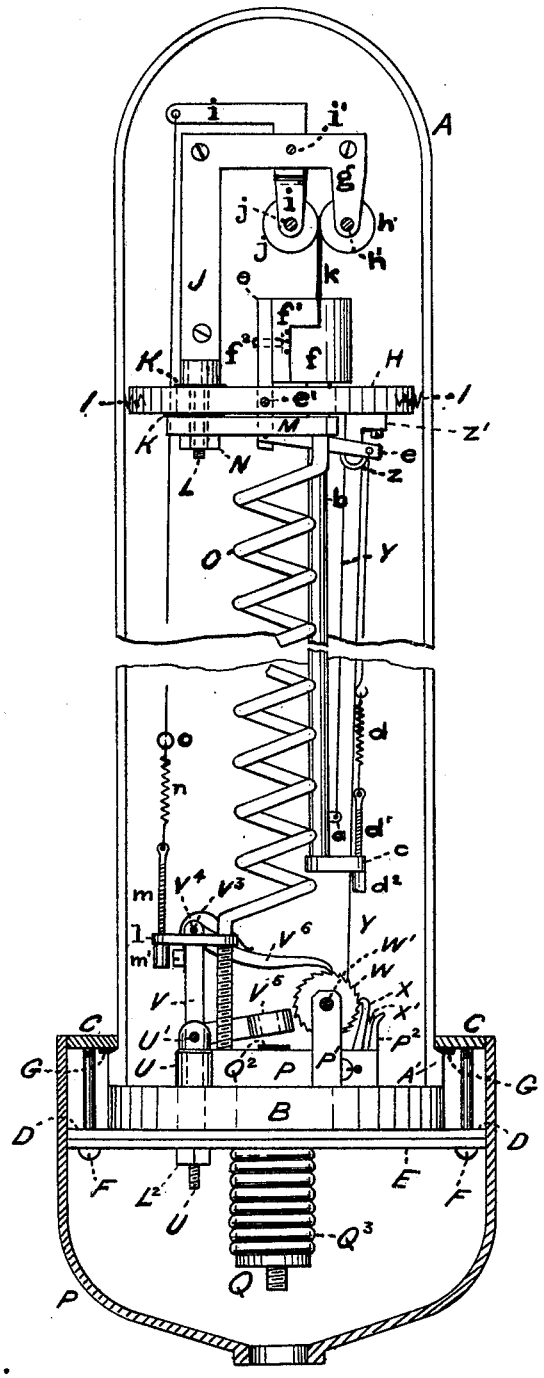
W. E. SAWYER.
Electric-Lamps.

No. 219,771. Patented Sept. 16, 1879.

FIG. 1.



WITNESSES.

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4 Sheets—Sheet 2.

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FIG. 2.

