between the carbon and its carrier and prevent heat from being communicated to the cylinder C and effecting the liquid, which is to be therein contained, as will be presently explained. The cylindrical carbon-carrier C extends upward into the tubular extension D. In said tubular extension, above the carbon-carrier, are two diaphragms, E and E′, which are centrally connected by a tube, F, the opposite ends of which are inserted in openings in the diaphragms respectively. These diaphragms are not connected at their edges to the tube D, but are supported entirely by a metallic rod, G, the upper end of which is connected to the upper diaphragm, E, and said rod extends downward loosely through the lower diaphragm to the bottom of the lamp-casing, where its screw-threaded lower portion enters a socketed stud, H, loosely, and is capable of adjustment therein by means of a nut and jam-nut, as shown at H′.

Around the tube F is arranged a spiral compression-spring, I, which is situated between the two slides J and J′, through which the tube F passes. These slides are forced apart by the spring I; but the distance of their separation is limited by the rods K K, while at the same time the slide J may approach toward the slide J′, when the spring I is properly compressed.

To the upper slide, J, are secured the ends of a wire loop, L, which extends downwardly into the cylinder C, and is connected to a bail, *l*, which carries a plunger, Q. The parts of this loop pass loosely through openings in the lower slide, J′, and the lower diaphragm, E.

To the extended end of the slide J′ are con-

nected the upper ends of rods M and M', which extend downward and are connected to the long arm of lever N, the short arm of which has pivoted to it the soft-iron core B of the helix A'. This long arm of the lever N is also connected with an adjustable hook, N', by means, of a suitable retracting-spring, *n*.

Through the small tube F depends a wire, O, the upper end of which is secured to the diaphragm E, while its lower end extends downward into the cylinder C, and is provided with an elongated hook, *o*, which hooks through a vertical elongated link, *p*, which is connected to the top of the valve P, which sets into a cavity at the top of the plunger Q, and when upon its seat this valve closes the passage *q* through said plunger. This valve P has a shoulder, *p'*, which rests upon the top of the plunger, and is provided with a suitable packing to make a close joint, and the depending part of said valve decreases rapidly in diameter to its point, for a purpose which will be hereinafter explained.

The plunger Q is packed in the usual manner, so as to be substantially fluid-tight in the cylinder C, and yet when the valve P is raised the cylinder will move downward freely on the plunger by its own gravity.

The lower-carbon holder C^2 is insulated from the frame of the lamp by suitable cup-shaped insulating-washers C^3, and the lower extremity of the lower carbon is protected by an ornamental wooden pendant, C^4, which is socketed to receive said carbon.

When the parts are arranged as shown in Fig. 1, the cylindrical carbon-carrier C is filled to near its top with a suitable liquid, preferably glycerine, for the reason that it will not evaporate at ordinary temperatures.

The operation of the lamp as now described is as follows: When the electric current is sent into the lamp and traverses the helix A', the soft-iron core B is drawn downward into said helix, depressing the short arm and raising the long arm of the lever N, which in its movement raises the slide J' by means of the rods M and M', and the said slide J' thus tends to compress the spring I; but it being already held in a compressed condition by the wires K K, so that its tension is more than is required to raise the combined weight of the plunger, the cylinder, and its fluid, the slide J is also raised simultaneously with the slide J', and through the loop L, raises the plunger Q on the interior of the cylinder C. The wire O is of such a length and the diaphragms and the tube F are adjusted to such a height by the rod G that the valve P is supported by the rod O and link *p* a short distance above its seat on the plunger Q. Now, the said plunger, in ascending, as above stated, first encounters its valve, which stops the circulation of the fluid through the plunger, and thus prevents the further independent rising of said plunger, and the cylinder C is compelled to rise therewith, so that the upper is separated from the lower carbon, and the arc is established. When the resistance of the arc becomes such that the feeding of the upper carbon becomes necessary, an increased flow of the current occurs in the shunt-coil which is carried by the soft-iron core B, and the magnetic effect of the helix A' on said core is so neutralized that the spring *n* is allowed to draw downward the long arm of the lever N, and thus the slides J and J' are allowed to descend, the descent of the loop L at the same time allowing the plunger, and with it the cylinder C, to descend a distance equal to the length of the link *p*, and when the upper end of said link strikes the bottom of the hook *o* a further downward movement of the plunger will cause it to leave its valve, and the passage through said plunger will be thereby opened to its normal extent of opening, which is very slight. If the passage through the plunger were entirely closed, the tendency of the cylinder to descend would tend to form a vacuum under the plunger, and this would result in the full arrest of the cylinder. The slight normal opening of the valve, however, allows a slow flow of the liquid from the upper to the lower side of the plunger and a correspondingly slow descent of the cylinder is thus allowed to occur by force of gravity. This slow movement effects a feed of the upper carbon.