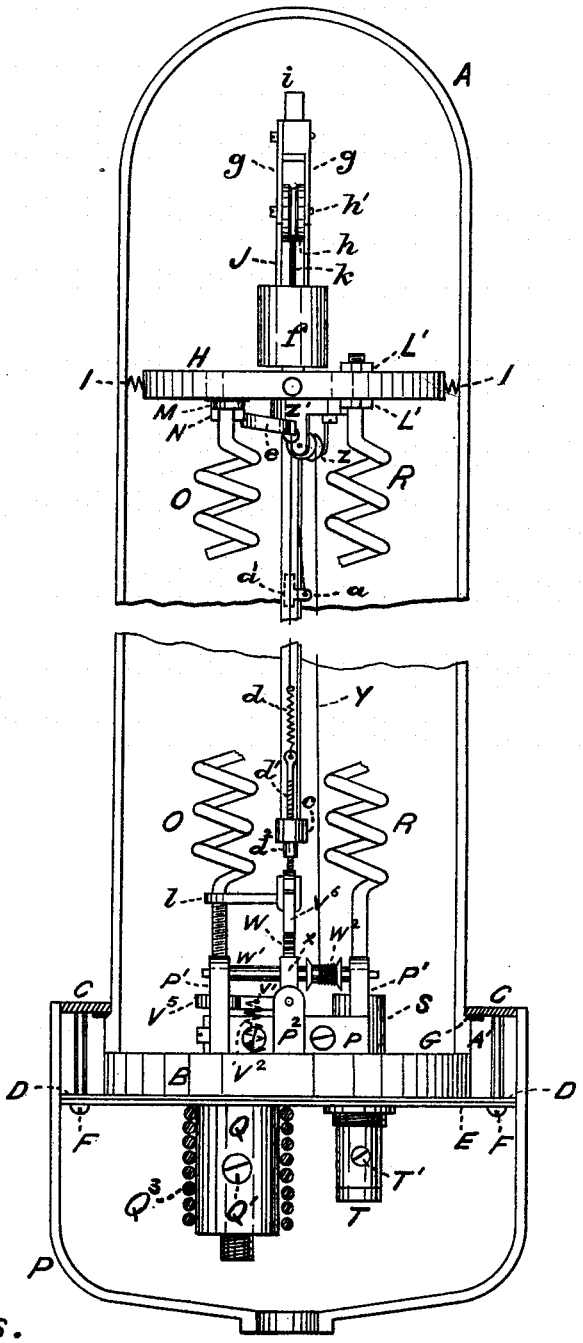

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FIG. 3.

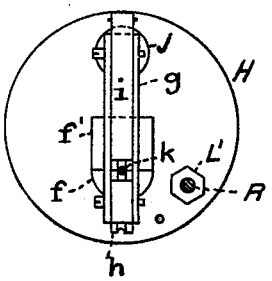

FIG. 4.

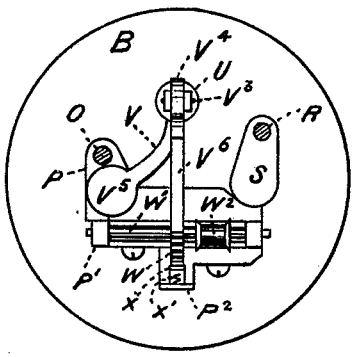

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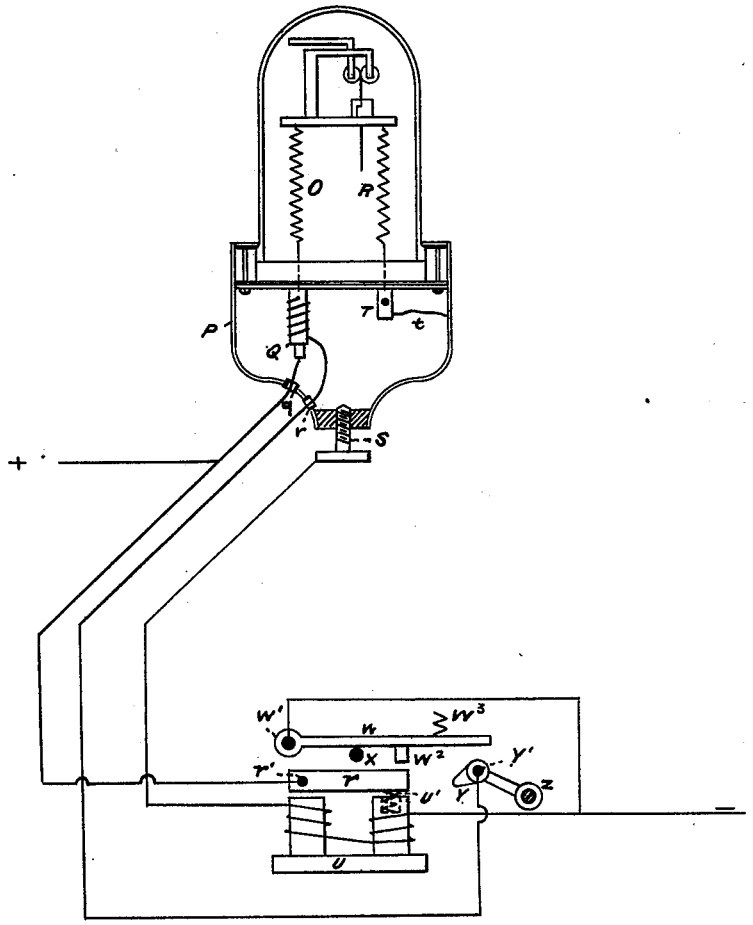
FIG. 5.



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UNITED STATES PATENT OFFICE.

WILLIAM E. SAWYER, OF NEW YORK, N. Y.

IMPROVEMENT IN ELECTRIC LAMPS.

Specification forming part of Letters Patent No. **219,771**, dated September 16, 1879; application filed April 23, 1879.

To all whom it may concern:

Be it known that I, WILLIAM EDWARD SAWYER, of the city, county, and State of New York, have invented certain new and useful Improvements in Electric Lamps and Switches therefor, of which the following is a full, clear, and exact description.

My invention relates to that class of electric lamps in which light is produced by the incandescence of a solid conductor, notably of a carbon pencil interposed between two large carbon electrodes, and constituting a part of the electric circuit.

The general principles upon which such lamps are constructed and operate are sufficiently well understood to render a detailed description here unnecessary; and many of the features connected with the lamp of my present invention are fully shown and claimed in Letters Patent of the United States No. 205,144, dated June 18, 1878, granted jointly to me and Albon Man, of Brooklyn, New York.

Experience has shown that the carbon pencils employed in lamps of this description after a time cease to maintain a perfect contact or connection with their carbon-holders. The result is the development of the voltaic arc, and, because of the consequent instantaneous shortening of the carbon pencils by disintegration, the lamps must be taken apart, new pencils substituted, and the sealing-globe refilled with a carbon-preservative atmosphere. Experience has further shown that this shortening of the carbon pencil occurs usually at its contact with the upper holder, probably on account of the concentration of heat at that point, and that the shortening is limited in extent to one-thirty-second of an inch.

In the poorest lamps of the incandescent order the life of a pencil of carbon prior to the occurrence of the voltaic arc is about five hours. In the best lamps the life of the pencil is in excess of two hundred hours. In some a life of probably a thousand hours will be attained, and it is barely possible that in some lamps the arc may never occur; but practically the manufacture of electric lamps for lighting by incandescence unprovided with a remedy for such destructive changes is so uncertain as to greatly impair the chances of the general introduction of electric lighting.

In my present invention I aim directly at this evil, correcting it whenever the voltaic arc occurs by at once establishing new points of contact. I place in the sealed globe a long pencil of carbon, which is fed up from the outside magnetically when necessary, and a lamp equipped with a pencil seven inches long will be equivalent to at least two hundred and twenty-four of the ordinary lamps, that being the number of times that new points of contact may be established. Hence it follows that as the poorest of the ordinary lamps will run for five hours without the occurrence of the voltaic arc, an equally poor "feeder" lamp provided with a pencil of carbon seven inches long will run for eleven hundred and twenty hours before renewal of the pencil will be necessary, or, say three hours a day for a year, and the best lamp will have a life of forty-four thousand eight hundred hours, or forty years with an average use of three hours per day.

In the drawings accompanying and forming a part of this specification, Figure 1 is a side view of the lamp; Fig. 2, a front view; Fig. 3, a top view of the upper works; Fig. 4, a top view of the feeding mechanism; and Fig. 5, a view of the lamp and its feeding-switch with their connections.

Like letters indicate like parts in all the drawings.

Referring to the drawings, Figs. 1, 2, 3, and 4, A is a glass globe, provided with a rim, A′. B is a glass stopper, ground to the same. C is a metal flange, supported on the rim A′ by any cushioning material, G. D is a wooden flange or cushion, supporting the metal flange E on stopper B. F F are screws, by which the flanges C and E are drawn together to clamp the stopper to the globe. All of this is fully shown and described in the Letters Patent hereinbefore referred to.

H is a copper diaphragm, into which are let three coiled springs, I, which keep the diaphragm from jarring against the glass, and at the same time hold it firmly in position. Passing through the diaphragm and secured by the nuts L′ is a long coiled copper tube, R, the lower end of which is brazed into offset-nut S, which is drawn to the stopper B by tubular bolt T, in which is a stop-cock, T′.

In charging the globe with a carbon-preserv-

ative atmosphere, the gas enters the tubular bolt T, and passes upward through the offset-nut and the coiled tube R to the top of the globe, thus displacing the air, which finds its exit by way of the opening and stop-cock Q′ of the tubular bolt Q, which will be more fully described hereinafter.