It will sometimes happen, from defective fitting or from jarring of the lamp, that temporarily the cylinder will move more rapidly than is desirable. If now the cylinder C, which it will be remembered is supported only by the plunger, should descend more rapidly than is due to the small elevation of the valve at its position of rest, a partial vacuum will be created under the plunger Q, which will cause said plunger to be pulled down vigorously with the cylinder, and said plunger thus being caused to pull down the loop L, the spring I is compressed by the slide J moving down upon the tube F. This allows the plunger Q to descend still farther, leaving its valve so far that the rapidly-decreasing diameter of said valve opens a wider annular space at the top of the plunger, so that a very free passage of the fluid is allowed through said plunger, and this prevents the formation of the vacuum and the forcing of the fluid over the top of the cylinder, and thus is obviated the necessity of an enlargement or reservoir at the top of said cylinder.

I would now call attention to the office of the rod G, as it is very essential to the proper working of the regulating devices. This rod, it will be seen, is the primary support of the valve P, as it directly supports the diaphragm E, from which said valve is suspended by the rod O. The fluid contained in cylinder C is found to change its mobility with changes in temperature, becoming somewhat viscid at low temperatures, and at such times the valve P should be caused to open a larger aperture for the flow of the fluid through the plunger. This I accomplish by making rods O and G, respectively, of different metals—as, for in-

stance, brass and iron, having different ratios of expansion, the rod G being of the metal which expands and contracts least under changes of temperature, and the rod O of the metal which expands and contracts most. The loop L and the rods M and M′ should be made of the same metal as rod G, so that their expansion and contraction will cause no change of relative positions of parts supported by these three supports.

It will now be observed that at a low temperature when the liquid is viscid and sluggish, the rod G will contract to a certain extent and slightly draw down the diaphragms. This would cause the rod O to be lowered, bringing the valve closer to its seat. This lowering would indeed be compensated by the contraction of the rod O, even if it contracted only in the same ratio as the rod G; but we want something more than a simple compensating action, which would keep the valve at a uniform distance from its seat—that is, at low temperatures it must stand farther from its seat than at ordinary temperatures, in order that the liquid rendered less fluent at such time may flow sufficiently freely through the plunger to allow a proper feed of the upper carbon, and this result is achieved by using metals of differential expansion and contraction, as stated—that is, a double compensation is effected, and the dimensions of the aperture from which the fluid must flow is varied to accommodate it at all temperatures.

Having now fully described my invention and explained the operation thereof, I wish it to be understood that I do not claim, broadly, a hollow carbon-carrier, the movement of which is controlled by a plunger moving in a liquid in said holder and itself controlled by a valve which regulates the flow of the liquid, as an electric-light regulator comprising such devices is old and well known.

What I claim is—

1. The combination, with the hollow cylindrical carbon-carrier, the plunger suspended therein and having a vertical passage and the valve suspended above said plunger, of compensating devices arranged to vary the distance between the valve and its seat upon the plunger in accordance with variations of temperature, substantially as described, and for the purpose set forth.

2. The combination, with the hollow cylindrical carbon-carrier C, of a plunger suspended therein and having a vertical passage, the valve supported immediately above said plunger, and means for permitting said valve to rise with said plunger when the latter rises and strikes said valve, and to descend therewith a limited distance independently of the valve-supporting rod, substantially as described, and for the purpose set forth.

3. In an electric-arc lamp, the combination, with the suitably-supported tube D, the upper hollow cylindrical carbon-holder, C, the lever N, and suitable electro-magnetic devices for operating said lever, of the diaphragms E E′, connected by tube F, the slides J and J′, the spring I, for separating said slides, the rods M M′, connecting the lower slide of the lever N, the hollow plunger Q, the loop L, connecting said plunger with the upper slide, the valve P, and the hook-rod *o*, and link *p*, connecting said valve with the upper diaphragm, and suitable means for supporting said diaphragms, substantially as described.

4. The combination, with the hollow cylindrical upper-carbon holder, of the hollow plunger Q, suspended therein, the valve P, the rod O, connecting said valve with a vertically-movable support, and the rod G, having its lower end fixed and its upper end connected with and supporting said movable support, said rods O and G having differential ratios of expansion and contraction, substantially as described, and for the purpose set forth.

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

ELMER A. SPERRY.

Witnesses:

A. A. GRIFFITH,

GALUSHA ANDERSON.