Passing through the diaphragm and insulated from the same by mica washers K K is a standard, J, whose bent arm *g* carries a grooved carbon roller, *h*, pivoted at *h′*. Pivoted at *i′* in the bent arm *g* is a second bent arm, *i*, which carries a second grooved carbon roller, *j*, pivoted at *j′*. The standard J is clamped to the diaphragm by nut N on the bolt-extension L of the standard, the offset-piece M under the nut N serving as a connection with the long coiled solid conductor O, the lower end of which screws into the brass offset P, which serves both as the frame-work for a part of the feeding mechanism and as a nut for the tubular bolt Q.

Fixed to coiled conductor O is an arm, *l*, to which is attached the adjusting screw and nut *m m′*, by means of which the tension of spiral spring *n*, connecting with bent arm *i*, is regulated so as to bring the two carbon rollers *j h* together with the requisite pressure, the glass link *o* insulating the arm *l* from the bent arm *i* by way of spring *n*.

Screwing into and through the diaphragm H, on a line with the groove in the carbon rollers *j h*, is a slotted tube, *b*, in which travels a plunger, *a′*, to the offset *a* of which is attached a fine steel wire, Y, which passes upward over pulley Z, pivoted in Z′, and thence downward over insulating wooden drum W^2 on shaft W^1, which rotates in standards P^1 P^1 of offset P. Surrounding the end of tube *b* which projects above the diaphragm is a carbon piece, *f*, cut away, as shown.

Pivoted in the diaphragm at *e′* is a bent arm, *e*, to which is fastened carbon piece f^1 by screw f^2. Fixed to the lower end of tube *b* is an arm, *c*, to which is attached the adjusting screw and nut d^1 d^2, by means of which the tension of spiral spring *d*, connecting with bent arm *e*, is regulated so as to bring the carbon jaws *f* f^1 together with the requisite pressure. Inclosed in the tube *b*, and passing between the carbon jaws *f* f^1 and the carbon rollers *j h*, is the long pencil of carbon *k*, by the incandescence of which, in that section which is between the jaws and the rollers, the light is produced; and by the rotation of the drum W^2 this pencil of carbon is fed upward as frequently as may be desired, the rollers *j h* turning slightly to allow for expansion and contraction of the pencil when heated and cooled.

Through the stopper B passes a third bolt, U, secured by nut L^2, and in the upper end of this bolt, at U′, is pivoted a bent arm, V, to which is fixed a silver-plated iron disk, V^5, so as to bring the same directly over the end of tube-bolt Q. The tube-bolt Q is of soft iron, and being wound with insulated wire Q^3 constitutes an electro-magnet, one of the poles of which appears at Q^2. The armature V^5 is normally kept away from the magnet Q by spiral spring V^2, which is held in place by pin V^1 in bent arm V, the range of its movement being limited on the one hand by its coming in contact with the pole of the magnet Q^2, and on the other by the shape of that portion of the bent arm V which plays in bolt-head U.

Pivoted in bent arm V at the point V^3 is a pawl, V^6, which engages in the teeth of ratchet-wheel W on shaft W^1, and this pawl is held to its bearing by spring V^4, screwed to the bent arm. Thus at every vibration of the armature V^5 the pawl V^6 moves the ratchel-wheel one tooth, and thereby winds the wire Y upon the drum W^2 and feeds the carbon pencil upward, as will readily be understood without further explanation.

The pawl X, actuated by spiral spring X′ from standard P^2, simply locks the ratchet-wheel against back action as the pawl V^6 causes it to rotate.

The methods of making the several joints of the lamp air-tight are fully set forth in the Letters Patent hereinbefore referred to, and in Letters Patent No. 210,809, dated December 10, 1878, granted jointly to me and to Albon Man, of Brooklyn, New York; and as the same constitute no part of my present invention, I have deemed it unnecessary to again describe them.

Referring now to Fig. 5, in which the connections of the lamp with its feeding-switch are shown, *p* is a spun-metal cup inclosing the entire base of the lamp, and provided with a threaded opening, by means of which it is screwed to any fixture, *s*. The current coming from the + point is conducted through the insulating-piece *q* to the magnet Q, and passes thence by way of conductor O, the carbon pencil *k*, and conductor R to the bolt T, thence to the spun-metal cup, standard *s*, and the coils of the electro-magnet *u* outward to the — point. The armature *v* of magnet *u*, pivoted at *v′*, is thus drawn away from the stop *x* against the force of spiral spring *w′*, let into one of the poles of the magnet. Connected with the armature *v* outside of the lamp is the conductor leading to magnet Q. When the magnet *u* is not energized its armature *v*, forced upward by spring *w′*, makes connection with the contact-piece w^2 of lever *w*, which is pivoted at w^1, and normally forced against stop *x* by spring w^3, and in that relation the current passes from the + point around the lamp to armature *v*, lever *w*, and outward at the — point. When the circuit of the carbon pencil *k* is broken the armature *v* is released and the above circuit established, thus preventing terruption of the light in other lamps in circuit.

One end of the helix of magnet Q is connected with the magnet, as shown. The other end passes through insulating-piece *r* in spun cup *p*, and thence to crank *z*, provided with cam *y* on pin *y′*. To energize the magnet Q and feed up the carbon pencil, the crank *z* is turned, and the cam *y*, coming in contact with

lever *w*, raises the latter from its connection with armature *v;* and instead of the current flowing from the + point to armature *v*, lever *w*, and outward at — point, it flows by way of the helix of magnet Q to cam *y* and lever *w* outward, thus energizing magnet Q and moving the ratchet-wheel, which feeds the carbon pencil one tooth, and so on until the circuit of the carbon pencil is re-established, when armature *v* is again attracted and the lamp once more operates.

In describing the lamp of my present invention, I have not considered it necessary to show its combination with a switch for graduating the light, or to indicate the many changes that may be made in the feeding-switch, such as rendering its action automatic by means of an electro-magnetic vibrator or of a circuit-breaker operated in any manner and controlled by magnet *u*. If desired, the feeding-switch may be combined in the base of the lamp, and there may be two magnets, one, so long as the circuit of the pencil of carbon exists, operating to open the circuit of the other or feeding magnet, and, when the circuit of the carbon pencil no longer exists, operating to permit the feeding-magnet to vibrate its armature until the circuit of the pencil is re-established.

I would have it understood that I disclaim in my present application the broad matter of a switch operating when the circuit of a lamp is interrupted to cut out, short-circuit, or throw a shunt around the lamp.

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

1. In an electric lamp, the combination, first, of the diaphragm H, tube *b*, hinged piece *e*, and jaws ff^1; second, of the diaphragm H, tube *b*, hinged piece *e*, jaws ff^1, and spring *d;* third, of the diaphragm H, the tube *b*, and the two carbon-holders *h* and *j;* fourth, of the diaphragm H, the two carbon-holders f^1 and *j*, free to move laterally, and the two carbon-holders *f* and *h*, prevented from moving laterally; fifth, of the two holders f^1 and *j*, free to move laterally, and the two holders *f* and *h*, prevented from moving laterally.

2. In an electric lamp in which light is produced by the incandescence of a carbon piece, rod, or pencil, the combination, first, of the carbon-holding tube *b*, the jaws ff^1, the carbon piece, rod, or pencil *k*, the follower or plunger *a'*, the flexible wire Y, the pulley Z, and the drum W^2, constructed and operating substantially as shown and described; second, of the standard J, the rigid carbon-holder *g*, and the jointed carbon-holder *i;* third, of the carbon-holding tube *b*, the upper and lower contact jaws, ff^1 and *h j*, and an electric apparatus operating to feed the incandescent carbon piece, rod, or pencil to a new contact when required or desired; fourth, of the tubular conductor R, the offset-nut S, and tube-bolt T; fifth, of the bolt Q, offset-nut P, standards P' P', shaft W^1, and ratchet-wheel W; sixth, of the magnet Q and bolt U, passing through the stopper B of the lamp, as and for the purpose specified.

3. In an electric lamp in which light is produced by the incandescence of a carbon piece, rod, or pencil, the combination of the diaphragm H and springs I, as and for the purpose specified.

4. The feeding-switch *u*, *v*, *w*, and *y*, in combination with the magnet Q.

5. The combination, with an electric lamp in which a carbon rod, piece, or pencil is fed to a new contact when required or desired, of a switch which shifts the current into and from the coils of an electro-magnet by which the feeding mechanism is actuated without destroying the continuity of the circuit.

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Witnesses:
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THOS. CROCKER.